ILD/ILC MDI/Integration/Siting

A dirty job, but someone has to do it…

Karsten Buesser
FLC Retreat
04. December 2017

HELMHOLTZ
GEMEINSCHAFT

DESY

ILD Integration

ILD Technical Deliverables

- For the ILD 2018 document as proposed by Claude
- Update on external constraints:
  - L*, backgrounds, luminosity spectrum,…
  - Primary focus on 250 GeV
- Technological studies since DBD:
  - Latest prototype and beam test results
  - Overall detector structure incl. updated layouts and open options for non-resolved issues
  - Subdetector interfaces (ICD)
  - Mechanical structure studies: static and dynamic
  - Beam background studies update
  - Alignment/calibration procedures
- Detector Modelling:
  - Simulation description incl. hybrid options for calos, methods for BG overlays, anti-DID
  - Two detector models: small (CLIC-like) and large (DBD-like)
- Detector performance on various levels as function of model size and/or technology (hybrid simulations)
  - Response to individual particles
  - Global response incl. particle flow
  - Performance on few physics benchmarks
- Clearly, overlap with Analysis and Software groups’ deliverables

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
-

R. Poeschl
H. Videau

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 Engineering Design study!!!
- Status will be monitored at ILD (Integration) meetings

Three documents

Document on ILD Conventions and rules

	ILD conventions and rules Template	Ref. : ????? Ed. : 0 Rev. : 3 Date: 21/10/16 Page : 1/8

ILD conventions and rules

ILD

Prepared by	*Signature*	Accepted by	*Signature*
Roman Pöschl			

Approved by	*Function*	*Date*	*Signature*

Summary	
Annexes	

Document Change Record

Edition	Revision	Date	Modified pages	Observations
0	1	21/10/16	all	Creation

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

Template V1.0

Obligatory document:
Author: Central Integration Group

Actual ICD

	Interface Control Document Template	Ref. : Ed. : 1 Rev. : 0 Date: Page : 1/9

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

Obligatory document
Author: Subdetector group

Technical Design Document of subdetector

	Interface Control Document Template	Ref. : ????? Ed. : 0 Rev. : 3 Date: 22/8/16 Page : 1/34

Technical Design Document

SiEcal

Prepared by	*Signature*	Accepted by	*Signature*
Marc Anduze Henri Videau			

Approved by	*Function*	*Date*	*Signature*

Summary	
Annexes	

Document Change Record

Edition	Revision	Date	Modified pages	Observations
0	1	7/10/16	all	Creation

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

Template V1.0

Optional document
(Highly recommended)
Author: Subdetector group
-> See talks by Henri and Marc

