SC FF Meeting
@ Annecy

Monday 14 June 2010 from 08:00 to 18:00 at LAPP
Chaired by Andrea Jeremie (LAPP) , Andrei Seryi (SLAC) ,
Toshiaki Tauchi (KEK), Philip Bambade (LAL IN2P3)

Superconducting FF at ATF2: Motivation & Status

Presented by: Brett Parker (BNL-SMD)

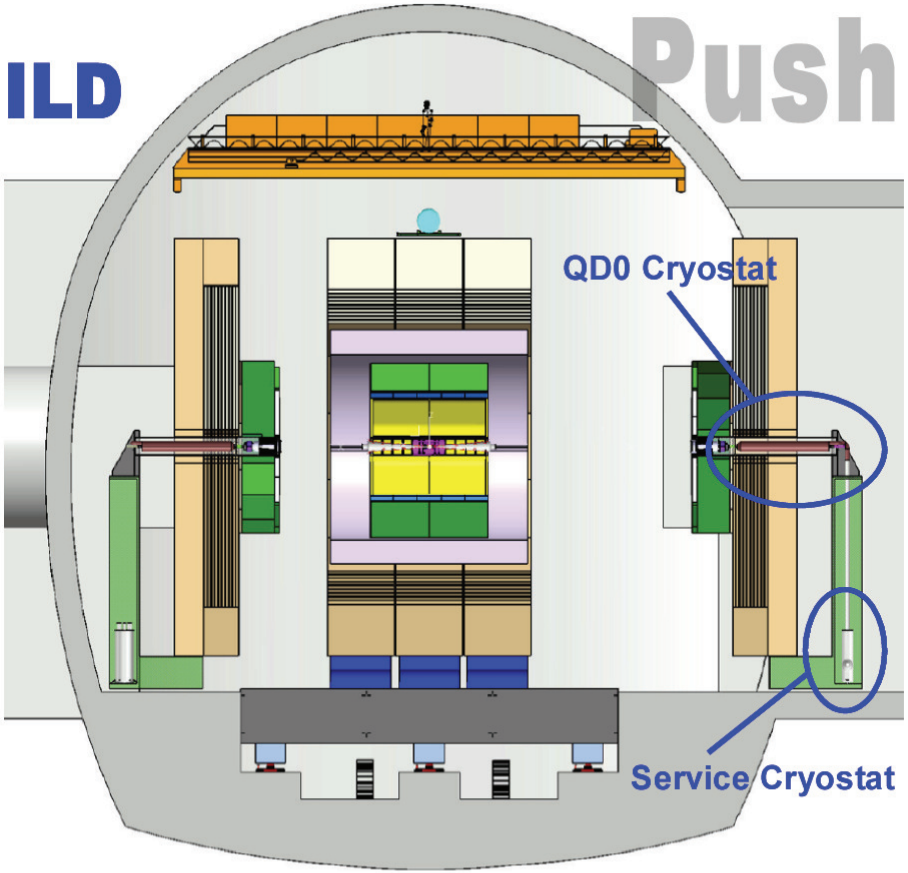
Content:

- For folks not yet in ATF2 Upgrade Collaboration...
  - Review ILC QD0 Baseline Design.
  - Outline QD0/ATF2 R&D Plans & Status.
- For folks in ATF2 Upgrade Collaboration...
  - Discuss preparations for ATF2 Upgrade TB Review.

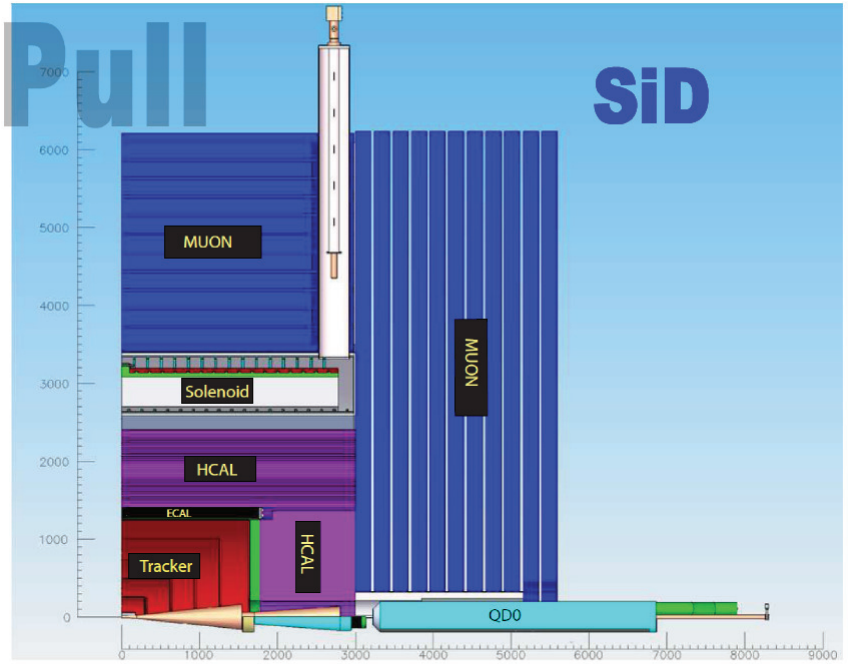
FF Superconducting Magnets In ILC Detectors.

