Contribution ID: **107** Type: **not specified**

Ultimate Heavy Ion Intensities

Tuesday 31 January 2017 19:18 (3 minutes)

To generate ultimate heavy ion beam intensities in synchrotrons, low charge states have to be used. This avoids stripping losses and the space charge limit is shifted to higher number of particles.
But at the same time, the probability for charge exchange in collision with residual gas molecules of such ions is much higher, than for highly charged heavy ions. Ionized ions are deflected different, than the reference ion and will get lost. At the position of impact on the beam pipe vacuum chamber, they induce a desorption process, which significantly increases the residual gas density in this area. This in turn increases the probability for further charge exchange processes, whereby a self-amplification up to complete beam loss can evolve. This mechanism limits the maximum possible heavy ion intensity.
To shift this limit to higher number of particles, several measures are possible. One is, to reduce the residual gas pressure, another is to reduce the number of desorbed gas particles by heavy ion impact. Both measures are subject of accelerator research within ST2.
A cryogenic environemt provides high pumping speed for all heavy residual gas particles. According to the vapour pressure courves, their partial pressure is reduced to ultimate low pressures. At 5K-15K, the typical operation temperature of cryogenic vacuum chambers cooled by liquid helium, hydrogen does not get condensated to acceptable low pressures. Hydrogen only gets adsorbed by the cold walls. This adsorption process also leads to sufficiently low pressures, although the capacity is limited. The investigation of capacity and pumping speed as a function of the temperature has been investigated.
The understanding of the desorption process on cryogenic and room temperature surfaces is the other subject of investigations. The temperature and energy dependence of the desorption yield by heavy ion bombardement has been investigated for different materials, as well as the energy dependence of several room temperature materials.
The result of all research subjects is condensed into the StrahlSim simulation code, which simulates the interaction bebween residual gas and heavy ion beam. The time dependent temperature change of cryogenic magnet chamber walls has newly been implemented. First results of dynamic vacuum simulations using dynamic chamber temperatures will be shown.

Topic (ARD or DTS)

ARD

Primary author: Dr BOZYK, Lars (GSI)

Presenter: Dr BOZYK, Lars (GSI)

Session Classification: Poster Session