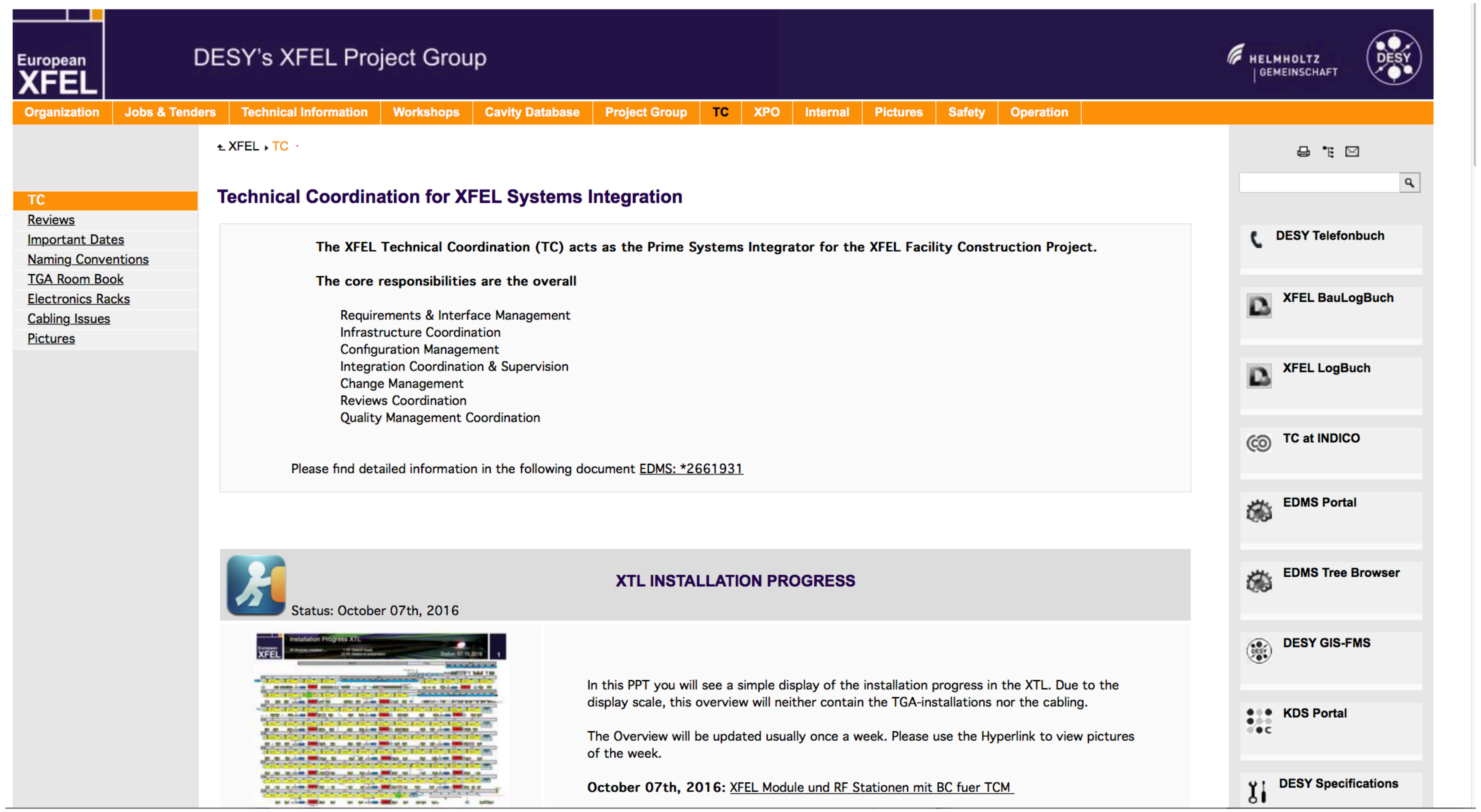
R. Poeschl

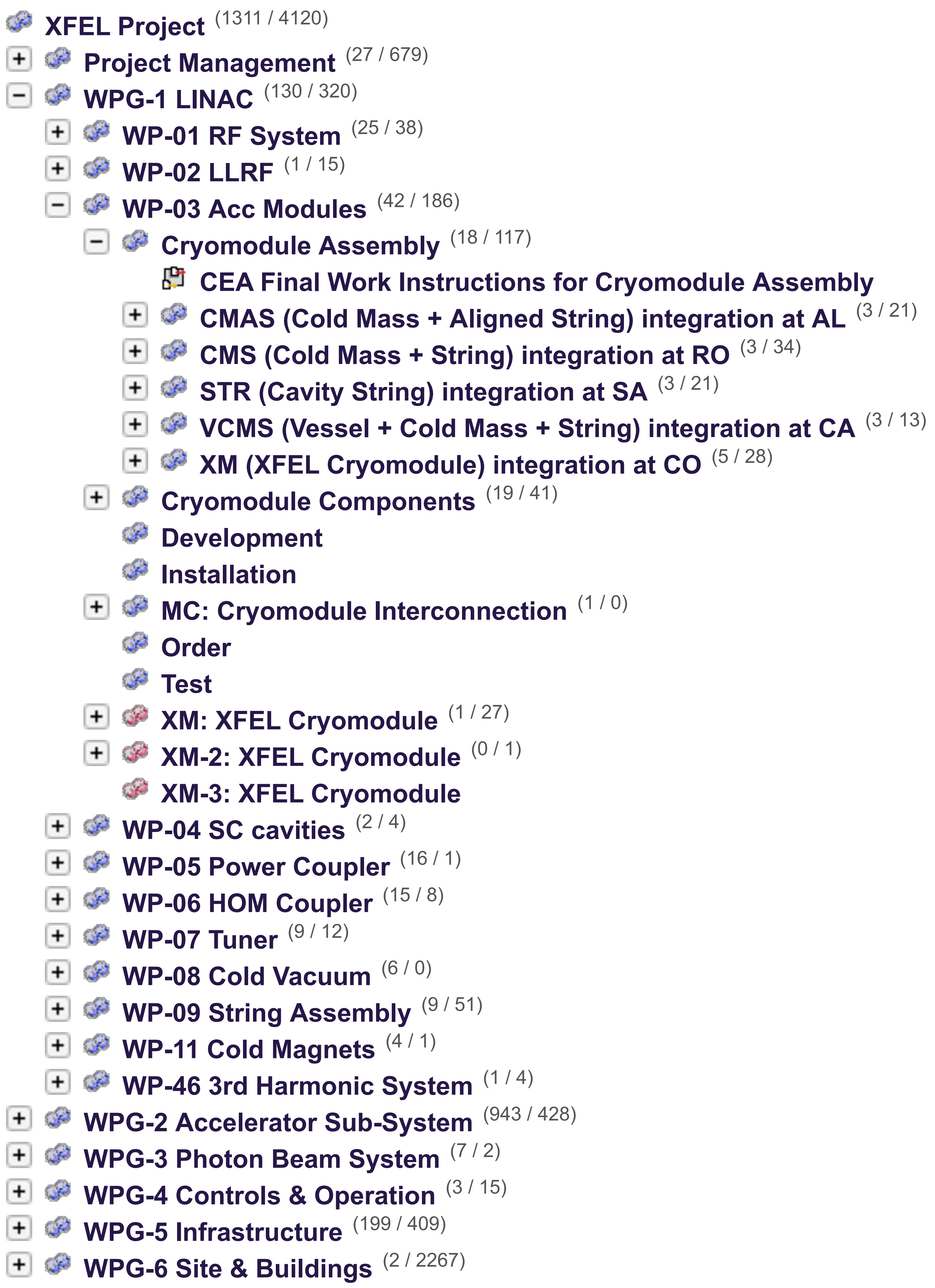
Interface Control Documents - Status

Subdetector	
VTX	discussions have started
SIT/FTD/ETD	discussions have started
TPC	fourth draft available
Si-ECAL	first draft available
Sc-ECAL	first draft available
A-HCAL	discussions have started
SD-HCAL	discussions have started
FCAL	discussions have started
Yoke/Muon	???
ILD Conventions/Rules	first draft available

ILD Work Breakdown Structure

- Work in progress together with IPP (Lars Hagge)
- Define work packages for ILD
- Make WBS available as EDMS tree browser
  - XFEL experience
- Could easily be integrated, e.g into ILD Confluence





ILD Work Breakdown Structure (Draft)

Project	Work Package	Scope	Deliverables
0. ILD		Coordination of the ILD technical design from concepts to publication of a Technical Design Report including simulations and alternatives.	
	1. Specifications and Parameters	Coordination, validation and communication of the boundary conditions.	1.0 Physics Parameters 1.1 Cross sections, Placeholders 1.2 High-ranking Milestones
	2. Vertex Detector	Coordination of the VTX technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	2.0 Specifications 2.1 3D Model 2.2 Interface Control Documents
	3. Intermediate Tracking	Coordination of the Intermediate Tracking technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	3.0 Specifications 3.1 3D Model 3.2 Interface Control Documents
	4. TPC	Coordination of the TPC technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	4.0 Specifications 4.1 3D Model 4.2 Interface Control Documents
	5. Si-ECAL	Coordination of the Si-ECAL technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	5.0 Specifications 5.1 3D Model 5.2 Interface Control Documents
	6. Sc-ECAL	Coordination of the Sc-ECAL technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	6.0 Specifications 6.1 3D Model 6.2 Interface Control Documents
	7. A-HCAL	Coordination of the A-HCAL technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	7.0 Specifications 7.1 3D Model 7.2 Interface Control Documents
	8. SD-HCAL	Coordination of the SD-HCAL technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	8.0 Specifications 8.1 3D Model 8.2 Interface Control Documents
	9. Coil	Coordination of the Coil technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	9.0 Specifications 9.1 3D Model 9.2 Interface Control Documents
	10. Yoke+Muon	Coordination of the Yoke and Muon System technical design in context of ILD from concepts to publication of the TDR in the framework of the given specifications and parameters.	10.1 Specifications 10.1 3D Model 10.2 Interface Control Documents
	11. Site and Buildings	Coordination of the site and building design in context of ILD and ILC from concepts to publication of the TDR.	11.0 Specifications 11.1 Plans/Models
	12. Integration	Coordination of the mechanical and electrical integration of ILD from concepts to publication of the TDR.	12.0 Conventions and Rules 12.1 3D Model
	13. Configuration Management		
	14. Physics Simulation		14.0 Performance Model 14.1 Geant Model
	15. Project Management		15.1. Planning 15.1.0 Assembly 15.1.1 Time Plans 15.2 Costing
	16. Technical Documentation	Compilation of all documents required by external recepients.	16.0 TDR 16.1 Technical Safety Concept 16.2 Radiation Safety Concept

ILD Integration Task Force

- Proposed by Claude
- Charge:
  - Foster production of Interface Control Documents
  - Define a coherent ILD detector within the experimental hall
  - To be documented in the ILD Technical Design Documentation and the ILD document by the end of 2018
- Face-to-face (open) meeting: one day, candidate days Jan 30/ Feb 1/ Feb 2 at LAL

Task	Physicists	Engineers
Central Design and Integration	Roman Poeschl, Yasuhiro Sugimoto, Claude Vallee, KB	Christian Bourgeois, Alexandre Gonnin
VTX	Auguste Besson	
FTD	Ivan Vila, Marcel Vos	David Moya, M.A. Villarejo Bermudez
TPC	Paul Colas	Volker Prahl
ECAL	Henri Videau	Marc Anduze
HCAL	Imad Laktineh, Felix Sefkow (Katja Krüger)	J-C. Ianigro, (Karsten Gadow)
Yoke/Coil	Uwe Schneekloth	Richard Stromhagen
VFS	Sergej Schuwalow	
DAQ	Mattthew Wing	

FLC Input on Integration

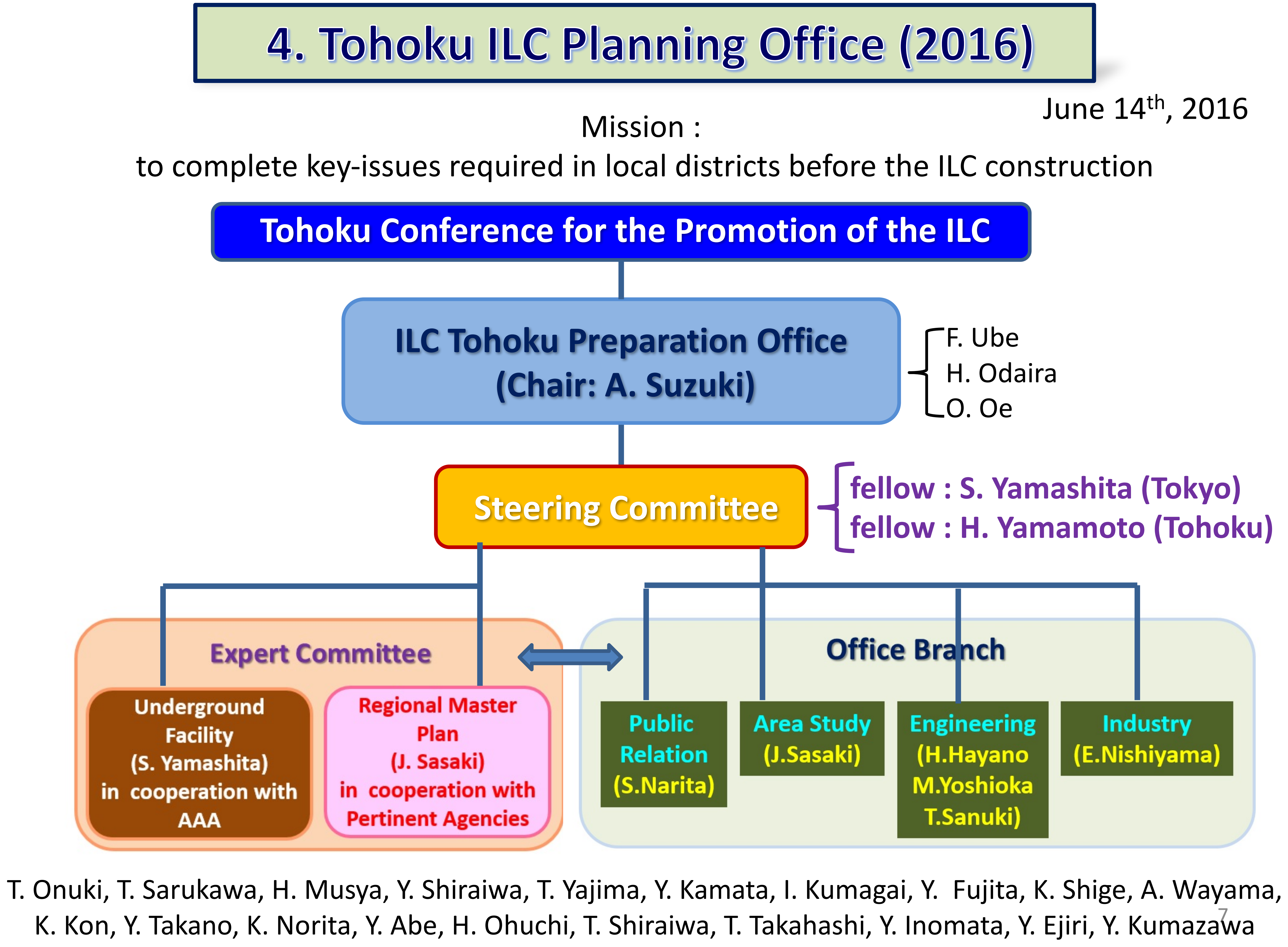
- A lot of work ongoing within the subdetector collaborations
  - A-HCAL: Felix, Katja, Karsten G
    - Dynamic simulations: Felix, Martin Lemke (ZM)
  - TPC: Volker
  - Magnet/Yoke: Uwe, Richard
- General ILD integration work at FLC: Claude, KB, (Klaus), Lars Hagge (IPP)
  - badly needed: an integration engineer at DESY: CAD model integration, collaboration with engineers at LAL

