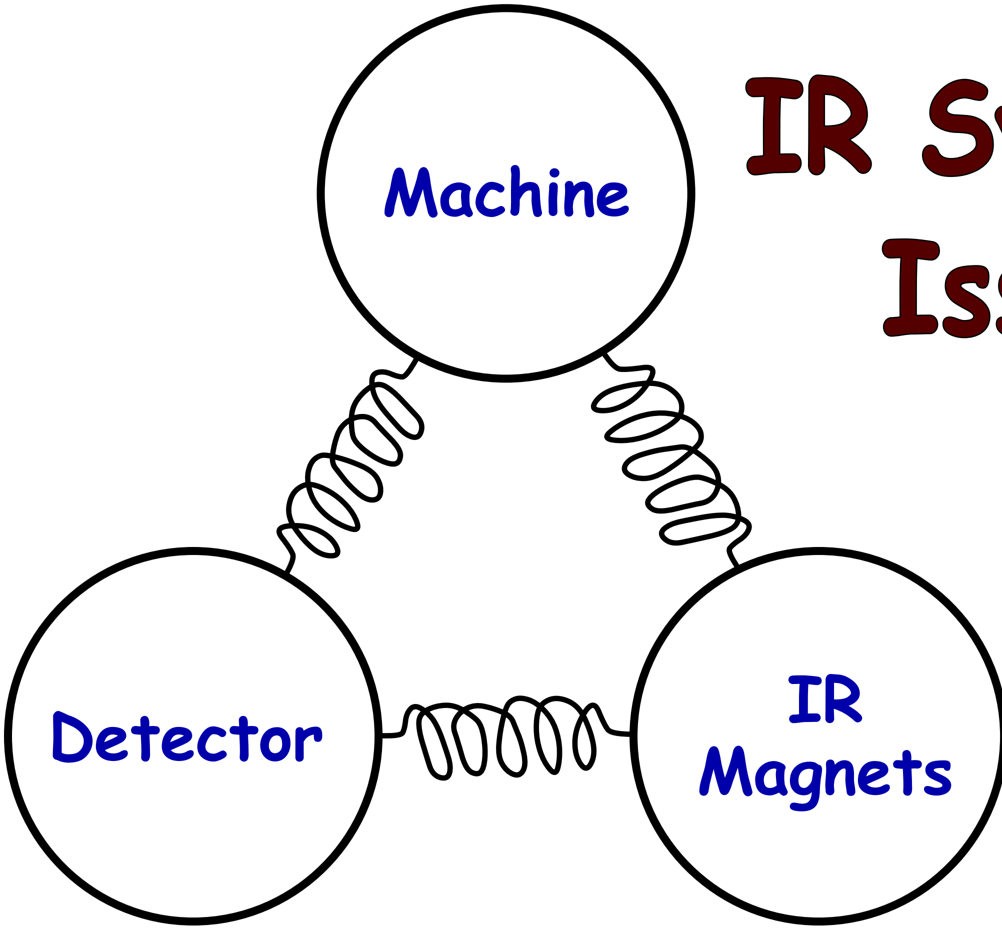
2007 INTERNATIONAL LINEAR COLLIDER WORKSHOP

May 30 until June 3, 2007

Worldwide Study of the Physics and Detectors for Future Linear e^+e^- Colliders

DESY

IR Systems Integration Issues Relevant to Push-Pull.



reported by
Brett Parker, BNL

Joint Session of the LCWS: MDI and ILC: BDS Workgroups held at DESY on 1 June 2007.

"IR Systems Integration Issues Relevant to Push-Pull," IR Magnet Point of View.

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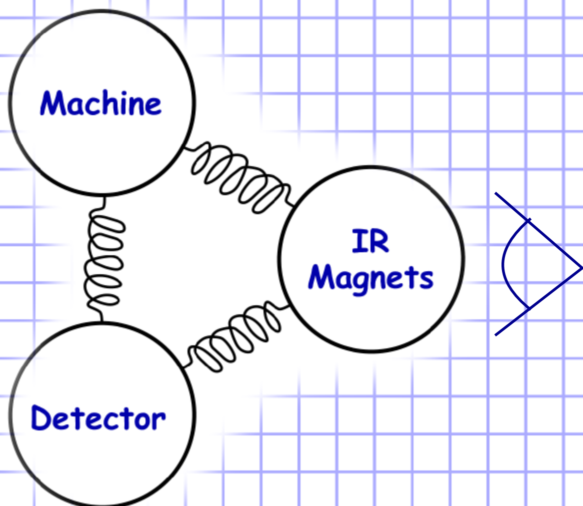


In this talk we will view the IR systems integration issues from the perspective of how our design decisions influence the IR magnet requirements.

