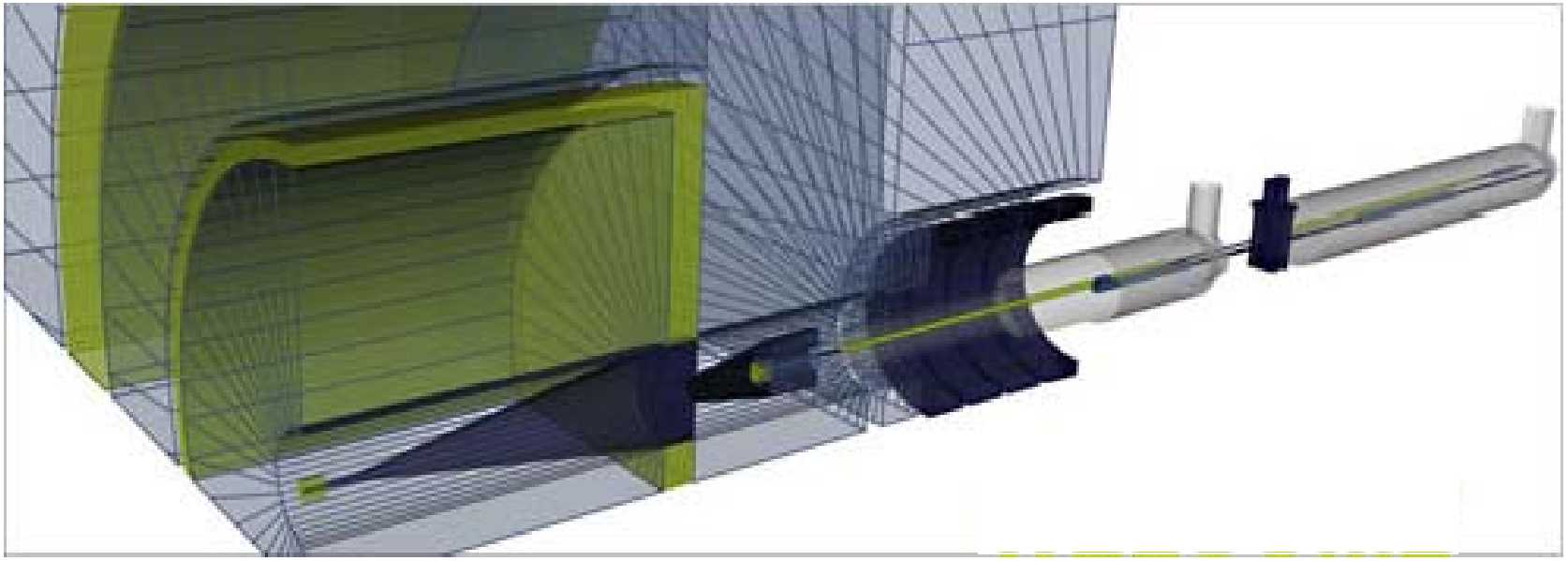
ILC Interaction Region Engineering Design Workshop

September 17-21, 2007
Stanford Linear Accelerator Center



Platform Issues

Marco Oriunno, SLAC

SiD Collaboration

Outline

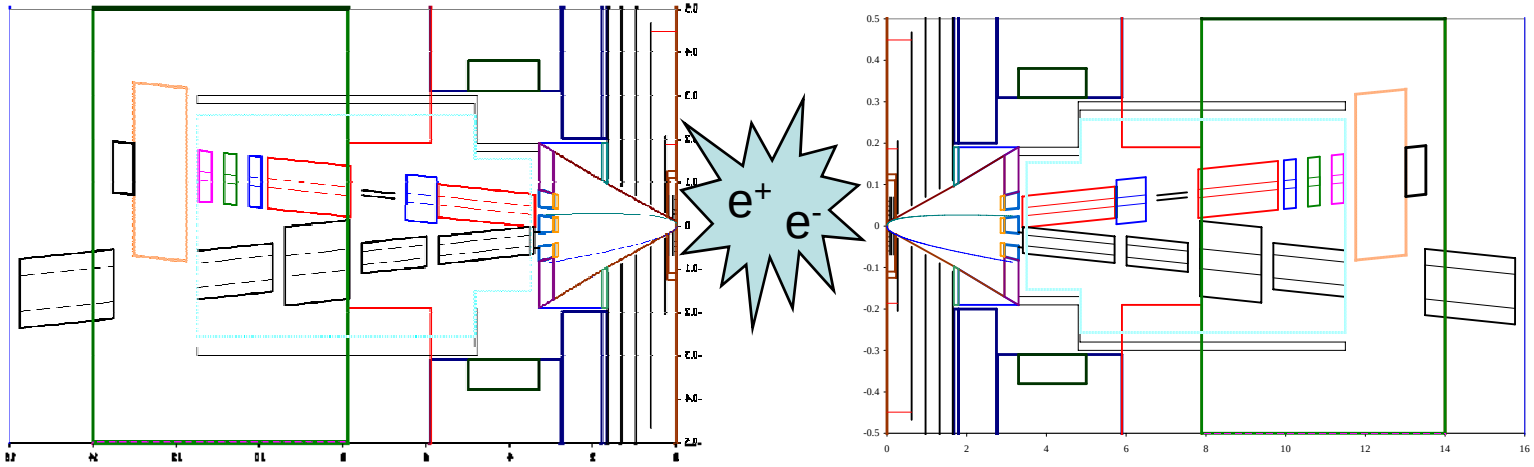
- The platform issues discussed in the WG and in the SiD engineering group meetings, held in preparation of the this workshop

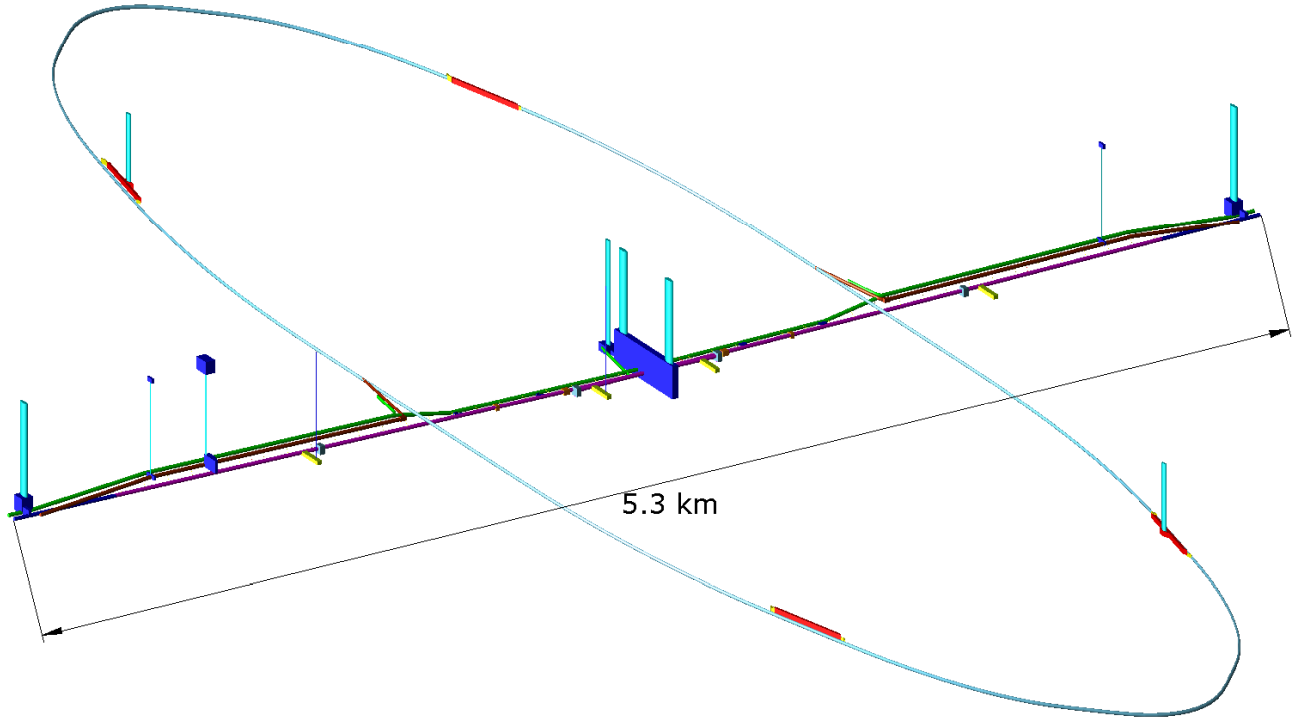
- A case study of the SiD push-pull is presented

- This talk contains contribution from the work of: J.Amann, M. Breidenbach, A.Herve, H.Gerwig, …..and all the colleagues of the SiD engineering group

