

# European Design Study Towards a TeV Linear Collider



## WP 2 : Beam Delivery System

Co-ordinator: Deepa Angal-Kalinin

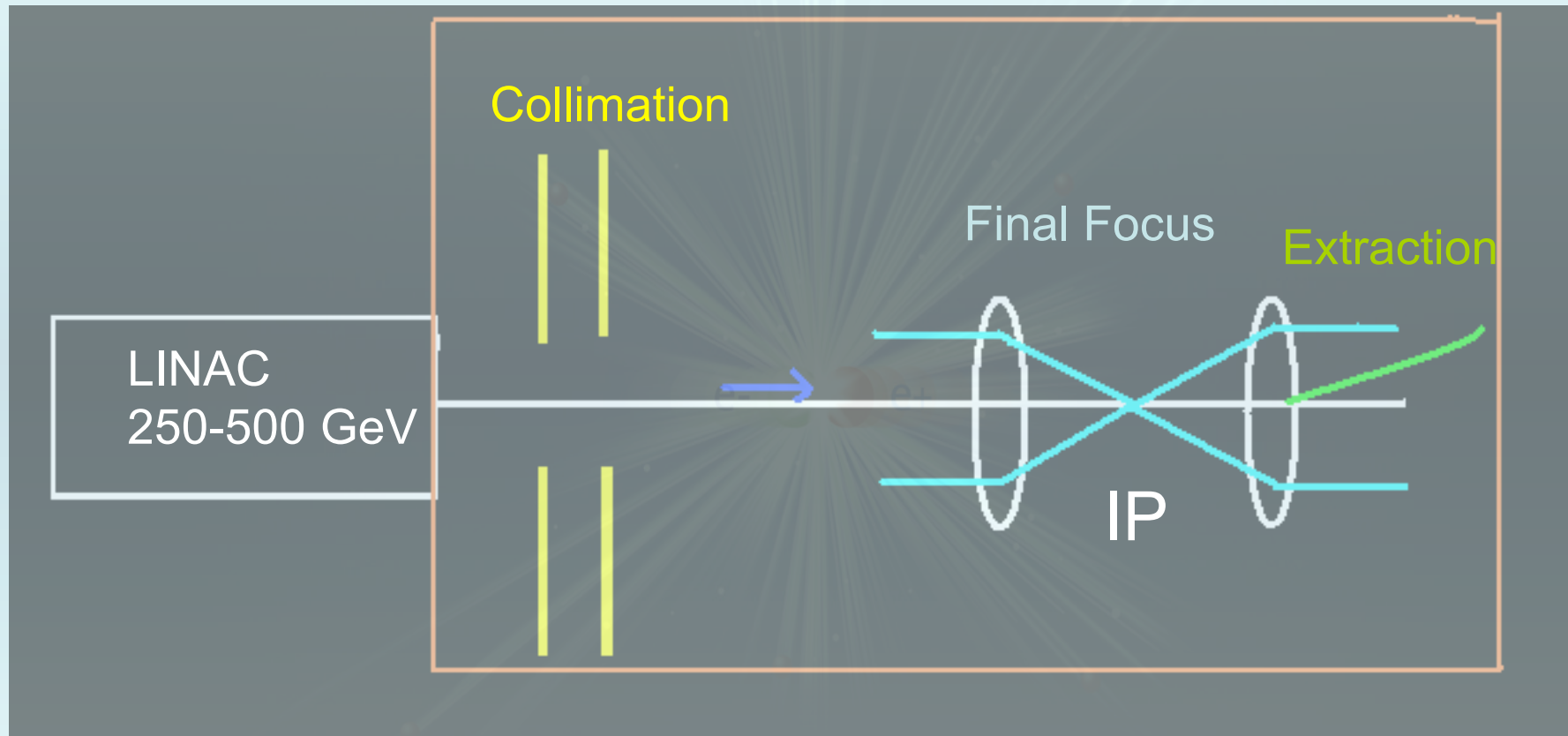
CCLRC, Daresbury Laboratory

# WP2 : Beam Delivery System

## Overall Goals

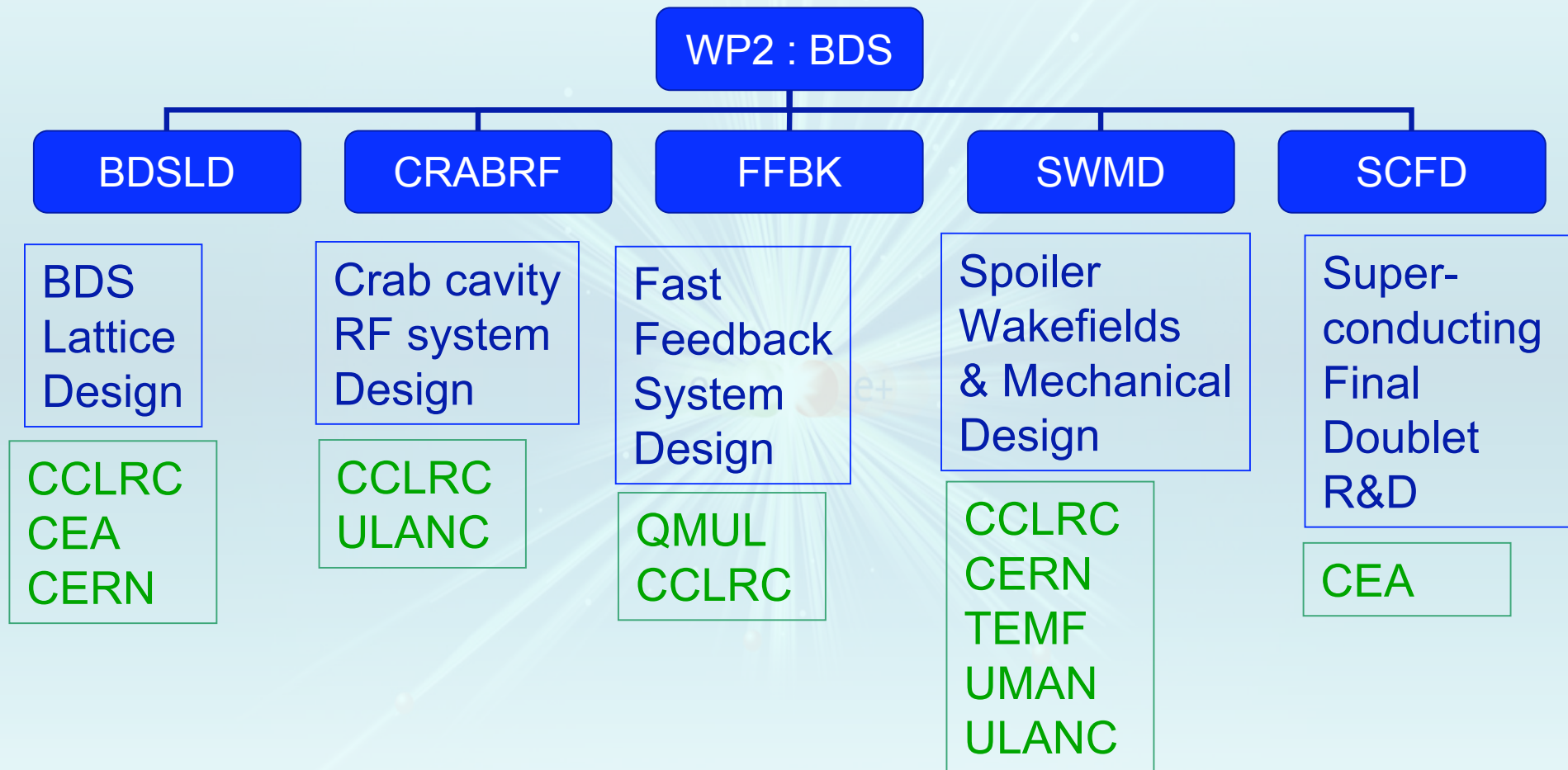
- The work package aims to contribute to the Beam Delivery System design challenges of the ILC.
- Decision on BDIR configuration for the ILC will decide critical design choices.
- The work will be done in close collaboration with ILPS and DIAG work packages to reach the luminosity performance goal.
- The regional groups will work together to provide the required designs, prototypes & beam tests to decide the design choices.
- Expertise from other regions and their participation will need some flexibility in this work package.

# Beam Delivery System



IP

# EUROTeV WP2 : BDS Overview



Tasks cover critical design choices for the BDS

# BDSL D – BDS Lattice Design

Contact person : D.Angal-Kalinin (CCLRC)

ILC BDS lattice will evolve after BDIR configuration will be decided. Earlier experience on NLC/JLC, TESLA & CLIC BDS designs will help to design the new BDS layout in best possible way.

- Complete lattice design for chosen BDIR configuration for two IRs
- Impact of lattice design on collimation efficiency
- Extraction scheme (head-on or small crossing angle)
- Design of extraction lines for both IRs
- Exploration of potential non-linear collimation system

## Deliverables

- BDS lattice designs with two IRs.
- Extraction line designs for two IRs and Fast extraction line

Close collaboration with ILPS and DIAG workpackages.

