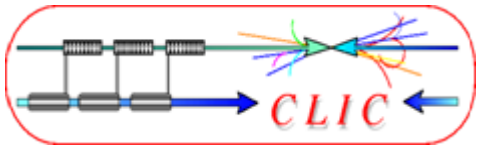


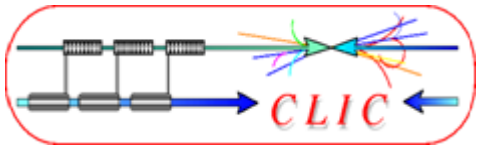
News from CERN LCD and CLIC

Konrad Elsener

CERN

Outline:

- LCD Project at CERN (and the CDR)
- Layout and Integration Studies
- Some News from CLIC
- Summary



Linear Collider Detector Project @ CERN

Who are we ?

Lucie Linssen (project leader)

Przemyslaw Majewski (Tech. Student from Gdansk, database, file catalogue, GRID-DIRAC, Muon System, ...)

Andre Sailer (PhD student, forward region, MDI, stau analysis, computing support, ...)

Christian Grefe (PhD student, Hcal, W Hcal testbeam, SiD tracking, ...)

Erik Van Der Kraaij (Fellow 1 March 2010, Muon System, ...)

Stephane Poss (Fellow 1 Jan. 2010, ILC Grid – DIRAC, CDR production, ...)

Martin Killenberg (Fellow 1 Dec. 2009, TPC simulations, ...)

Astrid Munnich (Fellow, 1 Sept. 2009, geometry package, tau_finder, ...)

Fernando Duarte Ramos (Fellow, Mech. Eng., 1 Sept. 2009, MDI, stabilisation, etc.)

Peter Speckmayer (Fellow, Hcal simulations, new PANDORA, ...)

Dominik Dannheim (staff, as of 1 June 2010)

Konrad Elsener (staff, FCAL, MDI, CDR WG 5 on Engineering, layout, cost, ...)

+ part time help from CERN staff (W. Klempt, M. Hauschild, D. Schlatter, B. Schmidt, F. Teubert, A. Gaddi, H. Gerwig ....) + CERN contribution to EUDET + AIDA

+ help from other labs

A. Herve (ETH Zurich)

J.J. Blaising, J. Blaha (Annecy)

M. Battaglia (UC Santa Cruz)

+... + ...

+ Thanks for all your help!

FCAL, CALICE, LC_TPC, ILD and SiD groups, etc.

visits from FCAL: Iftach Sadeh (Feb. 2009)

Ivan Smiljanic (Oct. 2009),

Eliza Teodorescu (Nov./Dec. 2009)

LCD immediate objective:

CLIC Conceptual Design Report Vol 3.

(new deadline: April 2011)

Main Editors: A. Miyamoto (ILD+Asia),
H. Weerts (SiD+Americas),
M. Stanitzki + L. Linssen (CLIC+Europe)

"Chapter Editors" are being nominated by the main editors.

CDR Working Groups:

(... do the hard work, provide material for CDR chapters ... Volunteers welcome!)

WG1: CLIC Physics Potential

Conveners: G. Giudice and J. Wells

WG2: Physics Observables related to Jets

Conveners: M. Thomson and J.J. Blaising

WG3: Physics Observables related to Tracking

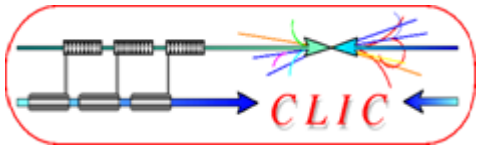
Convener: M. Battaglia and NN.

WG4: Vertex Detector Technology

Conveners (ad interim): M. Stanitzki and L. Linssen

WG5: Engineering, Layout, Solenoid and Cost

Conveners: K.Elsener and H. Gerwig



Layout and Integration Studies

Basic ingredient:

a lot is dictated by final quadrupole (QD0)

stabilisation requirements (vibrations < 0.5 nm at few Hz)

Two detectors with Push-Pull (at present, ILD_ish and SiD_ish)

both detectors on platform

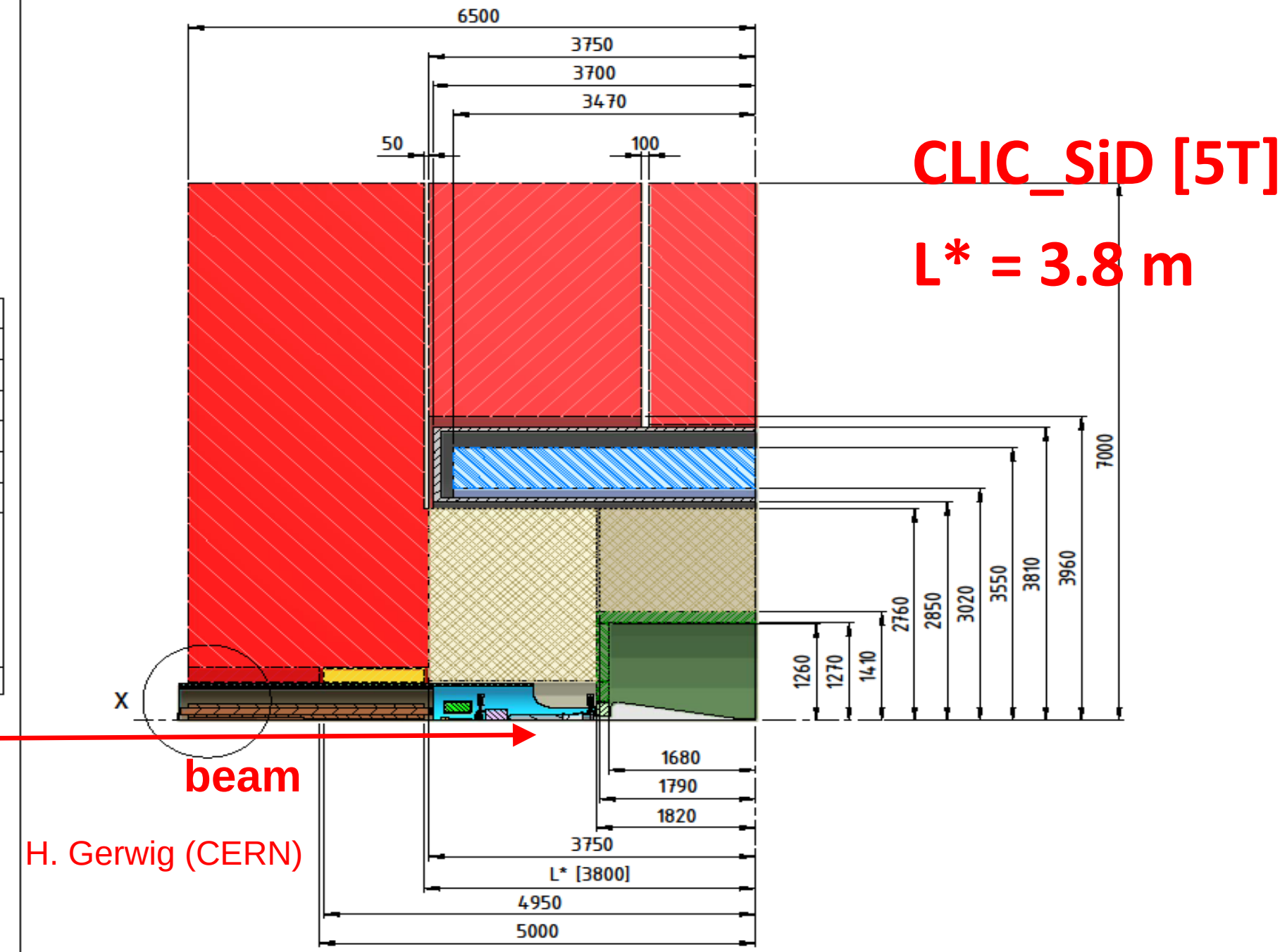
Detectors can not be opened on the IP

no need for “Pacman” shielding doors

QD0 supported from the tunnel, not from the detector(s)

