CEA/SACLAY LIGHT ION SOURCES STATUS AND DEVELOPMENTS

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Abstract: After several years of high intensity light ion beam production with the SILHI source, CEA Saclay is now involved in the construction of different injectors dedicated to large infrastructures like IFMIF or Spiral 2. Other installations are also interested by high intensity ion sources. Such machines plan to produce and accelerate proton or deuteron beams in pulsed or continuous mode. The SILHI source, based on ECR plasma generation, already demonstrated its performance in both modes.
As a consequence, at present time the construction of 2 new injectors for Spiral 2 and IFMIF (source and low energy beam lines) is in progress at CEA/Saclay. This article will report on the status of both installations. It will also point out on ongoing developments. Such developments are mainly done with the new BETSI test bench operating for several months. (see Poster TUPOT 03)

Spiral 2 and IFMIF injector characteristics

Requests	Unit	Spiral 2	IFMIF
Particle		(H^+), D^+	D^+, (H_2^+)
Intensity	mA	0.15 to 5	140
Energy	keV	(20), 40	100
Emittance	π.mm.mrad	0.1	0.2
D^+ fraction		99	99
Mode		CW / pulsed	CW / pulsed
Modulation capability			1 ms - CW @ 1 - 20 Hz
Beam turn off	µs		< 10

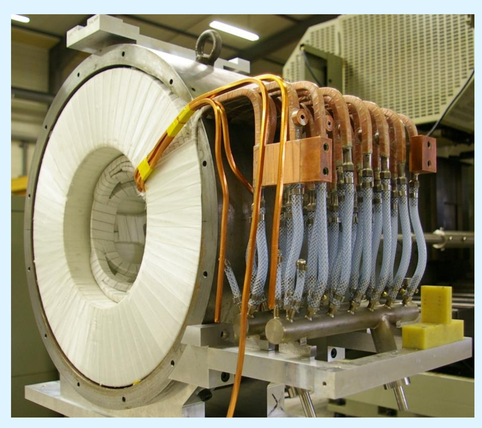
IFMIF injector design and construction

Source characteristics :

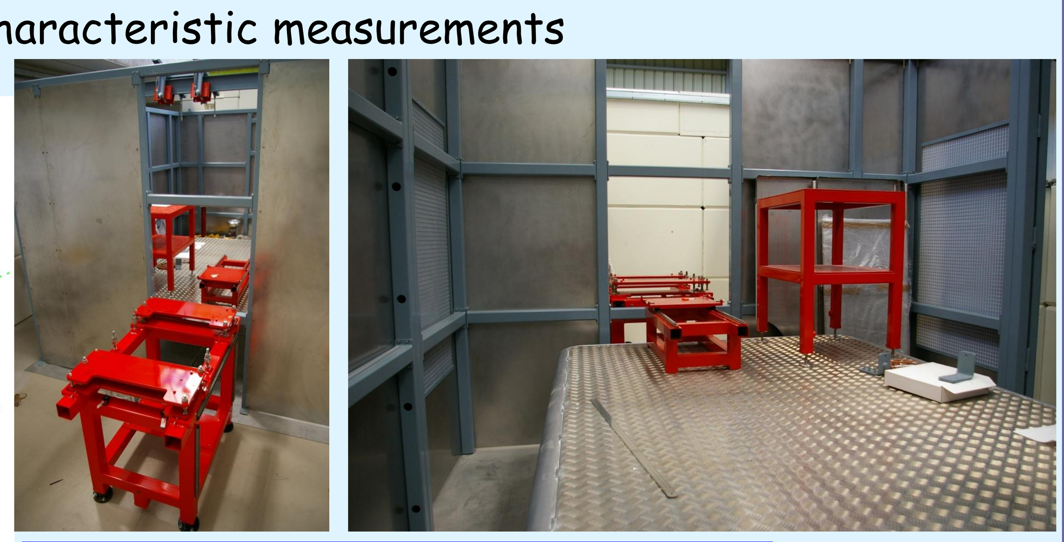
- ECR type source located on HV platform (100 kV)
- 2.45 GHz fed to the source via ATU and quartz window
- Tunable magnetic field provided by coils
- Four-electrode extraction system (PE, Puller, Repeller, Ground)

