Underground Hall Design Requirements

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DESY

ILD Regional Integration Workshop
Orsay
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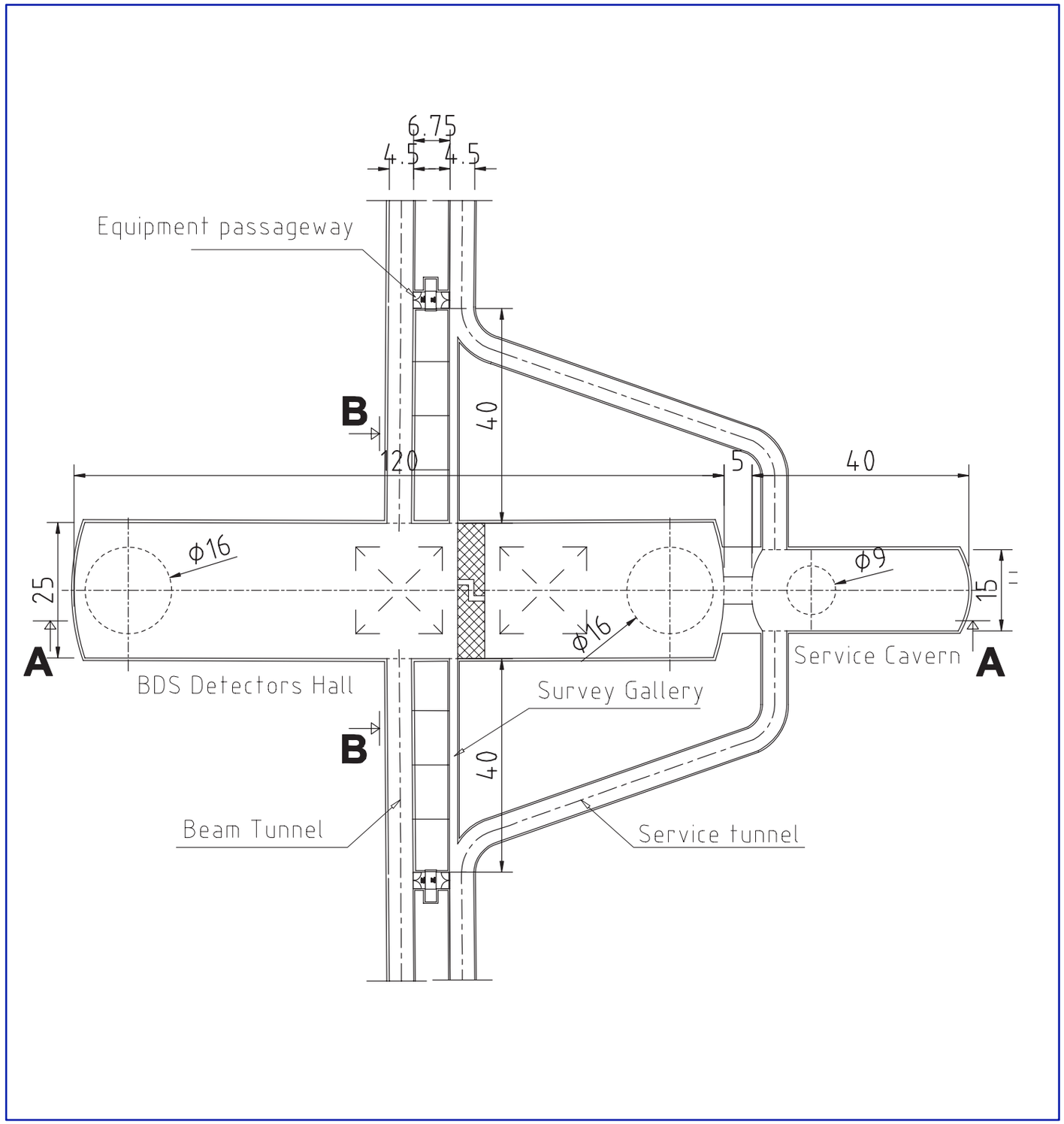
Problems

- Together with SiD and CFS
  - Define underground experimental area design
    - Common platform based push-pull detector motion system
    - Detector services and their impact on CFS issues
  - React on site-specific requirements (e.g. mountainous site boundary conditions)

- ILD internal
  - Design 1st-order engineering model of integrated detector
    - Subdetector services and supplies
    - Assembly procedures
    - Cable ways, cooling, support structures
    - Understand ILD and define all ILD service needs

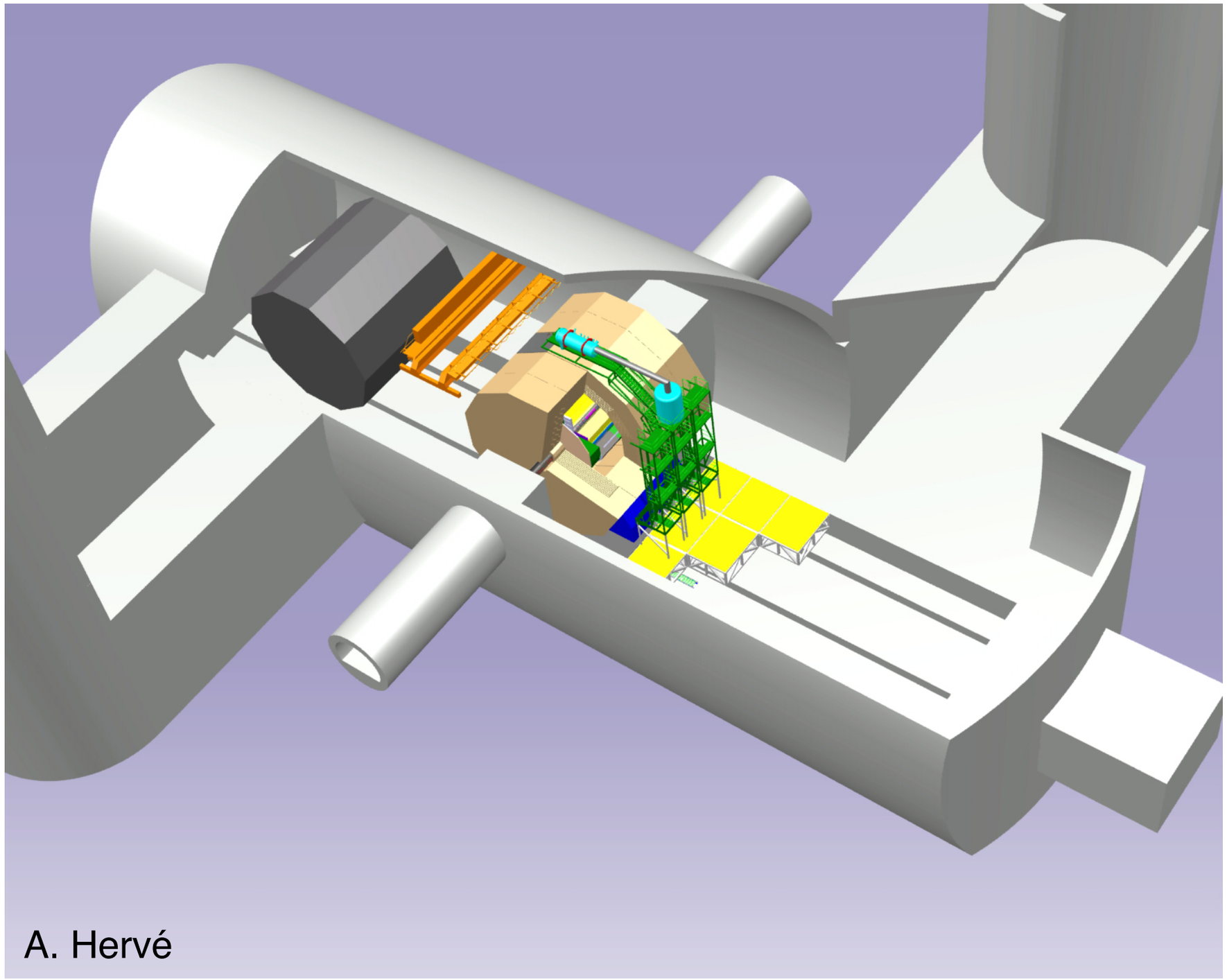
Experimental Hall (RDR Design)

