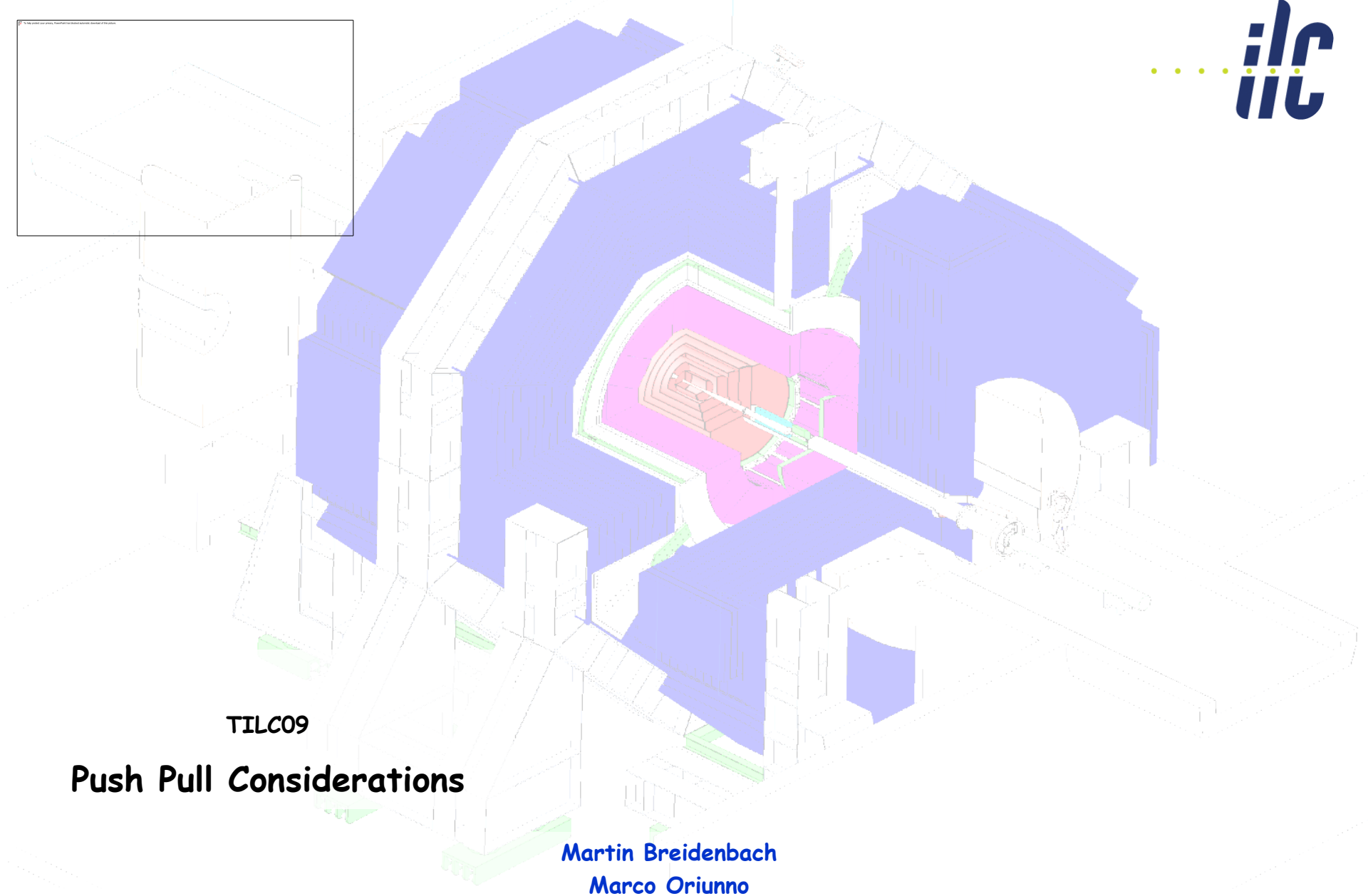


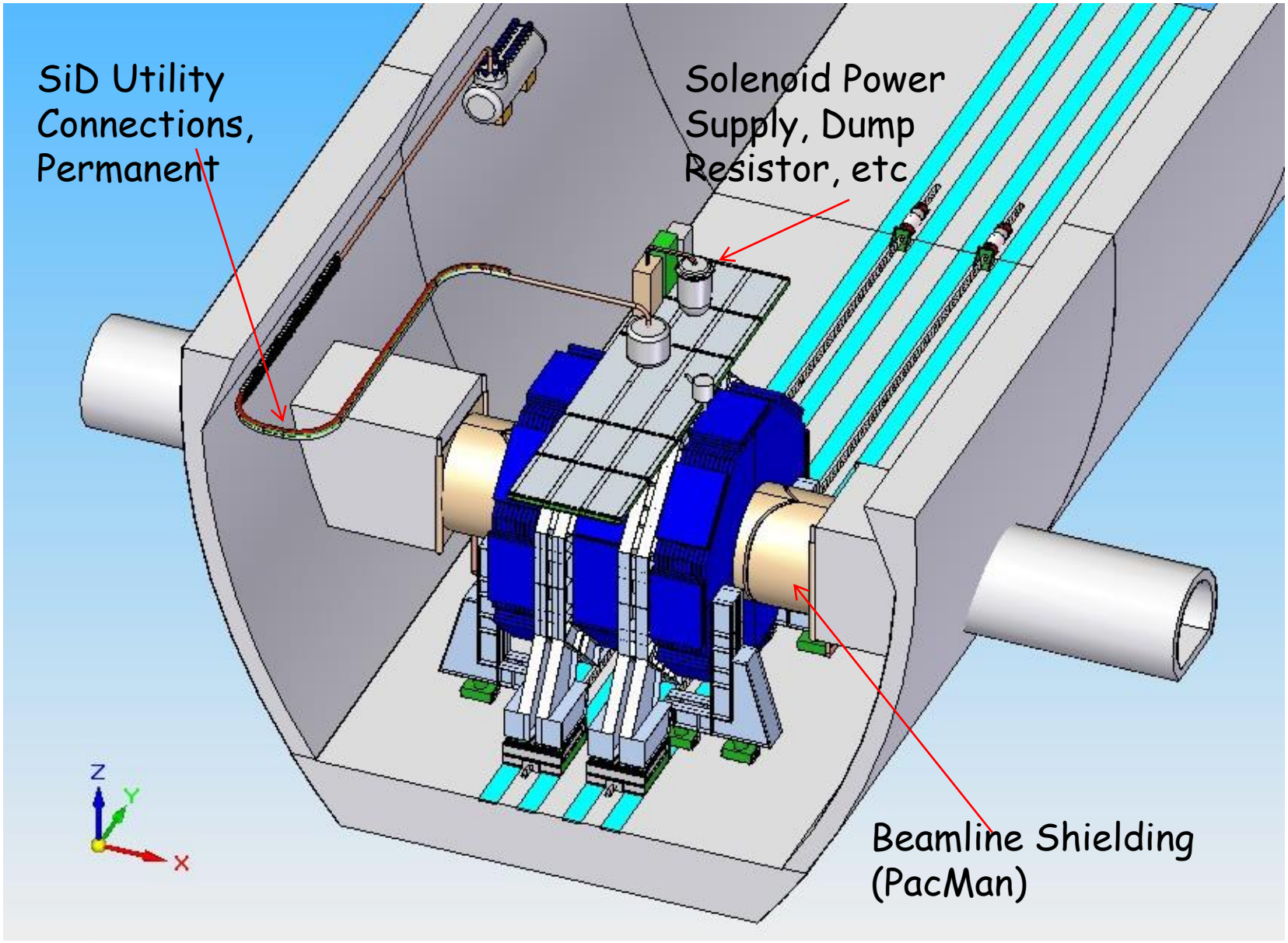
TILC09

Push Pull Considerations

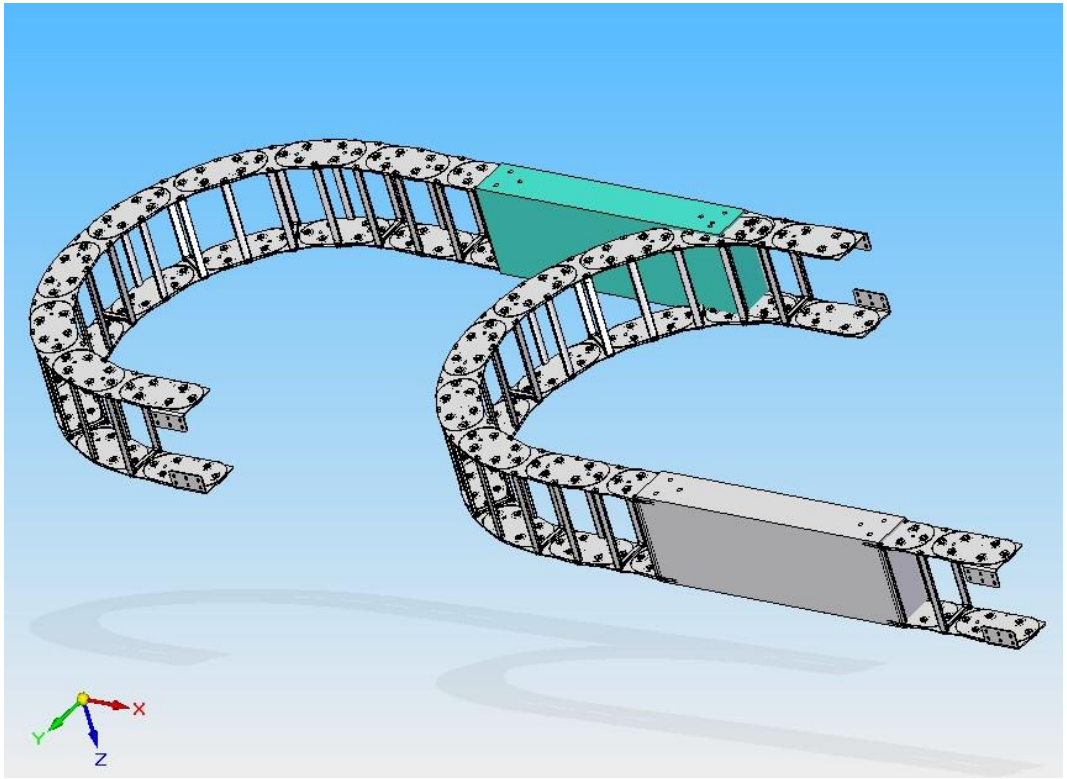
Martin Breidenbach
Marco Oriunno
Wes Craddock

Push Pull Detector Assumptions

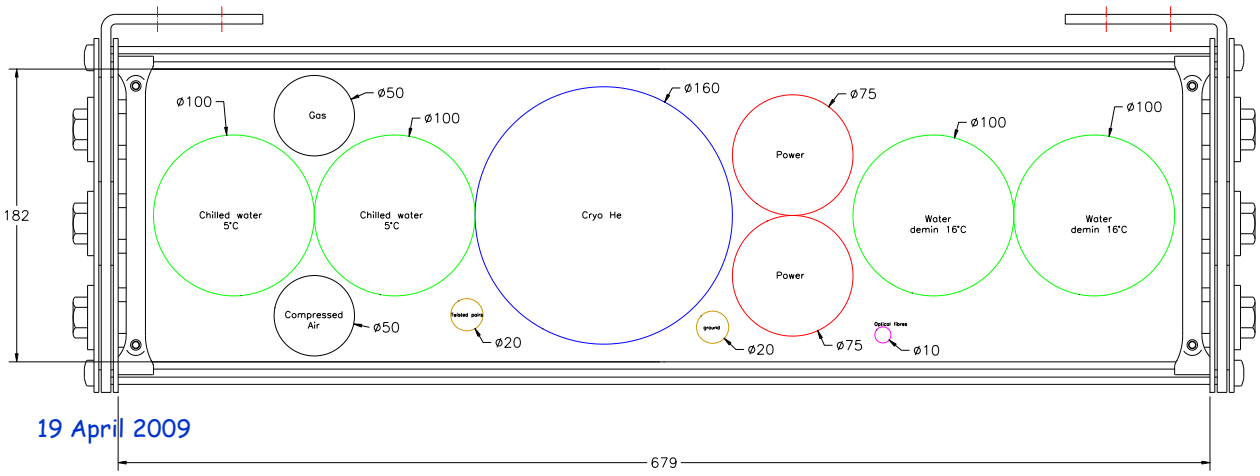
- The detectors are self-shielded.
- The beamline has portable shielding (Pacmen) that have a section meeting the tunnel mouth that is common with the other detector.
- Liquid He (4K) is delivered by a permanently connected flex line to the detector. 2K He is made by a system that moves with the detector, and all the QD0 plumbing moves with the detector.
- All detector power and data cables are permanently connected to the detector.
- The detector is designed so that small distortions of the steel do not change stresses on the cryostat, which in turn isolates the support of the calorimeters and tracker.
- The wavelength scanning interferometer system checks alignment for the barrel and relates the endcap positions.
- The full detector position is adjustable in X and Y to 1 mm. The Y range will need to be determined to accommodate floor motion.
- Roller and drive system designed for 1-5 mm/s.