LEBT characteristics :

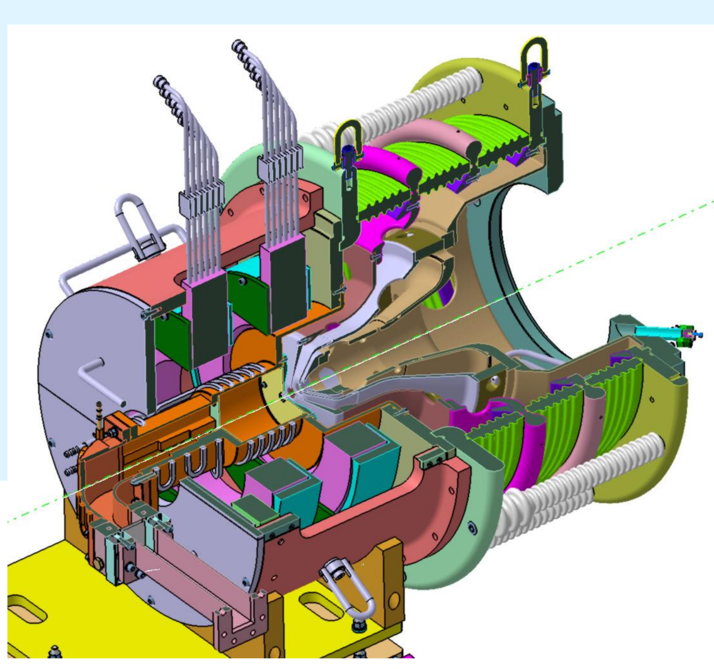
- Magnetic beam focusing (2 solenoid LEBT)
- Space charge compensation dominated beam ($P_{LEBT} \approx 10^{-3}$ Pa)
  ➔ dedicated code development (SOLMAXP)
- Cone at RFQ entrance to collect unwanted particles
- Adapted diagnostics for beam characteristic measurements

