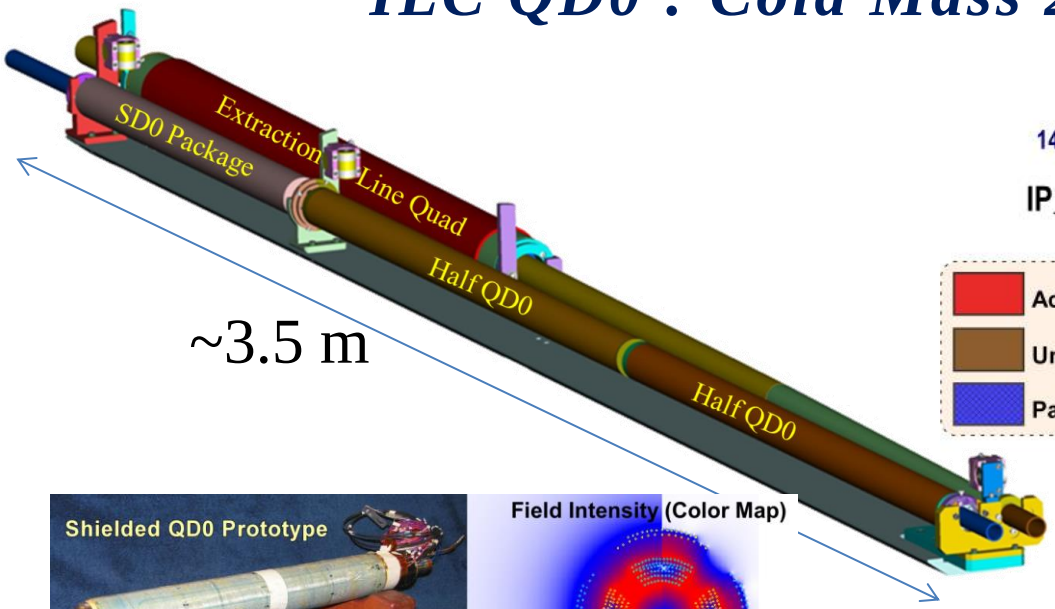
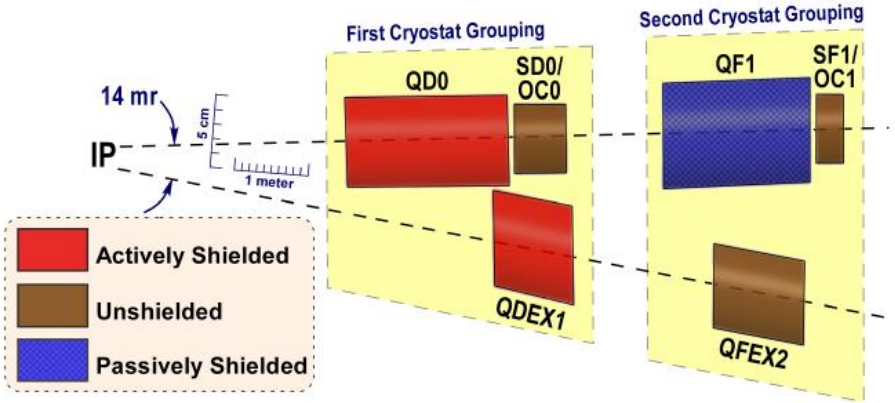
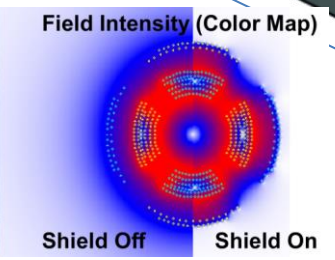
ILC QD0 : Cold Mass 2K Helium (BNL)







- Technology of the superconducting final focus magnets has been demonstrated by a series of short prototype multi-pole coils.
- QD0 magnet split into two coils to allow higher flexibility at lower energies.
- The quadrupoles closest to the IP are actually inside the detector solenoid.
- Actively shielded coil to control magnetic cross talk
- Additional large aperture anti-solenoid in the endcap region to avoid luminosity loss due to beam optics effects.
  - Large aperture Detector Integrated Dipole (DID) used to reduce detector background at high beam energies or to minimize orbit deflections at low beam energies.

Extraction Line

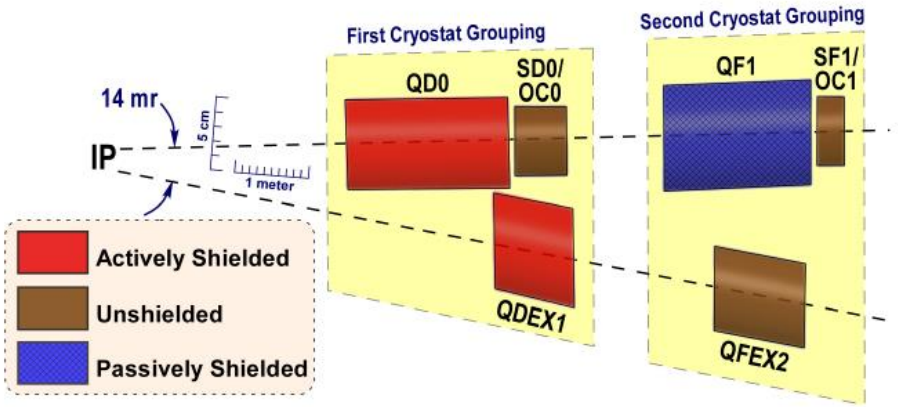
ILC e^+e^- collision creates disrupted beam:

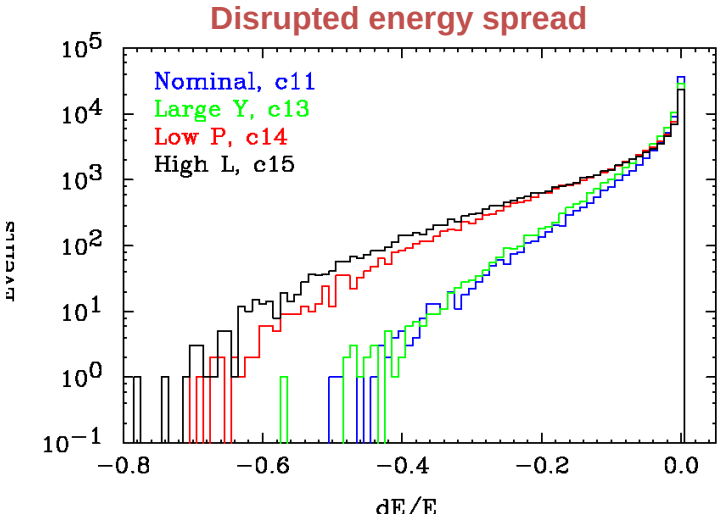
• Huge energy spread and large x,y divergence (emittance) in the outgoing electron beam.

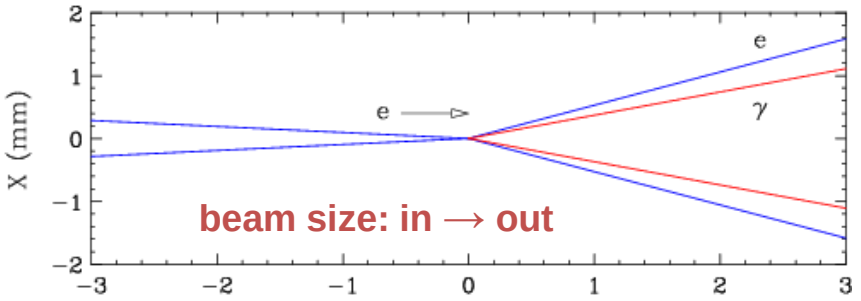
• High power divergent beamstrahlung photon beam in the same direction with electrons.

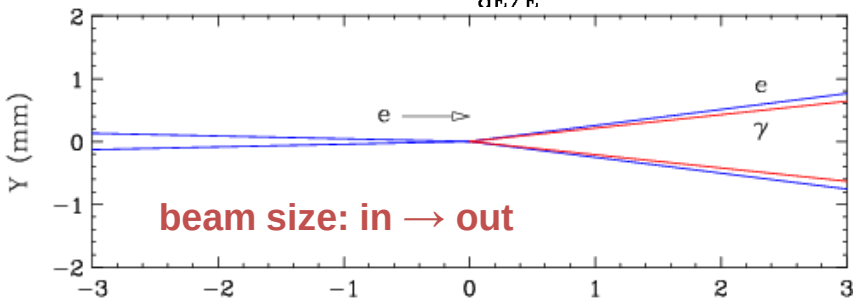
Issue:

• Potential high beam loss in the extraction line due to overfocusing of low energy electrons and divergence of the photon beam.

