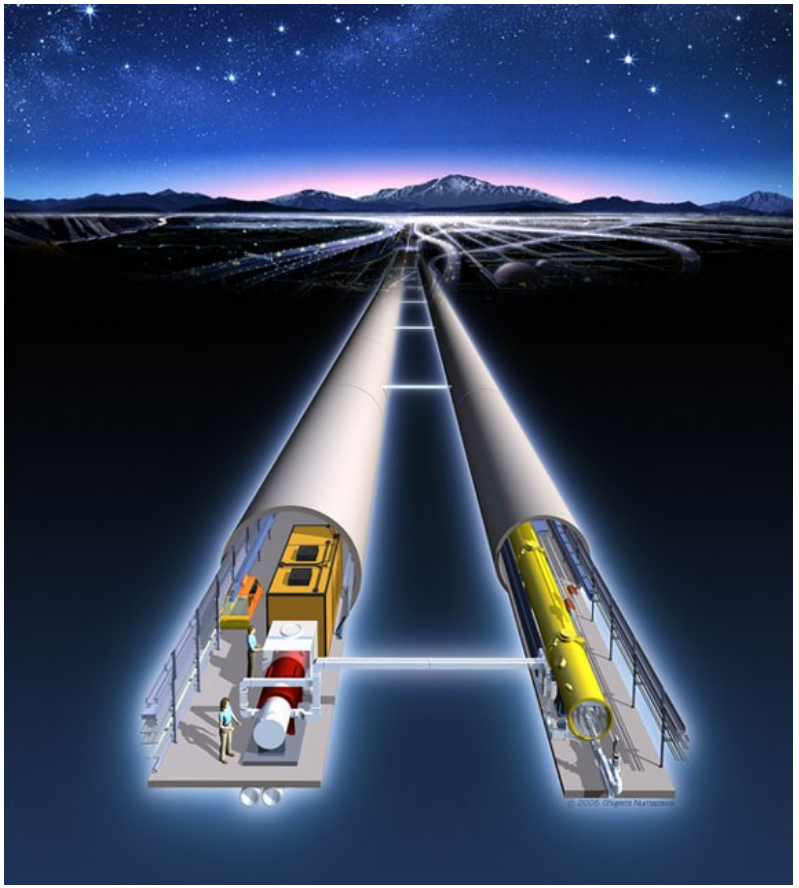
Summary of CFS MDI Mini-Workshop

15/3/16 – 16/3/16 at KEK

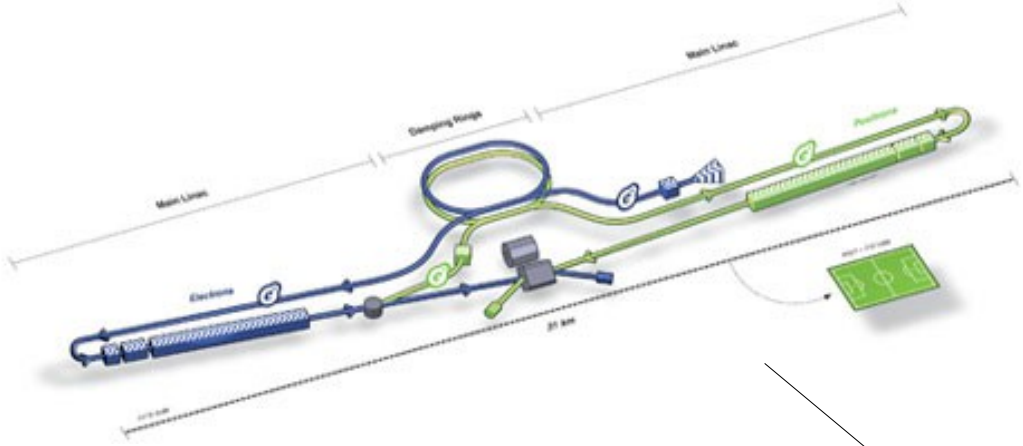
http://agenda.linearcollider.org/event/6910/other-view?view=standard

