Integration / MDI Status and Plan

T. Tauchi, ILC Tokushin Kickoff Meeting,

12 September 2011

Specific Issues in Tokushin on Detector Integration

for 2011 - 2015

1. Assembling procedure of the detector in the experimental hall by transporting divided coils of large detector solenoid

2. Alignment system for heavy components

3. Detector moving system with connecting signal cables and cryogenic pipes in the push pull operation

Recent Activities

ILC Experimental Hall, especially in Japan

Mountain site, e.g. assembling, access, vibration etc.
: the engineering specifications for Japanese site

ILD : MDI/Integration meetings (Webex)

22 May, 2011 ILD MDI/Integration Pre-meeting (ILD WS)
with participation from SiD, CFS groups and ARUP

MDI-CTG/BDS Meetings (Webex)

21 June,2011 : Discussion on the ARUP document on the LC study task 1 and 2

25-26 July,2011 : CFS Technical Workshop, intermediate review of ARUP work

15 August,2011 : Report of the CFS technical WS, plan at LCWS2011

15 September,2011 : webex meeting with CFS on experimental hall etc.

26 -30 September, 2011 : LCWS2011

24 -28 October, 2011 : TDR Technical Baseline Review meeting of BDS/MDI

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

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

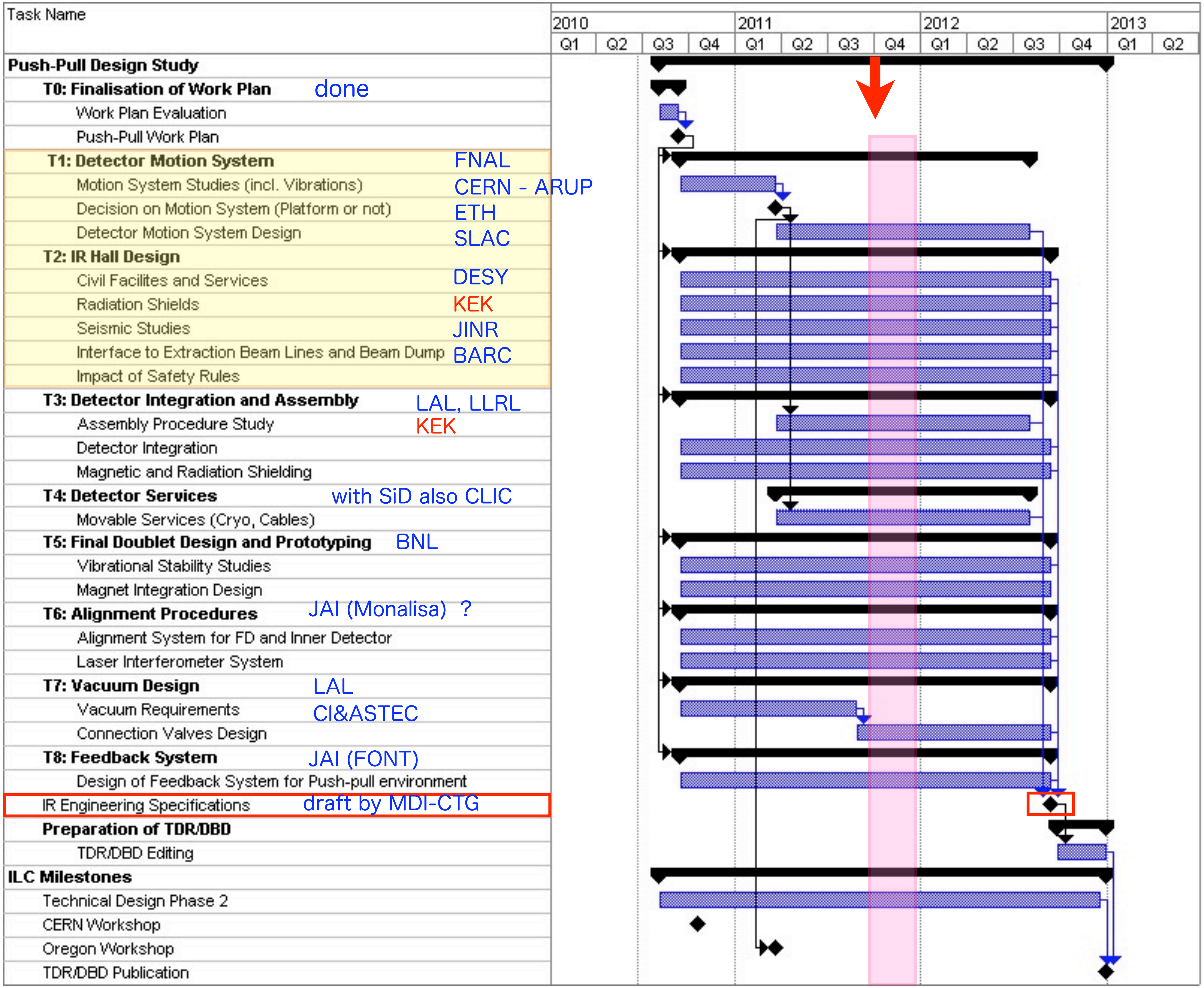
Ours (KEK)

Tasks (Work Plan)

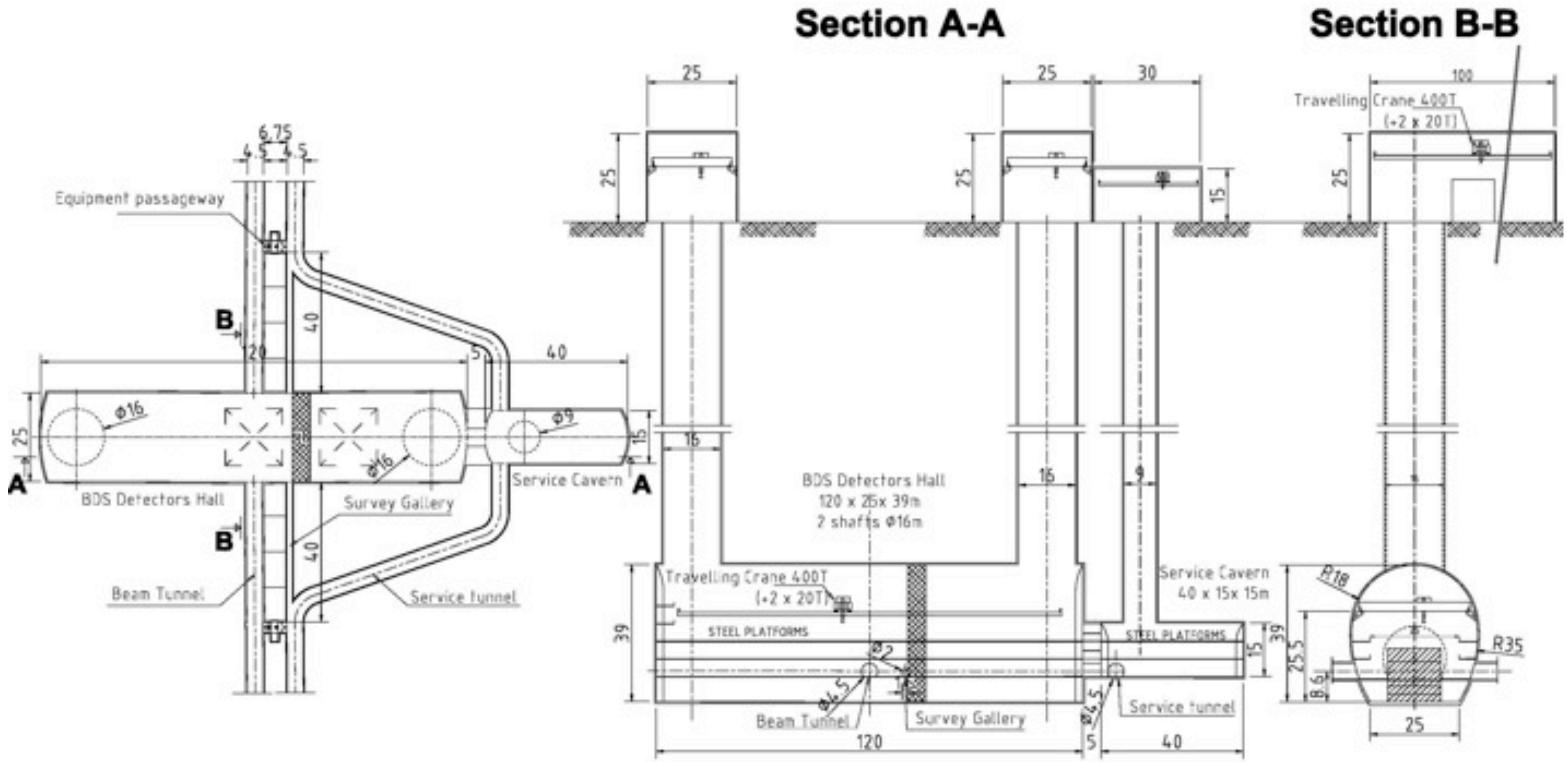
The following list summarizes the major tasks of the working plan.