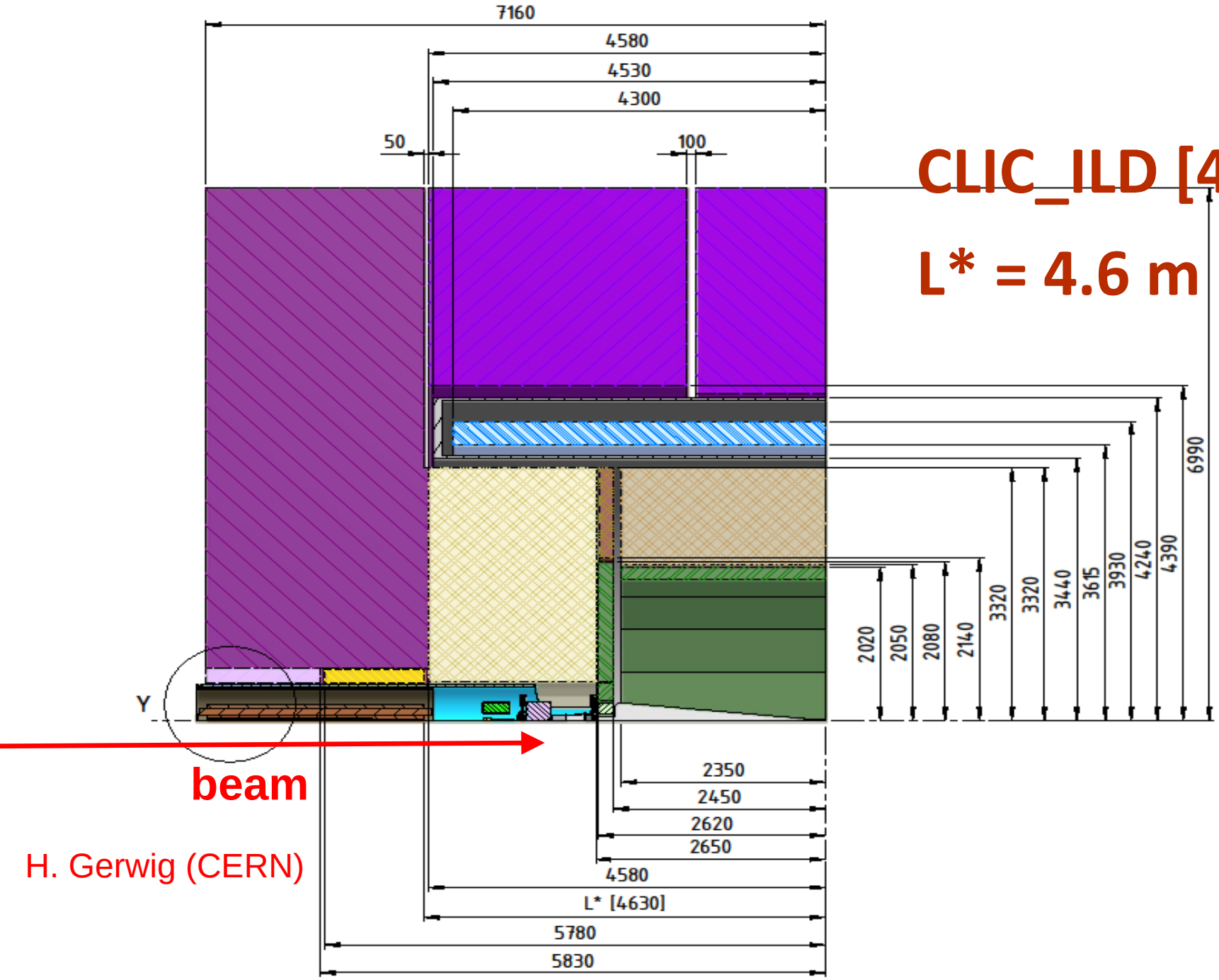
Pre-alignment requires “connection” across detector(s)

(NB. No Anti-DiD -> luminosity loss, see FCAL Oct. 2009)



CLIC_SiD [5T]

L* = 3.8 m

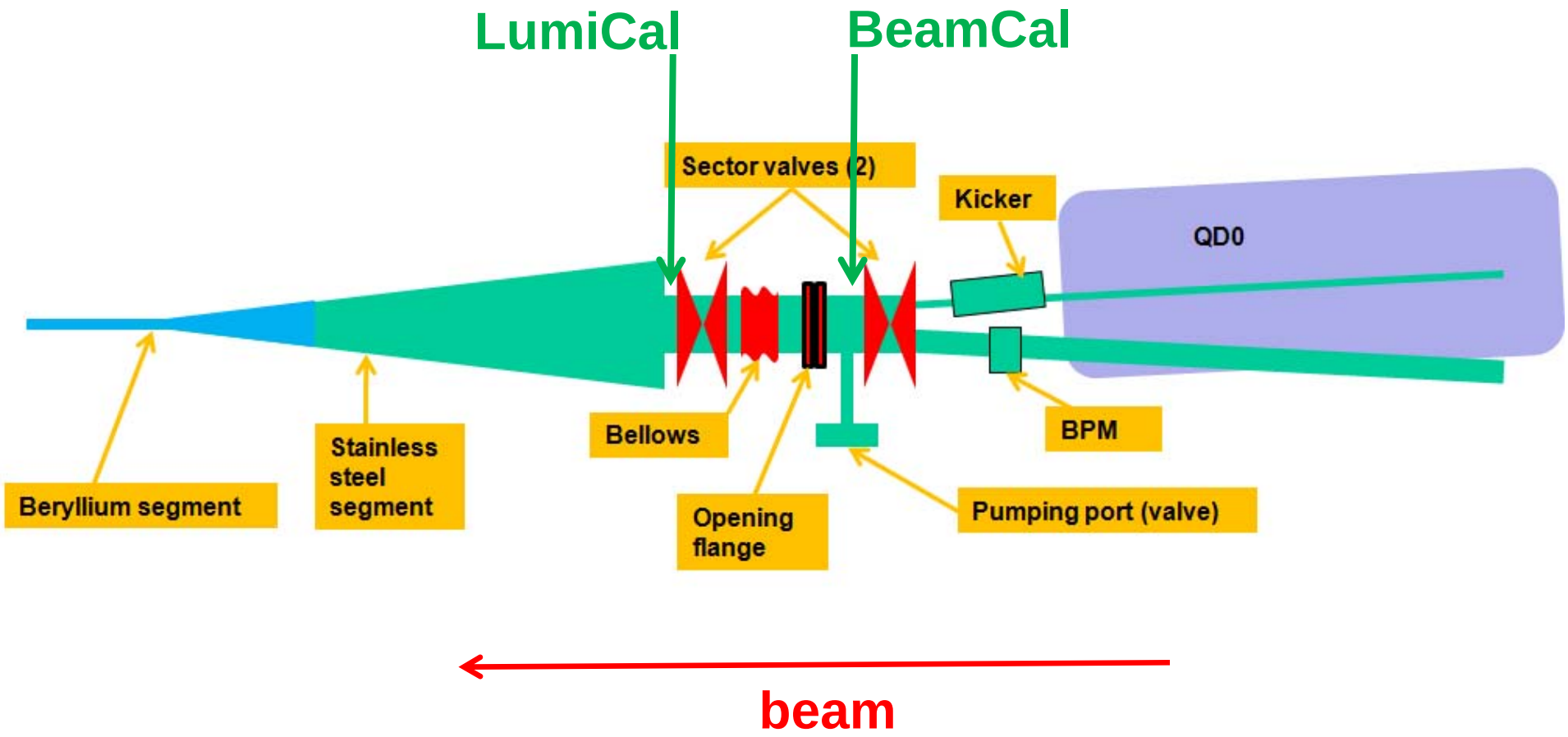


CLIC_ILD [4T]