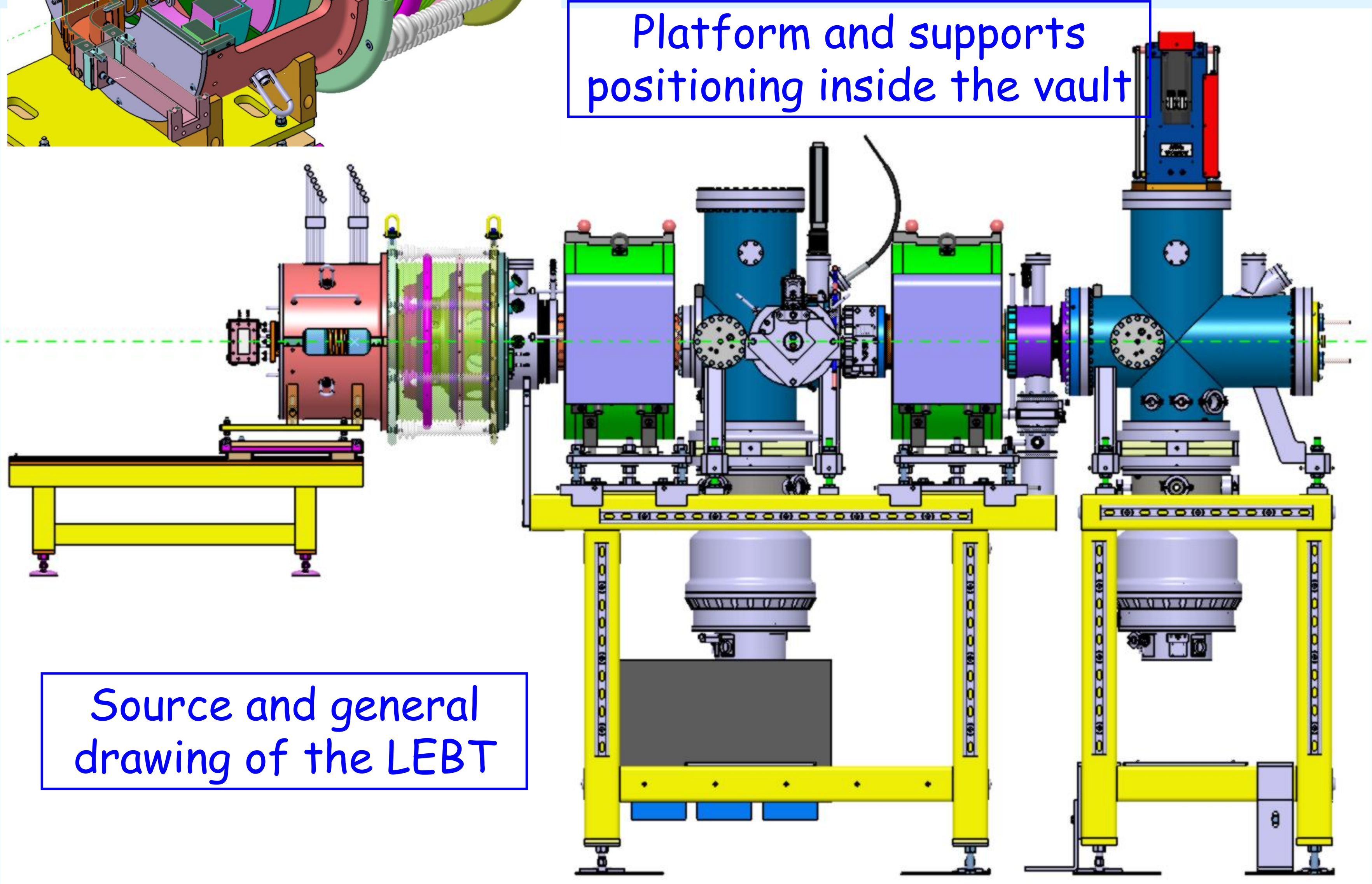


LEBT solenoid under construction



Platform and supports positioning inside the vault





Source and general drawing of the LEBT

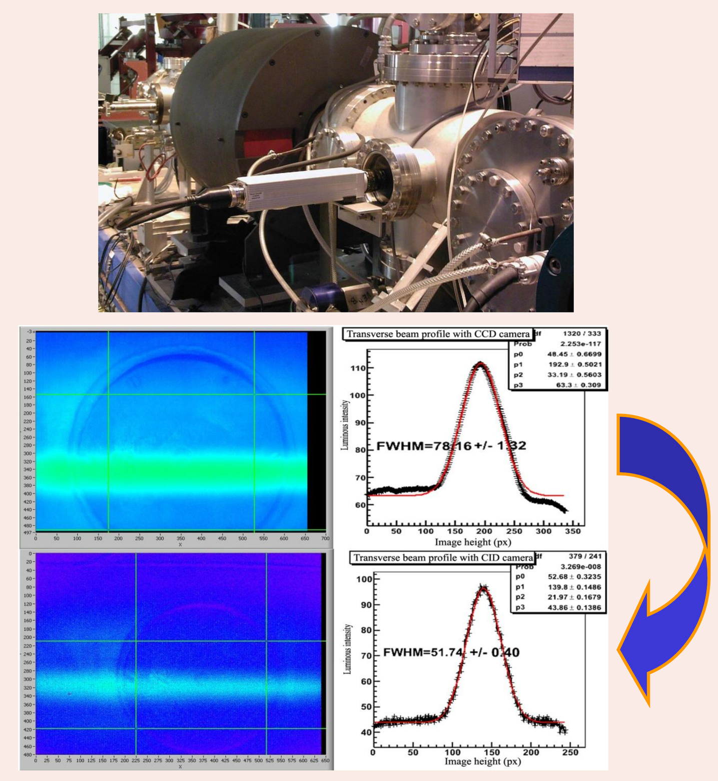
Schedule and Program:

