ILD MDI and Integration Issues

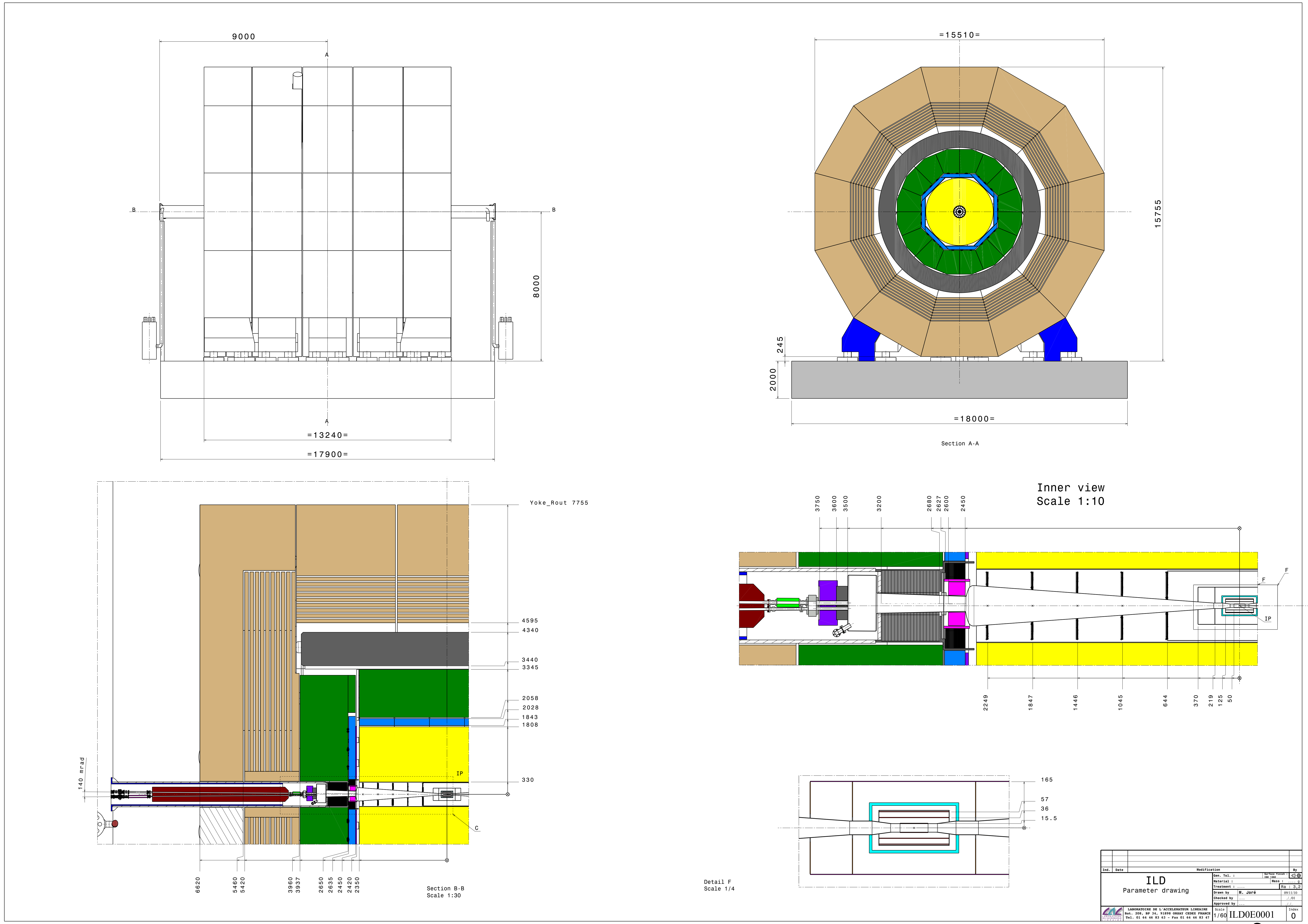
Karsten Buesser

ILD Software and Optimisation Workshop
25.02.2016

ILD Engineering Model

ILD CAD Model

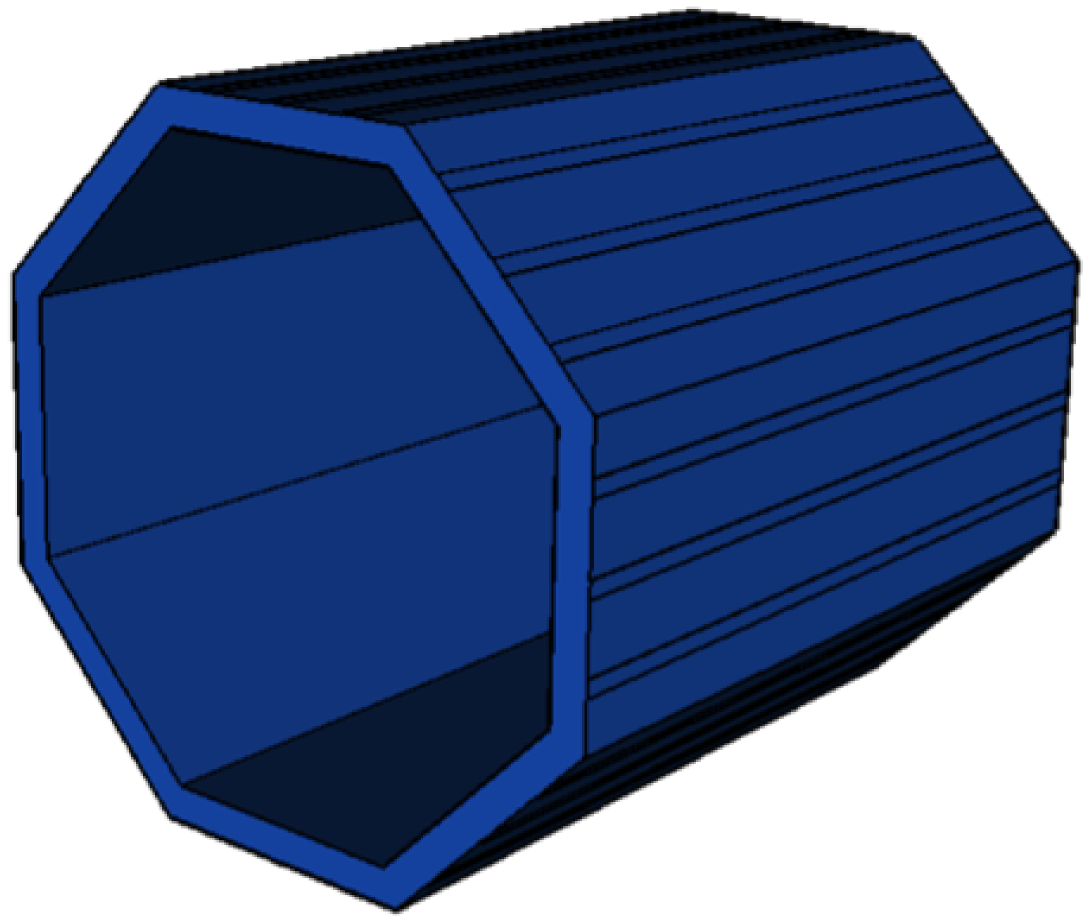
- The ILD engineering model is kept in ILC-EDMS
- Manager of the model is Christian Bourgeois (LAL)
- Combination of different CAD sources to a unified model with help from DESY IPP
- Need to evolve model to keep up with design work in subdetector collaborations
- Have started an initiative to define the interfaces in a more formalised way



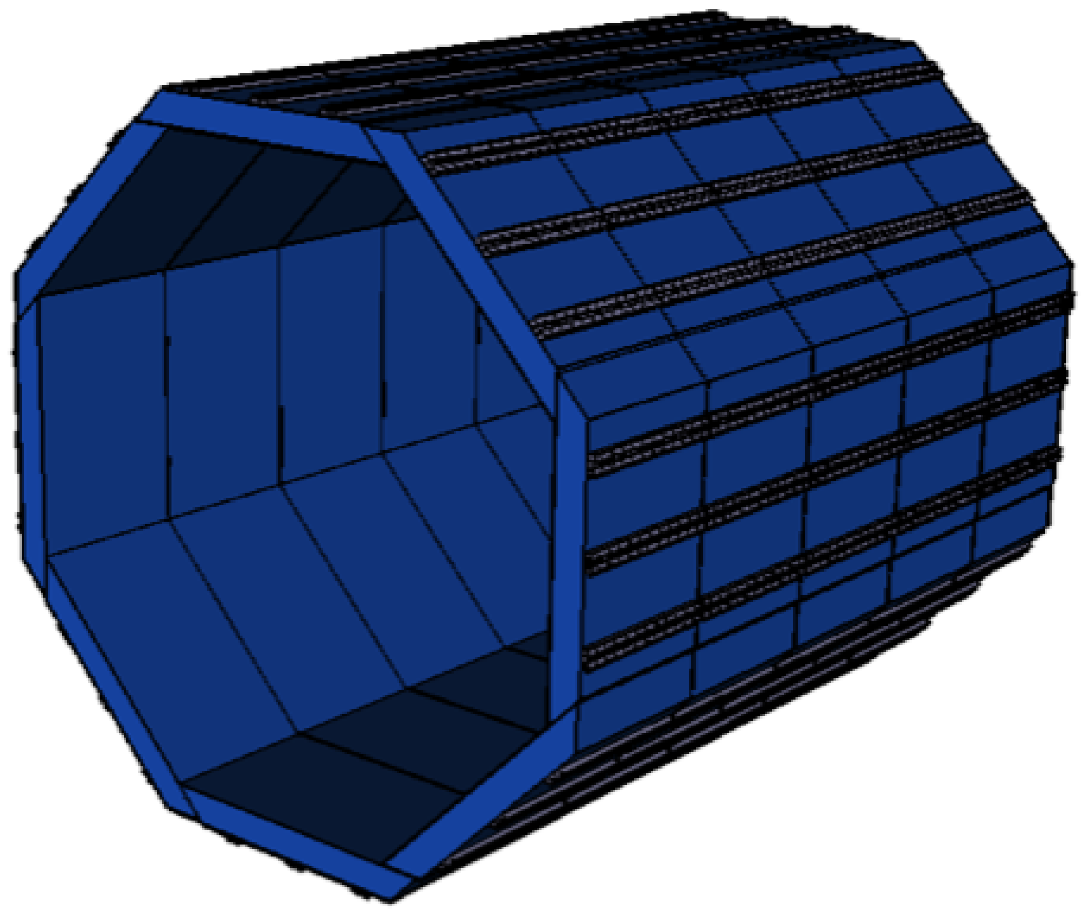
ILD Placeholder Model

- There is also a placeholder model of ILD in EDMS
- Should try to synchronise this with the simulation envelopes