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



ILD Experimental Hall Design Study

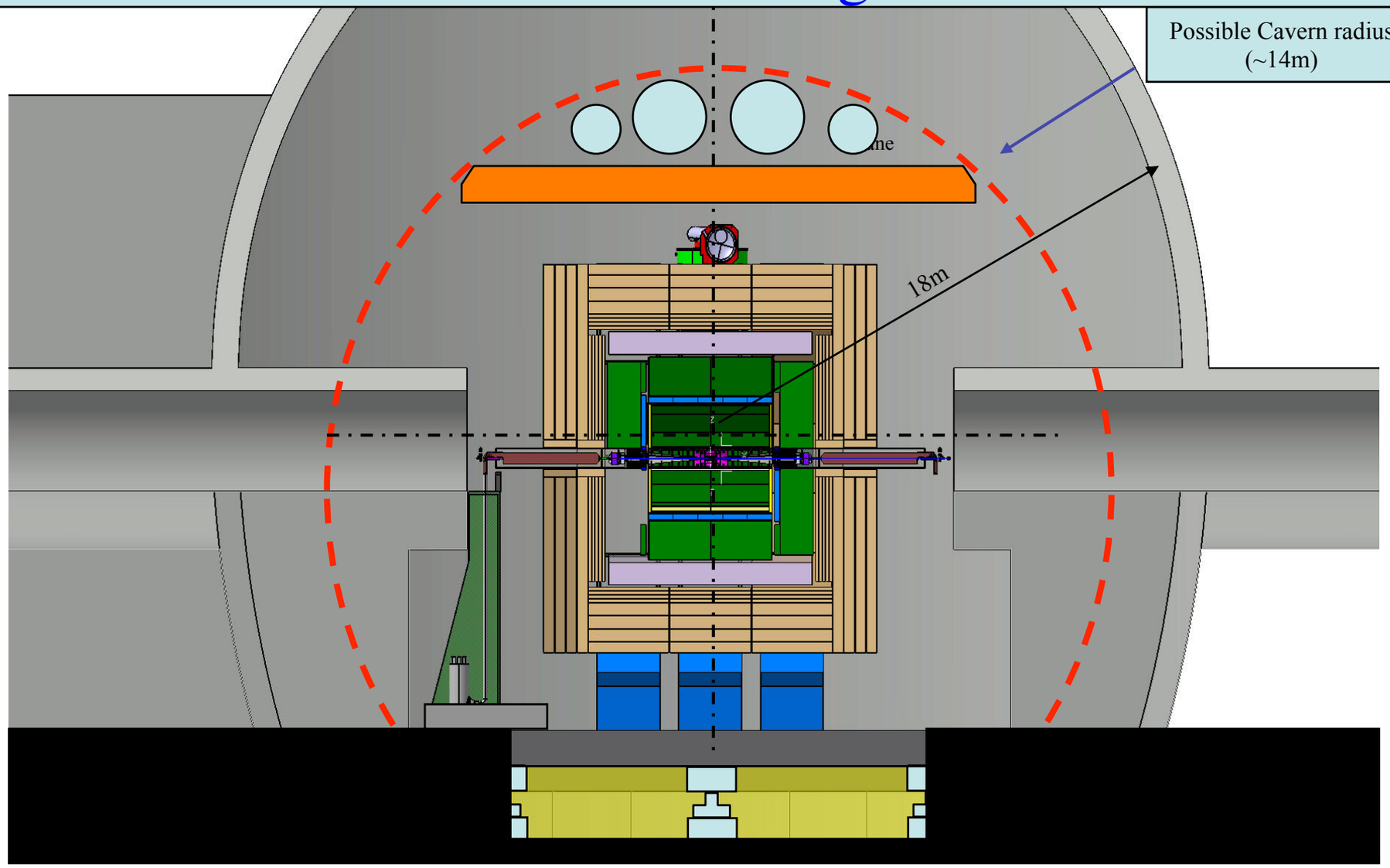
- Shafts not above experiments
- Alcoves provide access to shafts and space for detector maintenance in parking position
- Additional alcoves for detector services
- Potentially less expensive than RDR hall design (smaller volume)