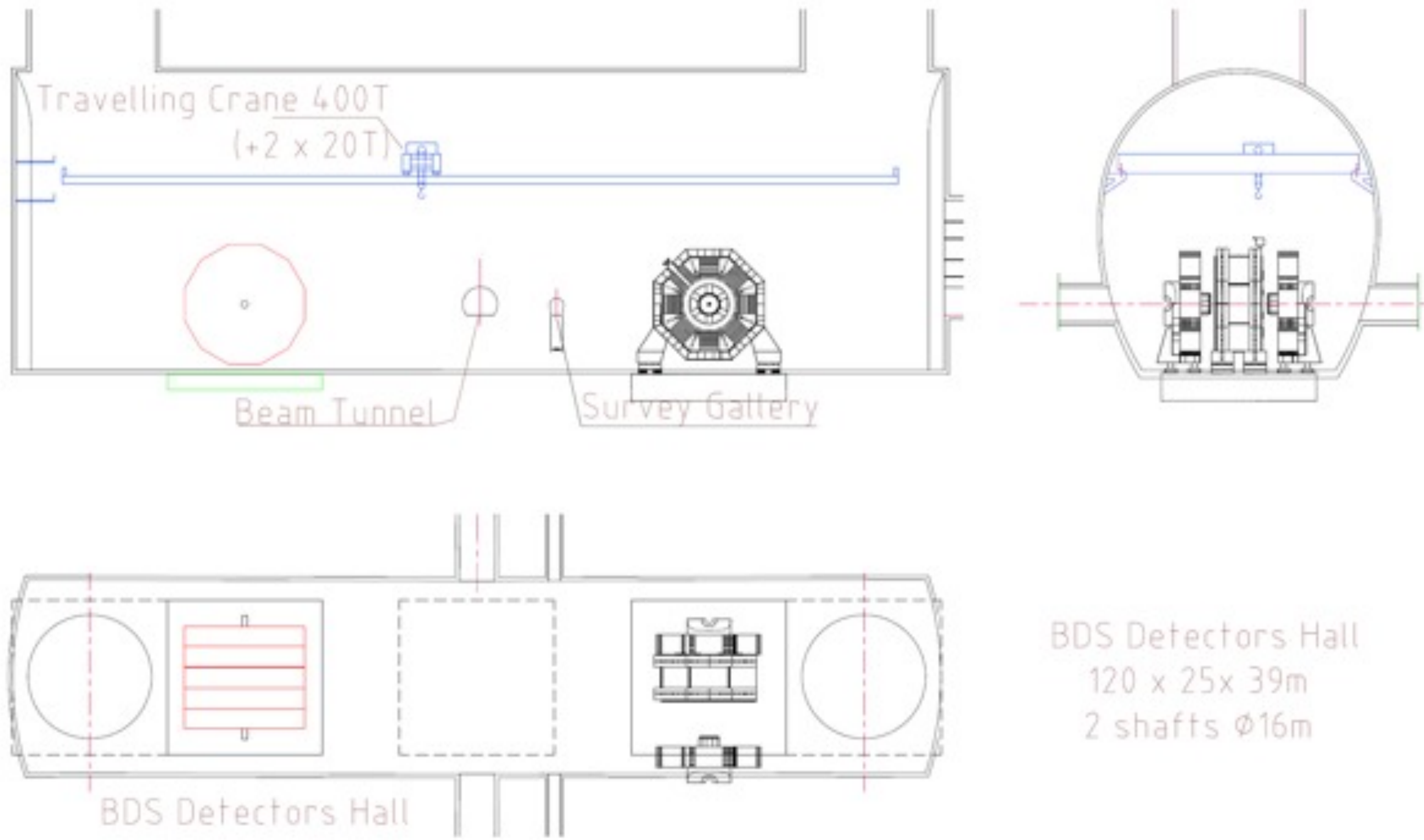
1. Design of the detector motion system; study of its vibration properties in simulation and experiment.
2. Design of the IR underground hall for push-pull, including facilities and services for the operation of the detectors, radiation shields, seismic issues, impact of safety rules.
3. Optimization 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.

Work Plan Diagram



RDR Experimental Hall Design





Experimental Hall Design in ILD-LOI

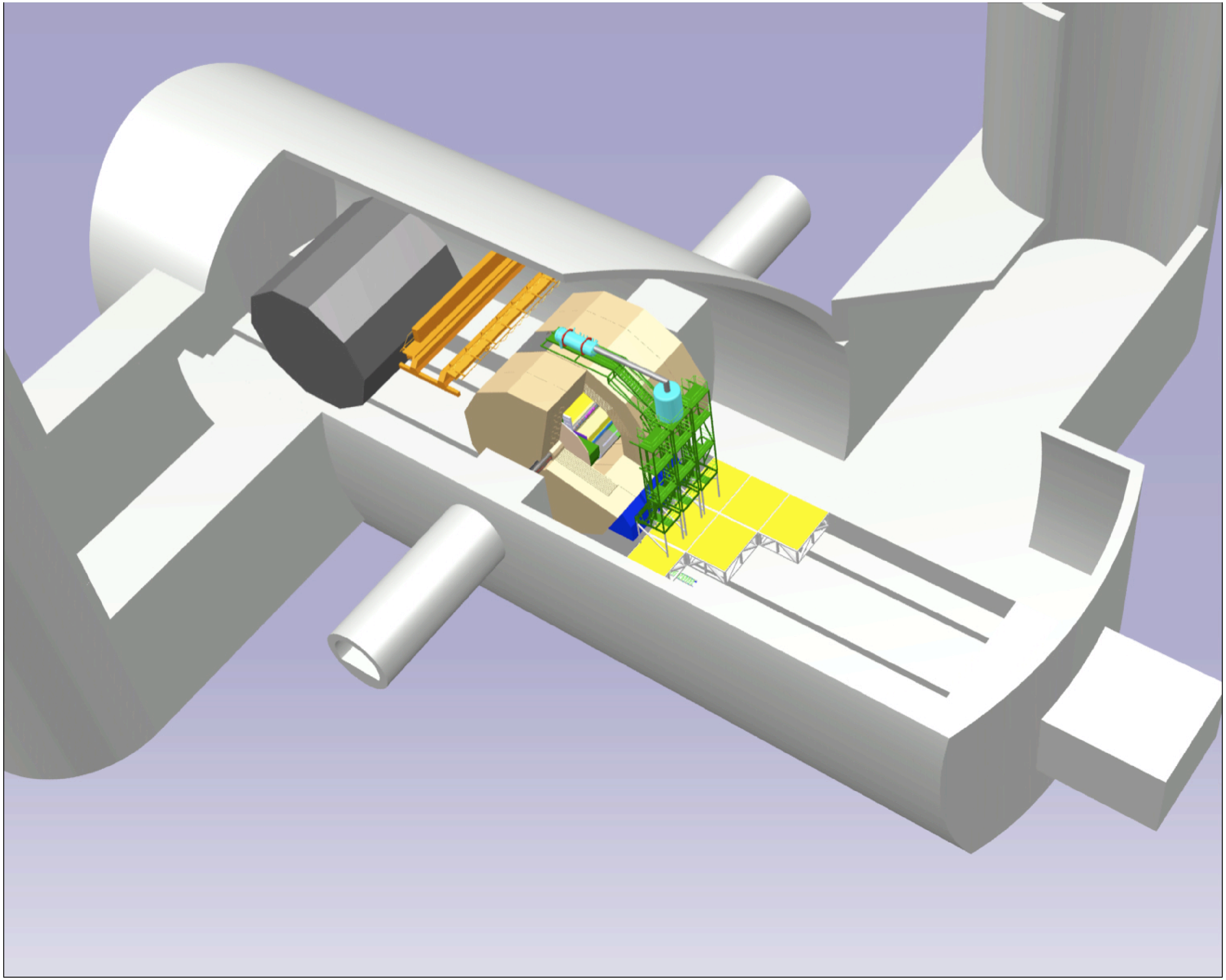


FIGURE 6.3-4. Design study of the underground experiment hall with ILD (left) and the second detector in push-pull configuration.

