ILC Superconducting QD0 Special Features

There were many special considerations for the present superconducting QD0 design:

- The magnet cryostat has a compact transverse size in order not to take up too much space in the experiment while having the smallest possible L*.
- Inside the cryostat in with QD0 are the additional necessary sextupole and octupole coils on the incoming beam line and a close in quadrupole that starts the downstream focusing beam line structure to accept the disrupted beam and prepare optics for a downstream diagnostic beam line before the final beam absorber.
- All of the above magnets are adjustable for easy optics (i.e. adjusting beta*, beam based alignment etc. for commissioning/finding luminosity) and energy changes.
- And in addition to the main coils these magnets have many integrated dipole, skew-dipole, skew-quadrupole and skew-sextupole correction coils for adjustment of field offsets and magnet rolls.
- All the above coils are produced using well-established Direct Wind technology.
- Because the outgoing beam passes fairly close to the IR end of the QD0 quadrupole coil, this coil has a second outer coil for active external field cancellation.
- Since the original RDR design we have decided to split the QD0 quadrupole coils into two sections so that it is possible to shift the center of focusing with respect to the IP. This give a useful knob for decreasing the effective L* even further in order to regain luminosity for low energy running without having to make IR geometry changes.
- The QD0 cryostat gives a natural location for implementing an anti-solenoid optics correction to deal with effects that would otherwise spoil the achievable luminosity. Note there always seems to be some confusion here; for the superconducting QD0 magnet coils to operate properly we do not need an anti-solenoid to fully kill (and therefore disturb) the detector solenoidal field. This unlike any magnet concept that incorporates saturable magnetic materials that would not function without a full anti-solenoid.
- Also because we can have a very small diameter superconducting anti-solenoid inside the QD0 cryostat, we can use a trick to make a longitudinal “force neutral anti-solenoid” that disturbs the experimental detector much less than a large diameter anti-solenoid would. But the force neutral trick does not work for a large diameter anti-solenoid that then has to be housed in a seperate large cryostat that must handle very large, many ton, longitudinal forces. Unfortunately many folks keep showing an old IR schematic CAD drawing that shows such a large anti-solenoid solution that fills up a lot of space in the detector and greatly perturbs the detector field; such a diagram gives a false impression of the actual ILC baseline force neutral anti-solenoid design.
- In order not to have anything “flowing” in the QD0 cryostat to be a source of vibration we deliberately chose to use superfluid He-II (pressurized) for cooling even though we do not need the additional margin that 1.9K provides. In this manner the magnet coils are effectively conduction cooled with heat passed on to a service cryostat far away from the magnet cryostat inside the experiment.

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