L* = 4.6 m

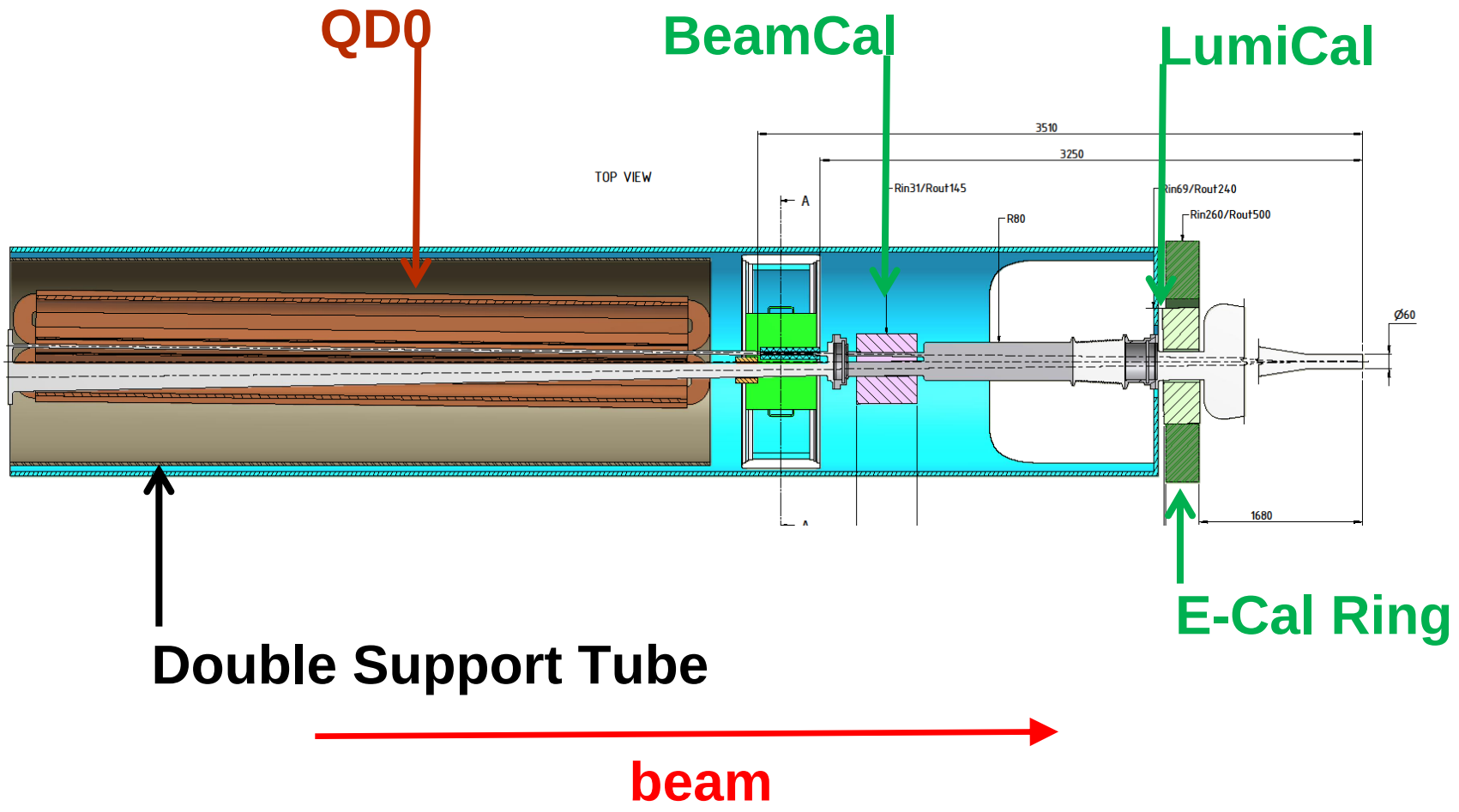
H. Gerwig (CERN)

CLIC Detector MDI – Vacuum Layout



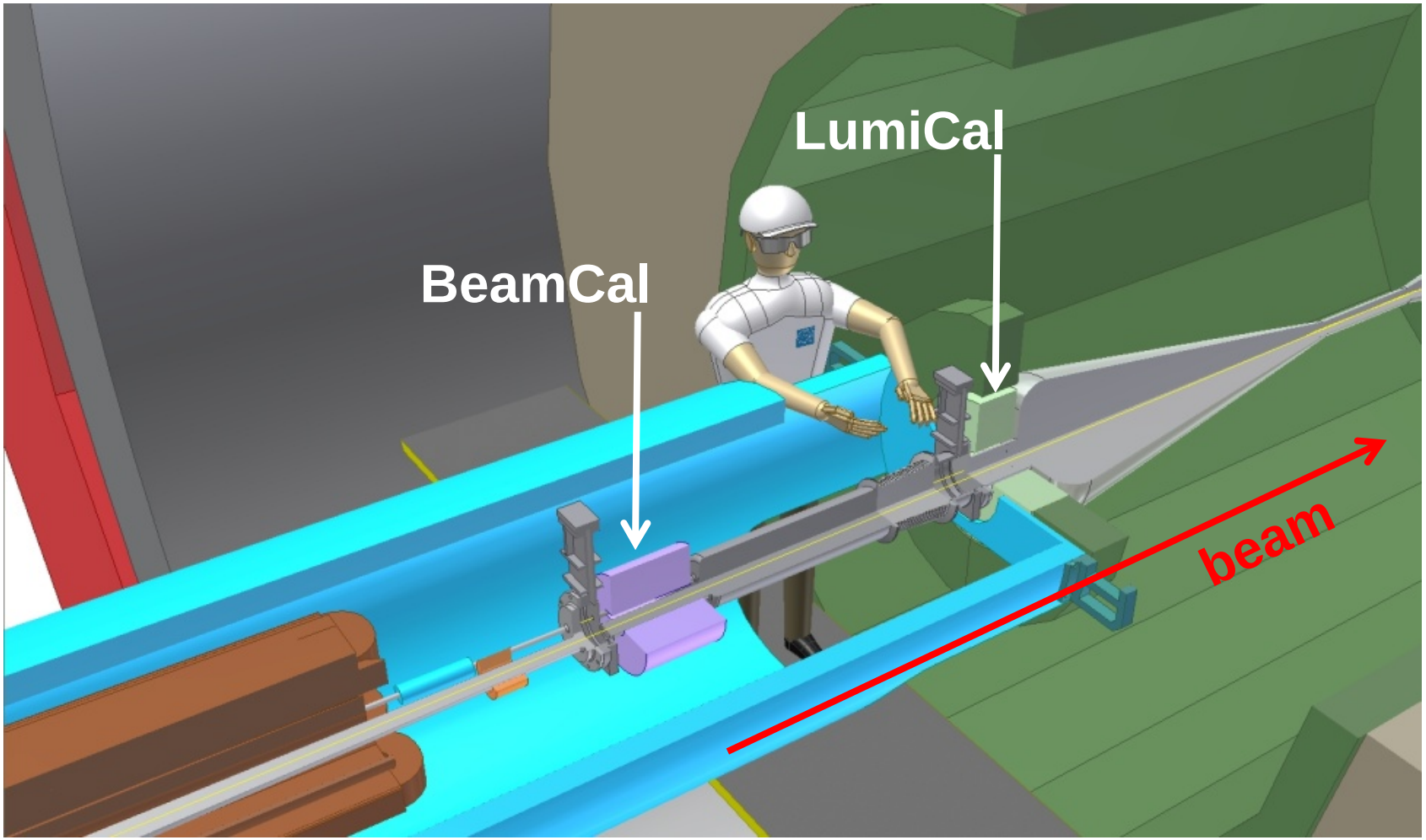
R. Veness, H. Gerwig (CERN)

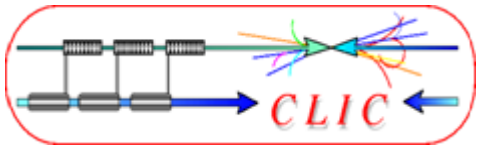
CLIC Detector MDI – Forward Region



H. Gerwig (CERN)

H. Gerwig (CERN)





Comments to the layout/integration studies:

WORK IN PROGRESS

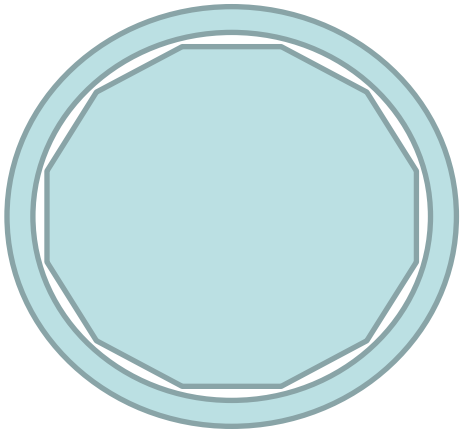
- presently, QD0 preliminary design for CLIC uses L*=3.5 m
  -> we use this design also in the CLIC_ILD Mokka model
- sc. antisolenoid to protect QD0 from detector solenoid field
- Model in Mokka not (yet) totally consistent with layout drawings

NB.