Personal Goal: In the discussion time after this talk I hope we can come up with a tentative list of contact people from the accelerator and technical groups as well as all four detector collaborations along with a list of homework assignments that can be completed in time for review at the September IR workshop at SLAC. – B. Parker

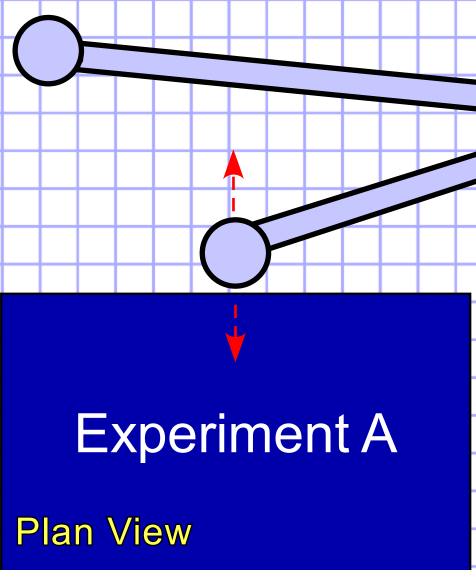
Homework Item #1: Implications of Desired Changeover Time Scale.

Assertions - Superconducting magnet (detector & final focus) warm-up/cool-down time scales are long enough that these magnets have to be moved while cold? But they may be de-energized?

If true, this drives a need for long "umbilical" connections to each of the experiments that are able to accommodate ≈20 m motion while cold.

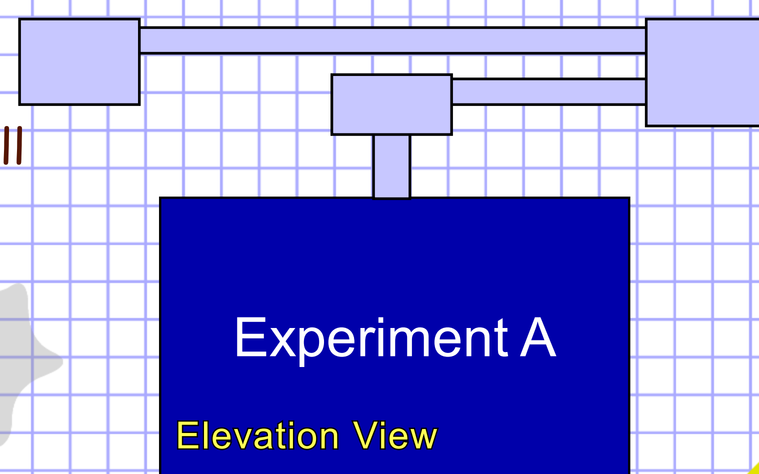
Cryogenic requirements? *Safety Codes?* *Previous experience?*

Interface requirements? *What about R&D and testing?*



Crane operations and hall utility right-of-ways?

Who will start working on such a scheme?



Homework Item #2: IR Cryogenic Heat Load and Power Requirements.

