

A tool for the LHCb MWPC production monitoring: the LNF on-line database

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Abstract

The LHCb Muon detector system is made of several (1368) Multi Wire Proportional Chambers (MWPCs). Those chambers differ in size, readout and constructing materials and are built in various countries: their assembly takes place in different sites and foresee many steps((1), (2)). To ensure the production quality and keep track of panels/chambers production an on-line database has been set up. This web based tool allows an easy sharing of the information: the database update is made possible through a web interface. The update is easy and reliable. The interface helps the information sharing in different sites and helps optimizing the production rate by allowing feedback on production needs and quality between sites contributing to the production chain. The planning is made using the information on the material availability. Quality tests and crosschecks are made easier, as well as the overall production monitoring. The tool has been developed using MySQL(3), PHP(4), ROOT(5) and PERL(6) software languages.

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1 Introduction

The LHCb muon detector(1) is mainly made of MWPCs: their production is demanded to several production sites distributed among different countries. The MWPCs are of different types and their production and test is a chain of several phases. In order to fulfill the constraints on the muon detector the quality of each chamber needs to be monitored. Furthermore the production phases of each chamber can be subdivided into different sites.

As an example the M2R3 chambers production chain is quoted below:

1. MWPC panels are produced in a factory in Teramo
2. Panels are glued in a production site near Potenza
3. Panels are prepared and MWPC chambers are assembled in Ferrara
4. Chambers are tested in Frascati or Rome II sites

Thus the information flow in all the sites involved in a particular MWPC type production line is crucial in order to minimize bottlenecks and to speed up the feedback to the companies/sites involved.

In the following an on-line database, built in order to have an easy to use application for the chambers production and quality monitoring, needed to deal with the above requirements is presented.

The production chain and test performed are outlined in section 2, while the database structure and its web interface are fully described in section 3 and 4. Tools and macros are outlined in section 5.

2 Production chain and quality tests

The production of a MWPC consists of different phases: each of them needs to be monitored, with different levels of accuracy, and records needs to be kept in a database for later crosschecks and QA monitoring.

2.1 Production chain

The different production steps are:

- The panels production. Each MWPC chamber is made of three to five panels (depending on the chamber type). The thickness as well as the planarity of each panel should respect tight requirements in order to ensure the correct gas gain in each chamber(1). All the panels are made and checked in the same factory and then shipped to all the various production sites for preparation and assembly.
- The panels preparation. Each panel needs to be cleaned, glued, wired and prepared for assembly. All those phases should be monitored in order to easy the production planning.
- The panels tests. Each panel, during the production phase, undergoes two different tests: wire pitch is measured, the tension of all the wires is measured.
- The chamber assembly and test.

2.2 Quality tests

During the production phases several tests are performed and displayed on the web interface. Cross-checks are then made possible: all the relevant information is monitored and kept in the database. The performed tests, with results available through a web interface, are:

- Planarity measurements at the factory
- Planarity measurements at the production site
- Results of preparation steps, pitch and tension measurements
- Chamber gas leakage, dark current, source test and gas gain uniformity

3 The on-line database

The on-line database mainly consists of an SQL database on a web server that can be accessed by a PHP interface. The SQL database is presented in section 3.1 while the PHP interface is outlined in section 3.2.

3.1 Description of the MySQL database

The SQL based database, written with MySQL, contains four different tables: one dedicated to the *panel* description and tests, one to the *chamber* description and tests and two other tables used to contain site specific informations. The first two tables are easily linked by the one to one relation that connects one panel with the chamber in which the panel is assembled. A similar link connects the five (three) panels of each quadri-(bi-)gap chamber to the entries in the *panels* table. Those two tables represent the core of the database. The additional tables have been setup in order to ease the customization of the information that needs to be stored in the database for different database users and in order to store the time of last change/access from different production sites to the database. Those tables are presented in detail in the following subsections.

3.1.1 The panel table

The primary key in the panel table is the panel number, stored with format PXXXX, where XXXX is an integer number between 0000 and 9999 (the whole production foresees less than 10k panels). For each panel we store some core information used to identify the panel:

- Production site (LNF, Ferrara, Potenza, Firenze, etc. etc.)
- Region and station information (M1R1 to M5R4).
- Panel type (gold-gold, copper-copper, gold-copper, pad-pad)
- Label. The format is CxxxLy where xxx is the chamber number, an integer with values in the range 000 and 999, and y is the layer information (positioning in the final chamber assembly) that can have integer values between 1 and 5.
- Panel weight (in grams), production date, factory tests.
- Comments, details.
- Position in the production line chain.