CERN

to be completed by LCWS2011

Linear Collider Study Task 1 and 2

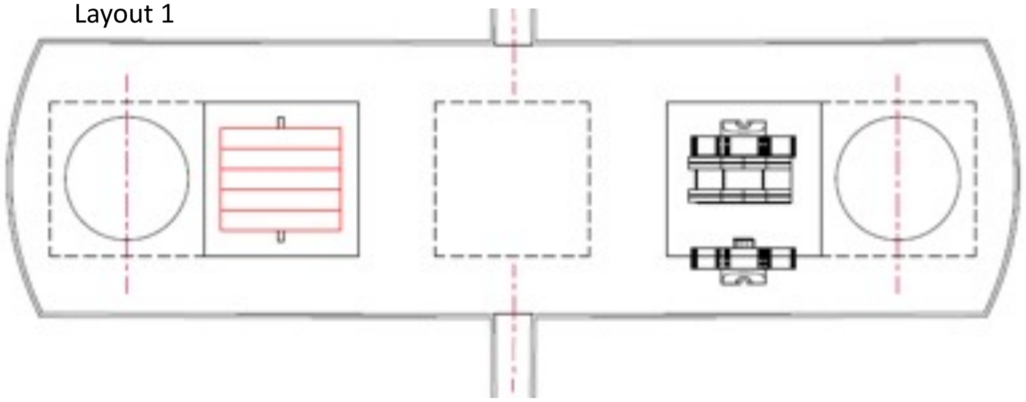
Technical Basis for Study

REP/Basis/216967/MJS/260511

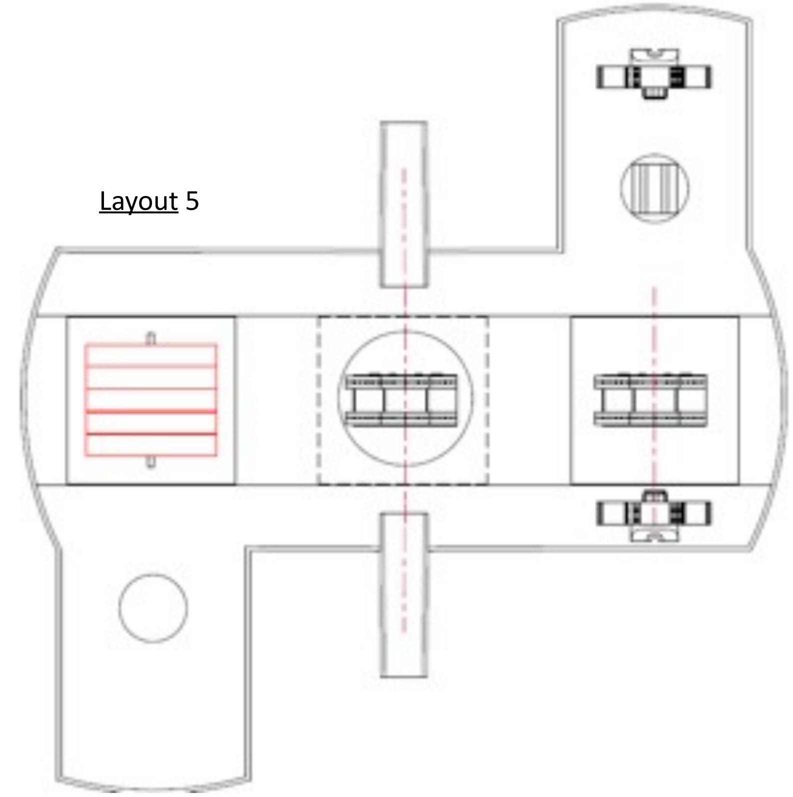
Rev 1 | June 2011

CFS technical workshop is planned for 25/26 July in London, to check on the design progress. Participants are J.Osborne, A.Gaddi , M.Gastal , A.Herve (ILD) , V.Kuchler , T.Lackowski, M.Oriunno (SiD), K.Sinram (ILD) ...

Layout 1



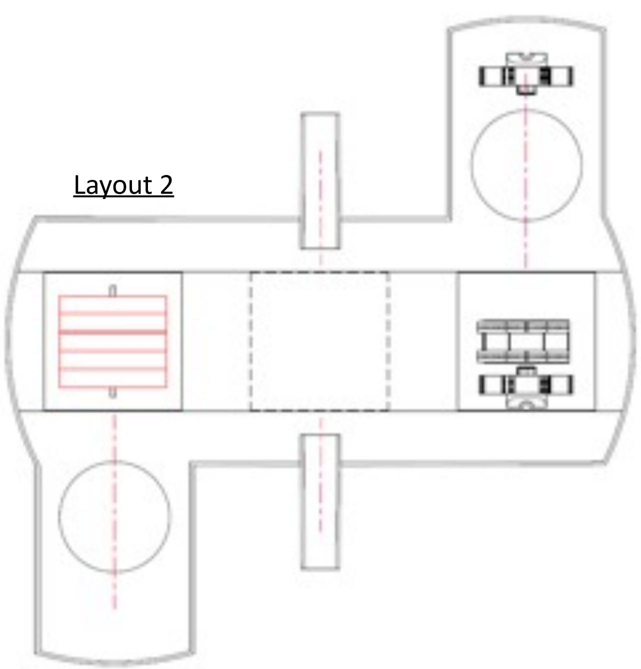
Layout 5



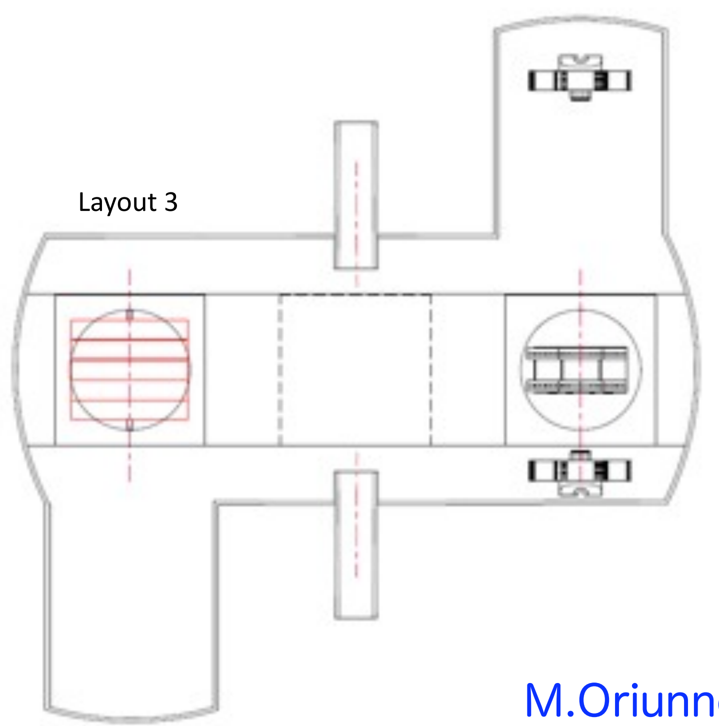
Rating Scale 1÷5 : 1=Low, 5=High

#	Requirement	Layout 1	Layout 2	Layout 3	Layout 4	Layout 5
1	Surface assembly of Magnet	1	4	3	3	4
2	Underground installation of Tracker, Calorimeters and Forwards	1	4	2	2	4
3	Number and Size of Cranes	3	3	3	2	4
4	Costs: Shafts and Halls size	4	2	2	2	3
5	Infrastructures	NA	NA	NA	NA	NA
6	Easy Maintenance, Smooth Operation	2	4	3	2	4
7	Beam Commissioning	1	1	1	4	4
8	Safety	2	4	2	2	4
	Final Score	14	22	16	17	27