# CRABRF – Crab Cavity RF System Design

Task contact person : A. Dexter (ULANC)

At least one IR will need crab cavity: Details after deciding the BDIR model. Specifications, phase stability for electronics, prototypes, beam tests?

- Parameters of crab cavities
- Design of crab cavities
- Low power validation tests on a prototype cavity
- RF system model for phase stability performance
- Klystron design and performance studies
- Design of high power prototype

## Deliverables

- Prototypes of crab cavities (Dec'05, Sep'06)
- Low Power RF source (June'06)
- Phase control system (June'06)
- Phase testing of crab cavities (April'07)
- Final report on SC crab cavity system (Dec'07)

# FFBK – Fast Feedback System Design

Task contact person : P.Burrows (QMUL)

Digital feedback systems for the long SCRF bunch train.  
Sensitivity to backgrounds, EMI, radiation damage.  
Feedback is critical for delivering luminosity → must be robust!

- Design & fabrication of BPMs, kickers and amplifiers for nm-level IP feedback
- Experimental set up in the beamline for stabilisation of long bunch train
- Design and development of intra-train beam-beam deflection system

## Deliverables

- Prototypes of BPMs and kickers for nanometer level feedback and their tests (Dec'05)
- Experimental verification of feedback (June'06)
- Prototype of intra-train beam-beam deflection scan system (Sep'07)

# SWMD – Spoiler Wakefields and Mechanical Design

Task contact person : N. Watson (CCLRC/Birmingham)

Simulation code to correctly simulate geometric/resistive wake fields of spoilers, spoiler designs, material damage, validation of simulations against measurements.

- Specifications of spoilers
- Material Damage studies
- Cold test measurements set up
- Fabrication of spoiler prototypes
- Development of wake field simulation codes
- Spoiler beam tests at SLAC test facility

## Deliverables

- Cold test prototype (Dec'06)
- ECHO: 3-D wakefield package (Dec'07)
- Optimal spoiler design (Dec'07)



# SCFD – Super conducting Final Doublet

Task contact person :O.Napoly (CEA)

High gradient superconducting quadrupoles for final focus – performance, mechanical stability and effect of external field of 2T parallel to its axis.

- SC final doublet test station
- Solenoid installation
- Experiment of high-field s/c quadrupole in a 2T external solenoid

Deliverable

- Demonstration of feasibility for LC final doublet (June'06)

# BDS Manpower

Institute	Person Months
CCLRC	242
CEA	69
CERN	34.8
QMUL	72
TEMF/TU	72
ULANC	130
UMAN	42
<b>Total</b>	<b>661.8</b> <b>(EU requested 179.4)</b>

# Time Schedule

- First lattice design decks will be available within 12-15 months. The time line for this task will need to fit within the ILC CDR time line.
- The prototypes of crab cavity and RF system : First version of report : after 24 months.
- IP feedback, final phase nm-level feedback performance analysis : after 30 months.
- Report specifying spoiler requirements : 15 months & Optimised spoiler design report : after 36 months  
ECHO-3D for ILPS WP available after 30 months.
- Final Superconducting doublet recommendations : available after 17 months.

# Beam Delivery System – Global contest

EUROTeV will contribute to the design choices for BDS for the ILC within international collaborations.

- Discussion on the critical CDR choices in ILC BDIR WP:
    - Crossing angle (IR1/IR2)
    - $L^*$  (IR1/IR2)
    - Final doublet technology (IR1/IR2)
    - Collimation choices (IR1/IR2)
    - Beam stabilisation Issues
    - Instrumentation choices
    - Machine Protection Issues
    - Positron source/Undulator location
    - Risk Mitigation
    - Detector layout
    - Detector VXD inner radius (IR1/IR2)
- EUROTeV- BDS & other WPs cover most of these topics. Exact contribution will depend upon the international global effort.

# Summary

- The work package aims to participate in the global design effort for the ILC.
- Main contributions to the ILC will include :
  - BDS lattice design
  - Spoiler designs - simulations, cold and beam tests
  - Crab cavity RF design and prototypes
  - Fast IP feedback – BPMs, kickers prototypes, beam tests
  - Demonstration of super conducting final doublet
- Participants of this WP will:
  - Participate in the global discussion to decide the new BDIR configuration for the ILC.
  - Provide prototypes with beam tests for some of the critical components.
  - Coordinate EUROTev BDS activities in an international collaboration.