- All defined milestones for ILD integration done before end of 2018
  - quite natural…
- If ILC comes, this effort needs to be ramped up significantly
  - DESY/FLC could really play the leading role for the ILD integration for a real TDR and beyond
- If ILC dies, the future of this work depends on the future of the ILD concept
  - If there is another application (CEPC?), we might continue on some level
  - If no foreseeable future of ILD, then this task will also go into hibernation

ILC Site-specific Design

Tohoku Activities

- The Tohoku ILC Planning Office (Suzuki et al.) is currently in the driver's seat
- Their engineering group has taken over the site-dependent design activities
  - some support from KEK (H. Hayano)
- This seems to be mostly de-coupled from LCC
  - change control does not work anymore
- It is hard to establish working relations with the local experts
- Need to find ways to make sure that ILD requirements are not forgotten



Site-specific Design Evolution

- Hitoshi Hayano:

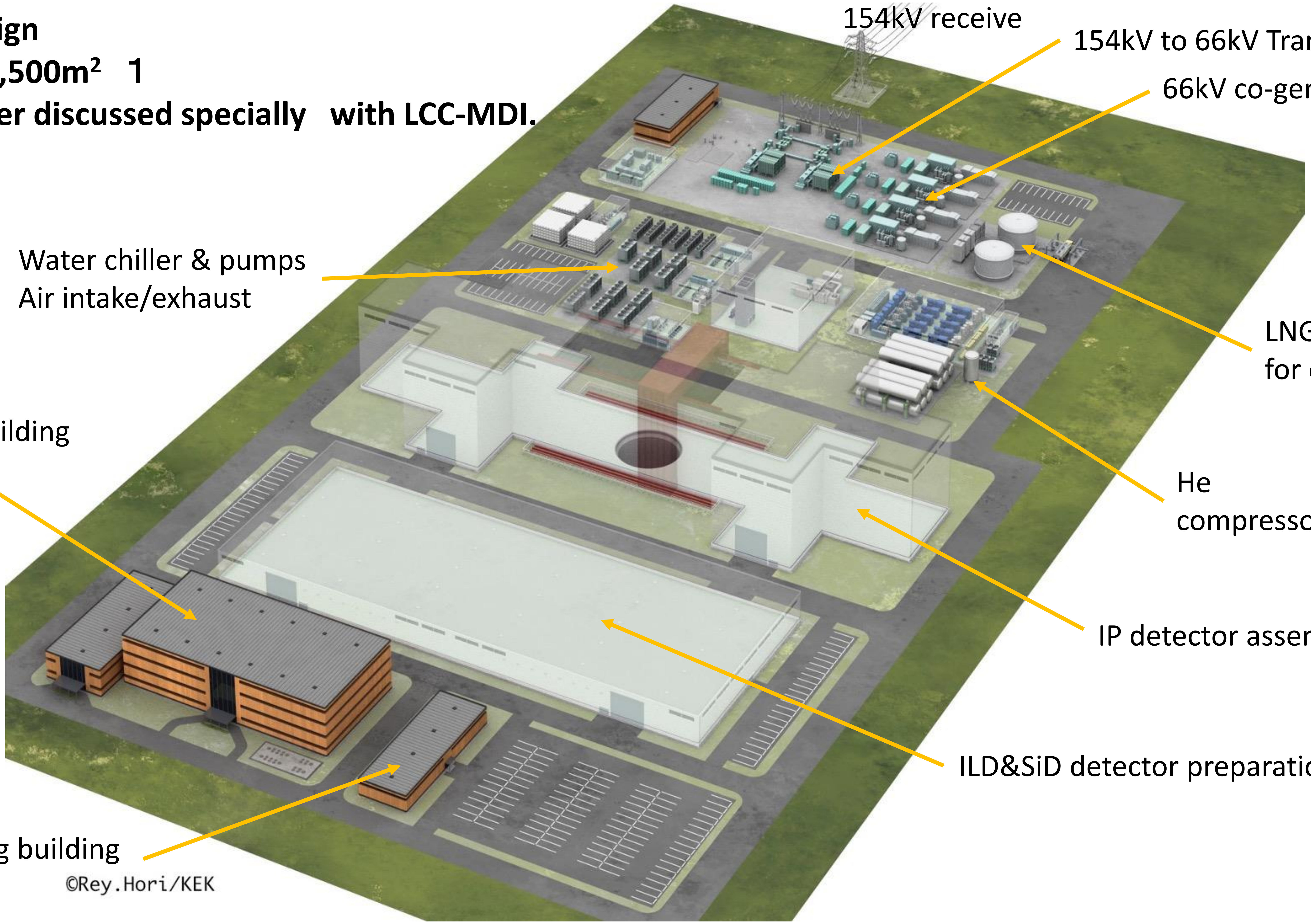
- Site-specific design deviates from TDR
  - to be expected
  - but what about Change Control?

Changes	Different points in RED	TDR Option C	Site-specific Option C
cost base		before 2011-earthquake	2014 for civil, 2016 for others
CFS-Civil	tunnel	9.5m width & 1.5m shield wall for ML, same to TDR for BDS, DR on-site construction of shield wall	9.5m width & 1.5m shield wall for ML, same to TDR for BDS, DR pre-cast shield wall & fabrication on site
	access tunnel	1km for 5 access tunnel assumed	site-dependent 5 access tunnel, total length=4876m, same cross-section shape to TDR
	drain tunnel	no cost cosideration	1 drain tunnel with 0.13% & 4335m to the river. natural drain for emergency (for long time AC down)
	underground access hall	180m x 20m x 14m cavern for 4 access halls	new design: separate 4 caverns for 5 access halls
	detector hall	TDR updated design 108m x 25m x 42m ϕ18 x 70m: 1 vertical shaft	Detector hall combined with-Utility-hall 133 x 25 x 42m ϕ18 x 75m: 1 vertical shaft
	Utility hall	TDR updated design 80m x 20m x 10m: 1 cavern ϕ10 x 98m: 1 vertical shaft	included to detector hall 2 new 3m-width bypass tunnel are added ϕ10 x 75m: 1 vertical shaft
	surface access station	5000m^2 x 4 stations, with land-dvlp, w-bldg	18000m^2 x 5 stations, with land-dvlp, w/o-bldg
	surface IP	20000m^2 x 1, land-dvlp, w-bldg	80000m^2 x 1, with land-dvlp, w/o-bldg
			new surface building design, costed by MEXT rule
	manage engineering	+5.5%	including in the estimation
CFS-others	Electric	275kV recv, 10MW emergency generator are included. Wire is excluded.	154kV recv & 10MW co-gneration, excluded (later, pay in operation)
	Mechanical (water, air)	cooling water for accelerator: ⊿T=10C, whole-vol air excg, tunnel temp=29C	water-line to ILC, excluded(later, pay in operation) cooling water for accelerator: ⊿T=30C, 1/3-vol air excg, tunnel temp= 18-22C
	handling, safty, survey	as TDR	TEL & Crane are excluded (lease) , accelerator handling & survey are excluded
	manage engineering	+5.5%	including in the estimation

IR Surface Area

- Hitoshi Hayano: **surface design**
  IP area 78,500m^2 1
  to be further discussed specially with LCC-MDI.