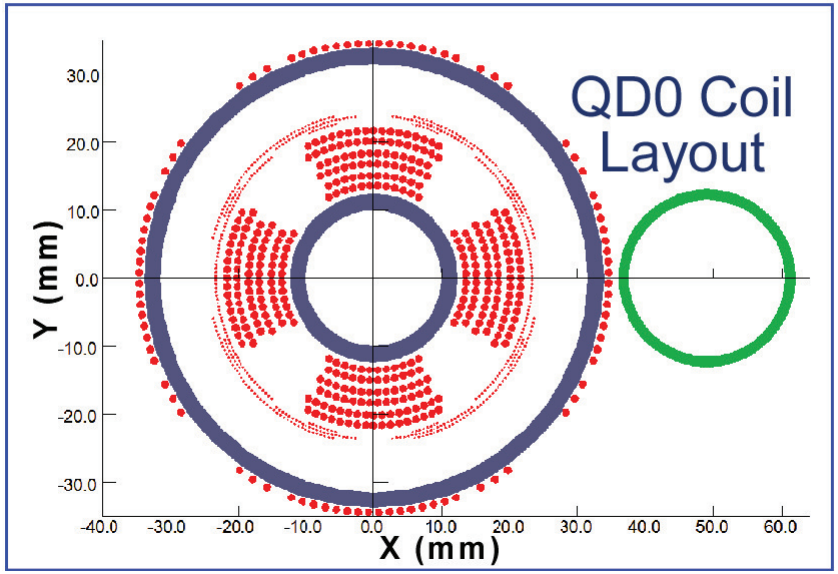
Push - Pull

ILD

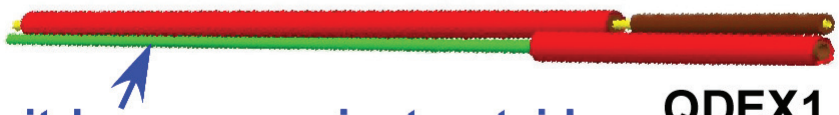


SiD





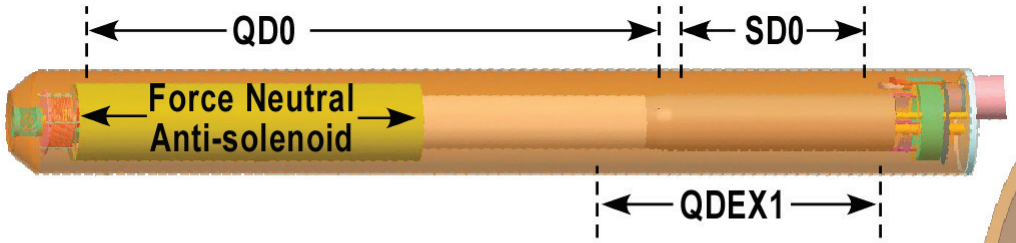
IP End QD0 14 mr X-ing Angle SD0



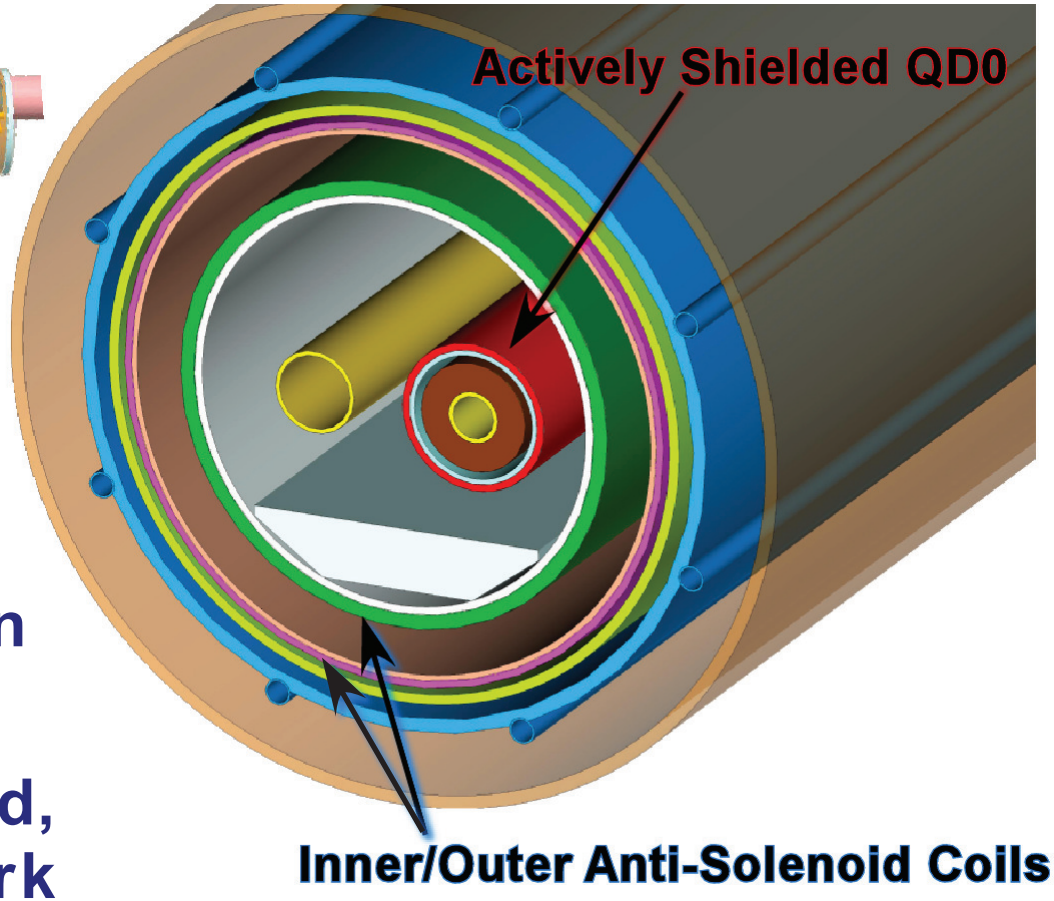
QDEX1

Exit beam goes just outside compact self-shielded coil.

Some ILC FF Magnet Design Challenges.



QD0 Cryostat Design for L* = 4.5 m.

