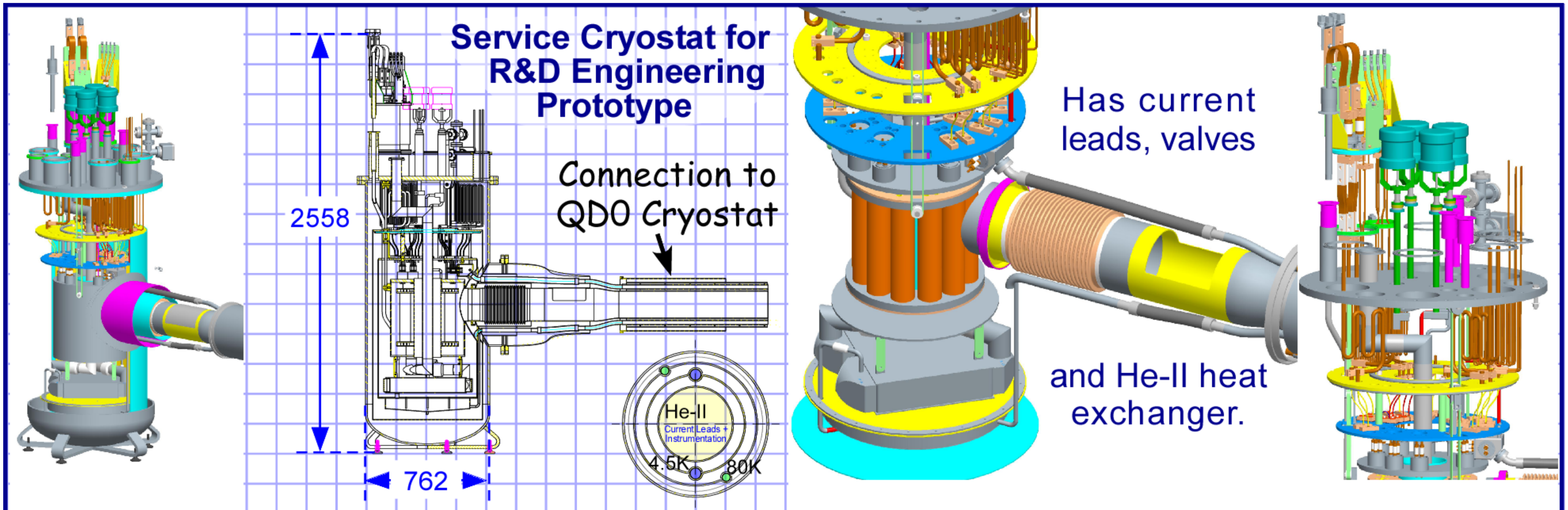
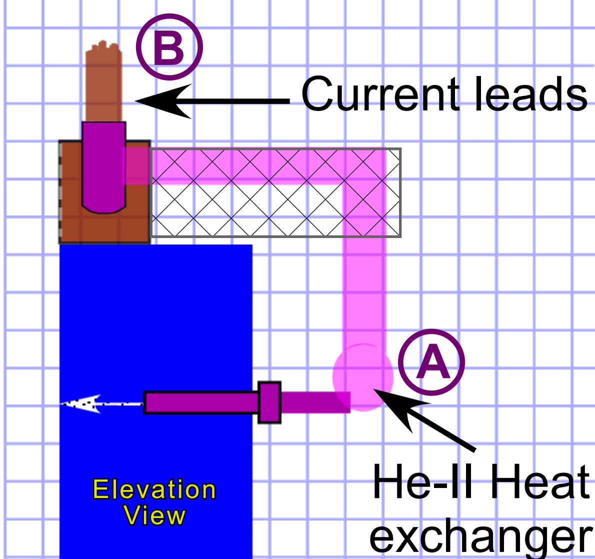
IR Strawman Design Parameters

as proposed by
Brett Parker, BNL

We are not going to get anywhere in time for September unless we temporarily agree on some assumptions & move on with the work.

Each QD0 cryostat gets its own dedicated service cryostat.





At Hamburg meeting suggested way to keep He-II heat exchanger close to QD0 while having vertical connection line was to split service cryostat functionality into two boxes. But this ends up dramatically complicating the system and box A ends up being about as big as the original service cryostat. For instance it needs 1.9 K to 4 K current bus feedthroughs and cold bus design between points A and B.

Vertical Layout for the Service Cryostat to QD0 Cryostat Transfer Line.

