

### A.6: Coupling of H<sup>-</sup> ion source with LEBT and ion beam characterization

A filament based multicusp arc discharge type H<sup>-</sup> ion source has been successfully coupled with solenoid magnet based Low Energy Beam Transport (LEBT) line, for beam transportation and characterization studies. The experimental setup is shown in Figure A.6.1.



Fig. A.6.1: Experimental setup of H<sup>-</sup> ion source coupled with LEBT and beam diagnostics.

H<sup>-</sup> ion source was operated in the pulsed mode with maximum of 8 mA current at 50 keV energy with 0.5 ms pulse duration and 2 Hz repetition rate. H<sup>-</sup> ion current of 3 mA was recorded at the beam diagnostic ports in the mid of the LEBT and 0.8 mA at the end of LEBT using the Faraday cup with proper biasing. Hydrogen gas was purged at 45 SCCM (standard cubic centimetre per minute) in plasma chamber and gas pressure of  $6.5 \times 10^{-2}$  mbar was maintained in plasma chamber and  $7 \times 10^{-4}$  mbar pressure in the beam diagnosis chamber of LEBT using TMP's. Beam profile measurements, carried out using a double slit method, recorded the beam size of 68 mm diameter (while solenoids OFF) and 25 mm (while solenoid ON with 50 A current) as shown in Figure A.6.2.

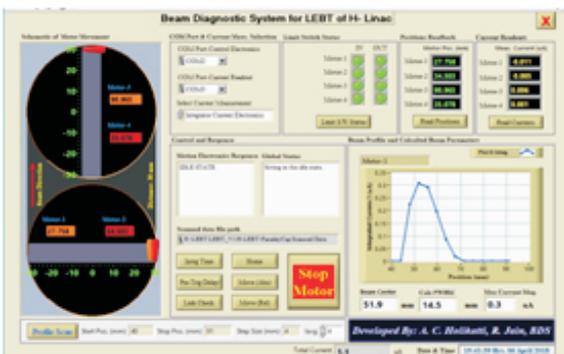


Fig. A.6.2: H<sup>-</sup> ion beam profile recorded with solenoid magnet ON with current of 50A (dia. ~ 25 mm).

Beam emittance was measured in between the two solenoids, using a double slit and Harp method, under solenoid magnets ON condition. The measured value of r.m.s. emittance was 0.435 mm-rad (un-normalized) as shown in Figure A.6.3. Beam spot image was recorded at the end of LEBT using a Chromox screen shows an oval shape of size 6 X 8 mm, and pepper pot emittance monitor as given in Figure A.6.4 (a) and (b), respectively.

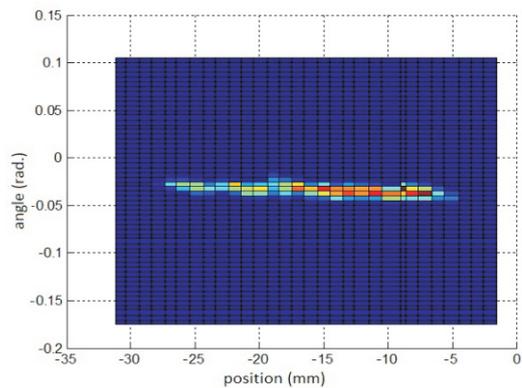
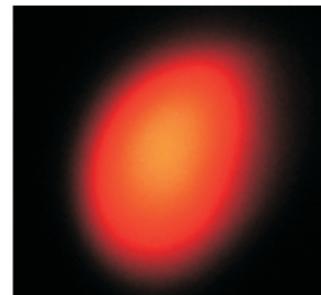
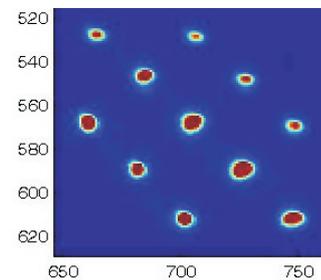


Fig. A.6.3: Recorded H<sup>-</sup> beam emittance using a slit and Harp method, at the centre of LEBT (RMS emittance ~ 25 mm-mrad (un-normalized)) after removal of noise.



(a)



(b)

Fig. A.6.4: Recorded H<sup>-</sup> beam spot (not to scale) using (a) fluorescent screen ~ 6 X 8 mm and (b) pepper pot emittance monitor.

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