

Cell 12 Top Loading Cryostat Overview

Helium 3 Insert

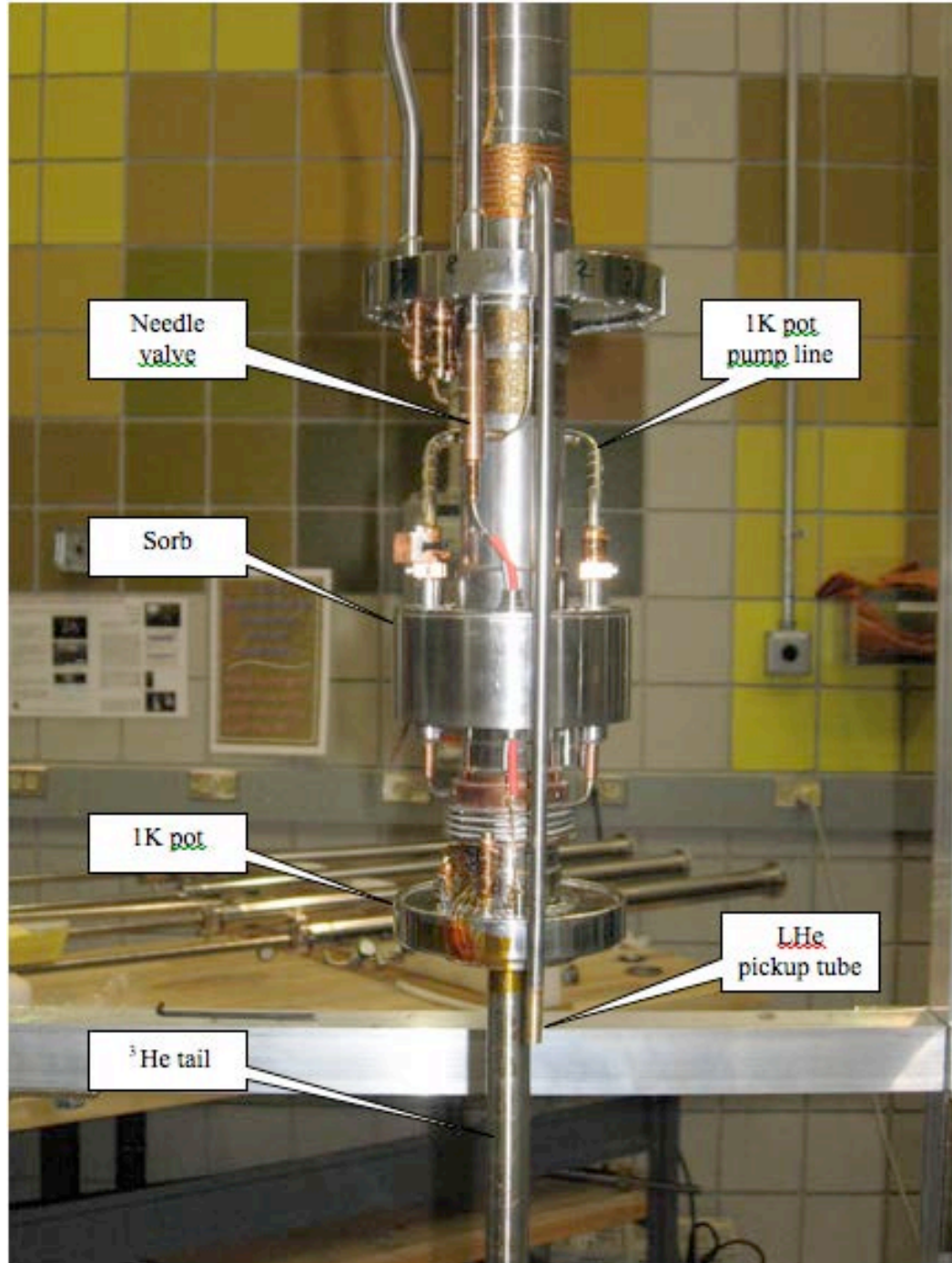


Photo 1

Photo 1 is a view of the ^3He insert with the IVC (inner vacuum can) removed.

Shown are the charcoal adsorber (sorb), 1K pot and the upper portion of the ^3He tail.



Photo 2

Photo 2 shows the insert with the IVC installed. As the name implies the IVC is under vacuum, which provides a thermal barrier to the liquid helium bath. The insert is placed in the cryostat and completely submerged in liquid ^4He during normal operation.

The purpose of the sorb is to store and release the ^3He gas as well as pump on the condensed ^3He liquid. The inner wall of the sorb is perforated and open to the ^3He space. The pumping line for the 1K pot runs through the sorb and is used to cool it. The sorb has a heater, which is controlled by the Lakeshore 336 Temperature Controller. Heating the sorb will release the absorbed gas; the amount released depends on the temperature. Setting the sorb to $\sim 20\text{K}$ will provide enough exchange gas to manually control the cooling rate of the probe while it is being lowered into the insert. During the ^3He gas condensation procedure, the normal temperature for the sorb is 40K . Once the gas has been condensed in the tail @ 1.7K reducing the temperature of the sorb can cool the subsequent liquid further. Below $\sim 30\text{K}$ the sorb will start adsorbing ^3He gas creating a drop in vapor pressure, which will lower the temperature of the liquid. The pumping speed of the sorb will reach its' maximum as the temperature drops below 8K .

