A new Detector Testbed for future FAIR based Slowed Down Beam Setups at the Cologne FN-Tandem Accelerator Facility

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At the new FAIR facility one will have the unique opportunity to slow down relativistic, highly exotic nuclei being produced by the SuperFRS to energies of about $5-10\mathrm{MeV/u}$ [1]. Thus a complete new field of research will become available. The major problem will be the creation of secondary fragments, spatial straggling and energy straggling. In order to maintain acceptable statistics for the desired nuclear reaction channels, one is in need of highly reliable and efficient auxiliary detectors.

Such detectors, not only for slowed down beams but experimental setups with SuperFRS beams in general, are under development within the NUSTAR collaboration. Since beamtime at most large research centers is very sparse, it is not easy for them to provide beamtime for basic detector tests. In addition, one is in need of a well defined, known beam for such basic tests. These conditions can be delivered at the Cologne FN-Tandem accelerator, where a dedicated beamline is being set up. First measurements have already been performed.

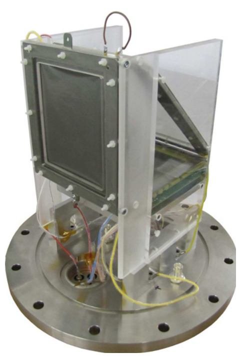

Figure 1: Single unit of the improved beam profile monitor / time of flight detector. Two successive units mounted in ISO 200 parts form the entire detector (as seen in figure 2).

The beamline is equipped with a variety of slits and ion optical lenses to form various kinds of beam spots. One major feature is an electrostatical sweeper to steer the beam over a large area. The beam currents of the many available stable ion beams being delivered by the $10\mathrm{MV}$ Tandem accelerator vary from $< 1\mathrm{pA}$ to several $10^1\mathrm{mA}$. A second feature of the beamline is an improved, highly transparent beam profile monitor (BPM) with integrated time of flight (ToF) measurements on an event by event basis, as seen in figure 1. Its spatial resolution is in the order of few millimeters and its timing resolution is roughly $200\mathrm{ps}$ [2, 3].

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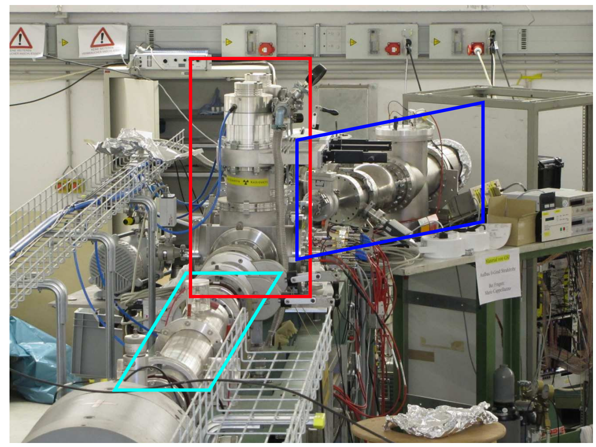

Figure 2: Picture of the cooled DSSSD preamplifier test at the new Cologne testbed. Framed in light blue one can see the electrostatic steerer, in red the highly transparent beam profile / time of flight detector and in blue the GSI testchamber mounted at $20°$ after a scattering chamber.

Afterwards a large ($\approx 60 \cdot 40 \cdot 40\mathrm{cm}^3$) vacuum chamber with an aligned optical bench and various feedthroughs is going to be mounted as major testbed. More specialised chambers might be used, as well.

Together with the ion optics and the BPM/ToF system this setup will give a unique opportunity to perform realistic tests of FAIR/SuperFRS based auxiliary detectors for future slowed down beams. A first test has been done with improved, GSI developed preamplifiers [4] in combination with a cooling frame and a $40\mu\mathrm{m}$ DSSSD. In this setup a scattering target was used and the detector was mounted at $20°$ with respect to the beam axis, as seen in picture 2. Future test experiments aim at an improvement of wide beam plunger measurements, as already being performed in a fast beam setup at GSI-FRS [5]. Work supported by F & E project KJOLIE1012.

References

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