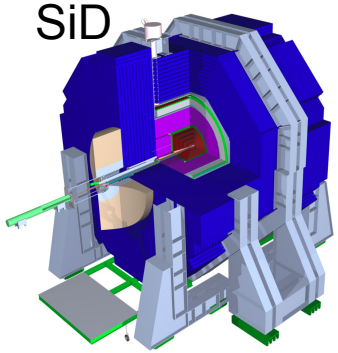


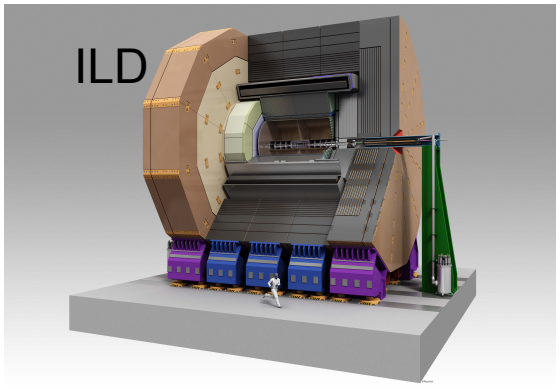
Roman Pöschl

4èmes Journées Collisionneur Linéaire – Paris March 2016

Machine Detector Interface Coordination

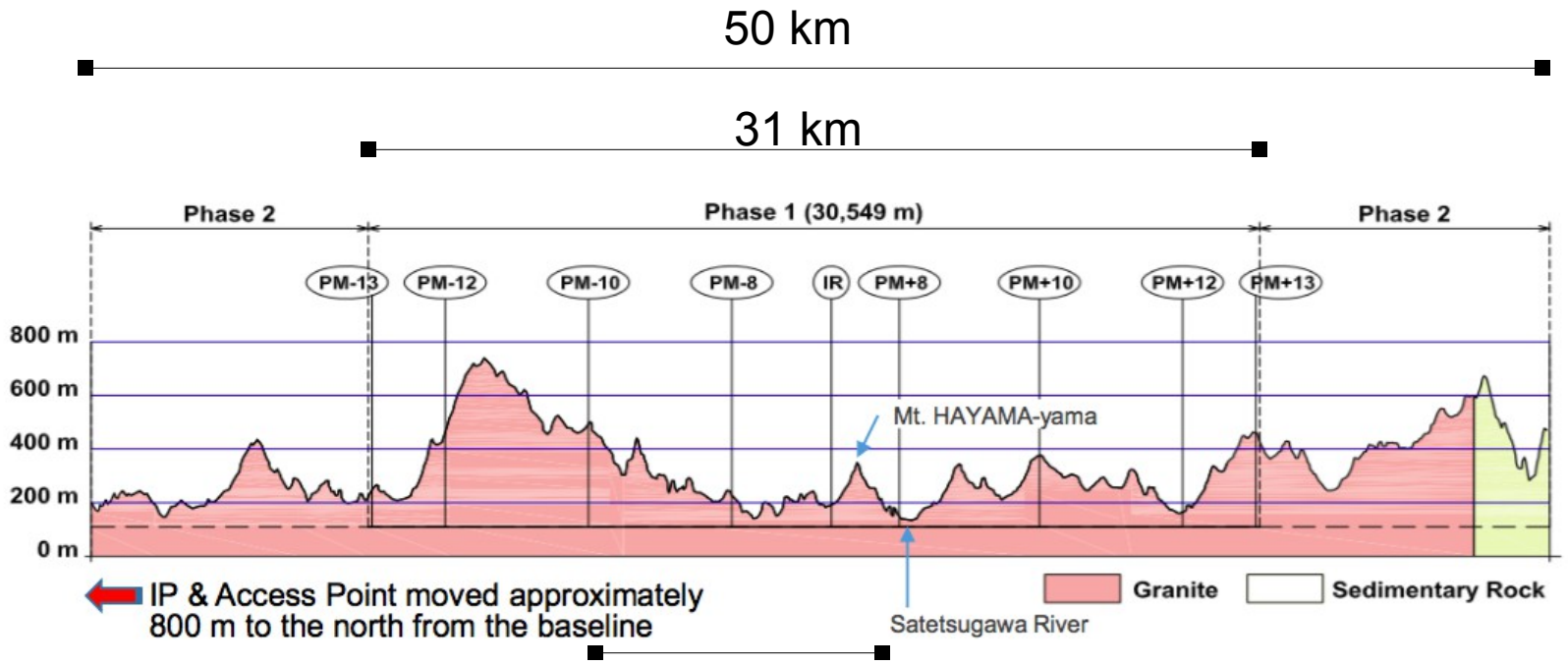






The IP Story I

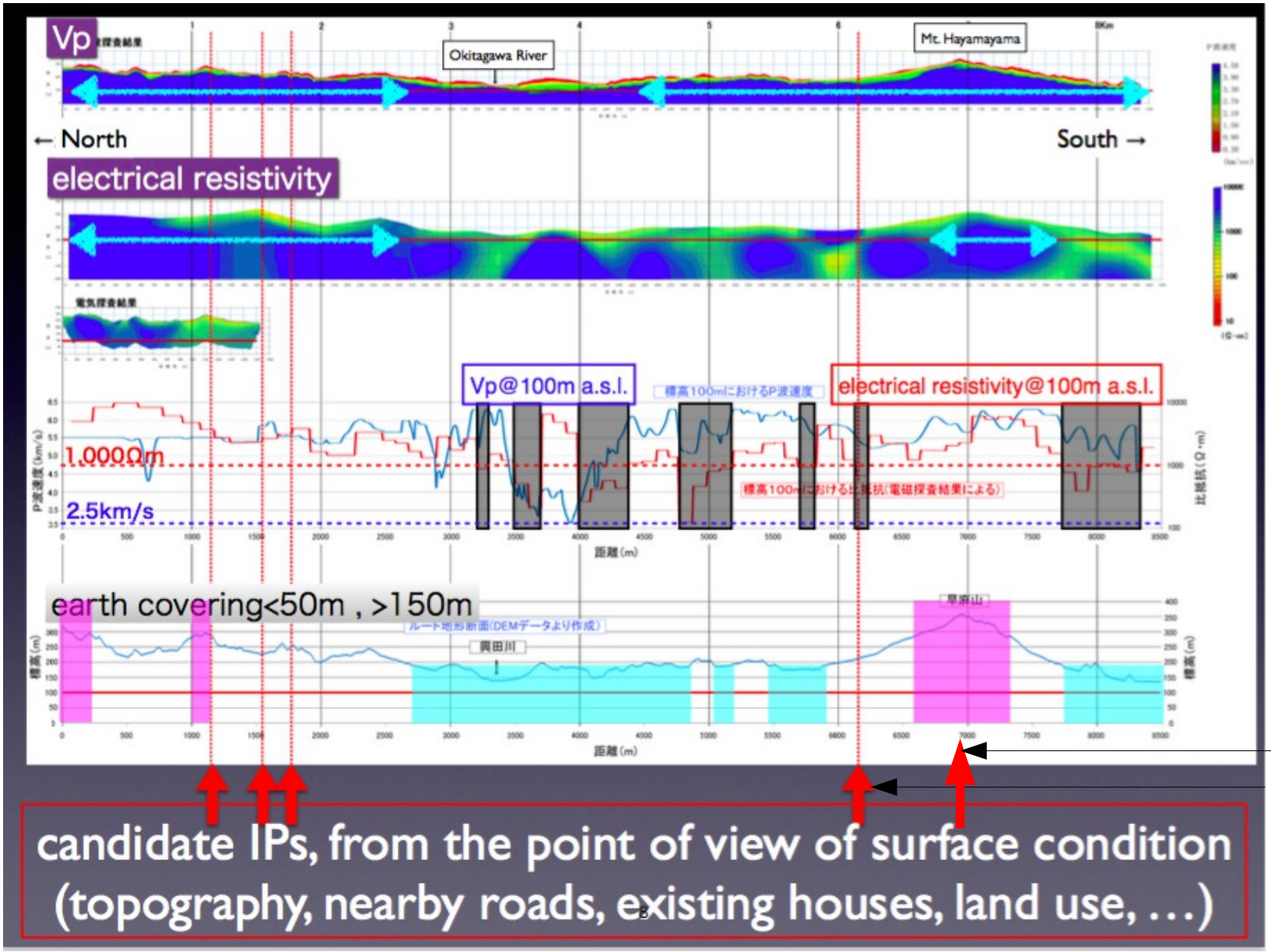
Longitudinal section of Kitakami site



~ 7 km zoom
In next slide

Masanobu Miyahara, ALCW15

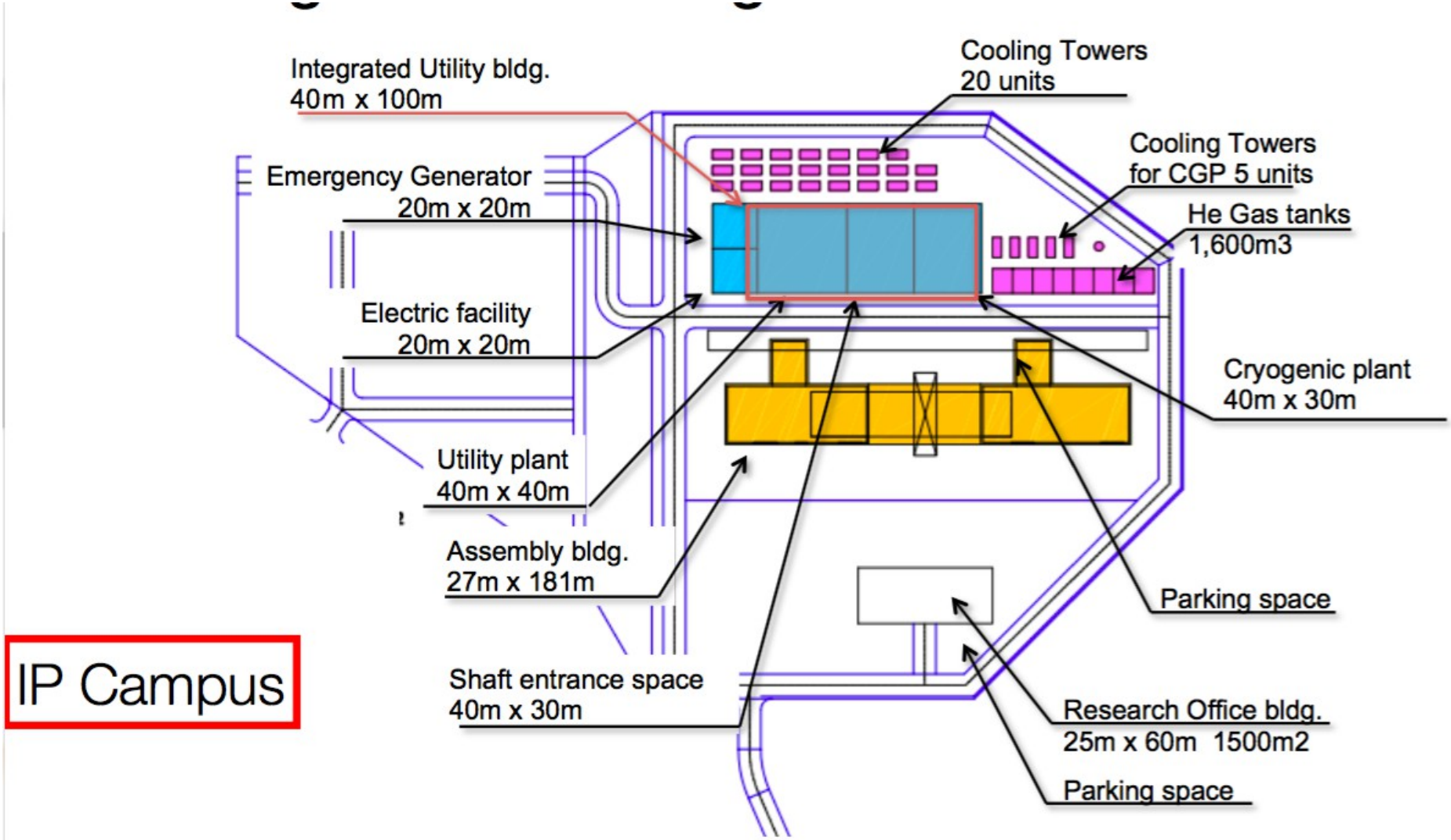
The IP Story II



Tomo Sanuki (Tohoku) New IP candidates seem to have better geological conditions

The IP Campus I

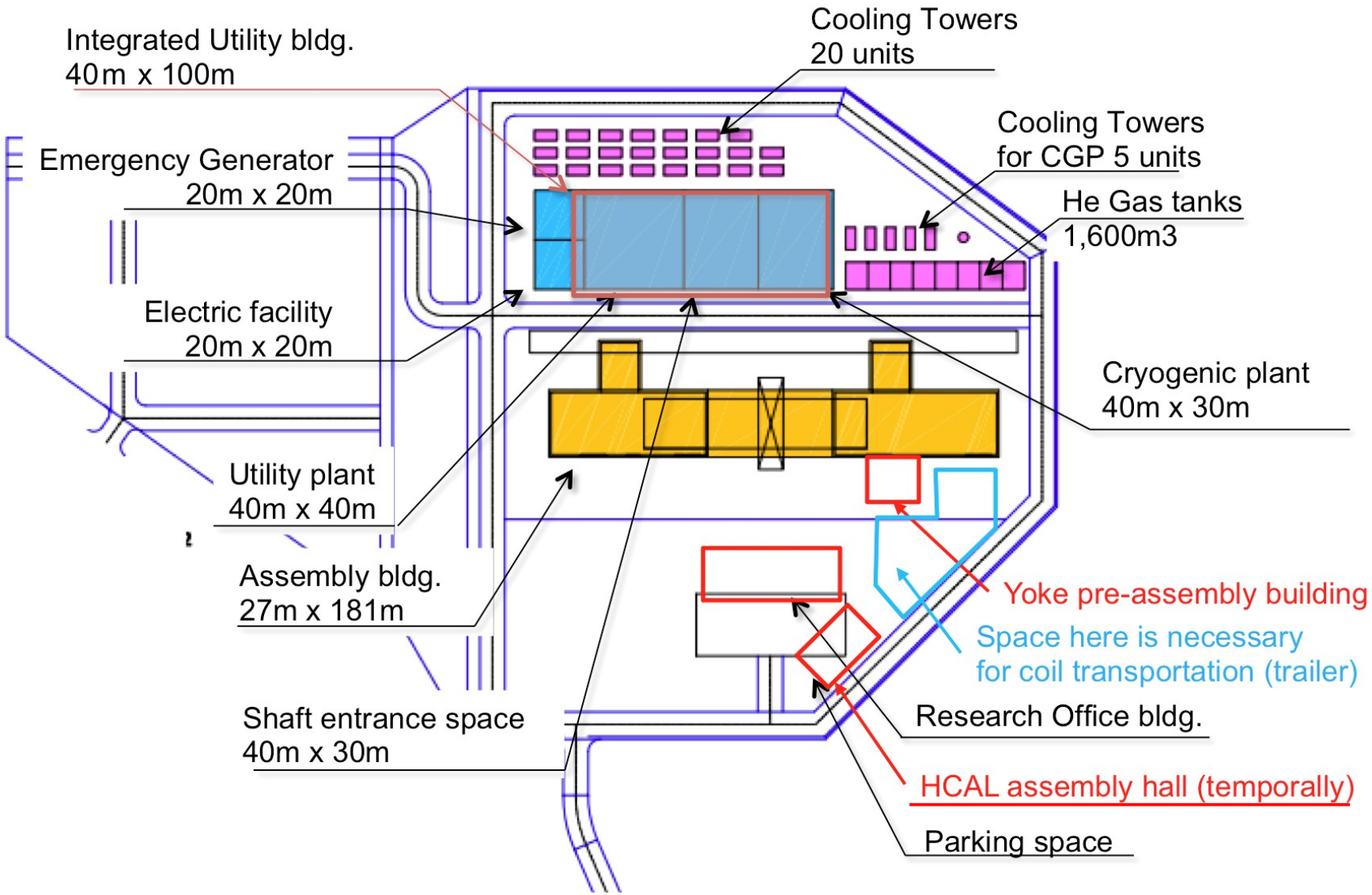
First idea by Sugimoto-san for original IP



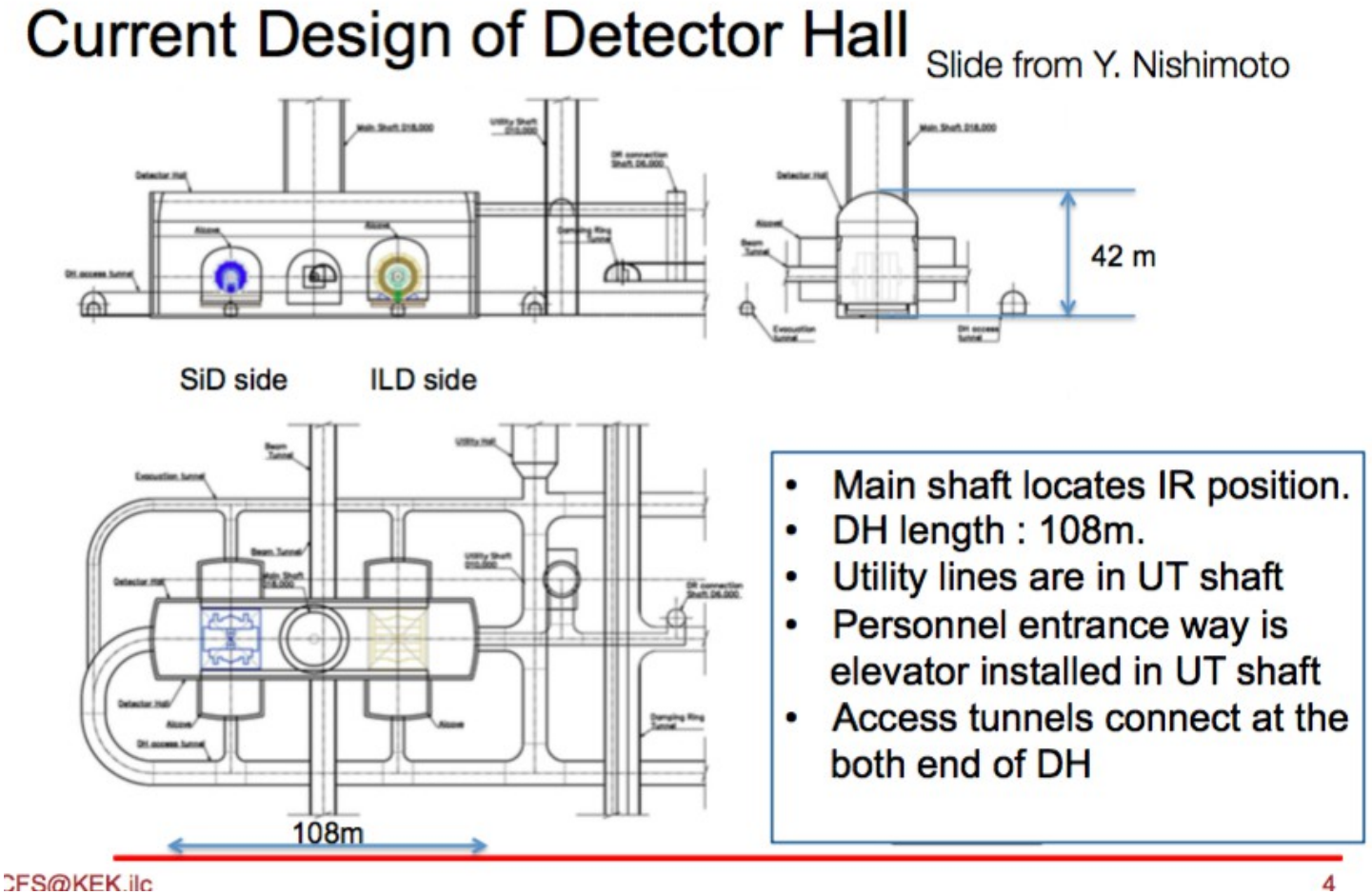
About 60000 m^2

The IP Campus II

First idea by Sugimoto-san for original IP + additional buildings



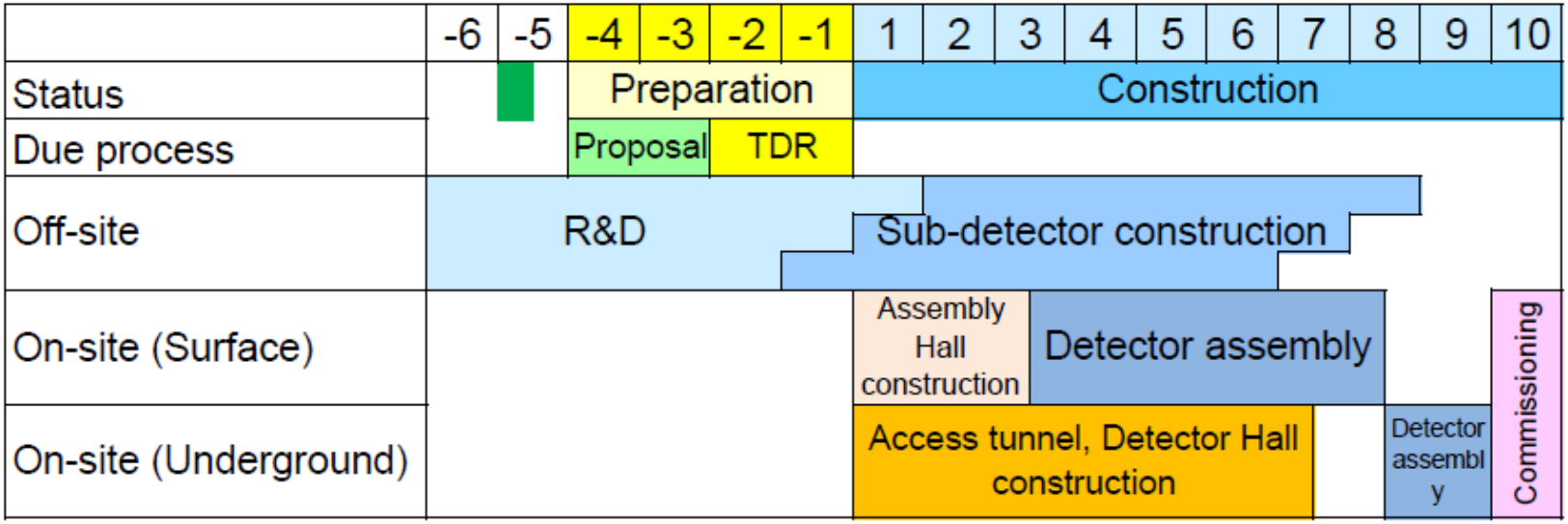
A sneak view into the detector hall



- Design stable but needs full engineering study needed
- Need to review detector services (nothing since 2009)

ILD Integration – Overall Timeline

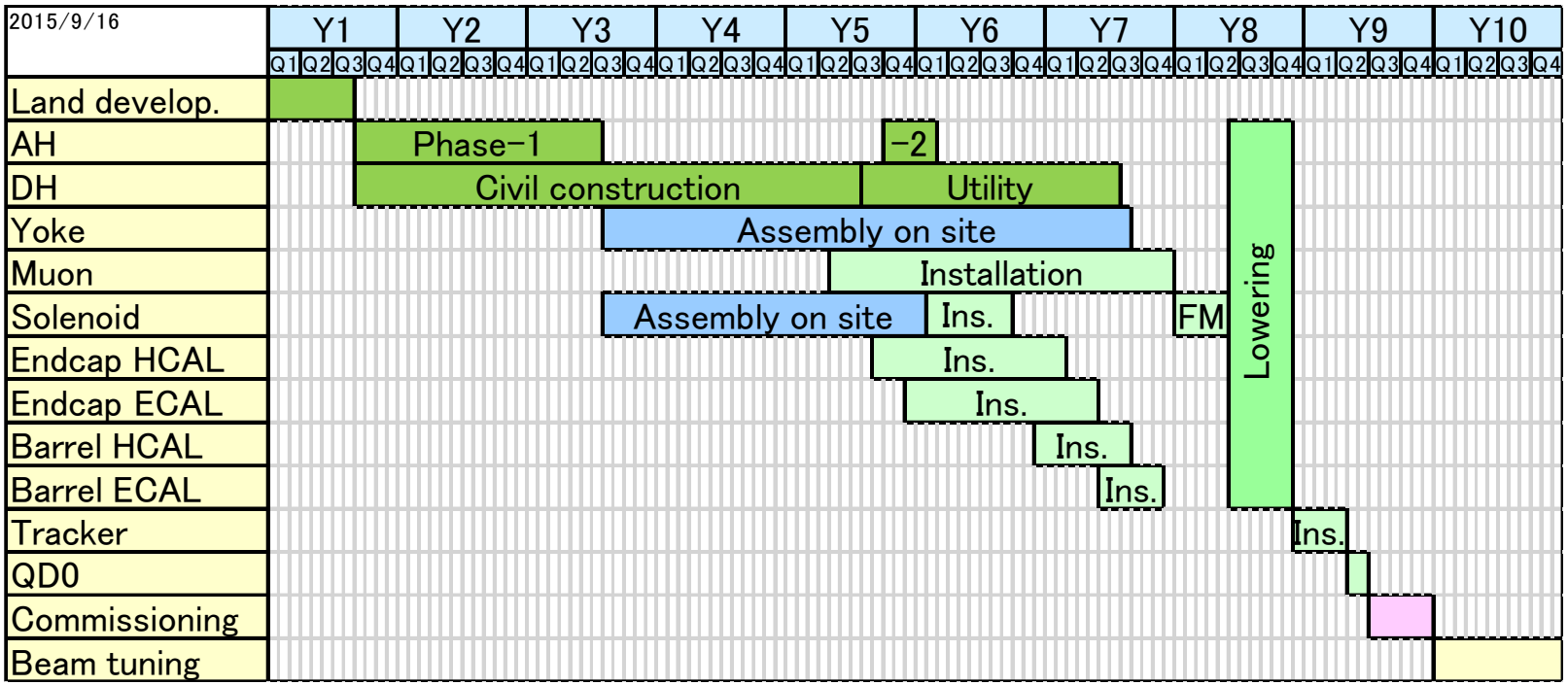
- There is no official timeline of ILC detector construction defined by LCC
- But we need a working assumption to make detailed designs
- Preparation period of 4 years with R&D budget substantially larger than present level is assumed
- Submission, review, and approval of the proposal and sub-detector TDRs would be in this preparation period (+∈)
- Full construction budget will be available at the same time as the ground breaking (T0)



Y. Sugimoto

ILD Integration plan

- ILD assembly timeline shown at the ILD Topical Integration Meeting on Oct. 8th
- In this timeline, magnet full-current test can be done only after barrel CAL installation
  - Yoke assembly period should be shortened
  - Solenoid assembly schedule is still uncertain

