

DATE: April 21, 2002

TO: RHIC E-Coolers

FROM: Ady Hershcovitch

SUBJECT: **Minutes of the April 19, 2002 Meeting**

Memo

Present: Ilan Ben-Zvi, Ady Hershcovitch, Derek Lowenstein, William Mackay, Stephen Peggs, Triveni Srinivasan-Rao, Dejan Trbojevic, Dong Wang, Qiang Zhao.

Topics discussed: Simulation & Calculations.

Simulation & Calculations: Dong reported on the status of simulations and calculations performed with SIMCOOL. According to Ilan, the purpose of these simulations and calculations is, in the long run, to set parameters that optimize electron beam cooling. In the short run, performance of the SIMCOOL code is being examined and compared to other codes. Short-term objective is to ensure understanding of the code by reproducing Parkhomchuk's design of "Electron Cooling for RHIC."

SIMCOOL is a short code based on equations describing the physics. For cooling, e.g., Parkhomchuk inserted empirical formulas. Other formula options are basic binary collision formulas (Budker's), plasma thermal equilibration formulas, or dielectric formulas (due to coupling between fields induced by ions and their subsequent effect on the ions). By comparison to SIMCOOL, BETACOOOL is a long code. In an answer to Steve's question of how long is long, Dong replied that SIMCOOL is a short Fortran program, while BETACOOOL is a long C++ code. Post meeting info: SIMCOOL is about 500 lines, while BETACOOOL is more than 10 times longer.

Dong showed the beam parameters (listed in the table below) used in the calculations. Dejan and Steve expressed concern about the unnecessary wide range in ion bunch length, since data from RHIC is available. In an answer to Waldo's question, beam and bunch dimensions are RMS value. To Ady's question about transverse ion temperature, Ilan replied a few KeV.

Highlight of the simulation results: intrabeam scattering calculations are in good agreement with Jie Wei's code. Recombination is not a severe problem, therefore, the transverse electron temperature can be lowered. Cooling calculations can now be performed with more realistic parameters.

Personal comment: on Nov. 9th, Ady, Dong, Ilan, & Jorg realized that Debye length > beam diameter. Therefore, coupled with Steve's concern with truncated Maxwellians, plasma physics formulas (as well as the dielectric model) are not rigorously applicable.

Beam Parameters

Ion beam

Energy	100	GeV/nucleon
No of bunches	120	
Bunch repetition rate	9.4	MHz
Particles per bunch	10^9	
Revolution frequency	78.2	kHz
Tunes	28.2/29.2	
Normalized emittance (95%) (start)	10 ~ 15	pi.mm.mrad
Longitudinal emittance	5	eV.s
Bunch length	30~150	cm
Solenoid length	30	meter
Solenoid field	10000	Gauss
Beta-function at cooler	60	meter
Solenoid error level	1.3×10^{-5}	

Electron beam

Energy	55	MeV
Particles per bunch	3×10^{10}	
Charge per bunch	5	nc
Ratio of cooler/circumference	0.0078	
Average current	47	mA
Beta function at cooler	1~10	meter
Transverse temperature	10~ 1000	eV
Energy spread	10^{-4}	
Bunch length	3~30	cm