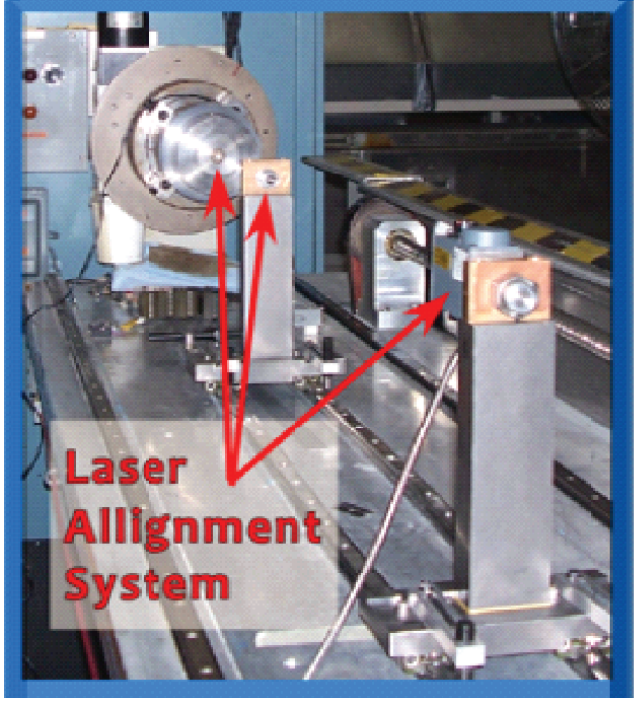


- Space is very tight inside the detector solenoid.
- Magnets must perform in ≈3T background field.
- For the active, beam based, feedback system to work need roughly 50 nm stability.

Present design avoids "flowing" helium; concept will be tested with QD0 R&D Prototype.

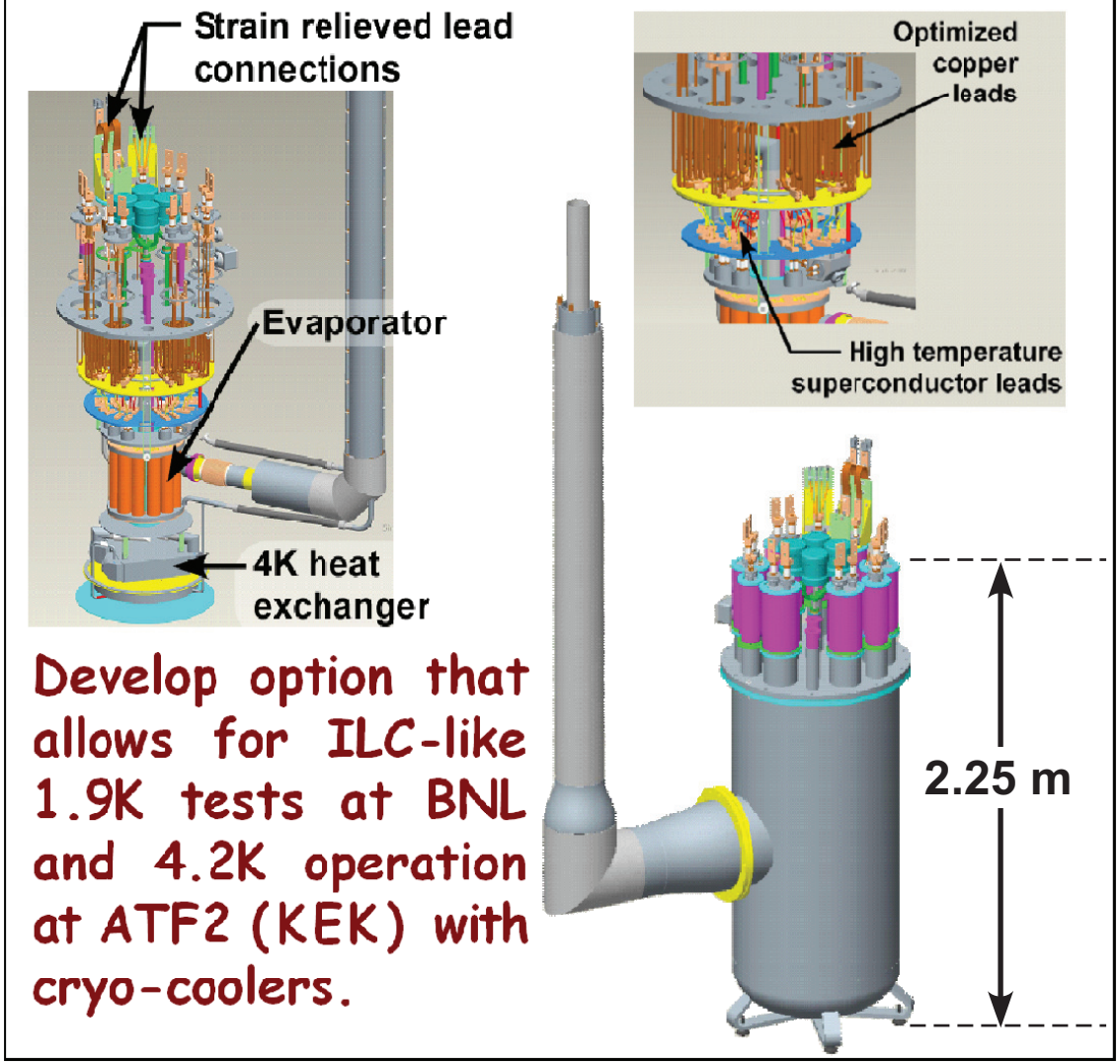
ILC QD0 Full Length R&D Prototype: Production.

- QD0 coil L_{mag}=2.2 m & shares tube with SD0.
- Support issues during first winding led us to wind QD0 in two halves with fixed supports in between (replacing moving support scheme).
- First QD0 coils sets now wound, wrapped & cured (magnetic measurements in progress).