- modular design arrangement could be different in reality



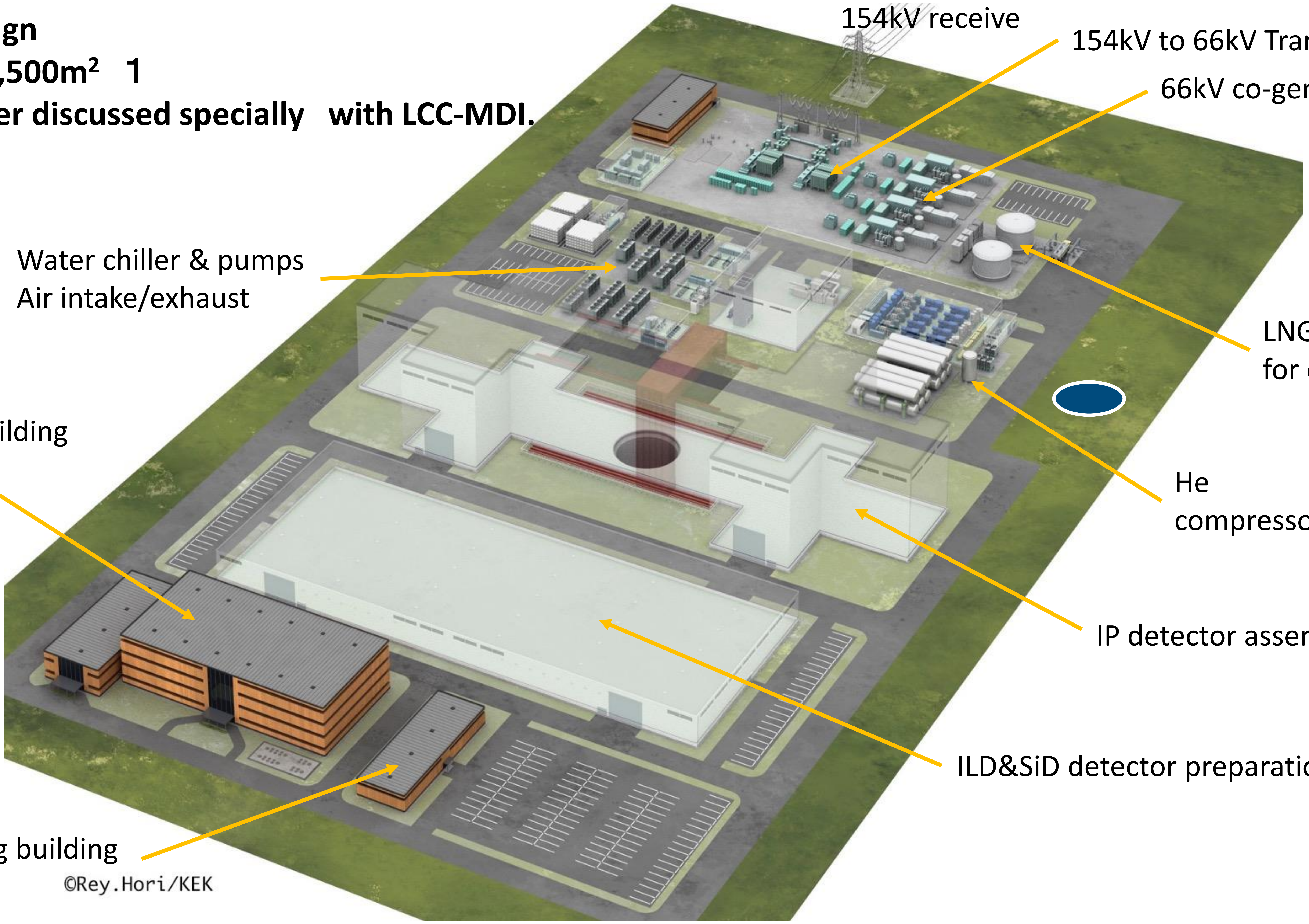
9

IR Surface Area

- Hitoshi Hayano:

surface design
IP area 78,500m^2 1
to be further discussed specially with LCC-MDI.

- modular design arrangement could be different in reality

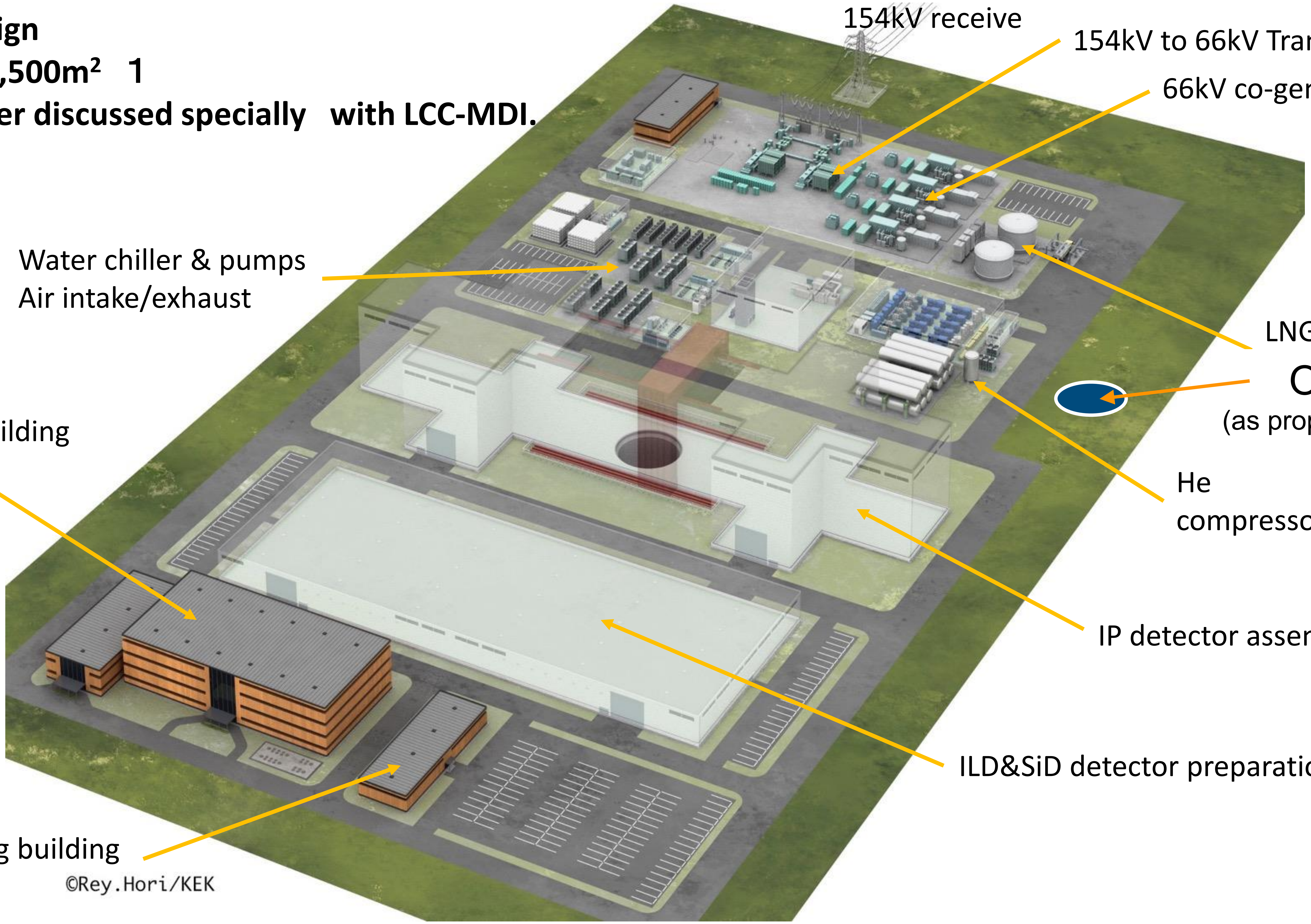


IR Surface Area

- Hitoshi Hayano:

surface design
IP area 78,500m² 1
to be further discussed specially with LCC-MDI.

