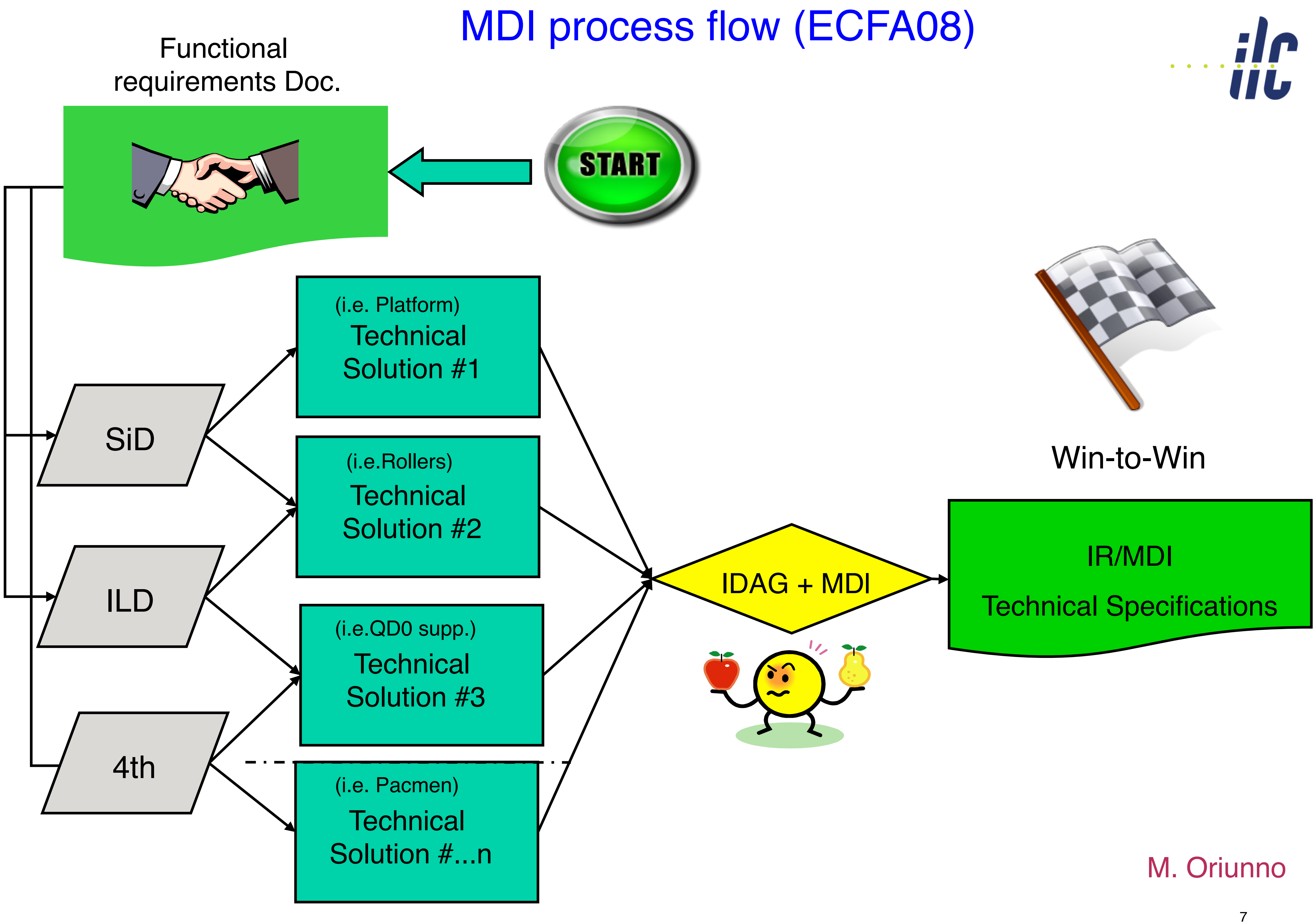
Report from MDI/Integration Working Group

Karsten Buesser
DESY

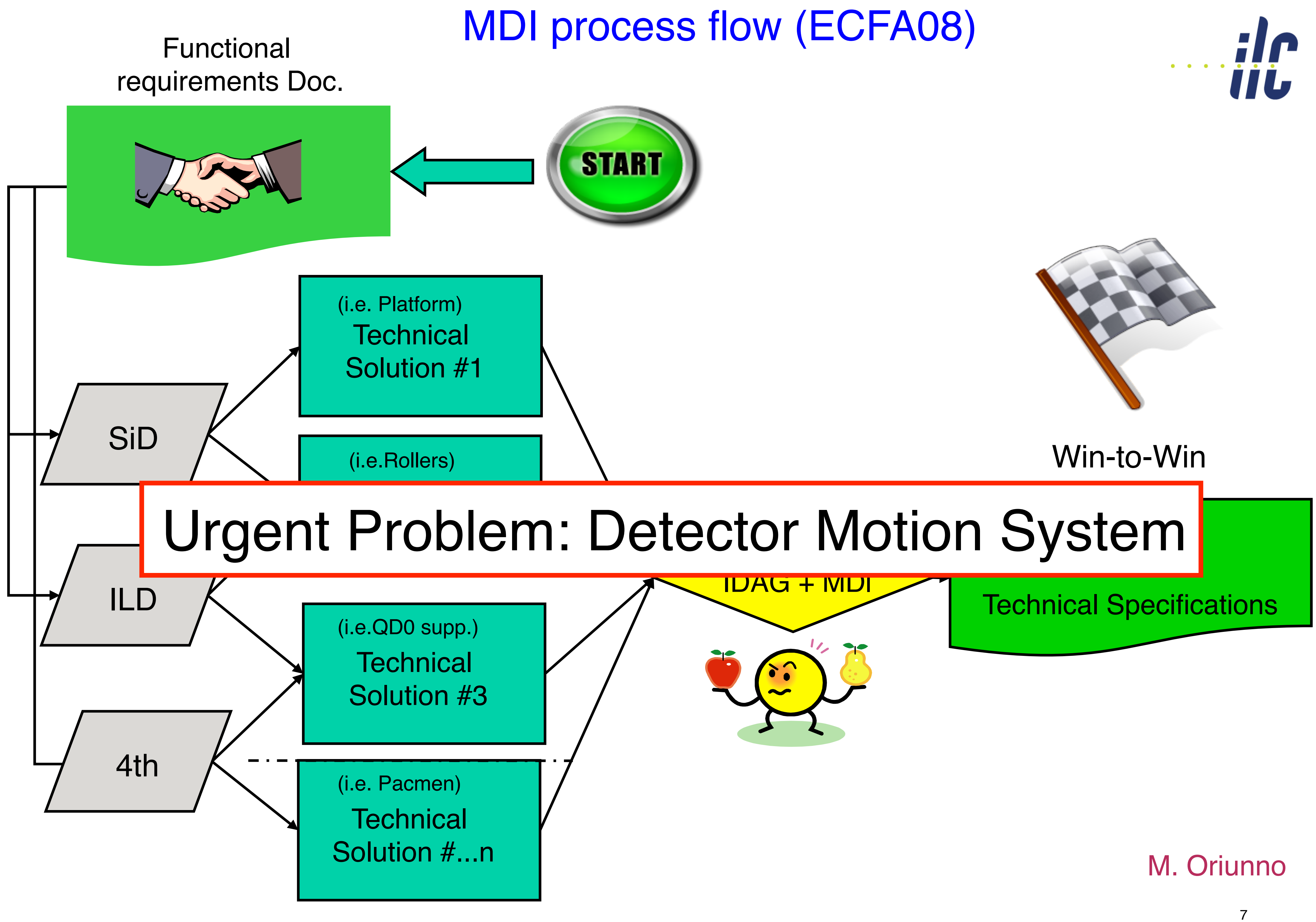
ILD Workshop
25. May 2011

Push-Pull

MDI Work Flow



MDI Work Flow



ILD and SiD Differences

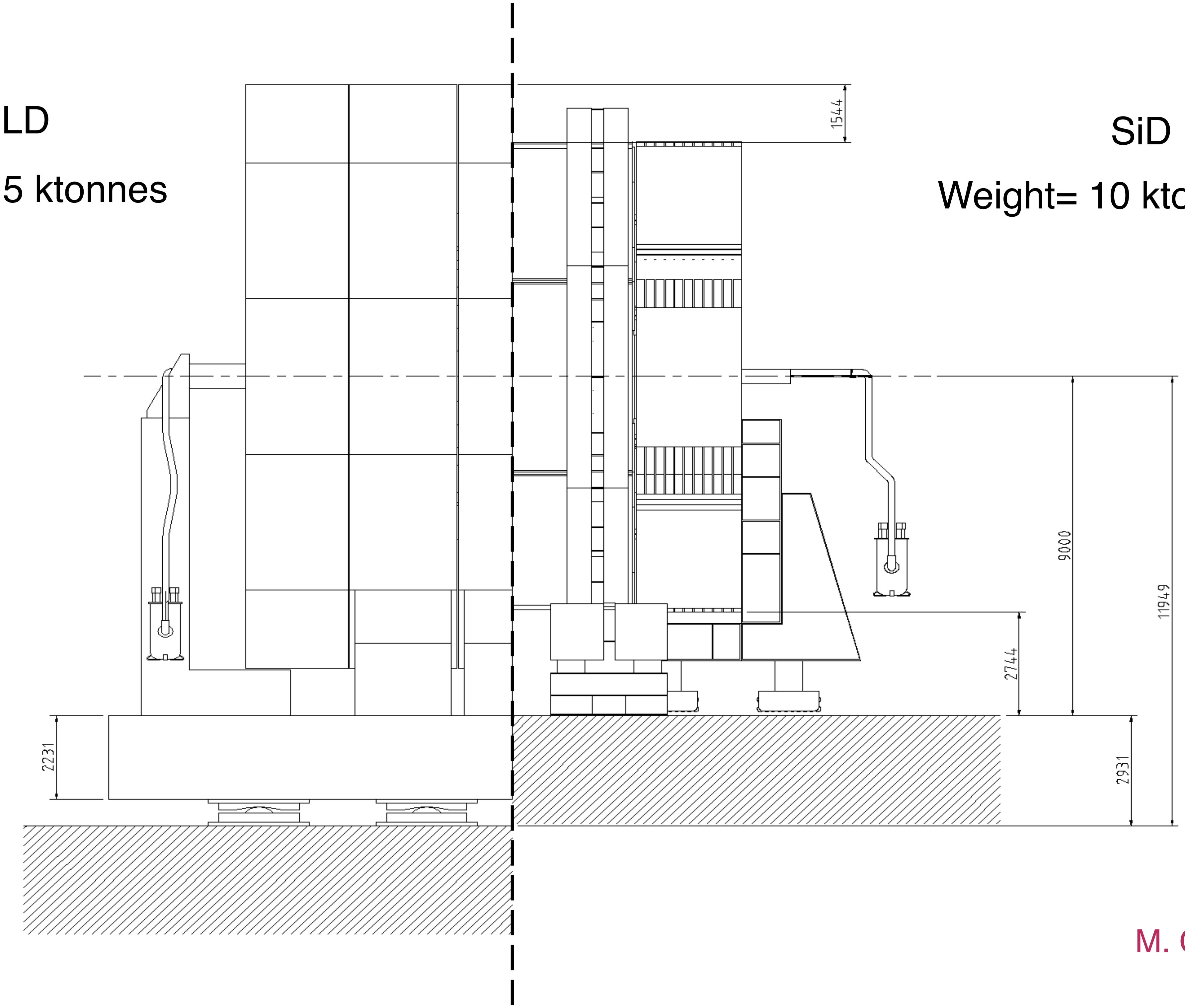
ILD and SiD differences

ILD

Weight= 15 ktonnes

SiD

Weight= 10 ktonnes



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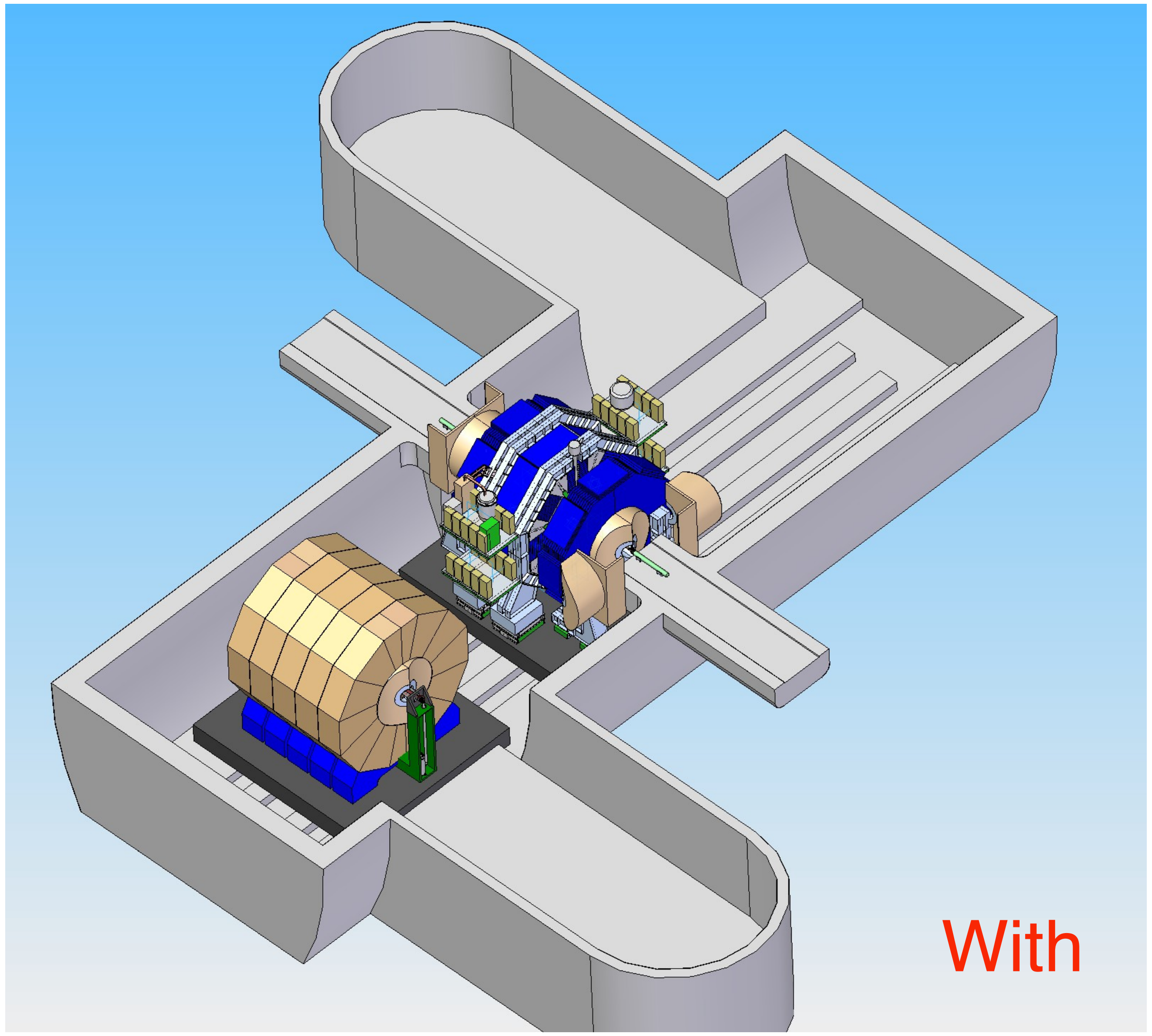
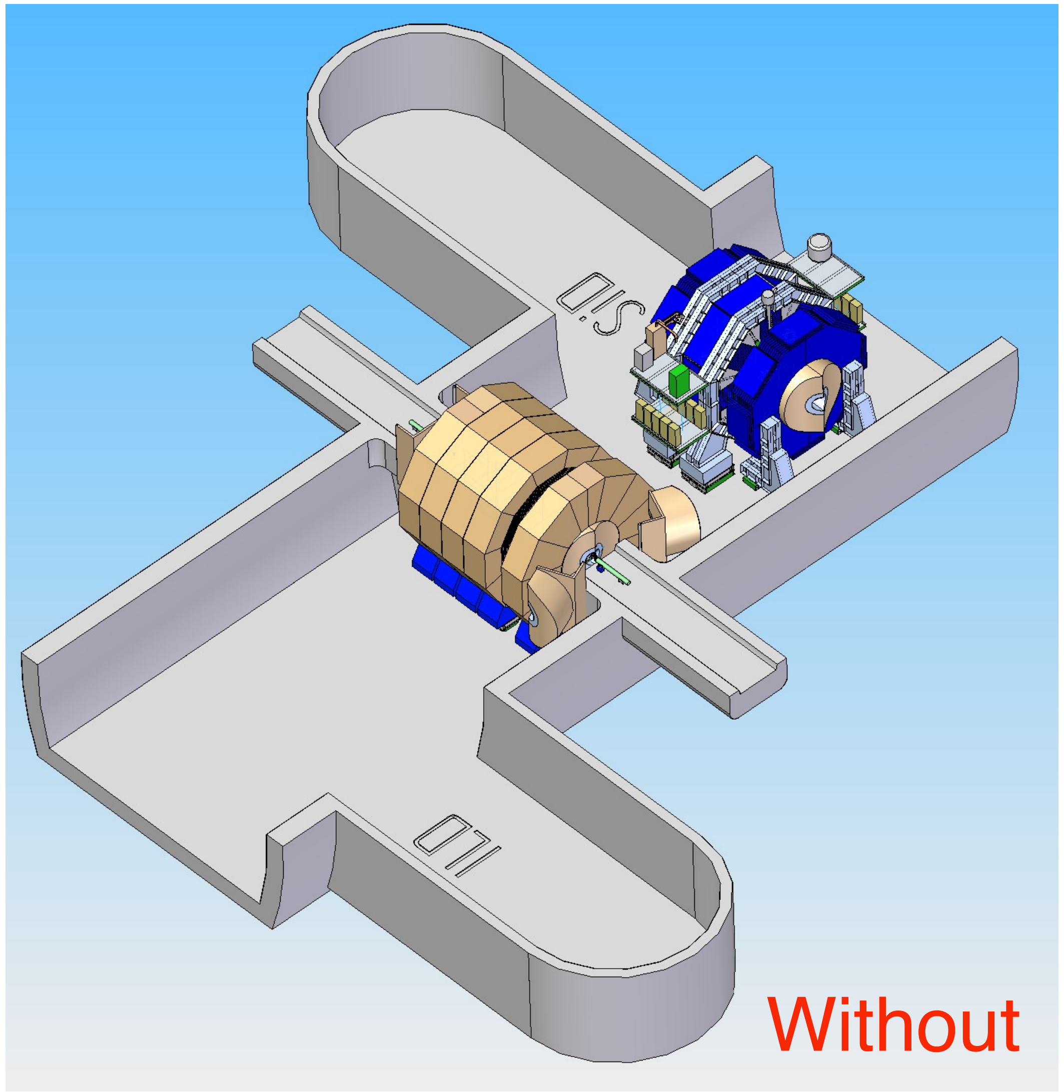
Detector Motion System

SiD and ILD with or without a platform ?





