CFS Studies at CERN for the Interaction Region :

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

-Design Brief for external design specialists

-Build-ability issues for concrete platforms underground

-Conclusions

Detector movement system and experimental area layout for a Linear Collider

chaired by John Andrew Osborne (CERN)

Wednesday 16 February 2011 from **09:00** to **17:00** (Europe/Zurich)
at CERN (354-1-016)

Participants Jean-Pierre Delahaye; Andrei Dudarev; Konrad Elsener; Andrea Gaddi; Martin Gastal; Lau Gatignon; Jean-Christophe Gayde; Hubert Gerwig; Michael Guinchard; Alain Herve; Mark Jones; Victor Kuchler; Hélène MAINAUD DURAND; Dirk Mergelkuhl; Hermann Schmickler; Steinar Stapnes

Wednesday 16 February 2011

09:00 - 09:05 Introduction *05'*
Speaker: Jean-Pierre Delahaye (CERN)

09:05 - 09:45 Civil engineering works for Linear Colliders *40'*
Speakers: John Andrew Osborne (CERN) , Martin Gastal (CERN) , Victor Kuchler (Fermilab)

09:45 - 10:15 Assembling, lowering and moving a 14'000-tonne experiment at CLIC *30'*
Speaker: Hubert Gerwig (CERN)

10:15 - 10:30 Coffee *15'*

10:30 - 11:00 Vibration issues at Linear Colliders and consequences for CLIC *30'*
Speaker: Andrea Gaddi (CERN)

11:00 - 11:30 Reflections on moving and aligning large masses around IP at CLIC *30'*
Speaker: Alain Herve (CERN)

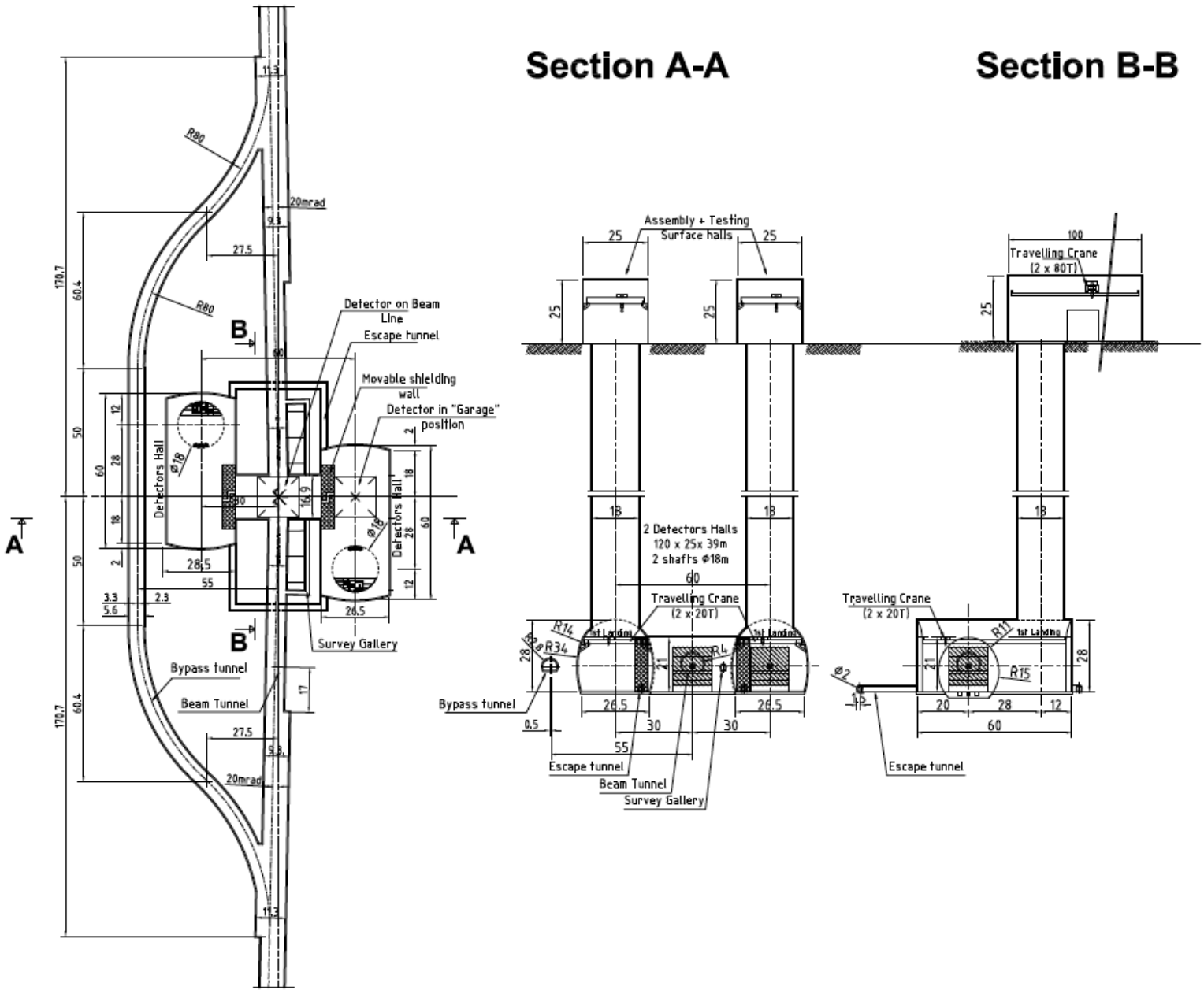
11:30 - 12:00 CLIC/LHC sub-micron ground motion and vibration measurements *30'*
Speaker: Michael Guinchard (CERN)