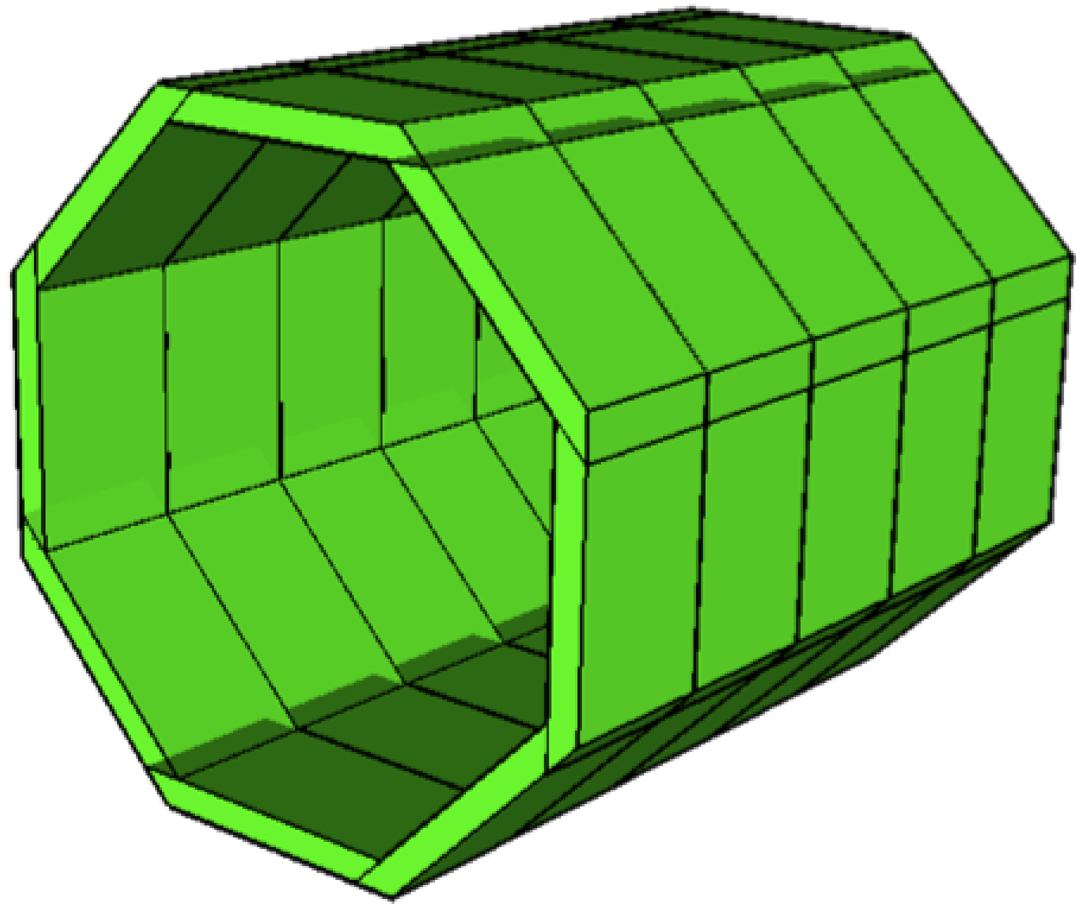
Placeholder

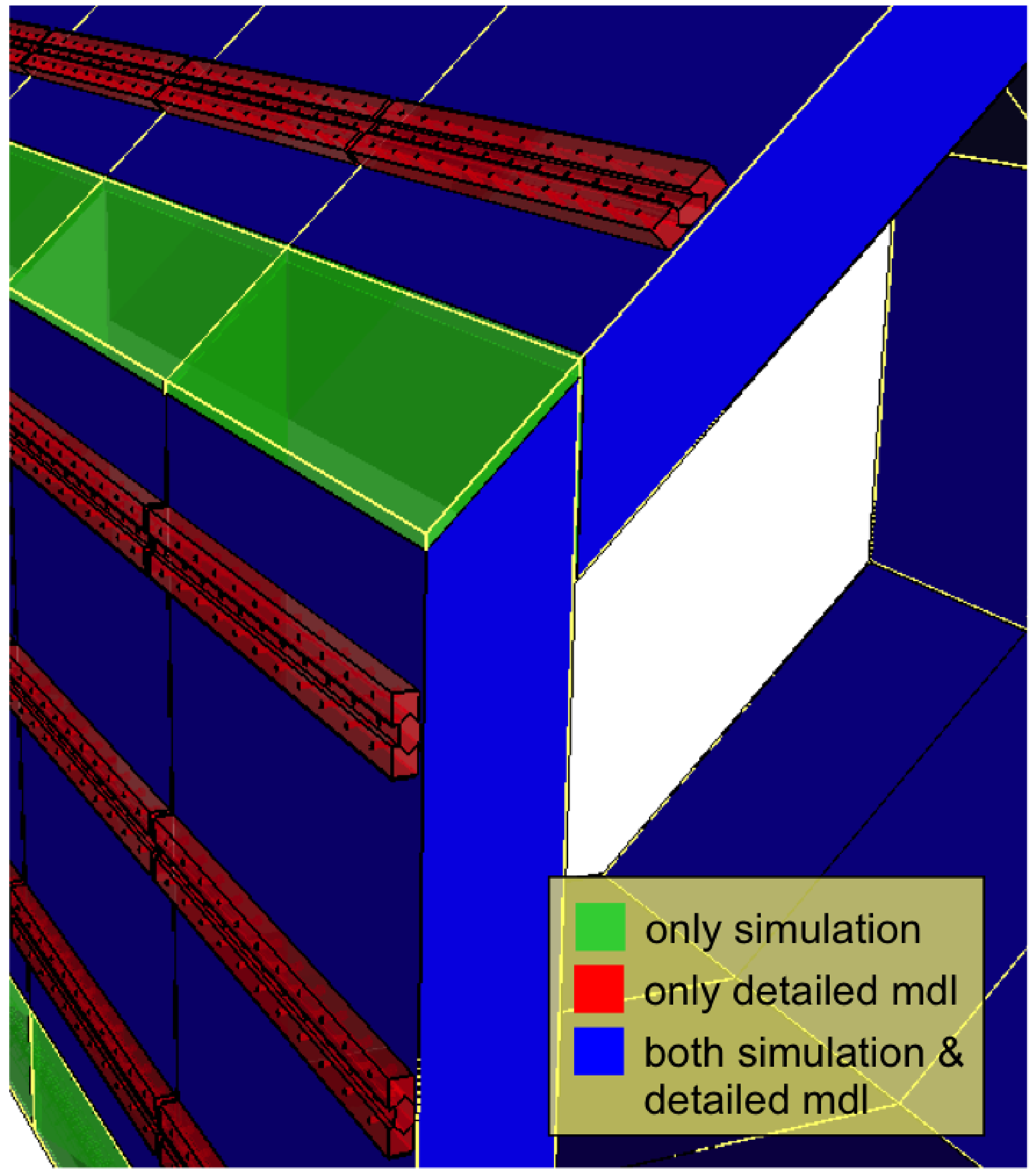


Detailed Design



Physics Simulation



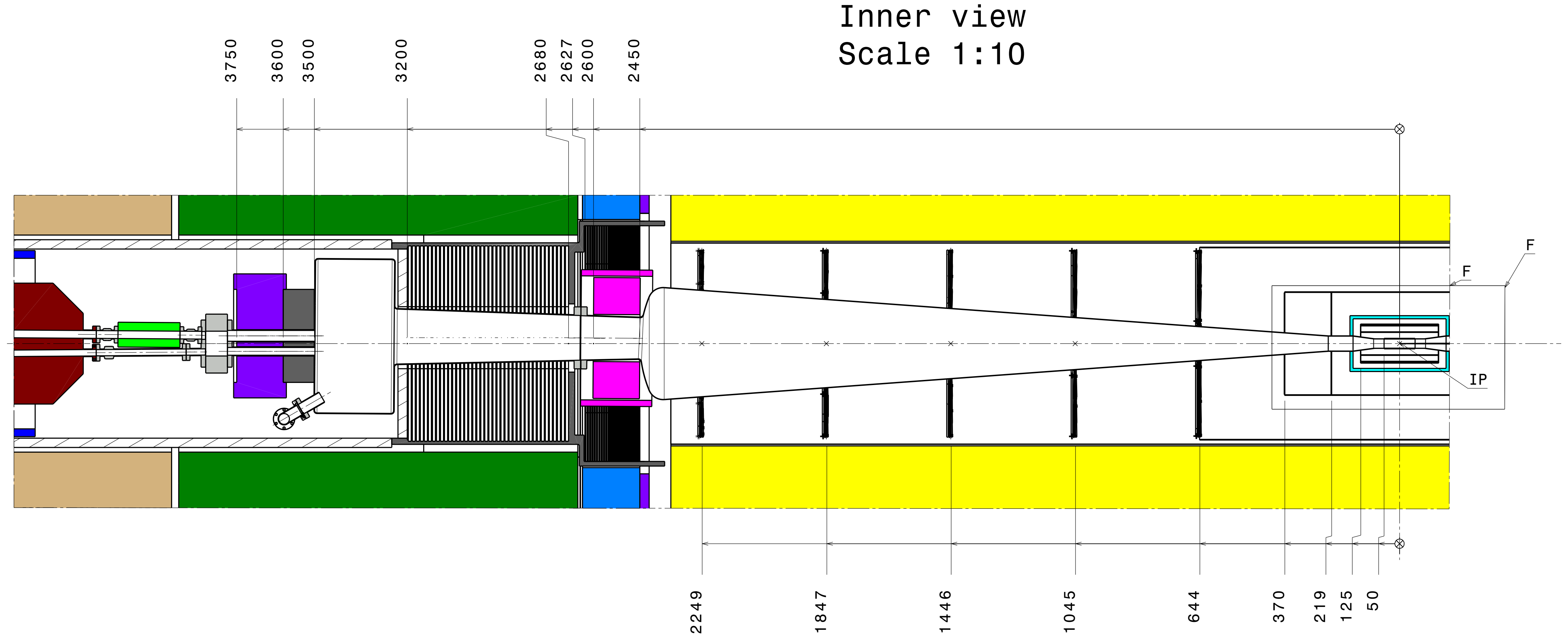


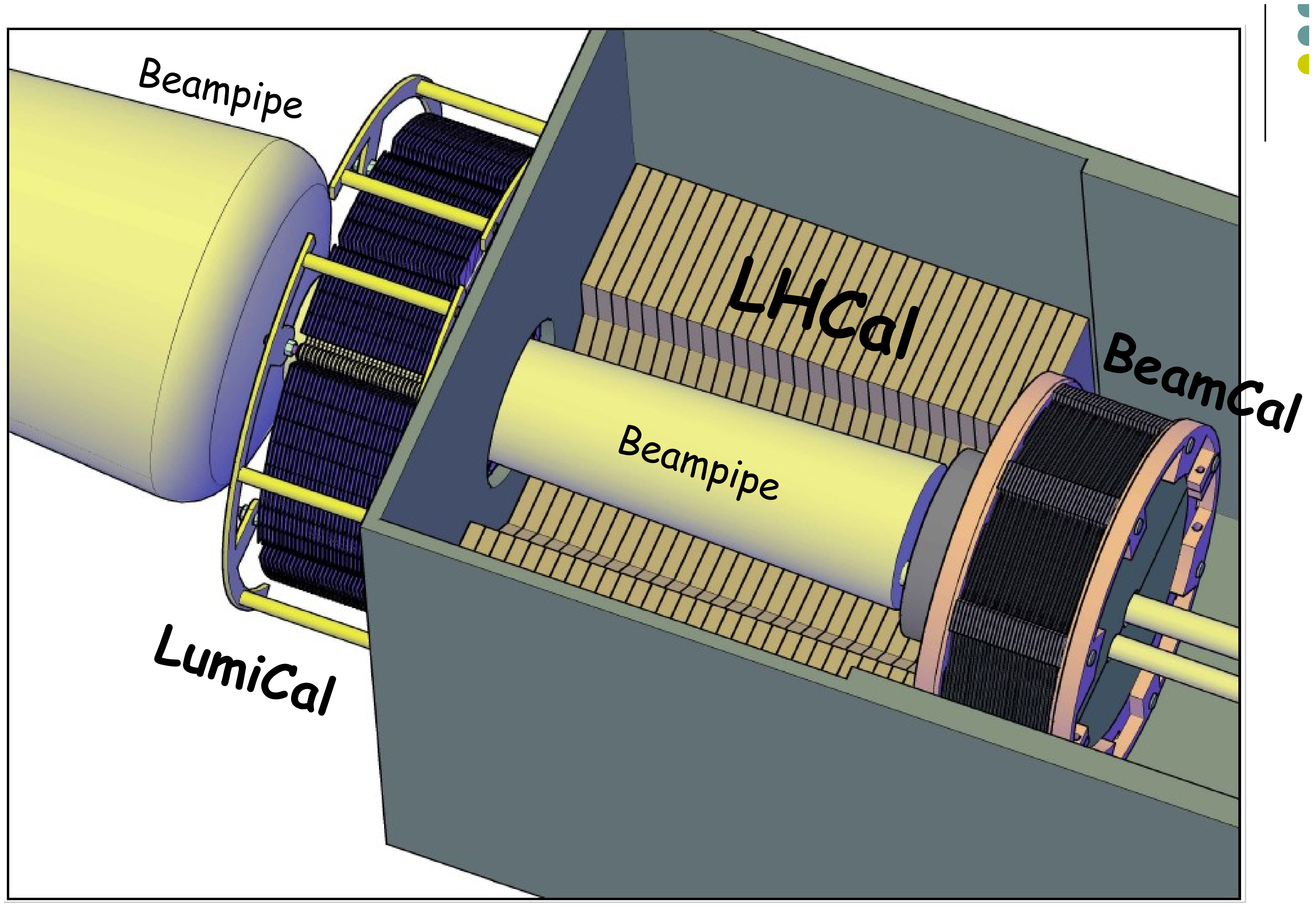
- Exercise has been done in 2010, tools to compare Geant4 and CAD models
- Should revive these activities in view of optimisation efforts
  - we probably don’t have the resources to keep detailed engineering models of ILD for all optimisation steps

L* and Anti-DID

Forward Region Changes

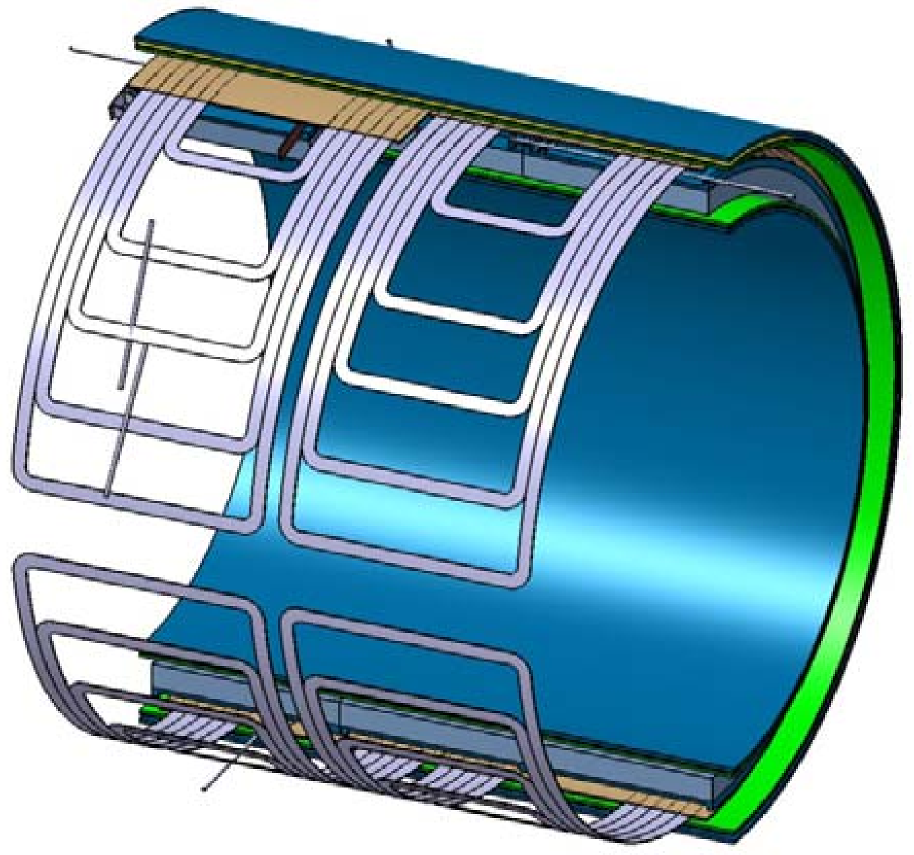
- ILD had L*=4.4m
- Change Request for L*=4.1m accepted
  - plus additional 10cm for BPM on incoming beam
- Tentative solution:
  - remove vacuum pump (30cm)
    - beam-gas scattering under control (R. Karl)
    - new vacuum solutions under study (LAL)
  - re-design LHCAL/BeamCal
    - work done in FCAL collaboration (S. Schuwalow)
- Need to study:
  - impact on backgrounds (L. Bortko)
  - magnetic field configurations
  - integration scheme with realistic LHCAL

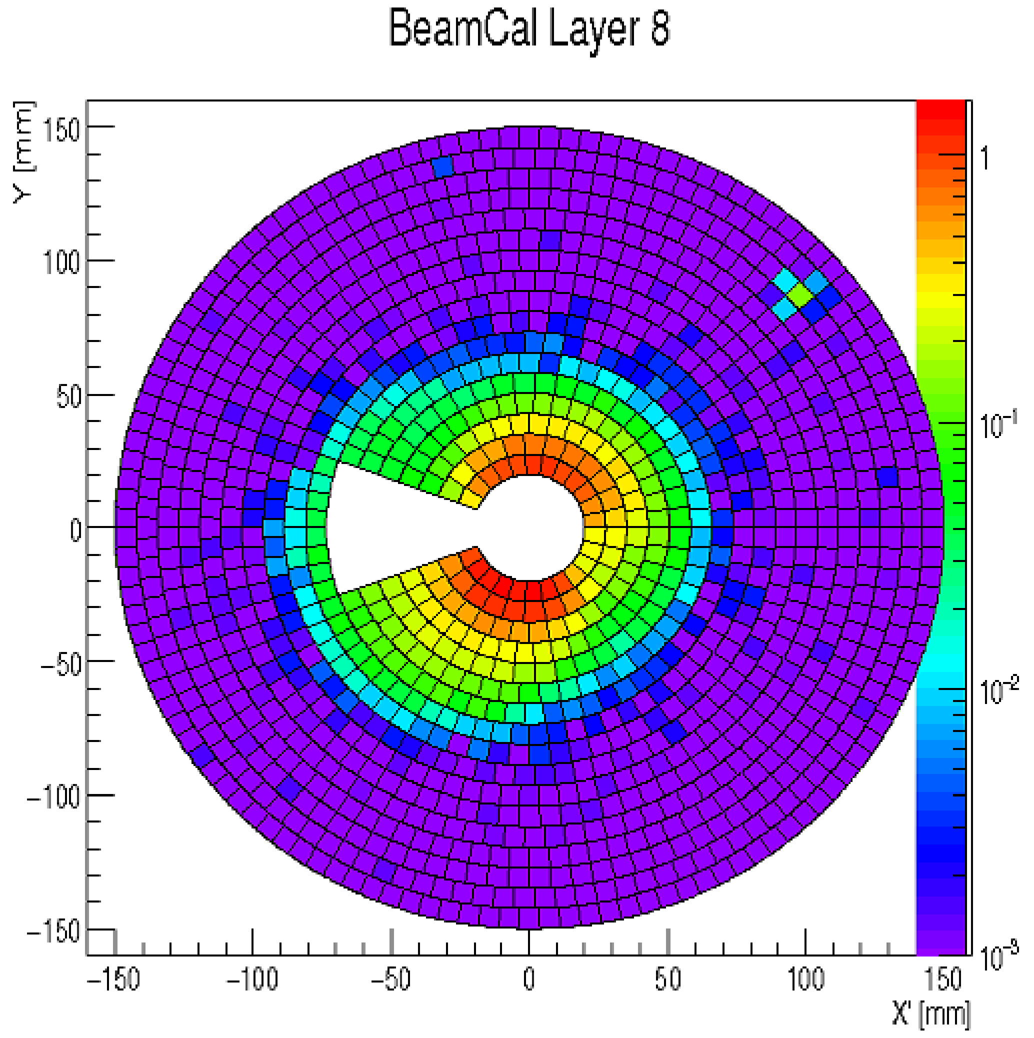




Anti-DID

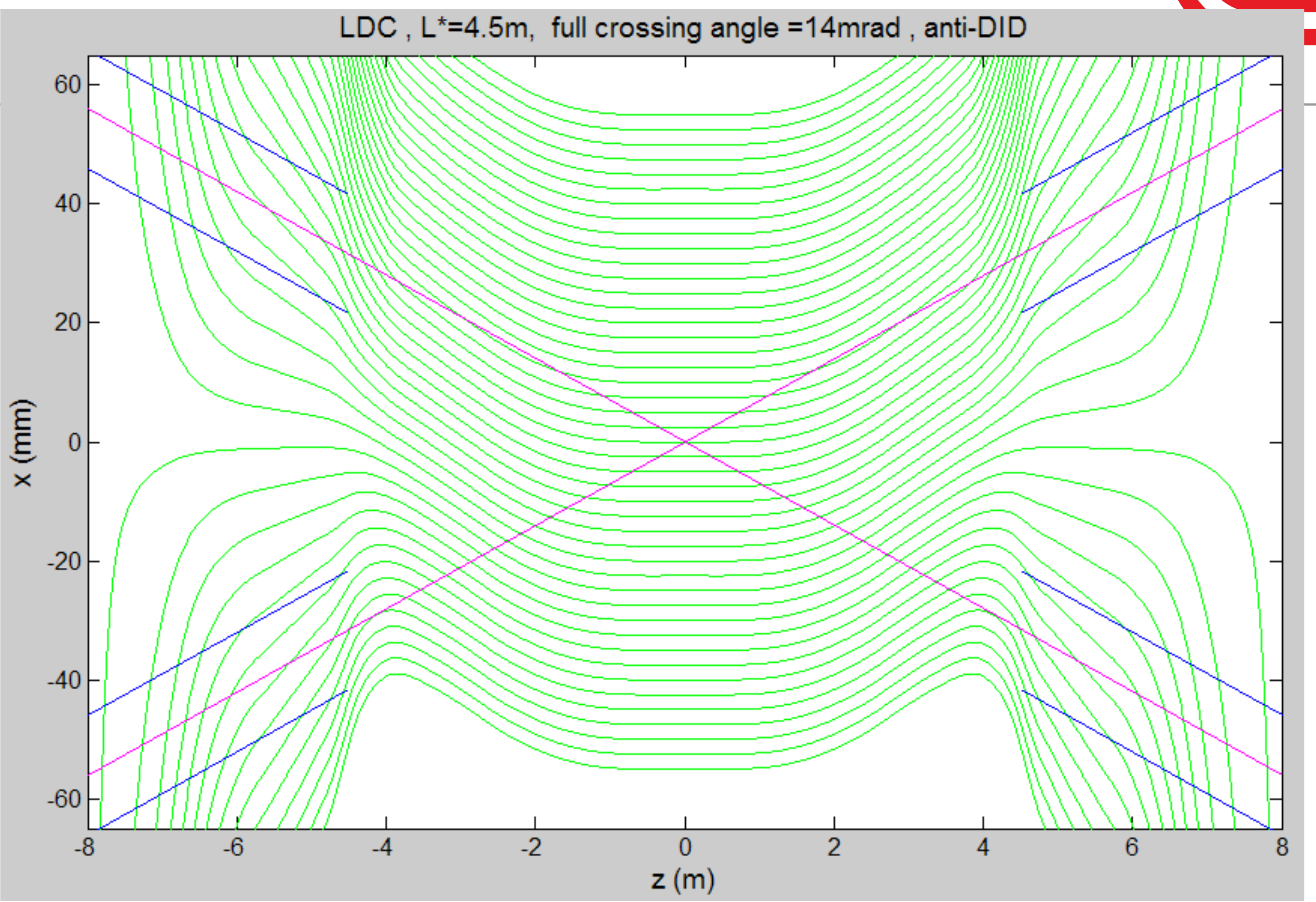
- Detector Integrated Dipole field was invented by Andrei Seryi and Brett Parker to make the net magnetic field parallel to incoming beams
  - polarisation tuning, reduce emittance growth due to synchrotron radiation
- Turned out that these problems were not as bad and could be corrected without DID
- Then proposed Anti-DID: make net magnetic field parallel to outgoing beam
  - reduce background on BeamCal as low energetic charged background particles are guided to exit hole



