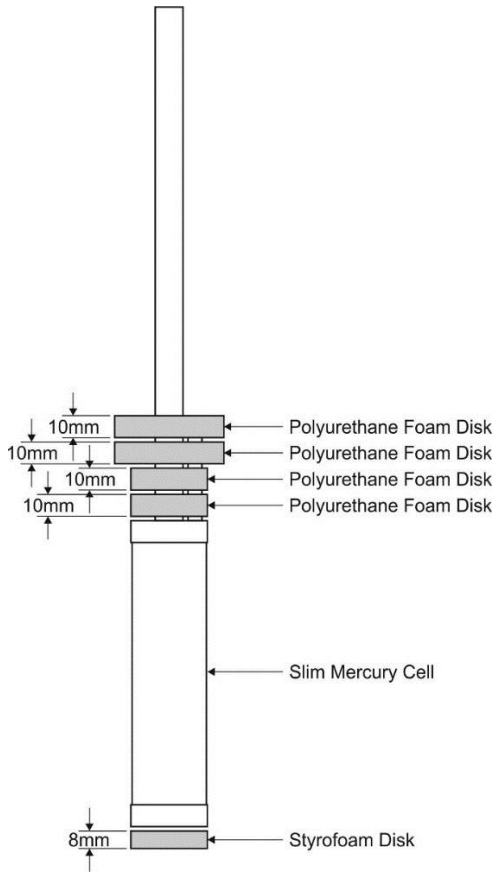
Mercury Triple Point realisation in a Europa Advanced Block Bath

The Mercury TP (Triple Point, -38.8344 °C) is one of the defining points of the ITS-90.

This point can be realised using an Isotech Model 17724M Slim Mercury TP cell and Europa Advanced unit.
The Mercury TP cell assembly inside the Europa block is shown below.



Preparation

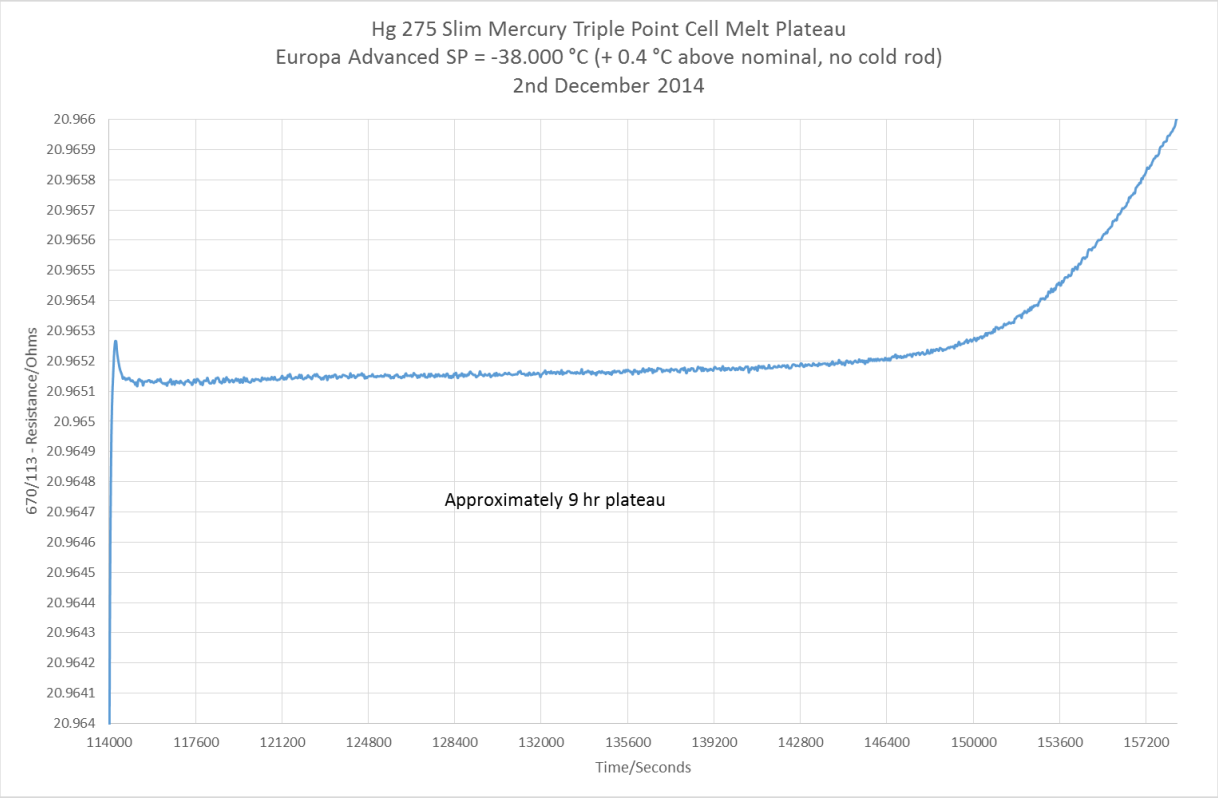
With the cell inside the Europa, place a calibrated thermometer into the re entrant tube of the cell. To provide good thermal contact between the cell and the thermometer it is advisable to use a pure alcohol, such as Ethanol or Acetone inside the re entrant tube, to act as a transfer fluid.

