

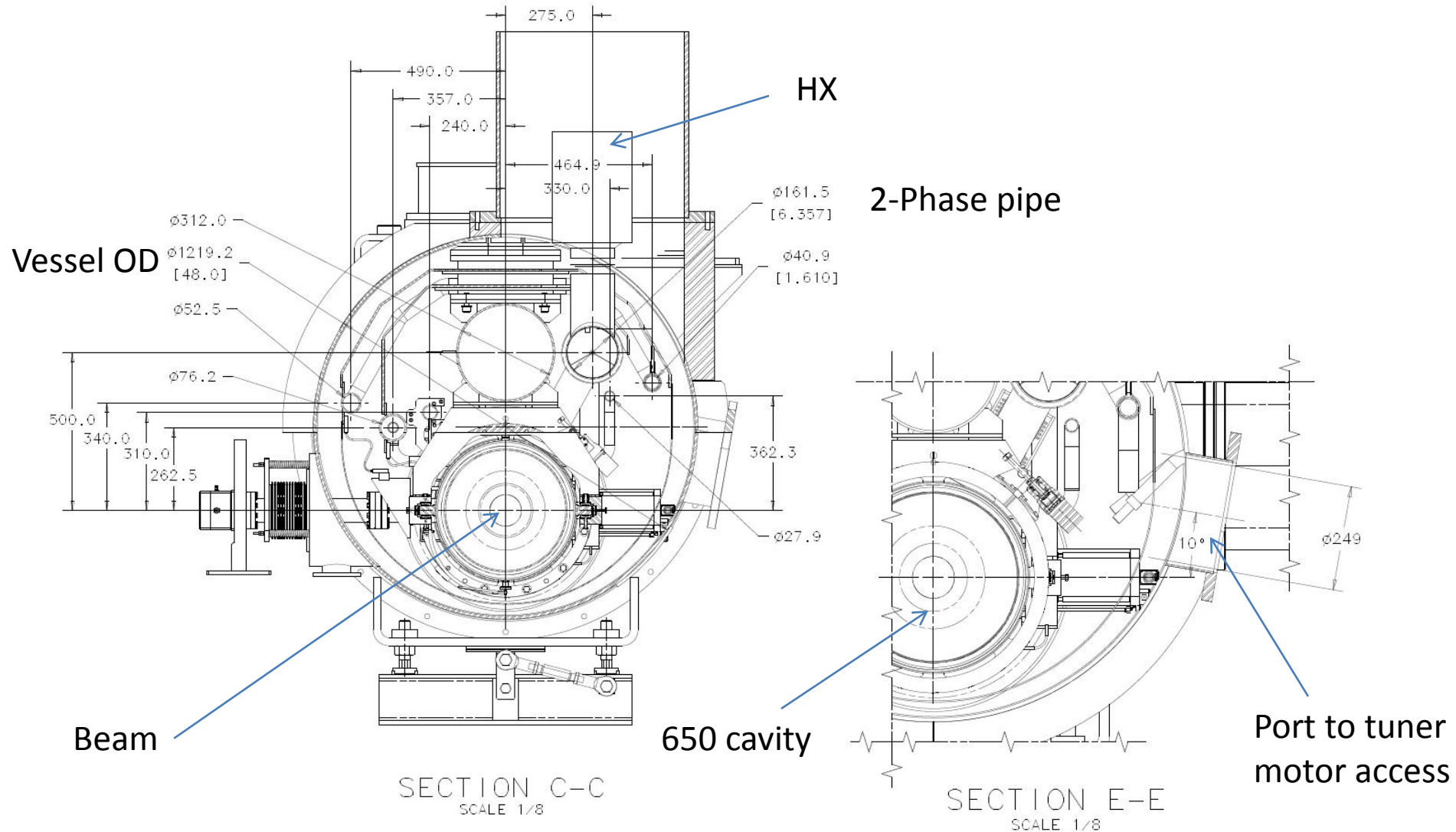
650 MHz Cryomodule Section,  
FNAL Proposal,  
and some comments about the  
elevation of the warm-up line

