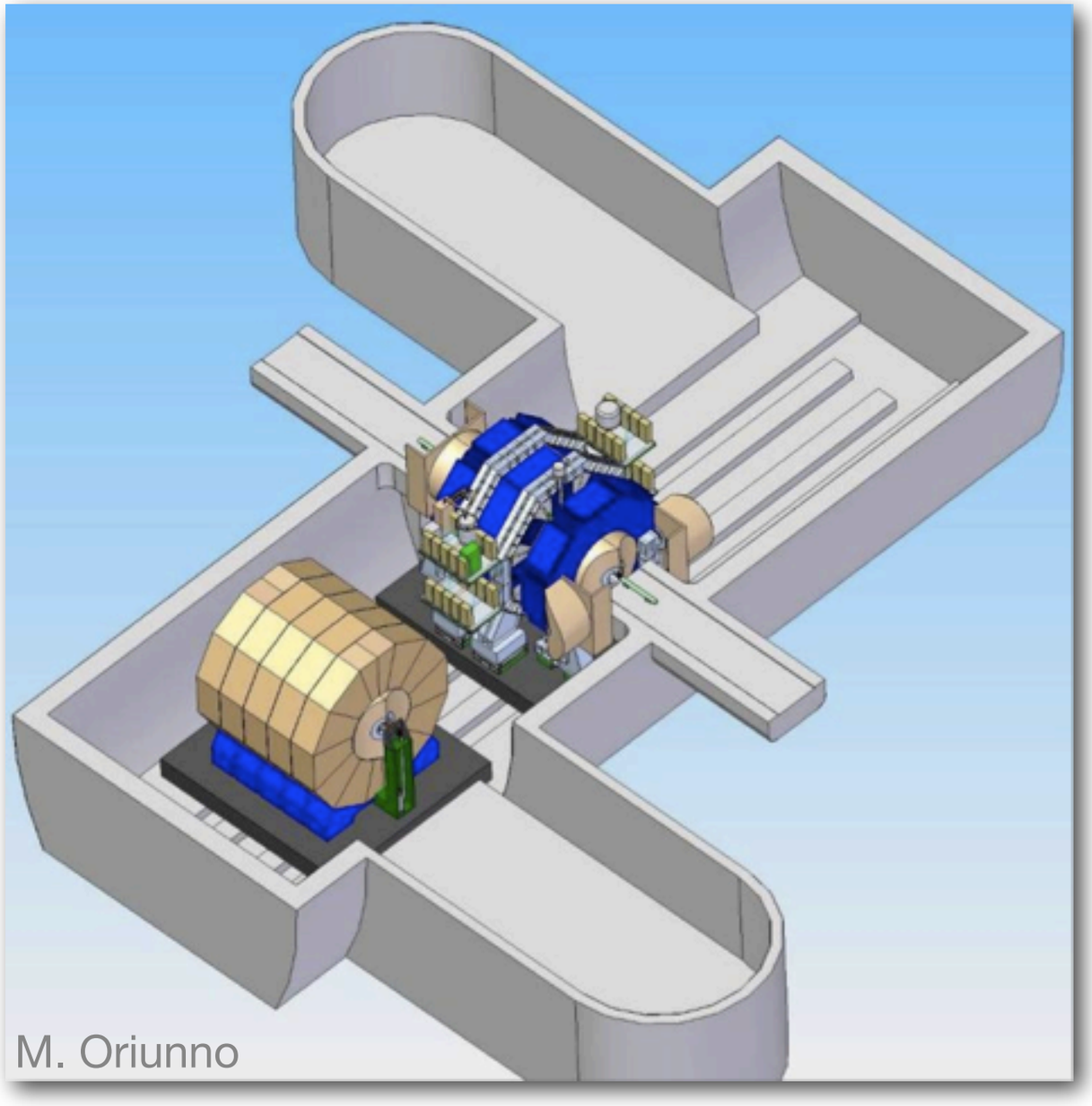
Status of Civil Facilities Discussions

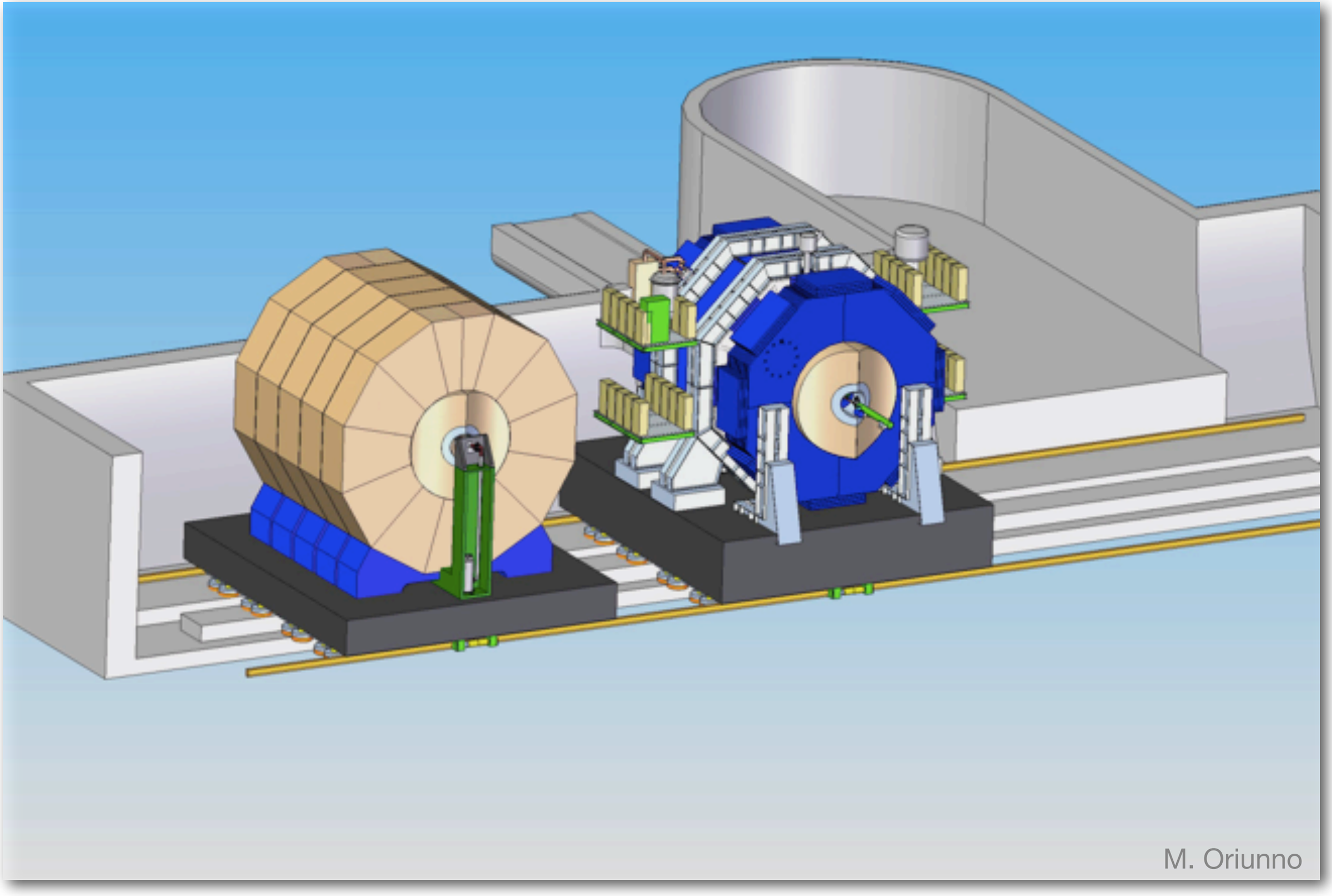
Karsten Buesser
DESY

ILD MDI/Integration Webex Meeting
17th November 2011

Global MDI
Main Topics

- Resources are limited
- Concentrate on topics that are of most relevance for the TDR/ DBD
- Concentrate on cost drivers
  - Civil facilities at the IR:
    - underground areas
    - surface buildings
  - Push-pull system
  - Detector services