Different fields are also used to monitor the *production status* of each panel. Different flags are recorded and can be used to keep track of the production of each panel:

- Planarity test (at production site).
- HV bar glueing status.
- Status and results of wiring, soldering, wire pitch measurement, wire tension measurement and panel preparation.
- HV test in air.

3.1.2 *The chamber table*

For each chamber we store in the database:

- Chamber number.
- Panels constituting a chamber.
- Station, region and the production site.
- Closing date.
- Tests results (results of gas leakage tests, HV tests, etc. etc.).
- Production notes.
- Quality flags (gain uniformity for each bi-gap, dark currents, etc. etc.).

The chamber table has no primary key: each chamber is uniquely identified by the combination of chamber number, production site and station/region information. This is to allow a free counting of the chambers for each production site.

3.1.3 *The update time table*

We store in this table the last access time for each different production site: this allows to make the database update status a site dependent information.

3.1.4 *The site specific table*

We store in this table the quantities that should be accessed just by a given production site. As an example, let us consider an M2R3 chamber (see also sec. 1). The panels produced in Teramo are glued in Potenza and then shipped to Ferrara: this is the only production chain that involves such panel relocation chain. We need therefore to record the shipping date just for this chamber type: to do that we use a dedicated field in the site specific table that can be accessed only by Potenza and Ferrara sites.

3.2 PHP interface

The PHP interface has been designed in order to fulfill the following requirements:

- Easy configuration and management of different users and site specific needs
- Separation of data input, update and display accounts and interfaces.
- Remote upload of test results

Thus the following PHP pages have been set up (described in detail in section 4):

- Pages related to panel management:
 1. A page for panel generic information insertion, removal and update.
 2. A page for panel glueing/testing real time monitoring
 3. A page for panel wiring/testing/preparation real time monitoring
 4. A summary page for the overall panel production monitoring (panels positions, production status, etc etc)
- Pages related to chamber management:
 1. A page for chamber generic information insertion, removal and update.
 2. A summary page for chamber production information. For each chamber the panels information, as well as the production tests and measurements, is available through links.
- Generic production tools:
 1. The Chamber Builder page: a page where the panel availability is used to plan the chambers assembly. This page is very useful to see which panels are missing and to help the production planning.
 2. A page for the overall chamber production monitoring: this page includes links to every chamber, and displays the results of data quality tests.

All the PHP scripts do include a configuration script that contains the utilities needed to adapt the interfaces in a user dependent way. Relative paths, as well as the usage of this single PHP script for the site and users configurations, allows an easy maintainability and relocation of the code to different sites. All these various pages are discussed in detail in section 4.

4 PHP pages

In this section the PHP interfaces and tools for the user, briefly outlined before, are discussed in detail. This section should be then intended as a reference manual for the on-line database usage: the following section discuss what information is made available and to whom and how to retrieve it.

The PHP page that contains the links for all the production tools and also the production overview is <http://www.lnf.infn.it/esperimenti/lhcb/private/mwpc/construction/php/ChambersProduction.php>. This PHP page can be used to select the chamber production to monitor and also contains the direct links to the last produced chamber pages: it will be discussed in detail in par.4.2.4.

4.1 Production pages

All the production pages are kept in a protected area that can be accessed only by production site managers and people in charge of database maintenance. Those are the only pages where the information can be inserted and modified.

You're logged in as **lhcb_db**

Insert a new panel: Number Region Type MSR4 r1-5 insert		Delete a panel: Number delete		Update Panel Layer: Number Layer 1 update		Update Panel Chamber: Number Chamber # update	
Discard Panel: Number Discard Assembled Glueing Prob Panel Prob Type update						Update Panel Position: Number Position G.R. update	

Panel	Type	Glued	Problems	Layer	Stmp date	Stmp Op	Weight	Arriv date	control	Op	Comments	Details	Vote	Position
														update

Find panel go

Figure 1 Panel update tools. The basic tools for panels management are contained in this PHP page. Panels can be inserted or deleted from the database and their information can be updated.

