4th International Beam Instrumentation Conference (IBIC) 2015

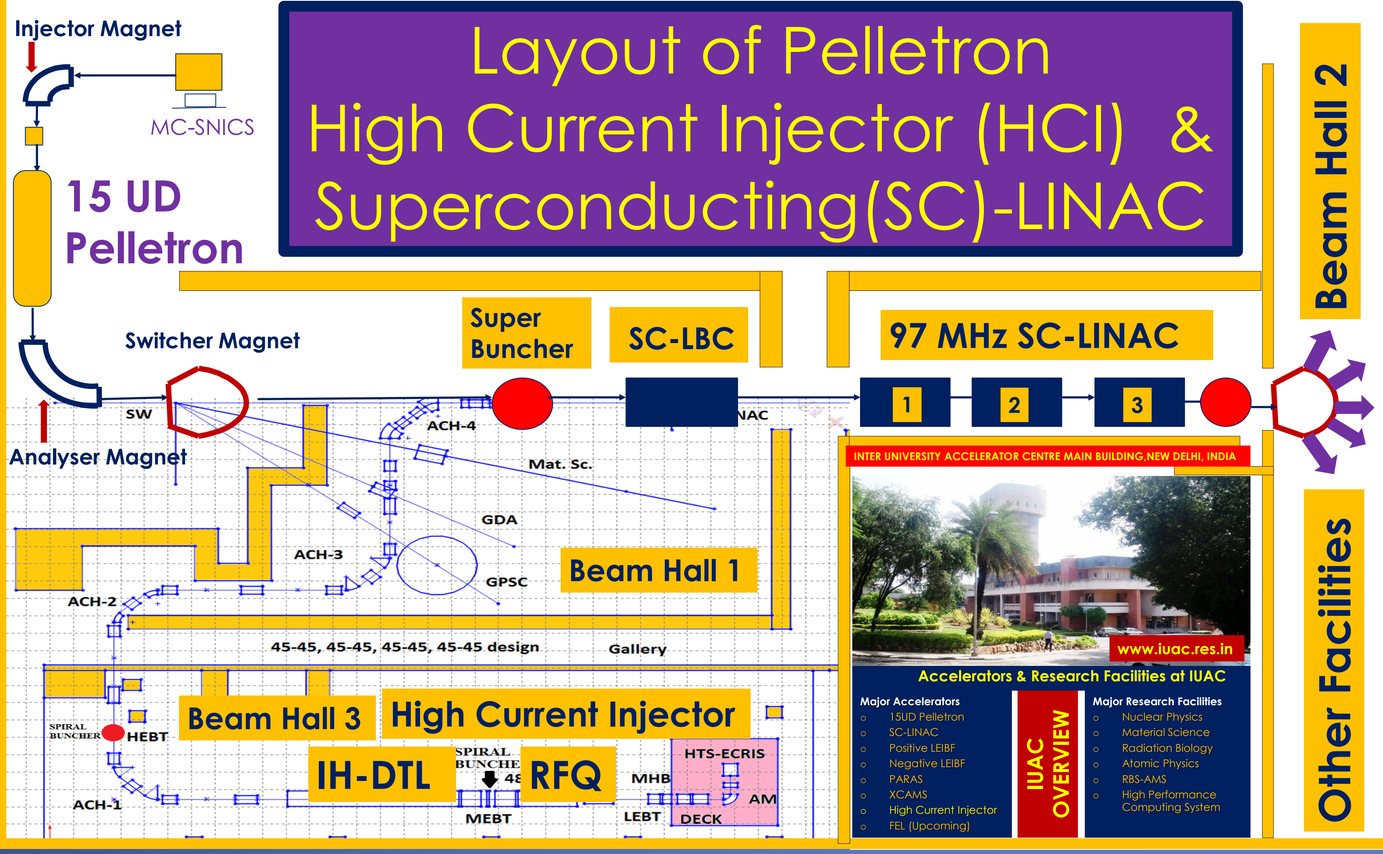
COMPACT AND COMPLETE BEAM DIAGNOSTIC SYSTEM FOR HCI AT IUAC

Rajesh V. Hariwal,[1,2,*] S.Kedia,[1] H.K.Malik,[2] V.Verzilov,[3] and R. Mehta[1]

