

# CLIC-ILD Cooperation

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★ Purpose of this talk:  
prompt discussion...



# CLIC Conceptual Design Report

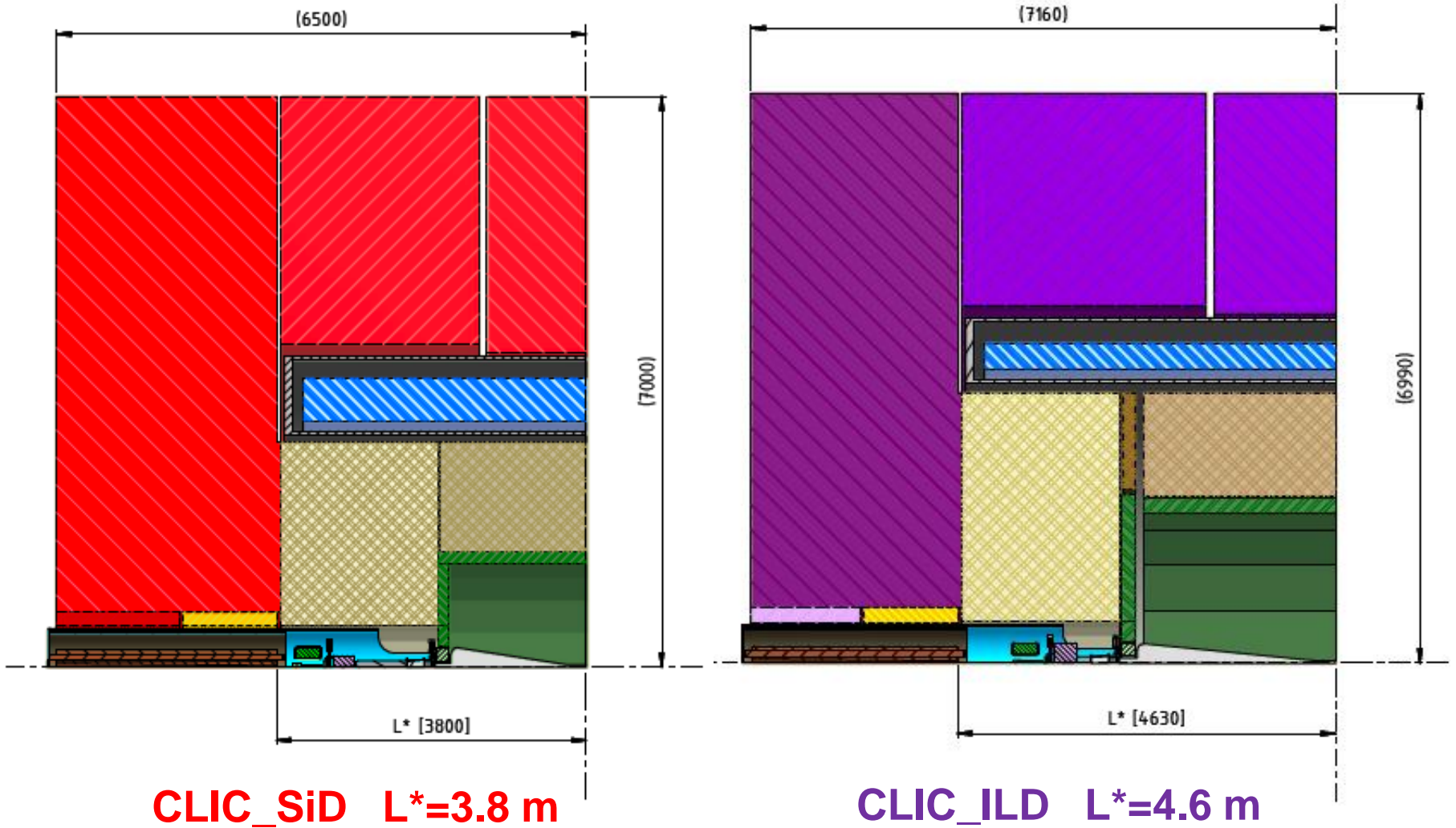
- ★ CLIC machine and detector CDR being produced for April 2011
  - Will be published as a CERN “yellow report”
  - This is a hard deadline – fixed by submission to CERN council for June 2011 sessions
  - This is a very challenging, but not starting from scratch
    - Detector work building from ILD and SiD Lols
  