4.1.1 Panels Update tools

In this PHP page all the tools for the panel table update and query are given. A Panel can be inserted or deleted from the database. The information on production status and quality tests can be updated and a "search" tool can be used to look for a given panel and view the relevant information about it (see fig.1).

4.1.2 Glueing room Production status

You're logged in as **lhcb_db**

Shows last MSR3 All panels in the glueing room. (Want to see also bad panels? Yes go)

Last update: June 23, 2005, 12:50 pm .

Panel	Type	Glued	Problems	Layer	Stmp date	Stmp Op	Weight	Arriv date	LNF control	LNF Op	Comments	Details	Vote	Position
P3299	oo	OK	OK	3	2005-02-17	Luca L	4783	2005-03-02	2005-03-04	Mario	no spessori	tape-Y	10.C	G.R. update
P3319	oo	OK	OK	3	2005-02-18	Luca L	3722	2005-03-02	2005-03-04	Mario	no spessori, peso s	tape-Y	10.C	G.R. update

Last update: June 23, 2005, 12:50 pm .

Panel	Type	Glued	Problems	Layer	Stmp date	Stmp Op	Weight	Arriv date	LNF control	LNF Op	Comments	Details	Vote	Position
P2376	or	OK	OK	5	2004-12-01	Luca	4568	2004-12-07	2005-02-21	Mario	L5 con pesi sopra. l	tape-N	9.5	G.R. update
P2378	or	Tb	OK	5	2004-12-01	Luca	4575	2004-12-07	2005-03-15	Mario	RECUPERATO	tape-N	9.0	G.R. update
P2407	or	Tb	OK	5					2005-03-15	Mario	recuperato	tape-N	9.5	G.R. update
P2413	or	Tb	OK	Tb					2005-03-15	Mario	RECUPERATO	tape-N	10.C	G.R. update
P2437	or	Tb	OK	Tb	2004-12-06	Luca2	4561	2004-12-17	2005-03-15	Mario	RECUPERATO	tape-N	10.C	G.R. update
P2493	or	Tb	OK	1	2004-12-10	Luca	4552	2004-12-17	2005-03-15	Mario	RECUPERATO	tape-N	9.5	G.R. update

Figure 2 Glueing Room (I). In this PHP page all the information related to the panel production phases before the wiring is monitored and can be accessed and updated.

In this PHP page all the information related to the panel production phases before the wiring is monitored and can be accessed and updated. A snapshot of this PHP page is shown in Fig.2 The page contains and shows all the panels received from the production factory that have not been sent to the wiring machine/room/site. When the panel is received for preparation the first thing to do is to insert it into the database (see par.4.1.1). Then in this PHP page all the information about its weight, quality and tests can be kept up to date until the panel is ready to be shipped for wiring.

The panels shown in the page are divided in groups related to their type and sorted by their number. Different colors are used in order to easy the search of a given panel in the page and also to signal, in red, if there are problems occurring in a given phase.

This page can also show, at the bottom of the other tables, the list of bad panels with comments explaining what went wrong and if there's a chance to recover them. All the panels in this room that

Last update: June 23, 2005, 12:50 pm .

