Detector Integration
Machine-Detector Interface
Polarisation

Karsten Buesser
DESY

LCWS13 Tokyo
15.11.2013

„I hear the roar of a big machine....“
The Sisters of Mercy

MDI Sessions

14:00 - 15:30 **Detector Integration, MDI, Polarisation**

Convener: Dr. Karsten Buesser (DESY), Prof. Guinyun Kim (Kyungpook National University), Dr. Thomas Markiewicz (SLAC), Marco Oriunno (SLAC National Accelerator Laboratory), Tomoyuki Sanuki (Tohoku University)

Location: FacEng2 (2F_exhibition)

Material: Fuzebox_Thu14_1400 Fuzebox_Tue12_1400 Fuzebox_Tue12_1600 Fuzebox_Wed13_1100

14:00 **Precision Luminosity Measurement at ILC** *20'*
Speaker: Dr. Ivanka Bozovic-Jelisavcic (Vinca Institute of Nuclear Sciences)
Material: Slides

14:20 **FCAL Integration and Alignment** *20'*
Speaker: Mr. Wojciech Wierba (Institute of Nuclear Physics Polisch Academy of Science)
Material: Slides

14:40 **Initial Results of a SI Sensor Irradiation Study for ILC Extreme Forward Calorimetry** *20'*
Speakers: Bruce Andrew Schumm (University of California,Santa Cruz (US)), Bruce Schumm
Material: Slides

15:00 **ILD Yoke Update** *20'*
Speaker: Dr. Uwe Schneekloth (DESY)
Material: Slides

16:00 - 17:30 **Detector Integration, MDI, Polarisation**

Convener: Dr. Karsten Buesser (DESY), Prof. Guinyun Kim (Kyungpook National University), Dr. Thomas Markiewicz (SLAC), Marco Oriunno (SLAC National Accelerator Laboratory), Tomoyuki Sanuki (Tohoku University)

Location: FacEng2 (2F_exhibition)

Material: Fuzebox_Thu14_1400 Fuzebox_Tue12_1400 Fuzebox_Tue12_1600 Fuzebox_Wed13_1100

16:00 **SID MDI Status Report** *20'*
Speaker: Marco Oriunno (SLAC National Accelerator Laboratory)
Material: Slides

16:20 **ILD MDI Status Report** *20'*
Speaker: Dr. Karsten Buesser (DESY)
Material: Slides

16:40 **CLIC MDI Status Report** *20'*
Speaker: Lau Gatignon (CERN)
Material: Slides

17:00 **ILC IR Requirements Revisited** *20'*
Speaker: Dr. Karsten Buesser (DESY)
Material: Slides

11:00 - 12:30 **Detector Integration, MDI, Polarisation**

Convener: Dr. Karsten Buesser (DESY), Prof. Guinyun Kim (Kyungpook National University), Dr. Thomas Markiewicz (SLAC), Marco Oriunno (SLAC National Accelerator Laboratory), Tomoyuki Sanuki (Tohoku University)

Location: FacSci1 (3F_338)

Material: Fuzebox_Thu14_1400 Fuzebox_Tue12_1400 Fuzebox_Tue12_1600 Fuzebox_Wed13_1100

11:00 **ILC Site Issues** *20'*
Speaker: Tomoyuki Sanuki (Tohoku University)
Material: Slides

11:20 **ILC Assembly Yard Issues** *20'*
Speaker: Marco Oriunno (SLAC National Accelerator Laboratory)

11:40 **IR Design Integration** *20'*
Speakers: Dr. Lars Hagge (Deutsches Elektronen-Synchrotron (DESY)), Dr. Benno List (DESY)

12:00 **Discussion Time** *30'*

14:00 - 15:30 **Detector Integration, MDI, Polarisation**

Convener: Dr. Karsten Buesser (DESY), Prof. Guinyun Kim (Kyungpook National University), Dr. Thomas Markiewicz (SLAC), Marco Oriunno (SLAC National Accelerator Laboratory), Tomoyuki Sanuki (Tohoku University)

Location: FacEng2 (2F_exhibition)

Material: Fuzebox_Thu14_1400 Fuzebox_Tue12_1400 Fuzebox_Tue12_1600 Fuzebox_Wed13_1100

14:00 **Spin Tracking and Polarisation Measurement at the ILC** *20'*
Speaker: Annika Vauth (DESY)
Material: Slides

14:20 **The Exact Beamstrahlung Radiation Angle and Spectrum** *20'*
Speaker: Anthony Hartin (DESY)

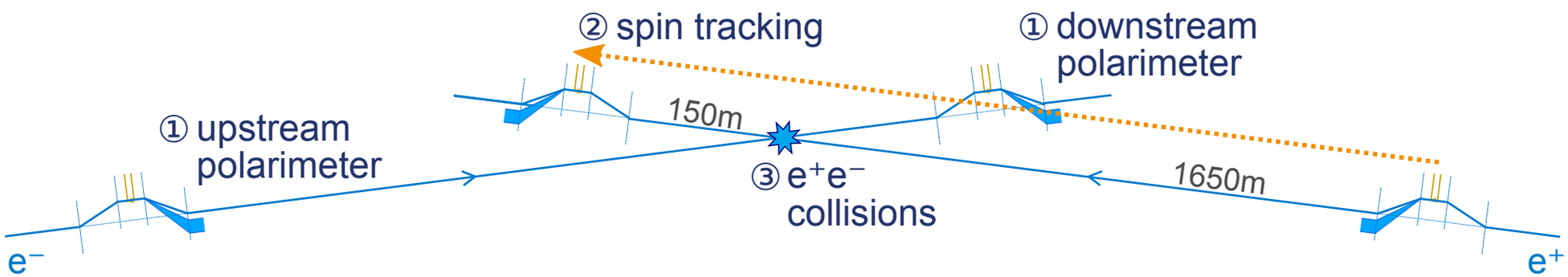
14:40 **IR Cryogenic System Update** *20'*
Speaker: Dr. Takahiro Okamura (KEK)

15:00 **ILD Solenoid Magnet** *20'*
Speaker: Yasuhiro Makida (High Energy Accelerator Res. Organ. (KEK))

- joint sessions with CFS/BDS
- thanks to all participants!