A. Hervé

Cavern Size

An effort has been made to reduce
the radius of the Underground Hall



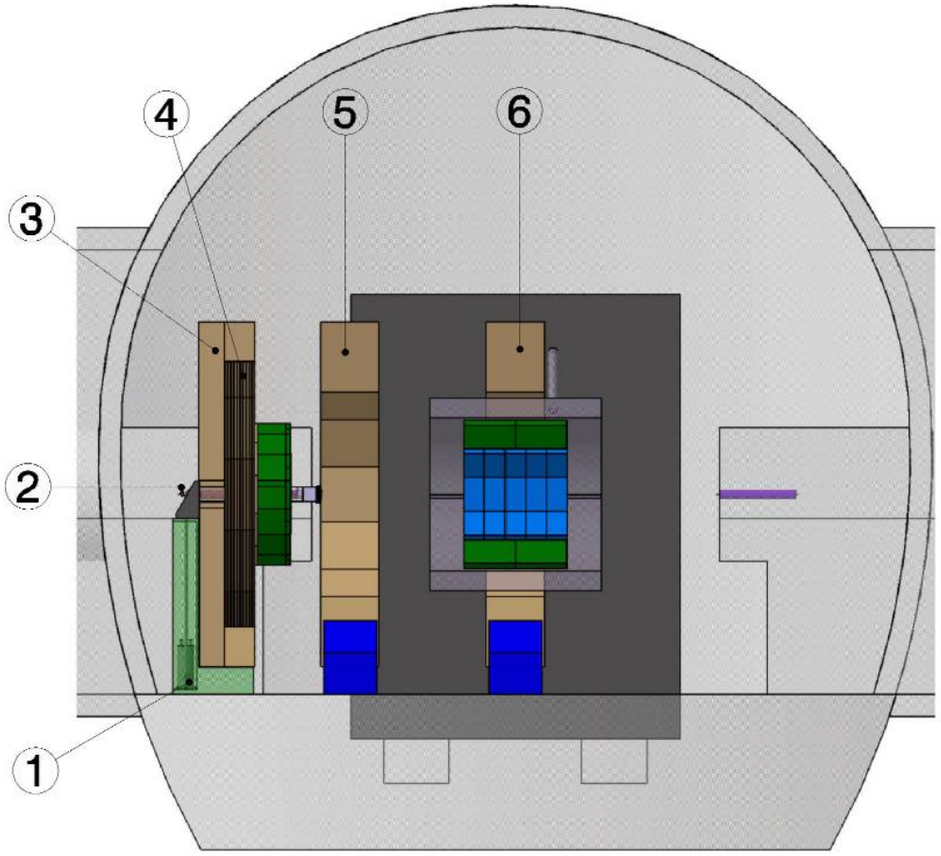
A. Hervé

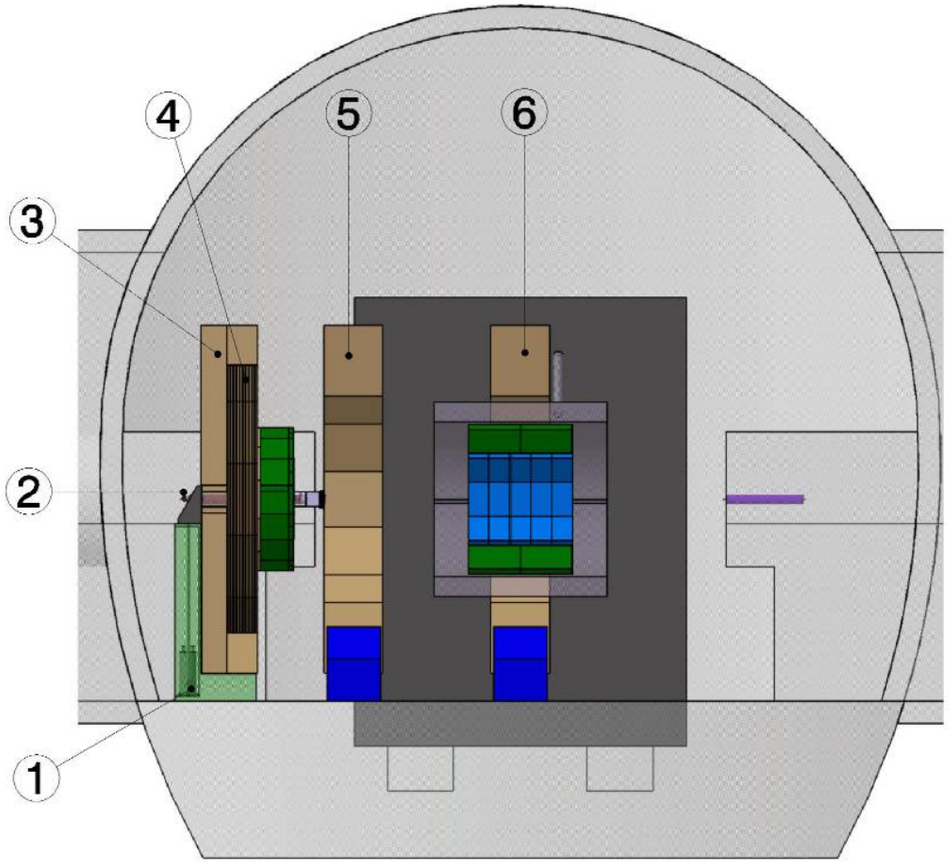
4366-ILD-T-Platform-and-environment.ppt A. Hervé

Design N.S. ETH-Z, January 2009.

- Radius of experimental hall could go down from ~18 to ~14m

Detector Assembly CMS-Style

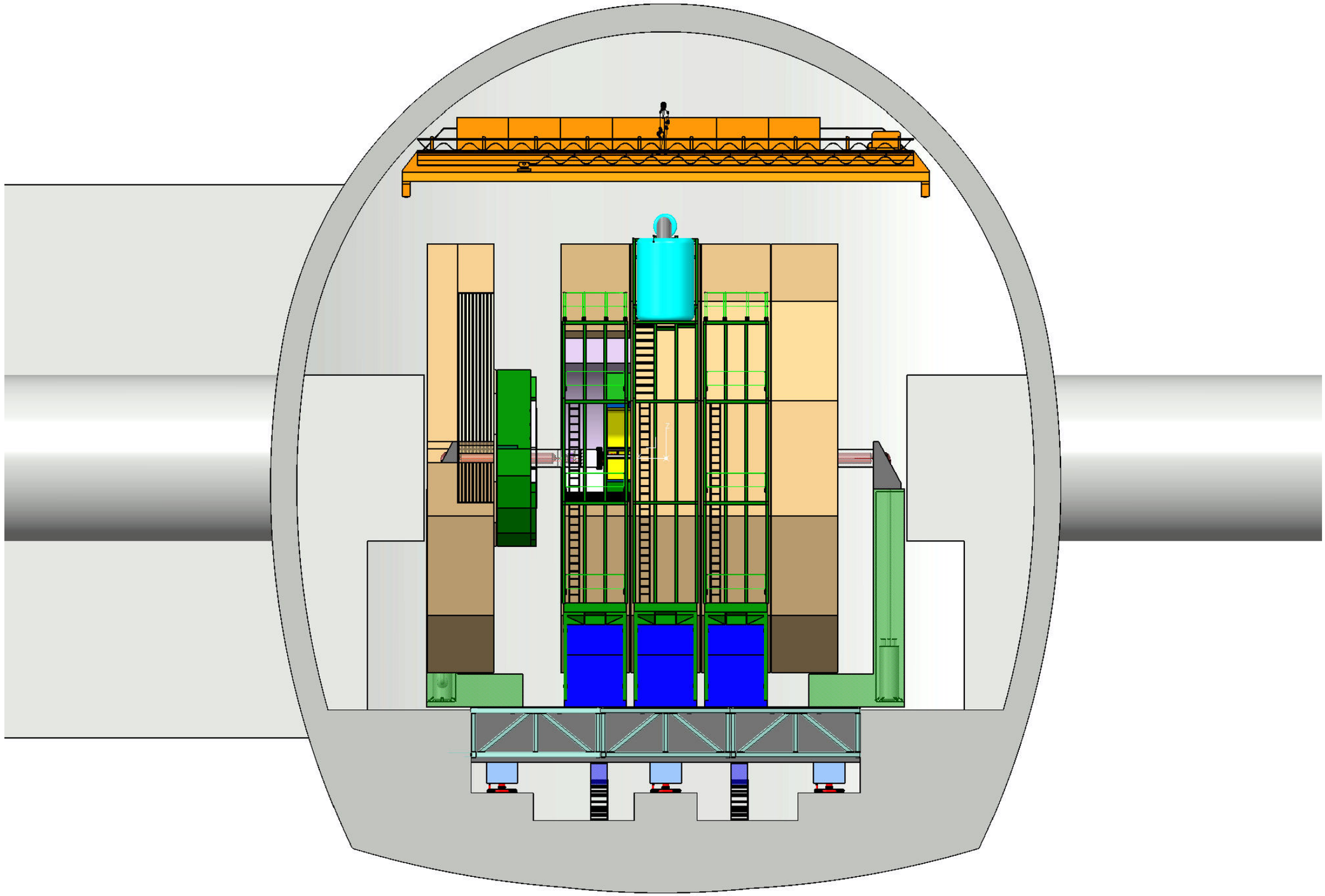




M. Joré, C. Clerc

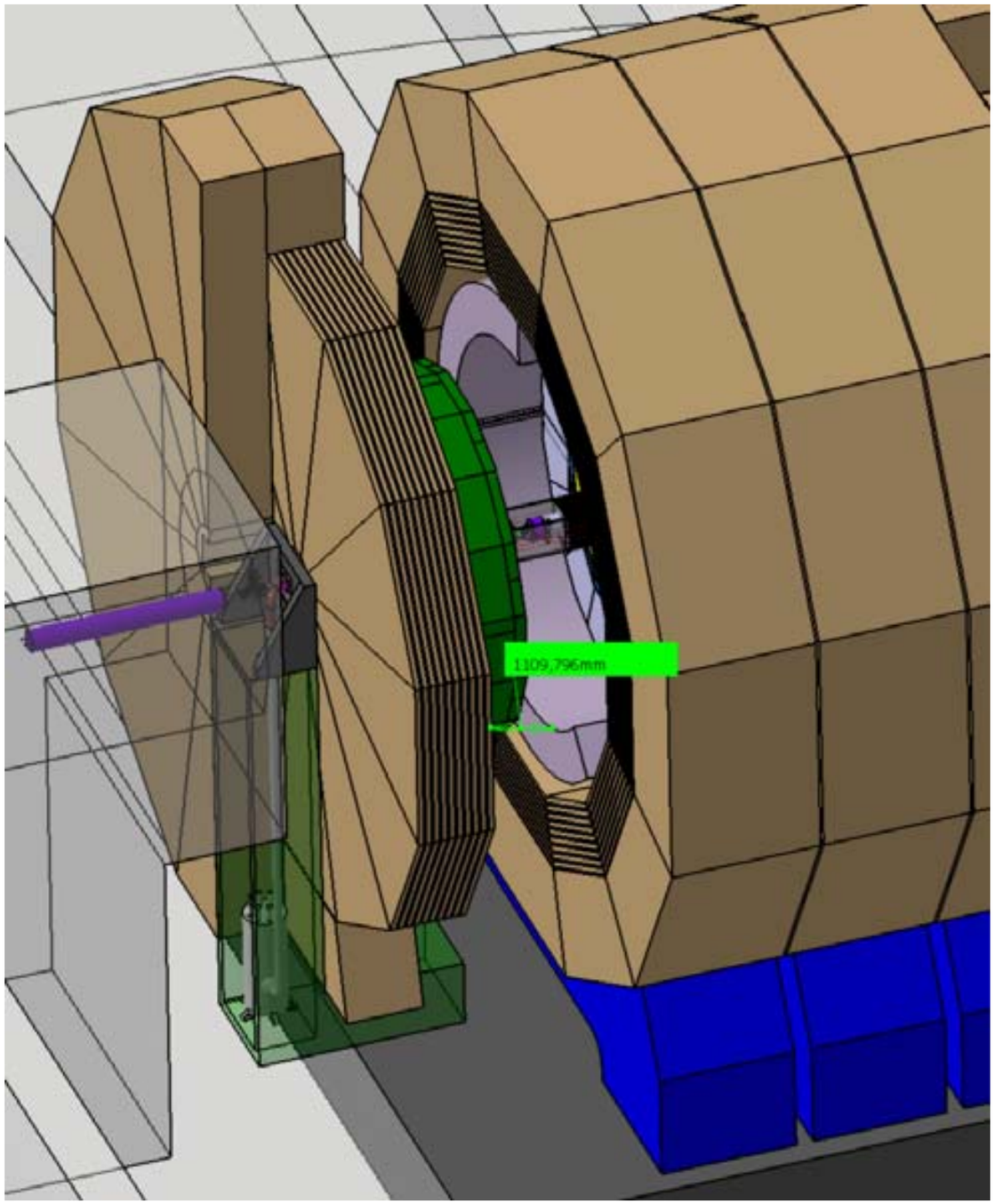
- Pre-assembly of large structures on surface
- Sub-assemblies lowered into the experimental hall
- Main parts:
  - three barrel yoke rings; central carries magnet and barrel detectors
  - two yoke endcaps
  - central tracking system (TPC)