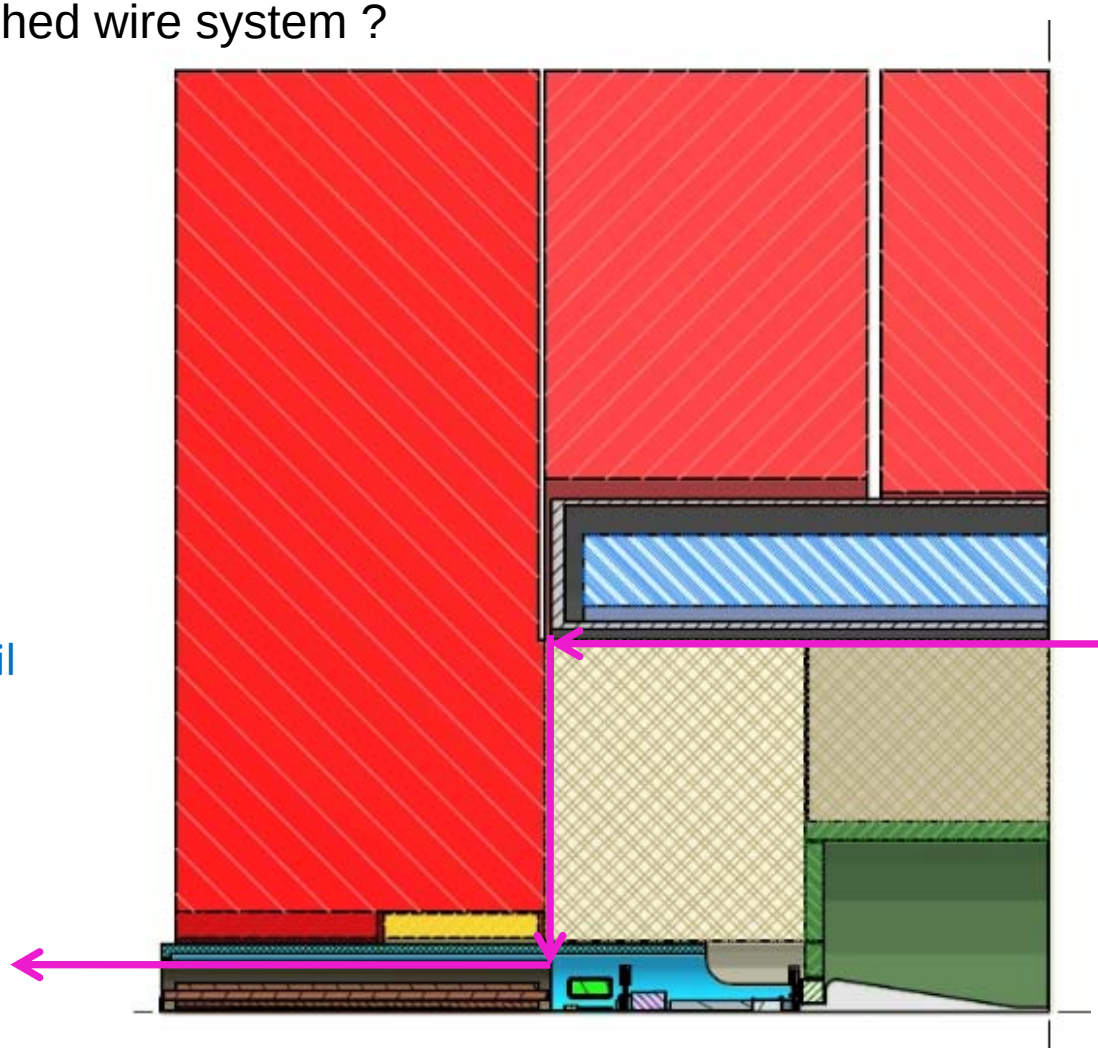
loss in forward region HCal and muon coverage: to be studied

Pre-Alignment Channels

CLIC accelerator components on both sides of the IP must be “linked” by pre-alignment; laser system or stretched wire system ?



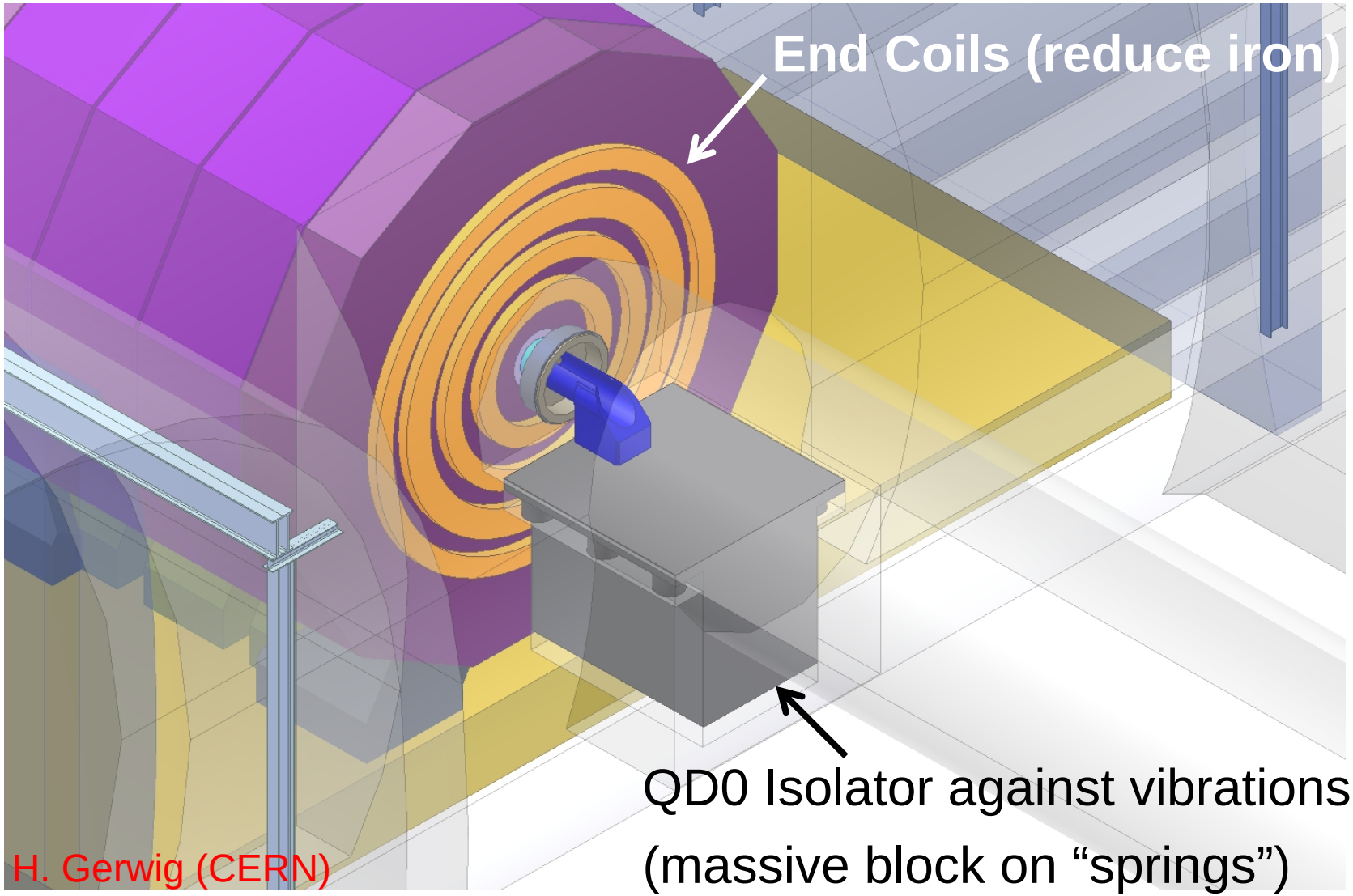
“transition region”
between HCAL and coil