ILC Polarimetry Challenge

Goal for ILC polarimetry: per mille level precision by combining



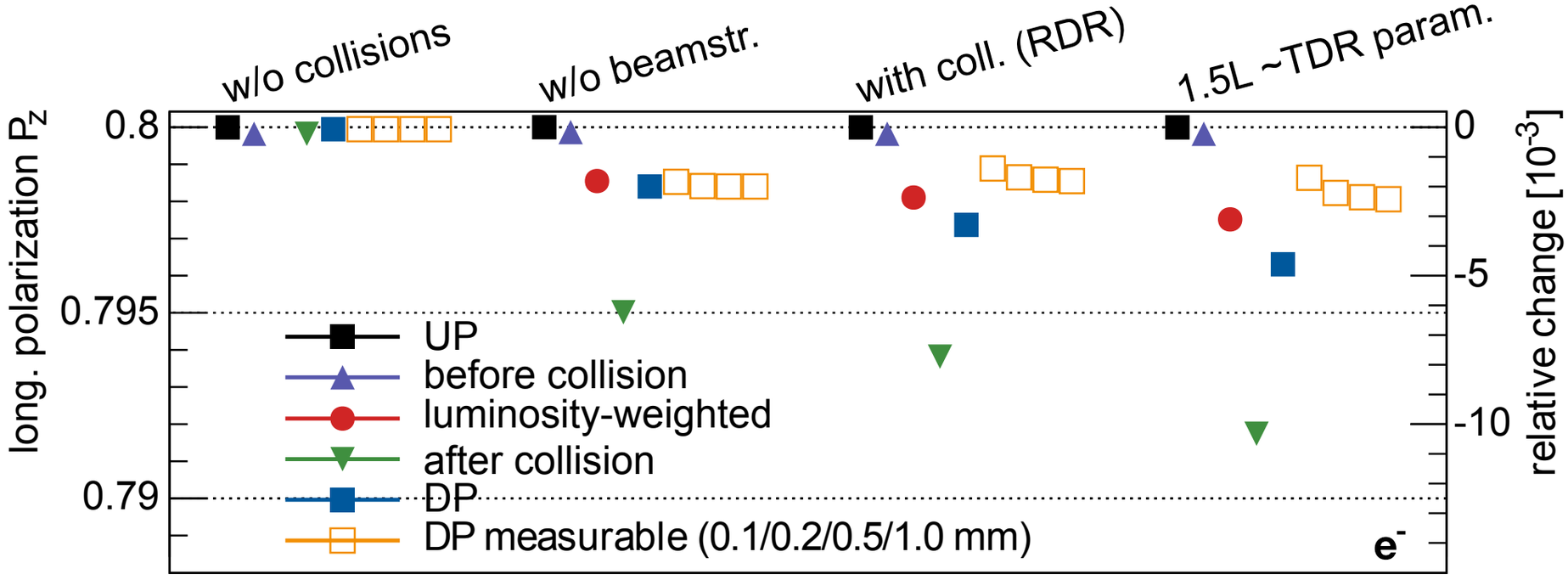
① Compton polarimeter measurements upstream and downstream of the e^+e^- interaction point

② Spin tracking studies to relate these measurements to the polarization at the e^+e^- interaction point

③ Long-term average determined from e^+e^- collision data as absolute scale calibration

Spin Tracking Studies

- Envisaged precision on polarisation knowledge: 0.25%
- Need to understand behaviour of polarisation to permil level:
  - with collision effects



- Up- and downstream polarisation measurement is mandatory

Annika Vauth

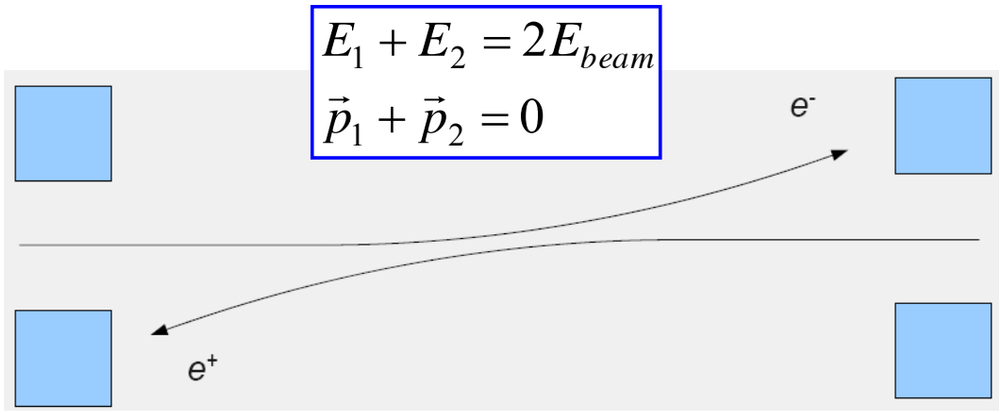
Cross-calibration of Polarimeters

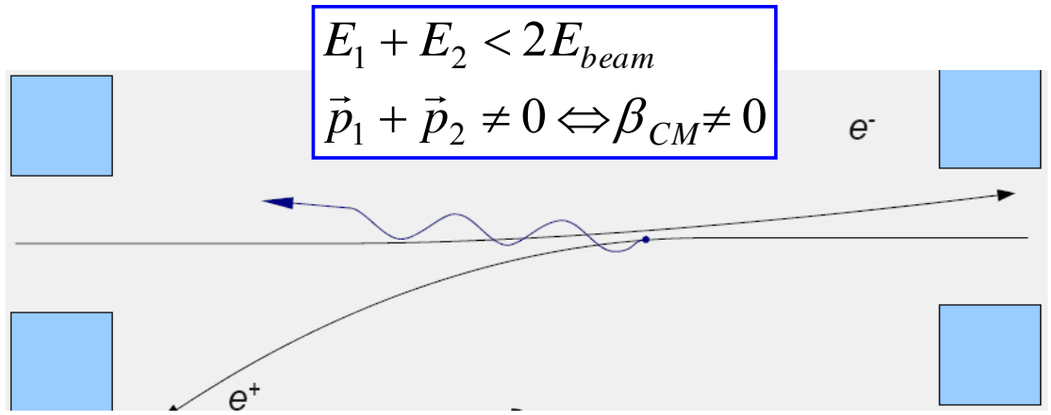
Without Collisions:
predict value at downstream location from upstream measurement

	effect on $P[10^{-3}]$
Beam and detector alignment at polarimeters ($\Delta\theta_{bunch} = 50\,\mu\text{rad}$, $\Delta\theta_{pol} = 25\,\mu\text{rad}$)	0.72
Variation in emittances	0.03
Crabbing	< 0.01
Detector magnets	0.01
Emission of synchrotron rad.	0.005
random misalignments (10 µm)	0.43
Total	0.85

