| | |
|---|---|
| ***Publication Year*** | 2014 |
| ***Acceptance in OA@INAF*** | 2023-02-15T14:51:33Z |
| ***Title*** | NISP- CU PDR report |
| ***Authors*** | Herbst, T.; Maciaszek, Thierry; Prieto, Eric; CORCIONE, Leonardo; Ducret, L.; et al. |
| ***Handle*** | http://hdl.handle.net/20.500.12386/33482 |
| ***Number*** | þÿ E U C L - - L A M - - R P  7 - - 0 1 8 |

| | | | |
|---|---|---|---|
| **TITLE:** | **NI-CU PDR report** | | |
| **Date:** | 18/07/2014 | **Issue:** | 1.0 |
| **Reference:** | EUCL-LAM-RP-7-018 | | |
| **Custodian:** | T. Maciaszek | | |

| **Authors:** | **Function:** | **Signature & date :** |
|---|---|---|
| T. Herbst | NI-CU PDR Chairman | |
| T. Maciaszek | NISP Project Manager & Co-Chair | |
| E. Prieto | NISP System Manager | |
| L. Corcione | NISP Electrical System Engineer | |
| F. Ducret | NISP PA Manager | |
| F. Grupp | NISP Optical System Engineer | |
| L. Martin | NISP Mechanical & Thermal Engineer & NI-OMA responsible | |
| G. Morgante | NISP Thermal System Engineer | 03-11-2014 DocuSigned by: CB3619E10F5F40E... |
| T. Pamplona | NISP Mechanical System Engineer | |
| S. Prezelus | ESA Euclid PA Manager | |
| **Approved by:** | **Function:** | **Signature & date :** |
| F. Hormuth | NI-CU Project Manager | 03-11-2014 DocuSigned by: |
| K. Jahnke | NISP Photometry Scientist | |
| **Authorised by:** | **Function:** | **Signature & date :** |
| T. Herbst | NI-CU PDR Chairman | |
| T. Maciaszek | NISP Project Manager | 03-11-2014 DocuSigned by: T. Maciaszek 610833C2BF2E41D... |

The presented document is Proprietary information of the Euclid Consortium.

| Issue | Date | Page | Description Of Change | Comment |
|---|---|---|---|---|
| 1.0 | 18/07/14 | all | First issue | |

The presented document is Proprietary information of the Euclid Consortium.

## Table of Contents

1 PURPOSE AND SCOPE ____ 4
2 REVIEW GROUP, REVIEW PROCESS AND SCHEDULE ____ 5
3 DOCUMENTS SUBMITTED TO REVIEW ____ 5
4 REVIEW OBJECTIVES AND SUCCESS CRITERIA ____ 6
5 REVIEW ITEM DISCREPANCY (RID) ____ 6
6 ASSESSMENT OF ACHIEVEMENTS OF REVIEW OBJECTIVES ____ 51
7 CONCLUSION ____ 52

The presented document is Proprietary information of the Euclid Consortium.

# 1 Purpose and Scope

This document presents the NI-CU PDR report.
In particular, it gives:

- the review group, the review process and schedule
- the documents submitted to review
- the review objectives and the success criteria
- the list of RID's with their answers by the NI-CU project team
- the actions taken during the final meeting
- the main findings of the Review Panel and proposes a conclusion on the outcome of this review

The presented document is Proprietary information of the Euclid Consortium.

## 2 Review group, review process and schedule

This PDR is a NISP internal review. ESA and the funding agency are invited to participate. The review group is constituted by:

| | |
|---|---|
| T. Herbst | NI-CU PDR Chairman (independent from the NI-CU project) |
| T. Maciaszek | NISP Project Manager & Co-Chair |
| E. Prieto | NISP System Manager |
| L. Corcione | NISP Electrical Architect |
| F. Ducret | NISP PA Manager |
| F. Grupp | NISP Optical Architect |
| L. Martin | NISP Mechanical & Thermal Architect & NI-OMA responsible |
| G. Morgante | NISP Thermal system Engineer |
| T. Pamplona | NISP Mechanical system Engineer |
| P. Strada | ESA NISP Engineer |
| S. Prezelus | ESA Euclid PA Manager |

The PDR datapackage has been delivered (in due time) during the NI-CU presentation meeting at MPIA on June 5th.
The RID's have been delivered on June 30th
A final meeting has been hold, at MPIA, on July 16th during which all the RID's have been discussed.

## 3 Documents submitted to review

The list of document provided for this review are :

**Management:**

EUCL-MPIA-PL-7-001_NI-CU_Development_Plan.pdf
EUCL-MPIA-PL-7-003_NI-CU_Management_Plan.pdf
EUCL-MPIA-PL-7-004_NI-CU_Documentation_Management_Plan.pdf
EUCL-MPIA-PL-7-005_NI-CU_Configuration_Control_Plan.pdf
EUCL-MPIA-PT-7-001_NI-CU_Product_Tree.pdf
EUCL-MPIA-SCH-7-001_NI-CU_Schedule.pdf
EUCL-MPIA-SCH-7-001_NI-CU_Schedule.pod

**Engineering:**

EUC-FM-3100-G_IF-NiCU_Calque_1.pdf
EUC-FM-3100-G_IF-NiCU_Calque_2.pdf
EUCL-LAM-RS-7-007_NI-CU Requirements Specification.pdf
EUCL-LAM-RS-7-020_NI-CU Interface Requirements Specification.pdf
EUCL-MPE-MAM-7-001_NISP Optical Design.ZAR
EUCL-MPIA-DOC-7-001_NI-CU_GSE_Description.pdf
EUCL-MPIA-ICD-7-001_NI-CU_Interface_Control_Document.pdf
EUCL-MPIA-OTH-7-001_NI-CU_Requirement_Compliance_Matrix.pdf
EUCL-MPIA-OTH-7-002_NI-CU_Requirement_Verification_Matrix.pdf
EUCL-MPIA-PL-7-002_NI-CU_Assembly_Integration_Test_and_Verification_Plan.pdf
EUCL-MPIA-RP-7-001_NI-CU_Technical_Budget_Report.pdf
EUCL-MPIA-RP-7-002_NI-CU_Design_Justification_File.pdf
EUCL-MPIA-RP-7-003_NI-CU_Design_Definition_File.pdf
EUCL-MPIA-RP-7-008_NI-CU_FEM_Analysis_Report.pdf
EUCL-MPIA-RP-7-009_NI-CU_Electrical_Simulator_NI-CUS_Design_Definition.pdf
EUCL-MPIA-TN-7-002_NI-CU_LED_Initial_Tests.pdf

**PA/QA:**

EUCL-MPIA-LI-7-001_NI-CU_Critical_Items_List.pdf

The presented document is Proprietary information of the Euclid Consortium.

EUCL-MPIA-LI-7-002_NI-CU_Qualification_Status_List.pdf
EUCL-MPIA-LI-7-003_NI-CU_Declared_Components_List.pdf
EUCL-MPIA-LI-7-004_NI-CU_Declared_Materials_List.pdf
EUCL-MPIA-LI-7-005_NI-CU_Declared_Processes_List.pdf
EUCL-MPIA-LI-7-006_NI-CU_Declared_Mechanical_Parts_List.pdf
EUCL-MPIA-LI-7-007_NI-CU_Configuration_Item_Data_List.pdf
EUCL-MPIA-LI-7-008_NI-CU_Long_Lead_Item_List.pdf
EUCL-MPIA-PAD-7-001_NI-CU_Part_Approval_Documents.pdf
EUCL-MPIA-PL-7-006_NI-CU_Product_Assurance_Safety_and_Inspection_Plan.pdf
EUCL-MPIA-PL-7-007_NI-CU_Cleanliness_and_Contamination_Control_Plan.pdf
EUCL-MPIA-PL-7-008_NI-CU_Qualification_Plan.pdf
EUCL-MPIA-PL-7-009_NI-CU_EEE_Components_Control_Plan.pdf
EUCL-MPIA-PL-7-010_NI-CU_Risk_Management_Plan.pdf
EUCL-MPIA-PL-7-011_NI-CU_LED_Qualification_Plan.pdf
EUCL-MPIA-QR-7-001_NI-CU_Risk_Register.pdf
EUCL-MPIA-QR-7-002_NI-CU_FMEA_Report.pdf
EUCL-MPIA-RP-7-004_NI-CU_Contamination_Analysis_Report.pdf
EUCL-MPIA-RS-7-002_NI-CU_LED_Specification_LMSNT.pdf
EUCL-MPIA-RS-7-003_NI-CU_LED_Specification_Epitex.pdf
EUCL-MPIA-RS-7-004_NI-CU_Harness_Specification.pdf
EUCL-MPIA-SC-7-002_NI-CU_PA_Compliance_Matrix.pdf
EUCL-MPIA-TN-7-001_NI-CU_Reliability_Apportionment_and_Prediction_Analysis.pdf

**Slides presented during the June 5th meeting**

2014_06_05_NI-CU_TM.pptx
NI-CU_Equipment_PDR_Presentation_Hormuth.pdf
nicu-vhs-vg-20140605.pdf

## 4 Review objectives and success criteria

The objectives of this review are :

- Agree and freeze the subsystem requirement (after PDR the requirements will be put under configuration control)
- States about the credibility of the sub system preliminary design
- States about the feasibility of the subsystem to respect the subsystem requirements with adequate margins (perfo, budget, interfaces, functional, ...)
- Analyze the AIV/AIT plan as well as the GSE associated to each step are well defined
- Verify that the TRL5 status is complete (technologies and processes are demonstrated on elementary mockup (not full scale needed))
- Verify and agree about the evaluation and qualification plans
- Verify the implementation of the Product Assurance Plan and the whole associated documentation
- Make sure that the critical items and risks are well identified
- Check that requirement specifications at components level are correctly flowdown from the subsystem requirement
- Analyze the development plan and the associated schedule and verify that adequate margins are exhibited

## 5 REVIEW ITEM DISCREPANCY (RID)

181 RID's have been issued.
ALL the RID's have been answered and discussed during the 16th of July meeting. All RIDs have been closed. 55 actions have been taken.
The RID's, the answers and the actions are given below.

The presented document is Proprietary information of the Euclid Consortium.