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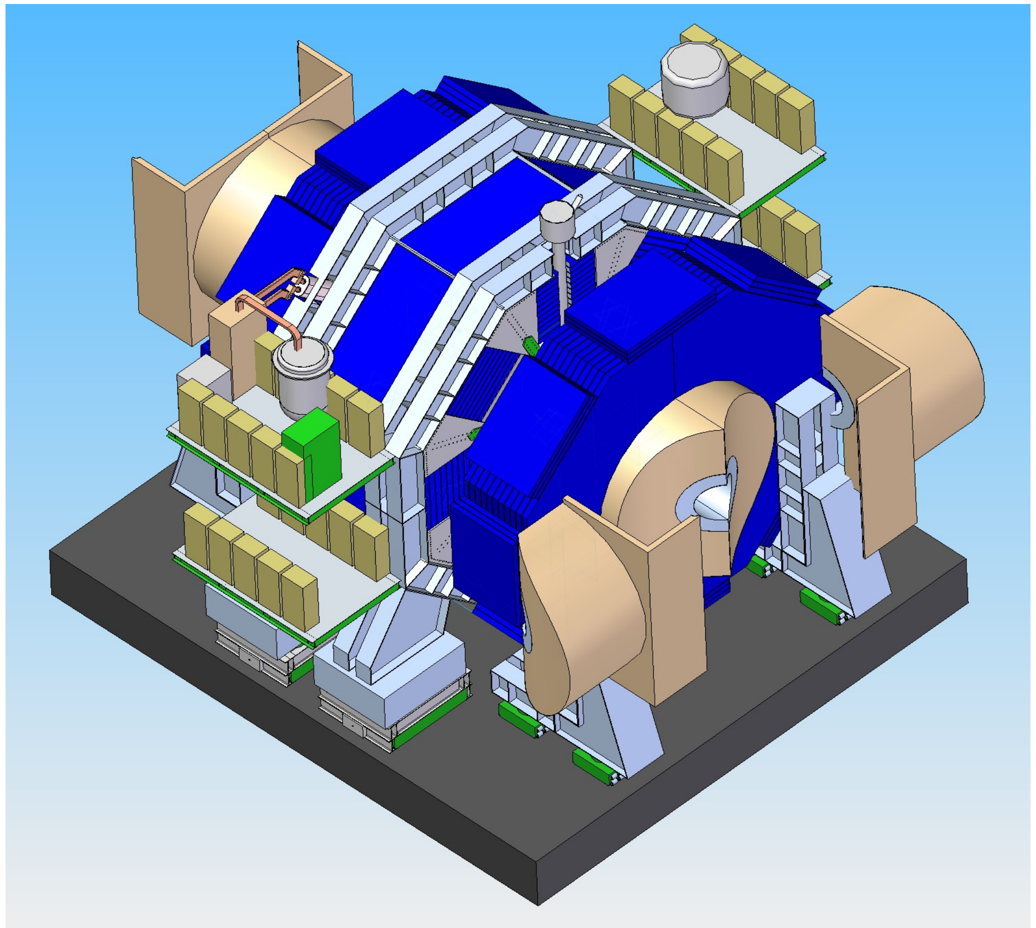
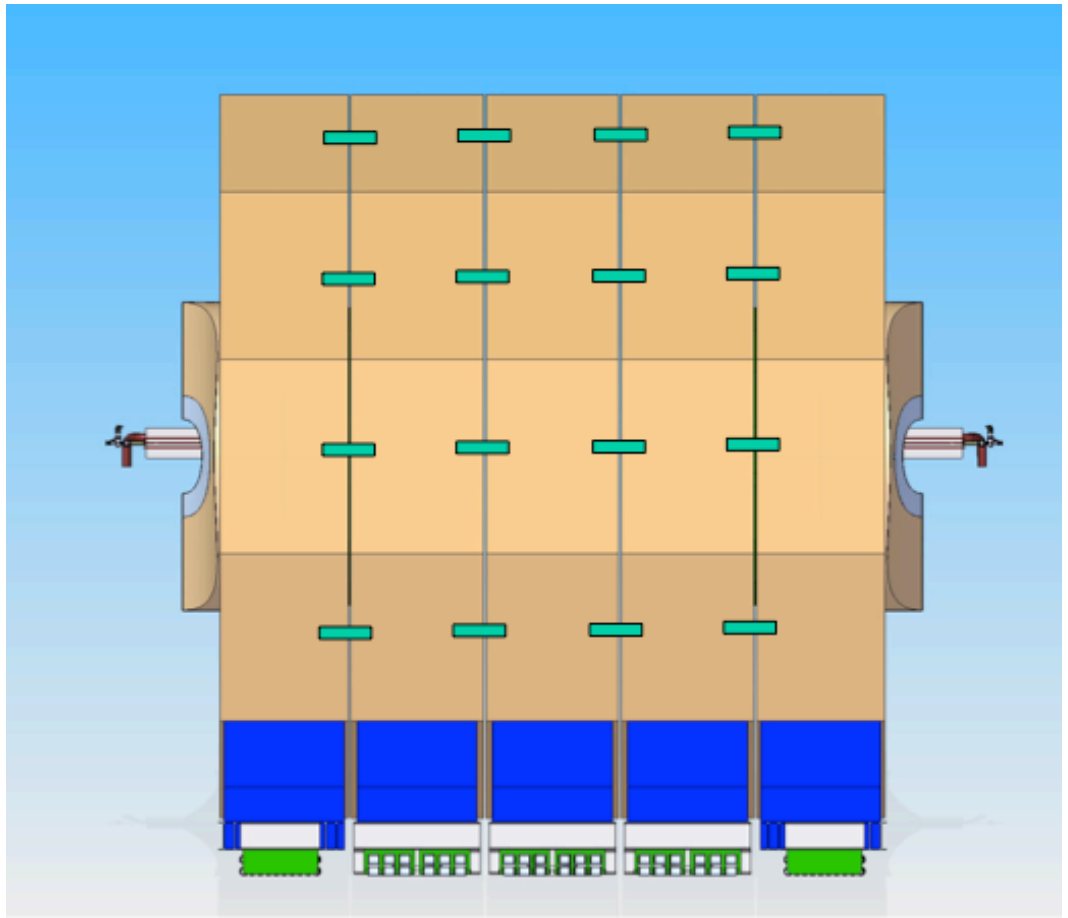
Trade off study



SiD on Platform



ILD without Platform

Mandatory requirements	SiD	ILD
Design Change Impact	None	High
Vibrations Amplification	Unkwon	Unkwon

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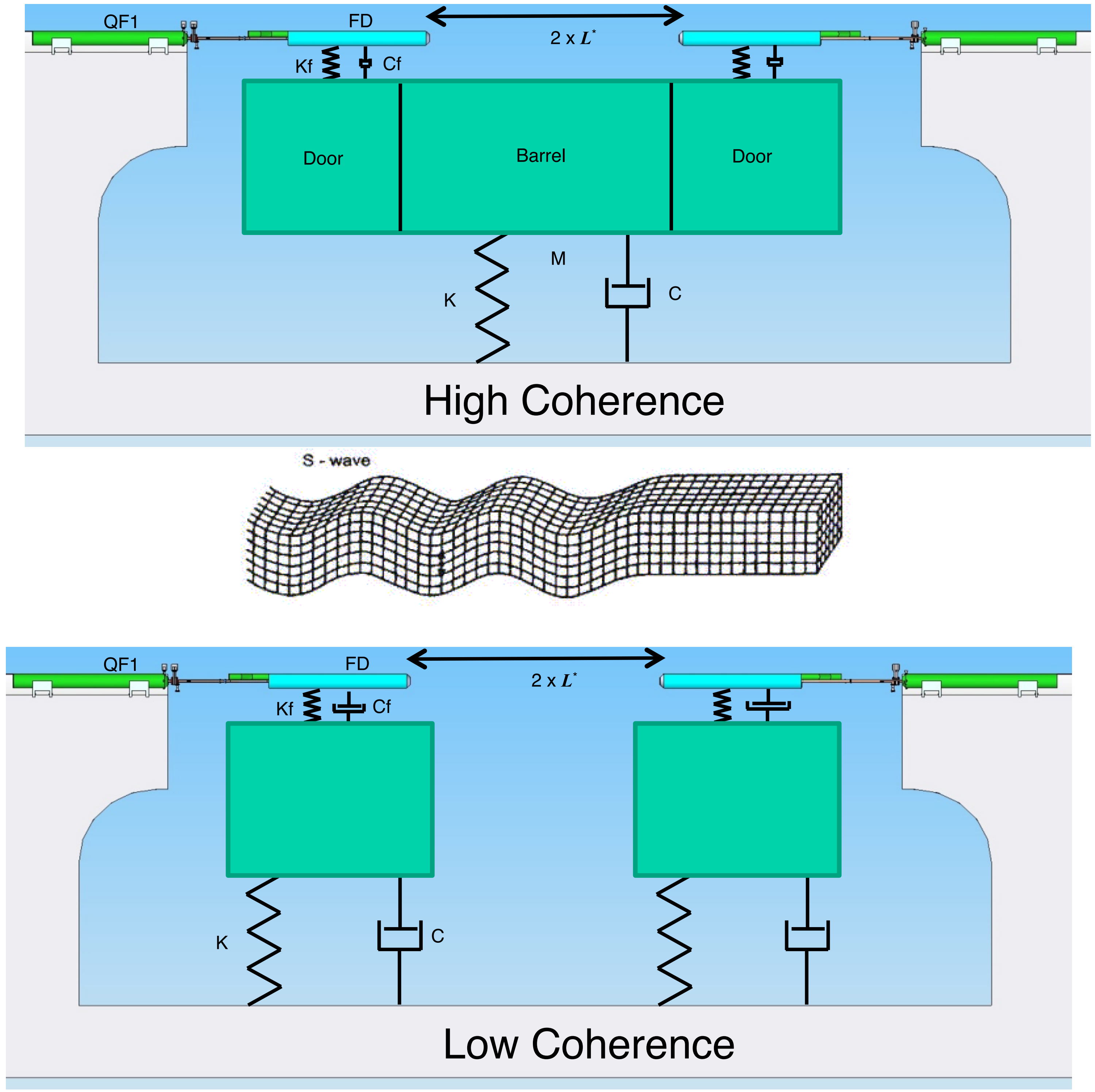
QD0 Support Models

QD0 Supports



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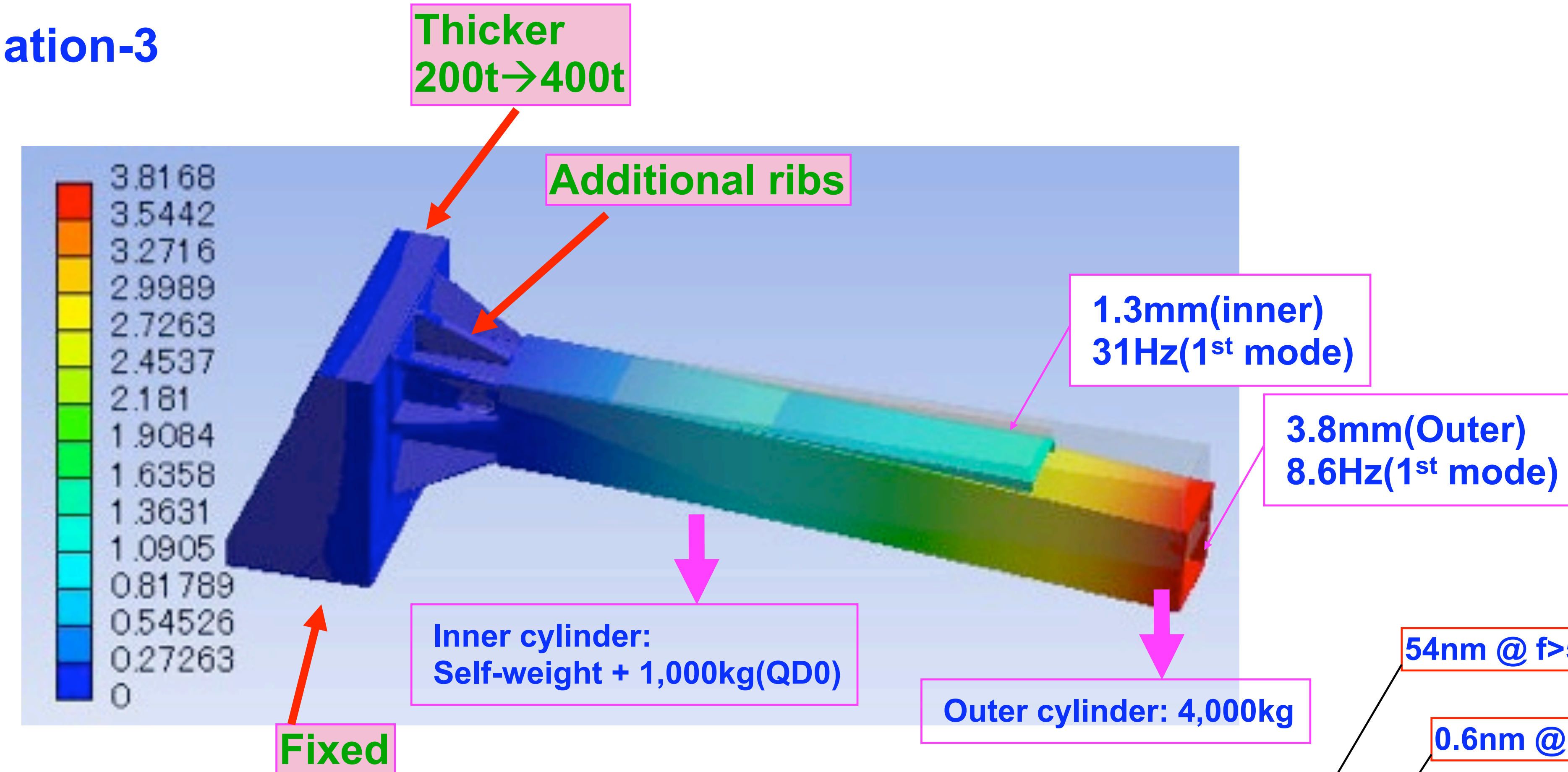
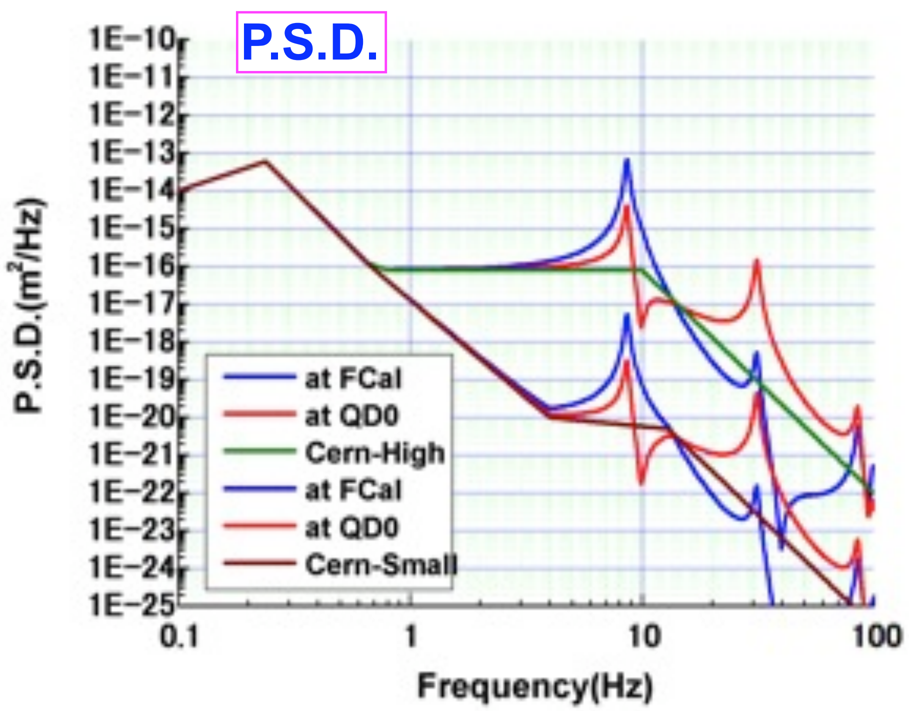
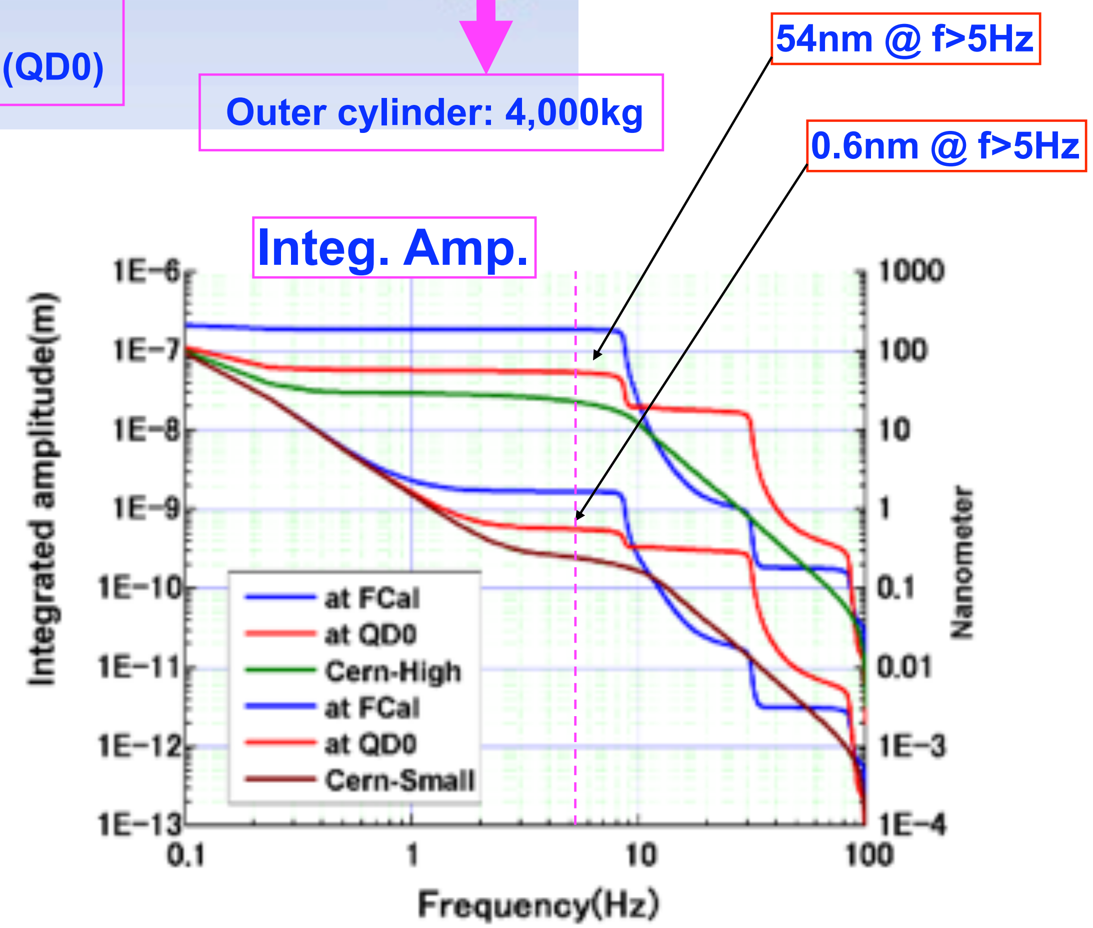
ILD QD0 Support Vibration Analysis