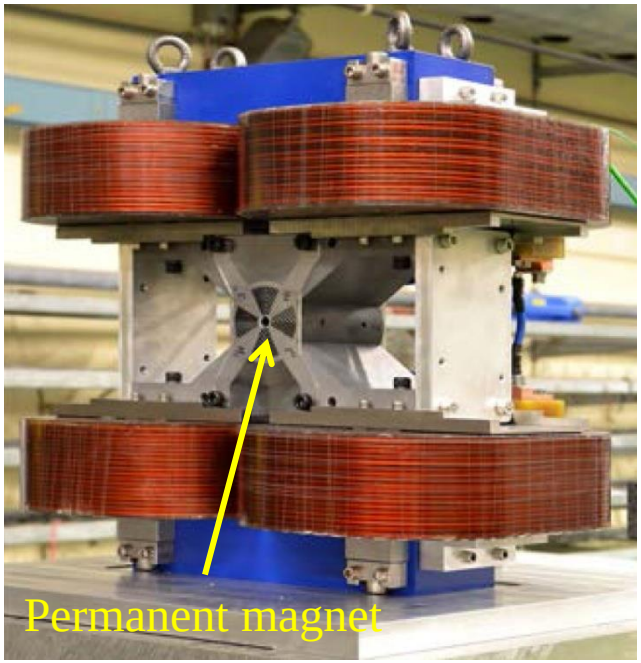








CLID QD0 : Hybrid magnet



CLIC QD0 Main Parameters		100mm prototype	Real magnet 2.7m
Yoke			
Yoke length	[m]	0.1	2.7
Coil			
Conductor size	[mm]	4×4	4×4
Number of turns per coil		18×18=324	18×18=324
Average turn length	[m]	0.586	5.786
Total conductor length/magnet	[m]	0.586×324×4=760	5.786×324×4=7500
Total conductor mass/magnet	[kg]	26.8×4=107.2	265.2×4=1060.8
Electrical parameters			
Ampere turns per pole	[A]	5000	5000
Current	[A]	15.432	15.432
Current density	[A/mm^2]	1	1
Total resistance	[mOhm]	896	8836
Voltage	[V]	13.8	136.4
Power	[kW]	0.213	2.1

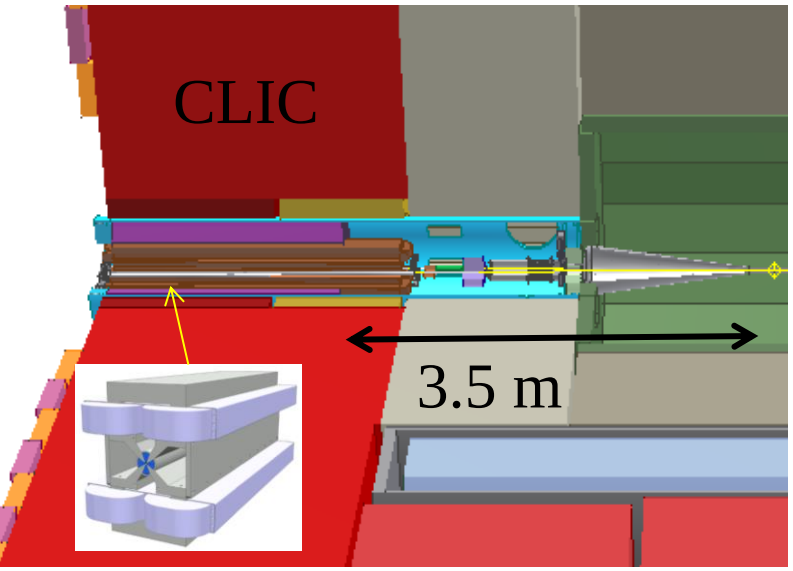
Why a an Hybrid magnet ?

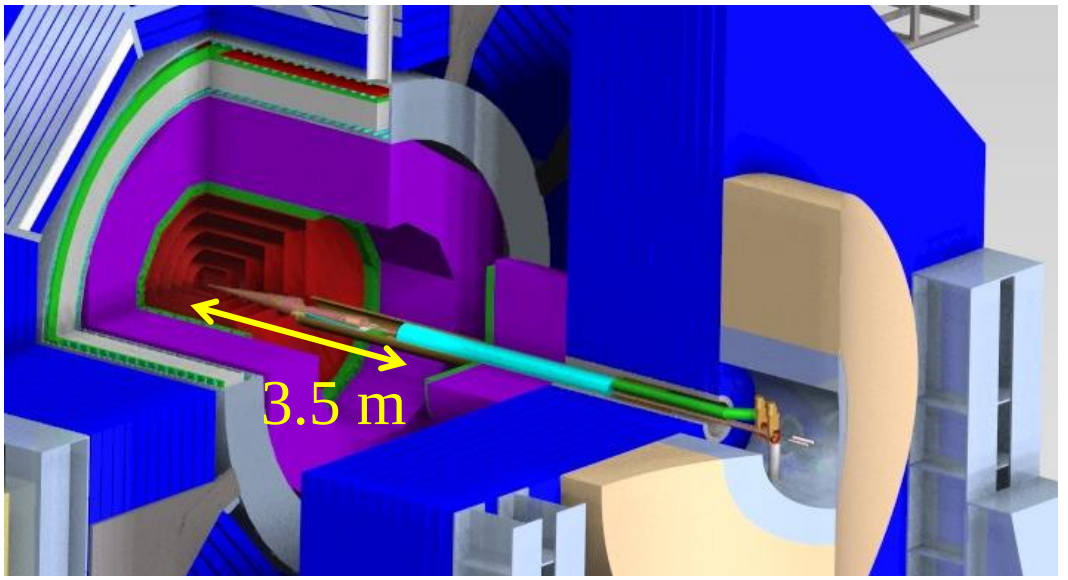
- Limited space available for the magnet difficult to accommodate a cryostat

- Magnet aperture too small to wind a superconducting cables given the large forces and the small radius;

- Complex assembly, difficult to align and stabilize at the sub-nanometer level (different layers of coils, collars, thermal insulation, cryostat);

- Difficult integration of a conical post-collision line in a cryostat assembly.





QD0 quadrupoles