| RID Nb | RID Title | Datapack Document | Originator | Discrepancy description | Initiator Proposal | Sub System team Answer | Action taken during colloation meeting | *Action #* |
|---|---|---|---|---|---|---|---|---|
| 1 | NI-CU interface forces at operationnal temperature too high | nicu-vhs-vg-20140605 p25 | TM | The NI-CU interface forces at operationnal temperature are much too high with regard to the allowable shear force of 130N | Introduce adequate flexures, compliant with a forst eigen frequency around 150Hz; eventualy change the NI-CU material | An initial design using INVAR has indicated compliance to the requirement<br>but additional analysis is required. Document will be updated once<br>a design solution has been found to be compliant. | update design with Invar, provide new analysis/design / LM: get exact SiC CTE / LM: are 130N shear load or total load? | ***AI1, AI2*** |
| 2 | Diode reverse voltage | EUCL-LAM-RS-7-007 | JDG | The ICU design at UPCT will guarantee a clean LED driving signal at the ICU connector. The ICU does not foresee any design strategy to prevent from LED reverse polarization due to bouncing produced by impedance mismatching along the harness and connectors from the ICU to the CU. In case of need this should be done on the CU side by properly matching the impedance of the harness to that seen by | Analyse effect of harness at CU level | DC Termination of harness lines at the LEDs is not feasable due to the line<br>impedance and required termination resistors in the order of 120 Ohms.<br>Series resistance of the ICU current driver would help to absorb harness<br>reflections if the termination resistor is in the order of<br>120 Ohms, but it is unrealistic to provide the necessary voltages and power at<br>the ICU driver.<br><br>AC termination at the LEDs is difficult or impossible to<br>match against the current source and not forseen.<br>Reverse protection diodes antiparallel to the LEDs inside the NI-CU might help<br>but realistic reverse voltages at this side will not reach 0.7V (TBC by test).<br>Protection diodes might therefore be useless wrt to reverse bounces but might<br>help suppressing EMI generated reverse voltages (TBD).<br><br>Spice Simulations using lossless transmission lines with both driving and sense<br>wires provide sufficient low reverse bouncing as long as the current driver edges<br>(slew rates) are in the order of 100ns or more for 750mm harness. | define slew rate / meeting NICU/ICU / analyse impact on PWM / include Leonardo | ***AI3*** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | Line impedance when no current is applied | EUCL-LAM-RS-7-007 | JDG | Two different circuits are connected to each LED. The current source and the voltage sense lines. The current source is a low impedance circuit while the sense lines are high impedance. There is not much the ICU can do to prevent from any induced current flowing due to coupled interference. Both circuits could be disconnected from the current source and the converter respectively, and connected to ground by resistors or kept open at the expenses of a sophistication of the ICU electronics. Before the option of adding electronics to the ICU is taken, the radiation produced by the LED due to EMI must be evaluated to determine if it is likely to reach significant values considering that:<br>.- When the CU is in use there will be no motor moving and no clutch activation occurs. Thus the major source of interference inside NISP is not present.<br>.- Cables are configured as twisted pairs with overall shield. This configuration should be not prone to EMI and the correct harness configuration to avoid EMI should be explored during testing. | Analyse potential interference and effects in LED circuits, and define at instrument system level the ICU and CU requirements | The issue of induced currents stems from: NI-CU-P-018: OFF condition. Therefore<br>it is precisely the activation of motor/clutch when the NICU is off which is of<br>concerned.<br><br>It is not good practice to leave any electrical line floating. Ideally the<br>current drive terminals of LED's whilst not in use should be shorted together<br>and connected to ground through a relatively low impedance path at the ICU end.<br><br>It is agreed that analysis should be performed to see if the theoretical<br>generation of photons via EMI would actually occur in practice; for photons of<br>the prescribed wavelengths to be produced a voltage of at least 0.4V must<br>generated on the LED terminals.<br><br>If the the analysis is performed by NICU, it can only be done against the EMC<br>enviroment provided by the requirements and cannot account for "unknown"<br>sources such as filter motor/clutch activation of which we have no knowledge<br>of.<br><br>Also analysis can not be done with out knowledge on the following parameters<br>- ICU drive CCT and grounding (essential)<br>- Full Harness length and type (essential)<br>- connectors - number and location on harness (not essential for initial<br>estimate)<br><br>It should be noted that the NICU harness is short and it is expected that the<br>majority of the length is located after the NICU electrical interface<br><br>As the majority of unknowns are external to NICU it has been assumed that the<br>analysis would be better performed at NISP instrument level or by ICU. However<br>it can be performed by NICU once the missing information is provided. | define requirement on harness for susceptibiity / assess crosstalk -> TWO requirements for Leonardo // change requie: n.a. during wheel activation | ***AI4, AI5*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | No current document changes | | |
| 4 | Mounting accessibility | EUCL-MPIA-OTH-7-001 | LMA | The proximity of NI-CaLA mounted previously on the panel P1 can occur same trouble to have full accessibility of the 3 fixing screws. | Provide a simulation (in CAD file) with the tool/dedicated tool to tight the 3 screws on the invar pads glued on the panel P1 when NI-CaLA is mounted. | NI-CU base component will be split into two items (Invar item plus Alu<br>item)to simplify mounting and also to improve compliance to IF shear forces.<br><br>GSE document will also be updated to include any extra mounting items. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | Thermo-mechanical analysis - Internal components | EUCL-MPIA-RP-7-008 | LMA | Only 'global' thermo-mechanical behaviour is shown. The study of the internal components is not given. What is the difference of design/material between NI-CU and NI-CUS ? How is fixed the reflector ? What are the properties of Spectralon ? What is the impact of the positioning of the reflector vs temperature ? | Please give more details on thermo-elastic study for internal components | The NICUS is an electrical simulator and has no impact on the mecahical<br>properties of the NICU.<br><br>Additional analysis provided relating to internal thermal-mechanical behaviour. Document to be updated in due course (not for PDR) | | |
| 6 | FEMs | EUCL-MPIA-RP-7-008 | LMA | Detailed FEM and validation of reduced FEM not provided. | Please provide detailed and reduced modelsl of last issue of NI-CU. | Was not on the deliverable list. Will be provided once design solution for<br>interfaces forces is found (ie for STM MRR) | TB delivered with MRR and at every review | ***AI1*** |
| 7 | AIT defaults | EUCL-MPIA-RP-7-008 | LMA | No AIT defaults considered ? The impact of the alignment of NI-CU could be negligeable but stresses in i/f glue layers and panel P1 not ? | Strength due to AIT defaults have to be evaluated and compared to allowable efforts at i/f. | Please clarify what is meant by AIT defaults - we assume bolt torques priovided<br>in the IRD drawing.<br><br>Stresses in IF glue layers and P1 out of NI-CU domain. | update stress analysis | ***AI6*** |
| 8 | Harness length | EUCL-MPIA-RS-7-004<br>EUCL-MPIA-RP-7-003 | LMA | Two harness lengthes defined: 750 and 1000 mm. | 750 mm seems longht enough ! | 750mm is assumed. 1000mm is mistake and has been corrected<br>eucl-mpia-rs-7-004 (dx63) changed | | |
| 9 | Mass taken in consideration for FEM analysis | EUCL-MPIA-RP-7-008 | LMA | Mass taken in consideration is w/o margin. | Consider mass with margin for analysis | Margin has not been included in analysis but can be added to densinty of each component for FEM simulation by vHS if requested. | | |
| 10 | Black painting for outside surfaces | niuc-vhs-vg-20140605 presentation) | LMA | mentioned in presentation not in documentation. Which materials are concerned ? Will PNC used for black painting ? Qualification done for all materials? | Precise what will be treated and how ? | PNC paint will be used as used as suggested by customer and used in rest of instrument. Qualification of PNC to be discussed at COLOC as well as change of related RQ as PNC is currently not compliant.<br><br>Only materials concerned are aluminium and invar, both for which the PNC<br>paint/PSX primer combination is qualified (Intespace report ref. M4558). Parts<br>painted identified in DPL, dc53. Qualification reference in DML added to DPL.<br>Invar added to DML (see RID#16).<br><br>Related issue - harness coating should be black ??? | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11 | Boundary conditions (constraints) | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 3.3: Only translations appears to be blocked. Each mounting point have also to be constrainted. | Please do the analysis constrainted translations and rotations. | Analysis was performed with translations blocked (and thus rotations aswell).<br>Clarification in document EUCL-MPIA-RP-7-008,dx68,FEM Analysis Report<br>needs to be done | update doc | ***AI7*** |
| 12 | FEM mass / technical budget mass | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 3.3: The total mass presented forthe FEM appears to be equal to 537.8g. This is not in line with the mass presented in the document EUCL-MPIA-7-001 (NI-CU technical budget report). In this document, a total mass of 1038g with margin is given. | Please explain this difference. | There is no total mass given in section 3.1 (material properties), but only the<br>mass of single components. Their sum does not add up to the NI-CU total mass,<br>since some of the components are used more then once and some of the NI-CU<br>components (given in the mass budget) are not considered within the analyses<br>(harness...) etc. | clarify in doc | ***AI7*** |
| 13 | FEM checks | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 4: No FEM check is presented in the document. | Please provide all the FEM checks required in the appropriate document. | To be added to next revision | update | ***AI8*** |
| 14 | Interface tolerance loadcases | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 4: Interface tolerance loadcases have to be treated (preload in the I/F mount during AIT phases). | Please provide a local defaults analysis at NI-SA I/F taking into account the stiffness of the NI-CU I/F | Analysis will be performed with IRD torque values into the effect of torque on<br>the NICU base plate once then shear force design issue have been solved.<br><br>Document EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report to be updated | see 7 | ***AI6*** |
| 15 | Random vibration loads | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 7.2: the frequency range of random spectra presented is [10; 400]Hz. The specified frequency range for random vribration is [10; 2000]Hz. | Please do the analysis up to 2000Hz. | Can be dome in the next revision however the effects in the higher frequencies<br>are considered negligible<br><br>Document EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report to be updated if required | updatea | ***AI9*** |
| 16 | I/F mount with NI-SA | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 5: The most adapted material appears to be Invar with a CTE very near from SiC. | Investigate the possibility to use invar M93 for this I/F mount | Current design solution using this material in progress. | update design with Invar, provide new analysis/design / LM: get exact SiC CTE / LM: are 130N shear load or total load? | ***AI1*** |
| 17 | Factor Of Safety | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | Section 4: No factor of safety appears to be taken into account in this analysis (not presented). Factor of safety described in appropriate ECSS document shall be applied | Please introduce factors of safety in all the analyses. | Factor of safety have been included.<br>Clarification needs tobe added to EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | update doc | ***AI7*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | (for example: Metallic material : 1.1 for yield strength and 1.25 for ultimate strength. | | | | |
| 18 | FEMs | EUCL-MPIA-RP-7-008 NI-CU FEM Analysis Report | TP | No delivered mathematical model has been found. Updated detailed and reduced FEMs are required for PDR. | Please provide these models. | No identfied as deliverable for PDR (see RID06 for delivery of Models) | update & deliver with next model | ***AI1*** |
| 19 | Mechanical design updating | EUCL-MPIA-RP-7-002 NI-CU design justification file | TP | The mechanical design presented in this document (figure 2) seems to be not in line with the one used for FEM. | Please clarify. | EUCL-MPIA-RP-7-002 NI-CU design justification file is to be updated with<br>model once the latest design iteration with IVAR is complete | update doc | ***AI1*** |
| 20 | Assessemnt of ESA alerts: missing document | None | Prezelus | An assessment of MPIA to the ESA alerts (since 2005) is not part of the CU PDR data-pacakge. Based on the NI-CU PA plan, refer to paragraph 3.6.4, this document shall be provided for the PDR. | Please MPIA to issue a document assessing the ESA alerts for the NISP CU. As this document is a "living"" document, it should be updated on a regular bais for example at every progress report. | Document created<br>Reference: NICU-VHS-LI-007<br>Title: ESA Alert Applicability and Status<br>Short Name: Alrt_Stat<br>Document Code: dx71<br><br>Will be released for PDR COLOC once project reference received | provide before july 26 | ***AI10*** |
| 21 | Comments to PA plan | EUCL-MPIA-PL-7-006 (PA plan) | Prezelus | 1. In paragraph 1.1, it is mentioned that no customer PA requirements are existing. MPIA is probably not aware that the following PA document is applicable for NISP and VIS instrument: EUCL-EST-RD-3-003 dated 24.01.13 and therefore for NI-CU.This document should be made applicable for NI-CU. 2.As indicated in paragraph 4.5.6, definition of KIP/MIP is made by PDR. What is the current situation wrt KIP/MIP ? In which document can they be found ? 3. Page 17 paragraph 3.10 EIDP: is it planned to deliver for each deliverable items (Stm, FM, ..) certificates of cleanliness | 1. Make applicable the ESA PA requirements for NI-CU: EUCL-EST-RD-3-003 dated 24.01.13. 2. To define KIP/MIP for NI-CU. 3. Add certificates of cleanliness for each deliverable items in EIDP. | 1. All applicable requirements from these PA requirements should be "flowed down" to the NICU units via the NISP instrument PA requirements<br>(EUCL-LAM-PL-7-005,N/A,NISP PA/QA Plan) which is an AD. Thus this document will be listed as a RD only<br><br>2. KIPs should be reviewed by LAM and MIPs need to be designated by LAM (or<br>appropiate authority)<br><br>3. CoC will supplied for the current requirement (visually clean) | 1) MPIA make applicable; already answered by PAQA comp matrix; 2) LAM to get back with MIPs based on AIV plan to be updated around STM MRR; 3) CoC to contain optical inspection results for particles - but there is no molec. req! --> use witness! Instead!, update doc | ***AI11, AI12, AI13*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | for MOC and PAC as part of the EIDP ? | | | | |
| 22 | Purging issue | EUCL-MPIA-PL-7-007 (CCC plan) | Prezelus | On page 6 paragraph 3.4, it is mentioned that purging is currently needed once the cover is mounted in order to avoid contamination. Is this purging also required during the integration phase of the PLM ? | Please define as whether purging is needed once the NISP instrument is integrated onto the PLM once the CU cover is on. | Section 3.4 states also:<br>The purging pipe and the cover must be removed before final integration of the<br>unit into the instrument.<br><br>These items are not required duing the integration phase of the PLM.<br><br>Specific statement to this effect will be added to the document EUCL-MPIA-PL-7-007 (CCC plan) | update document end of Sept | ***AI14*** |
| 23 | Bake-out issue | EUCL-MPIA-PL-7-007 (CCC plan) | Prezelus | 1. On page 5 paragraph 3.3, it is stated that spectralon material will be baked-out. What are the conditions of this bake-out operation : temperature+duration ? Is it planned to check the efficiency of this bake-out operation by monitoring ? If so, what are the monitoring method ? 2. Is it planned to bake-out the assembled harness ? If so, what are the conditions ? Will this operations be performed by the harness supplier or by MPIA ? Note: based on the harness specification (EUCL-MPIA-RS-7-004), no bake-out activity is currently planned; what is the rationale behind ? | 1.Bake-out conditions to be defined for Spectralon.<br>2. Define whether assembled harness needs to be baked-out. If not, justifications to be provided. | 1. Spectralon bake out conditions to be given by manufacturer, less than 400<br>degrees celcius and for at least 72 hours (from ECSS) until stable mass is<br>reached (monitored by intermitent weighing). Bake-out under dry nitrogen<br>performed by vH&S. EUCL-MPIA-PL-7-007,dc09,Cleanliness and Contamination Control updated.<br><br>2. Currently no bake-out required according to manufacturer as harnes is made<br>from low outgassing wires. Bake-out can be performed if necessary by vH&S as<br>per spectralon but at a temperature below 125 degrees celcius (connector<br>rating). No document updated.<br><br>3. Complete unit (including pigtail harness) will be baked out as in AIV flow<br>under the required bake out temp (40degC) under vacuum (TBC) | update document | ***AI14*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24 | Welding process of TO-18 package | EUCL-MPIA-PL-7-009 (Components Control Plan). | Prezelus | As reported on page 8 paragraph 4.3, it is likely that the LEDs will be procured in two parts from the suppliers and then the package welding process will be sub-contracted under vH&S control in order to get "reliable" hermically sealed packages. What is the current situation wrt the investigations performed by vH&S of the potential sub-contactors for the welding process ? Are they any characterization/evaluation exercises conducted for Euclid NI-CU ? | To report on the situation (evaluation, trade-off,..) with the potential welding sub-contractors for TO-18 package. | Although final selection of sub contractor is yet to be done, the preferred<br>choice has been previoulsy used by vH&S. It has significant experience<br>in optoeöectronic, defence and aerospace fields in component packaging and performing screening tests to both ESA and MIL standards.<br><br>Similarily the preferred choice of test house also posses experience of both aerospace and optoelectronic screening and component analysis.<br><br>It is proposed to add background information of each subcontractor to the qualfication plan in an appendix and new quotation to the agreed qualification plans have been established. | update documents when more/new information becomes available | |
| 25 | PCB meeting of 26 May 2014: LED issue | EUCL-MPIA-PL-7-011 (LED qualification plan) | Prezelus | Based on the MoM, there are still some open issues to be discussed within all involved parties prior to approve the LED PAD and the LED qualification plan in order to allow the LED procurement activities. Furthermore, CNES comments have been provided to the MoM in week 22. As far as we know, no responses have been provided. What is the way-forward ? | To reconvene asap a PCB meeting for the LED qualification/PAD approval. | A second PCB is expected to be undertaken in the near future (around the EPDR COLOC) with the presence of the NISP PM | organise new PCB meeting via Doodle this week; procure before PCB to start packing!; need authorization; vH&S to send parts for constr analysis next week; get conf email from Thierry, clarify financial risk. Ask Knud for OK | ***AI15*** |
| 26 | Materials to be used at Cryo temperature | EUCL-MPIA-LI-7-004 (DML) | Prezelus | There is no indication in the DML that the current selected materials intended to be used under cryo temperature are compatible with such low temperature. For example, from the data sheet of Urathane 5750, the tempertaure use is not indicated. | To assess (either by test or by use on another cryo application) whether all the current selected materials are compatible with cryo temperature. If not compatible, alternatives should be proposed. Outcomes of such assessements need to be reported in the DML. | Cryogenic compatability column added to DML. For the urethane coating a<br>reference for cryogenic testing has been added. All other materials have<br>details of the tesing or qualification for cryogenic usage or are in the<br>process of being tested (noted in EUCL-MPIA-LI-7-004,dc28,Declared Materials List,nicu-dml). | update doc | ***AI16*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 27 | Soldering operation | None | Prezelus | As far as we understood, the harness wire (LED side) is stripped of insulation and wrapped around the post and then soldered by hand. By which company (MPIA or sub-contractor ?) will the solder operatiion be performed ? Please provide evidence that operator who will be performing this operation has the relevant ESA certification. | To define which company will be performing the solder operation and provide evidence that operator has the relevant ESA certification. | vHS have trained staff in the areas of inspection and hand soldering of surface mount and through hole components to ESA requirements.<br><br>As vH&S is a small company engineers are re-certified only when there is a specific requirement for it. For NI-CU, application for retraining will be made in Q3/Q4 of 2014.<br><br>Information related to this RID has already been provided to the Instrument PA by email 7th April 2014 in answer to RID 4546 of the NISP IPDR | provide updated certs when available | |
