Norbert Meyners, MEA

Report of the

Interaction Region Engineering Design Workshop
IReng'07 Sept. 17-21; 2007 SLAC

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- Special Aspects
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    - FD-Magnets/Cryo Supply (WG A & WG B)
    - Vacuum (WG A & WG B)
    - Hall Dimensions (WG A & WG C)
    - General Supplies (WG A & WG C)
    - Experience from other detectors
- Conclusion

It is only a personal bias selection!

IR in RDR and goals of IRENG07

- ILC IR in Reference Design Report, major features:
  - **Single Interaction Region with 14mr crossing angle**
  - **Two detectors operating in push-pull mode**
  - **On surface assembly of the detectors**
  - **Deep site (added NM)**
- Goals of IRENG07
  - **To advance the design of the ILC Interaction Region, focusing in particular on integration, engineering design and arrangements for push-pull operation**

IRENG07 Working Groups

- **WG-A: Overall detector design, assembly, detector moving, shielding.**
  - **Including detector design for on-surface assembly and underground assembly procedures. Beamline pacman & detector shielding…**
    - **Conveners: Alain Herve (CERN), Tom Markiewicz (SLAC), Tomoyuki Sanuki (Tohoku Univ.), Yasuhiro Sugimoto (KEK)**
- **WG-B: IR magnets design and cryogenics system design.**
  - **Including cryo system, IR magnet engineering design, support, integration with IR, masks, Lumi & Beamcals, IR vacuum chamber...**
    - **Conveners: Brett Parker (BNL), John Weisend (SLAC/NSF), Kiyosumi Tsuchiya (KEK)**
- **WG-C: Conventional construction of IR hall and external systems.**
  - **Including lifting equipment, electronics hut, cabling plant, services, shafts, caverns, movable shielding; solutions to meet alignment tolerances...**
    - **Conveners: Vic Kuchler (FNAL), Atsushi Enomoto (KEK), John Osborne (CERN)**
- **WG-D: Accelerator and particle physics requirements.**
  - **Including collimation, shielding, RF, background, vibration and stability and other accelerator & detector physics requirements…**
    - **Conveners: Deepa Angal-Kalinin (STFC), Nikolai Mokhov (FNAL), Mike Sullivan (SLAC), Hitoshi Yamamoto (Tohoku Univ.)**

Work in preparation for IRENG07

- In preparation for the workshop, the Working Groups had series of preparatory meetings

- In these meetings ~50 talks were presented, and about a week of discussion time was integrated

- These meetings allowed to iterate on design and

- **WG-A, conveners meeting, July 5**
- **WG-D, conveners meeting, July 11**
- **WG-A, group meeting, July 12**
- **WG-B, conveners meeting, July 13**
- **WG-C, group meeting, July 17**
- **WG-B, group meeting, July 23**
- **WG-C, group meeting, July 24**
- **WG-A, group meeting, July 30**
- **WG-C, group meeting, July 31**
- **WG-D, group meeting, August 1**
- **WG-B, group meeting, August 2**
- **WG-A, group meeting, August 6**
- **WG-C, group meeting, August 7**
- **WG-A, group meeting, August 13**
- **WG-D, group meeting, August 15**
- **WG-B, group meeting, August 16**
- **WG-A, group meeting, August 20**
- **WG-C, group meeting, August 21**
- **WG-A, group meeting, August 27**
- **WG-C, group meeting, August 28**
- **Conveners and IPAC meeting, August 29**
- **WG-B, group meeting, August 30**
- **WG-B, group meeting, September 13**

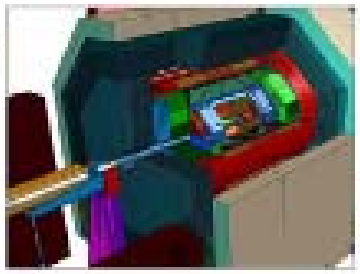
http://www-conf.slac.stanford.edu/ireng07/agenda.htm

Monday, Sept. 17th (morning, plenary)

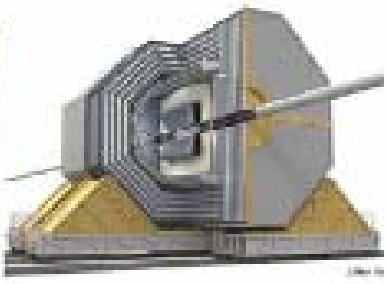
- Overview about the four detector concepts

09:50 GLD Concept (30') (Slides)	Toshiaki Tauchi (*KEK*)
10:20 LDC Concept (30') (Slides)	Norbert Meyners (*DESY*)
10:50 Coffee break (20') (Location: Kavli Auditorium, lobby)	
11:10 SiD Concept (30') (Slides)	Kurt Krempetz (*Fermilab*)
11:40 4th Concept (30') (Slides)	John Hauptman (*Iowa State*)

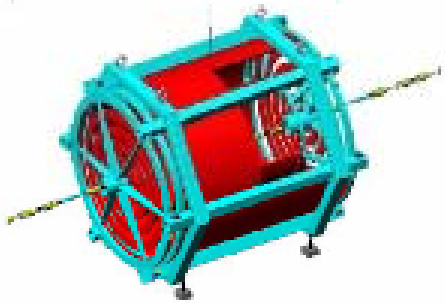
SiD



LDC



GLD



4th

Monday, Sept. 17th (afternoon, plenary)

- Constrains, requirements from/to the outside

13:45	FD magnetic design & connection model (30') (Slides)	Brett Parker (*BNL*)
14:15	Various possibilities for dispositions in experimantal area (30') (Slides)	Alain Herve (*CERN*)
14:45	Civil Engineering Works for the Interaction Region (30') (Slides)	John Andrew Osborne (*CERN*)
15:15	Overall IR cryogenic system, overview (30') (Slides)	John Weisend II (*SLAC*)
15:45	Coffee break (20') (Location: Kavli Auditorium, lobby)	
16:05	Radiation physics requirements for the IR (30') (Slides)	Toshiya Sanami (*SLAC*)
16:35	Utilities requirements, introduction & discussion (30') (Slides; document)	Tom Lackowski (*FNAL*)
17:05	Integrated design for ILC Detector Services (30') (Slides)	Andrea Gaddi (*CERN*)

Tuesday, Sept. 18th (morning, plenary)

- Constrains, requirements from/to the outside

09:00->*12:20* **Plenary** (Location: Kavli Auditorium)
Description:
Webex connection for Tuesday plenary

09:00 Life safety constraints and requirements (30') (Slides) atsushi Enomoto (*KEK*)

09:30 Seismic requirements (30') (Slides) Fred Asiri (*SLAC*)

10:00 ILC detector maintanance needs (30') (Slides) Ron Settles (*Max-Planck-Institut fuer Physik*)

10:30 Coffee break **Group photo at top entrance of Kavli** (20') (Location: Kavli Auditorium, lobby)

10:50 Heavy lifting at CMS (30') (Slides) Hubert Gerwig (*CERN*)

11:20 Endcap design in CMS (30') (Slides) Farshid Feyzi (*Physical Sciences Laboratory, UW-Madison*)

11:50 IR platform, rollers, deformations (30') (Slides) John Amann (*SLAC*)

Tuesday, Sept. 18th (afternoon, parallel)

Mainly SiD talks

13:30->*16:00* **Parallel Wg A (+C)** (Location: ROB #1)
Description:

Webex connection for Tuesday WG-A-C

13:30 Mechanical and magnetic FEM model of SiD (20') (Slides) — Bob Wands (*Fermilab*)

13:50 Platform Issues (20') (Slides) — Oriunno Marco (*CERN*)

14:10 SiD Beam Pipe Concepts & SiD Maintenance Schemes (20') (Slides) — William Cooper (*Fermilab*)

14:30 SiD End Cap/Door Concepts (20') (Slides) — Jim Krebs (*Stanford Linear Accelerator Center*)

14:50 SiD Preliminary Detector Assembly Schemes (20') (Max assembly; Min assembly; Slides) — Martin Breidenbach (*SLAC*)

15:10 Large platform proposal (10') (Slides) — Hitoshi Yamamoto (*Tohoku University*)

16:20->*18:00* **Working excursion to SLD, Wg A+C (primarily)** (Location: SLD)

16:20->*18:00* **WG-B work on Cryo-scheme** (Location: ROB #1)
Description:

Detailed layout of IR cryo scheme will be developed.

Tuesday, Sept. 18th (afternoon, parallel)

I could not attend!

13:30->*16:00* **Parallel Wg D** (Location: ROB #2)
Description:

Webex connection for Tuesday WG-D

13:30	Neutron and photon backscattering from the Beam dump (20') (Slides)	Takashi Maruyama (*SLAC*)
13:50	Synchrotron photons in ILC IR and PEP-II (20') (Slides)	Michael Sullivan (*SLAC*)
14:10	Study of collimation depths for different L* designs (20') (Slides)	Frank Jackson (*CCLRC, Daresbury Laboratory*)
14:30	Studies at SLAC's ESA of the transverse kicks due to collimator wakefields (20') (Slides)	Stephen Molloy (*SLAC*)
14:50	2mad scheme IR region and extraction line (20') (Slides)	Rob Appleby (*University of Manchester*)
15:10	Overview of extraction line designs and all issues (20') (Slides)	Yuri Nosochkov (*SLAC*)
15:30	Backscattering of photons into the ILC Detectors from Beam Losses Along the Extraction Lines (20') (Slides)	olivier dadoun (*lal orsay*)

16:00->*16:20* **Coffee break** (Location: ROB)

16:20->*18:40* **Parallel Wg D** (Location: ROB #2)

16:20	Muon shielding options for ILC BDS (20')	Noriaki Nakao (*Fermilab*)
16:40	IR padiation physics criteria discussion (20') (document)	Toshiya Sanami (*SLAC*) , Mario Santana (*SLAC*)
17:00	Magnetic field requirements (20') (Poster)	Sergei Seletskiy (*ILC*)
17:20	CFS & other needs to make 14mr compatible with gamma-gamma (20') (Slides)	Valery Telnov (*Budker INP, Novosibirsk*) , Jeff Gronberg (*LLNL*)
17:40	Permanent magnet option for 14mr IR (20') (Slides)	yoshihisa iwashita (*Kyoto Univ.*)

Wednesday, Sept. 19th (morning, parallel)

- Unfortunately parallel sessions I could not attend!

09:00->*12:30* **Parallel Wg B+D** (Location: ROB #2)
Description:

Webex connection for Wednesday ROB2

09:00	Vacuum requirements (20') (Vac. reqts. Summary ; Vacuum reqts. study)	Lewis Keller (*SLAC*)
09:20	IR vacuum system concept (20') (Slides)	Yusuke Suetsugu (*KEK*)
09:40	Vacuum system for IR (20') (Slides)	Norbert Collomb (*STFC*) , Oleg Malyshev (*ASTeC, STFC Daresbury Laboratory, UK*)
10:00	Final Doublet engineering design (30') (Slides)	Andrew Marone (*BNL*)
10:30	Coffee break (20')	
10:50	Feedback hardware engineering (20') (Slides)	Philip Burrows (*Oxford University*)
11:10	IR wake fields and HOM absorbers (20') (Slides ; Video)	Alexander Novokhatski (*SLAC Physicist*)
11:30	Simulations of RF fields in IR region (20') (Slides)	Shilun Pei (*SLAC*)
11:50	HOM heating (10') (Slides)	Hitoshi Yamamoto (*Tohoku University*)
12:00	EMI measurements (20') (Slides)	Nick Sinev (*University of Oregon*)
12:20	IR BPM idea, discussion (10') (Slides)	Manfred Wendt (*Fermilab*)

Wednesday, Sept. 19th (morning, parallel)

- Unfortunately parallel sessions

09:00->*12:20* **Parallel Wg A+C** (Location: ROB #1)
Description: Hall and building sizes, cranes, shafts, min space requirements, services and utilities
Webex connection for Wednesday ROB1

09:00 Push-pull constraints and criteria discussion (30') (Slides) Victor Kuchler (*Fermilab*)

09:30 Shaft and underground hall layout discussion (30')

10:00 Detector motion schemes and alignment discussion (30')

10:30 Utility requirements and layout of service areas discussion (30')

Wednesday, Sept.19th (afternoon, quasi plenary)

Mainly FD support & supply, consequences

13:30->*18:00* **Plenary Wg A+B+C+D** (Location: ROB)
Description:

Webex connection for Wednesday ROB (plenary)

13:30	Stability criteria from accelerator physics view (20') (Slides)	Glen White (*SLAC*)
13:50	FD alignment methods (20') (Slides)	Ping He (*BNL*)
14:10	Stability requirements discussion (10')	
14:20	IR cryogenic model (20') (Slides)	Kuo-Chen Wu (*BNL*)
14:40	Compact Water Based Dump Resistor (20') (Slides)	Wesley Craddock (*SLAC*)
15:00	DAFNE upgrade with large crossing angle, Engineering aspects to implement the crab waist scheme (20') (Slides)	SANDRO TOMASSINI (*INFN-LNF*)
15:20	Final focus magnet and its cryogenics system at Belle (20') (Slides)	Kiyosumi Tsuchiya (*KEK*)
15:40	Discussion of FD support, endcap splitting, opening, cryo system interference and self shielding (10')	
15:50	Implication of gamma-gamma on 14mr tunnels discussion (30') (Slides)	Valery Telnov (*Budker INP, Novosibirsk*)

Wednesday, Sept.19th (afternoon, quasi plenary)

- Mid Summary (Don't asked me why!)

16:40	Discuss plans for Summary WgD: Acc.ph. reqts: stability, field, vacuum; cfs need for gamma-gamma; etc. -- convener: (20') (Slides)	Michael Sullivan (*SLAC*)
17:00	Discuss plans for Summary WgA: Det. & endcap design, FD support, etc. -- convener: (20') (Slides)	Alain Herve (*CERN*)
17:20	Discuss plans for Summary WgC: CFS, services, requiremenst; etc. -- convener: (20') (Slides ; more information)	Victor Kuchler (*Fermilab*)
17:40	Discuss plans for Summary WgB: Cryo, FD design, forward hardware, etc. -- convener: (20')	John Weisend II (*SLAC*)
18:00	Dinner at Hunan Garden	

Thursday, Sept.20th (morning, parallel)

09:00->*11:30* **Plenary Wg B + all** (Location: ROB)
Description:

Webex connection for Thursday all day

09:00 Luminosity Feedback Detectors BeamCal and GamCal (20') (Slides) — Bill Morse (*BNL*)

09:30 LumiCal mechanical design and laser alignment system (20') (Slides) — Wojciech Wierba (*INP, Cracow*)

10:00 Enginering Details of BeamCal (20') (Slides) — Wolfgang Lohmann (*DESY*)

10:30 Rutherford cable option for 14mr FD (20') (Slides) — Mauricio Lopes (*Fermi National Accelerator Laboratory*)

11:00 Study of e-cloud in FD (20') (Slides) — Lanfa Wang (*SLAC*)

09:00->*11:30* **Part of A&C -- summary discussion preparation** (Location: Kavli Auditorium)

Thursday, Sept.20th (afternoon, pleanary)

Final Summaries

13:00->*18:00* **Plenary (Summaries and Discussions)** (Location: ROB)
Description:

Webex connection for Thursday all day

13:00	Summary on background study (30') (Slides)	Michael Sullivan (*SLAC*)
13:30	Summary on vacuum requirements and design options (30') (Slides)	Yusuke Suetsugu (*KEK*)
14:00	Summary of radiation physics study and criteria development (20') (Slides)	Toshiya Sanami (*SLAC*) , Mario Santana (*SLAC*)
14:20	Overall agreements on IR cryogenics system and how to move further (20') (Slides)	John Weisend II (*SLAC*)
14:40	Luminosity monitors discussion (20') (Slides)	Wolfgang Lohmann (*DESY*)
15:00	Discussion of 'real estate' around the IR beamline (30') (Slides)	Brett Parker (*BNL*)
15:50	Summary and discussion of options for IR hall and tunnels layouts (20') (Slides)	Victor Kuchler (*Fermilab*) , Alain Herve (*CERN*)
16:10	Endcap design summary and discussion (20') (Slides)	Bob Wands (*Fermilab*) , Jim Krebs (*Stanford Linear Accelerator Center*)
16:40	Discussion of possible assignements for Friday (post-workshop work) (20')	
17:00	Final discussions and closeout (20') (Slides)	Andrei Seryi (*SLAC*)

Comments (NM)

Preparatory Phone Meetings

- It was a busy summer!

Workshop Program

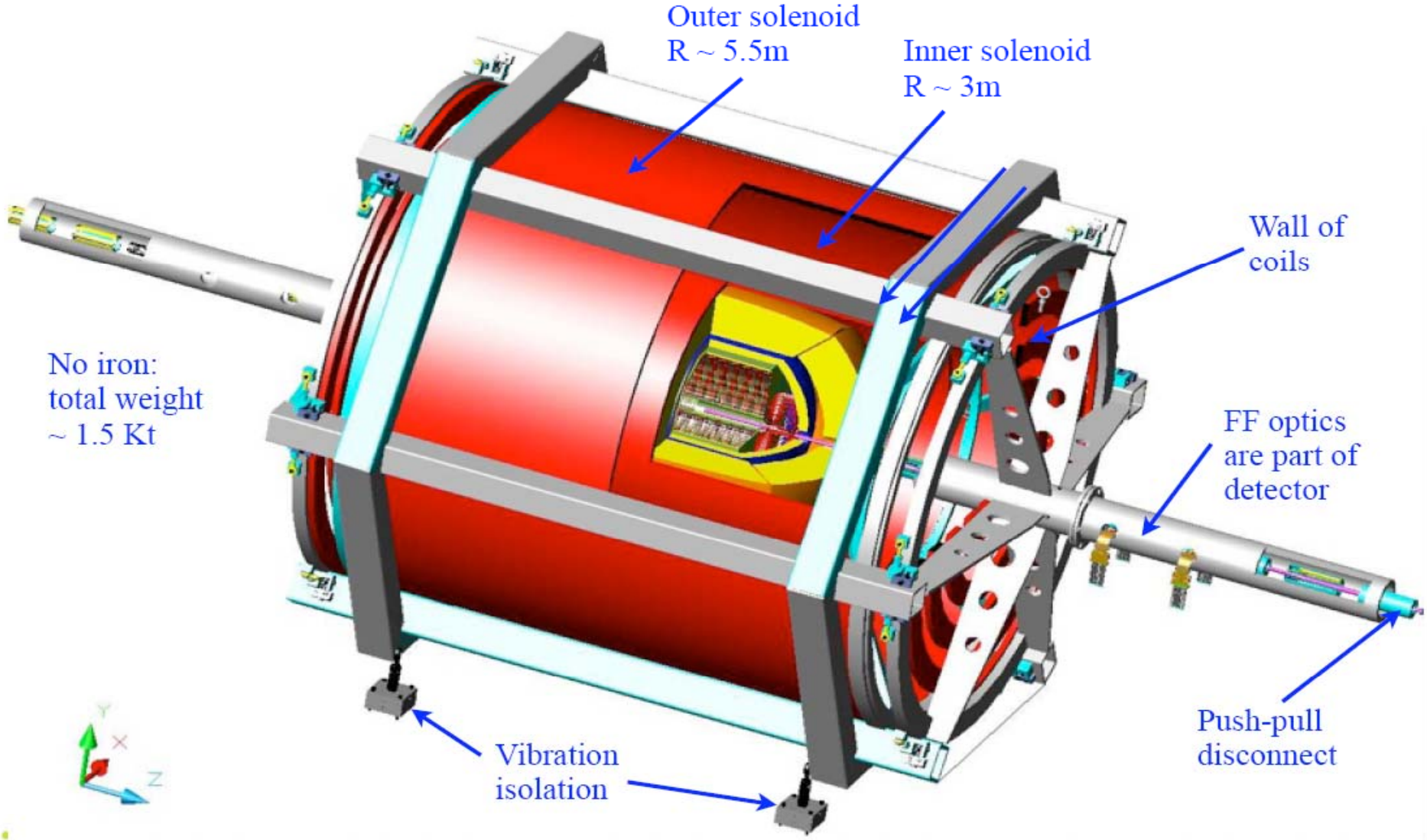
- To much talks,
  to less discussion!

Good

- A & C session
  - Hall Size
  - General Supplies
- A & B session
  - FD-Magnets (Size, Supply, Service Cryostat, Mover, Optical Achor)
  - Vacuum/Beam Pipe (First Time! Pumps, Beam Monitors)
- Experience from other detectors

Detector Concepts

Quick overview of detector geometry



Iron Age physics: why we don't like it

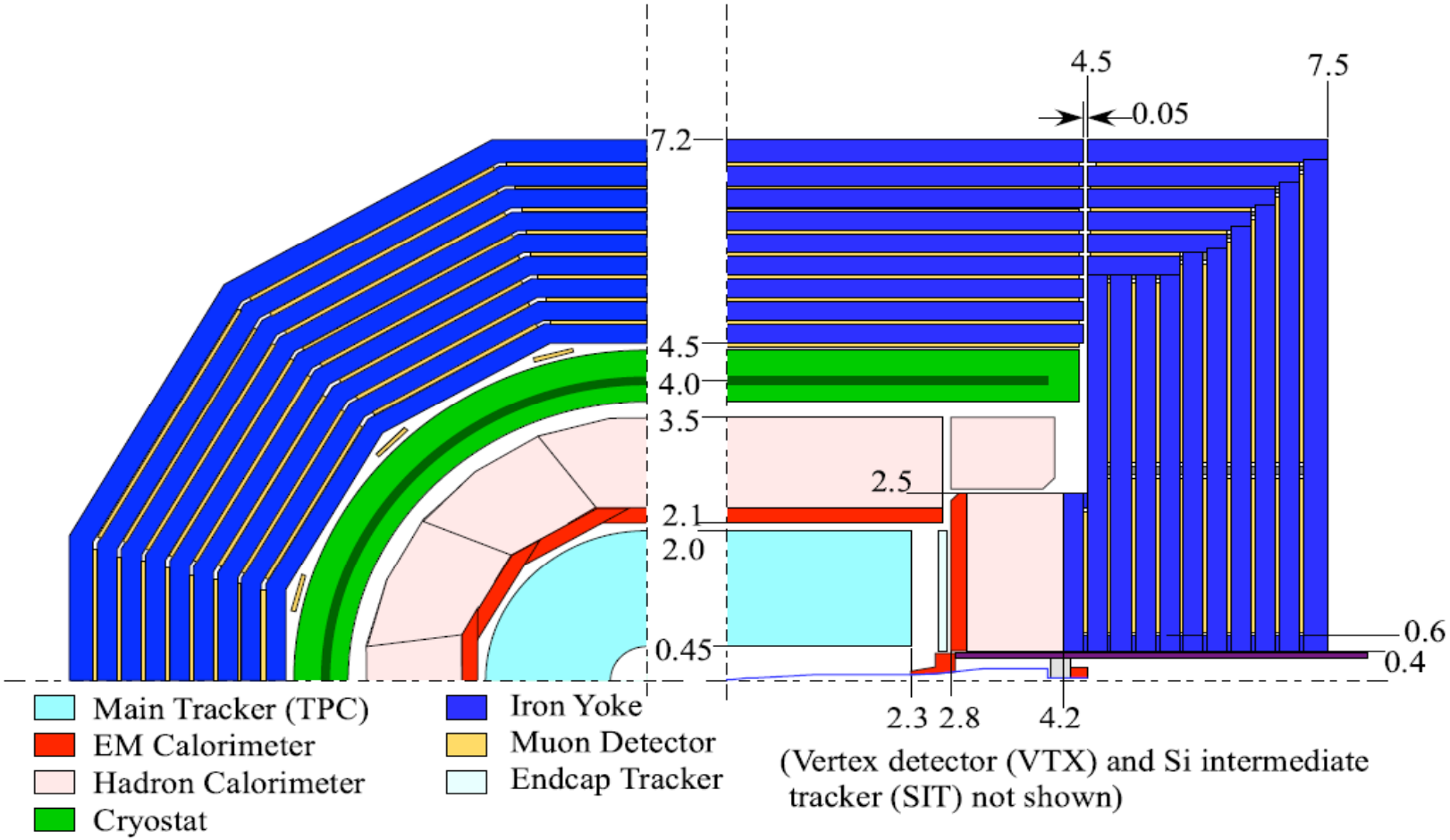
- An iron yoke adds little to the magnetic environment, is not necessary for field uniformity, serves as only a crude pion filter, and ruins the momentum resolution on a muon.
- The iron may be good for hanging the calorimeter, but it also forecloses forever alterations, improvements and additions to the detector outside the calorimeter.
- Access and movement are more difficult, push-pull is more difficult, including supports and floor settling.
- It is not cheap: CMS iron is $75M.