Platform-based detector motion system

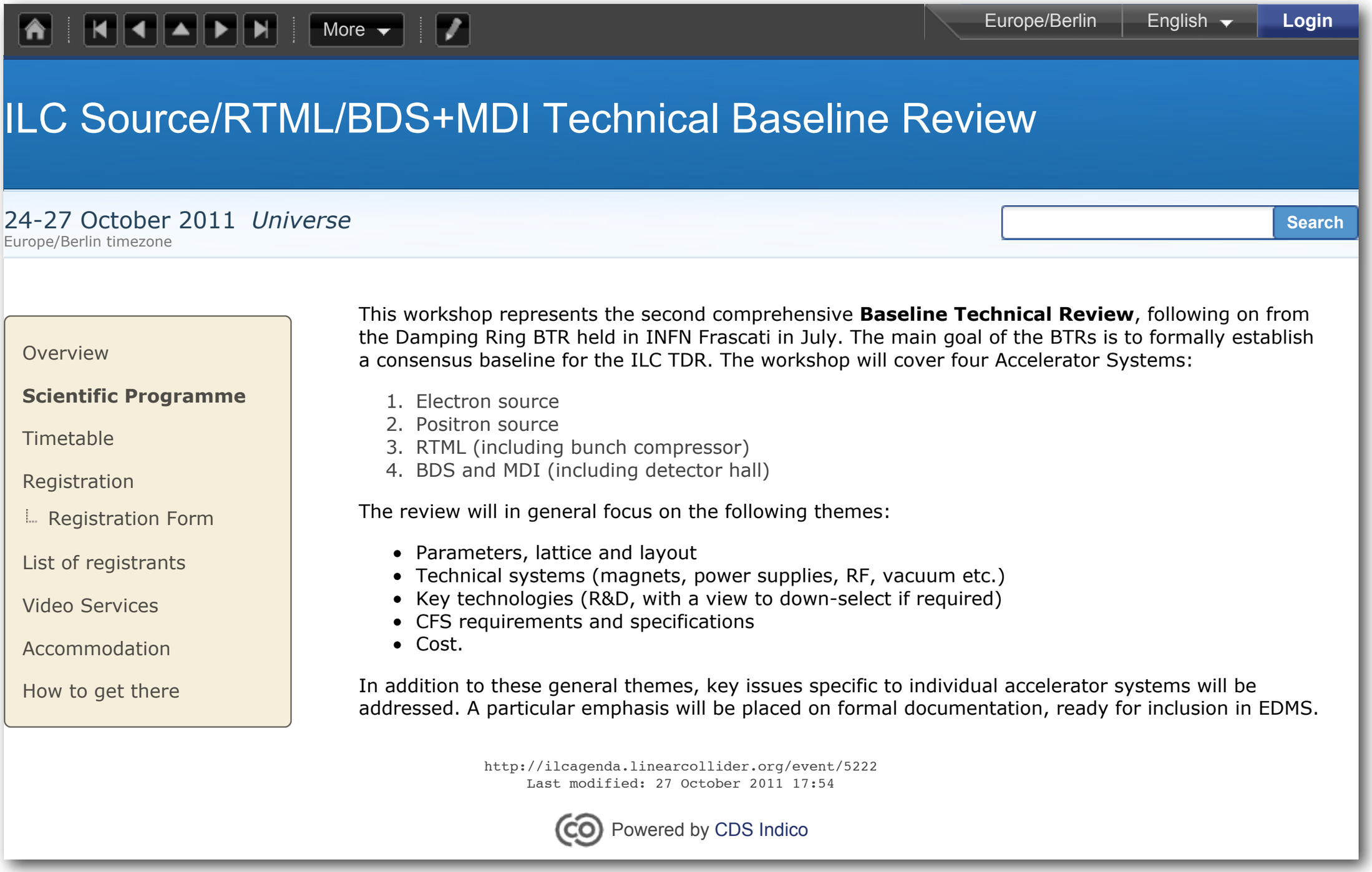
Engineering Specifications

- Ongoing work within the MDI Common Task Group
  - Compiled by T. Tauchi
  - ILC-EDMS ID 967835
- Will be main supporting specification for TDR/DBD
- Takes into account modifications for mountainous sites

9 November, 2011

Engineering Specifications (2) : Experimetnal Hall	RDR	SiD	SiD in Mtn. site	ILD	ILD in Mtn. site
Parameters that define the underground hall volume					
IR Hall Area(m) ; (W x L)	25x120		25x110		25x110
Beam height above IR hall floor (m)	8,6	9(7.5)	9(7.5)	8(9)	9
IR Hall Crane Maximum Hook Height Needed(m)	20,5	5m above top of detector	5m above top of detector	20,5	20,5
Largest Item to Lift in IR Hall (weight and dimensions)	400t	380t(HCAL)	380t(HCAL)	55t, 3x3x1.5m	400t
IR Hall Crane	400t+2*20t	400t(200tx2)/10t	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
Survice caverns(m) ; (W x L xH)	none			15x25x11	15x25x11
Resulted total size of the collider hall (W x L x H)	25x120x39	20.2x90x30	25x110x33	29x100x30	25x110x33
Area at garage position		19x 55.5	with side cavern	with side cavern	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	-	11x11, 10.2x8.0
Inclination of access tunnel at Mtn. site (%)	-	-	< 7	-	< 7
Length of access tunnel at Mtn. site (km)	-	-	1,5	-	1,5
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)	(solenoid)	180t	400t, 8.6ϕx8 (solenoid)
Surface Assembly Crane	400t+2*20t	400t(200tx2)/10t	400t(200tx2)/10t	2x80t	(200t+20t)x2
SurfAsm. Crane Maximum Hook Height Needed(m)	18	20	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		18x98	28x41	18x98
Maximum Detector Height(m)		16,15	16,15	15,74	15,74
Detector Width (m)		18.53(14.334)	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 (℃)	-				
Humidity control (%)	-				
Sump Pump Control System (ground water)	-				
Cryogenics system : 4K He liquefier and large dewar	-	same level as the coil	same level as the coil	service cavern	service cavern
Dump registor	-	on the detector	on the detector	service cavern	service cavern

MDI Technical Baseline Review

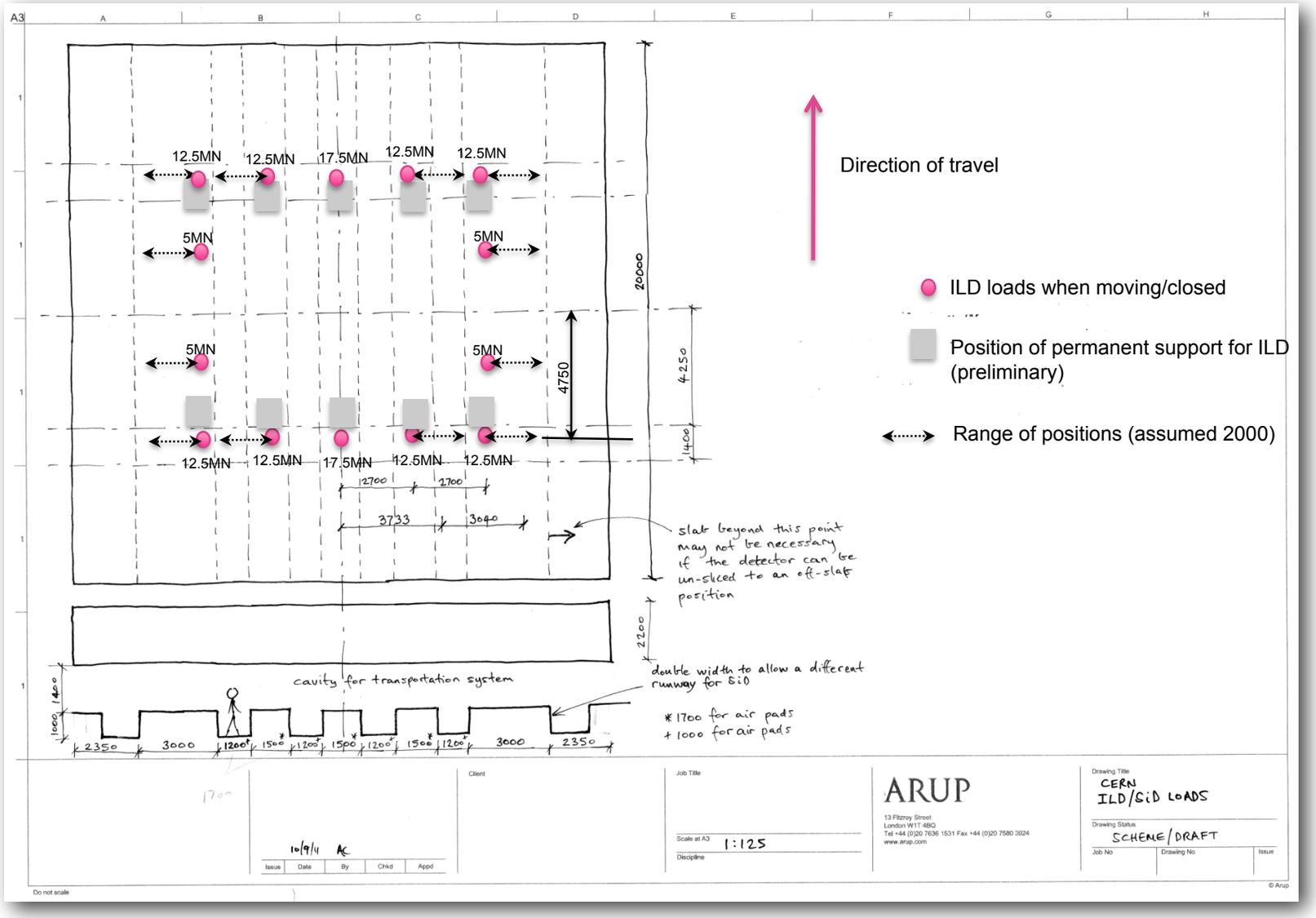


MDI Technical Baseline Review

CFS Interaction Region Studies

- Launched study with contractor ARUP on two tasks:
  - Task 1: Design concept for detector movement platform
  - Task 2: Layout of CLIC complex based on CERN geology
- Joint ILC/CLIC CFS initiative