SiD Utility Connections, Permanent
Solenoid Power Supply, Dump Resistor, etc
Beamline Shielding (PacMan)
Z
Y
X

Utilities in Cable Chain



	Qty	OD mm
Cryogenics	1	160
Demin. Water 16°C	2	100
Chilled Water 5°C	2	100
Power	2	75
Gas Mix	2	50
Compressed Air	1	50
Twisted Pairs	1	20
Ground	1	20
Optical fiber	1	10



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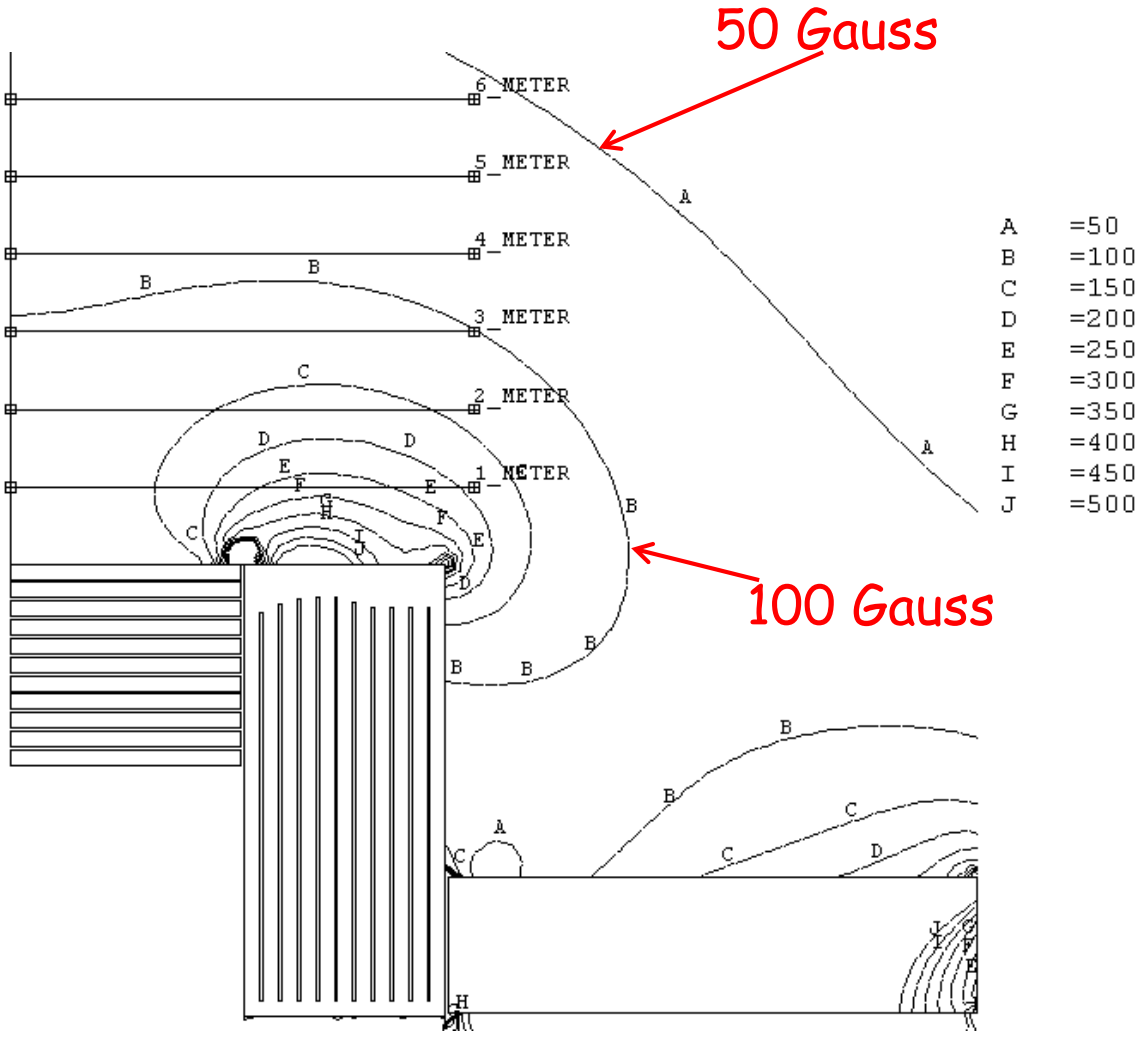
Fringe Field Map

