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Diagnostics for DESIREE

[Double ElectroStatic Ion Ring ExpEriment]

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Overview of DESIREE:

- Electrostatic → No upper mass limit for stored ions.
- Compact Device: Easy to opearte, Small Labs, Dimensions: outer ~ 5×3×1 m^3, inner ~ 4.4×2.4×0.3 m^3
- Two Storage Rings – same circumference (~ 9.2 m) & common straight section (~ 1m) for merged beam experiments with ions of opposite charges; Ring 1: Lighter ions, Ring 2: Heavier ions
- Operated at both ¤ room temperature ¤ cryogenic temperature (~ 10-20 K)
- Vacuum chambers § inner » aluminium § outer » iron,Vacuum ~ 10^{-11} mbar → long storage times.
- Two Ion Sources to Inject Ions: → 25 kV for lighter ions and 100 kV for heavier ions
  → analyzing magnet and different kinds of ion source.

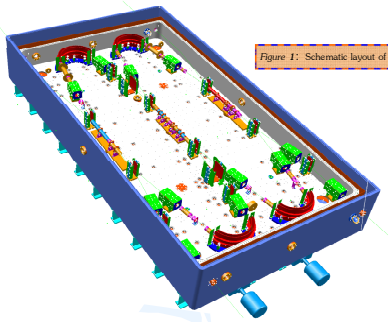

Figure 1: Schematic layout of DESIREE

Spatial Resolution test of a Beam Diagnostic system:

The beam diagnostic system consists of (i) Faraday cup (FC) to measure the beam current, (ii) collimator with circular apertures of different diameters to measure the spatial resolution of the system, (iii) a beam profile monitoring system (BPMS), and (iv) a control unit (PC). The BPMS, in turn, consists of (a) aluminim (Al) plate or foil, (b) a grid placed in front of the Al foil to accelerate the SE, (c) position sensitive MCP, (d) fluorescent screen (F.S), and (e) a CCD camera to capture the images. ***Spatial resolution better than 2 mm was achieved.***

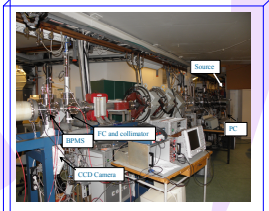

Figure 2: Experimental set-up at the CRYRING facility at Manne Siegbhan Laboratory, Stockholm University

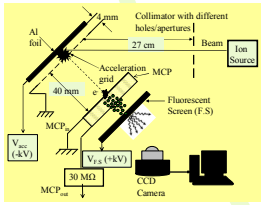

Figure 3: Schematic diagram of the beam diagnostic set-up to monitor the beam intensity profile, and to cover the wide range of beam intensities and energies. 10 keV proton beam was used.

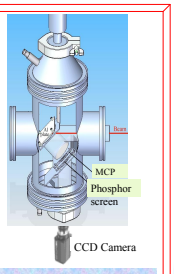

Figure 4: 3-D view of the BPMS.

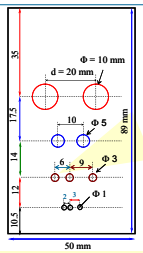

Figure 5: Collimator with circular holes of different diameters (Φ) and separation (d) between them. The collimator cuts out from the beam areas equal to the holes with separation *d* mm between the beams centers, and creates well separated (distinguishable) narrow beams of approximately same intensity close to each other.

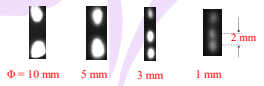

Figure 6: CCD images of the light produced in the F.S for fixed Al plate (V_{acc} = - 5 kV) and MCP (V_{MCP} = 1300 V) voltage. The 10 keV proton beam passed through the collimator of holes of different diameters and separations before strikes the Al plate. The beam spots are well separated and can be clearly seen on the screen, suggesting a ***spatial resolution of better than 2 mm of the diagnostic system.***

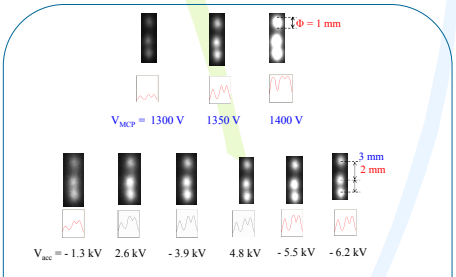

Figure 7: CCD images of the light produced in the F.S. Well separated and distinguishable beam spots are observed.. The intensity distribution is shown as a function of V_{MCP} (V_{acc} = ~ 5 keV) (upper panel) and V_{acc} (V_{MCP} = 1370 V) (lower panel). The beam profiles captured by the CCD camera are also shown. ***Spatial resolution better than 2 mm was achieved.***

References:

1. K. Kruglov *et al.*, NIM A **441** (2000) 595, **701** (2002) 193c,
2. The DESIREE project at MSL (www.msl.se)
3. Atomic Physics, Stockholm University [http://www.atom.physto.se/Cederquist/desiree_web_hc.html.]