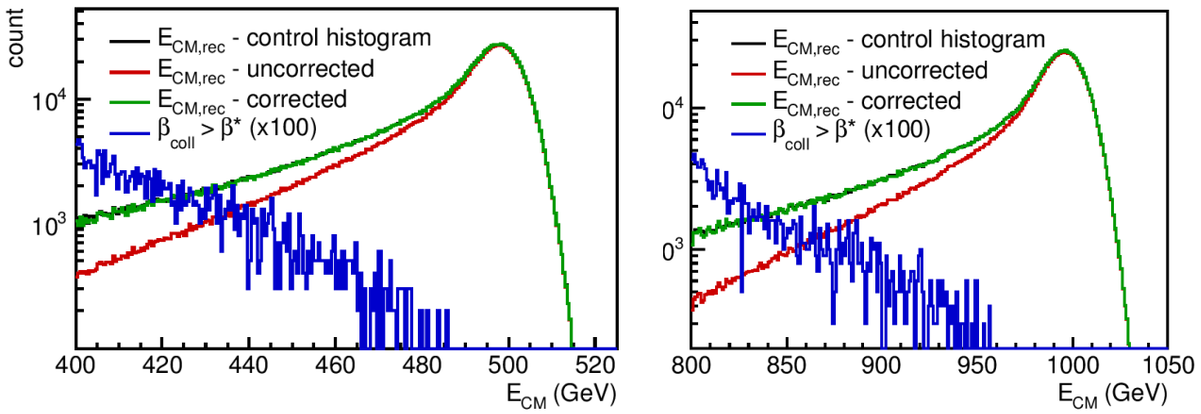
Annika Vauth

Fighting for the per-mill Level: Luminosity Measurement





Counting losses at 500 GeV and1 TeV ILC

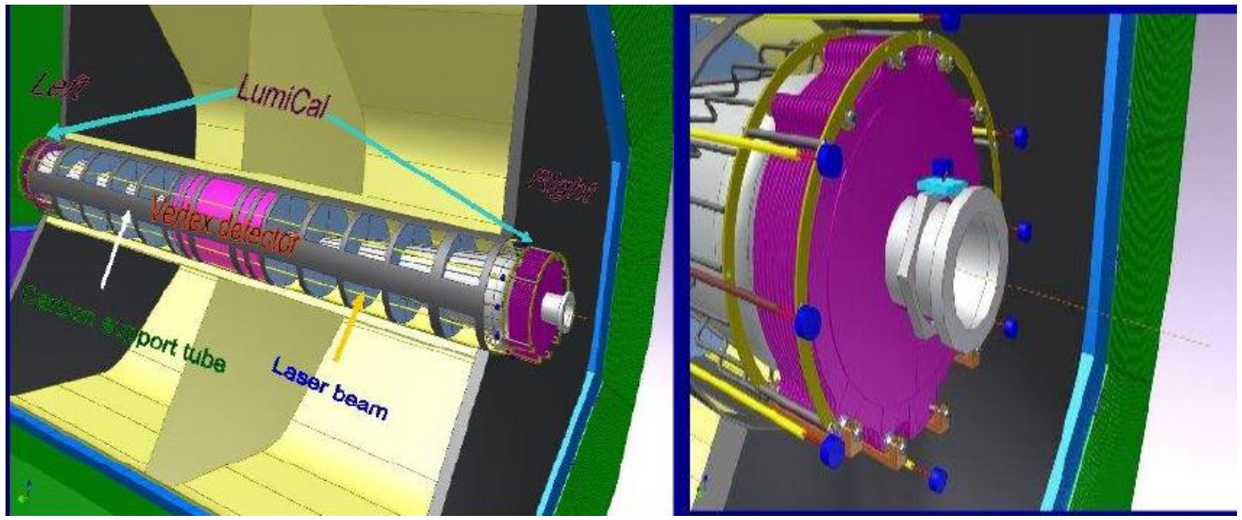


250 GeV	
BS+ISR uncorrected	8.4%
BS+ISR corrected/top 20% of *L* spectrum*	1.2‰
BS+ISR corrected/full event selection*	0.4‰
EMD uncorrected	4.3‰
EMD corrected	0.5‰

* simulation independent

LumiCal Alignment

High accuracy in luminosity measurements at ILC/CLIC ($\Delta L/L \sim 10^{-3}/10^{-2}$) require precisely measurement of the luminosity detector displacements:
less than 500 μm in X,Y directions , 1 mm in Z direction and
a few microns for internal silicon sensor layers

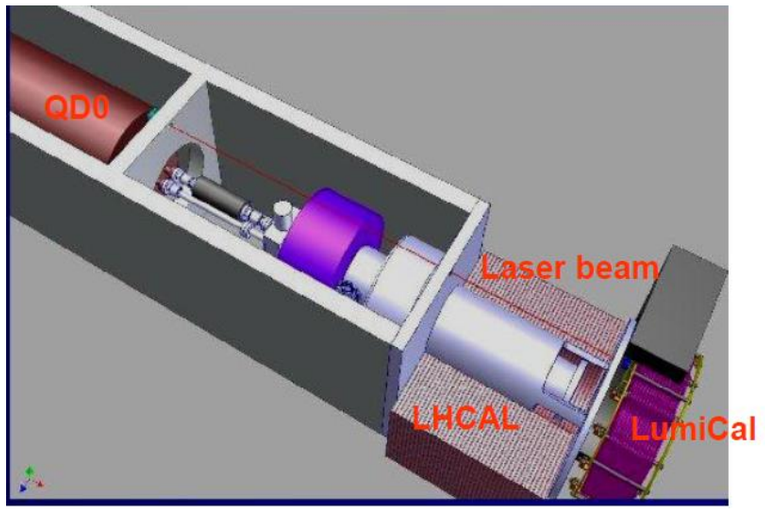


The measurements of absolute distance between
Left and Right
LumiCal calorimeters

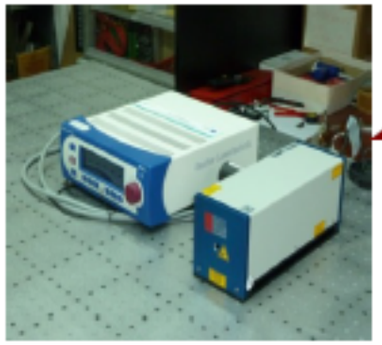
The measurements of the relative distances to QD0 in X,Y and Z directions

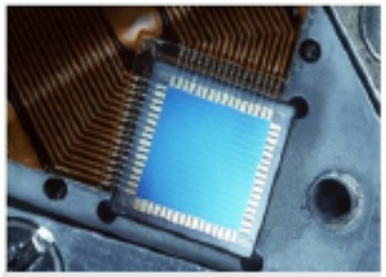
Good reference points for position measurement of LumiCal can be:

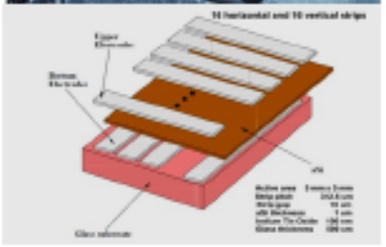
- QD0 magnet
- Beam Position Monitors
- also beam pipe

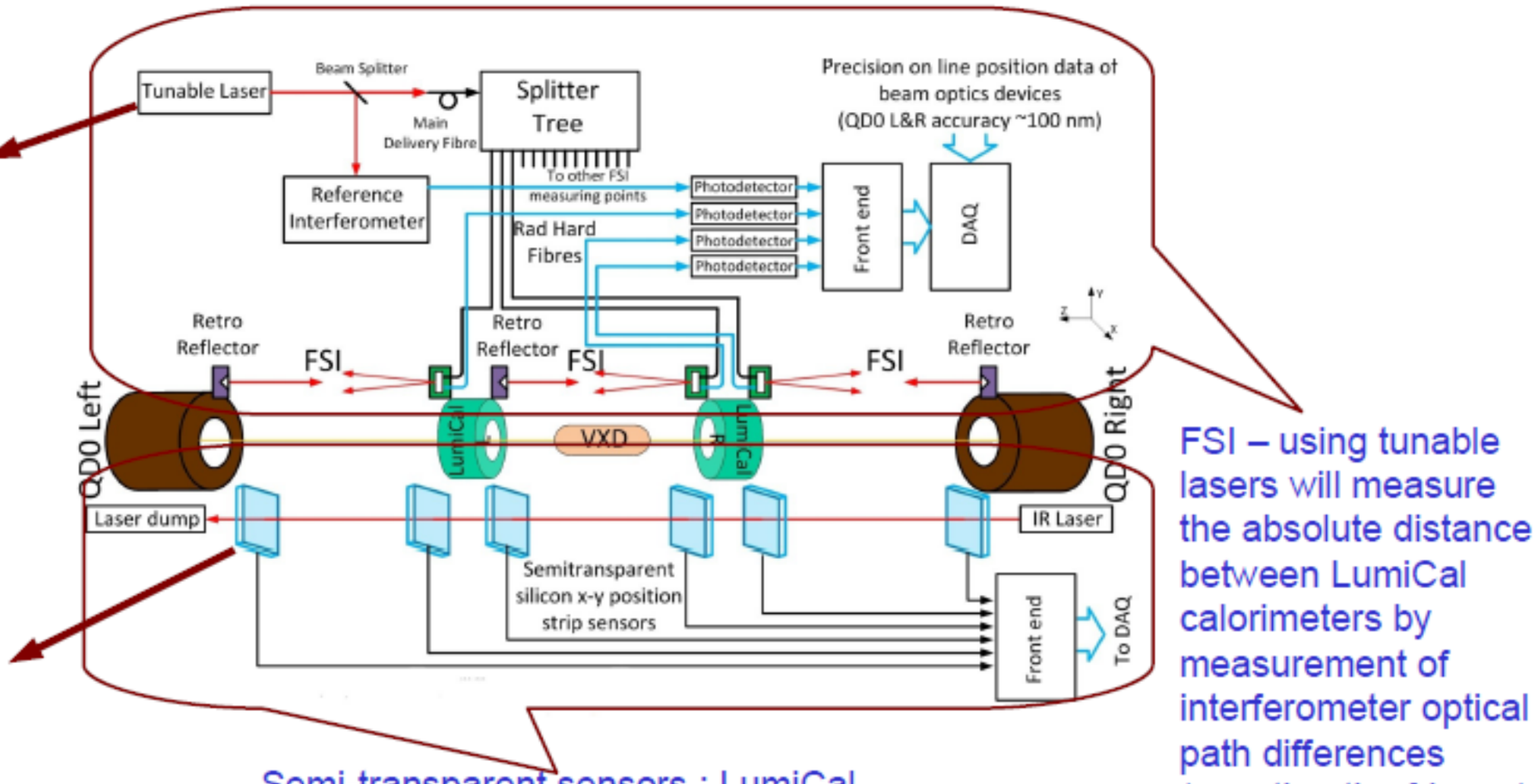


FCAL Alignment









FSI – using tunable lasers will measure the absolute distance between LumiCal calorimeters by measurement of interferometer optical path differences (counting the fringes)

