

DATE: January 2, 2004

TO: RHIC E-Coolers

FROM: Ady Hershcovitch

SUBJECT: **Minutes of the January 2, 2004 Meeting**

Memo

Present: Ilan Ben-Zvi, Ady Hershcovitch, Jorg Kewisch, Thomas Roser, Jie Wei.

Topics discussed: Simulation & Calculations

Simulation & Calculations: Ady gave a presentation on velocity space plasma microinstabilities that can potentially exist in the RHIC electron beam cooling. Potential for instabilities exists in plasmas that are inhomogeneous. In our case there are density gradients and anisotropic temperatures. Ady's analysis reveals that only one of these microinstabilities has the potential to occur. It is an instability due to anisotropy of the electron temperature in a magnetic field (the parallel component is much larger than the perpendicular component). Existence of this instability is well established; it has been observed in intense electron beams. However, in the case of the **RHIC E-Cooler**, this **instability does not have sufficient conditions to occur**. The electron density is a factor of over 70 below the density threshold.

Finally Ady pointed out there are good reasons to revisit prior stability analysis work. First, a number of frequencies in Parkhomchuh's analysis are below 1 GHz. Second, J. Bosser (CERN) claimed at an EBIS meeting that correlation between theoretical stability analysis for electron beam coolers and experimental results is not very good. Third, prior stability analysis was set up mathematically as a "classical anharmonic oscillator." In a book by Osrag and Bender (based on works by Kolmogoroff, Cole, as well as Bogoliubov & Mitroposky) on this topic, it is shown that time secularities can appear due to a mathematical art-effect in perturbation theory, where a lower order term can drive a higher order equation at the resonant frequency. To ensure that this does not occur, a two-time scale analysis must be performed.

Reminder: Waldo has been posting meeting minutes on the web. They can be found at <http://www.rhichome.bnl.gov/RHIC/luminosity/upgrade/minutes/>. Additional pages of interest are: <http://www.rhichome.bnl.gov/RHIC/luminosity/> a general page for luminosity issues in RHIC; and, <http://www.rhichome.bnl.gov/RHIC/luminosity/upgrade/> a page for upgrade issues.