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31 May 2011

# 650 MHz Cryomodule Section



# Warm-up / cool-down line position

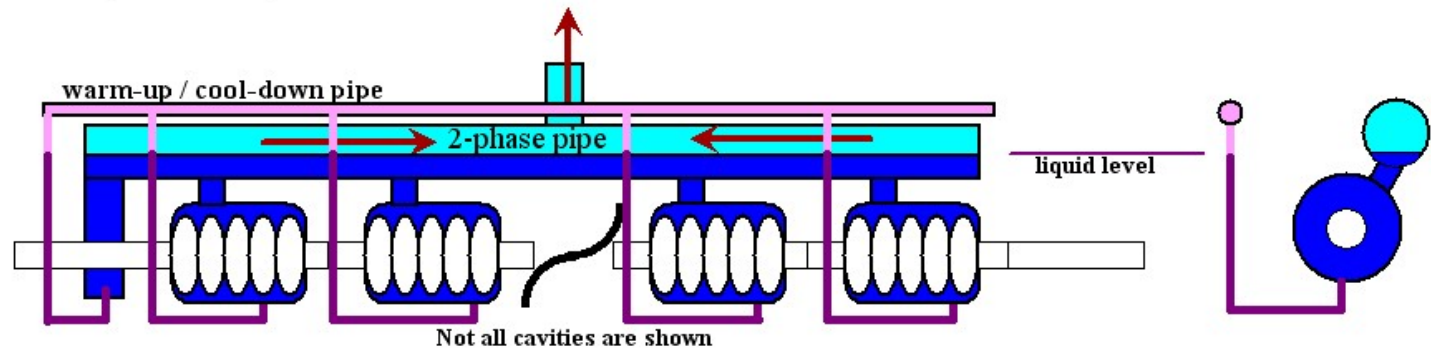
- There are two fundamentally different operational situations for a cryomodule depending on whether the warm-up / cool-down line (referred to as “warm-up line”) is above or below the helium vessel tops. The following two slides illustration the situations
  - Warm-up line above the helium vessels results in separated liquid levels in the helium vessels
  - Warm-up line below the helium vessel tops results in a common liquid level throughout the cryomodule when liquid is at or above the warm-up line level

# Full liquid level

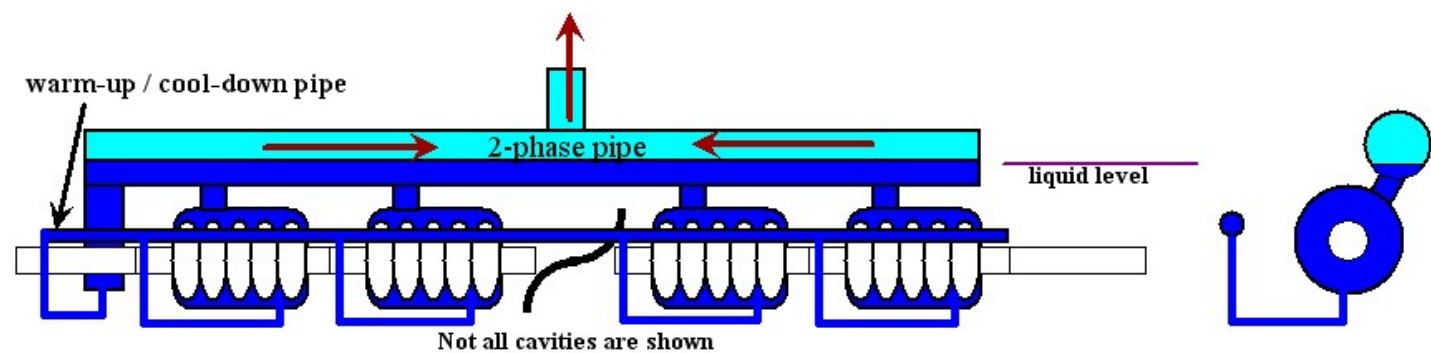
Cryomodule warm-up / cool-down line positions -- full liquid level