ARUP Task 1: Platform Design



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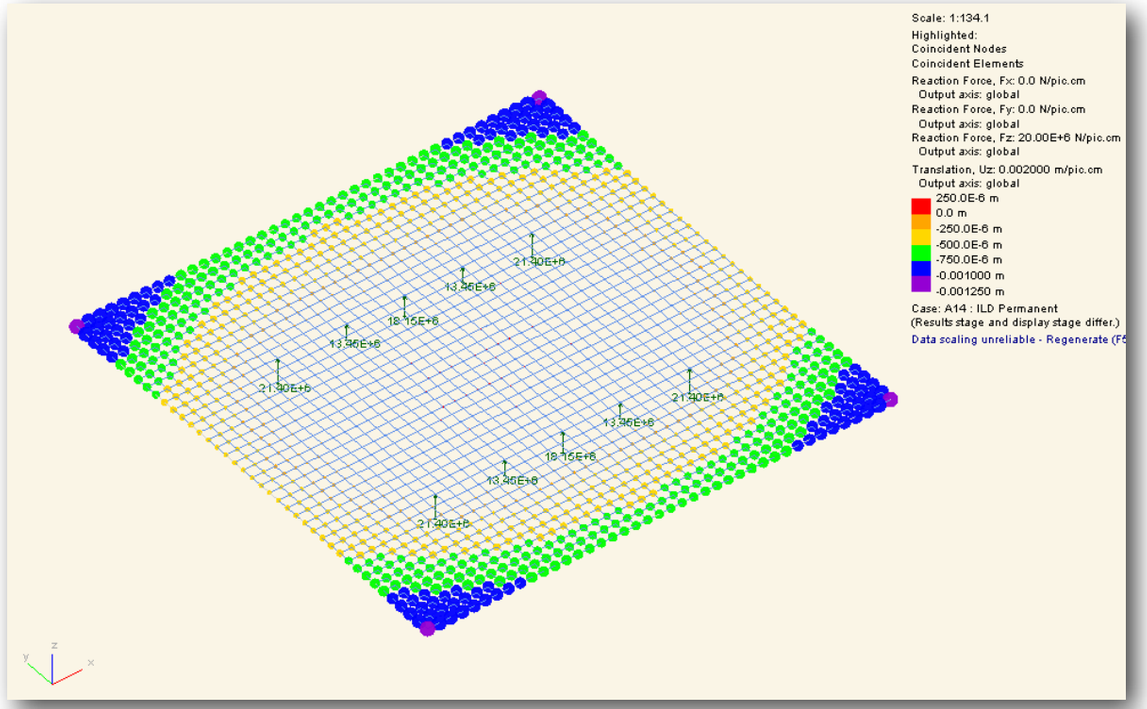
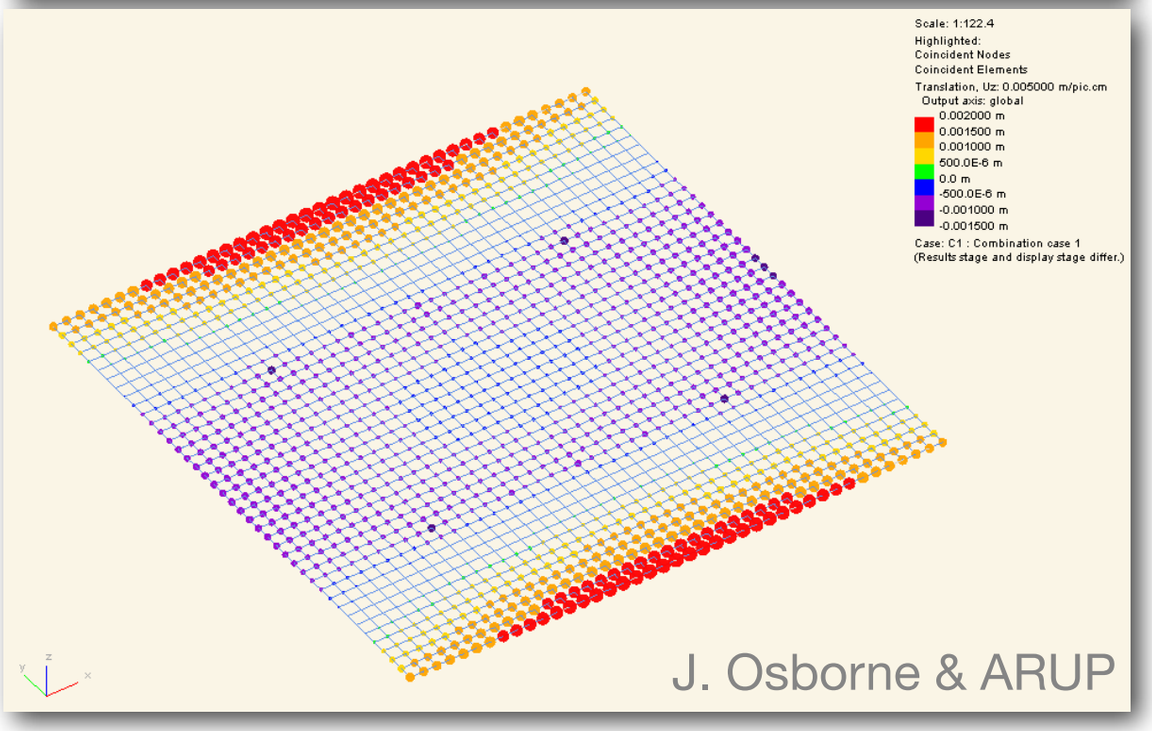
- ILD is the bigger challenge: heavier and larger than SID:
  - Thinner platform at same beam height
  - Larger loads on platform

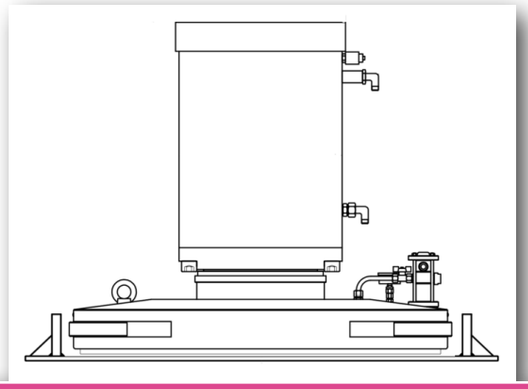
ARUP Task 1: Platform flexures

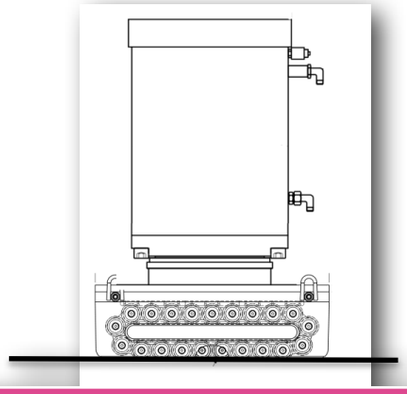
- Unloaded platform:
  - Flexure: +0.25mm; -1.25mm
- Loaded platform jacking onto transport system:
  - Flexure: +1.9mm; -1.0mm





ARUP Task 1:
Detector Movement System





Pads	Rollers
Min 60 required (for ILD, no redundancy)	Min 18 required (for ILD)
No hardened track->can accommodate minor steps	Specialist hardened and flattened track
Design for 1% friction	Design for 3% friction
Pressure infrastructure	Larger propulsion infrastructure
Run-away	Higher friction ->less run-away

- Two solutions under study:
  - Air pads
  - Hilman rollers

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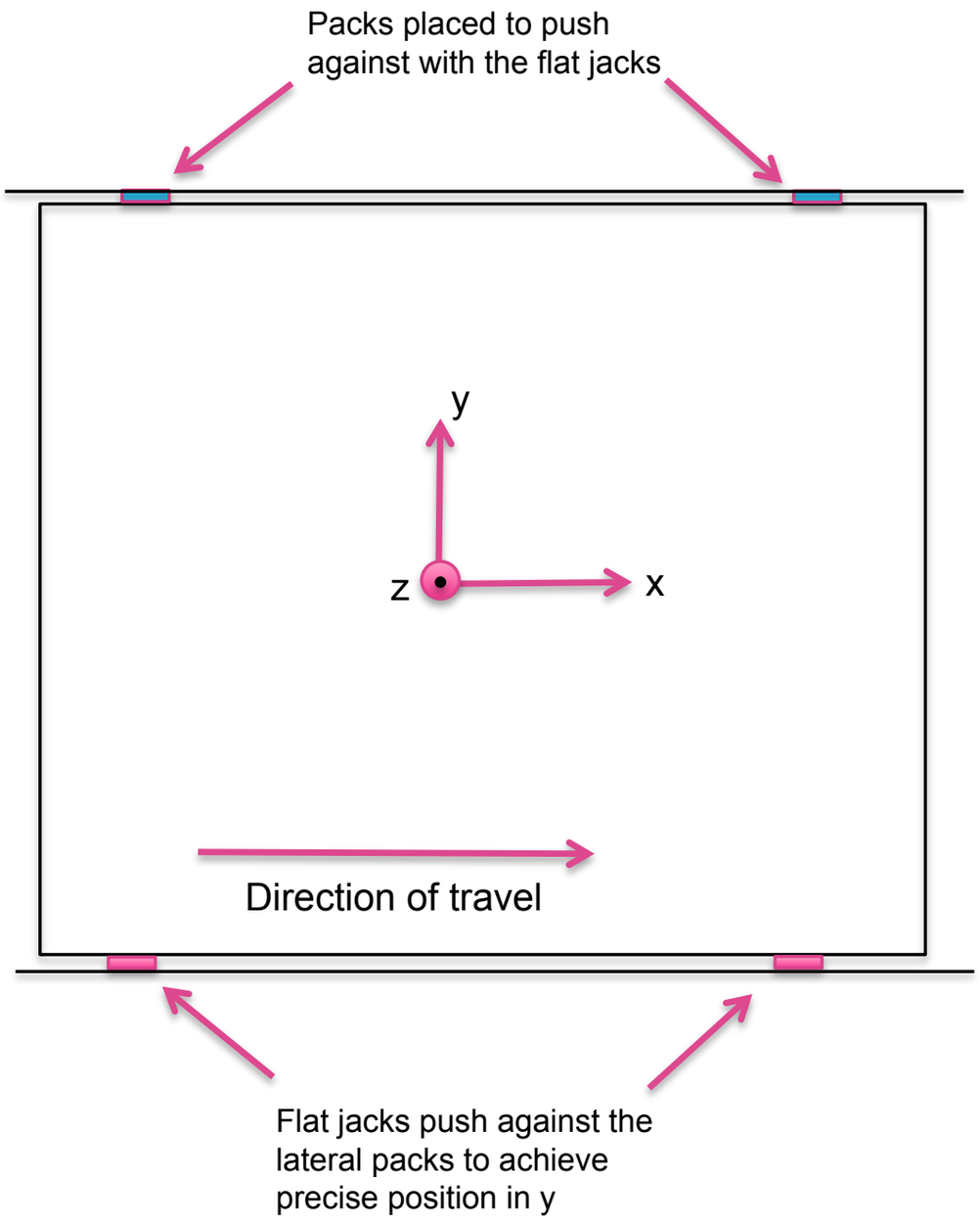
ARUP Task 1: Positioning System

