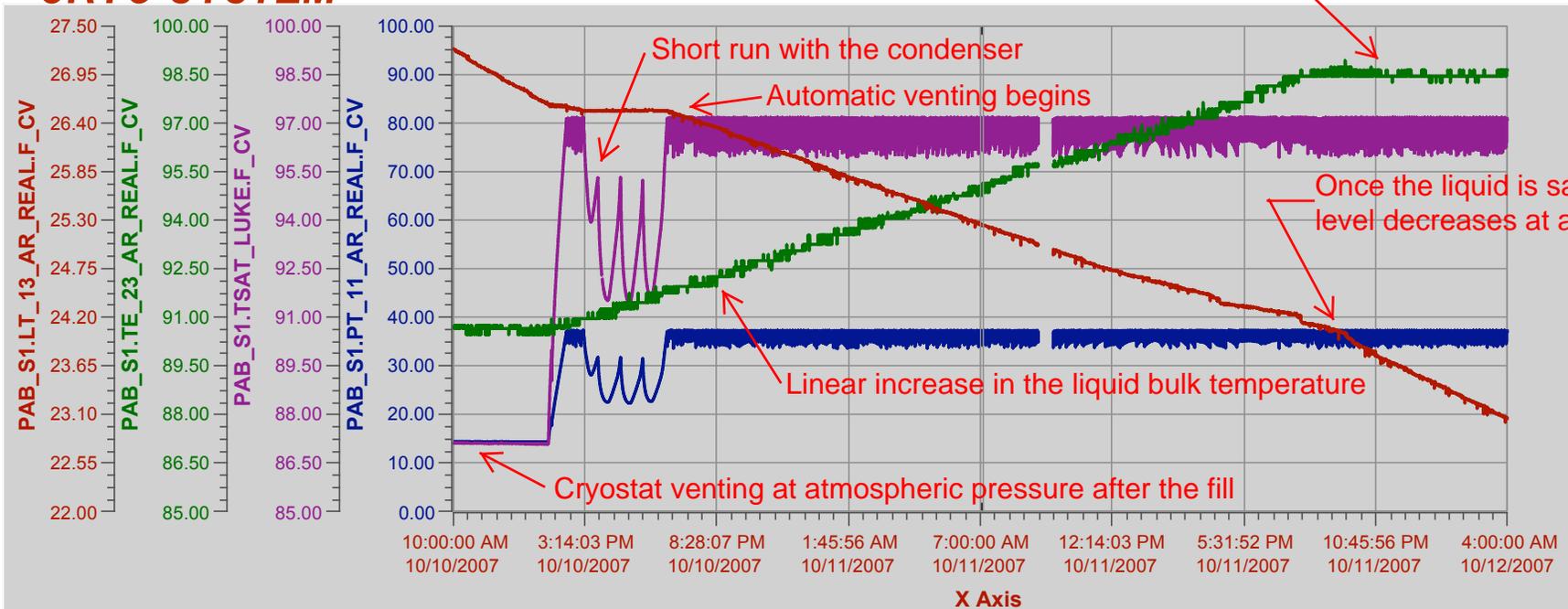


# CRYO SYSTEM

## FLARE HISTORICAL DATA - LUKE VALUES

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Pen Name	Description	Value	Eng Units	Low Ove...	High Ove...	Avg Over ...
PAB_S1.PT_11_AR_REAL.F_CV	AG- (F_CV)	36.48	psia	14.27	37.41	33.33
PAB_S1.TSAT_LUKE.F_CV	PAB_S1.TSAT_LUKE.F_CV	96.95	N/A	87.05	97.21	95.60
PAB_S1.TE_23_AR_REAL.F_CV	Luke Pressure Building Htr Temp (F_...	94.75	K	90.45	98.95	94.87
PAB_S1.LT_13_AR_REAL.F_...	Luke Argon Level Probe	25.25	inches	23.00	27.25	25.25

10/10/2007 10:00:00 AM 10/12/2007 4:00:00 AM

- Green = liquid temperature measured by thermocouple in heater block.
- Blue = cryostat vapor pressure measured by a Setra pressure transmitter
- Magenta = Saturation temperature based on the cryostat pressure.
- Red - argon liquid level measured by an American Magnetics transmitter.

There is an offset between the measured temperature and calculated saturation temperature at steady state.

At 6:58:05 PM on 10.10.07 the measured liquid temperature was 91.95 K and the level was 26.50 inches.  
 At 5:49:39 PM on 10.11.07 the measured liquid temperature was 98.15 K and the level was 24.31 inches.

See next page for heat leak estimate based on the rise in bulk temperature.

Average liquid level is  $\frac{26.50 + 24.31}{2} = 25.405 \text{ inches}$ .

Average volume of the cryostat during this period is  $\frac{\pi}{4}(22)^2(25.405) = 9657.14 \text{ in}^3 = 0.1582 \text{ m}^3$ .

The time period from 6:58:05 on 10.10.07 to 5:49:39 on 10.11.07 is 22.8594 hours or 82,294 seconds.

Heat leak into the cryostat is then calculated utilizing the specific heat and density of liquid argon

$$\frac{0.1583 \text{ m}^3}{1} \times \frac{1136 \text{ J}}{\text{kg} \cdot \text{K}} (98.15 - 91.95) \text{ K} \times \frac{1394 \text{ kg}}{\text{m}^3} \times \frac{1}{82,294 \text{ sec}} = 18.88 \frac{\text{J}}{\text{sec}} = 18.88 \text{ W} .$$