Service Cryostat & Other ILC Activities at BNL.

Service Cryostat Under Construction at BNL

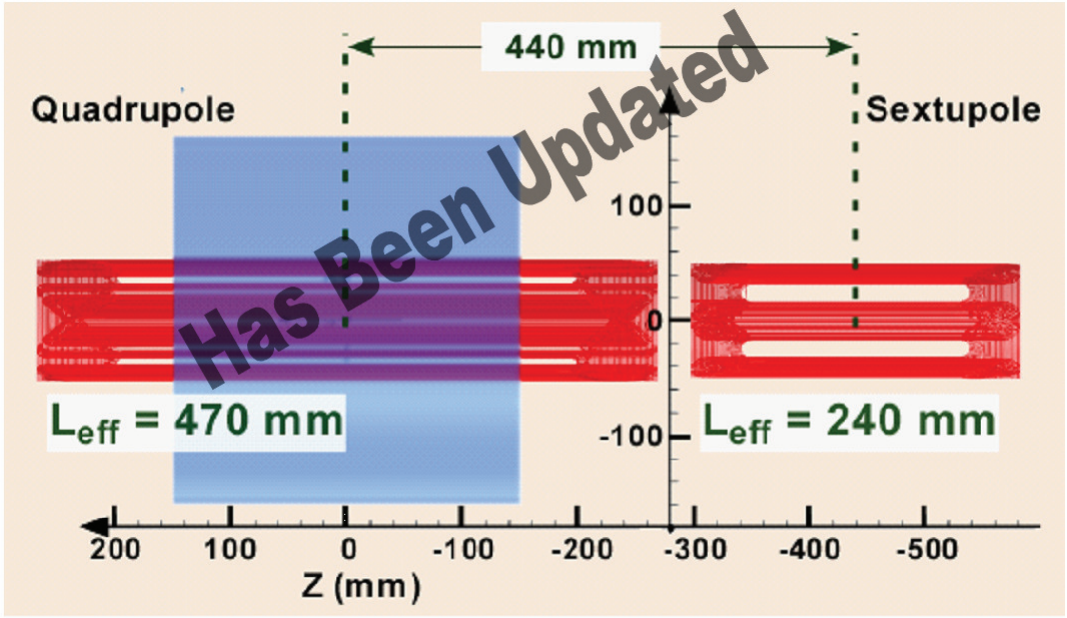


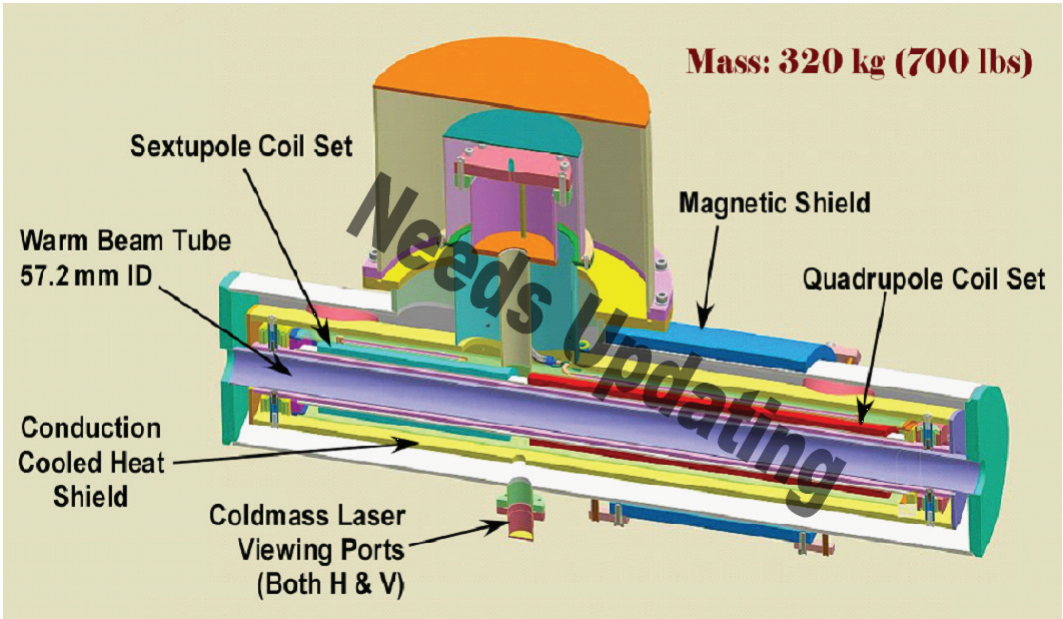
Develop option that allows for ILC-like 1.9K tests at BNL and 4.2K operation at ATF2 (KEK) with cryo-coolers.

- SC design features for ATF2 mode nearly finished.
- Detailed drawings for SC and QD0 now underway.
- SC and QD0 long lead time items are identified (initiate critical orders).
- For MDI, look to restart work on QF1 cryostat and the cryogenic transfer lines.
- Demonstrate ILC-like FF magnet system production and operation.
- Common ILC/CLIC work.

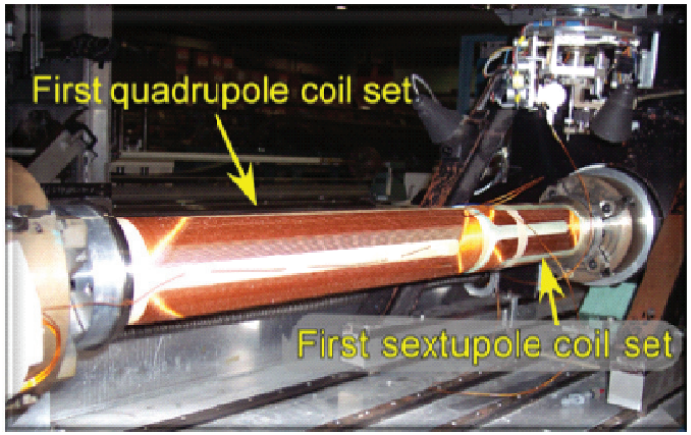
ATF2 Coil Coil Design Overview & Status.