GLD and GLDc

Y. Sugimoto/T.Tauchi (KEK)

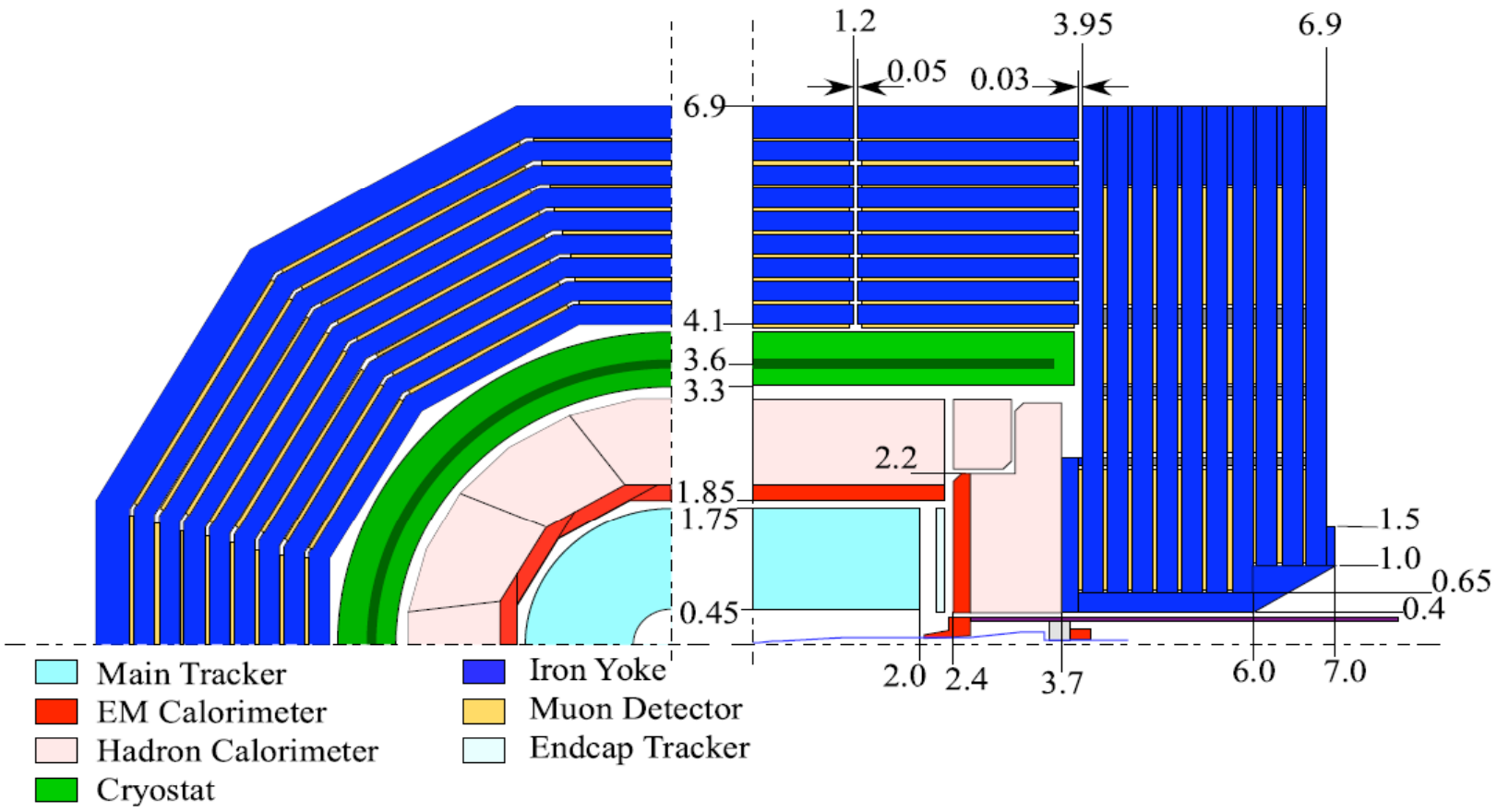
IRENG07, SLAC, Sep. 15, 2007

GLD


4.5
7.5
0.05
7.2
4.5
4.0
3.5
2.5
2.1
2.0
0.45
0.6
0.4
2.3
2.8
4.2
Main Tracker (TPC)
EM Calorimeter
Hadron Calorimeter
Cryostat
Iron Yoke
Muon Detector
Endcap Tracker
(Vertex detector (VTX) and Si intermediate tracker (SIT) not shown)

3

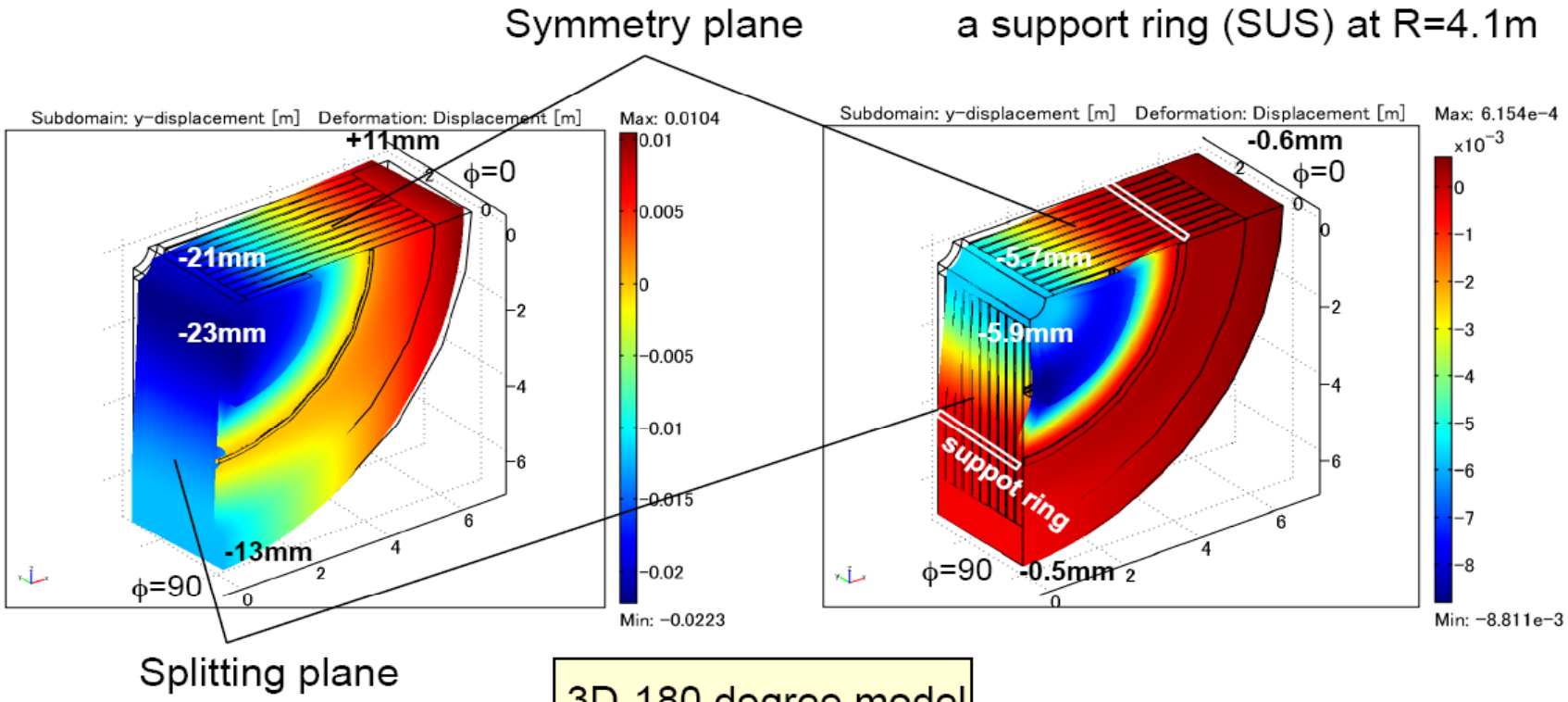
Compact GLD (GLDc)



"GLD and GLDc"; Y. Sugimoto/T.Tauchi (KEK)

Endcap Deformation

- No support ring
- One support ring/gap



3D-180 degree model

13

SiD showed comparable plots: "Magnetic and Mechanical FEA of SiD"; Bob Wands Report IReng'07

"GLD and GLDc"; Y. Sugimoto/T.Tauchi (KEK)

Endcap Deformation

- Results

	Split Angle	Support ring	ΔZ r=0.4 m	ΔZ r=6.9 m	
3D	180	No	-21 mm	+11 mm	at ϕ=0
			-23 mm	-13 mm	at ϕ=90
3D	no	No	-12 mm	-3.9 mm	
3D	180	1 (r=4.1m)	-5.7 mm	-0.6 mm	at ϕ=0
			-5.9 mm	-0.5 mm	at ϕ=90
3D	no	1	-4.6 mm	-0.2 mm	
3D	180	2 (r=2.3, 4.1m)	-2.6 mm	+0.5 mm	at ϕ=0
			-2.7 mm	-0.7 mm	at ϕ=90
3D	no	2	-1.8 mm	-0.4 mm	
3D	**180**	**3 (r=2.3, 3.2, 4.1m)**	**-1.7 mm**	**+0.3 mm**	at **ϕ=0**
			-1.8 mm	**-0.7 mm**	at **ϕ=90**
3D	no	3	-1.1 mm	-0.4 mm	
2D	no	No	-90 mm	0 mm - Fix	SiD-like: 23x(10cm Fe + 5cm gap)

3D: 3-dimensional model
2D: Axial symmetric 2-dimensional model

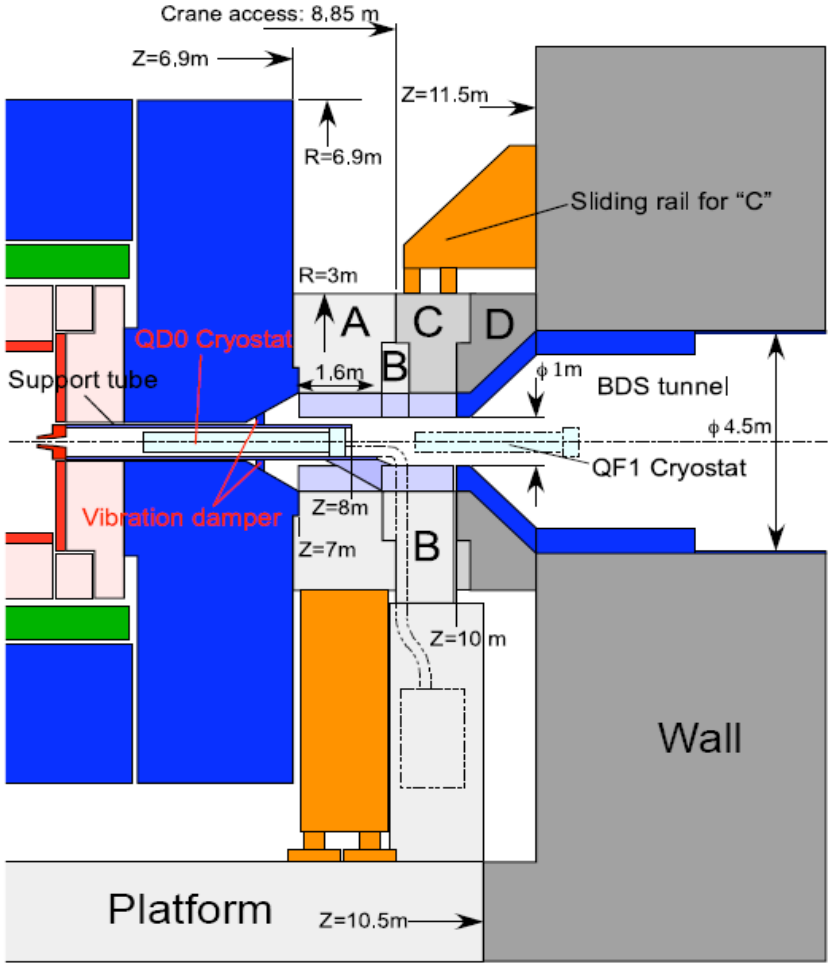
180: Splitting endcap
no: Non-splitting endcsp

12

Spliting the end cap yoke doubles the bending!

Q: Why is this bend a point of concern?

Pacman design and FD support



- A: slide sideway using air pad
- B: supported from the floor of platform
- QD0 cryostat is supported by the support tube and the support tube is supported from B
- We can put additional support for the support tube at the entrance of endcap yoke to damp the vibration, if necessary
- Upper part of B (~10 ton) must be removable by crane for installation and removal of the support tube
- C: slide along the wall (D) (common to both experiments) ~50 tonx2
- D: part of the wall
- Wall distance can be as small as 11.5 m from IP, if the crane can access to 2.65m from the wall
- Construction of C is done by a mobile crane (CMS style)
- Inner radius of pacman should be determined after design of gate valve etc. between QD0 and QF1 is fixed

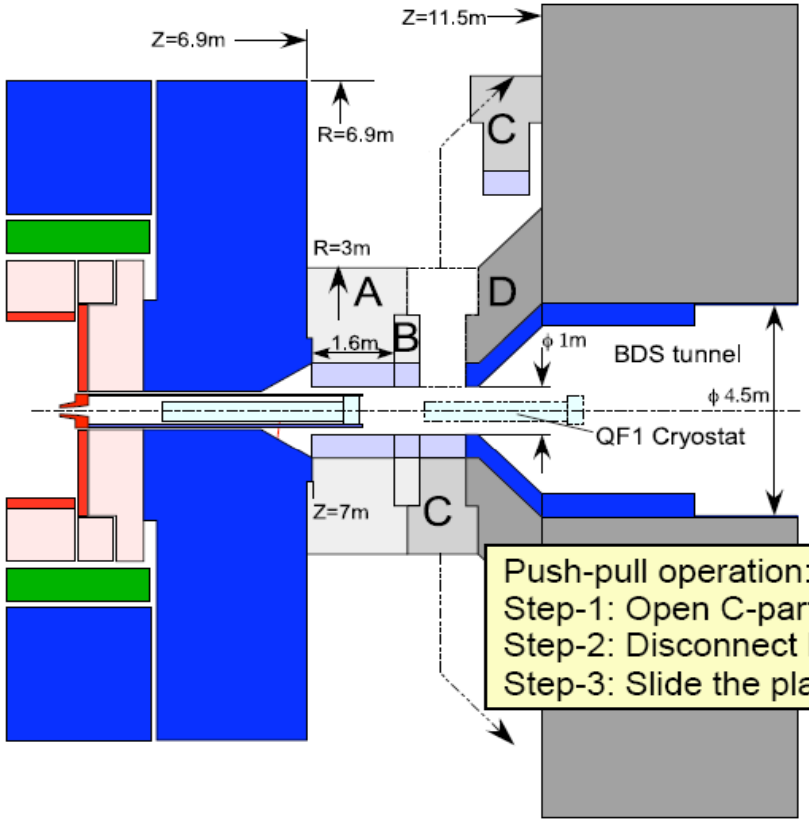
16

Most advanced concept

"GLD and GLDc"; Y. Sugimoto/T.Tauchi (KEK)

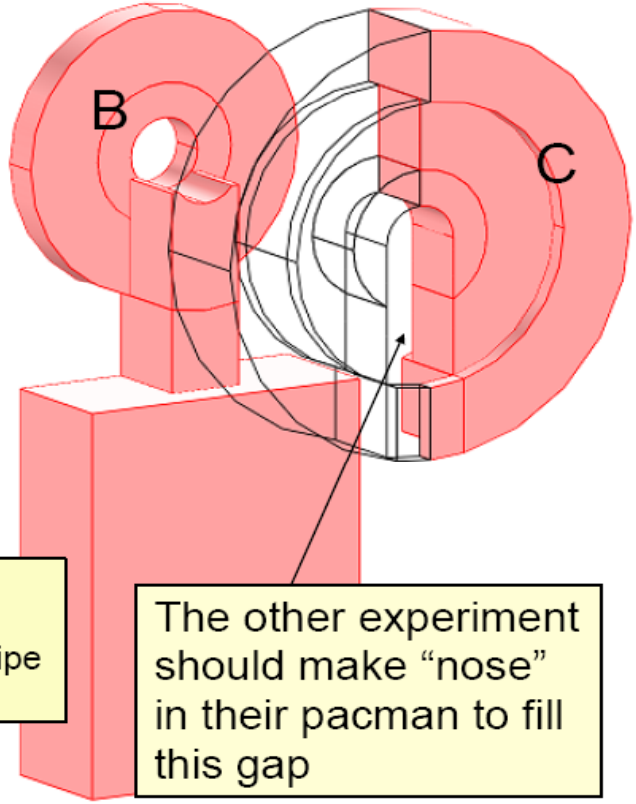
Pacman design and FD support

- Plan view



Push-pull operation:
Step-1: Open C-part
Step-2: Disconnect beam pipe
Step-3: Slide the platform

- 3D view



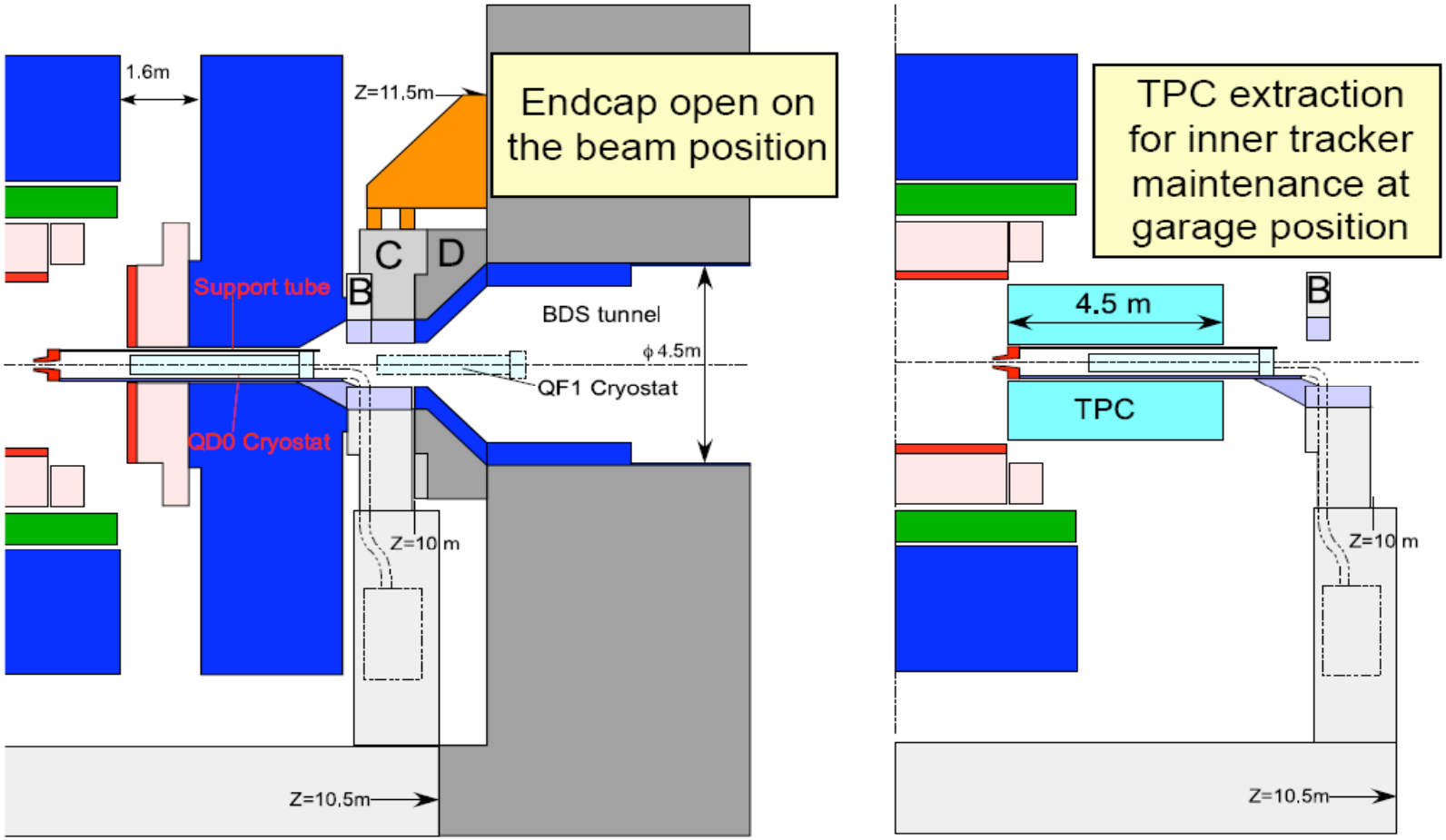
The other experiment should make "nose" in their pacman to fill this gap

17

Most advanced concept

"GLD and GLDc"; Y. Sugimoto/T.Tauchi (KEK)

Pacman design and FD support



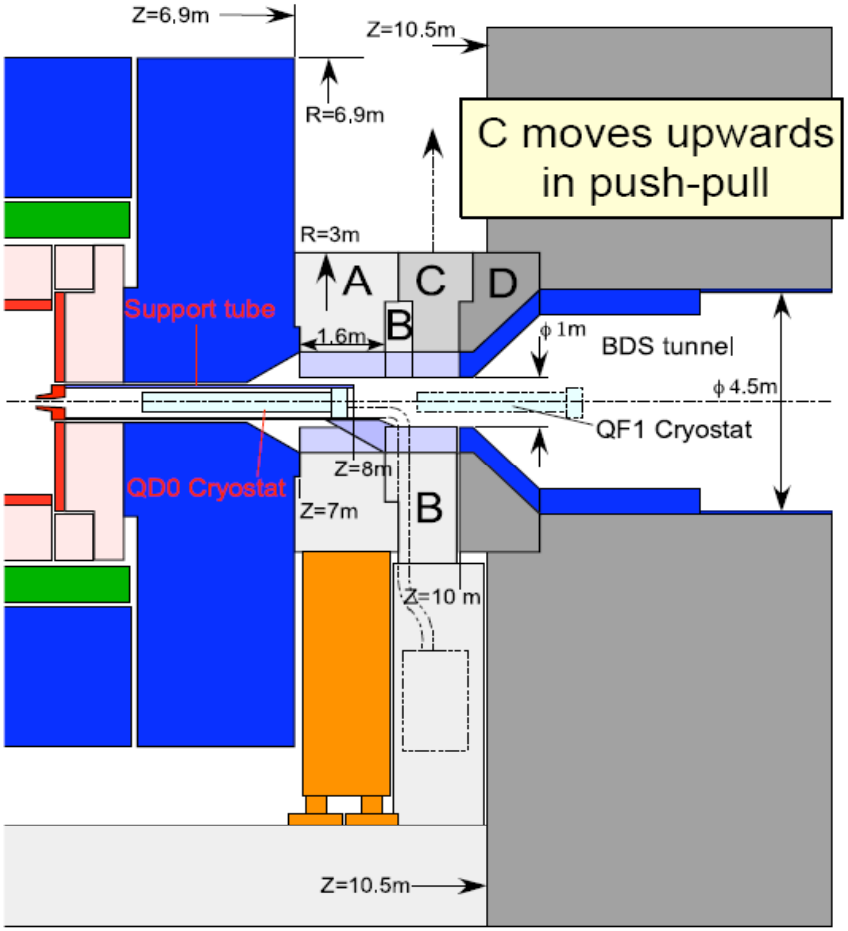
18

1.6m opening is very small

Similar to LDC V5 & TESLA

Still smaller cavern option

- Forget about crane access
- Forget about safety issues
- Design with cavern floor width as small as 21m can be drawn with the support-tube scheme
  - Pacman "C" moves upwards (using a small gantry crane fixed to the wall?) in push-pull operation
  - There is no way for a person to run away from one side of the detector to the other side (escape tunnel ?)