Panel	Type	Glued	Problems	Layer	Stmp date	Stmp Op	Weight	Arriv date	LNF control	LNF Op	Comments	Details	Vote	Position	Discarded	
P3019	pp	Tb	Pr	Tb	2005-01-26	Luca L	4467	2005-03-02		Mario	portare in officina	tape-N		G.R.	0	update
P2959	or	OK	Pr	Tb	2005-01-21	Luca	4654	2005-01-25	2005-01-26	Mario	SOLCO PROFONDO NEL RAM	tape-Y	10.0	Off	0	update
P2806	pp	Tb	Pr	Tb	2005-01-12	Luca	4468	2005-03-02		Mario	portare in officina	tape-N		G.R.	0	update
P2680	pp	Tb	Pr	Tb	2004-12-27	Luca L	4533	2005-01-31	2005-03-03	Mario	tornato dopo recupero, ma le mi	tape-N	7.5	G.R.	0	update
P2491	pp	Tb	Pr	Tb	2004-12-10	Luca	4405	2005-03-02		Mario	portare in officina	tape-N		G.R.	0	update
P2426	or	Tb	Pr	Tb	2004-12-06	Luca	4598	2004-12-17	2005-01-03	Carlo	IN OFFICINA PER RECUPERC	N/A	1.5	Off	0	update
P2421	or	Tb	Pr	Tb	2004-12-03	Luca	4604	2004-12-17	2005-01-03	Carlo	VOTO 5.5 DOPO RECUPERO	N/A	5.5	Off	0	update
P2417	or	Tb	Pr	Tb	2004-12-03	Luca	4552	2004-12-17	2005-01-05	Carlo	IN OFFICINA PER RECUPERC	N/A	2.0	Off	0	update
P2380	oo	Tb	Pr	3	2004-12-01	Luca	4626	2004-12-17			PANNELLO SPARITO	N/A		G.R.	0	update
P2369	pp	Tb	Pr	Tb	2004-12-01	Luca L	4372	2005-03-02		Mario	portare in officina	tape-N		G.R.	0	update
P2324	pp	Tb	Pr	Tb	2004-11-25	Luca	4425	2005-03-02		Mario	portare in officina	tape-N		G.R.	0	update
P2028	pp	Tb	Pr	2	2004-10-22	Luca	4650	2004-11-05	2004-11-05	Mario	scartato x planarita'	N/A	1.0	G.R.	0	update
P2016	oo	OK	Pr	3	2004-10-20	Luca	4622			Alex	già filato, da rivedere	N/A	5.0	G.R.	1	update
P2487	oo	Tb	Pr	3	2004-10-12	Luca	4625	2005-02-16	2005-02-17	Mario	DA RIVEDERE >100 in 5 punti	tape-N	7.0	Off	0	update
P2812	pp	Tb	Pr	Tb				2005-01-13	2005-01-13	Carlo	170,140,160,110,150,160,140,11	N/A	1.5	G.R.	0	update

Figure 3 Glueing Room (II). At the bottom of the page the list of bad panels (with comments explaining what went wrong and if there's a chance to recover them) is shown.

have not been "glued" appears in *white* in the "Chamber Builder" page (see par.4.2.1). When glued, the color change to *orange* showing that there's a new panel ready for wiring.

4.1.3 Clean Room production status

You're logged in as **lhcb_db**

Shows last panels in the glueing room. (Want to see also bad panels?)

Last update: June 23, 2005, 3:58 pm .

Panel	Wiring	Glueing	Soldering	Ret. Sold.	Pitch	WTM	Preparation	Gluing bars	HV test	Comments	
P4317	OK	OK	Tb	Tb	Tb	Tb	Tb	Tb	Tb		update
P4338	OK	OK	Tb	Tb	Tb	Tb	Tb	Tb	Tb		update

Last update: June 23, 2005, 3:58 pm .

Panel	Wiring	Glueing	Soldering	Ret. Sold.	Pitch	WTM	Preparation	Gluing bars	HV test	Comments	
P4396	OK	OK	Tb	Tb	Tb	Tb	Tb	Tb	Tb		update
P4444	OK	OK	Tb	Tb	Tb	Tb	Tb	Tb	Tb		update

Last update: June 23, 2005, 3:58 pm .

Panel	Wiring	Glueing	Soldering	Ret. Sold.	Pitch	WTM	Preparation	Gluing bars	HV test	Comments	
P4486	OK	OK	Tb	Tb	Tb	Tb	Tb	Tb	Tb		update

Last update: June 23, 2005, 3:58 pm .

Panel	Wiring	Glueing	Soldering	Ret. Sold.	Pitch	WTM	Preparation	Gluing bars	HV test	Comments	
P4426	OK	OK	Tb	Tb	Tb	Tb	Tb	Tb	Tb		update

Figure 4 Clean Room (I). In this page all the information related to the panel production phases between the wiring and the assembly in a given chamber is monitored and can be accessed and updated.

In this PHP page all the information related to the panel production phases between the wiring and the assembly of the panel in a given chamber is monitored and can be accessed and updated. The scheme is the same as the one presented in par.4.1.2. The only change is the information that can be accessed, but the code structure and features are identical. An example is shown in fig.4.

When a panel is wired, its color in the "Chamber Builder" page (see par.4.2.1) turns to *green*. Then, when the panel is ready for assembly its color is changed to *blue*. All the problems occurring during quality tests or panel preparation can be viewed or updated in the web page with the relative comments. For example in fig.5 are shown the forms for a panel seeking in the database and the one used

to insert a comment about the wiring of a given panel (the wiring side is important whenever the wiring machine wires two panels for each wiring).