- modular design arrangement could be different in reality

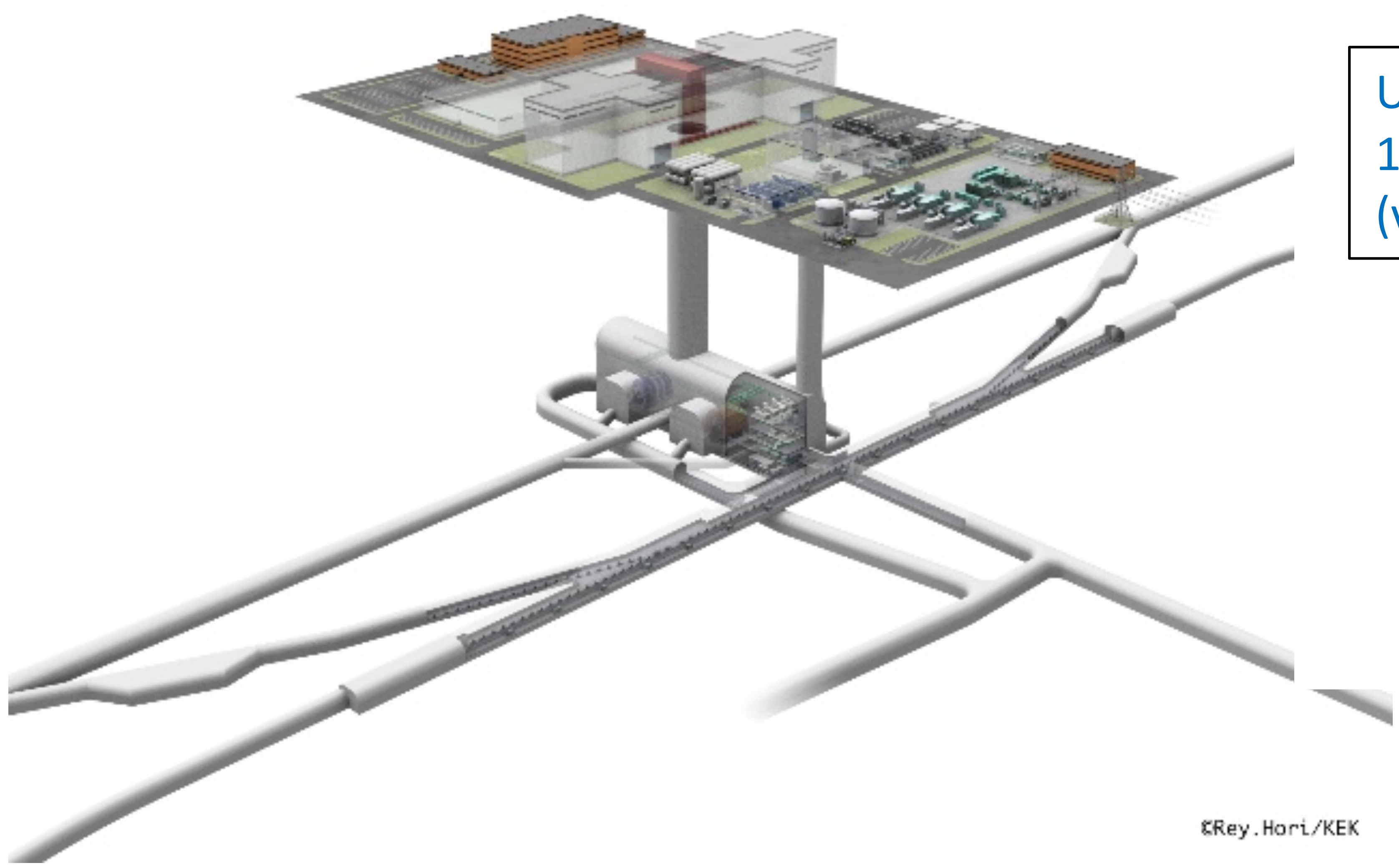


9

Conflicts (?)

- Hitoshi Hayano:

- Space for detector utilities not sufficient



Proposal of Utility Cavern Movement at Interaction Point

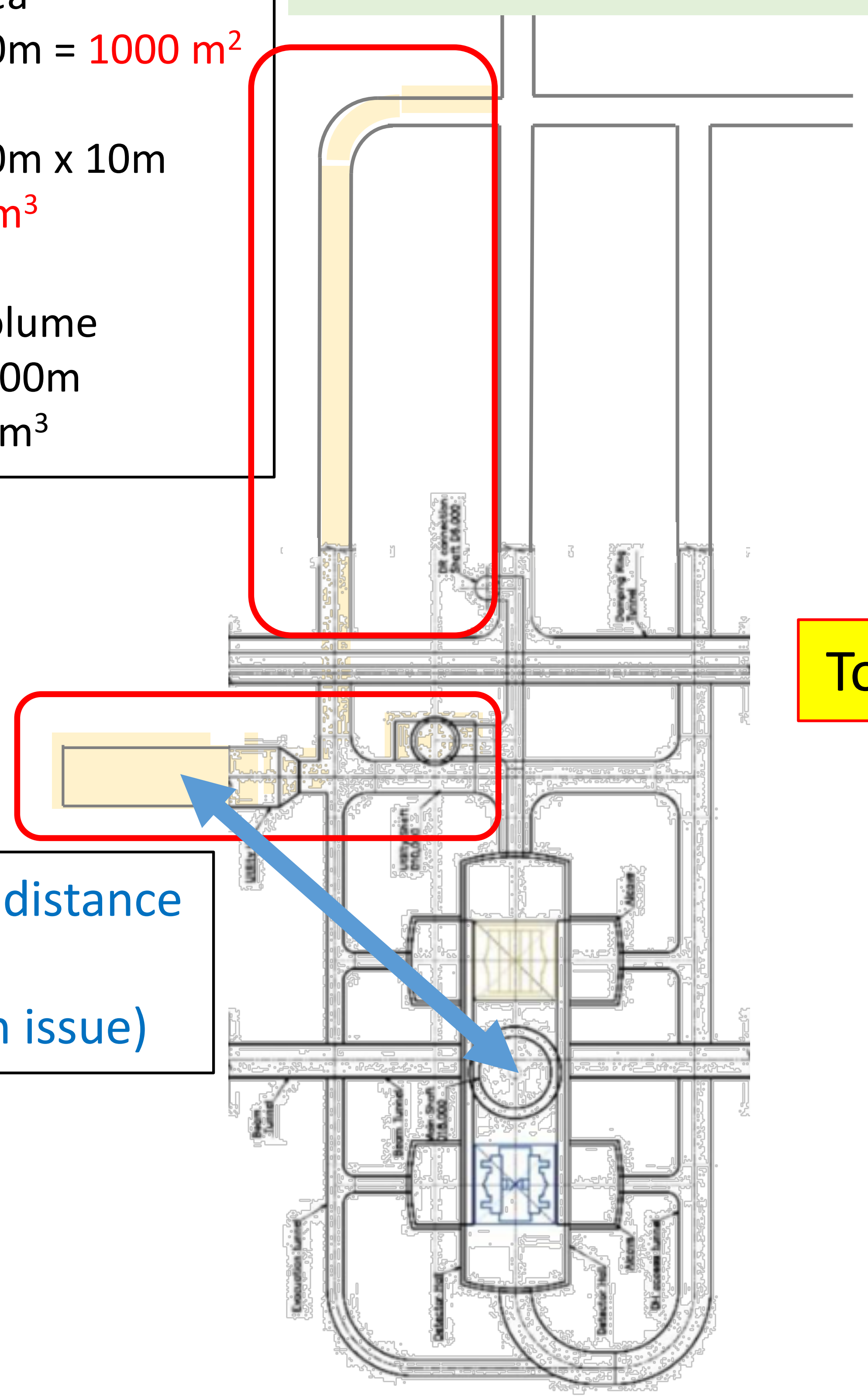
Considering power flow, water flow and air flow between utility shaft and the devices,

TDR updated (two vertical shafts)

Utility hall
Floor Area
50m x 20m = 1000 m^2
volume
50m x 20m x 10m
=10,000m^3

Tunnel volume
53m^2 x 200m
=10,600 m^3

TDR updated in 2015



Utility-IP distance
109m
(vibration issue)