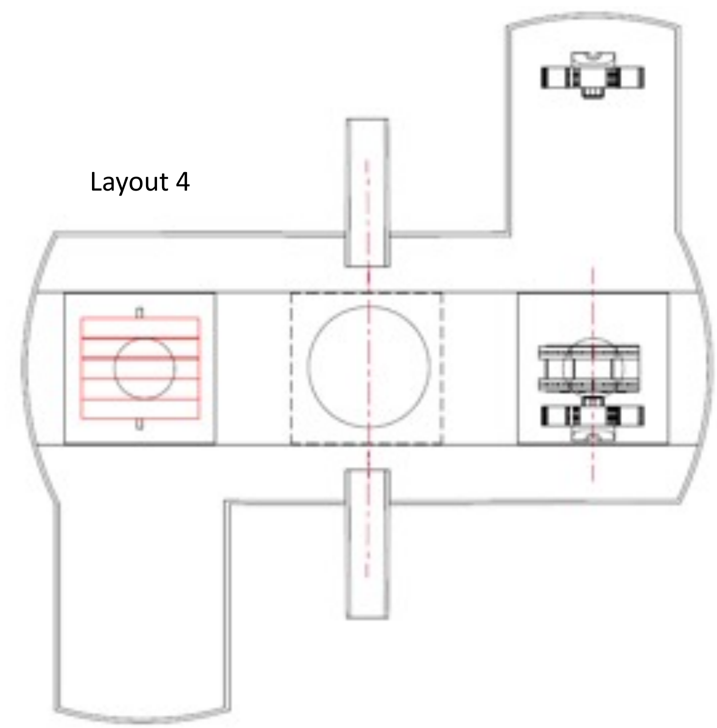
Layout 2



Layout 3

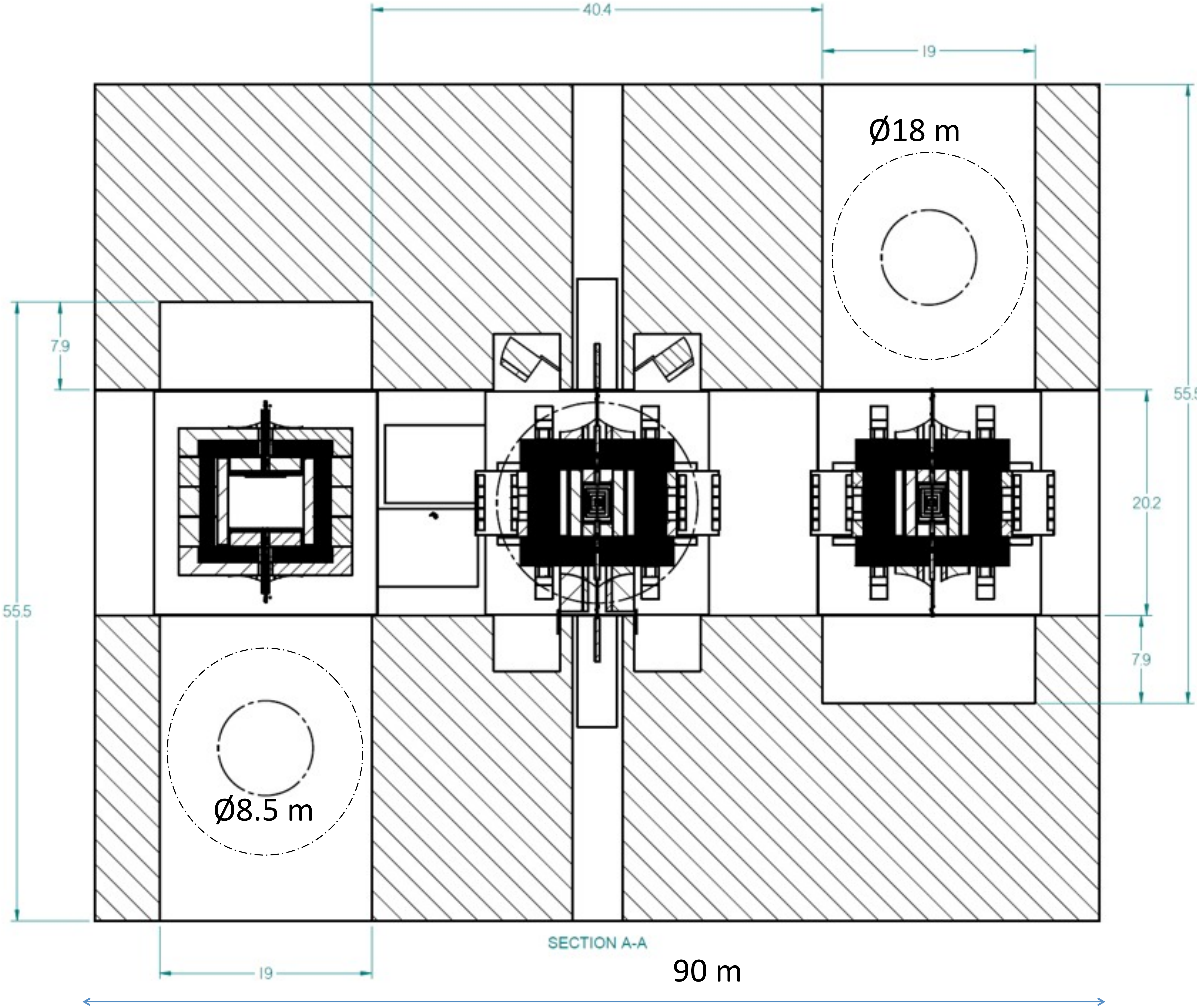


Layout 4

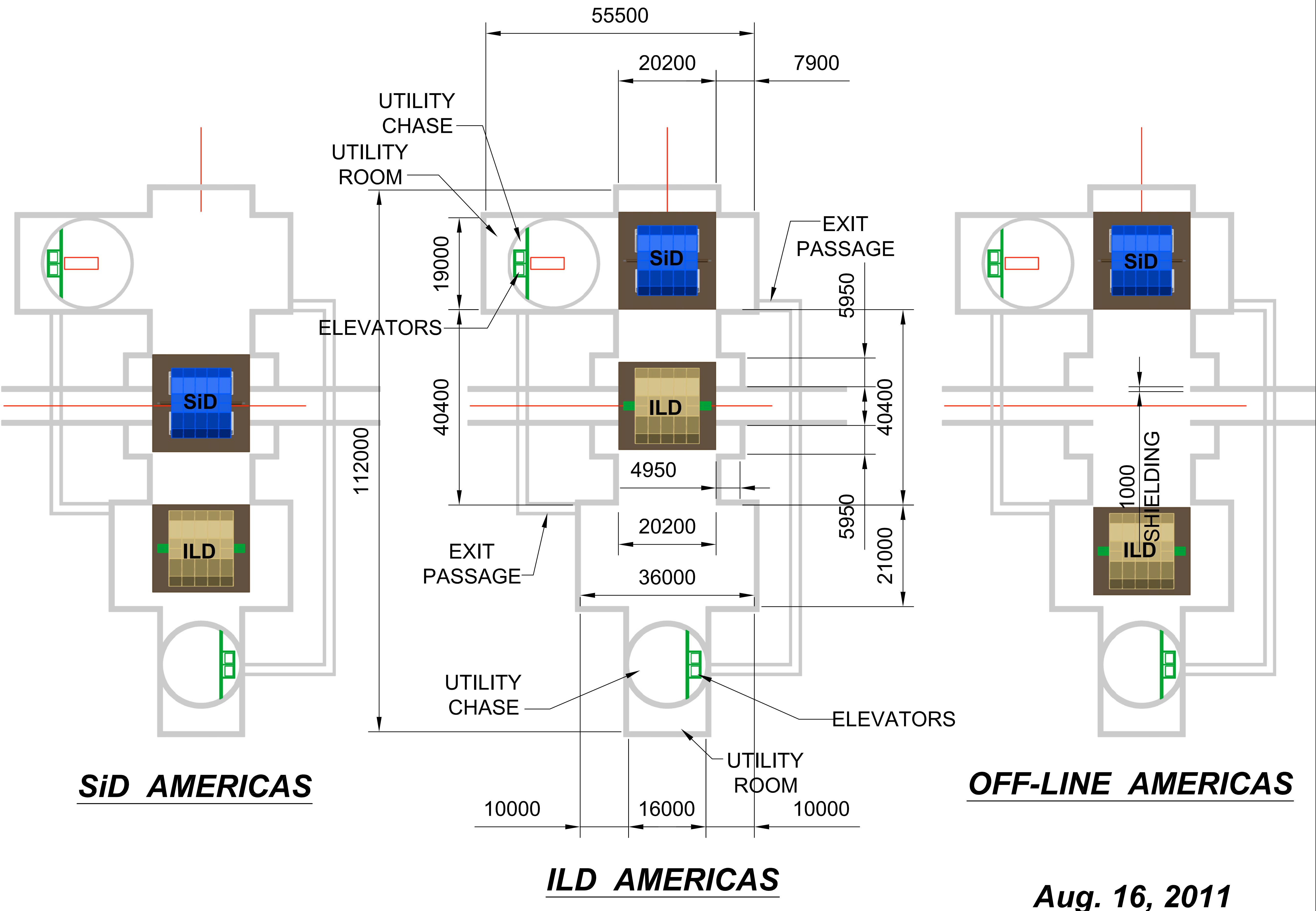


M.Oriunno (SiD),25-26 July, 2011, ARUP meeting

2011年 9月 10日 土曜日