Find panel

Insert a Wiring comment into the database:

Panel	Wiring Side	Comments:
<input type="text"/>	<input type="text" value="1"/>	<input type="text"/>

Figure 5 Clean Room (II). Available tools for information update concerning clean room production phases: the forms for panel seeking and wiring information update are shown.

4.1.4 Chamber Update tools

In this page all the information relative to the chamber table can be accessed and updated. There are different tools that can be used:

- A form for the chamber insertion (takes as input the chamber number in 3 digits), the chamber deletion (input: chamber number with 3 digits) and one for the panels assignment (Input: the five(three) panels assigned to a given chamber. All the panels must be fed to the form, even when trying to update just the information for one of them). Those forms are shown in fig.6.

Insert a new chamber into the database (number with 3 digits) Delete a chamber from the database (do you know what you're doing?)

Chamber	Region	Chamber	Region
<input type="text"/>	<input type="text" value="M5R4"/>	<input type="text"/>	<input type="text" value="M5R4"/>

Update chamber panels into the database:

Chamber	Region	L1	L2	L3	L4	L5
<input type="text"/>	<input type="text" value="M5R4"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure 6 Chamber update tools (I). This PHP page contains the forms for chamber insertion, chamber deletion and chamber update into the database. The last form is used for the association of a set of panels to a given chamber.

- Every time a chamber is closed the form shown in fig.7 is used. The recorded time can be used to keep track of the chamber production rate.
- A form for the chamber quality tests update is shown in fig.8. This form is used to keep track of the quality tests performed on the chamber. The chamber overview page (presented in sec.4.2.2) shows the results of all the tests updated with this form. In this form is it also possible to keep track of dark current problems in a given gap of each chamber (the "hospitals").

4.2 Quality test and monitoring pages

All the monitoring pages are protected with an account that is different from the one used for the information access and update. In the pages presented in this section, the user can only browse the information without having the possibility to change it.

Insert Closing Chamber Date

Chamber	Region	Day	Month	Year	Time	Format
xxx	Select	xx	xx	xx	xx:xx	
<input type="text"/>	M5R4	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	update

Figure 7 Chamber update tools (II). Forms used for chamber information update. The height and closing information can be easily inserted/updated.

Closed chamber resume (performed tests)

Chmb	Region	Leak	dP (mbar/h)	Cond	Hosp	Pos.	Bigap AB	Bigap CD	HV max	Dark Curr. (nA)
<input type="text"/>	M5R4	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
update										

For the bigap criteria (A,B,C) please refer to the Chia and December Coll. Meet. definitions. [Upload Files Sorgente](#)

Chmb	Region	H gap A	H gap B	H gap C	H gap D
<input type="text"/>	M5R4	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
update					

Figure 8 Chamber update tools (III). Those forms can be used to update the results of the chamber quality tests and include the link to the page that can be used to upload the results of the source scans.

4.2.1 Chamber Builder

This PHP script has been set up in order to easy the production monitoring and to optimize the material flow between production sites and production phases. The page takes as input the type of chambers that the user wants to monitor and then fills a table with all the available panels (those that have been produced in the factory and are registered in the database).

Those panels are arranged in “chambers” according to the following logic:

- First of all, the panels belonging to *assembled* chambers are considered and stored in the table according to their chamber positions (as shown in fig.9).
- then all the panels that are ready to be assembled are assigned to “future” chambers according to their type (E.g.: the M5R3 chambers do need: 2 gold-copper panel as covers, 2 pad-pad panels as middle layers and one gold-gold panel as inner layer).
- then all the glued panels are added in this “chamber building” procedure, according to their type (as shown in fig.10. Panels of this type are shown in orange).
- then we add all the remaining panels according to their type (as shown in fig.10. Panels of this type are shown in white).

You're logged in as **lhcb**

Shows chambers.

Last update: June 23, 2005, 3:58 pm .