Barrel: 11 - 200 mm plates

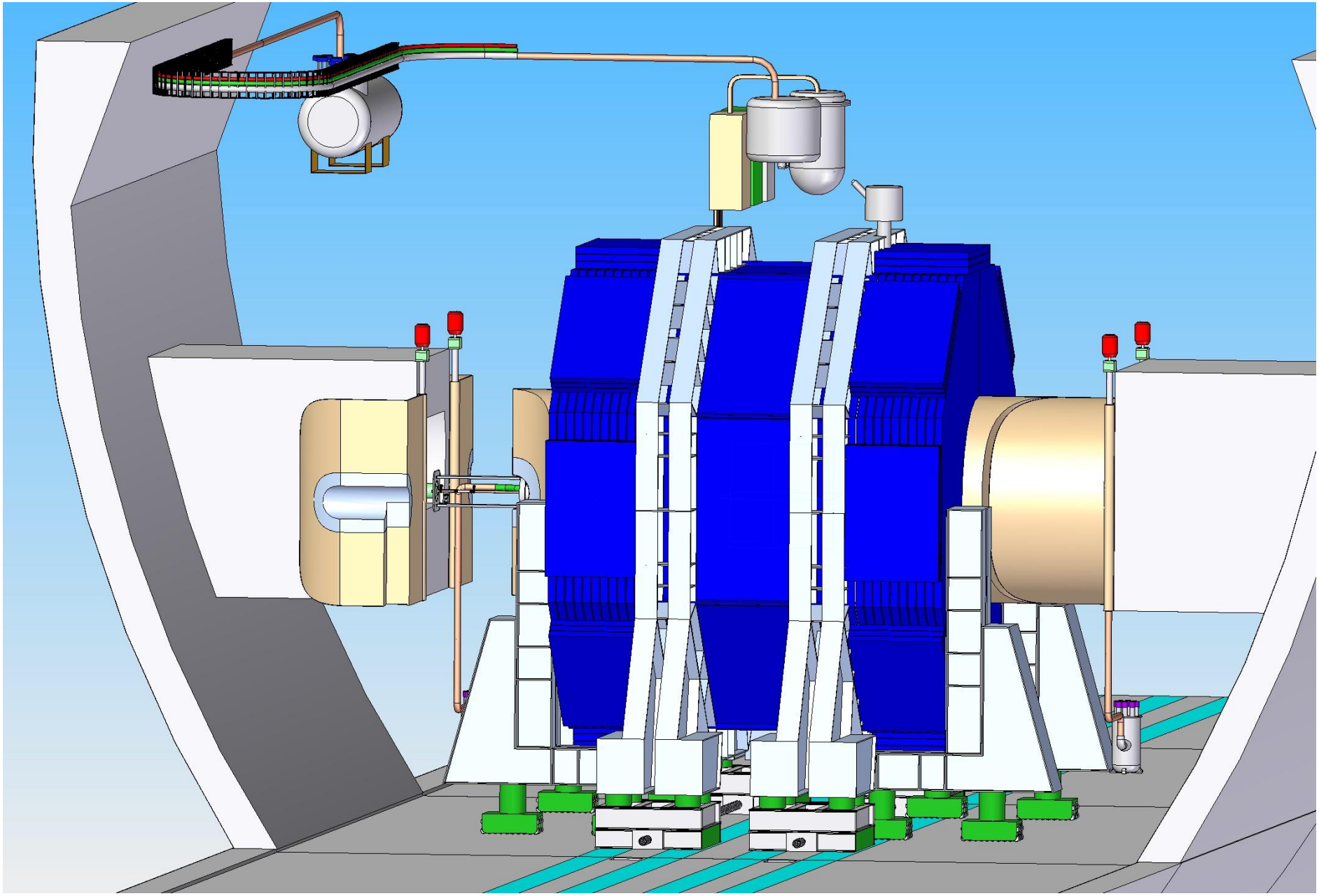
Endwall: 11 - 200 mm plates



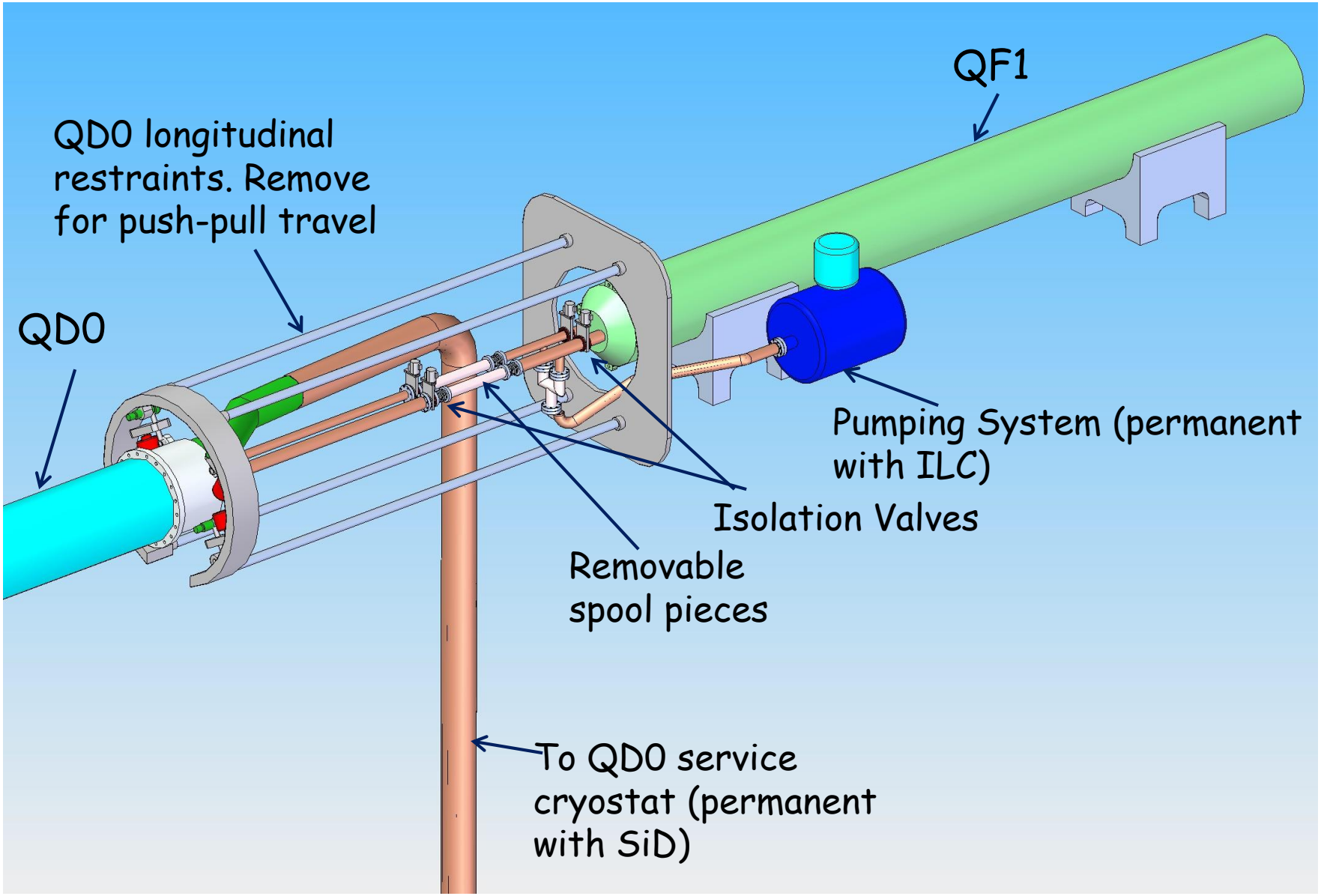
total mass of barrel and endwall = 7700 tonnes

First Steps

- Secure accelerator: de-energize and lock critical BDS components.
- Ramp down magnet. Assume LdI/dt = 100V, then ramp time = 0.5 hours.
- Open Pacmen. This also gets access to the beamline connections between QD0 and QF1.
- Disconnect beamlines:
  - Close isolation valves
  - Vent to dry Nitrogen
  - Remove spool pieces
  - Remove QD0 longitudinal restraints