Calculation-3



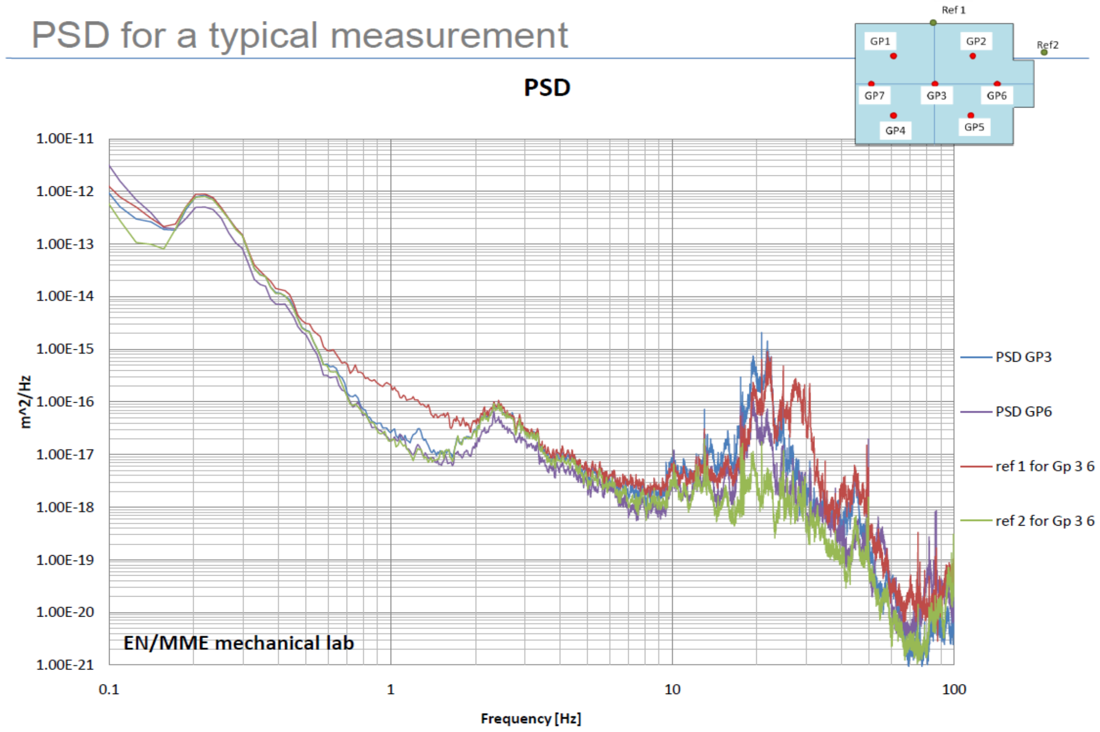




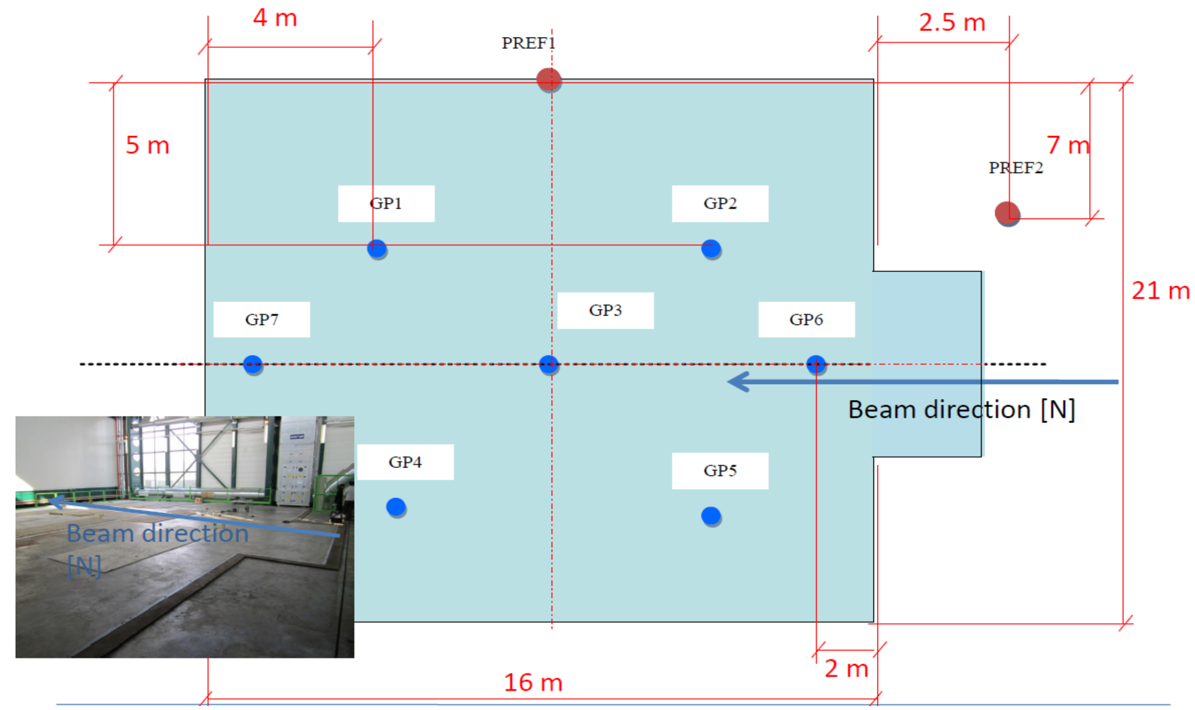
Vibration Measurements at CMS Plug

Experimental Vibration measurements – CMS Plug

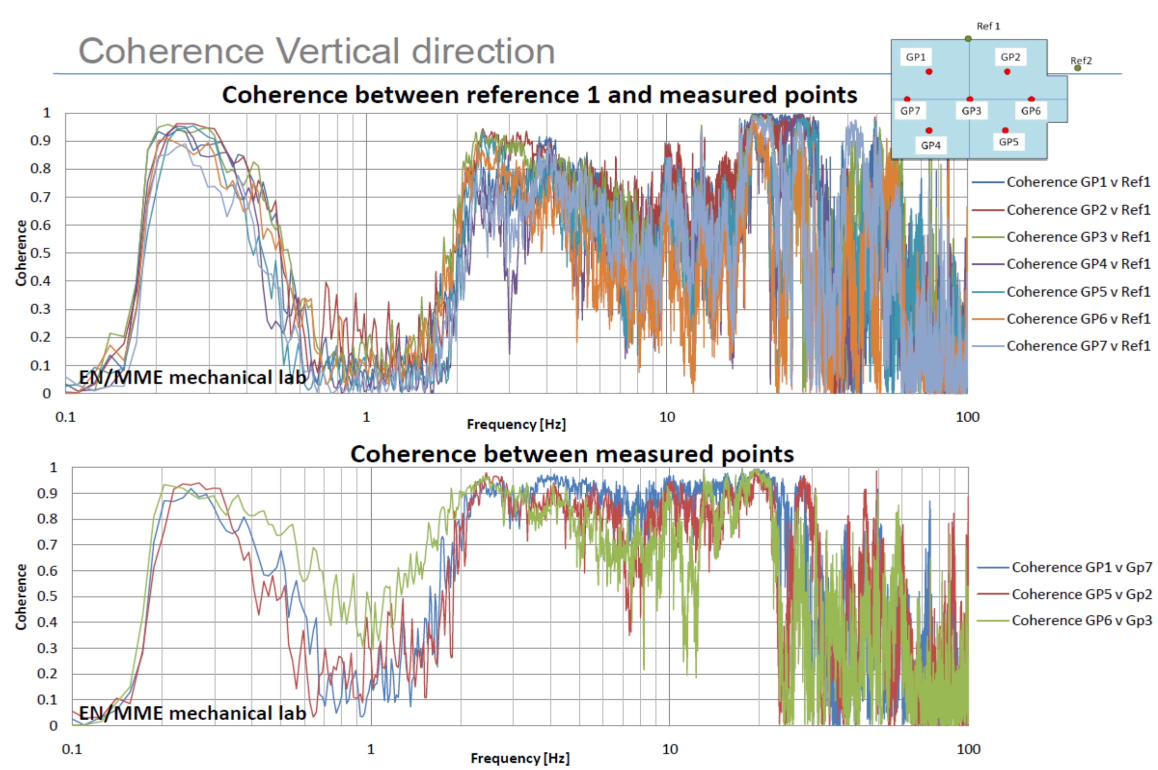
PSD for a typical measurement



Sensor position



Coherence Vertical direction



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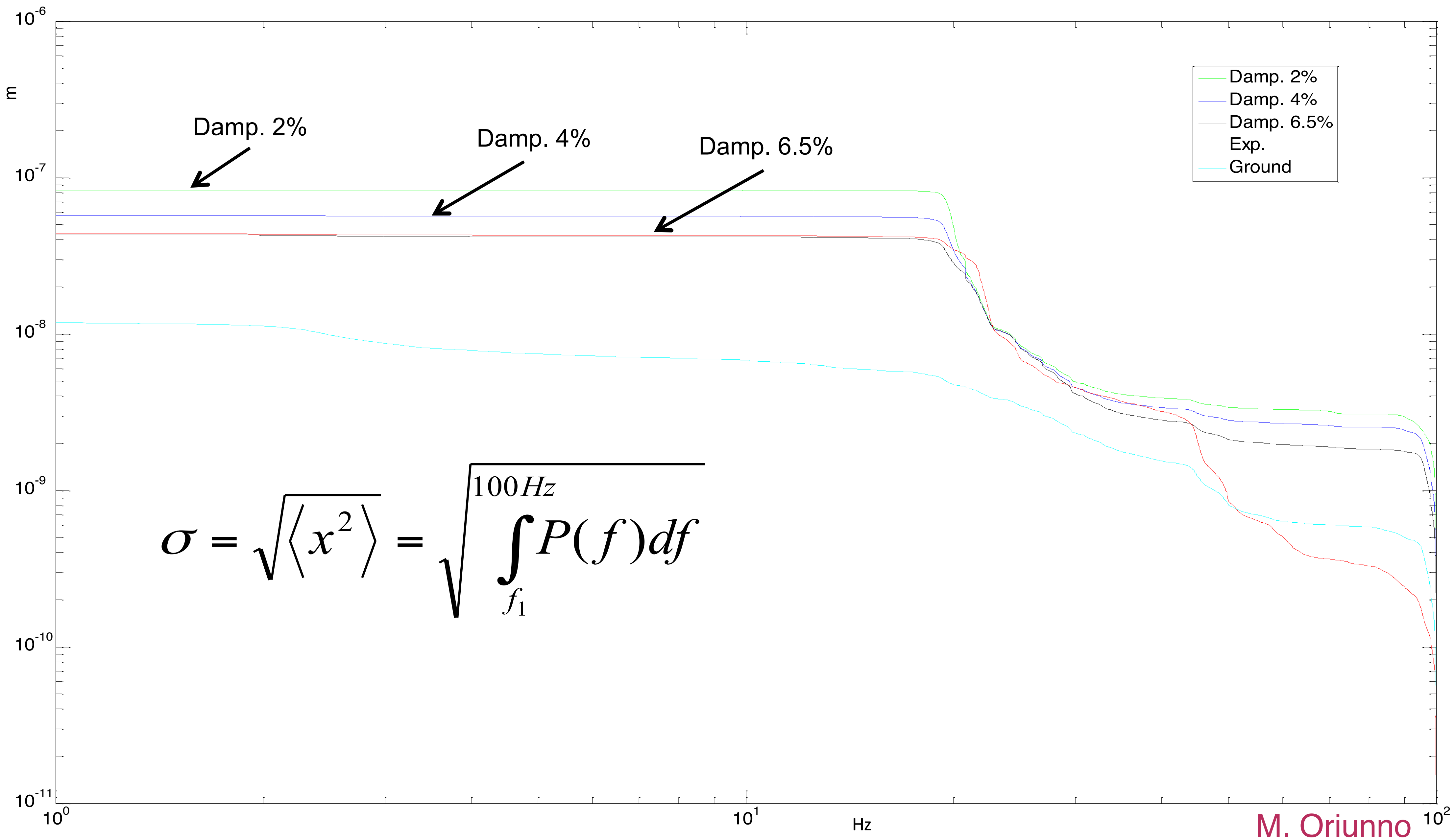
Platform Vibration Amplification

Integrated Displacement (r.m.s.)



$$\sigma = \sqrt{\langle x^2 \rangle} = \sqrt{\int_{f_1}^{100Hz} P(f)\,df}$$

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Marco‘s Conclusions

Conclusions

- Platforms are a technically acceptable solutions for the push pull, which preserves the respective design of the detectors and does not amplify the ground vibrations.
- The platforms must be designed according to a set of Functional Requirements, specifying the static and dynamic performances. These requirements will be defined by the detectors.
- The design and construction of the platforms becomes a task of the CFS group, which will develop the project along the requirements list and together with the detectors.

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Earthquake

- Belle detector after 3.11
  - Bell detector was rolled out from the beam line and fixed to the ground
  - 32 fixing bolts (M22) have been broken by the earthquake, and Belle detector moved 6 cm on the rail
- How should platforms be supported on the occasion of big earthquake?
  - Move with the ground?
  - Isolated from the ground?