- Mechanical devices, Power supplies and RF chain provision by end of 2010
- First proton beam production by March 2011
- Diagnostic installation and validation 2011
- H^+ and H_2^+ beam characterization by end 2010
- D^+ beam production and characterization by spring 2012
- IFMIF injector transfer to Japan during summer 2012

SILHI as diagnostic test bench

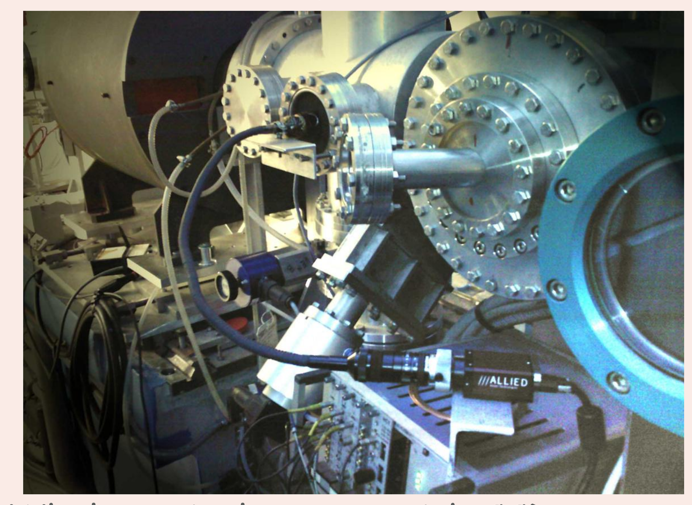
(D,d) reaction
↓↓↓
NEUTRON PRODUCTION
↓↓↓
Tests of Neutron Resistant Devices.

CID camera on SILHI source

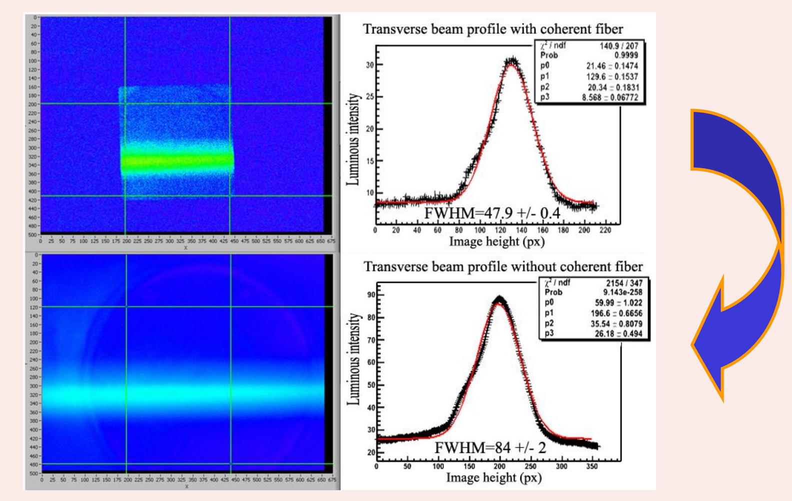


≠ FWHM with CDD and CID = 7 %

Schott fiberscope on SILHI source

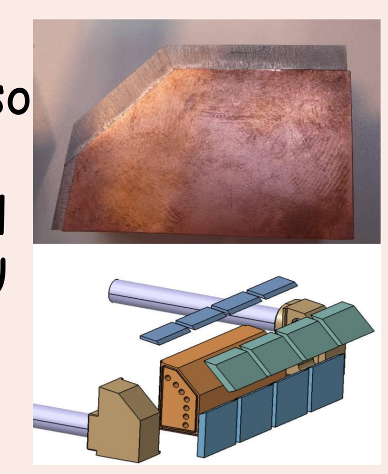


Whole optical system with CCD camera on SILHI source

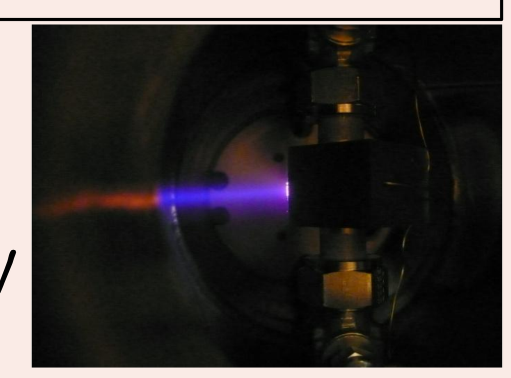


< ≠ FWHM with fiber and without > = 10 %

Moreover, the SILHI beam has also been used to test the future thermal screen of the EMU presently under development at Saclay.

