Subject: Comments on thesis
From: Robert Openshaw <Openshaw@triumf.ca>
Date: Mon, 21 Sep 2009 19:24:13 -0700
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Hi James,

I have finally got around to browsing thru your thesis. I think the paragraph on the gas system on pg 39 (bottom) isn't very clear. For what its worth, my suggested text ....

A mixture of helium and nitrogen in the ratio 97:03 was continuously flowed at 1 l/min into the volume between the chambers. The continuous flow was necessary to prevent contamination of the He/N2 mixture by diffusion of air or chamber gasses into the volume. The helium minimized material and the nitrogen prevented sparking. A continuous gas flow of 20 cc/min into each chamber was provided to dilute contaminants due to He/N2 diffusion through the cathode foils and outgassing from chamber materials. A pressure control system adjusted the output from the chambers to maintain the differential pressure across the cathode foils to less than ± 2 mTorr.

Also section 5.4.5 Chamber foil bulging

Again a slight misrepresentation of reality (reality is much more complicated than you suggest).... the chambers were "vented to atmosphere" through a pump, so the chamber pressure could theoretically be anything wrt atmosphere. The differential pressure across the cathode foils (directly affecting the bulging) was controlled by a pressure control system. The differential pressure between the He/N2 volume and the chambers (PC's and DC's independently controlled) was measured and the outflow from the chambers was adjusted to maintain a constant differential pressure ~ 0 mTorr at the center of the chambers (as measured by the differential pressure transducers). However, changes in temperature (or atmospheric pressure) affected the density of the gas in the pressure sensing tubes of the pressure transducers. This caused the measured differential pressure to be different than the actual actual differential pressure at the center of the chambers, causing the control system to adjust the differential pressure to an incorrect value, thus moving the foils from their nominal positions.

Section 6.4.5 Chamber foil bulge

The pressure control system could easily respond fast enough to follow ambient pressure changes. Response time for a 20 mTorr step change was the order of seconds. Atmospheric pressure in Vancouver changes much slower than that.
The foils were NEVER exactly flat. The difference in density between the He/N2 and the DME causes the foils to bulge out at the bottom and in at the top. Even if the differential pressure was perfectly adjusted to be 0.0 mTorr at the center of the foils, the foils would bulge in by ~ 30 microns at the top and out by ~ 30 microns at the bottom (i.e. an "S" shape). (I calculated these distortions at some time in the distant past, and could probably find my notes on this if I looked for them).

The major cause of foil shape instability with time was the temperature change effect (and to a lesser degree atmospheric pressure change effect) on the density of the gas in the pressure sense lines, discussed above.

Robert