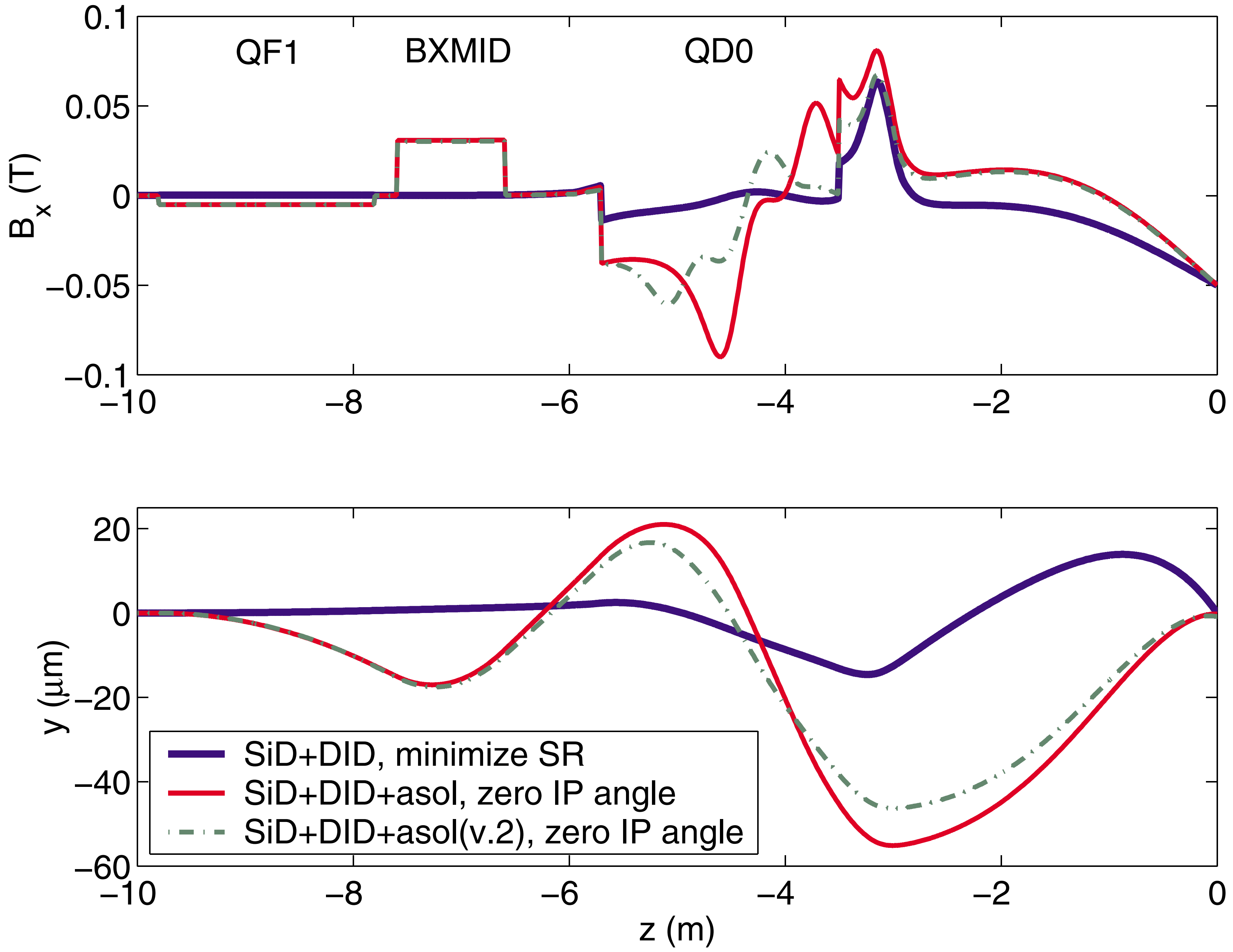


Forward Region Magnetic Fields

Seryi et al. SLAC-PUB-11662



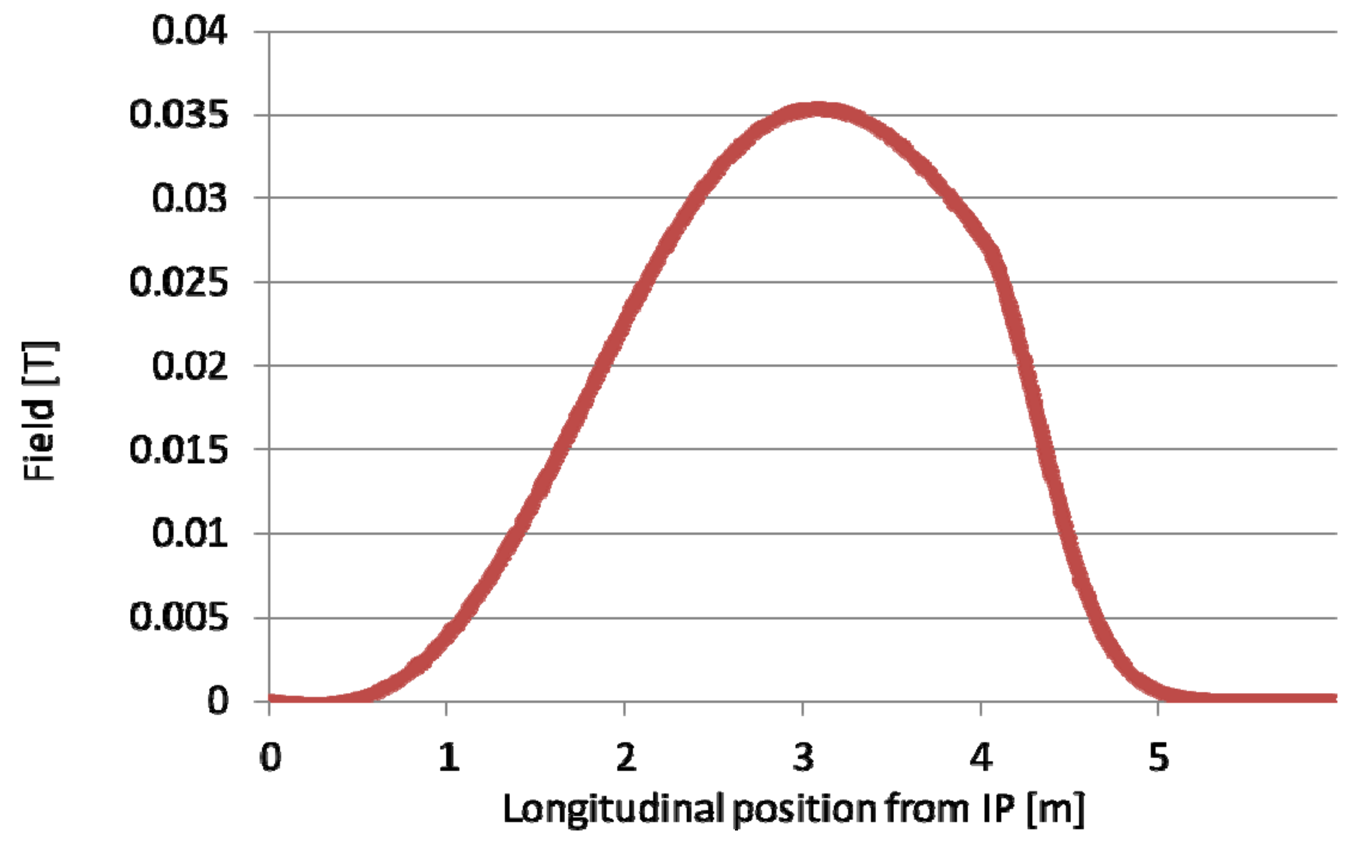
- The magnetic fields that determine the background distribution in the forward regions are complicated overlays:
  - Detector solenoid (fringe) fields
  - QD0 quadrupole (fringe) fields
  - Anti-solenoid (fringe) fields
  - Anti-DID (fringe) fields
- A detailed 3D model of all fields would be needed to do proper background simulations.
- This needs to be done anyhow for the new L* geometries
  - collaboration with machine experts required
  - probably hard to get in view of resources at machine groups…



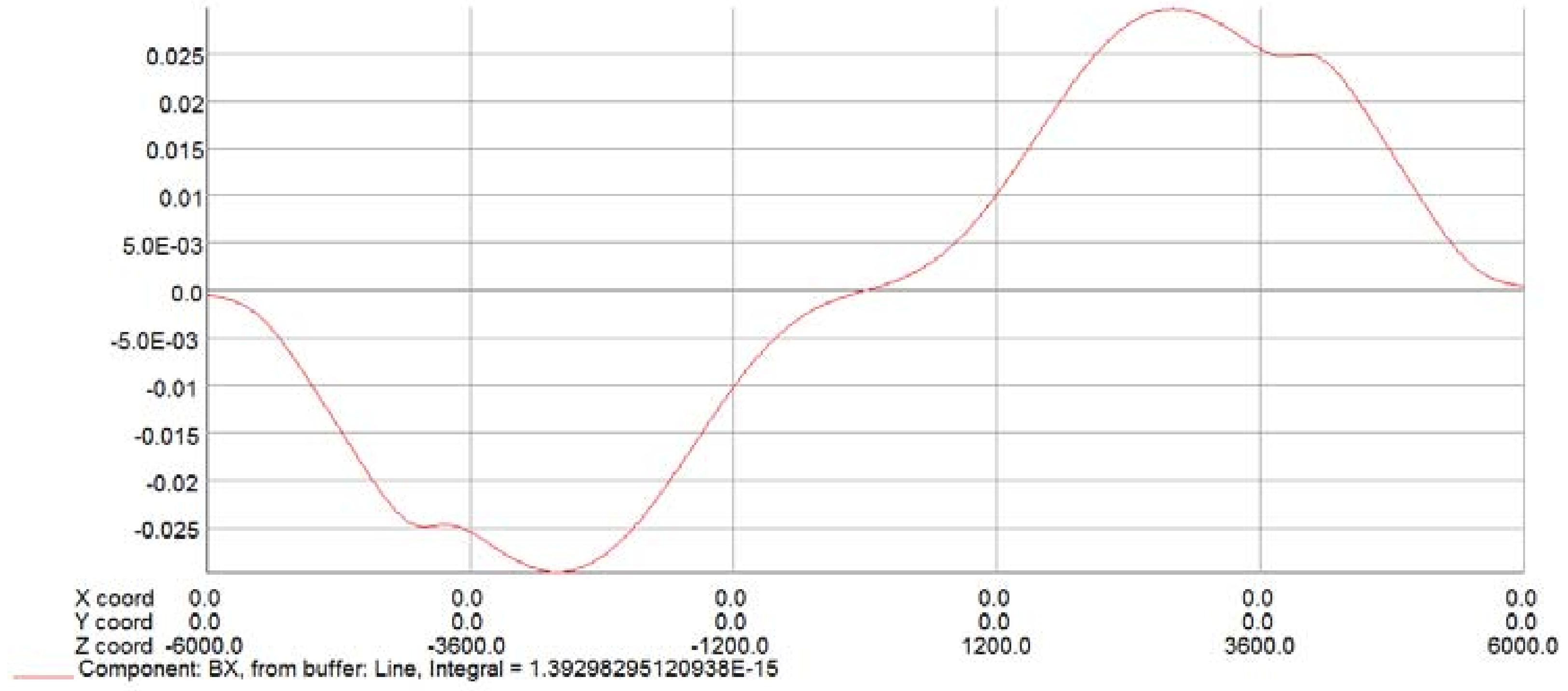
Parker, Seryi, PR STAB 8.041001

Realistic Anti-DID?

- Technical realisation studied for TDR
  - LC-DET-2012-81
- Conclusion: current field assumed in Mokka (2012) has no technical solution at this time. Need common effort between physics groups and magnet experts.
- We are in discussions with SiD; their preliminary conclusion: Anti-DID in the proposed form as a dipole cannot be built or will be very expensive.
- SiD is even looking into solution with two tilted solenoids
  - would fix the crossing angle forever
- SiD is seriously considering to abandon the Anti-DID



