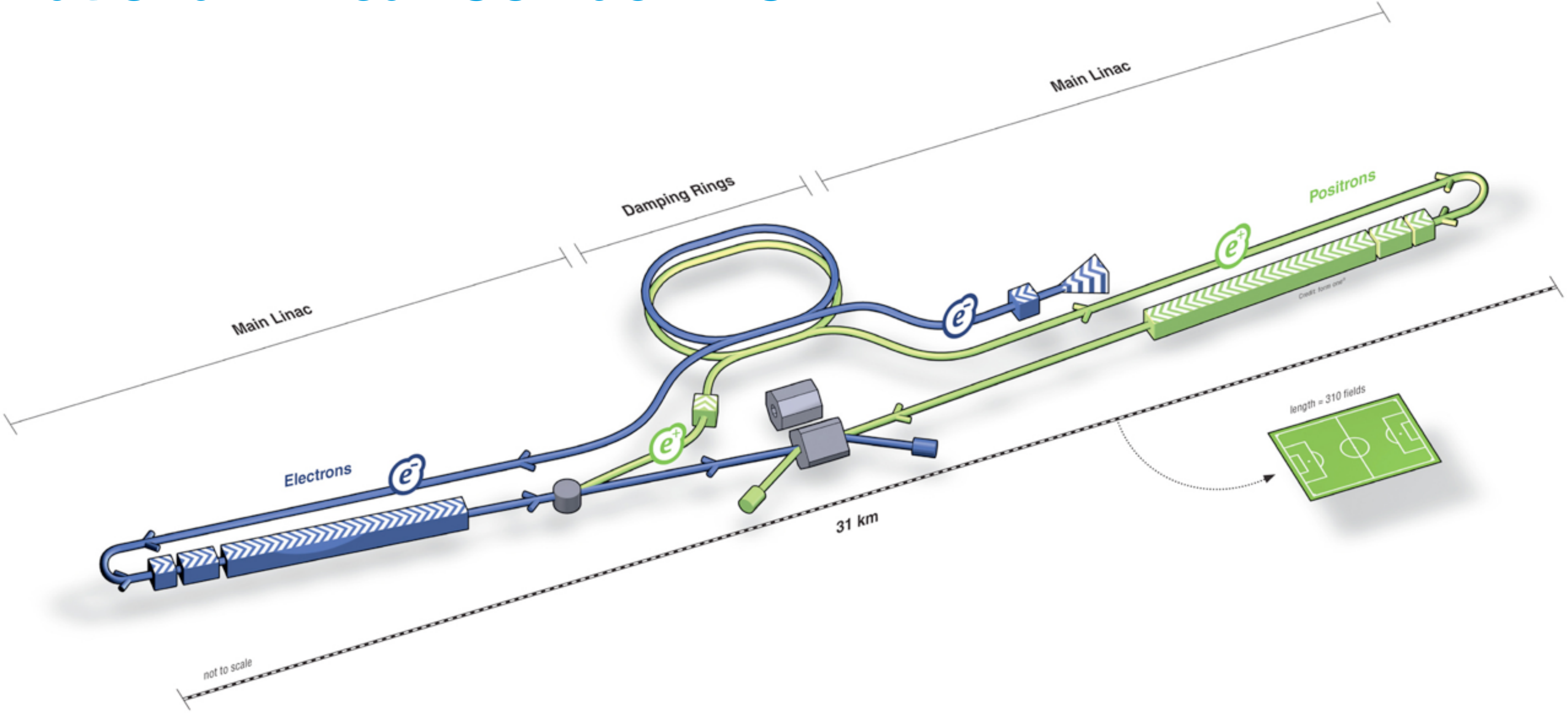
# International Linear Collider ILD

## Part I: Introduction and Environment

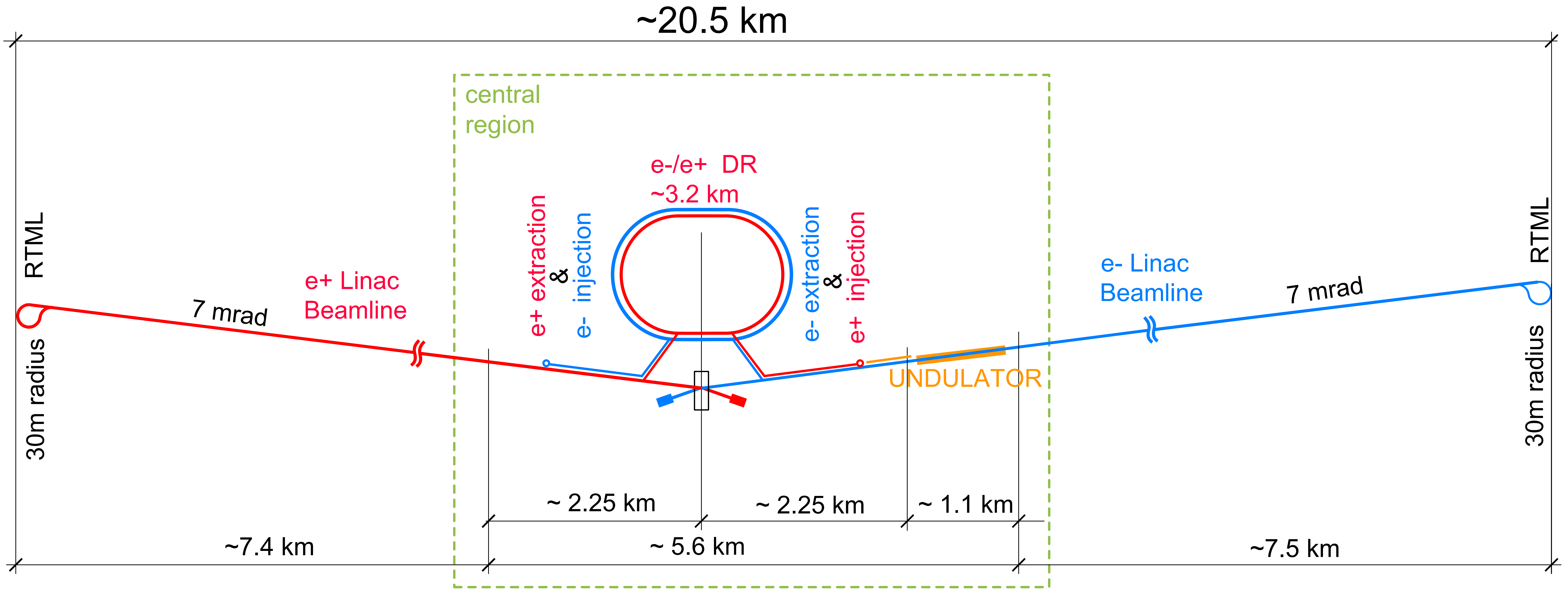
Karsten Buesser
S/C Magnet Workshop
12.09.2022