| 28 | Safety issue | EUCL-MPIA-SC-7-002 (PA compliance matrix) | Prezelus | Iit is indicated in section Safety that no assessment will be performed on the safety aspects of he NISP calibration Unit (CU). This statement is not accepted since some safety inputs of MPIA will need to be provided to LAM to indicate that LEDs are currently used in the CU design and no human risk (eyes damage) has been identified when the LEDs are in use. | MPIA safety assessemnt/inputs needed to be provided to LAM. | Saftey assessment document will be provided. | provide before end of September | ***AI17*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 29 | Connector/harness. | EUCL-MPIA-LI-7-003 (DCL) | Prezelus | The following information are provided in paragraph 2 page 5:The D-"Sub HD 26P connector is part of the harness, built by the connector manufacturer, either Glenair or Axon. As the temperature and connector-type requirements changed since the last quotations from these potential manufacturers, vH&S is now in the ongoing process to get updated information regarding the connector qualification. Current information from one manufacturer is, that the harness — including connector — will be qualified. It is confirmed that the Glenair builduppprocess has space heritage. The exact qualification information is still missing at the moment, but it will be delivered as soon as vH&S gets more detailed information." According to which standard will the harness be procured , ESCC or any American standards ?. Please advise. | | Procurement will be done by following the ESCC process, using the ESCC part numbers<br><br>Axon' tests conditions:<br><br>- Linear resistance and insulation resistance at ambient temperature.<br><br>- then Harnesses submerged in liquid nitrogen (temperature = -190°C)<br><br>- following is a Visual inspection and linear resistance at ambient temperature.<br><br>The acceptance criteria's are:<br><br>- no visual damage<br><br>- short linear resistance difference (maximum difference to be defined).<br><br>- Insulation resistance > 5000 Mohms. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 30 | Cleaning operation of LED window | EUCL-MPIA-RP-7-004(Contamination analysis report) | Prezelus | 1. As mentioned in paragraph 4.1, it is planned to perform cleaning operation prior to start the integration process. It it planned to clean the window of the LED ? If so, what is the cleaning process in place ? 2. On page 7, it is indicated that bake-out for 16 hours is currently planned; based on the relevant ECSS, a minimum of 48 hours is needed. What is the rationale to define 16 hours ? | | LED window to be cleaned before assembly as well at cleaning stages throughout<br>assembly (when possible). The cleaning process is the same as for electronic<br>parts using isopropyl alcohol 80% water 20%.Cleaning process in DPL modified to<br>include LEDs. dc53 and dc09 updated.<br><br>Bake-out set to 72 hours as per ECSS-Q-ST-70-01C. dc61 updated by DS.<br><br>dc09 updated to include bake-out information for completeness.<br><br>Updated documents:<br>dc09,EUCL-MPIA-PL-7-007,Cleanliness and Contamination Control Plan,nicu-clean-ctl<br>dc53,EUCL-MPIA-LI-7-005,Declared Processes List ,nicu-dpl<br>dx61,EUCL-MPIA-RP-7-004,Contamination Analysis Report,nicu-contam-anlys | update doc end of september | ***AI18*** |
| 31 | Potentail failure mode of LED due to window molecular contamination/glass window obstruction due to radiation | EUCL-MPIA-QR-7-02 (FMEA) | Prezelus | In paragraph 8 (FMEA worksheets), there is no item related to "glass window molecular contamination" or glass window "obstruction" due to radiation. How can MPIA demonstrate that these failure modes are not credible ? | To demonstrate at NISP instrument level that the LED glass window has not the coldest temperature during the Euclid contamination phase. MPIA to demonstrate/characterize threshold wrt molecular contamination of the LED window. | NI-CU has no details of the Euclid contamination phase npr of the general thermal<br>conditions of the rest of the instrument.<br><br>Expect that detectors will be the coldest point of the NISP instrument.<br><br>LED's may be heated indvidually wrt to NI-CU structure by normal operation.<br><br>Radiation damage of glass will not occur between 0.9 and 1.2um but at shorter wavelengths. Devices have already been tested in a radiation enviroment. | | |
| 32 | Populated PCB visual inspection: item 17.2 | EUCL-MPIA-LI-7-005 (DPL) | Prezelus | On item 17.2 related to visual inspectioon, internal procedure of vH&S is indicated as applicable. Does this procedure comply with criteri of the relevant ECSS for visual examination ? If so, please indicate the relevant ECSS in the "justif column" in addition to the vH&S procedure. If not, please identify differences/discrepancies and submit them to LAM, | | The vH&S Electrical Assembly internal standard refer to and are compliant with<br>ECSS-Q-ST-70-08, ECSS-Q-ST-70-28, and ECSS-Q-ST-70-38. dc53 DPL updated. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | CNES and ESA for disposition. This a key driver for the MIP activities. | | | | |
| 33 | KIP/MIPs | EUCL-MPIA-PL-7-002 (AIV plan) | Prezelus | On page 7 figure 1, some KIPs have been defined during the AIV flow of the NISP CU; however, no MIPs has been identified. What is the status of discussion between MPIA and LAM about MIP definition for the NISP CU ? Is it agreed that CNES will be providing the relevant manpower to support the defined MIPs ? Please adivse. | MIPs of CU to be defined between MPIA and LAM. CNES to confirm that MIPs will provide support for such activity. | Discussion to be held with MPIA/LAM over which KIPs should be MIPs<br><br>Document to be updated when agreement is made | see above; CNES will provide manpower | |
| 34 | Outgassing requirement values: CVCM and RML | EUCL-MPIA-OTH-7-002 (verification matrix) | Prezelus | On page 15, there are no requirement values defined for CVCM and RML so what will be the pass/fail criteri for the NISP-CU ? | | Values for CVCM and RM defined in requirement spec EUCL-LAM-RS-7-007. Howver<br>table in RQ document is truncated and RML values not visible - to be corrected<br>by LAM. See RID 124<br><br>RQ text in verification matrix is supplied for info/help only | | |
| 35 | Venting analysis | None | Prezelus | In which document such analysis can be found-out ? | | No cavities in design except for ends of blind threaded holes. These will be<br>identified and additional venting ducts provided.<br><br>No specific analysis will be performed, list of blind holes and vents will be<br>provided in design definition document in the next release.<br><br>Document to be updated<br>dc12,EUCL-MPIA-RP-7-003,Design Definition File and Trade-Off,nicu-ddf | update doc | ***AI19*** |
| 36 | CORR and SCC data | EUCL-MPIA-LI-7-004 | Ducret | The CORR and SCC data are missing in the DML. | To add the missing information | CORR and SCC data has been added as per ECSS-Q-70-71A and ECSS-Q-ST-70-36C.<br><br>Document updated:<br>dc28,EUCL-MPIA-LI-7-004,Declared Materials List,nicu-dml | update doc | ***AI20*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 37 | Outgassing data | EUCL-MPIA-LI-7-004 | Ducret | For materials not listed in the agencies database, indicate the date of the outgassing measurements reports in order to check that the measurements are within the last 10 years.<br>If the component is referenced in the ECSS-Q-70-71 (18 June 2004) or CNES database or ESA dartabase, we consider that the outgassing data have less than 10 years.<br>Concerning the EEE components, we consider the outgassing data less than 10 years if the ESCC qualification extension has less than 10 years. | To indicate the dates of the outgassing measurements reports when necessary. | Most data sourced from ESA database. This is oftern old - PDR board needs to<br>confirm data is still acceptable (ie considered less than 10 years old).<br><br>Not access to CNES database available to vHS.<br><br>EUCL-MPIA-LI-7-004 will be updated as necessary. | Check CNES database, get access from Gilles; Thierry/Gilles to ask if data in ESA/CNES database is always valid. | ***AI21, AI22*** |
| 38 | Galvanic compatibitlity | EUCL-MPIA-LI-7-004 | Ducret | Further to the IPDR RID, a galvanic compatibility matrix has to be included in the DML | To add the matrix in the annex of the DML. | Galvanic compatibility added to dc28,EUCL-MPIA-LI-7-004,Declared Materials List,nicu-dml | update doc | ***AI23*** |
| 39 | Declared Process list | EUCL-MPIA-LI-7-007 | Ducret | The adhesive process 1.1VHS does not allow to clearly identify the various gluing types: the sealing of the LEDs, potting between LEDS and bushings, ... ?<br>Especially as 6.6vhs and 15.2vhs items are not in the DML.<br>Are all the gluing process qualified in the temperature range of NISP? | 1. To update the DPL separating the various types of gluings.<br>2. To check if they are qualified at cryo temperature | The hermetic sealing of the LEDs isdone by laser welding.<br><br>Potting of the LEDs is now exclusively 1.1.VHS in the DPL, using the 10.3.vHS glue (DML).<br><br>The 10.2.vHS 2216 glue is used for securing screws but is currently not part of the baseline (sprung washers will be used for securing).<br>6.6.vHS fixed typo to 6.1.vHS.<br>15.2.vHS was after 17.1.vHS, also fixed.<br><br>dc53,EUCL-MPIA-LI-7-005,Declared Processes List ,nicu-dpl updated<br><br>Glue qualification:<br><br>10.2.vHS is with extensive space heritage (ECSS-Q-70-71) and is certified to -253C (3M Scotch-Weld 2216 Technical Datasheet).<br><br>10.3.vHS is newer but is also certified down to 4K (EP21TCHT-1 Technical Data Sheet). | Update DPL w.r.t. gluing processes | ***AI24*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 40 | RFW | EUCL-MPIA-LI-7-002 | Ducret | Formal RID:<br>RFD instead of RFW have to be submitted for the harness and for the Sectralon. The RFW is used when we have a NC. The RFD anticipate the non- conformities of the models we have to make. | To take into account in the next update of the document. | Agreed. | | |
| 41 | Contamination CoC | EUCL-MPIA-PL-7-007 | Ducret | Indicate that a CC indicating the measured MOC and PAC will be supply to LAM at the delivery. | To update the C&CC Plan | Cleanliness requirement for NICU is only visually clean.<br>CoC will confirm that the unit conforms to this requirement only.<br><br>Clarification made in EUCL-MPIA-PL-7-007 | see above | ***AI11*** |
| 42 | MOC and PAC monitoring | EUCL-MPIA-PL-7-007 | Ducret | The C&CC Plan shall provide the logic, the approach and the monitoring techniques that will be implemented to verify the MOC and PAC depositions and check that they are in accordance with the planned ones. | To update the C&CC Plan | NICU cleanliness requirement is "visually clean", that is PAC 300ppm (mm^2/m^2). ECSS-Q-ST-70-01C states that we can see contaminations of 300ppm with the naked eye.<br><br>Clarification added to EUCL-MPIA-PL-7-007 | see above | ***AI13*** |
| 43 | HR and T | EUCL-MPIA-PL-7-007 | Ducret | HR and T monitoring in the cleanrooms? Not described in the CCCP. | To update the C&CC Plan | Added to EUCL-MPIA-PL-7-007 | updated doc | ***AI14*** |
| 44 | trade off for led component selection | general | GQ/CNES | A document describing the techical trade off for the selection of the various manufacturers and LEds available on the market is lacking. What's about the rationals (constructional analyses, evaluation tests data under cryogenic temperature , radiation hardness, etc) that allowed the selection of these LEDs demanded for the application and the packaging options retained in terms of supply chain? | | Manufacturer survey performed during an initial study two years ago.<br><br>Suppliers of LED's at required wavelengths very limited. Only one manufacturer with suitable wavelengths between 950nm and 1600nm and for wavelengths greater<br>than 1600nm only one manufacturer at all.<br><br>Trade off of possible packages performed in the dc12,EUCL-MPIA-RP-7-003,Design Definition File and Trade-Off,nicu-ddf | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 45 | reliability requiremnts at LEDS level | EUCL-MPIA-TN-7-001 | GQ/CNES | What are the technical manufcaturer heritage in particular for low remperature storage (cryogenic conditions) which allow to demonstrate the suitability of the parts for a reliability requirement of 0.999? | | No reliability data available from the manufacturers of LEDs espesically at low temperature. These are COTs devices<br><br>As the document states - the calculation is based on MIL-HDBK-217F and thus contains the limitations of the reference.<br><br>The NICU does not have a reliability value requirement to meet. | TBD PCB; Anne & Knud to finally agree on number of channels needed; system to decide on realistic number; details to be discussed at PCB, test to be defined | ***AI25*** |
| 46 | industry supply chain | general | GQ/CNES | The number of subcontractotrs involved in the follow-up of the procurement an qualification activities is very wide. Are in this sense clear the responsabilities matters for each one? What are the cautions taken in terms of dispatching, handling and delivery? What is the heritage of the assembler in the field of qualification of the packaging of optoelectronic parts for such high costraints applicatiion? A visit of the supply chain may be suitable to this purpose. | | Disagree. The number of subcontractors is small - one for the welding (and the following verification) and then all other tests done by one contractor.<br><br>Both contractors hace experience in their fields of high rel, aerospace, defence and optoelectronics. | | |
| 47 | procurement requirement for LEDs | EUCL-MPIA-RS-7-003 and EUCL-MPIA-RS-7-002 | GQ/CNES | In what way is fulfilled the requirement of batch unicity purpose? What input controls are sheduled to verify the compliance of the parts? | | Assured by supplier it is provided from single Wafer Batch.<br><br>All devices will be tested electrically/optically at room temperature to<br>remove statisical outliers as well as a complete knowledge of procure device<br>characteristics.<br><br>All evaluation tests are prerformed on a random sample of 10 (as defined by ECSS) from a population of about 100 procured. | | |
| 48 | leds integration on board qualification | EUCL-MPIA-PL-7-011 | GQ/CNES | The plan does not describe any additional validation of the process demanded for the qualification of the integration on board of optoelectronic parts, that may be exposed to a | | Solderability tests is performed during evaluation.<br>Parts are inspected at various stages of the AIV process to detect/prevent damage. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | potential damage. What are the philosophy to avoid this issue? | | | | |
| 49 | leds qualification | EUCL-MPIA-PL-7-011 | GQ/CNES | please refer to the comments transmitted to vH&S after the meeting in may 23rd and annexed separetely | | To be discussed at next PCB meeting | PCB meeting | ***AI15*** |
| 50 | Epitex Leds assessment | EUCL-MPIA-TN-7-002 | GQ/CNES | No test was performed on a capped representative version . May the assessment, done after the tests sequence, be considered complete because of this lack of represenativity? An additional technical analysis for the encapsulation relmais to be performed to assess its suitability through design, thermal simulation and tests. | | It is not clear what the issue the reviewer is raising.<br><br>Stem (with LED attached) and cap supplied by EPITEX (ie exactly the same as<br>purchasing a capped part) but only the final welding performed by the<br>subcontractor in Germany where the welding process can be controlled and verified at the point of welding.<br><br>Welding process will be validated on empty packages (supplied by EPITEX) prior to final run on the actual devices.<br><br>All parts subjected to gross and fine leak tests | | |
| 51 | Epitex Leds radiation assessment | EUCL-MPIA-TN-7-002 | GQ/CNES | the reference at 970 nm looks sensitive (-40% of optical emission degradation) to proton radiation at 3*E10 p/cm² during tests at room temperature. What is the expected degradation in mission temperature representative conditions (i.e. 125K)? | | To be discussed at next PCB meeting. | PCB meeting | ***AI15*** |
| 52 | LMSNT Leds visual assessment | EUCL-MPIA-TN-7-002 | GQ/CNES | The attach of the die on the stem looks immediately out of the state of the art existing for space (see ESCC 2049000), because of the presence of the welding not under the whole surface of the die (at least 75 % of the perimeter surface has to be covered), but just under a specific | | This issue was already stated as problematic by vhs in section 5.4.<br>As stated this has been resolved by the manufacture and this has been<br>observed in the new soldered samples. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | edge. What are the strenght of such die attach (die shear results?)? Is this acceptable in terms of heat power dissipation as well? | | | | |
| 53 | Leds assessment | EUCL-MPIA-TN-7-002 | GQ/CNES | Any low temperature storage to evaluate fatigue effects during time at cryogenic temperature has been included in the test sequence. Why? | | To be discussed at the next PCB meeting | PCB meeting | ***AI15*** |
| 54 | "it should be stated that the handbook (MIL-HDBK-217, Release F) itself both old and also conservative and does not reflect the development of technology in the last 20 years"<br><br>"Thus this is a worse case value." | EUCL-MPIA-TN-7-001 PDF page 4 & 12 | PEF/CNES | Regarding operational environment, can you demonstrate the "conservative" aspect ?<br><br>This sentense seemes hard to demonstrate. | | Assume reviewer means page 5 and 11.<br><br>Page 5 the document states:<br><br>"The launch duration is a conservative estimate". The referred to estimate in Figure 1 states a launch duration of 12 hours - I have no knowledge of any rocket burn of such duration and thus this value can be considered as conservative rather than assuming a value of, say, 30 mins.<br><br>Page 11:<br>The handbook with which the reliability calculations was published in 1991. It is reasonable to assume the process and materials have improved since that time and with it the base reliability values - the 1991 values used in the calculation can be considered as conservative<br><br>The reliability value for the LED was assumed to be a COTs device (without screening) whereas we are intending to perform significant testing on our devices - surely the whole excerise of evaluation/screening is to improve the reliability from that of the a basic COTs device and in this way the used value is conservative compared to the reality,<br><br>It is acknowledge that the handbook reliabilty values are significantly based on acceleration factors derived from the Arrenhius equation which may/may not be applicable to the cryogenic enviroment of the NICU but it is what is available. The alternative, direct measument of reliability in a such an enviroment for the life time durations intended, is far beyond the scope of the defined work of vHS. | see above: storage/reliability crit | ***AI25*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 55 | Led Reliability | EUCL-MPIA-TN-7-001 PDF page 10 | PEF/ CNES | "The LED is a COTS […] Thus this is a worse case value."<br><br>Reliability equal to 1 doesn't seems to be "a worst case value"..... | | By following the calculation and method based om the MIL handbook, an extreme<br>enviroment for a short period will still give the reliability of the device to<br>a value very close to 1.<br><br>In the table provided the reliability values were provided to a large number of places - 9 decimal places. However when considered with redundancy, even this number of decimal places, the value rounds up to 1.<br><br>The screening level of the LED was taken as worse case (ie none) where as we will actually be performing a signficant amount of testing of the devices. | see above | ***AI25*** |
| 56 | NI-CU Reliability | EUCL-MPIA-TN-7-001 PDF page 12 | PEF/ CNES | R= 0.9999984 For entire NI-CU ? This value is supposed to be conservative ? | | Please see RIDS 55 abd 54.<br>It is not surprising as the calculation is based on MIL-HNDBK-217F, there are very few components in the NICU and spends almost half its life at cryogenic temp which for the HNDBK signifcantly reduces aging effects, | see above | ***AI25*** |
| 57 | NI-CU-I-021 / NI-CU-I-022 / NI-CU-I-023 / NI-CU-I-024 / NI-CU-I-025 / NI-CU-I-030 / NI-CU-I-721 / NI-CU-I-726 | EUCL-MPIA-OTH-7-001_NI-CU PDF page 20 | PEF/ CNES | "A at subsystem level" -> in which document ? Analysis ? | | NI-CU-I-022 does not exist<br>NI-CU-I-021 / NI-CU-I-023 / NI-CU-I-024 / NI-CU-I-025 / NI-CU-I-030 / NI-CU-I-721 / NI-CU-I-726<br>For me these are validated by Inspection and not analysis but were<br>not provided by an inspection code for the verification matrix. | check/update FMEA | ***AI26*** |
| 58 | "Unwanted background illumination seen by NI-DS during nominal operation" | EUCL-MPIA-QR-7-002 PDF page 14 | PEF/ CNES | The failure effect number 5 : "Unwanted background illumination seen by NI-DS during nominal operation" presented as Severity 1.<br><br>Could you explain why (regarding ECSS def) | | Severity level 1: dependanibilty effect - failure propagates to interfacing unit in this case the NU-DU - the detectors, causing artifacts in the measured scientific data, | system level action | ***AI27*** |
| 59 | FMEA critical item list | EUCL-MPIA-QR-7-002 PDF page 14 | PEF/ CNES | Why items appears several times on FMEA critical item list ? | | Many items in the CIL list appear to be similar but differ either in failure mode or in the part they are related to.<br><br>Failure modes can also be very similar to each other but are in fact different.<br><br>Keep an eye on the first 3 columns to identify the differences. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 | Cross ref between FMEA and CIL | EUCL-MPIA-LI-7-001 PDF page 6 | PEF/ CNES | Item #4 seems to be the FMEA CIL item #1. Can you confirm ? Could you add a better traceability between the two analysis ? | | Yes, item 1 in the list provided in text on page 16 in FMEA doc Doc ref (RD4) relates to the FMEA and the cause item relates to the critical items identified in section 7.3 of the FMEA. However, in order, not to make the CIL to unwieldy, table 5 is summarised in the text on page 16, which is then used in the CIL.<br><br>Cross referencing will be improved between EUCL-MPIA-LI-7-001 and EUCL-MPIA-QR-7-002 | update doc | ***AI28*** |
| 61 | LEDs-rings assembly | EUCL-MPIA-LI-7-004 (DML) | DV/C NES | The LEDs (Kovar) are potted in the aluminum rings using epoxy. There is a risk of failure at cryogenic temperature: misalignment, cracking and degradation of thermal dissipation, damages of the LEDs or the electrical connections. What are the past experiences at cryogenic temperature for this type of potting?<br>If no background, the process has to be qulified in conformance with the NISP qualification plan. | | Misalignment will be checked during aiv and is anyway non critical as the<br>illumination cone from the led is much larger than what is acceepted from the<br>tube and reflector patch. See RID#39 for all other glue qualification details. | propose eval test (glue, put in LN2, check cracks & insulation) | ***AI29*** |