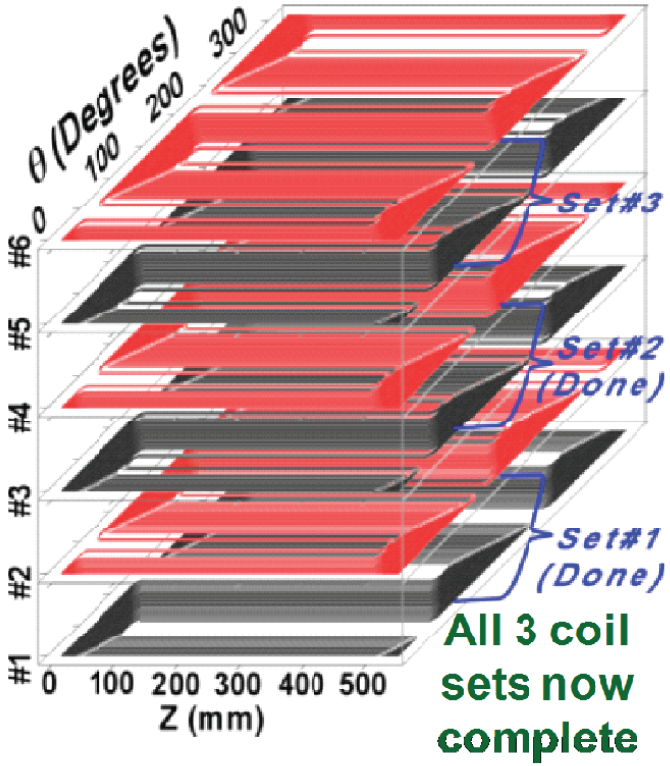
- Main coil winding now complete.
- Measured harmonics are small.
- A first pass cryogenic interface made at '09 face-to-face meeting.
- Magnetic shielding calculations (homework) done; results indicate we can make both Hor./Vert. laser penetrations (through the quad's magnetic shield) at the center of each magnet coil without spoiling their good harmonics and still ensuring sufficiently low B-field at the external geophone locations.





ATF2 Coil Coil Design & Production Overview.





- Winding of the main quadrupole (six layers) and sextupole (four layers) coils now complete.
- Production measurement results for field harmonics are consistent with our understanding of the requirements for future ATF2 "pushed β* optics" studies.
- In order to keep to a "2012 delivery schedule," we do need to start winding corrector layers soon (have resource conflict with QD0 long-coil winding).
- Under the most aggressive delivery schedule, we would want to vertically cold test later this year (also resources).

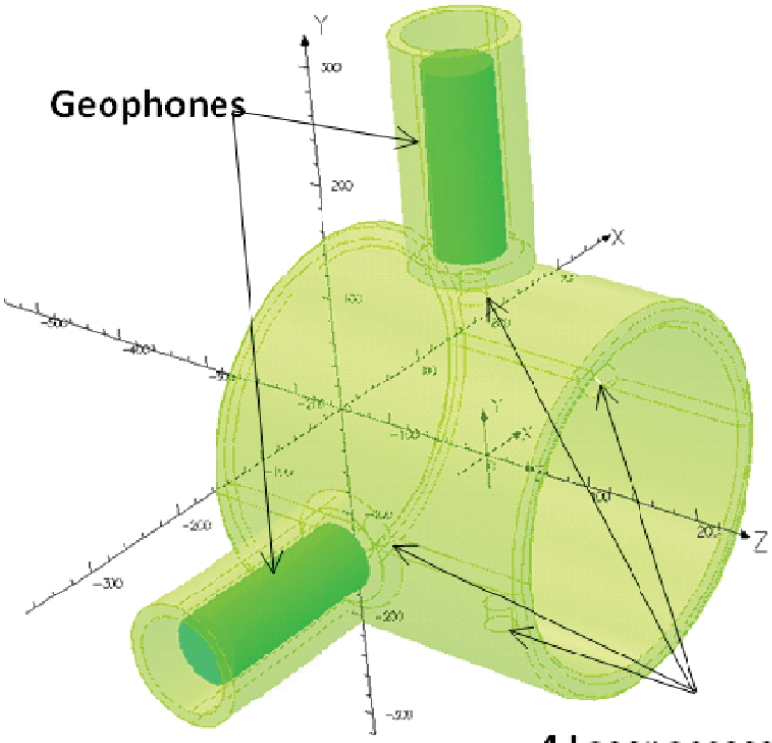
Summary of Integral Field Quality in ATF2 Magnet.

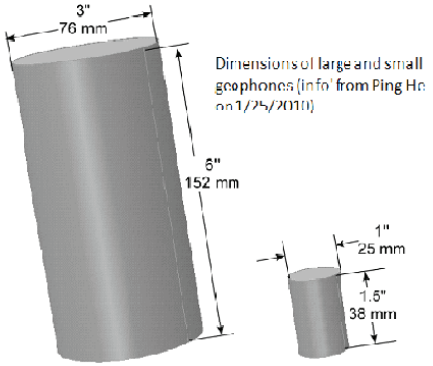
Normal	Quadrupole	Sextupole
I.T.F.	26.959	194.00
Fld. Ang. (mr)	-12.5	14.8
Leff(m)	--	--
b1	--	-0.3
b2	10000.0	--
b3	1.2	10000.0
b4	-1.3	0.6
b5	0.4	-0.8
b6	0.7	0.1
b7	0.0	0.2
b8	-0.1	0.4
b9	0.0	0.4
b10	0.0	0.1
b11	0.0	0.5
b12	0.0	0.1
b13	0.0	0.0
b14	0.0	-0.1
b15	0.0	-0.5