# International Linear Collider ILC



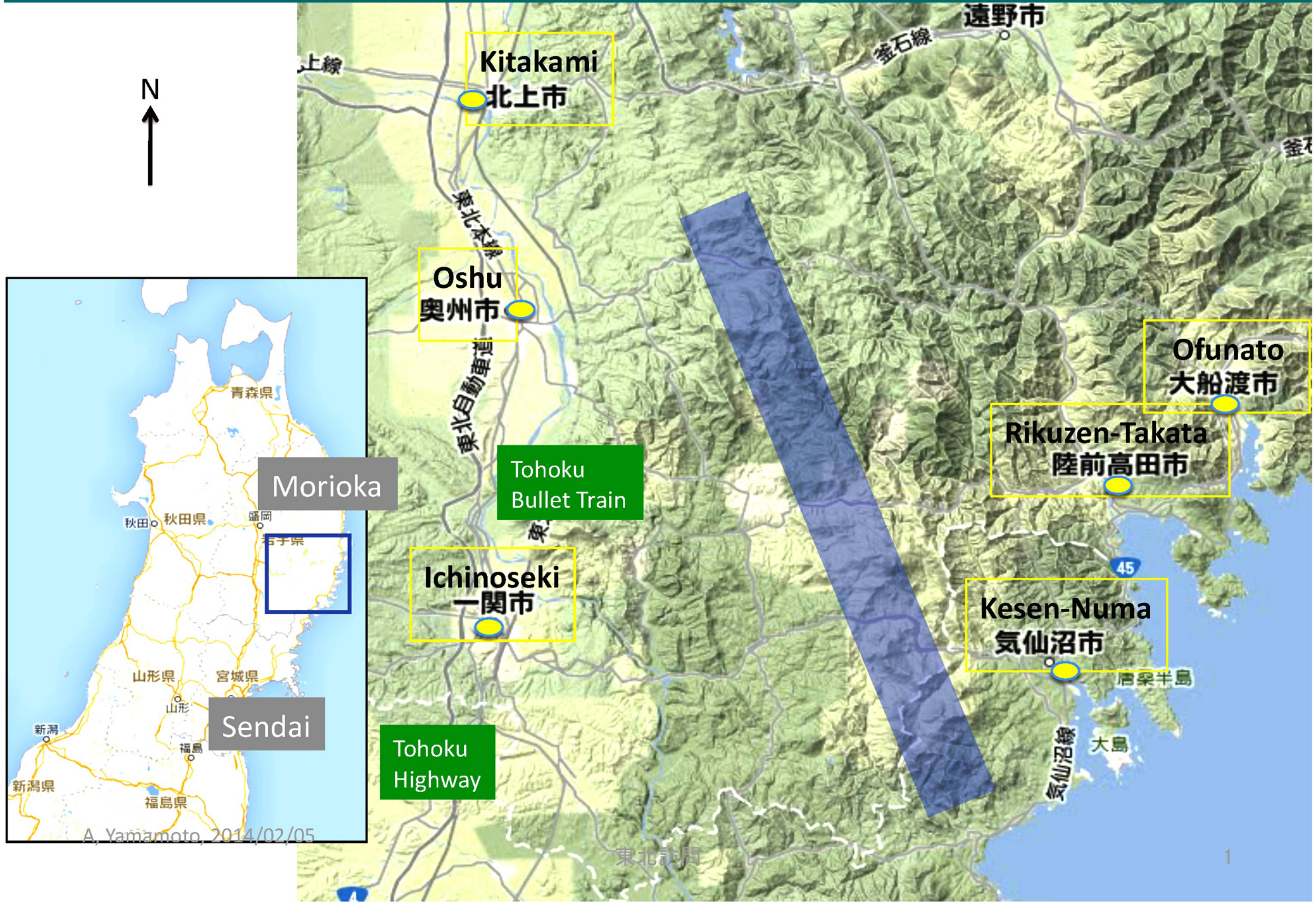

ILC Scheme | © www.form-one.de

# ILC Footprint (Baseline)




Not To Scale

# ILC Candidate site in Kitakami, Tohoku



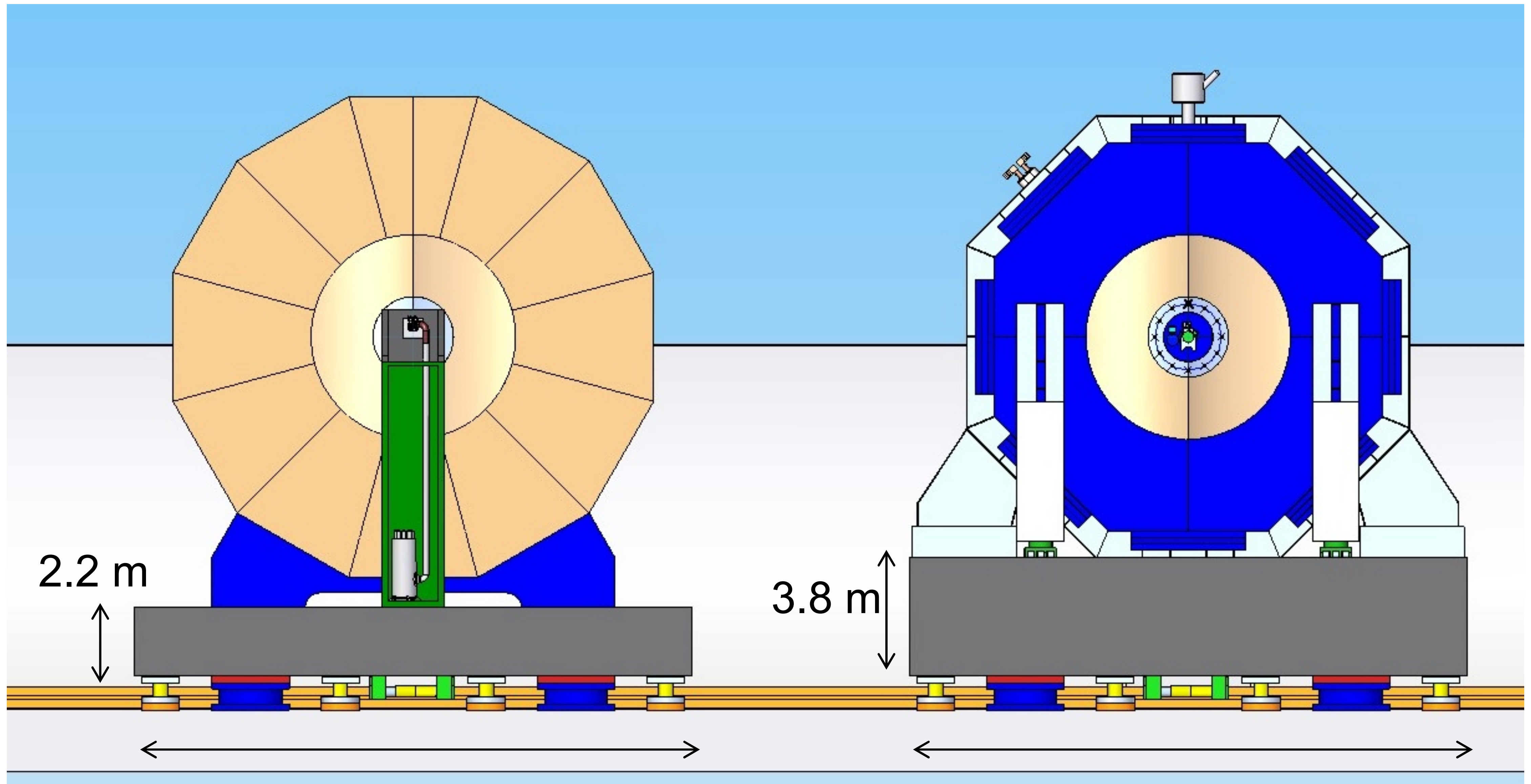
# Push-pull System

**ILC Baseline**

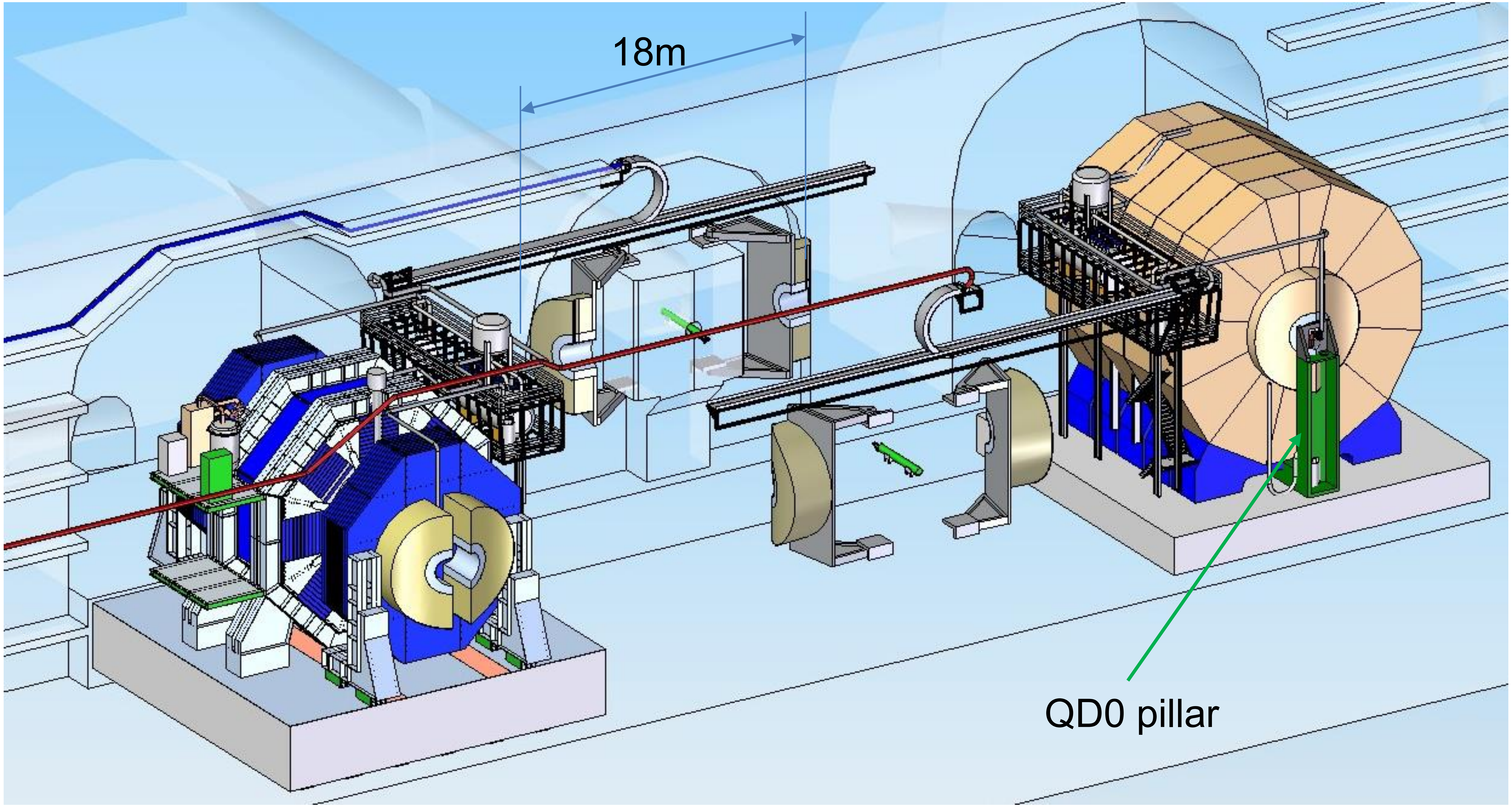
- one interaction region for two detectors
- push-pull system allows for lumi-lumi transition within O(1d)

**Constraints**

- Set of rules for the friendly co-existence of two detectors
  - one taking data, one being maintained
- Functional requirements laid down in 2009
  - SLAC-PUB-13657
  - geometric boundary conditions
  - magnetic and radiation environment
  - vacuum
  - alignment and vibration limits
  - etc.