The final positioning system



Degree of freedom	Methodology
x, Rzz	Push pull system
z, Rxx, Ryy	Pack adjustment under slab
y (air-pads) *illustrated*	Lateral push with flat jacks whilst air pads are active
y (rollers) *illustrated*	Lateral push with flat jacks whilst the lateral slider (on the roller) is un-locked

Note, Rxx is rotation about the x-axis, etc

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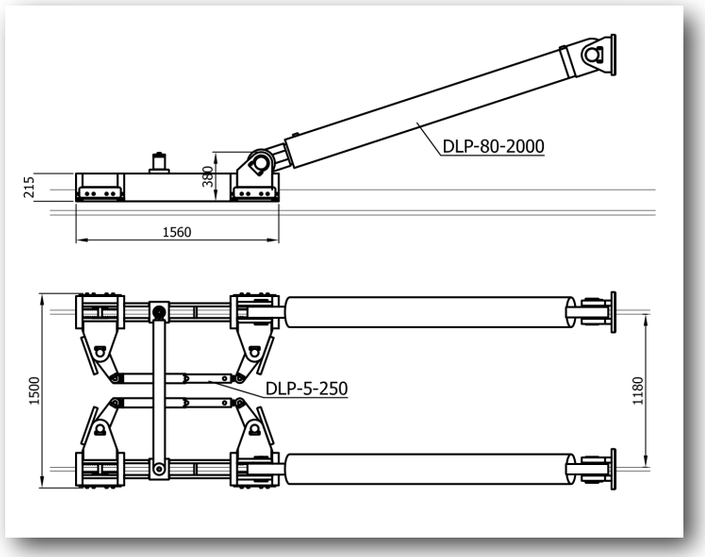
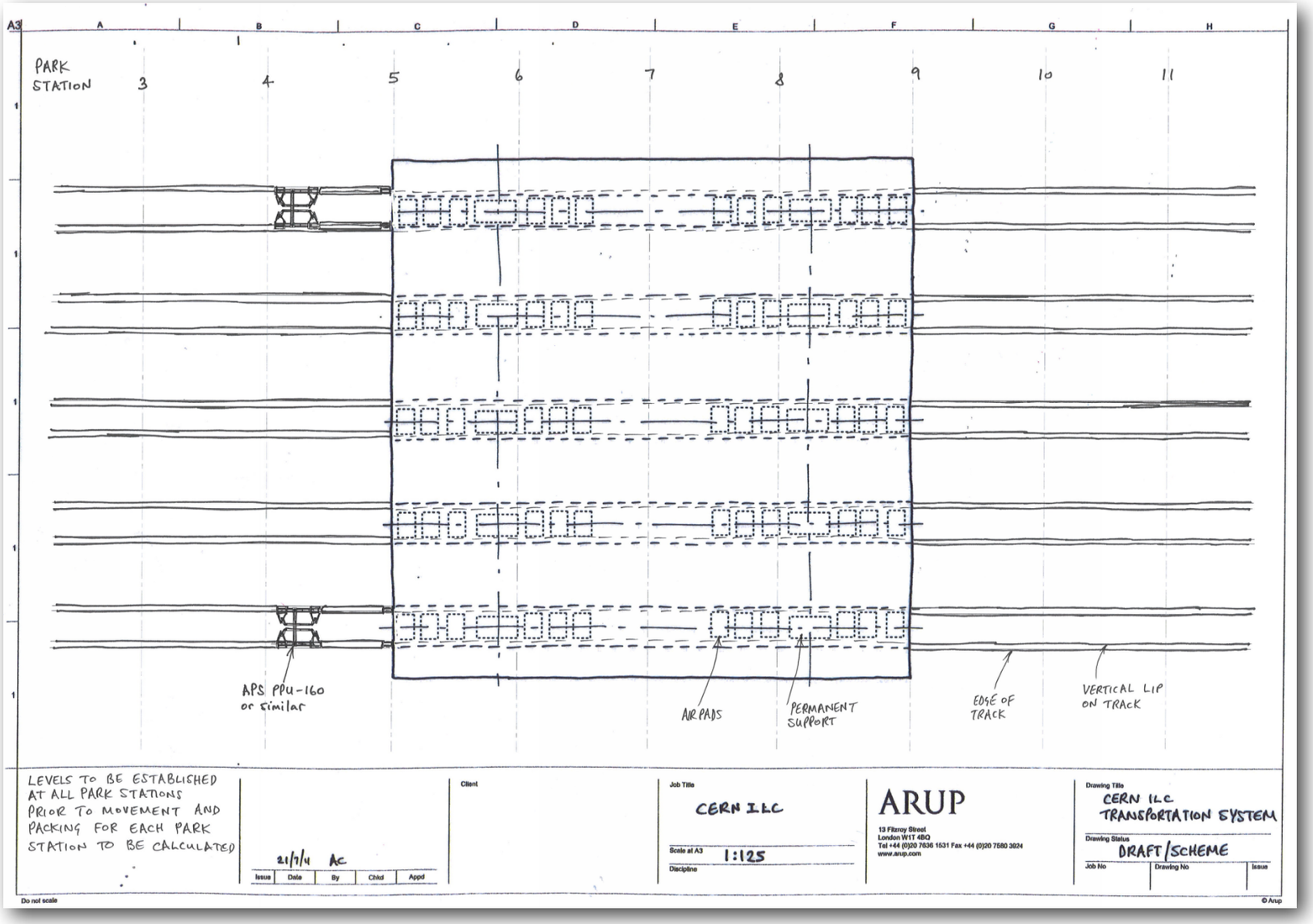
ARUP Task 1: Drive System