Tom Peterson, 31 May 2011

(Not to scale)



Cryomodule



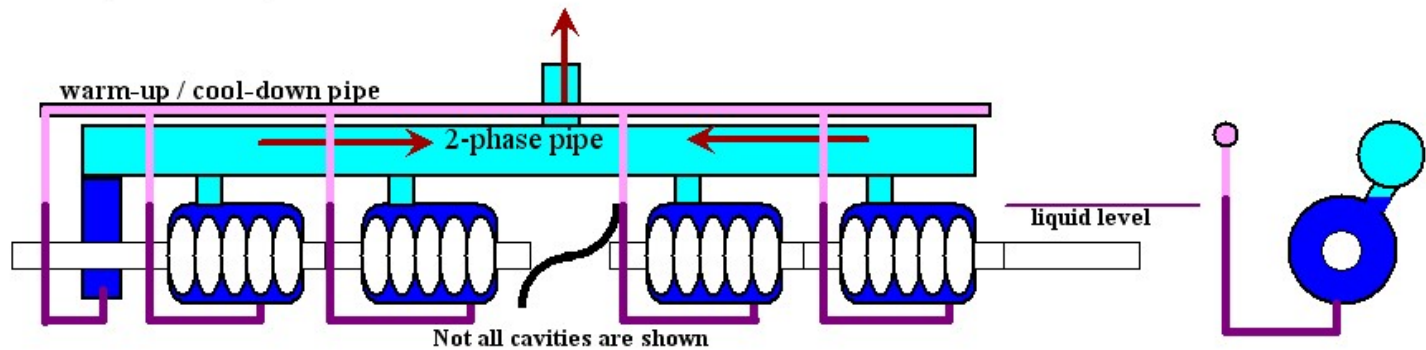
Cryomodule

# Low liquid level

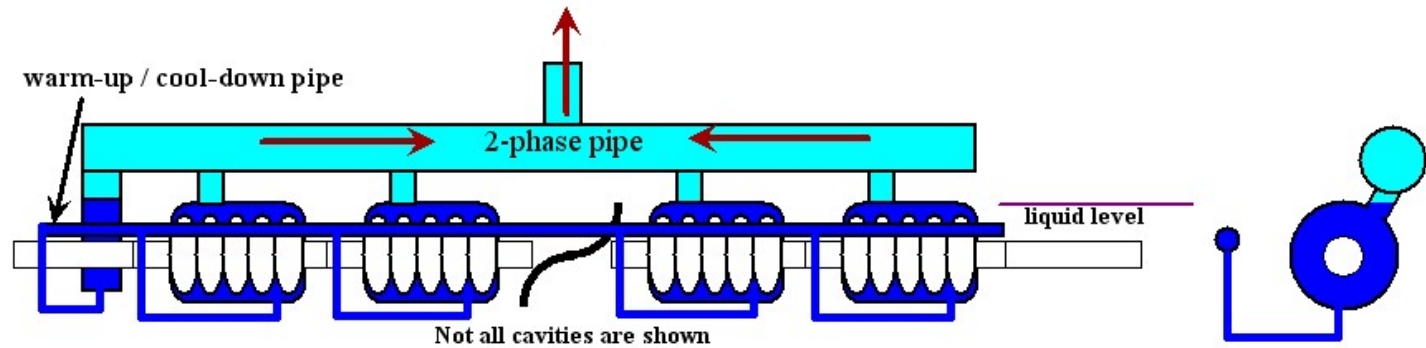
Cryomodule warm-up / cool-down line positions -- low liquid level

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(Not to scale)



Cryomodule



Cryomodule

# Warm-up pipe elevation conclusion

- For a sloped system, the warm-up manifold pipe should be ABOVE the liquid level at all times
  - Below, it would transfer liquid to the downhill helium vessels
- For a level system, one may take advantage of the warm-up pipe to provide a uniform liquid level through the cryomodule including when the liquid top is below the top of the cavity
  - Allows better control of the final stages of filling
  - Allows a liquid level measurement over a large range down into the helium vessels