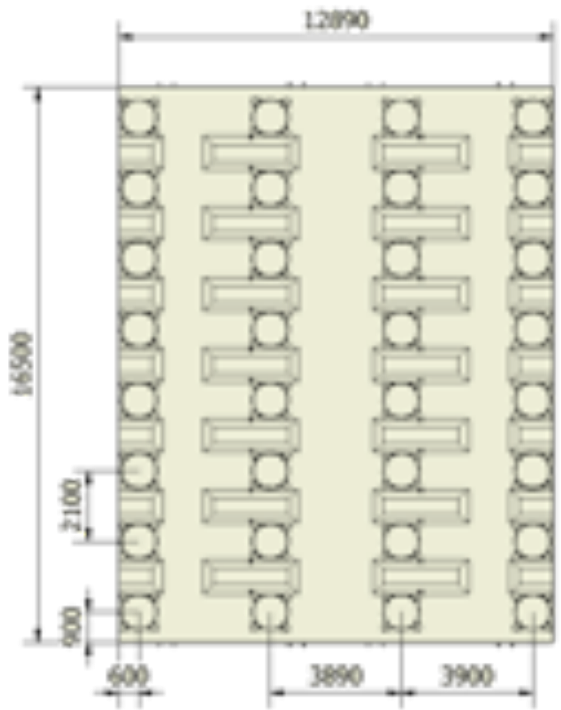
Seismic isolation support for buildings

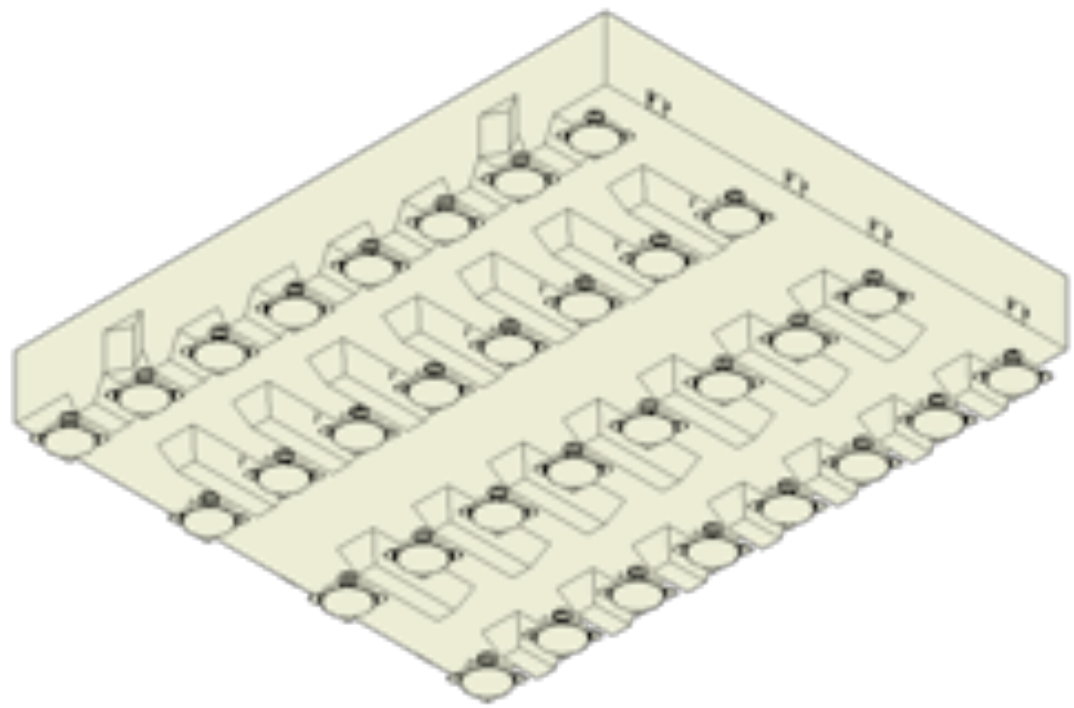
8

Platform Motion System

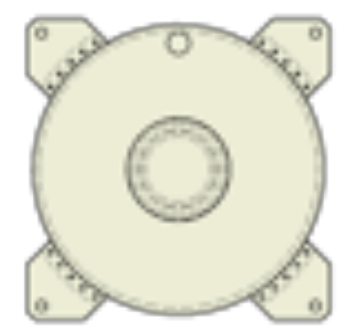
LCD Engineering & Integration

AIRPADS

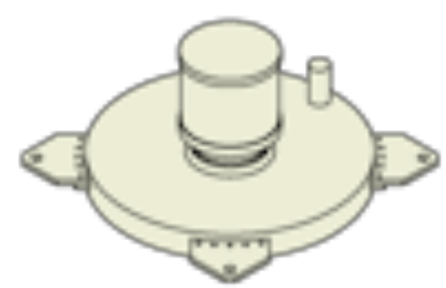




Total weight of platform with detector	12000[t]
Airpad weight capacity	400[t]
Number of needed airpads	30



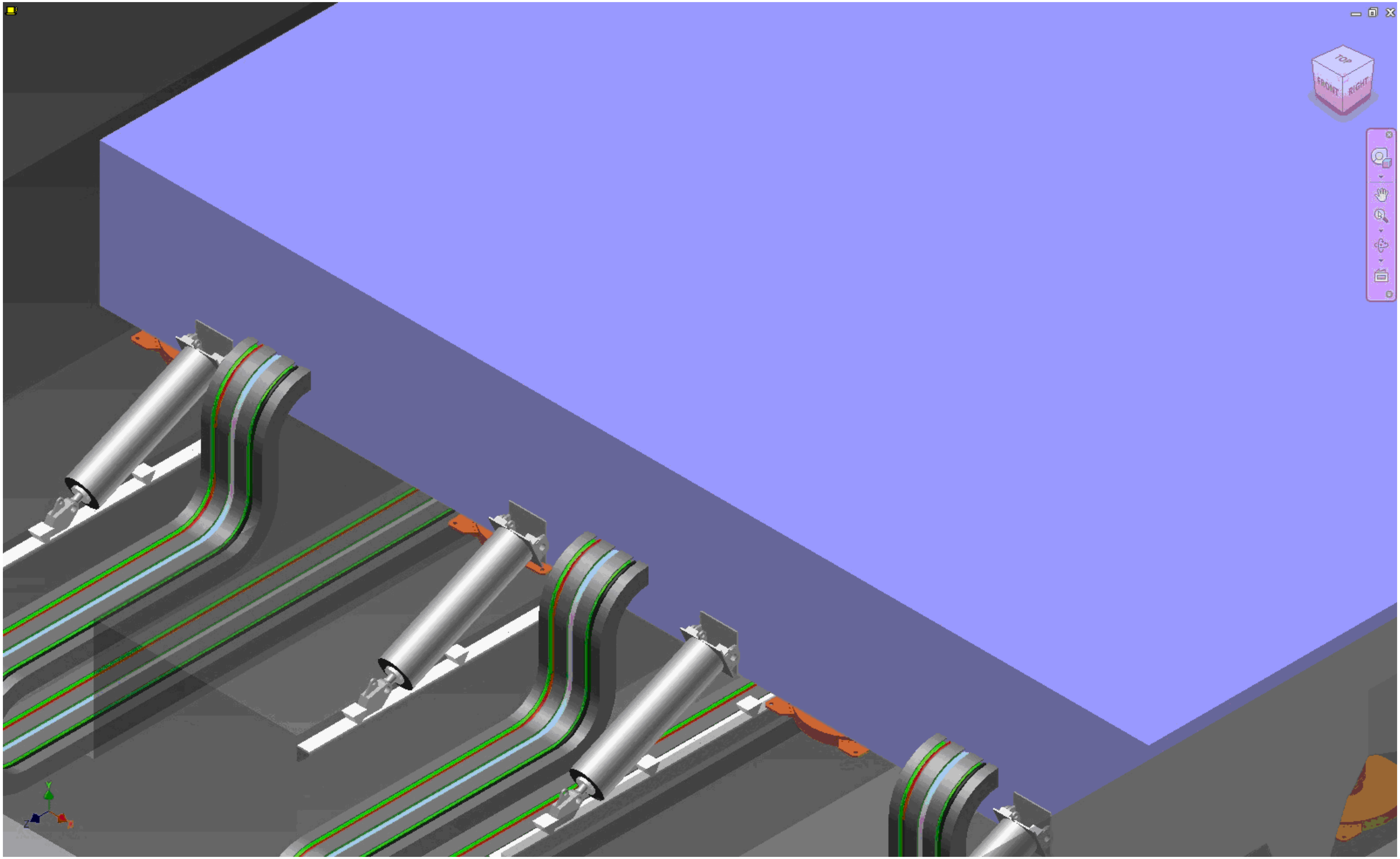
4 rows with 8 airpads in each guarantees possibility of move with safety margin



May 22-25, M. Herdzina, Physics Dept. CERN

Page 6

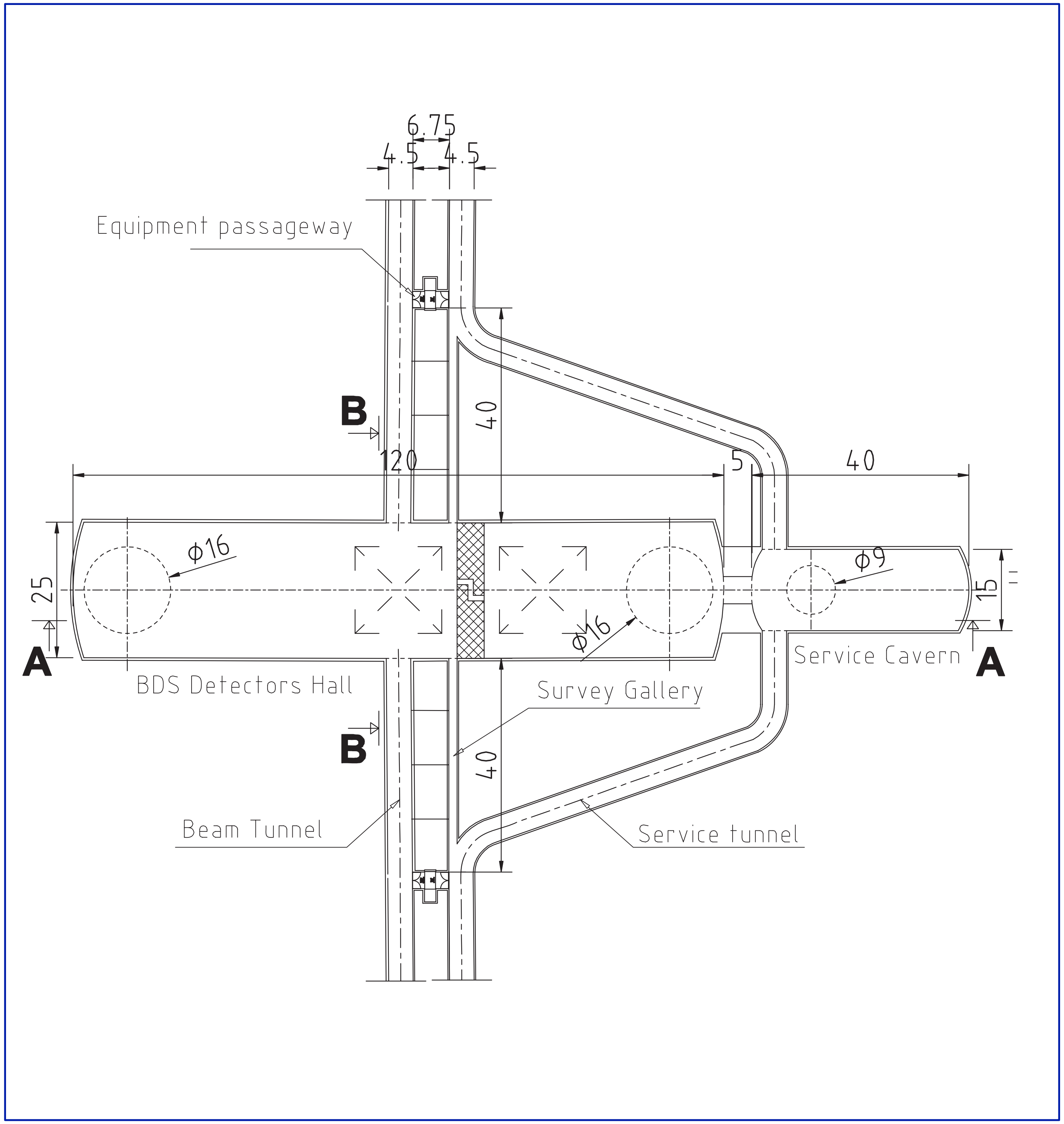
Platform Motion System

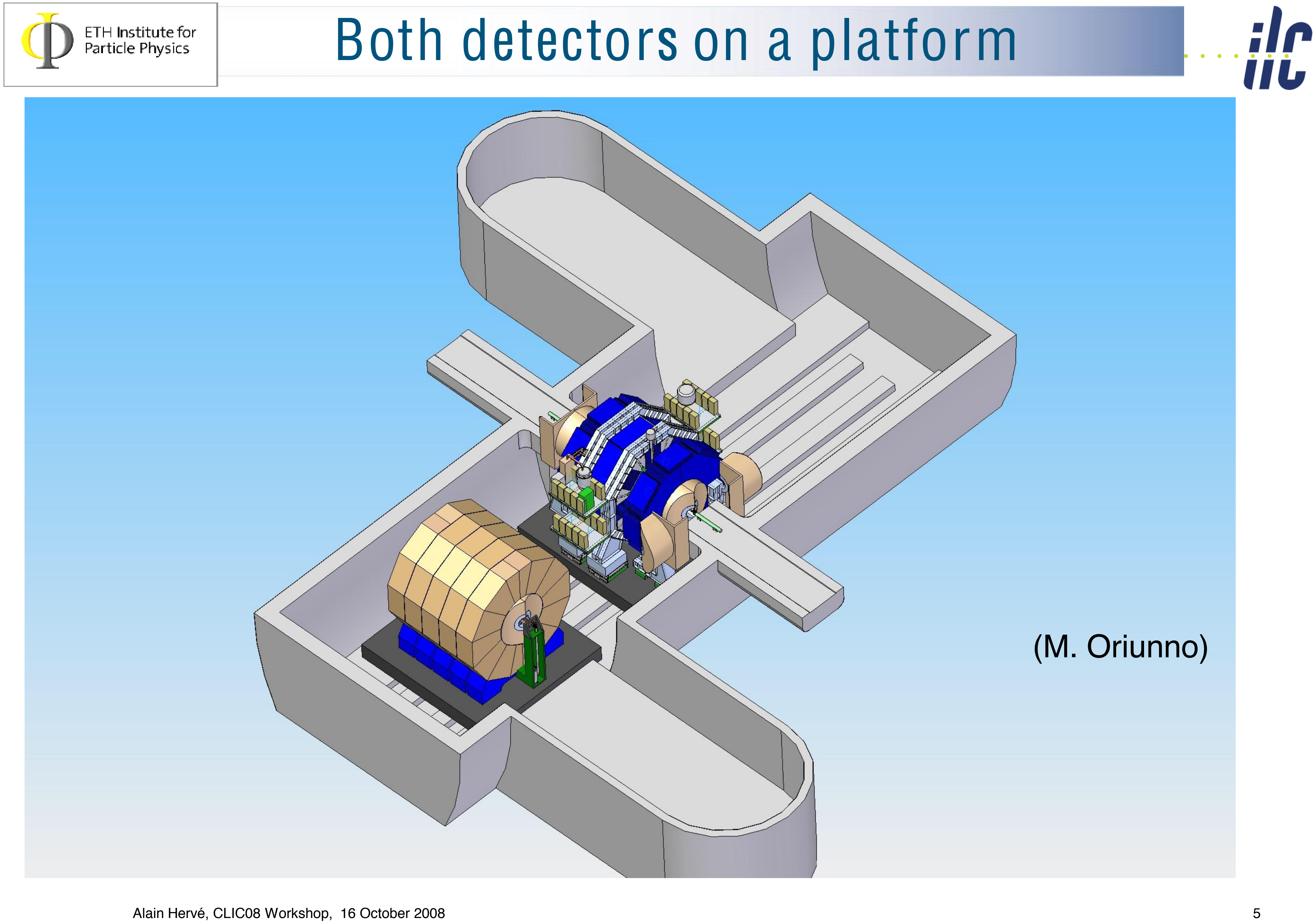


Hall Design

Experimental Hall (RDR Design)

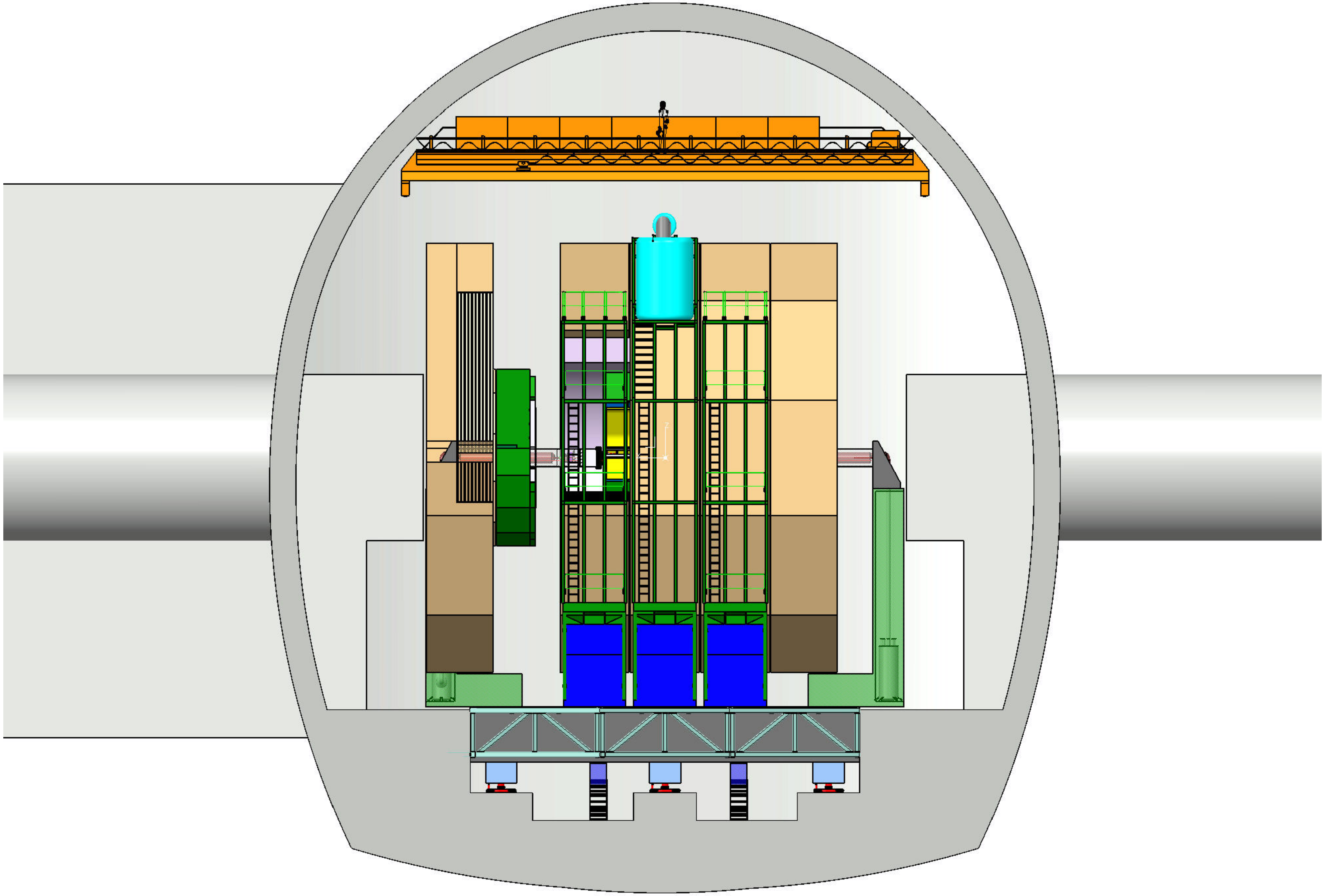
- Rather large (120m)
- Shafts above experiments
- Not enough space for detector maintenance in parking position
- Unnecessary shielding wall
- No service caverns for detectors