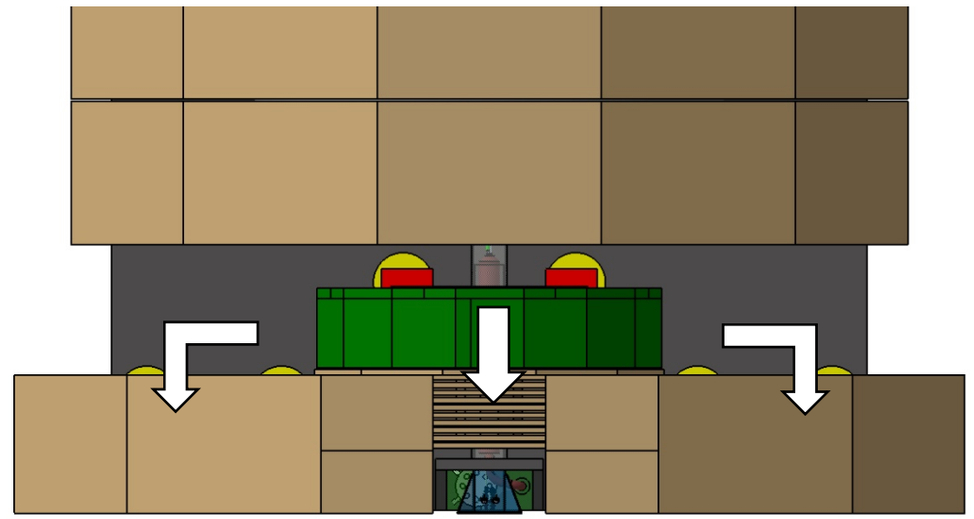
Detector in Beam Position



- NB: Optimised hall size

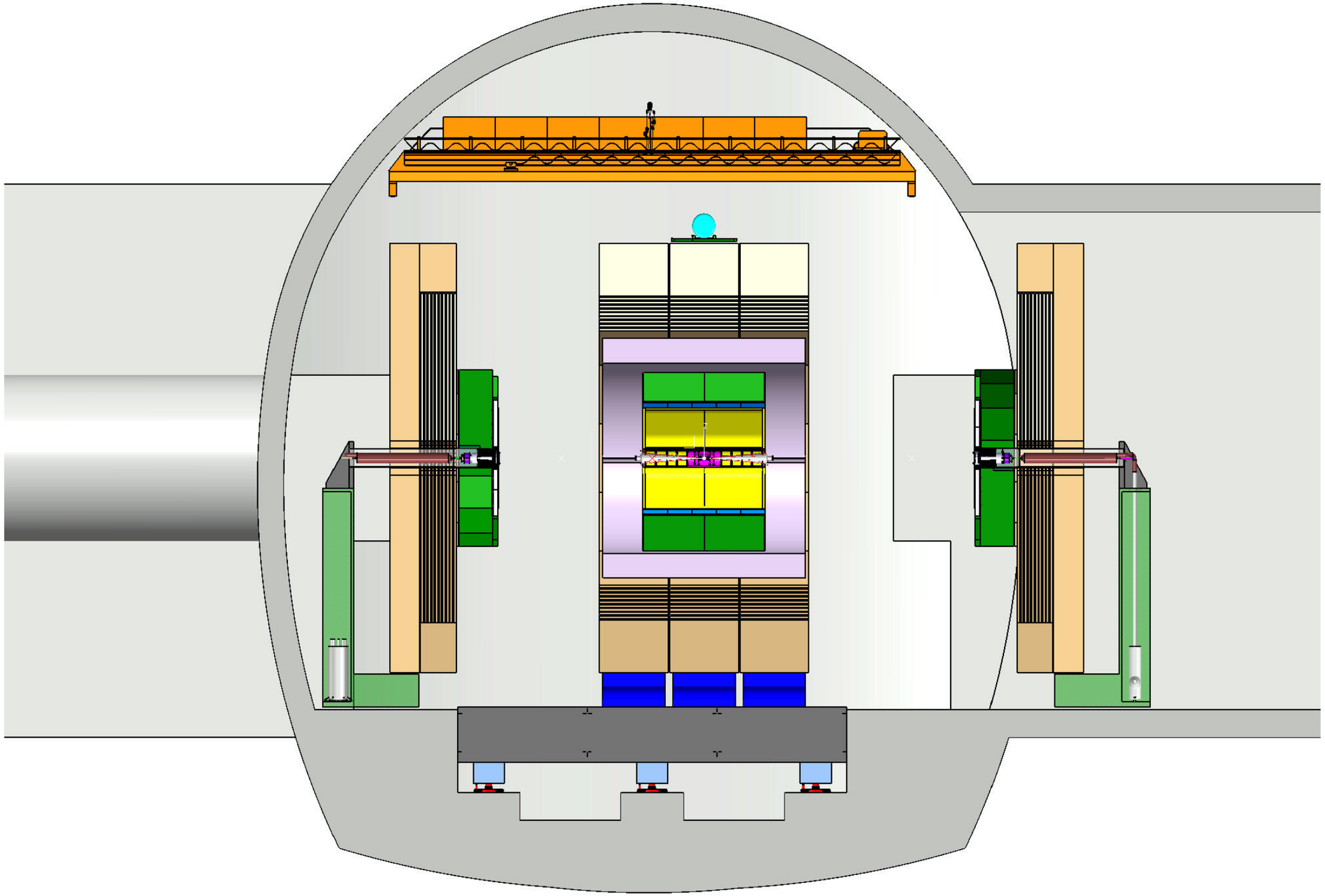
Detector Opening - Beam Position





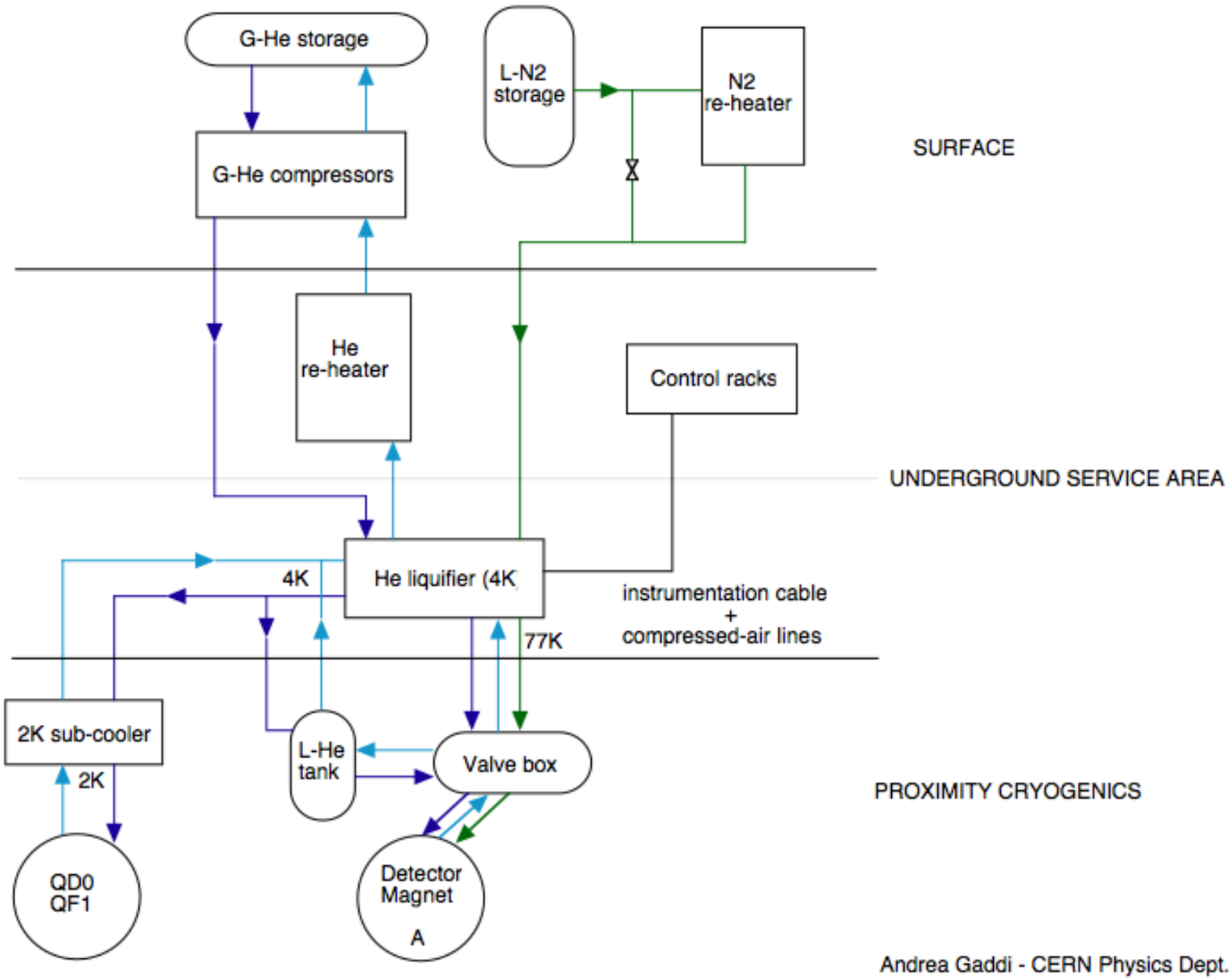
- Option to open the endcap in the beam position for limited access
  - Still under discussion; might not be needed if push-pull concept is taken seriously

Detector Opening - Garage Position



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