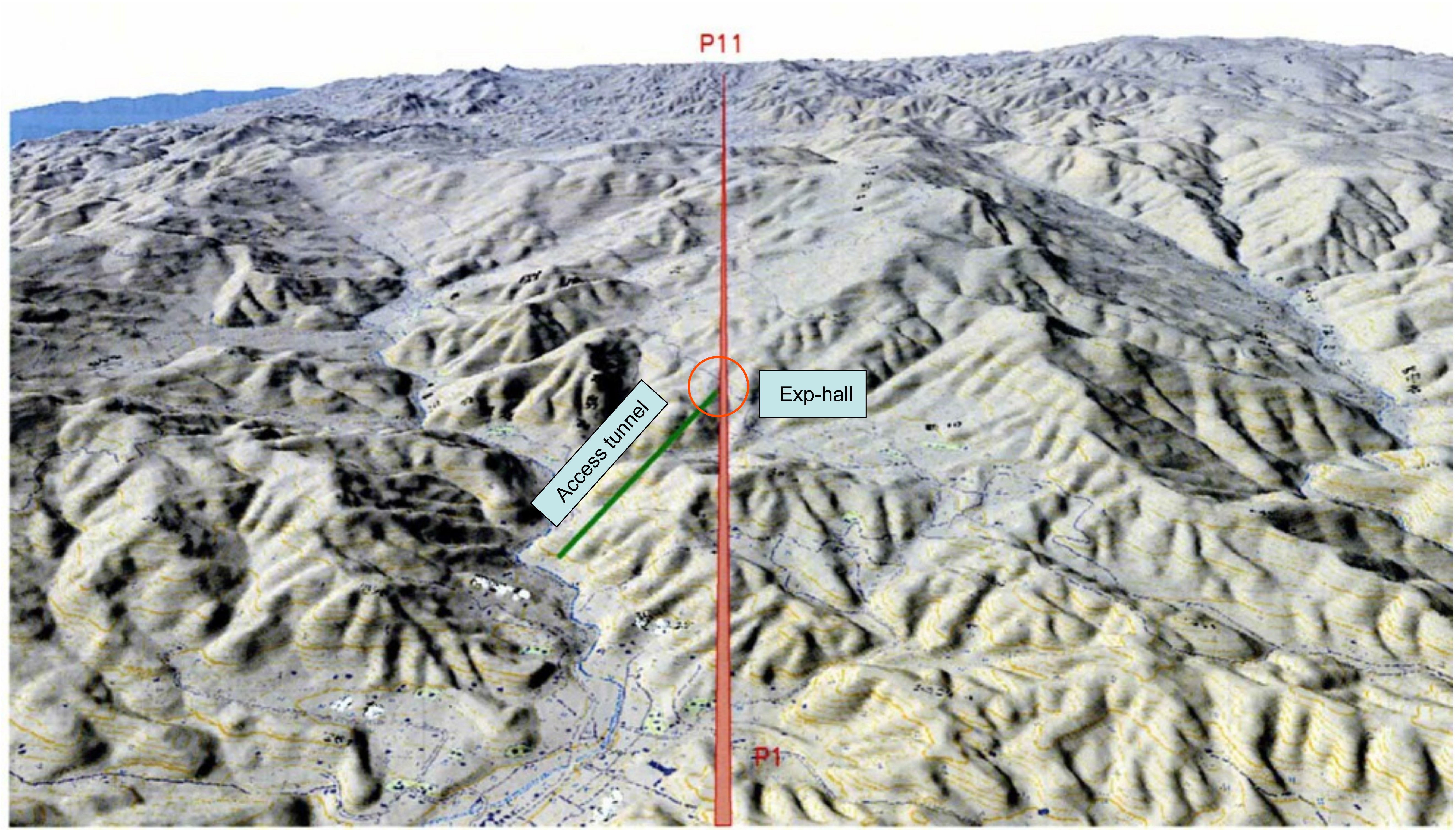


M.Oriunno (SiD),25-26 July, 2011, ARUP meeting

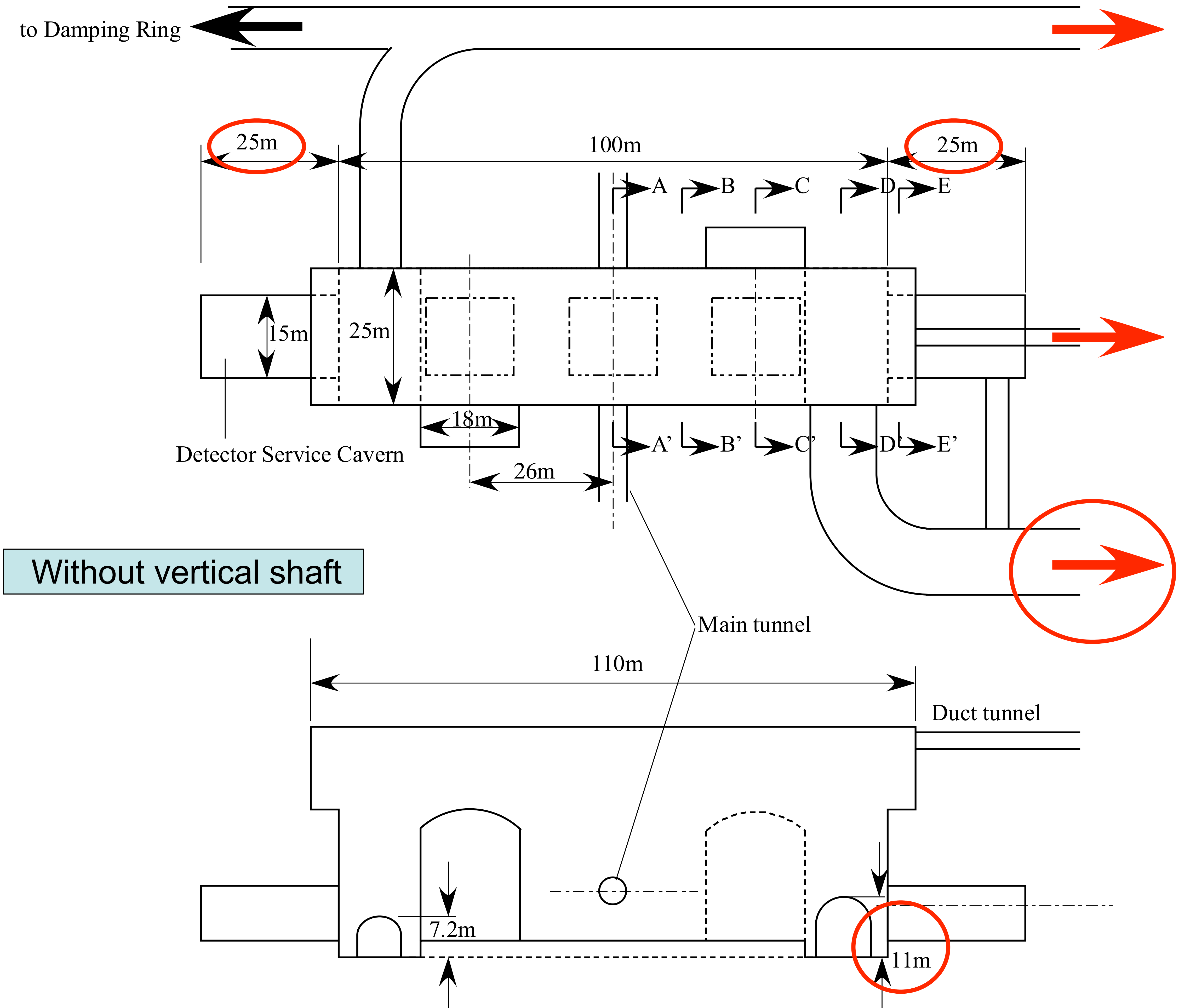


Tom Lackowski (FNAL), MDI-CFS webex meeting

An example of Asian mountain site

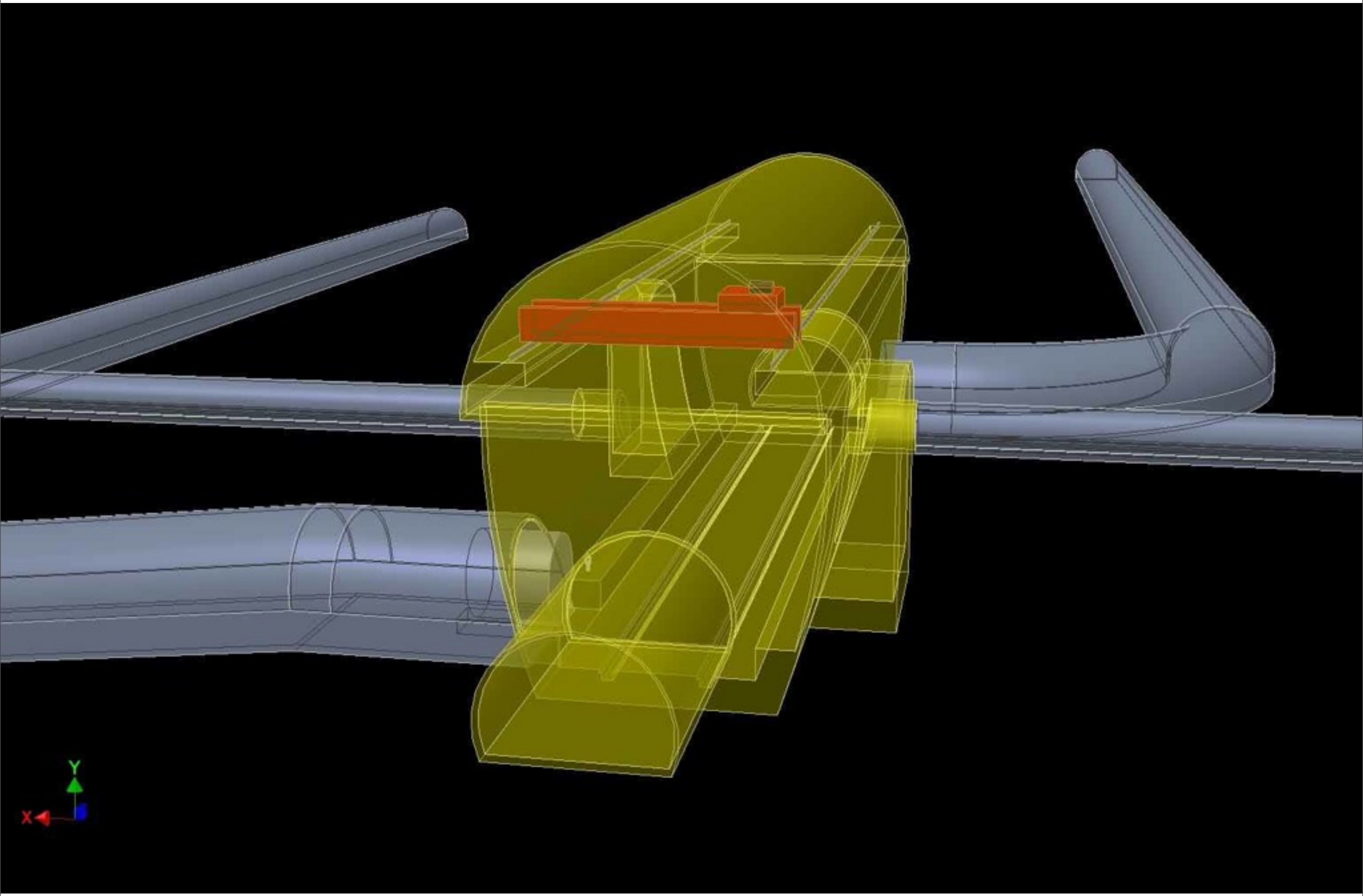