# Push-pull



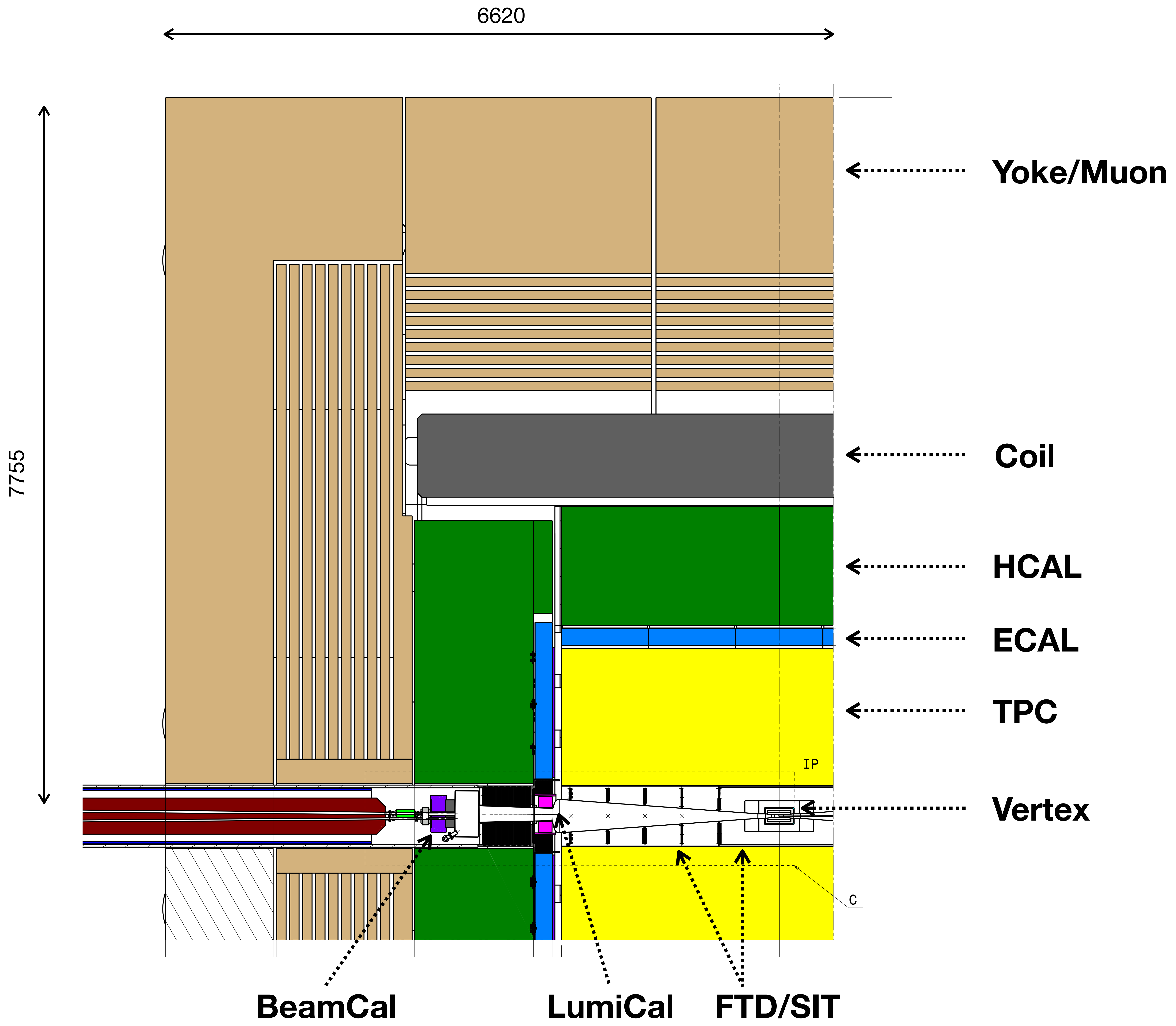
# ILD Detector Concept

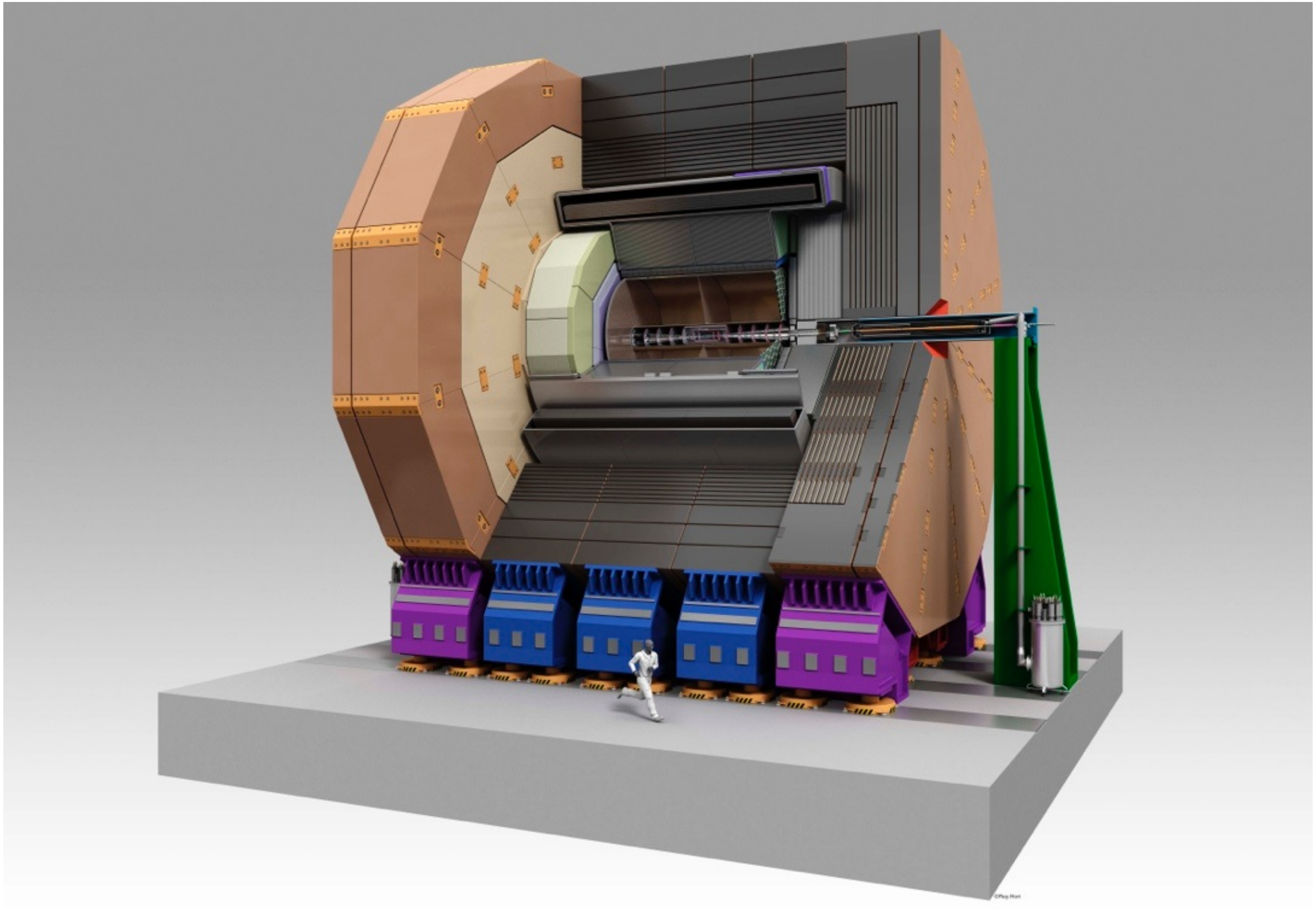
## Multi-purpose Detector

- optimised for electron-positron collisions at the Higgs threshold and beyond
- Inner tracking system: Si
- Central tracking system: TPC
- Highly granular calorimeter systems inside of the detector solenoid
- Forward instrumentation
- Instrumented iron yoke