[1]High Current Injector Division, Inter-University Accelerator Centre, New Delhi 110067, INDIA
[2]Plasma Waves and Particle Acceleration Laboratory, Department of Physics, I.I.T. Delhi, Delhi 110016, INDIA
[3]Accelerator Division, TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C. V6T2A3, CANADA

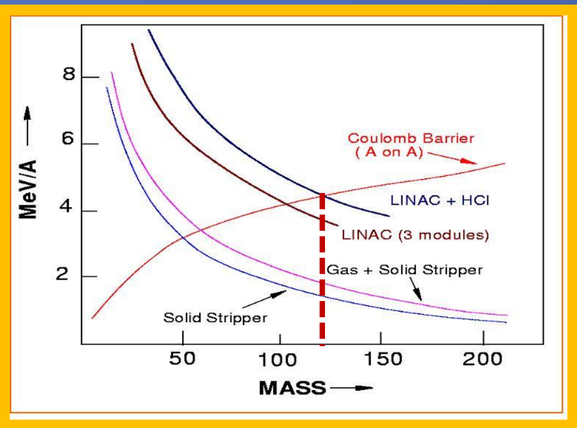
*Email: hariwal@gmail.com

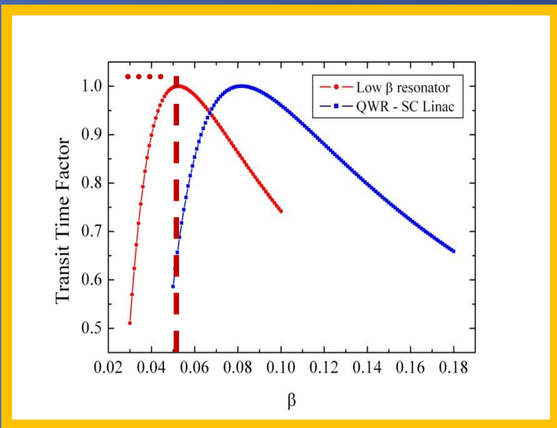
Layout of Pelletron High Current Injector (HCI) & Superconducting(SC)-LINAC



HIGH CURRENT INJECTOR

- Novel HTSC-ECR Ion Source
- State of the Art Accelerator Development
- High Current ~A Few Hundreds of microAmperes
- Accelerate Ions of Mass <120 A.M.U.
- More Species-Nobel Gases
- Pelletron as a Stand-Alone Operation
- HCI as an Injector for Existing SC-LINAC
- Accelerate Ions with A/q≤6
- Output Energy ~1.8 MeV/ A.M.U.