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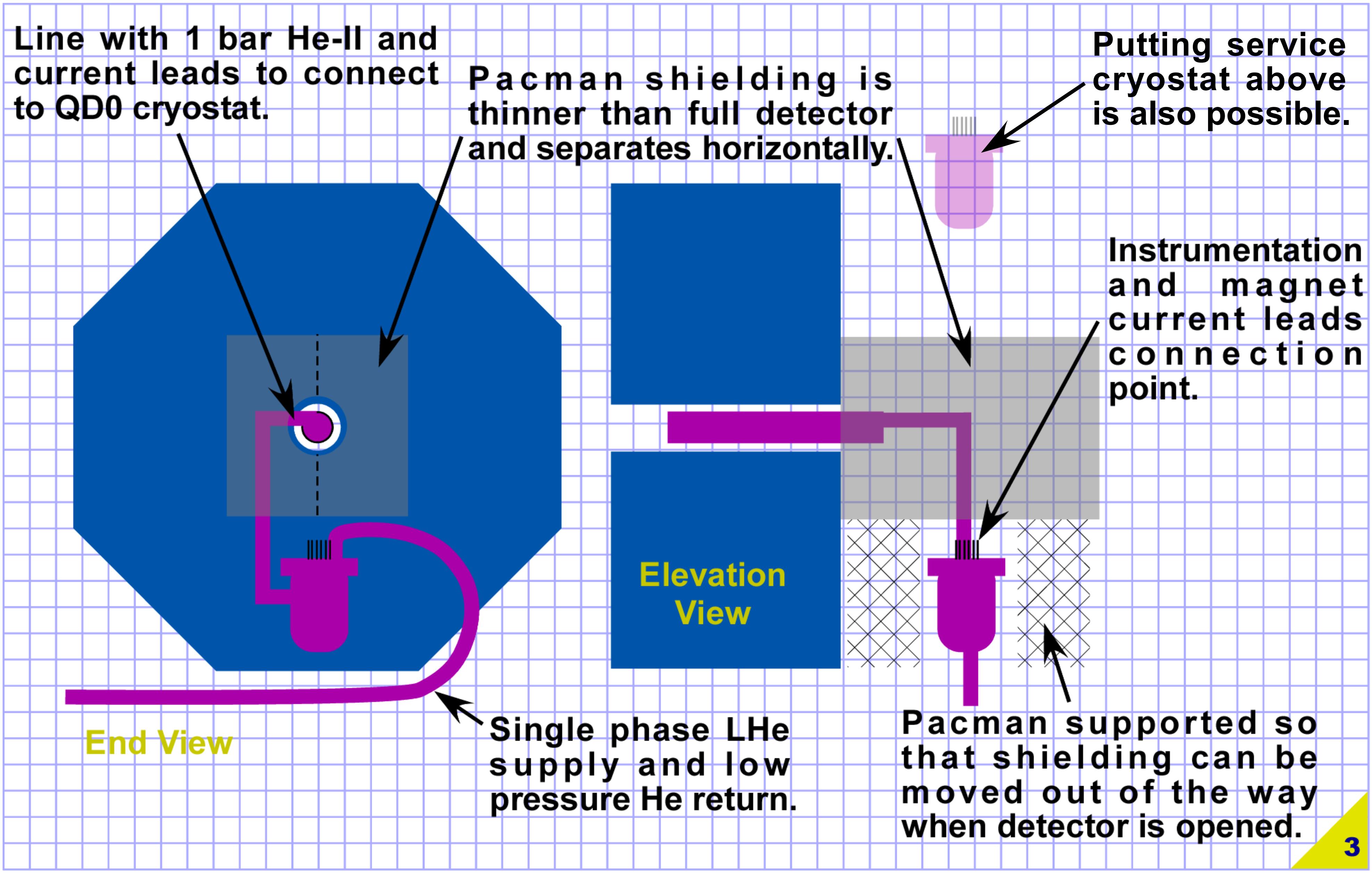