| 62 | References of the past cryogenic application | EUCL-MPIA-LI-7-004 (DML) | DV/C NES | In the "Justification for approval" column, there are standard references (ECSS, NASA) but no reference to past space projects. For the majority, the materials are known for space application but what about the cryogenic ones (glue, coatins, etc…)? | | Data added to DML. See RID#29 | provide updated doc | ***AI16*** |
| 63 | PCB references | EUCL-MPIA-LI-7-004 (DML) | DV/C NES | There are 2 references for the PCBs. Why? | | 15.1.vHS is the current baseline, if for some reason we are not able to use this we will switch to 15.2.vHS which is the back up. This has been noted in the document. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 64 | Outgassing data | EUCL-MPIA-LI-7-004 (DML) | DV/CNES | The outgassing data of the 11.1, 19.4 and 19.5 are not within the specifications. | | 11.1 is 3m Kapton tape with long space heritage in electronics. It would be used in very small quantities to provide isolation on suitable surfaces (ie flat ones where a suitable amount of adhesion is obtained). It is somewhat water absorbant (1.3% at 50%RH) causing it to be out of specification. The majority of wire isolation is provided by heat-shrink tubes as well as physical seperation by design.<br><br>19.4 and 19.5 are Sil-pad thermal conductor to be used at the front of each LED in a small ring. Only one will be used per LED. Again this is in very small quatities and only just out of spec (0.11% CVCM instead of 0.1%). There are some other options however they also are not within spec. If necessary a bake-out (10m at 145C) can be used to bring them within spec (NASA GSC15112)<br><br>dc28,EUCL-MPIA-LI-7-004,Declared Materials List,nicu-dml updated | prepare RFD | ***AI30*** |
| 65 | Spectralon | EUCL-MPIA-LI-7-004 (DML) | DV/CNES | The Spectralon is not in the CNES database. The suppplied one is not space grade. Need for specific validation? | | Space grade spectralon comes at an immense expense, $75000 (documentation included) rather than $200 per part. This is due to the entire facility needing to be cleaned and documentation for the process provided. We are happy to use space grade spectralon if the funding is provided.<br><br>The manufacturer has told us the normal spectralon is the same material and manufacturing process as space grade and has the same reflectance properties. By performing a bake-out of the spectralon at vH&S according to the manufacturers specifications we can confirm the cleanliness and outgassing properties are within requirements. No doc updated. | get heritage info / check datasheets on cryo / check VIS | ***AI31*** |
| 66 | DML formal remarks | EUCL-MPIA-LI-7-004 (DML) | DV/CNES | Formal remarks: materials 17.1 19.3 seem to be the same. The coatings (gold and nickel) are identified as adhesive (10), and not as metallic materials (8). | | Editorial error, some old materials were left in. The gold coatings have been changed from material type 10 (adhesive/coatings) to 8 (miscellaneous metallic). dc28,EUCL-MPIA-LI-7-004,Declared Materials List,nicu-dml updated. | update doc | ***AI32*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 67 | SnPb brazing | | DV/CNES | SnPb brazing at 120K. Qualified? | | No mention of "SnPb brazing at 120K" in DPL or DML, either clarify with document reference or refer to RID#27 for soldering of harness to LED (via adaptor PCB) | update doc, compare heritage with no. of cycles required in NISP PA plan | ***AI33*** |
| 68 | DPL lack of information | EUCL-MPIA-LI-7-006 (DPL) | DV/CNES | The DPL does not allow to know what parts are glued and what parts are screwed (1 single procedure for all gluings). There isn't an assembly process associated with the Spectralon. Is it glued to the aluminum compoent? Which glue? | | First line corrected (refer to RID 39)<br>Spectralon not glued. The exact mechanical attachment needs to be decided and added into the design definition. | update DDF, assess thermal stress / misalignment. If necessary, define validation strategy | ***AI34*** |
| 69 | Valve | DMPL | DV/CNES | A valve is identified in the DMPL. No information fount on the materials taht compose it and on its assembly. | | The valve is a rectus-20KA-AM05-RVX, made from stainless steel 1.4305, 1.4310 and 1.4401 as well as fluoroelastomer for the internal seal and external seals. According to the manufacturer the fluoroelastomer is not safe to have below even -40C, and would not survive thermal cycling. It is not logical to remove the valve before flight as we need it for purging during qualification (eg vibration tests) and it would affect the results. We are in the process of seeing if it possible to produce the part with teflon seals which would be safe to use at cryogenic temperatures but with a small loss in sealing pressure (this is of no concern to us as there is never a large pressure differential). This part has been chosen for its small size and space heritage (Rosetta Cosima). | tradeoff on valve material TBD; provide updated information | ***Ai35*** |
| 70 | Thermal cycles for qualification | Qualification plan | DV/CNES | For the EQM, 8 thermal cycles are planned. How many cycles the FM models undergo? What's the margin? | | 4 cycles intended which is compliant to NI-CU-I-629 | (FM sees 12, but quali on comp level done with more), monitor which processes could be critical enough, design to be monitored for potential critical changes needing more validation | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 71 | 2216 glue | EUCL-MPIA-LI-7-004 (DML) | DV/CNES | For which materials the 2216 glue will be used? What are the past experiences with this glue at cryogenic temperature? Need of qualification? | | The 2216 glue is a back up material if required only for screw locking. Current baseline is not to use any glue on screws, instead to use sprung washers for screw locking (add to doc somewhere?). Scotchweld 2216 has "extensive" space heritage (ECSS-Q-70-71) however typical temperature range is to -50C.<br><br>However the Scotchweld data sheet rates it down to -253C http://multimedia.3m.com/mws/mediawebserver?6666660Zjcf6lVs6EVs666GGfCOrrrrQ-<br><br>See rid#41 for cryogenic qualification. | | |
| 72 | NISP configuration control plan Implementation | EUCL-MPIA-PL-7-005 | A. COMMEAU | NISP Configuration Control Plan is not identified as Applicable document. Has the document been taken into account for writing this plan? | Check your configuration process according to NISP configuration control Plan and, if necessary, adapt your process. | Configuration control tools taken from previous project before details of NISP config control plan was released. The NICU items needs to be check for compliance/deviation. | Update Config Control Plan to agree with instrument CCP, align CIDL and CIL content | ***AI36*** |
| 73 | Configured Item list should be products (physical parts) | EUCL-MPIA-LI-7-007 | A. COMMEAU | In paragraph 4, Configured item should be products and not documents and have to be uniquely identified as physical parts. | | Agree. Will update when Configuration control plan is checked for conformity | Update Config Control Plan to agree with instrument CCP, align CIDL and CIL content | ***AI36*** |
| 74 | under-configuration documents into NI-CU CIDL should be identified per model | EUCL-MPIA-LI-7-007 | A. COMMEAU | In the document datapack to deliver when equipement is delivered should be the CIDL, then this apply to only one model. | Model concerned for each document should then be either added to the document table or a CIDL per model should be issued. | Not necessarily - our product tree is constructed hierarchically - currently all documents are applicable to all models (ie generall NICU design). When specific documents are generated for specific models then there will be attached to the appropiate product - eg STM design model/drawings will have the product NI-CU-STM.<br><br>An ss-built configured Data Item list will be provided with each model. The CIDL is the record of the current (overall) design status (ie for product NI-CU) | Update Config Control Plan to agree with instrument CCP, align CIDL and CIL content | ***AI36*** |
| 101 | Delivery dates in Q3/2013 | EUCL-MPIA-PL-7-001 | TH/MPIA | Development plan contains delivery dates in Q3/2013. Still valid? (section 4) | | Schedule updating in parallel to PDR preparation and LED qualification negotiations was difficult, and not all changes made it into the DevPlan, I fear. We'll need to continuously update anyway. The delivered schedule basically demonstrates that we have sufficient margin for all tasks. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 102 | Definition of "up-screened" | EUCL-MPIA-PL-7-001 | TH/MPIA | Please define up-screened (section 4) | | Up-screening is the process of performing additional testing on flight components (in this case to electronic components) to raise the parts level<br>from their procured reliability level (eg commercial) to a higher reliability level eg ECSS Class 1.<br><br>Usually the reliability levels and tests are defined by standards (eg ESCC/ECSS or MIL-STD) but these are based on normal space conditions.<br><br>In this case the exact tests required are subject to extensive discussion.... | | |
| 103 | Significance of thermal model | EUCL-MPIA-PL-7-001 | TH/MPIA | I don't understand the value of a thermal model which does not contain any of the components which generate and dissipate heat (section 4.1) | | It allows e.g. cooldown analysis of the instrument. For this heat conductivity / capacity must be in the NI-CU thermal model. The LEDs itself do<br>not need to be included as heat sources (confirmed by system thermal architect)<br>as the dissipation is negligible or can be simulated by applying heat load at<br>the interface. | | |
| 104 | Correct LEDs for NI-CUS | EUCL-MPIA-PL-7-001 | TH/MPIA | "… If procured lots are not available at the appropriate time for the NI-CUS manufacture, spare Epitex devices held by vH&S will be used…" Shouldn't you use Russian devices for the long wavelength?(section 4.2) | | The Russian ones are fortunately less problematic. In any case, also for<br>these there is old stock at MPIA and vH&S available.<br><br>Text in doucment changed to include both types of LEDs | | |
| 105 | Different electrical LED characteristics | EUCL-MPIA-PL-7-001 | TH/MPIA | presumably the (visible) redundant LEDs have different electrical characteristics (section 4.2) | | Yes, visible LED's meant to provide a quick and dirty possibility to check if current arrives at all without the need of any instruments. | | |
| 106 | N2 flow box explanation | EUCL-MPIA-PL-7-001 | TH/MPIA | Presumably this is an $N_2$ flow box which allows continuous, mild overpressure? (section 6.1) | | This is a transport container not a flow box. Depending on final selection of container, it will be designed so that it may be purged with dry clean nitrogen after closure to a slight over pressure. Once purging complete the container vent is closed and nitrogen supply is removed from the one-way valve. | | |
| 107 | Clarify purpose of NI-CUS | EUCL-MPIA-PL-7-001 | TH/MPIA | I don't see how the NI-CUS fits in here. Are you putting the 130x60x70 mm box on the X-Y table? It doesn't have any reflecting patch, baffles, or qualified LEDs (?) (section 7.2) | | The NI-CUS is a specified deliverable to the customer.<br><br>It will be used by the ICU team as an electrically similar load during the ICU electronics development.<br><br>NI-CUS is not required as part of thw NI-CU development either internally or<br>externall of vHS. It will also not be used for any optical simulations | related to figure; Tom to ask if more need for clarification | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | or measurements. | | |
| 108 | Irradiance measurement method | EUCL-MPIA-PL-7-001 | TH/MPIA | How do you measure absolute irradiance? (section 7.2) | | Absolute irradiance measurement will be difficult.<br><br>Currently we are investogating of providing the NICUT with a calibration<br>from a NIR light source.<br><br>Otherwise the gain of the system will need to be derived. | Update AIV(?) plan end of September | ***AI37*** |
| 109 | Long wavelength IR measurement method | EUCL-MPIA-PL-7-001 | TH/MPIA | How do you measure at 2 µm using an ambient temperature lab setup? Is the photomultiplier tube sensitive at these wavelengths? What does “darkroom” mean at 2 µm? (section 7.2) | | The NI-CUT Photodiode Sensorhead is contains an InGaAs sensitive at 2um.<br>During the tests the NI-CU should be at constant temperature to avoid<br>a changing thermal IR background.<br>At 2um and highest NI-CU required intensity of 2e11 photons/s/m^2<br>the calculated IR power arriving at the photdiode using the collecting lens is<br>3e-10W.<br><br>Integral thermal background absorbed by the photodiode due to NI-CU thermal emission in the band of 1um to 2um is in the order of<br><br>4e-11 W at 300K<br>3e-12 W at 273K<br><br>Using the lock-in system and a Peltier-cooled InGaAs it should be possible<br>to operate the GSE at 2um. Background variation at roomtemperature is<br>sufficiently low in the order of 3e-12W/K. | | |
| 110 | Local manager position | EUCL-MPIA-PL-7-003 | TH/MPIA | Is the local manager (Hormuth) on a long-term position? If not, is there a mechanism for replacement should he depart? The mission will last at least a decade. (MPIA section 5.2) | | The local manager contract at MPIA runs until end of 2015. Clarification of future<br>contract needs to be addressed. | Add remark to panel report! | ***AI38*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 111 | Jahnke/Wachter management tasks | EUCL-MPIA-PL-7-003 | TH/MPIA | No section on management roles of others (Jahnke, Wachter?) (MPIA section 5.2) | | Knud Jahnke is primarily Instrument Scientist towards the consortium and<br>contact towards DLR/industry in funding matters. He can act as substitute for<br>MPIA Local NICU Manager (FH) in case of absence/illness etc. Stefanie Wachter does not have a managing role in relation to hardware development. | | |
| 112 | Reporting of vH&S | EUCL-MPIA-PL-7-003 | TH/MPIA | to whom does vH&S report expenses and hours? MPIA or PO? (vH&S section 7) | | vH&S reports directly to MPIA | | |
| 113 | Define SME | EUCL-MPIA-PL-7-003 | TH/MPIA | I couldn't find what "SME" means in the acronym list. (section 12) | | "Small and Medium Enterprise" (German: "Mittelstand")<br>Item added to standard acronymns list. | add SME to acronyms list | ***AI39*** |
| 114 | Early LED order | EUCL-MPIA-SCH-7-001 | TH/MPIA | LED order place on 17 June 2014? Isn't this well before PDR? (section 3) | | See similar comment on development plan (RID101): hard to keep schedule in sync with developments on the qualification front. We had the first meeting with ESA/CNES about LED procurement before that date, therefore there was some hope to order before PDR to minimise schedule risk at acceptable financial risk if LEDs fail. | | |
| 115 | Wording | EUCL-MPIA-PL-7-004 | TH/MPIA | "Approbation" This is what the Americans call a "two-dollar word." The word "approval" is in much more common use (but perhaps not within ESA?) (MPIA section 4.6) | | Relates to section of document not provided by MPIA and not vHS. Please see RID116.<br>General agreement that this word is horrible and will be removed in next version. | | ***AI40*** |
| 116 | Document numbering | EUCL-MPIA-PL-7-004 | TH/MPIA | Another remark – this document and the previous one have sections from MPIA and from vH&S with identical numbering (i.e. there are two Section 1's, two Section 2's etc. This is confusing. (MPIA section) | | Also relates to RID115<br>I understand that the version we provided is not the reviewed document even though reference is the same - I propose to switch the vHS document back to<br>a vHS number to avoid further confusion. This applies to documents that are<br>combined MPIA/vHS submissions. | | |
| 117 | Document title case | EUCL-MPIA-PL-7-004 | TH/MPIA | vH&S seem to use lower case for document names, while MPIA uses upper case. Most modern computer operating systems differentiate on this. (vH&S section 3.1) | | See RID117 | | |
| 118 | Define system level | EUCL-MPIA-PL-7-005 | TH/MPIA | I don't understand this paragraph. What does "on system level" mean? (section 3) | | At instrument level / on project office level | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 119 | No spare harness in product tree | EUCL-MPIA-PT-7-001 | TH/MPIA | This document and EUCL-MPIA-PL-7-001 seem to show that no spare harness is part of the deliverables. Is this true? Is this wise? (section 3) | | The NI-CU harness is a pig-tail harness and thus is an integral component<br>of the NI-CU flight unit and as well as the flight spare unit.<br>The NI-CU flight spare unit thus fulfills the spare function for the harness.<br><br>The harness is physically attached to the unit HW and cannot be replaced without dissassembly, reassembly and requalification. | make doc more clear | |
| 120 | Source of diagnostic informaton | EUCL-LAM-RS-7-007 | TH/MPIA | F-005 Diagnostic information – where does this come from in NI-CU? Similar remark for P-014. I do not recall from the presentations in Heidelberg that there was on-board logic for fault testing. | | Diagnostic information comes from the ICU which has requirements to measure voltage & current, react to values outside defined limits, and report via telemetry. | | |
| 121 | Stability requirement | EUCL-LAM-RS-7-007 | TH/MPIA | P-016 – 1200 seconds is 1/3 of an hour, or 1/2400$^{th}$ of the mission life (P-011). What drives this choice? It sounds rather long. Same remark for P-017. | | To be answered at NISP instrument level. | Clarify reasoning behind 1200s length | ***AI41*** |
| 122 | Photons in off-state | EUCL-LAM-RS-7-007 | TH/MPIA | P-018 – I do not understand Note2 | | The note implies that voltage induced in the harness by electromagnetic field in the instrument should not be high enough to let the LEDs emit photons. This is<br>something that needs to be taken care of on ICU side by low-ohmic off-state and<br>or sufficient analysis/test to demonstrate that instantanious voltages<br>across the LED terminals is not greater than 0.41V (voltage need to generate<br>photon of the specified wavelengths).<br><br>vHS believes that most of the variables for analysis and test lie at a higher level and vHS is not in the best position to perform this work. | Add to req.: not applicable while wheels are moving; possibly investigate<br>crosstalk in NICU harness between channels; ACTION ON SYSTEM LEVEL | ***AI4*** |
| 123 | Definition NI-OMA | EUCL-LAM-RS-7-007 | TH/MPIA | I-040 – I don't find a definition for NI-OMA | | "Opto-Mechanical Assembly". The instrument without ICU and readout<br>electronics. | | |
| 124 | Cut-off table | EUCL-LAM-RS-7-007 | TH/MPIA | I-587 – This table is cut off in my document | | To be corrected at instrument level | ACTION ON ERIC | ***AI42*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 125 | CoG on which level? | EUCL-LAM-RS-7-007 | TH/MPIA | I-117 – You have to specify the center of gravity of each component? Not just of the assembled system? | | Discussion required at PDR coloc about:<br>- What CoM do we provide (with/without pigtail harness)<br>- Method/stage of verification (difficult with harness attached)<br><br>The requirement NI-CU-I-119: CoG location between models specifies a tolerance diameter of 2cm. vHS beleives that it is thus possible to verifiy the unit's<br>CoG with the harness in a known configuration (stretched out or coiled) and<br>compare with mechanical model with harness in similar condition.<br><br>Direct comparison of STM with other HW models will not be possible as the STM<br>is supplied without harness. | open for waivers if model is good anough; also MoI; update verif matrix | ***AI43*** |
| 126 | CoG measurement method | EUCL-LAM-RS-7-007 | TH/MPIA | I-118 – How will you measure the CoG? | | To be discussed at COLOC.<br>The unit has a pigtail harness. As the tolerences of the CoG knowledge is not so fine (2cm), the measurement of CoG will be made with the harness secured in a known configuration eg straight out on mounting plane or coiled around unit.<br><br>Kniwledge of harness length is needed as is yet to be specified by customer. | open for waivers if model is good anough; also MoI; update verif matrix | ***AI43*** |
| 127 | Safety factor | EUCL-LAM-RS-7-007 | TH/MPIA | I-101 – A safety factor of only 20%? | | This is applied to the qualficication loads which have their own margin above the operational loads.<br><br>NI-CU has no items covered by this RQ - the LED windows are not structural | | |
| 128 | Meaning of NDI | EUCL-LAM-RS-7-007 | TH/MPIA | I-102 – What is NDI? | | Assume “non destructive inspection”<br>Confirmation to be provided from instrument level. | acronym… | ***AI39*** |
| 129 | Verification of NIR reflectance | EUCL-LAM-RS-7-007 | TH/MPIA | I-923 – How will you verify the NIR reflectance? | | We assume manufacturer specification to be sufficient.<br><br>The paint PNC has been recommended by the customer as it is used (and assumed tested for compatibilty) for the rest of the instrument.<br><br>However information provided by the manufacturer says it does not<br>match this requirement although the discrepancy may<br>arise from different test methods.<br><br>Would prefer requirement to be changed to specify that PNC is to be used.<br><br>To be discussed at PDR COLOC | check/provide manufacturer info, especially cryo;<br>change req to PNC; if not qulified, then need to do so… | ***AI45*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 130 | M5 bolts used | EUCL-LAM-RS-7-007 | TH/MPIA | I-078 – M5 bolts for a 1 kg object? Wow. I think the breaking load of a single M5 bolt is over a tonne! | | IF defined by customer with M5 bolts.<br><br>From a practical standpoint dealing with M5 bolts with gloves on is<br>far better than trying to do it with M2 or less, espescially if you dont want<br>them to fall onto a crucial detector/mechanism. | | |
| 131 | Emissivity measurement | EUCL-LAM-RS-7-007 | TH/MPIA | I-198 – And how will you measure the emissivity? And what material has 2% reflectance (from I-923) and 88% emissivity? | | See RID129. This is the issue with the paint PNC recommended to us by LAM.<br>It should have the correct properties and qualification, but we're waiting for<br>confirmation. I insist that either the requirements is changed to values which<br>are definitely confirmed or that it just reads: "Shall be painted with PNC" | see 129 | ***AI45*** |
| 132 | ASAP expertise | EUCL-LAM-RS-7-007 | TH/MPIA | I-383 – Is there ASAP expertise within the consortium? The calculations presented at the kickoff used Zemax nonsequential ray-tracing. | | Requirement reads "or equivalent. NI-CU will not provide an ASAP model but<br>e.g. a geometrical model with surface properties, maybe in the form of a Zemax<br>model. For simulation of the NI-CU anyway Zemax is the best choice. | | |