## Main Solenoid

- will be presented by Y. Makida
- 3.5T (max 4T) central field





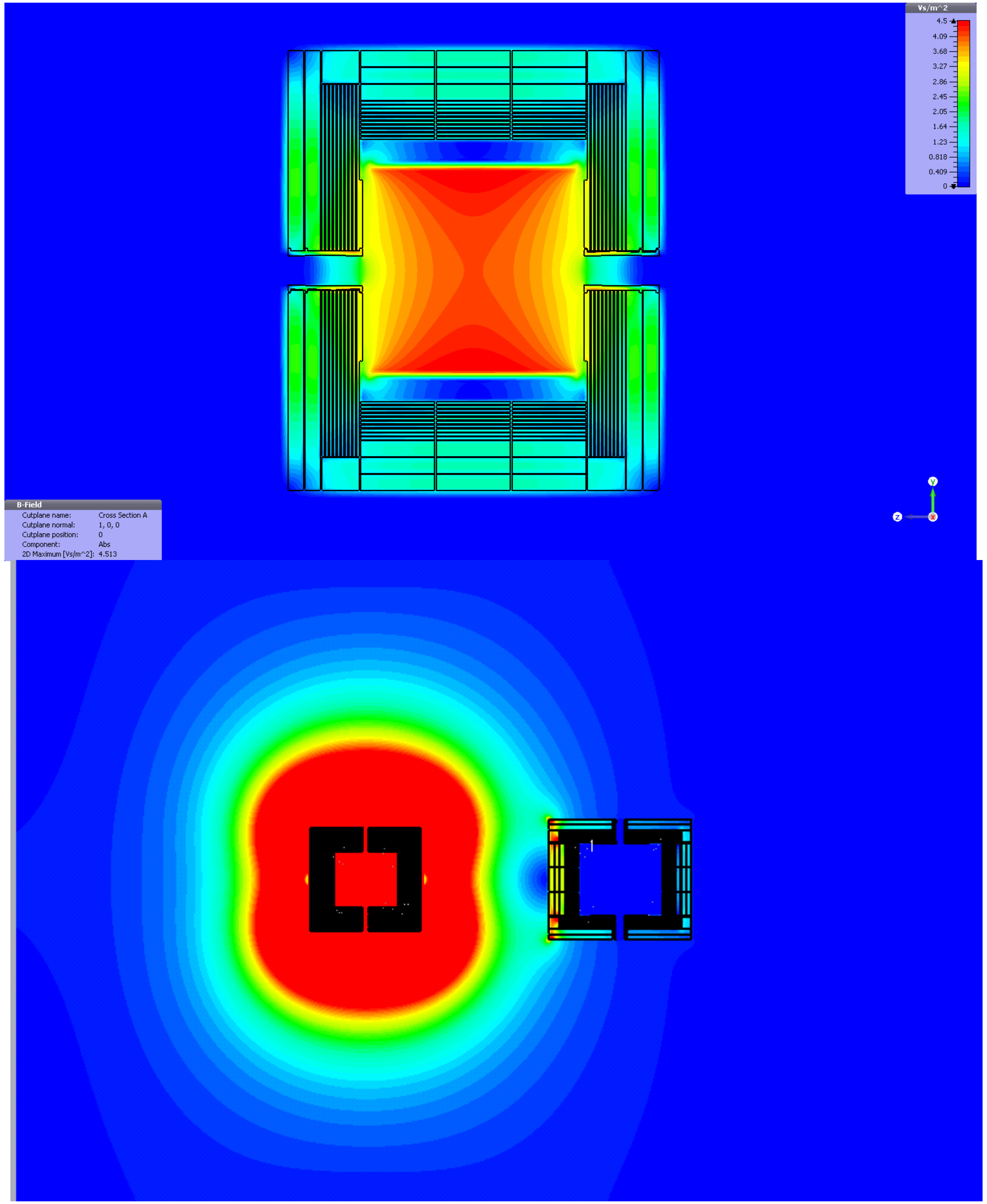
# Magnetic Fields

## Magnetic stray fields

- are of concern in an environment shared by two detectors
- „on-beam“ detector should be able to operate while maintenance work in „off-beam“ detector, 10m away, is required

## Limits drive thickness of iron yokes

- and this defines the radius of the central access shaft



# Detector Integrated Dipole DID

## Paper from B. Parker and A. Seryi: PR ST 8, 041001 (2005)

- At this time ILC had still 20 mrad crossing angle

## Conclusion:

### Compensation of the effects of a detector solenoid on the vertical beam orbit in a linear collider

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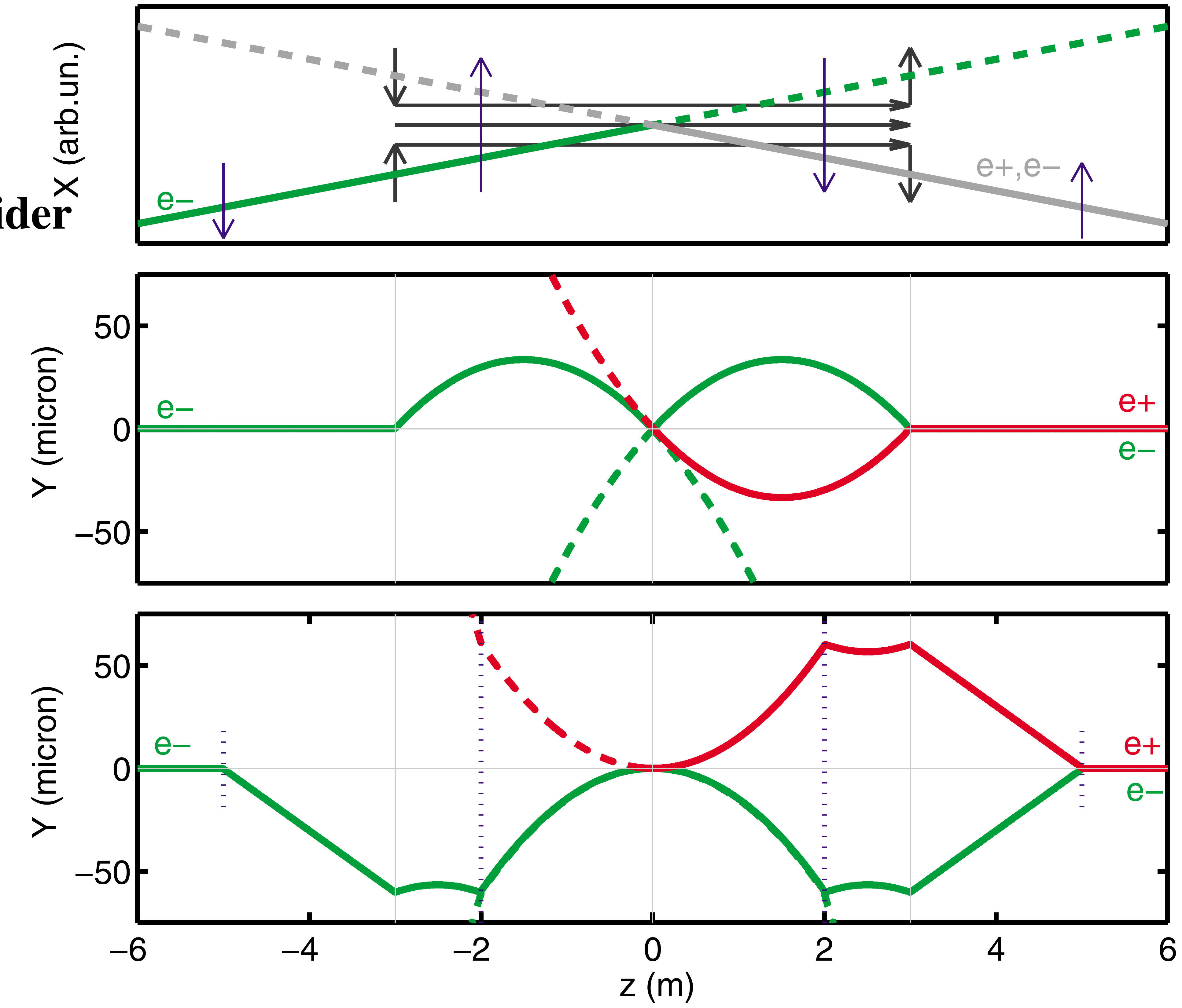
*Brookhaven National Laboratory, P.O. Box 5000, Upton, New York 11973, USA*

Andrei Seryi†
*Stanford Linear Accelerator Center, P.O. Box 20450, Stanford, California 94309, USA*

(Received 19 January 2005; published 1 April 2005)

This paper presents a method for compensating the vertical orbit change through the interaction region that arises when the beam enters the linear collider detector solenoid at a crossing angle. Such compensation is required because any deviation of the vertical orbit causes degradation of the beam size due to synchrotron radiation, and also because the nonzero total vertical angle causes rotation of the polarization vector of the bunch. Compensation is necessary to preserve the luminosity or to guarantee knowledge of the polarization at the interaction point. The most effective compensation is done locally with a special dipole coil arrangement incorporated into the detector (detector integrated dipole). The compensation is effective for both $e^+e^-$ and $e^-e^-$ beams, and the technique is compatible with transverse-coupling compensation either by the standard method, using skew quadrupoles, or by a more effective method using weak antisolenoids.



# From DID to Anti-DID

**Parker/Seryi reacted quickly to the Snowmass discussions on detector backgrounds: SLAC-PUB-11662**

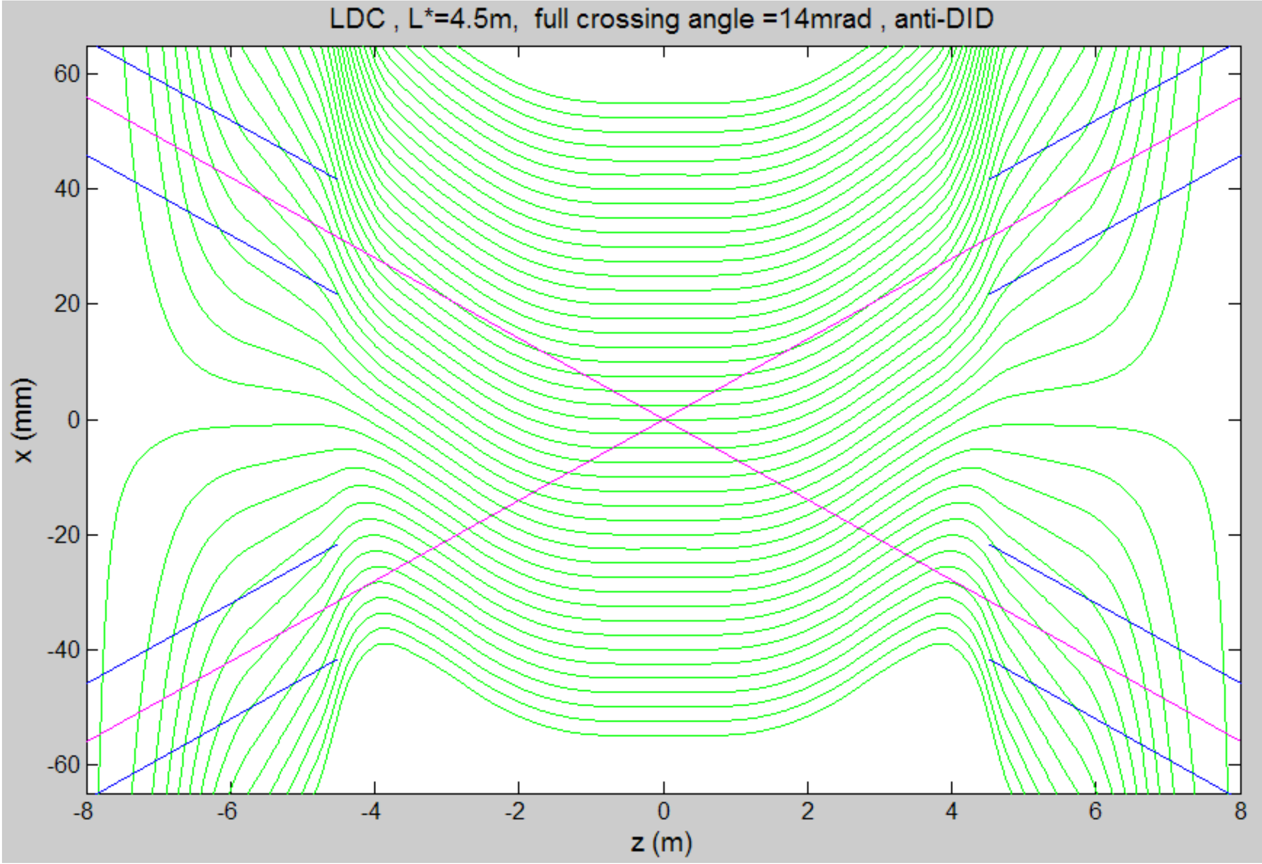
**Crossing angle was reduced to 14mrad**