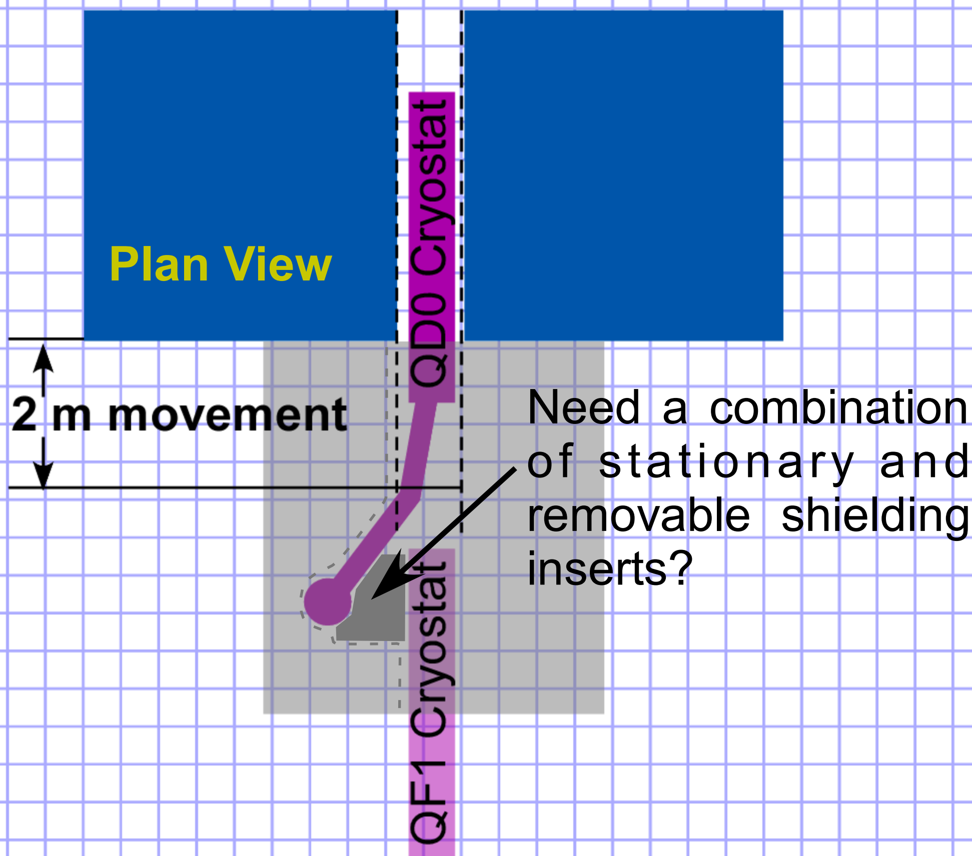
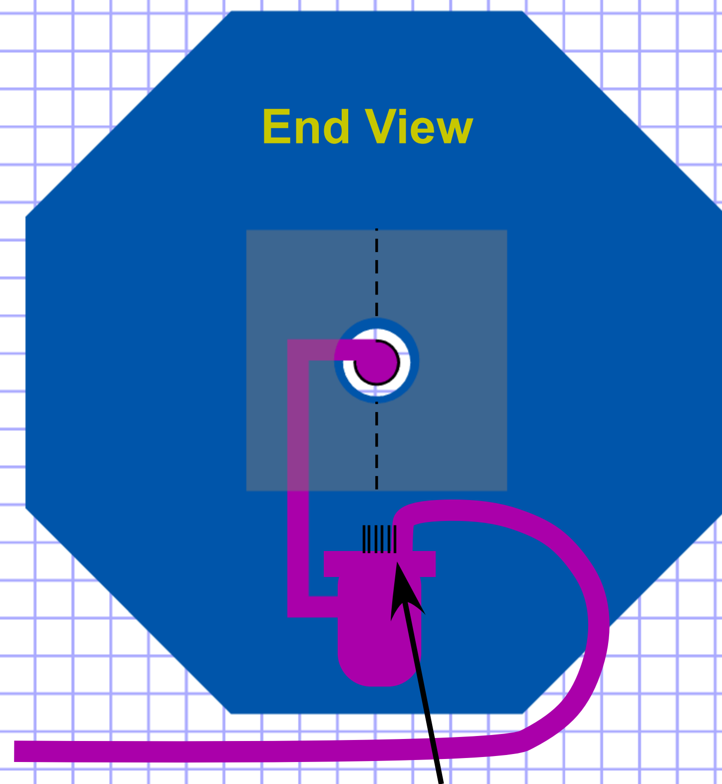