Mokka 2012



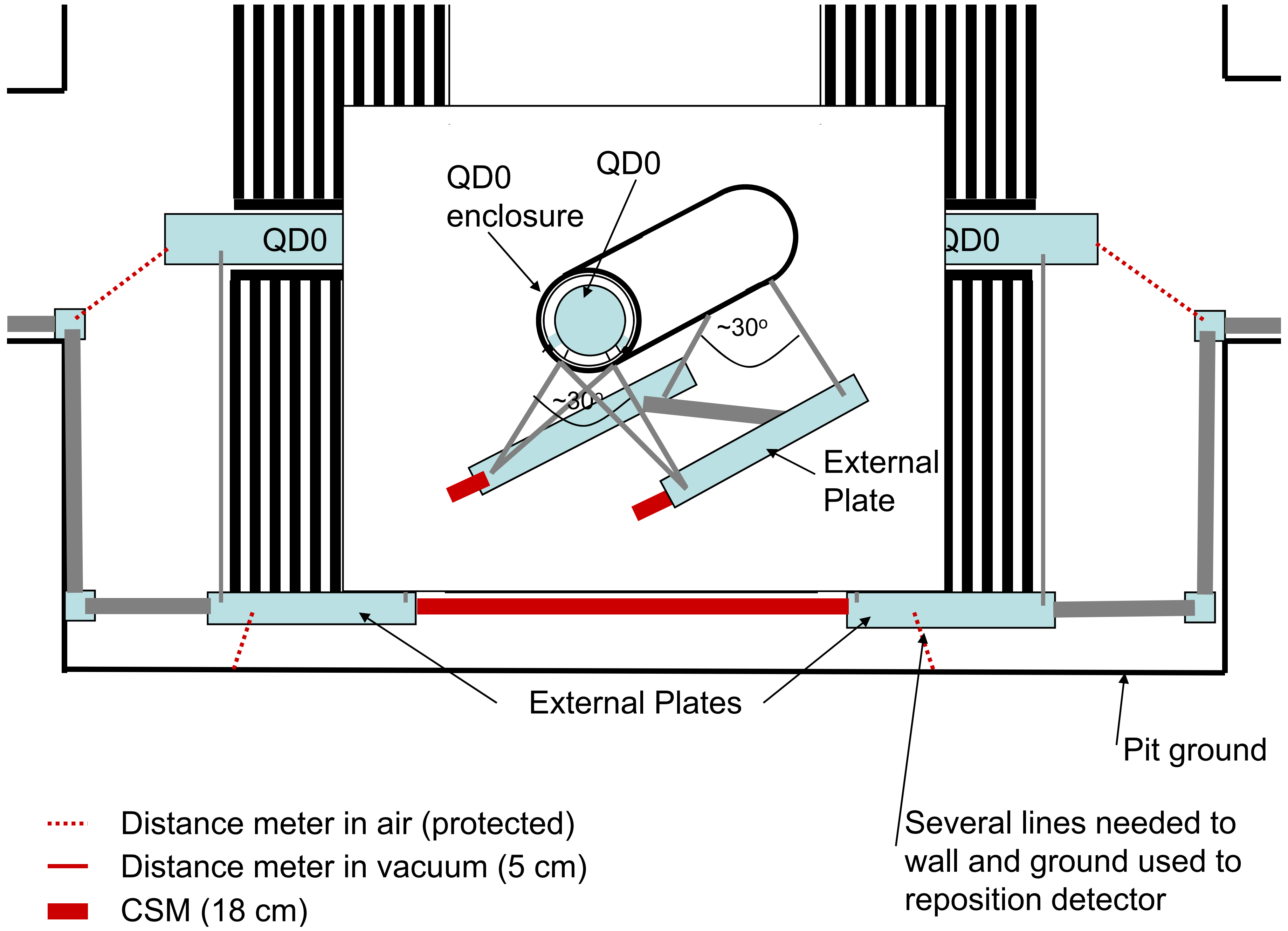
Kircher et al. LC-DET-2012-81

ILD Alignment

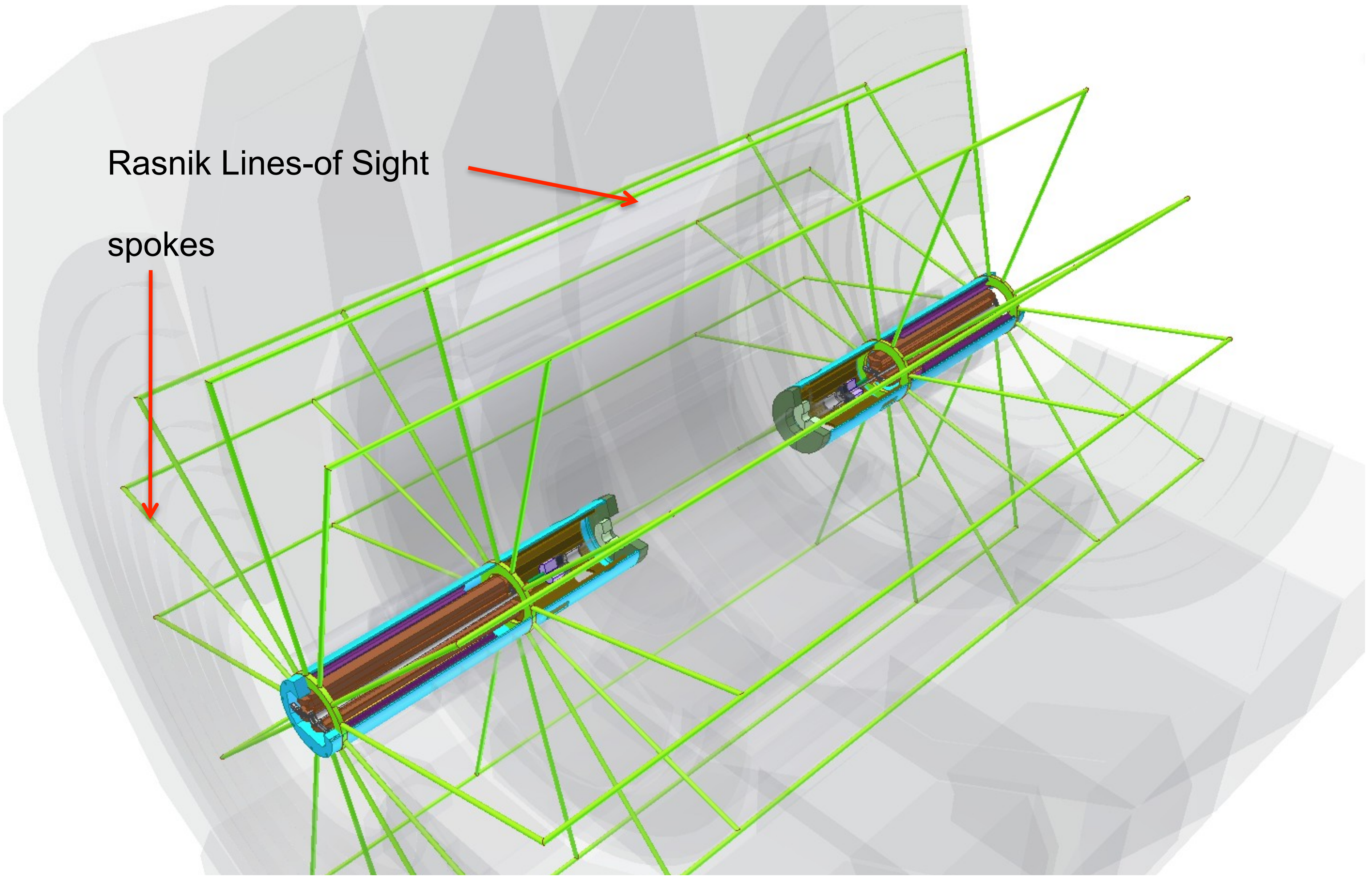
ILD Alignment Strategy

- Many parts of ILD have tight alignment requirements
  - e.g. QD0 magnets, LumiCal, Si Tracker, etc.
- Some require alignment systems and those need space
- Reviewing the ILD alignment strategy could be a topic for a joint Integration/Software effort

- QD0:
  - Laser interferometer
  - Rasniks
  - ??



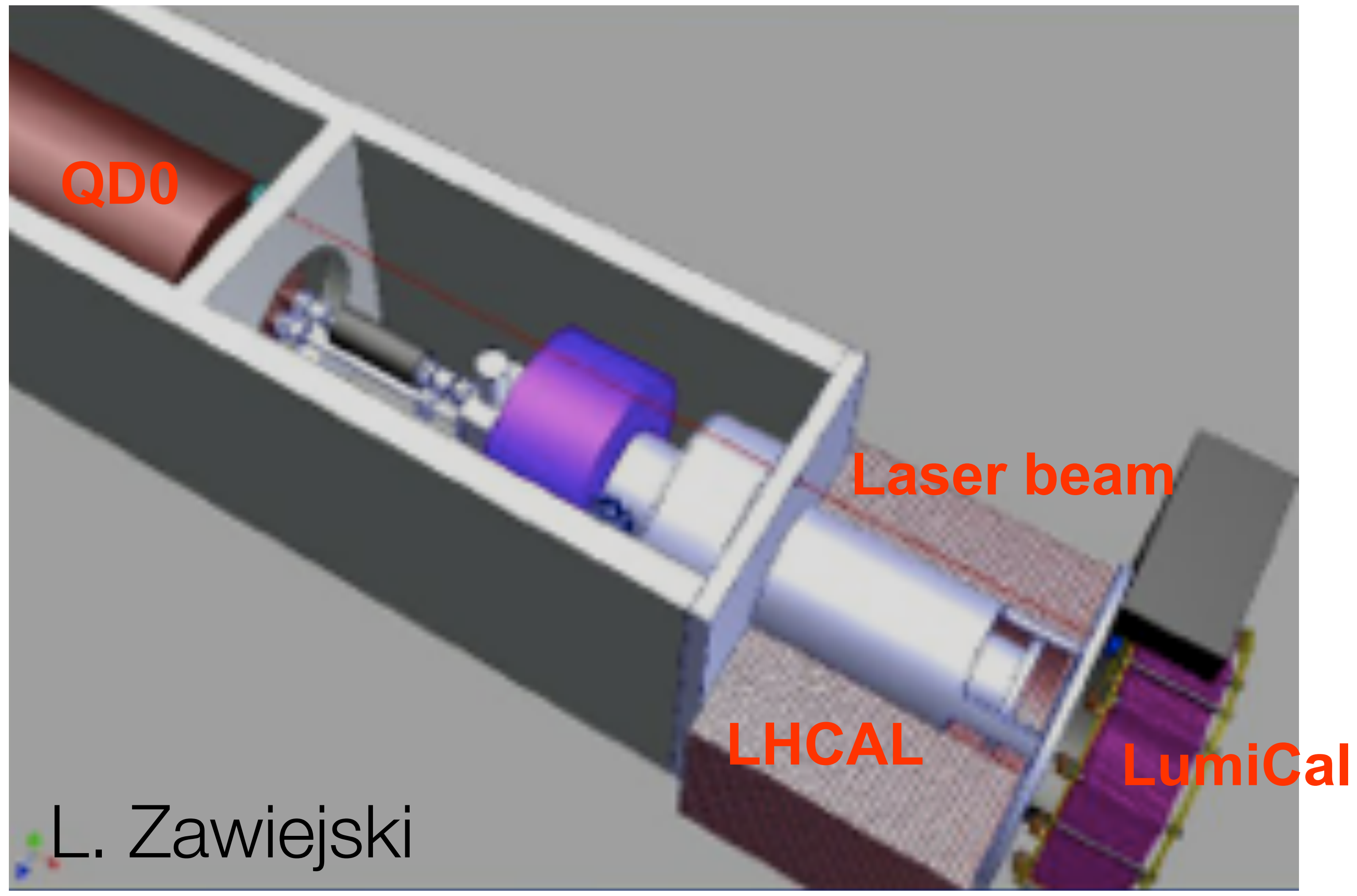
D. Urner

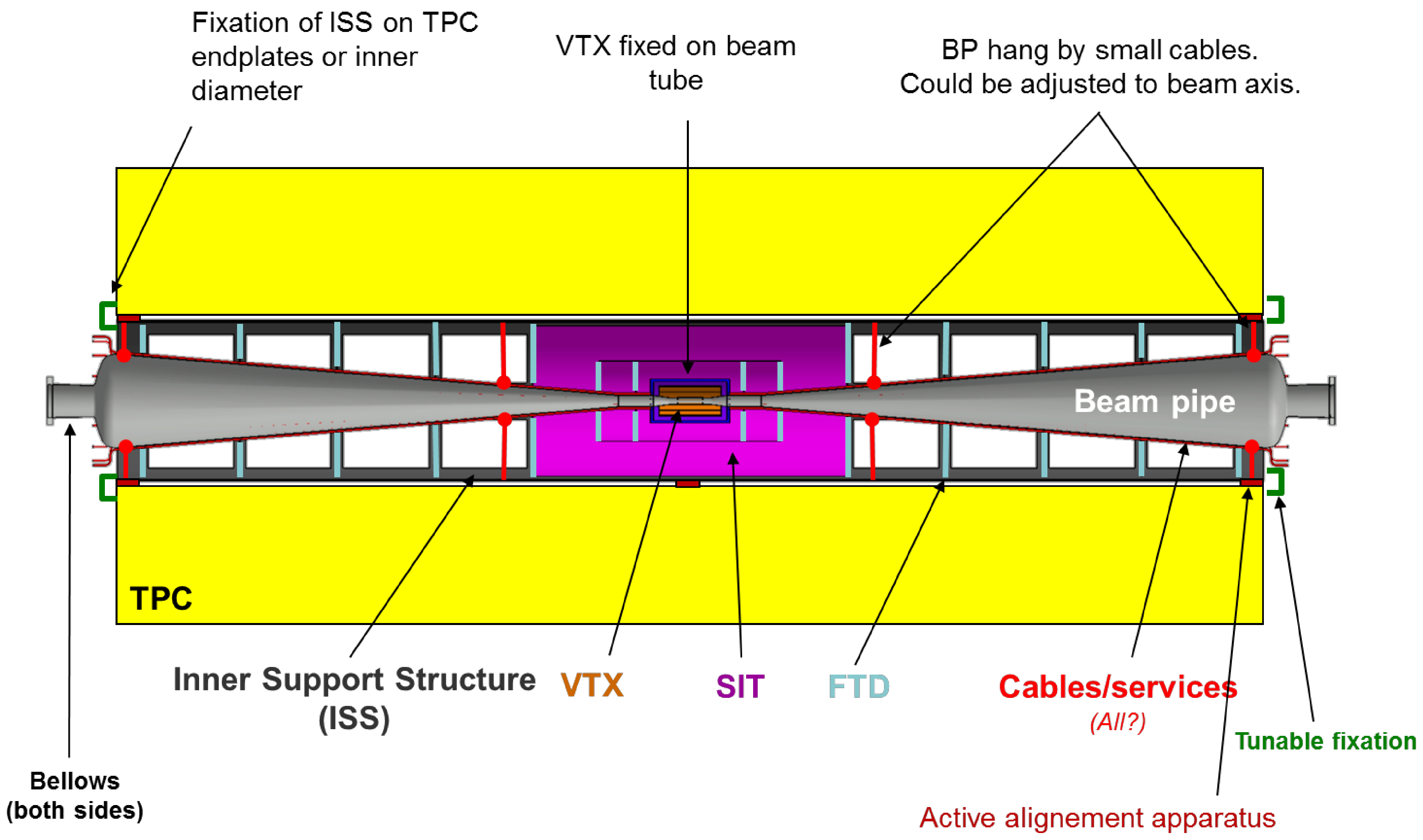


H. v.d. Graaf

ILD Inner Detector Alignment

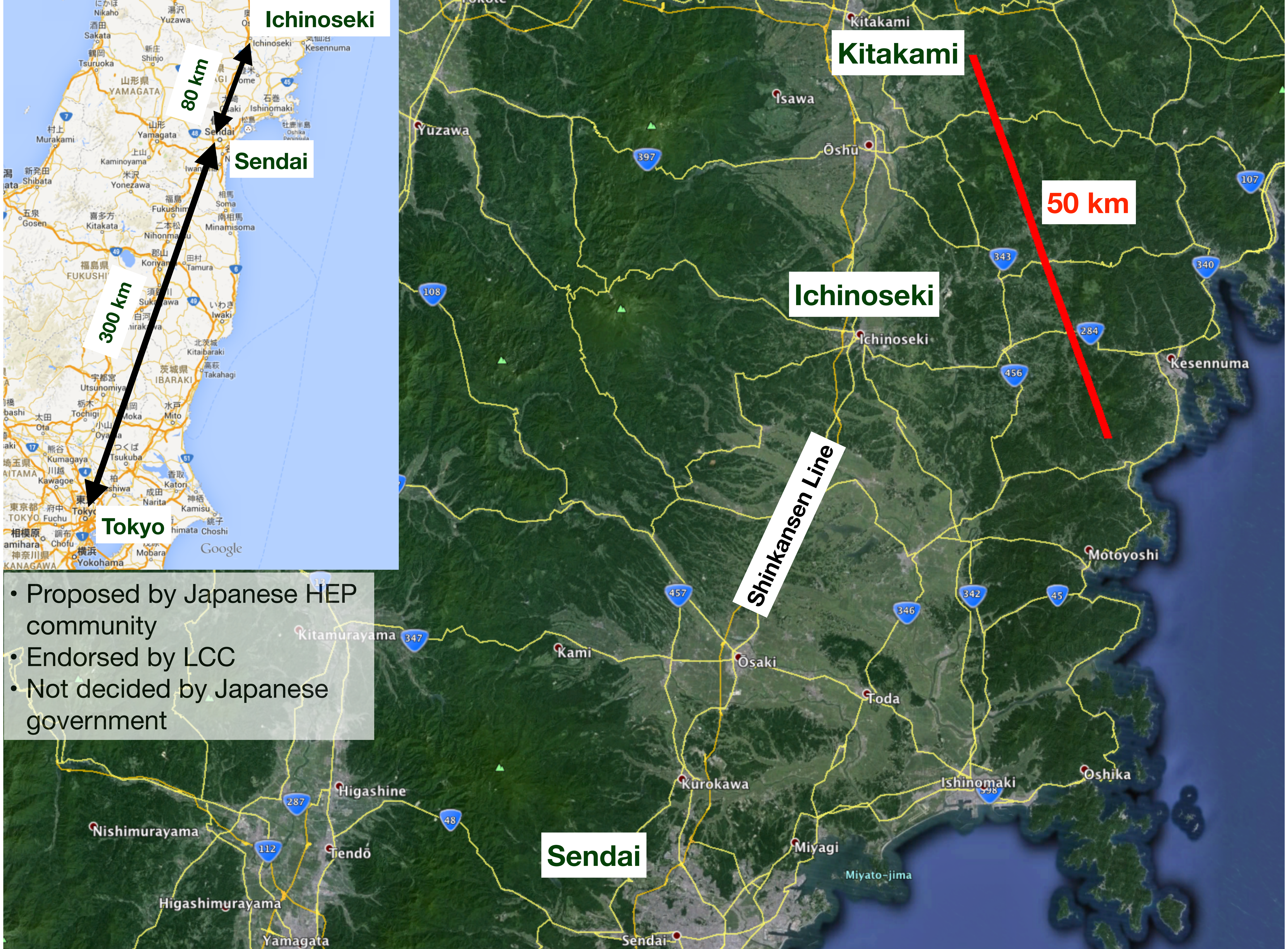
- FCAL collaboration did a study on the alignment of forward calorimeters (LumiCal)
- Laser system couples left and right forward regions
- Lasers need to pass the inner tracking system
  - which needs its own alignment system…





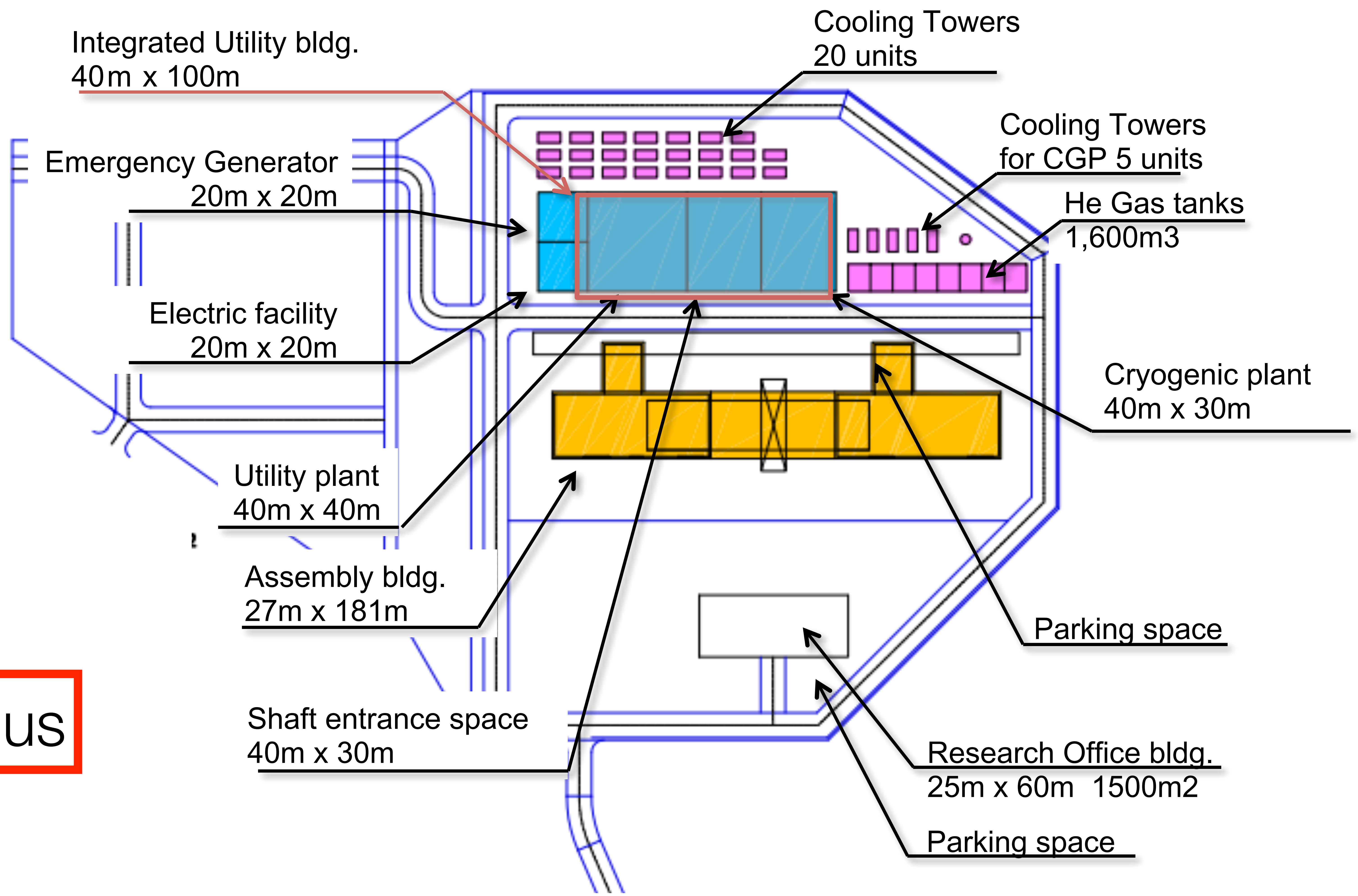
- And we do push-pull: inner detector support would be movable and aligned after each pp cycle
- Engineering solutions exist only on conceptual level, input on material budget not clear