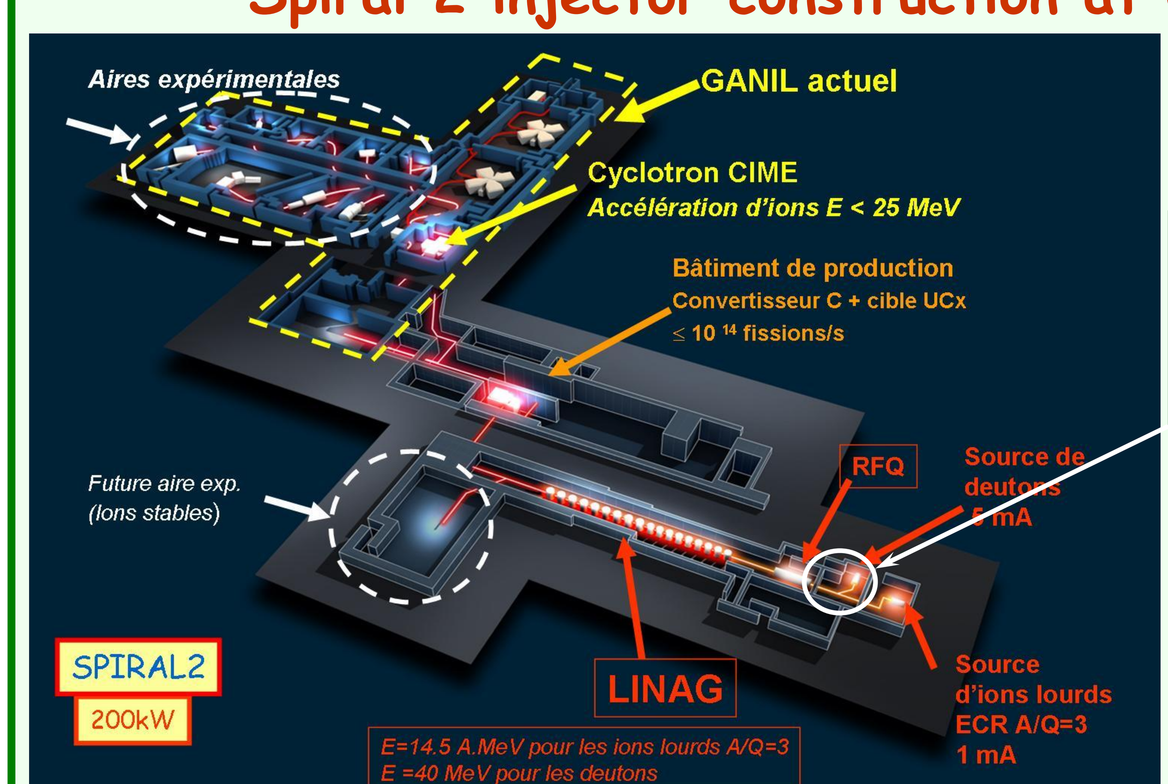


EMU thermal screen: Copper and W to bear **> 15 kW** cw beam



Test of a copper block covered with a W tile.