- SR effects were strongly reduced
- beam angle could be corrected with other magnets in the final focus

**Changing the polarity of the DID to Anti-DID turns the device from a „machine requirement“ to a „nice-to have for the detectors“**

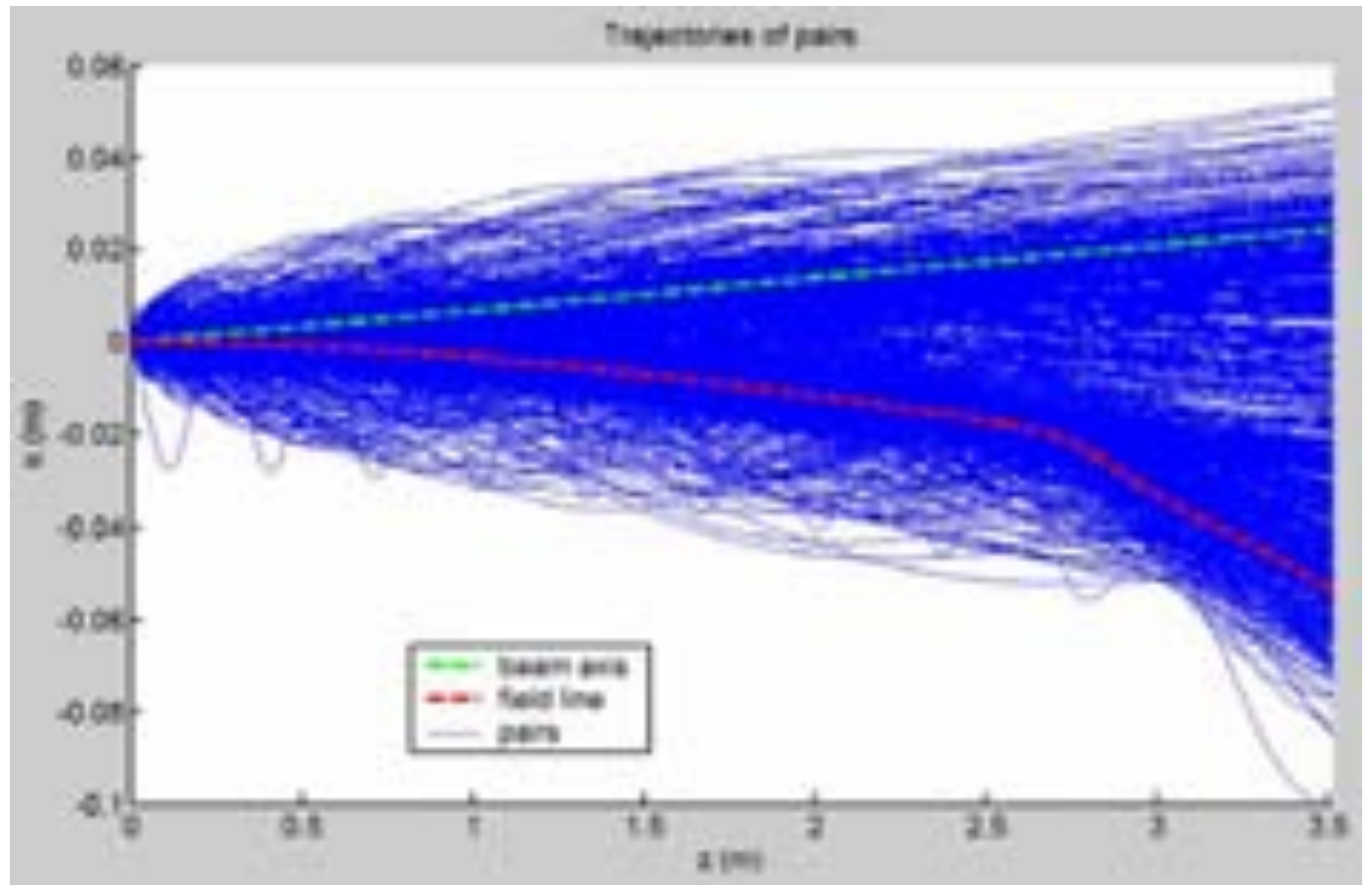
**Significant reduction of energy deposited on BeamCal**

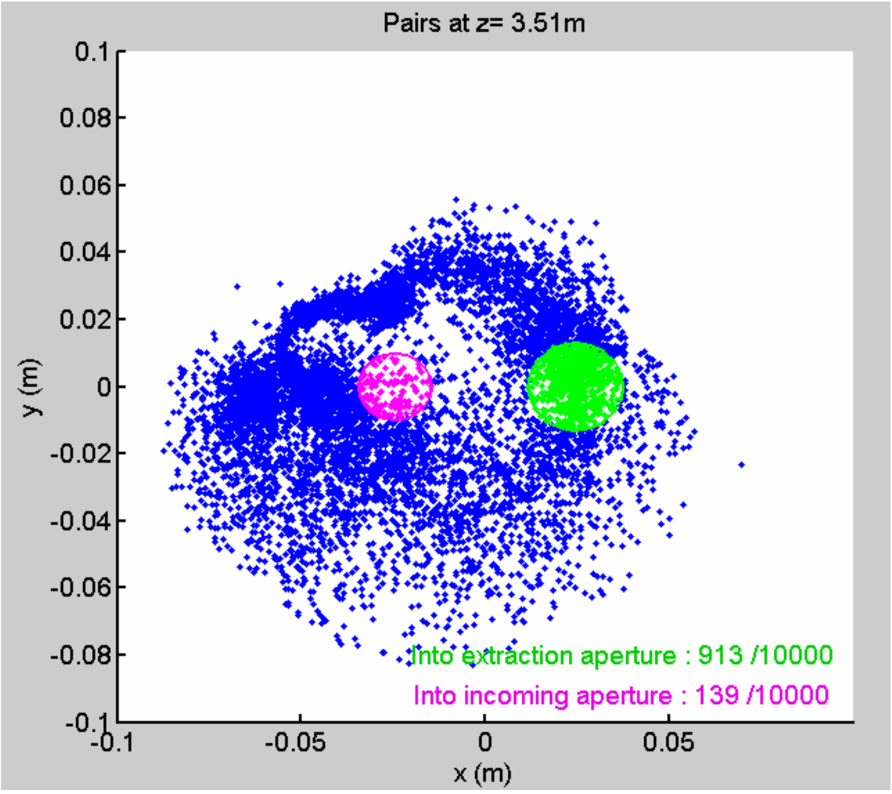
- Interesting for searches for BSM physics