Kitakami Site



- Proposed by Japanese HEP community
- Endorsed by LCC
- Not decided by Japanese government

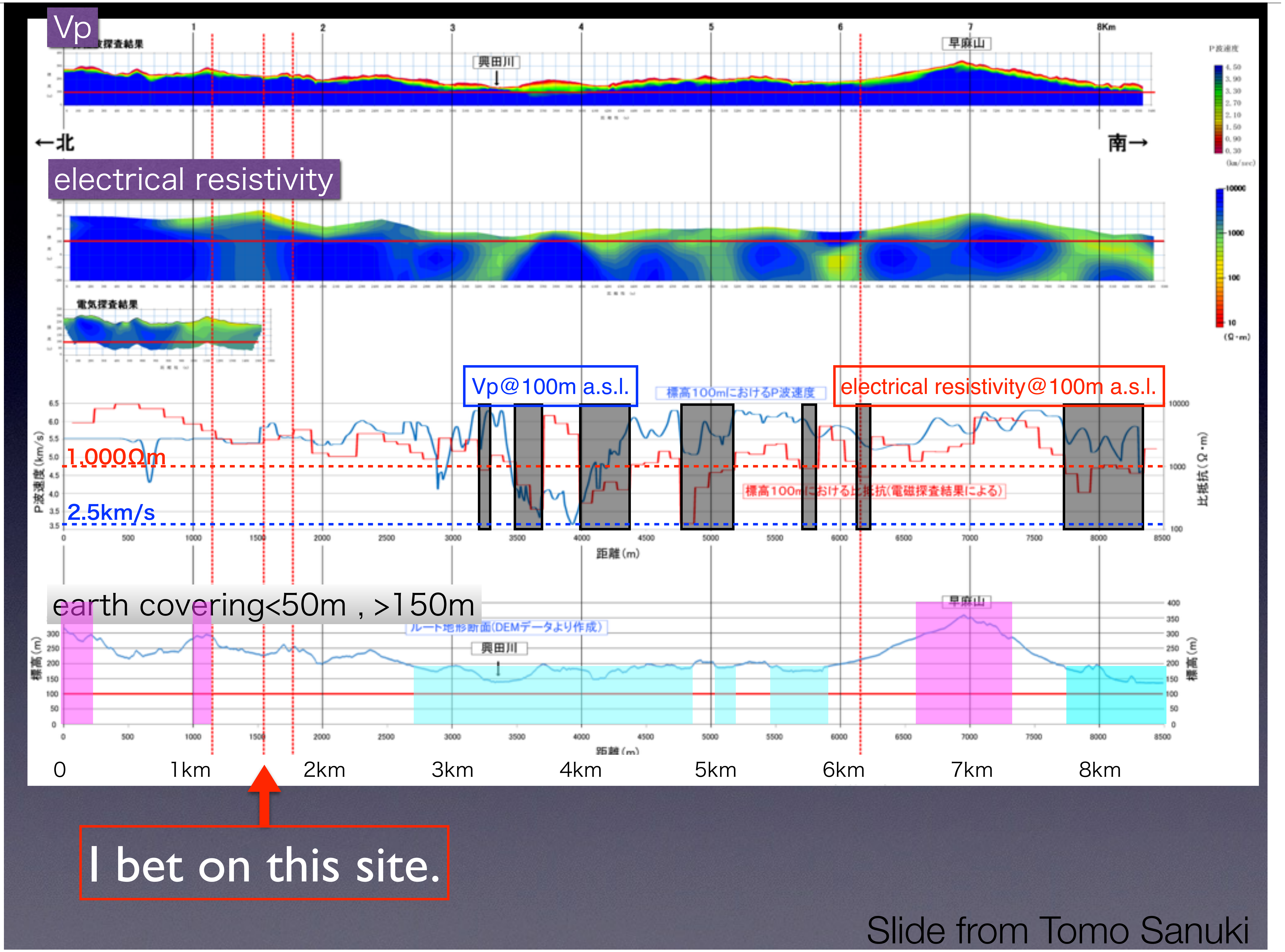
Surface ground Buildings and facilities



IP Campus

New IP Location Under Study

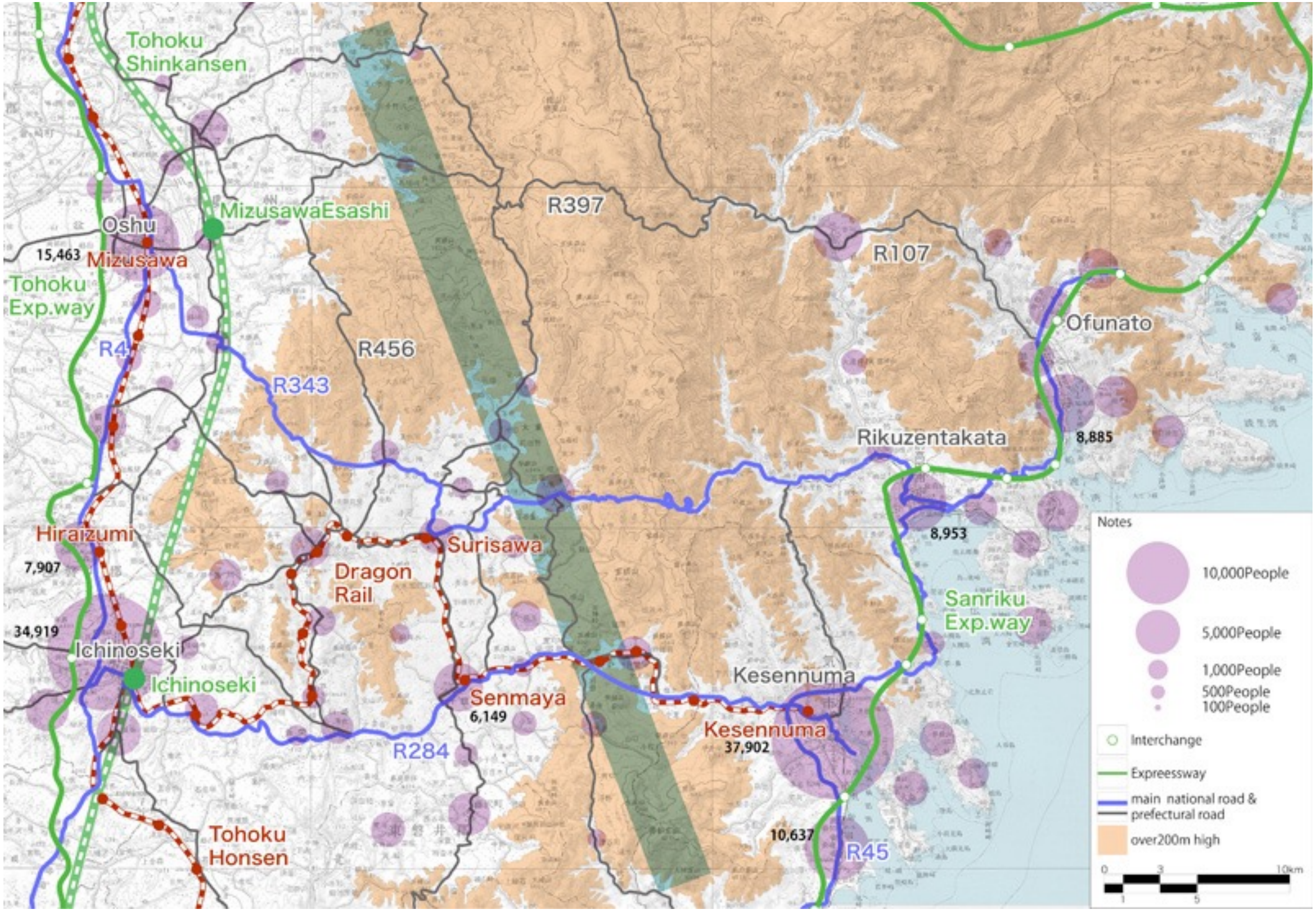
- Geological studies showed that there are better locations for the IP
- New location ~4km north of the old one is under study
  - test drilling has been done, results seem to be good
- Possibly more surface space at new location
- No selection done by now, we should work with both IP options for the time being



Slide from Tomo Sanuki

KITAKAMI Site: Transportation

Slide from Tokiko Onuki



General rule

total weight	trailer/ track	our package	daytime	night	Xpwy	paper work
25 ton	~10 ton	~15 ton	YES	YES	YES	0
44 ton	~20 ton	~24 ton	YES†/ NO	YES	NO	1
80 ton	~30 ton	~50 ton	NO	YES	NO	10

† Probably "YES", if our package fits into a standard container (W=2,438mm).

Slide from Tomo Sanuki

ILD Assembly
(selected examples)

AHCAL Assembly

Kitakami Side

or anywhere in any detector

HELMHOLTZ ASSOCIATION

Slide from Karsten Gadow

DESY

AHCAL Assembly

solution: all needed AHCAL parts fit into here

AUSSENMASSE		
Länge	mm	6058
	ft	19' 10 ½"
Breite	mm	2438
	ft	8'
Höhe	mm	2591
	ft	8' 6"

GEWICHT		
Tara	kg	2700
	pd	5950
Max. Zuladung	kg	27780
	pd	61250
Max. Bruttogewicht	kg	30480
	pd	67200

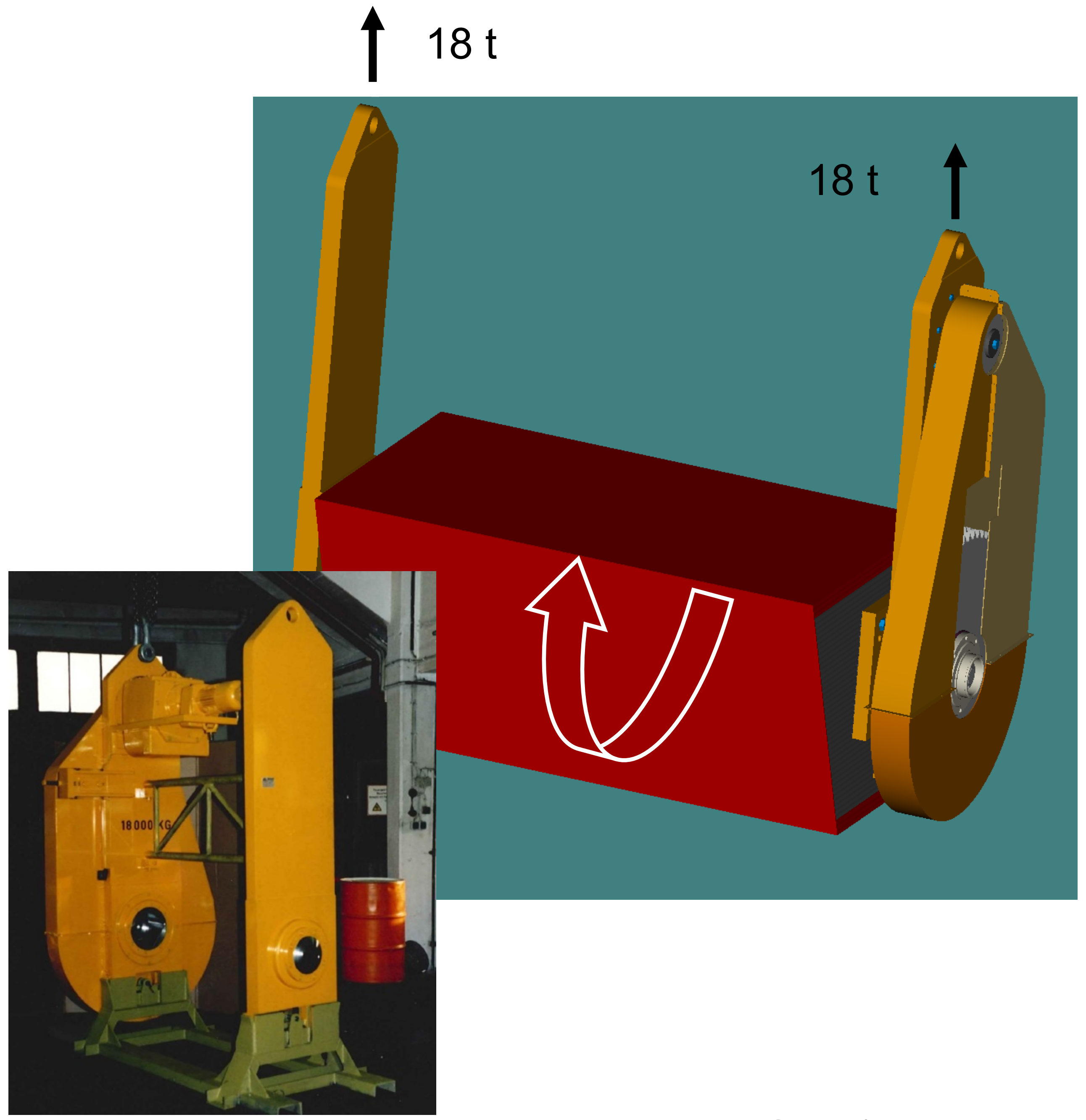
the container fits to standard transport systems

as ships, railways, trucks and through tunnels…..