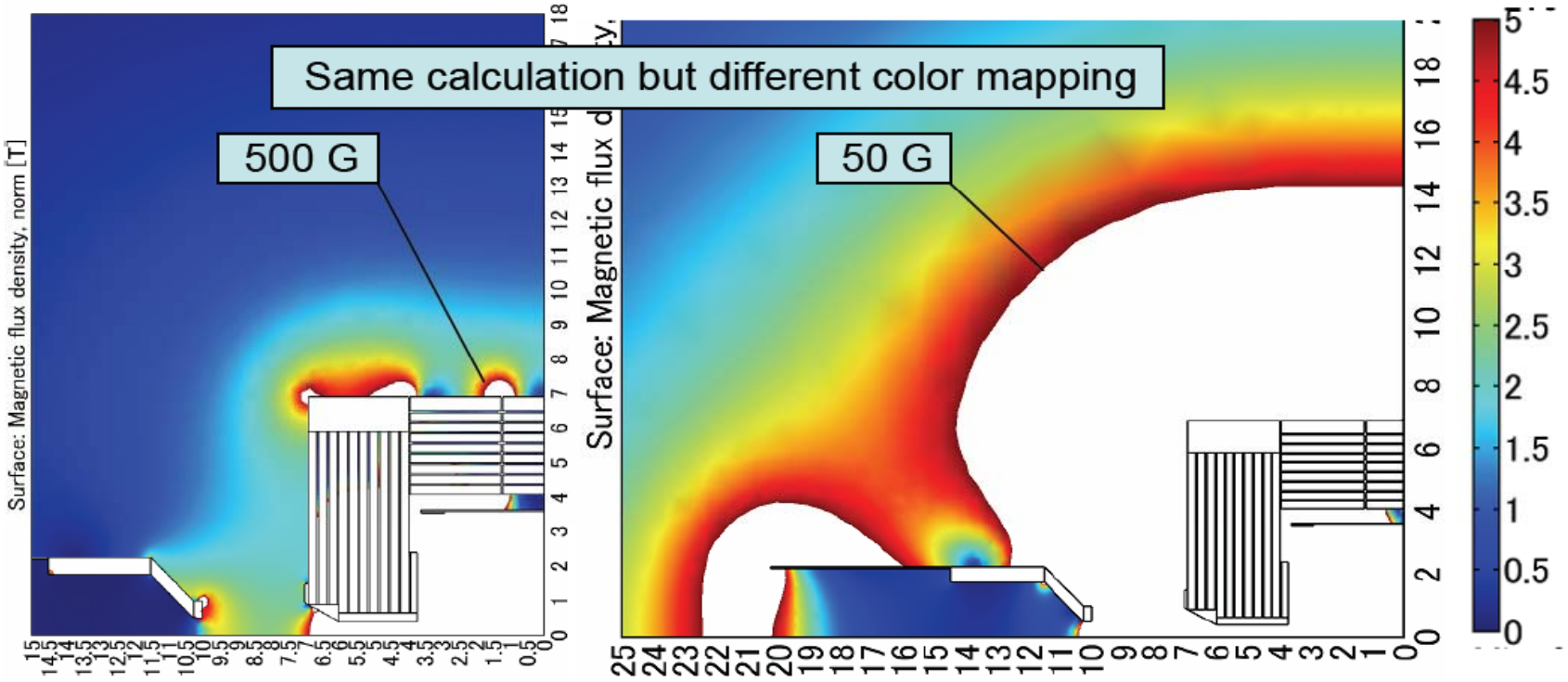


"Hey, SiD we try harder!"

But severeal people did not like crane operation above the FD-magnets/beam pipe

"GLD and GLDc"; Y. Sugimoto/T.Tauchi (KEK)

B field of GLDc



B_0=3.5 T

B(10.5m<Z<20m) <50 G

B(R>8m) <500 G

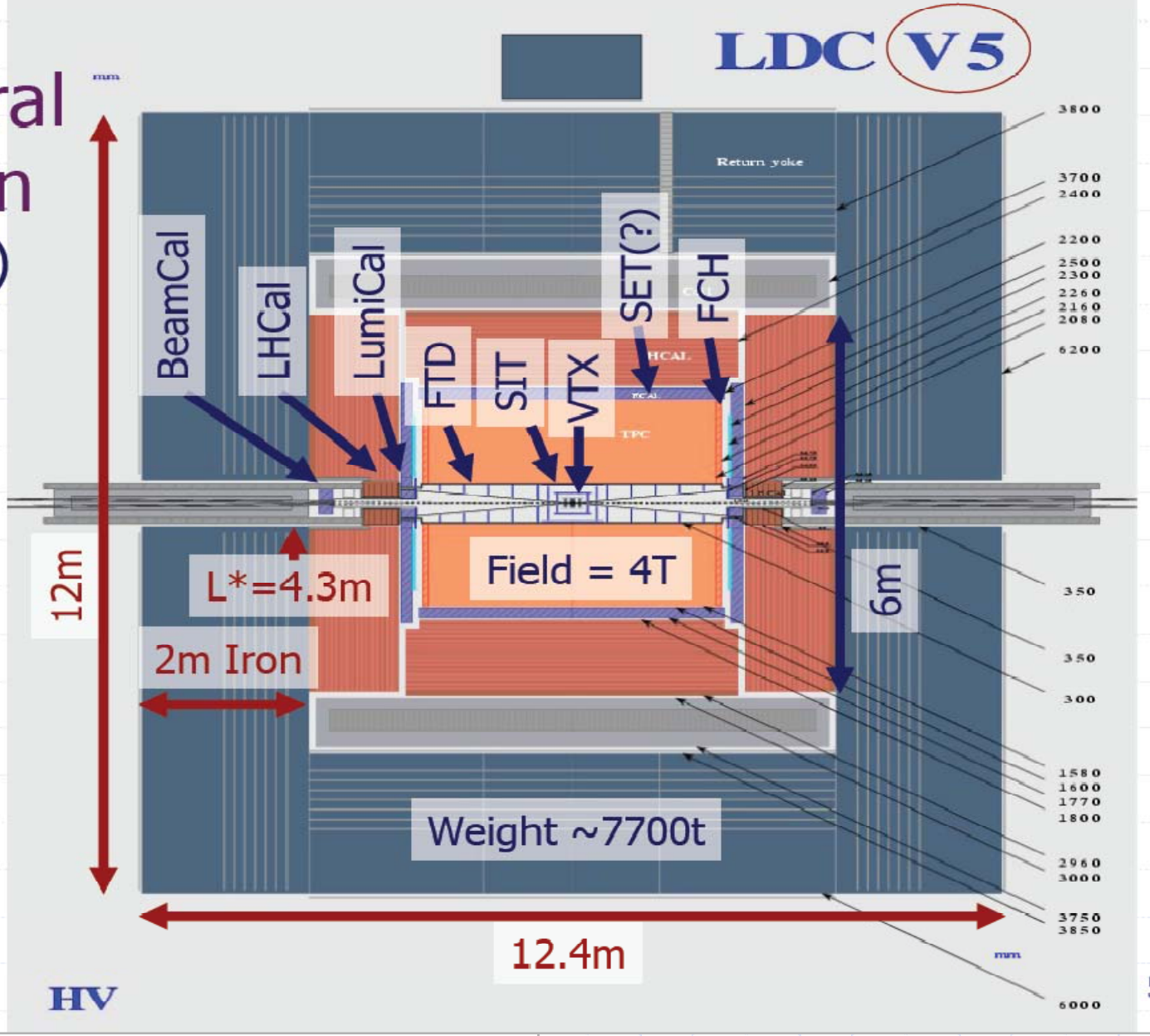
Q: Limit of stray field? Not answered!

20

SiD showed comparable plots: "Magnetic and Mechanical FEA of SiD"; Bob Wands Report IReng'07

MEA Machine and Experiment Assembly
Norbert Meyners, MEA 17. Sept. 2007
ILC IRENG07; SLAC

General Design (cont'd)

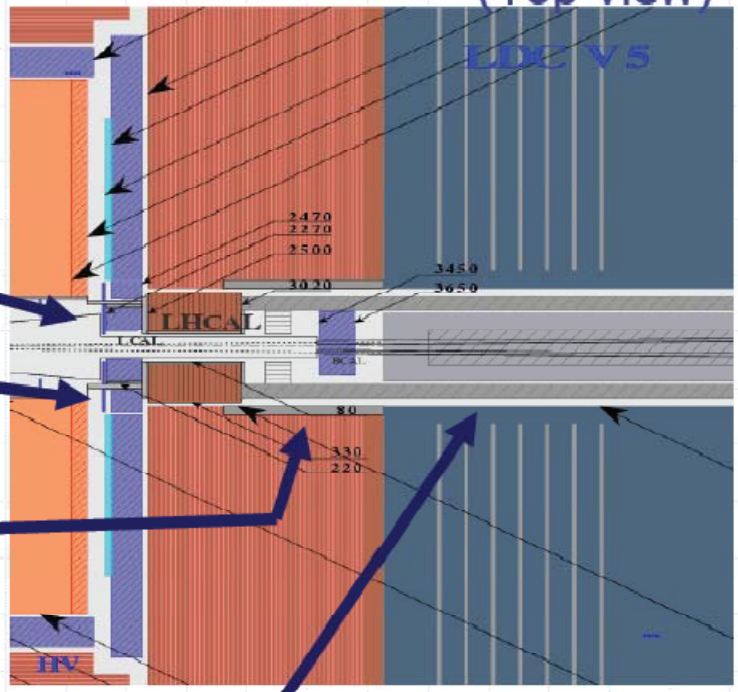


"LDC Engineering Design (Status)"; N.Meyners, DESY

General Design (Forwards Region)

14mrad solution

(Top view)



LumiCal smaller!

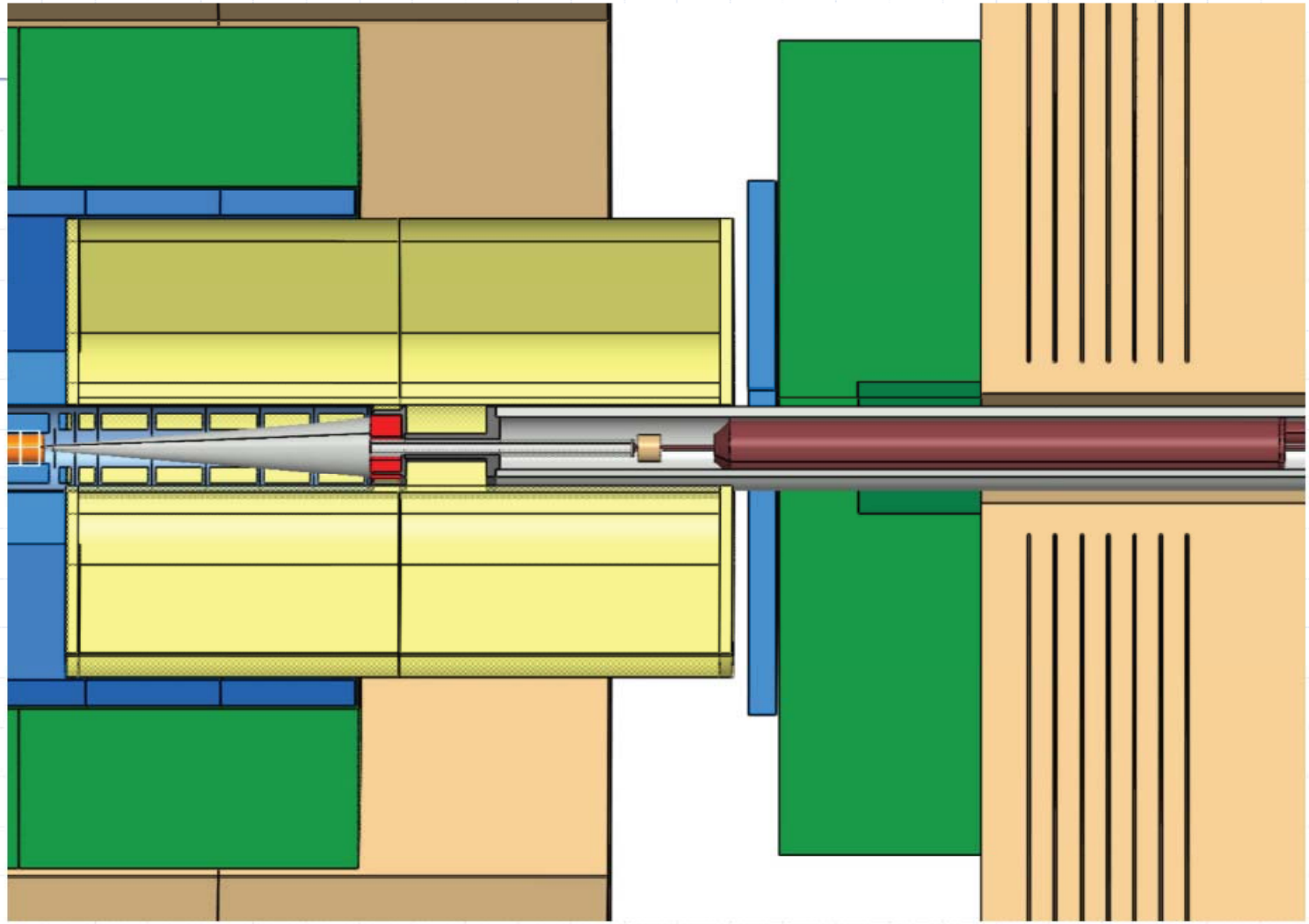
Intermediate ECAL closes gap between ECAL and LumiCAL

Tungsten Shielding (>6cm; Between LHCAL and BeamCAL; Gap at the BeamCAL to filled)

Support Structure for QD0, BeamCAL, LHCAL, LumiCAL, Central Beam Pipe

Goal: Vertex Detector Maintenance

without breaking the vacuum i.e. warming up QD0

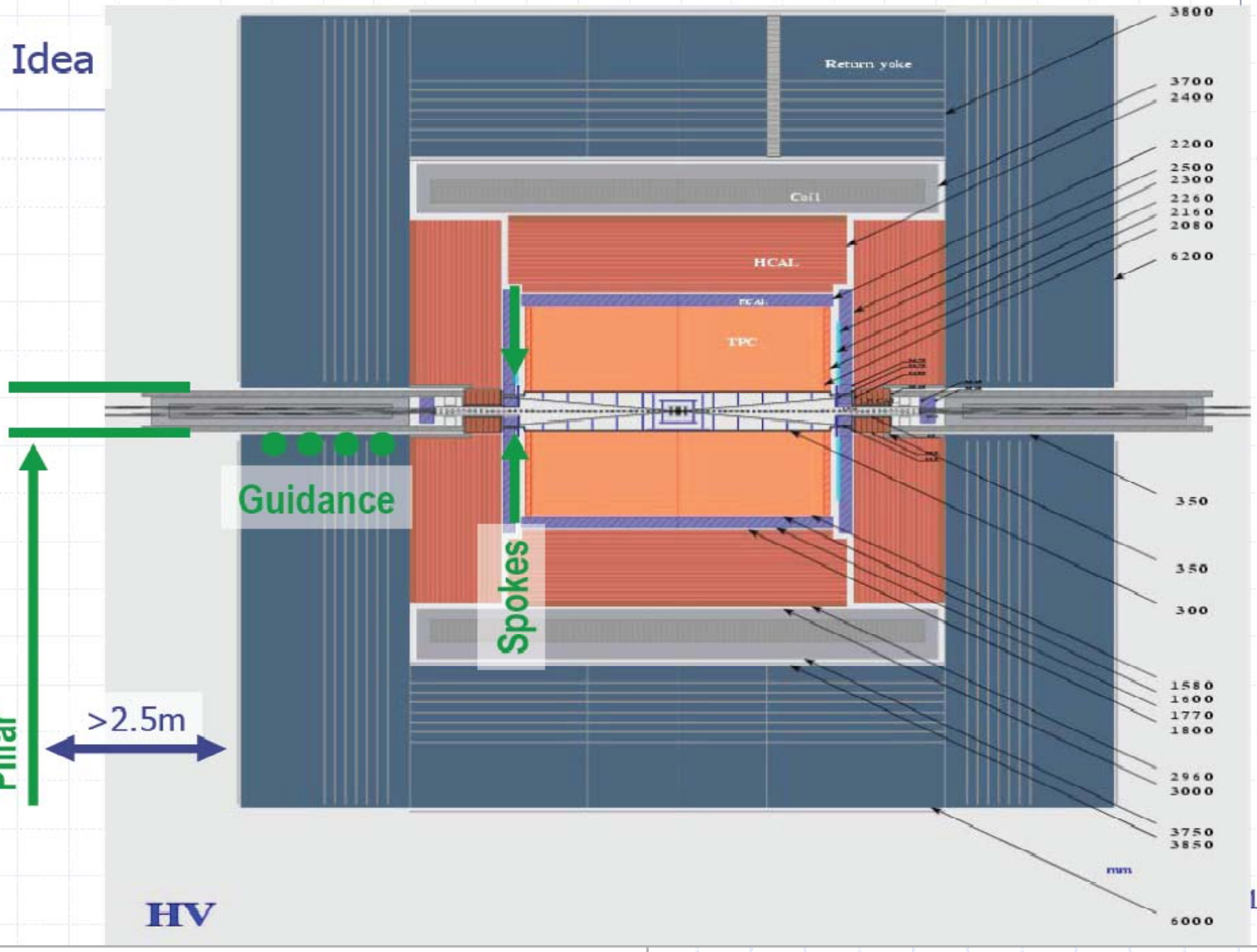


"LDC Engineering Design (Status)"; N.Meyners, DESY

MEA Machine and Experiment Assembly
Norbert Meyners, MEA 17. Sept. 2007
ILC IRENG07; SLAC

Support Structure Supports

First Idea



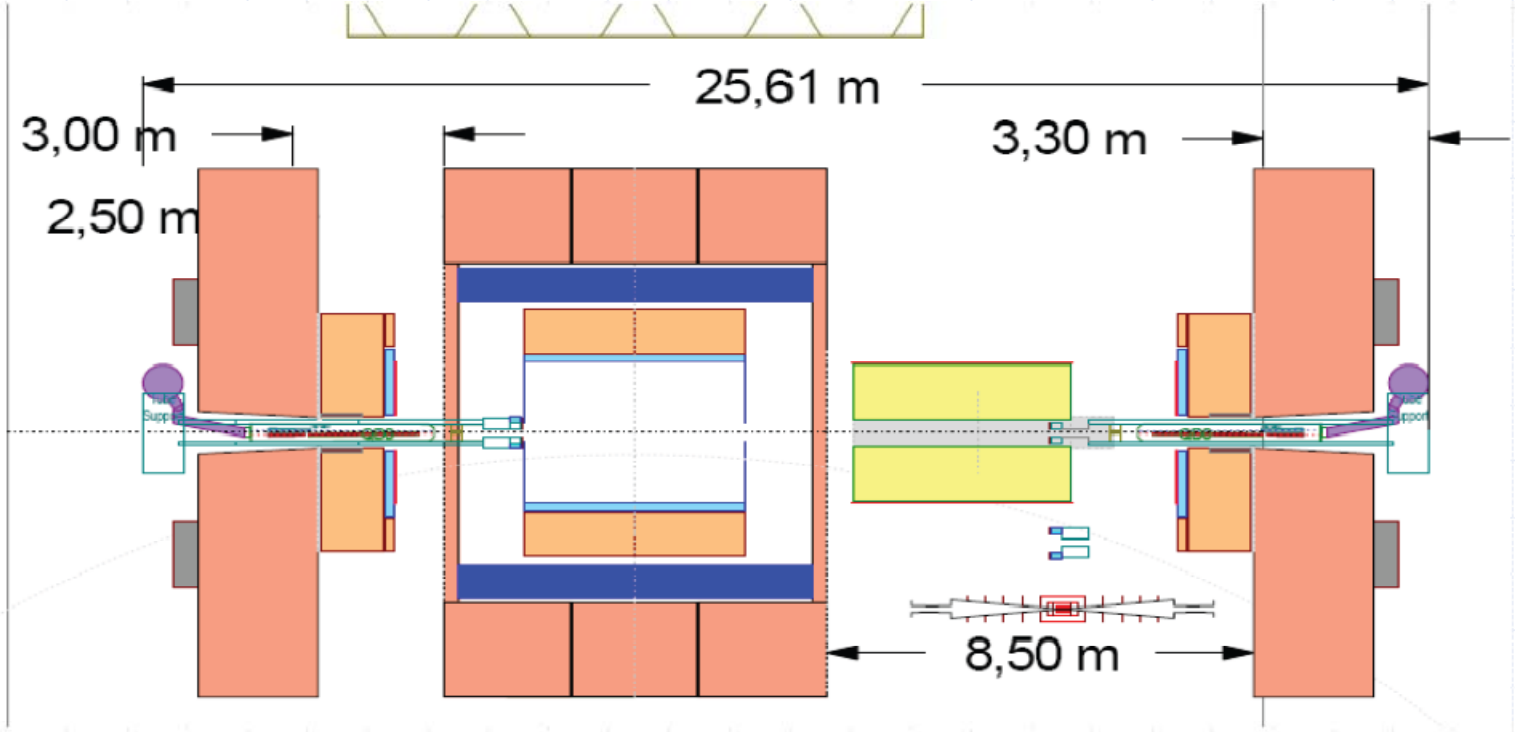
10

"LDC Engineering Design (Status)"; N.Meyners, DESY

Detector Opening (End Cap Yoke NOT split)

➔ If not split, the end cap yoke has to be moved 8,5m longitudinal (or aside) for TPC exchange!

➔ QD0 and service cryostat have to go with the end cap yoke while the Helium supply line is not cut!



"LDC Engineering Design (Status)"; N.Meyners, DESY

Detector concept

Plenary introductory talk

IRENG07

Kurt Krempetz

September 17, 2007

Global Design Effort

ILC INTERACTION REGION ENGINEERING DESIGN WORKSHOP SLAC

Caveats

- The Detector Parameters have not been finalized.
- Little engineering effort been put into the design.
  - **But an Engineering Group has been established.**
- Share our current thoughts on the issues.
- Willing to be flexible but concerned about "boxing ourselves into a corner"
- Looking forward to progress at this Workshop.

After this warning we had nearly full session of SiD details (Tu afternoon)

Summary

- Additional Workshop Talks Planned
  - **Bob Wands-Field Mapping Calculations**
  - **Marco Oriunno- Platform Issues**
  - **Bill Cooper- SiD Beam Pipe Concepts**
  - **Jim Krebs- End Cap Concepts**
  - **Marty Breidenbach- Assembly Schemes**
  - **Wes Craddock-Water Cooled Dump Resistor**

NM: A part of the SiD talks was a review of SiD detailed solutions.

The technical work was quiet okay, but the overall concept is still biased by at cost saving attitude.

Another part was annoying in typical SiD manner that I still find strange and makes it quiet hard to work with them!

"Platform Issues"; Marco Oriunno, SLAC

Conclusion

- The push-pull problem evolves in a bidimensional space : weight of detectors, amount of umbilicals
- Platform is an appealing concept for large detectors requiring large amount of services
- Compact detectors with integrated electronics can directly move on the floor if well engineered from the beginning
- No virtual limitation in the Hilman rollers capacity, viable for large detectors
- Magnets (Solenoid and QD0) drives the services requirements on the detector
- ILC detectors will have a generational gap and different constraints from the LHC :
  - very limited radiation
  - low consumption and fast electronics (…and pulsed)
  - higher level of on board integration possible for the above reasons
- → Can the big detector drives the requirements of the smaller ? **Does it?**
- → Can both solutions be implemented in the IR hall ? **Yes!**
- → A compact detector can be swapped and calibrated in shorter time **Why?**

M.Oriunno SLAC, 18 September 2007

Is SiD small/compact detector? NO!