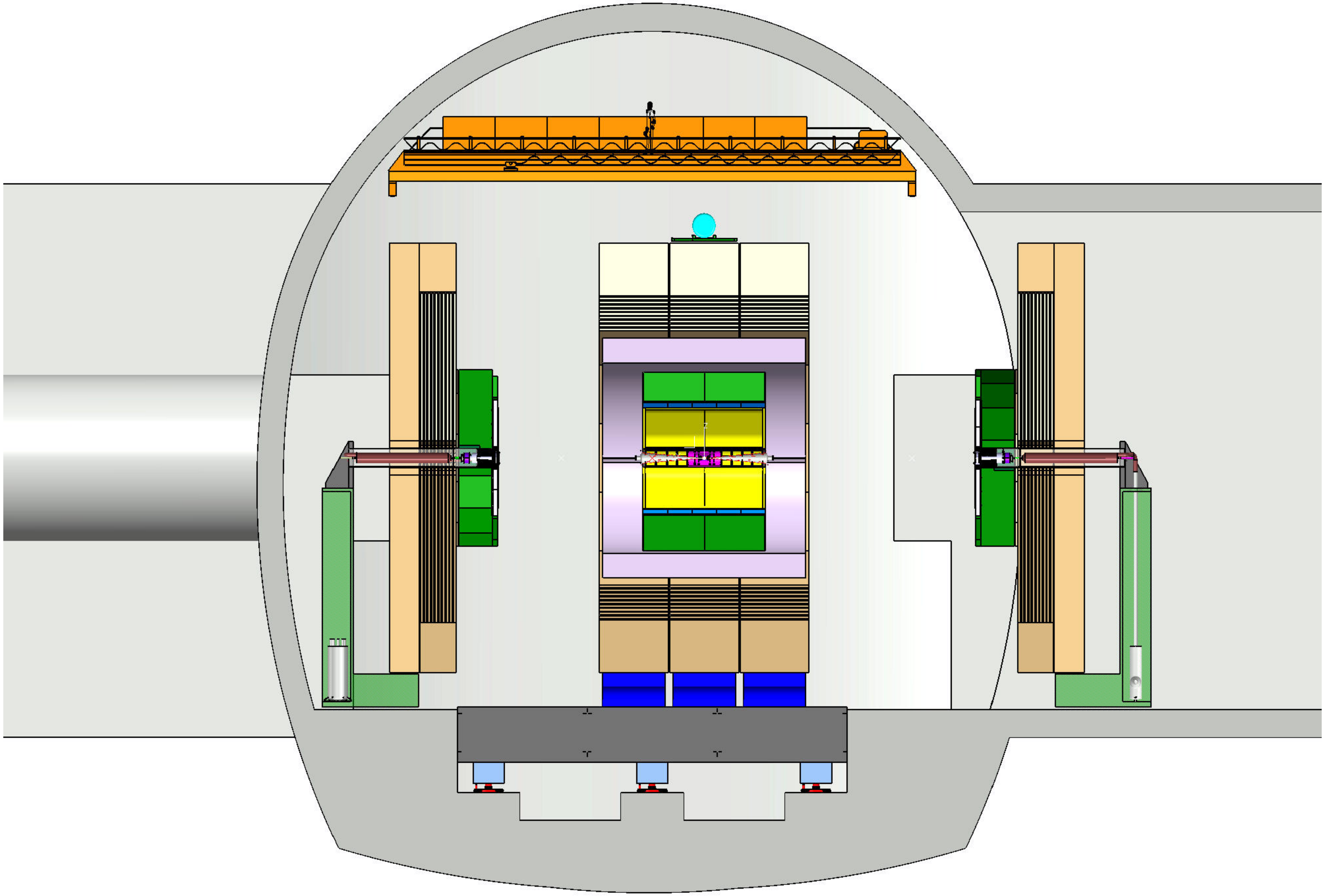
- ILD Hall Design Study (A. Hervé et al.)

Detector in Beam Position



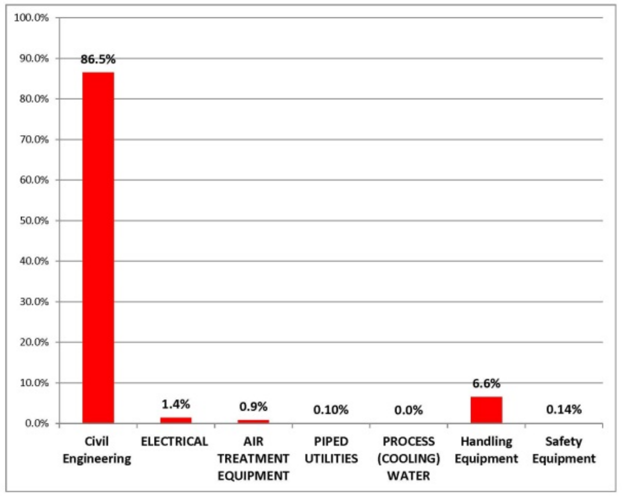
- NB: Optimised hall size

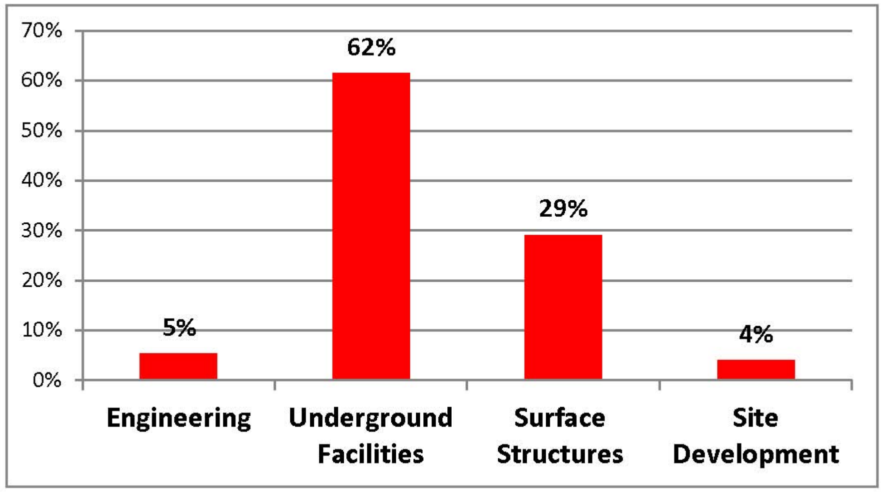
Detector Opening - Garage Position

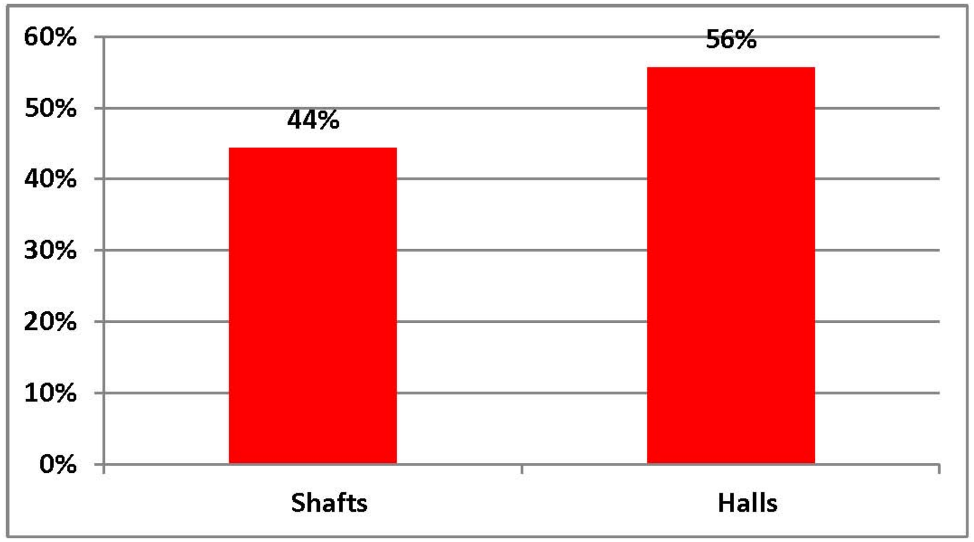


- Alcove needed for allowing access to subdetectors
  - TPC removal needs ~6m opening

RDR Cost

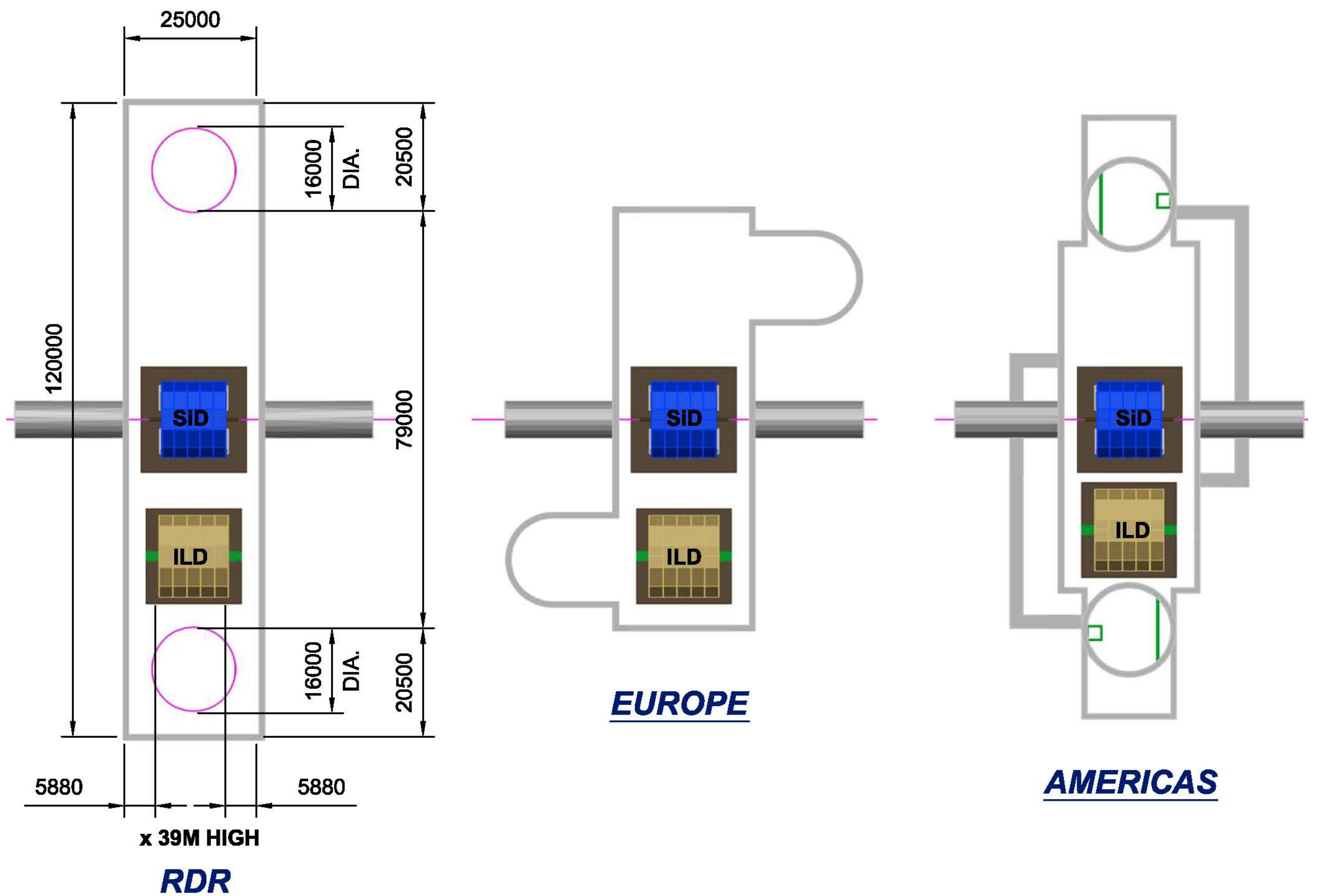






- Majority of Conventional Construction cost are the underground shaft and hall

T. Lackowski (ILC-CFS)



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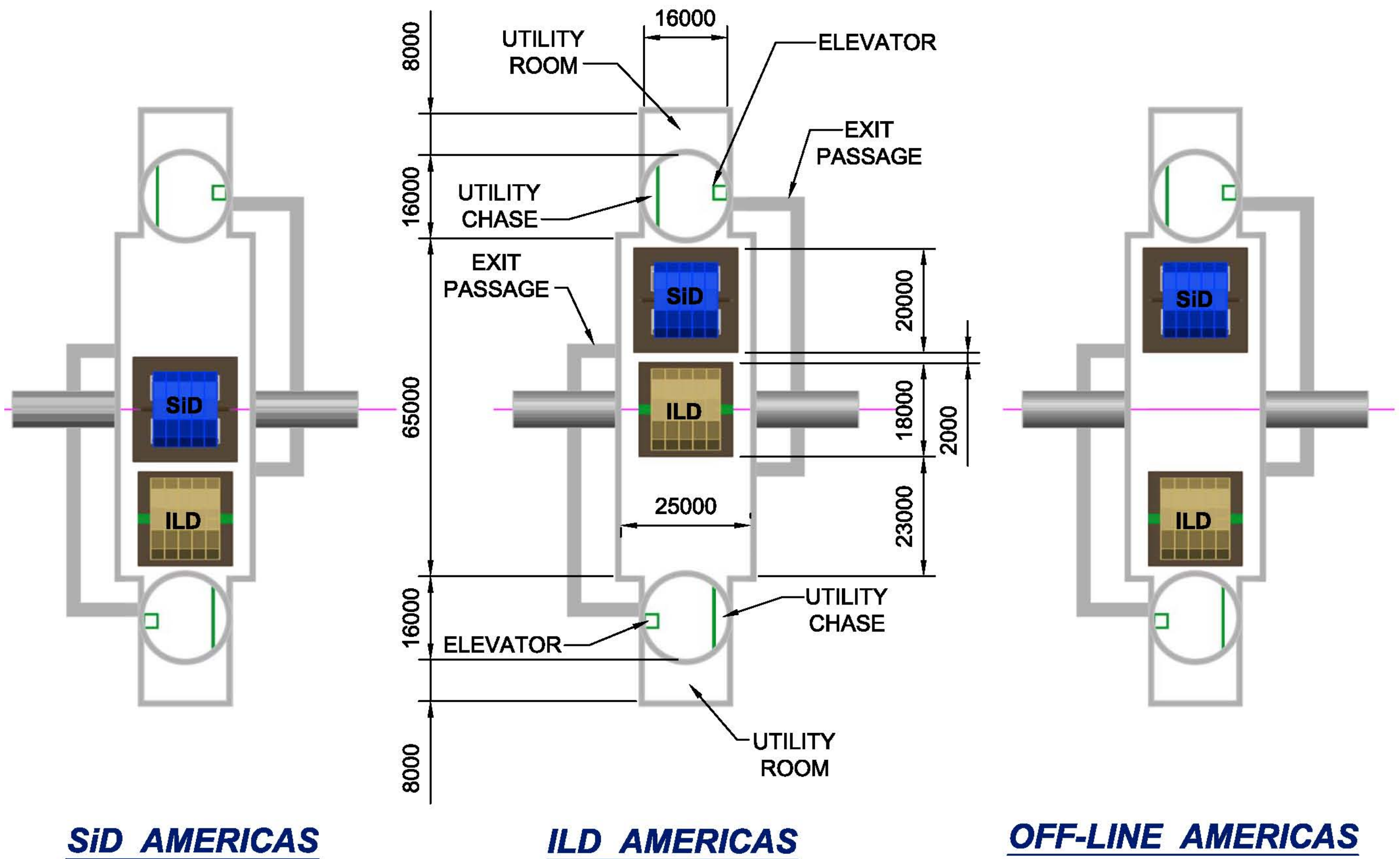
5

T. Lackowski (ILC-CFS)



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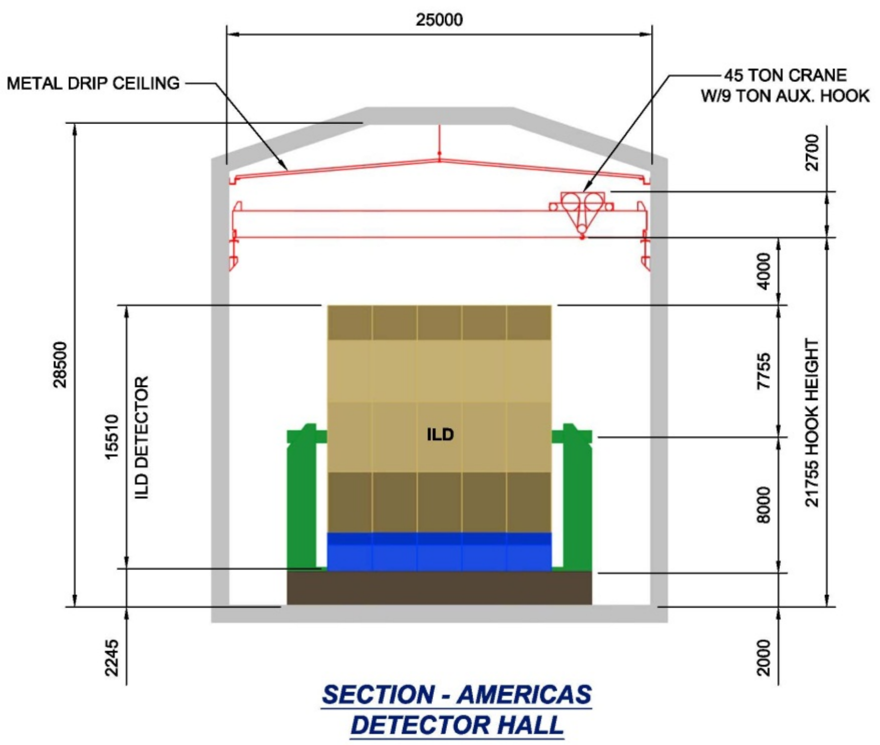
6

T. Lackowski (ILC-CFS)

- Hall roof span is a simple span
  - **Rock bolts provide the structural support**
  - **Drip Ceiling provides a dry and clean space.**
- Walls and floor use rock bolts for structural support, concrete lined.