Semi-transparent sensors : LumiCal displacements of the internal Si layers and detectors relative positions

Wojciech Wierba

ILC needs to have “Lean” Detectors

SLAC

Toyota Factories pioneered Lean Assembly :

“*preserving value with less work*”

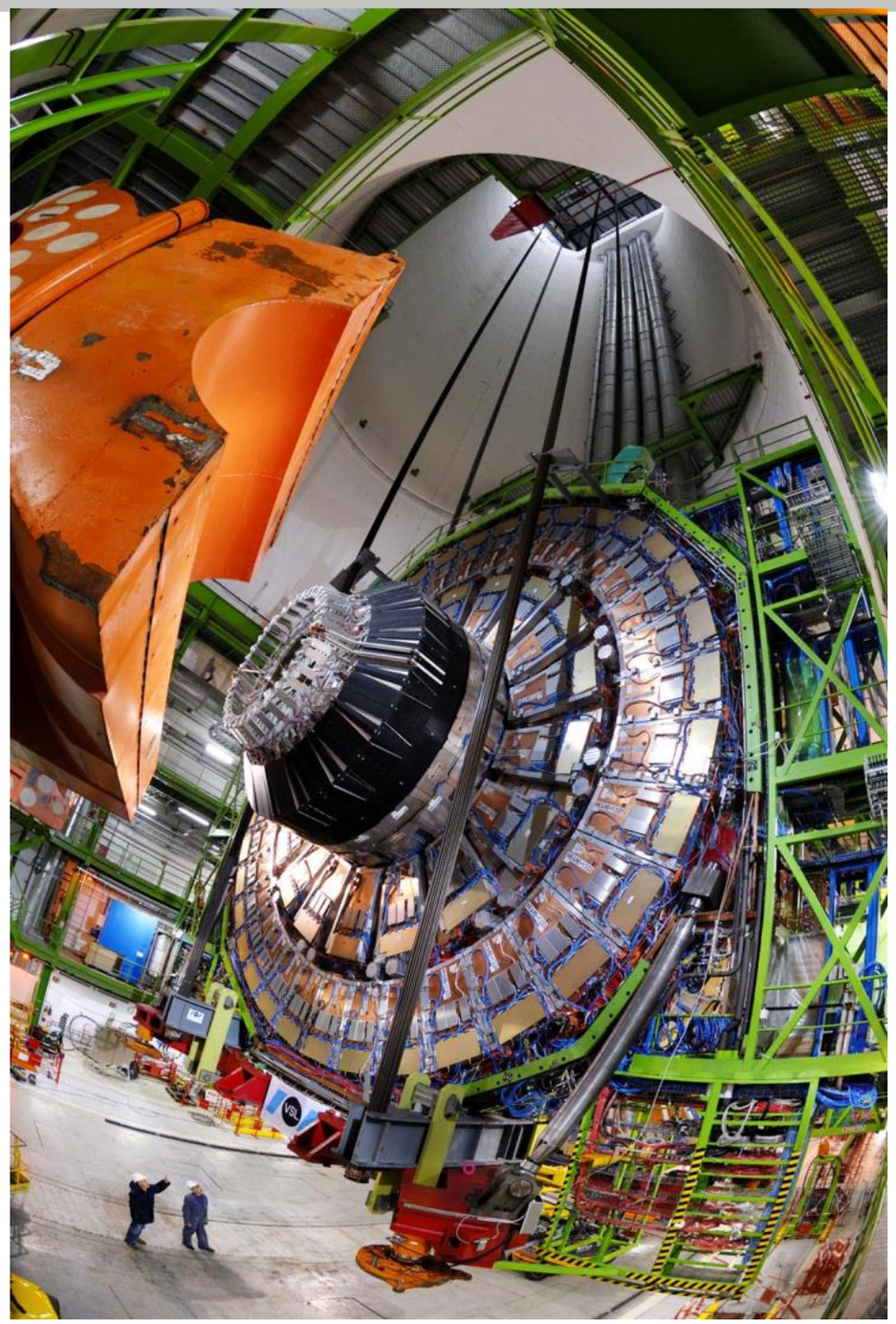
Fight The Seven Muda (futilities)

Transportation, Inventory, Motion, Waiting, Over-processing, Over-production, Defects.

Big Detectors for Big Science must be Lean :

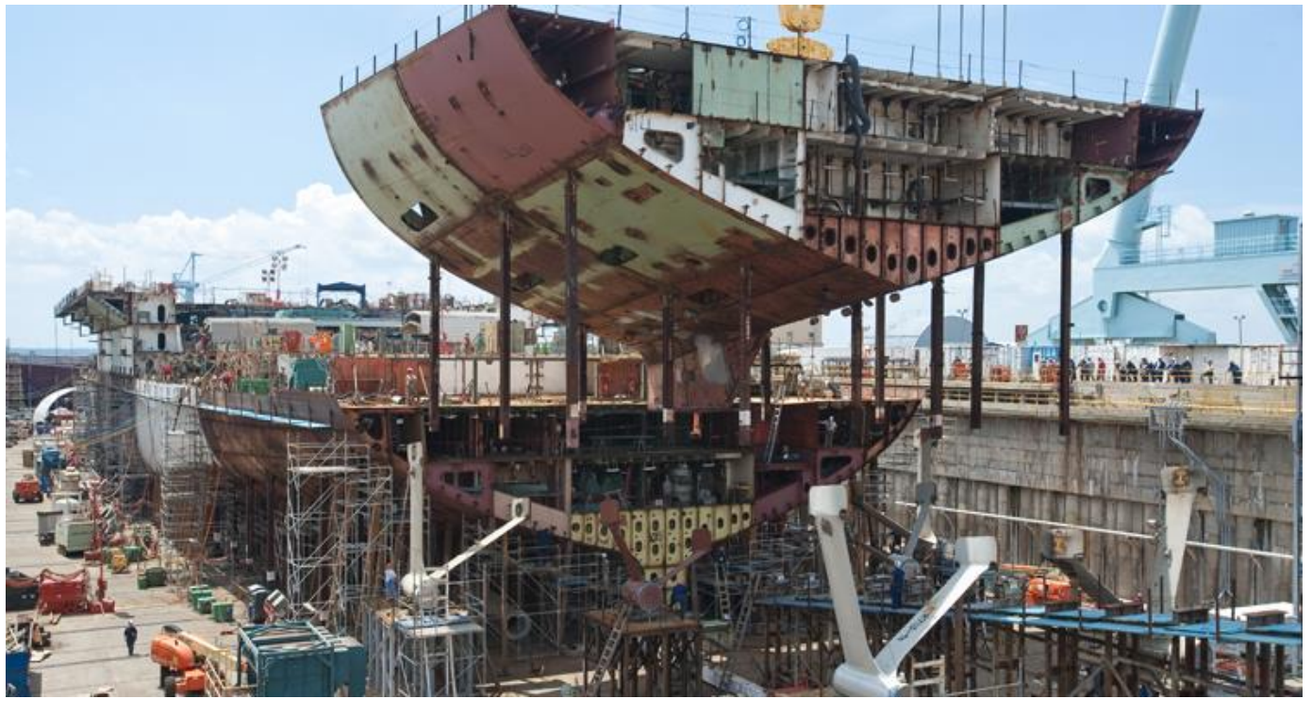
- Time vs labor (Costs)
- Time vs Technology drive (Increasing Performances)
- Low Maintenance (Costs)
- High Upgradability (Costs and Scientific reach)
- Shorter commissioning to get nominal performances
- International Competition