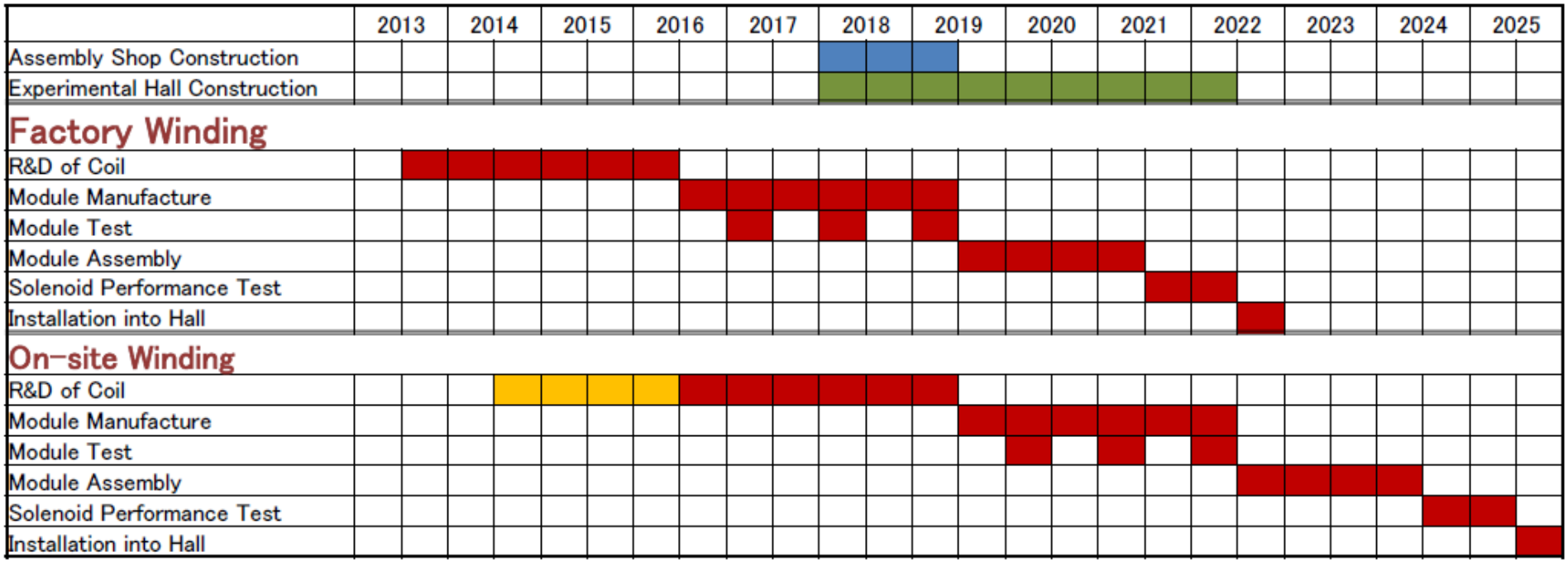


Y. Sugimoto

Solenoid assembly I

- There was a study by Toshiba few years ago on the assembly schedule of solenoid
  - ~12 years for on-site winding
  - ~10 years for factory winding (3.5y on-site)

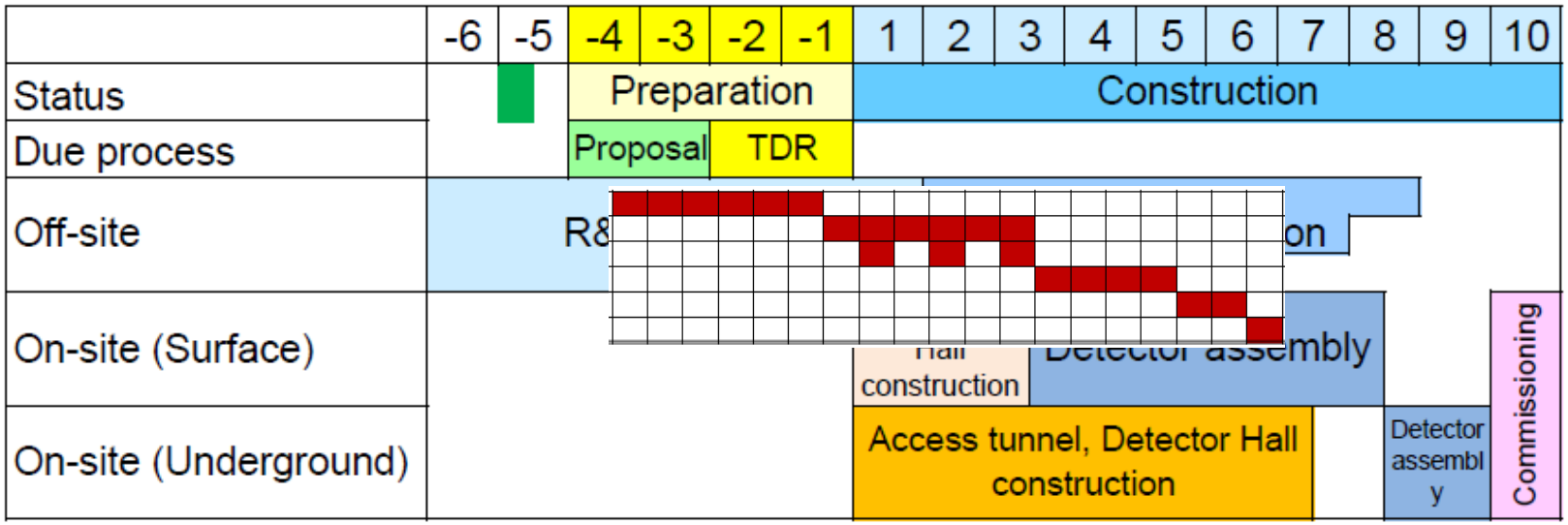
Lead Time of Manufacture



Y. Sugimoto

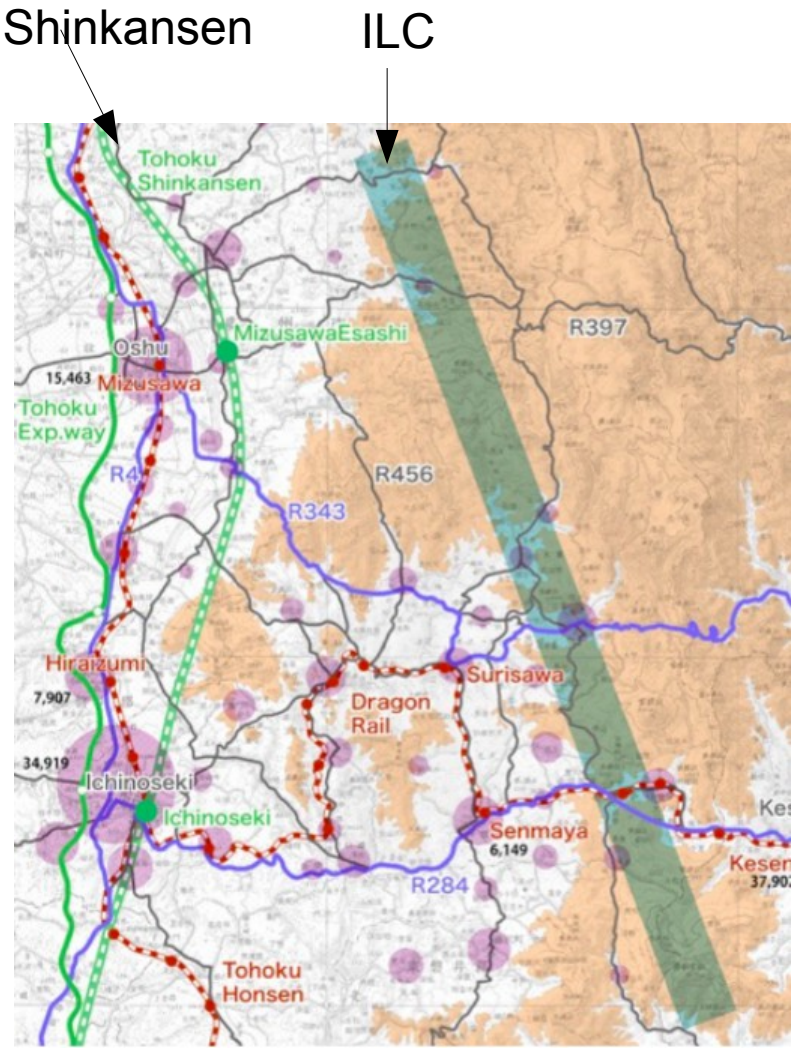
Solenoid assembly II

- Assembly on-site should be somewhat shorter
- R&D has to be started before proposal approval
- Bidding and module manufacturing has to be started before the ground breaking (unrealistic?)
- New study will be done in FY2016

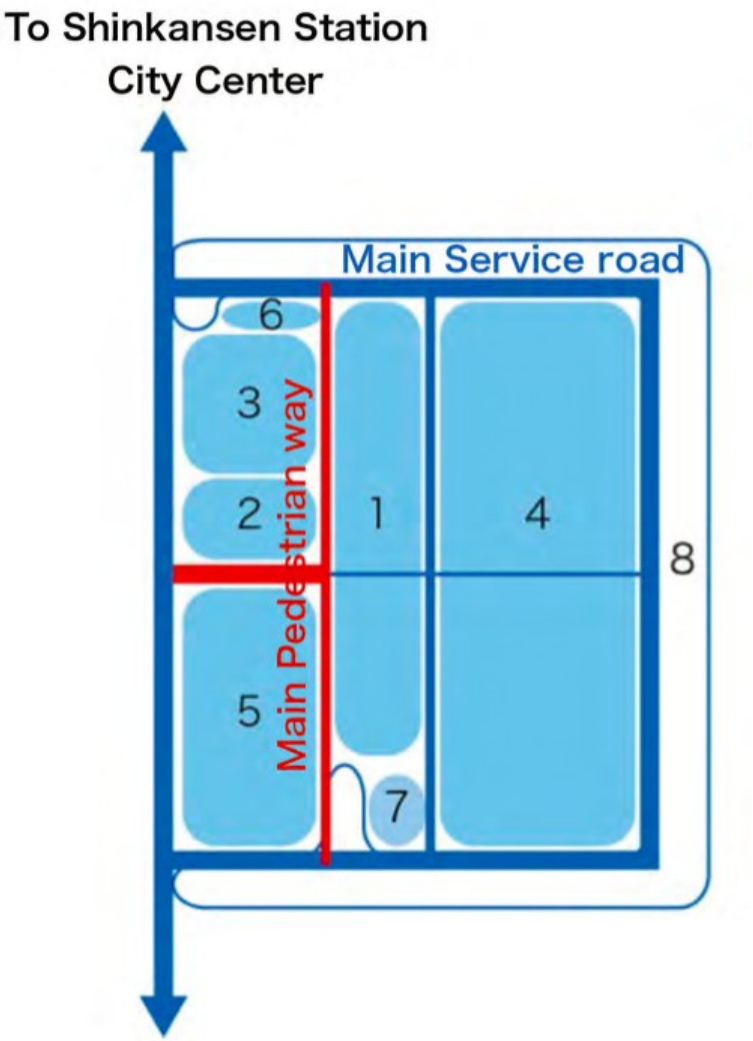


Y. Sugimoto

Flash on main campus issues



Main Campus can/will be about 30-45 minutes away from IP
=> Influence on facilities on IP Campus



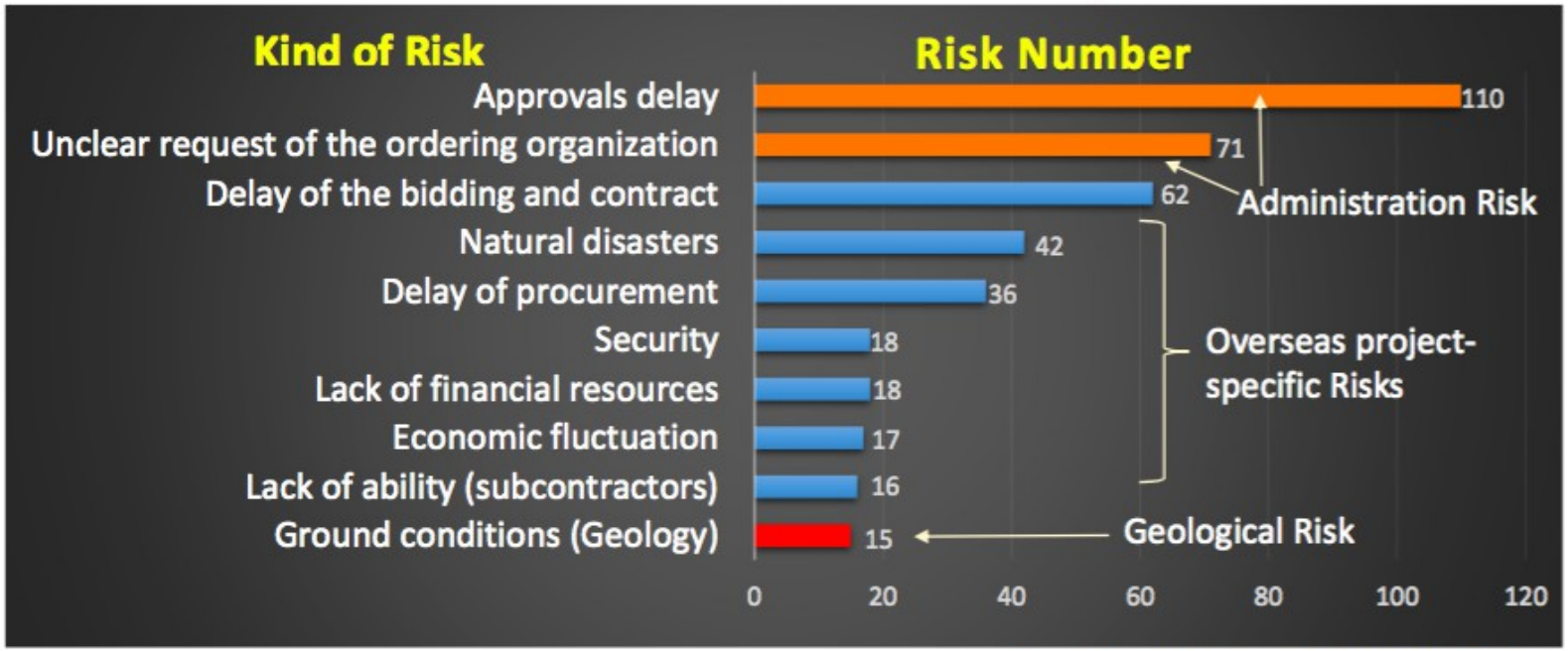
1.Office
2.Conference
3.Service
4.Experimental
5.housing
6.Transportation
7.supply and disposal services
8.buffer green/ open space

Tokiko Onuki

Interesting risk analysis

Extraction of Risk Factors in Big Project

- Ex-post Evaluations about Cost increase and Schedule delay in 377 cases of Japan's ODA Project



From the public report by JBIC in 2008

- Administration Risk:
  - Approval Delay: Acquisition of the Construction Site
  - Unclear Request: Design Specification, Project budget plan ,etc.
  - others: Japanese Budget system, Complicated Decision-making system, etc.

Masanobu Mikyahara

Keeping an eye on the details ...

Transport vessel “MOL Comfort” in deep trouble in the Indian Ocean

Vessel sunk (finally) in July 2015 ...

Found by K. Büßer

Summary of summary

- MDI Activities face a number of open issues and moving targets

- Position of the IP
  => Size and layout of Assembly Hall
  => (w/o discussion here) New IP seems to offer more space (but may be more difficult to reach)

- The actual ILD assembly plan depends decisively on the availability of the coil
  - 4 years of R&D prior to construction
    .... i.e. During a phase in which funding may not yet be abundant

- It is very important to review constantly CFS/MDI activities to be quickly ready at Green Light

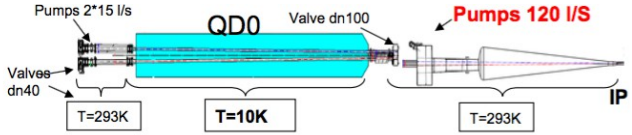
- Nice and important overarching activity

- French groups play active role in MDI/CFS activities

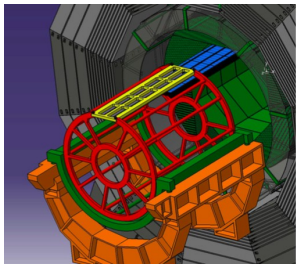
  => See next slide

Survey on recent MDI activities in France

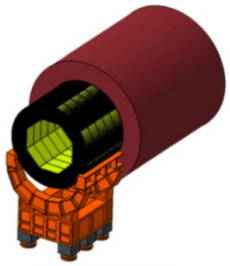
- 3D CAD Model of ILD, validation of detector interfaces and inner region assembly (LAL)
  C. Bourgeois, A. Gonnin



- Vacuum studies (LAL)
  B. Mercier, C. Prevost



- ILD Ecal Assembly and Integration (LLR, LPSC)
  M. Anduze, H. Videau, D. Grondin



- SDHCAL Integration (IPNL)
  C. Inagrio

CEA/Irfu TPC Integration and work on coil (see talks of Gautier and Maxim)

Highly motivated teams despite of little up to no funding

Backup ....

Communication with the machine ...