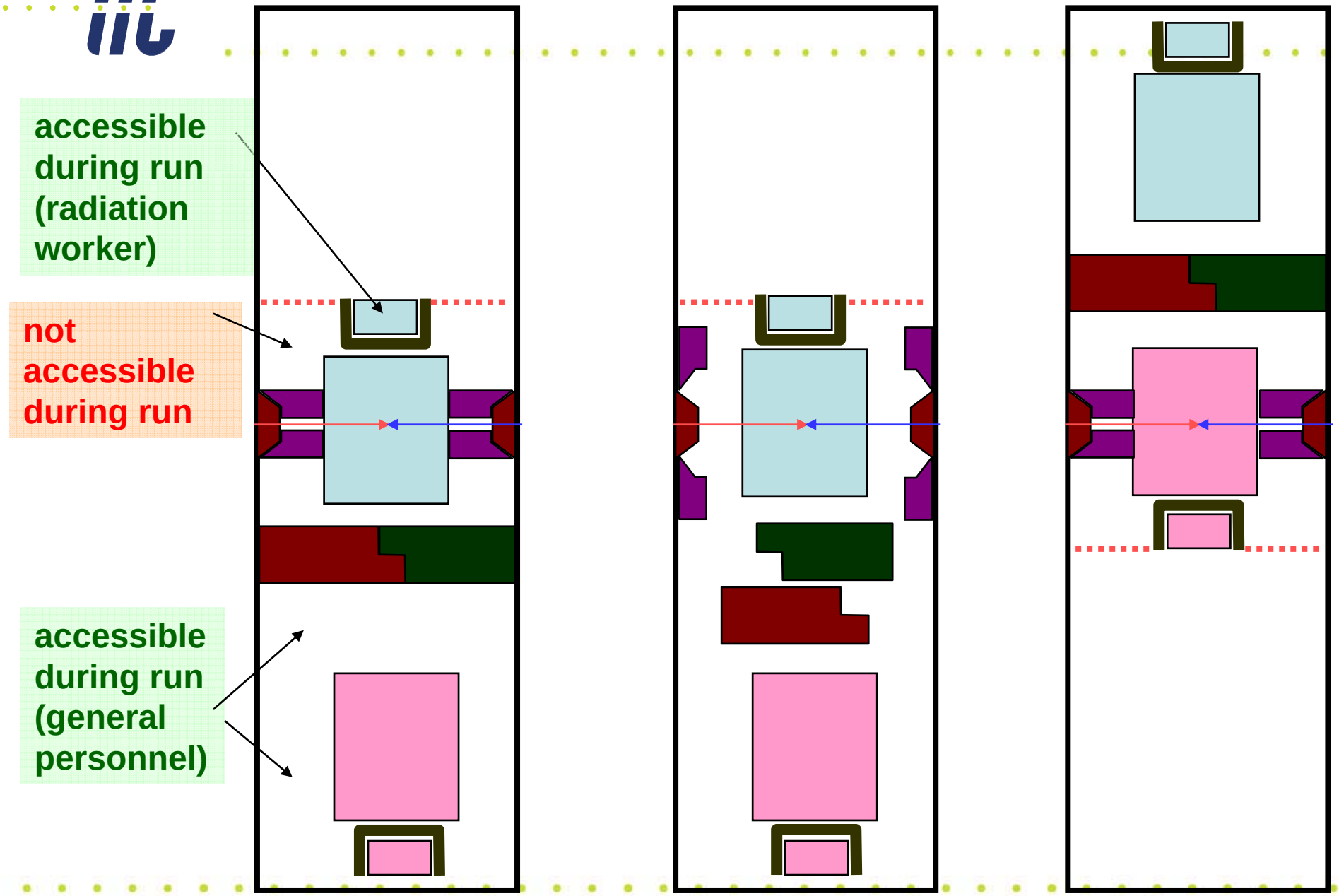
* WG-A, conveners meeting, July 5 (& minutes)
* WG-D, conveners meeting, July 11 (& minutes)
* WG-A, group meeting, July 12 (& minutes)
* WG-B, conveners meeting, July 13 (& minutes)
* WG-C, group meeting, July 17 (& minutes)
* WG-B, group meeting, July 23 (& minutes)
* WG-C, group meeting, July 24 (& minutes)
* WG-A, group meeting, July 30 (& minutes)
* WG-C, group meeting, July 31 (& minutes)
* WG-D, group meeting, August 1 (& minutes)
* WG-B, group meeting, August 2 (& minutes)
* WG-A, group meeting, August 6 (& minutes)
* WG-C, group meeting, August 7 (& minutes)
* WG-A, group meeting, August 13 (& minutes)
* WG-D, group meeting, August 15 (& minutes)
* WG-B, group meeting, August 16 (& minutes)
* WG-A, group meeting, August 20 (& minutes)
* WG-C, group meeting, August 21 (& minutes)
* WG-A, group meeting, August 27 (& minutes)
* WG-C, group meeting, August 28
* Conveners and IPAC meeting, August 29
* WG-B, group meeting, August 30
* WG-B, group meeting, September 13

ILC baseline : single Beam Delivery System, 14mrad scheme





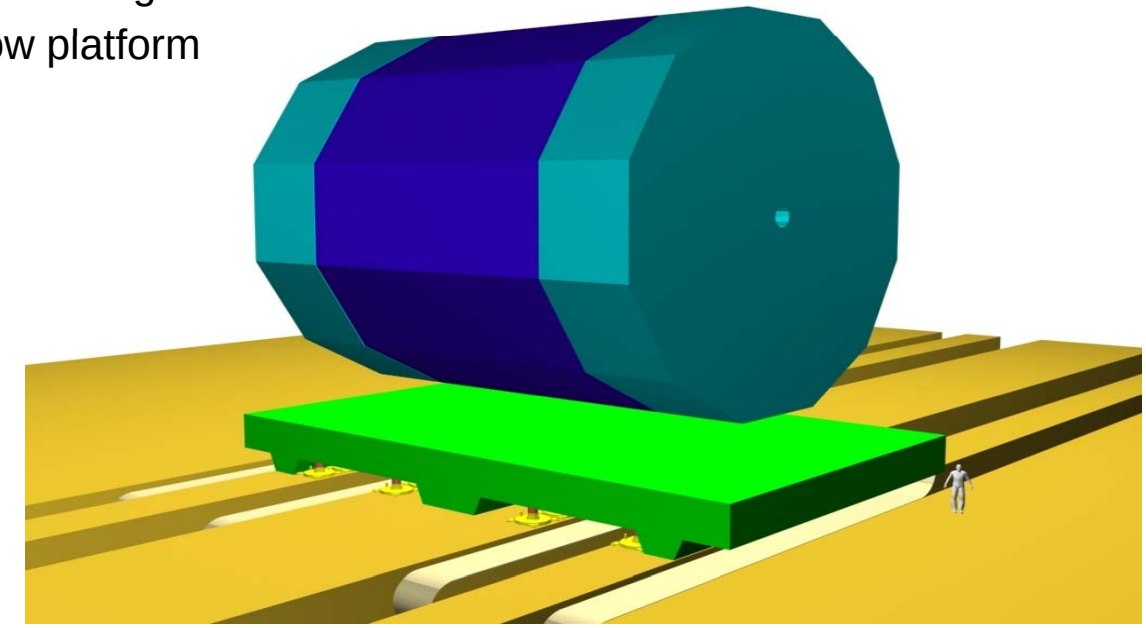
Push-Pull


accessible during run (radiation worker)
not accessible during run
accessible during run (general personnel)

Basic ideas about the moving platform

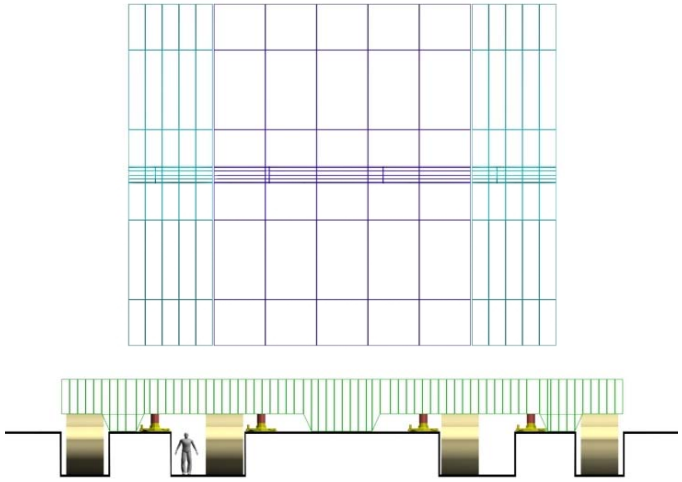
(A.Herve / H.Gerwig, CERN)

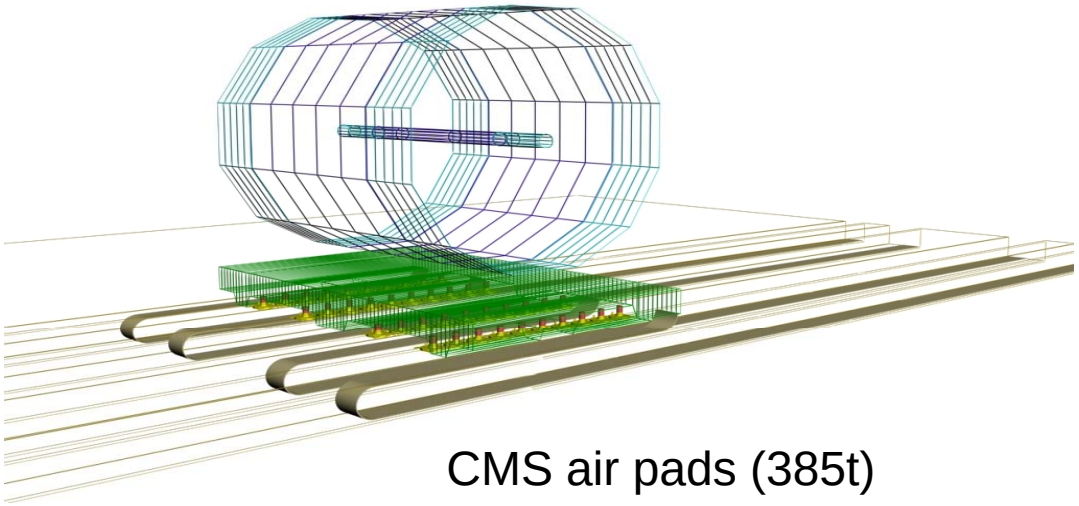
- Could be made of reinforced concrete f.ex.
- About 2.25 m thick, 21 m long and 12 m wide
- Weight 1100 tons, detector on it ca. 15000 tons
- Hilman rollers or airpads to move platform
- Friction = 1%, movement horizontal (no slope)
- Hydraulic jacks of ca. 200 tons needed
- Access for maintenance and exchange are foreseen
- Cable chains in trenches below platform



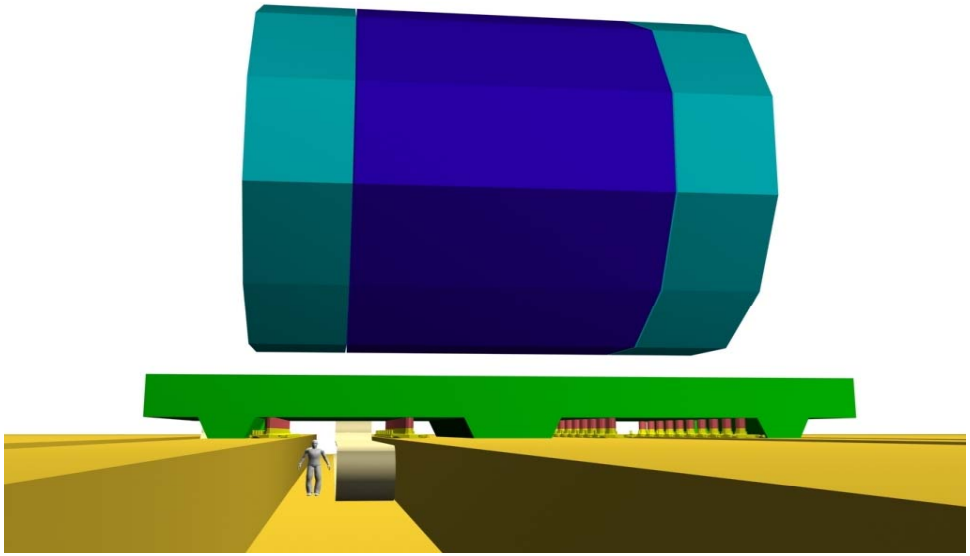
Cable chain in trench

(A.Herve / H.Gerwig, CERN)