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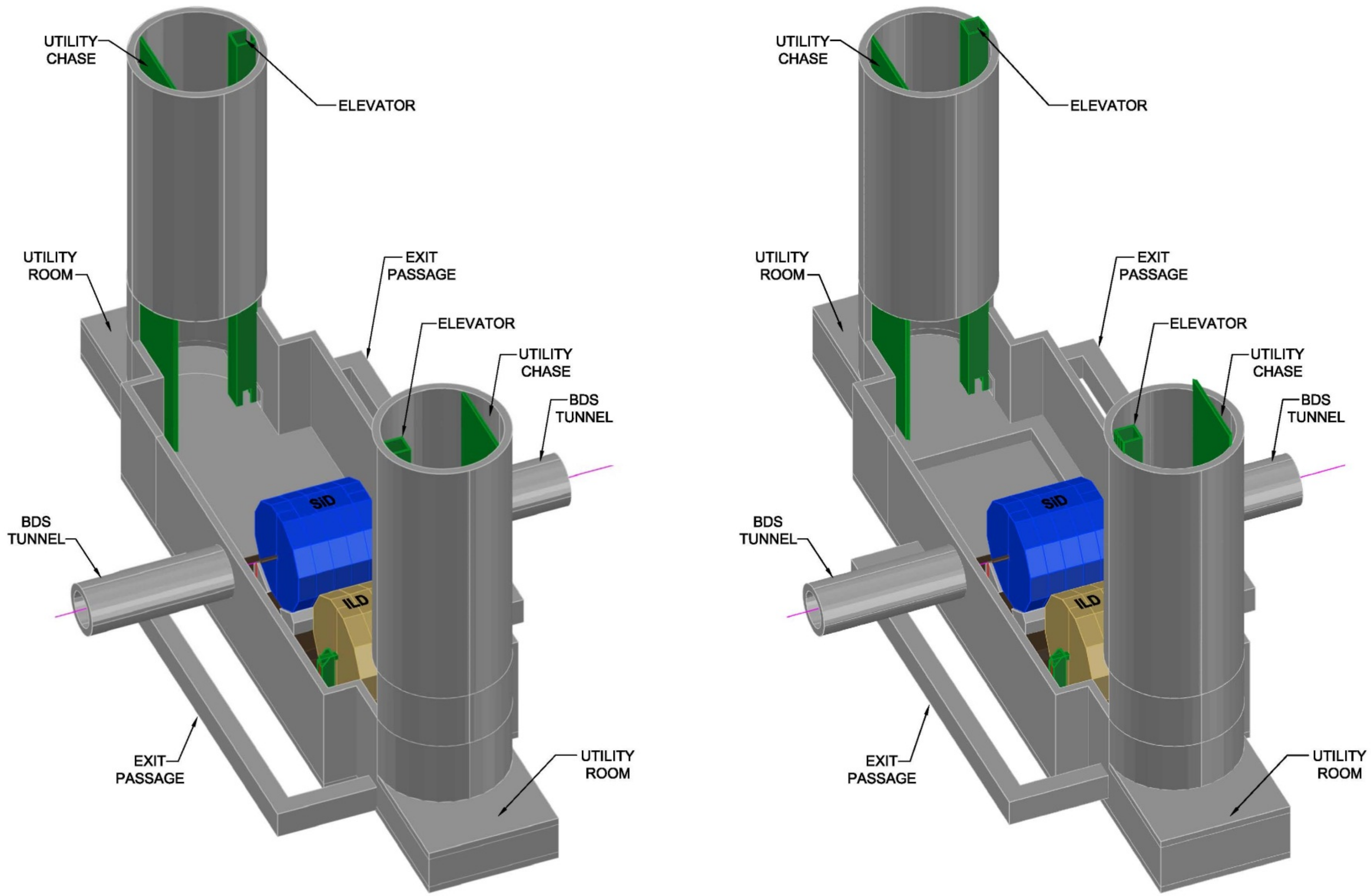

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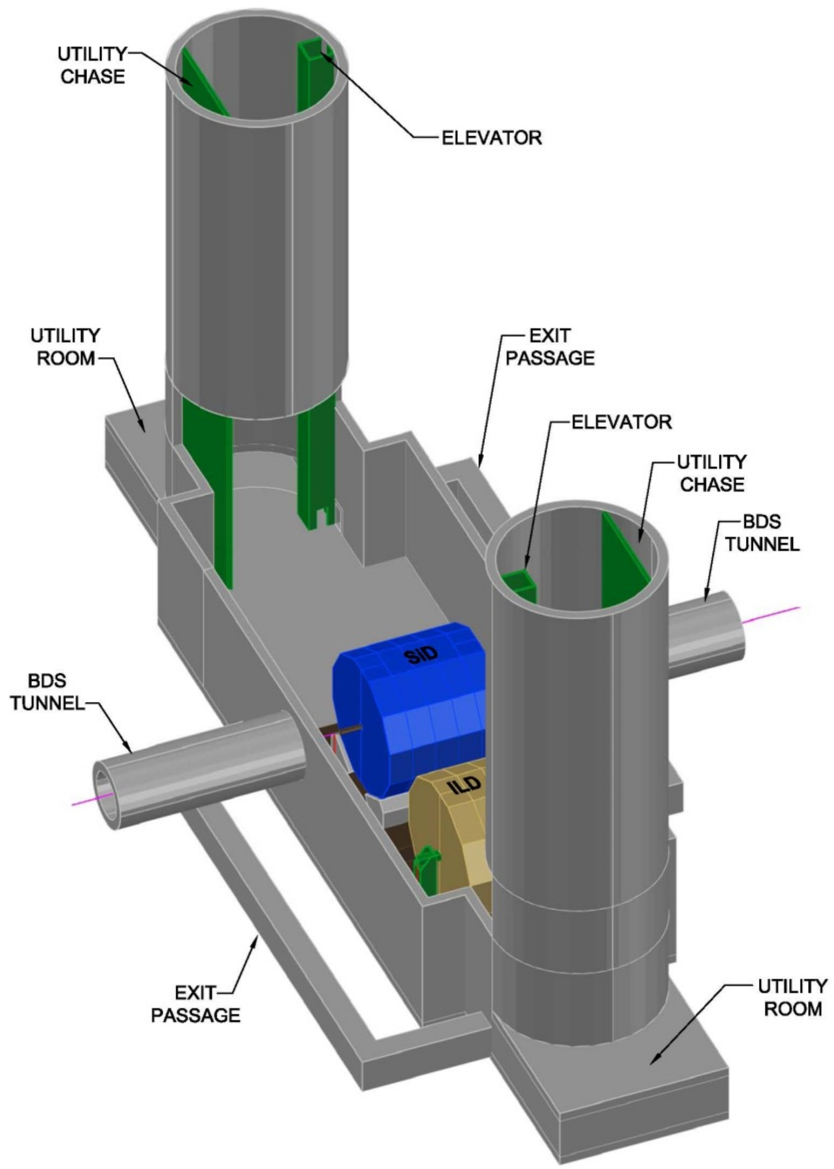
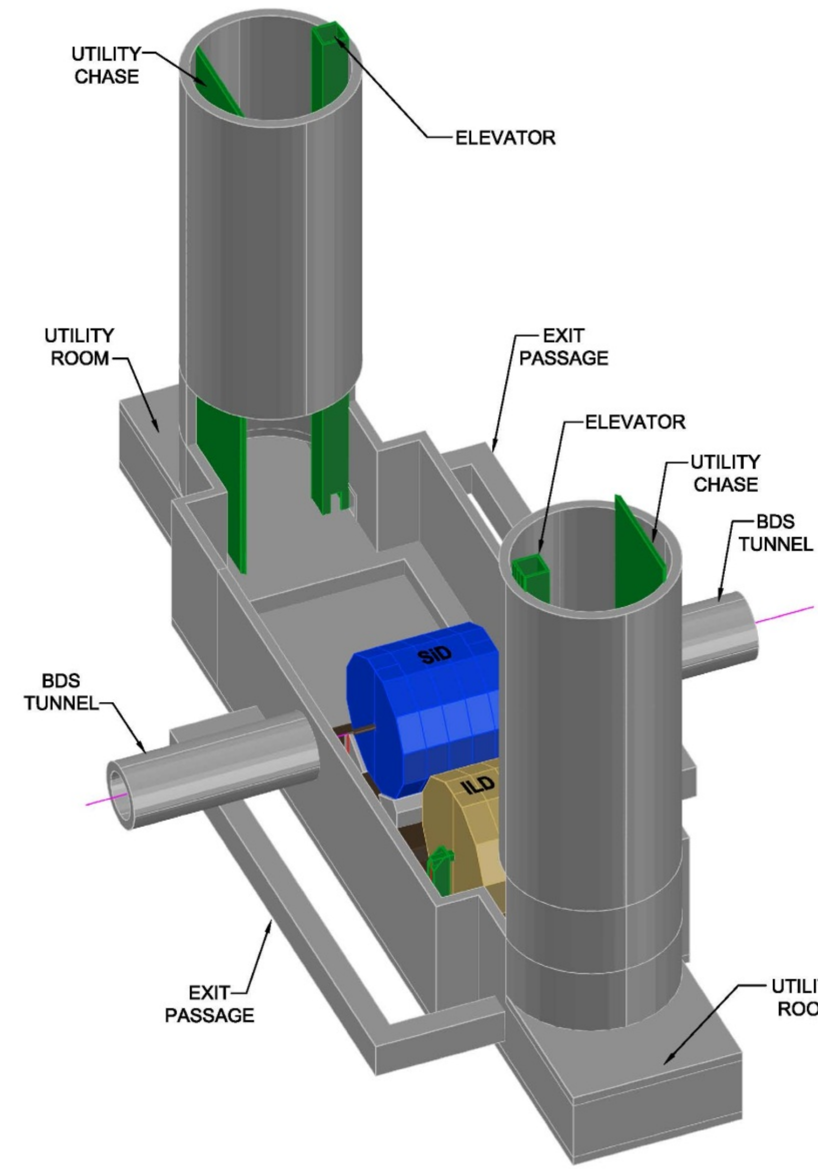
First design:

Not enough lateral space in parking position





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ILD Workshop 2011 at LAL, Paris

ILC CFS / CLIC CES Studies for the Interaction Region :

- An action was given at the Geneva Linear Collider Meeting for CFS to develop a more in-depth civil engineering study of the IR

- Linear Collider IR meeting at CERN held on 16 February 2011

-Design Brief for external design specialists

-Kick-off meeting with ARUP is today

-Next steps

J.Osborne (CERN) for ILC CFS/ CLIC CES 1

J. Osborne (ILC-CFS & CLIC-CFS)

Task 1 - The design of the underground concrete platforms required to transport each of the two Linear Collider Detectors on and off the beam-line position.

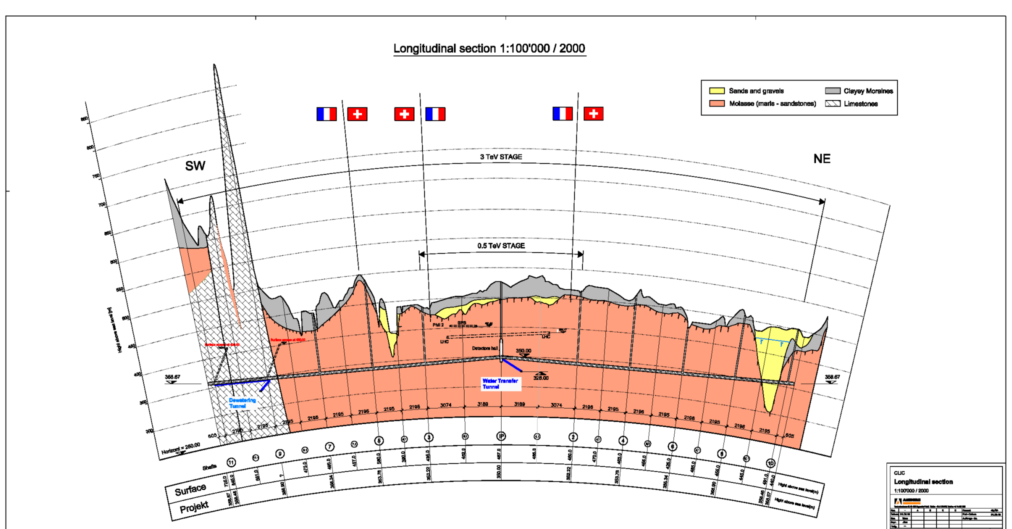
- Two platforms would be required, one for each detector.
- Load of each detector, excluding platforms, of approximately 14,000tons
- Intermediate supports determined by the preferred movement system.
- Platform movement on/off the beamline to be moved over a period of the order of five hours,
- Up to 20 movements per year during machine operation.
- Accelerations of the detector during movement to be limited to 0.5g
- ~~Location of the platforms to within +/-1mm and +/-0.1 milli-rads of their target location relative to final focus quadrupole base slab~~.

ARUP's were asked to tender for 4 distinct tasks

J. Osborne (ILC-CFS & CLIC-CFS)

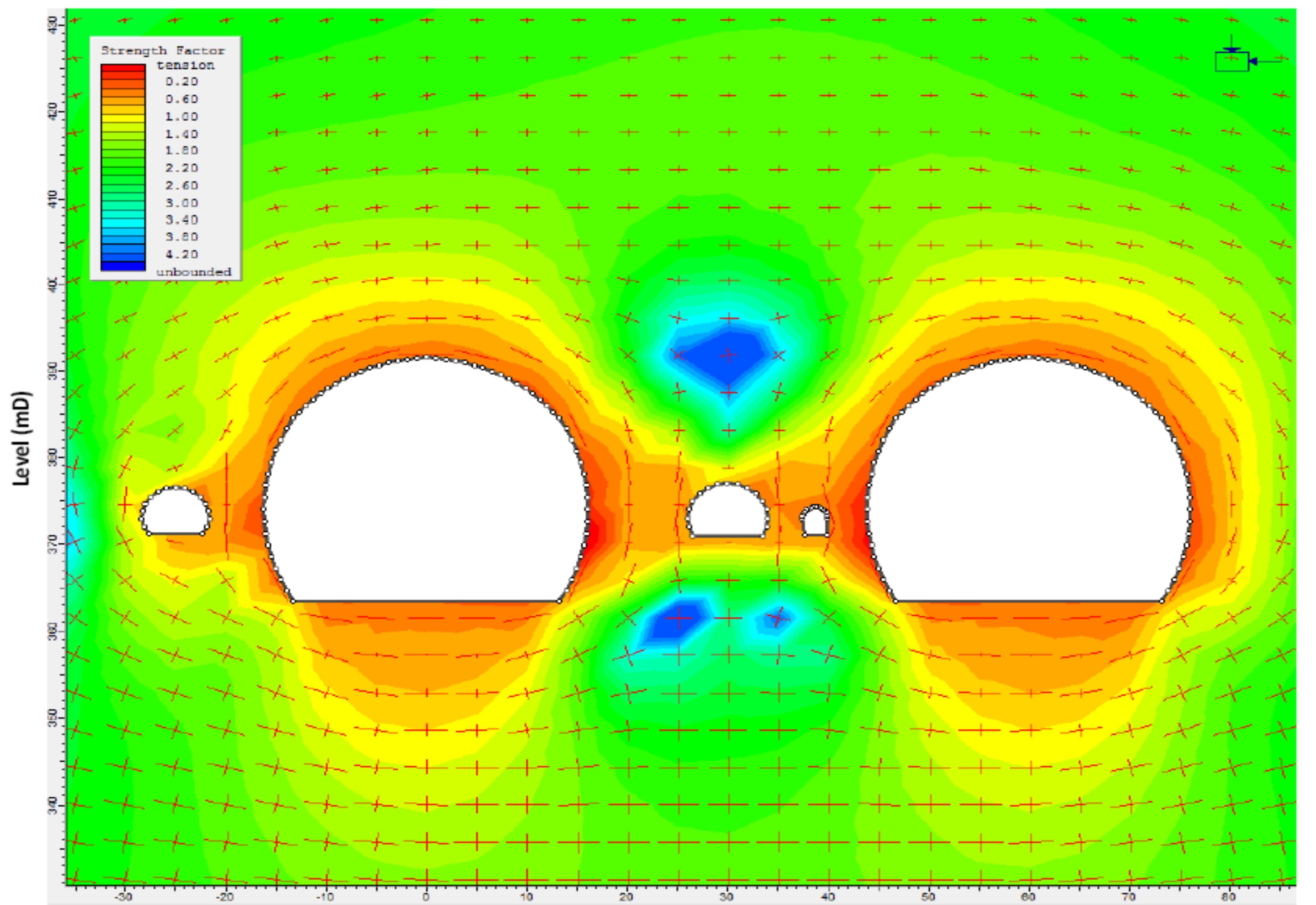
Task 2 - A detailed study of the potential behaviour of the rock mass surrounding the experimental area during the estimated 20-year life span of the machine.