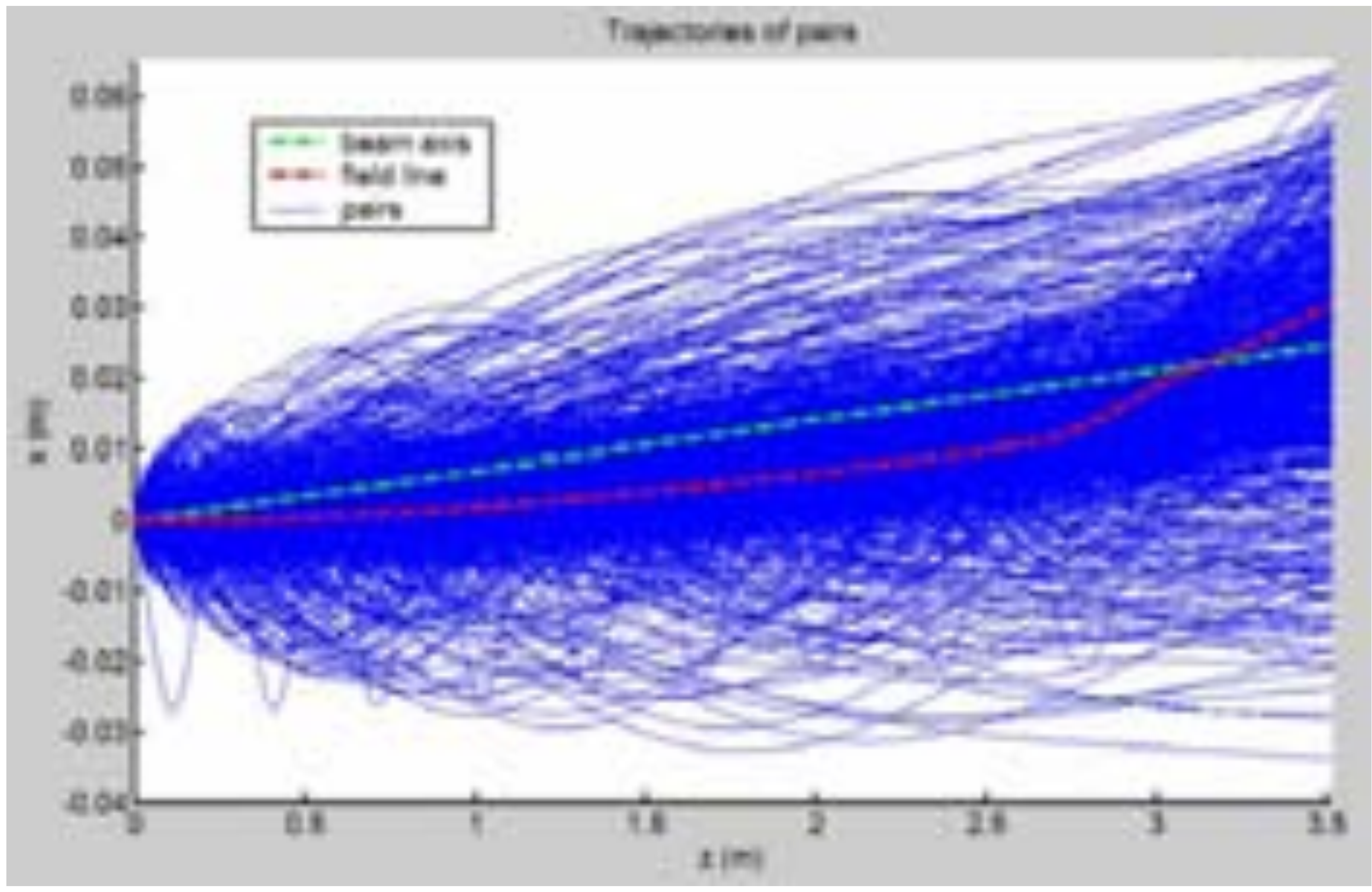


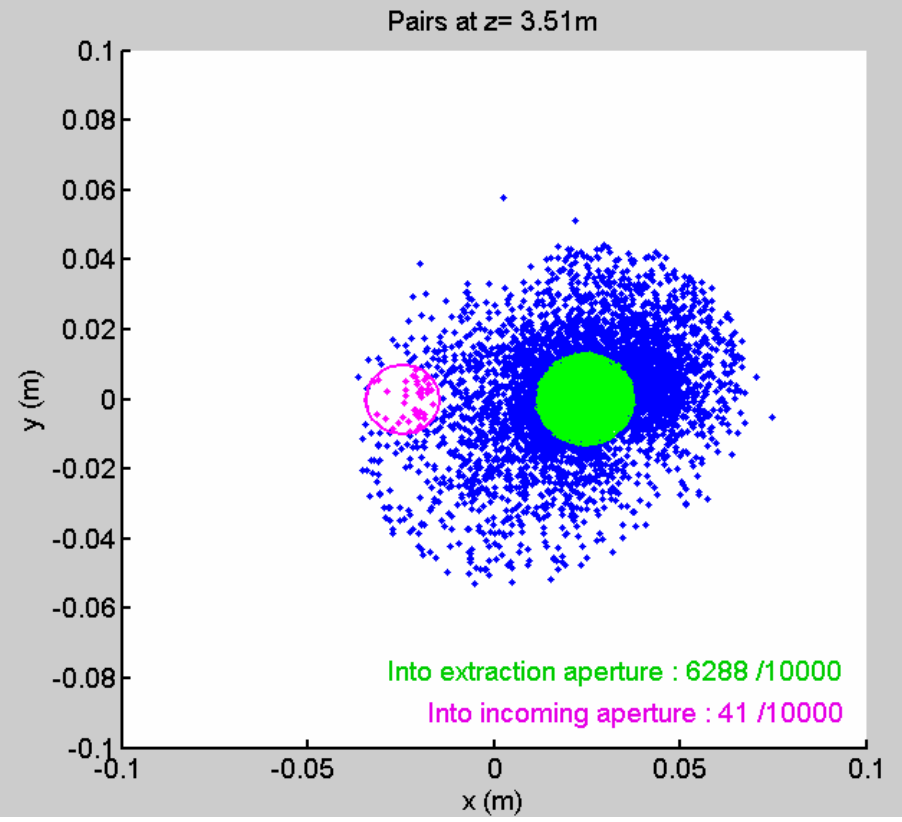

**IR OPTIMIZATION, DID AND ANTI-DID***


Andrei Seryi, Takashi Maruyama, SLAC, Stanford, CA, USA
Brett Parker, BNL, Upton, NY 11973, USA.

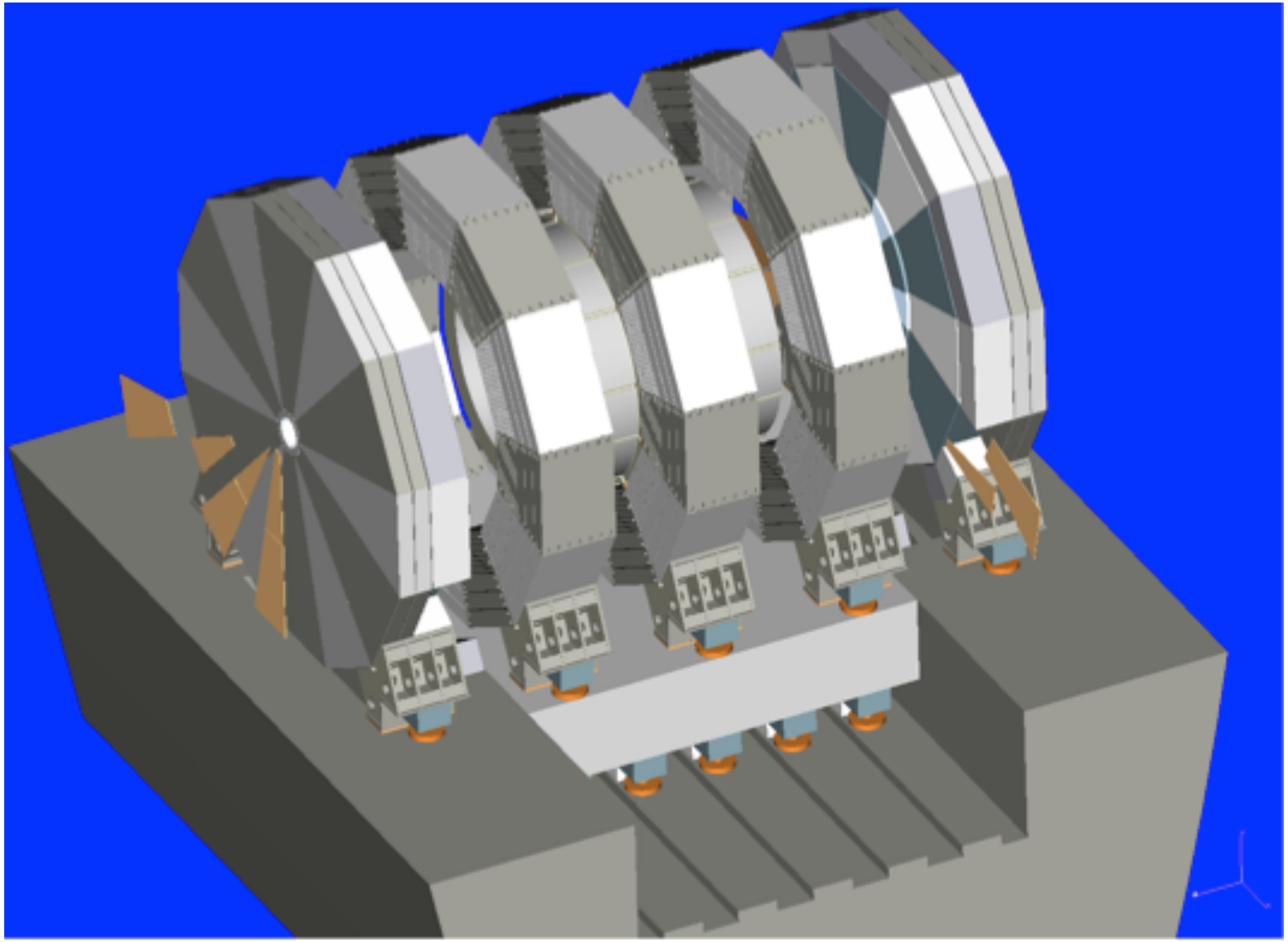
# ILD Mechanical Structure

**Main structure**

- 5 Yoke rings
- central ring carries solenoid and inner detectors
- 2 endcaps with endcap calorimeters