| 133 | Fringing caused by LEDs? | EUCL-MPIA-RP-7-003 | TH/MPIA | General question: Will you verify that narrow band sources such as LED's do not cause fringing on the science detector? | | Therefore we have a minimum FWHM requirement of 50nm which should be safe.<br>Anyhow, infrared detectors are not prone to fringing compared to thinned CCDs. | | |
| 134 | Black paint flaking off? | EUCL-MPIA-RP-7-003 | TH/MPIA | Won't black paint flake off and contaminate the telescope? (section 3.2) | | Expected exterior coating is to be PNC as recommended by customer due its<br>use other parts of the instrument. It assumed that is has been qualified for<br>the cryogenic enviroment and will not flake off metal surfaces if correctly<br>applied with suitable process- | see 129 | ***AI45*** |
| 135 | Radiation test done? | EUCL-MPIA-RP-7-003 | TH/MPIA | Last paragraph: "assumed to have been radiation tested" ? (section 4.1.1) | | Wording changed to:<br>Coincidentally these devices have already been radiation tested by the customer\citeRD{nicu-led-intl-tsts}. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 136 | Why seal LEDs? | EUCL-MPIA-RP-7-003 | TH/MPIA | I asked this at the kickoff, but it deserves documentation…why use a hermetically sealed LED rather than bare die? Also, do the manufacturers specify vacuum operation (i.e. can the sealed unit sustain a 1-bar pressure difference long term)? (section 4.2.1) | | Hermetcially sealed packages are preferred for the space components due to the<br>protection of the semiconductor devices agains degradation due enviromental conditions such as humidity and protection from general handling.<br><br>Naked die are rarely used in space programs and only in special cases.<br><br>The hermetic packages/sealing will be tested by gross and fined leak tests defined by MIL-STD-750 TM1071 and applied to the majority of space level discrete semiconductor components.<br><br>The subcontractor will perform the sealing to satisfy this test and inherently this will imply suitablability to long term vacuum conditions. | | |
| 137 | Location of LEDs | EUCL-MPIA-RP-7-003 | TH/MPIA | Why can't you just locate the LEDs closer to the reflecting patch? (section 4.3) | | Physical limitation of accomodating 10 LED's in a symetrical<br>pattern around the reflector and close to its normal. | | |
| 138 | Ray-tracing of concentrators | EUCL-MPIA-RP-7-003 | TH/MPIA | Tube concentrator – have you ray-traced this? I suspect that a relatively short, highly reflective tube will act more like a lens than a long optical fiber. (section 4.3) | | Trade-off for length of tube has been performed with analysis using non-sequential raytracing in Zemax. The results are yet to be reported in<br>Trade-off/Design definition doc dc12 EUCL-MPIA-RP-7-003. Document is<br>currently being updated as normal work.<br><br>The review is correct in his statement. The critical aspect is that the tube<br>length needs to be greater than half the distance from the LED to the<br>reflector. | Add non-seq raytracing results reagrding LED illumination pattern and tube concentrators to DJF | ***AI46*** |
| 139 | Tube simulation | EUCL-MPIA-RP-7-003 | TH/MPIA | Why limit the calculation to one reflection on the tube? (section 4.3.2) | | Initial calculation - see RID138 | Add non-seq raytracing results reagrding LED illumination pattern and tube concentrators to DJF | ***AI46*** |
| 140 | Why assembled LEDs? | EUCL-MPIA-RP-7-003 | TH/MPIA | Again, you seem to be suffering under the constraints of a pre-packaged commercial device. Can't the manufacturer supply just the bare LED die with bond wires? (section 4.5.1-4.5.3) | | See RID 136 | | |
| 141 | Why pre-packaged LEDs? | EUCL-MPIA-RP-7-003 | TH/MPIA | Again, problems associated with pre-existing packaging. | | See RID 136 | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | (section 5.1) | | | | |
| 142 | LED illumination pattern | EUCL-MPIA-RP-7-003 | TH/MPIA | Third bullet – I am sceptical that an LED behind a flat window (and no further optics) has a qualitatively different near-field and far-field illumination pattern. (section 5.1.2) | | A far-field pattern basically assumes a point source. Alternatively it can be considered as the pattern take from at a distance which is signficantly larger to the source dimensions so that the difference in angular location to the measurement point from difference locations on the source is insignificant.<br><br>The LED is not a point source - it usually a slab of semiconductor 400um square and the light is emitted in directions not to far from the normal from all faces before being multiply reflected inside before reaching the window.<br><br>For dimesions of the order of 5mm, close field effects may occur and could be prominent when considering the reflector tube for instance.<br><br>For Zemax optical simulation (not reported in this document), a source has been used over a finte area of the window with a defined far-field distribution. This provided a representative model of the LED for both near and far field with out the overhead of modelling the detail of the LED. | Add non-seq raytracing results reagrding LED illumination pattern and tube concentrators to DJF | ***AI46*** |
| 143 | Tube illumination pattern | EUCL-MPIA-RP-7-003 | TH/MPIA | Last paragraph – Are you implying that a short, reflective tube will make the illumination pattern more uniform? (section 5.1.3) | | Section 5.1.3 deals with straylight and baffles. Cannot find text the reviewer is refering to. | solved with nonseq raytracing, see other RIDs | ***AI46*** |
| 144 | Missing harness info | EUCL-MPIA-RP-7-003 | TH/MPIA | Last paragraph – missing references for further info on the harness (section 5.3.1) | | Compilaton error of Latex source. Will be corrected in the next issue of document dc13,EUCL-MPIA-RP-7-002,Design Justification File,nicu-djf | | |
| 145 | Reason for high flux margin | EUCL-MPIA-RP-7-002 | TH/MPIA | Why was there so much discussion (and effort) dedicated to increasing the photon flux if the brightness is a factor 20 to 300 times higher than needed? (section 6.1) | | Calculations are preformed at maximum average current and including 50% derating. No consideration has been made for possible end of life state such as radiation damage, aging loss of effiicency etc<br><br>Ideally the LED should be operated at the lowest current possible to minimise<br>stabilising time and possible ageing.<br><br>Maintenace of a lareg margin will facilitate this as well as providing more managable measurements of all channel at room temperature during manufacture. | monitor, normal work | |
| 146 | LED QE at cryo | EUCL-MPIA-RP-7-002 | TH/MPIA | Page 8 third bullet – Has the quantum efficiency versus temperature | | Yes: Lab tests by FH/MPIA. Up to a factor of 2 is gained. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | behaviour of LED's been verified down to cryogenic conditions? (section 6.1) | | | | |
| 147 | Layout/content of ICD | EUCL-MPIA-ICD-7-001 | TH/MPIA | General remark – I was a little surprised at the informal nature of this ICD (especially the lack of tables and tolerances, etc.). Presumably ESA demands a more rigorous, structured document (which may actually already exist)? Also, the document contains NI-CU internal interfaces (e.g. figure 2), as well as external interfaces. | | No DRD have been supplied for this document and any other. It is expected the PDR process will identify any deficiences in the ICD.<br><br>The ICD is a reply to the published requirements which include IRD (interface requirements doc/drawing) and is maintained by vHS.<br><br>Figure 2 is actually an external interface so tha the developer of the ICU can ascertain which channel generates which wavelength. They will need this I guess<br>for definition of their telecommands/telemetry database. | | |
| 148 | Health diagnostics in ICD? | EUCL-MPIA-ICD-7-001 | TH/MPIA | Also, the requirements doc specifies that there should be health diagnostics (F-005). Shouldn't that be part of the interface? If you just supply LED sense lines, then the ICD should indicate that the ICPU (?) is responsible for this function. | | Health diagnostics are measured by the ICU.<br>However the document will be updated to include a section on how and what we expect the ICU to measure. | sync with ICU requirements | ***AI47*** |
| 149 | Responsibility for drive current | EUCL-MPIA-ICD-7-001 | TH/MPIA | A final general question…different LED's require different drive currents (and hence usually different inline resistors for current limiting). Will all of this be taken care of elsewhere (i.e. ICPU?). | | This is defined by NI-CU-I-XXX: Command signal definition - we assume matching<br>requirements are supplied to the ICU | sync with ICU requirements | ***AI47*** |
| 150 | Harness length | EUCL-MPIA-RP-7-001 | TH/MPIA | Section 3 - Mass budget – Although it is mentioned elsewhere (other documents) you might consider including uncertainty in the harness length here. | | NI-CU requires a definition of harness length from the instrument system. | | |
| 151 | PWM mode clarification | EUCL-MPIA-RP-7-001 | TH/MPIA | I was confused by what "low" and "high" mean here. For example, the "high PWM mode" in Section 5.3 lists 50% PWM, while the | | Document editorial error. Document will be updated with table as per review's suggestion. | Minor DDF changes: PWM mode, thermal section | ***AI48*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | same wording in Section 5.4 corresponds to 5% PWM. A table would help. (section 5.1-5.4) | | | | |
| 152 | Section 7 imcomplete | EUCL-MPIA-RP-7-001 | TH/MPIA | Section 7 imcomplete | | Will be defined after thermal analysis | Minor DDF changes: PWM mode, thermal section | ***AI48*** |
| 153 | Lifetime test cycle duration | EUCL-MPIA-TN-7-002 | TH/MPIA | Section 4.3.4 – I mentioned this at the kickoff, but it deserves documentation. Due to the long thermal settling time, the lifetime tests reported here do not drive the devices between the full range of conditions. | | Correct, from thermal simulation reported in EUCL-MPIA-RP-7-003 (DDF, dc12) Fig6/7, an on period of at least 30 seconds would be required plus a signficant longer cool town periods in off state - this would make the 'quick' initial test very long and impractical (with the current conditions it took 14 days).<br><br>The conditions/duration we selected are representative because<br><br>a) The greatest stress in the device occurs when there is the greatest difference in temperature between the stem and the die - this occurs when the die temperature has the greatest temp gradient which is during the first few seconds after power on (it rises in an exponential decay manner).<br><br>b) The current passing through the device is the maximum - normal operation will will use significantly less current and in herently the stress between die and<br>chip due to CTE mismatch will be less as the differences in temperature between the two will be less. | | |
| 154 | Why sealed LEDs? | EUCL-MPIA-TN-7-002 | TH/MPIA | Section 4.4 – Hermetical seals. Again, consider leaving the LED's unsealed and uncapped. | | See RID 136 | | |
| 155 | Missing values | EUCL-MPIA-TN-7-002 | TH/MPIA | Section 5.3.1 – first bullet – missing value. third bullet – something missing here | | Will be corrected in next issue | | |
| 156 | Lack of nitrogen?? | EUCL-MPIA-TN-7-002 | TH/MPIA | Section 5.3.2 – "Only 6 cycles was performed due to limitation on the amount of liquid nitrogen." You've got to be kidding. | | The reasoning was incorrect. Document updated. | | |
| 157 | Clarify figure | EUCL-MPIA-DOC-7-001 | TH/MPIA | Figure 1 – I realize that this is a schematic, but won't the NI-CU be tilted? | | Figure in document to be updated | | |
| 158 | Example status message | EUCL-MPIA-DOC-7-001 | TH/MPIA | page 10 - NICU-GSE-22 – An example status message would help. | | Document to be updated as reviewer suggests | | |
| 159 | Inconsistent LED numbering scheme | EUCL-MPIA-DOC-7-001 | TH/MPIA | NICU-GSE-24 – The LED numbering scheme here is inconsistent with that in the | | LED numbering to be made consistent to ICD | ICD: sync with ICU requirements: drive currents, diagnostics, | ***AI47*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | ICD and could lead to confusion. | | | housekeeping; correct LED numbering | |
| 160 | LED voltage vs. temperature | EUCL-MPIA-DOC-7-001 | TH/MPIA | Section 4.1.1 – “The forward voltage versus temperature coefficient is in the order of −2mV/K” Has this behavior (and the other material in this section) been verified at the operating temperature? (or will these LED’s always be warm?) | | LED's will be operated at cold temperature. Measurements of LED performance at<br>cold temperatures have been perfomred by vHS on LED samples in the preliminary study and also by MPIA. | | |
| 161 | Adding geometrically | EUCL-MPIA-DOC-7-001 | TH/MPIA | Section 4.2.5 – last paragraph - What does “add geometrically” mean? Do you mean in quadrature? | | Document text to be corrected. | Minor changes to EUCL-MPIA-DOC-7-001: Lock-in, wording | ***AI49*** |
| 162 | Lock-in layout | EUCL-MPIA-DOC-7-001 | TH/MPIA | Presumably this device also provides sync information to the lock-in. | | Correct. Clarification added to document. | Minor changes to EUCL-MPIA-DOC-7-001: Lock-in, wording | ***AI49*** |
| 163 | Raspberry PI | EUCL-MPIA-DOC-7-001 | TH/MPIA | Raspberry Pi. I am not sure whether to be impressed or shocked (this is a joke). | | This is not a joke: PI has excellent support, is cost-effective and replacements are very easy and fast to obtain.<br><br>It has been used in other GSE equipment built by vH&S | | |
| 164 | Lens of NI-VTS | EUCL-MPIA-DOC-7-001 | TH/MPIA | Section 4.2.9 – What is the lens material? Do chromatic effects have any influence? (I doubt it). Also, based on the next section, you should mention that the sensor box and harness must be ISO-5 clean room compliant. | | Lens material is e.g. N-SF5<br>with a negligible chromatic change of refraction index in the range of 1um..2um<br>dn/dlamba = 1.6e-5 / nm<br>1.63 @ 2um<br>1.65 @ 1um<br>1.68 @ 0.5um<br><br>ISO-5 cleanroom compatibility of NI-CUT sensorhead and harness mentioned in<br>next doc release. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 165 | Transportation boxes | EUCL-MPIA-DOC-7-001 | TH/MPIA | Section 5.1 – Does this section describe transportation boxes for the NI-CUT (fig 3) or for the whole instrument? I can't imagine that you will put the assembled NI-CU into a foam padded Pelican case (?). Don't you need proper shock-isolated clean cases. (Note: I don't have access to AD3 to follow up…). Also, what is PTFE? | | Section 5.1 relates to transportation of the NICU<br>Section 4.2.10 desccribes transport/storage of the NICUT<br><br>PeliCases are not provided with foam liner as standard.<br><br>For NICU the exact specification has not been decided but foam will not be used<br>but an innternal frame within the contain with integral shock/vibration absorbers.<br>The box may be Peli or a clean metal box such as a Zarges Box.<br><br>For the NICUT a peli case will be used. Anti static bubble wrap will be used for shock prevention and the NICUT will be packed inside multiple (at least two)<br>bags.<br><br>Document dc19,EUCL-MPIA-DOC-7-001,GSE Description,nicu-gse-dscrptn<br>updated with latest concept<br><br>(PTFE: Polytetrafluorethylen, also known as Teflon.) | | |
| 166 | Black paint sensitive? | EUCL-MPIA-DOC-7-001 | TH/MPIA | Section 5.2 – The dead-black paint is not susceptible to mechanical damage by handling? (many such paints have a "fractal" finish to trap light) | | The black paint used does not have a "fractal" finish for this reason (resulting in slighly more reflectivity). PNC has been tested by MAP with 3M kapton tape and 1mm squaring for adhesion. For anodized aluminium the coating is ISO class 1 and for invar ISO class 2 (out of 5). Any handling will not be sufficient to damage the paint at this class (providing some care is taken not to scratch the part).<br><br>Bolted and adjoining surface areas are masked before painting to avoid risk of flaking during assembly. The painted parts are also added at the end of the AIV procedures just before the spectralon patch is installed to reduce risk of contamination. | | |
| 167 | NI-VTS operating conditions | EUCL-MPIA-DOC-7-001 | TH/MPIA | Section 7.1 – Will the NI-VTS operate at NIR wavelengths? At ambient temperature? If not, how will you verify the irradiance of the long wavelength LEDs? | | VTS operation at visible wavelengths is agreed with the customer. This is due to the difficulties of performing the measurement at long wavelength. It is hoped that a solution can be found using the 970nm channel but vHS will move<br>to shorter wavelengths if this is still impractical. | Clarify NI-VTS operation / choice of short wavenlength in AIV plan | ***AI50*** |
| 168 | FEM missing reference | EUCL-MPIA-RP-7-008 | TH/MPIA | Section 7.2, first paragraph. Missing reference. Also, what is ASD? | | Reference is now given.<br>ASD = acceleration spectral density, information also added to document<br><br>FEM report has been updated | acronym… | ***AI39*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 169 | Shear load value | EUCL-MPIA-RP-7-008 | TH/MPIA | Section 8 – The 2nd paragraph mentions 120N, yet Section 5 says 130N (?) | | The value is defined as 130N in the IRD. This is a typo and has been corrected. | | |
| 170 | Cleaning of Spectralon | EUCL-MPIA-PL-7-007 | TH/MPIA | Section 3.3 – I doubt that deionized water and dry nitrogen will remove the contamination to which Spectralon is most sensitive, that is grease and oil vapour. | | No it won't. The spectralon reflector is small and is designed<br>to be easily replaced if contamination occurs.<br><br>More than 1 reflector will be procured so that spares are availble in case original reflector is contaminated.<br><br>This is reported in the C&CC plan. | | |
| 171 | Nitrogen flushing system | EUCL-MPIA-PL-7-007 | TH/MPIA | Section 3.4 – What allows the overpressure of nitrogen to escape? Just non-hermetic seals? What happens if there is an accidental overpressure? Also, why send an unnecessary item (the coupling) into space? | | The unit is open at one end so no over pressure is possible. A lid is installed for transport/storage but no flow of gas occurs after an initial flush with the lid in place but not tightenned.<br><br>The valve is required to ensure that purge gase passes from the reflector to the open end and not in the opposite direction. As this is required during vibration testing, the valve cannot be removed without invalidating the mechanical qualification. | | |
| 172 | Pelican case foam contamination | EUCL-MPIA-PL-7-007 | TH/MPIA | Section 3.5.3 – Every Pelican type case I have used comes with foam inserts that could in principle crumble and contaminate. | | See RID 165 | | |
| 173 | Isopropanol properties | EUCL-MPIA-PL-7-007 | TH/MPIA | Section 3.5.4 – What grade of isopropanol? Presumably no denatured type… | | We use 99,9% isopropanol which is not denatured | | |
| 174 | PCB cleaning procedure | EUCL-MPIA-PL-7-007 | TH/MPIA | Section 3.9.1 – You actually clean populated, multi-layer, circuit boards using water? Interesting. Can dry compressed air (Step 4) actually dry a populated PCB sufficiently? No bakeout? | | Cleaning with water is needed to remove salt left over, which wouldn't be<br>removed with isopropanol.<br><br>The process is following ECSS and has long time space heritage at vH&S<br>(e.g. COSIMA, CIDA).<br><br>The PCB will be dried with a short bake out. Full bake out,<br>as this will happen nevertheless in a later stage on the complete unit.<br><br>To clarifiy this, the drying bake-out will be added to the CC&C plan. | CCC plan: clarify purging strategy and bakeout conditions, add RH and T monitoring info; add PCB cleaning/bakeout info; harness cleanliness requirements | ***AI14*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 175 | NI-CUT harness cleanliness | EUCL-MPIA-PL-7-007 | TH/MPIA | Section 3.10 – Does the NI-CUT harness get special cleanliness attention (i.e. not just the sensor head)? | | Yes, the harness has the same C&C requirements as the sensor head.<br>By design the sensorhead and harness will have a fixed connection,<br>so that the user is forced to handle the sensorhead and harness together<br>with the same cleanliness & contamination attention.<br><br>CC&C plan will be updated to add this info. | CCC plan: clarify purging strategy and bakeout conditions, add RH and T monitoring info; add PCB cleaning/bakeout info; harness cleanliness requirements | ***AI14*** |
| 176 | M5 vs. M10 | EUCL-MPIA-PL-7-008 | TH/MPIA | Section 3.1 – M10 bolts? I thought they were M5? | | Document corrected to M5 (cut and past error from proposal). | | |
| 177 | Meaning of optical SMA | EUCL-MPIA-PL-7-008 | TH/MPIA | Section 5.2.5 – What is “optical SMA”? | | Same physical shape as an electrical SMA, but for optical fibres. Standard connector for non-angled multimode fibres. | acronym… | ***AI39*** |
| 178 | Meaning of "LAT testing" | EUCL-MPIA-PL-7-009 | TH/MPIA | Section 4.1 – What is “LAT testing”? | | Lot Acceptance Test - test performed on a sample of a procurement LOT which<br>usually comes from a single manufacturing LOT. | acronym… | ***AI39*** |
| 179 | EEE components procurement specification missing | ./. | TH/MPIA | No document? | | The single specification document has been replaced by the 3 specification documents dealing with separate items. This allows distribution of documents<br>to suppliers. The documents are:<br>EUCL-MPIA-RS-7-002,dx66,LED specification LMSNT,nicu-led-spec-lmsnt<br>EUCL-MPIA-RS-7-003,dx67,LED specification Epitex,nicu-led-spec-epitex<br>EUCL-MPIA-RS-7-004,dx63,Harness Specification,nicu-hrnss-spec<br>(see comment in document list). | | |
| 180 | Document quality | EUCL-MPIA-RS-7-004 | TH/MPIA | This document needs to be spell-checked. | | Document to be updated. | Spell-check and improve document quality | ***AI51*** |
| 181 | Meaning of PCN | EUCL-MPIA-RS-7-002 | TH/MPIA | What is PCN? | | PNC paint used to blacken NICU (see RID #194,129) | | |
| 182 | Compliance w/o cold test? | EUCL-MPIA-SC-7-002 | TH/MPIA | 5.3.1.3a – Shouldn’t this be PC if you are not doing a cold test? | | Assume item contained in section 3.3 Compliance matrix to ECSS-Q-ST-20 – Quality Assurance – with AD1 modifications<br><br>The NI-CU will be tested under representative enviromental conditions most notabilily cryogenic thermal vaacuum tests of the QM, FM and FS units.<br><br>It will not be possible to measure all performance parameters during this test but these parameters will be inferred from warm testing by analysis. | review comment / change / adjust | ***AI52*** |
| 183 | LED not limited lifetime? | EUCL-MPIA-SC-7-002 | TH/MPIA | LEDs don’t have limited life? | | This requirement rather refers to mechanisms designed for a limited number<br>of activations/cycles. | | |
| 184 | Unclear requirement 1 | EUCL-MPIA-SC-7-002 | TH/MPIA | 6.4.2.9a – I don’t understand this one. | | 1:1 copy from instrument level. Requirement therefore n/a to subsystem. | | |