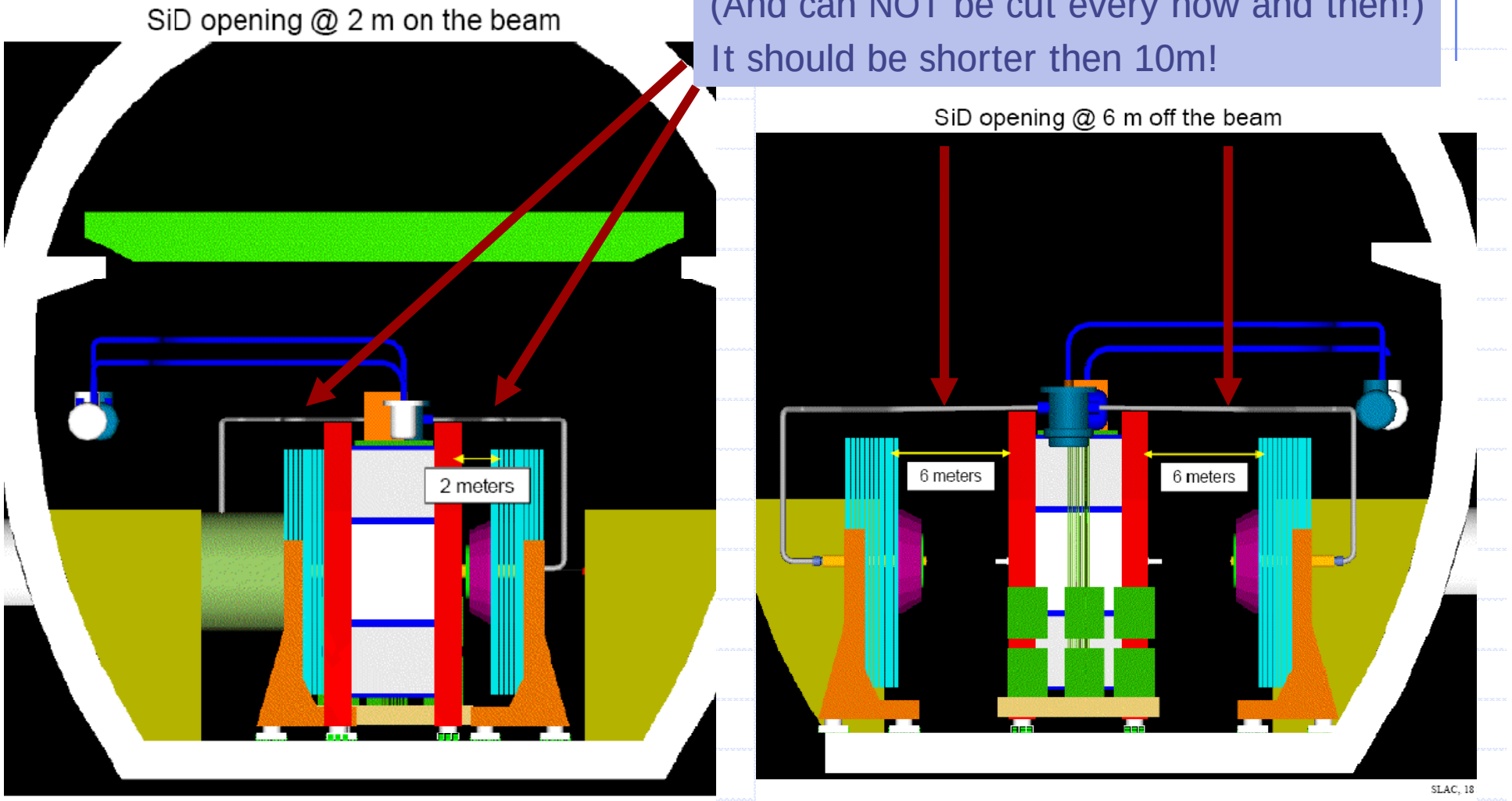
I missed the opportunity to jump (again) on the SiD folks!

If can save money constrains from outside do not count.

We (at least I) had discussed this lengthy with B.Parker et.al..

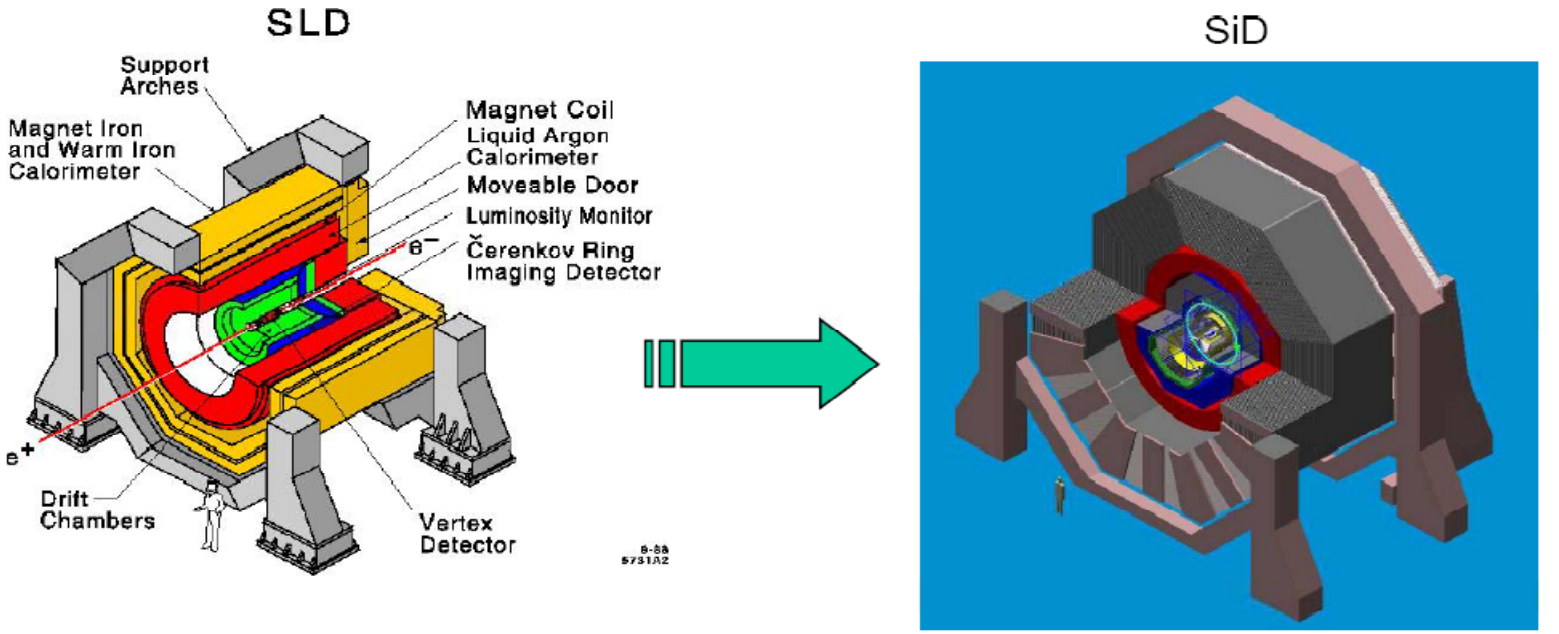
"Platform Issues"; Marco Oriunno, SLAC

This 2K-Helium lines can NOT be flexible!
(And can NOT be cut every now and then!)
It should be shorter then 10m!



~~SLD~~..... SiD

evolution of a proven concept

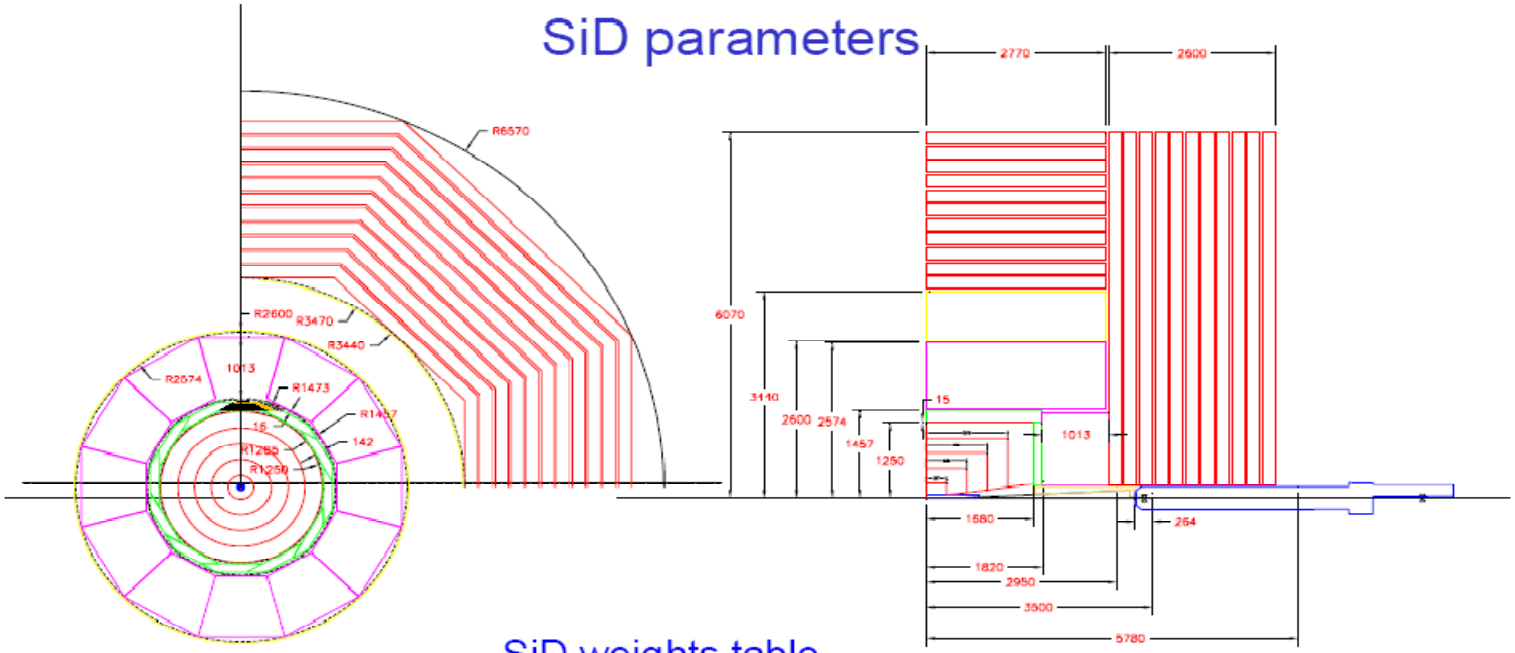


M.Oriunno

SLAC, 18 September 2007

"Platform Issues"; Marco Oriunno, SLAC

SiD parameters



SiD weights table

Item	Tons
Tracker + VTX	3
Ecal Barrel	59
Hcal Barrel	367
Total Inner Detectors	**429**
Cold mass	104
Vacuum Tank	117
Yoke Barrel	3000
Muon detectors Barrel	50
Self Shielding Barrel	100
Infrastructure	50
Feet x 6	180
Barrel subtotal	**4459**

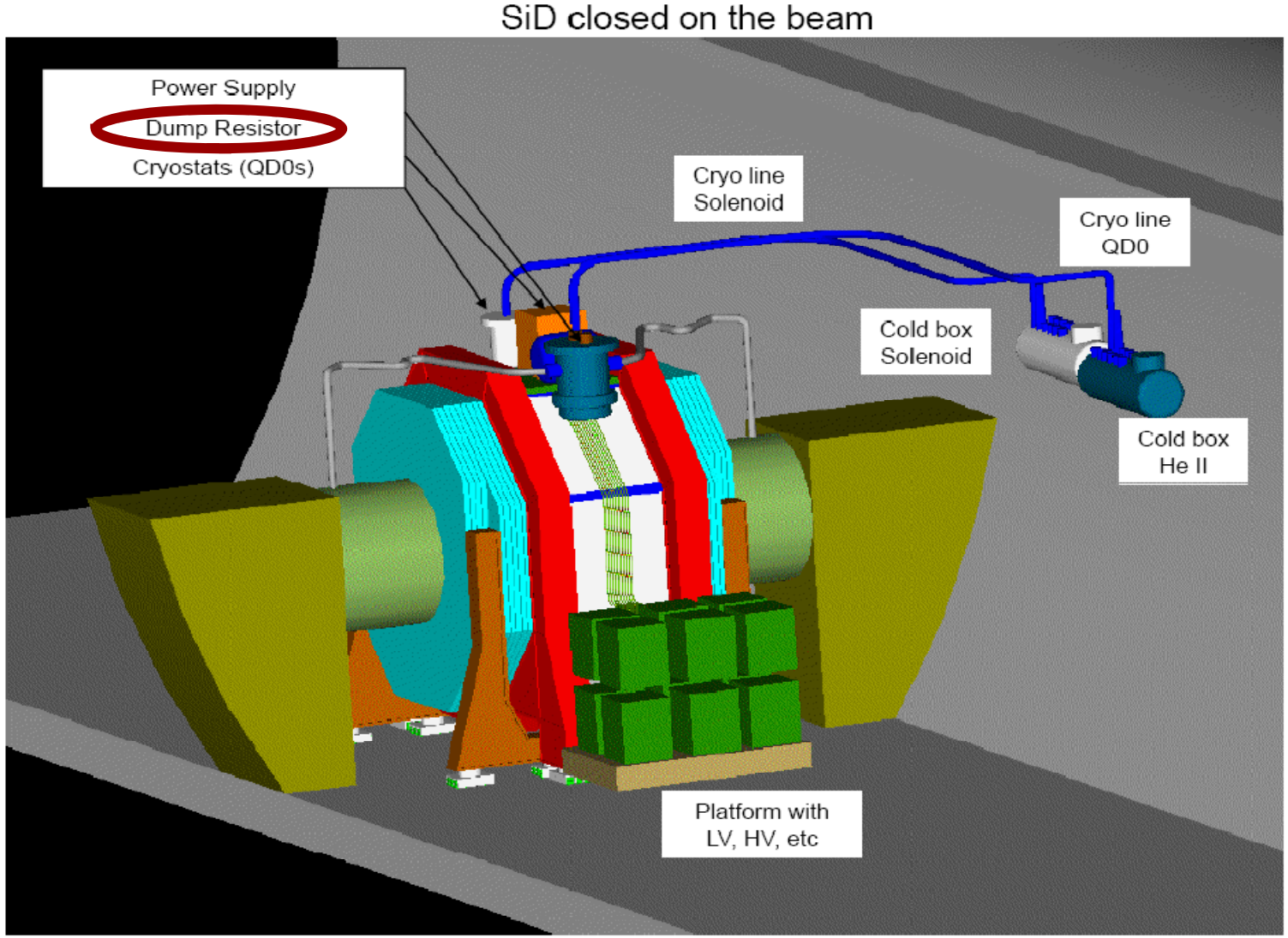
Item	Tons
Doors	
Ecal Fwd	10
Hcal Fwd	23
Yoke Forward	2315
Muon Forward	30
Feet x 2	60
Self Shielding Forward	50
BDS	5
Door subtotal	2493
Two Doors total	4986

SiD Gran Total	**9445**

M.Oriunno

SLAC, 18 September 2007

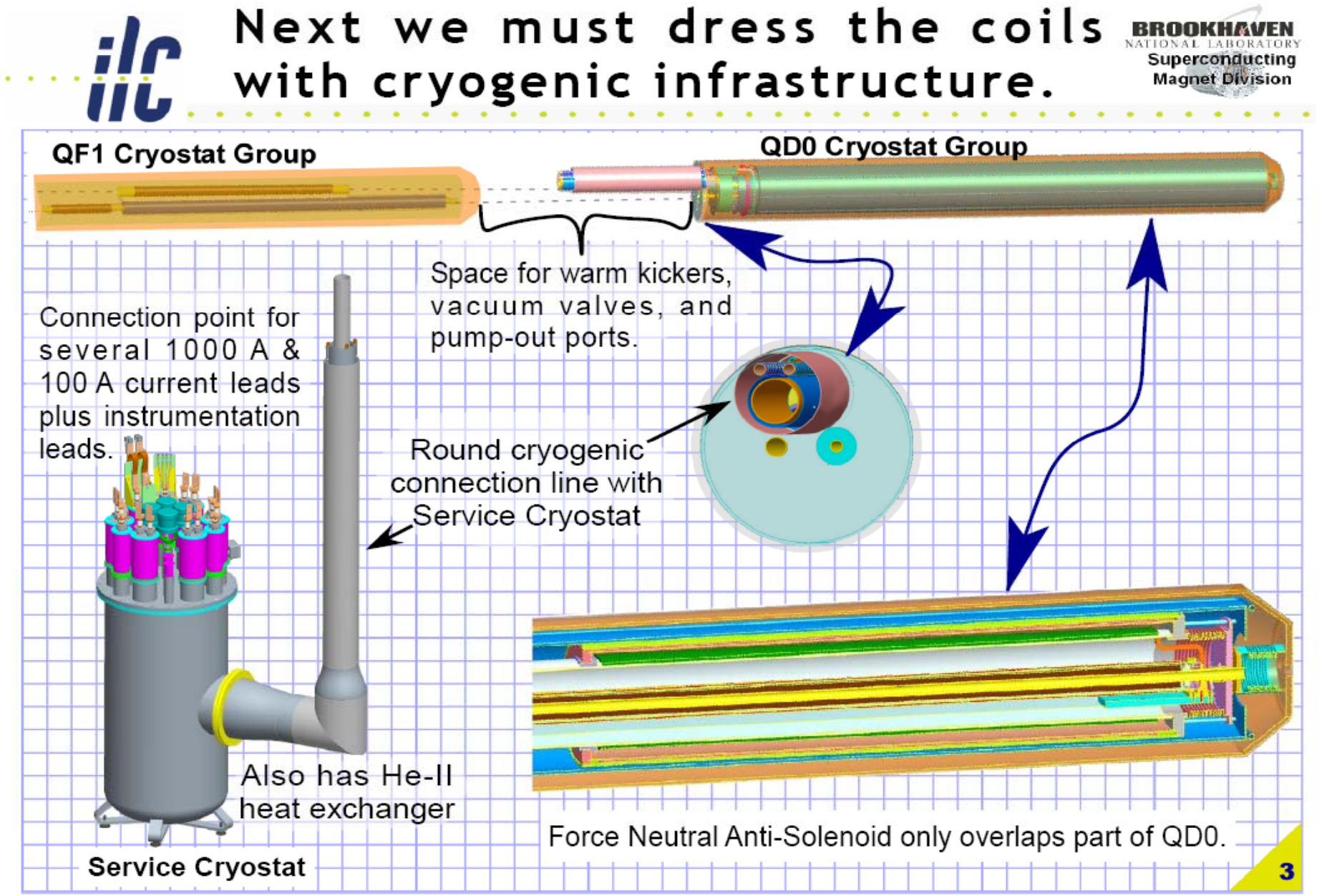
"Platform Issues"; Marco Oriunno, SLAC



"Platform Issues"; Marco Oriunno, SLAC

FD-Magnets, Cryo Supply, Vacuum

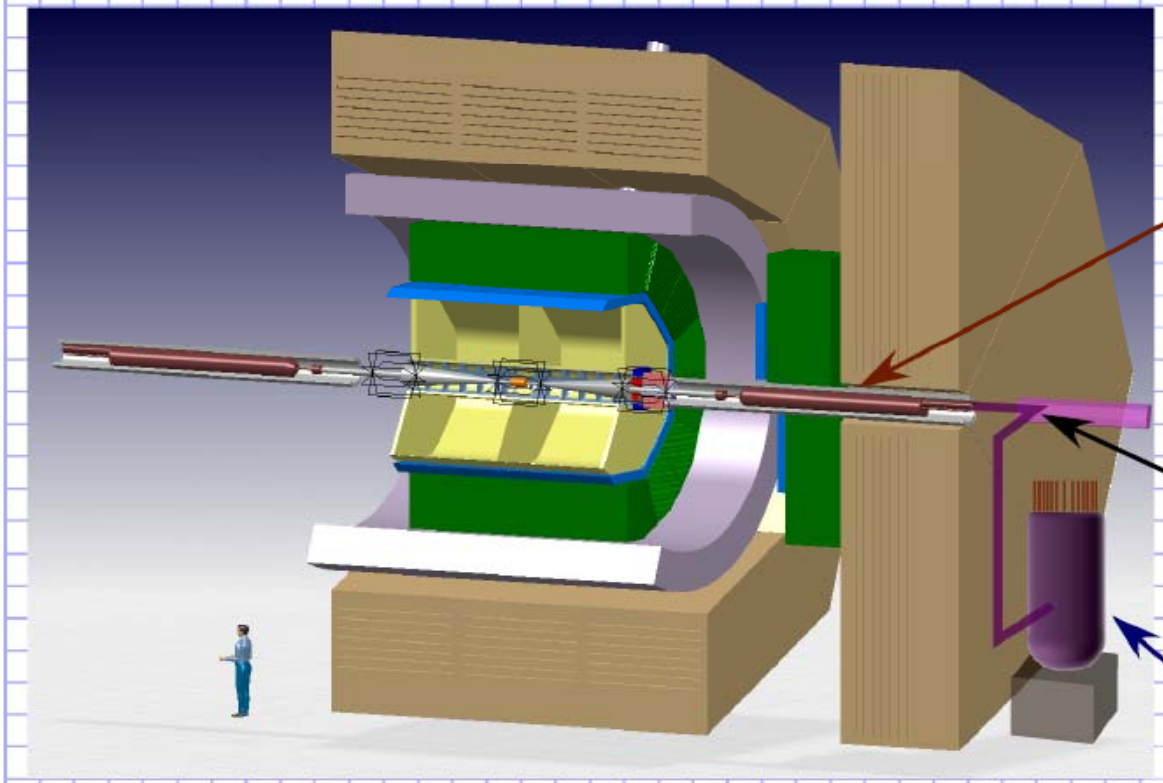
“Final Doublet Magnetic Design & Connection Model”; B. Parker, BNL



“Final Doublet Magnetic Design & Connection Model”; B. Parker, BNL

BROOKHAVEN NATIONAL LABORATORY
Superconducting Magnet Division

Finally we can start to see the tight spots.



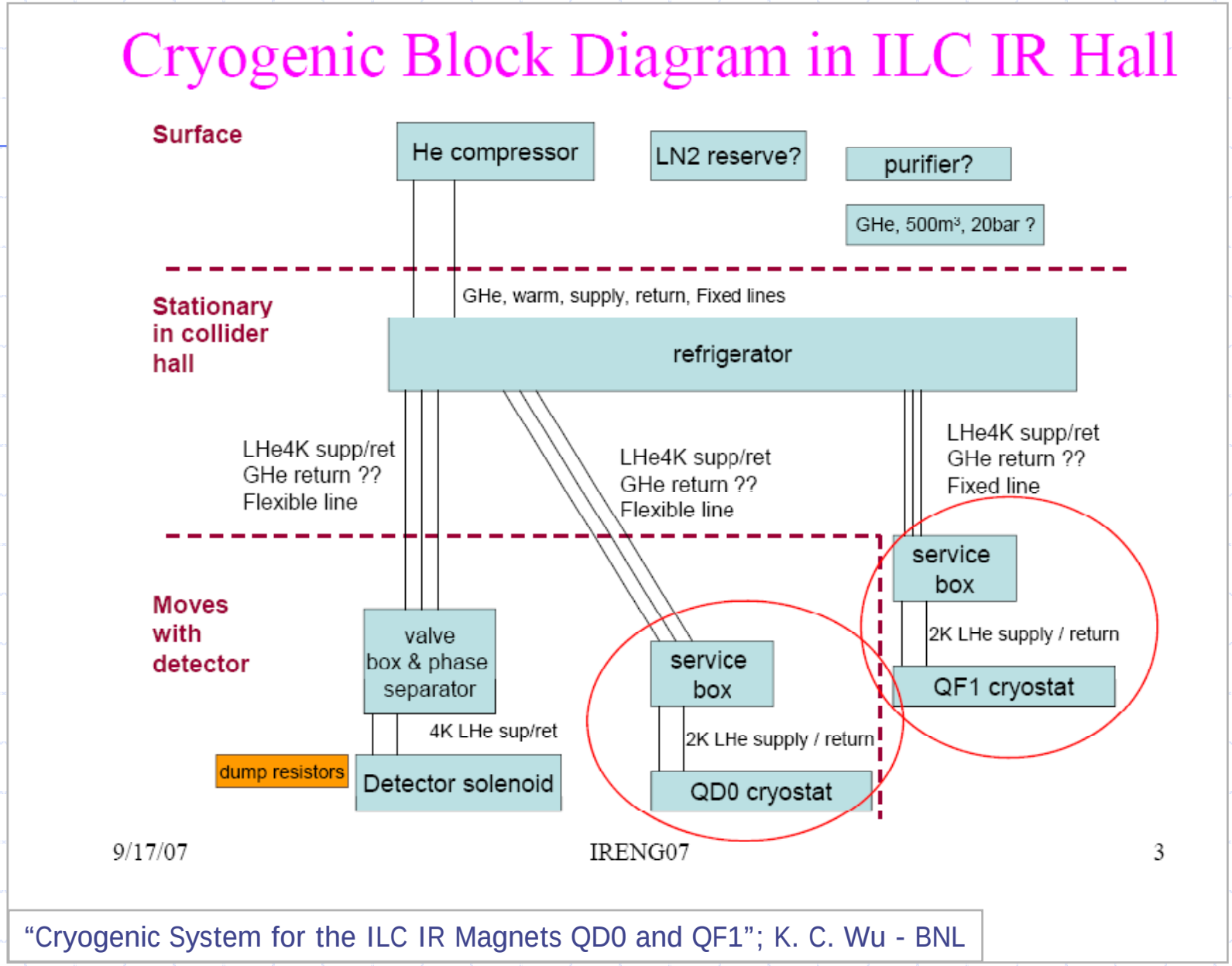
In garage position, if door needs **routinely** to be pulled further out, then we need to come up with scheme for detaching beam pipe at IP end and sliding QD0 and Service cryostat as a single unit.

Watch for QF1 interference!

Every effort is taken to minimize width of Service Cryostat since it (along with QF1) limits how far door can be opened.

Much study is needed at both the on beam and garage positions.