**Designed for push-pull**

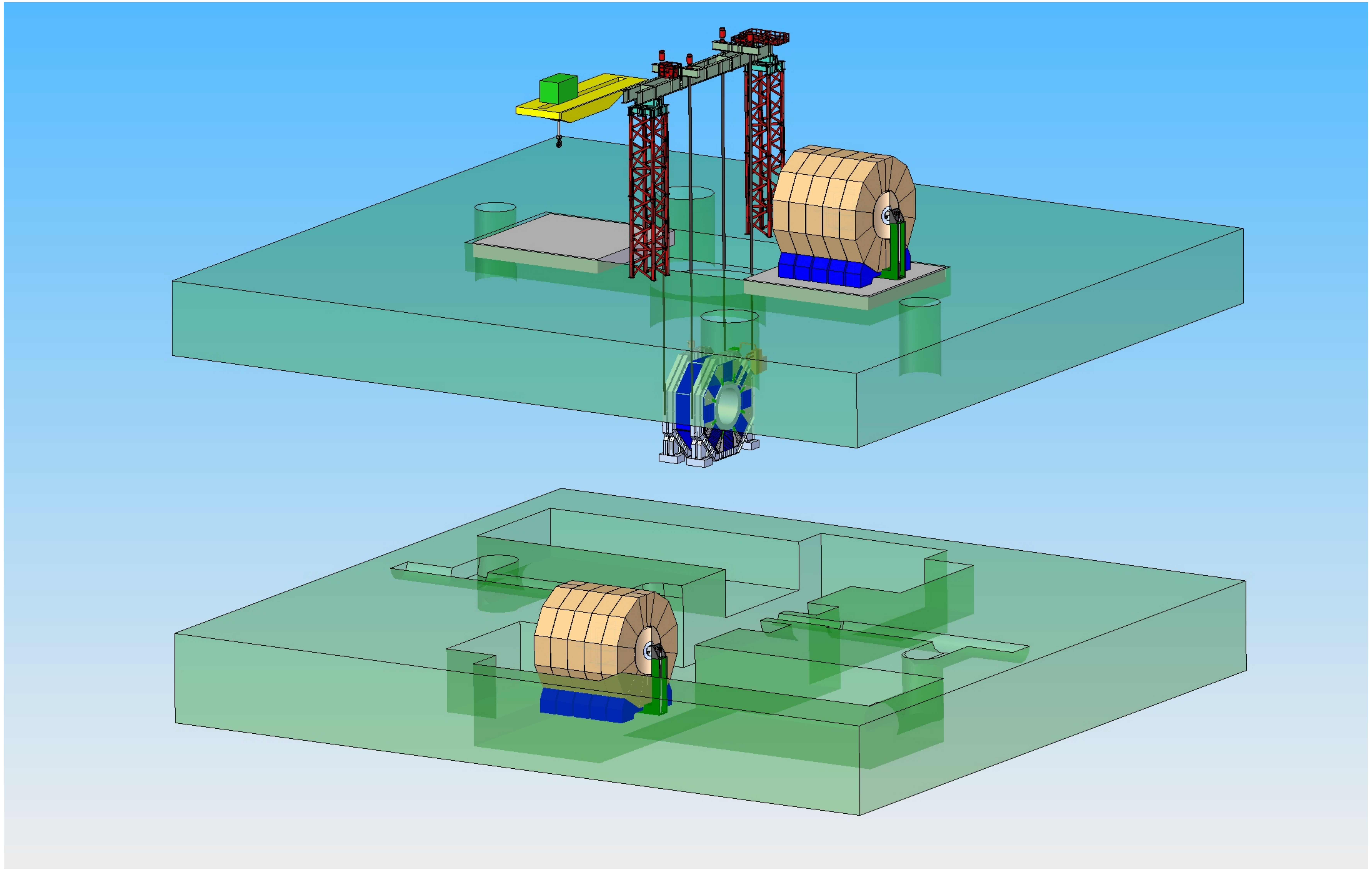
- on platform for rapid beam-beam transition



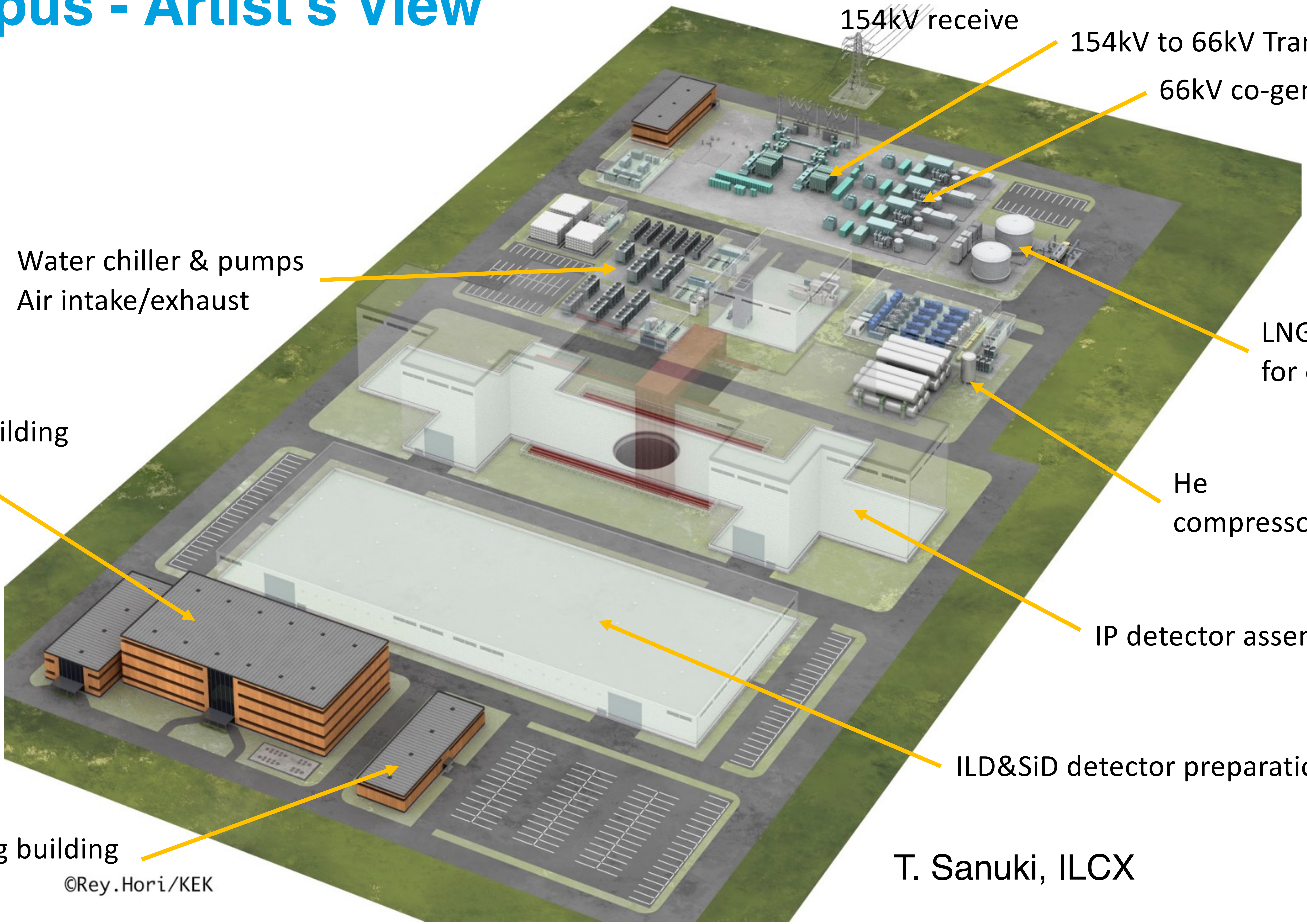
# Surface Assembly - CMS Style

**Handling**

- Gantry crane (temp)
  - 4000t
- 250t cranes in assembly hall
- 40t cranes in underground area
- air pads
- platform system



# IP Campus - Artist's View

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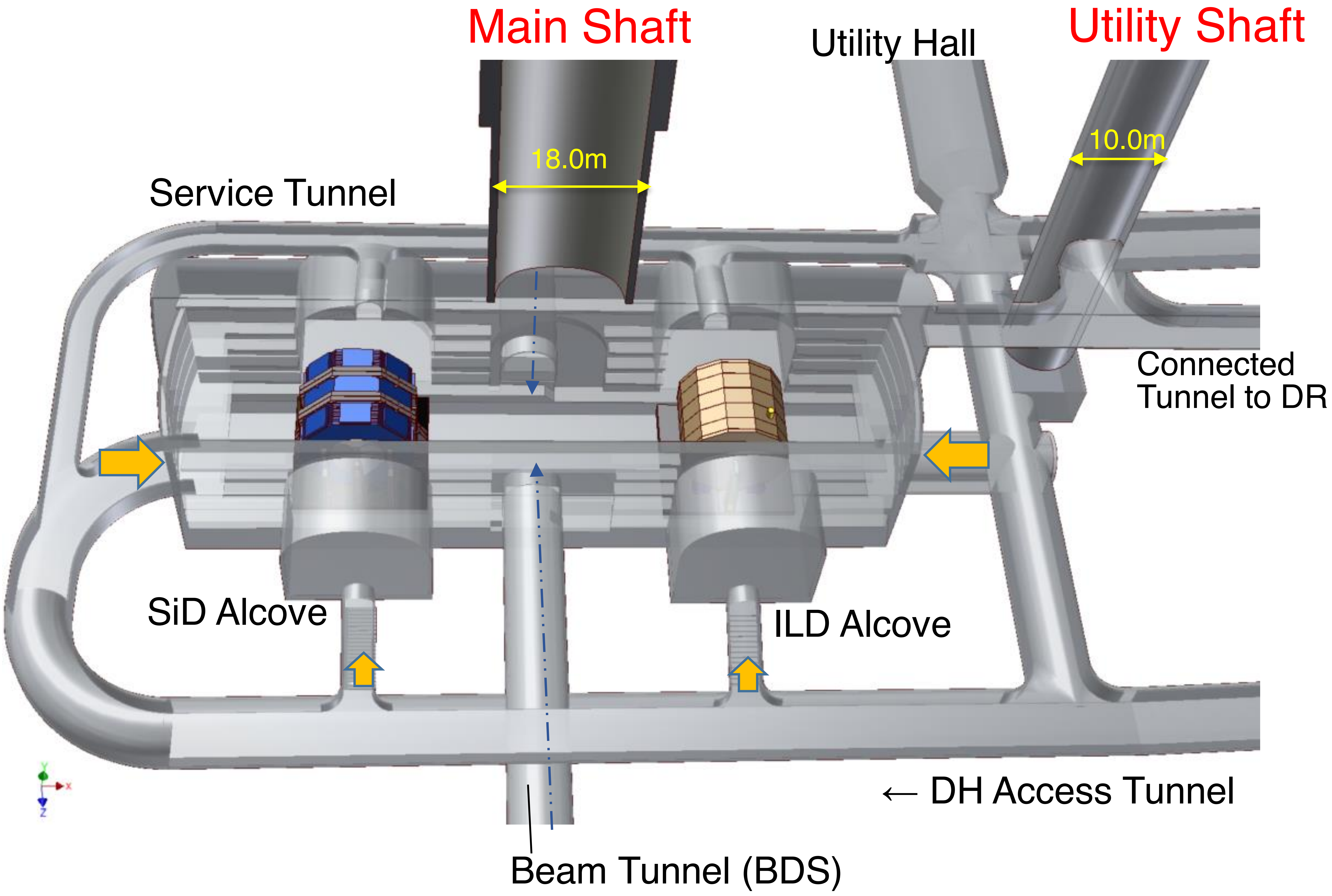
# Underground Detector Hall