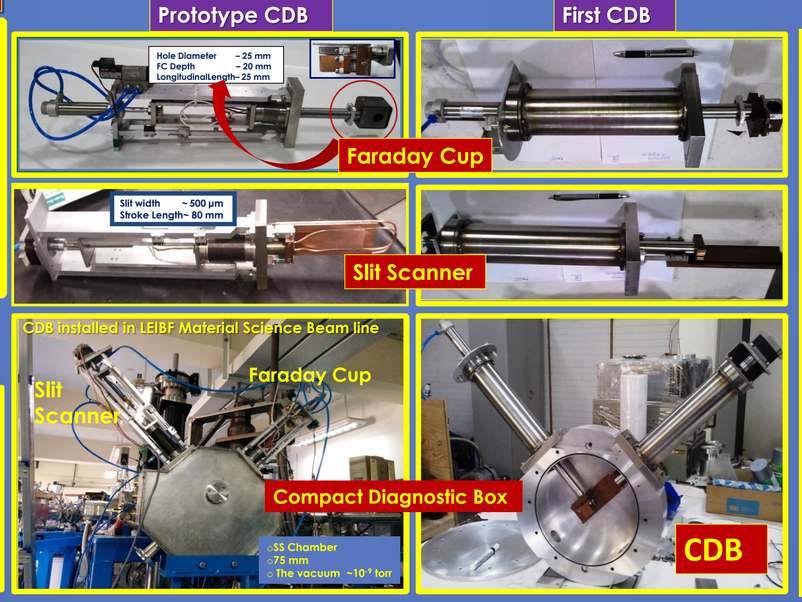


High Current Injector + LINAC

Design Value A/q ≤ 6

- 18 GHz PKDELIS, High Tc Axial coils, Injection 1.8 T, Extraction 1.5 T, Operating at 23⁰ K, RF Power 1.7 kW, TE ~50 π mm mrad, First HTSCECR-GR
- 48.5 MHz RFQ, Radio Frequency Quadrupole, 8-180 keV/u, Power ~80 kW, 4 Rod Structure, 2.5 Meter
- 97.0 MHz RT IH-DTL, Room Temperature, Interdigital H-type Drift Tube Linac, 180 keV/u-1.80 MeV/u, Power ~25 kW(Max), Integrated Bunching, 6 Tanks ~7 Meters
- 97.0 MHz SC-LBC, Superconducting Quarter Wave Resonator –Low Beta cavity, 8 Cavities, Optimum β ~0.06
- 97.0 MHz SC-LINAC, Superconducting Linear Accelerator, 3 Modules, 24 Cavities, Optimum β ~0.08, Average Electric Field ~3MV/m

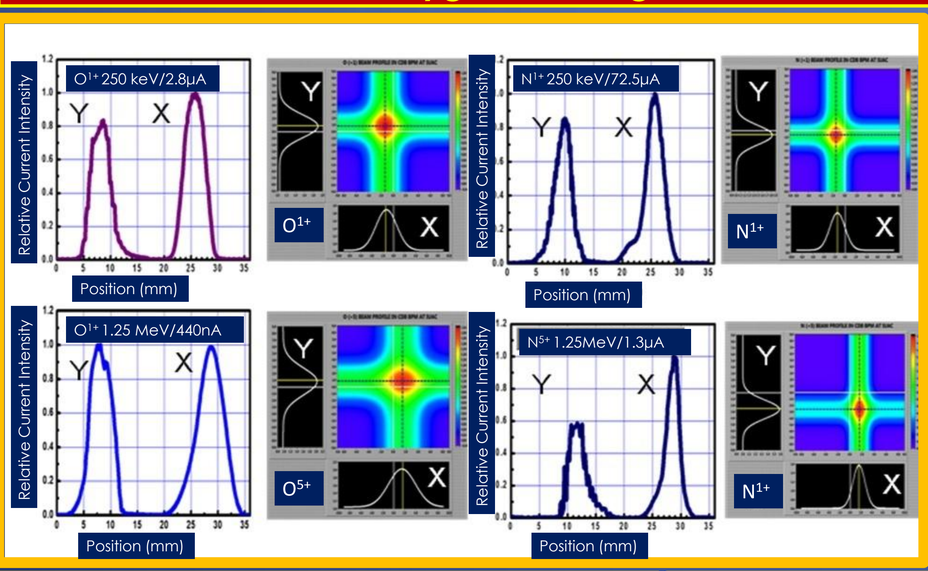
Compact Diagnostic Box (CDB) Development



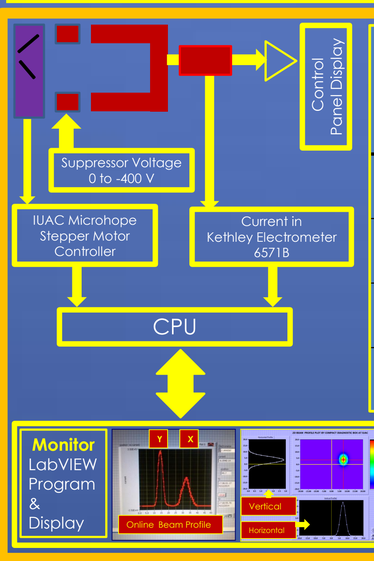
Salient Features of First CDB

- Compact Size (Longitudinal)~70 mm
- Approximately 10 pA to 100 µA
- Water Cooled/1kW Beam Power (approx.)
- Ease of Machining
- Mechanical Robustness
- Electrical/ Electronics Operation
- Compatible with DTL Tank
- Low Cost and Reliable
- Beam Current, Position, Profile, Spot Size and Bunch Length