Chamber	C001	C002	C003	C004	C005	C006	C007	C008	C009	C010
L1	P3510	P3267	P3263	P3444	P3252	P3414	P3438	P3417	P3358	P3354
L2	P2704	P3465	P3473	P3532	P3329	P3325	P3270	P3479	P3549	P3374
L3	P3411	P3337	P3339	P3494	P3487	P3498	P3408	P3496	P3523	P3361
L4	P3468	P3456	P3552	P3546	P3272	P3327	P3331	P3274	P3383	P3389
L5	P3345	P3441	P3500	P3254	P3447	P3420	P3432	P3257	P3356	P3520

Figure 9 Chamber builder (I). This PHP page is used to plan the chamber production. Available panels are inserted in a table, according to their type, in order to see how many chambers can be made. This figure shows chambers already *assembled*.

The BAD panels, shown in red at the end of the page in a separate table, are not considered until they are recovered, if possible. The result allows to have a quick graphic idea of what's going on, which panel is missing, which panels are needed and in which order

This page can also serve as a feedback to the production factory that needs to know what (how many) panels are needed in order to complete the production of chambers of a given type.

4.2.2 Chamber Overview

In this PHP page the quality of the chambers is monitored. The PHP scripts generate a table for chambers of a given type and a given production site. For each chamber the table shows:

- The chamber gas leakage.
- The result of the chamber HV conditioning.
- The uniformity scan results for each bi-gap (AB and CD), classified according the LHCb standards (7).
- The quality of the chamber, classified according the LHCb standards (7), with a link pointing to the picture of the uniformity scan.
- If there are any hospitals in the chamber and where they are.
- What is the current chamber location.
- The dark current drawn by the chamber at the higher applied voltage test.
- Chamber closing time.

Thus in one single page we keep all the information needed to determine if a chamber is accepted or not following the LHCb prescriptions. Colors help highlighting the good chambers (in green) and the failed tests (in red).

Last update: June 23, 2005, 3:58 pm .

Chamber	C021	C022	C023	C024	C025	C026	C027	C028	C029	C030
L1	P2995	P3179	P2933	P3084	P3241	P2948	P2944	P2997	P4262	P4265
L2	P3237	P2982	P3230	P2985	P2968	P3167	P3004	P4280	P4282	P4352
L3	P3078	P3183	P3181	P2937	P3173	P3165	P3149	P4302	P4306	P4333
L4	P2974	P3218	P3025	P3222	P3015	P3189	P4286	P4290	P4284	P4281
L5	P3003	P2993	P2989	P2929	P3175	P3147	P3014	P4304	P4331	P4329

Legend

Pxxxx	(Ready to be) Assembled panel
Pxxxv	Panel ready for wiring
Pxxxw	Glued Panel
Pxxxx	Panel received from Internormal

Last update: June 23, 2005, 3:58 pm .

Chamber	C031	C032	C033	C034	C035	C036	C037	C038	C039	C040
L1	P4346	P4344	P4340	P4259	P4327	P4300	P4317	P4338	P3171	P3177
L2	P4350	P4354	P4458	P4323	P4402	P4396	P4400	P4444	P4398	P4436
L3	P4336	P4460	P4414	P4310	P4449	P4485	P4486	P4410	P4408	P4404
L4	P4313	P4419	P4358	P4477	P4475	P4479	P4426	P4583	P4553	P4555
L5	P4308	P4417	P4325	P4296	P4294	P4298	P4496	P4424	P4420	P4428

Last update: June 23, 2005, 3:58 pm .

Chamber	C041	C042	C043	C044	C045	C046
L1	P4271	P4342	P3247	P3125	P2973	
L2	P4550	P4434	P4547	P4492	P4543	
L3	P4406	P4490	P4498	P4688	P4604	
L4	P4559	P4514	P4561	P4589		
L5	P4430	P4432	P4494	P4697	P4622	P4680

Figure 10 Chamber builder (II). Snapshot of the PHP page that shows the process of chamber production. The table contains chambers already assembled (up to C035), chambers ready to be closed (up to C037) and chambers with panels still under preparation (up to C041). Chambers from C042 to C046 are chambers with panels that need to be glued (white ones).