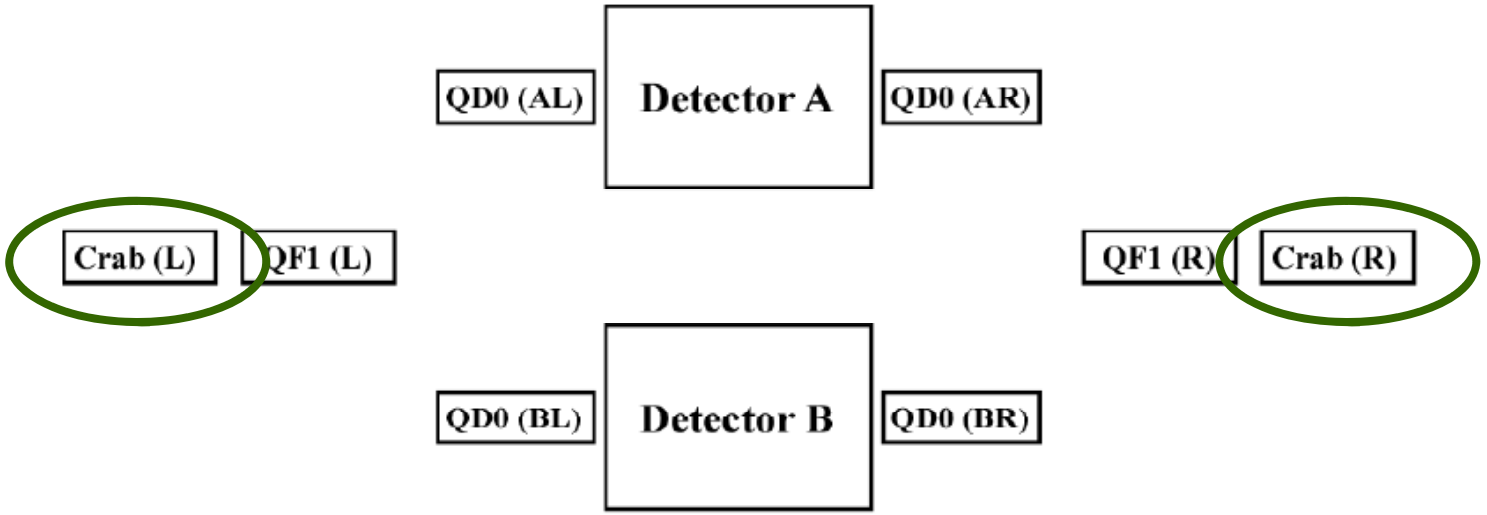
Cryo Supply



"Cryogenic System for the ILC IR Magnets QD0 and QF1"; K. C. Wu - BNL

Cryo Supply (cont')

Moving Requirement of Detector and QD0s



Detector and QD0 need to be moved by ~ 20 meters

Require ~ 50 m of Flexible Transfer lines between QD0 service cryostat and liquefier (or CDS)

QF1 and Crab Cavity do not move (Rigid Transfer Lines between service cryostat and liquefier (or CDS))

9/17/07 IRENG07 13

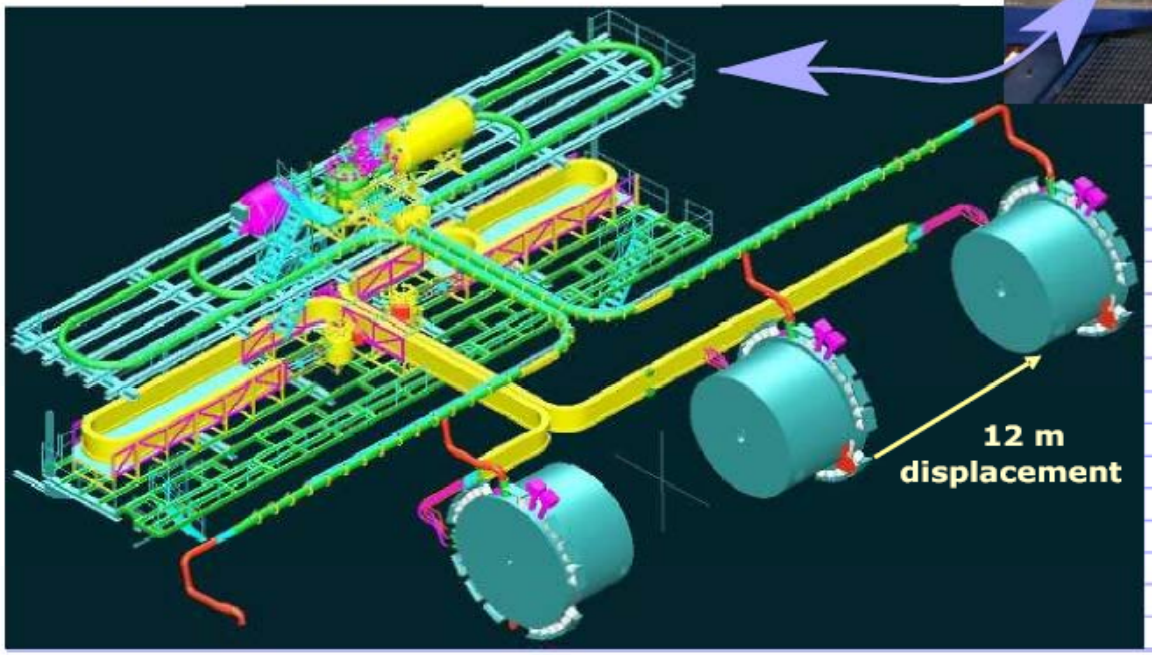
"Cryogenic System for the ILC IR Magnets QD0 and QF1"; K. C. Wu - BNL

Push-pull complications for cryogenic system.

BROOKHAVEN NATIONAL LABORATORY
Superconducting Magnet Division

Use flexible chain support and constrained semi-flexible transfer lines, in a controlled way, to enable linear motion of cryogenic components.

Ruggero Pengo, **Status of the cryogenics project (LAr, He, N2)** at Glasgow Meeting, *July 10th, 2007*



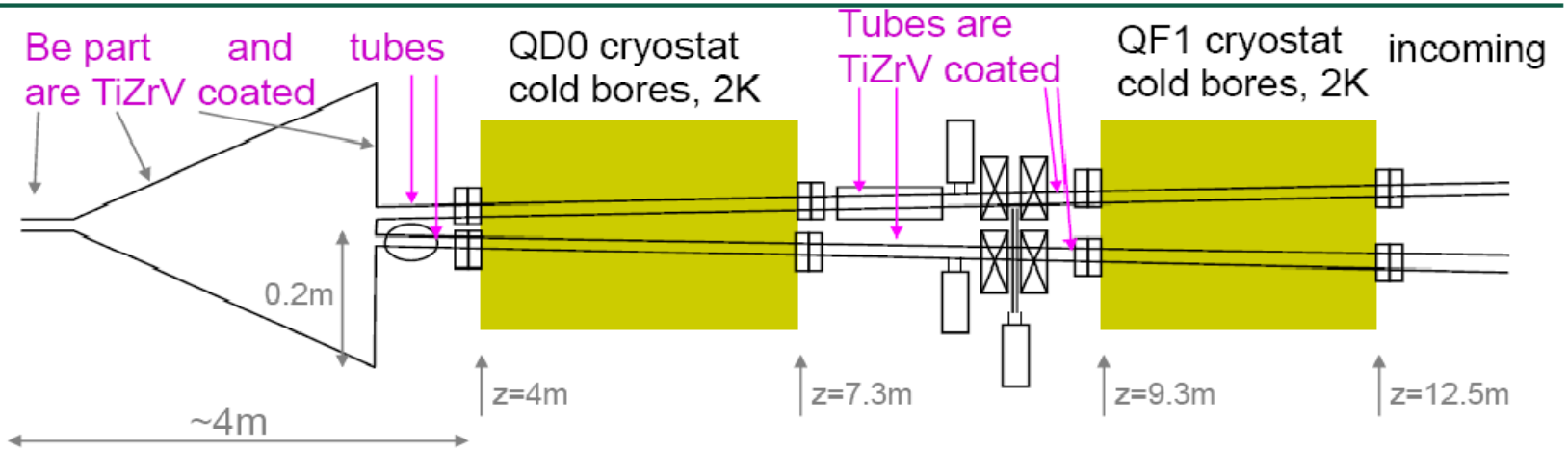
- ILC push-pull needs an even larger range of motion.
- Note that total cryogenic path length is several times longer than the range of motion.

15

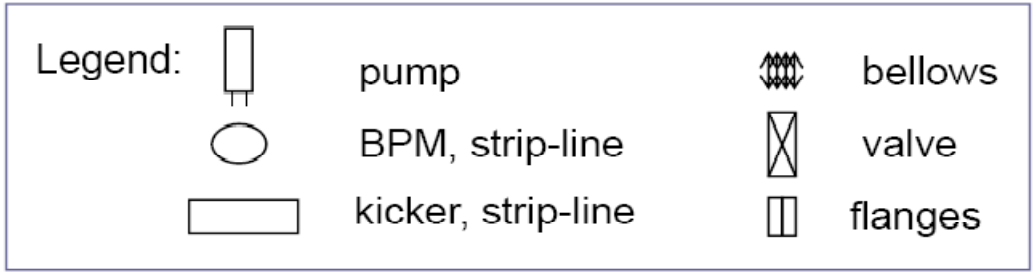
"IR Vacuum Systems first thoughts"; Oleg Malyshev

ASTeC Accelerator Science and Technology Centre

Two possible solutions: solution 1



NEG Material (TiZrV) would need bake out (~200°C)



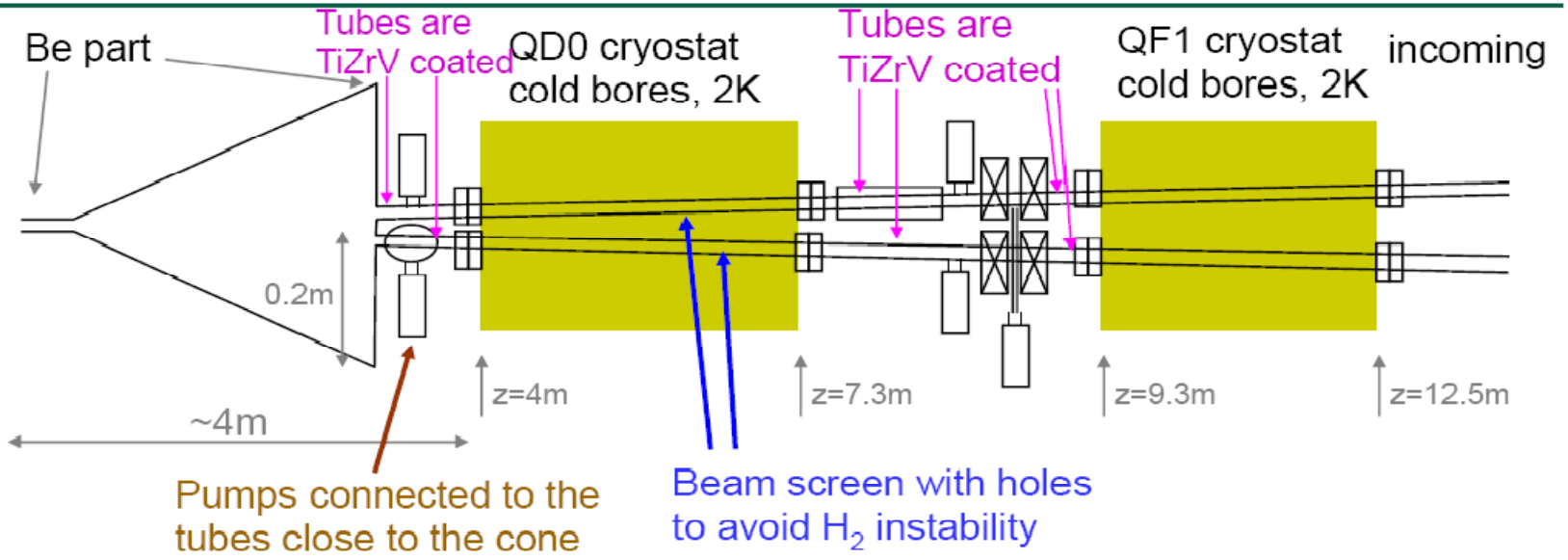
September 17-21, 2007

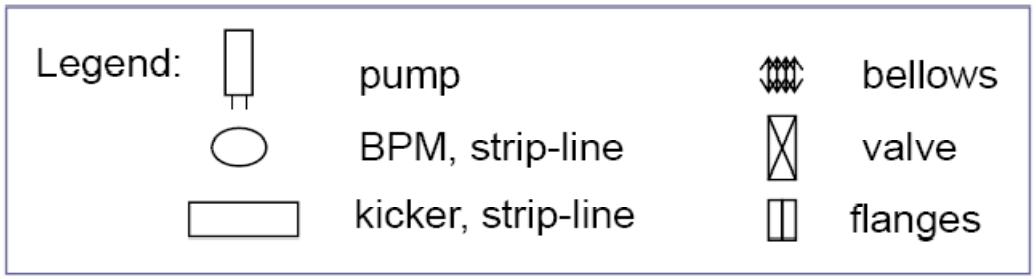
Workshop on ILC Interaction Region Engineering Design, SLAC

"IR Vacuum Systems first thoughts"; Oleg Malyshev

ASTeC Accelerator Science and Technology Centre

Two possible solutions: solution 2





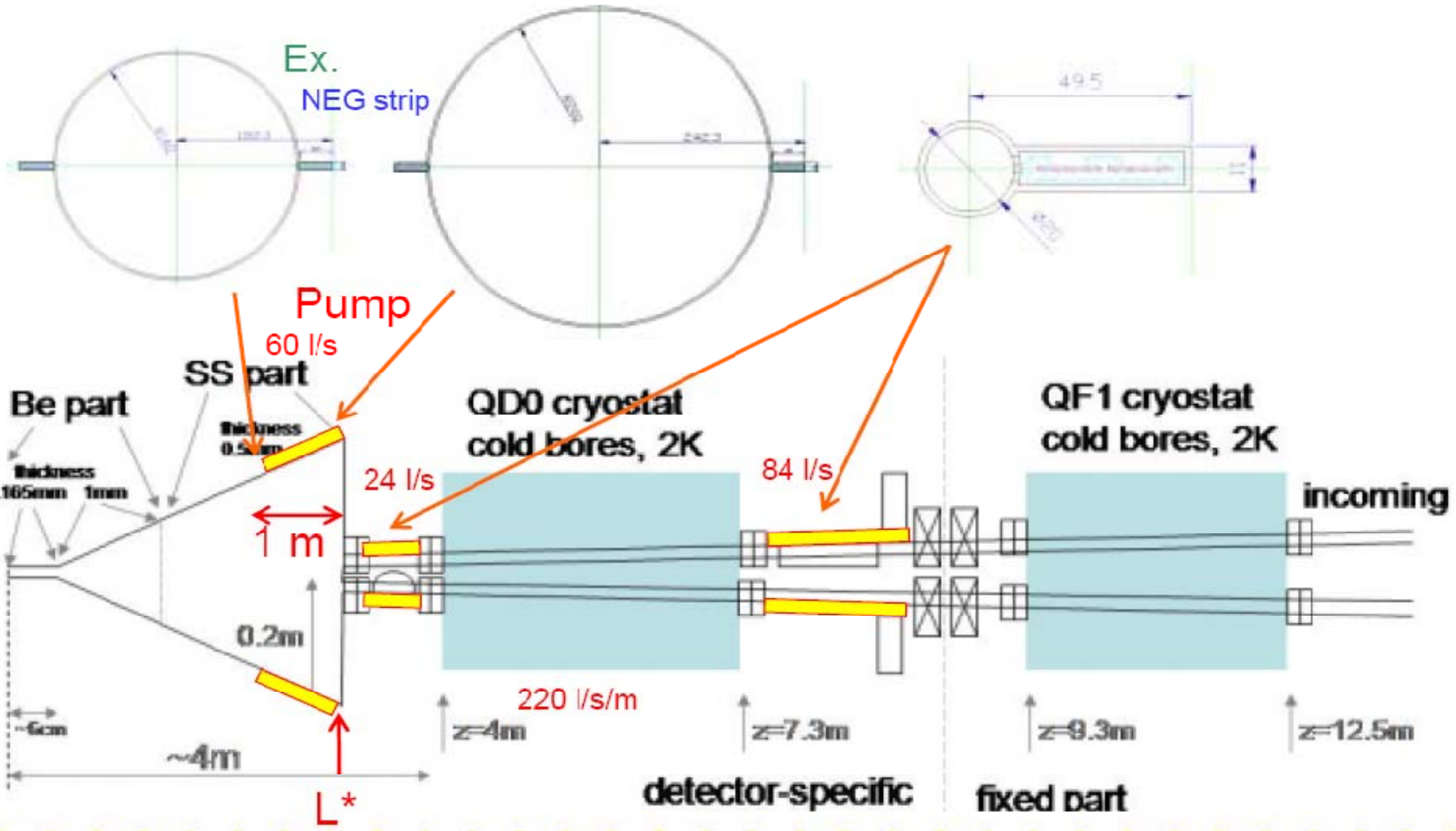
September 17-21, 2007

Workshop on ILC Interaction Region Engineering Design, SLAC

"A Basic Design of IR Vacuum system";
Y. Suetsugu, KEK

Pump system_6

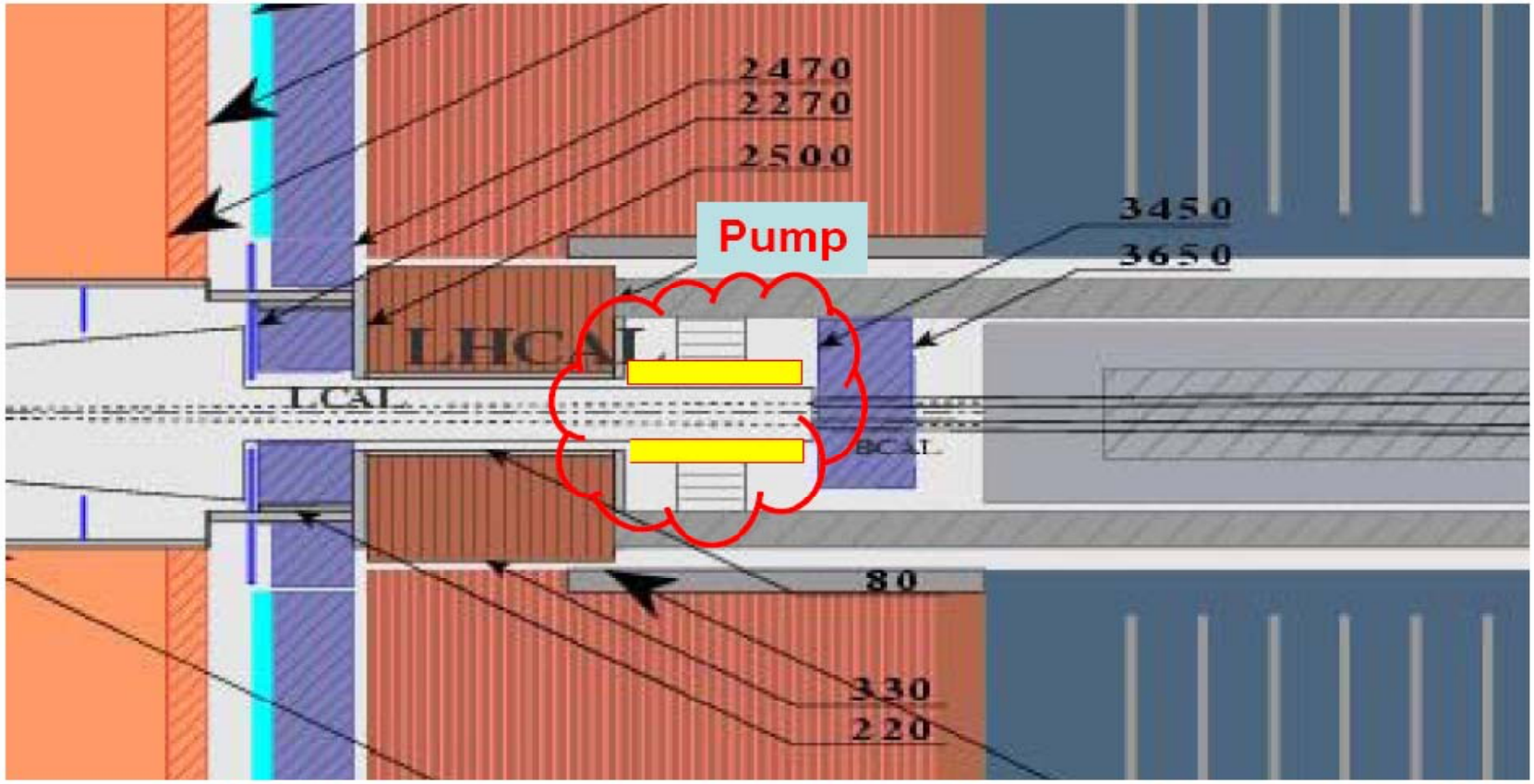
- For example, NEG pumps at the last 1 m of cone



"A Basic Design of IR Vacuum system";
Y. Suetsugu, KEK

Pump system_11

- for LDC

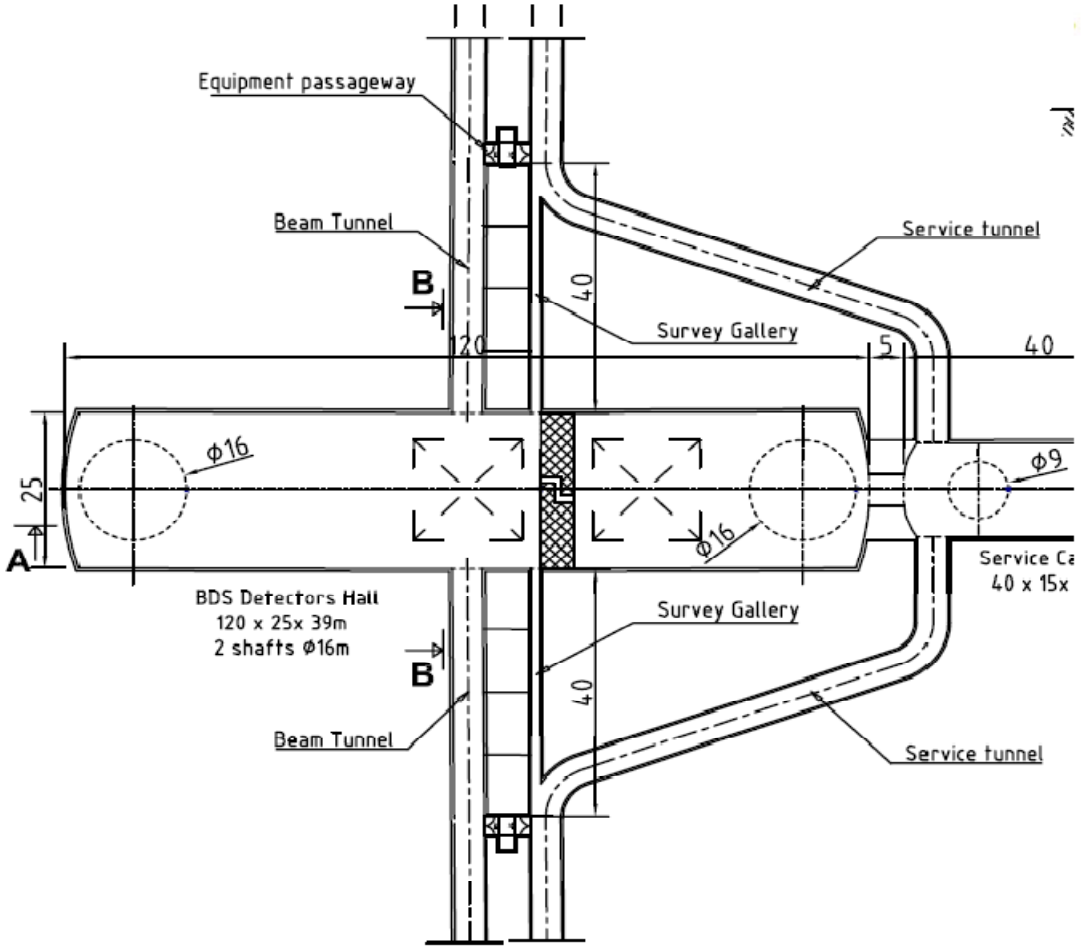


(by N. Meyners

Detector Hall

Detector Hall (cont')