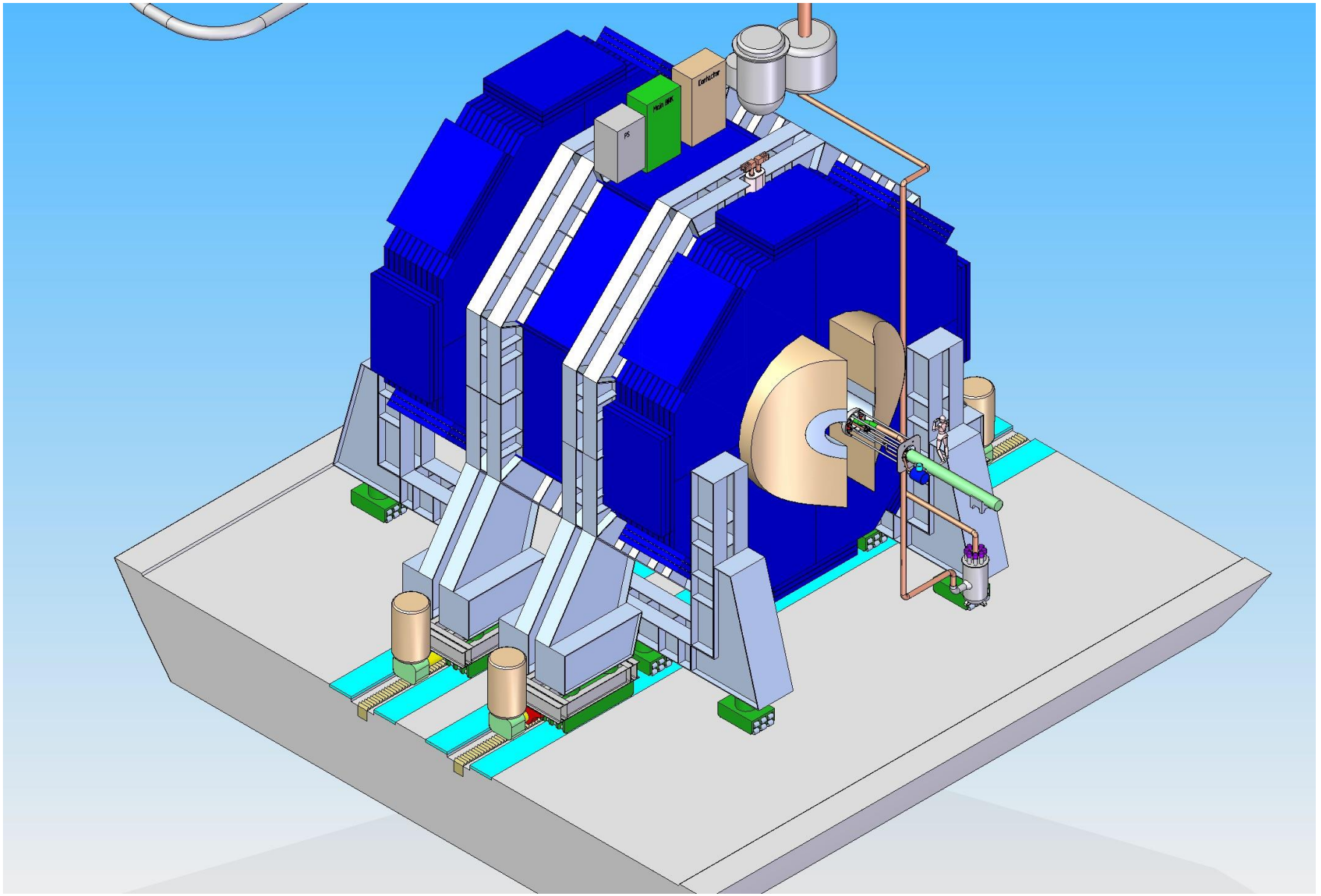
Beamline Disconnects



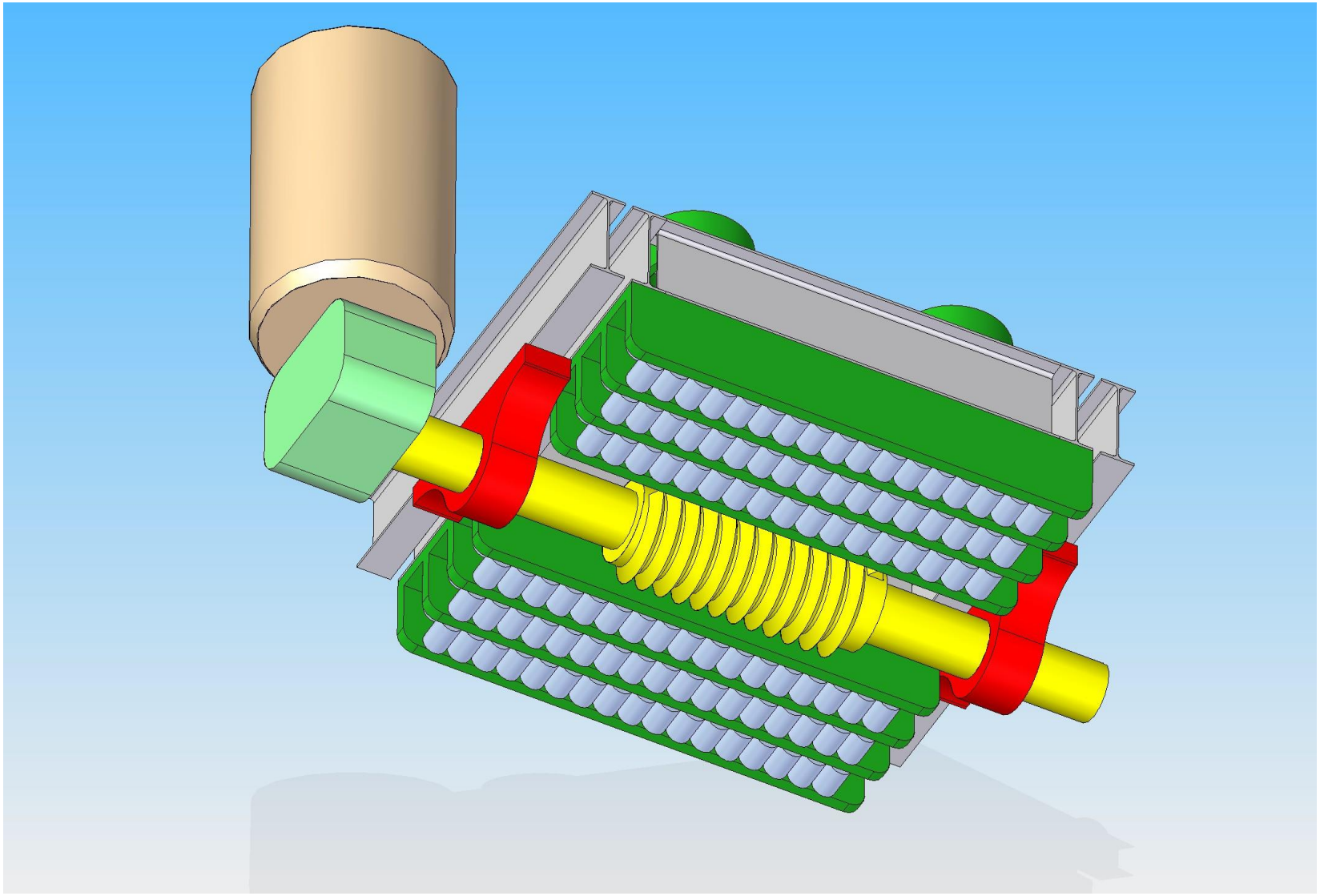
SiD Drive Studies

- SiD prefers roller sets under each leg. The roller set is integrated with hydraulic jacks for Y motion, and may have a fine X adjustment.
- The doors are carried by the barrel.
- The rollers run on hardened steel rails. The rails could be shared with the other detector, or arranged to be independent.
- The drive force is applied to the roller sets and is balanced to minimize stress of the detector steel.
  - Kinematic support of the solenoid within the steel and of the tracker within the calorimeters is being studied.
  - Frequency scanning interferometers are envisioned to measure any internal deformations of the detector, and to measure the position of SiD relative to ILC coordinates.
- A travel velocity of ~ 5 mm/sec is assumed, ~1 hour for 20 m.
- Three drive mechanisms have been considered:

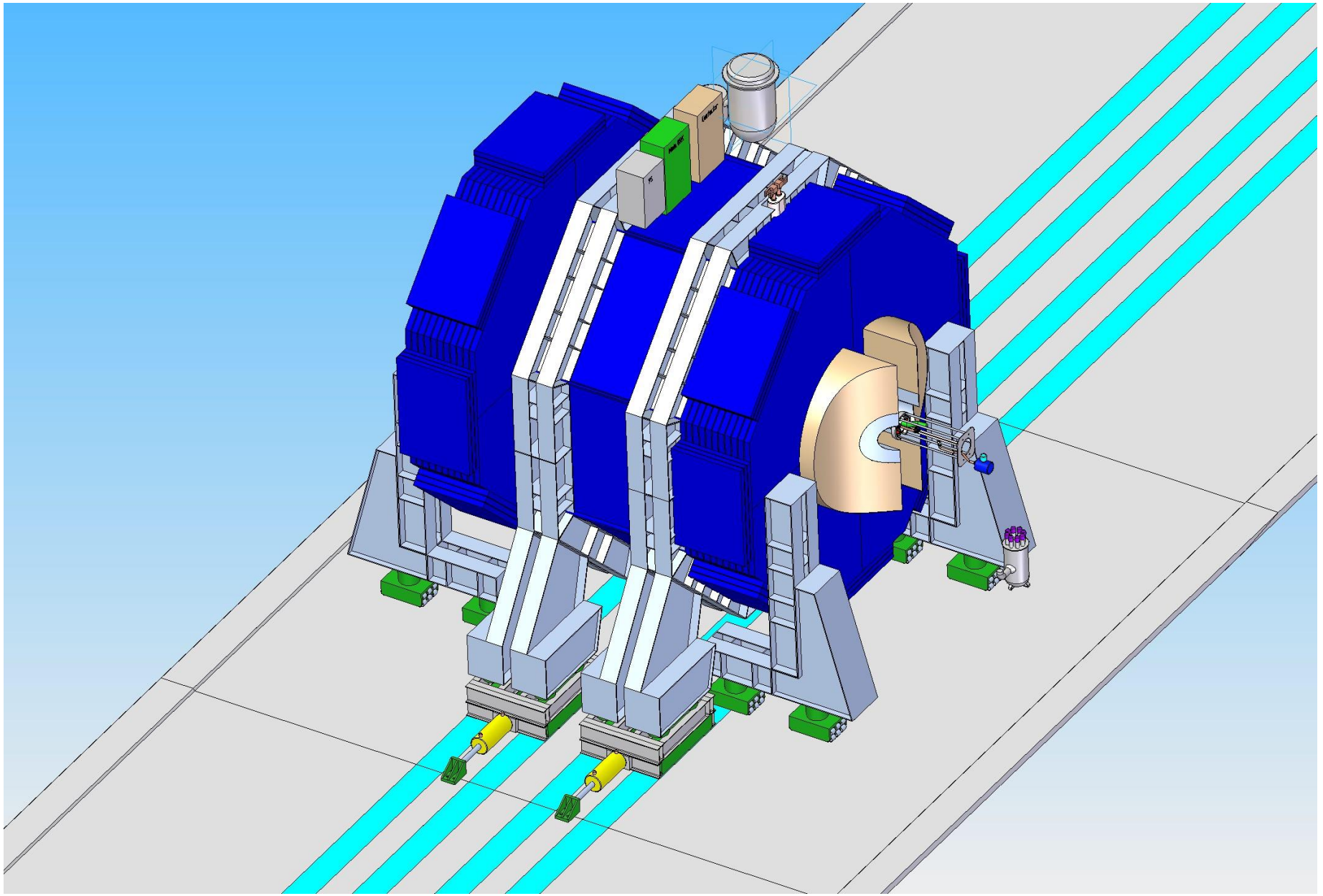
Gear/screw mechanism



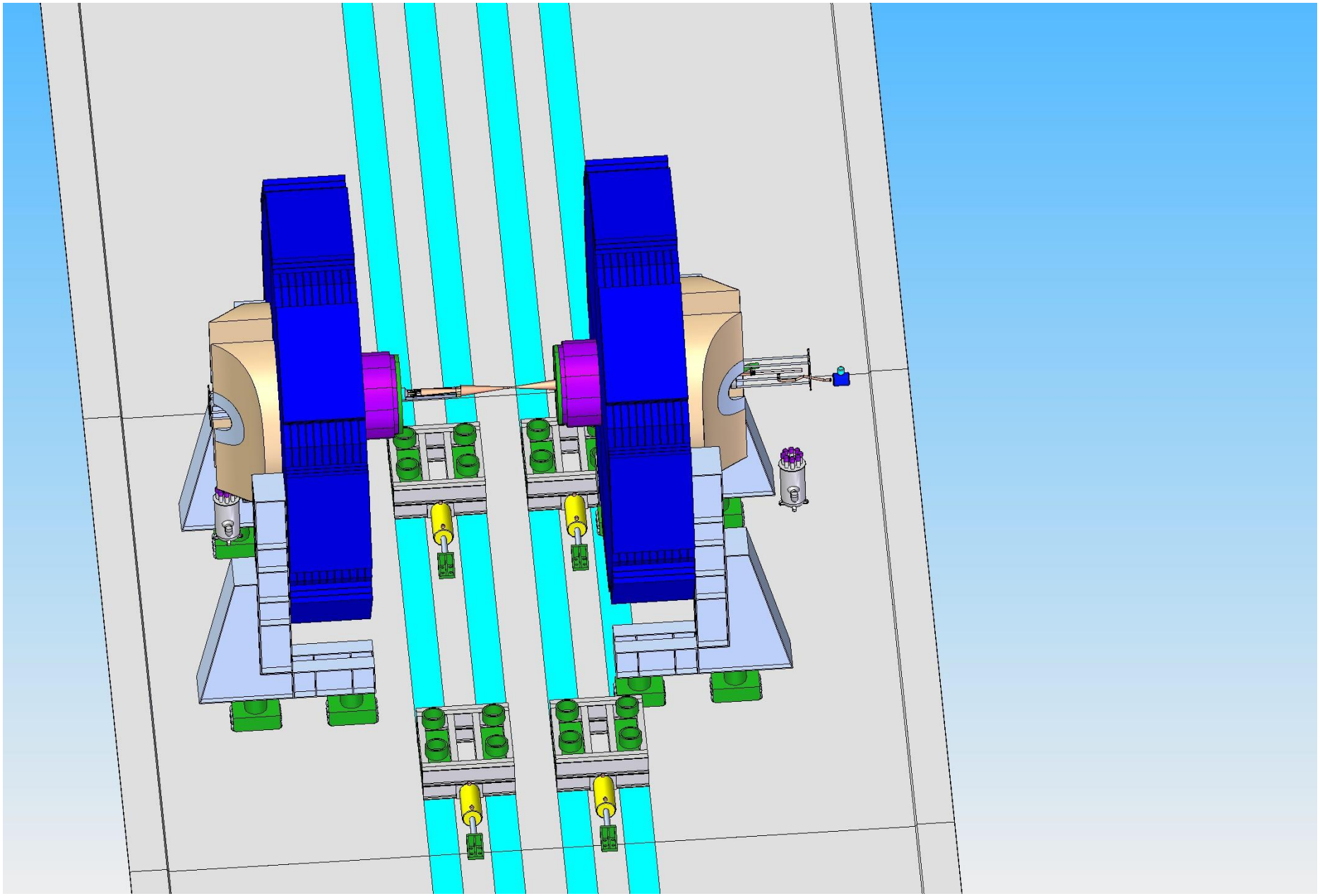
Gear/screw mechanism



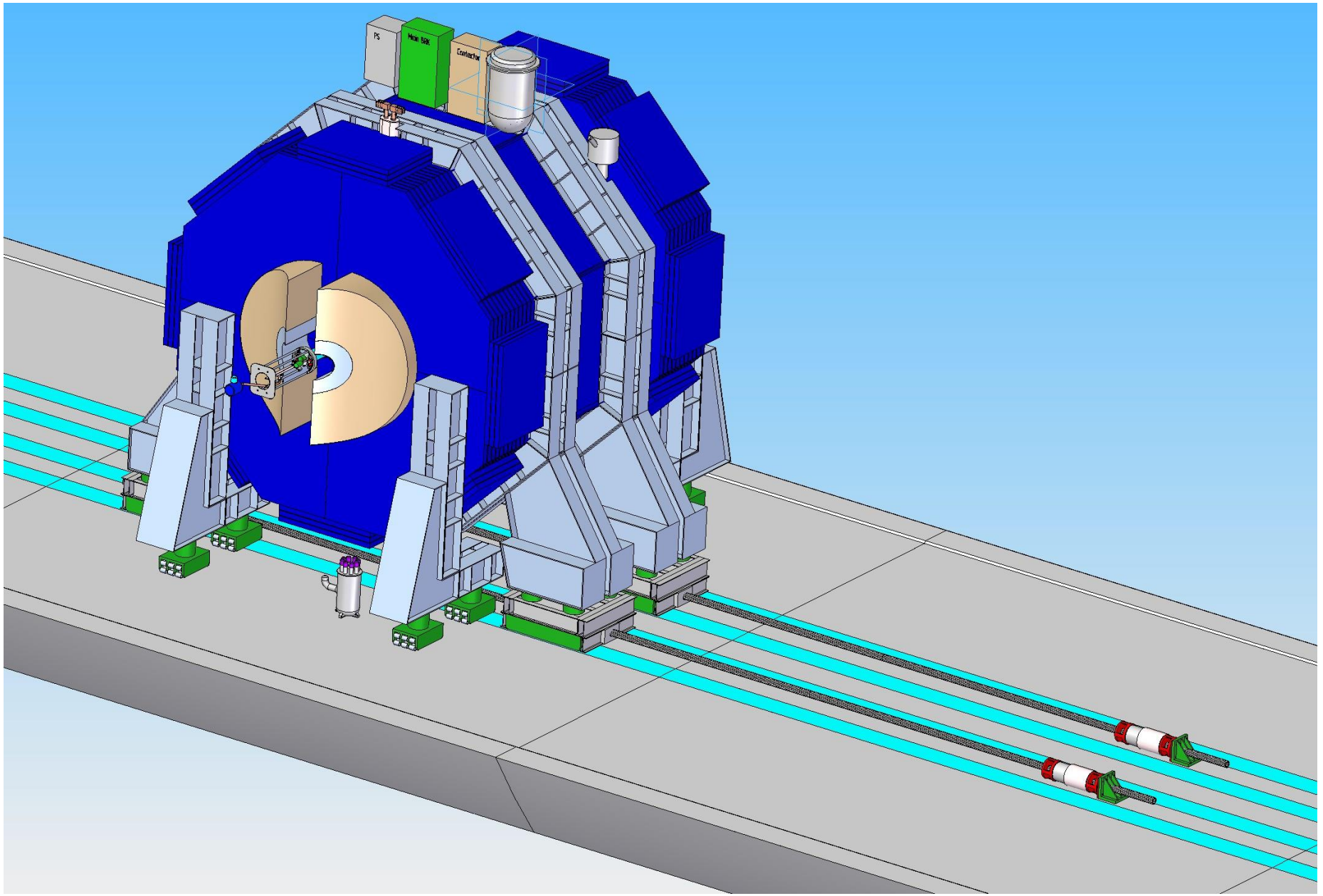
Plunger jack



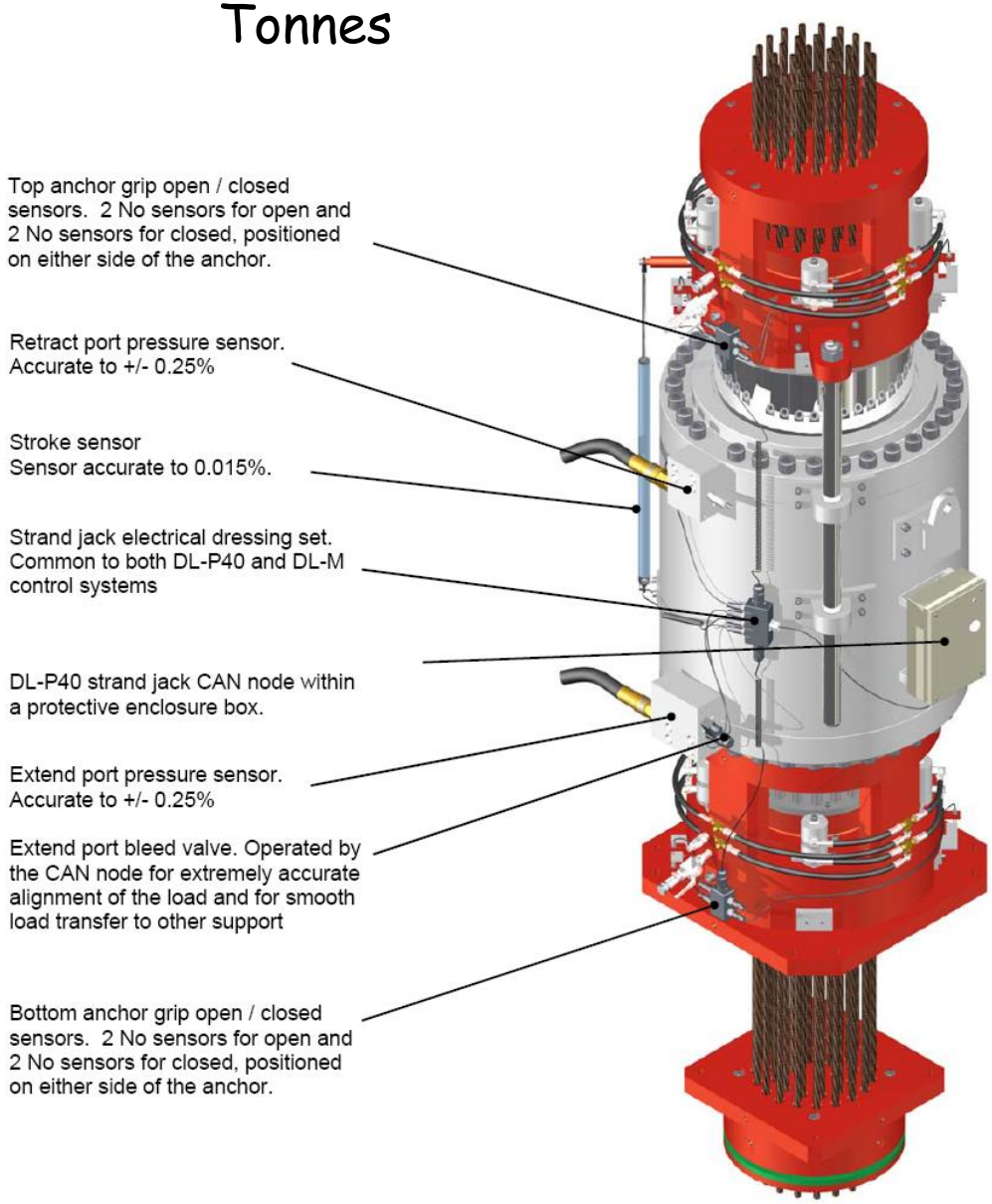
Plunger jack



Strand Jacks



Off-the shelf ~ 523 metric Tonnes



Quick Comparison

	Availability	Detector Integration	IR Integration	Cost	Flexibility/Scalability
Gears/Screws	R&D required	High	High	High	Low (permanent installation)
Plunger Jack	Off-the shelf	Low	High	Low	Medium
Strand Jacks	Off-the shelf	Low	Low	Low	High

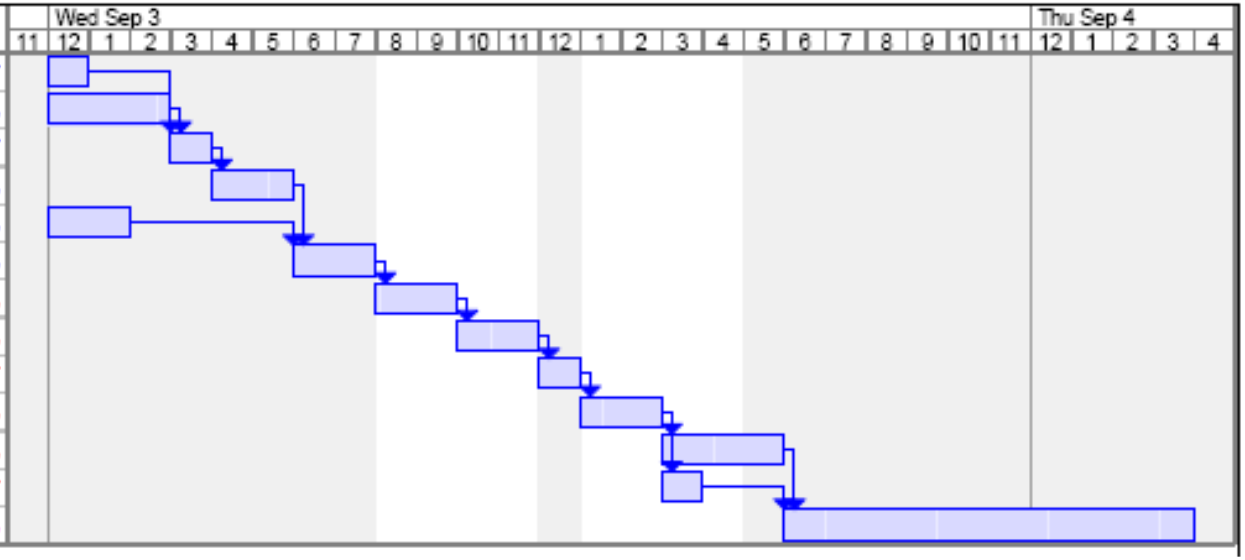
At this time, SiD favors the strand jack approach, but more study is required.