Panel	Type	Glued	Problems	Layer	Comments	Vote	Position	Stamp Date	Discarded
P3560	r2-4	Tb	Pv	L	recuperare 2 punti 180,200 um	5.5	G.R.	2005-03-03	0
P3555	r2-4	Tb	Pv	L	recuperare	3.5	G.R.	2005-03-03	0
P3526	r1-5	Tb	Pv		da recuperare	0.0	G.R.	2005-03-02	0
P3502	r1-5	Tb	Pv		da recuperare	6.0	G.R.	2005-03-01	0
P3485	r3	Tb	Pv	L3		5.0	G.R.	2005-02-28	0
P3476	r2-4	Tb	Pv		da recuperare	6.0	G.R.	2005-02-28	0
P3481	r2-4	Tb	Pv		da recuperare	3.5	G.R.	2005-02-28	0
P3394	r2-4	Tb	Pv	L5	recuperare 2 punti a 180 um	7.0	G.R.	2005-02-23	0
P3380	r2-4	Tb	Pv		da recuperare	0.0	G.R.	2005-02-22	0
P3343	r3	Tb	Pv	L3		4.5	G.R.	2005-02-21	0
P3226	r2-4	Tb	Pv	L4	L4 per camera gobba	4.5	G.R.	2005-02-11	0
P3224	r2-4	Tb	Pv	L	da recuperare		G.R.	2005-02-11	0
P3123	r3	Tb	Pv	L3		3.5	G.R.	2005-02-07	0
P3052	r2-4	Tb	Pv	L4	L4 per camera gobba		G.R.	2005-02-01	0
P3050	r2-4	Tb	Pv	L	da recuperare	0.0	G.R.	2005-01-28	0
P3048	r2-4	Tb	Pv	L	da recuperare	0.0	G.R.	2005-01-28	0
P3029	r2-4	Tb	Pv	L	da recuperare	0.0	G.R.	2005-01-27	0
P2991	r1-5	Tb	Pv	L	effetto scotch esagerato:gobba al contrario > 300	0.0	G.R.	2005-01-25	0
P3397	r3	Tb	Pv	L3		5.0	G.R.		0

Figure 11 Chamber builder (III). Table, attached to the PHP chamber builder page, containing the list of BAD panels with information about their problems and their possible recovery.

4.2.3 Source scan results upload

This page, linked from the Chamber Update Tools page (see sec. 4.1.4), can be used from all the production sites to upload the plots of the results of the gain uniformity scans. The type and number of each chamber, deduced from the name of the image file (MsRt.Cxxx.png, where s and t are respectively the chamber station and region and xxx is the chamber number given in three digits), are used by a PERL script, ran by a cronjob, that copy the file under the corresponding chamber folder making

You're logged in as **lhcb**

Shows chambers.

Last update: June 27, 2005, 11:42 am

Chmb	Leakage : dP(mbar/h)	Cond	AB	CD	Source	Hosp. status	Position	Dark Current	Closing Date
C001	OK : dP = 0.23	SI	A	B	Good	--	C	<2.00 nA (in each gap) @ 2850	23-03-05 at 17:00
C002	OK : dP = 0.21	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	25-03-05 at 17:00
C003	OK : dP = 0.01	SI	A	A	Good	--	GLT	<2.00 nA (in each gap) @ 2850	29-03-05 at 17:00
C004	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	31-03-05 at 1000
C005	OK : dP = 0.18	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	01-04-05 at 1500
C006	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	04-04-05 at 1000
C007	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	06-04-05 at 1500
C008	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	08-04-05 at 1000
C009	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	11-04-05 at 1500
C010	OK : dP = 0.03	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	13-04-05 at 16:00
C011	OK : dP = 0.27	SI	A	B	Good	--	C	<2.00 nA (in each gap) @ 2850	21-04-05 at 1500
C012	OK : dP = 0.25	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	18-04-05 at 1300
C013	OK : dP = 0.03	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	22-04-05 at 1500
C014	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	26-04-05 at 1500
C015	OK : dP = 0.01	SI	A	A	Good	--	C	<2.00 nA (in each gap) @ 2850	28-04-05 at 1300

Figure 12 Chamber Overview. This PHP page displays the quality test results for each assembled chamber. Colors are used to easy the browsing of relevant information.

Key	Explanation
Missing	Missing test
	Bad Test Result
	Chamber is OK
	Chamber has hospitals recovered but not tested
--	No hospitals from beginning
OK	Hospitals recovered with conditioning
TbR	Hospitals To be Recovered
UR	Hospitals Under Recovery
C	Container
A	Anticamera pulita
HR	Hospital Recovery
UC	Under Conditioning
ST	Source Test
CT	Cosmics Test
GLT	Gas Leakage Test

Figure 13 Chamber Overview (II). At the end of the page the legend that explains font customization and color codes is shown.

the information available trough the web interface.