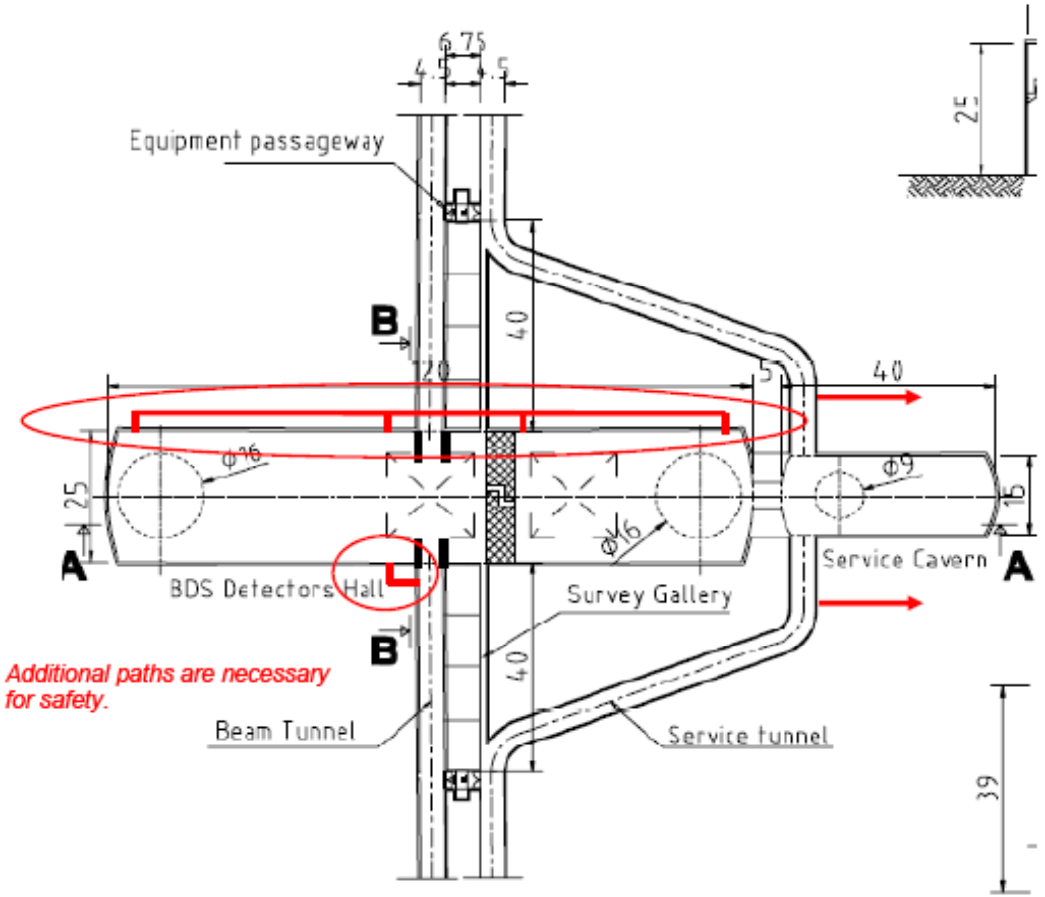
RDR Baseline Layouts for Interaction Region



By the way
the service cavern
is for the machine
not for the detector

IRENG07 Civil Engineering Works Work for Interaction Region John Osborne CERN

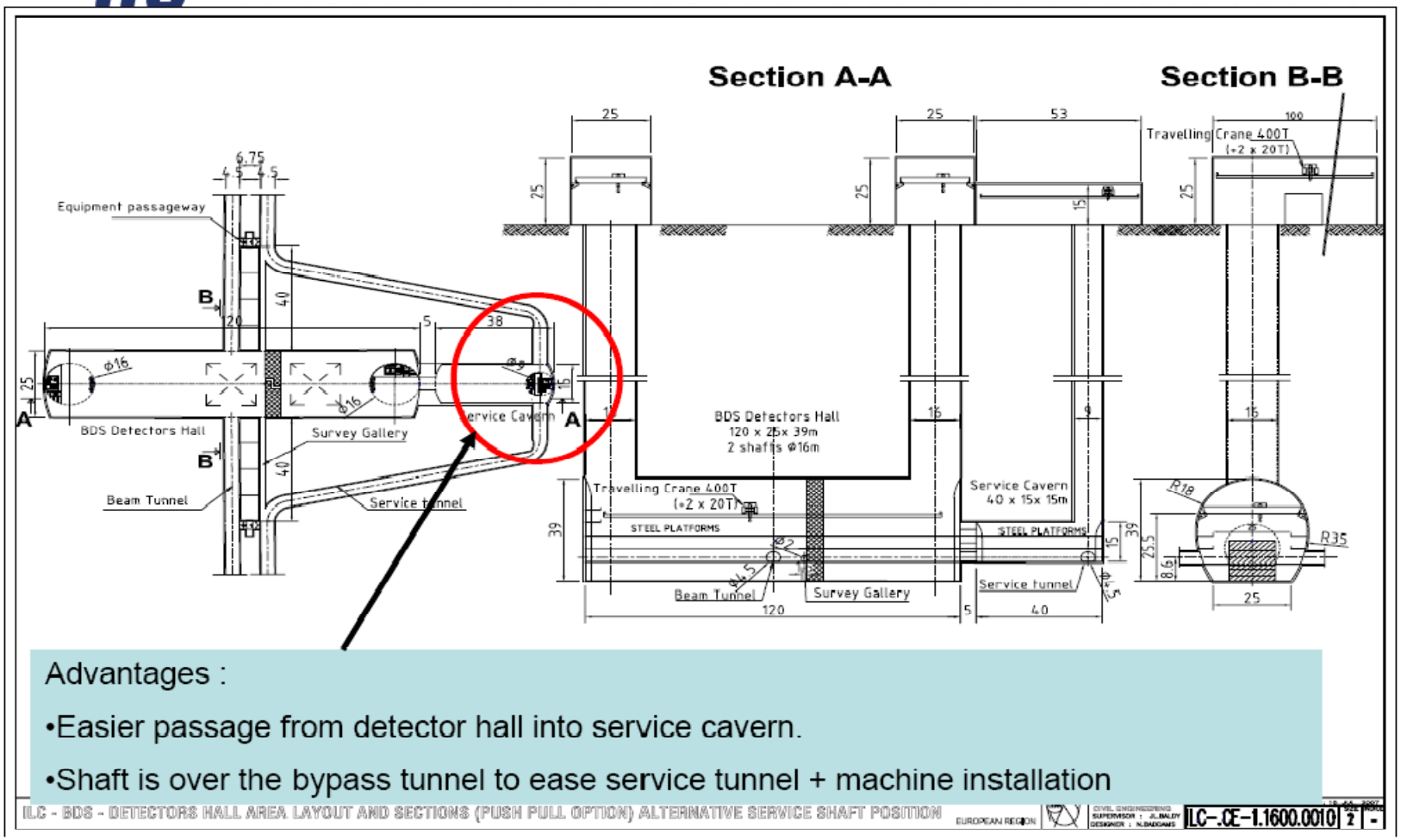
One Solution



"Safety Requirements for IR"; *Atsushi Enomoto (KEK)*

Detector Hall (cont')

Value Engineering : Move shaft to other end of service cavern ?

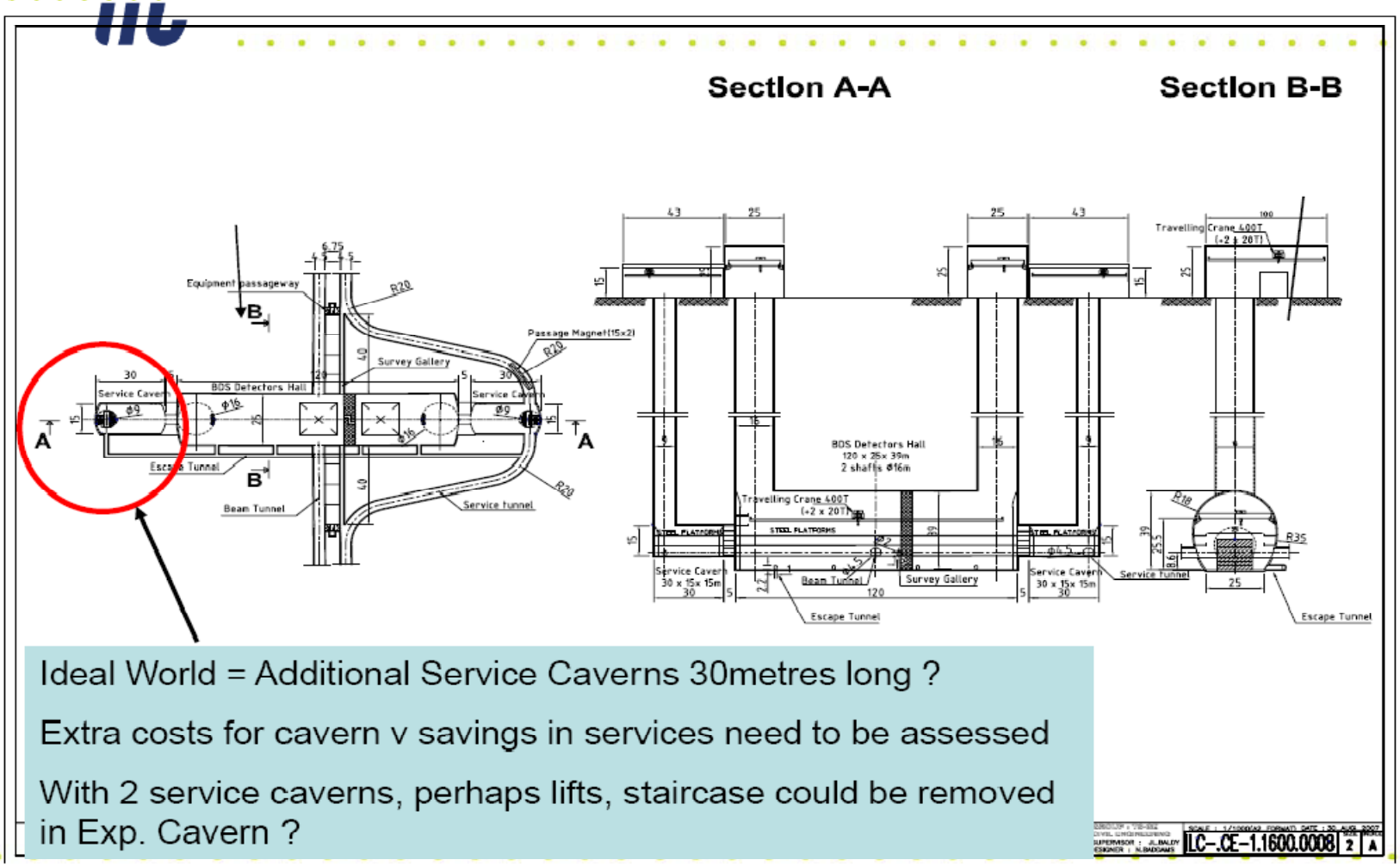


Advantages :

- Easier passage from detector hall into service cavern.
- Shaft is over the bypass tunnel to ease service tunnel + machine installation

Detector Hall (cont')

Value Engineering : Two service caverns ?



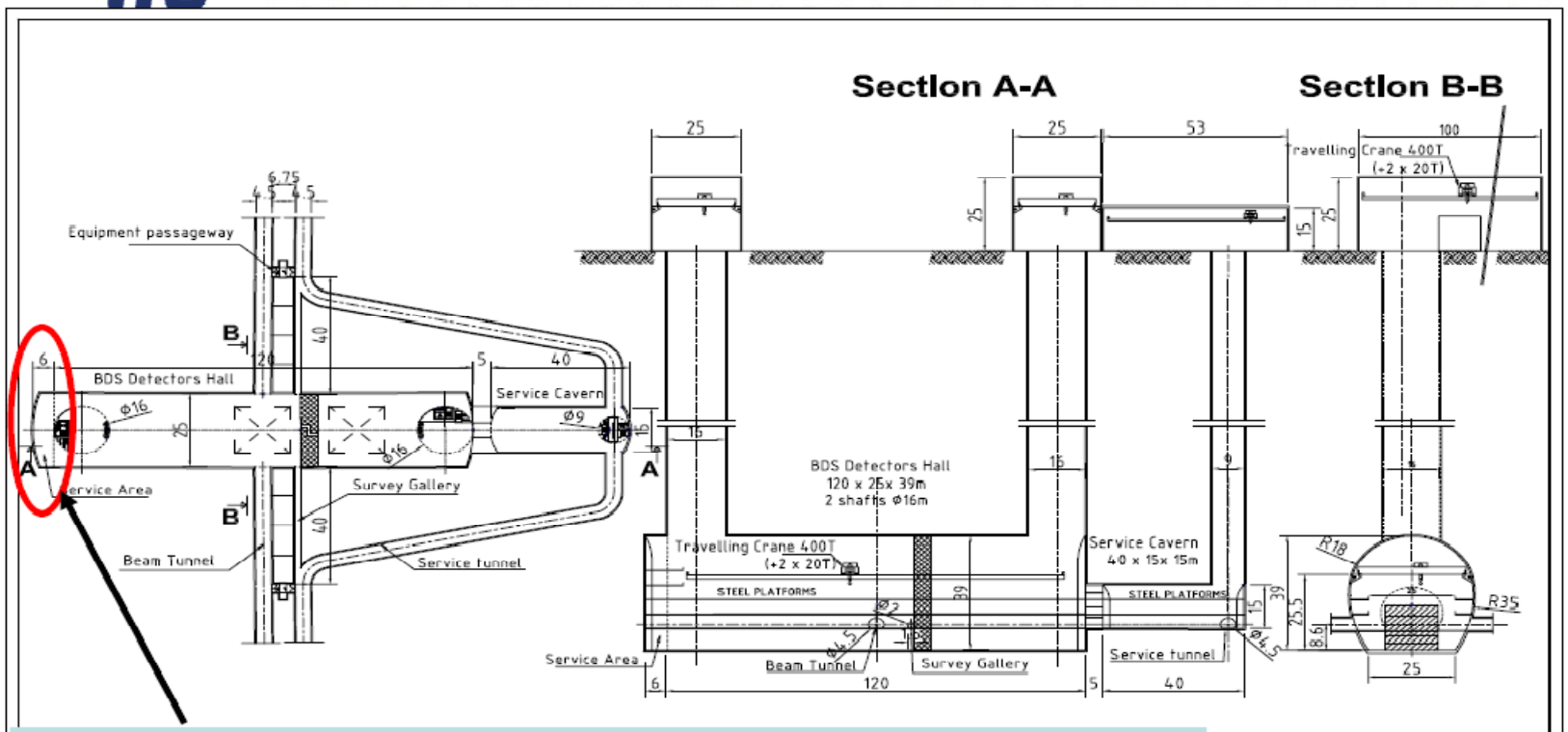
Ideal World = Additional Service Caverns 30metres long ?

Extra costs for cavern v savings in services need to be assessed

With 2 service caverns, perhaps lifts, staircase could be removed in Exp. Cavern ?

Detector Hall (cont')

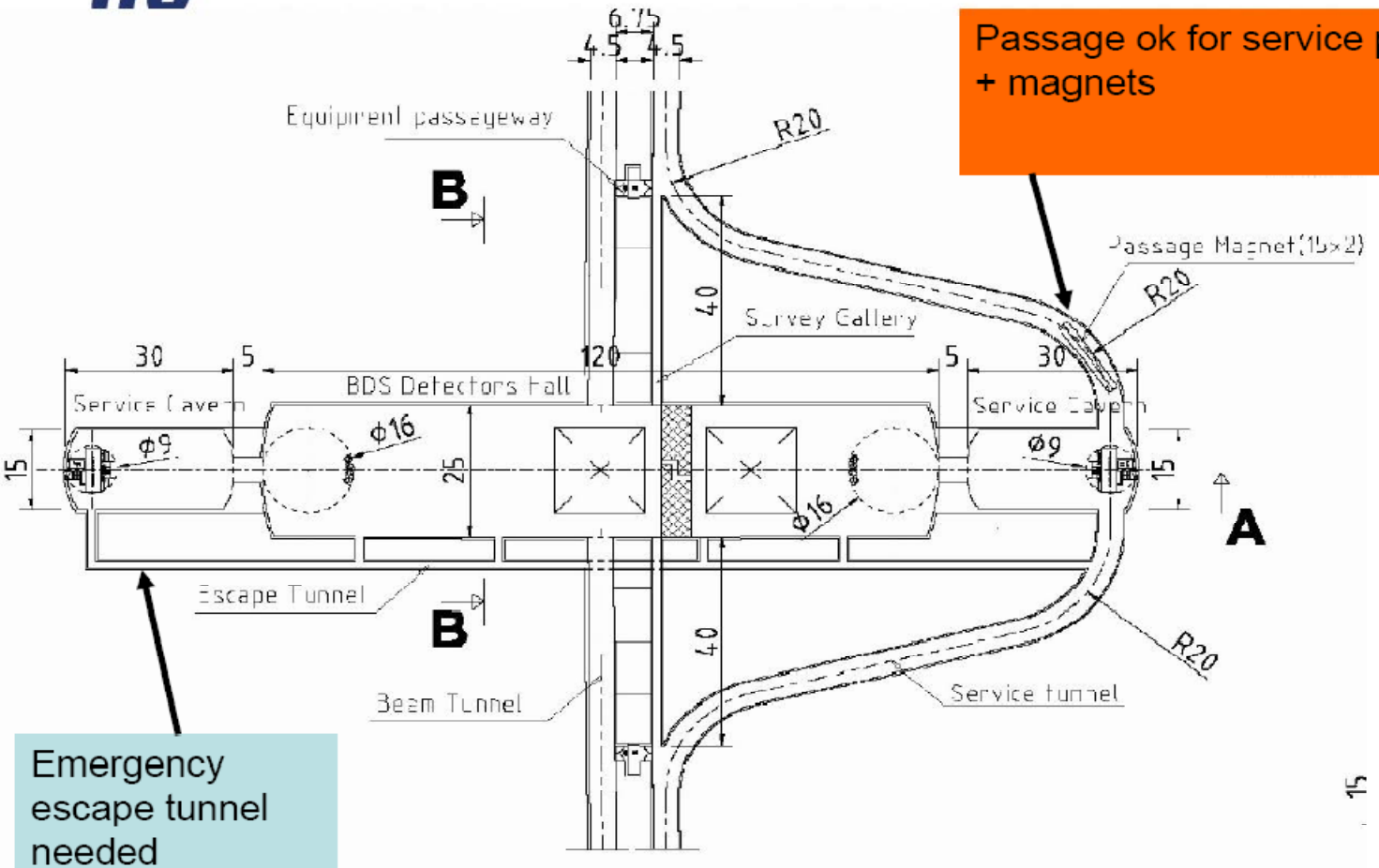
Value Engineering : Instead of two service caverns, extend experimental cavern ?



Extend Experimental Cavern by 6metres for Secondary Services such as : magnet electrical cooling circuits (transformer, DC power supply etc), cryogenic and vacuum components for the magnet, cooling water for the skids……

Detector Hall (cont')

Value Engineering : Two service caverns ?



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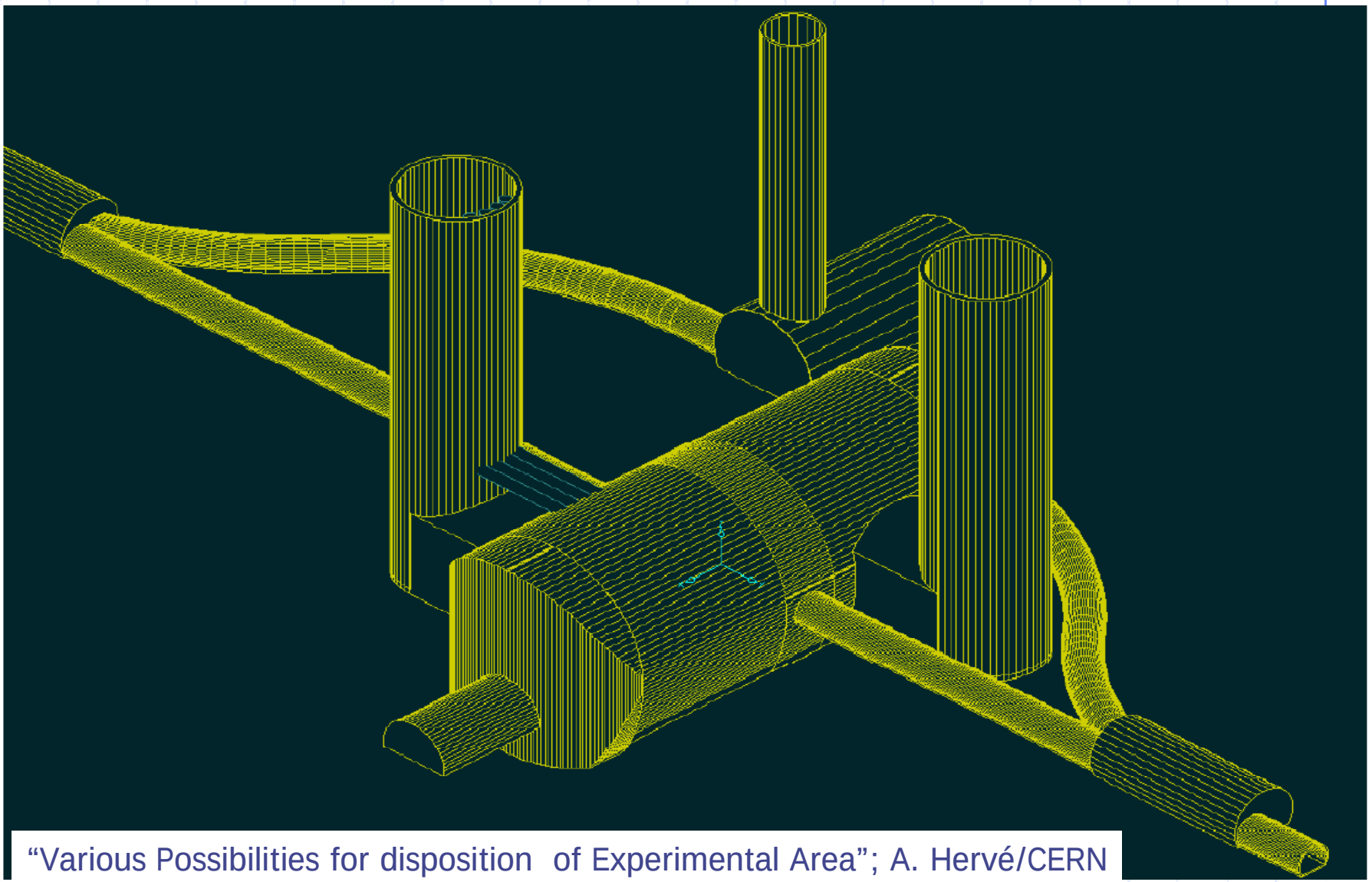
Detector Hall (cont')

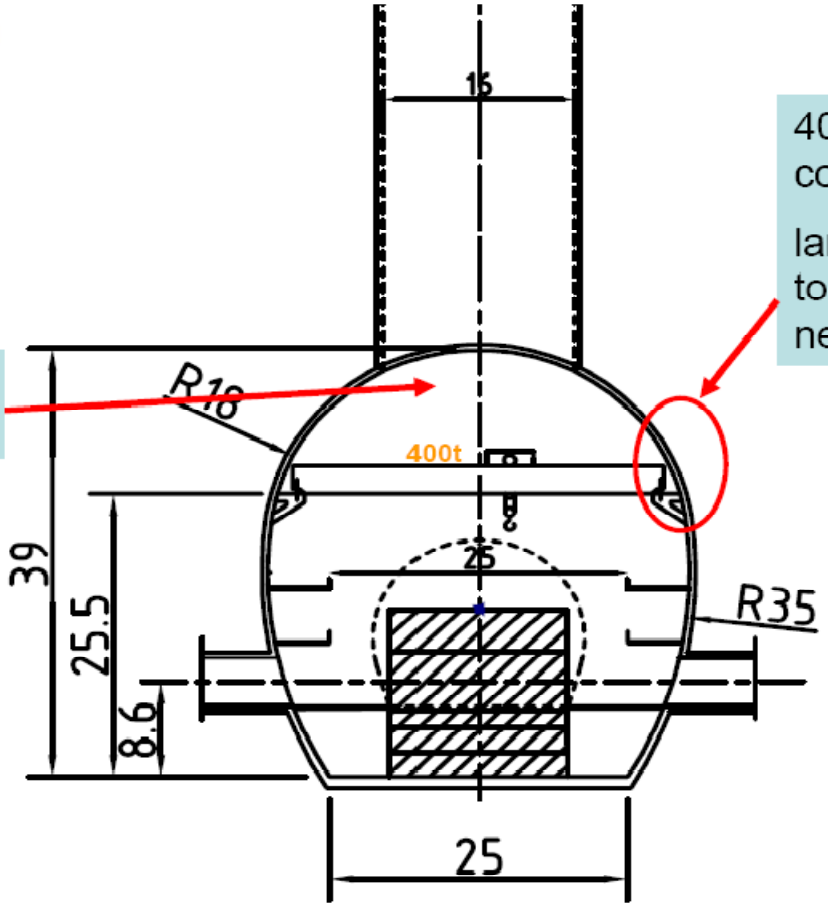
Would need a change control request!