Lean assembly – Some Examples

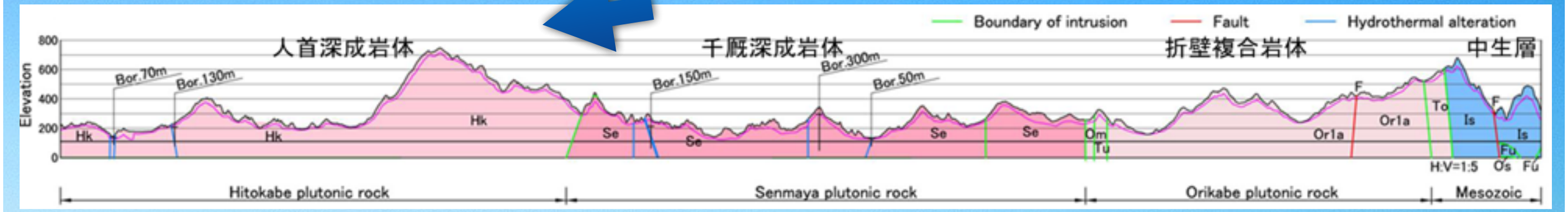


CMS Detector

Airbus

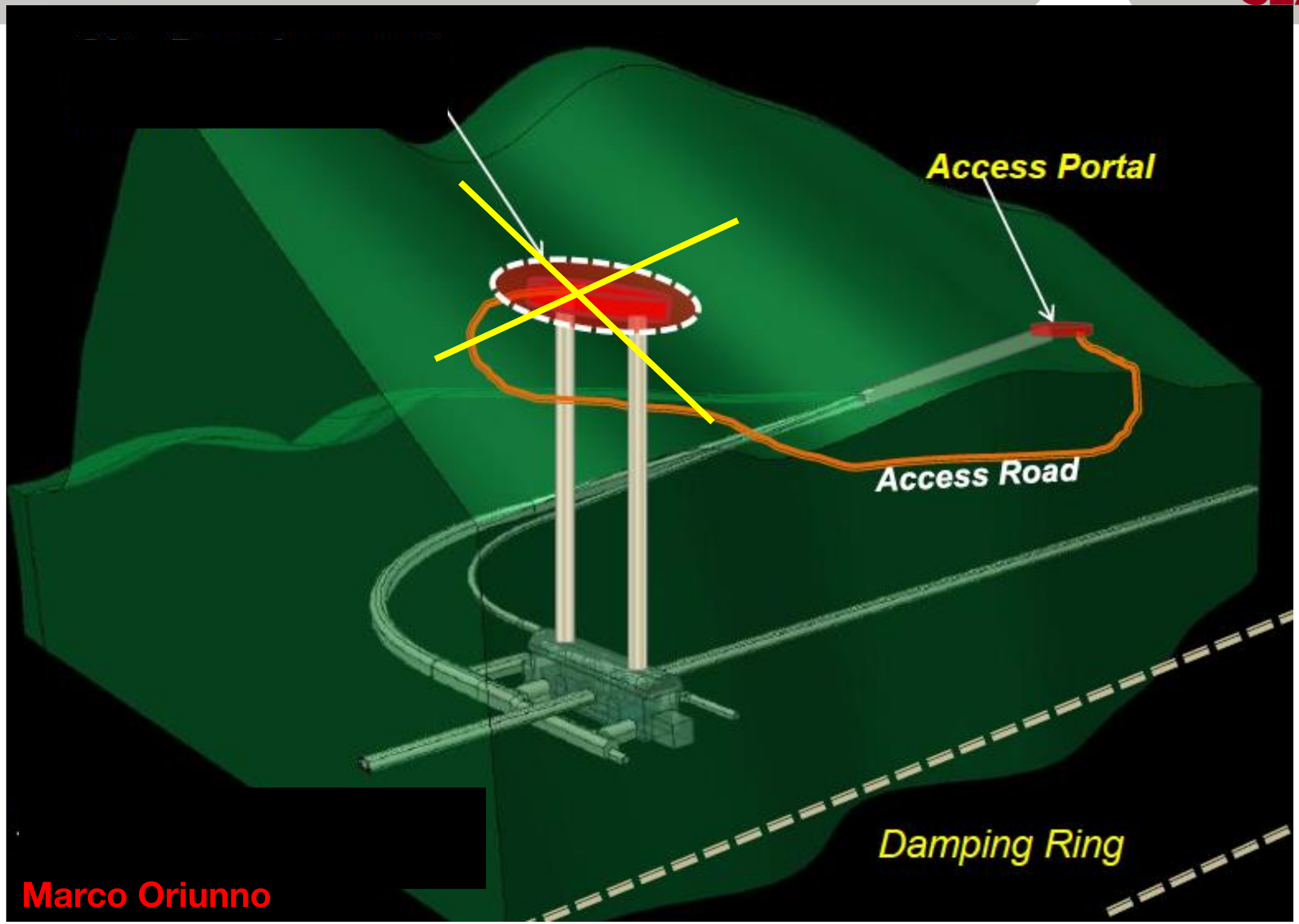


Shipbuilding



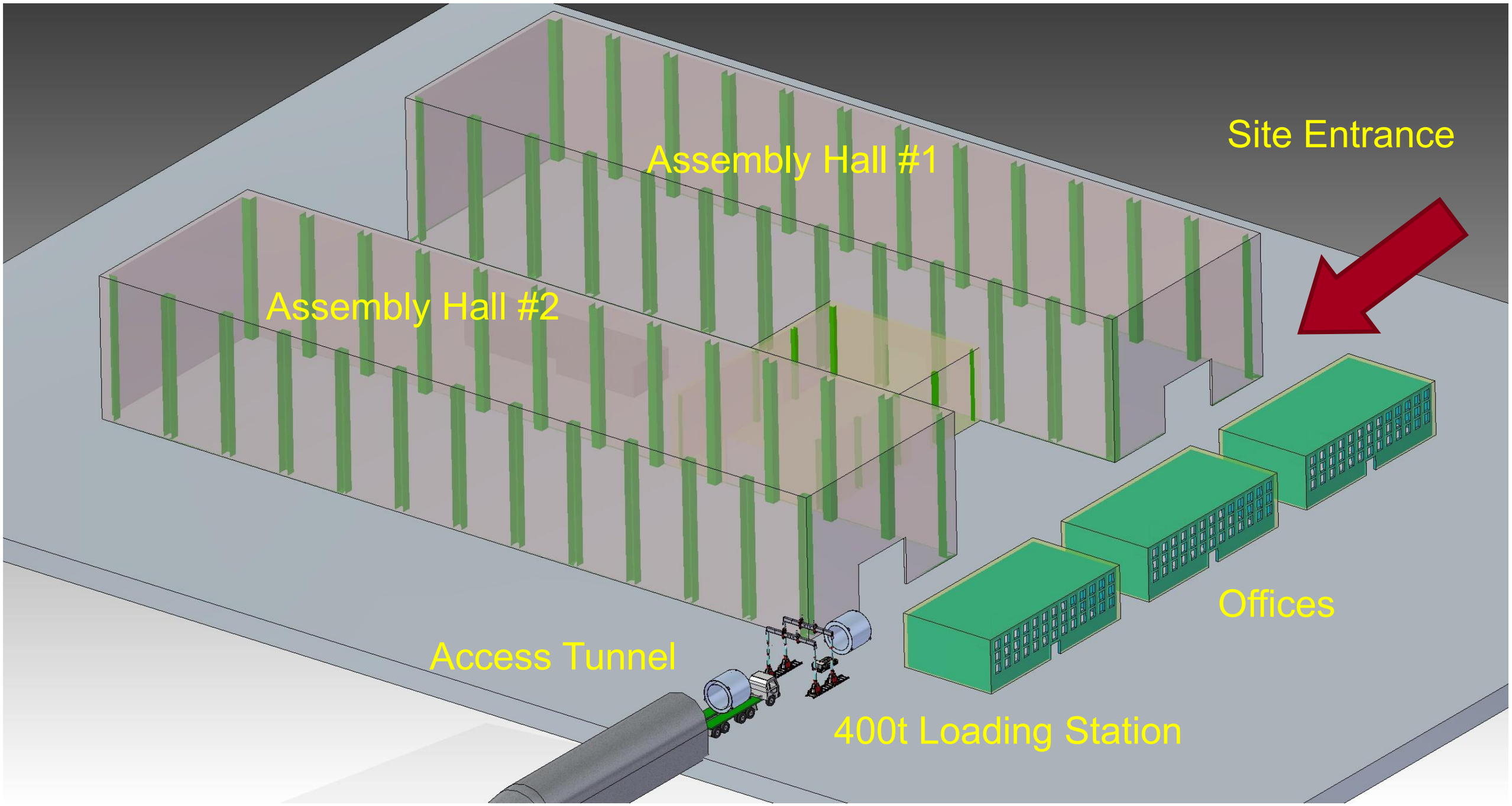
aerial photograph

Japanese ILC Site – Horizontal Tunnel Access