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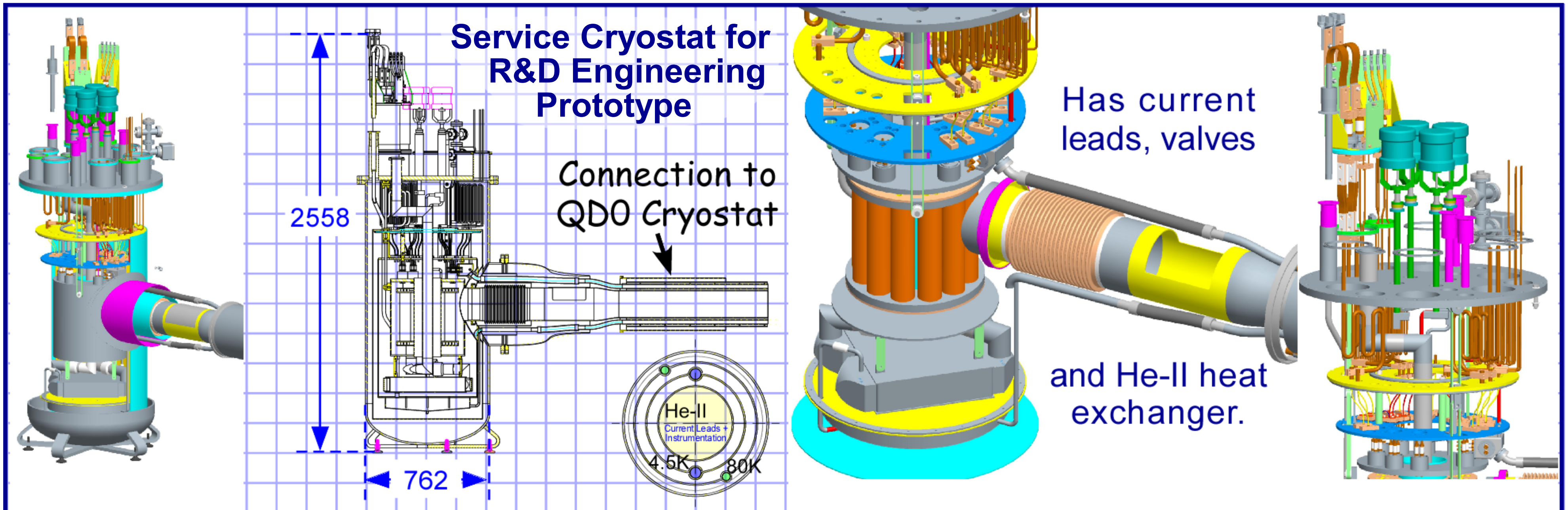
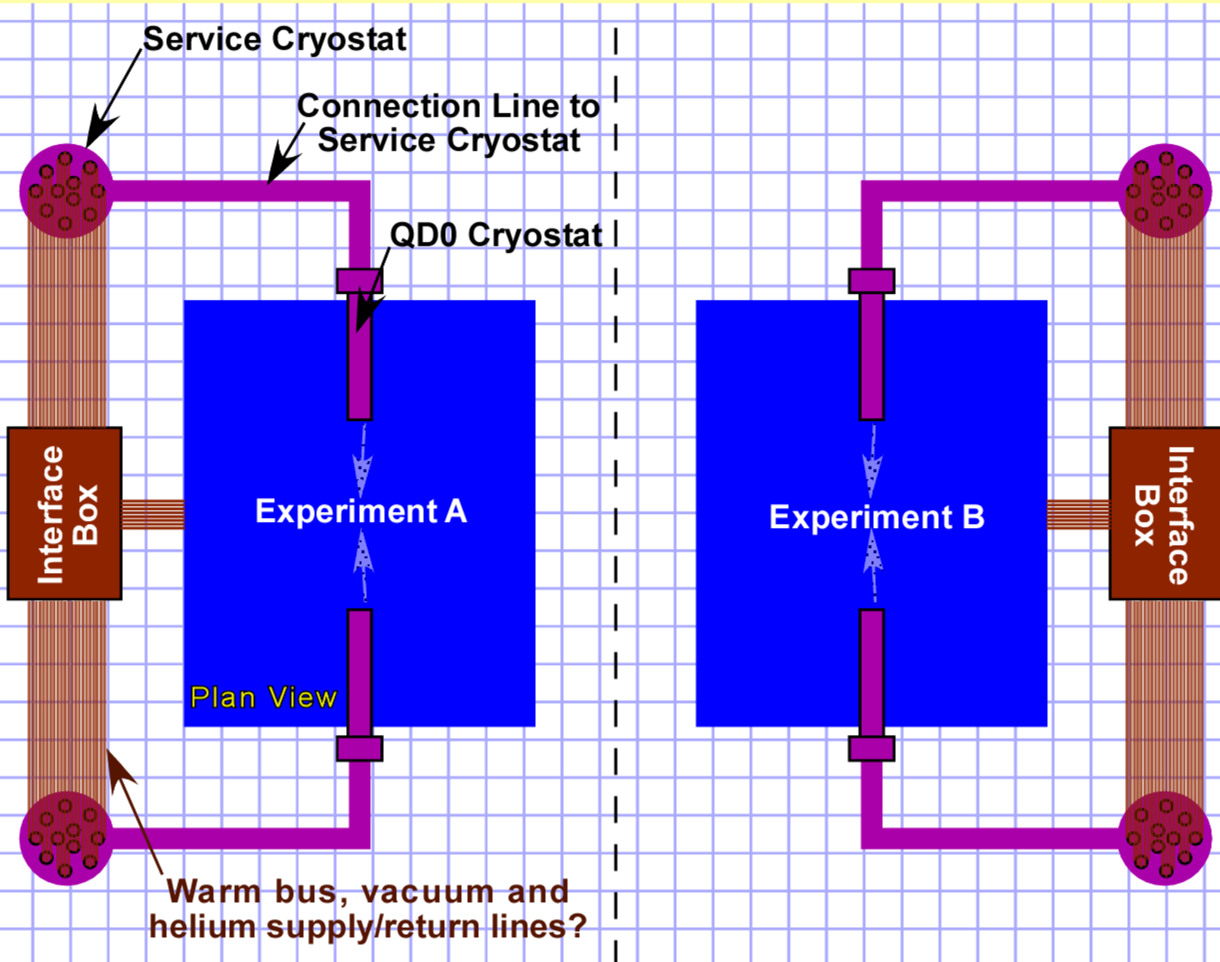


At this point in time the service cryostat that is being designed for the QD0 engineering prototype (see above information) is being used as a place holder for the cryogenic interface definition. Note the diameter of the cryogenic connection to the QD0 cryostat <u>depends critically on assumptions of static and dynamic heat load as well as the distance to the service cryostat</u>.

What are reasonable static (warm-cold & supports) heat loads (4.5K & 1.9K) and how much should we budget for the dynamic (normal running & upset conditions) heat load?

Homework Item #3: Path & Length Between QD0 and Service Cryostat.

Topology proposed for push-pull to keep the path length between QD0 and the service cryostat to about 10 m...



while keeping heat exchanger's elevation close to that of QD0.

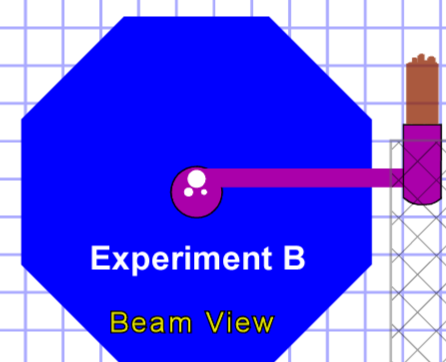
Impact on cryo of a net elevation change?

If/how each experiment opens up while at beam position?

Separate the recooler and current lead functionality?

Where is the interface box and connection to umbilical?

What about the pacman?



Homework Item #3': Path & Length Between QD0 and Service Cryostat.