Y. Sugimoto, IWLC10, CERN/CICG, 8 Oct.2010



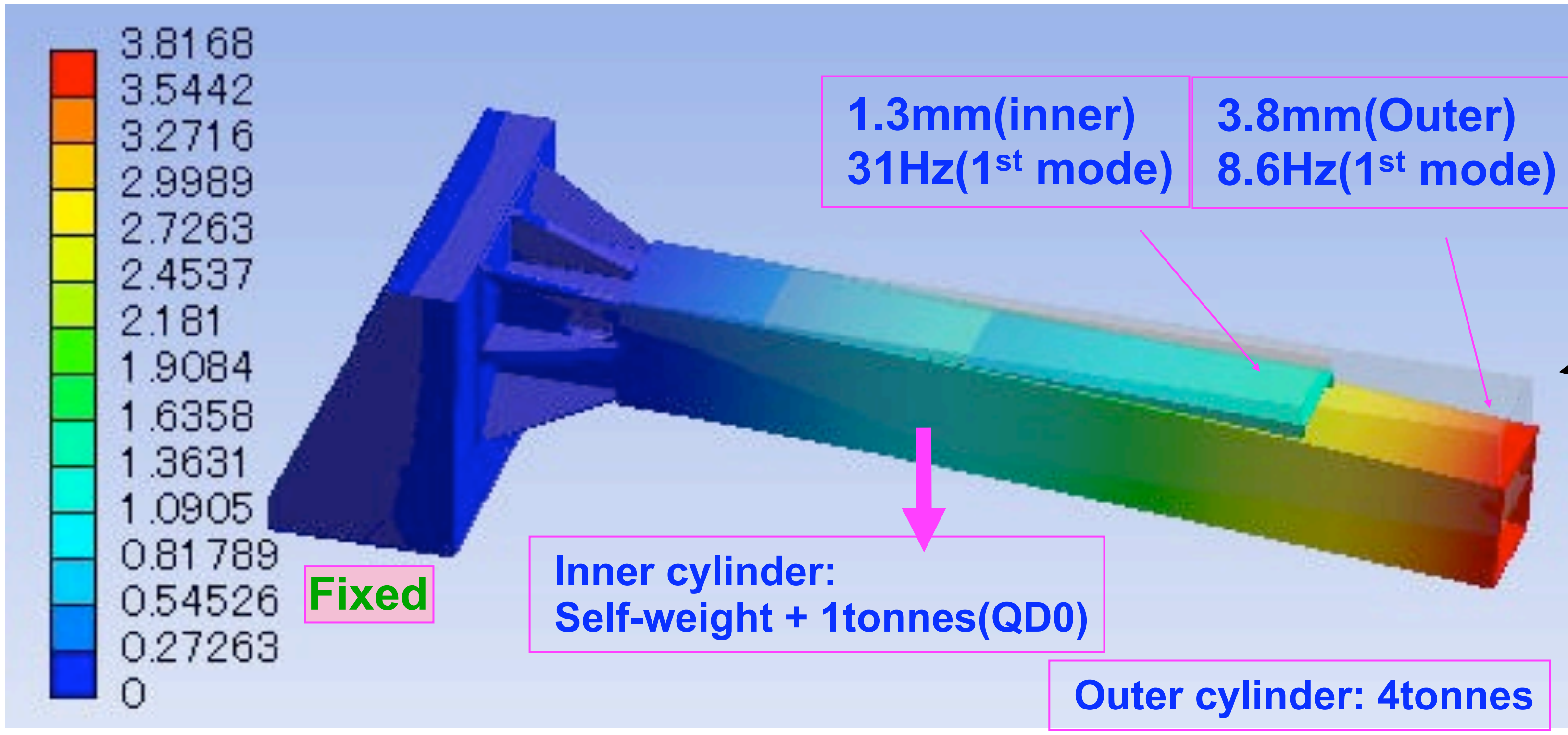
Without vertical shaft

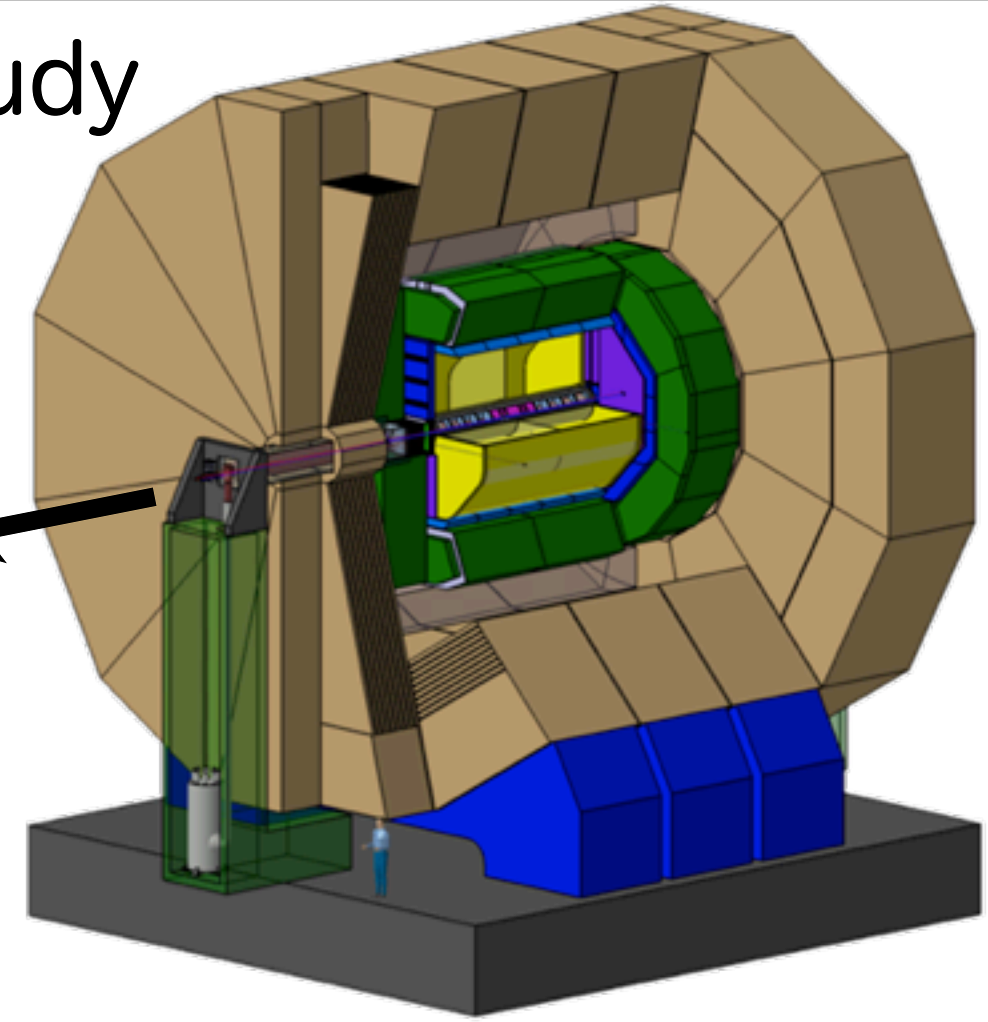
Y. Sugimoto, ALCPG11, 20 March, 2011

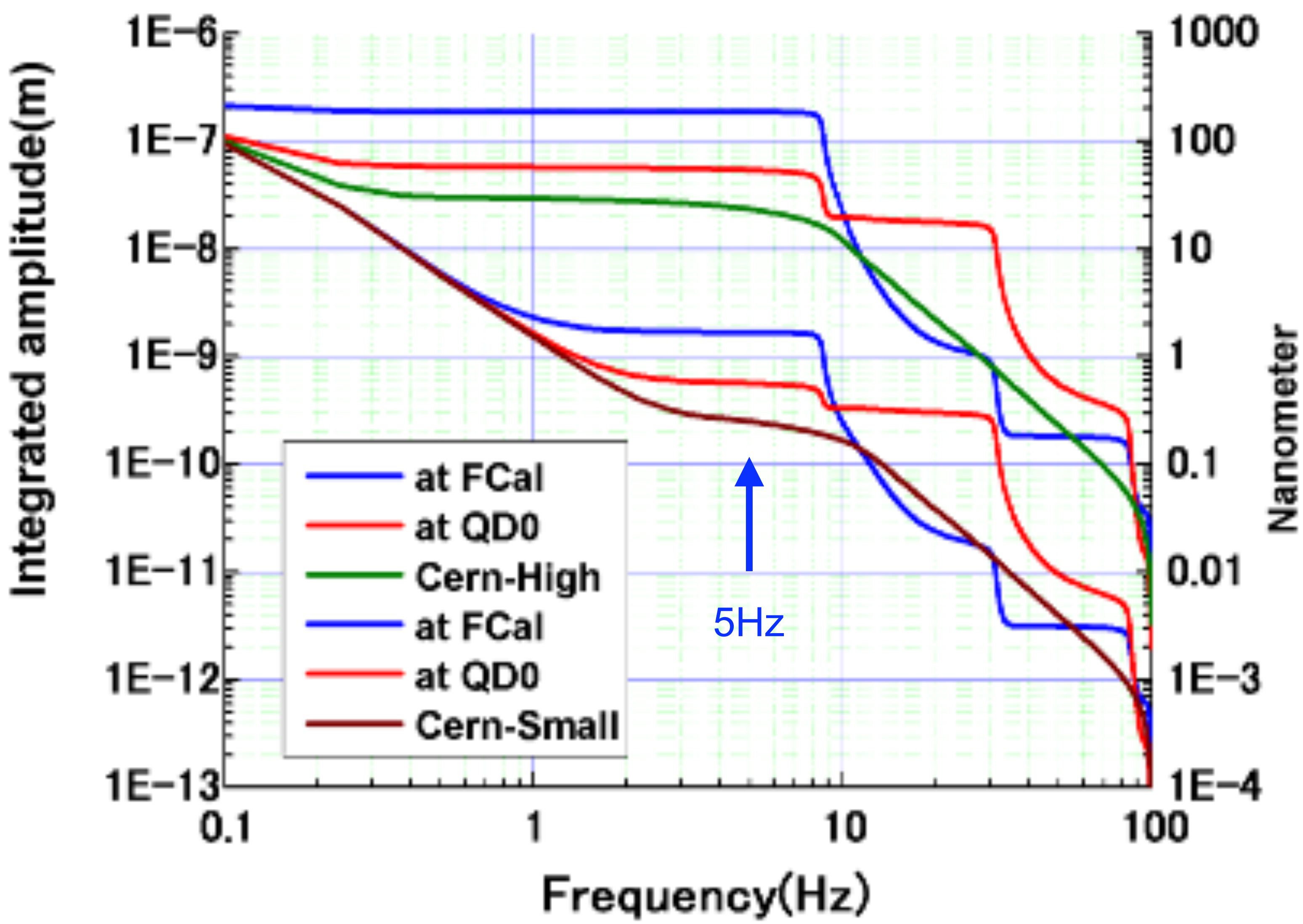