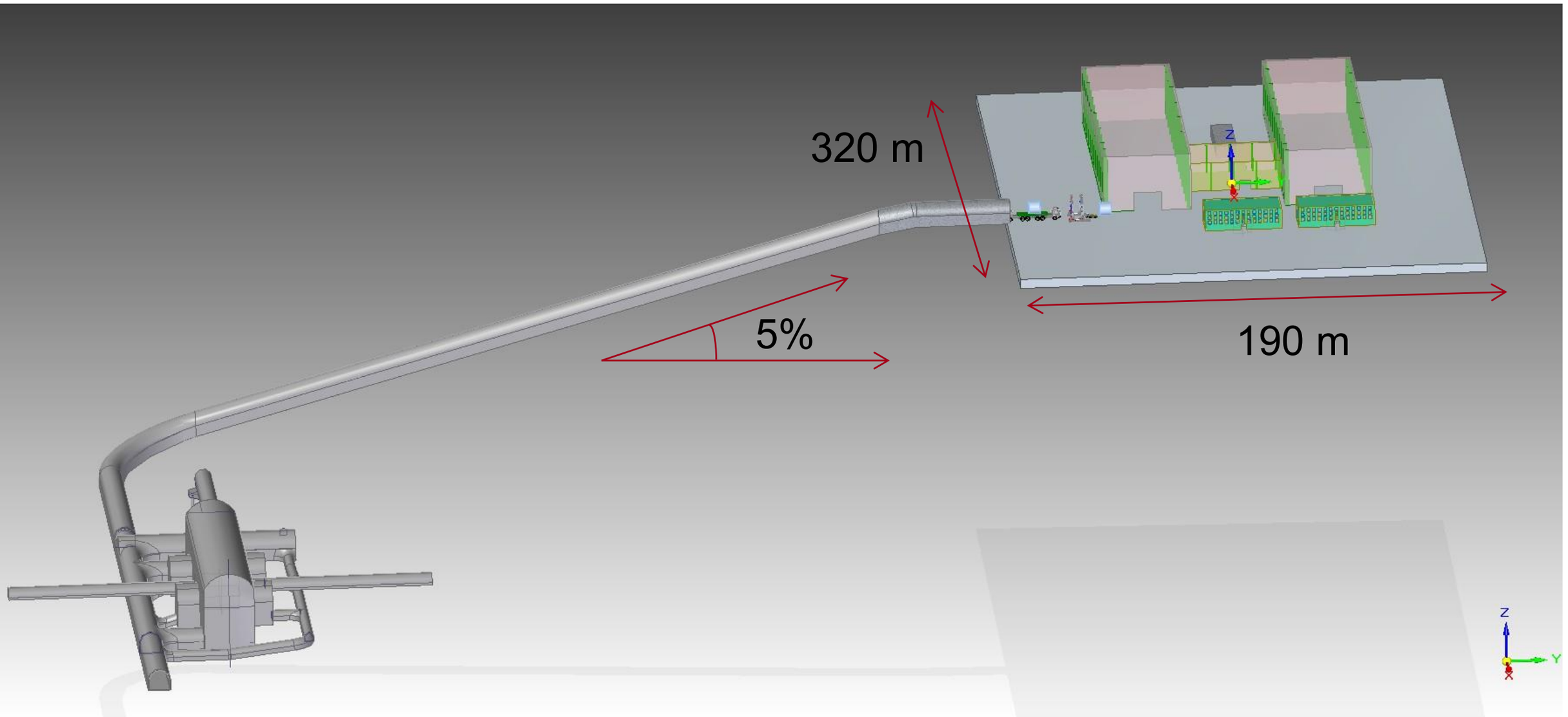


Marco Oriunno

Access Yard Buildings

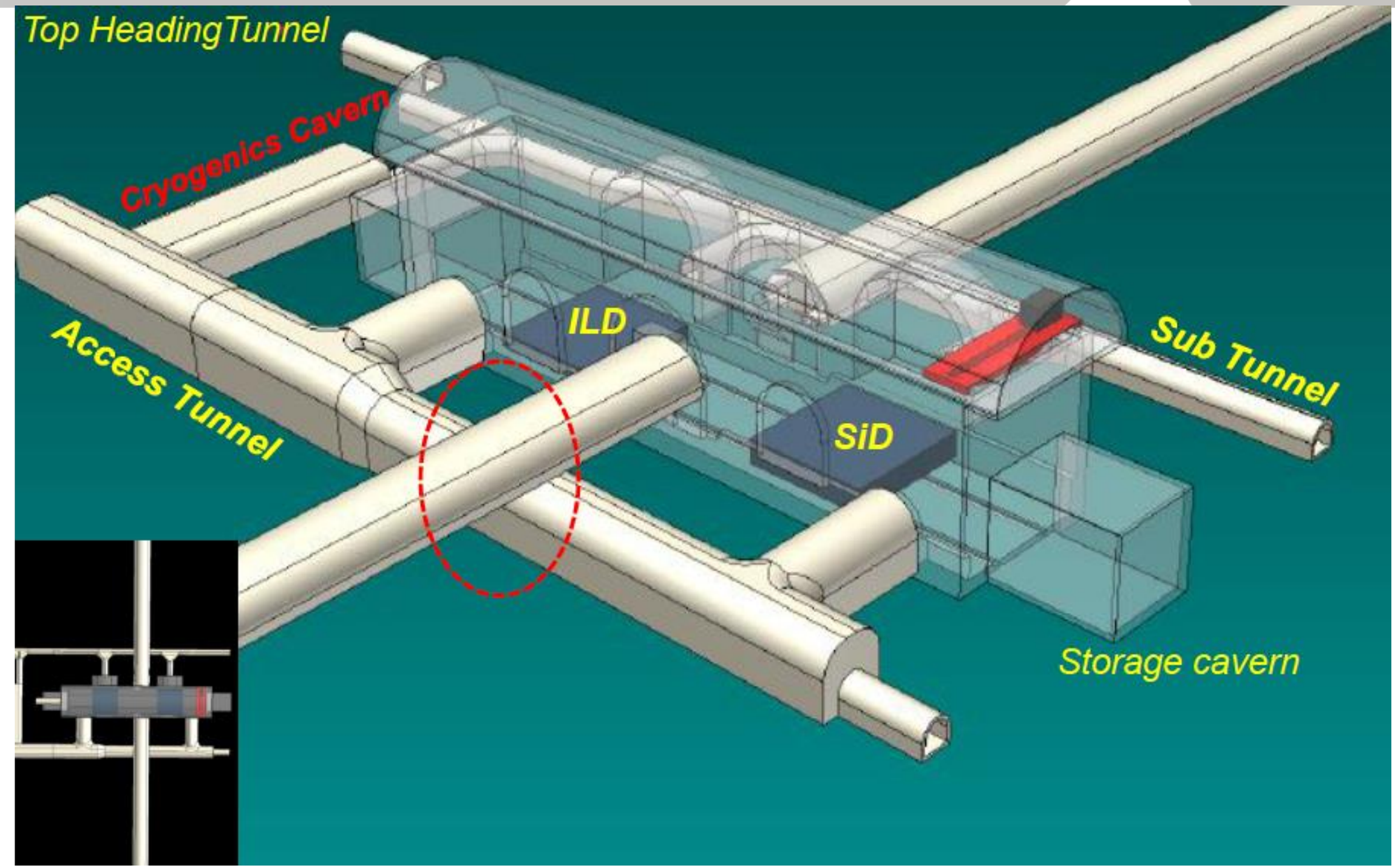


Kitakami Access Yard



Undergound Detector Hall

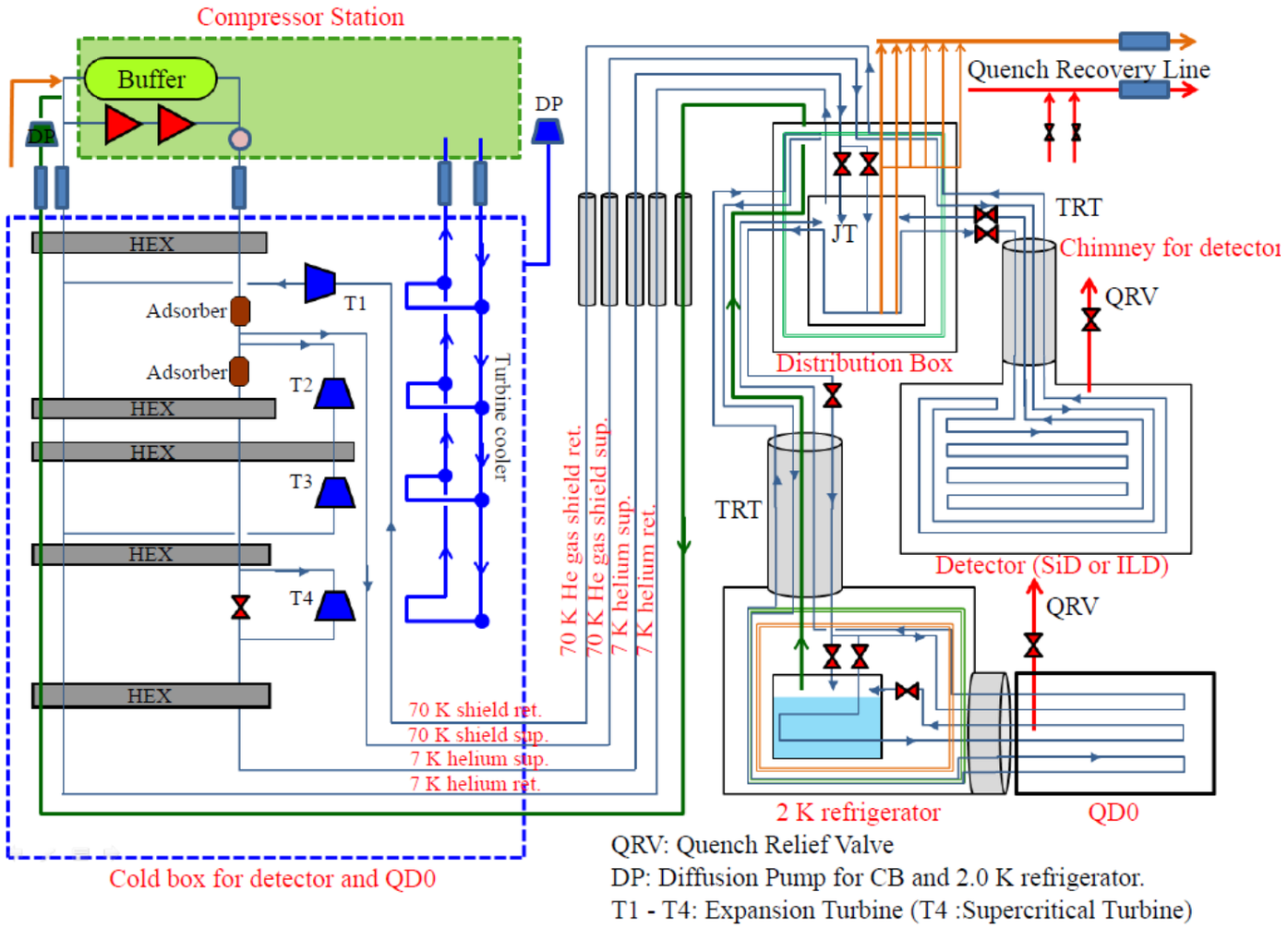
Detector Hall



Common Cryogenic System Studies

Dynamic Simulation for IR cryogenics