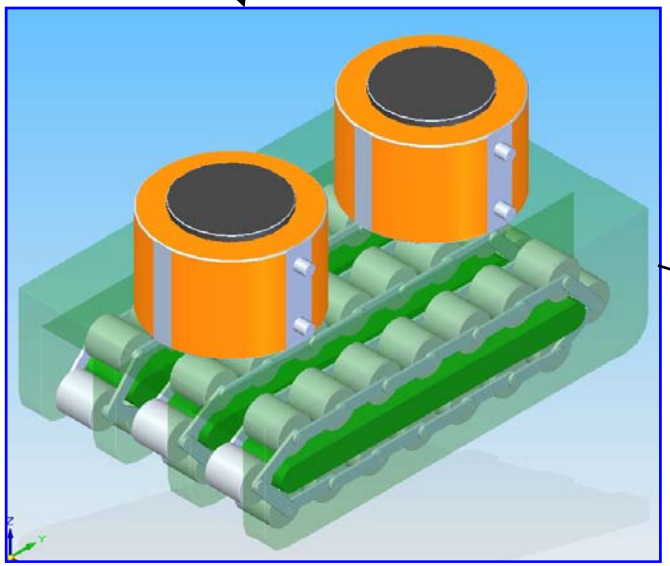
CMS air pads (385t)

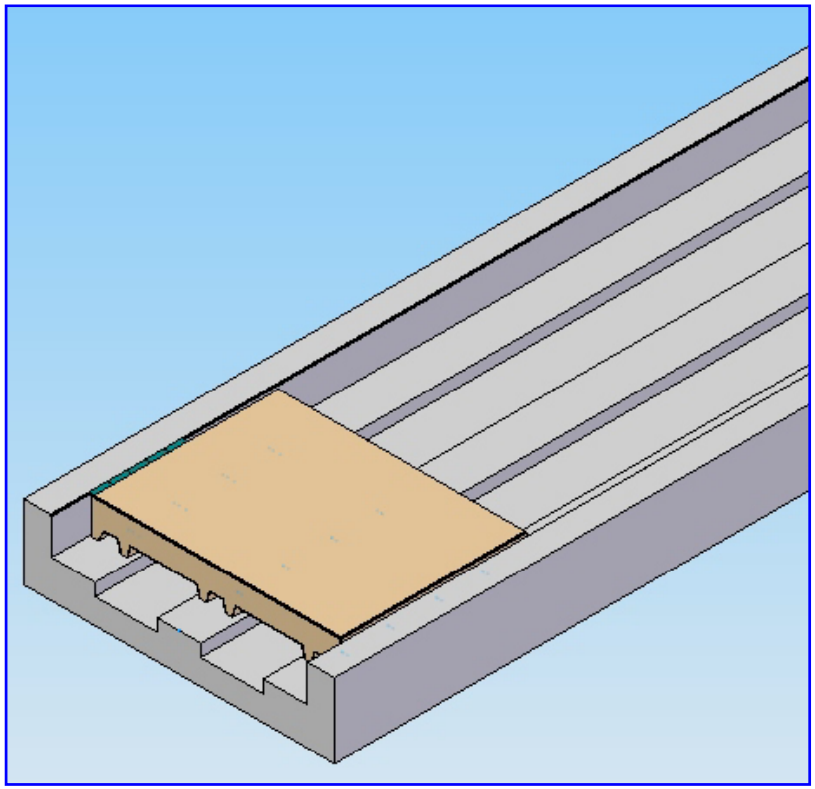


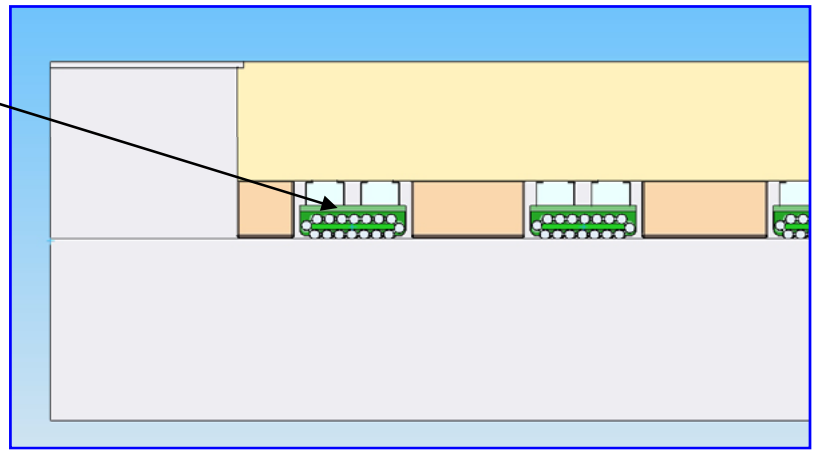
Sliding Platform Design Concept

J.Amann (SLAC)

Uses 1.5kT roller module with 1kT hydraulic jacks. Design must be optimized to distribute load evenly over roller module.







Is a platform needed for Push-Pull?

Marty Breidenbach

- A platform may be motivated by the basic detector architecture – e.g. a legless structure might need a platform.
- A stiff platform might be useful if the detector is floppy – but a stiff platform needs some height – which is likely to increase the beamline elevation in the IR Hall – which is probably expensive.
- A stiff platform might be useful if the floor is uneven – but see above. It seems relatively easy to adjust detector leg length hydraulically. (A 560 ton hydraulic jack with a follow nut costs ~$9K)
- The floor may move when loaded and unloaded on a scale that must be corrected. A platform doesn't directly address this.
- A platform could carry auxiliary equipment, such as the solenoid power supply, dump resistors, etc. It seems plausible that this kind of equipment could be on platforms on top and on the sides of the detector, which would not raise the beamline.

Comments

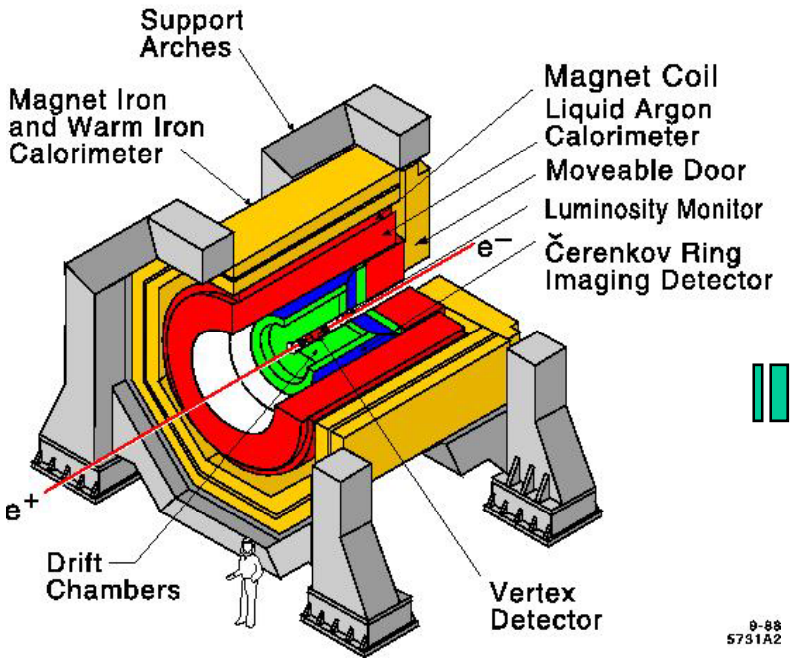
Marty Breidenbach

- A platform provides a transversely stiff support for the detector so it can be pushed or pulled without distorting the structure. True- but this would appear to need some analysis to compare the costs of a platform to the costs of struts between the legs to get the necessary stiffness.
- SLD moved on 8 500 ton Hilman Rollers supporting 500 ton jacks, pushed by long stroke jacks. Worked well, but would not copy for SiD. Would suggest looking at roller system on a guide track, and moved by a ball screw(s).
- Whatever the motion system is, it should be a detector responsibility and cost!