The purpose of the 1K pot is to condense the ^3He gas and cool the sorb. The ^3He gas does not enter the 1K pot, but rather condenses on the ^3He insert space wall that is surrounded by the 1K pot. As shown in **Photo 3**, the 1K pot is welded around the main body of the insert. The 1K pot is pumped continuously by a vacuum pump located in the gas handling system and draws ^4He liquid from the bath through the pickup tube and the needle valve. The needle valve can be set to continuously draw liquid or it can be shut to reach the lowest possible temperatures. If the needle valve is left shut the 1K pot will eventually empty and the pot temperature will begin to rise. As mentioned previously the pump exhaust of the 1K pot cools the sorb. Normal operating pressure of the 1K pot is 2.5 to 5 mbar.

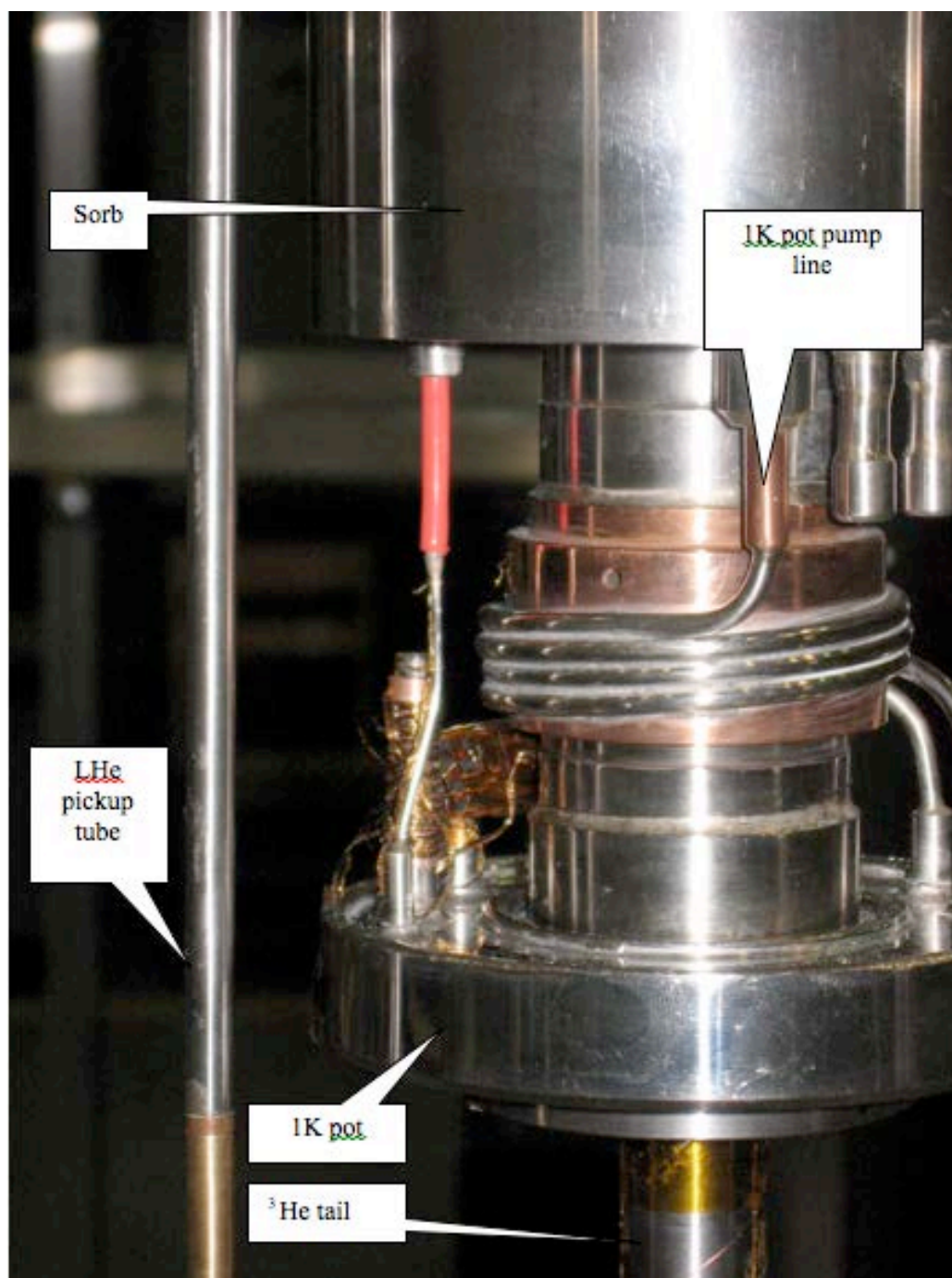


Photo 3

Variable Temperature Insert (VTI)

Using the VTI, the sample temperature can be controlled over the range 1.5K to 325K. The VTI is vacuum insulated from the ^4He bath using an IVC similar to the one on the ^3He insert. Liquid helium is drawn into the VTI from the main bath through a needle valve. The needle valve is controlled using the Oxford ITC 503 Temperature Controller. Once past the needle valve the helium flows through a heat exchanger on the bottom of the VTI tail and sprays up onto the probe sample. The Lakeshore 336 Temperature Controller uses a Cernox sensor and a heater mounted on the heat exchanger to control the temperature of the flow. The tail of the VTI can be filled with liquid helium and a constant level can be maintained by setting the needle valve to allow enough flow to replace the evaporating helium. The typical temperature in continuous fill mode is 1.5K. At this point temperatures below 1.5K can be obtained for a limited time by completely closing the needle valve