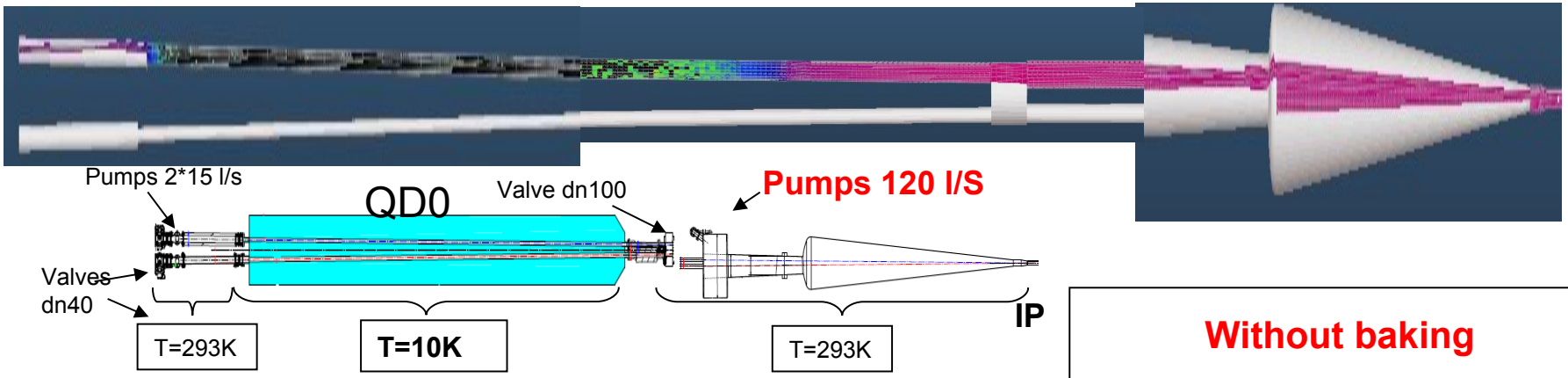
Technical changes to ILC Baseline

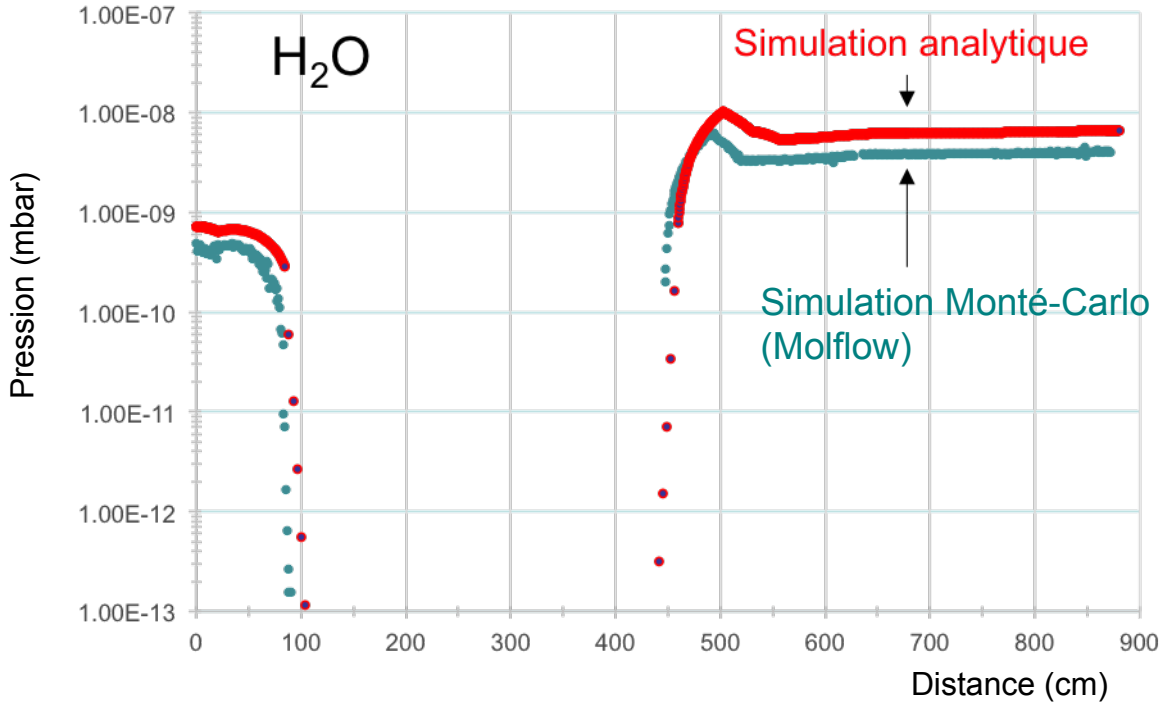
- In the meantime the technical baseline of ILC is also moving forward
  - Change Management Process
- Change Requests with consequences for ILD:
  - CR2: common L* at 4.1m ← Dedicated ILD study Before agreement
  - CR3: vertical shaft assembly at Kitakami ← Makes life much easier
  - CR6: adding a stripline BPM to the outgoing beam
  - CR7: adoption of Kitakami as the sole baseline site
- More to come…

Vacuum study on ILD

UNDER STATIC CONDITION — QD0 + IP region

Comparison of a Monté-Carlo simulation and analytical simulation for H_2O





Without baking

T=293K

τ (H_2) = 5.10^{-12} mbar.l.s^{-1}.cm^{-2}

τ (CO_2) = 1.10^{-13} mbar.l.s^{-1}.cm^{-2}

τ (H_2O) = 2.10^{-11} mbar.l.s^{-1}.cm^{-2}

τ (CO) = 1.10^{-13} mbar.l.s^{-1}.cm^{-2}

After 100h pumping

T=10K

σ (sticking coeff CO, CO2, H2O) = 1

τ (all gases) = 0 mbar.l.s^{-1}.cm^{-2}

For H_2 pumping by holes in beam screen 2% surface

Without outgassing valves dn40

Vacuum study on ILD - Summary

Study by B. Mercier, C. Prevost LAL

DP0 + IP	Pumps IP 120 l/s	Without baking	5,6 nTorr	H2O	initial
DP0 + IP	No pumps IP	Without baking	120 nTorr	H2O	DP0 and IP volume not separated / Lenght reduction
DP0 + IP	Neg coating	Baking IP	0,23 nTorr	H2/ H2O	Length reduction
DP0 + IP	Neg satured	Baking IP	1,4 nTorr	H2O / H2	Length red uction

- Vacuum pump can be removed => 40cm gain => Favorable reply to machine change request
- NEG Coating would assure an excellent **static** vacuum in interaction region
  Would have some operational consequences (heating wires and bakeout after shutdowns)

  Technical note written, will be available soon to ILD

- 120 nTorr static **vacuum** doesn't seem however compromise physics (study by R. Karl, DESY)

- Next step is study on ***dynamic*** vacuum
  Common wisdom says that this is not an issue for linear colliders but will be better to be sure

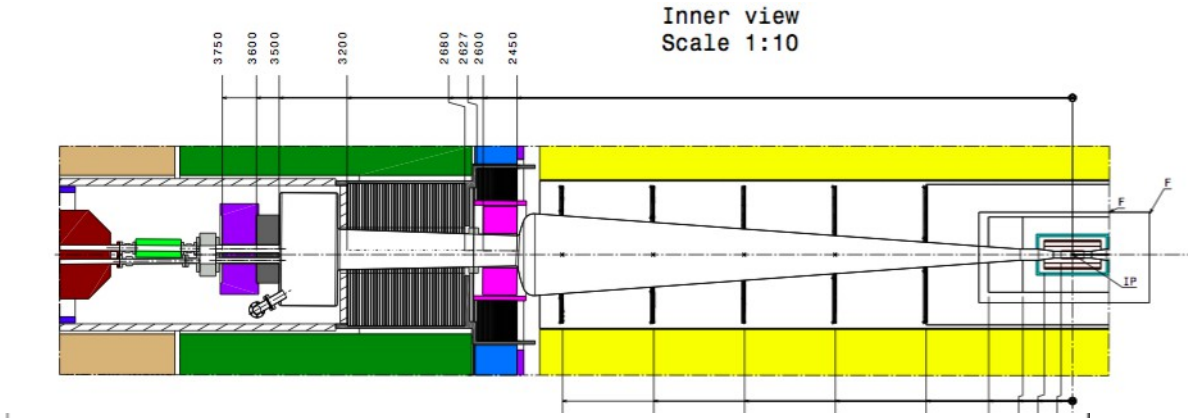
New design of forward region

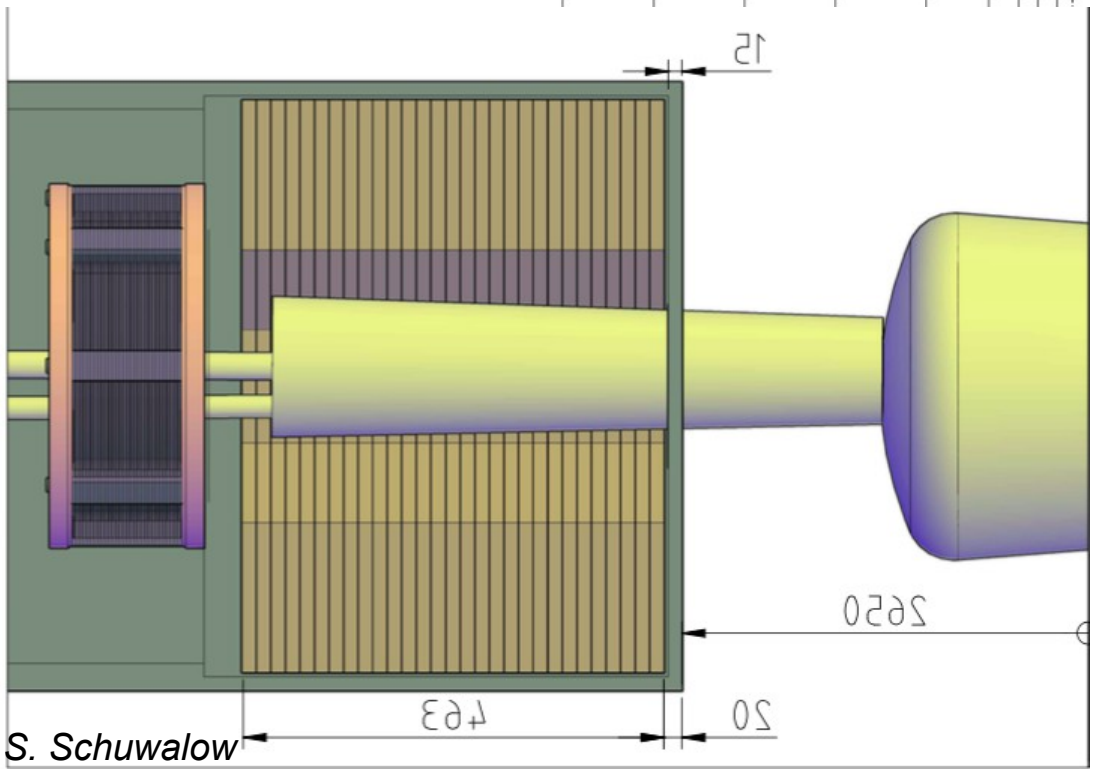
- Conceptual design of LHCAL

- Put BeamCal directly behind LHCAL

To be done:

- Check rate of Beamstrahlung pairs, backscattering

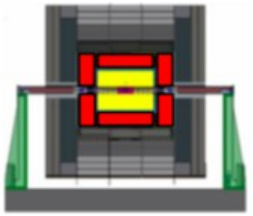




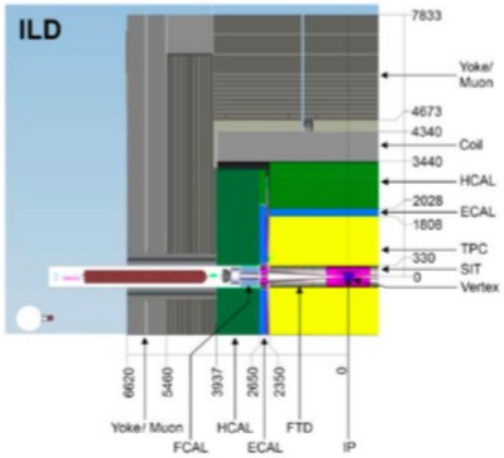
S. Schuwalow

ILD Integration – Engineering Model

Maintained and validated by C. Bourgeois, A. Gonnin (LAL)



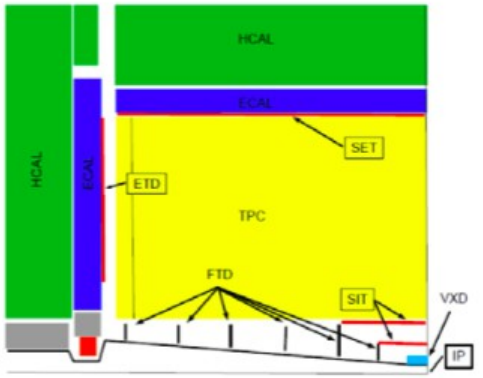
- Reminder : The **DBD 3D CAD model** on CATIA **is frozen**



- Starting a **new CAD version** with update
  - ➢ LAL still collecting all informations (3D model, services placeholders..)

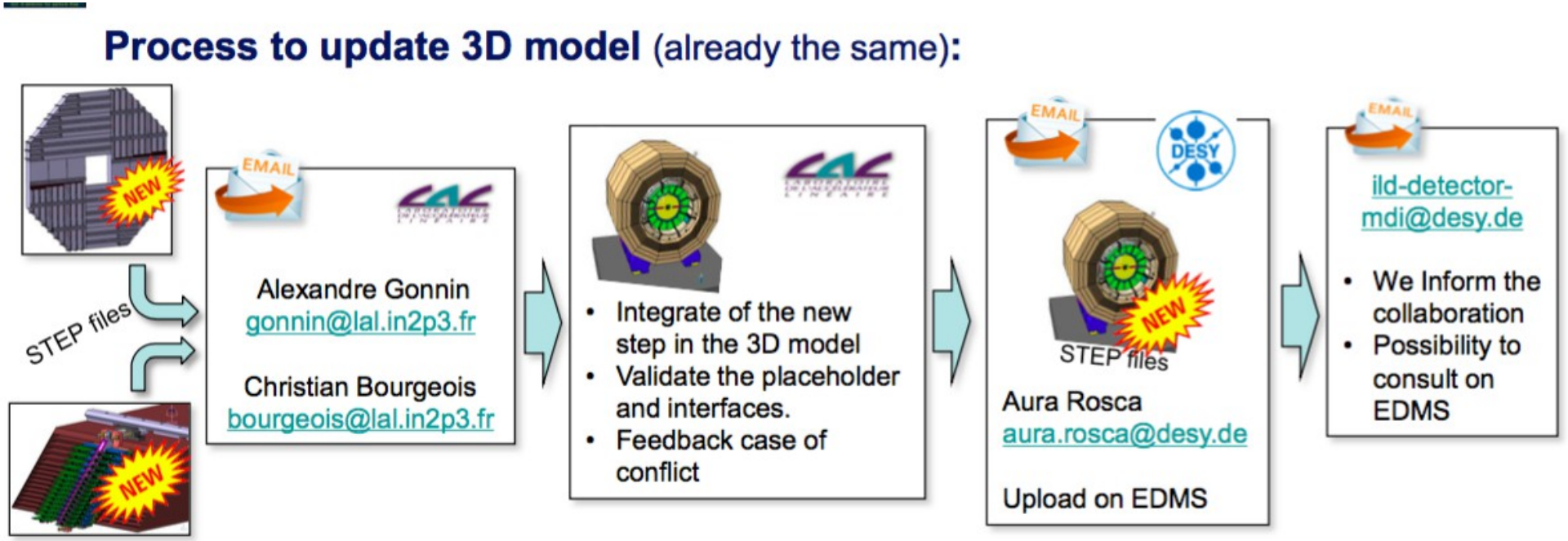
  for example: in june 2014 SDHCAL update design sent by LPNL

- **Brainstorming group**, start to work on an update of the ILD detector model: Karsten Buesser (DESY) ; Henry Videau (LLR) ; Roman Poesch (LAL) ; Alexandre Gonnin (LAL) ; Christian Bourgeois (LAL),



The length and diameter of the experience could change.

