

Decision #3 Straight or earth's curvature - Incline Limit, Cryogenic standpoint

Drivers: The TESLA Cryomodule design has only one element that is incline sensitive: the 2.0 K 2-phase line. The current parameters for this line are 8.5 cm ID and 167 m long. This ID must be allocated to three elements:

A) Minimum gas height, B) Minimum liquid height, and C) the pipe incline, figure #1.

- A) The minimum gas height is driven by the gas pressure drops; I have assumed that one can live with a 1.5 to 6.5 cm taper. **Note: This must be confirmed by an experimental test program.**
- B) The minimum liquid height is the radius of the cavity He vessel interconnect tube, 2.0 cm; below this number, the superfluid heat transfer is reduced.
- C) This leaves 5.0 cm for the incline.

Options:

- 1) <0.3 mrad
- 2) <0.6-0.9 mrad
- 3) <4.0 mrad

BCD: <0.3 mrad

Pro:

- 1) Minimizes the component count
- 2) Easiest controllability
- 3) Minimizes the heat load.

Con:

- 1) None from cryogenic standpoint

BCD R&D: The pressure drops for the BCD must be calculated and a small test setup is required to confirm the calculations. Note: It may be possible to get a head start from the LHC cryo test stand which ran limited parallel and counter flow tests.

ACD Option for <0.6-0.9 mrad:

For a small increase in angle one can shorten the pipe length and/or increase the diameter. The penalty is the increase in number of JT valves and control loops.

ACD Option for <4 mrad:

This will require a solution using a weir system (figure #2 & 3); this was used in the LBL "ESCAR" project. There will need to be four styles of CM (w/wo weirs, and R/L). This will also require that the 200 JT PID control loops be customized as a function of angle and the weir spacing.

ACD R&D: This is a difficult 2-phase helium control system; it will require constructing a 167m full length inclinable prototype transfer line.