- Dynamic simulation will be done to find optimal flow diagram of 2K-4K combined system.



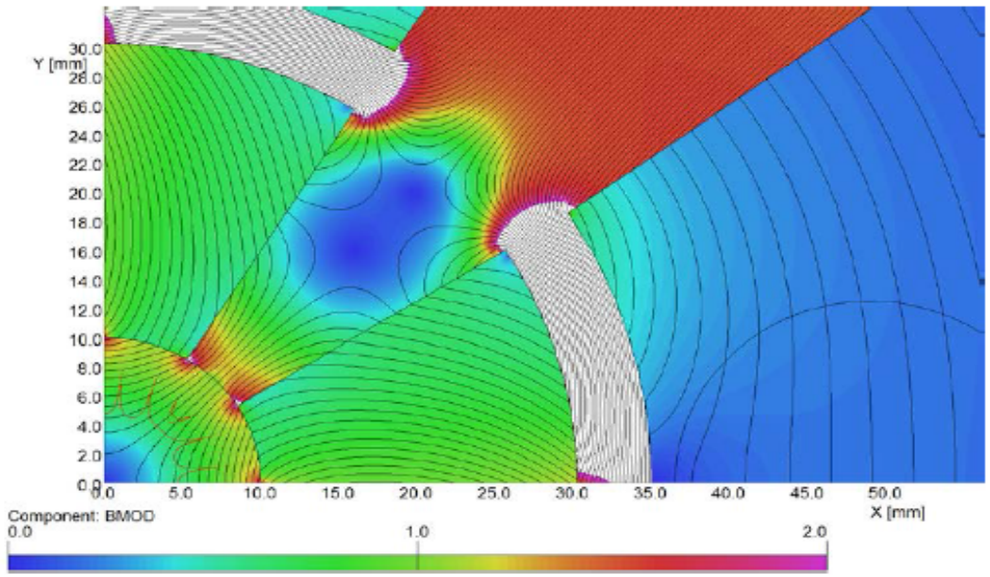
QRV: Quench Relief Valve
DP: Diffusion Pump for CB and 2.0 K refrigerator.
T1 - T4: Expansion Turbine (T4 :Supercritical Turbine)