DESY

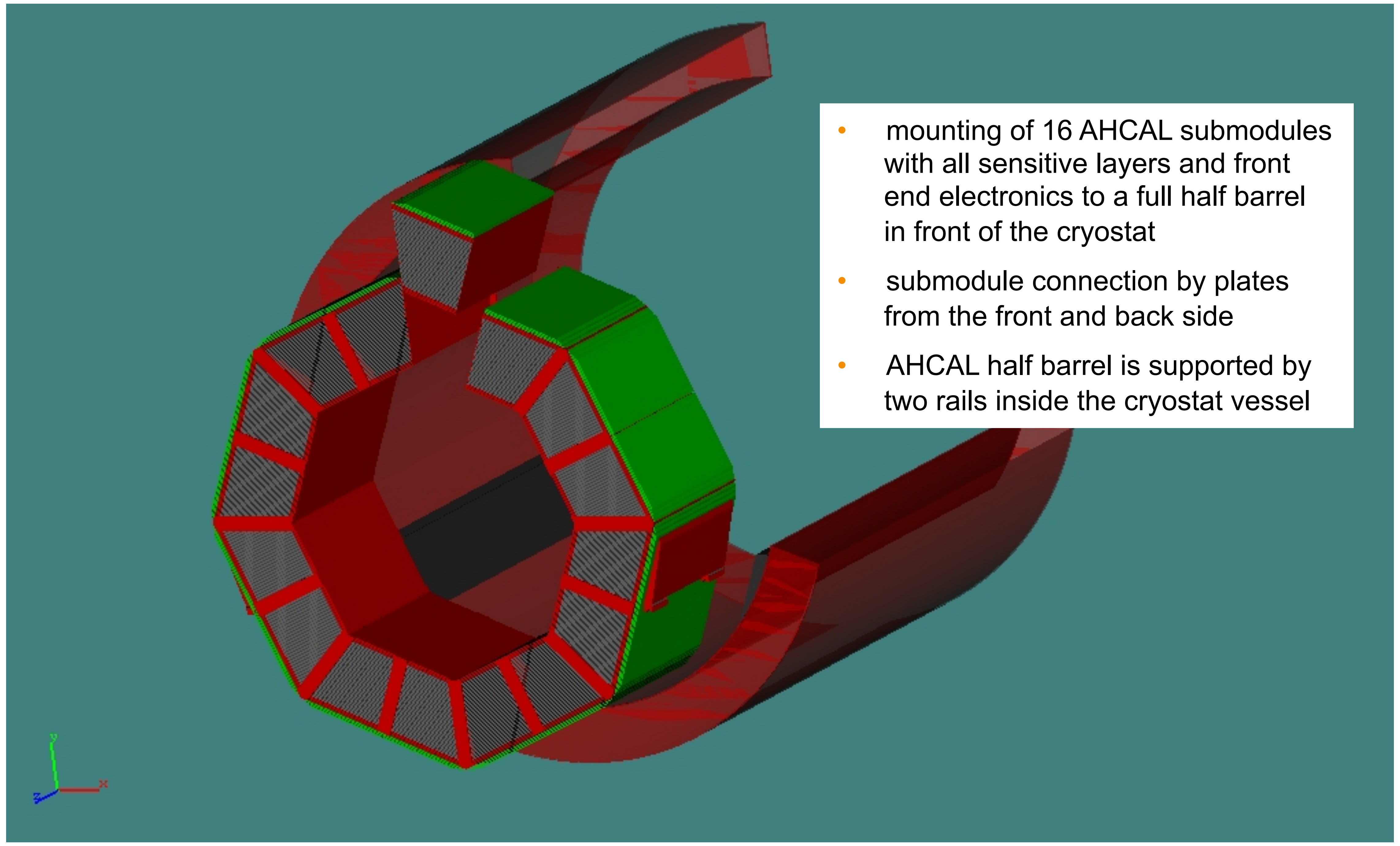
Slide from Karsten Gadow

AHCAL barrel integration tools



- lifting and turning tool for AHCAL barrel absorber submodules available
  - 2 x 18 t capacity
  - operation with 2 hooks (z angle adjustment)
  - precise motor controlled turning
  - design for adaptation for sub-modules with and without sensitive layers started
- mounting, support and insertion frame
  - insertion frame design ready
  - insertion frame support design depends on final yoke size and useable space
- push and pull tool available
  - must be modified to the rail distance and rail shape/size

AHCAL half barrel absorber installation
step 1



- mounting of 16 AHCAL submodules with all sensitive layers and front end electronics to a full half barrel in front of the cryostat
- submodule connection by plates from the front and back side
- AHCAL half barrel is supported by two rails inside the cryostat vessel

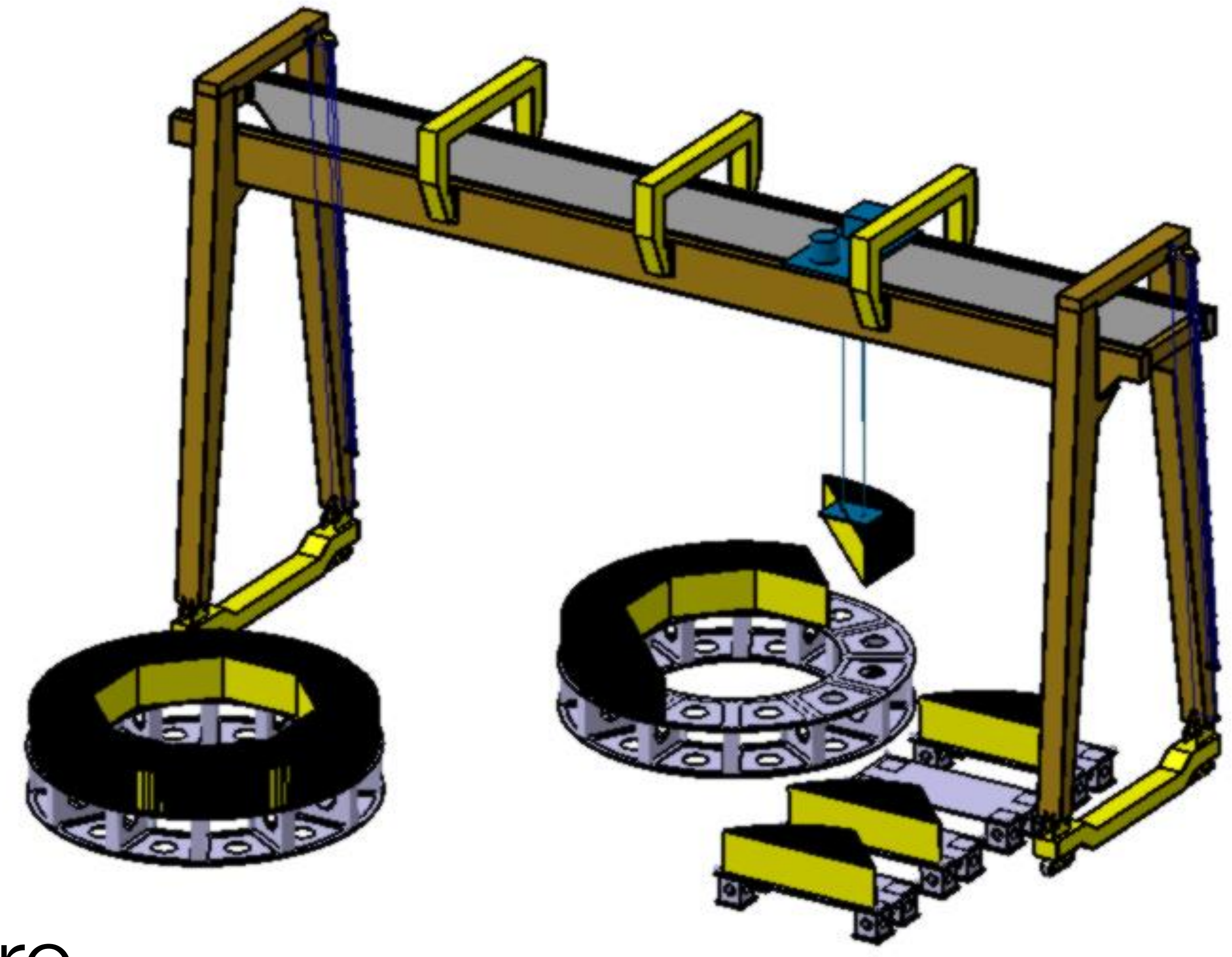
Slides from Karsten Gadow

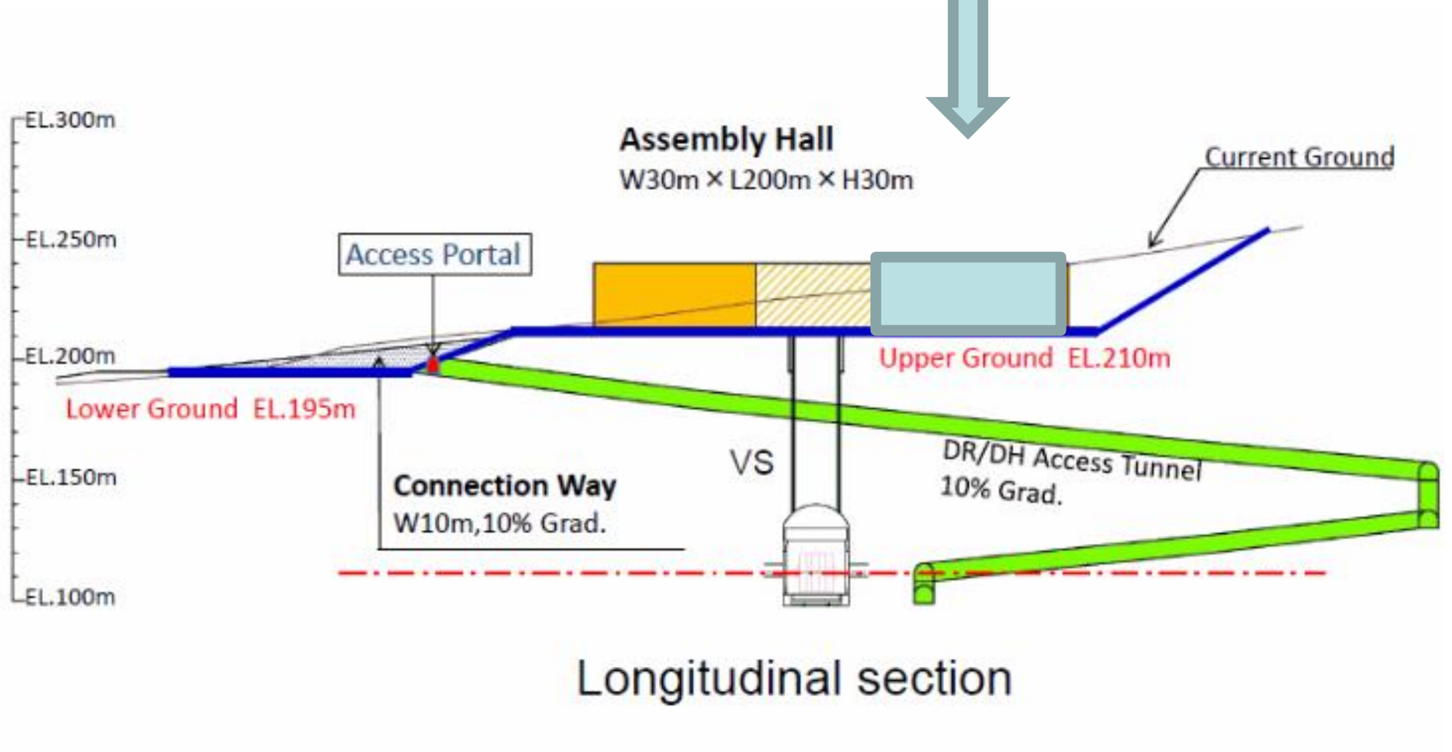
Wheel Building in **Assembly Hall** : 8 modules x 5

Transport to Assembly Hall with normal truck - ILD area

- **Step 1** : Wheel structure transport (8 travels) & assembly
- **Step 2** : Modules transport 40 travels with 11 t
- **Step 3 :** Modules assembly on the wheel structure with 100 t crane
    - 8 modules in position on specific tool & screwing/welding