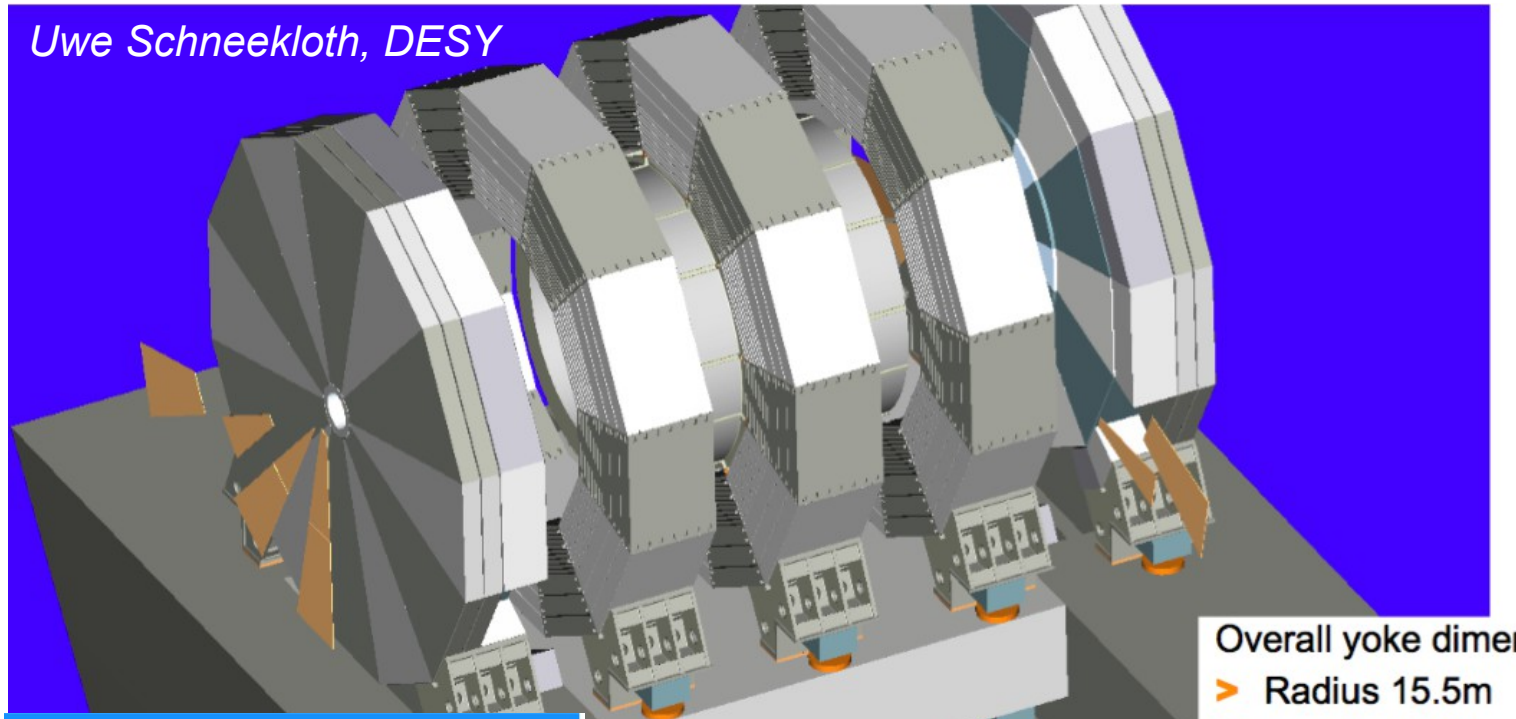
Engineering Model – Update process

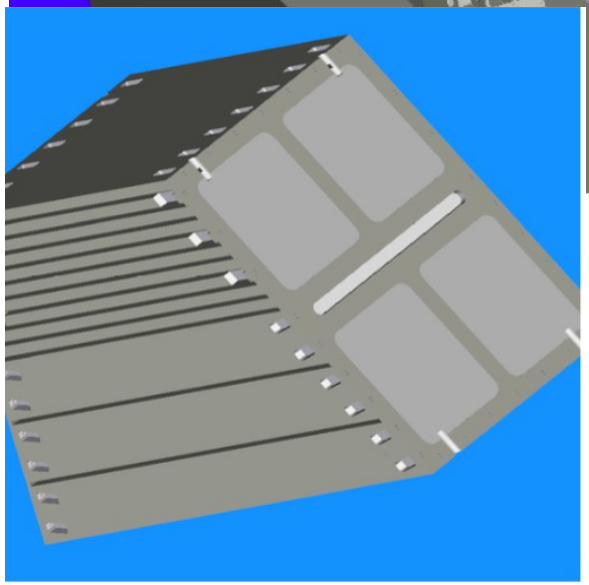


- Updates of the engineering model have to be communicated to Christian Bourgeois and Alexandre Gonnin
  Otherwise they don't exist!!!!!

- Fill the interface control document

The ILD Yoke





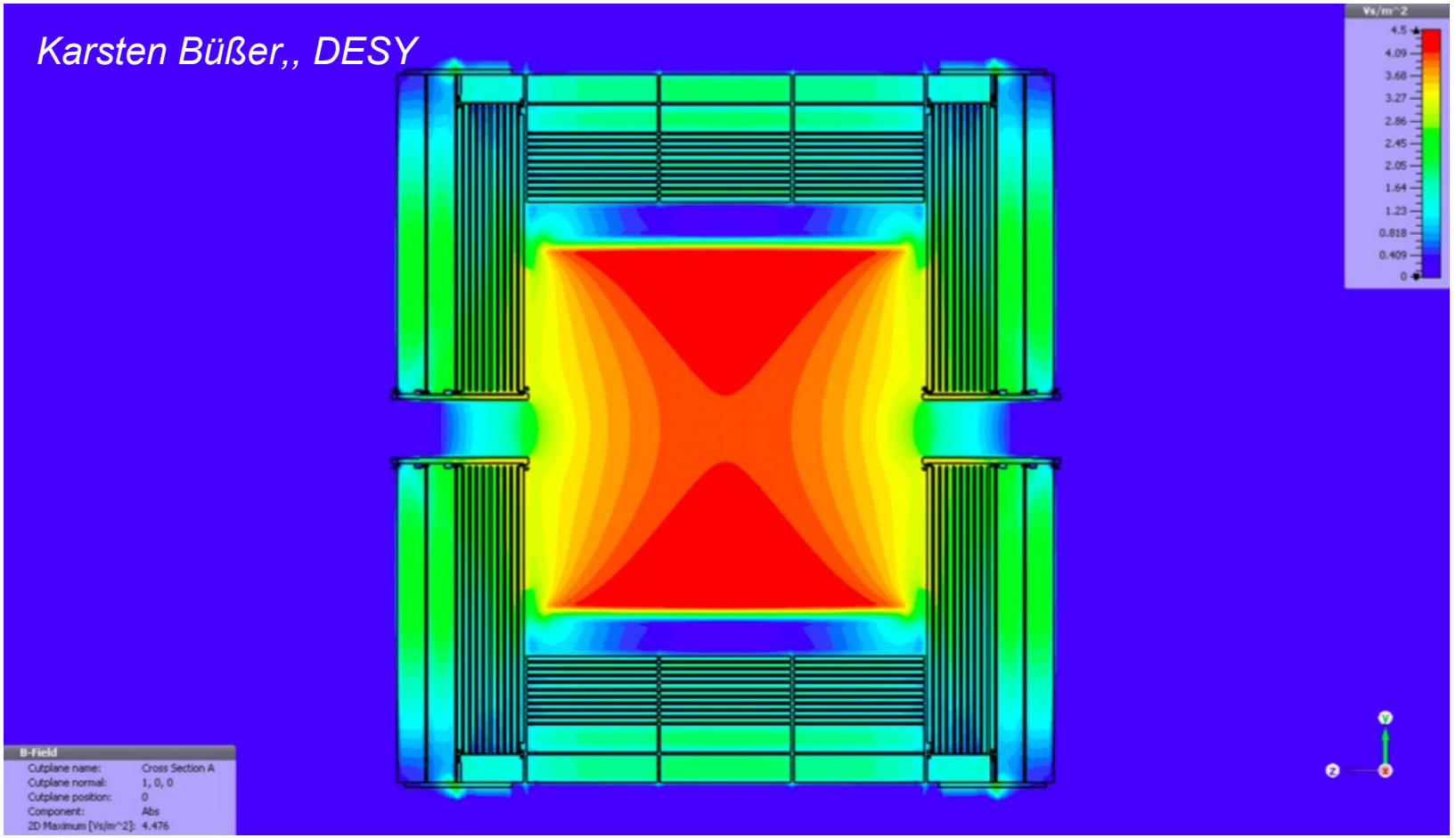
Overall yoke dimensions
- Radius 15.5m
- Length 13.2m
- Barrel weight 6900t
- End-cap weight 6500t

total 13400t

- (Barrel) segment weight 210 t
- May become a transportation issue
- Alternatives with bolted plates under study

ILD Magnetic Field

Thin(ner) ILD yoke: Remove 60cm of iron w.r.t. DBD design



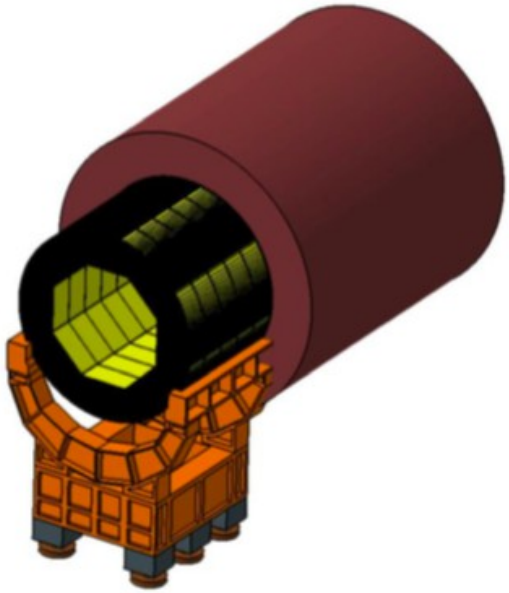
Money savings, Stray field similar to SiD

SDHCAL Assembly

Barrel insertion

- Wheels put on the structure one by one
- Barrel with 5 linked wheels on **same sub-structure as ECAL** (similar to CMS)
- Rails inside the yoke
- Insertion « push-pull »
- Fixation inside the yoke on both sides

C. Inagrio, IPNL



Barrel insertion

CMS « enfourneur »

Where to assemble?

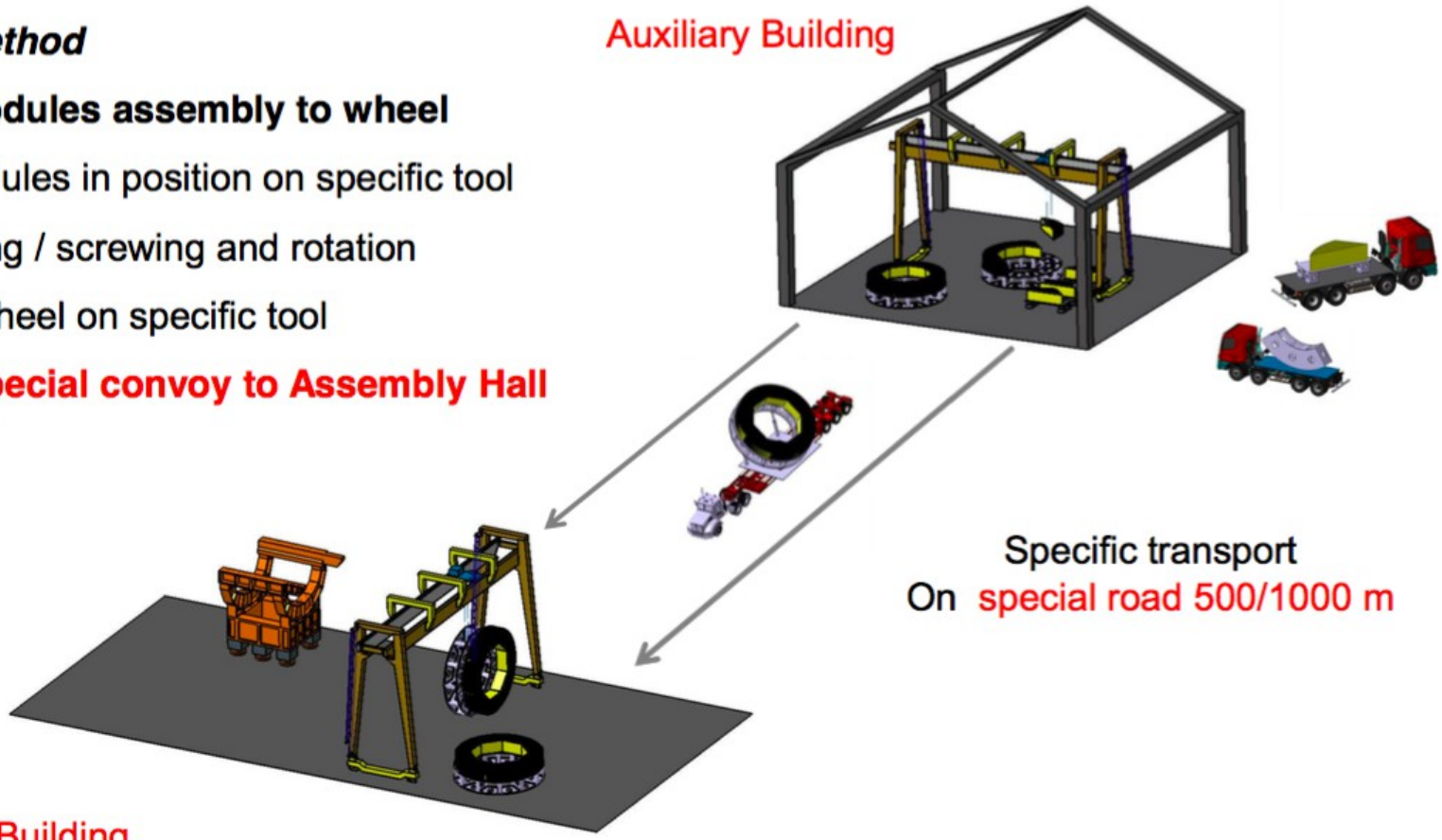
We will have ILC Campus, ILC Experimenal hall with surface building
Need pf auxiliary building?