12:00 - 13:30 LUNCH *1h30'*

13:30 - 14:00 LHC long term ground movement measurements *30'*
Speaker: Jean-Christophe Gayde (CERN)

14:00 - 14:45 ARUP experience in similar fields *45'*

14:45 - 16:45 General discussion on future studies *2h00'*

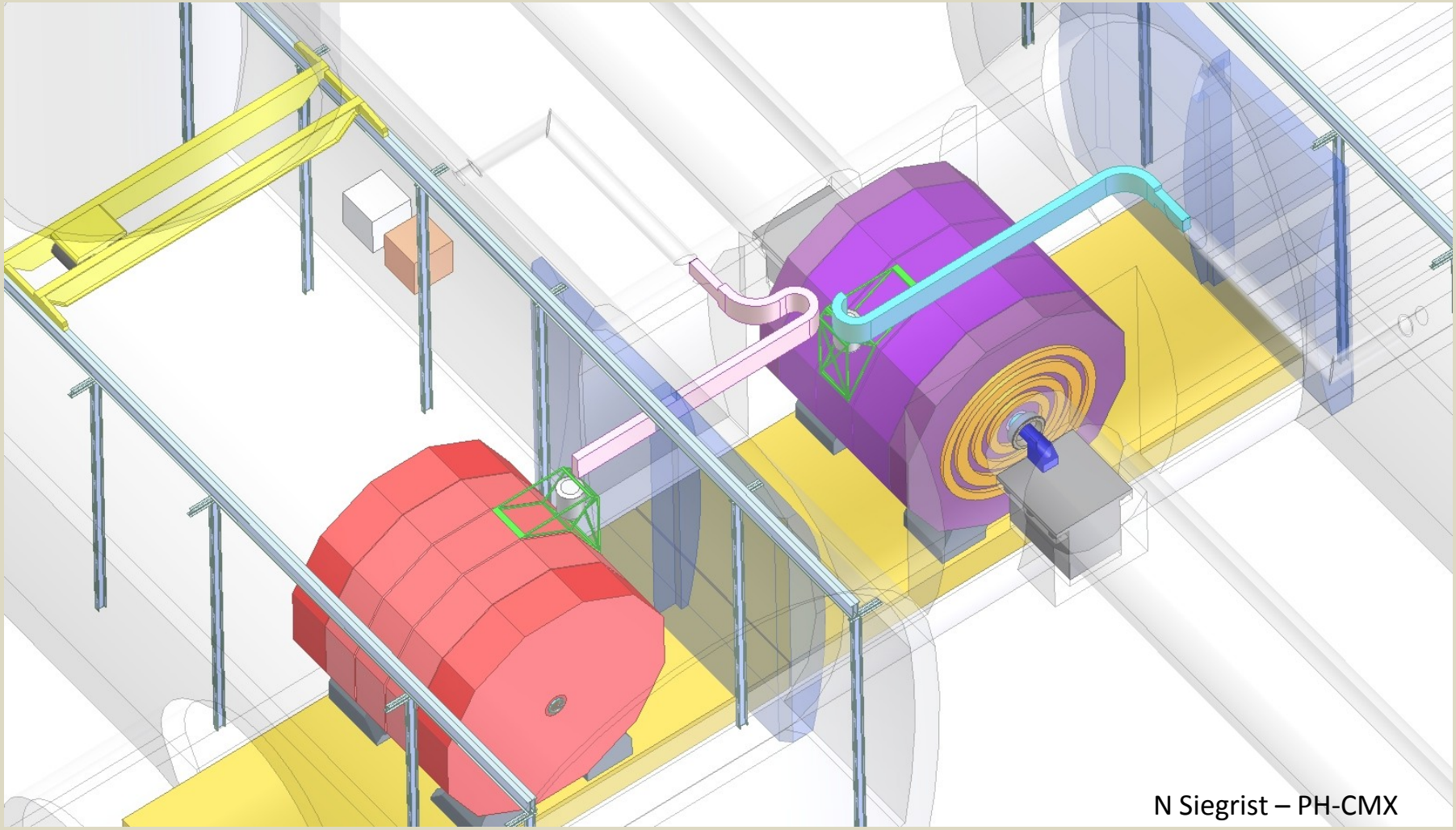


CLIC- DETECTORS HALL AREA (SURFACE AND UNDERGROUND)