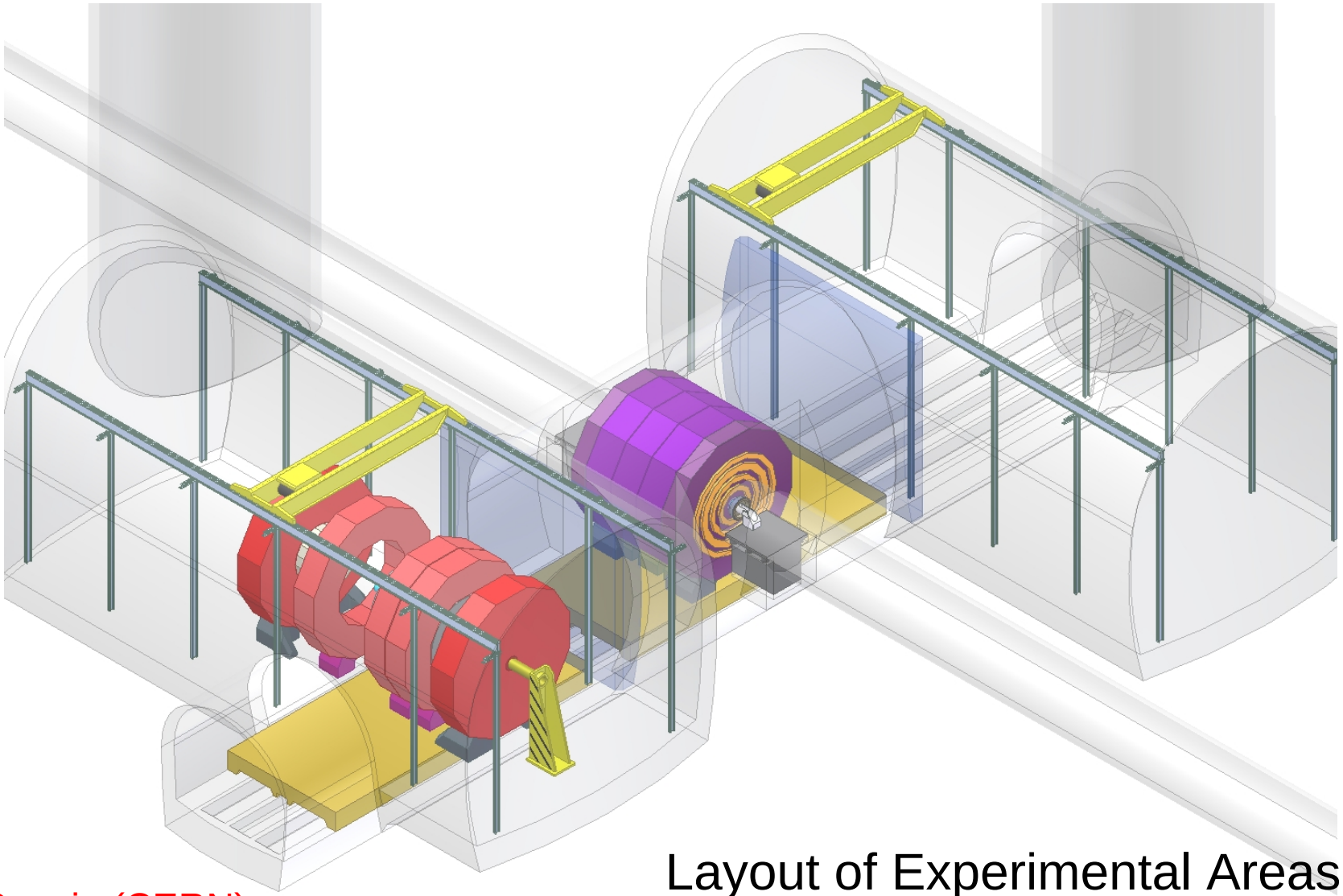
Proposal:
Ø 60 mm

H. Gerwig (CERN)

Other topics under study



Other topics under study



Layout of Experimental Areas

H. Gerwig (CERN)

News from CLIC

Reminder:

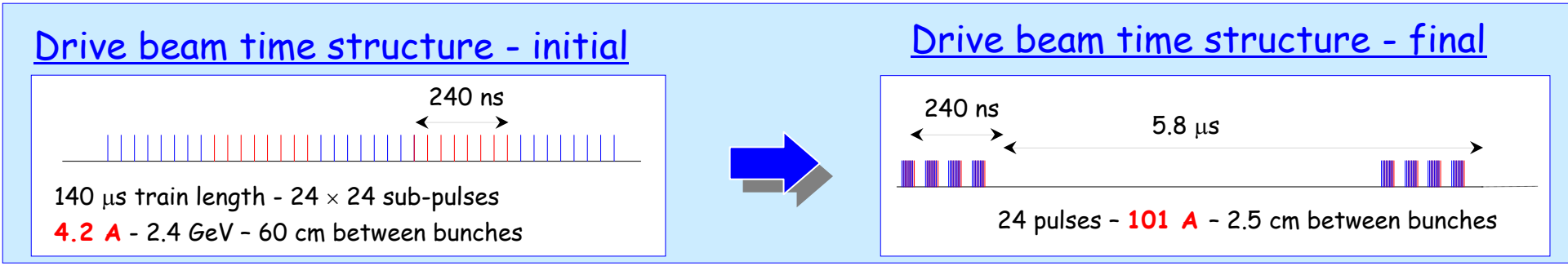
CLIC two-beam scheme

(1) high intensity 2.4 GeV "drive beam" to distribute the RF power

(this beam decelerated in Power Extraction Structures)

(2) main beam, lower intensity, accelerated by RF extracted from drive beam

Drive Beam Generation for CLIC:



News from CLIC

Steady progress towards feasibility demonstration of key ingredients

Highlights from 2009:

-> tests of accelerating structures (using klystrons, SLAC+KEK)

-> tests of Power Extraction (decelarating) structures (CTF3)

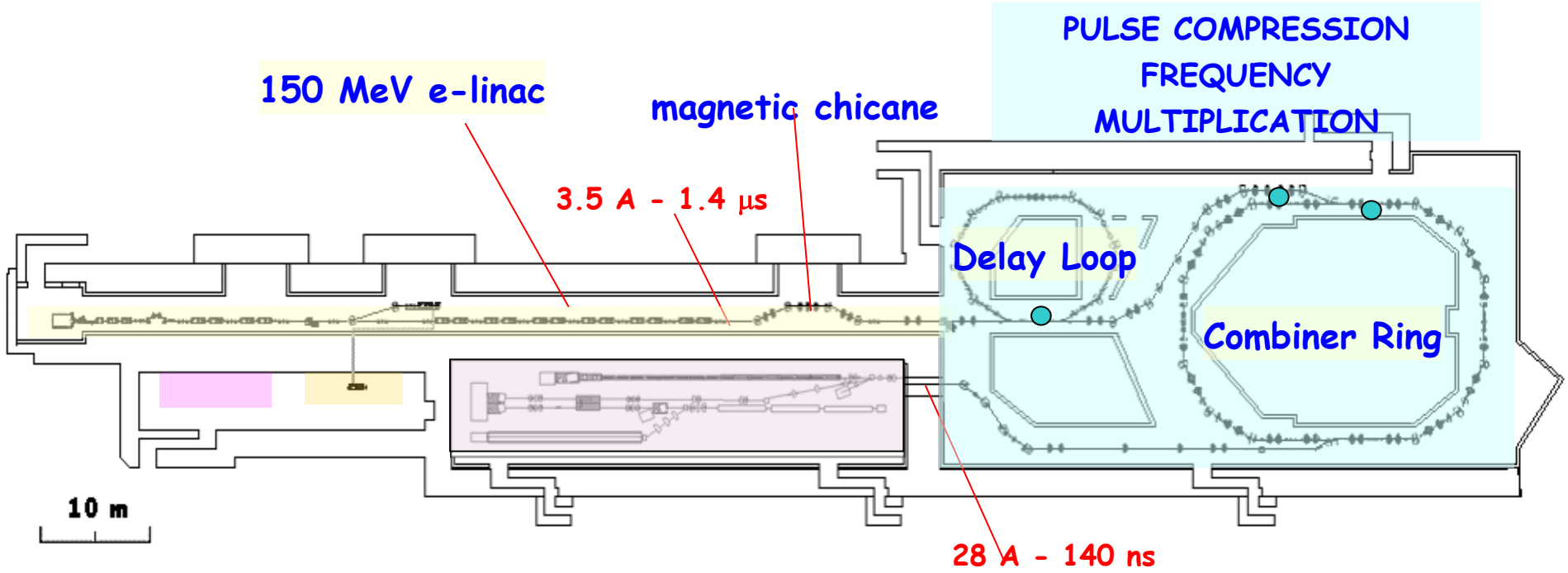
-> demonstration of drive beam generation