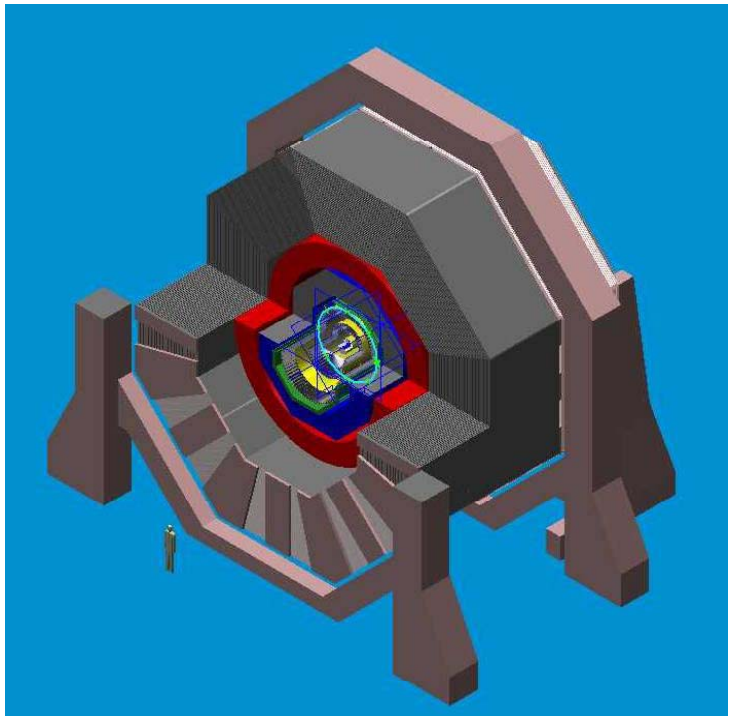
~~SLD~~..... SiD

evolution of a proven concept

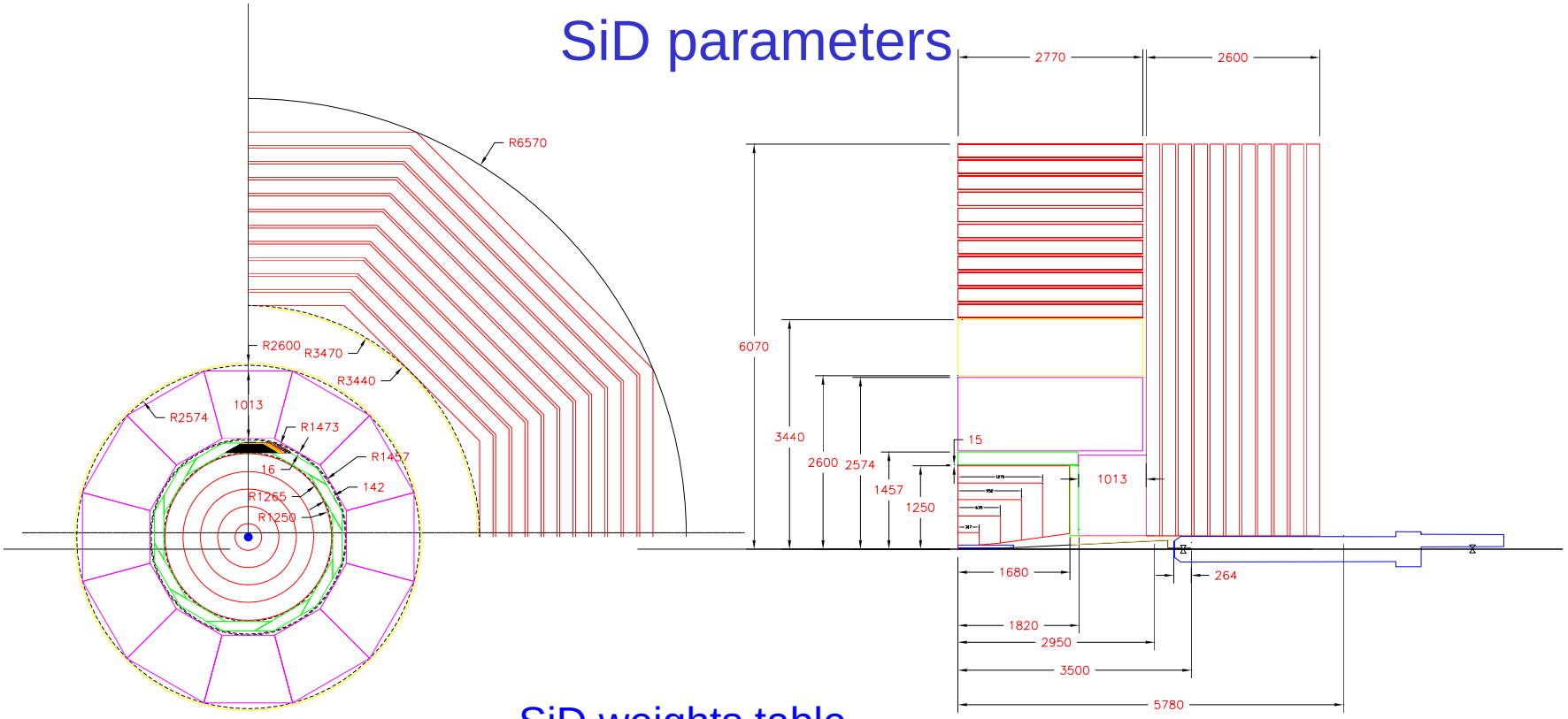
SLD



SiD



SiD parameters



SiD weights table

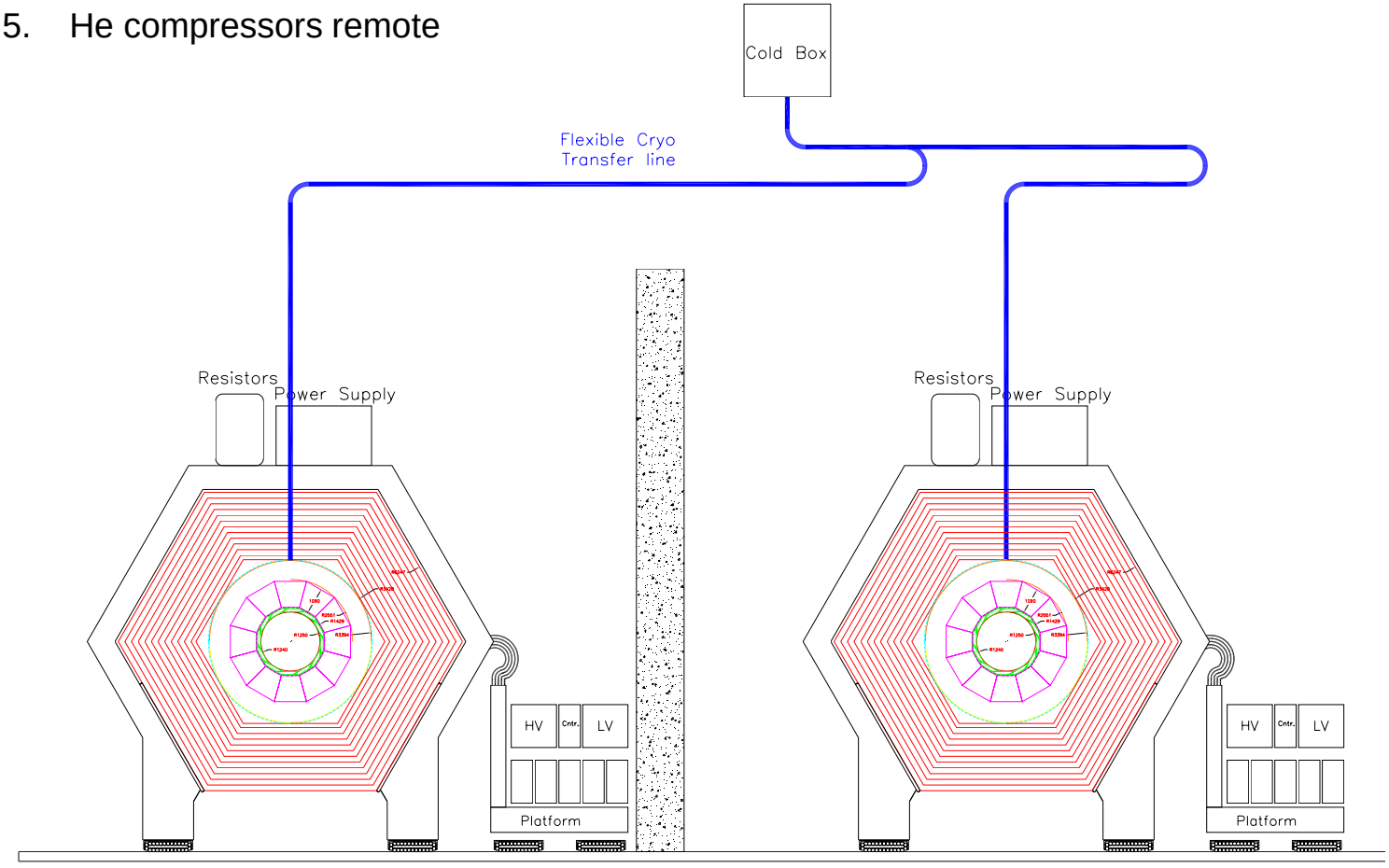
Item	Tons
Tracker + VTX	3
Ecal Barrel	59
Hcal Barrel	367
Total Inner Detectors	**429**
Cold mass	104
Vacuum Tank	117
Yoke Barrel	3000
Muon detectors Barrel	50
Self Shielding Barrel	100
Infrastructure	50
Feet x 6	180
Barrel subtotal	**4459**

Item	Tons
Doors	
Ecal Fwd	10
Hcal Fwd	23
Yoke Forward	2315
Muon Forward	30
Feet x 2	60
Self Shielding Forward	50
BDS	5
Door subtotal	2493
Two Doors total	4986

SiD Gran Total	**9445**

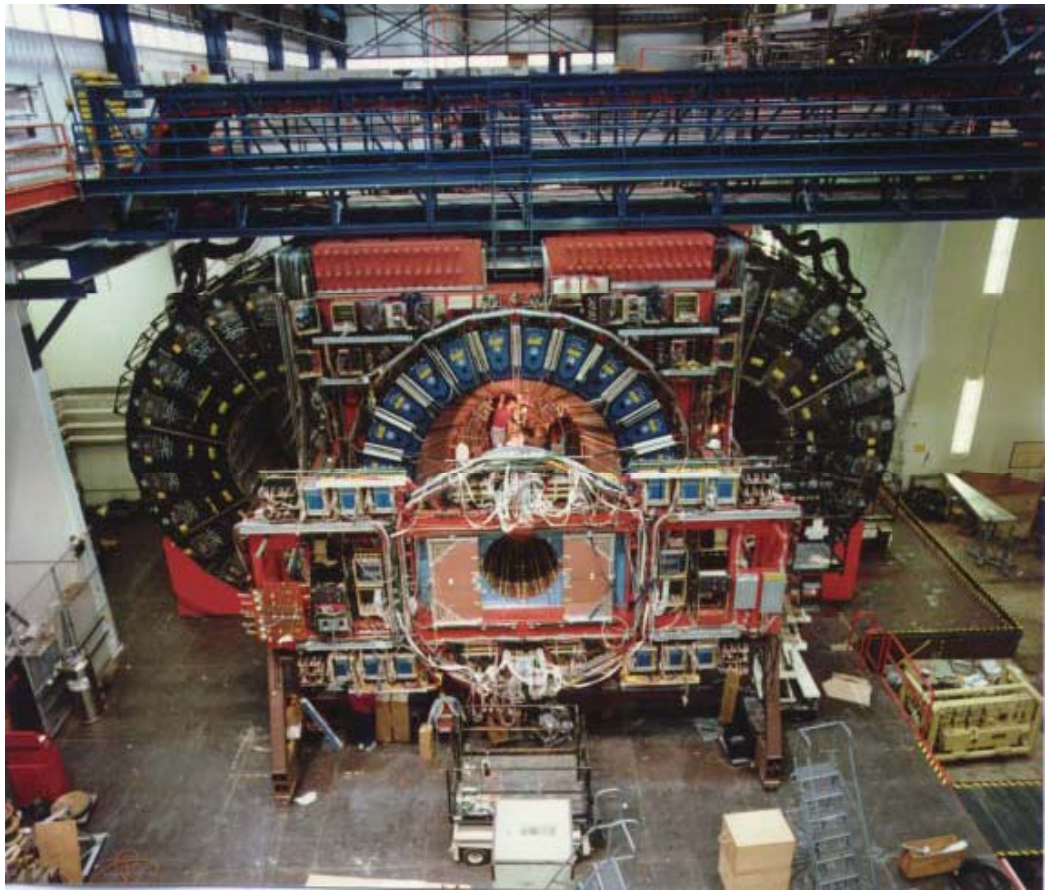
IR Hall Assumptions

1. Push-Pull and doors opening with Hilman Rollers
2. Racks and ancillaries on SiD or on a side platforms (location driven by the the fringe field)
3. Cold Box off detector (in the hall)
4. Flexible cryogenic transfer line (100mm OD) Solenoid-Cold box
5. He compressors remote



Using Hilman Rollers

- Hilman Rollers are industrial proven successful devices for very heavy loads
- Their usage is virtual unlimited
- Hilman Rollers have small deflections and compact footprint



D0 detector

Removing a large heavy reactor from the upper level of the refinery presented a challenge. A customized transport cart was fabricated using four 50-QT **HILMAN ROLLERS**. The cart enables each half of the reactor to be rolled onto a deck and then removed by crane.