- Experience from other cavern rock related mass conditions should be taken into account e.g LHC.
- 2D and 3D effects to be assessed.
- The study should assume that the experimental area is to be built in CERN geology, in the Molasse Rock
- The long-term behaviour of the excavation



8

J. Osborne (ILC-CFS & CLIC-CFS)



2d and 3d models will be developed for CLIC to do a "Time-dependant" state analysis.

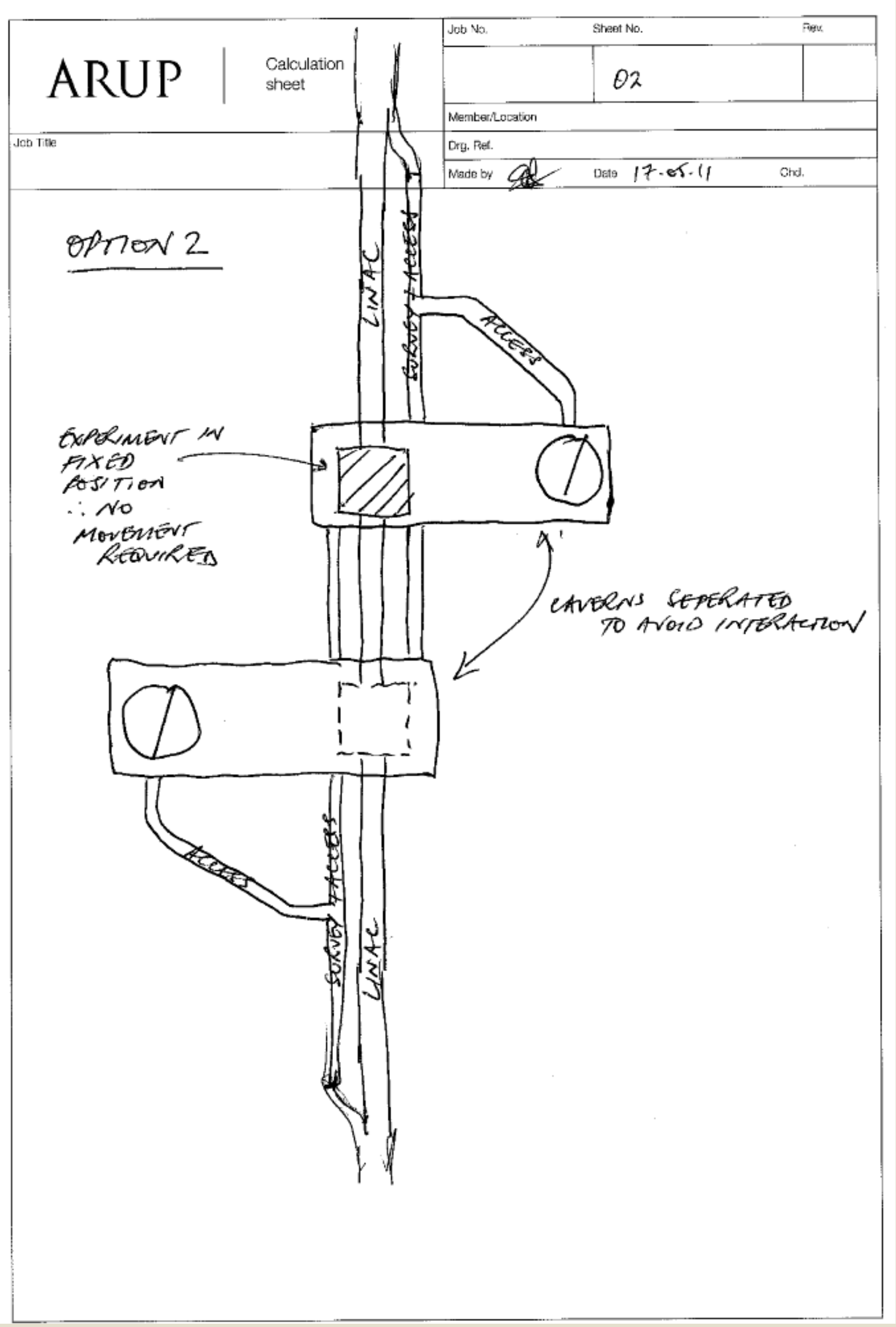
Possible 2nd phase use of these models for ILC layouts/geology.

To get this study going, ARUP have prepared a list of questions including a 'brainstorming' proposal for the IR layout.

To be discussed this afternoon......

For example, ARUP have made a '**brainstorming' proposal for the IR layout :**

To be discussed this afternoon......



J. Osborne (ILC-CFS & CLIC-CFS)

Budget for this Linear Collider IR study :

- FNAL (Task 1) CERN (Task 2)

Some key decisions for ILC were resolved at Eugene meeting :

- Are both detectors using the "concrete" platform strategy : **Yes**
- Are the level of the platforms the same **?**
- For the overall layout :
  - Gantry crane capacity in the experimental hall **?**
  - Should shafts be directly over the cavern or offset **?**
  - Self shielding detectors : **Yes for ILC**

12

Next Steps

- ARUP’s now ready to proceed with :
  - Task 1 - funded by FNAL
  - Task 2 - funded by CERN
- This study will be of benefit to both ILC and CLIC projects
- Design Criteria to be established at this meeting

J.Osborne (CERN) for CES

13

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Interaction Region Engineering Requirements

Push-Pull System Design Study (MDI CTG + BDS)

For DBD/TDR : Design Study for the Interaction Region; Push-Pull System for the I

by the MDI-CTG + A.Seryi (BDS) , July 2010

Tasks (Work Plan)

The following list summarises the major tasks of the working plan.

1. Design of the detector motion system; study of its vibration properties in simulation and experiment.
2. Design of the IR underground hall for push-pull, including facilities and services for the operation of the detectors, radiation shields, seismic issues, impact of safety rules.
3. Optimisation of the detector integration and its impact on assembly procedures, magnetic and radiation shielding, vibration sources.
4. Design of detector services supplies for push-pull (data and HV cables, cryogenics).
5. Design and prototype of the final doublet quadrupoles and verification of their stability.
6. Design of alignment system for the final doublet magnets and the inner detector components, including the design of a laser interferometer system.
7. Study on IR vacuum design, including vacuum requirements and design of quick connection valves.
8. Study of intra-train feedback systems in a push-pull system.

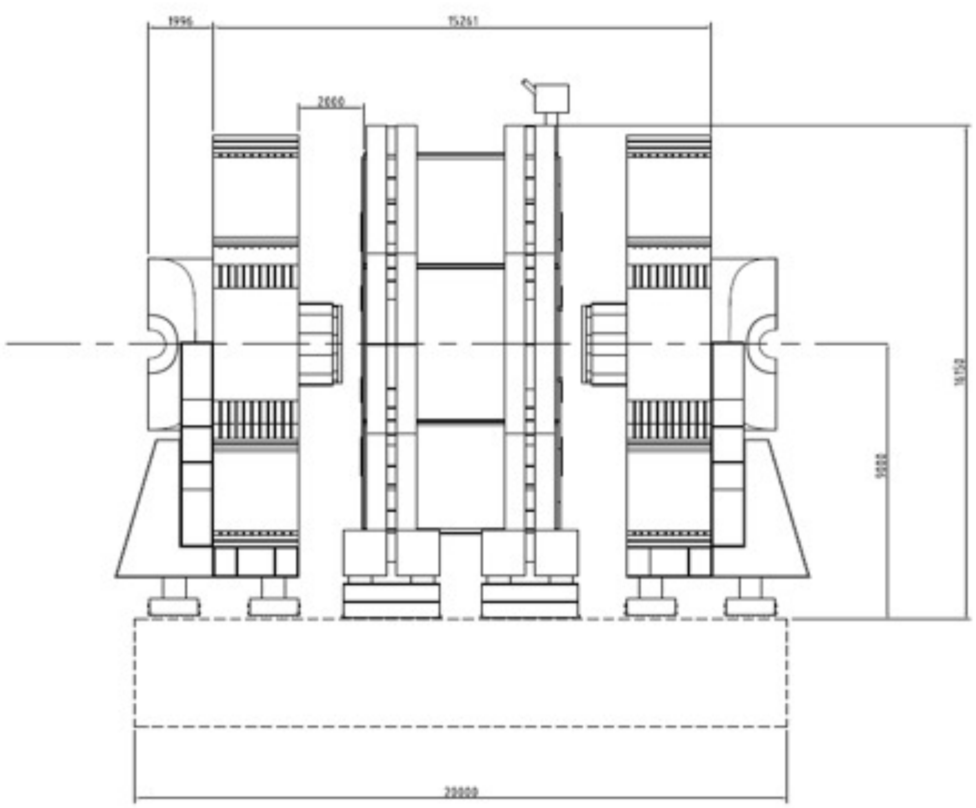
Push-Pull System Design Study (MDI CTG + BDS)

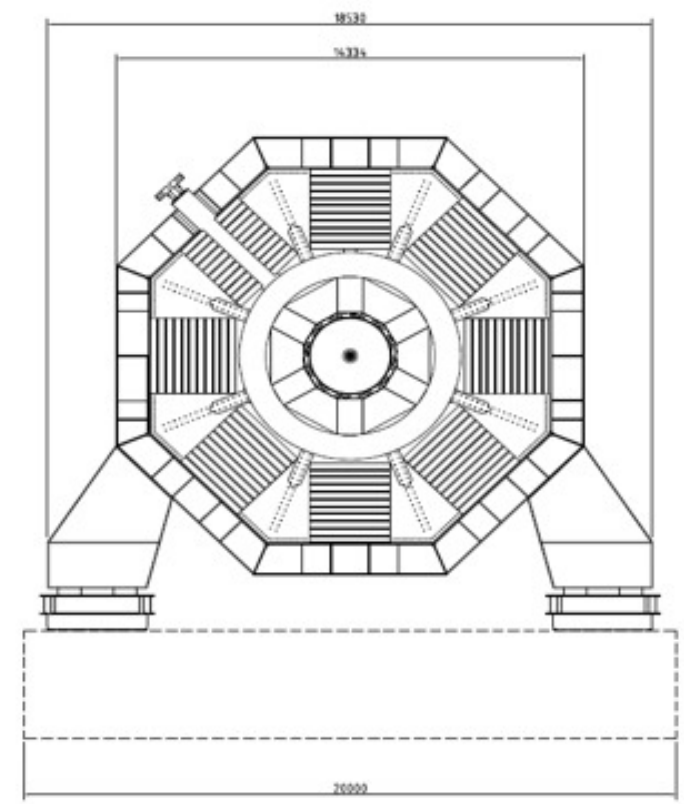
Table 1 Milestones

Date	Milestone
Summer 2010	Finalisation of work plan, implementation of additional resources
October 2010	Linear Collider Workshop at CERN
March 2011	Linear Collider Workshop (ALCPG11) , Eugene
Spring 2011	First draft of IR engineering specifications
Fall 2012	Finalisation of IR engineering specifications
End of 2012	Finalisation of ILC Technical Design Report and the Detailed Baseline Description

Functional Requirements for Platform (SID)

SiD Platform Functional Requirements





SiD nominal mass: Barrel   5000 T; (each) Door 2500 T

Dimensions:
- Z = 20.0 m
- X = 20.0 m
- Delta Y = 9 m (Top of Platform to beamline)

Positioning Tolerance on beamline
- Consider points Z=+-max, X=0. Position to + 1mm wrt references in X,Y,Z
- Consider points Z=+-max, X=+-max: Position to +- 1 wrt references in Y.

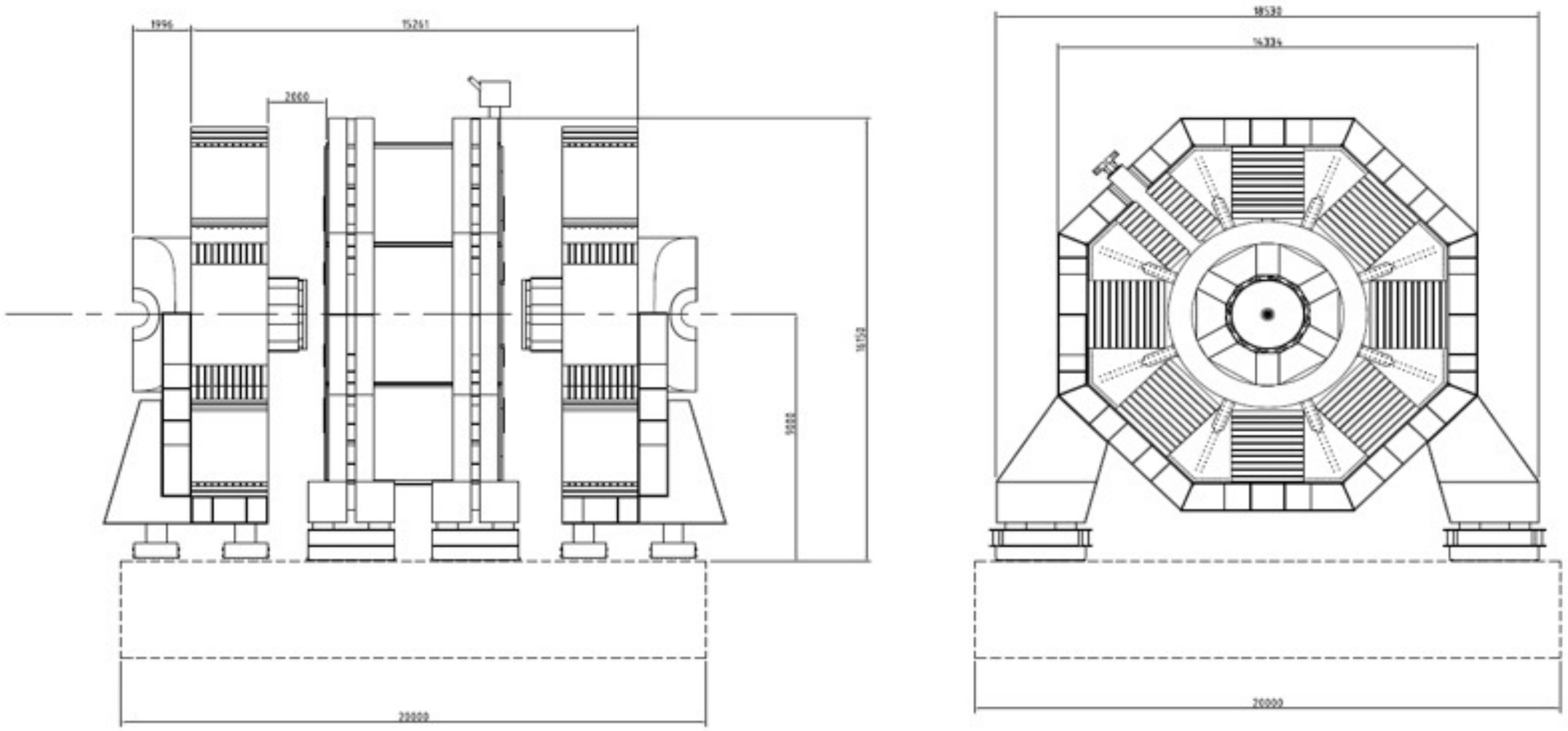
Static Deformations: <+-2 mm

Vibration Transfer Function from ground : Amplification < 1.5 between 1 and 100 Hz.

Seismic stability: Appropriate for selected site. (Beamline must be designed with sufficient compliance that VXD will survive)

Functional Requirements for Platform (SID)

SiD Platform Functional Requirements



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OK for ILD (?)