Detector Services

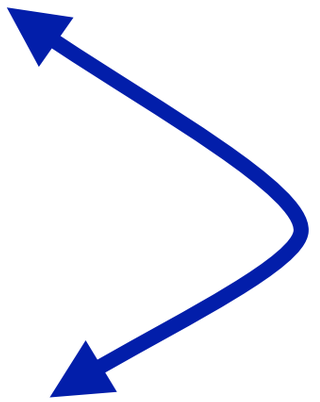


- Cryogenics for the magnets

Detector Services

- Primary services (on surface)
  - Water chillers
  - HV transformers
  - Diesel and UPS facilities
  - He storage and compressors
  - Gas storage

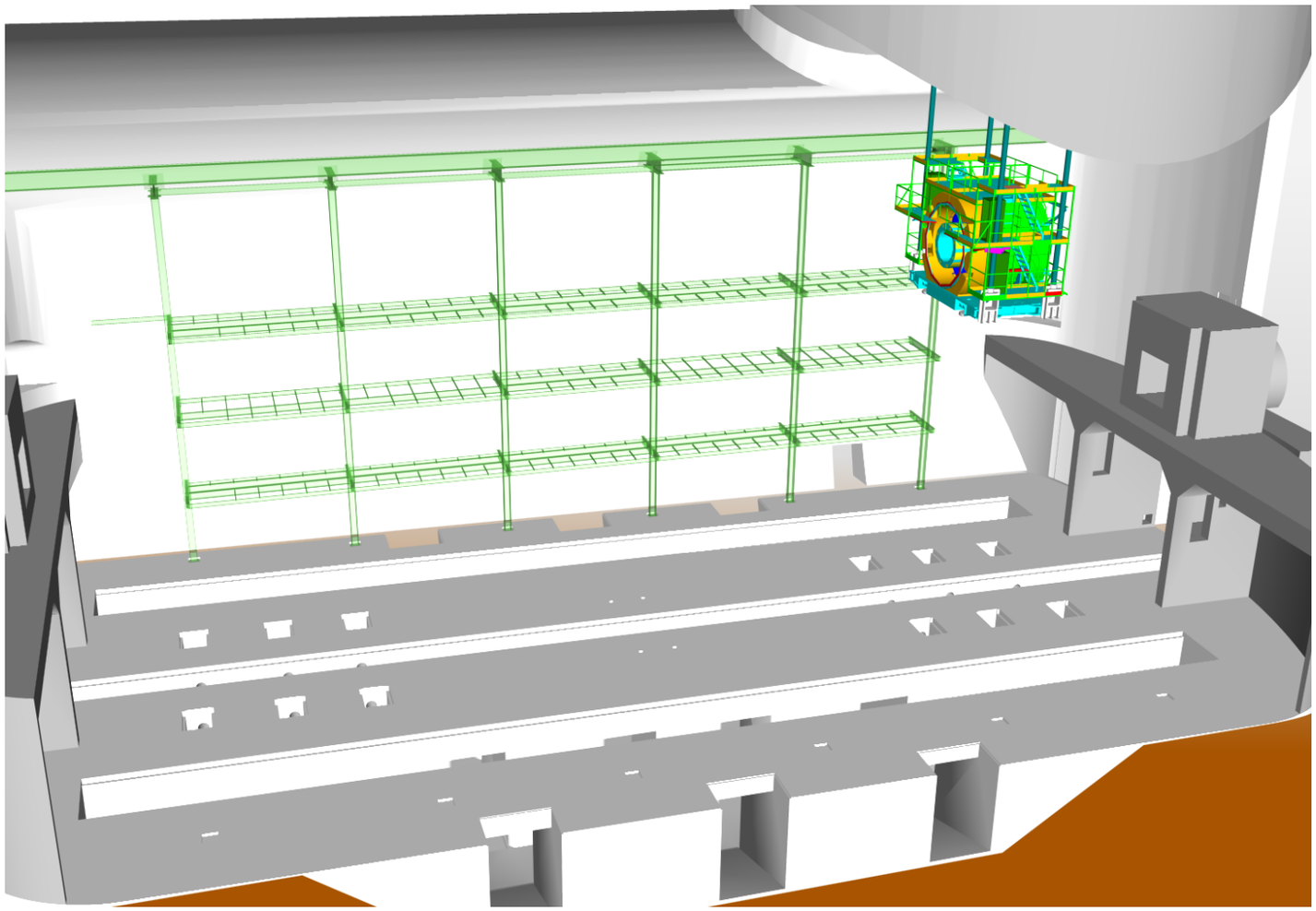
- Secondary services (underground in alcoves)
  - Cooling water
  - Power supplies
  - Gas mixtures
  - Power converters
  - Cryogenics