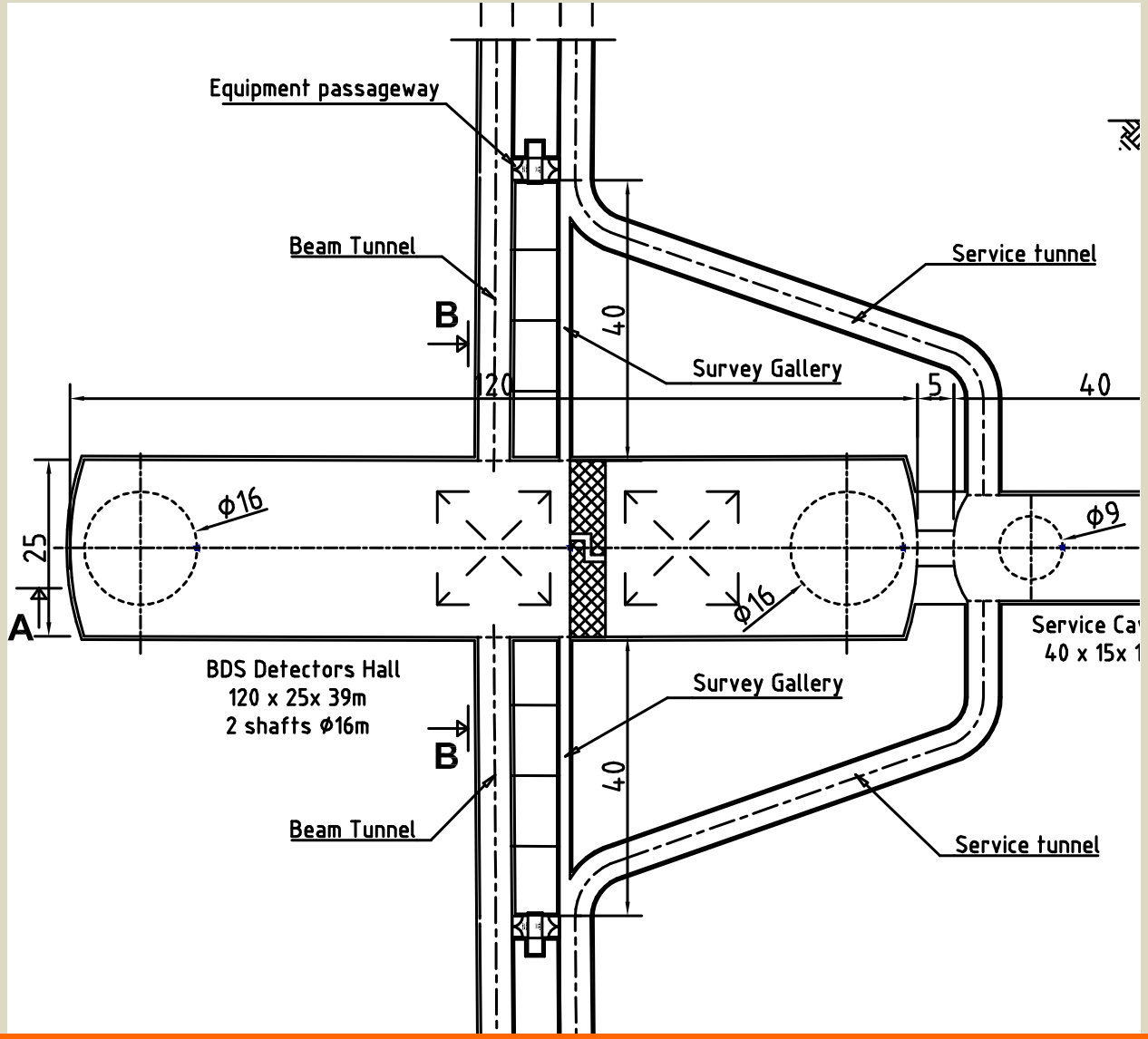
GROUP : 62-231
CIVIL ENGINEERING
SUPERVISOR : J.OSBORNE
DESIGNER : N.BADDAMS

SCALE : 1/1000(A2 FORMAT) DATE : 19 AUG 2010
CLIC.CE-1.1700.0001 SIZE 2 SHEET D

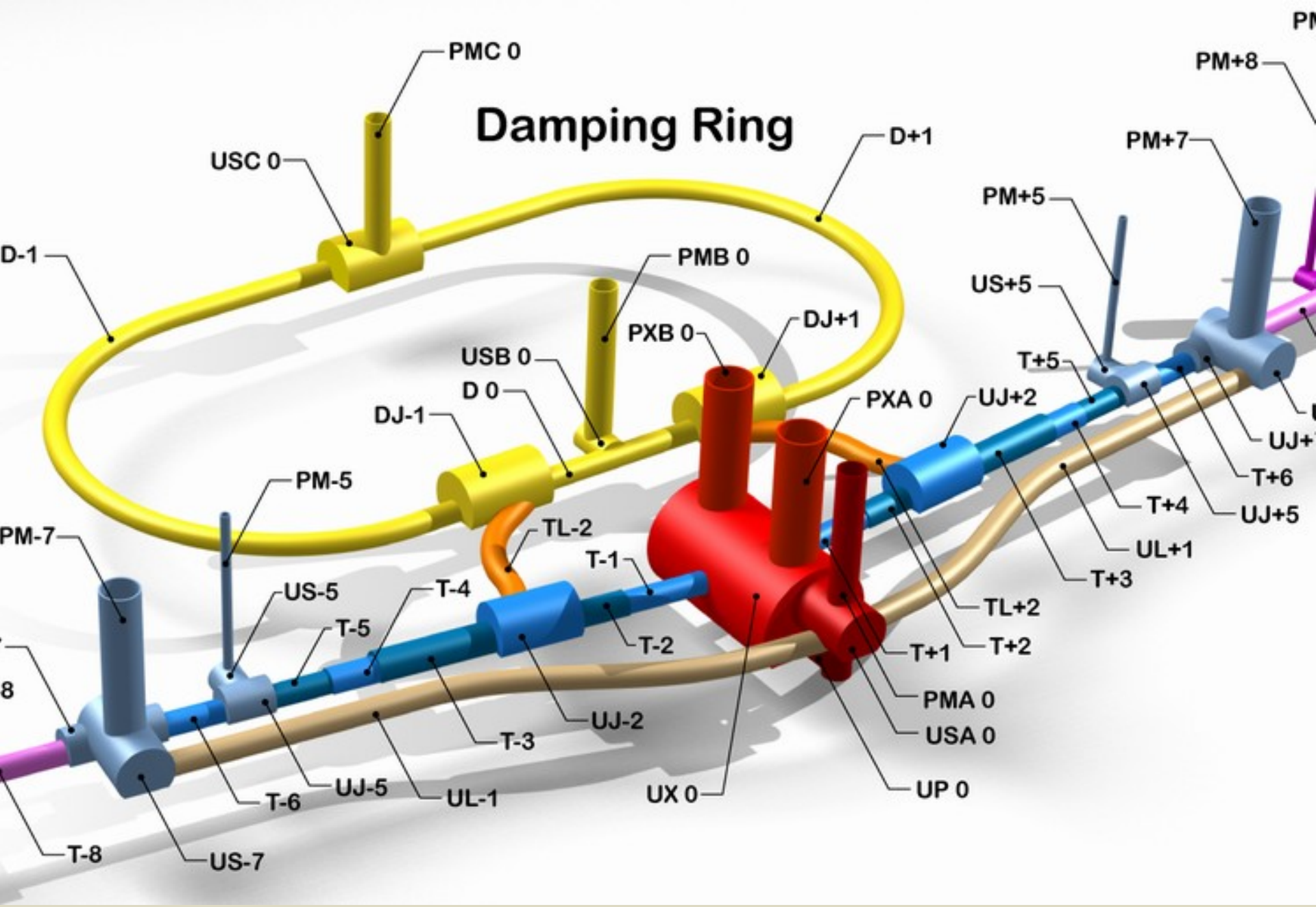
The detector would be moved into beam position on a moving platform
The concept could be similar to the CMS PX56 plug (2200 tons)



ILC RDR Baseline Layouts for Interaction Region



ILC Concrete platform concept / shaft layout / crane capacities still need to be finalised before CE study can start



ILC KlyCluster at CERN 3d layout of IR

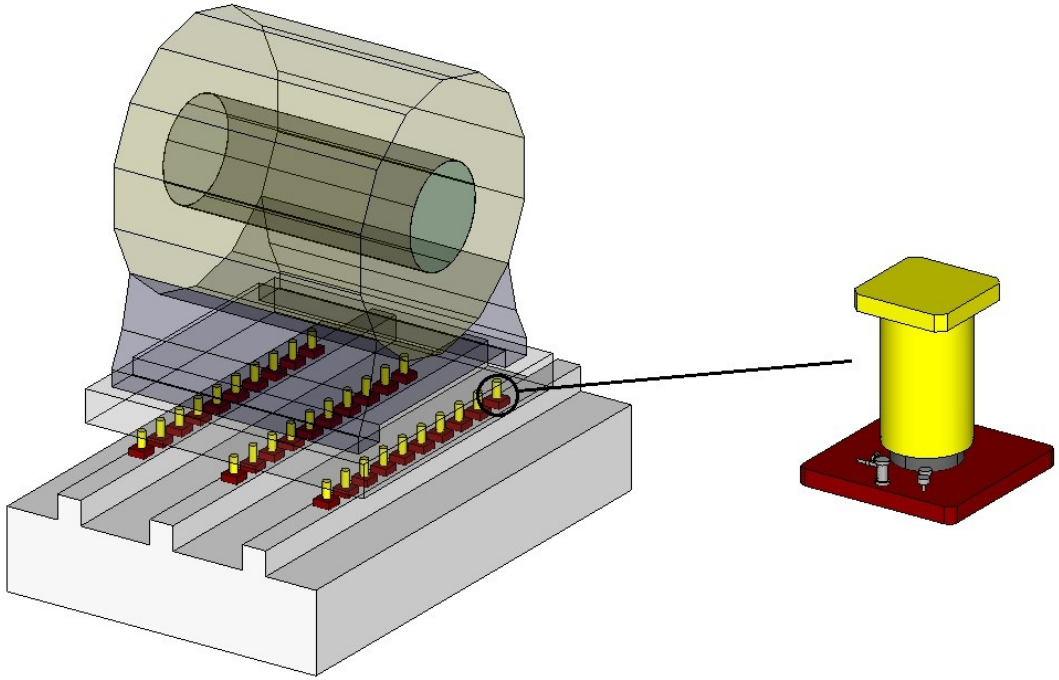
Transport mechanism 1,1	Excess pore pressure, cyclic load degradation 1,2	to limit to 0.5g during transport 1,3	Influences Cavern geometry 1,4
EDZ & creep may adversely affect tolerances 2,1	Ground Behaviour 2,2	Damping characteristics reduced with > yield, softening 2,3	Profiles to minimise EDZ, creep, load asymmetry 2,4
Probably minor 3,1	Probably minor 3,2	Vibration effects 3,3	Foundation to provide adequate damping characteristics 3,4
Adequate space required for chosen mechanism 4,1	Methods to minimise EDZ and provide early cover to Molasse 4,2	To avoid design that amplifies vibrations 4,3	Construction & design 4,4