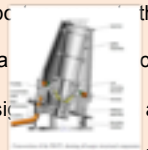
The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 185 | Unclear requirement 2 | EUCL-MPIA-SC-7-002 | TH/MPIA | 5.11.2c – Same remark. | | 1:1 copy from instrument level. Requirement therefore n/a to subsystem. | | |
| 186 | Unclear requirement 3 | EUCL-MPIA-SC-7-002 | TH/MPIA | 4.1.3c – Same remark. | | 1:1 copy from instrument level. Requirement therefore n/a to subsystem. | | |
| 187 | Micrometeroids | EUCL-MPIA-SC-7-002 | TH/MPIA | 5.14a – Does the spacecraft stop all micrometeroids? | | Protection against meteroids is beyond the scope of subsystem design | | |
| 188 | PAC and MOC explanation | EUCL-MPIA-RP-7-004 | TH/MPIA | Section 4.1 – What are PAC and MOC? | | PAC: Particular Contamination as obstruction factor in mm^2/m^2 or ppm<br>MOC: Molecular Contamination in g/cm^2<br><br>Abreviation List will be updated and Cleanliness Analysis will list the unit of<br>PAC. | acronym… | ***AI39*** |
| 189 | N2 purging sufficient? | EUCL-MPIA-RP-7-004 | TH/MPIA | Section 5.1 – I doubt that that a slow nitrogen purge will prevent settling of dust into the NI-CU (it should prevent condensation of contaminants, however). As I mentioned at the meeting, an obvious solution is to keep the opening pointed downward whenever the cover is off. | | A slow nitrogen flow will not prevent dust settling, therefore the purge rate will be generous and the tests performed in ISO5 environment . The analysis was right, but the section is missleading.<br><br>For mechanical tests it is not possible to hang the unit upside down with out a significantly complex test adaptor which must also be characterised. | doc clarify | ***AI53*** |
| 190 | Abrasion from cover? | EUCL-MPIA-RP-7-004 | TH/MPIA | Section 5.2 – It would be good to verify that repeated removal and replacement of the cover does not produce debris due to abraded paint, metal shavings from threaded holes, etc. | | Yes, at the moment is is planned to remove this risk by design (design of the<br>cover). | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 191 | Define JAN | EUCL-MPIA-TN-7-001 | TH/MPIA | Section 5.1.5 – What is “JAN”? | | US Quality level classes for discrete semiconductors. The classes are as<br>follows: JAN, JANTX, JANTXV, JANJ, JANS<br>The classes relate to the tests performed as described by MIL - STD-750 Test<br>methods<br><br>Class JAN: Military level QCI Only<br><br>Class JANTX: Screening and QCI without Visual inspection<br><br>Class JANTXV: JANTX with Visual inspection<br><br>Class JANJ: Space level product as defined in the specification sheet that<br>shall be capable of passing the test and inspections in Appendix E for JANTXV<br>as a minimum. Not available for all semiconductor devices.<br><br>Class JANS: Highest Space level product | acronym list | ***AI39*** |
| 192 | Reliability calculation | EUCL-MPIA-TN-7-001 | TH/MPIA | Section 5.2 – Is cumulative reliability the product of the individual inputs or a quadrature sum? (presumably most reliability factors are statistically uncorrelated). How does the fact that there are redundant LEDs enter the calculation? | | Cumalitive reliability is the product of the individual inputs. Redundancy is modelled as two identical half units each containing 1 LED channel<br>for each wavelength (see figure 2).<br><br>The reliability of the complete model is calculated by calculating the probability of failure of both redundant halfs and taking if from 1<br><br>ie P of not failing of a redundant half unit = R_hu<br>P of NICU not failing = 1-(1-R-hu)^2 | | |
| 193 | Number of LEDs in FMEA | EUCL-MPIA-QR-7-002 | TH/MPIA | Section 4.1.2 – There are only 5 drive circuits, not 10? (same comment for the Sense Circuit, LED Devices, etc.). | | Only a redundant half is considered in the analysis (as they are identical). Redudnancy is indicated in the section 4 and SL (severity level) column defined in section 6.1. Analysis follows ECSS. | | |
| 194 | Paint not in DML | EUCL-MPIA-LI-7-004 | TH/MPIA | I could not find the paint used to blacken the NI-CU outer shell, baffles, etc. | | The paint is item 12.1.vHS, PNC with PSX primer in the DML (EUCL-MPIA-LI-7-004) | | |
| 195 | Meaning of EPDR | EUCL-MPIA-LI-7-006 | TH/MPIA | Section 1.2 – What is EPDR? | | Equipment Preliminary Design Review (the review we are currently performing) | | |
| 196 | Meaning of PNC | EUCL-MPIA-LI-7-005 | TH/MPIA | What is “PNC”? | | The black paint recommended to us by LAM, also used for the NISP structure. | | |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 197 | Coating performance at cryo | EUCL-MPIA-LI-7-005 | TH/MPIA | I presume that the gold coatings (with nickel barriers) are Ok at cryo temperatures? There will be a bi-metal effect, but I suspect you don't care. | | We are currently investigating this issue, the bimetal effect between the nickel and gold is negligible as they have very similar CTE, however the CTE of aluminium is much larger, so there is some concern that the tube could be crushed or warped slightly on cooling (especially as the current baseline is to use an interference fit to hold the tubes in place). The design will be modified based on the outcome of the testing. | Assess bimetal effect of concentrator tube coating | ***AI54*** |
| 198 | Spelling | EUCL-MPIA-LI-7-008 | TH/MPIA | Section 2 – "Epitex" is misspelled in the table | | Will be corrected | Spelling of "Epitex" in EUCL-MPIA-LI-7-008 | ***AI55*** |
| 199 | LED laser marking | EUCL-MPIA-PL-7-011 | TH/MPIA | Section 5.1.2 says that all LEDs will be individually laser marked, yet the two LED specification documents say: F.2.1.1a-11,F.2.1.5a -Trace code A trace code needs to be on the package, so that LEDs can be tracked. It is not necessary to mark the single LED. Trace code at the boxes would be provided. | | LEDs are individually marked at the start of the LED qualification/evaluation process. They are individually marked so that we can keep their test results for each device.<br><br>The trace code in the specification documents relate to how they are delivered from the manufacturer. At this point we need to be able to trace to device to a waver batch. The LED's are not individually marked at this point but the package is. | | |
| 200 | Efficiency of LEDs | EUCL-MPIA-PL-7-011 | TH/MPIA | Figure 2 – How do you evaluate the relative efficiency of the LED's (LineNo 5, 26, 29 etc.)? | | The light output of the device for a set current and duty cycle will be measured using a cosine corrector (or during the cryotest in the test system).<br><br>Relative efficiency means comparing later measurements with the initial measurement using the same test method. | | |
| 201 | Residual notes | EUCL-MPIA-PL-7-011 | TH/MPIA | LineNo 47 – Residual red VHS note? Same remark for LineNo 67 | | Not residual, but a marker of a test whose conditions are difficult to define (due to the low max temp of one of the LED devices) | | |
| 301 | Design justification not in line with FEM report | RP-7-002 and FEM analysis report RP-7-008 | ESA/DJ | The mechanical design of the CU is not defined yet. The design justification file (RP-7-002) and the FEM analysis report (RP-7-008) are not in line for what concerns the mounting interface and also the general shape. Which one is the latest design? What is the purpose of the | Please provide details and justification on the design. | he FEM repo the latest iteration of the design but it s shown at there is a ce as identified by the reviewer.<br><br>oth the Desi and FEM analysis will be updated in e latest design iteration which will solve the shear load issue.<br><br>Documents to change: dc12,EUCL-MPIA-RP-7-003,Design Definition File and Trade-Off,nicu-ddf  | | ***AI1*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | interface ring? Would it not be easier to have some kinematic mounts? Is this interface in line with the NISP requirements? (the CU will be mounted on a very delicate Sic part). | | dc14,EUCL-MPIA-ICD-7-001,Interface Control Document,nicu-icd<br>dx68,EUCL-MPIA-RP-7-008,FEM Analysis Report,nicu-fem-rprt | | |
| 302 | HIGH SHEAR LOADS | FEM analysis report (EUCL-MPIA-RP-7-008_NI-CU_FEM | ESA/ DJ | The current design introduces high shear loads in the Sic structure of the NISP under thermo-elastic loads. What is planned to reduce these loads? A proposition to have the interface in Titanium is investigated as well as a proposition to change the stiffness of the springs of the interfaces. How do you justify this? Please provide details on the updated design. As a conclusion it is mentioned that the design of the mounting interface need to be modified. | Please provide details, analyses on an updated design. | Mechanical interface is currently being redisigned to deal with this issue<br>See RID 01 | | ***AI1*** |
| 303 | INCOMPLETE ANALYSIS REPORT | FEM analysis report (EUCL-MPIA-RP-7-008_NI-CU_FEM | ESA/ DJ | The analyses performed only reports the stress on the external structure of the CU. What about the loads of the LEDs and internal structures? Nothing is reported on the interface screws (MoS under static and vibration loads, thermo-elastic loads, sliding etc…). | Please provide information. | Will be perfoemd during the detailed analysis phase. | | ***AI1*** |
| 304 | FoS missing in the analysis | FEM analysis report (EUCL-MPIA-RP-7-008_NI-CU_FEM | ESA/ DJ | The analyses performed do not include any Factor of Safety. | Please include those in the analyses. | See answer to RID 17 | | ***AI7*** |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 305 | Missing MoS for random analysis | random analysis | ESA/ DJ | (At the moment only pictures are included in the document) | Please provide results and MoS for the random analyses. | The accelerations caused by the random and sinusoidal analysis are lower than for the static case. Thus the specific results and MOS for the random vibration are not mentioned but it is referring to the static case and its results/MOS. | | ***AI7*** |
| 306 | Assessment on structural stability and alignment | design definition | ESA/ DJ | In the design definition document, it is stated that the structural stability and alignment are some driving requirement for the CU but nothing is reported on this aspect. Please provide information on this topic. | Please provide information on this topic. | Alignment issues have been considered opticalically and mechanically but results did not make the Design Desifintion Document. Will be provided in latest revision of Design as with RID 301 | | ***AI1*** |