Y. Sugimoto, IWLC10, CERN/CICG, 8 Oct.2010

ILD : QD0 Vibration Study







54nm @ f>5Hz at CERN-High (between Model C and B)

0.6nm @ f>5Hz at CERN-Small (~model B)

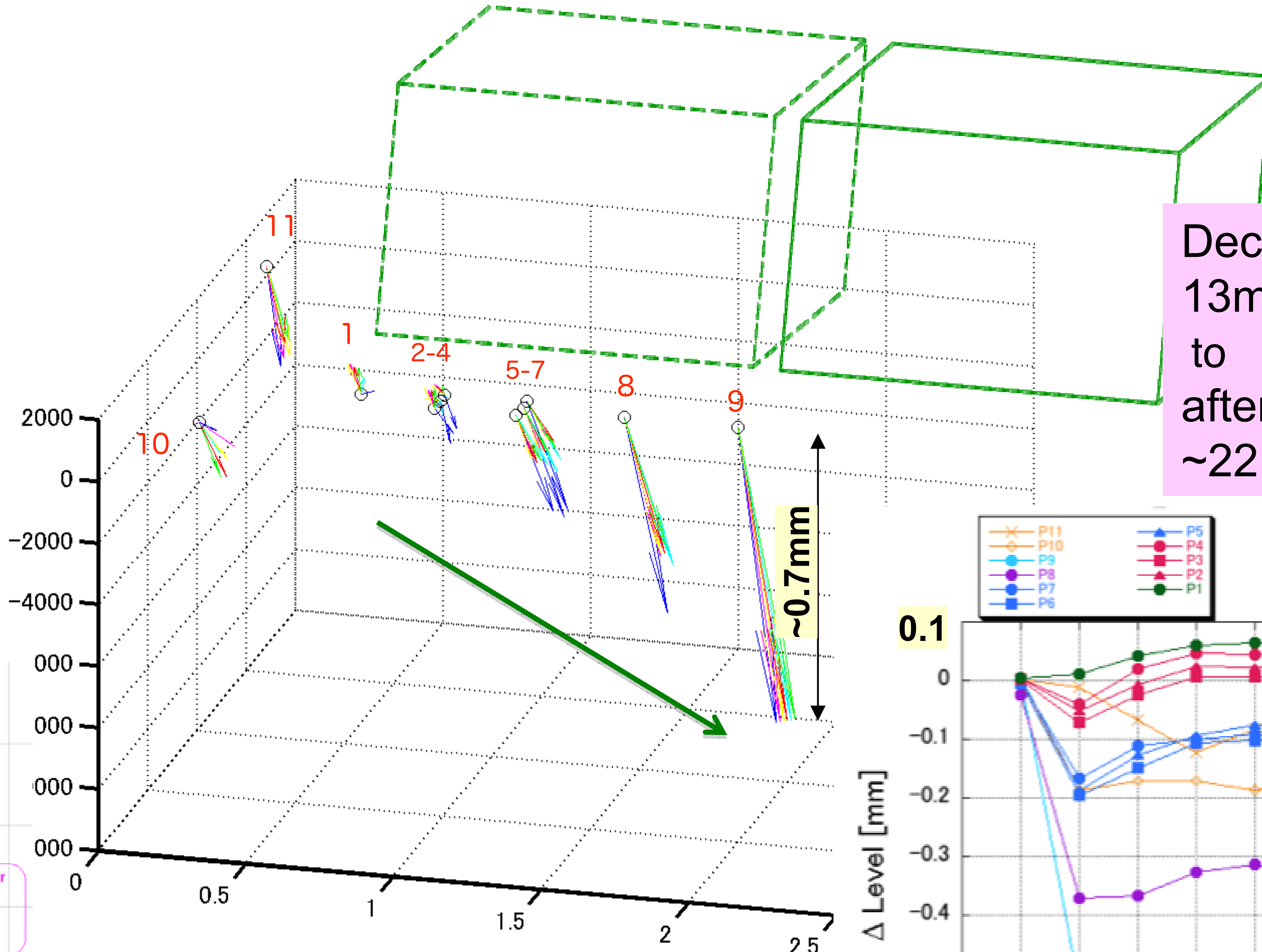
(with 2% damping factor)