# Conclusions

**ILC is a proposed Linear Collider as a future Higgs Factory**

**ILD is a detector concept for ILD**

- also being studied for other future collider concepts: CEPC, FCC-ee
- main solenoid with 4T max. central field
- integrated dipole-coils („Anti-DID“) under study

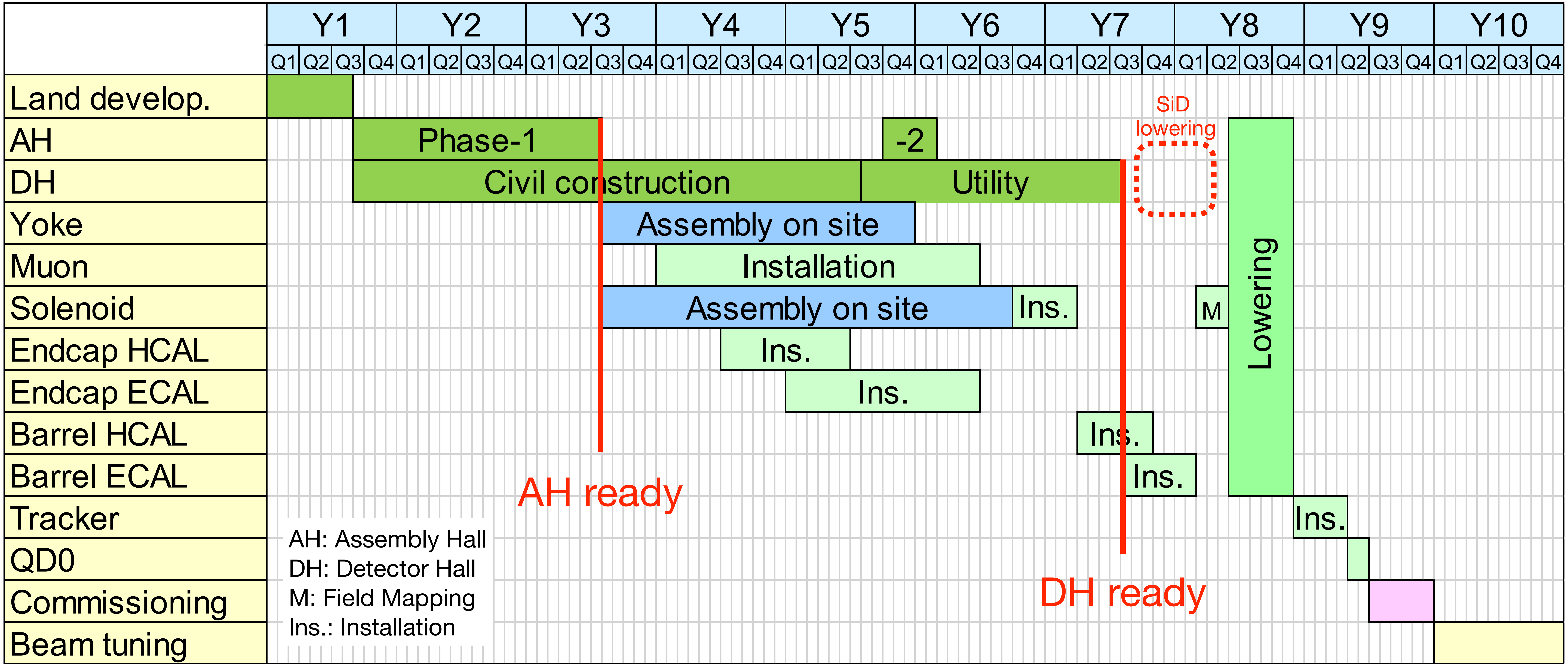
**ILC requirements are special**

- two detectors in close vicinity
- implications on magnetic stray fields, radiation protection, etc.

**Technical design of ILD solenoid will be presented by Y. Makida now**

# Backup

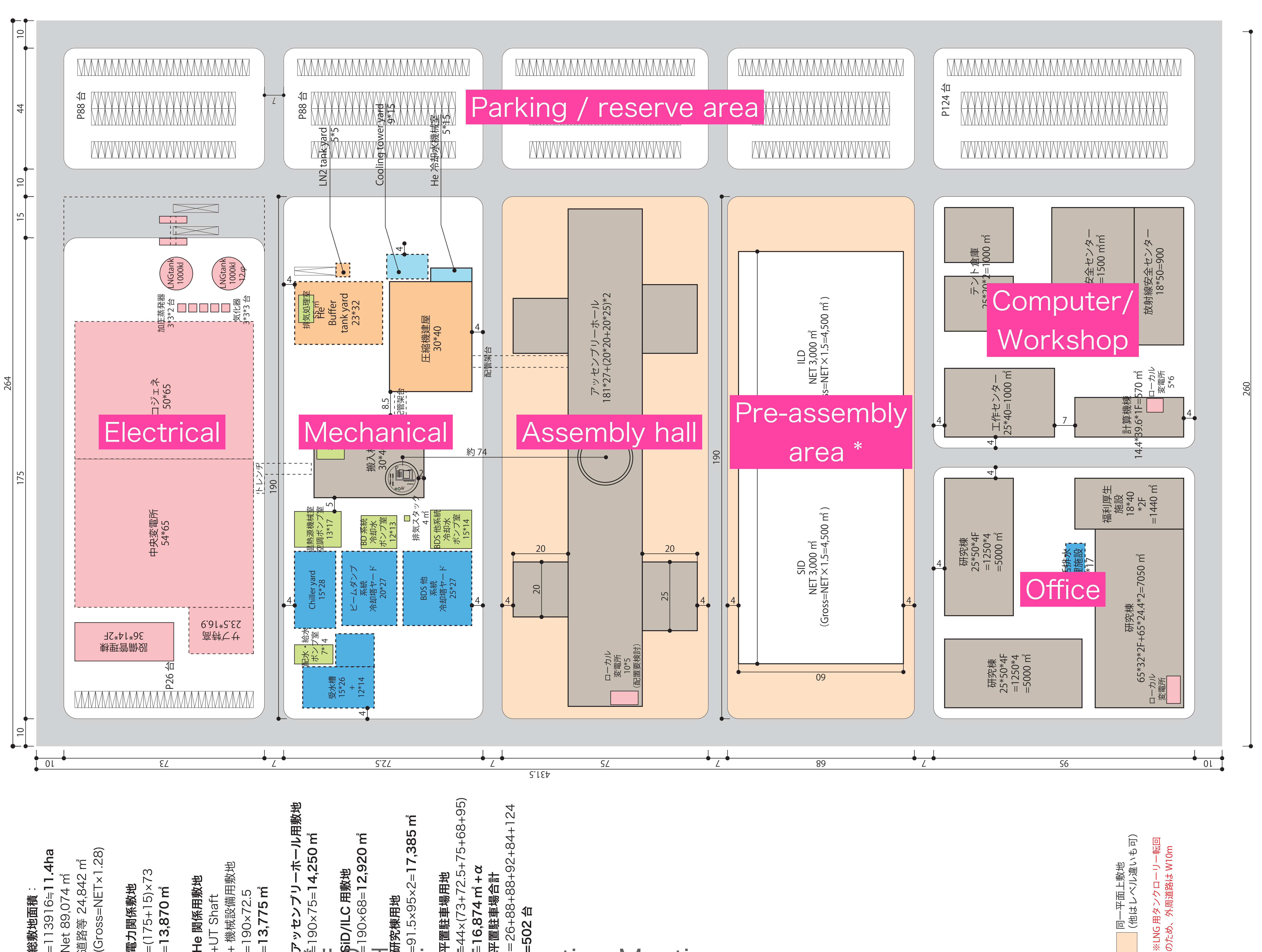
# Technical Detector Construction/Assembly Time Line



# IP campus

## In virtual site

IP campus ~10ha





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# Underground Areas