"Various Possibilities for disposition of Experimental Area"; A. Hervé/CERN

Detector Hall (cont')

Value Engineering : Reduce height and widen cavern



Lot of lost space

400 ton gantry crane is the cost driver

large steel columns down to floor level would be needed

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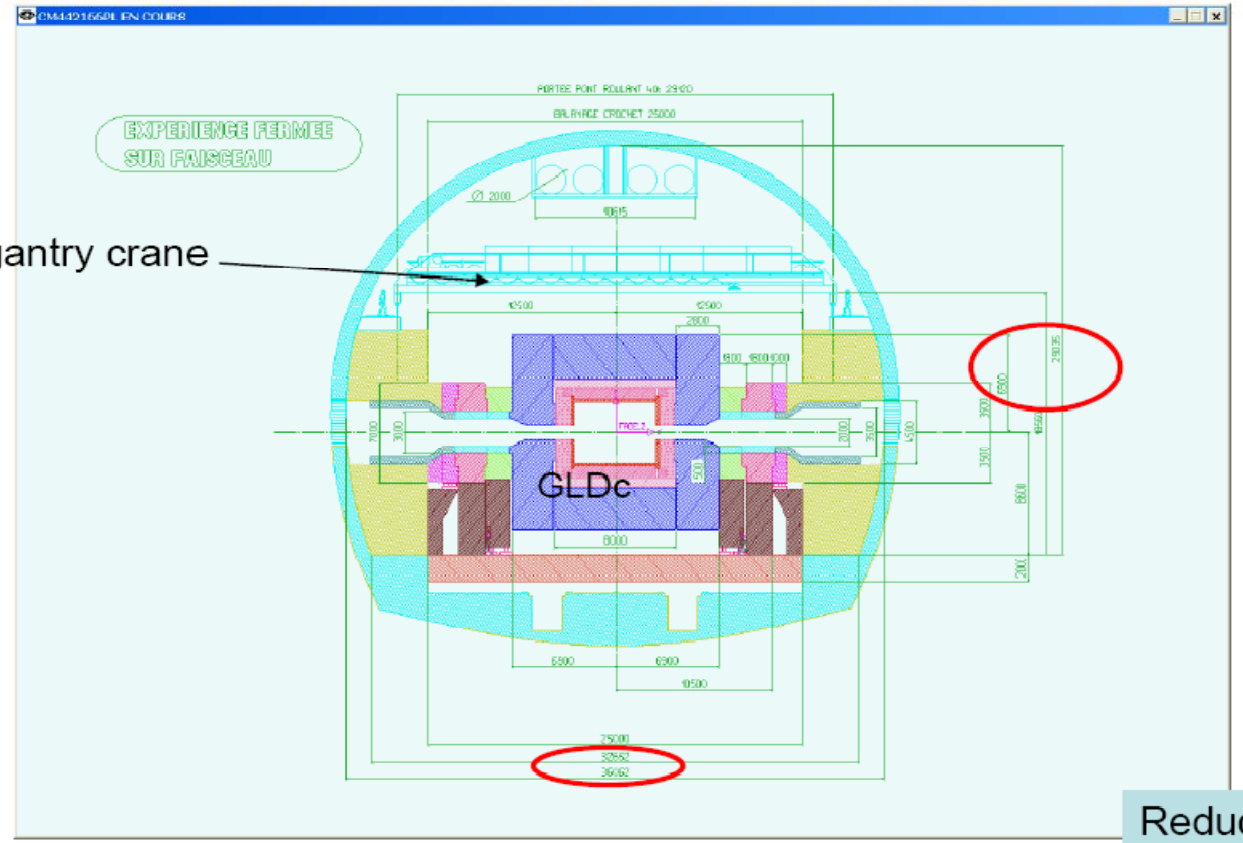
Detector Hall (cont')

Value Engineering : Reduce capacity of cavern gantry from 400tons to 20tons ?

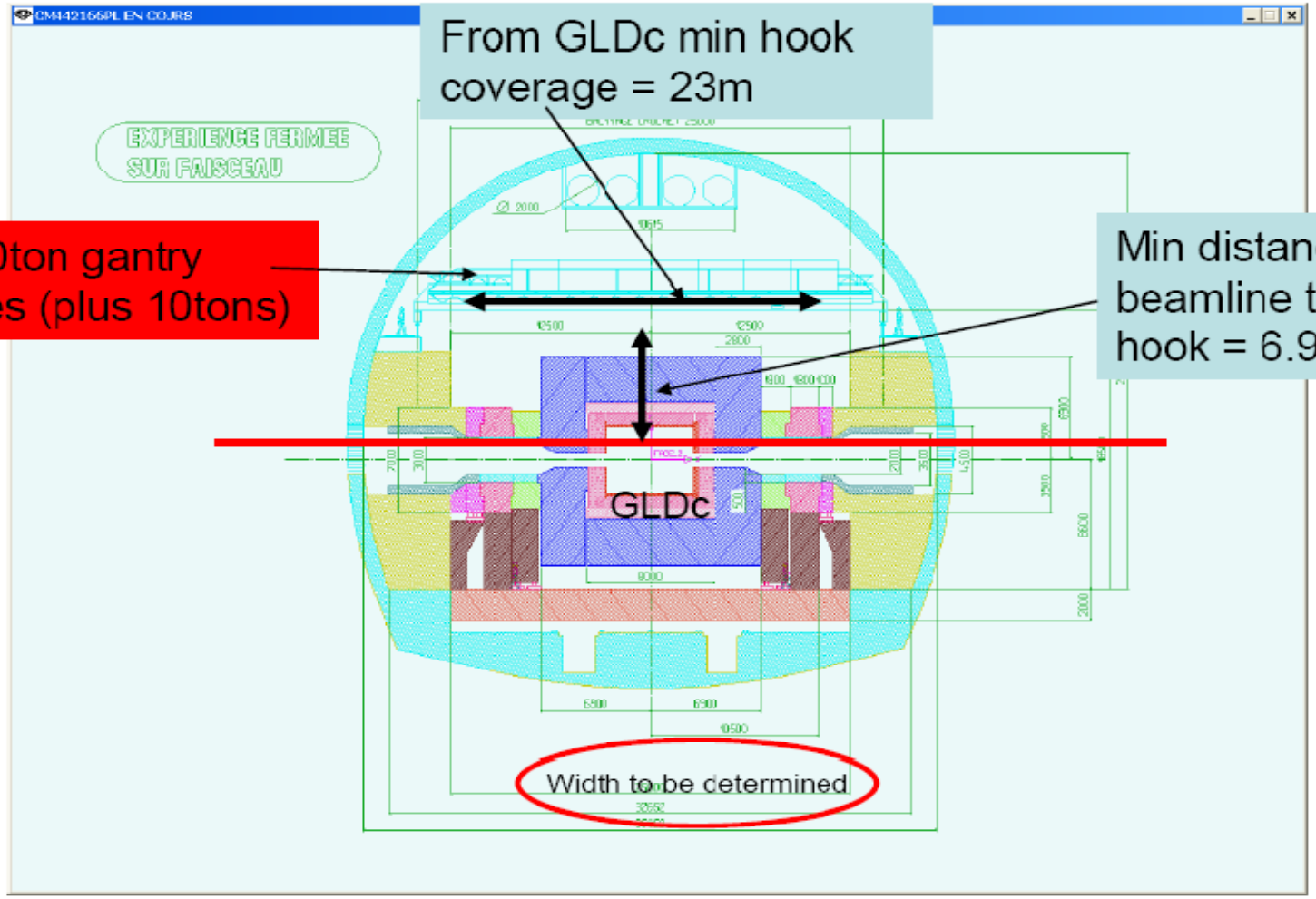


Reduce cavern height, but increase width ?
Cost neutral.

IRENG07 Civil Engineering Works Work for Interaction Region

Detector Hall (Starting Point)

IREN07 : Experimental Cavern Criteria



General Supplies (Starting Point)

Impressive fast Agreement

Criteria Examples

IRENG07 Draft Utilities Requirements
20-Sep-07

Item	Description	Generic	GLD	GLDc	LDC	SiD	4th Type
1	Hall SA End Temperature (Deg C)	21	21	21	21	21	21
2	Hall Stratified Temperature Rise (Deg C)	3	3	3	3	3	3
3	Hall Air Temperature Stability (+/- Deg C)	2	2	2	2	2	2
4	Hall Dew Point Temperature (Deg C)	13	13	13	13	13	13
5	Hall Maximum Relative Humidity (%)	60	60	60	60	60	60
6	Process Load to Hall Air per Detector (kW)	40	40	40	40	40	40
7	Process Detector Load to CHW per Detector (kW)	200	200	200	200	200	200
8	Process Load to Other CHW per Detector (kW)	100	100	100	100	100	100
9	Process Load to LCW per Detector (kW)	200	200	200	200	200	200
10	Hall Space Load to Air (W/Sq M - Dry Xfmrs, tools, pumps, lights, etc.) ???	40	40	40	40	40	40
11	Ventilation (Numer of Persons in Hall - Add separate fan coil people heat load)	100	100	100	100	100	100
12	Ventilation (Cu M/Hr)	4300	4300	4300	4300	4300	4300
13	Hall Pressurization (Negative milliBars)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
14	Hall Pressurization Stabilization (+/- milliBar - Bubblers or Chambers)	0.05	0.05	0.05	0.05	0.05	0.05
15	Shaft/Egress Pressurization (Positive milliBar)	0.2	0.2	0.2	0.2	0.2	0.2
16	Process CHW Supply Temperature (Deg C)	16	16	16	16	16	16
17	LCW Supply Temperature (Deg C)	16	16	16	16	16	16
18	LCW Make Up Source (Accelerator? Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
19	Hall ODH Purge (Y/N - Cu M/ Hr if Y)	No	No	No	No	No	No
20	Hall Activated Air Purge (Y/N - Cu M /Hr if Y)	No	No	No	No	No	No
21	Permanent Hall Smoke Purge (Y/N - If No use ventilation AHU at high-speed)	No	No	No	No	No	No
22	Thermal Dimensional Stability Provided from Skids (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
23	Sub-Atmospheric Utility Water Systems Needed (Y/N)	No	No	No	No	No	No
24	CHW Cooling for Magnets & Power Supplies (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
25	Non-Dessicant Dehumidification for Hall (Y/N - If Yes Hall surfaces are sealed)	Yes	Yes	Yes	Yes	Yes	Yes
26	Ventilation Provided by Ground Level AHU's (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
27	Hall Air Load & Dehumidification Provided by Hall Fan-Coils (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
28	All Cooling to Hall Provided by Insulated CHW to HXs (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
29	Surface to Hall CHW Pressure Interruption Provided by HXs (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
30	Utility / Detector Interface at Hall Spiggots (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
31	Compressed Air Supply Volume per Detector (Standard Cu M /Min)	200	200	200	200	200	200
32	Compressed Air Supply Pressure (MegaPascals)	1	1	1	1	1	1
33	Compressed Air Supply Oil Free Plant at Ground Level (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes

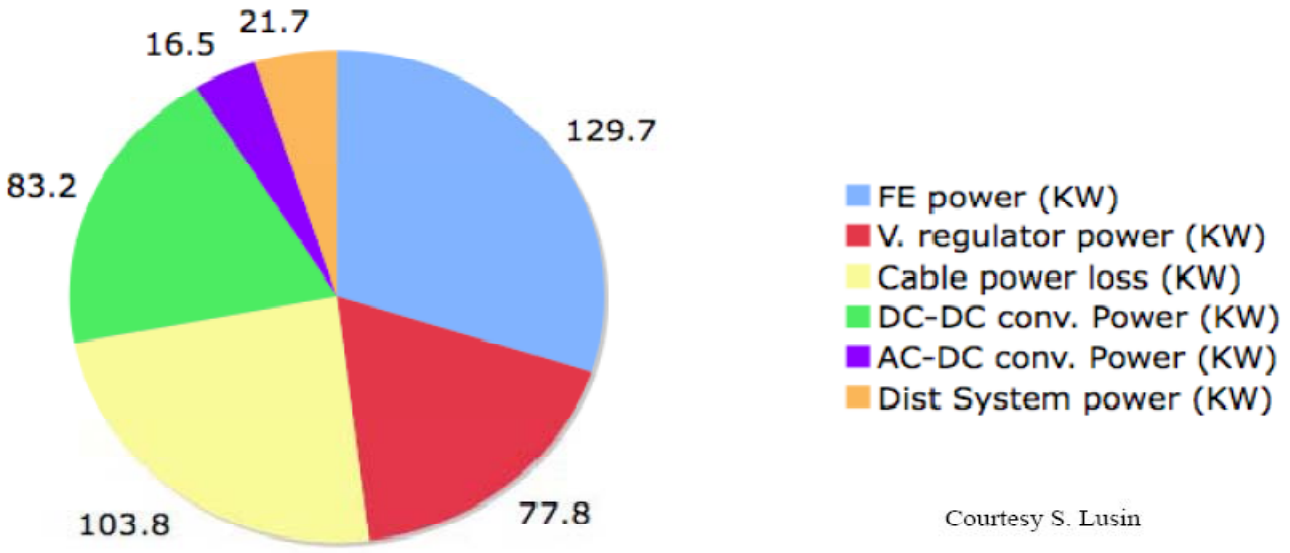
"Working Groups A & C Parallel Session Summary"

General Supplies (CMS experience)

Power Losses

Consider a factor 2 wrt final end user to design transformers and power lines.
As an example, CMS Ecal use 207 kW over a total available of 432 kW

ECAL Power Distribution



Courtesy S. Lusin

Andrea Gaddi, CERN Physics Dept.

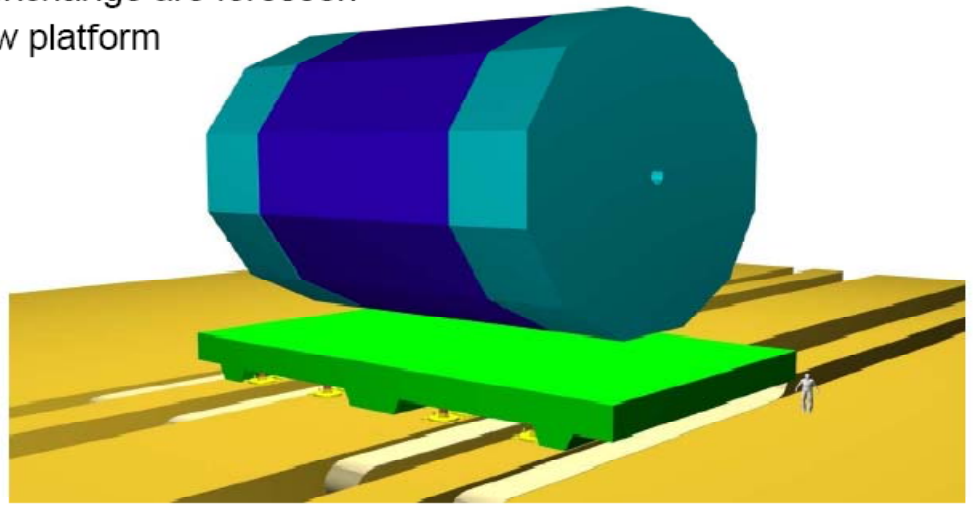
An integrated design for ILC detectors services"; A.Gaddi

Detector Hall (Platform)

Basic ideas about the moving platform

(A.Herve / H.Gerwig, CERN)

- Could be made of reinforced concrete f.ex.
- About 2.25 m thick, 21 m long and 12 m wide
- Weight 1100 tons, detector on it ca. 15000 tons
- Hilman rollers or airpads to move platform
- Friction = 1%, movement horizontal (no slope)
- Hydraulic jacks of ca. 200 tons needed
- Access for maintenance and exchange are foreseen
- Cable chains in trenches below platform

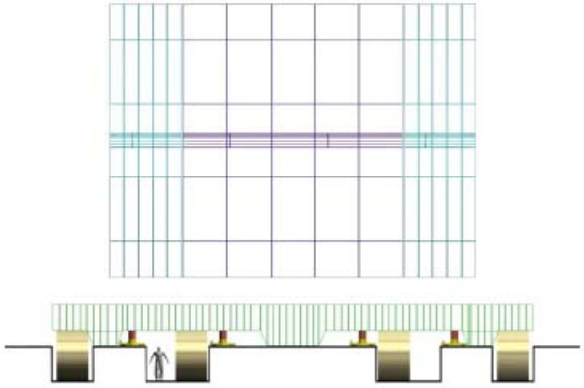


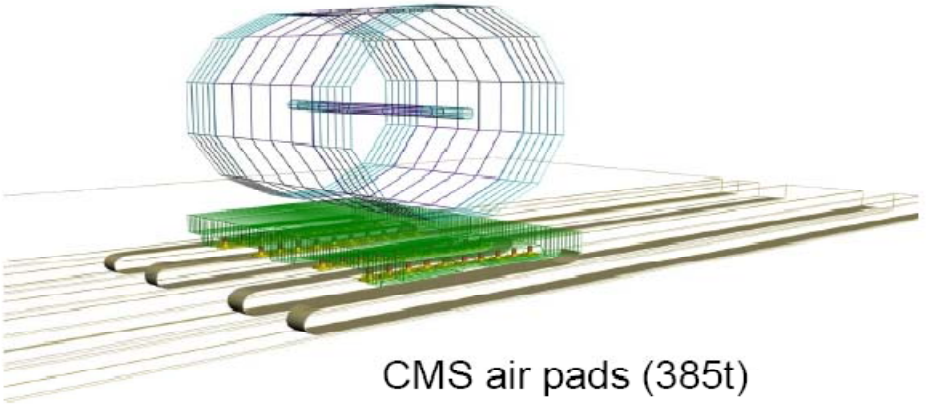
"Platform Issues"; Marco Oriunno, SLAC

SLAC, 18 September 2007

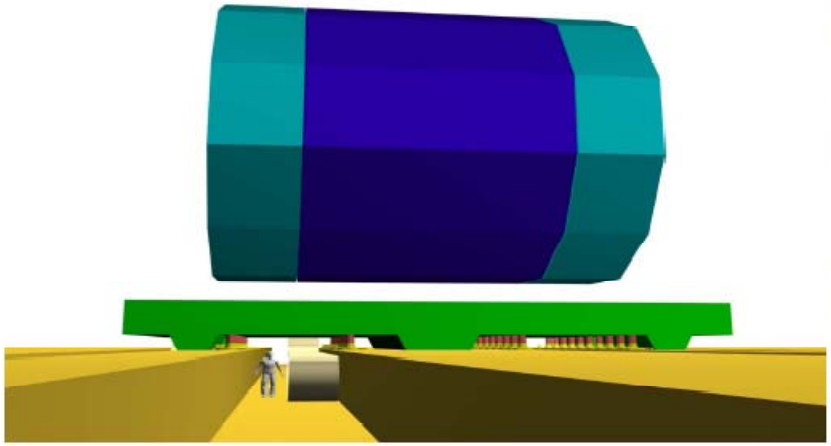
Detector Hall (Platform cont')

Cable chain in trench
(A.Herve / H.Gerwig, CERN)





CMS air pads (385t)

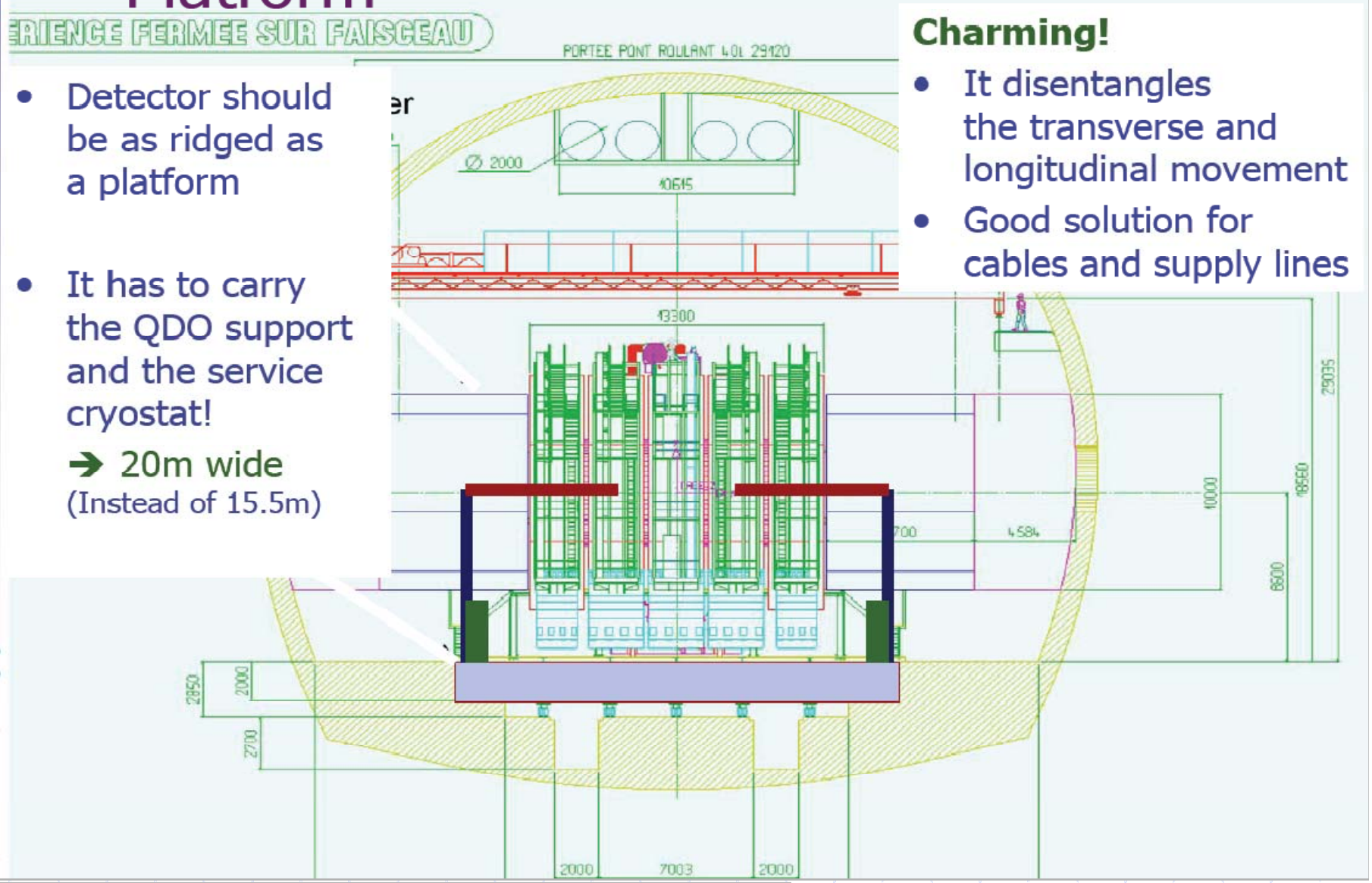


SLAC, 18 September 2007

"Platform Issues"; Marco Oriunno, SLAC

Platform

- Detector should be as ridged as a platform
- It has to carry the QDO support and the service cryostat!
  - ➔ 20m wide (Instead of 15.5m)



Charming!