SDHCAL

- 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**

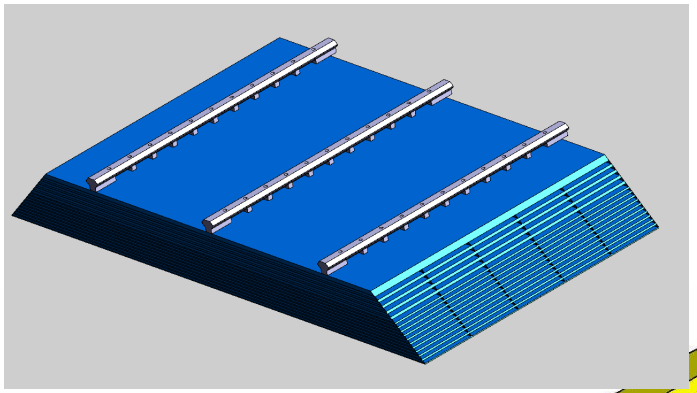


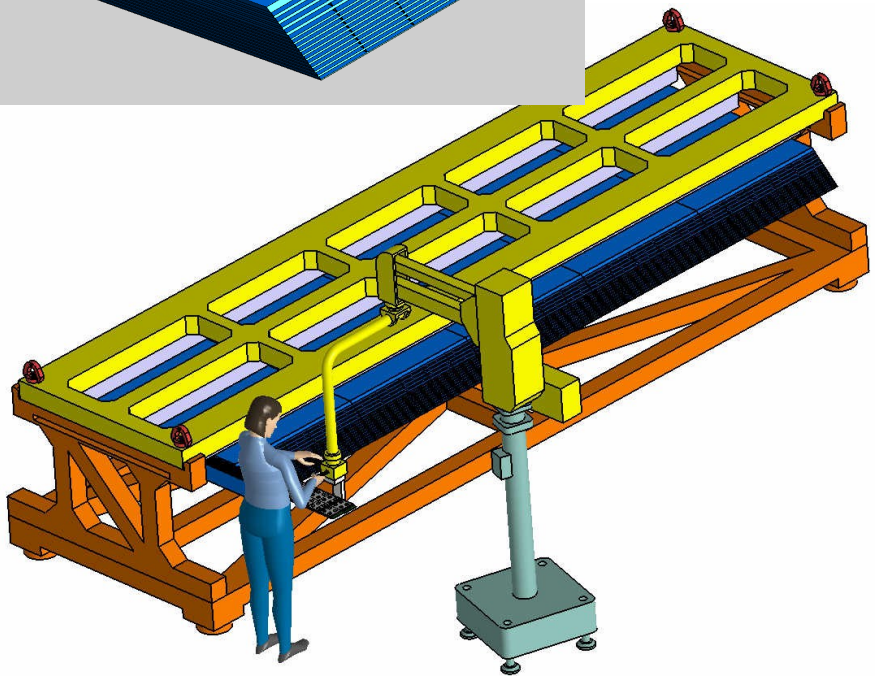
C. Inagrio, IPNL

SiW ECAL Assembly I

"Off detector" assembly

e.g. On ILC Campus

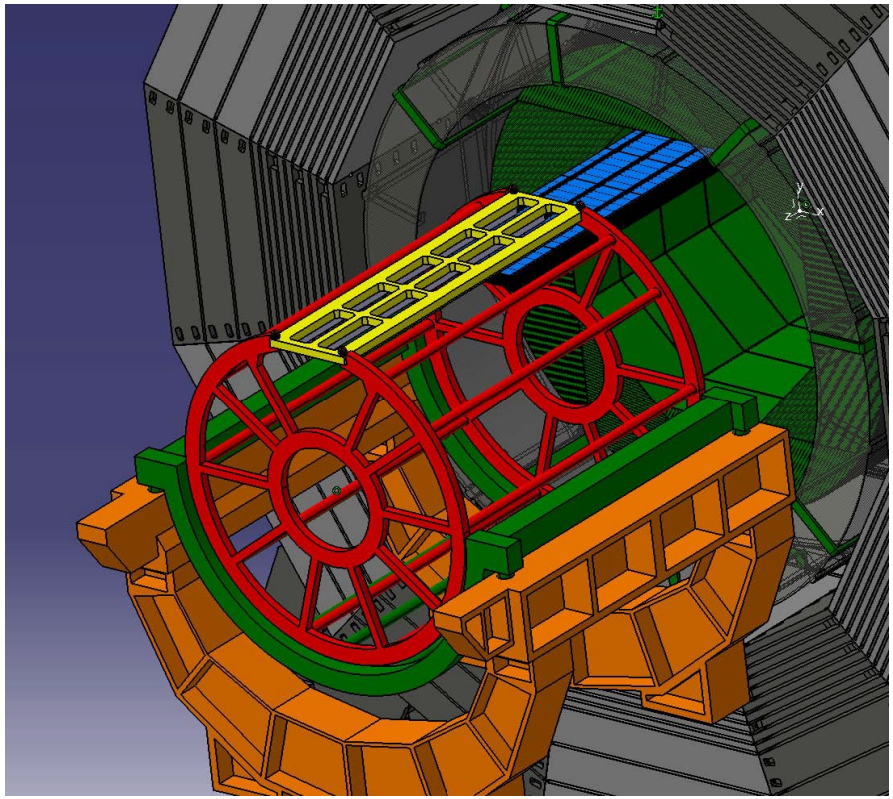




Total modules+cradle can be transported
By a 10-15t truck

"On detector" assembly

e.g. On ILD in pit

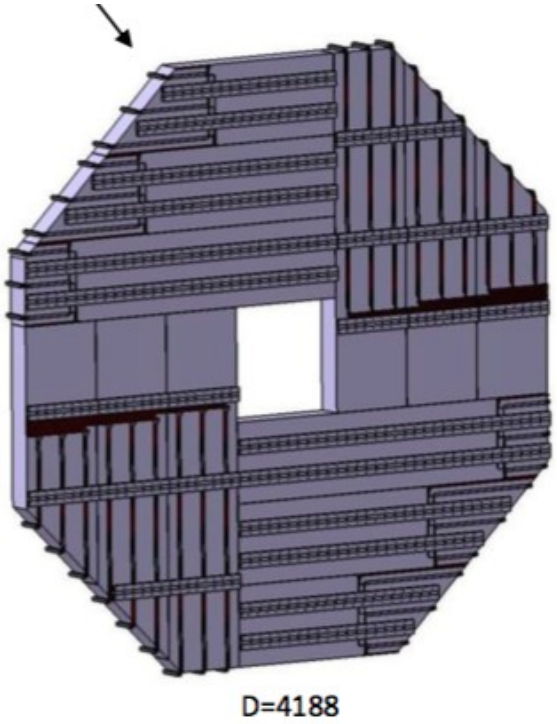


CMS like assembly tool
To be stored (most likely) in assembly hall

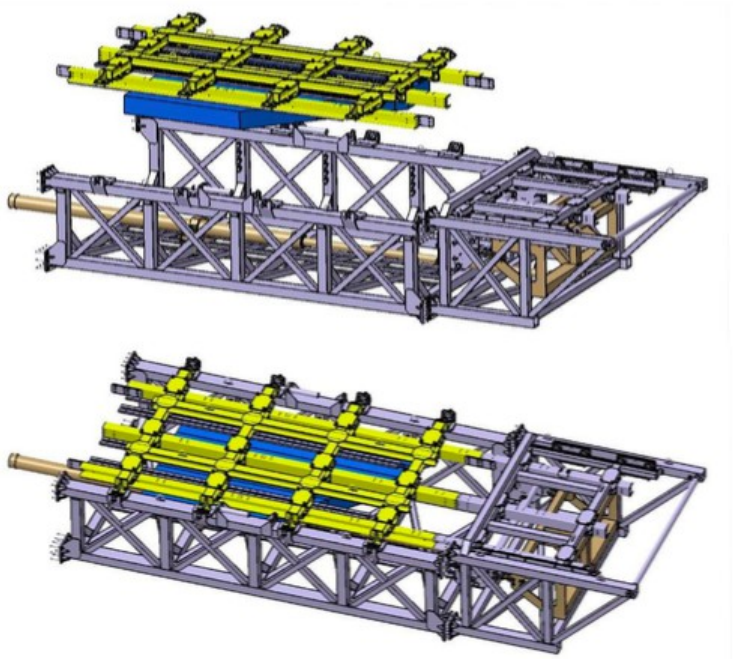
H. Videau, LLR

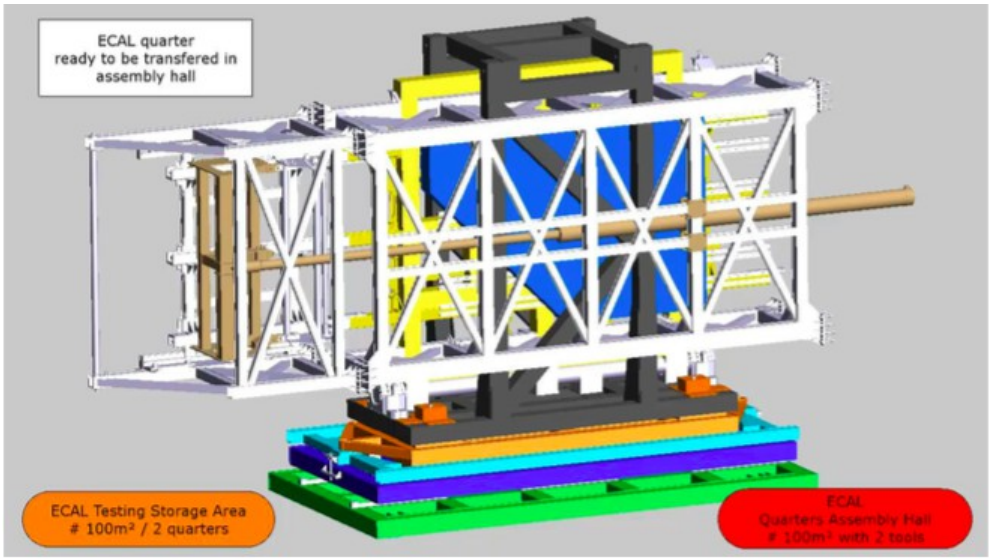
SiW ECAL Assembly II

SiW ECAL Endcap

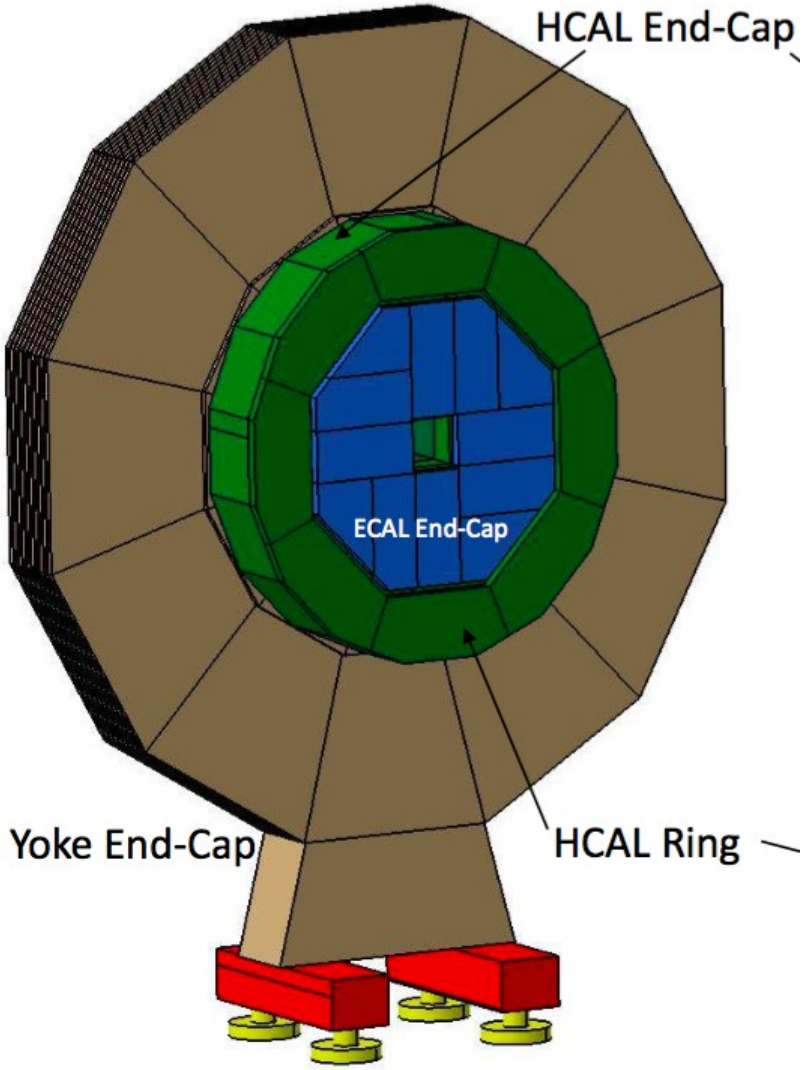


Weight 25.5 t
4 Quadrants





Completed ILD Endcap



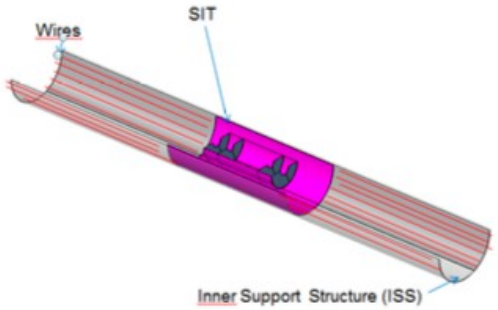
- Combination of many/sall elements discussed so far

- Looks “easy” but requires Well defined interfaces between Detectors

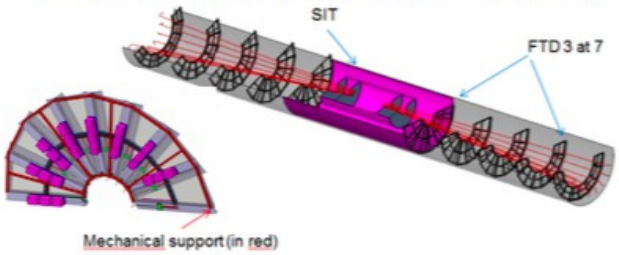
- See Interface Control Document above

Assembly of inner region

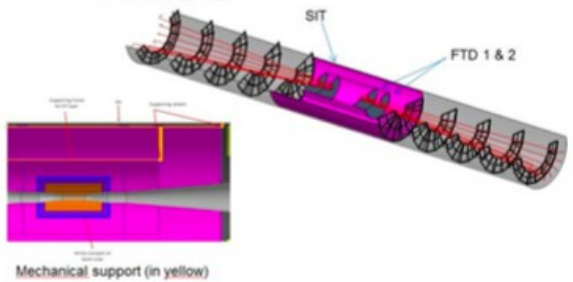
Assembly procedure details : Reminder



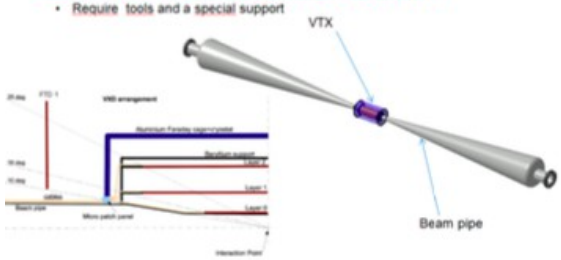
– FTD 3 at 7 fixed and located on ISS (external mounting)



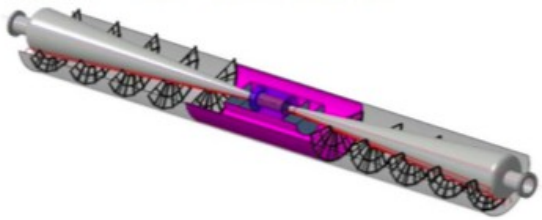
– « Supporting wheels » fixed and located on the ISS
- For the SIT (half part)
- For the FTD 1&2



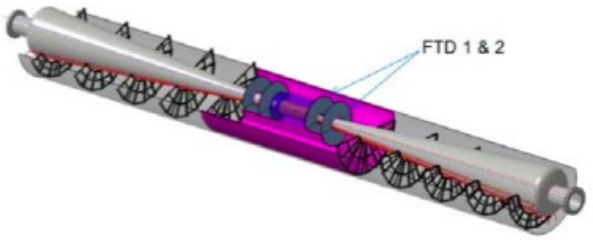
– Beam pipe with VTX assembled and mounted upon 1st assembly: Vertex clamped around the Beam pipe
- Require tools and a special support



– Beam pipe with VTX assembled and located on the 1st assembly
- By cables or « striplines » or « tie rod » on the ISS



– Close the FTD 1 & 2
- Located and fixed to the lower half part



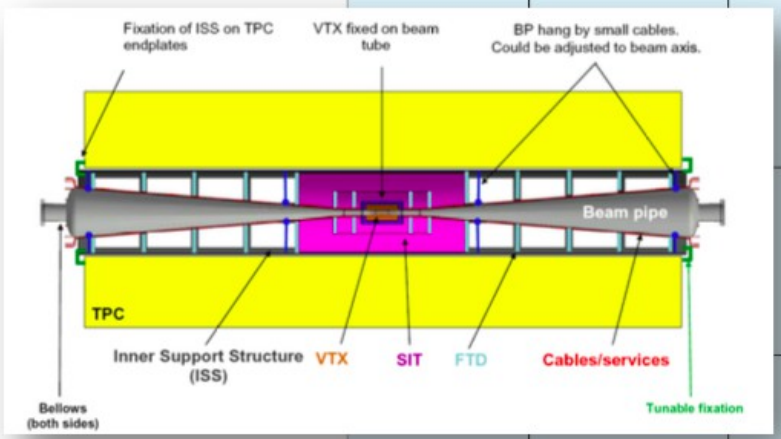
- Procedure a la Alexandre Gonnin, LAL
- Similar procedure proposed by groups at IFIC and IFCA (Spain)