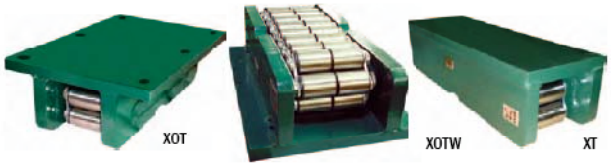
ILC applications

SHD SERIES

- **INDIVIDUAL ROLLERS 100-1000 TONS**

*Heavy structures skate almost effortlessly on **Hilman's** SHD Series (Super Heavy Duty) Rollers! With load capacities from 100 to 1000 tons per unit, virtually any load is transportable. Typical applications range from installing steam generators or precipitators, rolling entire bridges, advancing launching trusses, skidding drill works aboard offshore rigs, even relocating entire multi-story structures!*

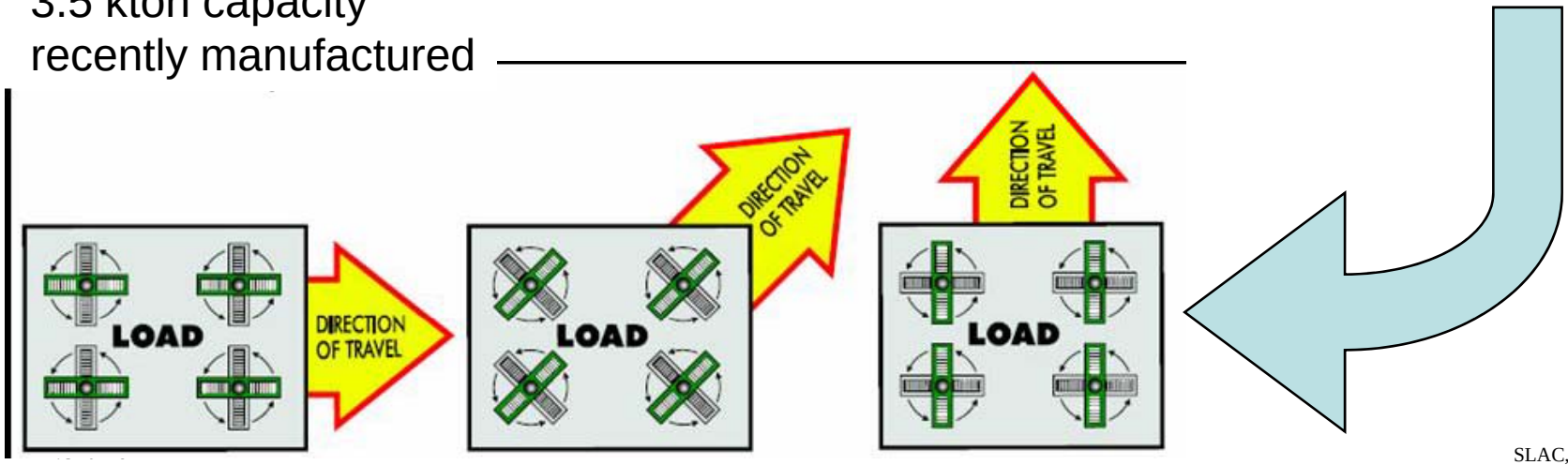
*The same top plate configurations are available as for **Hilman Roller's** OT, T and NT Series. The "T" style top is flush with the frame body width and length. The "NT" style top overhangs the body at the ends. The "OT" style top overhangs the body sides. 150 and 200 ton SHD Series Rollers have long frame and wide frame configurations as well. Standard hole patterns are supplied in the OT and NT versions. The user can specify no holes if preferred. Special modifications, such as drilled and tapped holes, short or wide versions are also available.*



CAPACITY (TONS)	PRODUCT NUMBER	HEIGHT in	mm	TOP PLATE WIDTH in	mm	TOP PLATE LENGTH in	mm	WEIGHT lb	kg	CONTACT ROLLS	
100	100-XT	6-3/4		171	8	203	21	533	217	98	7
150	150-XTL	6-3/4		171	8	203	32	813	329	149	11
150	150-XTW	6-3/4		171	9-7/8	251	21	533	307	139	14
200	200-XTW	6-3/4		171	12	305	21	533	313	142	14
200	200-XTWC	6-3/4		171	14-1/2	368	21	533	387	176	14
300	300-XT	10		254	10-3/4	273	34	864	706	320	8
500	500-XT	10		254	20	508	34	864	1290	585	16
750	750-XT	consult factory for specifications and weights									
1000	1000-XT	consult factory for specifications and weights									
100	100-XNT	6-3/4		171	8	203	27	686	242	110	7
150	150-XNLT	6-3/4		171	8	203	38	965	365	166	11
150	150-XNTW	6-3/4		171	9-7/8	251	27	686	280	127	14
200	200-XNTL	6-3/4		171	8	203	42	1067	396	180	14
200	200-XNTW	6-3/4		171	12	305	27	686	333	151	14
200	200-XNTWC	6-3/4		171	14-1/2	368	27	686	408	185	14
300	300-XNT	10		254	10-3/4	273	42	1067	739	335	8
500	500-XNT	10		254	20	508	42	1067	1355	615	16
750	750-XNT	consult factory for specifications and weights									
1000	1000-XNT	consult factory for specifications and weights									
100	100-XOT	6-3/4		171	14	356	21	533	250	113	7
150	150-XOTL	6-3/4		171	14	356	32	813	399	181	11
150	150-XOTW	6-3/4		171	16	406	21	533	299	136	14
200	200-XOTL	6-3/4		171	14	356	36	914	463	210	14
200	200-XOTW	6-3/4		171	21	533	21	533	364	165	14
200	200-XOTWC	6-3/4		171	21	533	21	533	423	192	14
300	300-XOT	10		254	21	533	34	864	849	385	8
500	500-XOT	10		254	30	762	34	864	1430	649	16
750	750-XOT	consult factory for specifications and weights									
1000	1000-XOT	consult factory for specifications and weights									

3.5 kton capacity
recently manufactured

Swivel Ram Roller



A preliminary model of the SiD services

- Electronics:
  - SiD is instrumented with pulse power electronics, active for ~5 ms/s (200Hz).
  - Platforms for many services can be located on the sides of SiD, assuming fringe fields are ok. A platform of ~full footprint can be either on top or beside SiD, depending on hall optimization.
  - Warm Tracker and SVX, i.e. +20°C, low consumption electronics

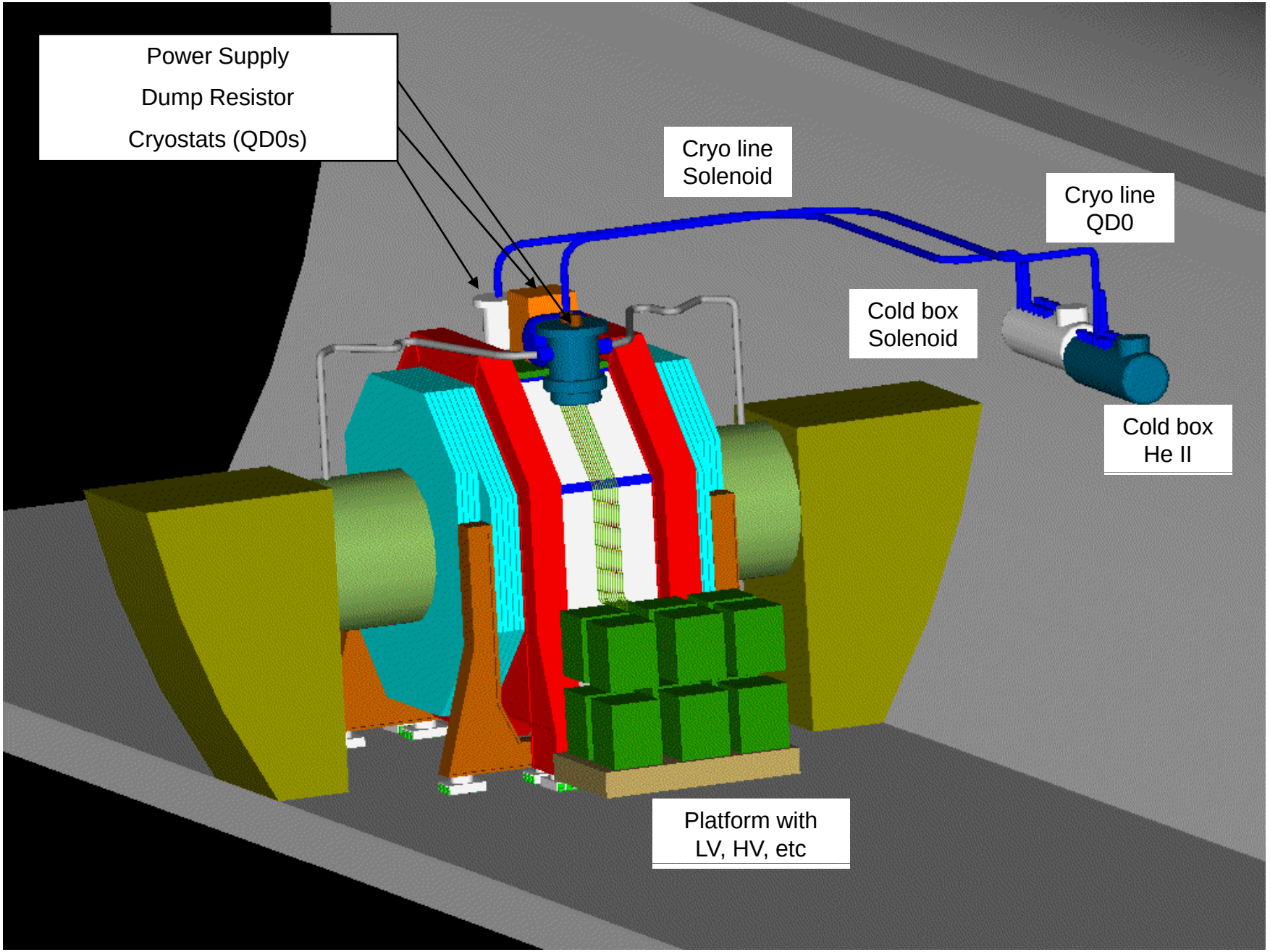
+

- Solenoid:
  - ~200 KW supply on detector – charging time of ~4 hours
  - Dump resistor (pressurized water load) on detector (cylinder ~2 m D x 3m high).
  - ~15 KW solenoid leads
  - Liquefier is located in hall, off detector.
  - Compressors are remote to avoid vibration.
  - Liquefier – detector connection is by flexible quad-axial line.
- Connection is ~10 cm OD.