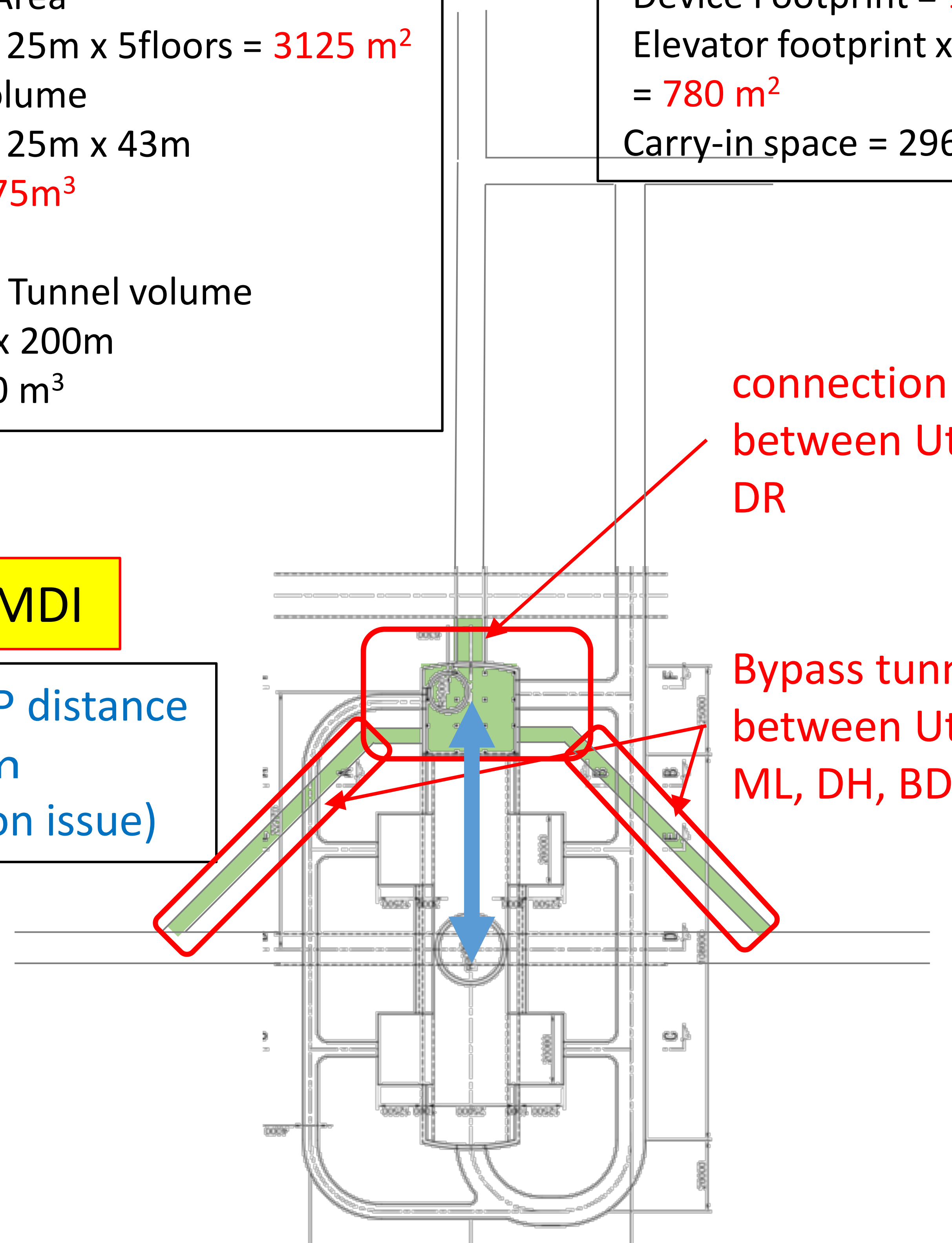
To be discussed w/ LCC-MDI

Proposed design of Utility cavern

Utility hall
Floor Area
25m x 25m x 5floors = 3125 m^2
hall volume
25m x 25m x 43m
=26,875m^3

Bypass Tunnel volume
13m^2 x 200m
=2,600 m^3

Required Utilities footprint
Device Footprint = 1305 m^2
Elevator footprint x 5 floors
= 780 m^2
Carry-in space = 296 m^2



connection tunnel between Utility and DR

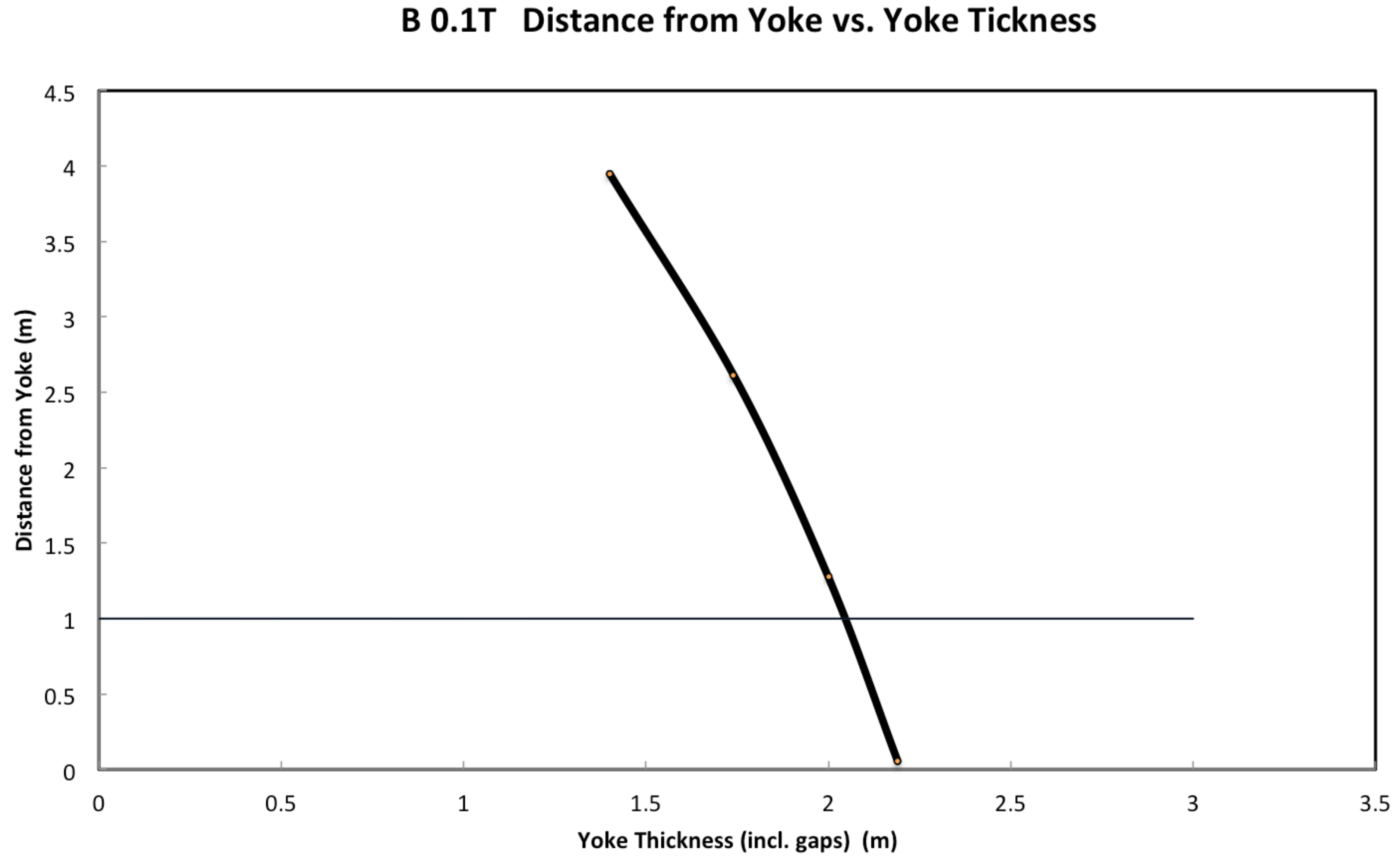
Bypass tunnels between Utility and ML, DH, BDS, dumps

Utility-IP distance
66. 5m
(vibration issue)

Q: How simple is Energy flow?
what is the effect of mechanical vibration to IP?