Road to





Slide from J.C. Ianigro

Wheel assembly in Auxiliary building : s

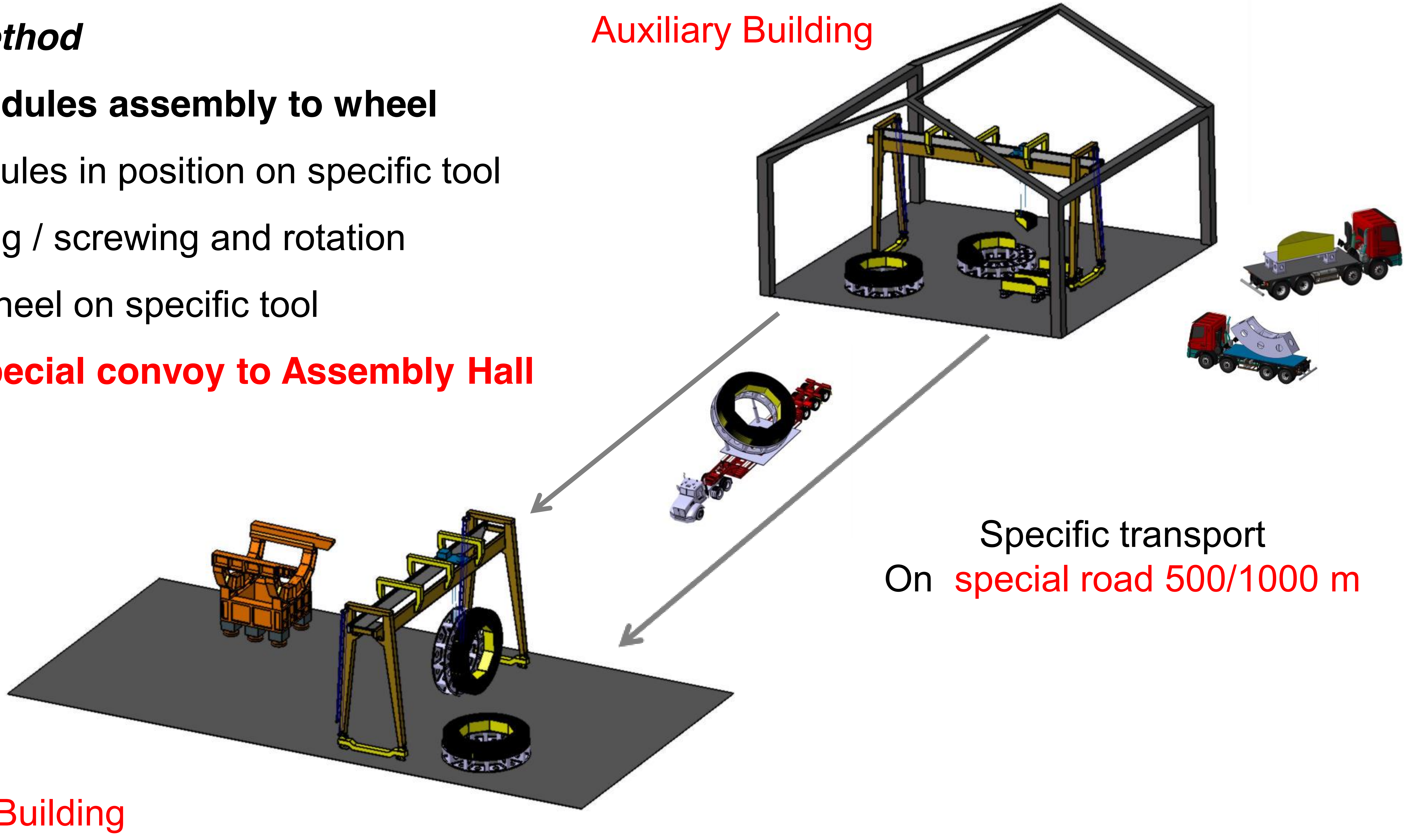
Building Method

•**Step 1 : Modules assembly to wheel**

- 8 modules in position on specific tool
- welding / screwing and rotation

• **Step 2 :** Wheel on specific tool

• **Step 3** : **Special convoy to Assembly Hall**

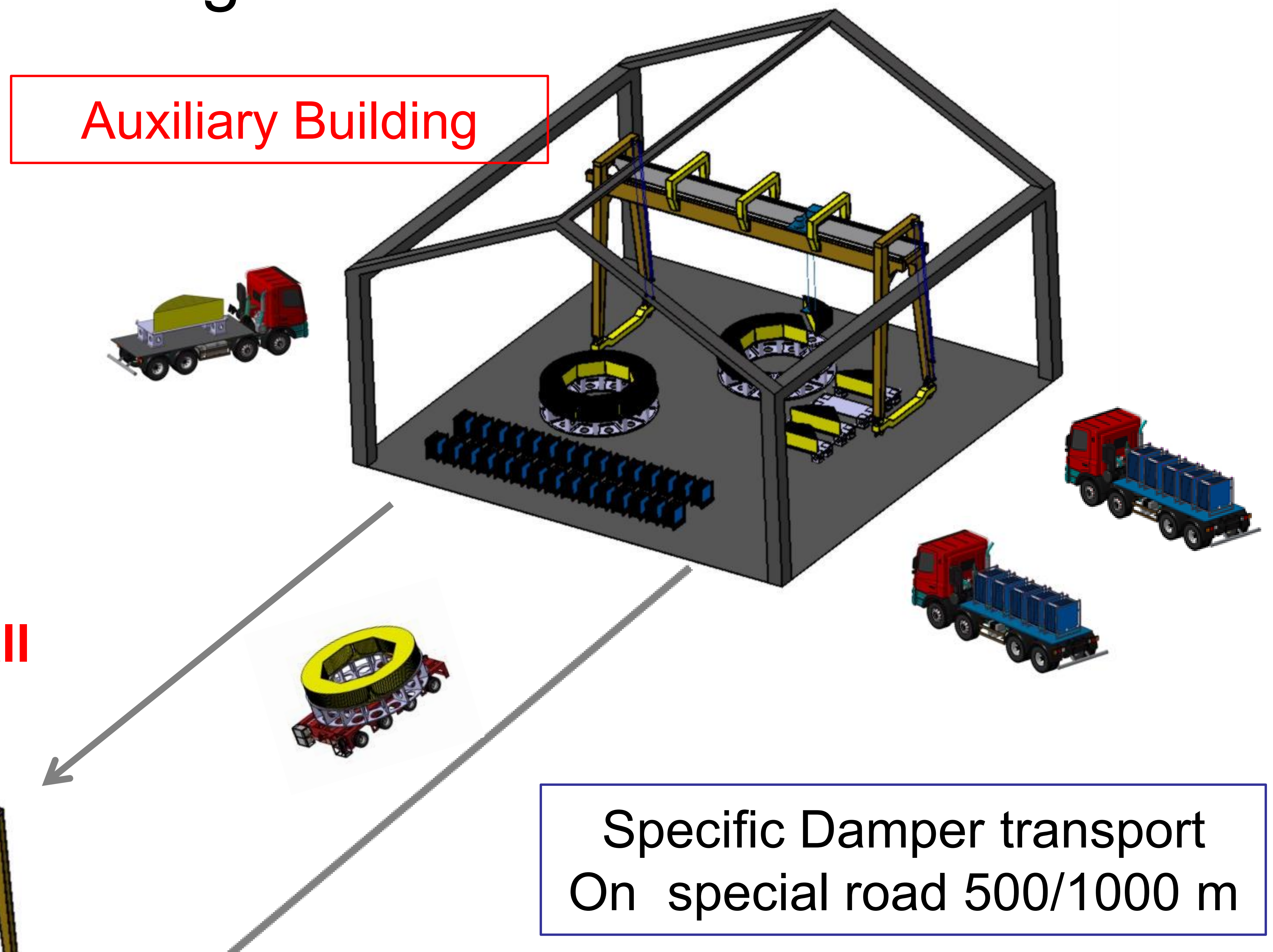


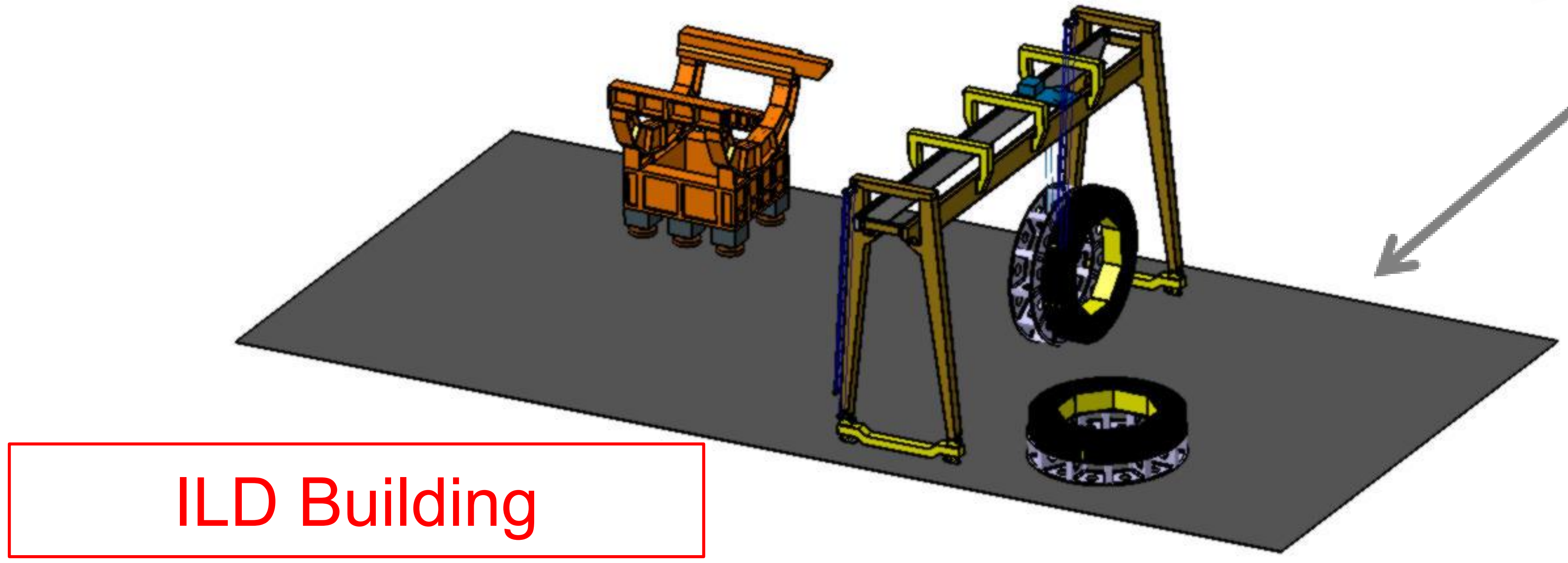
Slide from J.C. Ianigro

Wheel assembly in Auxiliary building : 8 modules => 5 wheels

Building Method

- **Step 1 : Modules assembly to wheel**
  - 8 modules in position on specific tool
  - welding / screwing and rotation
- **Step 2 :** Wheel on specific tool
- **Step 3** : GRPC insertion and connected
- **Step 4** : **Special convoy to Assembly Hall with GRPC inside wheels – ready to be connected**

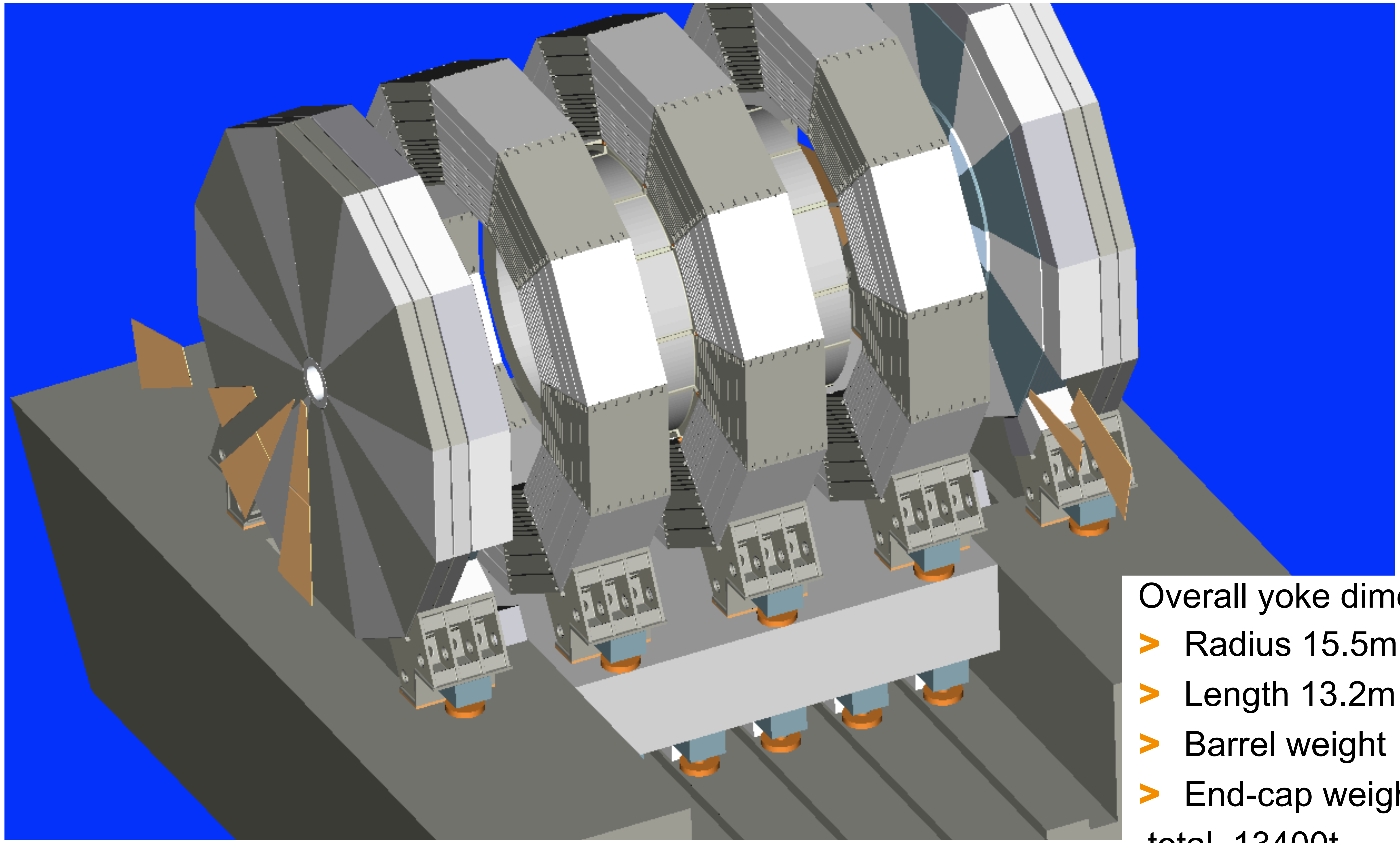




Slide from J.C. Ianigro

Heaviest Problem: Iron Yoke

Present Design



Overall yoke dimensions

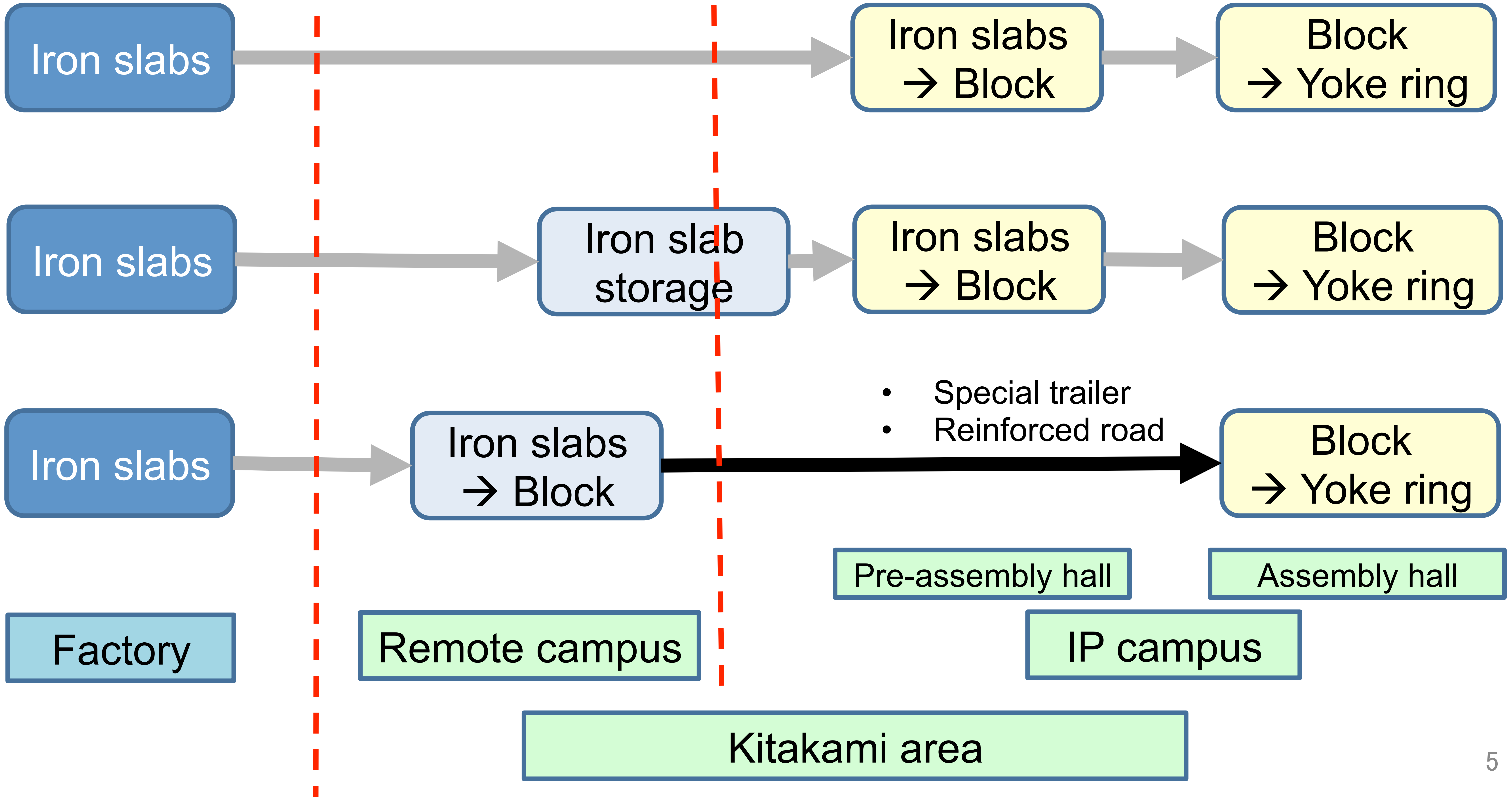
- Radius 15.5m
- Length 13.2m
- Barrel weight 6900t
- End-cap weight 6500t

total 13400t

Slide from Uwe Schneekloth

Assembly scenario

- There are three options



Slide from Uwe Schneekloth

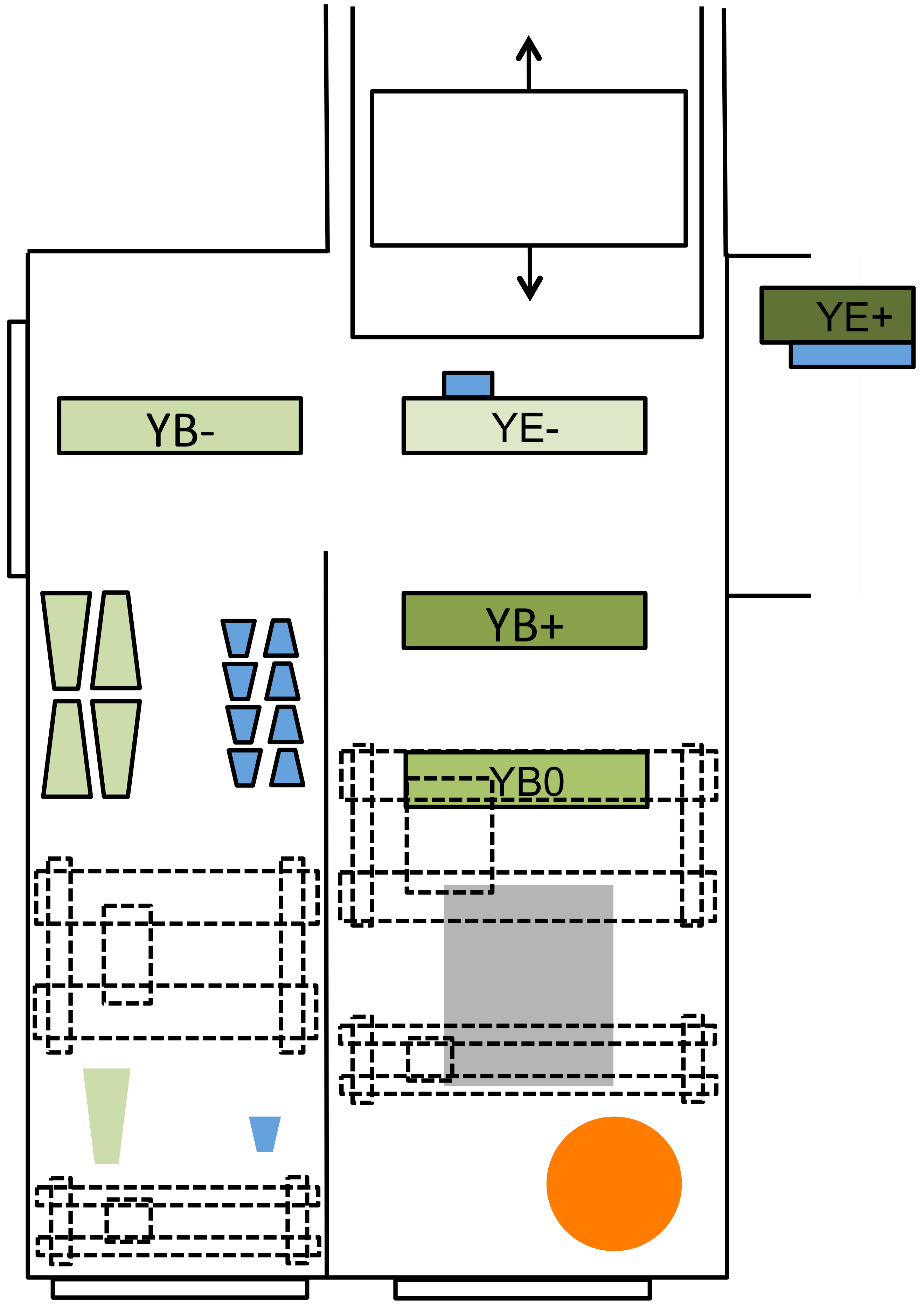
Assembly Study

- Try to optimise the ILD assembly in a possible Kitakami scenario
- Biggest uncertainty:
  - where and how to build the coil
- A combined effort between sub-detectors, CFS group, ILD integratior team is required to come up with a realistic assembly scenario for ILD
- Where can we do what?
  - at vendours/home institutes
  - at central lab campus
  - at IP campus
- This is cost relevant!

