

# First analysis of the loss pattern in cern machines

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Beta Beam Workshop 14th April 2005

## Outline



- Introduction to StrahlSim
- First results of loss calculations for the SPS
- Discussion and outlook



## **Dynamic Vacuum Effects**



#### Life Time decreases drastically with intensity



#### caused by beam loss induced vacuum effects



14.4.2005

#### Simulation with tracking and vaccum effects: StrahlSim by C. Omet (GSI)



#### Status of implemented mechanisms ins StrahlSim

- Initial systematic beam losses (e.g. multi turn injection losses, RF capture losses)
- Projectile and target ionization and capture cross sections and the resulting ionization and multiple ionization degree
- Collimation efficiency for each generated charge state
- Energy dependence of the collimation efficiency and of the cross sections
- Effective desorption rate of the collimation system (leakage rate)
- Initial residual gas composition
- Desorption coefficient and assumption for the composition of the desorped gases
- Desorption generated by target ionization
- Coulomb scattering with the residual gas

## Simulation with tracking and vaccum effects: StrahlSim by C. Omet (GSI)



SIS12/18 regular cells with tracked particles



The code tracks single particles, beam loss due to charge exchange and vacuum effects.

SIS18: Strahlverluste über Umfang

Calculated loss distribution:

(adoptable to decay induced losses?!)



14.4.2005

#### Solution for the FIAR Project: Collimation in a charge separator lattice



The existing synchrotron will be upgraded with dedicated collimators. The future FAIR accelerators will have a lattice structure optimized for charge collimation

A: Lattice ohne Speicherung von U<sup>29+</sup>

B: Lattice mit Speicherung von U<sup>29+</sup>





## Loss pattern of SIS100



198.7 m



Losses only happen at the dedicated collimators

## First analysis of the SPS lattice

1.) Loss pattern for the decay of helium





Beta Beams in

## First analysis of the SPS lattice





Beta Beams in

## **Loss pattern in SPS lattice**





- The losses occur mostly inside of the optical elements
- no prominent loss locations for collimators
- overall not much space for additional installations
- BUT in SPS the energy and therefore the loss rate is already high. Further time dependant simulations are possible with StrahlSim will show more detailed data

## **Outlook and discussion**



- The loss analysis with StrahlSim is possible for the CERN machines. PS simulation has been started.
- The code offers global simulation of vacuum effects. The detailed localized simulation of the residual gas is under development. Interesting for Beta Beams too?
- The simulation of ramping and energy dependent lifetime of the ions in the beta beam facility is/can be implemented.
- The RCS injector can be optimized in respect of beam losses with the present tools.

## **Angular distribution**



Winkelverteilung