Monitoring knowledge on inner region

Inner region matrix .. to get and overview what we knpwow and what we don't know

TPC In charge: Desy	Tune table fixations with endplates (TBD)				***Interfaces design***	
Position tolerances: Alignment apparatus: laser+ sensors References: TPC (TBC)	**ISS (Inner Support Structure)** In charge : LAL, Orsay Design: Carbon structure half part or block part (TBD) Power: for alignment apparatus (TBD) Wires: for alignment apparatus; sensor;... Cooling: No	Cables and Tune table fixation (TBD)	Fixation points on external FTD diameter (TBC)	Suspended fixation ? (TBD)	Fixation?	
	Position tolerances: Calibration ? References:	**Beam Pipe** In charge : Design: OK Power: No Wires: no Cooling: No	Support FTD services (wires,...)		Fixation?	Fixed or clamped Beryllium support ?
		Position tolerances: Calibration ? References:	**FTD 3 at 7** In charge : IFIC, Santander? Design: Petals structure Power: Yes Wires: 32 cables/FTD Cooling: ?		FTD 3 fixed on SIT?	
			Position tolerances: (SIT / FTD)= 5µm Calibration ? References:	**FTD 1 & 2** In charge : IFIC, Santander? Design: Petals structure Power: Yes Wires: 96 cables/FTD Cooling: ?	FTD 1&2 Fixation ?	
				Position tolerances: (SIT / FTD)= 5µm Calibration ? References:	**SIT** In charge : ? Design: ? Power: Yes (TBD) Wires: SIT 1=44 cables SIT 2=88 cables Cooling: ?	
					Position tolerances: Calibration ? References:	**VTX (Vertex)** In charge : IPHC Strasbourg Design: Beryllium structure; aluminium Cryostat; Faraday cage Power: No Wires: 30 cables Cooling: ?
		Technical values				

TBC : To Be Confirm
TBD : To Be Design

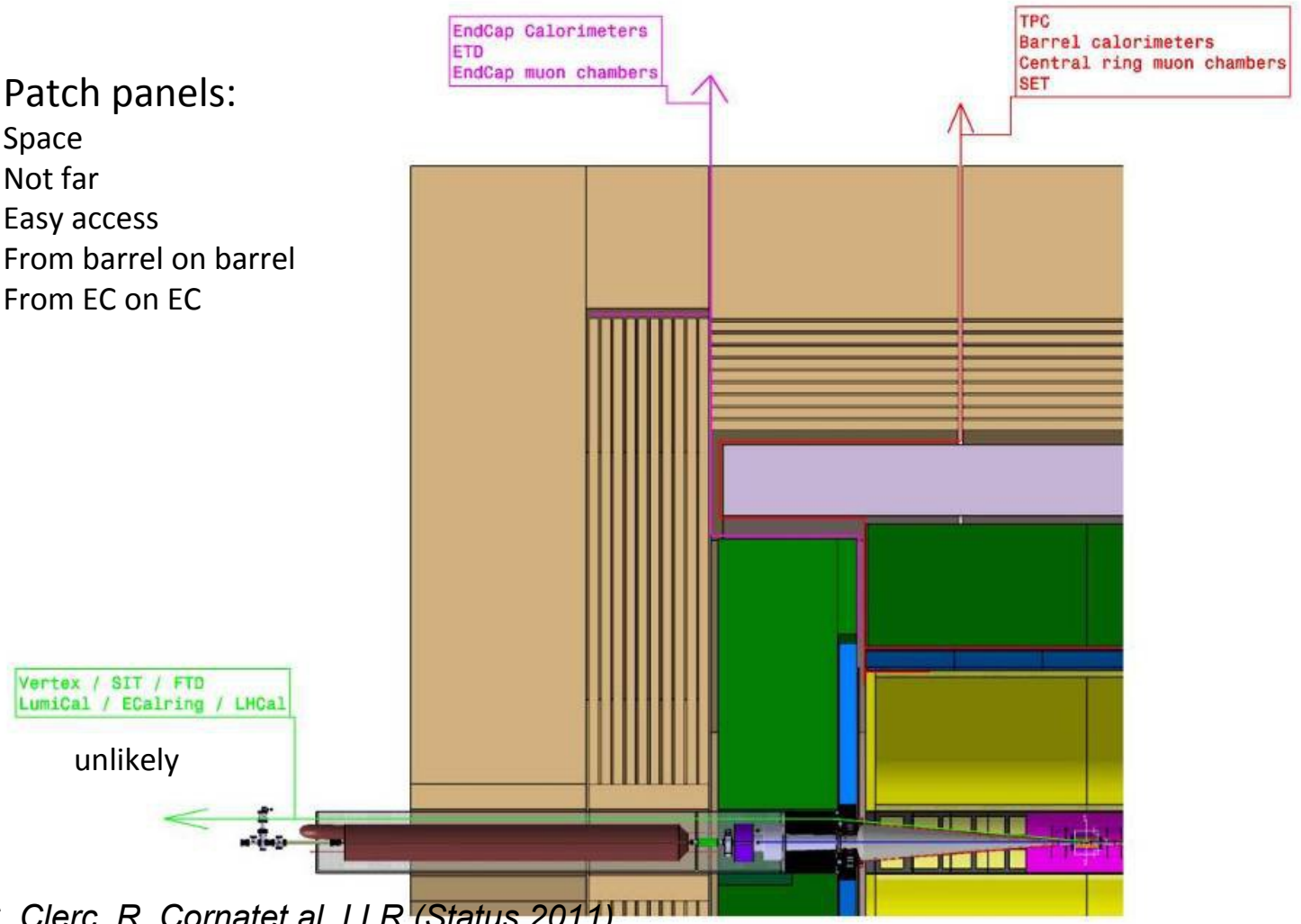


A. Gonnin, LAL

Cabling and power

A reminder

Patch panels:
Space
Not far
Easy access
From barrel on barrel
From EC on EC



C. Clerc, R. Cornatet al. LLR (Status 2011)

Study for DBD needs regular update!!!!

Summary and Conclusion

- Discussion on MDI issues reveal a big number of moving targets
  - IP Point where?
    => Assembly halls
  - Harmionising time scales
  - A lot depends on the fabrication of the solenoid

- Big parts need considerable work planning and money before project approval
  - e.g. Solenoid but also (in our case) calorimeters

- Regular MDI/CFS Meetings are important for an efficient ramp-up after green light

- All sub- detectors proposed by European Groups and in particular
  by French groups have developed first ideas on assembly procedure

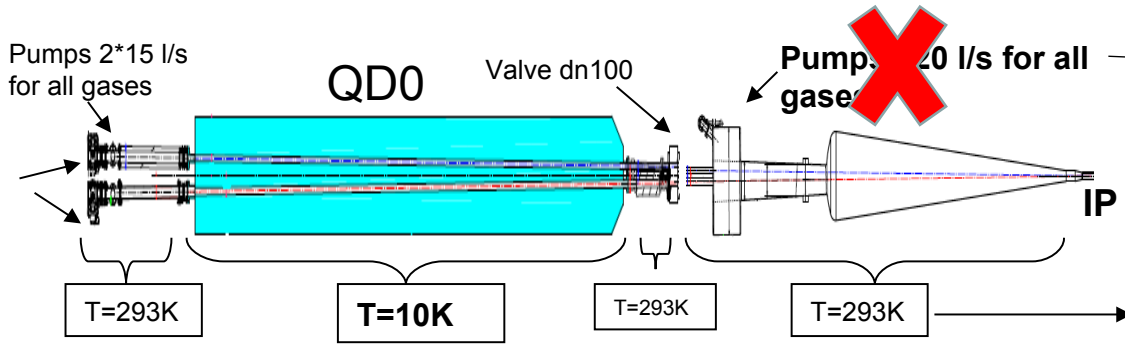
- Basically no dedicated funding available since ILC/ILD as a project doesn't exist

- All e.g. Engineers work for ILD since they find it challenging and consider it
  as “their” future project

Vacuum study on ILD

UNDER STATIC CONDITION

QD0 + IP region



NEG coating

L=30 cm Ø = 179 mm

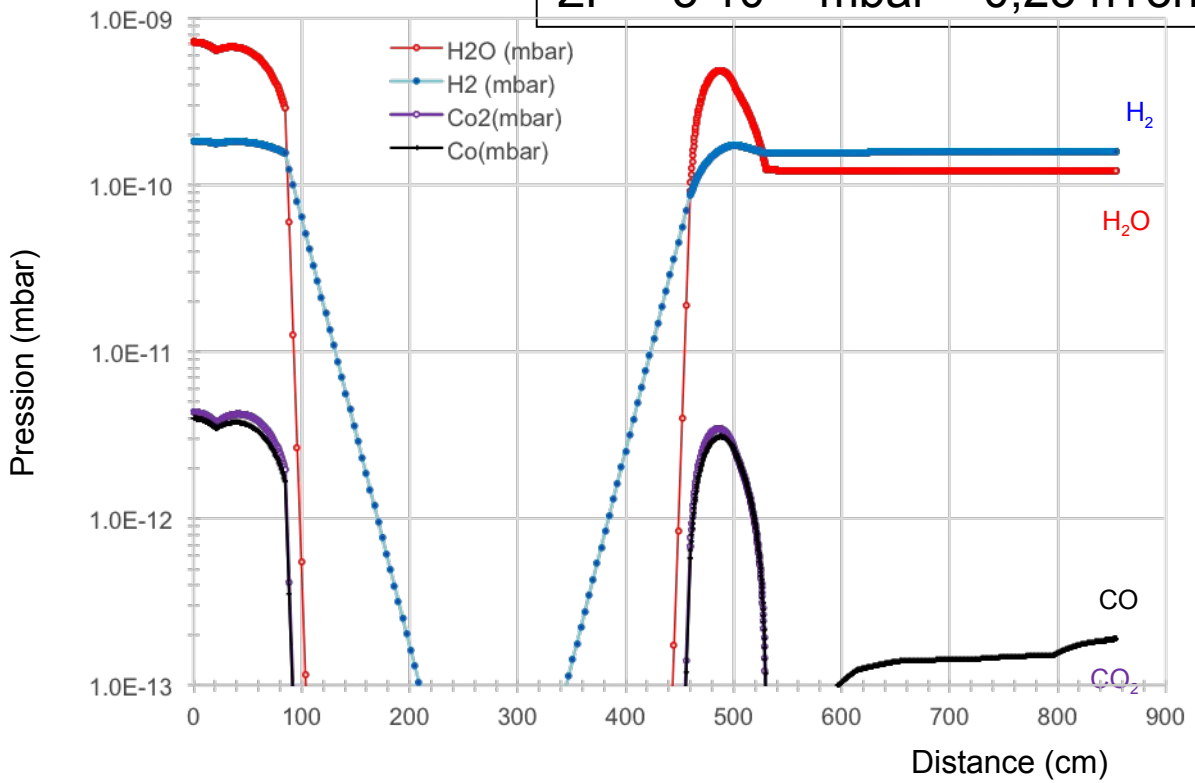
sticking coeff σ(CO;CO2)=0,1
σ(H2)=0,0005
σ(H2O)=0,0005 ??

IP region **with baking**

Alu or Cu or SS after 100h pumping

τ (H_2) = 2.10^{-13} mbar.l.s^{-1}.cm^{-2}
τ (H_2O) = 0 mbar.l.s^{-1}.cm^{-2}
τ (CO) = 2.10^{-15} mbar.l.s^{-1}.cm^{-2}
τ (CO_2) = 5.10^{-16} mbar.l.s^{-1}.cm^{-2}

$\Sigma P = 3\ 10^{-10}$ mbar ~ 0,23 nTorr



Between valves dn40 and dn100
Without baking

T=293K

τ (H_2) = 5.10^{-12} mbar.l.s^{-1}.cm^{-2}
τ (H_2O) = 2.10^{-11} mbar.l.s^{-1}.cm^{-2}
τ (CO) = 1.10^{-13} mbar.l.s^{-1}.cm^{-2}
τ (CO_2) = 1.10^{-13} mbar.l.s^{-1}.cm^{-2}

T=10K

σ (sticking coeff CO, CO2, H2O) = 1

For H_2 pumping by holes in beam screen 2% surface

Interface control document

Proposal of an Interface Control Document (ICD):

Purpose of this document is:

- To know and record technical details of each subdetector
- To understand the consequences at the interfaces (gap, fixations, weight,)
- Follow up of different progress
-

One document by sub detector

Enter all technical details you know today (dimensions, weight, attachment points, center of gravity, positioning constraints, services, power consumption, thermal dissipation, integration specfications,)

Items may be missing (Please help actively to improve the document)

Each ICD will evolve during the phase of study.

They are not casted in stone yet

- ICD will become backbone of ILD Design study!!!
- Status will be monitored at ILD Integration meetings

Interface control document

	Interface Control Document Template	Ref. : Ed. : 1 Rev. : 0 Date: Page : 1/7

Interface Control Document Template

XXXXXXXX (Sub detector name)

Prepared by	*Signature*	Accepted by	*Signature*

Approved by	*Function*	*Date*	*Signature*

Summary	
Annexes	

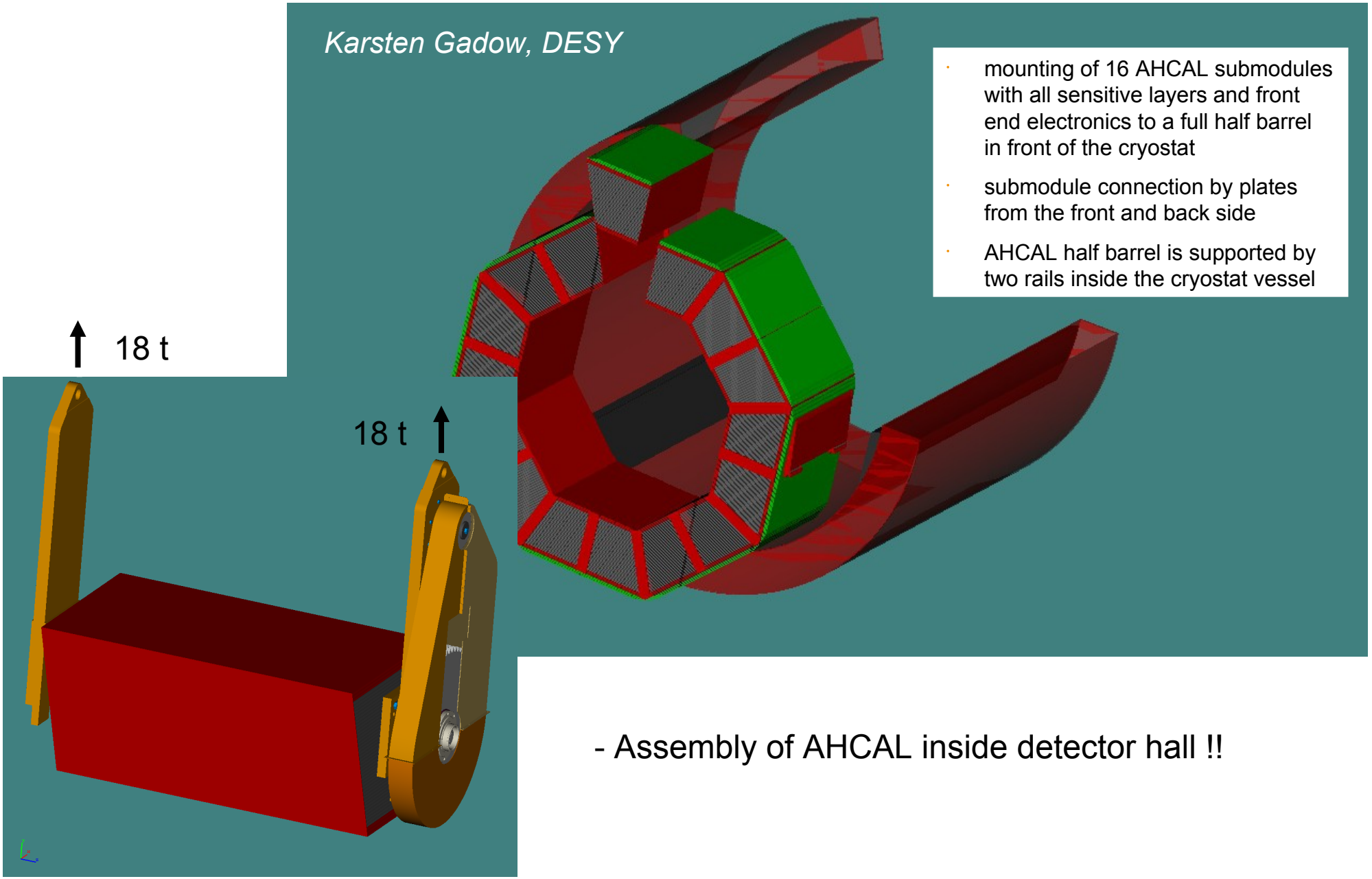
Document Change Record

Edition	Revision	Date	Modified pages	Observations
1	0			

Distribution	*See Distribution list at the end of this document*

Template V1.0

AHCAL Assembly

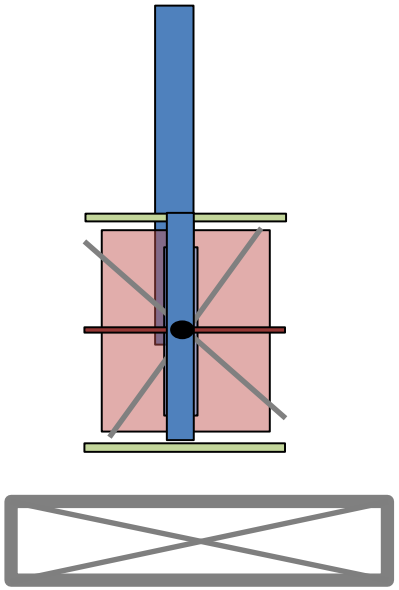


- Assembly of AHCAL inside detector hall !!

