SPIRAL2 MEBT COMMISSIONING

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Abstract

The SPIRAL2 injector is made of a 5mA p-d ion source, a 1mA heavy ion source (up to A/Q =3) and a CW 0.75 MeV/u RFQ. They have been successfully commissioned using a diagnostic-plate in parallel with the superconducting linac installation. The green light has been obtained for the LINAC commissioning, starting with the Medium Energy Beam Transport (MEBT) line. The injector is now connected to the SC LINAC without the diagnostic-plate. The MEBT includes a bunch selector design for the NFS physics which is briefly described. Firsts results are presented for proton.

Introduction

- The Low Energy Beam transport Lines (LEBT) and RFQ have been successfully commissioned in a previous phase. The RFQ transmission and emittances correspond to the ones expected [1].
- The ASN authorization to send the beam to the SC LINAC was obtained in July 2019. The accelerator commissioning started with the tune of the Medium Energy Beam Transport Line (MEBT) immediately.
- The main objectives are to tune the quads and rebunchers and compare to the TraceWin simulations [2] .

SPIRAL2

Spiral 2				
Particles	H+	D+	Ions	Ions Option
Q/A	1	1/2	1/3	1/6
Max. I (mA)	5	5	1	1

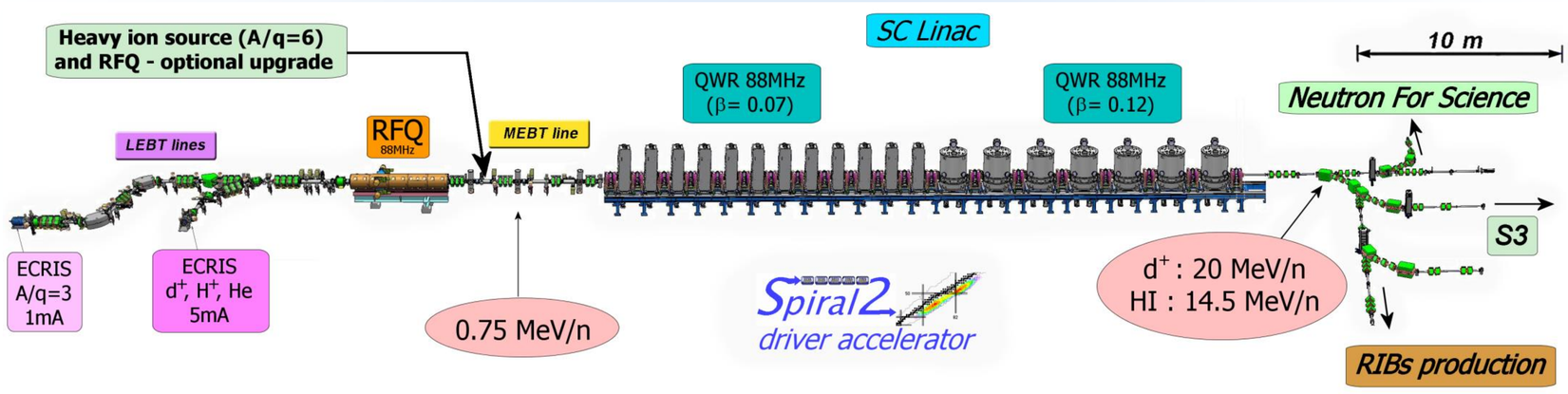

Figure 1. Spiral2 Accelerator Layout

Medium Energy Beam Transport

- 10 Quadrupoles, diameter 90mm, Gradient : 15T/m
- 3 Rebunchers
- Emittance meter (2 planes)
- 3 Slits
- FC and fast FC
- Fast chopper
- 3 wire profilers
- ACCT-DCCT