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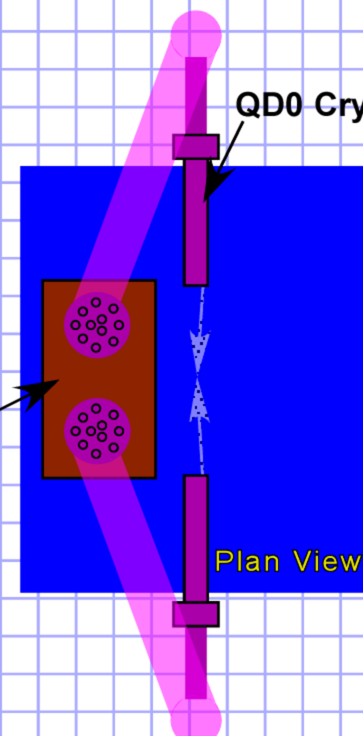
Suggestion to consider: Separate out functionality of service cryostat to keep He-II heat exchangers close to QD0 but then make a vertical transfer to a more complicated control box that then houses all the current leads and umbilical interface.

With a different layout it may still be possible to keep the He-II heat exchanger close to the QD0 cryostat but run the cryogenic connection lines vertically so that the pacman shielding can separate horizontally instead of vertically.

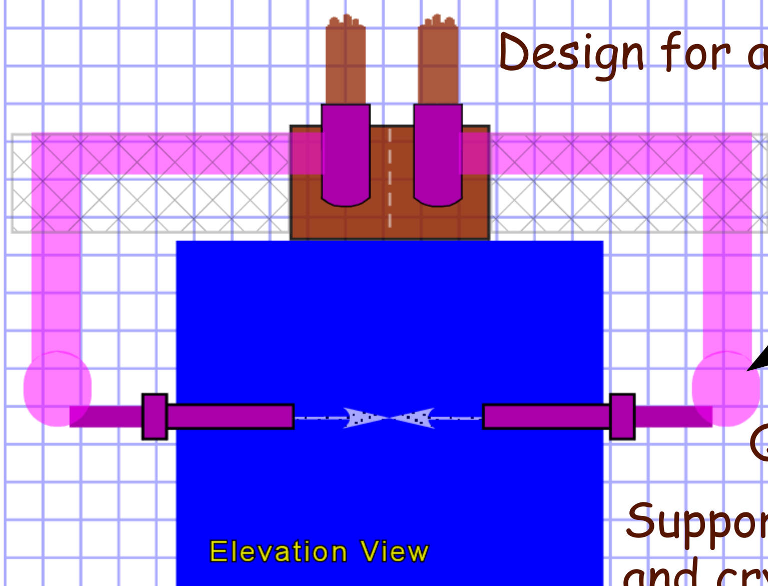


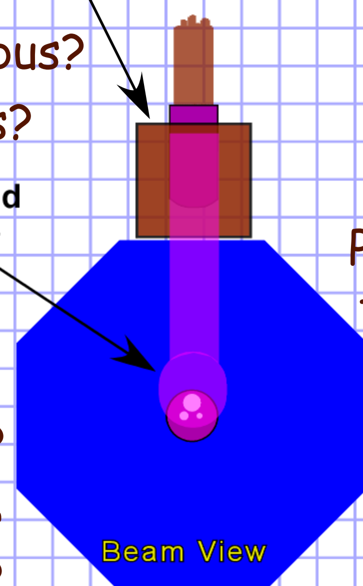
Control Box with Current Leads

Design for a long run of cold bus?

Cool-down issues?

Heat Exchanger and Vertical Cryo Line





Pacman needs cavity for heat exchanger.

QF1 interference?

Vertical cryo line's diameter?

Support heat exchanger and cryo lines from top?

Homework Item #4: Pacman Scenario.

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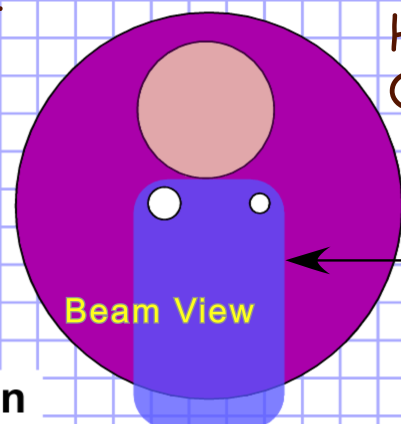
Assumption - Consistent with minimizing distance between QD0 and the HE-II recooler, I show the Pacman (end region radiation shielding) opening vertically.

How does the pacman open?