H. Yamaoka, LCWS2010, Beijing, March 2010

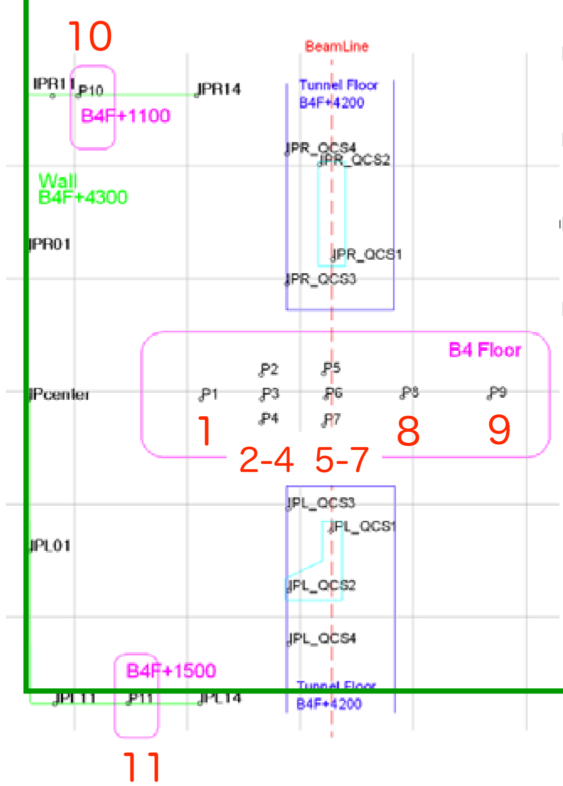
Made by Masuzawa-san@KEKB Review

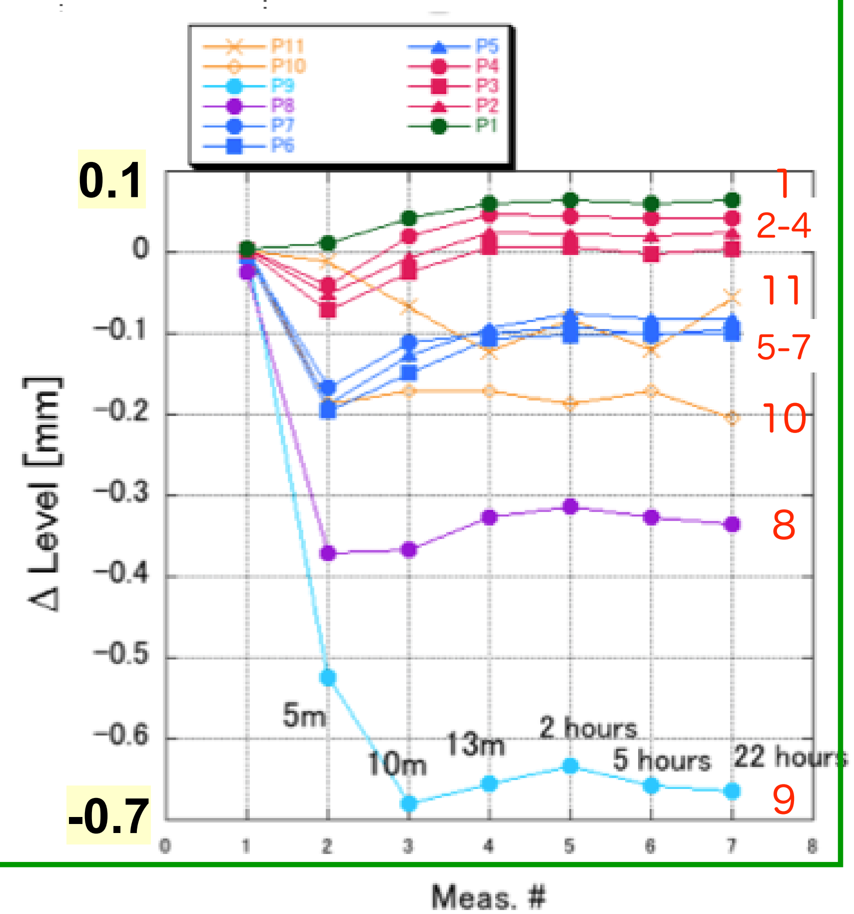
(Belle detector 1,300t, 90cm/min, in Fuji experimental hall, KEK)

Vertical motion of the B4 floor



Dec.10 9:00
13min
to
after
~22 hours





Experimental building floor (B4 floor) tilts towards Belle

Major Issues : ILD - MDI

1. Beam Level from top of the platform

   9m of ILD v.s. 7.4m of SiD, however recently 9m of SiD at ALCPG11

2. Iron Yoke : number of layers, thickness

   Residual magnetic field - 50 Gauss on the beamline and the 2nd garage
   Muon identification and pion rejection: 95% and 99% for P>4GeV, respectively
   Tail catcher for HCAL, also coil instrumentation?

3. Split the endcap w/o opening at IP to be decided

   necessity, e.g. assembly, and engineering difficulty

4. Optimization of experimental hall

   smaller size, assembling the detector
   crane capacity, alcoves and facilities for detector services

5. Integration of sub-detectors

   complete the baseline design with insensitive zones as realistic models
   especially for the inner region, beam pipes, SIT, FTD etc.
   a realistic simulation model

6. Push pull operation with the Platform

Draft of “engineering specifications”, 12 September 2011

Engineering Specifications (1) : Push Pull Issues	unit	value	SiD	ILD
Time for Exchange experiments with rough alignment (mm)	day	1		
Time for Fine alignement, vacuum evacuation	day	1		
Time for Restart the machine and experiment	day	1		
Time for Beam calibration and alignment for the nominal luminosity	day	1		
Number of Pushpull operation	/year	10		10
Number of Pushpull operation for 15 years	times	150	100	150
Detector total weight	tons	15,000	10,000	15,500
Detector beam level	m	9	9	9
Maximum acceleration on the detectors during the movement	G	0.5	0.0001	
Total moving distance from IP to the garage position	m	15		25
Residual magnetic field at IP from detector in the garage	Gauss	50		50
Pulling forces with two lines (multiple anchoring points?)	tons/line	300		
Number of anchoring points		4		
Movement speed	cm/min	10	6 to 30	
Displacement due to the movement : radius	mm	20		
Displacement due to the movement : angle	mrad	2.5		
Adjustment of the movement : x,y	(±)mm	1		
Adjustment of the movement : angle	mrad	0.1		
Slow downward movement of the floor within ±50m around IP (for several weeks?) with feedback system	mm	5		
Platform : width	m		20	14
Platform : length	m		20	14.8
Platform : thickness	m			2.2
Platform : wall clearance	mm		10	
Platform : max. vibration transfer function for microseisms	1<f<100Hz		1.5	
Platform : pulling force in locomotion system with rollers	tons	750	500	750
Platform : pulling force in locomotion system with airpads	tons	300		300
Roller : a roller system must be supplemented by another system that allows a 3-axis movement on IP. A good candidate would be a grease-pad system on top of the roller supporting platform.				
Airpad : Standard airpad systems have the disadvantage of requiring a slight lift of the load of around 5 mm. However as the landing is obtained by leaking air through orifices this landing is very smooth as it had been verified by installing accelerometers on CMS elements.				
hydraulic jacks :				

Draft of "engineering specifications", 12 September 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			25x100
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	380t(HCAL)	55t, 3x3x1.5m	400t
IR Hall Crane	400t+2*20t	400t(200tx2)/10t	80t(40tx2)	(200t+20t)x2
IR Hall Crane Clearance Above Hook to the roof (m)	14.5(includes arch)		6	12.5
Surivce caverns(m) ; (W x L xH)	none		15x25x11	15x25x11
Resulted total size of the collider hall (W x L x H)	25x120x39	20.2x90x30	29x100x30	25x100x33
Area at garage position		19x 55.5	w/ side access tunnel	with side cavern
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	2500t	3500t, 15.7x7.81m	-
IR Shaft Size : diameter(m)	16	18	18	-
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, 10.2x8.0
Parameters that define dimensions of the surface assembly building and its crane				
Surface Assembly Building Area ((W x L , m)	25 x 100 / detector		30x60	27x100 / detector
Largest Item to Lift in SurfAsm. Bldg. (weight and dimensions)	400t	380t(HCAL)	180t	400t, 8.6ϕx8
Surface Assembly Crane	400t+2*20t	400t(200tx2)/10t	2x80t	(200t+20t)x2
SurfAsm. Crane Maximum Hook Height Needed(m)	18	20	19	20.5
SurfAsm. Crane Clearance Above Hook to the roof (m)	7		5m to ceiling	6.5
Resulted volume of surface assembly building (W x L x H, m)	25 x 100 x 25		30x60x24	27x200x27
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	18x98
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 x H, m)			15.67x13.26x15.74	15.67x13.26x15.74
FILL IN OTHER IMPORTANT PARAMETERS WHICH ARE MISSING				
Maximum AC power (MW)	-			
Temerature control (°C)	-			
Humidity control (%)	-			
Sump Pump Control System (ground water)	-			
Cryogenics system : 4K He liquefier and large dewar	-	same level as the coil	service cavern	service cavern
Dump registor	-	on the detector		service cavern

Draft of “engineering specifications”, 12 September 2011

Engineering Specifications (3) : QD0 Issues	unit	value	
Mover : number of degrees of freedom		5	horizontal x, vertical y, pitch ! , yaw " , roll #
Mover : Range per x,y degree of freedom	mm	± 2	
Mover : Range per ! , " degree of freedom	mrad	± 1	
Mover : Range per # degree of freedom	mrad	± 30	
Mover : Step size per degree of freedom of motion	μm	± 0.05	
Before BBA : Accuracy per x,y degree of freedom	μm	± 50	
Before BBA : Accuracy per ! , " degree of freedom	μrad	± 20	
Before BBA : Accuracy per # degree of freedom	mrad	± 20	
BBA : alignment accuracy per x,y	nm	± 200	from a line determined by QF1s for 200ms
BBA : Accuracy per # degree of freedom	μrad	± 0.1	from a line determined by QF1s for 200ms
Vibration stability : $ (QD0(e^+)-QD0(e^-))	nm	50	within 1ms long bunch train

Engineering Specifications (4) : Radiation shield	unit	value	
Self shielding		must	
Normal operation : anywhere beyond the 15m zone housing the off-beamline detector	μSv/hour	0.5	
Accidental beam loss : dose for occupational workers	mSv/hour	250	The acident is defined as the simultaneous loss of
Accidental beam loss : integrated doze for occupational workers	mSv/accident	1	both e^+ and e^- beams at 250 GeV/beam
Accidental beam loss : beam shut-off time after the accident	beam-train	1	anywhere, at maximum beam power.

Engineering Specifications (5) : Vacuum	unit	value	
in the 200m upstream of the IP	nTorr	1	=1.3 x 10^{-7} Pa
in the remainder of the BDS system	nTorr	10	=1.3 x 10^{-6} Pa
in the 18m zone of the detector			not specified in the IR document

Work plan for DBD/TDR and Tokushin

1. Detector solenoid

Y. Makida, Solenoid/cryogenics design/R&D in synergy with CLIC, JPARC

M. Kawai, 3D Field calculation with anti-DID

2. Integration

Y. Sugimoto, Experimental hall in the mountain sites

H. Yamaoka, QD0 support system and detector integration/
assembling in the mountain sites

Y. Suetsugu, Beam pipe design, vacuum system

T. Sanami, Self-shielding evaluation - PACMAN design

3. Push pull

H. Yamaoka, Moving system with alignment, and stability issues

T. Tauchi, Operational time (general issues)