Engineering Specs (T. Tauchi, Draft)

Draft of “engineering specifications”, 20 May 2011

Engineering Specifications (2) : Experimetnal Hall	RDR	SiD	ILD	ILD in Mtn. site
Parameters that define the underground hall volume				
IR Hall Area(m) ; (W x L)	25x120			
Beam height above IR hall floor (m)	8.6	9(7.5)	8(9)	9
IR Hall Crane Maximum Hook Height Needed(m)	20.5	5m above top of detector	20.5	20.5
Largest Item to Lift in IR Hall (weight and dimensions)	400t	100t PACMAN	55t, 3x3x1.5m	400t
IR Hall Crane	400t+2*20t	100t/10t	80t	400t
IR Hall Crane Clearance Above Hook to the roof (m)	14.5(includes arch)		6	
Survice caverns(m) ; (W x L xH)	none			15x25x11
Resulted total size of the collider hall (W x L x H)	25x120x39	28x48x30		
Parameters that define dimensions of the IR hall shaft and the shaft crane				
Largest Item; Heaviest item to Lower Through IR Shaft (weight and dimensions)	9x16m, 2000t	600t	3411t, 15.7x8m (ring 2.7m thick)	-
IR Shaft Size : diameter(m)	16	9	16	-
IR shaft fixed surface gantry crane. If rented, duration	1.5 years	1.5 years	1.5 years	-
Surface hall crane should serve IR shaft	Yes	Yes	Yes	-
Other shafts near IR hall for access	No	Yes	No	-
Elevator and stares in collider hall shaft	Yes	?	Yes	
Size of access tunnel at Mtn. site (W x H, m)	-	-	-	11x11, 10.2x7.2
Parameters that define dimensions of the surface assembly building and its crane				
Surface Assembly Building Area ((W x L , m)	25 x 100		30x60	27x100
Largest Item to Lift in SurfAsm. Bldg. (weight and dimensions)	400t	70t	180t	180t
Surface Assembly Crane	400t+2*20t	100t/10t	2x80t	400t
SurfAsm. Crane Maximum Hook Height Needed(m)	18	20	19	25
SurfAsm. Crane Clearance Above Hook to the roof (m)	7		5m to ceiling	
Resulted volume of surface assembly building (W x L x H, m)	25 x 100 x 25		30x60x24	
Parameters that define crane access area and clearance around detector				
SurfAsm. crane accessible area (needed) / available (W x L, m)	20 x 102		28x56	
IR hall crane accessible area (needed) / available (W x L, m)	22 x 98		28x41	18x39
Maximum Detector Height(m)		16.15	15.74	15.74
Detector Width (m)		18.53(14.334)	15.665	15.665
Minimum Detector Clearance (W x L H, m)			15.67x13.26x15.74	15.67x13.26x15.74
FILL IN OTHER IMPORTANT PARAMETERS WHICH ARE MISSING				
Electronic hut size			18x9x10m	
Electronic hut location				
When the electronic hut is installed underground				

2011年 5月 20日 金曜日

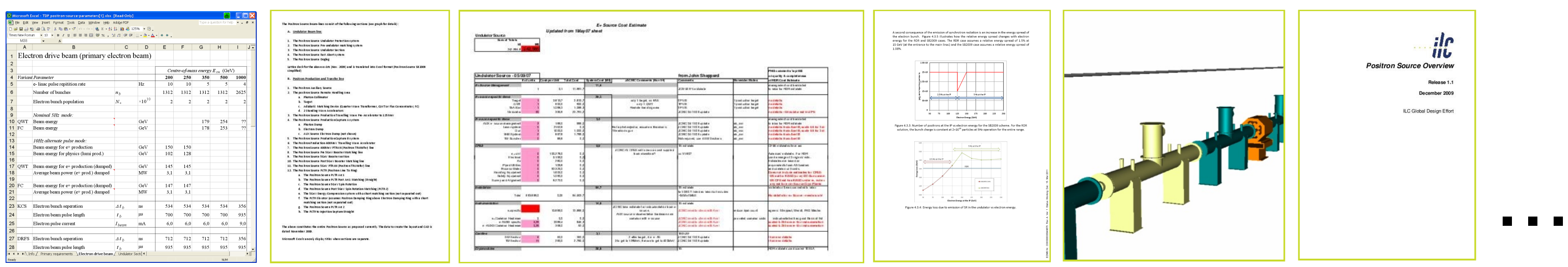
Detailed Design Documentation for the DBD

Technical Design Documentation for the ILC-TDR

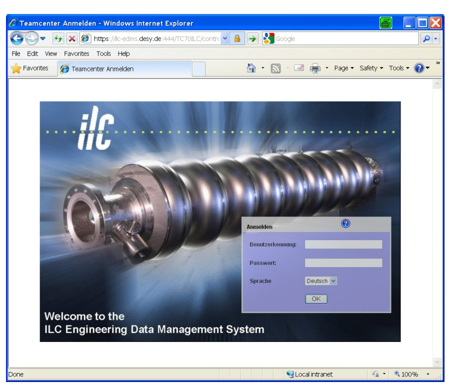
TDD, TDR and ILC-EDMS

Technical Design Report (TDR) summarizes TDD for publication

Technical Design Documentation (TDD) captures entire design efforts, results & rationale



Parameters | Specifications | Cost Estimation | Calculations | CAD Models | Design Summary



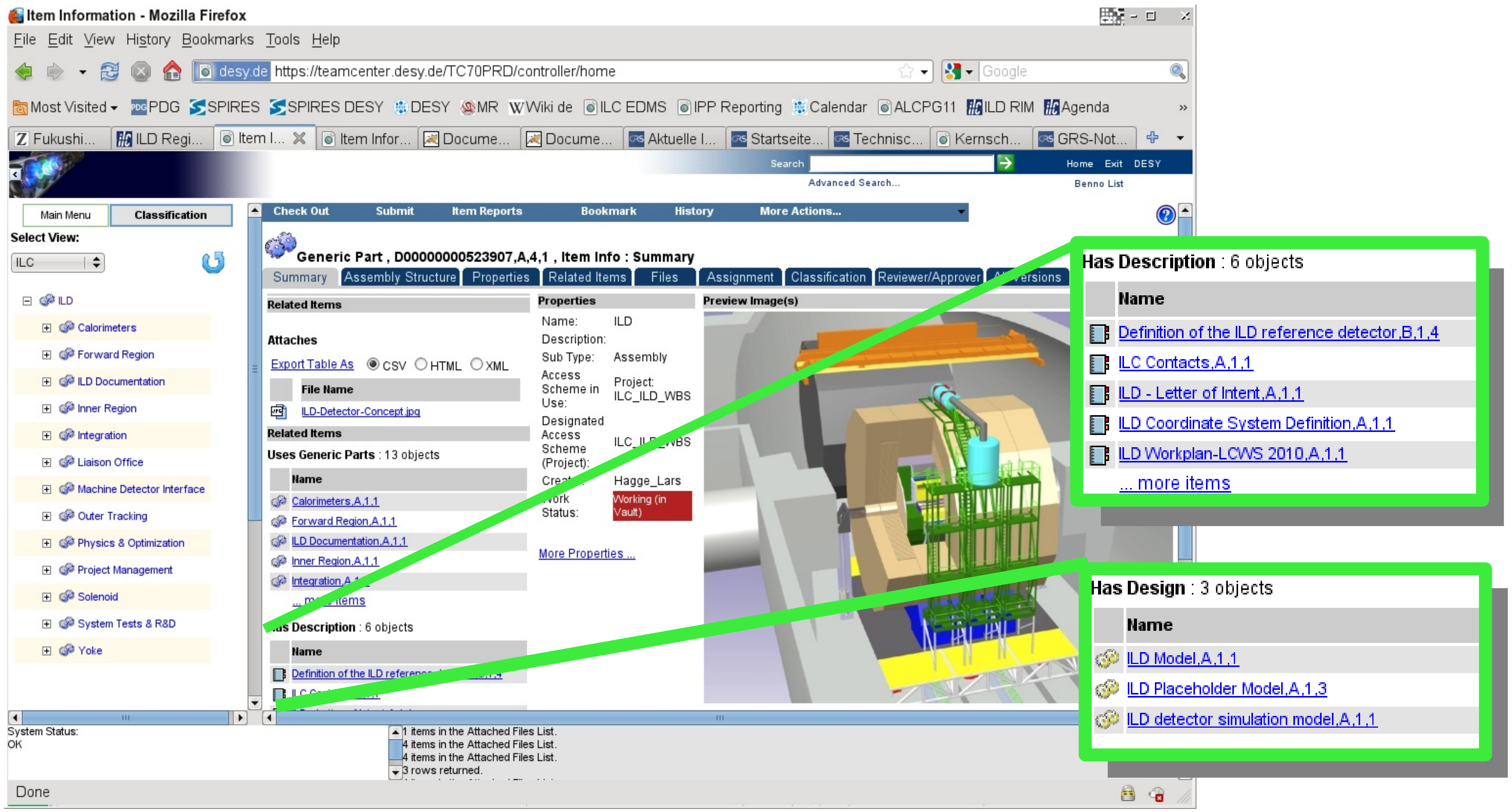
ILC-EDMS organizes the Technical Design Documentation, providing **structure**, **traceability**, **version & configuration mgt.**, and **change control**

Benno List | Collaborative Engineering Supported by EDMS | 20.4.2011 | **Page 2**

- We need the same for ILD, the DBD cannot contain it all!

ILD in EDMS

ILD Top Level WBS Node

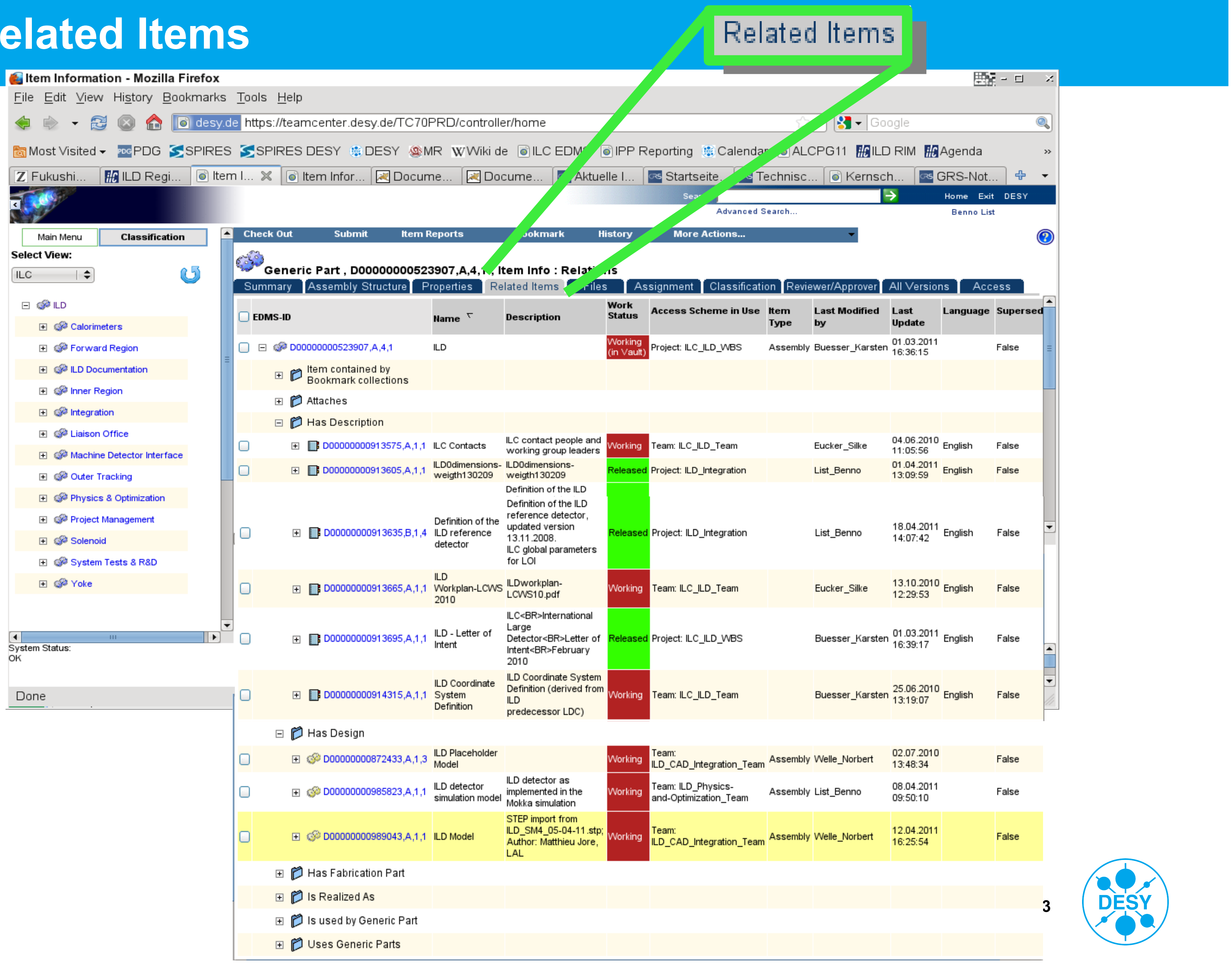


Benno List | Collaborative Engineering Supported by EDMS | 20.4.2011 | **Page 12**

- ILD Work Breakdown Structure exists already!

ILD and EDMS

Related Items



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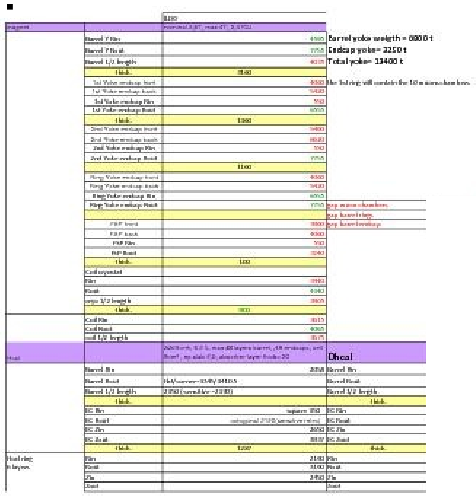
- And there is already information stored!

Parameter Documents in EDMS

Important Documents: Parameter Tables

> ILD0dimensions-weigth130209: D00000000913605



> Definition of the ILD reference detector: D00000000913635

> Both taken from ILD Wiki pages

> If I had a Wiki password, I would have put links to EDMS into Wiki

Definition of the ILD reference detector

ILD Joint steering board, September 21, 2008
(updated version: November 13, 2008 F. Gaede)

1. Introduction

In the following document the ILD detector is defined, as discussed on the second ILD meeting in Cambridge, UK, September 2008. The detector defined is the so-called reference detector for ILD, which has the following implications:

- The overall dimensions and main features of the detector are defines as a basis for the further evolution of ILD. They will be used for the LOI in 2009.
- The details of the detector are defined primarily for the purpose of performance studies. This detector will be implemented in the ILD simulation software (MOKKA and Jupiter) and will be used for future performance studies. This detector will be used for any large scale Monte Carlo production from now on.
- As much as possible the choice of parameters is based on studies which were presented at Cambridge. However in many cases studies have either not yet been finished, or are still inconclusive. Decisions taken in these cases are driven by the desire to define one detector. They may change later, once more information is available, or better reconstruction and/or analysis techniques have been developed.
- Wherever possible we have tried to define a virtual detector, which will deliver a certain performance, but which does not define a specific technology. In some In general this does not mean that ILD has chosen this technology typically the technology chosen is the currently most mature technology. This however does not imply any pre-decision on an eventual technology choice for the ILD group.
- In some cases we distinguish between a baseline detector, and possible upgrade or extension options. This refers to additional detector elements, which may or may not be included, depending primarily on the wanted performance, and possible optimization results.
- In many cases we have not yet chosen a specific technology, but follow more than one solution. These solutions currently are all considered with equal weight, and achieving more R&D results on all of them is considered of highest priority. During the process leading up to the LOI we will continue to evaluate this, and decide how many different options we will describe in the LOI.

2. Basic Parameters

The following table shows the main parameters of ILD_1:

Coil				
Rmin	3440		(Mokka: coil and cryostat modeled as one Al tube with 750 thickness)	
Rmax	4190			
Z	3872			

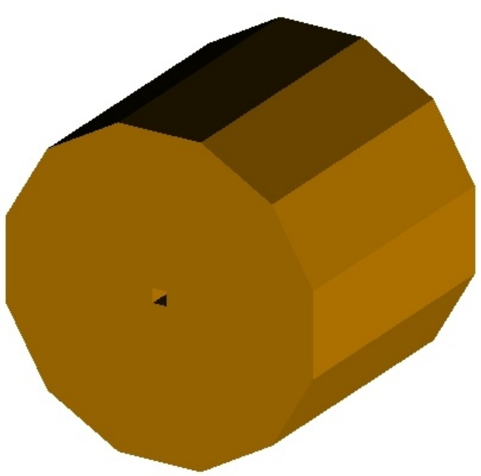
DESY

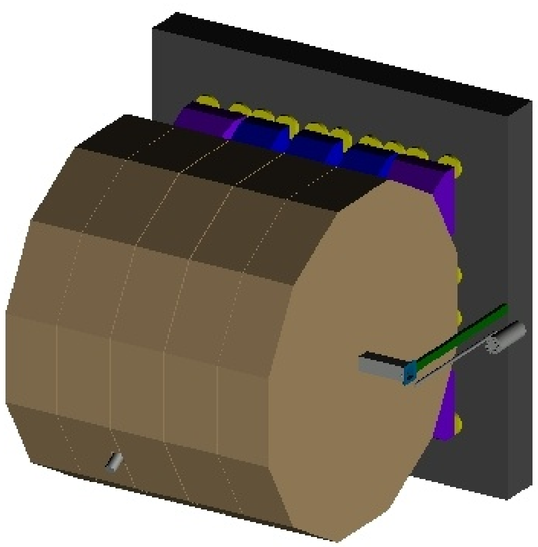
• Parameter lists

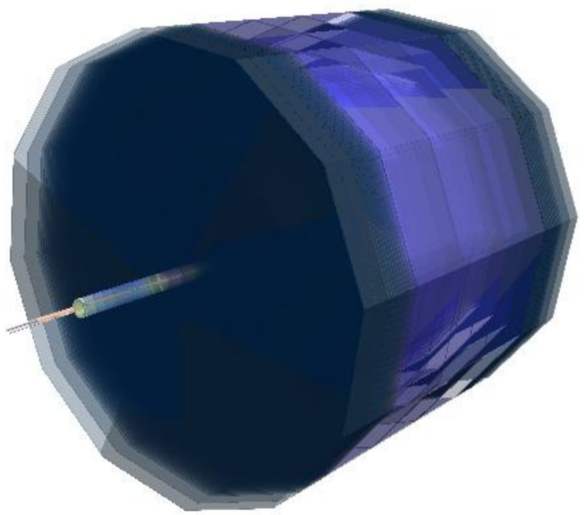
Detector Models in EDMS

Available CAD Models for ILD in EDMS

- D00000000872433: Placeholder model: Still a very preliminary version
- D00000000989043: Engineering model from Matthieu
  → will be updated
- D00000000952125: Mokka simulation model ILD_01_pre01
  → the plan is to update this model, as new Mokka pre-releases become available
  → Also available as 3D-PDF (but veeeeeeeery slow, because of too much detail in SIT/SET/ETD subdetectors)
- It is possible that you cannot access (some) of the models, until they have been released







Conclusion

- The MDI work has become a friendly collaboration between detector concepts, ILC-CFS, ILC-BDS and CLIC!
- The engineering requirements for the interaction region are being defined
- Many open issues are identified
- Unfortunately the work is resources-driven not task-driven
- We should make sure that the „ILD Legacy“ is documented properly so that it can be used whenever, whereever and whatever TeV lepton collider will be built