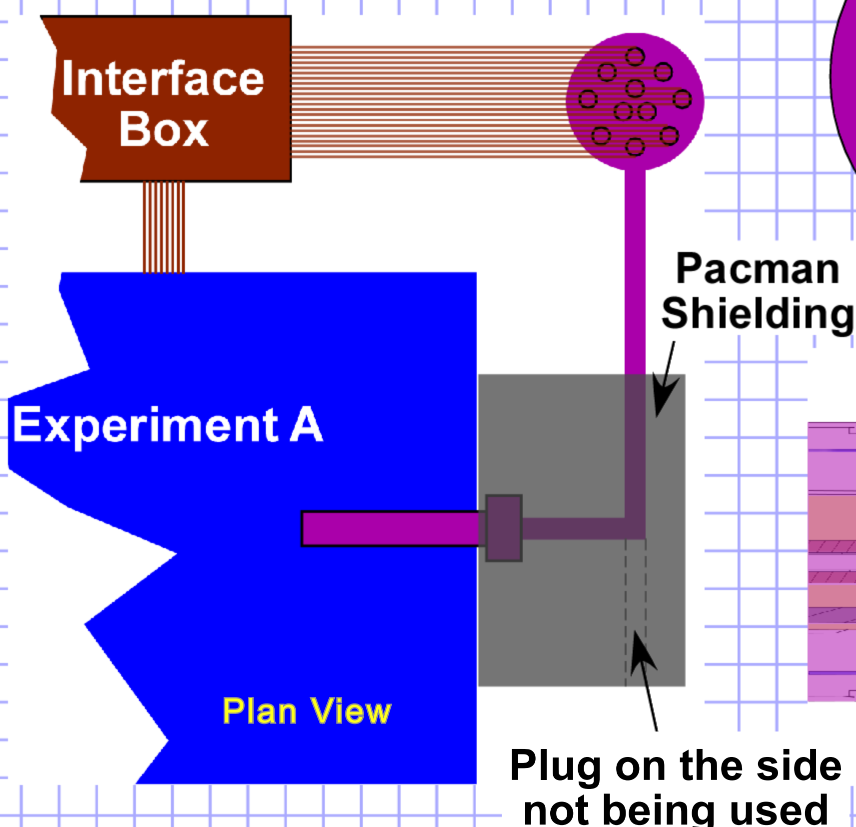
Path for cryo connection consistent with radiation shielding goals?

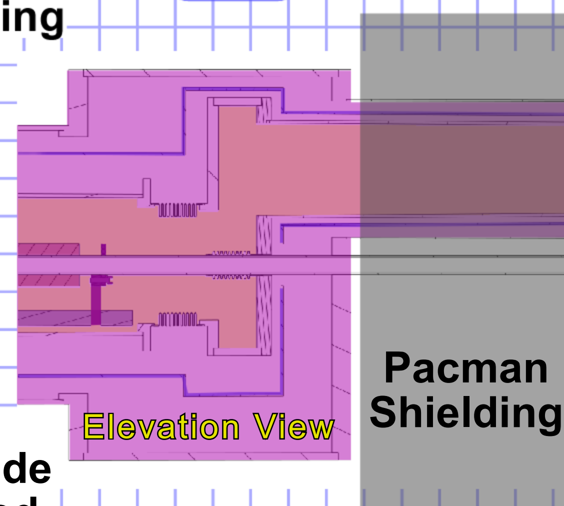
What about the QF1 cryostat?

How do we support/align the QD0 cryostat in the detector?



Space for vacuum valves, pumps and supports is provided below cryogenic connection line.





Cryo connection and beam lines are at different elevations (for no direct view) but we may need an extra "jog" to meet the shielding needs?

Information Gained Via QD0 Cryostat Engineering Prototype Systems Test.

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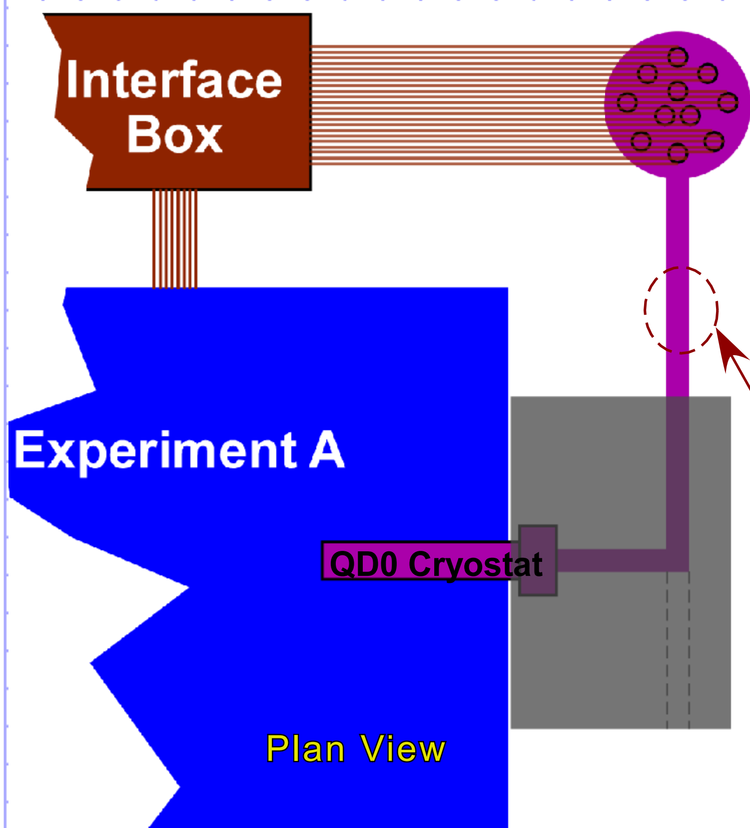
BDS R&D plan stresses the importance of integrated systems testing of an engineering prototype (QD0 with connection to service cryostat) to among other things establish the degree of coupling of external vibration sources to the QD0 cold mass. For a 100 nm goal will standard practice be good enough or will we need to develop mitigation schemes? Is "100 nm" a reasonable goal?



What noise is expected from technical systems?

How well can the QD0 cold mass be isolated?