Skew	Quadrupole	Sextupole
I.T.F.	26.959	194.00
Fld. Ang. (mr)	-12.5	14.8
Leff(m)	--	--
a1	--	-8.6
a2	--	--
a3	-1.2	--
a4	-2.2	-2.0
a5	-0.3	-1.5
a6	0.1	-4.2
a7	0.2	-0.4
a8	0.1	0.2
a9	0.1	0.3
a10	-0.2	0.2
a11	0.0	0.1
a12	0.0	-0.2
a13	0.0	-0.1
a14	0.0	0.0
a15	0.0	0.0

Harmonics are in “Units” of 10-4 of the main field at 25 mm as seen from the lead ends of respective magnets (yielding opposite sign of field angle in the two magnets). I.T.F for Quadrupole is in T/kA; ITF for Sextupole is in T/m/kA (Integral of B“ in sextupole is two times the value reported for the I.T.F).

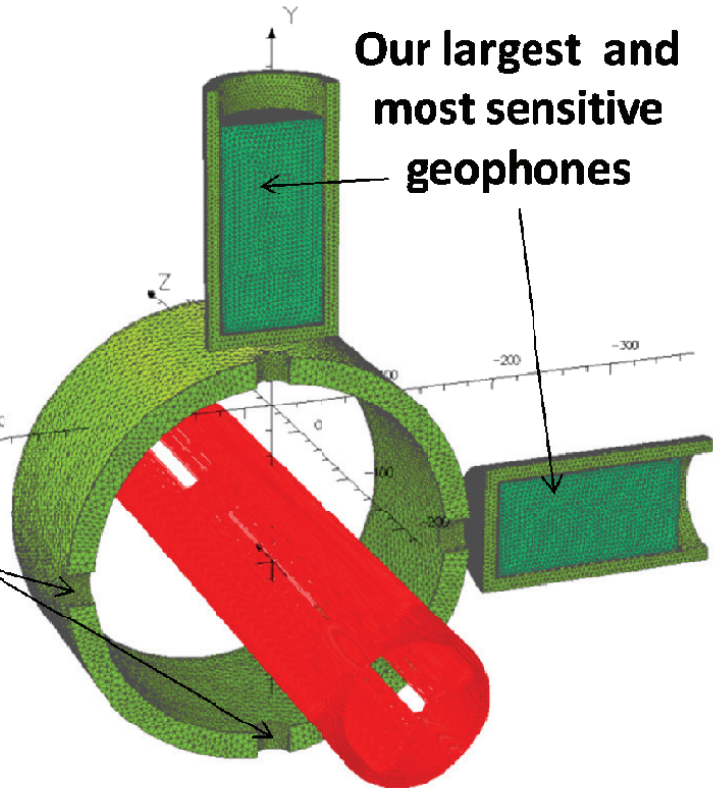
Laser View Port & Geophone Homework Status.





Dimensions of large and small geophones (info from Ping Ha on 1/25/2010)

Only two holes are needed for the laser access but we make four holes to keep quad' symmetry.