(very close to specification for the case of CTF3)

...

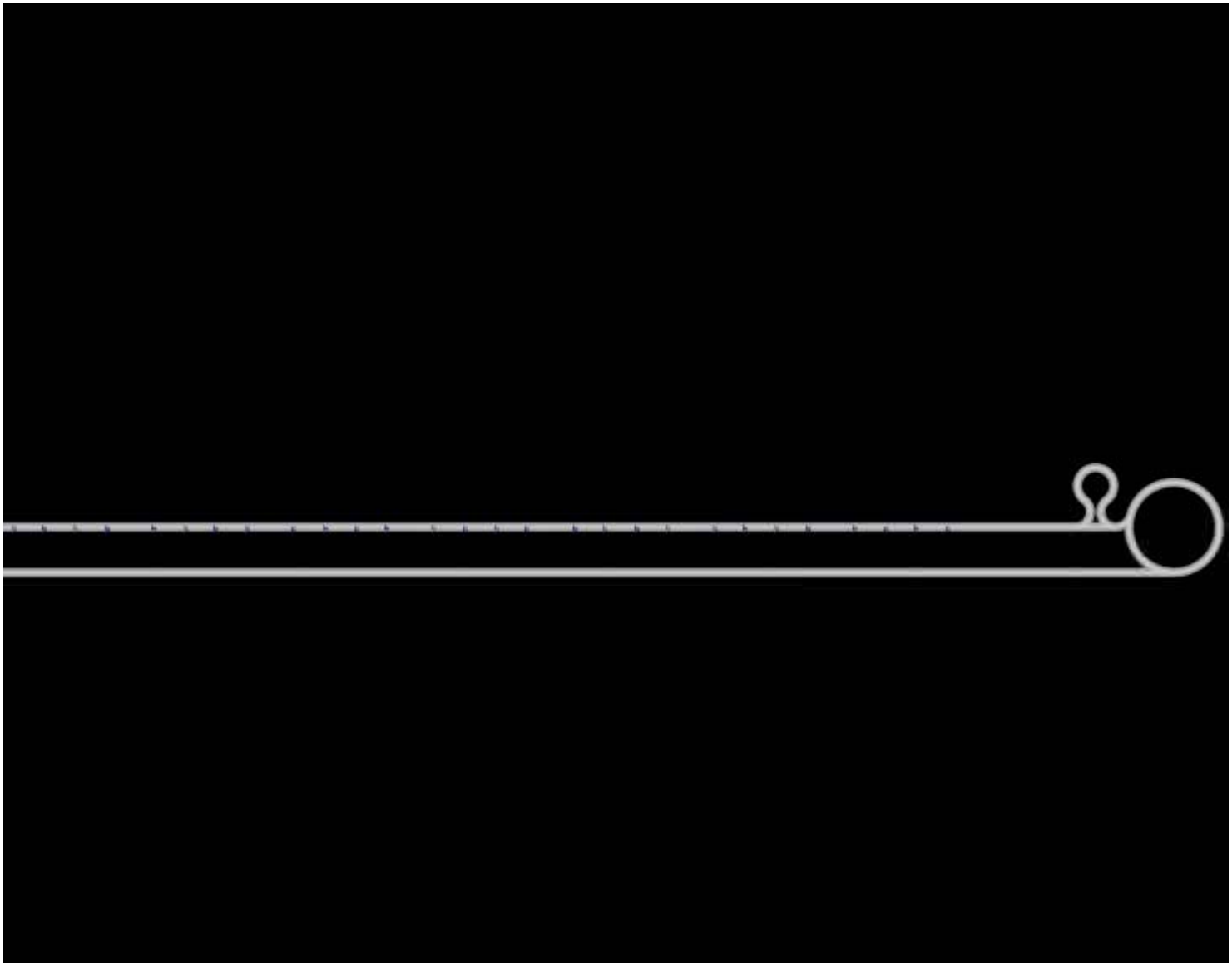
Two-Beam Acceleration: CLIC Test Facility (CTF3)

- Demonstrate Drive Beam generation
  (fully loaded acceleration, beam intensity and bunch frequency multiplication x8)
- Demonstrate RF Power Production and test Power Structures
- Demonstrate Two Beam Acceleration and test Accelerating Structures