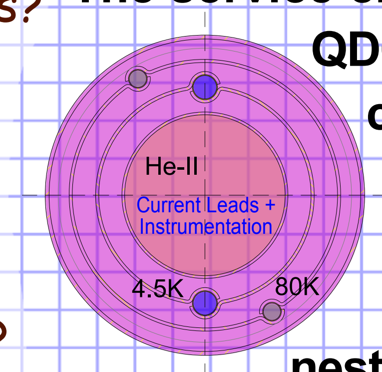
What about bellows?

Are there any internal modes to worry about?

How well can QD0 be supported in the detector?

Intermediate stabilization/isolation?

The service cryostat to QD0 cryostat cryogenic transfer line has several nested layers.



How do we isolate the QD0 cryostat from external vibration sources? Particular attention is needed in this regard to the design of the cryogenic transfer line between the service and QD0 cryostats.

Homework Item #5: All Detector Concepts! We Need QD0 Support / Access Scenarios.

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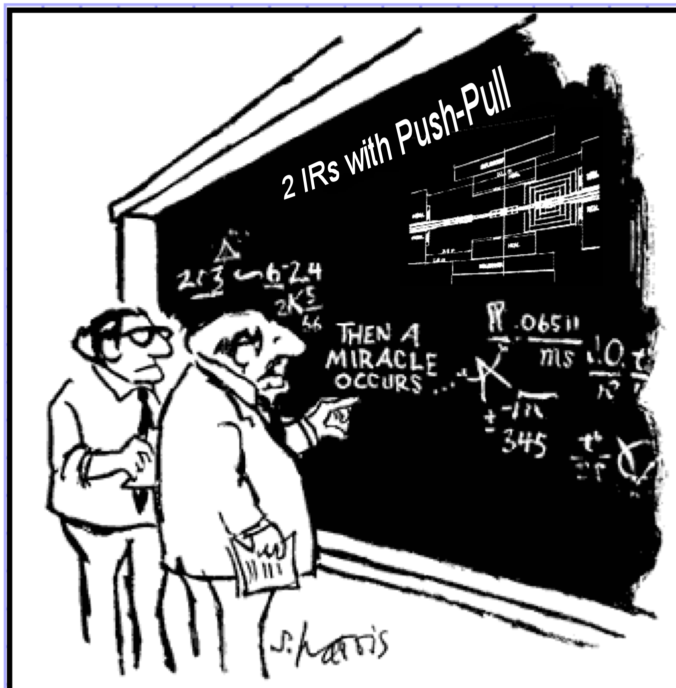


"I think you should be more explicit here in step two."

Apologies to Harris - BP.

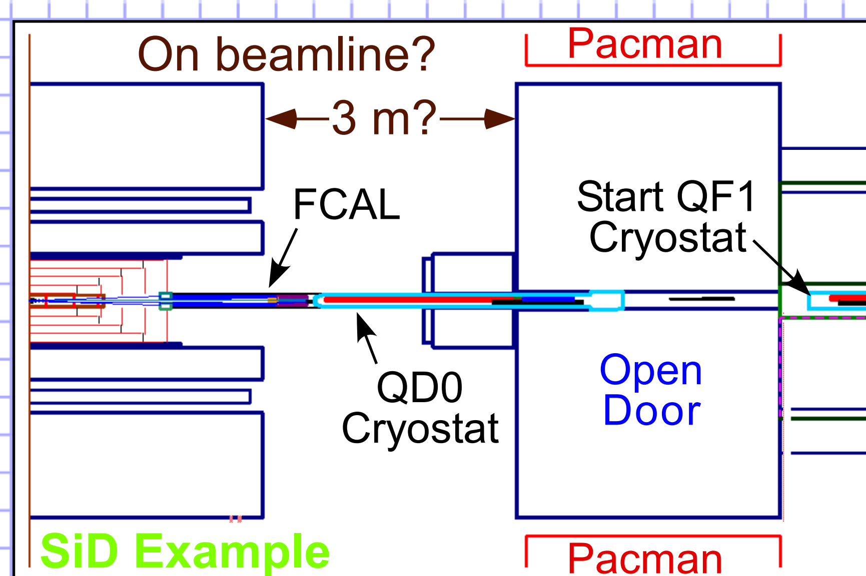
Detector access scenario(s)?

On/off beamline differences?

What else does QD0 support?

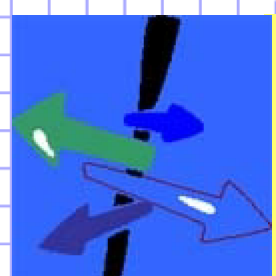
How is alignment assured after a move? Or detector access?

Use "support tube," rails or something else?



Door opens longitudinally or has a vertical split?