The presented document is Proprietary information of the Euclid Consortium.

The action list is :

| # | RIDs | Description | Actionee | Due Date |
|---|---|---|---|---|
| ***AI1*** | 1, 6, 16, 18, 19, 301, 302, 303, 306 | Update and deliver mechanical design with Invar ring to meet interface force requirements; update and deliver new DDF, DJF, FEM analysis, FEM models; analyse interface screws forces; align mechanical designs to be the same in each document; alignment issues/tolerancing to be addressed in DDF | NI-CU | 30.9.2014 |
| ***AI2*** | 1 | Communicate exact CTE of P1 SiC; clarify if 130N I/F force limit is shear load or total (all directions) | Martin / Pamplona | 31.7.2014 |
| ***AI3*** | 2 | Define ICU requirement: maximum slew rate for ICU LED drivers to prevent reverse voltage conditions at LEDs | NI-CU | 29.8.2014 |
| ***AI4*** | 3 122 | Define harness requirements: a) maximum induced voltage by external EMI, b) maximum induced voltage by crtosstalk between LED channels | NI-CU | 29.8.2014 |
| ***AI5*** | 3 | Change no-spurious-photon requirement: not applicable while wheels activated | Hormuth / Prieto | 15.8.2014 |
| ***AI6*** | 7,14 | Consider AIT defaults in FEM analysis | NI-CU | 30.9.2014 |
| ***AI7*** | 11, 12, 17, 304, 305 | Minor changes to FEM analysis: 1) clarify that rotations are blocked in analysis; 2) clarify mass budget vs. mass listed in table; 3) clarify that FoS have been taken into account; 4) clarify that random/sine loads are much smaller than static loads | NI-CU | 30.9.2014 |
| ***AI8*** | 13 | FEM analysis: add FEM checks | NI-CU | 30.9.2014 |
| ***AI9*** | 15 | FEM: perform random vibration up to 2000Hz | NI-CU | 30.9.2014 |
| ***AI10*** | 20 | Assess applicability of ESA alert, provide status document | NI-CU | 26.7.2014 |
| ***AI11*** | 21,41 | Changes to PA plan: 1) make PARD applicable, verify that all requirements already covered by Q10-Q80 compliance matrix; 2) add certificates of cleanliness (CoC) to EIDP | NI-CU | 30.9.2014 |
| ***AI12*** | 21 | Review proposed KIPs and propose MIPs -- repeat on updated AIV plan | Ducret | 30.9.2014 |
| ***AI13*** | 21,42 | PA plan: clarify CoC content (visually clean), investigate potential use of witness samples | NI-CU | 30.9.2014 |
| ***AI14*** | 22, 43 | CCC plan: clarify purging strategy and bakeout conditions, add RH and T monitoring info; add PCB cleaning/bakeout info; harness cleanliness requirements | NI-CU | 30.9.2014 |
| ***AI15*** | 25, 49, 174, 175 | Organise new PCB meeting to clarify open LED procurement and qualification issues | NI-CU / LAM / CNES | 30.9.2014 |
| ***AI16*** | 26,62 | Add cryogenic compatibility information to DML | NI-CU | 30.9.2014 |
| ***AI17*** | 28 | Provide NI-CU safety assessment document; change PA compliance matrix accordingly | NI-CU | 30.9.2014 |
| ***AI18*** | 30 | Update CCC plan, DPL and CC analysis wrt to LED window cleaning and bakeout conditions | NI-CU | 30.9.2014 |
| ***AI19*** | 35 | Update / provide venting analysis | NI-CU | 30.9.2014 |
| ***AI20*** | 36 | Provide SCC and CORR info in DML | NI-CU | 30.9.2014 |
| ***AI21*** | 37 | Check material outgassing data in CNES database, update DML | NI-CU | 30.9.2014 |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | |
|---|---|---|---|---|
| ***AI22*** | 37 | Check / provide access to CNES outgassing database; verify if data contained in database is always applicable | Hervet / Maciaszek | 15.8.2014 |
| ***AI23*** | 38 | Add galvanic compatibility information to DML | NI-CU | 30.9.2014 |
| ***AI24*** | 39 | Update DPL w.r.t. gluing processes | NI-CU | 30.9.2014 |
| ***AI25*** | 45, 54, 55, 56 | Define NI-CU reliability requirement <<0.99 based on number of required working LED channels. Add this requirement to the Requirement Specification Document before PCB meeting! PCB to devise / agree on LED qualification strategy based on reliability requirement. | Ealet / Jahnke / Prieto / PCB | 22.8.2014 |
| ***AI26*** | 57 | Update FMEA | NI-CU | 30.9.2014 |
| ***AI27*** | 58 | Re-assess severity of unwanted NI-CU emission | Prieto / Maciaszek | 30.9.2014 |
| ***AI28*** | 60 | FMEA & CIL: improve cross-referencing | NI-CU | 30.9.2014 |
| ***AI29*** | 61 | Propose (cryogenic) evaluation test for LED gluing / potting | NI-CU | PCB |
| ***AI30*** | 64 | Prepare RFDs for materials with outgassing out of spec; update DML | NI-CU | 30.9.2014 |
| ***AI31*** | 65 | Get / provide more information on Spectralon heritage and cryogenic use. Check with VIS team -- same issue should be there. | NI-CU | 30.9.2014 |
| ***AI32*** | 66 | Update DML, editorial corrections / old materials left in | NI-CU | 30.9.2014 |
| ***AI33*** | 67 | Provide information on soldering and cryogenic tests of soldered parts (-> Exomars) with test conditions, e.g. number of cycles. | NI-CU | 30.9.2014 |
| ***AI34*** | 68 | Clarify Spectralon mounting design in DDF, assess need for special qualification. | NI-CU | 30.9.2014 |
| ***AI35*** | 69 | DMPL/DJF: more information & tradeoff on valve material to be added. | NI-CU | 30.9.2014 |
| ***AI36*** | 72,73,74 | Update Config Control Plan to agree with instrument CCP, align CIDL and CIL content | NI-CU | 30.9.2014 |
| ***AI37*** | 108 | Clarify approach to absolute irradiance masurements in AIV plan | NI-CU | 30.9.2014 |
| ***AI38*** | 110 | Include concern about contract period for local NI-CU PM in panel report | PDR panel | 25.7.2014 |
| ***AI39*** | 113, 128, 168, 177, 178, 188, 191 | Add acronyms: SME, NDI, ASD, SMA, LAT, PAC, MOC, JAN | NI-CU | 30.9.2014 |
| ***AI40*** | 115 | Wording: "approbation" to be corrected… | NI-CU | 30.9.2014 |
| ***AI41*** | 121 | Clarify reasoning begin 1200s duration of calibration and stability requirement. | Prieto | 30.9.2014 |
| ***AI42*** | 124 | Provide complete version of table for NI-CU-I-587 requirement | Prieto | 30.9.2014 |
| ***AI43*** | 125 | Re-assess CoG measurement strategy: model good enough? Waiver required? Update verification matrix if necessary. Propose strategy for pigtail harness. | NI-CU | 30.9.2014 |
| ***AI44*** | - | Feed back verification & compliance matrix changes to Eric / EA model | Hormuth | 30.9.2014 |
| ***AI45*** | 129, 131, 134 | Re-check use of PNC on a all NI-CU materials at cryo. Re-assess need of additional qualification. If no | NI-CU / Prieto | 30.9.2014 |