Prohibit any line of sight penetrations through pacman to beam line .





Make the current lead, instrumentation, process gas, vacuum line, etc. connections outside to minimize penetration of pacman.

QD0-Service Cryostat connection line has to permit 2 m opening by door but vertical section must not point directly to incoming/outgoing beamlines.

(Implicit assumption: mirror symmetric cryogenic layouts for the two experiments)

To minimize hall excavation, we make push-pull cut point between QD0 and QF1.

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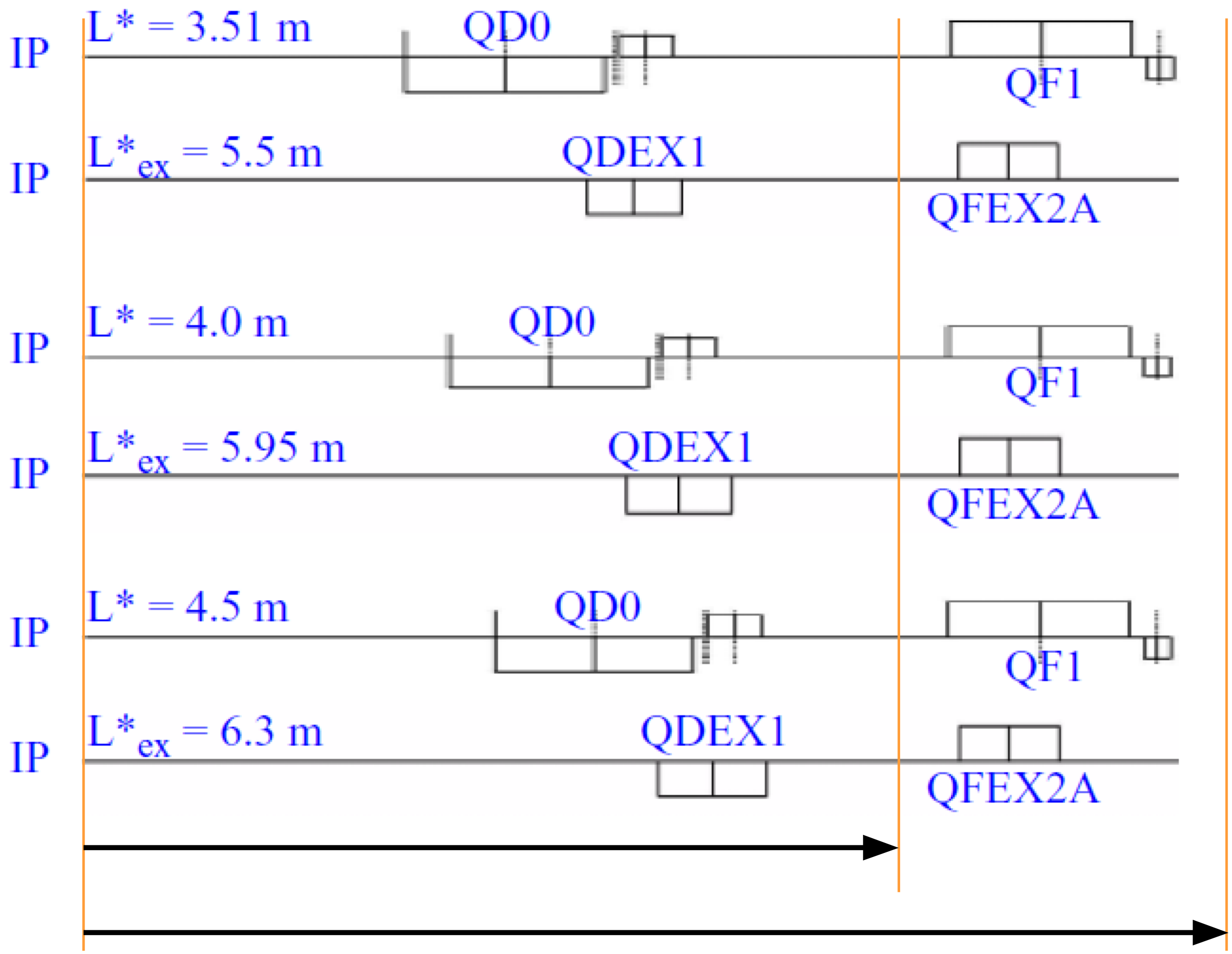

Comparison of half-hall size with push-pull cut point before or after the QF1 cryostat.

Cutting between QD0 and QF1 is certainly the most aggressive scenario and is motivated by our desire to minimize the size of the underground hall. Once we have a solution, if later on we find some reason that dictates cutting after QF1 (i.e. for common support structure) it is straightforward to implement such a change.

Service cryostat connection is taken apart only a few times during lifetime.