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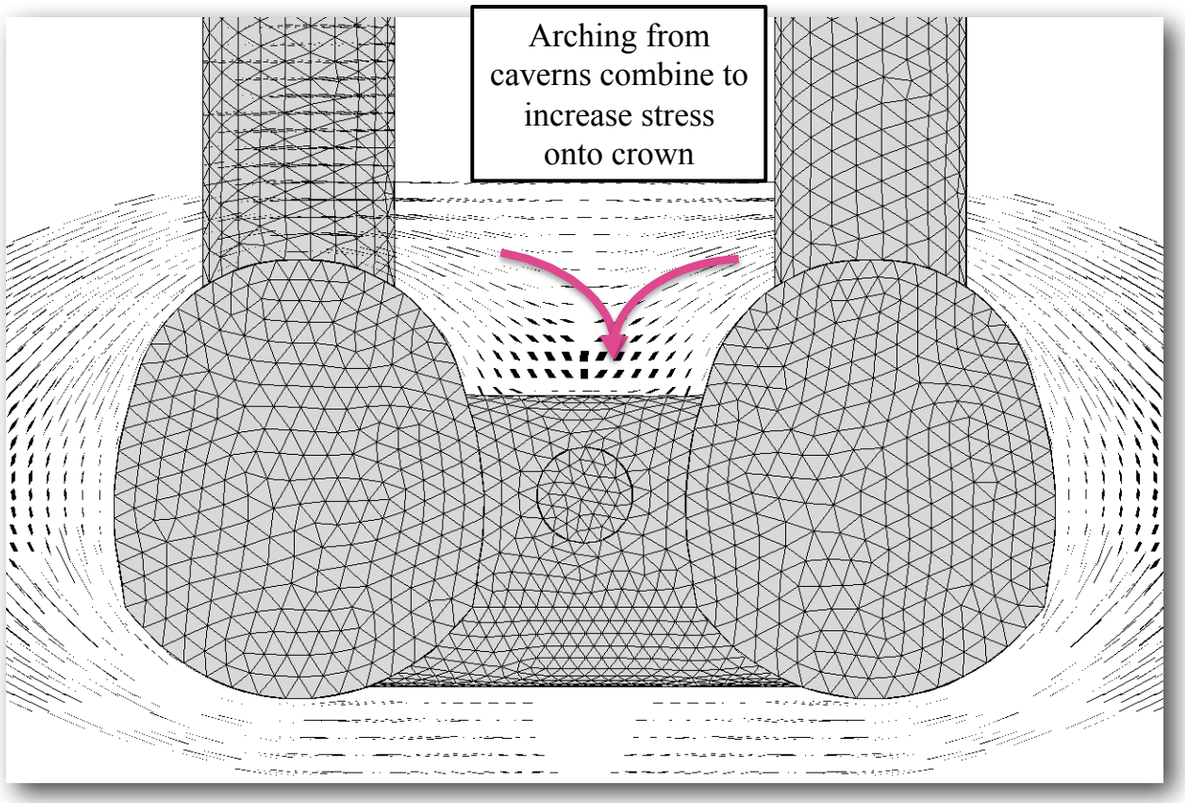
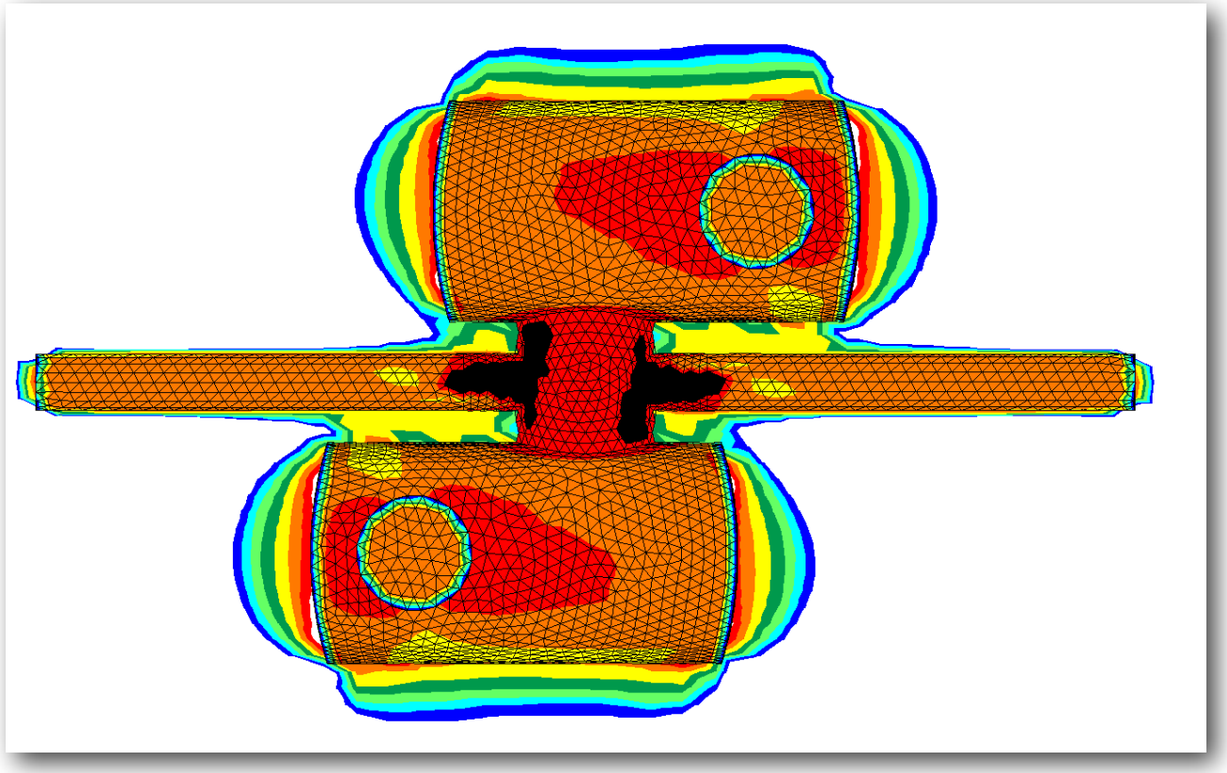
- Air pad drive system using grip jacks

ARUP Task 2:
CLIC Underground Hall





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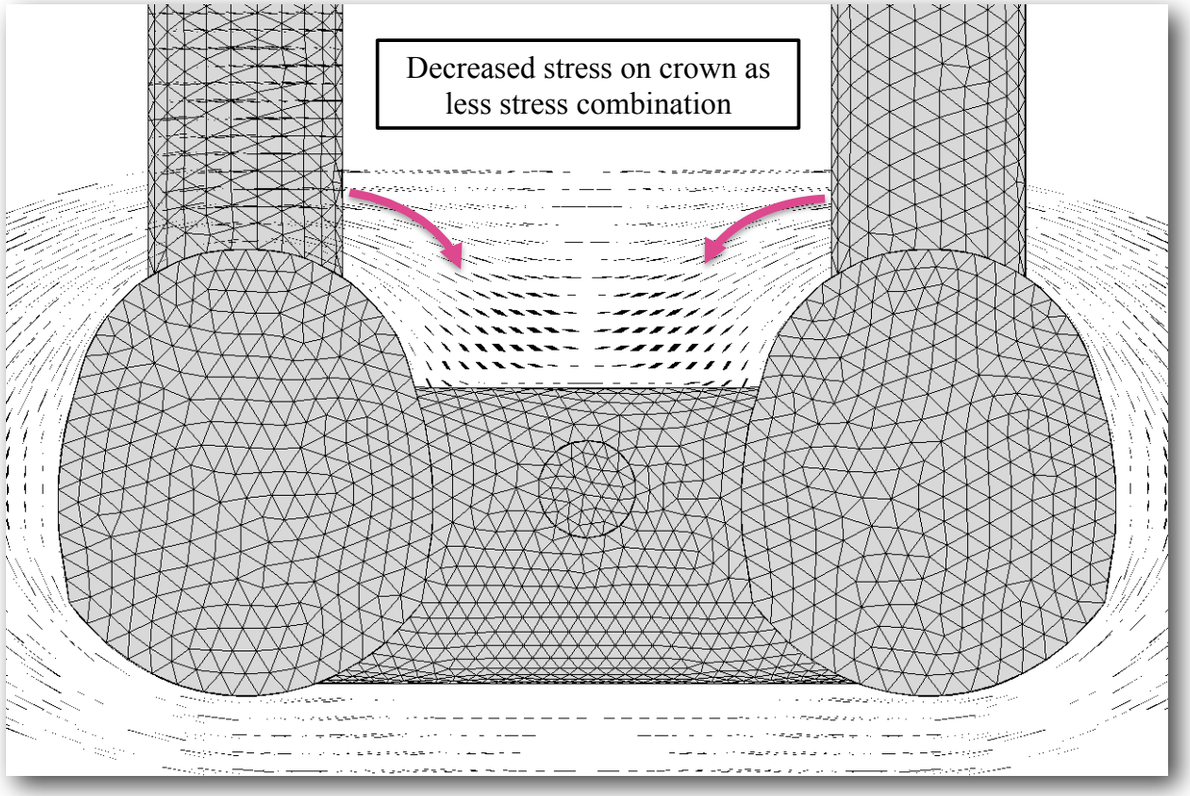
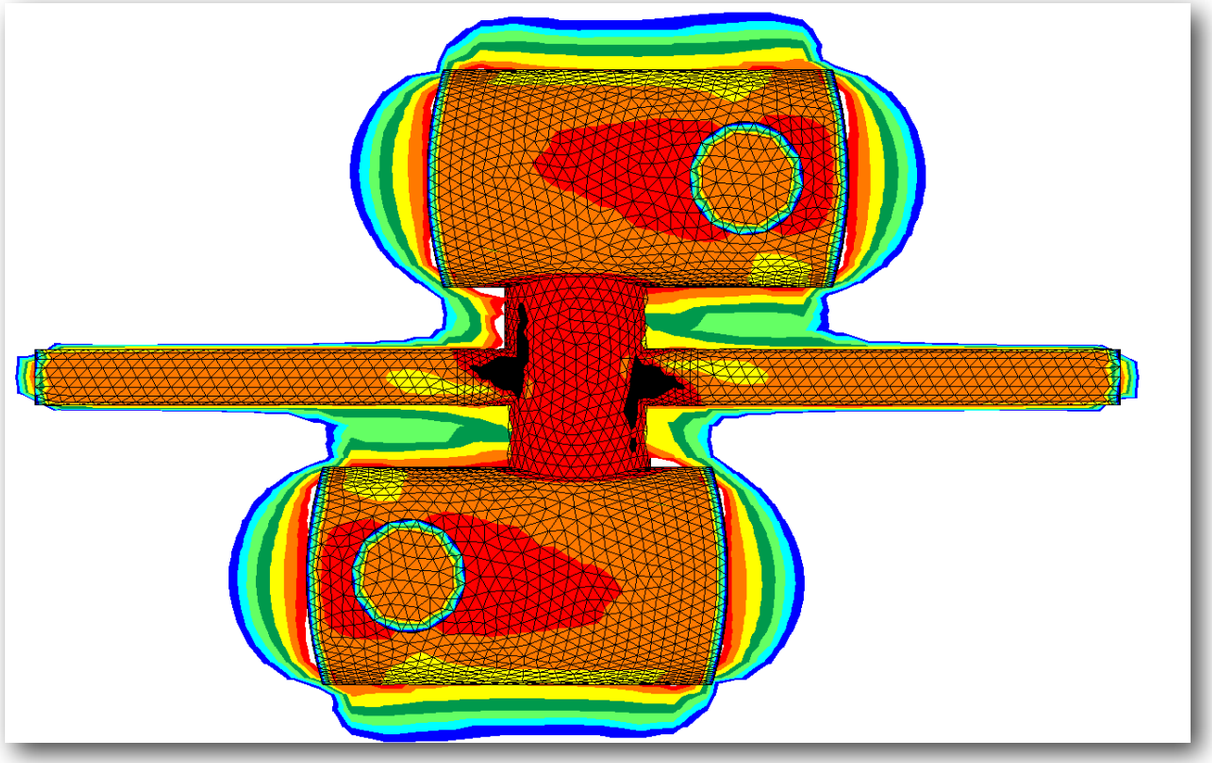
- Layout of CLIC underground hall in CERN geology
- Higher stresses mean more complicated lining and rock support and higher risk of rock yield

