Contribution ID: **52** Type: **Poster**

P07 - Beam Transport of High Brightness Beam through a Tandem Accelerator for a High Energy Ion Microprobe

Friday, 11 July 2014 13:00 (1 hour)

For running an ion microprobe a high brightness beam is the basic requirement for sub-µm beam focus in order to fill the small phase space that is accepted by a usual ion microprobe with enough ion current for the desired application. Raytracing simulations of the lens design for the ion microprobe SNAKE at the Munich tandem accelerator demonstrate, that a brightness of B = 1 µA mm-2 mrad-2 MeV-1 is at least required for a 100nm beam focus with 100pA ion current under ideal conditions [1]. So far we achieved 10 times less brightness and a beam spot size of about 1-2µm at 30pA at SNAKE that is installed at the Munich tandem accelerator [2-3]. In order to increase the beam brightness and thus reduce beam spot size we installed a multicusp ion source for negative hydrogen ions manufactured by HVEE [4] at the Munich 14 MV tandem accelerator [5]. At the ion source exit we measure a beam brightness of B = 27 µA mm-2 mrad-2 MeV-1 that in fact represents the space charge limit for conventional ion sources at 30 kV extraction potential. However, the beam brightness is reduced to B = 2.3 µA mm-2 mrad-2 MeV-1 at the high energy side of the accelerator at 17 MeV proton energy.
In order to understand the brightness reduction due to the beam transport through the tandem accelerator we performed beam transport simulations to elucidate the requirements for even larger beam brightness at SNAKE. A main limit for the beam transport is set by additional constraints that the injected beam current into the accelerator is limited to 10-50 µA although the ion source would deliver up to 1 mA into the full acceptance of the accelerator. We discuss the effects of the stripping foil in conjunction with the intrinsic astigmatism in the beam transport and possible parasitic influences. From the calculations we obtain the optimum ratio in the angular and object apertures to form the optimized phase space volume of the beam to keep as much as possible the beam brightness of the source. In addition we present first consequence in our beam transport system and future suggestions on possible improvements for transporting a stable high bright beam through a tandem accelerator.

References:
[1] G. Hinderer, et al., NIMB 130 (1997) 51
[2] P. Reichart, et al., Science 306 (2004) 1537
[3] P. Reichart, et al., NIMB 219–220 (2004), pp. 980–987
[4] J. Visser, et al., NIMB 231 (2005) 32
[5] M. Moser, et al., NIMB 273 (2012) 226

Primary author: Mr MOSER, Marcus (Universitaet der Bundeswehr Muenchen, Germany)

Co-authors: Mr GREUBEL, Christoph (Universitaet der Bundeswehr Muenchen, Germany); Prof. DOLLINGER, Günther (Universitaet der Bundeswehr Muenchen, Germany); Ms PEEPER, Katrin (Universitaet der Bundeswehr Muenchen, Germany); Dr REICHART, Patrick (Universitaet der Bundeswehr Muenchen, Germany); Mr CARLI, Walter (Beschleunigerlabor MLL, 85478 Garching, Germany)

Presenter: Mr MOSER, Marcus (Universitaet der Bundeswehr Muenchen, Germany)

Session Classification: Poster Session with Cheese and Wine