Going on beamline

- The process is largely the reverse.
- SiD gross alignment will be within 1 mm of ILC beam coordinates.
- The QD0's will have a 5 axis remote position system. The QD0's are adjusted by interferometry and beam based alignment to be centered on the ILC beamline.
- The QD0's carry the beampipe, which in turn carries the vertex detector. Thus the vertex detector and any internal masks are centered on the beamline, but the tracker and the rest of the detector may be off by up to 1 mm. This displacement is measured by the frequency scanning interferometers.

Time Estimate

ID	Task Name	Duration
1	Secure ILC Beams	1 hr
2	De-energize magnets	3 hrs
3	Open Beamline Shielding	1 hr
4	Disconnect Beamlines	2 hrs
5	Checkout Detetctor Transport s	2 hrs
6	Transport Detector 20 m	2 hrs
7	Transport other detector on bea	2 hrs
8	Connect beamline	2 hrs
9	Close Beamline shielding	1 hr
10	Check gross detector alignment	2 hrs
11	Energize magnets	3 hrs
12	Safety Checks before beams	1 hr
13	Begin Beam Based alignment	10 hrs



The time intervals in this estimate appear conservative.

With careful engineering and an experienced, well rehearsed crew, it seems plausible to make the push-pull cycle, not including the beam based alignment and re-tuning of the machine, in less than a day.

The converse is also true!