ARUP Task 2:
CLIC Underground Hall





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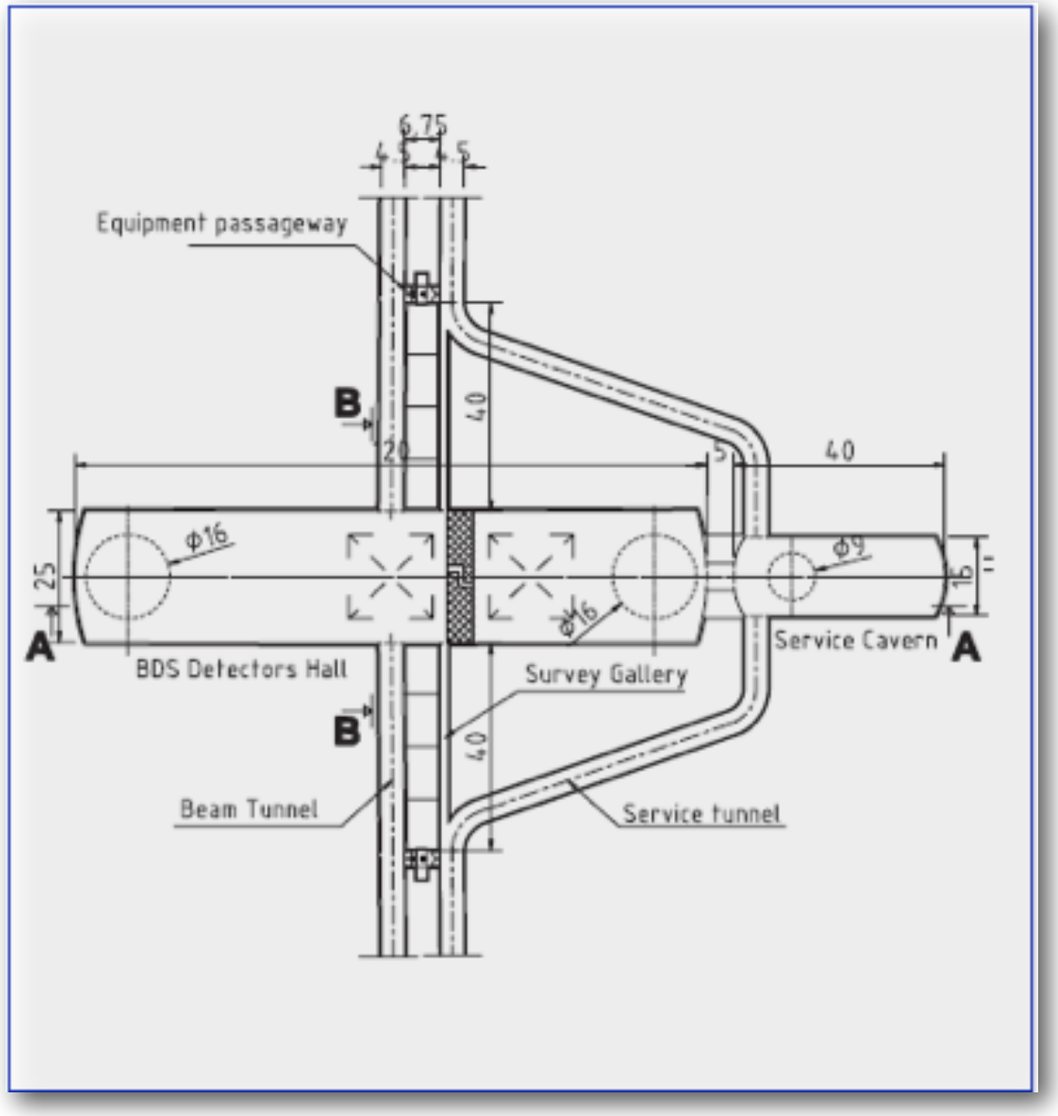
- Modification to the layout could reduce stresses
- Results can help to evaluate also other geologies

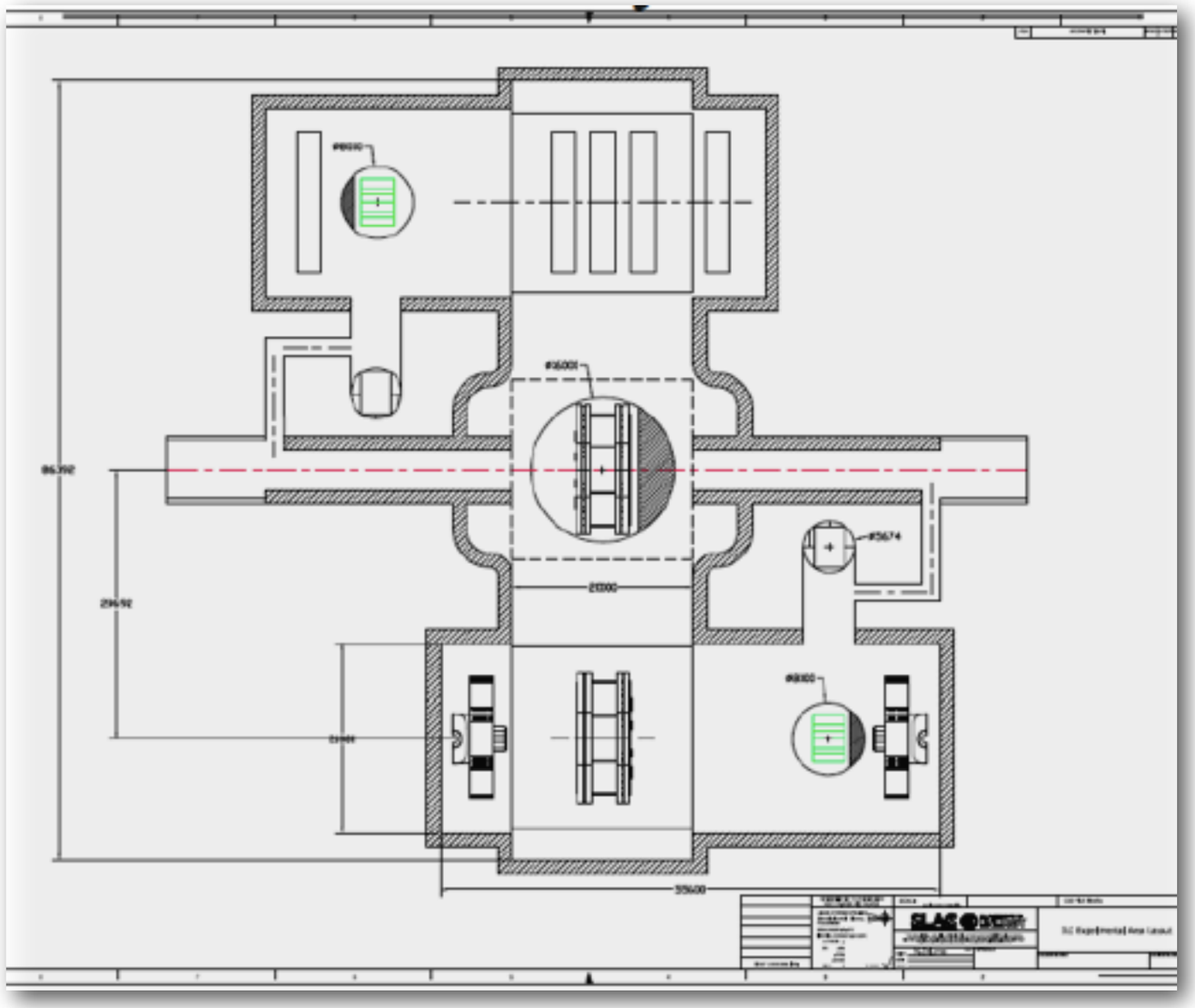
RDR IR Hall Layout

- Large (120m long)
- Shafts above experiments
- Not enough space in garage positions
- No space for services
- Not optimised for push-pull operations

