Meeting on Cryogenics Distribution for 400 MHz LHC RF system

18th February 2005

Present:
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The meeting was based on the presentation by Serge at the 2005 LHC "Chamonix" Performance Workshop.

1. Clarification of points made in the Chamonix presentation

1) Ultimate beam does not need more cryo power. Normal operation is 400 W per module.
2) It can take 6 days from the start of sector cooldown before pressure is low enough in line D to start to cool the cavities
3) RF tests when one sector down – not in baseline design of cryo system. However the QRL provides redundancy – for one sector down.
4) Options:

Option 0: Present baseline is not acceptable (no wrl connection, no regulating valve).
Option 1: With the above points addressed is the minimum solution.
Option 2: Direct connection to cold box output, guarantees no overpressure in the output line, but need to keep QRL connection as back up if we want to run all cavities with one sector down.
Options 3 onwards: not realisable in the present time-scale

2. Points arising in discussion

A) Option 1

1) New safety check valve (to prevent high Line D pressure in the cavities). This is a simple valve which can only allow flow when pressure in the cavity is greater than the D line (like a simple bicycle tyre valve!). Reliability is 100%, approved by TIS. It will also be used to protect the DFBs.

2) Return valve. The cryo baseline has only a simple ON/OFF valve. Pressure variations were originally expected to be taken by the large volume of line D. A regulating valve (Pressure control valve – PCV) is now preferred. It will also have a fast closing system, shut on high D line pressure, by the cryo process control system, providing the first line of protection.

3) Warm recovery line (WRL). Connection to the warm recovery line is needed, principally to take helium back to the plant if the connection to the D line has been closed. If not provided the only exit is via the safety valves or rupture disc – which is not acceptable.

4) The WRL connection also allows operation of RF for a short period, but with very low cryo efficiency and in practice this would probably not be done.

5) Icing around warm recovery line outlet – heaters required (See questions below)

6) Safety valves on modules – Use of double valves, to allow changeover for regular TIS inspections.

7) Valves or rupture discs. Valves have 10% margin closed to fully open. Rupture discs 5 %.

8) Dimensioning of valves and rupture discs: to be taken up with A. Perin.

9) We need to make an ECR to justify option 1

B) Option 2:

1) Requires modification to QPLB and QULA lines. Maintaining redundancy would need completely and rather complicated new valve box. Cannot be designed and built now, even with infinite resources

3) Other Questions. (post meeting!)

1) With the check valve, can we say there is no possibility of emptying line D through the cavities? If so, we have only the 320* litres of helium (1/4 that of LEP modules) to evacuate, in the worst case. Would TIS accept that this could simply be discharged into the tunnel?

2) If we say that we will never run using WRL to recover helium when line D is shut, is there really a problem with icing up of the exit line (with risk to adjacent He level gauge connection) when only 320* l of helium is taken out?

3) Option 2: Taking away the redundancy requirement, would it be an option to connect permanently to just one of the QPLB and QULA lines, avoiding the new valve box ?

E. Ciapala, 24th Feb 2005

* Correcton 2nd. March 2005 320 replaces 80 ec