- ★ The CDR will have 3 volumes:
  - 1 Executive summary (~50 pages)
  - 2 The CLIC accelerator and site facilities (~400 pages)
  - 3 Physics and detectors at CLIC (~150 pages)
  
- ★ Volume 3 editors: Harry Weerts (ANL, SiD),  
Akiya Miyamoto (KEK, ILD)  
Marcel Stanitzki (STFC-RAL, CLIC)  
Lucie Linssen (CERN, CLIC)

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## ★ The CLIC Detector for the CDR

- Based on both SiD and ILD
- Modifications to SiD and ILD made for CLIC, e.g. CLIC01\_ILD:
  - 4 Tesla field
  - Vertex detector moved to 31 mm
  - HCAL (77 layers scintillator/Tungsten)
  - modified forward region
- CLIC01\_ILD Mokka model maintained by Andre Sailer
- Both CLIC\_ILD and CLIC\_SiD detector models will be used in CDR
- But no direct comparison of ILD/SiD performance
  - example studies to demonstrate physics performance in CLIC environment

# CLIC\_SiD and CLIC\_ILD



# CLIC/ILC Joint WG

- ★ At start of 2010 CLIC/ILC joint WG formed
  - Sakue Yamada (RD)
  - Francois Richard (RD Team)
  - Marcel Demarteau (Detector R&D Panel)
  - Felix Sefkow (CALICE)
  - Lucie Linssen (CLIC)
  - Mark Thomson (ILD)
  - Marcel Stanitzki (SiD)

Reports to ILCSC and CLIC Collaboration Board

## Mandate:

- ★ Promoting the physics and the detectors of the Linear Collider
- ★ Identifying synergies between the detectors of ILC and CLIC in performance studies, detector R&D, and software tools
- ★ Discussing detailed plans for the ILC and CLIC efforts, in order to explore possible collaborations on issues such as critical R&D on sub-detectors, coil studies, push-pull mechanism and MDI aspects
- ★ **Discussing a possible format of collaboration between the ILC validated detector groups and CLIC**

# CLIC/ILC Joint WG in Practice

- ★ First meeting took place at Beijing LCWS
- ★ Subsequent discussions help define role in practice
  - Light touch
  - Encourage collaboration between CLIC and ILC Concepts and ILC Detector R&D groups
    - focussed workshops on areas of common interest
    - e.g. software workshop on Monday
  - Also maintain channels of communication

## CLIC/ILD Collaboration

- ★ Collaboration is already happening
- ★ Through CLIC activities, CERN is already contributing to ILD
- ★ CERN signed both ILD and SiD Lols
- ★ CERN Linear Collider Detector (LCD) Project is formally a member of: **CALICE, LC-TPC, FCAL, EUDET, AIDA**
- ★ From CLIC side (Lucie) have a list of current activities (next few pages) which are benefitting the ILC detector community

# LCD Group Activities benefitting ILC

## Core Software development

Core software Mokka/Marlin	Improvements to the geometry descriptions in Mokka/Marlin (involving mostly members of CERN, DESY, LLR)
Pandora_PFA_new	Participation in the re-write of Pandora, in particular the photon clustering algorithm (Cambridge univ, with help from CERN)
Pandora_PFA_new	Assessment of performance of Pandora PFA new in jet reconstruction, PFO muon-id, PFO tau-id
GRID production tools	Setting up of automatic GRID production tools and file database for Mokka/Marlin and for SLIC/LCSim (using the LHCb DIRAC framework)
TPC pattern recognition and track reconstruction	Development of improved TPC pattern recognition and track reconstruction
Hadronisation in Geant4	Study and improvements to the hadronisation models in Geant4