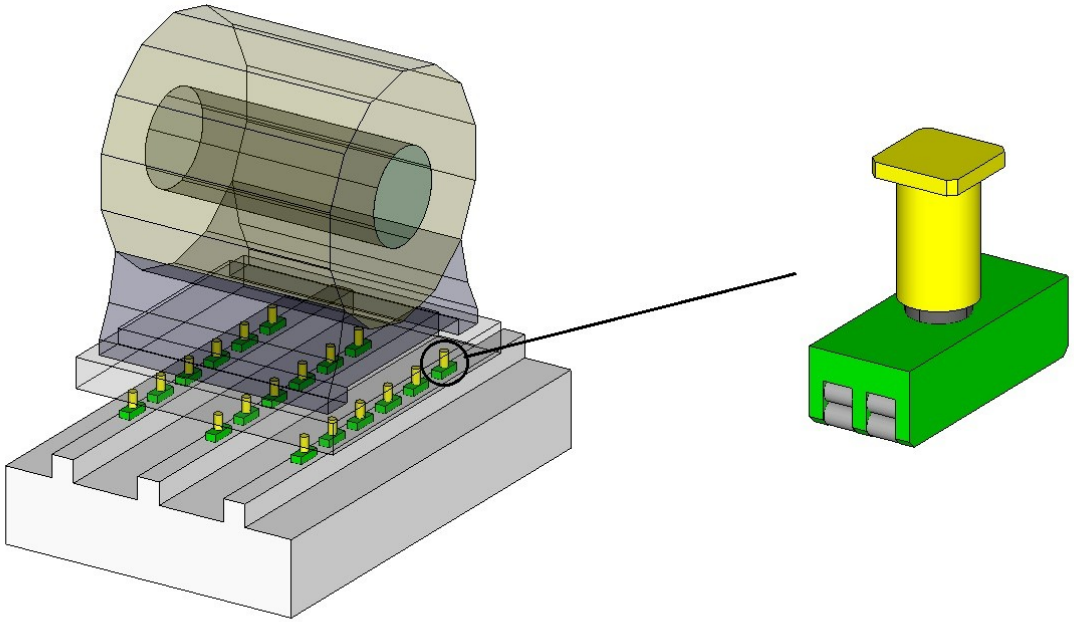
ARUP's matrix analysis strategy

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

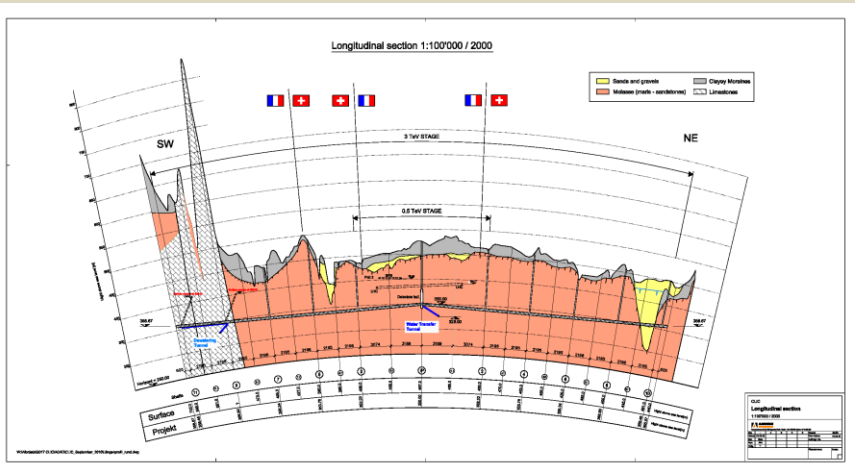


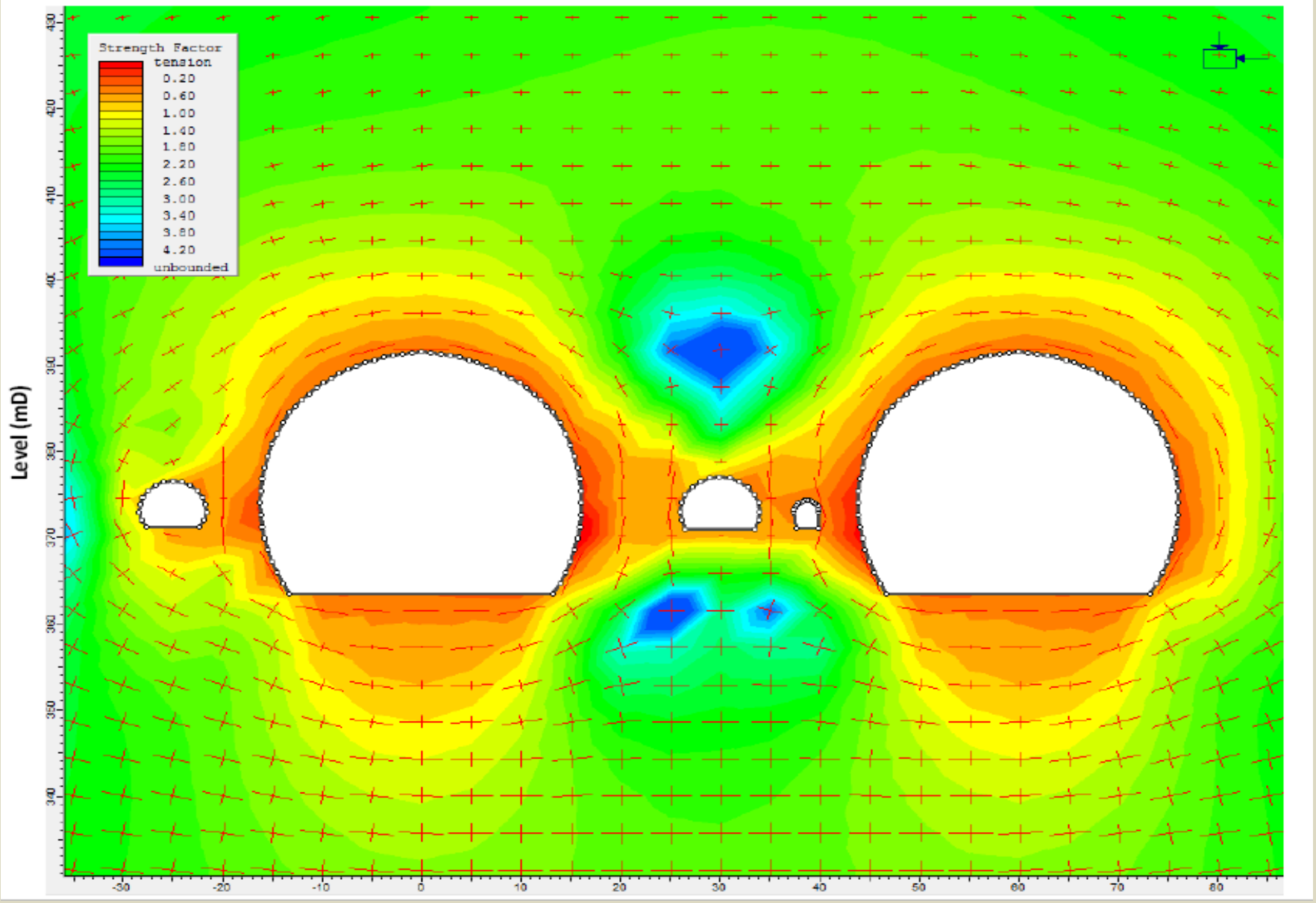


Air pads v Rollers for concrete platform movement will be further analysed

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





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.

Task 3 - Passive isolation slab design

- Required maximum relative rms displacement of the beams is 0.1nm.
- Below 4Hz, vibration can be mitigated by active systems through steering the beam.
- Provide passive isolation at the end of each accelerator tunnel, where the beams emerge from the tunnel before entering the detector.
- Slab could be approximately 50 – 100 tons of concrete, resting on several springs and dampers – this will be assessed through our evaluation, as outlined below.

Task 4 - Review of the Experimental Area design

- Layout of the shafts/cavern based on available geotechnical information and current space proofing.
- Review of suitability of various strata depths for cavern location