Online Beam Test of Oxygen & Nitrogen and Profiles



Data Acquisition &Current in FC Vs **NEC-FC

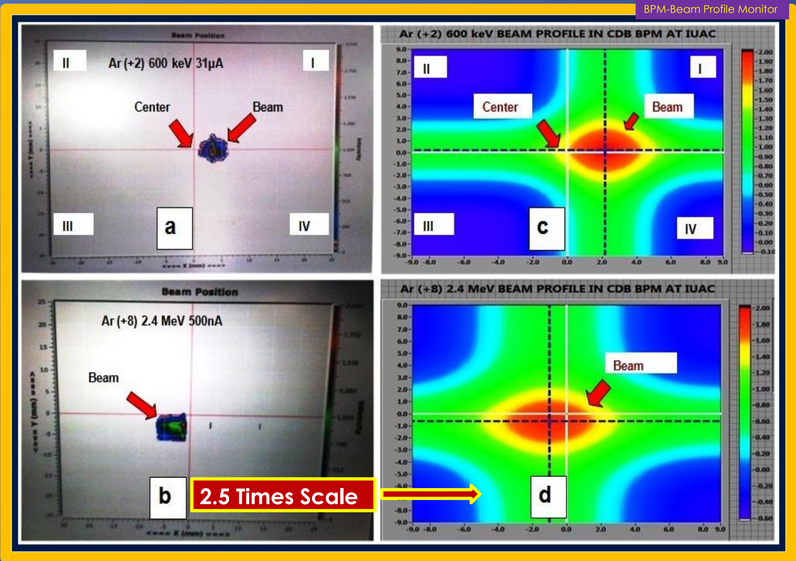


Beam Specification	Energy keV	Current in NEC Faraday Cup	Current in CDB Faraday Cup	Difference
C^{+1}	300	30 µA	30 µA	Match
N^{+1}	250	74 µA	72.5 µA	2 %
Ar^{+1}	14	2.15 µA	2.15 µA	Match
O^{+5}	1250	440 nA	440 nA	Match

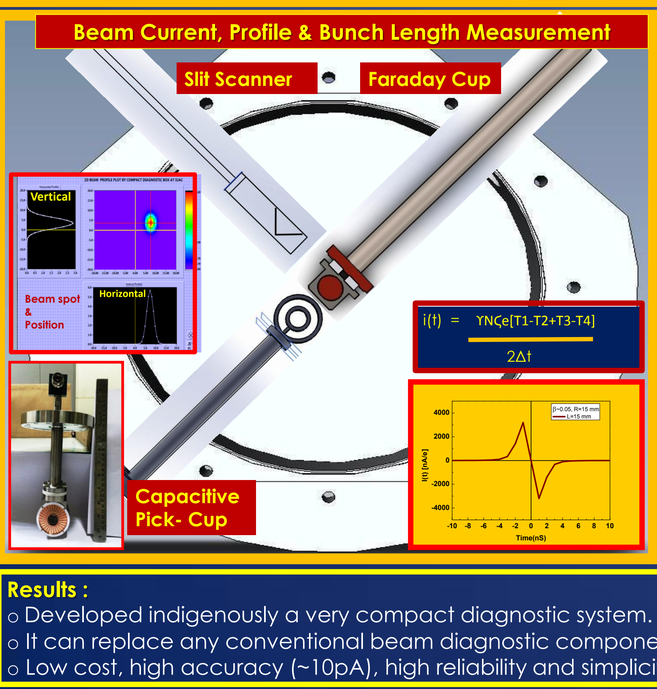
**NEC-National Electrostatics Corporation, USA

Beam Current, Profile, Spot Size and Position Measurement Display

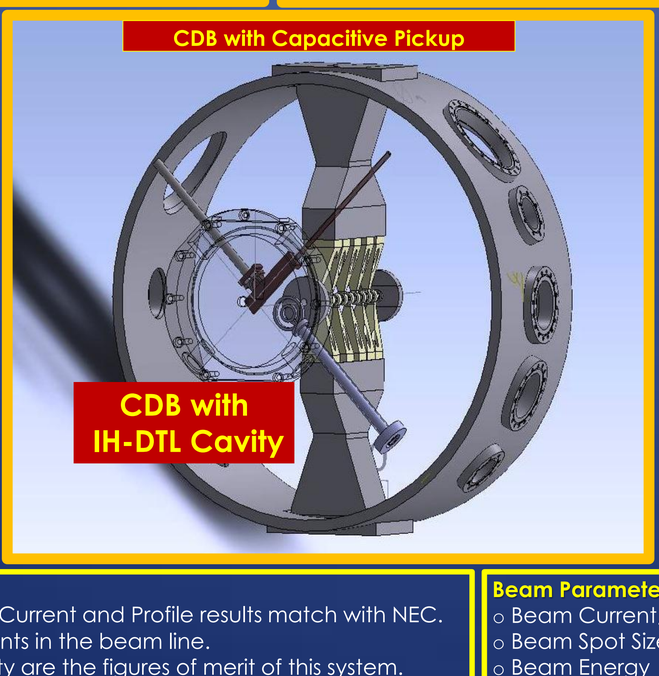
Beam Digitization and Matching with NEC BPM