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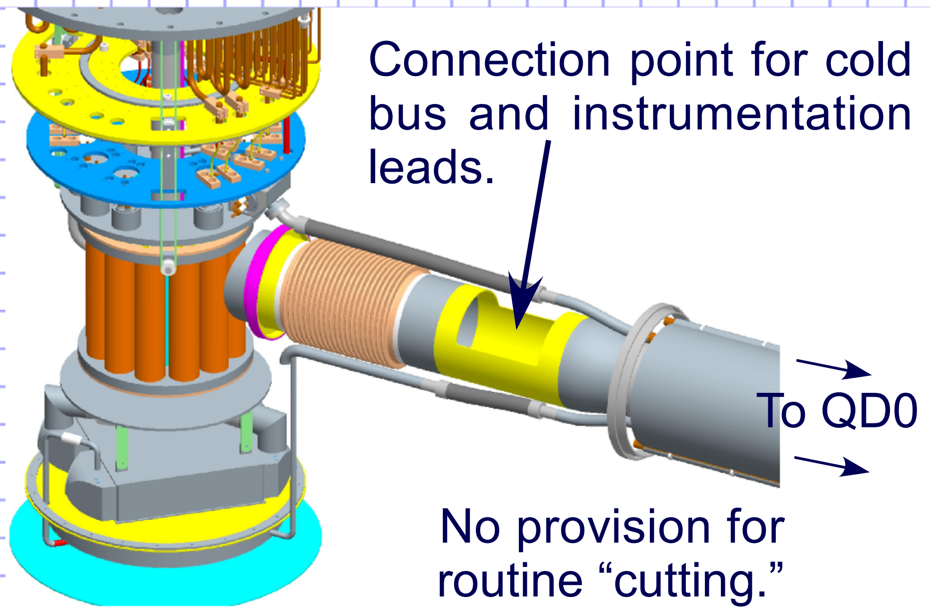

There are a large number of cold bus conductors and instrumentation leads running between the service and QD0 cryostats in the 1.9 K He-II channel. Breaking/remaking these connections is a reliability issue. We do not assume that this is done for any routine operation.

Note this also has implications for detector access in the off-beam "park" position. If QD0 has to be moved, then the service cryostat has to move with QD0 even if the service cryostat is itself disconnected from its helium supply and vacuum return lines.

Work is in progress to further reduce maximum transverse size of QD0 cryostat.

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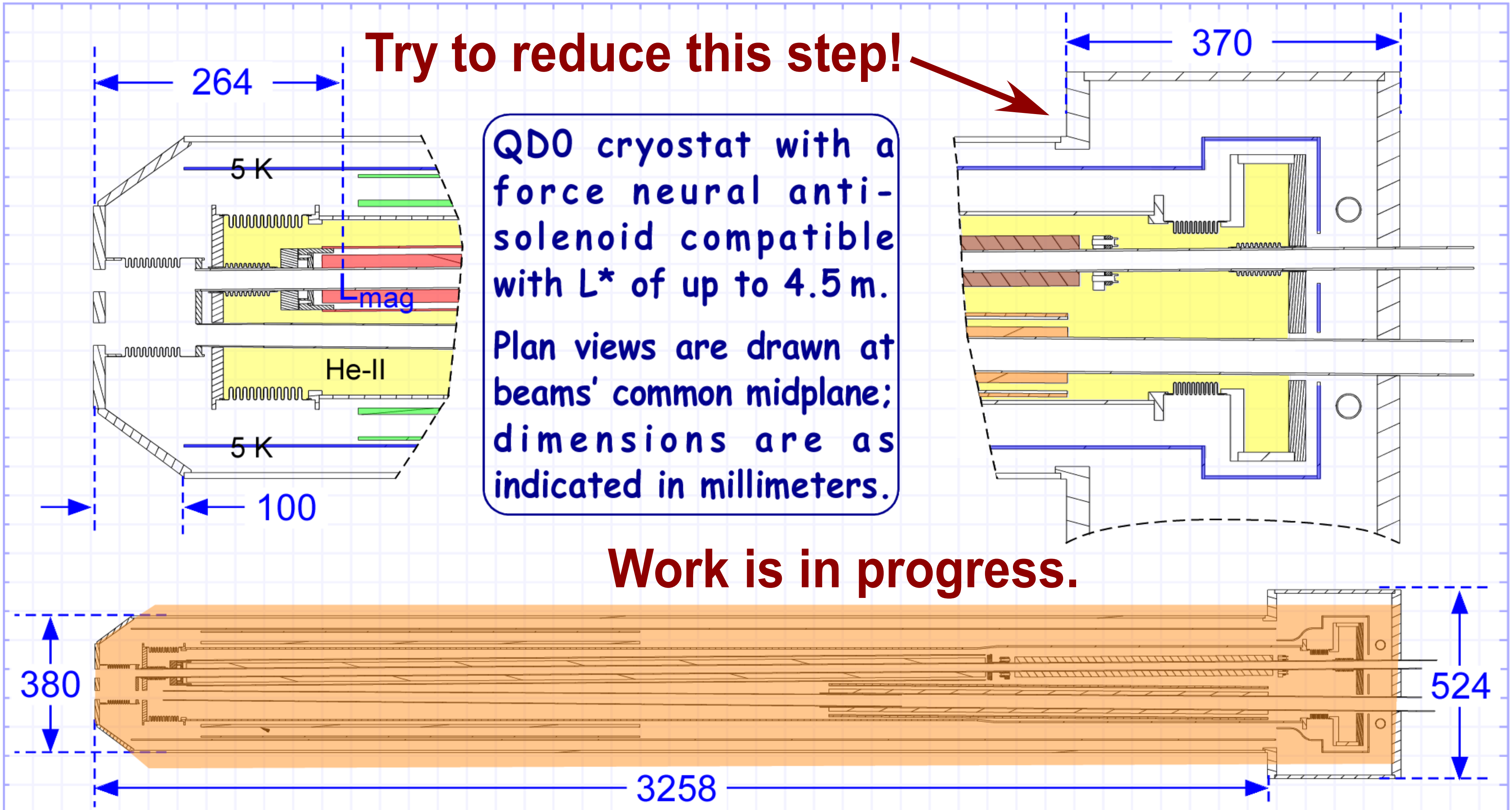