Reducing Yoke Thickness

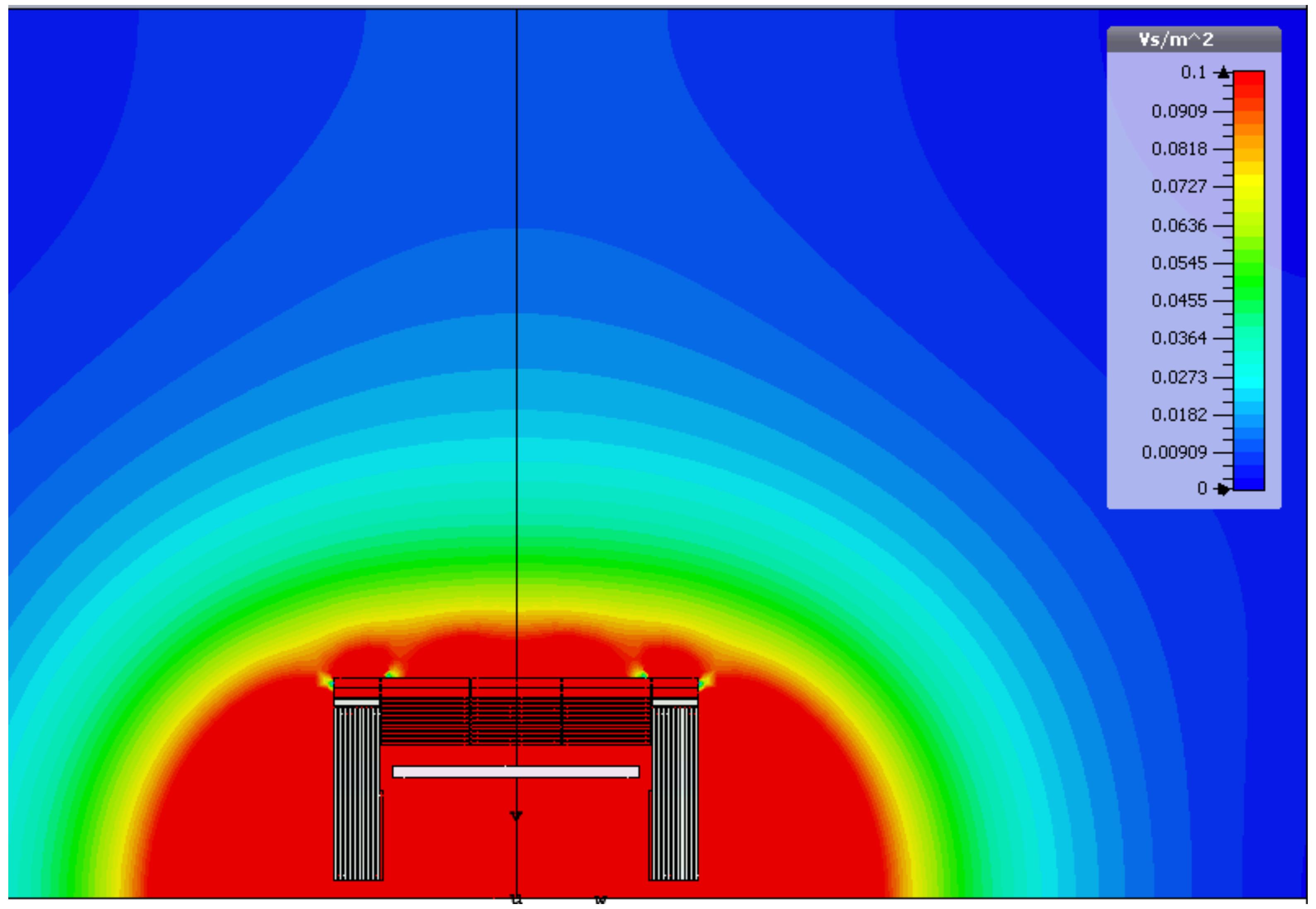
- U. Schneekloth:

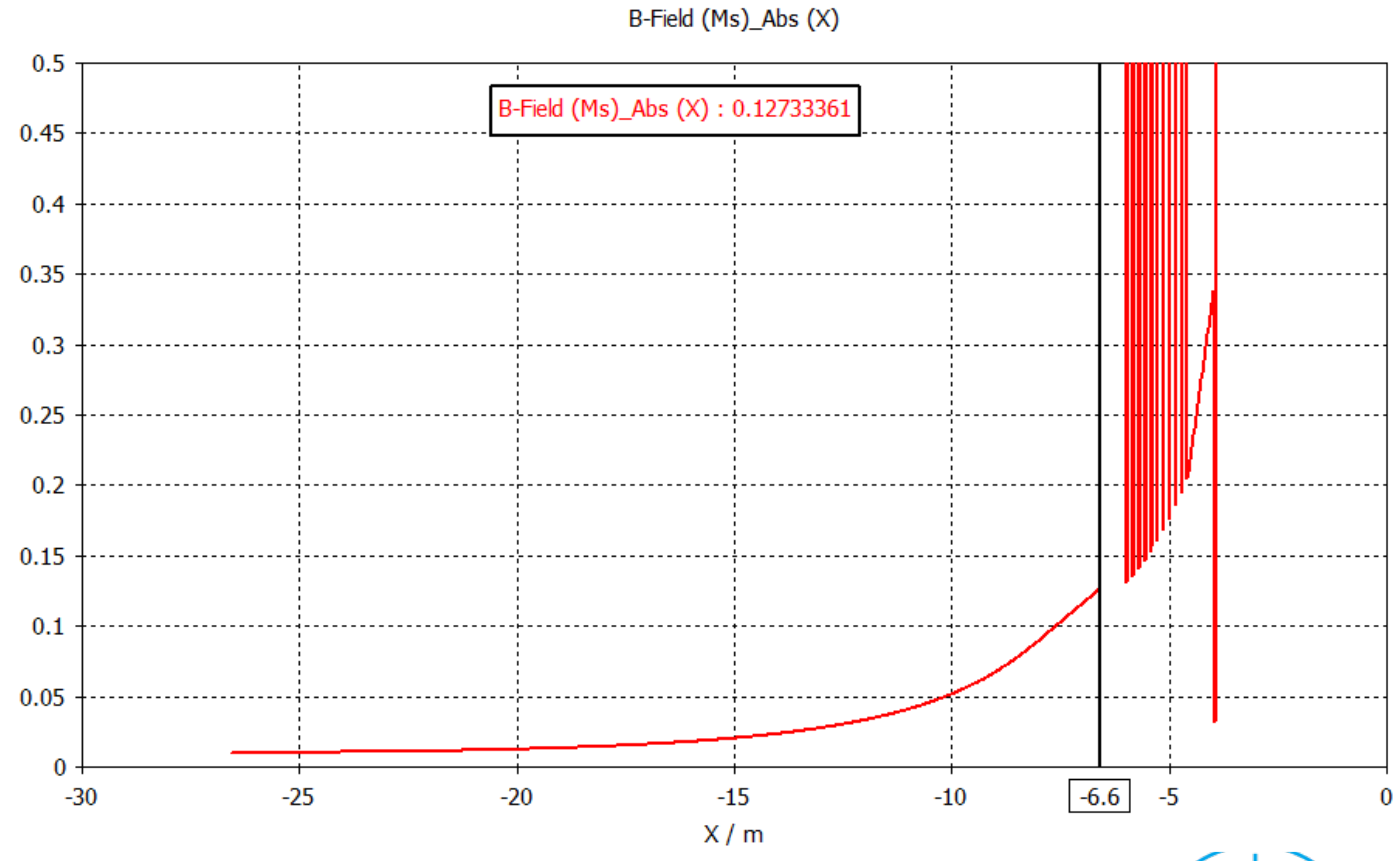


Yoke size and thickness reduced

> B 0.1mT at 1m from yoke for

- R_{out} = 6.6m (instead of 7.76m)
- iron thickness 2.04m including gaps

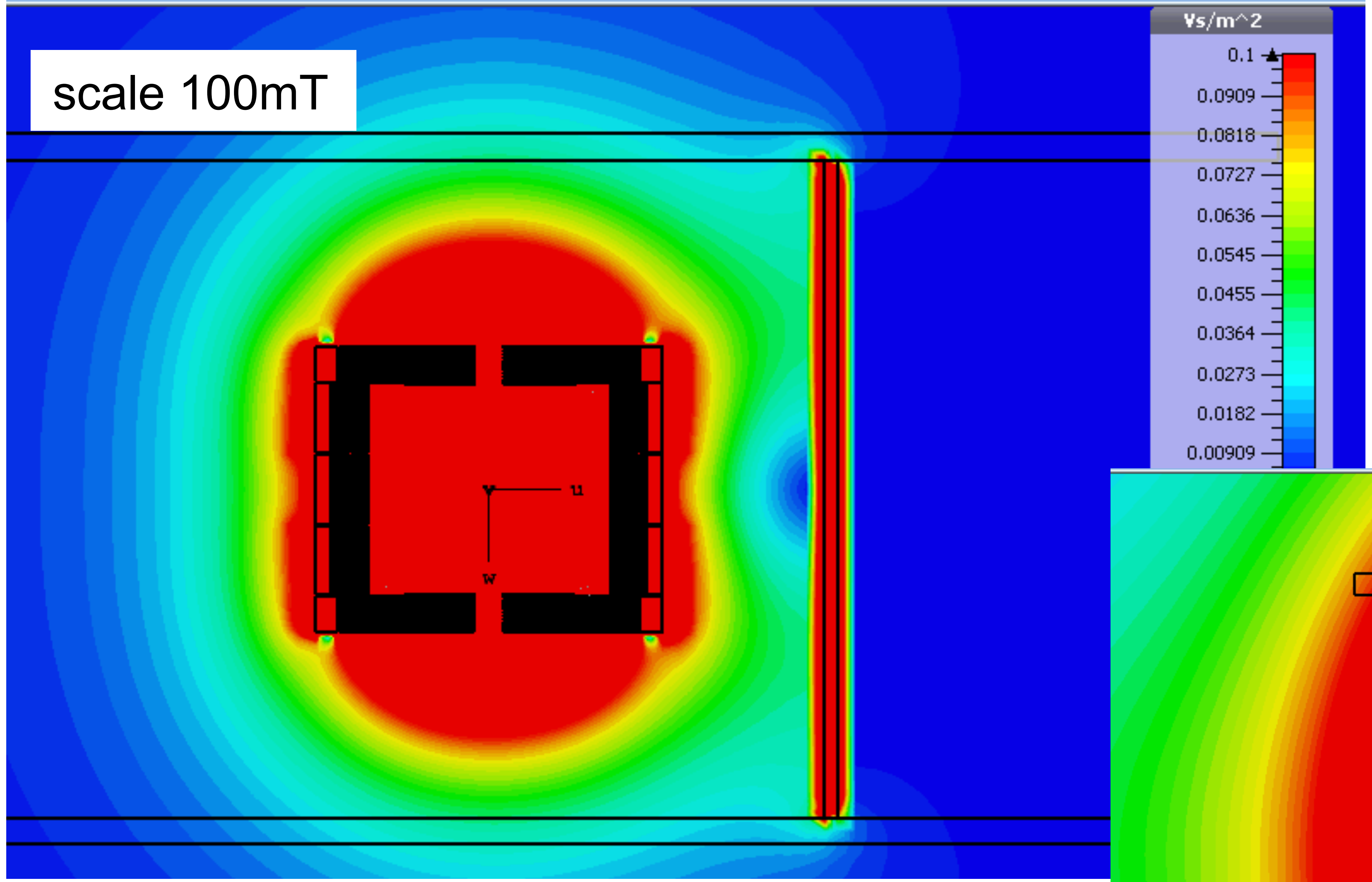




Uwe Schneekloth | ILD B-Field, Yoke Options, Dec 2016| Page 17

Reduced Yoke – Shielding Wall

- U. Schneekloth:

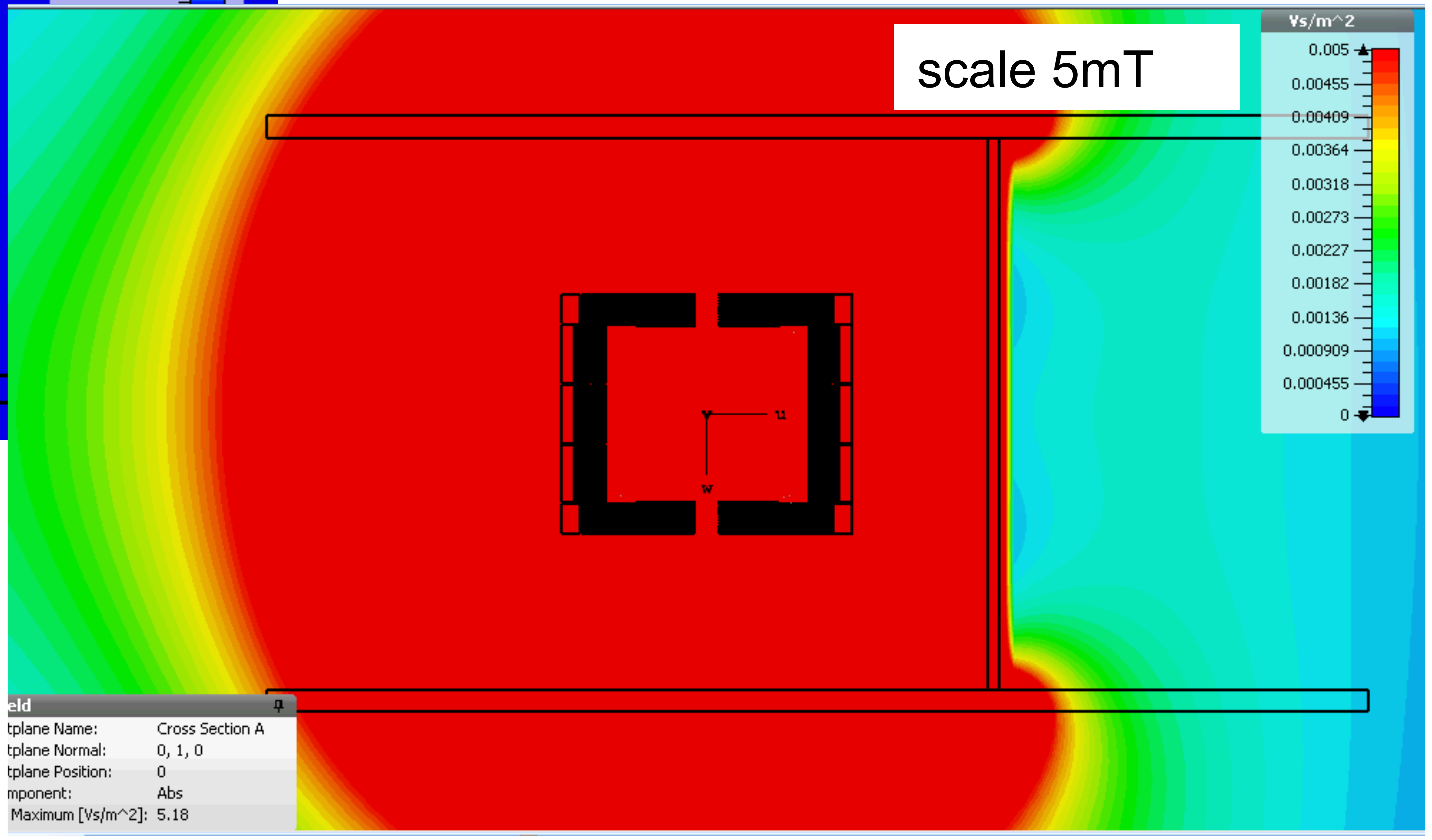


Preliminary, hexahedral mesh

Movable iron shielding wall

> 13m from beam line

> 25m x 12m x 0.5m



Rough cost estimate

> Yoke 37 instead of 81MILCU

> Shielding wall O(7MILUC), assuming same unit cost as for yoke
> (Should be cheaper, but need moving platform)

> Could reduce hall height by approx. 1m

> May need some concrete shielding

Mini-Workshops on ILC Infrastructure for Detectors

- Spin-off of the LCCPDeb Infrastructure Working Group (S. Yamada)
- Forum to bring together experiments, machine experts, CFS group and local experts
  - Status of local planning
  - Detector requirements on infrastructure
  - Access and transportation
  - IP Campus and central lab design
  - Magnets (Solenoids, Anti-DID)
  - Cryogenics
  - …
- Sponsored by E-JADE
- Five workshops so far:
  - 08/09 2015
  - 03/2016
  - 09/2016
  - 05/2017
  - 09/2017
- About 15-20 regular participants
- Next: 23.02.2018, right after ILD workshop

E-JADE
Europe -Japan Accelerator
Development Exchange Programme

FLC Input on Infrastructures

- ILD requirements (transportation, facilities, etc.)
- Estimates on number of people at IP and central campus during assembly, operations, maintenance periods
- Requirements for central lab infrastructure (DESY experience)
- Requirements for IP infrastructure and detector/machine assembly (HERA experience)
- Studies on ILD yoke and magnet
- Requirements for/from sub-detectors (services, assembly)
- Earthquake protection

- Regular FLC (and friends) participants:
  - Felix, Klaus, Richard, Thomas, Uwe, KB

- SiD is not able to make significant impact, all requirements are driven by ILD
- FLC is recognised as centre of competence for these questions!
  - Prominent example: the vertical shaft access was the result of an FLC initiative!
- It is natural to continue our involvement until end of 2018
  - co-incides also with end of E-JADE

Summary

Summary and Outlook

- All current work is nicely focused towards a decision point in 2018
- ILD integration work has two main goals
  - Technical design documentation on EDMS WBS
  - Input for ILD documents to be written by end of 2018
- List of technical deliverables is being followed up

- Infrastructure work continues until end of 2018 when also E-JADE comes to an end
  - whatever follows, depends on the future of the ILC
- If there is no positive sign from Japan, this part of the work will surely stop
  - Document as much as possible and keep experience and expertise for other future projects
  - I see no large future collider project where we could contribute to at a similar level at this time
    - CLIC/FCC are in good CERN hands, CEPC organised by China (maybe we could help there when it gets more realistic)

- If ILC does not come, any integration/infrastructure work would have to focus on subdetector designs
  - conceptual studies, integration for dedicated problems, for generic future collider projects
- Or re-focus on other projects, e.g. IAXO, MADMAX, …
- If ILC comes, times will get interesting…
  - MDI/Infrastructure: International ILC lab has to take over organisation - focus would naturally shift towards local experts
  - ILD integration would be a major work package for a future TDR and beyond - DESY could be a major player