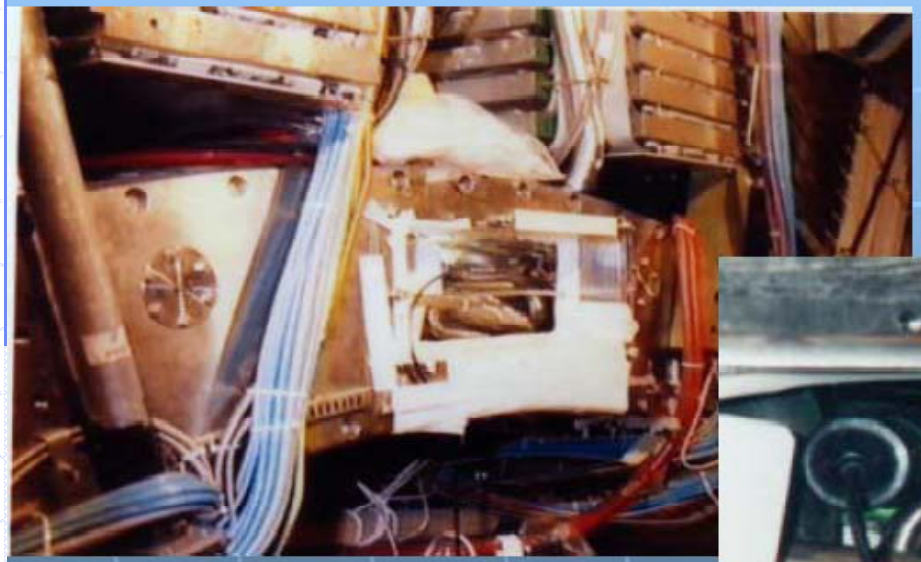
- It disentangles the transverse and longitudinal movement
- Good solution for cables and supply lines

"LDC Engineering Design (Status)"; N.Meyners, DESY

Experience from other Detectors

Experience from other Detectors
(Failure in Aleph Coil)

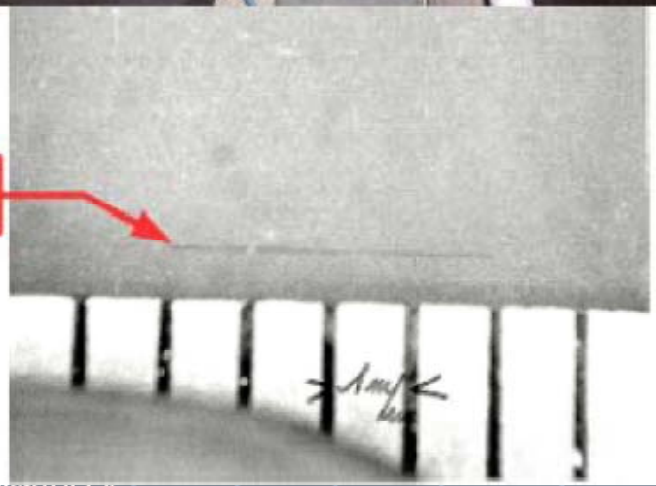
- For some unknown reason, during assembly, the stainless pipe had been blocked between two pipes; thus the flexible part supposed to take care of the contraction of the screen due to temperature could not play its role, and the result was an enormous tensile stress on the pipe, until it broke.



Experience from other Detectors
(Carbon fiber in Aleph TPC)

(N.B., design your detector to be easily accessible...)

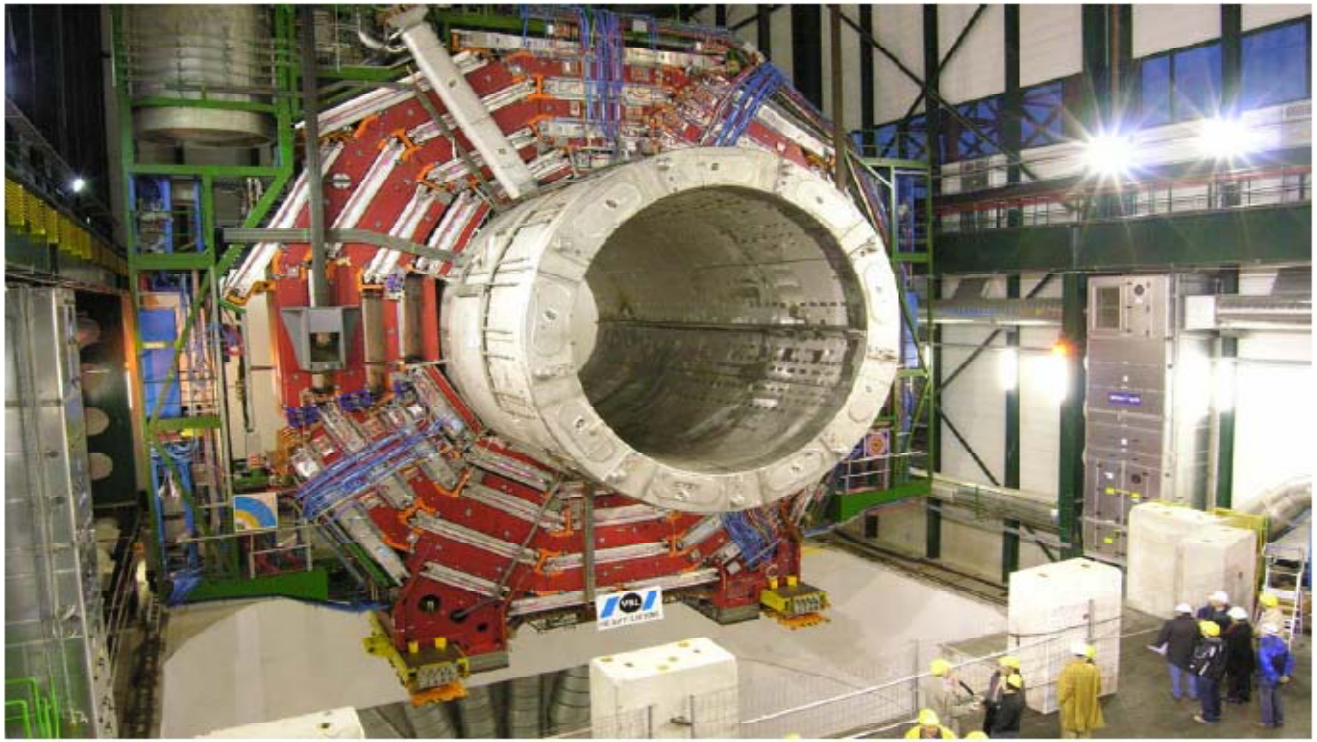
Fibre found at z=36 cm



Intervention during 1999 shutdown

Heavy Lifting

2000 tons traveling down 100 m



Hubert Gerwig
CERN, Physics Department

Pro and con's of airpads

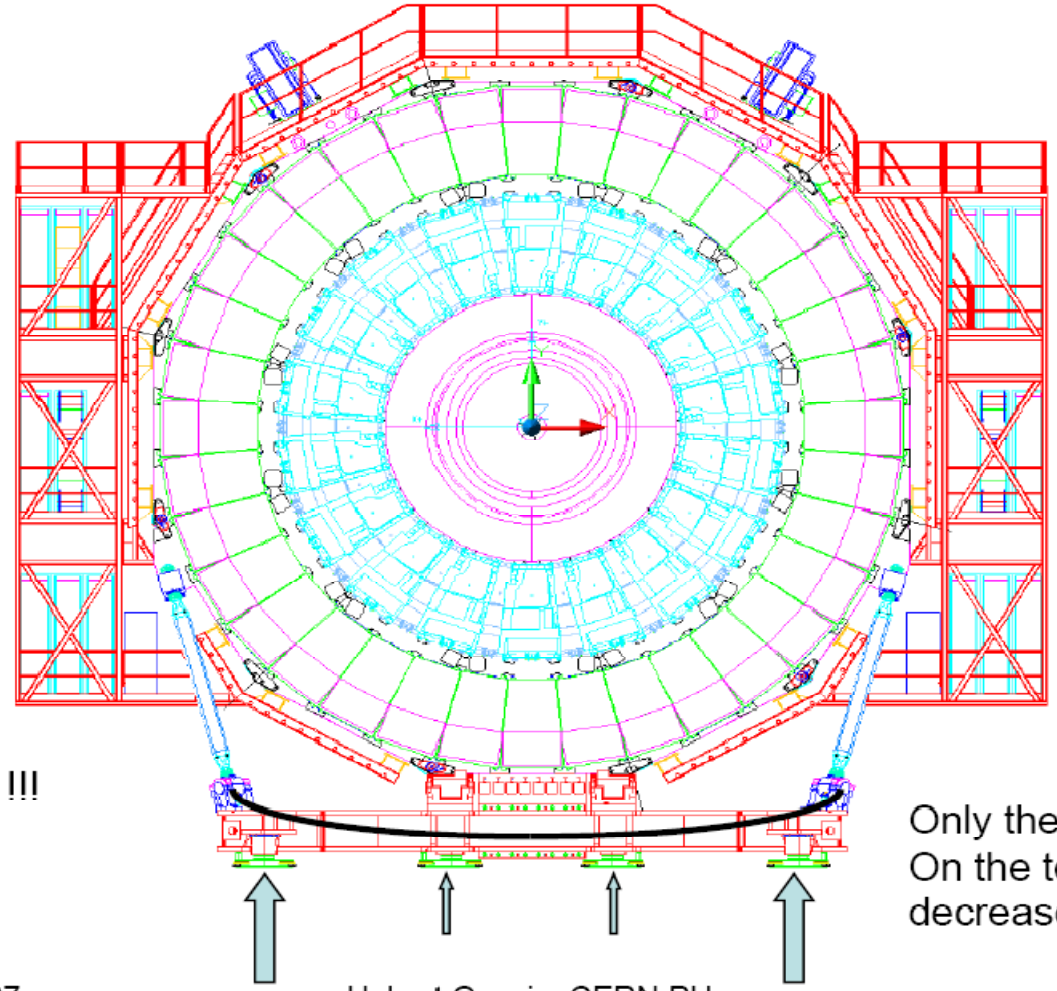
Pro's

- Low air losses
- Low friction μ= 0.01
- Movements in x and z and rotation in plane
- Works from air bottles
- Very good for long and complicated movements

Con's

- Needs some lubrication
- Vertical movement at least 5 mm
- Due to this not suited for delicate final approach moves

Heavy Lifting, H.Gerwig



No lift-off !!!

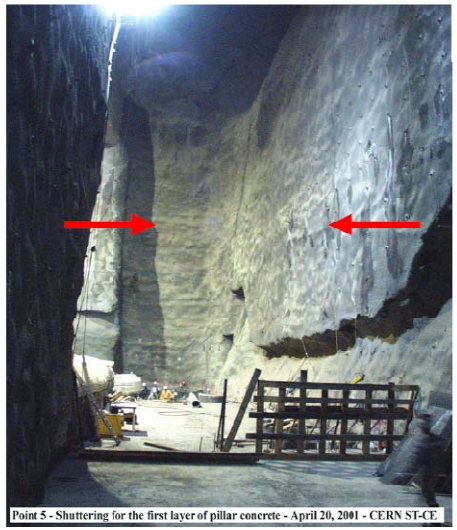
Only the vertical load
On the teflon pads
decreases

ILC - IRENG07 Hubert Gerwig, CERN PH 26

Ground Freezing for CMS shaft excavation

Hydraulic Breakers used for Rock Excavation

Typical Problem encountered during construction



Excessive Horizontal Displacements of the Rock during Pillar excavation :

Contract Procedure called Adjudication utilised (FIDIC form of Contract)

LEP Breakthrough

IRENG07 Civil Engineering Works Work for Interaction Region John Osborne CERN

Steel anchorages for Blockhouse shielding cast into concrete

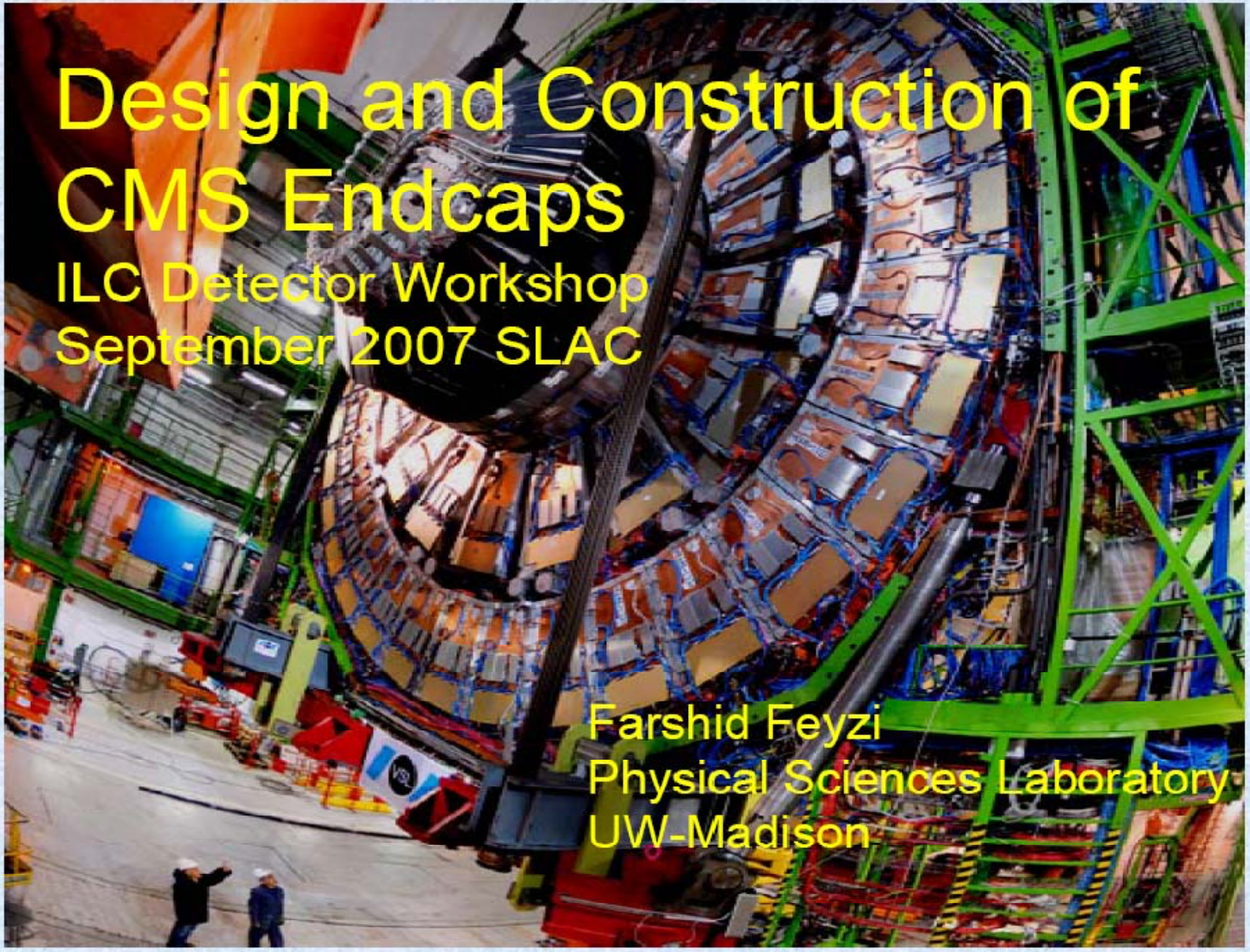
CMS cavern 53m long, 27m wide by 25m high

CMS Rotating Shielding installation in cavern

Installation Windows for other contractors included within Civil Engineering Contract For example :

Shaft Services installed prior to completion of surface hall

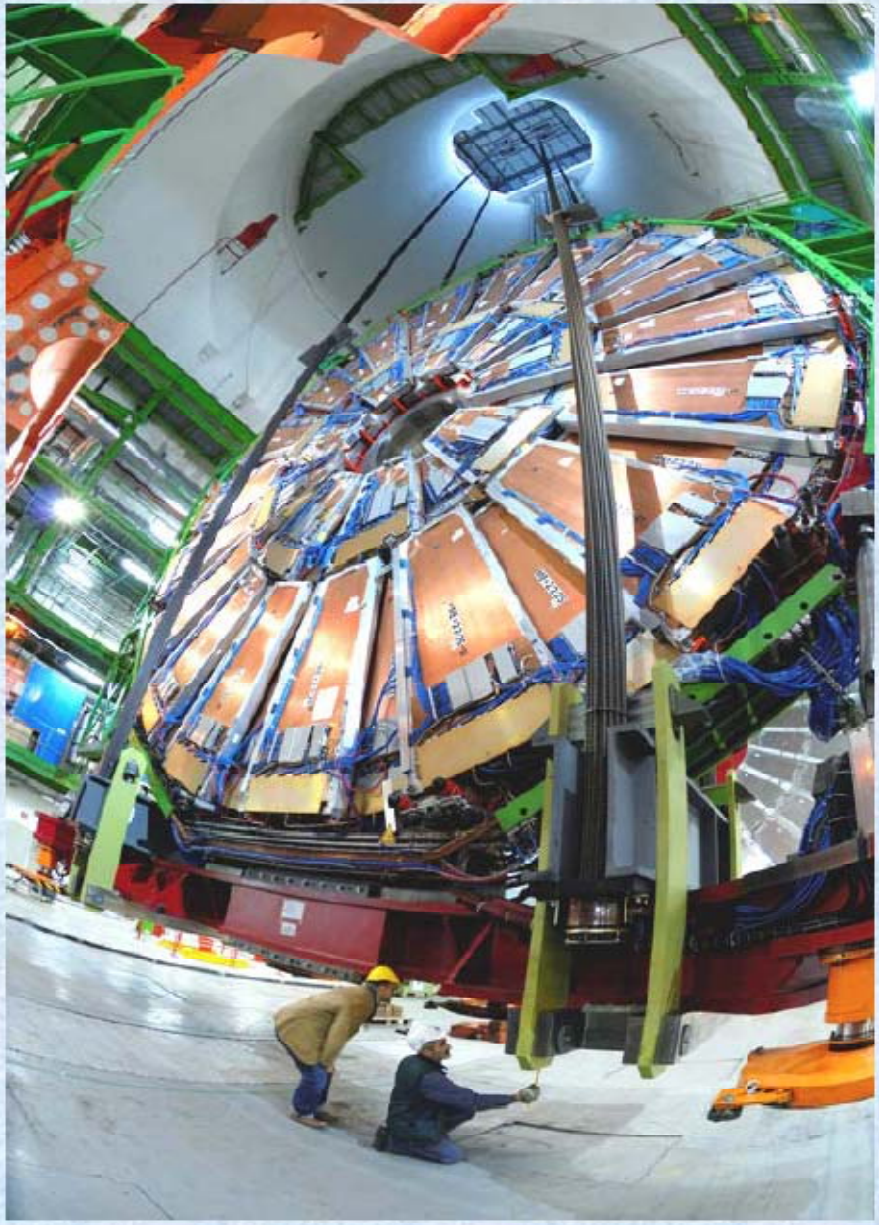
Experimental Hall gantry cranes installed prior to building roofing & cladding



Design and Construction of CMS Endcaps

ILC Detector Workshop
September 2007 SLAC

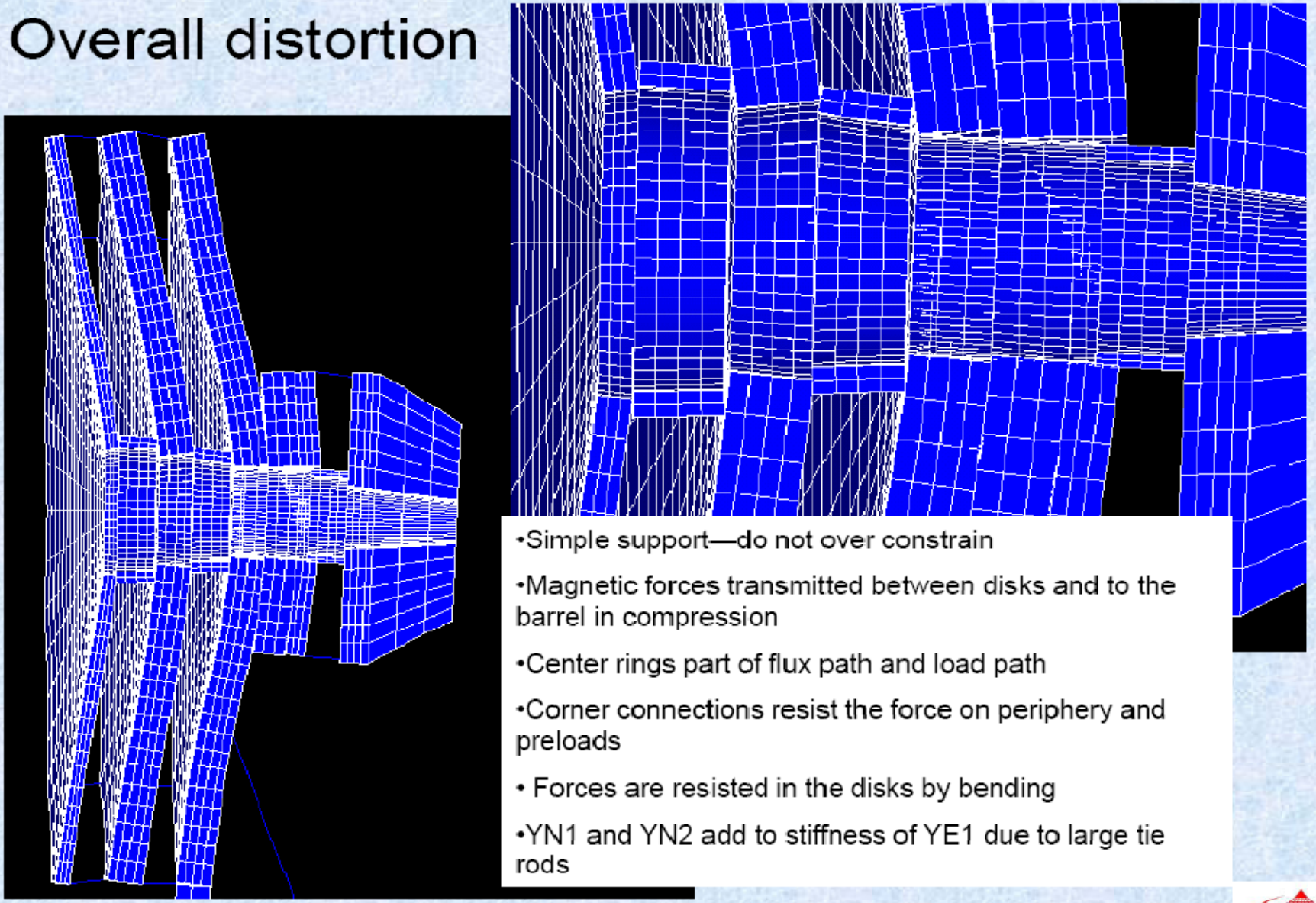
Farshid Feyzi
Physical Sciences Laboratory
UW-Madison



Lessons and summary

- Use precision in design and construction—it is NOT more expensive than the alternative
- You only have time to do it right the first time
- Use industrial partners and count on their ideas
- But have a full design just in case
- Strive for high rigidity but know where deflections are
- Make it safe!!!

Overall distortion

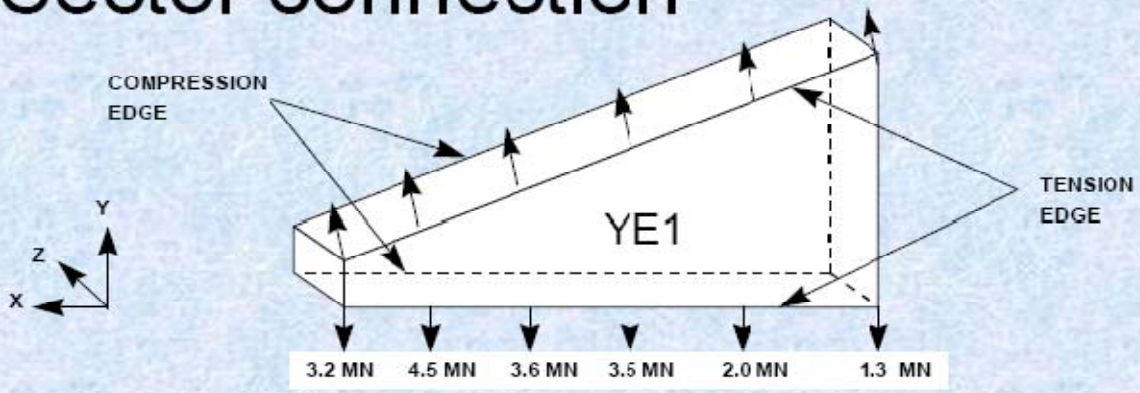


- Simple support—do not over constrain
- Magnetic forces transmitted between disks and to the barrel in compression
- Center rings part of flux path and load path
- Corner connections resist the force on periphery and preloads
- Forces are resisted in the disks by bending
- YN1 and YN2 add to stiffness of YE1 due to large tie rods

Trial assembly

- 10 sectors were assembled into ½-disk
- Mating surface to other half was machined

Sector connection



Shared among 10 bolts

- Use Superbolts® for connecting sectors
- All bolts (1600) tested to 2.7 MN
- Each bolt preloaded to 2.5 MN

Conclusion

- A lot of different experts where around
- All detector concepts have similar problems
- Progress:
  - Hall Dimension
  - General Supplies
  - FD magnets and Cryo Supply
  - Vacuum/Beam Pipe/Beam Equipment
- Several Items not settled:
  - Platform
  - Magnetic Stray Field
  - Vacuum Requirements
  - Movers for FD-Magnets
  - Optical Anchors for FD-Magnets
  - There are still people questioning the deep site