QD0 cryostat with a force neural anti-solenoid compatible with L* of up to 4.5 m.

Plan views are drawn at beams' common midplane; dimensions are as indicated in millimeters.

Work is in progress.

Size He-II connections for 15 watt heat load.

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

Assume heat load is dominated by static and not dynamic (beam related) effects.

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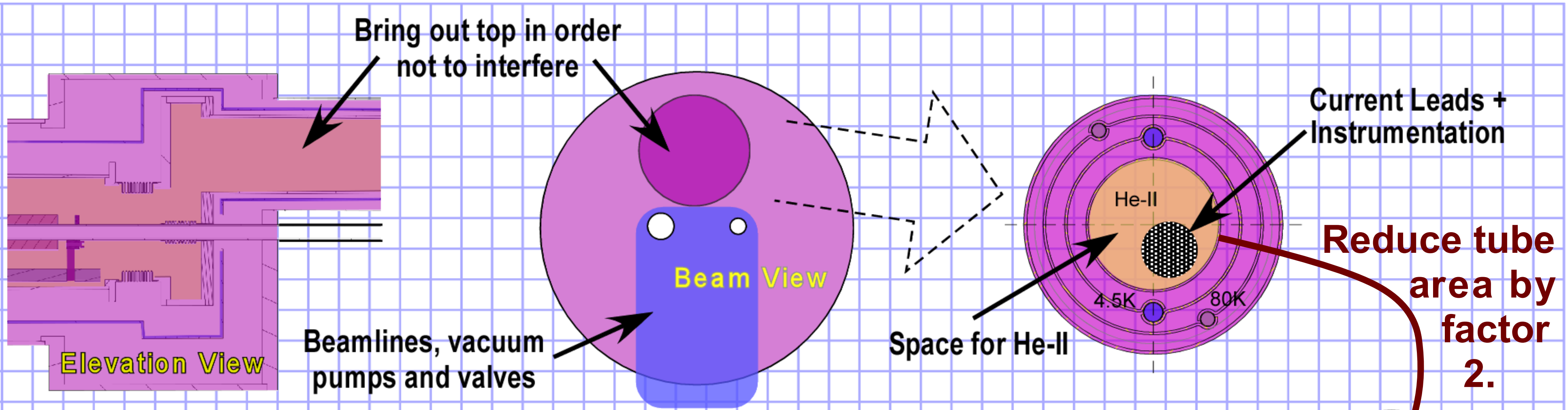
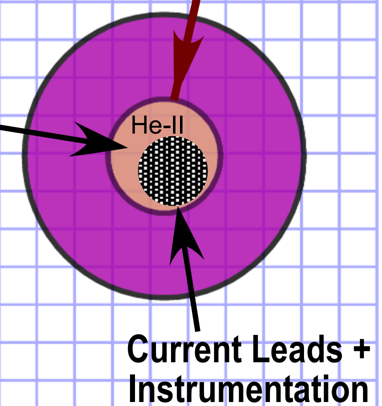


Temperature difference between magnet and heat exchanger depends both on cross sectional area for He-II and the path length.



For **sizing the connection** between QD0 and the service cryostat we take the maximum 1.9K heat load to be 15 watts (14 static + 1 dynamic). Note that QD0 is conduction cooled and when the area for He-II gets very small then small changes in parameters, such as the size of the cable bundle, can make a big difference in performance and cool down time.