## Work on overlay of background and physics

Overlay of incoherent pairs and $gg \Rightarrow$ hadron events	Work on overlay of background and physics events, gaining experience that is also of use for ILC
Forward region background studies	Detailed forward region simulations with study of backscattered particles in Mokka/Marlin
Muon background from machine	Study of (horizontal) muon background from the machine and its rejection in the tracking/calor codes

**Assessment of high energies, with clear interest for future 1 TeV ILC work**

SiD tracking at high energies	Assesment of SiD tracking at high energies and with background overlay
Muon id and muon optimisation	Study of muon-id, dramatic energy loss by muons, hadron shower leakage
Tau finder	Development of a tau finder and tau reconstruction (currently in Marlin, but can extend to SiD software)
SiD and ILD detector adaptations for higher energies	For the CLIC study, the ILD and SiD concepts are adapted to higher energies (and of course also to CLIC background conditions). These adaptations will provide useful input to define 1 TeV detector strategies for the ILC.
Optimisation of physics observables	For the CLIC study we work on the optimisation of physics observables at 3 TeV. The corresponding adaptations to the various codes will serve the ILC as well.



### **Engineering studies**

Vibration studies, forward region quadrupole suspension	Vibration studies at LHC locations, study of QD0 suspension including FEA and design, corresponding opening scenarios
Push-pull studies and requirements for experimental area	Push-pull studies and requirements for experimental area and its services
Solenoid magnet studies	Solenoid magnet (4T and 5T) calculations and design parameters
Solenoid services	Studies of solenoid services and quench protection compatible with push-pull

## Electronics developments

TPC pad readout	Development of TPC pad readout electronics, based on S-Altro (microelectronics) design
TPC pixel readout	Design of pixel chip for TPC readout (Timepix2 chip)
Microelectronics support	Microelectronics support, training, foundry services, design reviewing for LC community

## HCAL R&D

Tungsten-based HCAL studies within CALICE	Preparation of beam tests of a large HCAL prototype, based on Tungsten absorbers and various CALICE active media
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## FCAL

Beamcal and lumical simulation models	Setting up and maintenance of Mokka/Marlin/Geant4 simulation model of Beamcal and Lumical; software support for ILC FCAL members
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# CLIC/CLIC CDR activities outside CERN

## **Non-exhaustive list of ongoing CLIC-related activities outside CERN**

**LAPP Annecy:** SUSY benchmark studies and detector requirement studies; DHCAL studies (SW+HW) based on micromegas;

**DESY:** Tungsten HCAL simulations, including PFA; preparations of HCAL test beam; polarisation studies

**MPI-MPP Munich:** Preparations for tungsten HCAL test beam in view of understanding the time profile of the shower.

**Cambridge University:** PFA studies at higher energies, and adaptations to Pandora PFA; re-wrtie of Pandora PFA (indispensable for CLIC)

**UCSC:** CLIC background studies, detector requirements studies, tracking studies, UCSC

**Prague, Oxford (and also KEK?):** Study of LCFI flavour tagging at high energies

**IFIC Valencia and Barcelona Univ. (Spanish LC consortium):** Forward tracking studies and 3 TeV

**ETHZ:** engineering and magnet studies

**Tel Aviv University:** simulation and optimisation of Lumical for CLIC

**Several institutes:** Coordinating roles (working groups) for the CLIC studies

Participation in the **CLIC CDR editing** (4 main editors and 30 chapter editors, of which 9 from inside and 25 from outside CERN)

# ILD Contributions to CLIC

- ★ Presented list of CLIC activities benefitting ILC
- ★ There is a lot going on...
- ★ Would be useful to compile a similar list of ILD activities directly benefitting CLIC, e.g. background studies
  - ensure everyone is aware of what is going on

# Concluding Comments

## The good

- ★ CERN LC detector activities are having a real impact
- ★ Important to note that available effort at CERN has increased significantly over past year (still increasing)
  - positive impact on ILD should increase

## The less good

- ★ Communication between LCD and ILD perhaps could be improved

## Overall

- ★ I believe the ongoing collaboration between CLIC and ILD has already been very positive

## Finally

- ★ Currently, relationship between ILD and CLIC is informal
  - is the the right approach for ILD?

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**Comments...?**

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