The LIGHT beamline as a potential synchrotron injector

Martin Metternich[1], Haress Nazary[1], Dennis Schumacher[2], Abel Blazevic[2,5], Florian-Emanuel Brack[3,4], Florian Kroll[3,4], Christian Brabetz[2], Ulrich Schramm[3,4], Vincent Bagnoud[1,2,5], Markus Roth[1]
[1]*Technische Universität Darmstadt, Darmstadt, Germany*
[2]*GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany*
[3]*Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany*
[4]*Technische Universität Dresden, Dresden, Germany*
[5]*Helmholtz-Institut Jena, Jena, Germany*
m.metternich@gsi.de

In many accelerator facilities, linear accelerators are used to accelerate ions to several MeV, which can then be injected into a synchrotron for post-acceleration. Since high power laser systems can also be used to provide ions with such energies via the target normal sheath acceleration (TNSA), they could also be used as an alternative ion source for synchrotrons in the future, especially if the repetition rates of advanced laser systems get within the same order of magnitude as those of linear accelerators. This concept has the potential to reduce the injection time, provide ion beams with lower emittances and to reduce the cost and the size of future accelerator facilities.

However, since the initial TNSA-generated ion beam typically has a high energy spread and a large initial divergence, the ion beam has to be adjusted to obtain a sufficient number of particles within the acceptance range of the synchrotron. For this purpose, conventional accelerator structures can be used, as it is done at the Laser Ion Generation, Handling and Transport (LIGHT) beamline. This laser-driven ion beamline is located at GSI in close proximity to the transfer channel between the Universal Linear Accelerator (UNILAC) and the Heavy Ion Synchrotron SIS18, which makes this experimental area ideal for a first proof-of-principle experiment.

In my talk, the setup and the working principle of the LIGHT beamline will be presented first. Then the ion beam shaping with the beamline will be characterized precisely and finally, it will be evaluated whether it is possible to generate an ion beam with the LIGHT beamline which has a suitable number of particles within the acceptance range of GSI's Heavy Ion Synchrotron SIS18.