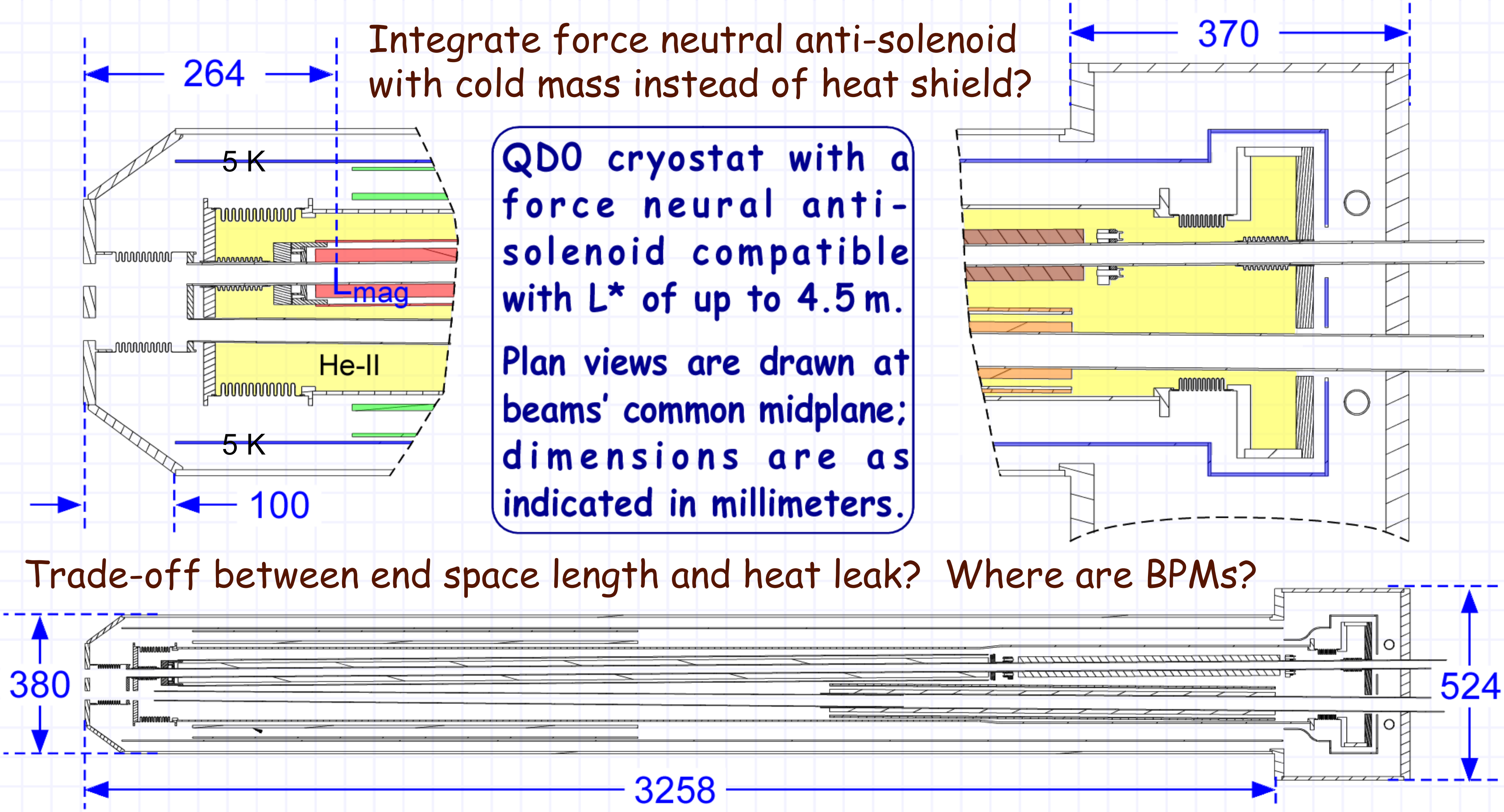
Interference with QF1, transfer line, pacman or service cryostat during access?



At this point it "feels" like the support / access requirements are moving in four different directions.

Homework Item #6: Space and Position of QD0 Cryostat for Each Detector Concept.

Integrate force neutral anti-solenoid with cold mass instead of heat shield?



Trade-off between end space length and heat leak? Where are BPMs?

What is L*? Can all experiments agree upon the same L*? Use two different L*s?

Minimum cryostat diameter depends upon L*; worst case scenario, 4.5m is shown.

Homework Item #7: All Detector Concepts! Backgrounds & Magnet Energy Deposition.

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Experiments are especially concerned with computing (minimizing) detector backgrounds. For the magnet system we need to understand the expected level of energy deposition in magnets.

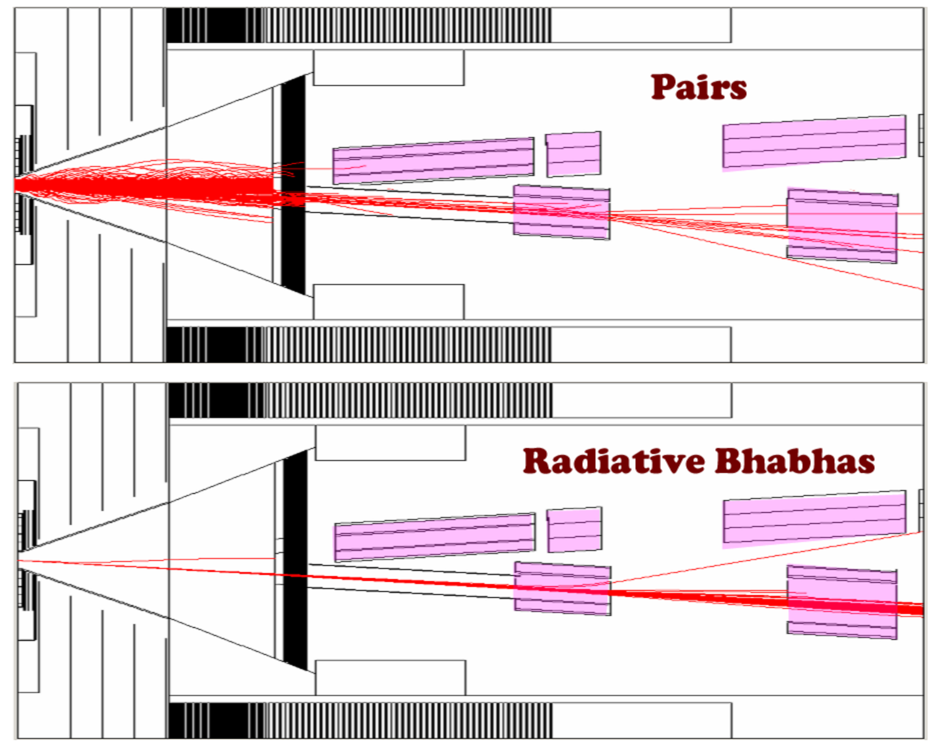
Optimized (anti)-DID field profile?

