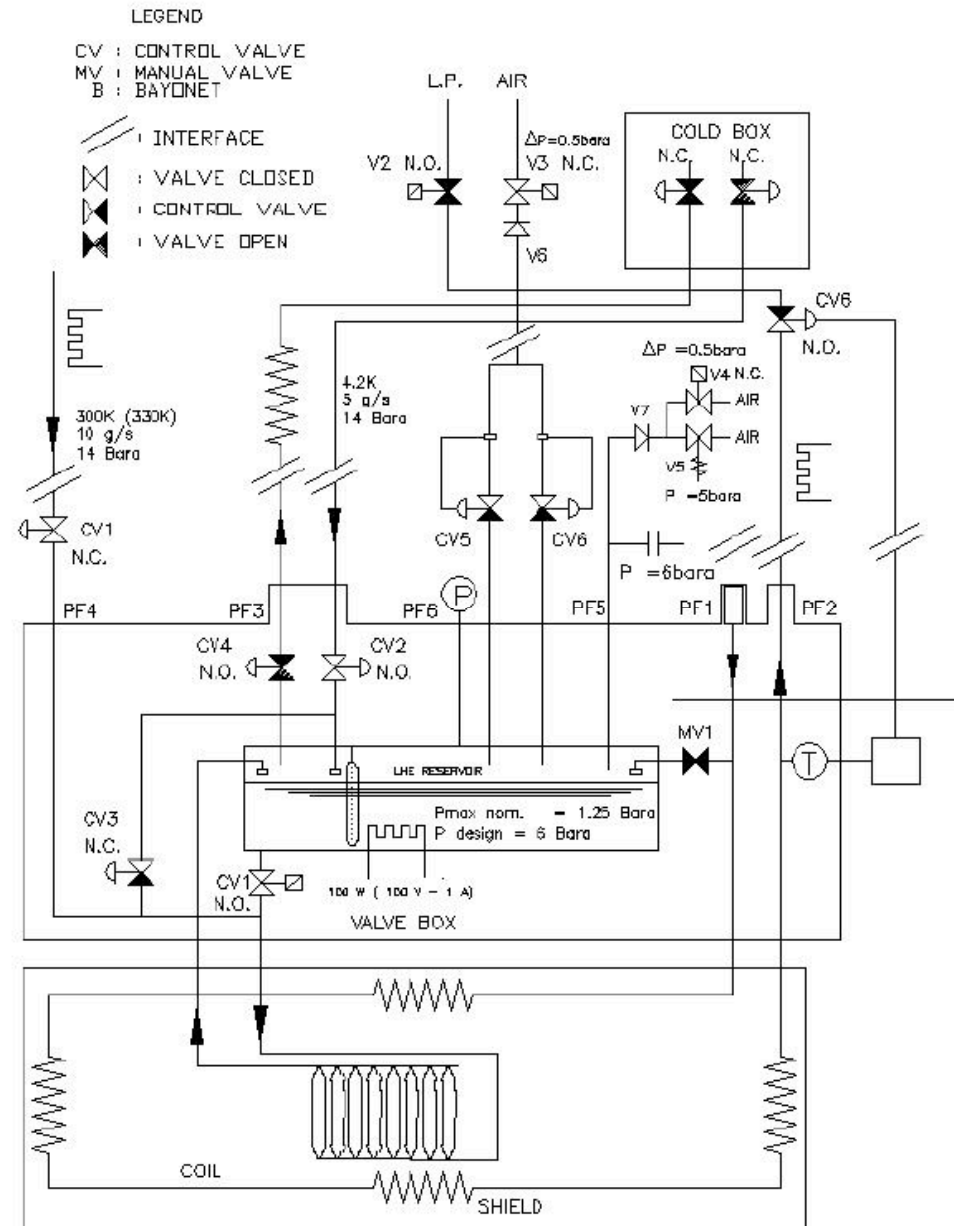


# **The Panda Cryogenics Requirement.**

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# PANDA SOLENOID CRYOGENIC SCHEME



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	<b>Watt @4.5 K</b>	<b>Mains Power</b>	<b>surface m<sup>2</sup></b>	<b>W/m<sup>2</sup></b>
<b>radiation Load (60K 10 layer Superinsulation)</b>	2.73	636.09	<b>39.00</b>	<b>0.07</b>
<b>Distribution Box (cryogenic Chimney)</b>	10	2330		
<b>Conduction Load (Coil supports 60 Tons, 60 K intercept)</b>	6	1398		
<b>Gas Load (vacuum ~10<sup>-6</sup> mbar)</b>	1	233		
<b>Dianostic Wires</b>	1	233		
<b>Eddy Currents at ramp up (3000 s)</b>	2	466	<b>3000 sec ramp time</b>	
<b>Total</b>	<b>22.73</b>	5296.09		
<b>Safety factor 2</b>	<b>45.46</b>	10592.18		

5/12/2005

	<b>Watt @60 K</b>	<b>Mains Power</b>		
<b>radiation Load (300K 20 layer Superinsulation)</b>	50	1200	39	1.28 w/m <sup>2</sup>
<b>Conduction Load (Coil supports 60 Tons, 60 K intercept)</b>	15	360		
<b>Gas Load (vacuum ~10<sup>-6</sup> mbar)</b>	2	48		
<b>Dianostic Wires</b>	1	24		
<b>Eddy Currents at ramp up (3000 s)</b>	10	240		
<b>Total</b>	<b>78</b>	<b>1872</b>		
<b>safety factor of 2</b>	<b>150</b>	<b>3600</b>		

5/12/2005

# The Panda Coil operation He Requirement

- 17 l/hour of liquid helium for the Current Leads, returned as He Gas at STP (300K, 1033mb)
- 2 g/sec saturated LHe at 4.5K fed to the Control Dewar for the coil refrigeration to compensate for the 2 g/sec vaporized helium at 4.5K, returned to the Control Dewar in the **cryogenic chimney** on top of the magnet. (the 2g/sec figure include a factor 2 safety margin on operation and the eddy current losses at the magnet charge/discharge time of 2000 sec.)
- 0.7 g/sec Helium gas at 4.5K from the Control Dewar flowing in the Intermediate Radiation shields (kept around 50 K) returned (after regeneration to allow a safe operation of CV6) as He gas STP (300K, 1033mb).
- The residual 1.3g/ sec of 4.5 He Gas (sent back from the control Dewar to the Buffer Dewar) are used to shield the transfer lines from the Control Dewar (on the magnet) to the buffer Dewar.

# All the operation of the Cryogenic System depends on:

- 1. The absolute pressure of the Control Dewar (1.3 bara) defining the operating point (4.5K ) of the superconducting coil and the temperature margin of the Superconducting Cable (1.8K).
- 2. The pressure at the room temperature output of the Cryogenic Current Leads and of the 50K shields circuit, setting the mass flow of the gas coolant for the Current leads (17 litres/hour or ~ 0.6g/sec) and the shields (0.7g/sec ~150 watt).
- 3. The total 4.5K liquid helium mass Flow corresponding to 17 litres/hour for the current leads plus 2 g/sec to compensate for the thermal losses of all the Cryogenic Coil Cryogenic system, (including safety factor of 2)