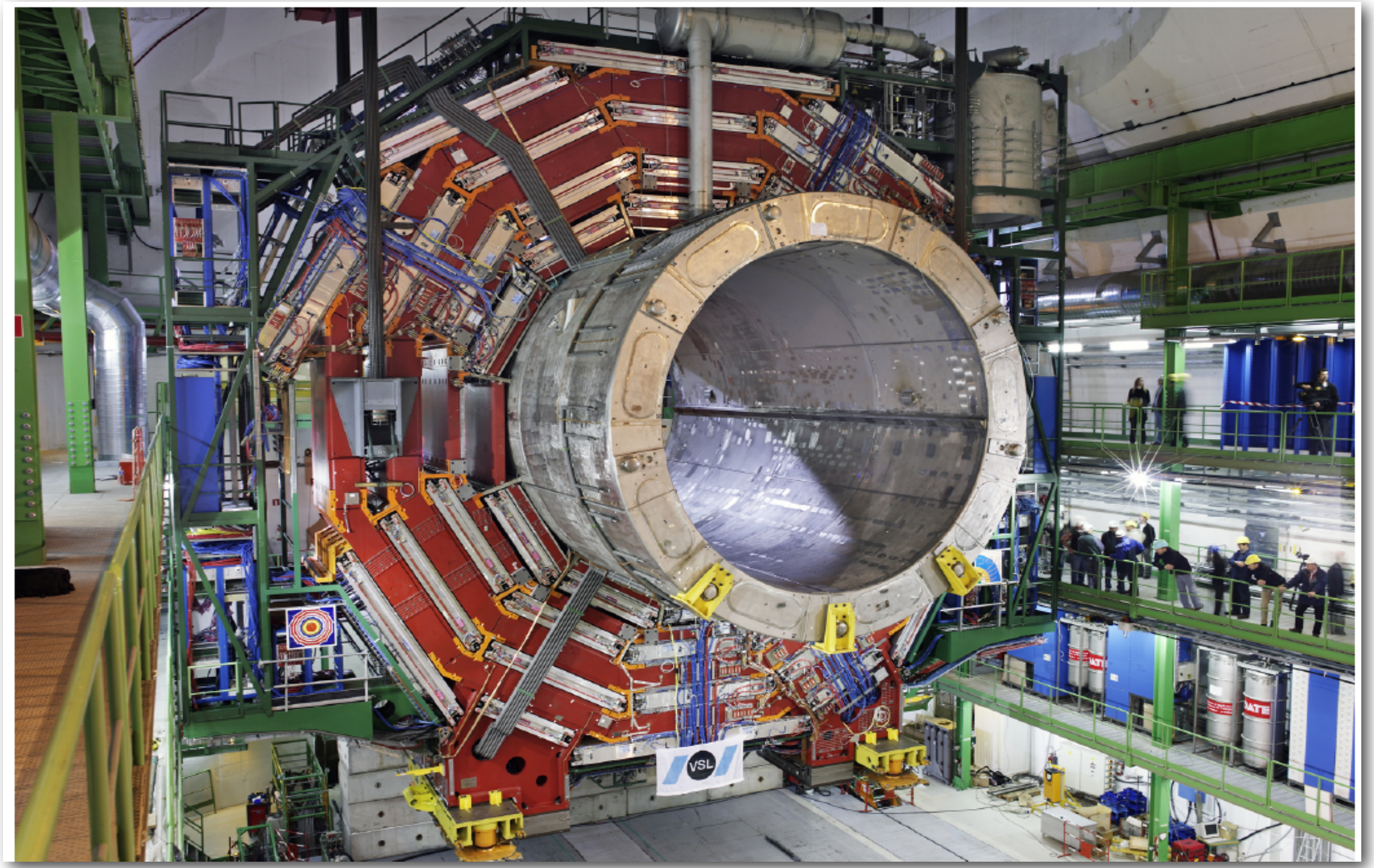


Latest IR Hall Layout

- Z-Shape
- Garage positions allow detector maintenance
- Only one large (~18m) shaft
  - used only in installation phase
- Maintenance shafts (~9m) in garage positions
- Small shafts for elevators (safety issues)
- Work in progress



CMS Assembly



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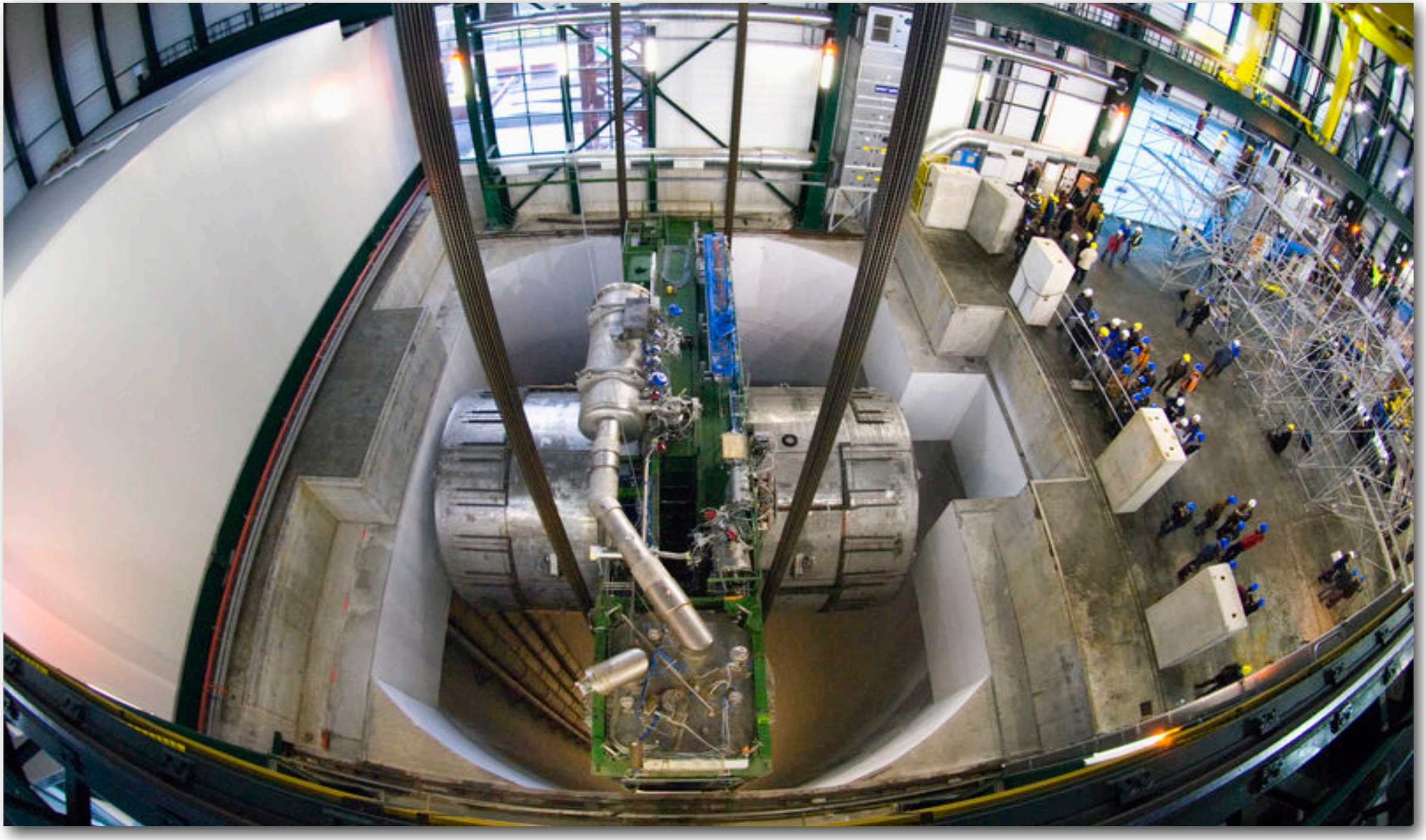
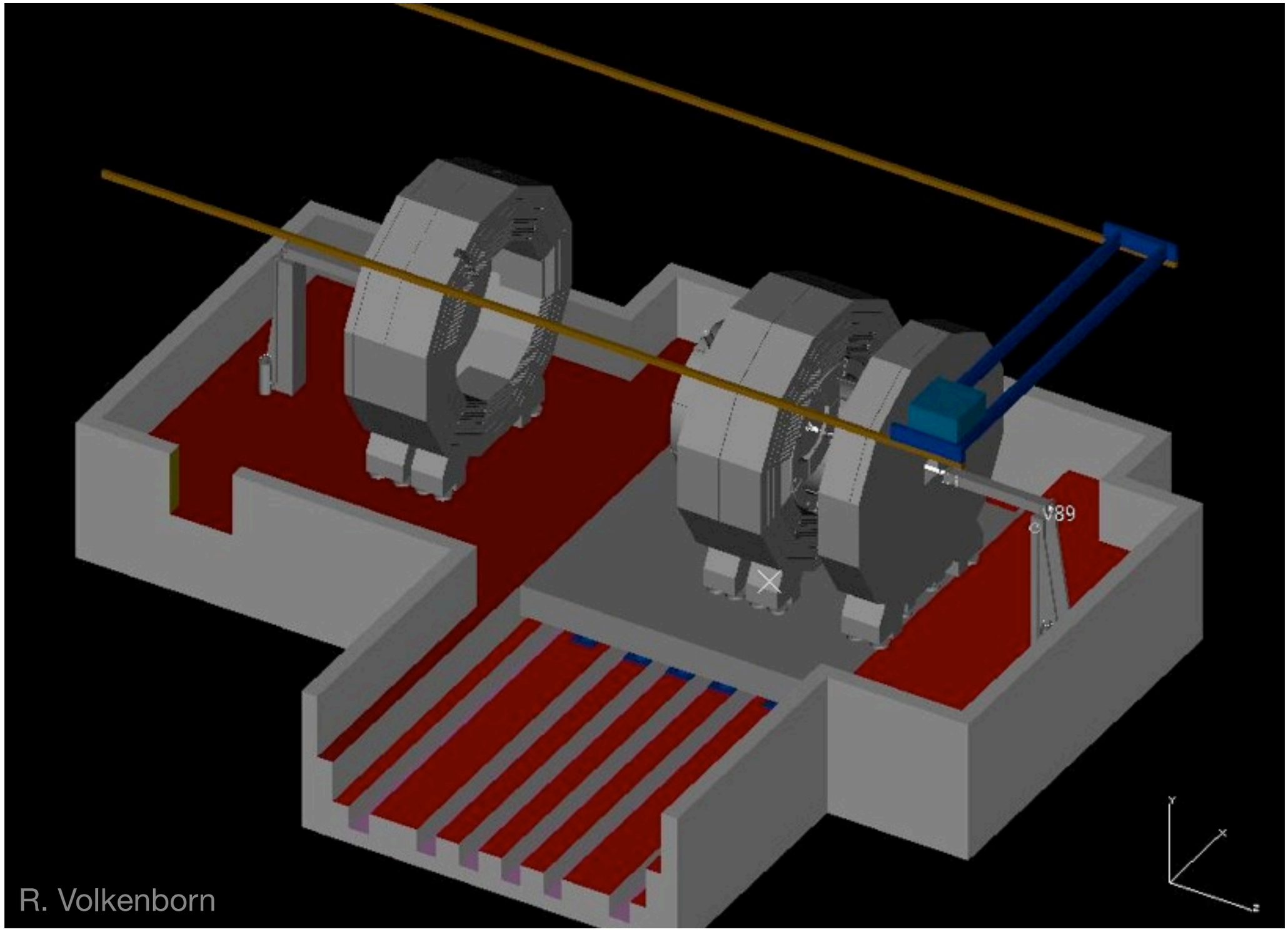
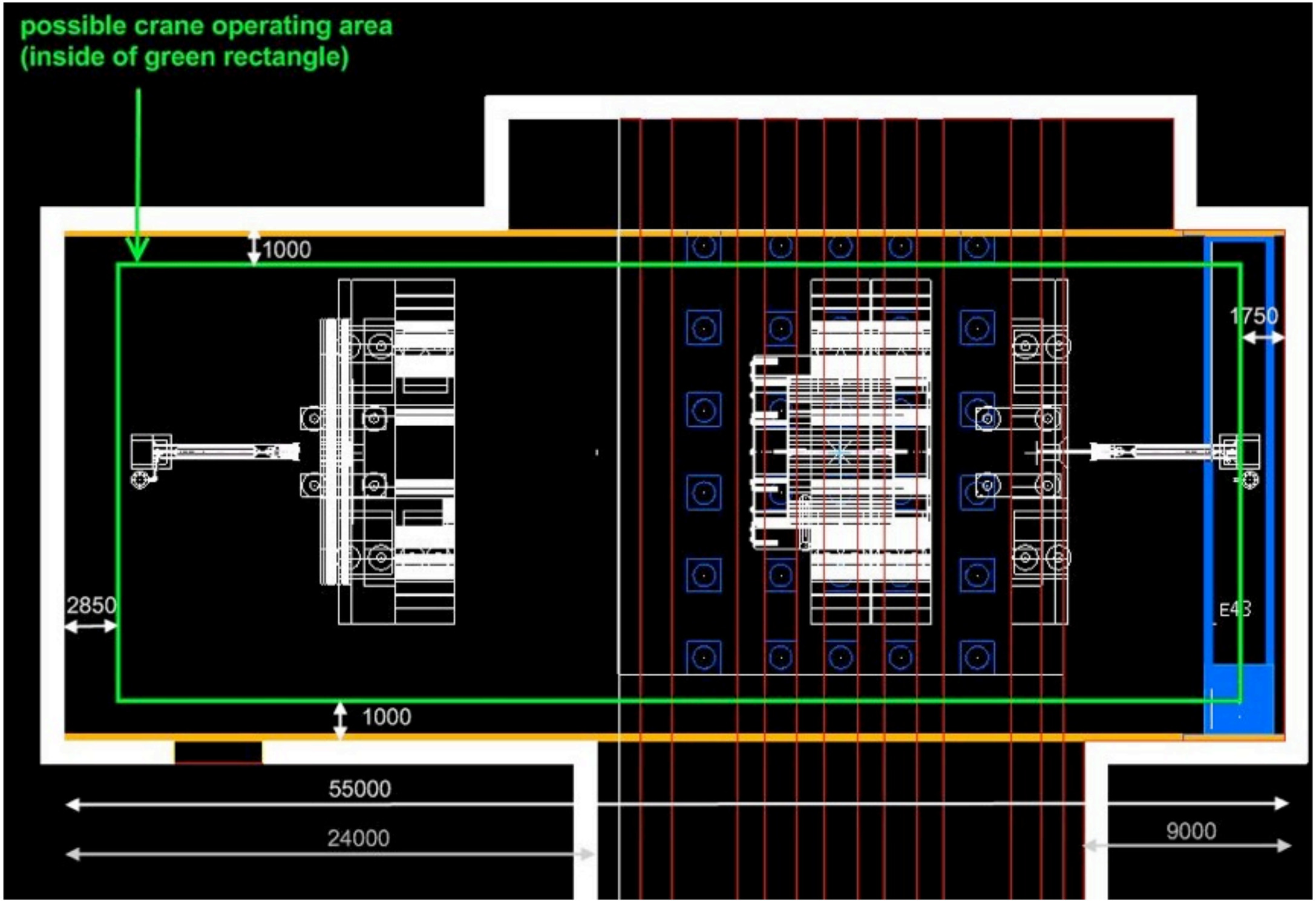