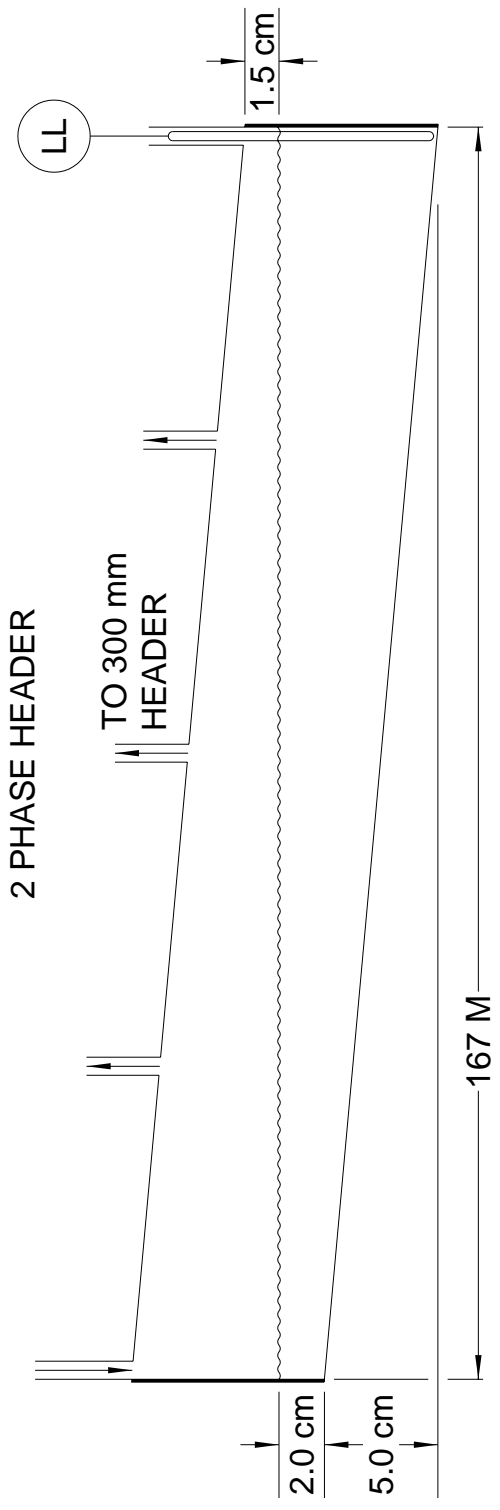


FIGURE #1
BCD

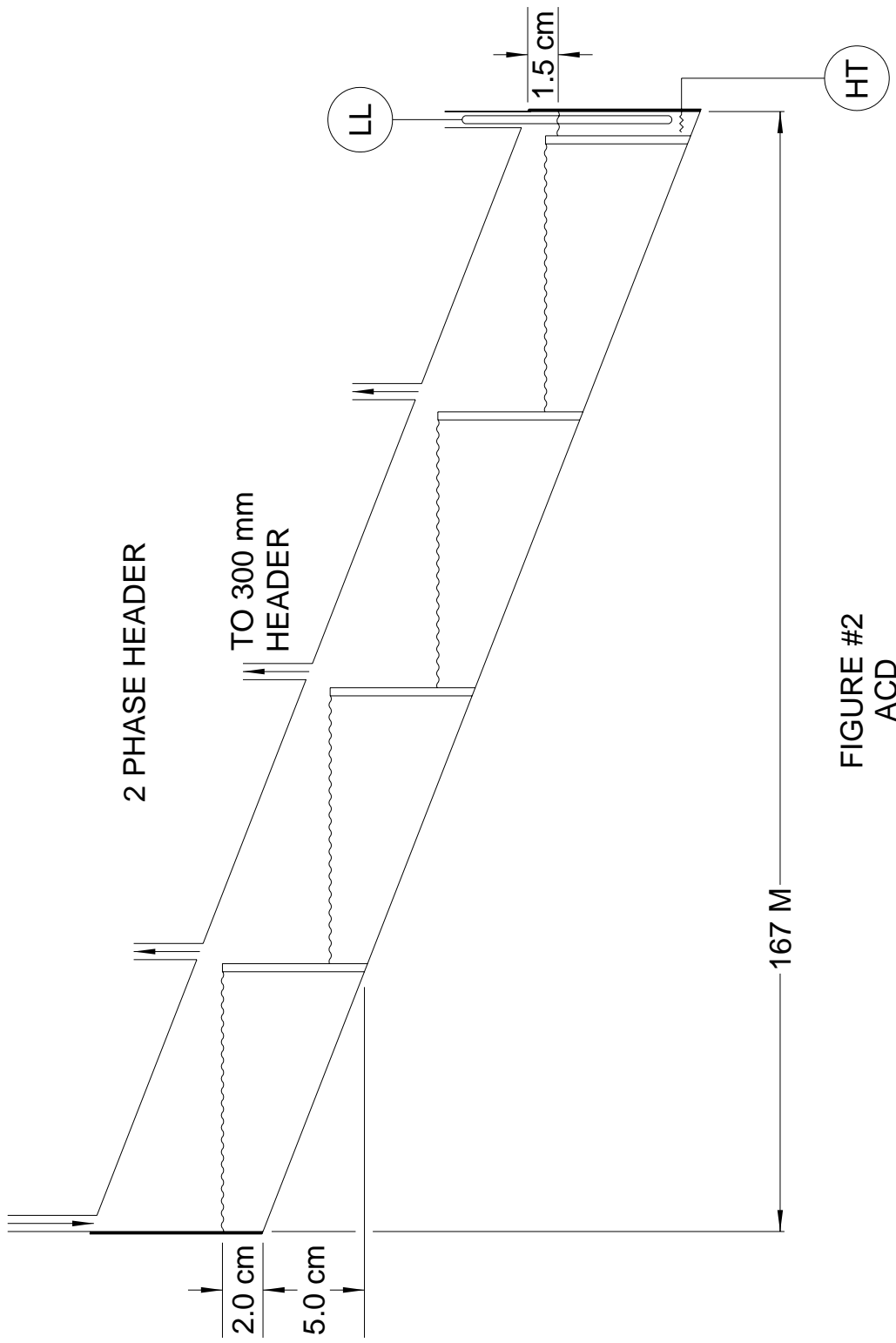


FIGURE #2
 ACD

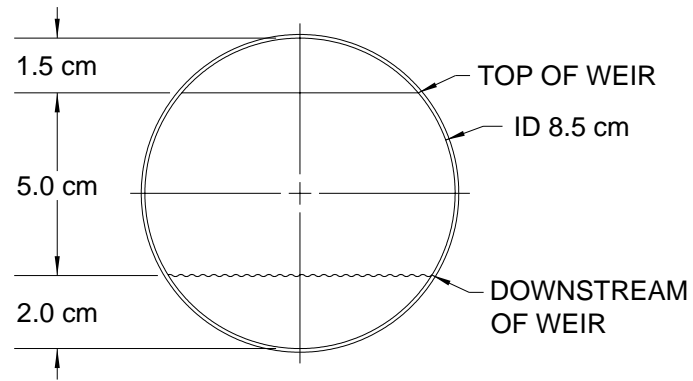


FIGURE #3
2 PHASE HEADER CROSS-SECTION AT WEIR