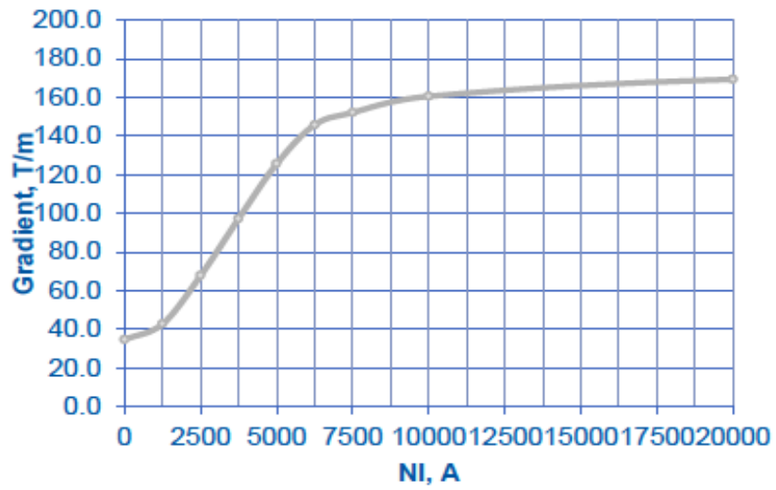
Takahiro Okamura

Hybrid QD0

A hybrid QD0 for ILC ?

We have tried to "scale" our CLIC QD0 design taking into account the ILC layout and geometric conditions but also starting an optimization of the main parameter toward a wider field quality range for the demanded tunability.





"red line" inside the aperture: area where ΔG/G ≤1 unit (good field region)

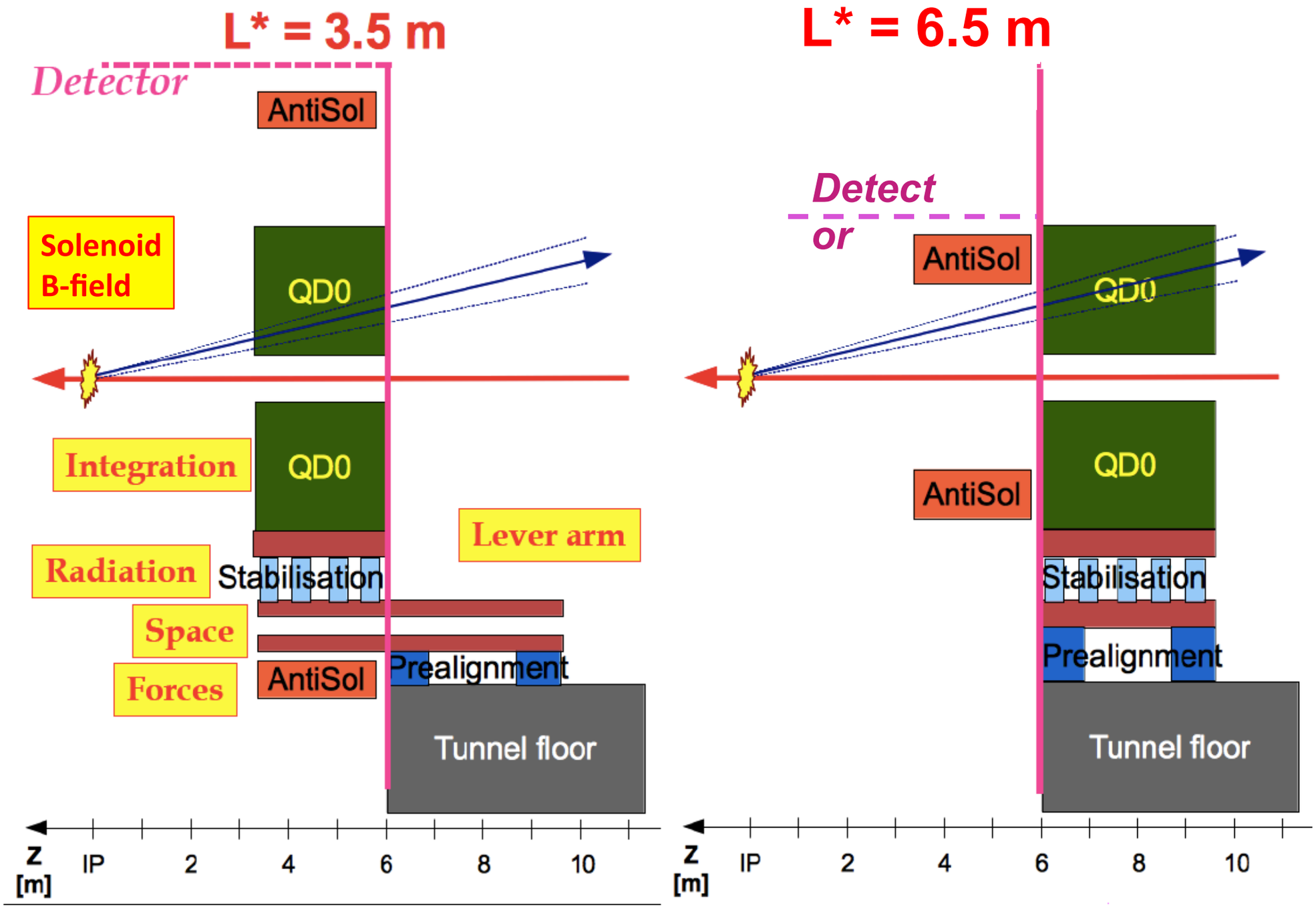
NI	A	0	1250	2500	3750	5000	6250	7500	10000	20000	40000
Gradient	T/m	34.7	42.8	67.8	97.3	125.7	145.8	152.2	160.6	169.4	174.9
b6	units	61.2472	45.2059	19.9428	6.8605	-0.0183	-3.3895	-4.2944	-5.3982	-6.4427	-7.0075
b10		0.1978	0.1510	0.0769	0.0386	0.0215	0.0173	0.0173	0.0182	0.0201	0.0217
b14		0.000192	4.51E-04	8.62E-04	1.07E-03	1.16E-03	1.16E-03	0.001148	0.001123	0.001086	0.001056
b18		0.003501	2.58E-03	1.14E-03	3.89E-04	-4.59E-06	-1.98E-04	-0.00025	-0.00031	-0.00037	-0.0004

Main multipoles estimated at r = 3 mm; 5000 NI is the nominal working point (125 T/m)

(Computation: courtesy A. Aloev)

Lau Gatignon

Increasing L*?



Lau Gatignon

Summary

- We had very lively and interesting discussions during the MDI sessions
- Physics properties of the ILC beams will be measured to permille precision:
  - Polarisation
  - Luminosity
- There is a site for the ILC now
  - need to adapt the interaction region planning
- There are two linear collider projects
  - established fruitful collaboration and start to exploit synergies

The Future

The Future

Spring wind blowing, both plumblossoms and cherry blossoms are to bloom around the mountainside.

Your Fortune	Excellent

Have a strong will and be calm. Do not waver in your determination, when you meet with misfortune. Work hard and be patient and abide your time, and you'll have gooe luck.