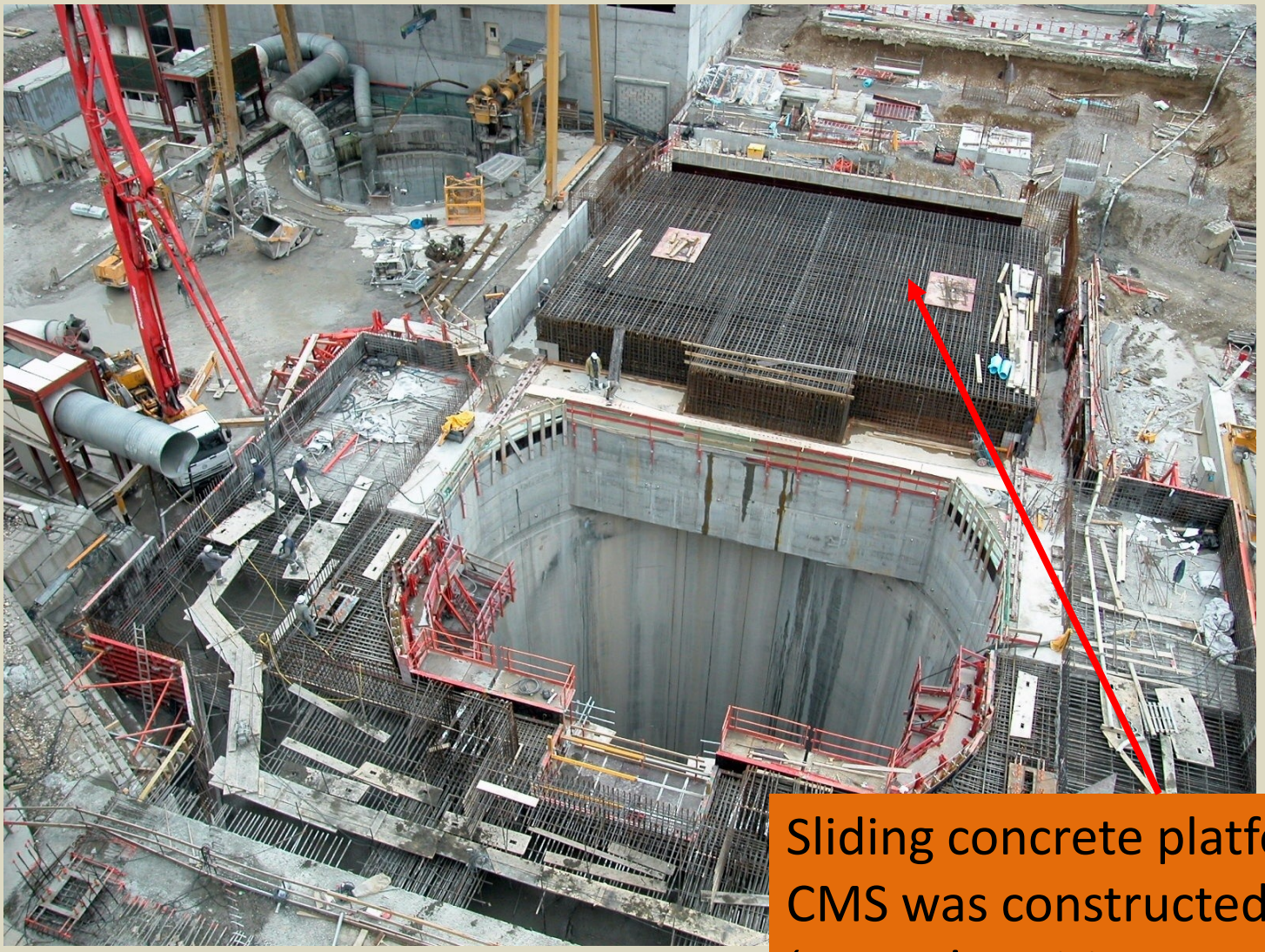
Budget for this Linear Collider IR study needs to be sourced :

- Possible cost sharing CERN & Fermilab

Some key decisions for ILC to resolve first, in order to allow a more 'useful' study :

- Are both detectors using the "concrete" platform strategy
- 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