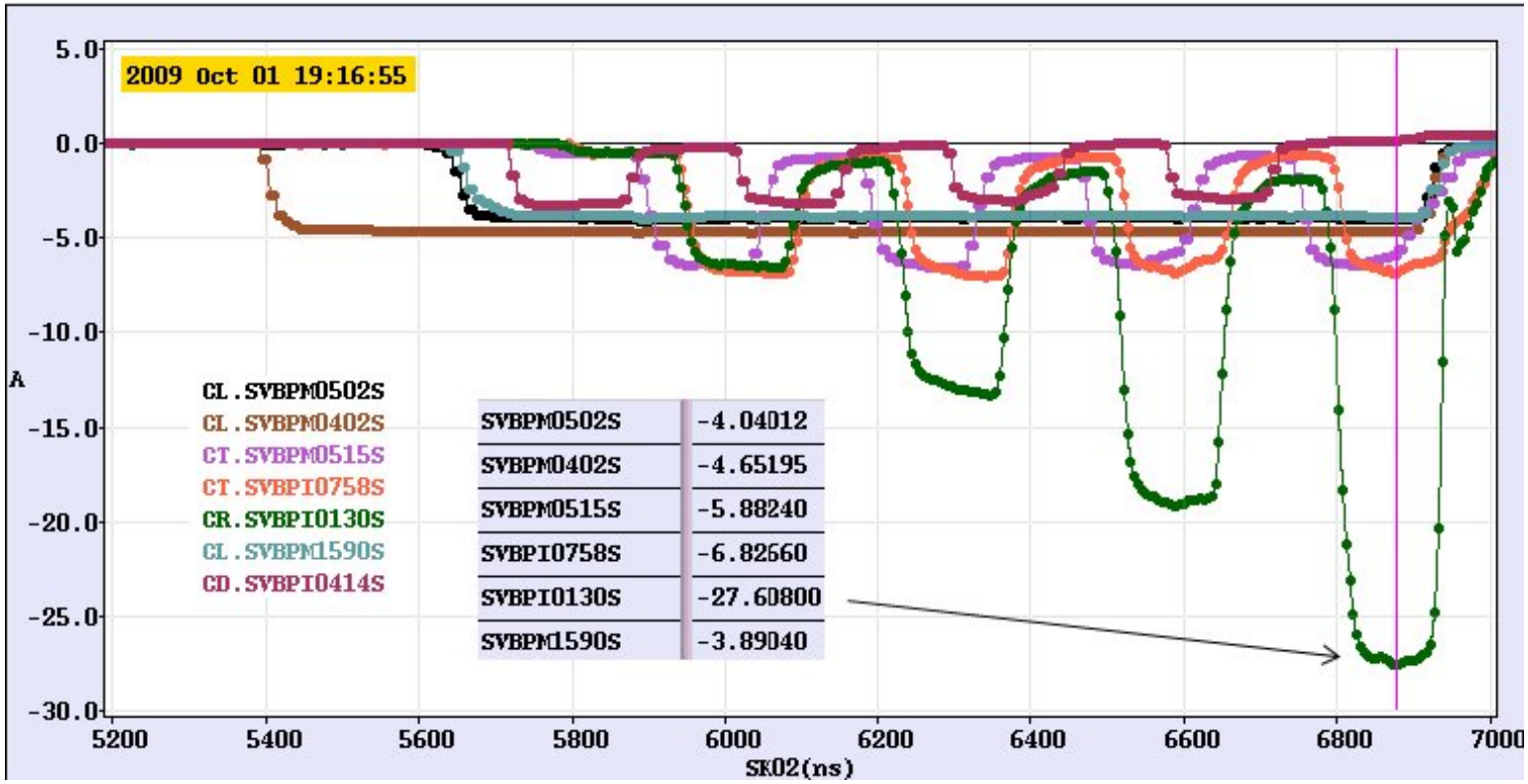
News from CLIC

Illustration of Drive beam generation at the CTF3 Test facility (courtesy Alexandra Andersson CERN BE-RF)



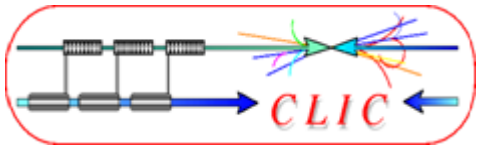
News from CLIC

Drive Beam Generation – CTF3



Current stability in drive beam accelerator approaching target (1.5×10^{-3} vs. 0.75×10^{-3})

S. Bettoni et al.



Summary

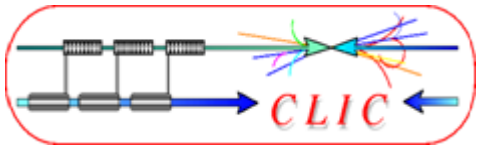
The CERN Linear Collider Detector Project is gaining momentum, but:
a lot of work to do for the CLIC CDR – all help is welcome !
Four CDR main editors are at work, will announce chapter editors soon.

Collaboration with ILC detector concepts, FCAL, CALICE etc.
has been intensified and proves to be very helpful for the CLIC detector study.

In some areas, CERN-LCD has been able to advance considerably, to the benefit also of the ILC detector concepts.
The CERN-LCD team would like to explore ways to contribute more to FCAL.

The CLIC accelerator study team, with the CTF3/CLIC collaboration, has made substantial progress in 2009 - a number of “feasibility items” have been demonstrated, in time for the CDR.

Thank you !



- Spare slides

News from CLIC

T18 and TD18 built and tested at SLAC and KEK

Goal: 3×10^{-7}/m at 100 MV/m loaded at 230 ns

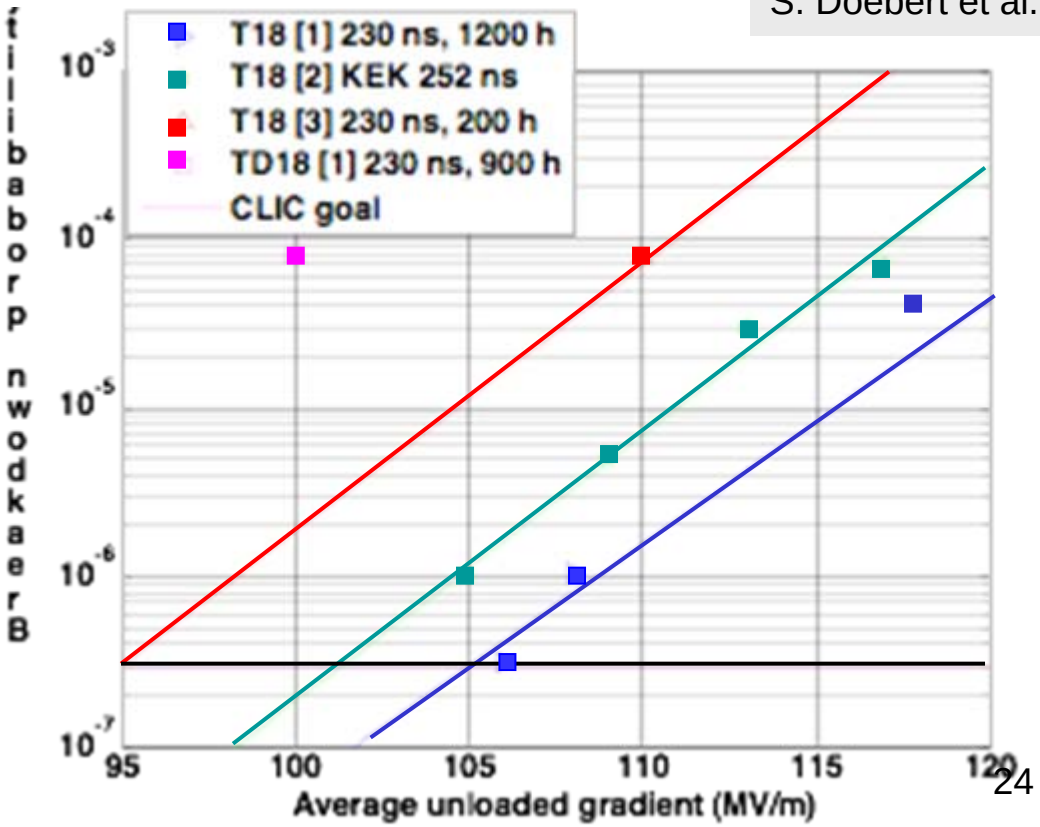
T18 reaches 95-105 MV/m

Damped TD18 reaches an extrapolated 85MV/m

- Second TD18 under test at KEK
- Pulsed heating expected to be above limit

TD18

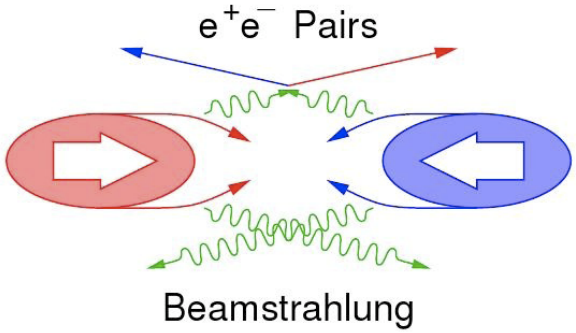
S. Doebert et al.



CLIC 3 TeV
Beam-induced background

Backgrounds:

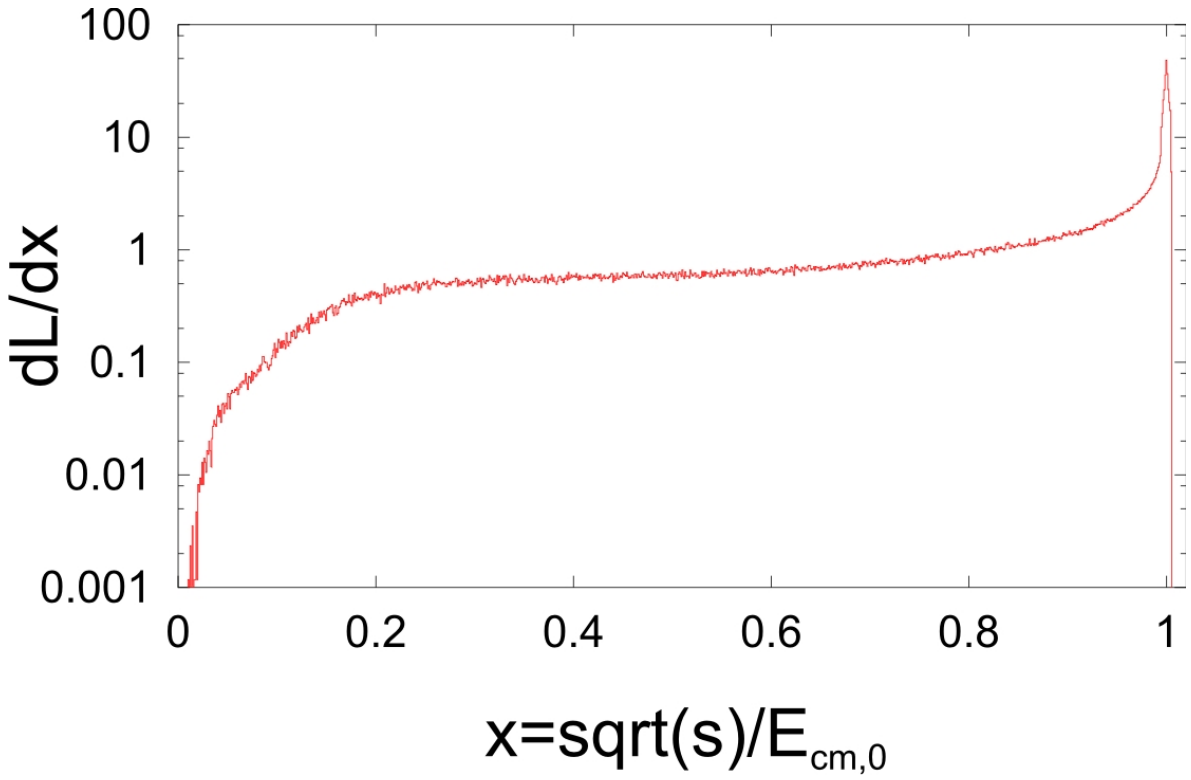
Due to the higher beam energy and small bunch sizes backgrounds are significantly more severe at CLIC.



Main backgrounds:

- CLIC 3TeV beamstrahlung average energy loss: **29%** ($10\times ILC_{value}$)
  - **Coherent pairs** (3.8×10^8 per bunch crossing) <= disappear in beam pipe
  - **Incoherent pairs** (3.0×10^5 per bunch crossing) <= suppressed by strong solenoid-field
  - $\gamma\gamma$ interactions => hadrons (**≈ 3 hadron events per bunch crossing**)
- Muon background from upstream linac
  - More difficult to stop due to higher CLIC energy (active muon shield ?)

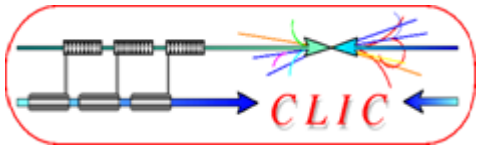
CLIC 3 TeV centre-of-mass energy spectrum



Due to beam-beam effects:

- At 3 TeV only 1/3 of the luminosity is in the top 1% centre-of-mass energy bin

- asymmetric situation -> many events with large forward / backward boost



CLIC synchrotron radiation, solenoid, anti-DiD etc. …

3 TeV, crossing angle 20 mrad

Work by **Barbara Dalena**, CERN (CLIC study team):

- PAC'09 contributed paper

  "Solenoid and Synchrotron Radiation Effects at CLIC"

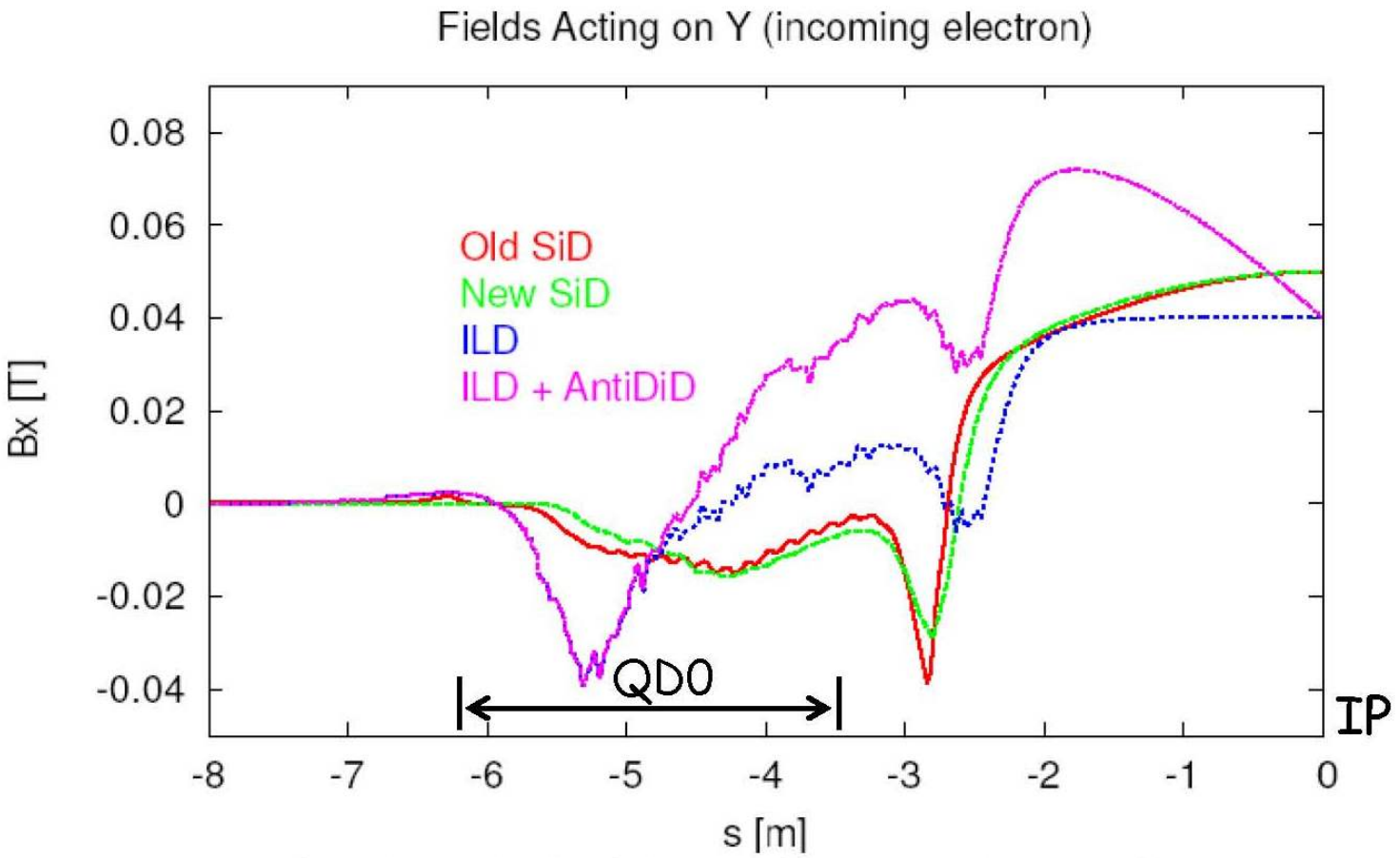
- presentation at ILC-CLIC LET Beam Dynamics Workshop, 24 June 2009

  http://indico.cern.ch/contributionDisplay.py?contribId=20&sessionId=3&confId=56133

Map	Bz [T]	L[m]	Lumi loss [%]
Old SiD	5	2.8	~4.0
New SiD	5	2.8	~3.0
ILD	4	3.7	~4.0
ILD + AntiDiD	4	3.7	~25.0

CLIC synchrotron radiation, solenoid, anti-DiD etc. …

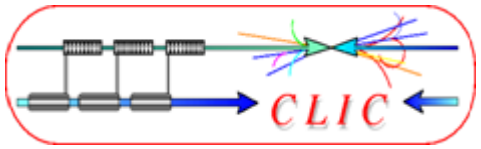
Work by **Barbara Dalena**, CERN (CLIC study team):



CLIC

20 mrad

B_x component of solenoid fields in the beamline reference system



CLIC synchrotron radiation, solenoid, anti-DiD etc. … very recent results - preliminary

Work by **Barbara Dalena**, CERN (CLIC study team):

-> Anti-DiD is bad for luminosity at 3 TeV

Work by **André Sailer** (cf. talk later this afternoon):

-> Anti-DiD is badly needed (BG !)

PS. Barbara Dalena, PAC'09:

A longer detector (solenoid) makes things worse !