Spiral 2 injector construction at CEA/Saclay



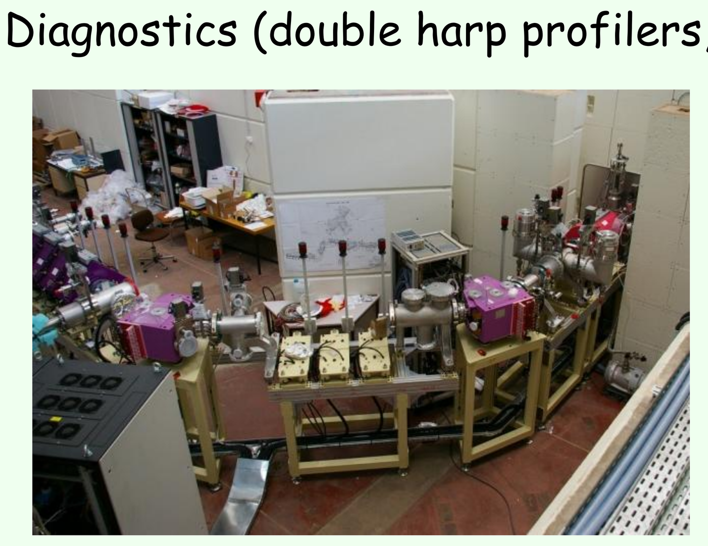
D^+ Spiral 2 injector to be installed and tested at Saclay

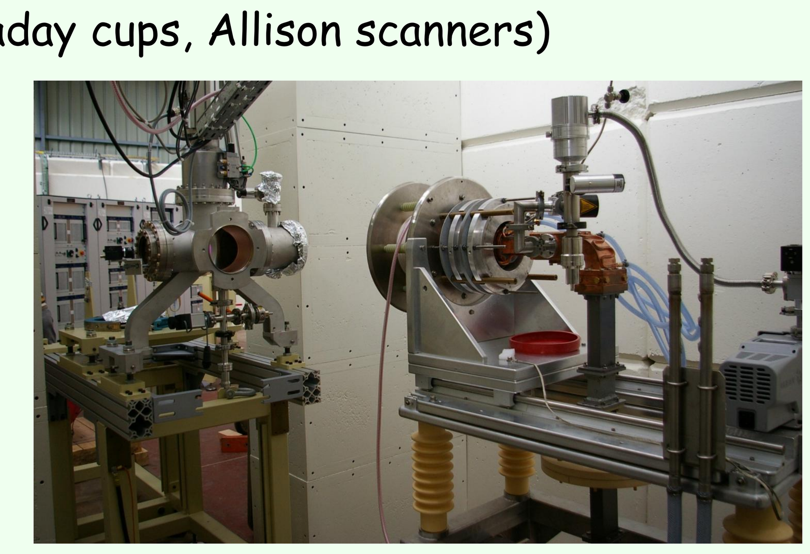
Source characteristics :

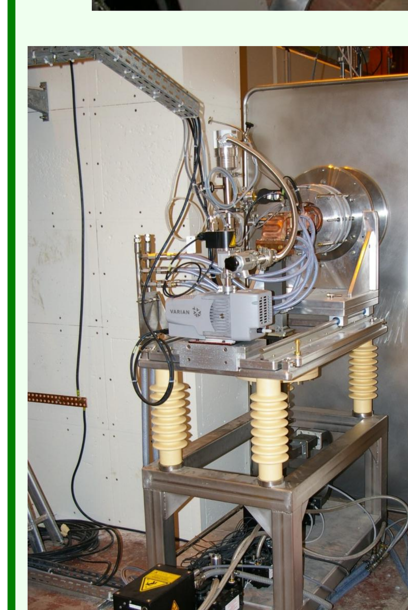
- ECR source with no HV platform (40 kV max.)
- 2.45 GHz fed to the source via ATU and quartz window
- Permanent magnet structure
- Five-electrode extraction system (PE, Puller, Repeller, 2 Ground)
- Plasma electrode Φ =3 mm

LEBT characteristics :

- Magnetic focusing (solenoids and multipoles) and bending (2 dipoles)
- Diagnostics (double harp profilers, Faraday cups, Allison scanners)







First H^+ beam produced end 2009 in CW and pulsed mode

hydrogen beam
I_{total} = 8 mA
Energy = 20 keV
RF power = 700 W
200 ms at 1 Hz