Hall Optimisation Study for ILD



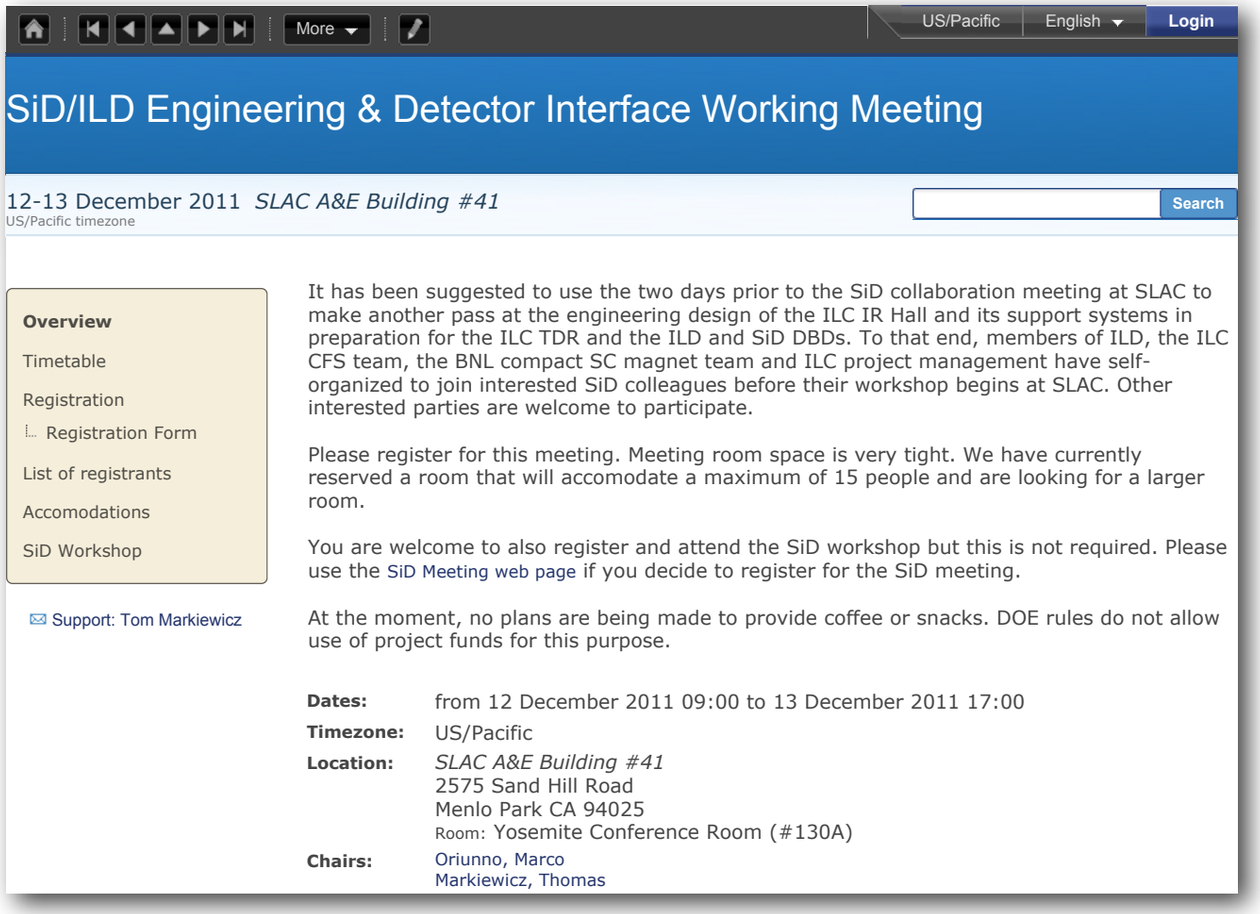
R. Volkenborn

Define Final Hall Dimensions for ILD



Next Milestone

- Common ILD/SiD/ILC-CFS Workshop on engineering and civil facilities, 12-13 December 2011
- Finalise the layout and dimensions of the IR civil facilities for the „standard“ ILC sites
- Status discussion on mountain site implications
- Finalise work plan towards the TDR/DBD



Timeline

- On-going studies (platform, civil facilities) use parameters of the current ILD model
- Main parameters for underground and surface facilities will be fixed before the end of this year
  - CFS Technical Baseline Review March 2012
- Cost estimates for CFS for TDR:
  - Americas region: March (prel.), June 2012 (final)
  - Asian region: August 2012 (final)

Comment

- From the detector point of view, it is very benefical to simplify the ILD solenoid and reduce the size of the yoke:
  - Smaller dimensions, less mass
  - Less cost
  - Less complexity
- The biggest cost impact will not be on the detector, but on the CFS cost!
  - Underground volumes, shaft diameters
- It is already very late to change the relevant parameters for the „DBD“ model of the detector
  - all engineering studies for TDR/DBD assume LoI detector dimensions!
- Last chance to have any impact: December MDI meeting at SLAC...