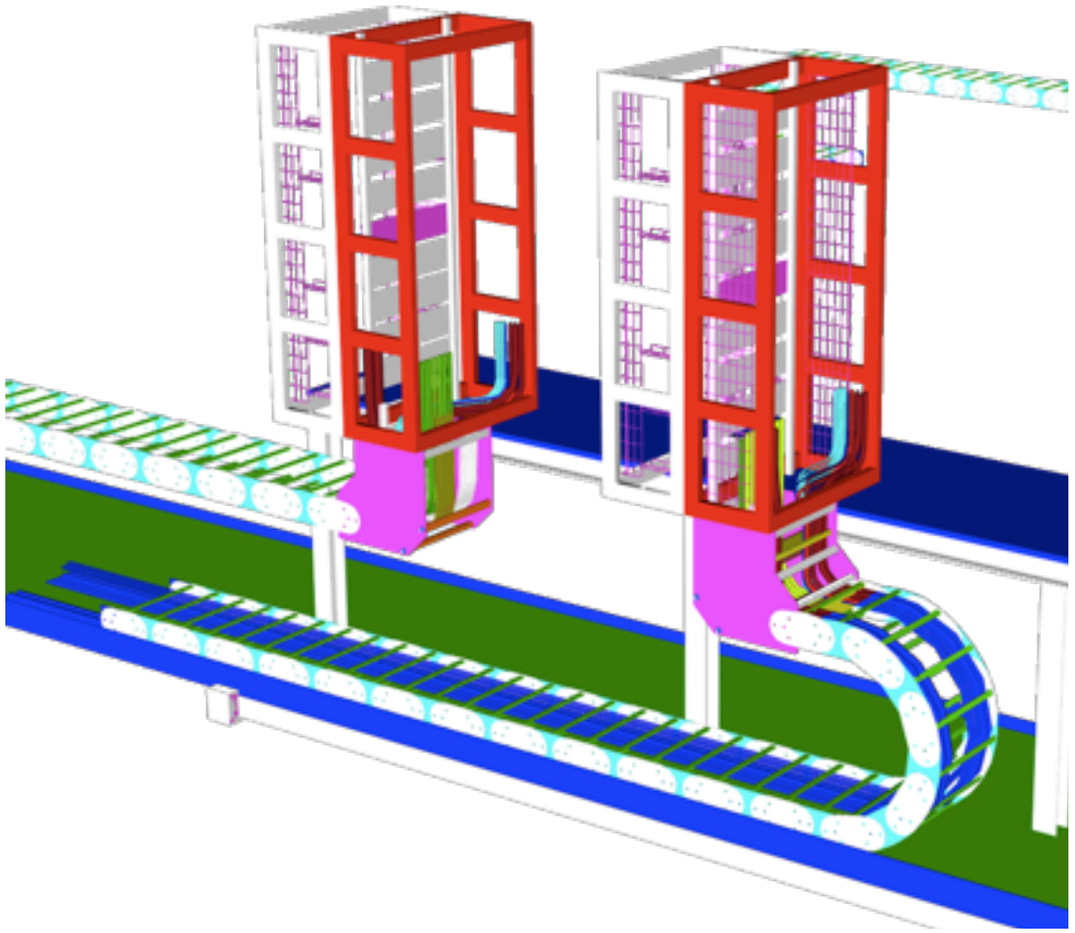


- On-board services (move with detector)
  - Electronic containers

- Need an integrated approach to the service needs of ILD and SiD!

Cable Ways and Supplies

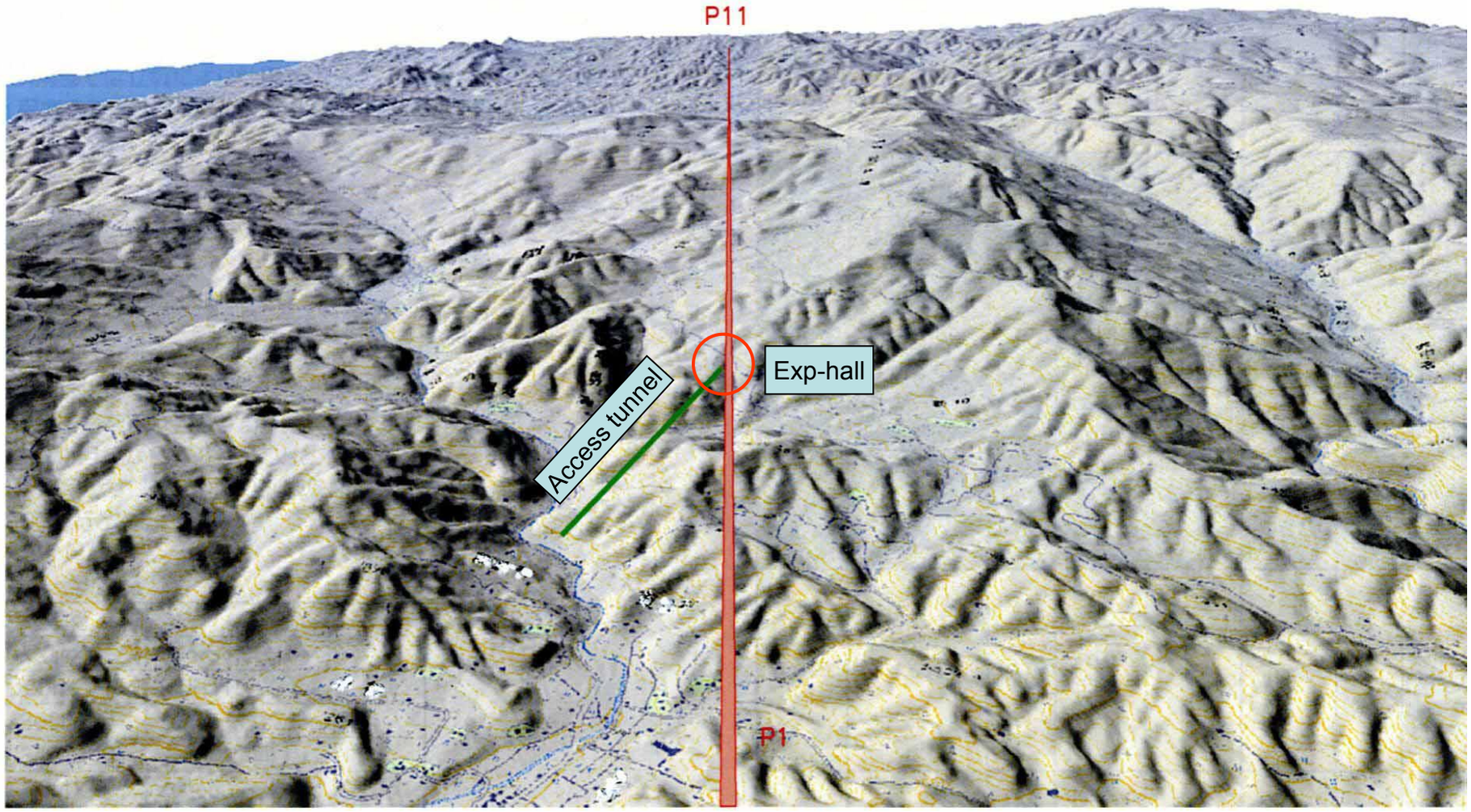




- CMS Example
- Trenches are needed under a platform: cables, safety, motion system access

Alternative Detector Assembly Studies (Y. Sugimoto)