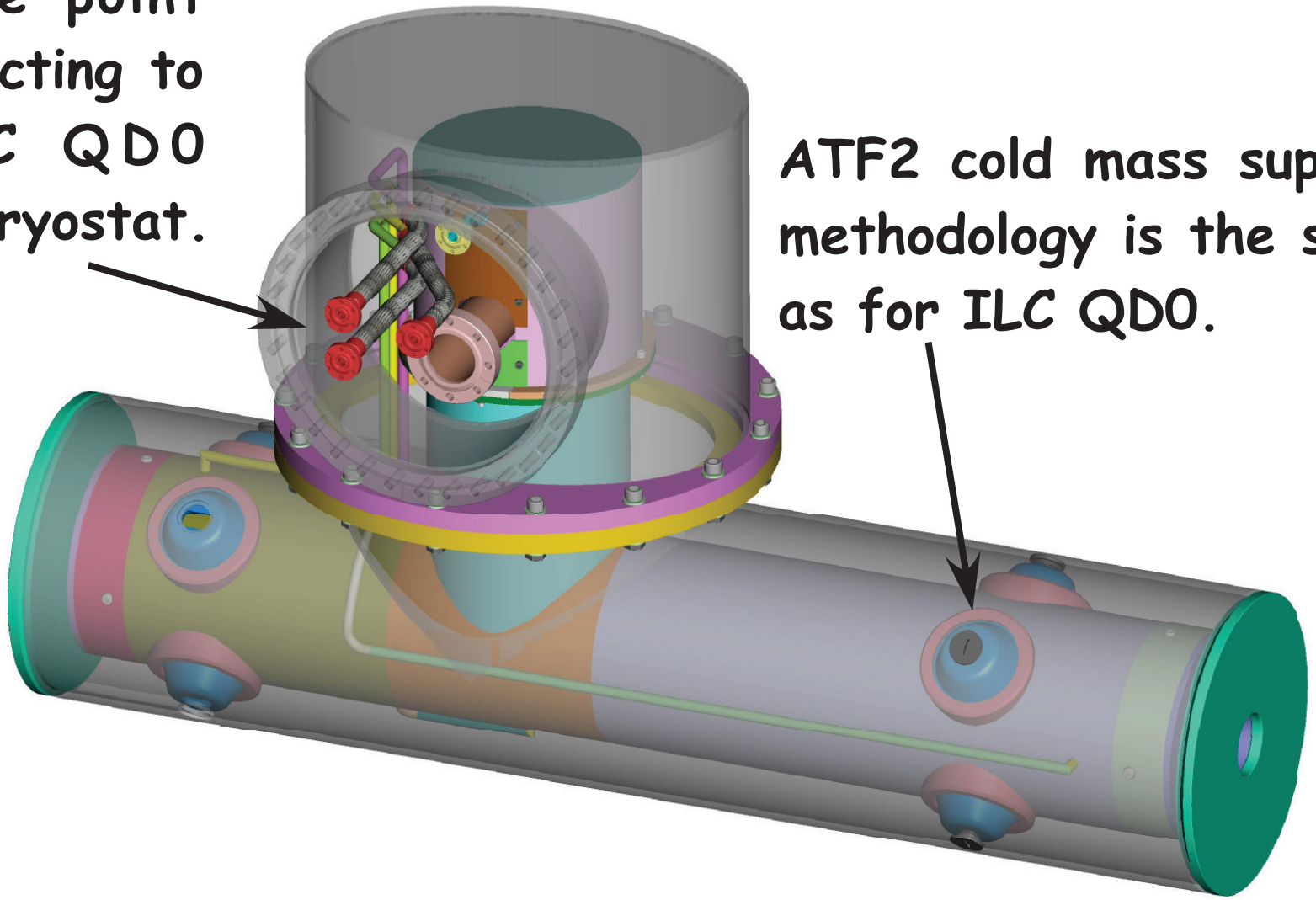


4 Laser access holes

- At R_{ref} = 25mm, the harmonics change by less than 0.1 unit.
- External field is low enough, even for our largest geophone.
- Passive shielding still works even with 25 mm ID holes!

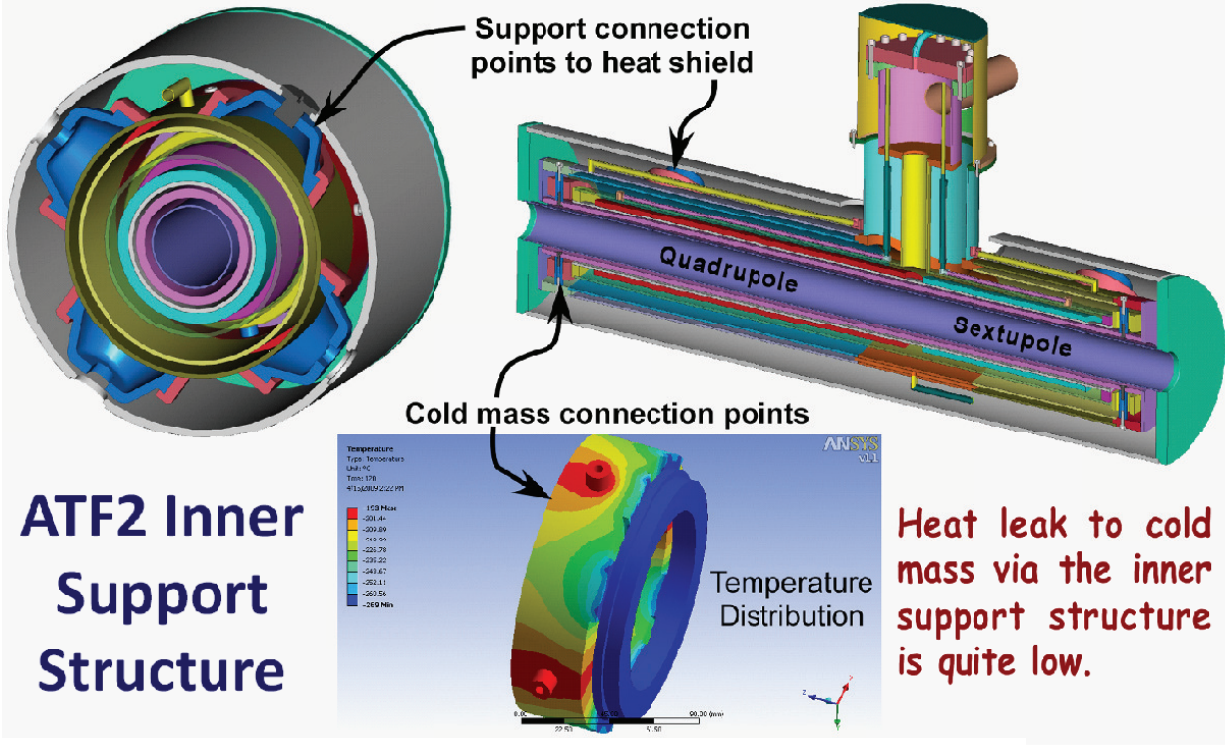
ATF2 Upgrade Cryostat Design.

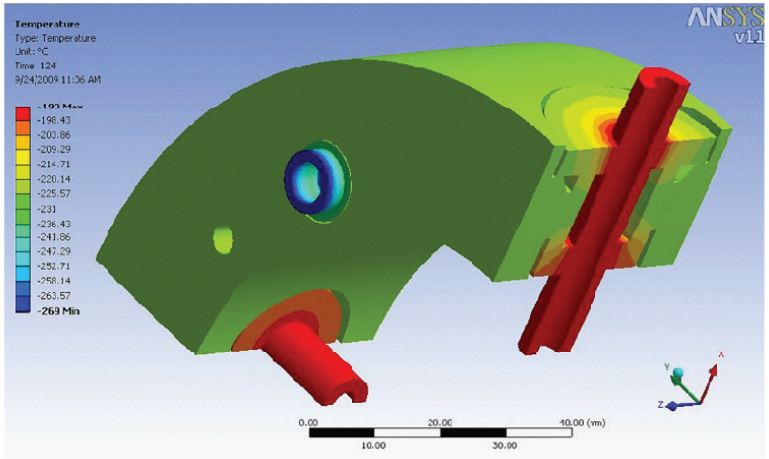
Interface point for connecting to the ILC QD0 Service Cryostat.



ATF2 cold mass support methodology is the same as for ILC QD0.