Firstly freeze the cell by setting the Europa to -40 °C, assuming a 25 °C ambient temperature (as the lowest temperature the Europa operates at is 65 °C below ambient). The cell will pass through a brief freeze plateau before stabilising at the set point temperature.

Once stable at the set point temperature leave for 2 hours to ensure the mercury is fully frozen. At some point during this period the controller set point error can be established.

Realisation

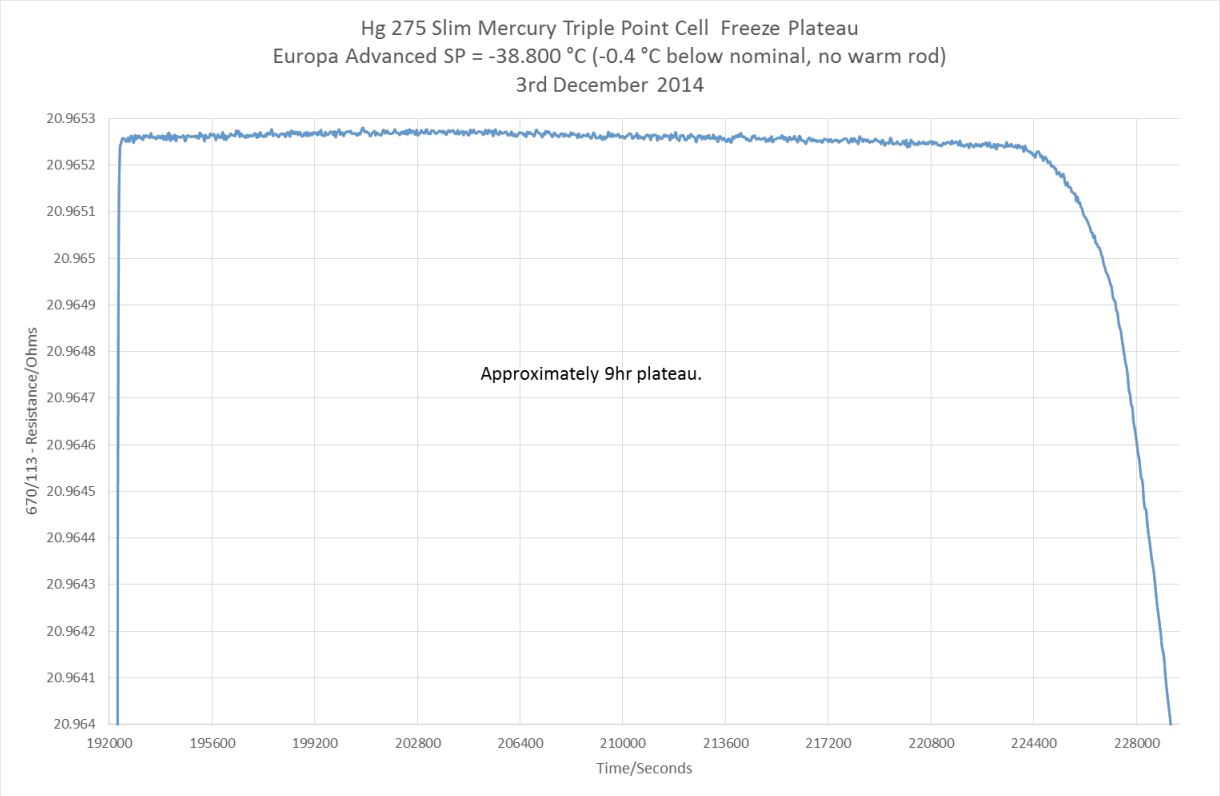
- To realise the melt plateau change the set point temperature to a value +0.4 °C above the Mercury TP temperature (taking into account any controller error).
- The cell temperature will begin to increase and then stabilise at the Mercury TP.
- The cell is now on the plateau and any test thermometers can be pre cooled and sequentially placed into the cell and calibrated.
- Periodically the calibrated reference thermometer should be placed back into the cell to verify it is still on the plateau.
- Some hours later the cell temperature will start to increase again until it stabilises at the set point; + 0.4 °C above the triple point temperature, the cell will now be fully molten.
- Leave the cell at this temperature for 2 hours to ensure complete mixing of the mercury inside the cell. Below is a typical full melt plateau.



- To realise the freeze plateau change the set point temperature to a value -2.0 °C below the Mercury TP temperature (taking into account any controller error).
- The cell temperature will rapidly cool and continue until the cell supercools.
- At some point the temperature will be seen to increase suddenly back towards the Mercury TP temperature.

- At this point change the set point temperature to a value -0.4 °C below the Mercury TP temperature (taking into account any controller error).
- The cell temperature will increase and stabilise at the Mercury TP.
- As before test thermometers can be pre cooled and sequentially placed into the cell and calibrated.
- Some hours later the cell will begin to cool until it stabilises at the set point; - 0.4 °C below the triple point temperature, the cell will now be fully frozen.

Below is a typical full freeze plateau.



Results

80% of the melt plateau range occurs within < 1mK

50% of the freeze plateau range occurs within < 0.5 mK