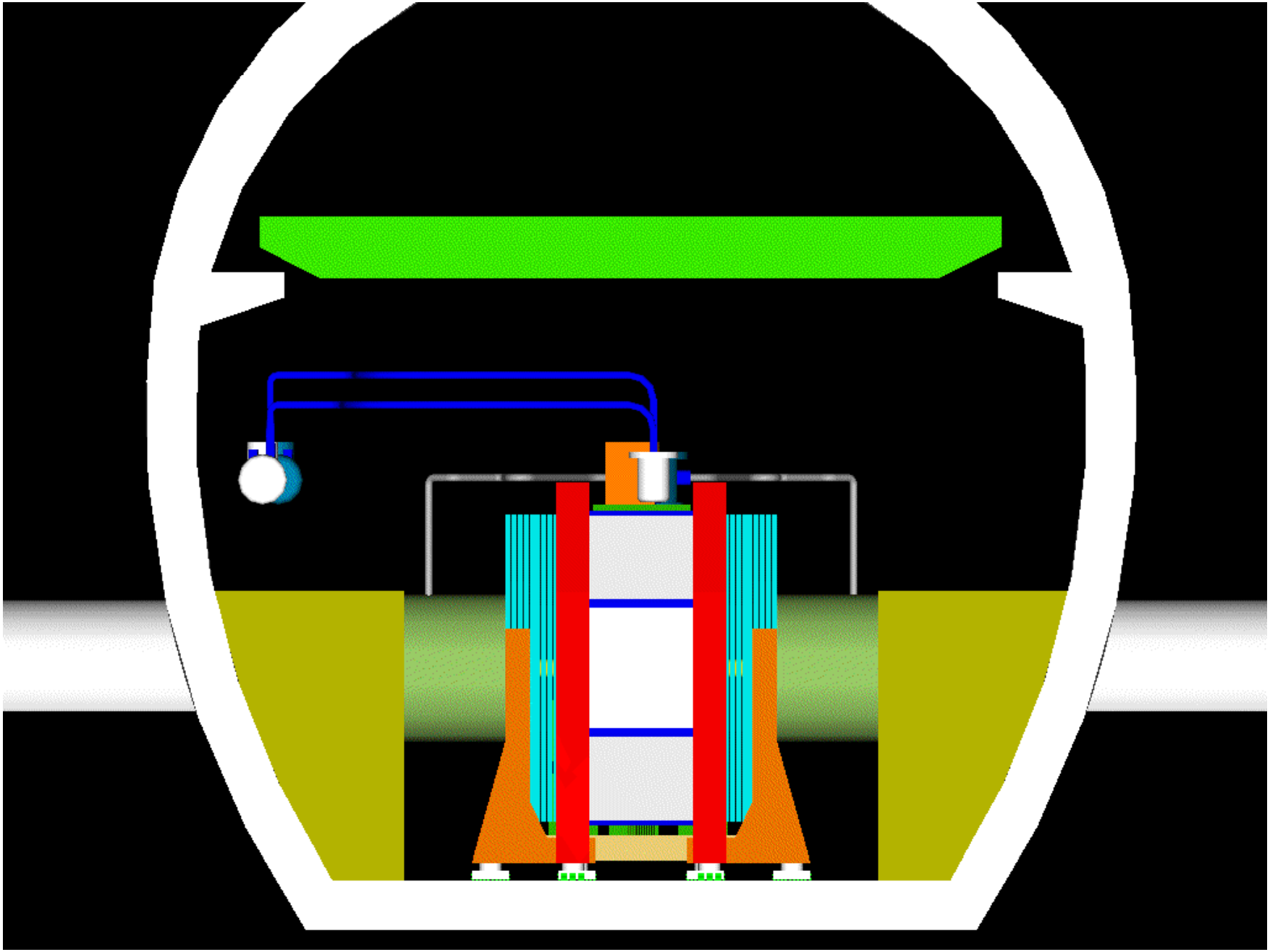
=

- All services so far envisioned can be flexible.
- SiD will return most of its power to chilled water and LCW systems, and relatively little to the HVAC.
- Connection to "outside" world are mainly a few AC connections, a few (<10) fibers: easy to connect/disconnect.
- It appears that the SiD services could connect overhead without difficulty.