Optimized anti-solenoid field profile?

Get ED results from tracking?

What about beam tuning or abnormal operating conditions? What are "safe" (but not too conservative) ED budgets? (see Homework Item #2)

Pairs and Radiative Bhabhas in 14 mrad Crossing Geometry (interaction turned off).



"Detector Background Update for L*=3.51 m, L*(ext)=5.5m," Takashi Maruyama, BDS Weekly Meeting at SLAC.

Right now I (BP) can generate sample field profiles for the DID and anti-solenoid but to go further we need agreed upon requirements for each detector concept. Maintaining multiple L*s and layouts does increase the work to be done.

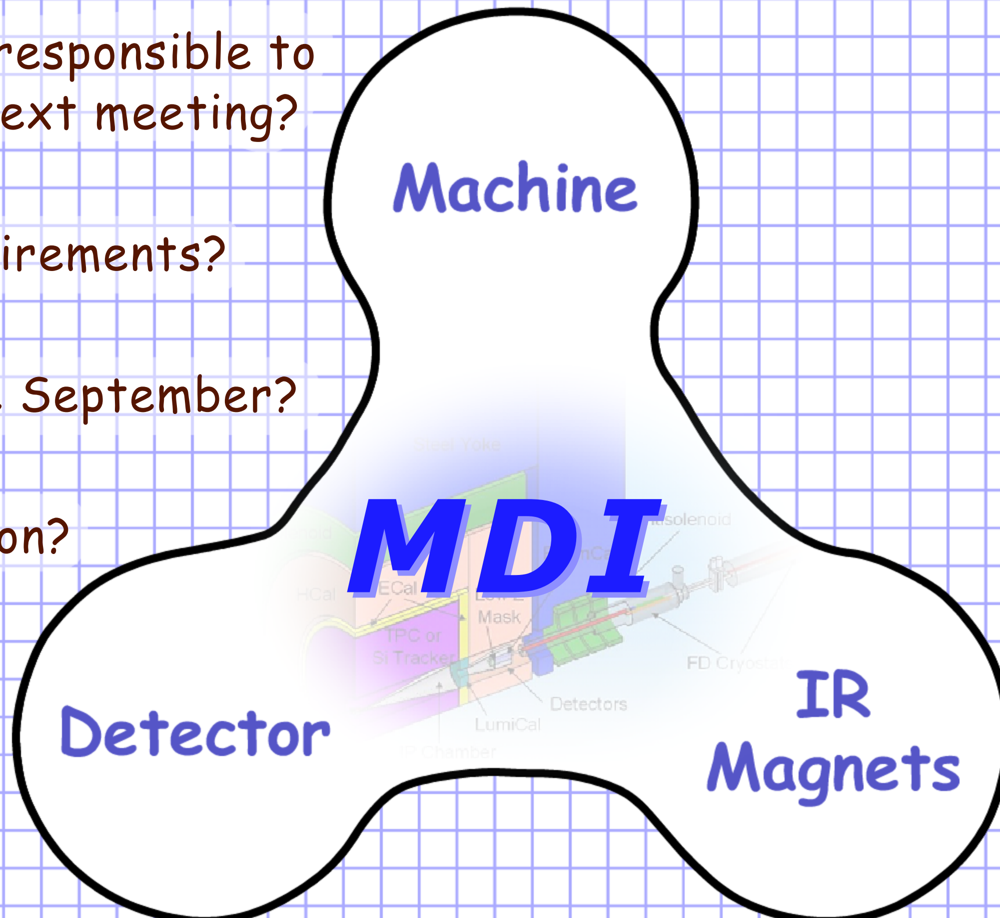
Homework Item #8: Responsibility for Pulling the Information Together.

Can we identify <u>here</u> folks who will be responsible to do the homework outlined in time for next meeting?

How should we balance conflicting requirements?

Schedule of interim discussions before September?

What resources do we have to draw upon?



Almost all of these issues have been discussed in many different venues by a variety of people. Up until now there has been intense time pressure to complete the BCD, RDR, reduce costs etc. but it seems to me that now that we are starting the EDR, it is time to really flesh out IR systems integration issues in detail.

Thank you for your attention. - B. Parker