

Short summary of the first INTAS 'Advanced beam dynamics for storage rings' project meeting. Taras Shevchenko University of Kyiv, 28.5-29.5.2004.

Participants: I. Kadenko, R. Yermolenko (Kiev), I. Meshkov, A. Sidorin, A. Smirnov, G. Trubnikov (JINR Dubna), P. Alekseev, A. Bolshakov, P. Zenkevich (ITEP), A. Fedotov (BNL), A. Lehrach (FZ Jülich), V. Ziemann (Uppsala), O. Boine-Frankenheim, A. Dolinskii, R. Hasse (GSI)

Status of the storage ring design for FAIR

A number of Letters of Intent (LoI) were submitted to GSI. The outcome of the evaluation of the LoIs can affect the final layout of the FAIR storage ring complex. The evaluation will take place June 14-16, when the international steering committee will meet at GSI. Technical reports (TRs) will be prepared by the end of 2004, by this time all basic ring parameters should be known. The Jülich team is presently studying different types of lattices and magnets for the HESR. One of the design goals is the control of the transition energy. The final determination of the HESR ring parameters still depends on the outcome of the evaluation of the experiment proposals submitted to the FAIR project. In the technical report (due end 2004) the final HESR lattice structure should be described. During the meeting there were no detailed design reports on the CR/RESR/NESR rings. This will be a subject for the next project meeting.

A. Lehrach

A. Dolinskii

Beam cooling

The Dubna team is implementing a map representation for the cooler section. Besides the effect of the cooling forces on the beam this map will include the electron beam space charge field, noise effects and beam loss due to recombination. It should be possible to include this cooler map into other codes. The detailed documentation (physics and code) as well as result obtained with this map in BETACOOOL and other codes (e.g. PTARGET) should be ready before the next project meeting or earlier, if possible. For simplified calculations (one-dimensional or rms rates) it should be possible to use the (averaged) cooling forces from the first layer of the map directly. Here further discussions with the library keepers might be necessary. The benchmarking of different models for the cooling forces with the kinetic particle simulation code VORPAL developed by Tech-X should be considered. First results presented by A. Fedotov for magnetized cooling showed good agreement with Parkhomchuck's formula. Presently the joint work focuses mostly on the accurate description of electron cooling. Later (next meeting) also the possibility of adding stochastic cooling to the joint library should be discussed (A. Burov from FNAL developed a one-dimensional model).

Dubna team

O. Boine-F.
Kiev team

R. Hasse

Intrabeam scattering

The IBS theory can be described most accurately within a collision map, that randomly pairs up individual collision partners. Such a treatment is well known from PIC codes in plasma physics and can be extended to beam physics. Presently this method is implemented in the MOCAC code by the

ITEP team. The goal is to make this map available to other tracking codes , if possible, until the next project meeting.

P. Zenkevich
A. Bolshakov

In a different approach the Fokker-Planck equation can be formulated in invariant phase space and solved numerically. For the simulation collective long-time phenomena, rf stacking or beam stability accurate one-dimensional approximations of the friction and diffusion terms will be very important.

Beam-target interaction

The joint work focuses especially on the accurate modeling of dense pellet targets. V. Ziemann presented a numerical approach together with experimental measurements at CELSIUS. The Kiev team kindly agreed to take over the responsibility for the target modeling. V.Ziemann's modeling will serve as the starting point. The benchmarking with target effects observed in CELSIUS and COSY will be essential.

A. Dolinskii
Kiev team

Trapped particles

Recent experiments at HIMAC showed a significant influence of secondary ions trapped in the electron beam. The continuation of these important studies is planned for June in COSY. If possible, the obtained beam intensity threshold should be compared with existing theoretical predictions (three-stream-type instabilities). During this meeting trapping of secondary particles in antiproton beams was not discussed (topic for our next meeting !).

I.Meshkov
P.Zenkevich

Collective Effects, Impedances

Should be covered in detail during the next general meeting

O.Boine-F.

Library issues

The existing tools, like BETACOOOL, MOCAC, PTARGET, should benefit jointly from the improved modeling of cooling, IBS and target effects. In addition each developed module should be documented (code, interface, physics), benchmarked and integrated into a joint library. This library should serve also as a basis for the beam dynamics studies for the FAIR storage rings. The Kiev team agreed to serve as the library keeper, together with the GSI team. Presently the GSI concept foresees the 'gluing' of the different modules and MAD-X (for the maps). The developer interface will be the scripting language Python (at some point one might consider a UNIX version of BOLIDE for a user interface). PTARGET could serve as a starting point. This will be discussed during the next weeks. Results should be presented until the next workshop.

O. Boine-F.
A.Dolinskii
R.Hasse
Kiev team

G.Trubnikov

Experiments

An extensive overview was presented by V.Ziemann. First results on the measurement of transverse cooling forces using a kicked pencil beam look extremely promising. These measurements should of course be continued in CELSIUS, and also in COSY and ESR, if possible. This method might enable also an improved mapping of the magnetized cooling regime (?) in existing

V.Ziemann

machines. The 'good' and 'bad' magnetization regimes are of importance also to the RHIC e-cooling project. In addition information should be collected on possibilities to manipulate the transverse electron temperatures in the different coolers. In addition there will be experimental activities on the beam-target interaction (CELSIUS) and trapped particles (COSY).

Code benchmarking

It was pointed out that the scaling of the equilibrium momentum spreads with the number of ions in the ESR is not in agreement with existing models. This data, together with the beam/machine parameters, should be made available to all project members in order to facilitate the benchmarking of existing codes with these ESR results. For the RHIC e-cooling project a code benchmarking initiative has been established. The focus until the next workshop should especially lie on the benchmarking of the individual processes with measured data, if available.

R.Hasse

Project coordination

By now the full 50% of our funds were transferred by INTAS to the 12 individual grant holders and to the 7 teams leaders.

Many thanks to the organizer of this meeting Igor Kadenko ! It was a perfect meeting. The next general project meeting was scheduled for March 2005 (still before the INTAS first report deadline). Igor Meshkov kindly agreed to host the meeting in Dubna. **The next project milestone will be the first report due 1.4.2005 !**

I.Meshkov

A MoU on 'Beam dynamics for high energy cooling' (covering theory and experiments) was signed between BNL and GSI. A. Fedotov and O. Boine-F. will serve as the local coordinators.