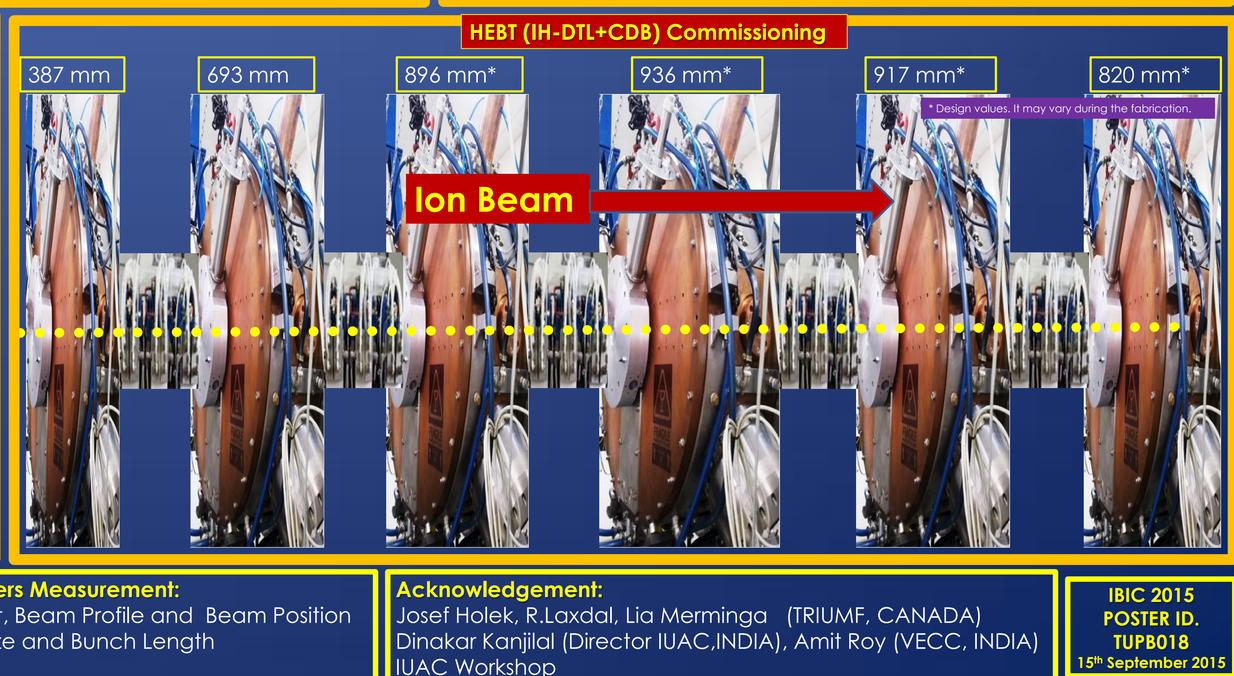
Beam Current, Profile & Bunch Length Measurement



CDB with Capacitive Pickup



HEBT (IH-DTL+CDB) Commissioning



Results :

- Developed indigenously a very compact diagnostic system. Current and Profile results match with NEC.
- It can replace any conventional beam diagnostic components in the beam line.
- Low cost, high accuracy (~10pA), high reliability and simplicity are the figures of merit of this system.

Beam Parameters Measurement:

- Beam Current, Beam Profile and Beam Position
- Beam Spot Size and Bunch Length
- Beam Energy

Acknowledgement:
Josef Holek, R.Laxdal, Lia Merminga (TRIUMF, CANADA)
Dinakar Kanjilal (Director IUAC,INDIA), Amit Roy (VECC, INDIA)
IUAC Workshop

IBIC 2015
POSTER ID.
TUPB018
15th September 2015