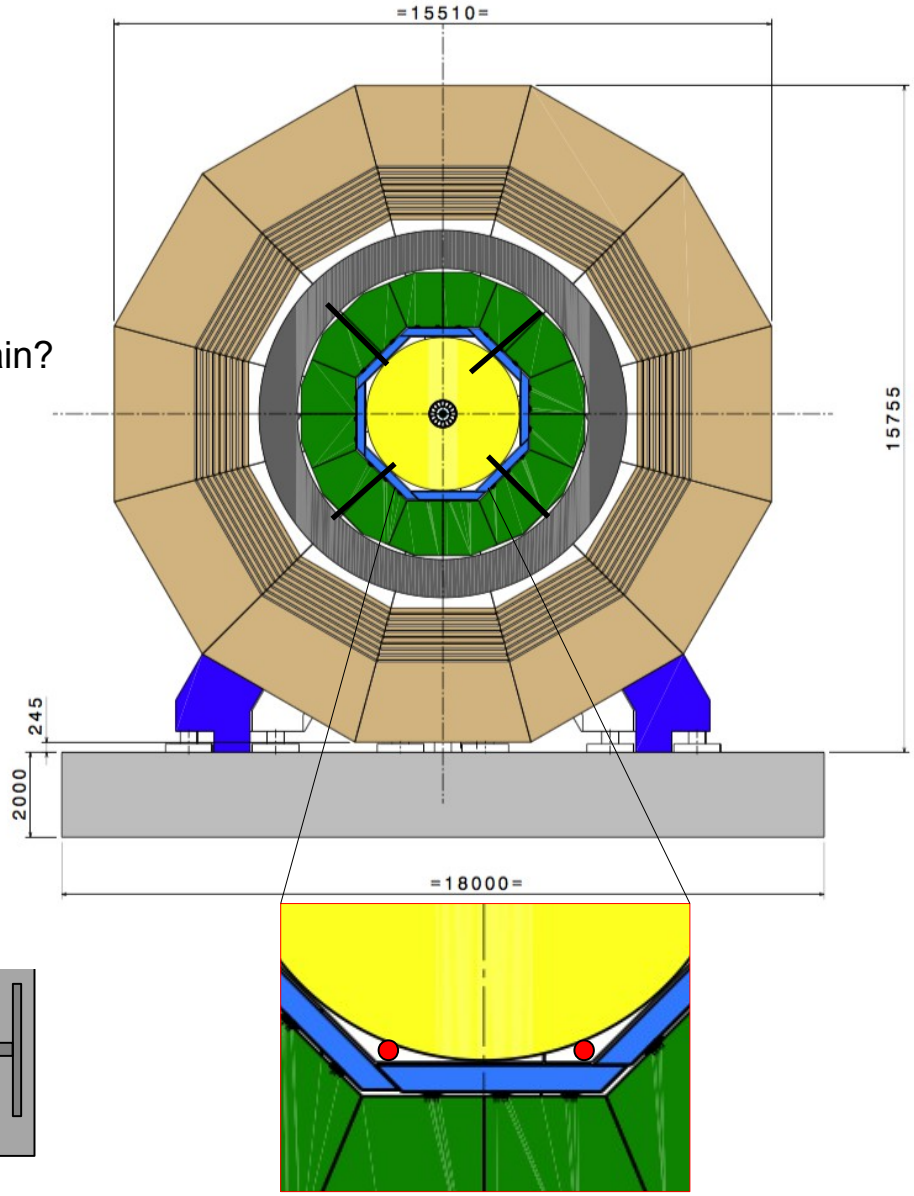
TPC Assembly

Two alternatives considered for assembly:

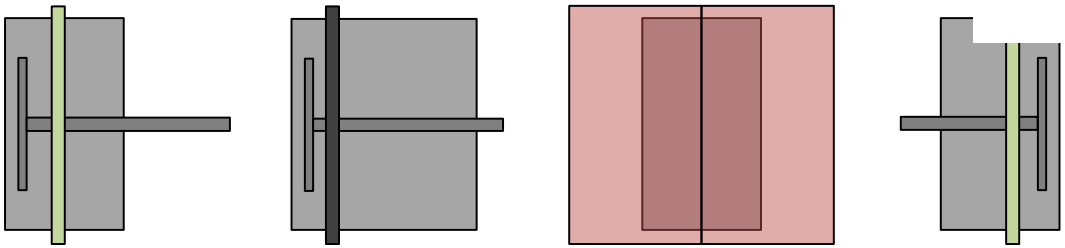
Vertical assembly:



Carbon bands
- How many?
- Size?
- How about longitudinal strain?



Horizontal assembly:

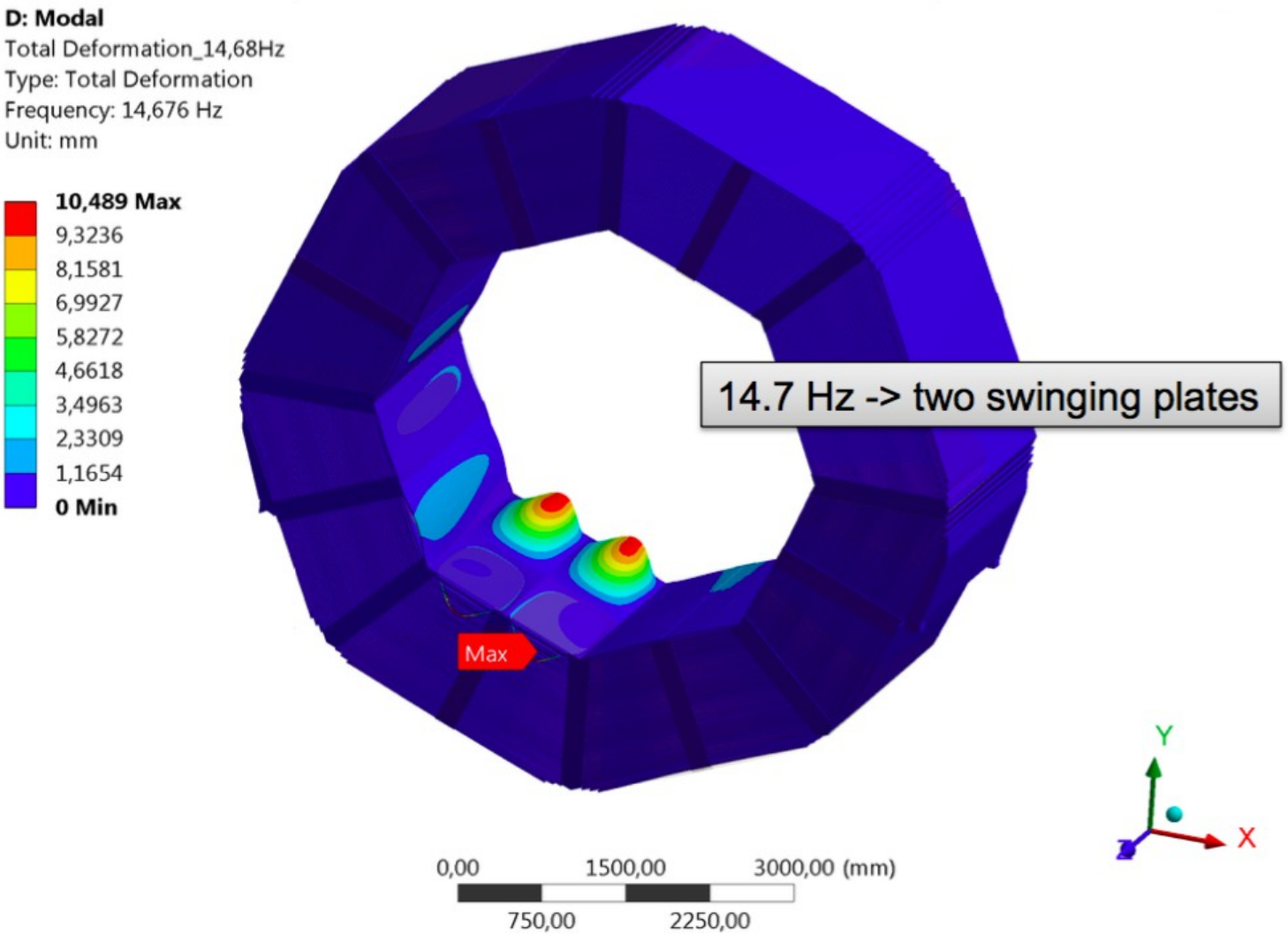


Space for rails?

V. Prahl, T. Schorner-Sadenius, DESY

Seismic Studies

Study Effects of excitation by Earthquake-waves on AHCAL



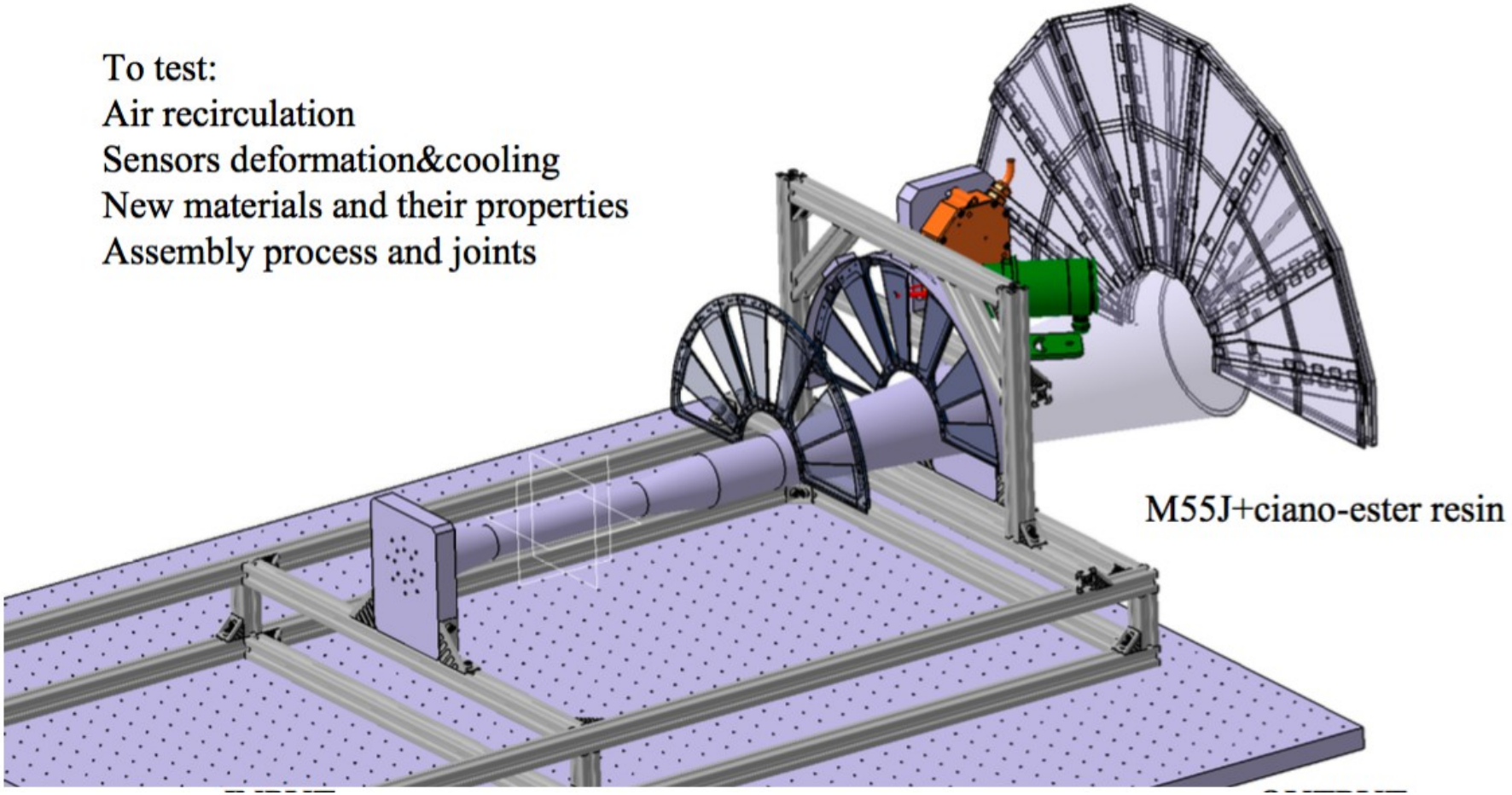
- Detailed simulation
  Different frequencies
  Excite different pieces
  (Different eigenfrequenciest
- Need to find compromise on detail
- Need to extend study to ILD as a whole

K. Gadow, F. Sefkow, DESY

Forward tracking – Mock up

Objective: mechanical setup understanding

To test:
Air recirculation
Sensors deformation&cooling
New materials and their properties
Assembly process and joints



IFIC and IFCA, Spain

Ecal

Per 2/3 stave

LDA		1 per column	5 per module						
			cable ∠	mm²	Nbre	S total cm²	Cu cm²/cable	Cu total	
LV to DC/DC 48>3,3 V	48V/2A	2*1,5mm²of Cu	8	50,24	15	7,536	0,03	0,45	5,97%
HT depletion Wafers 250 V/50µA par layer	250V/1,5mA		8	50,24	15	7,536	0,03	0,45	5,97%
Signal/CC	flat multiwire cable 2,54 mm	0,05cm²*10wires		50,67	15	7,6		0	0,00%
Ground line		1 per module ?		210	3	6,3		6,3	100,00%
			Total			28,972		7,2	24,85%

Where is the optical conversion of signal ?

AHcal

For one half octant

per layer	(48 per 1/2 module)		cable ∠	mm²	Nbre	S total cm²	Cu cm²/cable	Cu total	
1Power	50v 0,3 µA per channel 276 ch/layer	2*5pins SAMTEC IPL1 0,64mm	10*2,54 mm	50,67	48	24,3216	0,032	1,536	6,32%
1 HDMI			8	50,24	48	24,1152	0,03	1,44	5,97%
Ground line		1 per Half octant		210	1	2,1	2,1	2,1	100,00%
			Total			50,5368			
								5,076	