Build-ability Issues for concrete platforms underground



Sliding concrete platform for CMS was constructed in the ‘garage’ position

2004

Steel plates with tangs placed on building floor slab


2004

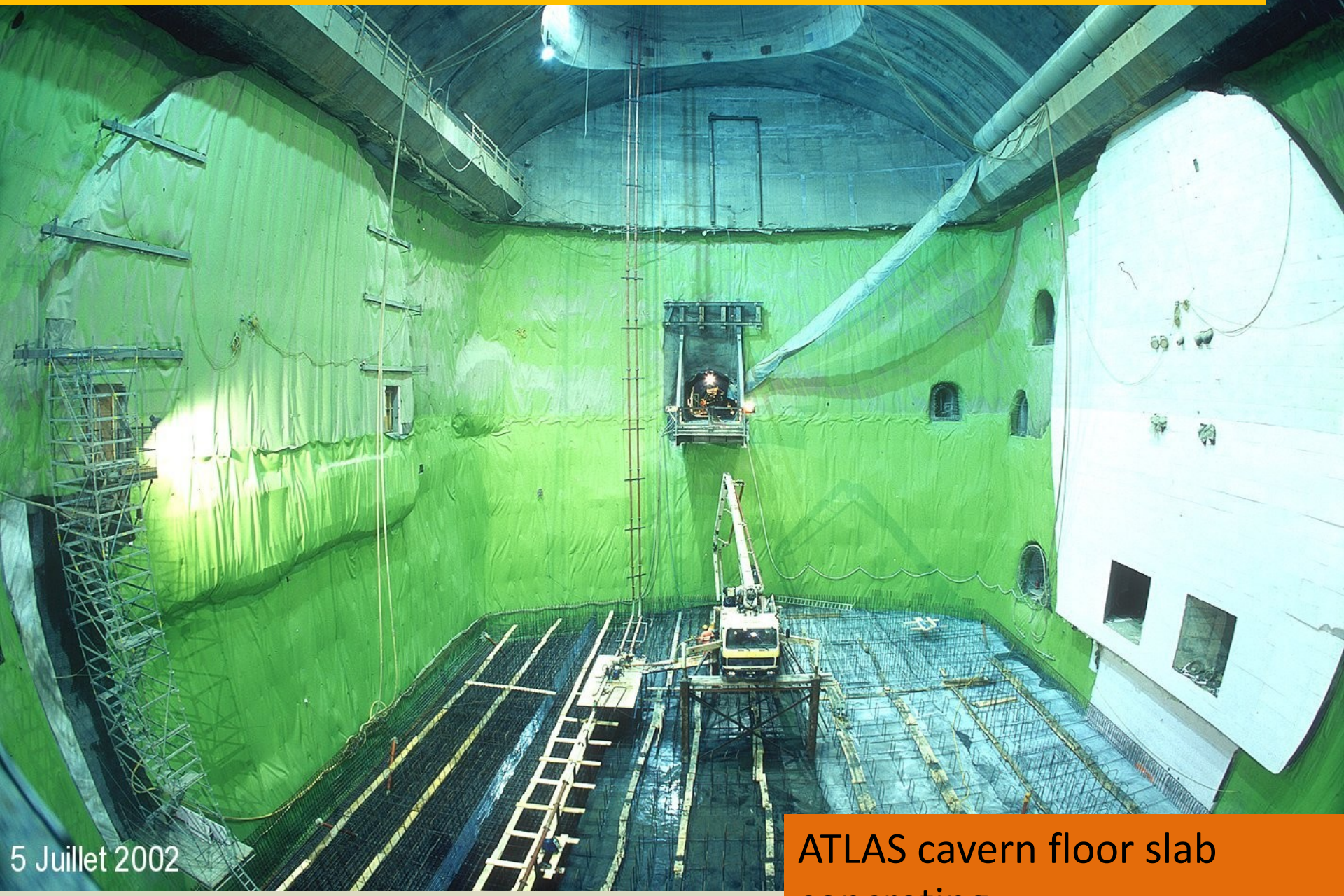
150 tons of reinforcing steel =(150Kg/m3)

Total weight 2200tons

2004

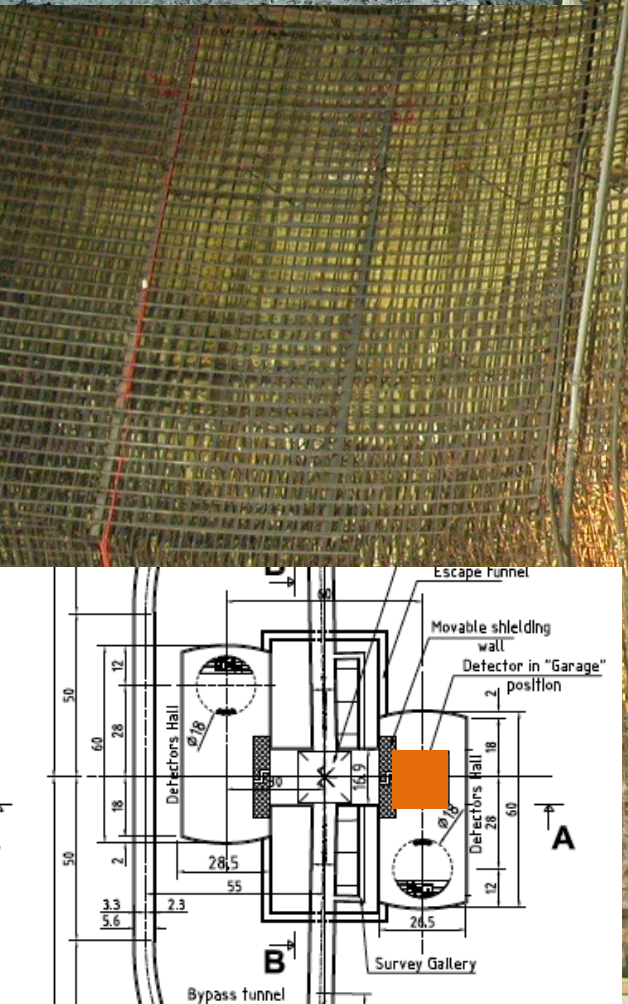

2004

Build-ability Issues for concrete platforms underground



ATLAS cavern floor slab concreting

ATLAS cavern wall concreting



CMS complexity of reinforcement

Conclusions

- Build-ability issues of concrete platforms is NOT a show-stopper
- CE Design studies for IR to be launched once budget is confirmed
- This study will be of benefit to both projects
- Several ILC detector issues need to be resolved before this study can go to the next level of detail