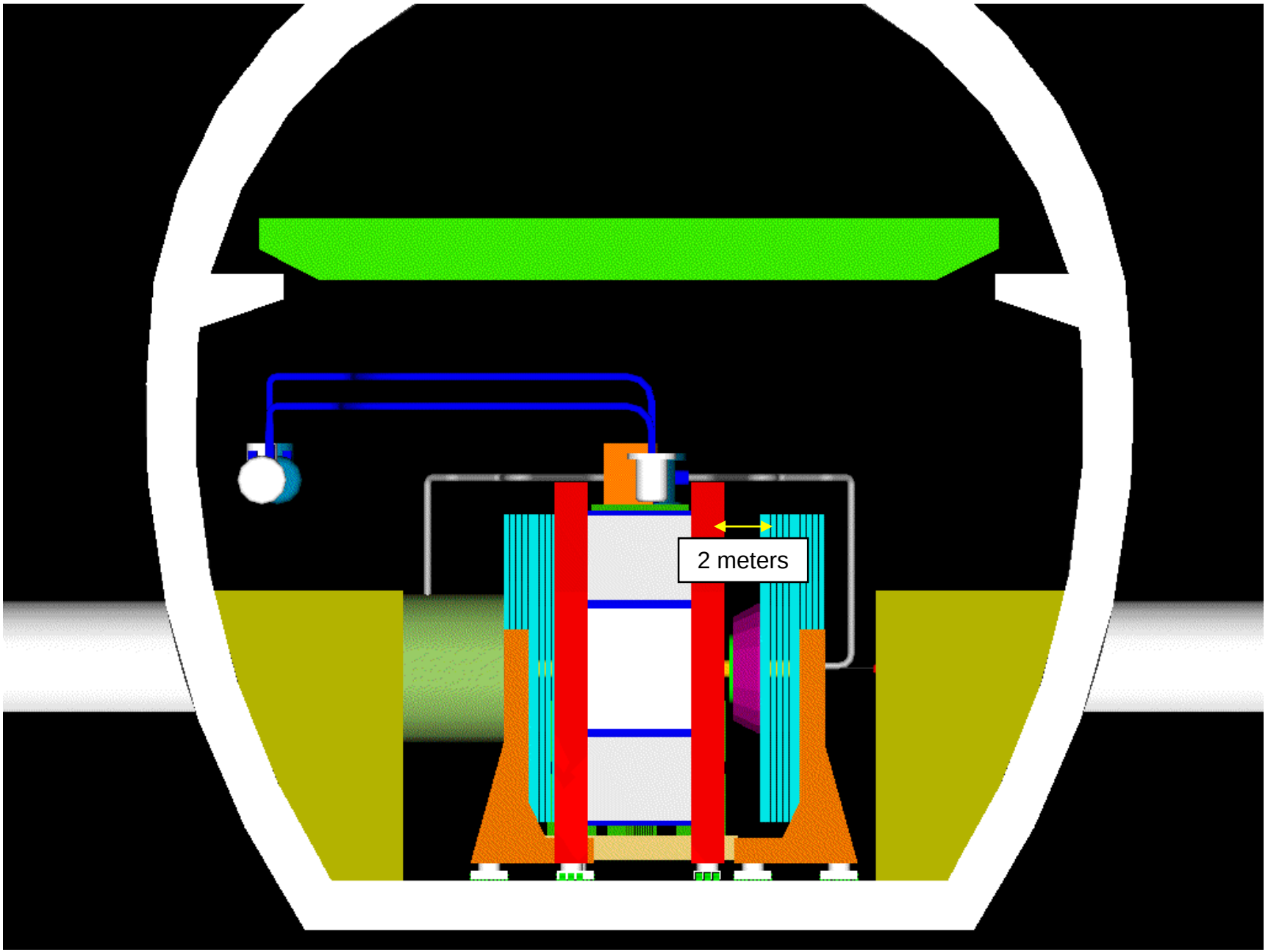
SiD closed on the beam



SiD closed on the beam



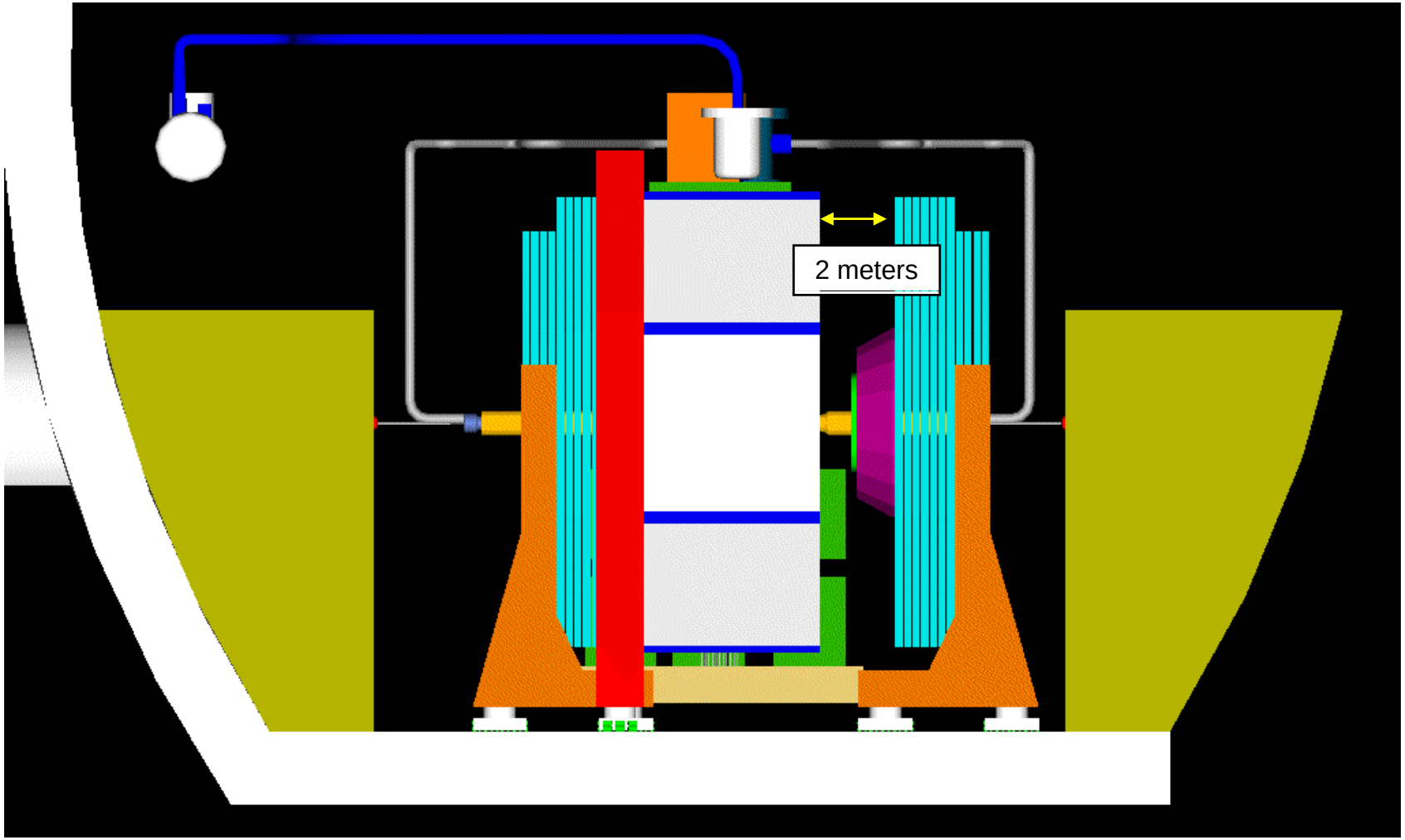
SiD opening @ 2 m on the beam



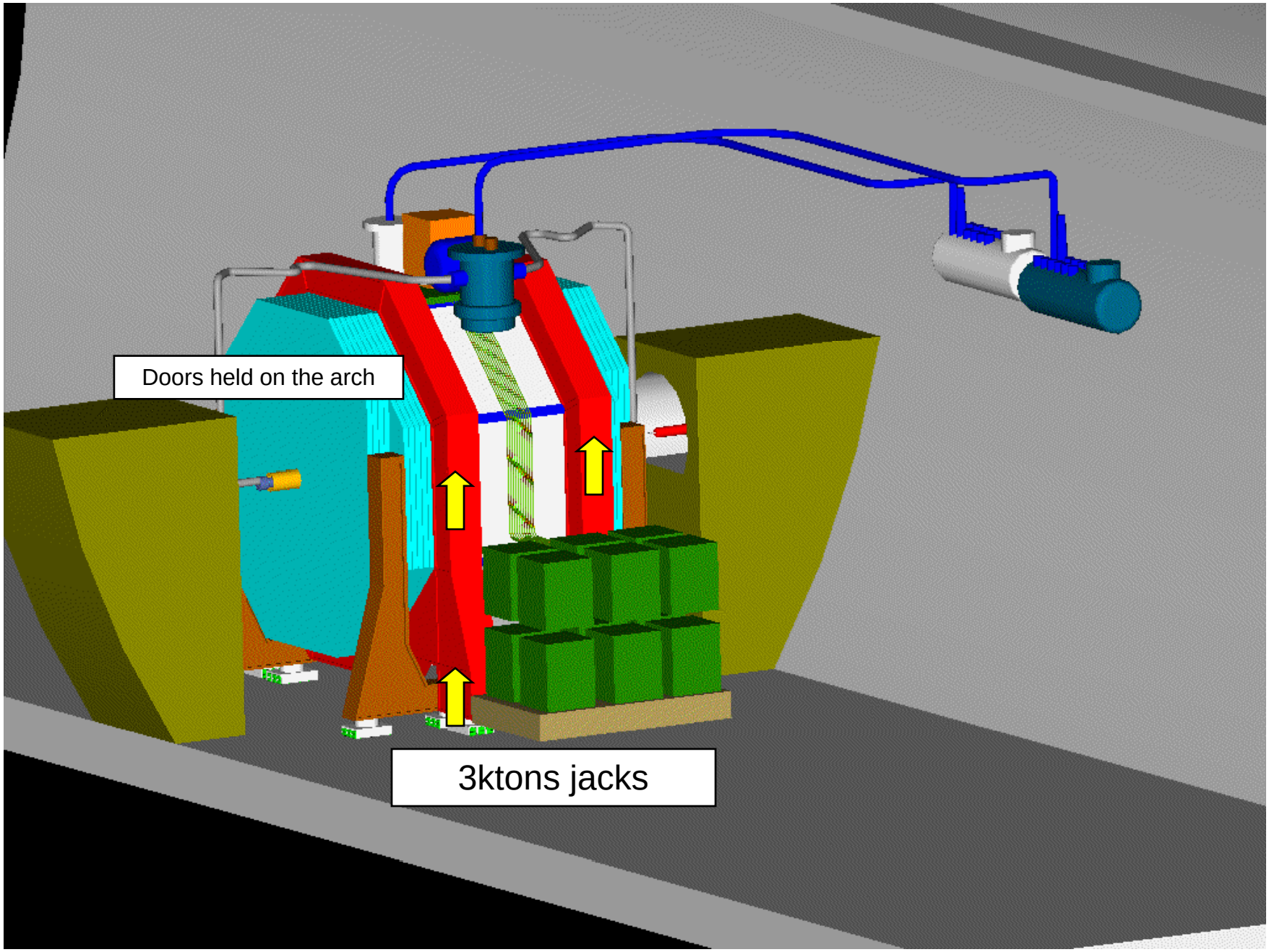
QD0 support tube

Supported and stabilized in the doors

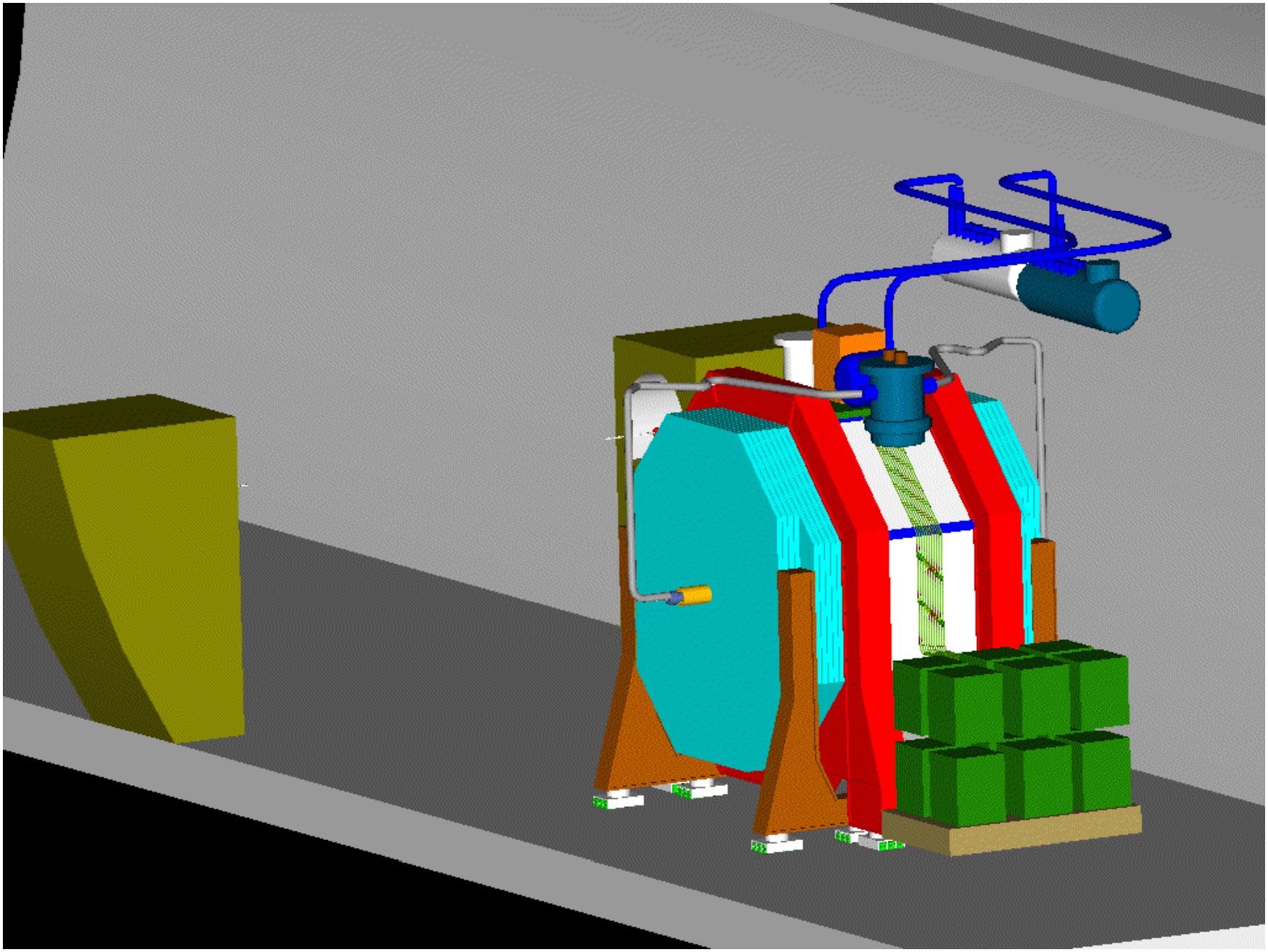
Sliding mechanism for the 2 m opening on the beam