By adopting a 1 watt budget for dynamic heat load we had better be sure to consider all possible energy deposition scenarios (beam tuning, upsets, wakefield heating etc.).

See only a small change in transfer line size but big difference in area for He-II.

We assume warm up/cool down is done in the park position (i.e. magnets move cold).

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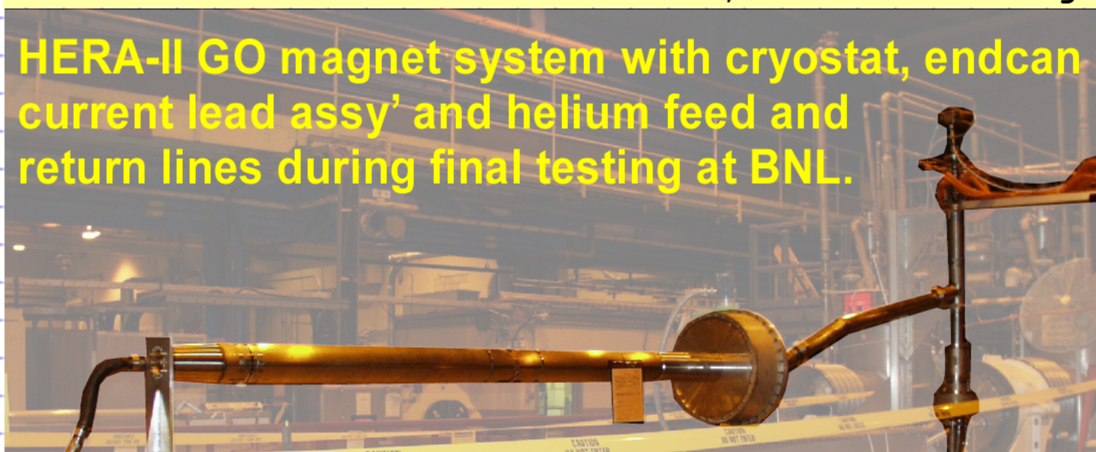
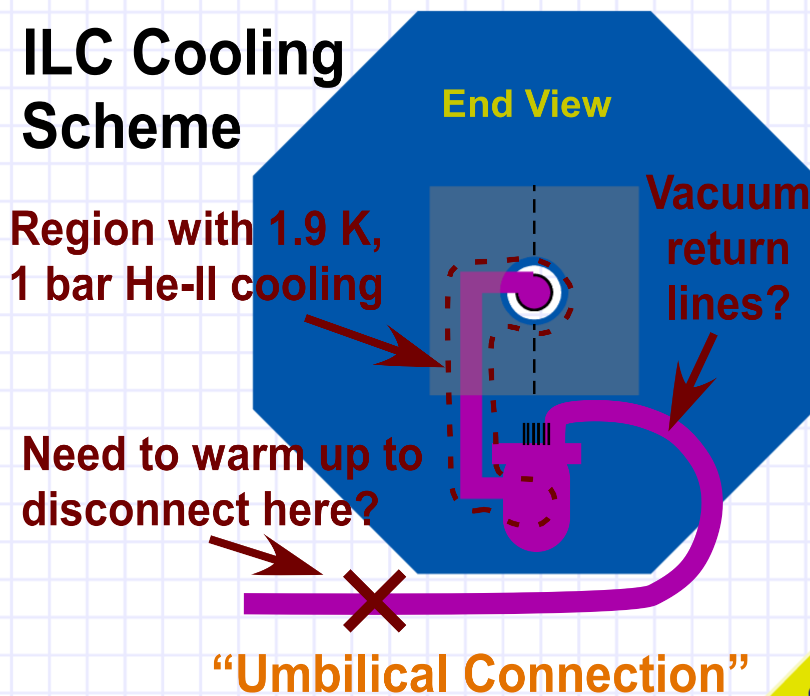
Lieber Herr Meyners, im HERA-Betrieb haben wir die sl. Magnete in den WW-Zonen in 6-8 h von 4K auf 300K aufgewärmt und dann zum Abkühlen wieder 6-8h gebraucht. Von der Anlage her wäre schneller möglich gewesen. H1 hat aber damit grosse Schwierigkeiten gehabt, weil sich die Magnete während dem Abkühlen und Aufwärmen um einige Millimeter bewegt haben. Deshalb sindwir mit etwas geringeren Temperaturgradienten gefahren, damit hieltensich die Bewegungen in Grenzen. Mit freundlichen Grüßen, Hermann Herzog


HERA-II GO magnet system with cryostat, endcan current lead assy' and helium feed and return lines during final testing at BNL.