4.2.4 Chambers Production Page

This page contains the links to all the various production pages and provides an easy access to all the information stored in the database and the results of the quality tests. It also shows the graph of the production rate, see Fig.14, that is updated twice a day (see sec.5).

4.3 Portability to other sites

The database code has been designed in order to ease the inclusion of additional production sites and the code relocation (in case the software needs to be transferred in different directories or sites). To achieve this flexibility all the site dependent configurations are kept in a single utility file: by changing the content of few code lines it is possible to add or reconfigure different production sites or different monitoring needs. It is also easy to configure in this file the user accounts and their database access rights: for security reasons, this file is not visible to the users but only to the database administrator.

5 ROOT and PERL analysis

A very quick overview of the possible quality crosschecks that can be made using PERL(6), ROOT(5), PHP and MySQL is given in this section.

In order to flag the quality of the chambers we have developed a ROOT based application: a cronjob, every day, executes a PERL script that queries the web information, updates the list of produced chambers and scans and analyze the results of the gain uniformity test producing the list of bad and good chambers as a function of the LHCb criteria.

The resulting plots, displaying the information resulting from the uniformity tests performed with a radioactive source, can be viewed from a web interface located in the url www.lnf.infn.it/esperimenti/lhcb/private/mwpc/construction/php/monitor

This script can be used also to generate and update the graph showing the production rate (as shown in fig. 14) and to produce the histograms for wire pitch and wire tension measurements of all the new panels that have been tested.

In this way the information update is fully automated and useful plots, needed to check for “trends” in the production, are kept up to date every day.

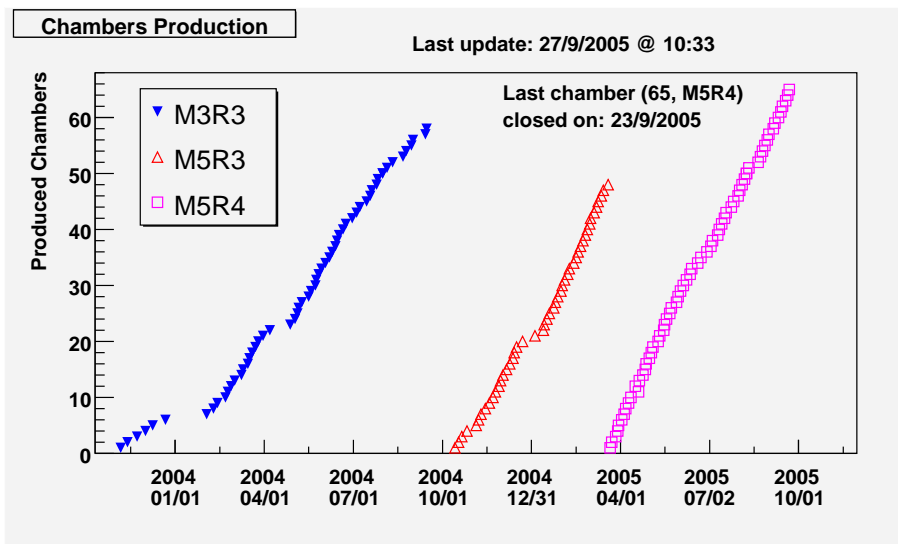


Figure 14 Production monitoring plot. This plot, generated every 12 hours with a cronjob using PERL and ROOT software, shows the integrated chambers production, as a function of the chamber type.

6 Conclusions and outlook

In this note a tool for the LHCb MWPC production monitoring has been presented: details on the database structure and organization and about web interfaces have been given. The tool has proved, so far, to be useful in monitoring and planning the production of three Italian sites since 2004. The maintenance of the code ended nearly six months after the project start-up: it has proved to be safe, stable and reliable. Adding other production sites (like Potenza or Ferrara) has proved to be straightforward: the portability to other sites or production lines being made easy by the usage of only one configuration file. The code has been designed to be as flexible as possible: few changes in the configuration files and in the sql tables can be easily accomplished if a different use case for such production monitoring is found.

References

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