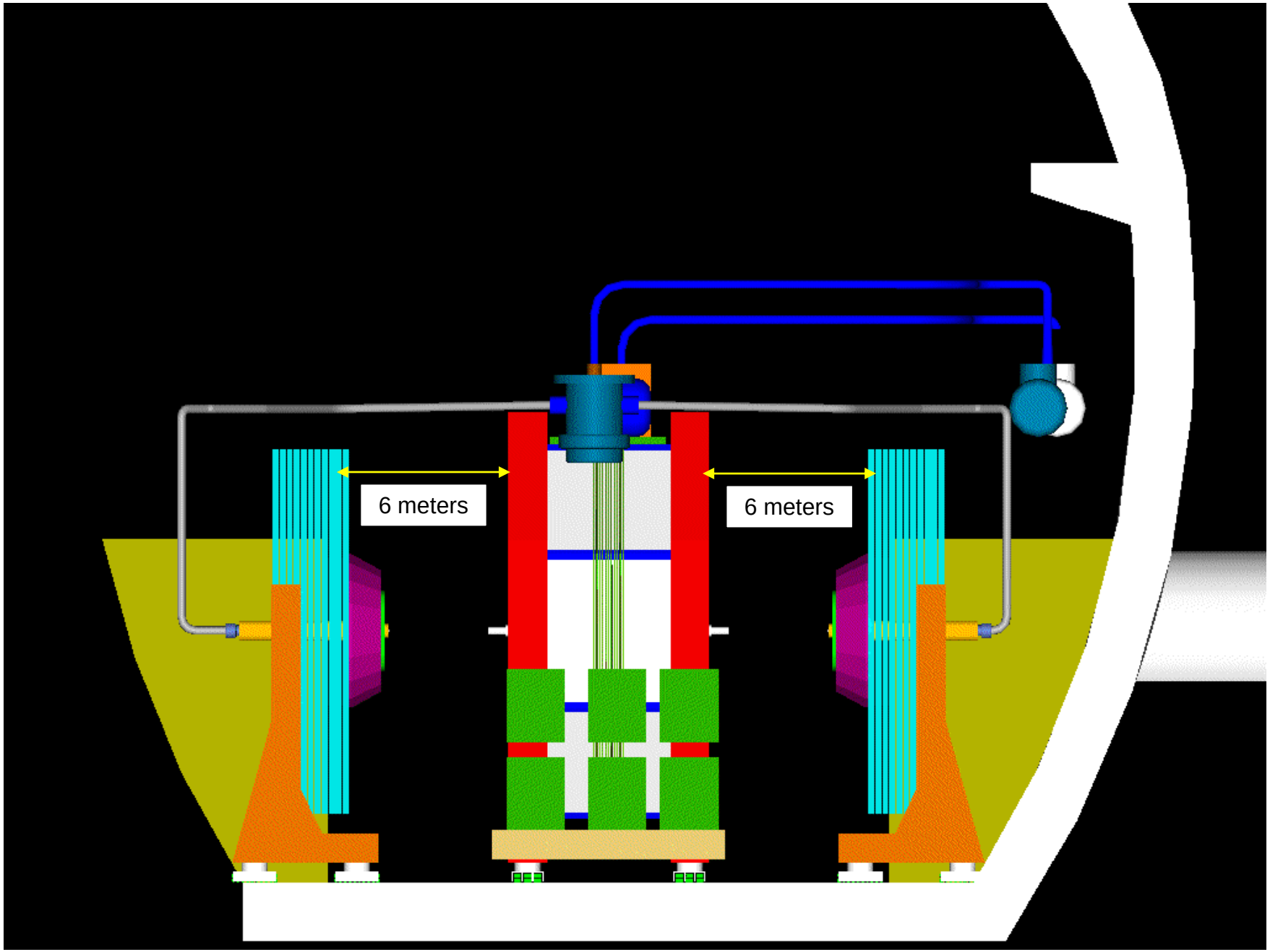
SiD Push-Pull



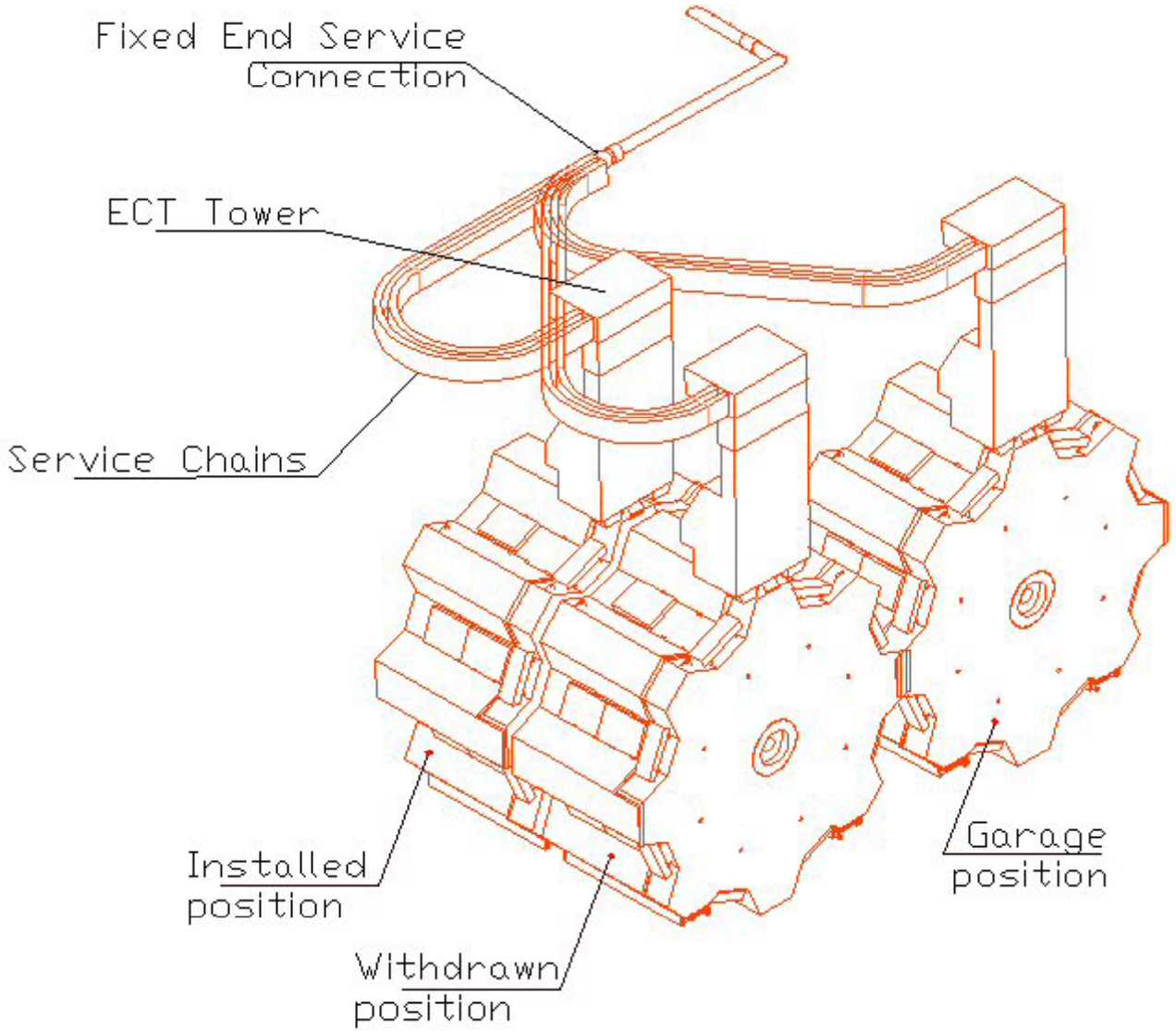
SiD push-pull (30 meters stroke)



SiD opening @ 6 m off the beam



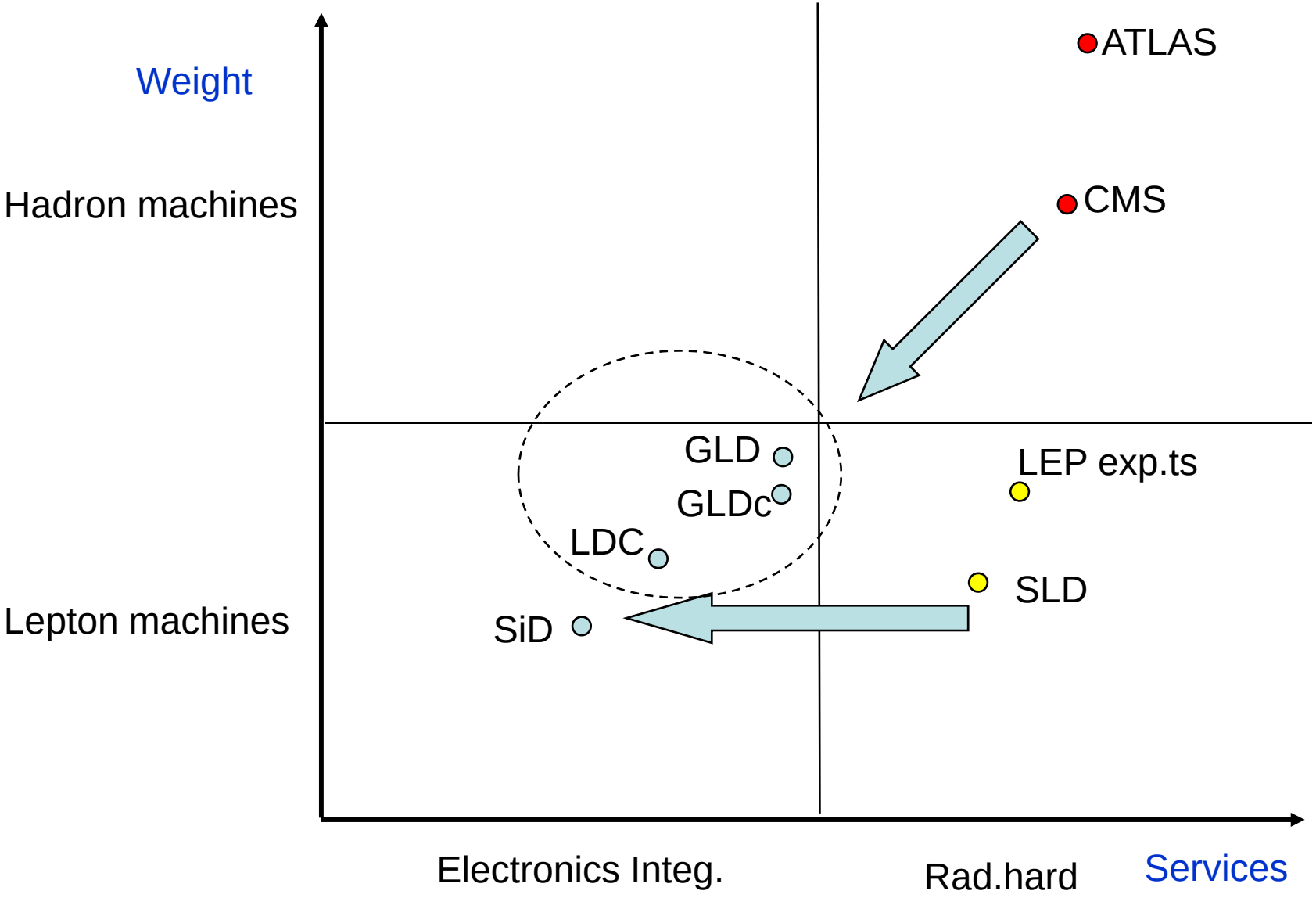
Cryogenics Transfer Line End Cap (ATLAS)



Conclusion

- The push-pull problem evolves in a bidimensional space : weight of detectors, amount of umbilicals
- Platform is an appealing concept for large detectors requiring large amount of services
- Compact detectors with integrated electronics can directly move on the floor if well engineered from the beginning
- No virtual limitation in the Hilman rollers capacity, viable for large detectors
- Magnets (Solenoid and QD0) drives the services requirements on the detector
- ILC detectors will have a generational gap and different constraints from the LHC :
    - very limited radiation
    - low consumption and fast electronics (…and pulsed)
    - higher level of on board integration possible for the above reasons
- Can the big detector drives the requirements of the smaller ?
- Can both solutions be implemented in the IR hall ?
- A compact detector can be swapped and calibrated in shorter time

Evolution Map



…and talking about evolution branches

One should look at similar examples in the nature !

…..an optimization process over million years

The push-pull dilemma