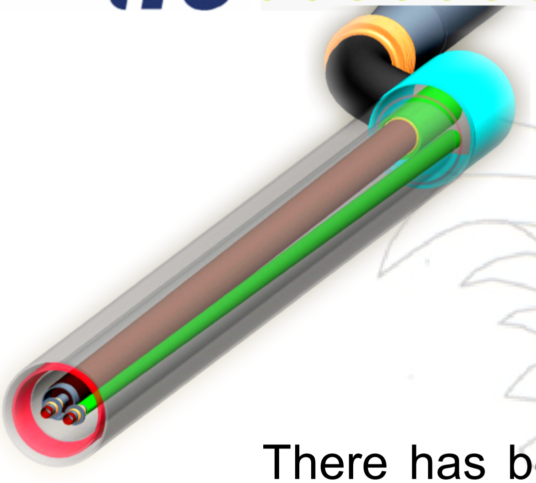
The much simpler HERA-II magnets took 6-8 hours to warm up and again to cool down to 4.35 K with massive LHe flow. But ILC system also has to fill with 1.9 K He-II which will require even more time (also add service cryostat) so the ILC case could easily take more than one day.

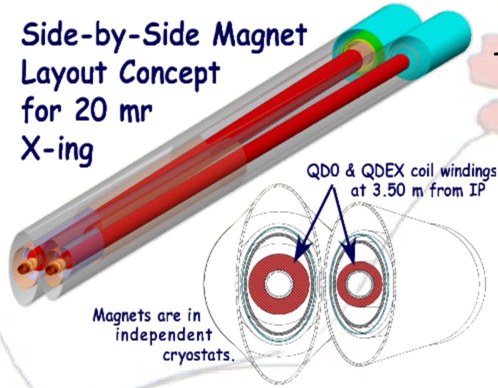
ILC Cooling Scheme

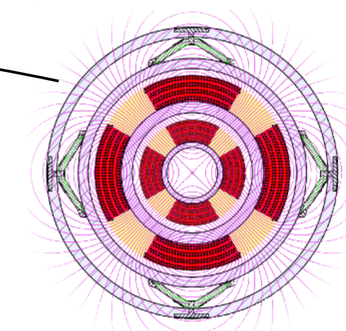


Predicting cool down and warm up times is not a simple task and can depend strongly on system details. We need to do estimates for this system do determine natural limitations and then can see what (if anything) can be done to speed things up.

Strawman Design for '07 SLAC IR Workshop.

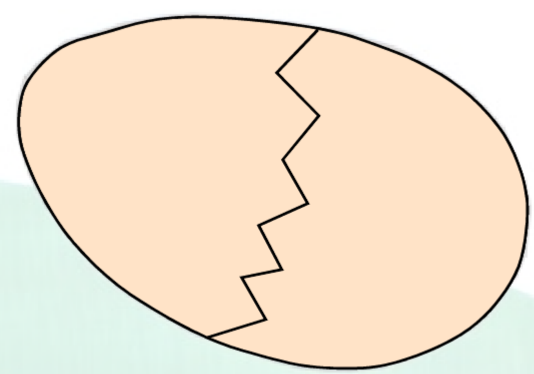


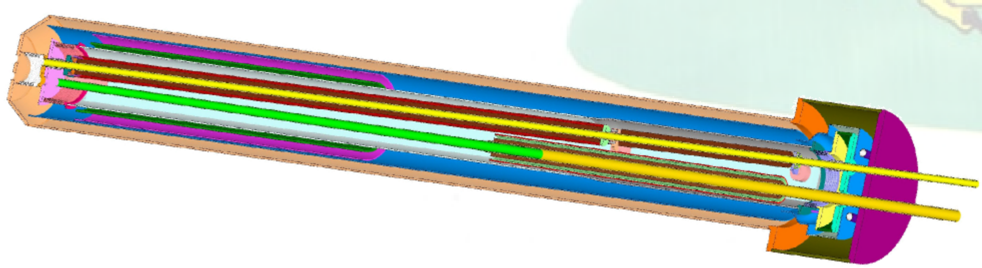




There has been an almost continuous evolution of the IR magnet design over time in response to new requirements of four detectors and the machine. One consequence of this is that at present we do not have fully self consistent set of of parameters to work from. For the upcoming IR workshop lets adopt a strawman design as presented here and try to more fully work out any impacts, backup our assumptions with calculations and do our best to make the system work.

Once we have this, it should be easier to come up with ideas for further improvement. B. Parker





It is time to start cooking.