An example of Asian mountain site

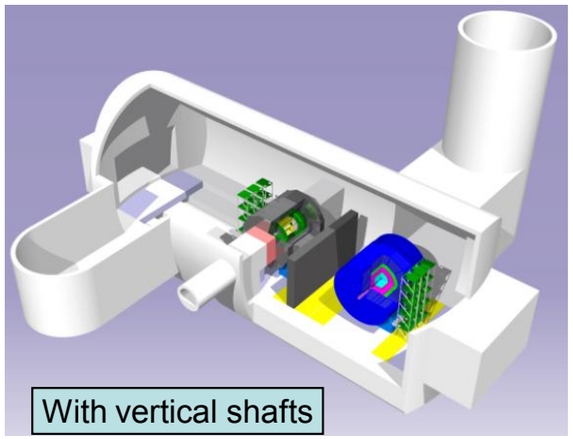


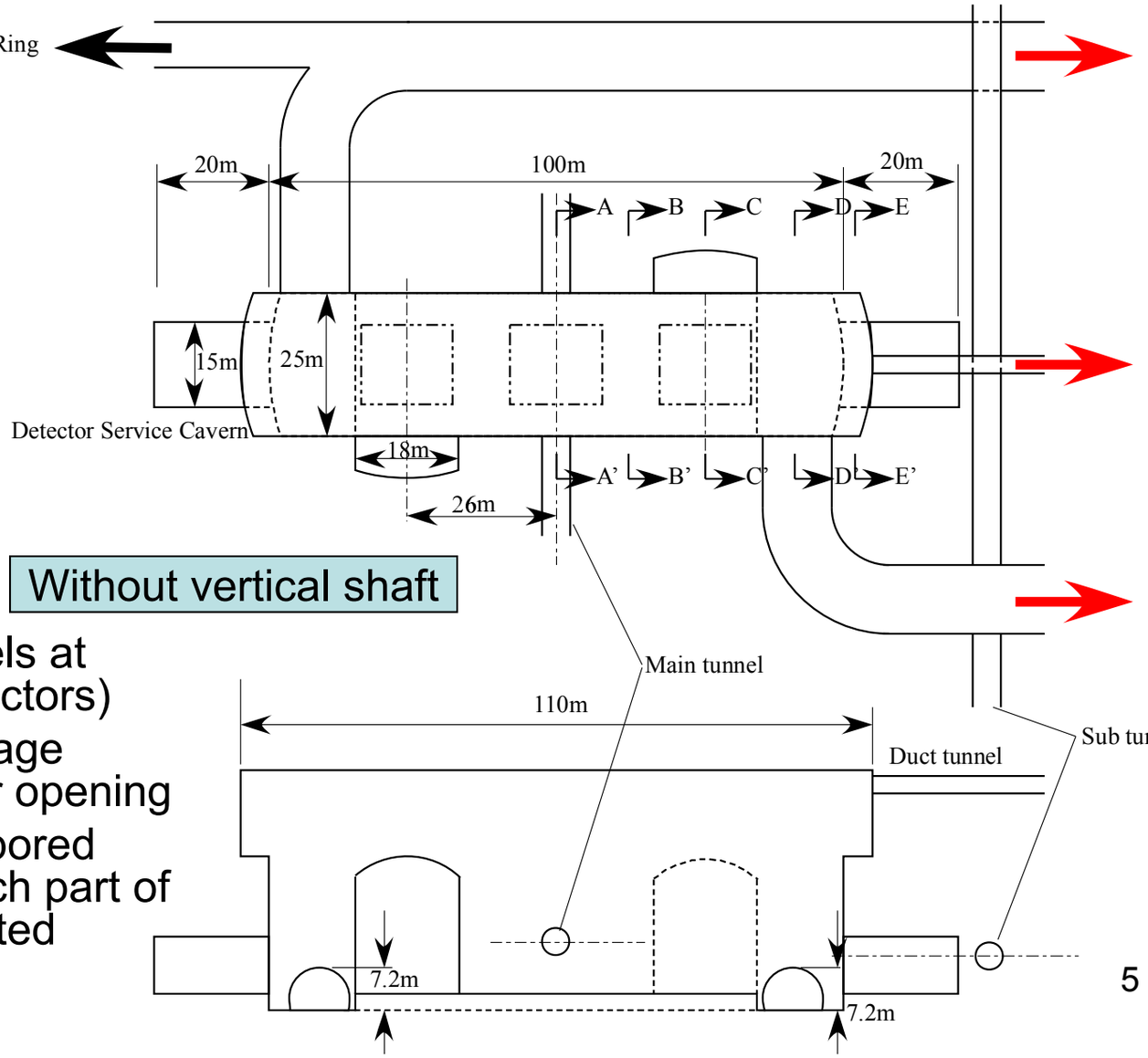
3

- ILC site could be quite different from „plain field“ assumptions
- No vertical access shafts (~100m) but horizontal access tunnels (~1km)
- CMS-type assembly of detector needs to be reviewed

Alternative Detector Assembly Studies (Y. Sugimoto)

A possible design of exp-hall



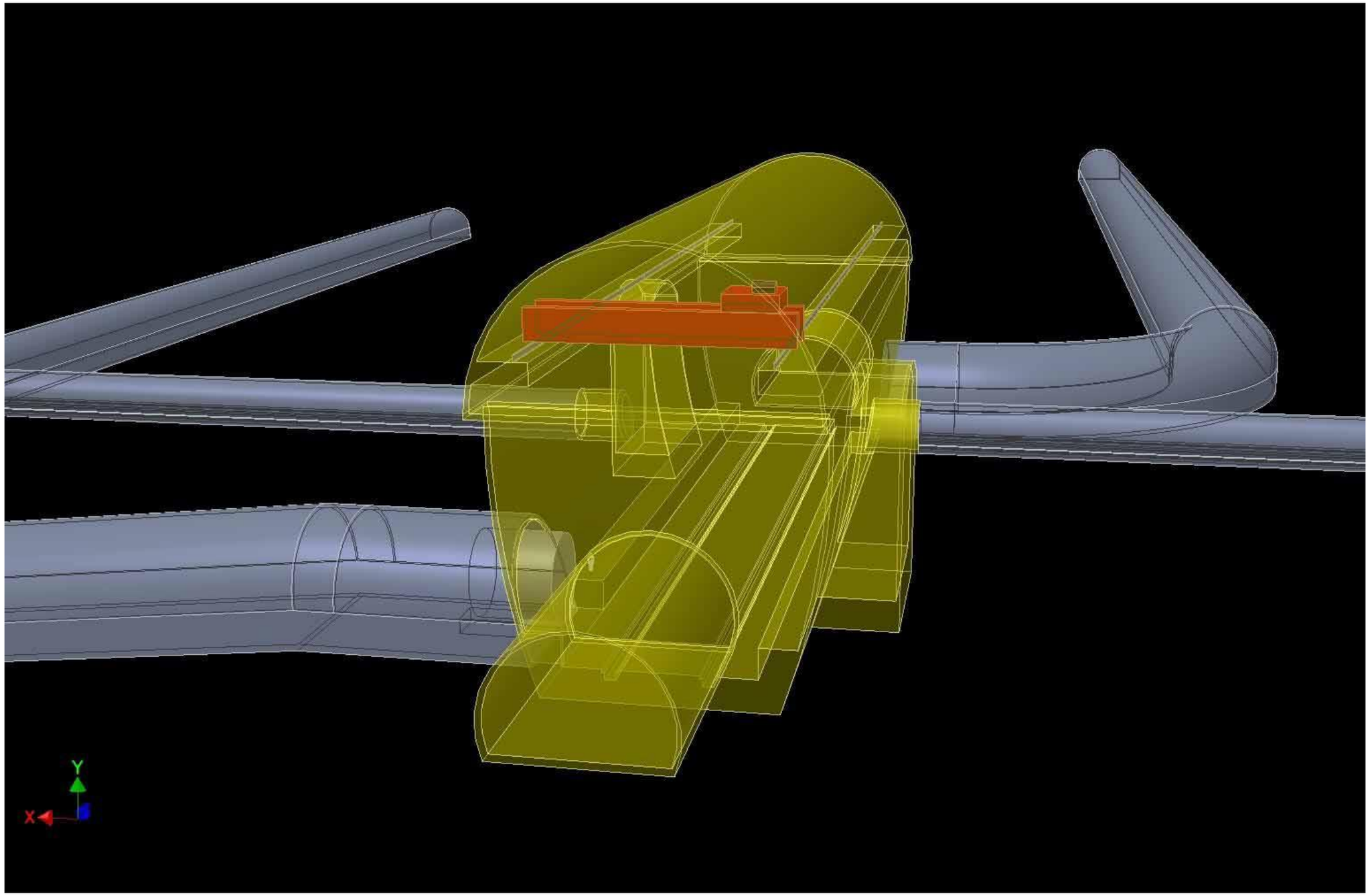


Without vertical shaft

- Bottom access tunnels at both ends (for 2 detectors)
- Small alcoves at garage positions for detector opening
- Top (duct) tunnel is bored first, and then the arch part of the cavern is excavated