Integration Proposal

> YB-: production + assembly
- One production lane for about 6 months (12 modules)
- In parallel: solenoid assembly
- In parallel: finalisation of muon installation in YE+ and begin muon installation in YB0 (120 days)

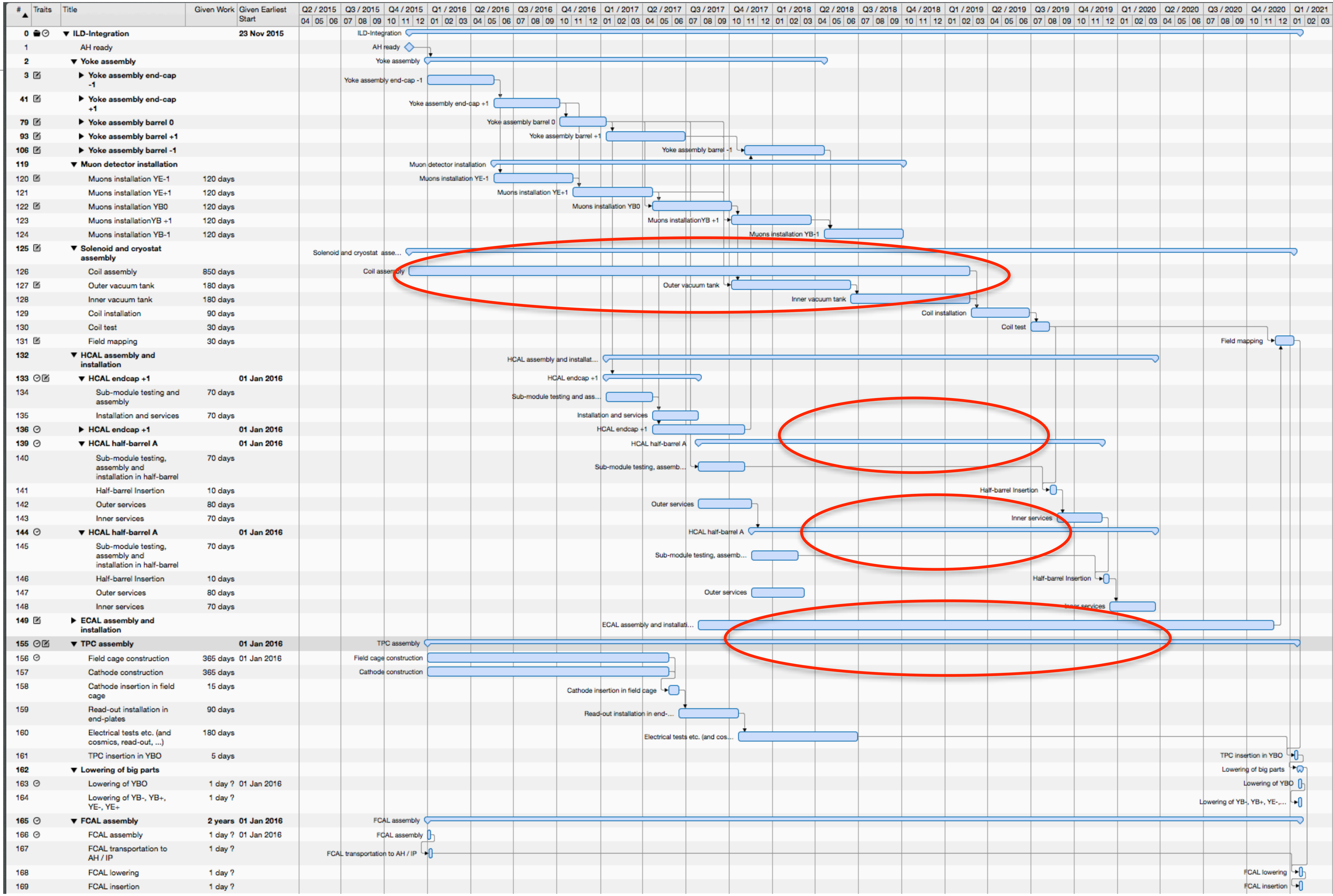
> HCAL production for endcaps
- Mounting YE- HCAL
- Start YB- yoke assembly once YE-HCAL is ready or assemble YB- wheel in garage



Slide from Thomas Schörner-Sadenius

ILD Assembly Plan

- Goal: one central plan - coordinated with sub-detectors
- Biggest uncertainty:
  - Coil schedule!
  - Vendours might need considerable R&D time before construction can start
  - and where should it be built? On-site, at vendour?



Risks (a.k.a. the container ship slides)

„MOL Comfort“ 17.6.2013 (as shown at LCWS15/Whistler)

- Indian Ocean between Singapore and Jeddah

Foto: IANS

„MOL Comfort“ - Failed Salvage Operation

Foto: gCaptain

Foto: Indian Coast Guard

„MOL Comfort“ - Failed Salvage Operation

Foto: gCaptain

Foto: Indian Coast Guard

„MOL Comfort“ - Failed Salvage Operation

Foto: gCaptain

Foto: Indian Coast Guard

„MOL Comfort“ - Failed Salvage Operation

Foto: gCaptain

Why should we care?

Foto: Indian Coast Guard

„MOL Comfort“ - Failed Salvage Operation

Why should we care?

A Toshiba klystron for the XFEL was on board of this ship….

Foto: gCaptain

Foto: Indian Coast Guard

„CSCL Indian Ocean“

- Container vessel of the newest generation 400mx59m
- Ran on ground in the river Elbe (~20 km upstream of Hamburg) on 03.02.2016 ~22:00
- Problems with the steering gear
- Unfortunate: happened during a tide that was higher than normal due to heavy weather in the North Sea

Foto: Havariekommando

Salvage Operation (09.02.2016, ~02:10)

- Third try was successful
- 5 days of preparatory work: dredging the river bed, pumping of ballast water and fuel
- At spring tide, with the help of 12 tug boats (including 2 very large oceangoing tugs)

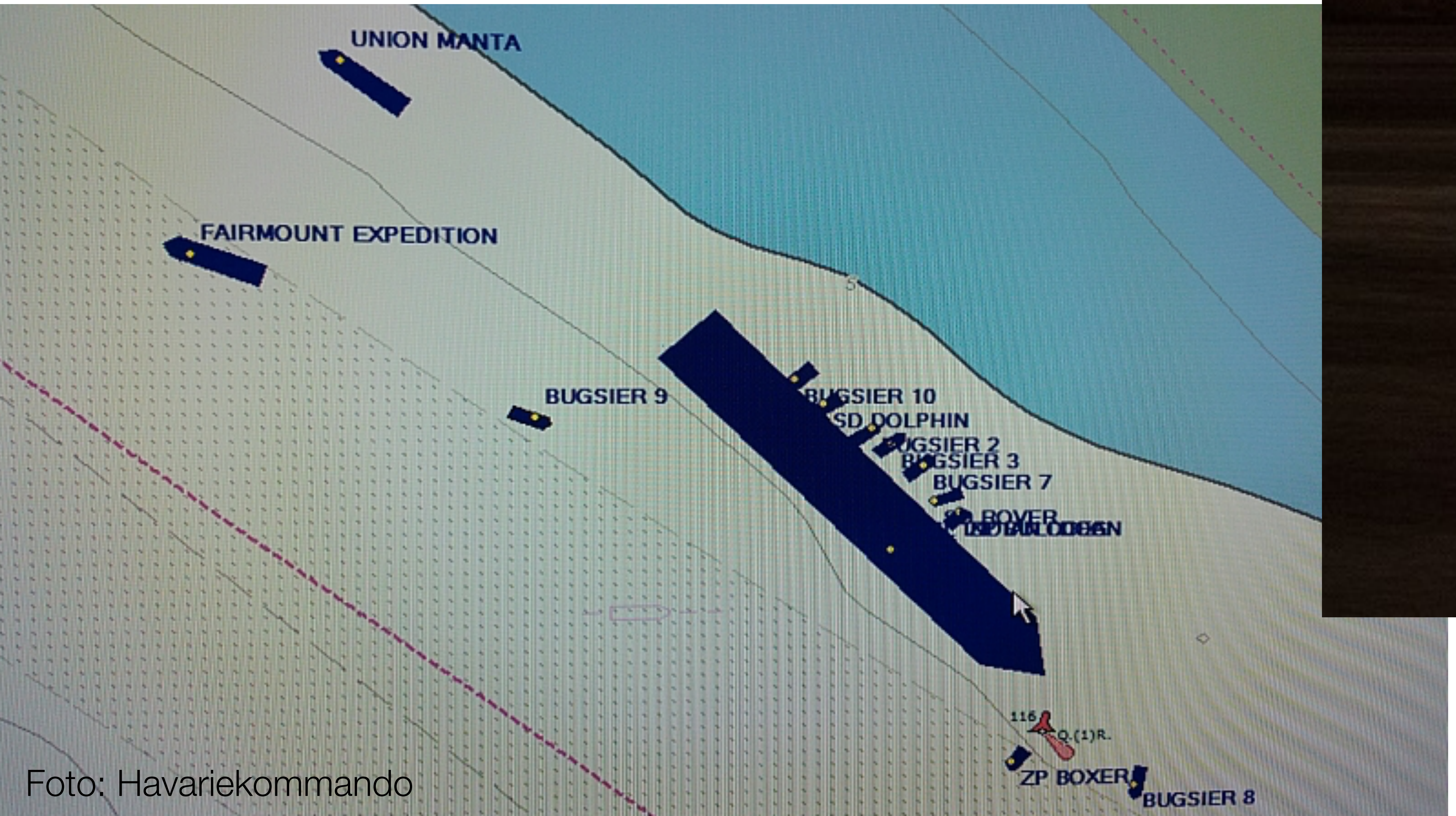


Foto: Havariekommando

Foto: Fabian. forum-schiff.de

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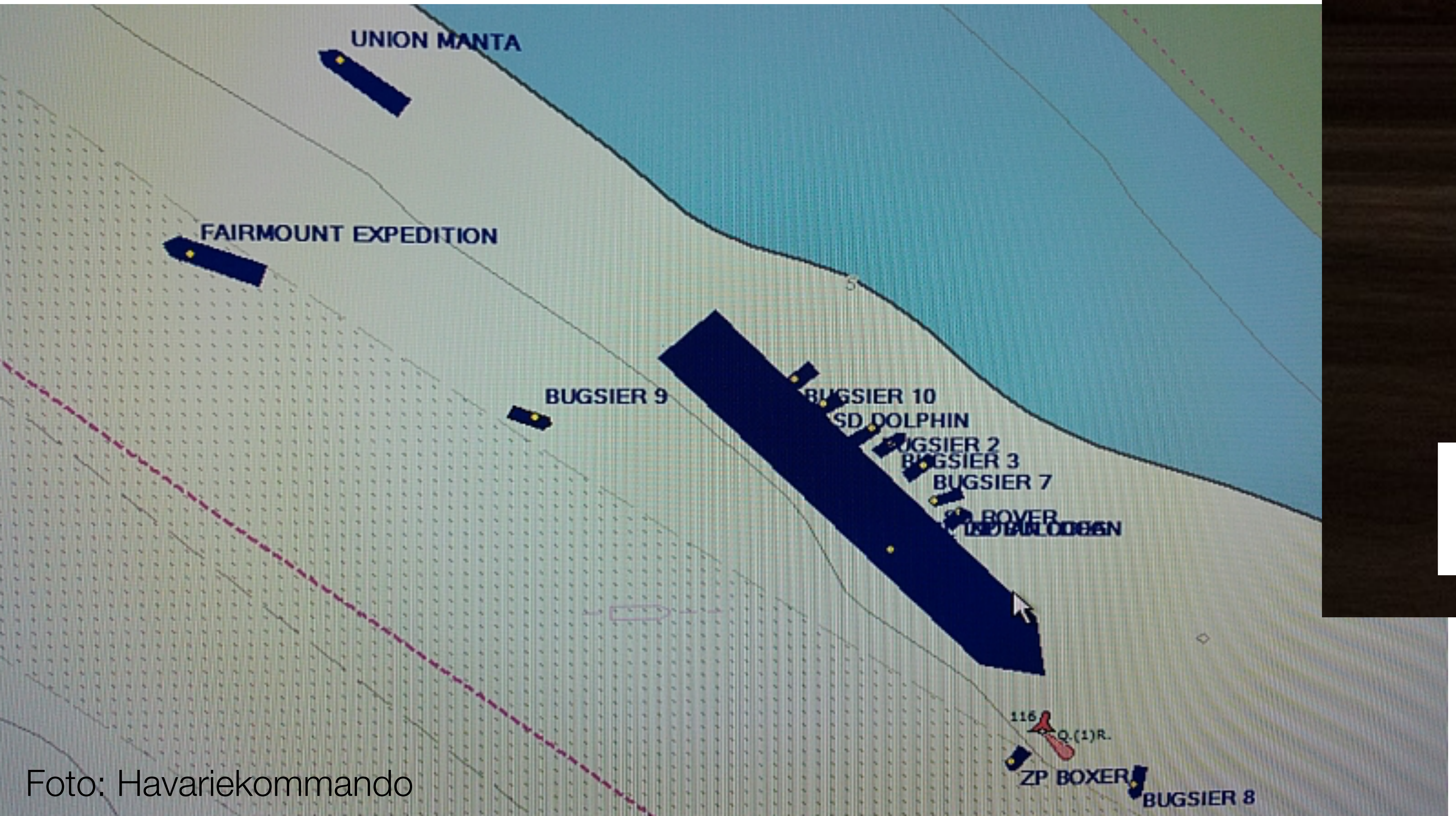

Foto: Havariekommando

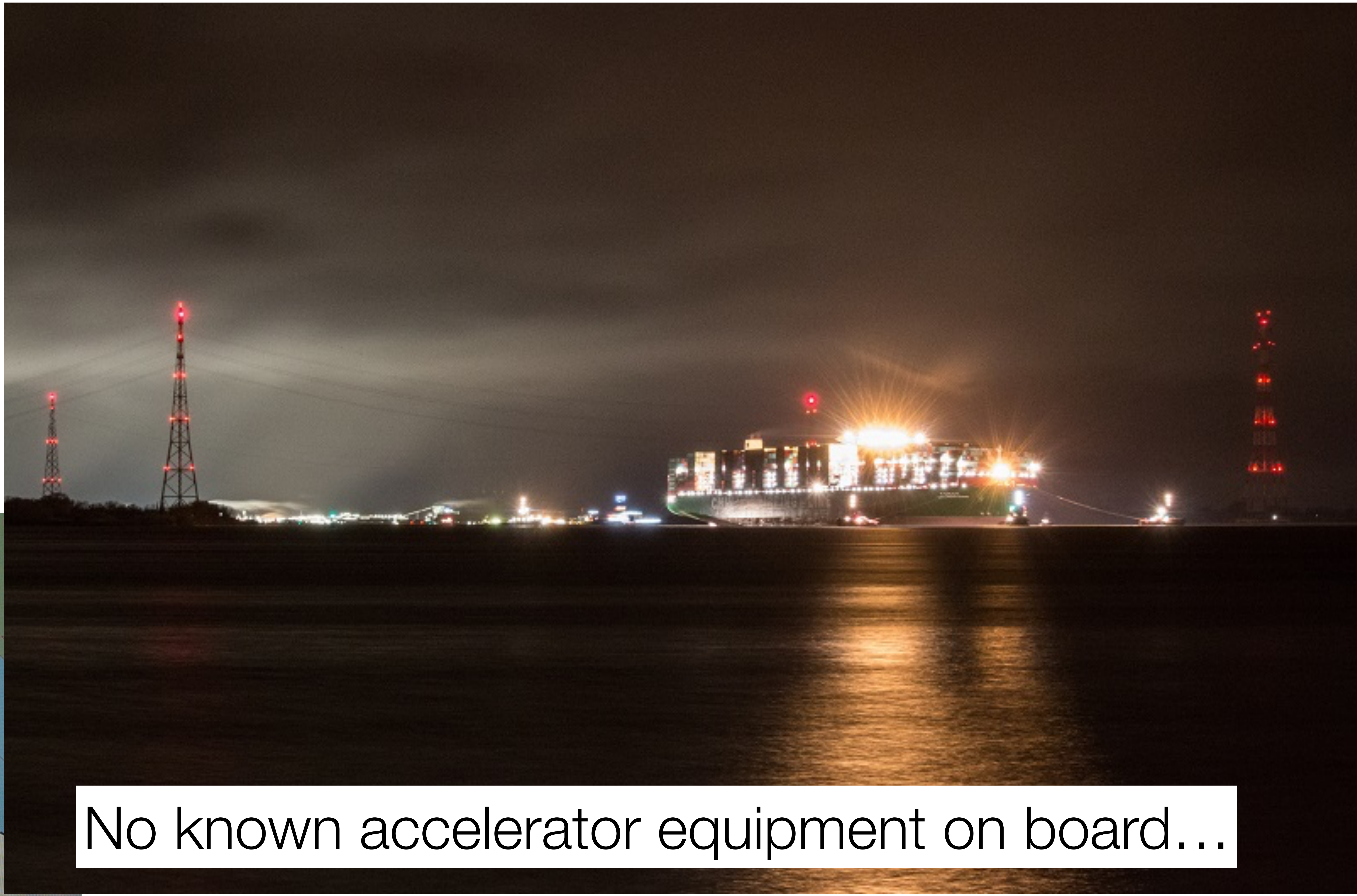

Foto: Fabian. forum-schiff.de

Summary

- A rather detailed engineering model of ILD is kept in EDMS
- A round of updates to this model is required, e.g. implementation of the new forward region
- Tools exist(ed) to compare engineering placeholders with Geant4 geometries
- There are open engineering topics that could have an impact on optimization studies
- The planning for the layout and infrastructure at the Kitakami site is advancing
- Now is the time to provide input from detectors for this process
  - Area and space requirements
  - Infrastructure: power, cooling, computing, etc.
  - Special environments: clean rooms, etc.
- Need to understand the dependencies on local conditions, e.g. transportation limits, on detector assembly and maintenance philosophy
- ILD is working on common installation timeline including planning status of all subdetector collaborations

Detector Infrastructure Workshop at KEK

Mini-Workshop on ILC Infrastructure and CFS for Physics and Detectors

15-16 March 2016
KEK
Asia/Tokyo timezone

Search

- Overview
- Timetable
- Registration
  - Registration Form
- Participant List

Support

karsten.buesser@des...

This Mini-Workshop is dedicated to discussions on the detector driven infrastructure needs for the ILC campus at the IP and at the central lab. Topics to be discussed include:

- Latest news on the IP area, results from test drillings, adaptations of the surface infrastructure to the new site;
- Requirements from ILD and SiD for surface infrastructure: assembly and buffer space, cranes, transportation;
- Detector assembly plans with interdependencies on required infrastructures;
- Common cryogenic facilities;
- Requirements for central lab;
- Review of handshake points between SiD and ILD: magnetic stray field limits, crane usage, cryo, etc.