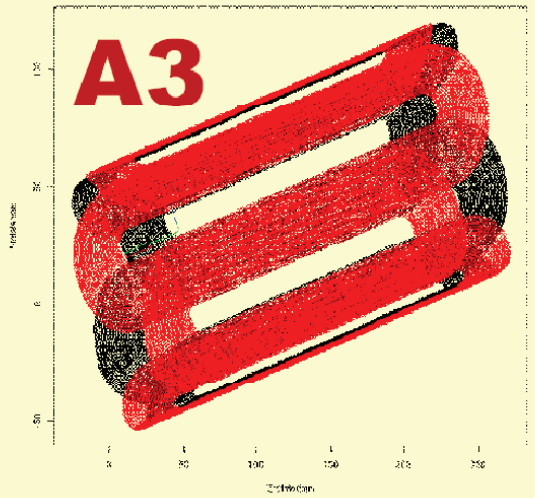
ATF2 Upgrade Cryostat Design Parameters.

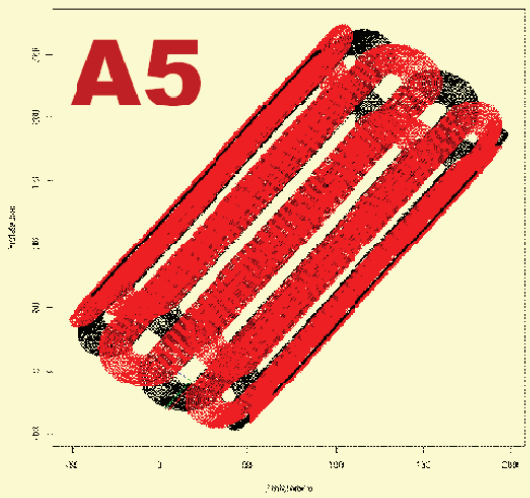




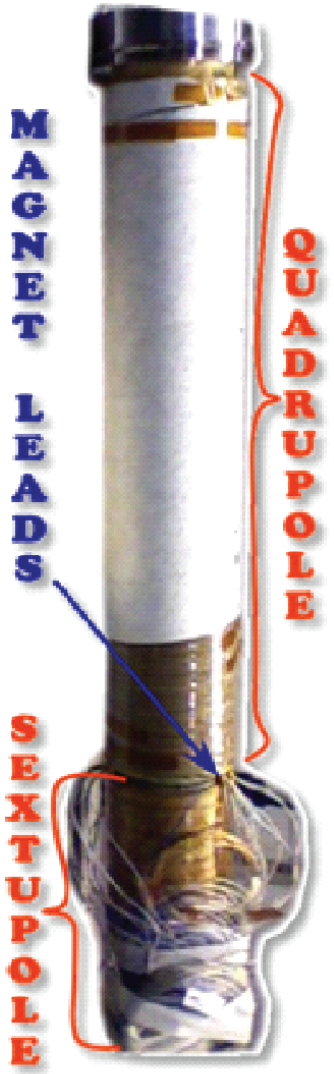
The ATF2 upgrade magnet and the ILC QD0 have very similar cold mass support structure designs.

Our ATF2 Upgrade Magnet Decision Point.



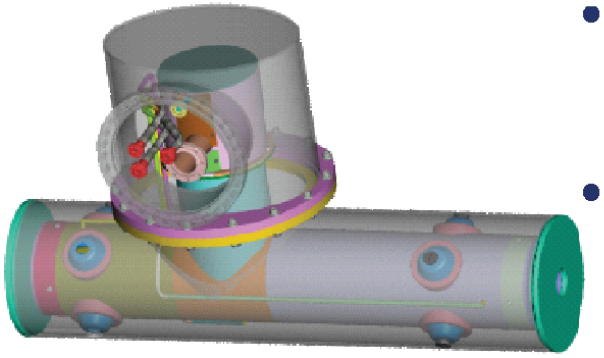


Skew-octupole & skew-dodecapole correctors could be useful to compensate aberrations from other ATF2 beam line magnets.



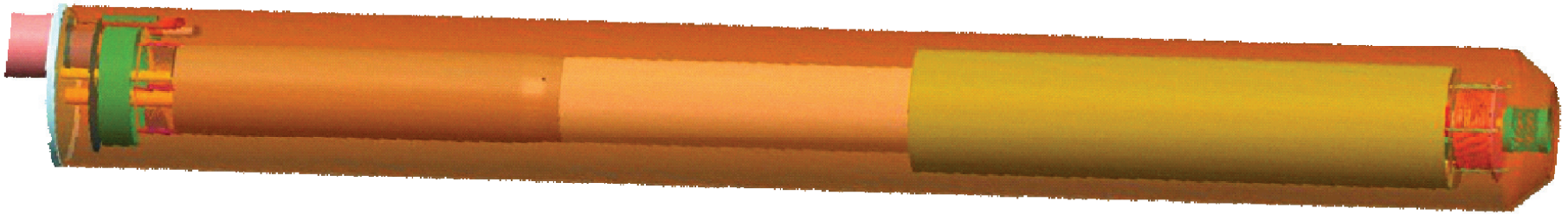
Before we finish winding the dipole and skew dipole correctors on top of the quad, we should decide wether to wind above coils atop sextupole.

ILC R&D Prototype and ATF2 Comparison.



ATF2 Upgrade Magnet
(concept test with beam)

- Both are compatible with 1.9K testing via an ILC-style Service Cryostat (SC) at BNL.
- ATF2 magnet should be 4.2K tested at BNL with SC and the ATF2 Cryogenic Box before being shipped to KEK.
- The ATF2 magnet can be tested with beam; there is no way to beam test R&D prototype.



ILC QD0 Full-Length R&D Prototype Magnet Program
(a full-scale, instrumented, 1.9K ILC SC, systems test)

Thank you for your attention.