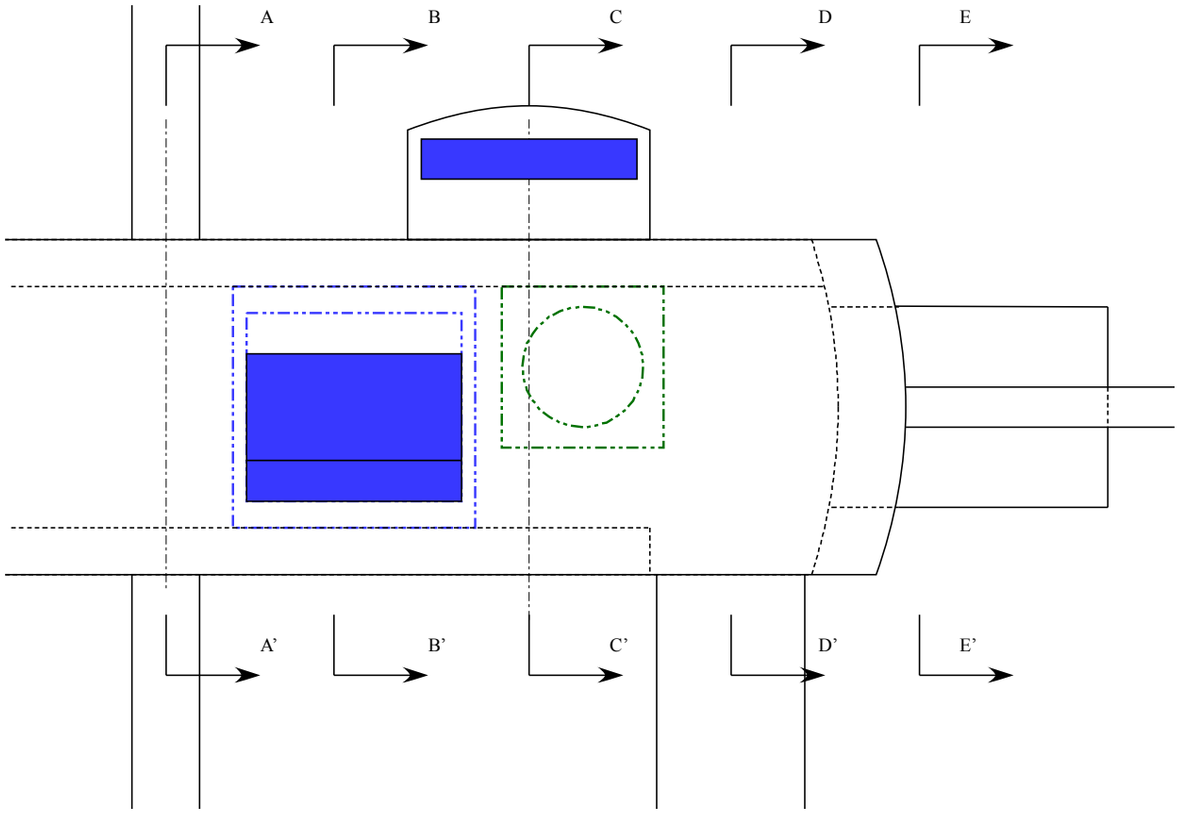
5

Alternative Detector Assembly Studies (Y. Sugimoto)



Space for assembly

- We need enough space to assemble the iron yoke and the solenoid in parallel
- Solenoid assembly procedure and installation method have to be studied
- Exp-hall should be equipped with two 200-ton cranes: usually one for each detector, and occasionally two cranes are used together to carry heavy (>200 ton) components



12

- Needs to be studied carefully

Detector assembly

- Assembly hall locates at the entrance of access tunnel where wide flat surface and wide roads exist
- Detector would be assembled to relatively small pieces (<100~200 ton) at the assembly hall, carried to the cavern through the access tunnel, and integrated to the large detector inside the cavern (Similar to “modified CMS style assembly” which was proposed by GLD group in 2006)
- Barrel iron structure would be divided in ϕ (and R) direction, rather than Z direction
- Solenoid coil would be wound on surface for 5 modules, and these modules are connected into one solenoid in the cavern
- Detailed study on the assembly method is necessary

6

T. Lackowski at ALCPG'11

- CFS must advance the IR Region and Detector Hall design for the TDR.
  - **Improved understanding of the Detector Requirements for CFS.**
  - **Regional CFS Designs that satisfy the Detector Requirements**
  - **A much more complete cost estimate**

  - **The design(s) presented and costed in the TDR must have the concurrence of each of the Detector Collaboration.**

T. Lackowski at ALCPG'11

- We can move forward towards the TDR CFS goals with some direction from the Collaborations.
  - **Specific, or exact information is NOT necessary; Placeholders or Ranges will advance our efforts.**
  - **CFS would like to focus on those items that are cost drivers**
  - **We need requirements, not system designs at this point**
    - Requirements are based on detector and physics optimum performance.
    - Requirements are the same for all regions

Requirements Outline

- Site
  - **Access Roads Weight Limits**
  - **Parking (# of people)**
  - **Storage Hardstands**
  - **Cryo and Gas Storage (Mixing)**
  - **Fire Brigade Access**
- Site Utilities
- Water
  - **Fire Protection**
  - **Primary Cooling**
  - **Potable (Drinking)**
  - **Sanitary Sewer**

T. Lackowski at ALCPG'11

- Utilities (continued)
  - **Electrical Service**
  - **Communications**
- Building(s)
  - **Detector Sub-Assembly Space**
  - **Ancillary Space**
- Control Room
- Office
- Tech
- Electronics
- Machine Shop
- Testing
- Access Control

Building Requirements

- Buildings (Continued)
  - **Mechanical**
    - HVAC
      - Temperature range - Stability
      - Humidity criteria
      - ODH
      - Special Ventilation for gases, fire protection
    - Process Water loads
      - Water Temperature
      - Water Type – LCW / Chilled LCW / Chilled
  - **Electrical**
    - Power distribution
    - Lighting
    - Fire Detection

Detector Hall Access

- Shafts or Horizontal Access
  - **Governing Load dimensions and weights**
  - **Services routed in shafts**
  - **Shaft environmental criteria (Ground Water Infiltration)**

Detector Hall Requirements

- Detector Hall
  - **Footprint required to construct Detector**
  - **Detector Footprint in beam**
  - **Detector Footprint in Parked Area(Gross footprint including access platforms, servies, and detector opened for maintenance)**
  - **Platform dimensions and travel**
  - **Cranes, lifts and hoists**
  - **Ancillery Space**
    - Control Room

Detector Hall Requirements

- **# of people**
  - During Construction
  - During Running
  - Maintenance Periods
  - Sub, sub point

Let's Start- Can we Concur

- Each detector will be designed to provide beam radiation shielding and no shielding external of the detector is required for unrestrictive occupancy and maintenance of the parked detector.
- Both the MDI and ILD detector will be supported and transported on independent platforms.

ILD and SiD said „yes" to both! Agreed that platform issue might be reviewed for Japanese site....

Outlook

- The list of tasks is long, the time to the DBD/TDR is short:
  - The underground hall design presented in the RDR is not optimal for ILD
    - Common design needed that fits ILC, SiD, ILD and is aligned with the push-pull paradigm
    - Common collaboration between ILD, SiD, ILC-BDS and ILC-CFS started
    - Site-specific modifications need to be taken into account
  - GDE-CFS people will send us a questionnaire to start the underground hall requirements document process
    - Vic Kuchler plans to attend the ILD workshop in May
- All tasks are unfortunately resource-driven and not goal-driven
  - The content of the DBD will be defined by the work done, not by the work planned