The presented document is Proprietary information of the Euclid Consortium.

| | | | | |
|---|---|---|---|---|
| | | need, then change emissivity requirement to prescribe "painting with PNC" instead of giving hard-to-verify numbers for NIR reflectance. | | |
| ***AI46*** | 139, 139, 142, 143 | Add non-seq raytracing results regarding LED illumination pattern and tube concentrators to DJF | NI-CU | 30.9.2014 |
| ***AI47*** | 148, 159 | ICD: sync with ICU requirements: drive currents, diagnostics, housekeeping; correct LED numbering | NI-CU | 29.8.2014 |
| ***AI48*** | 151, 152 | Minor DDF changes: PWM mode, thermal section | NI-CU | 30.9.2014 |
| ***AI49*** | 161, 162 | Minor changes to EUCL-MPIA-DOC-7-001: Lock-in, wording | NI-CU | 30.9.2014 |
| ***AI50*** | 167 | Clarify NI-VTS operation / choice of short wavenlength in AIV plan | NI-CU | 30.9.2014 |
| ***AI51*** | 180 | Spell-check and improve document quality | NI-CU | 30.9.2014 |
| ***AI52*** | 182 | EUCL-MPIA-SC-7-002: re-consider "PC" for full test w/o cold (5.3.1.3a). | NI-CU | 30.9.2014 |
| ***AI53*** | 189 | Clarify N2 purging strategy / protection against dust settling | NI-CU | 30.9.2014 |
| ***AI54*** | 197 | Assess bimetal effect of concentrator tube coating | NI-CU | 30.9.2014 |
| ***AI55*** | 198 | Spelling of "Epitex" in EUCL-MPIA-LI-7-008 | NI-CU | 30.9.2014 |

The presented document is Proprietary information of the Euclid Consortium.

# 6 ASSESSMENT OF ACHIEVEMENTS OF REVIEW OBJECTIVES

- Agree and freeze the subsystem requirement (after PDR the requirements will be put under configuration control)

  **Objective achieved pending answer to actions and issue of DCR's**

- States about the credibility of the subsystem preliminary design

  The review panel considers that the level of maturity for the NI-CU subsystem is at the good level for a PDR. Modification of the NI-CU interface in order to comply with the interface load due to thermoelastic has been presented during the July 16th meeting but shall be detailed in the documentation update for the PDR close out. The approval of the LED's is still pending but shall be done beginning of September

  **Objective achieved pending answer to actions for the PDR close out**

- States about the feasibility of the subsystem to respect the subsystem requirements with adequate margins (perfo, budget, interfaces, functional, ...)

  The NI-CU complies with their requirements (excepted minor non compliances which are acceptable) with adequate margin (considering the new NI-CU Invar interface).

  **Objective achieved pending answer to actions for the PDR close out**

- Analyze the AIV/AIT plan as well as the GSE associated to each step are well defined

  The AIV/AIT plan is well detailed and is at good level

  **Objective achieved pending answer to actions for the PDR close out**

- Verify that the TRL5 status is complete (technologies and processes are demonstrated on elementary mockup (not full scale needed))

  All technologies and processes are at least TRL5 for the NI-CU excepted the LED's which are commercial components. Many evaluation tests have been done (cryo cycling, radiation, ...) for the LED selection but additional expertise must be done in order to confirm the acceptability of the selected LED (construction analysis).

  **Objective partially achieved. Should be achieved for the formal LED approval.**

- Verify and agree about the evaluation and qualification plans

  With regard to the document presented at the PDR, complementary activities have been proposed and agreed by the NI-CU team.

  **Objective achieved pending answer to actions for the PDR close out**

- Verify the implementation of the Product Assurance Plan and the whole associated documentation

  **Objective achieved pending answer to actions for the PDR close out**

- Make sure that the critical items and risks are well identified

  **Objective achieved**

The presented document is Proprietary information of the Euclid Consortium.

- Check that requirement specifications at components level are correctly flowdown from the subsystem requirement

  **Objective achieved**

- Analyze the development plan and the associated schedule and verify that adequate margins are exhibited

  The NI-CU development plan and schedule is not critical and fully compliant with the NISP instrument needs.

  **Objective achieved**

# 7 CONCLUSION

The review panel acknowledges the good quality work performed by all parties involved in the preparation and conduct of this review.

The overall objectives of the review are considered to be met pending the result of the actions to be answered before mid October 2014 for the NI-CU close out date (TBD).

The review panel considers that the level of maturity for this NI-CU subsystem is at the good level for a PDR.

No specific recommendation other than normal work to be done is proposed.

The review panel would like to thank all NI-CU team.

The presented document is Proprietary information of the Euclid Consortium.