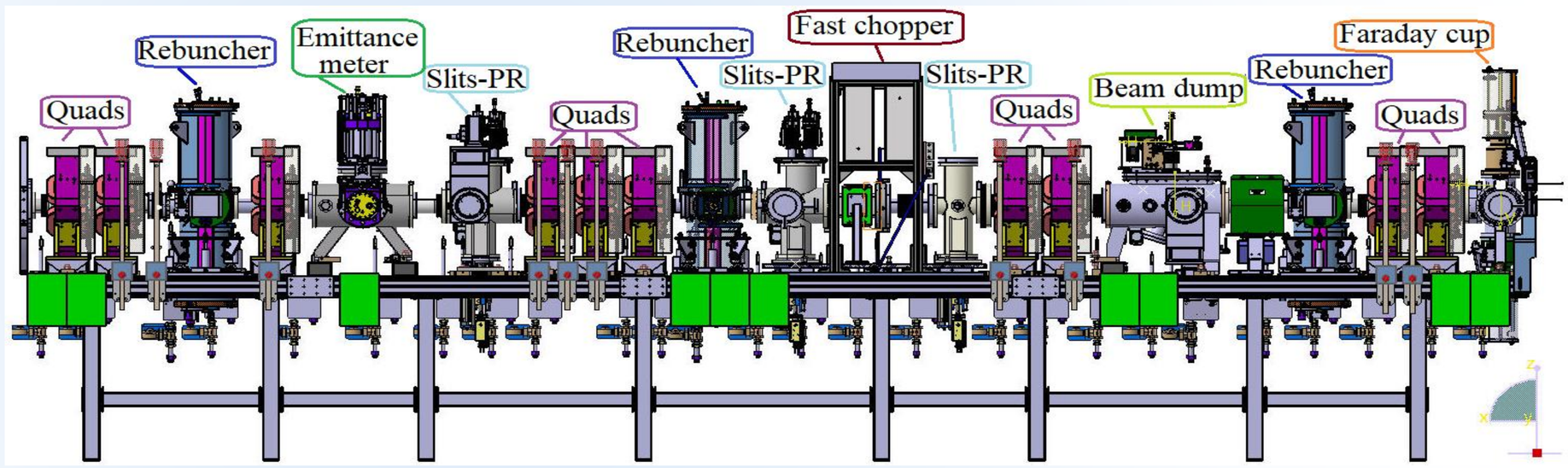

Figure 2. MEBT Layout.

Emittances

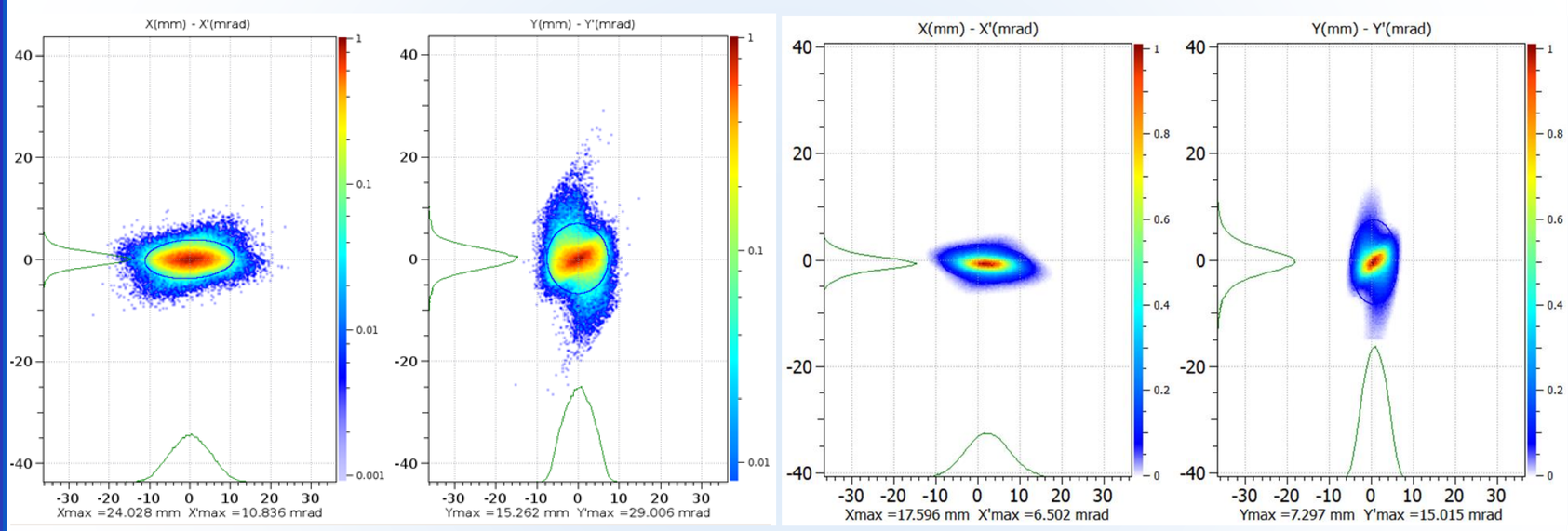

Fig 3. Transversal emittance for a proton beam in the MEBT.
Simulation [left] - Measurement [right].

Emittance [rms]	Simulation	Measurement	Difference [%]
X-X' [π.mm.mrad]	0.3014	0.3348	9.98
Y-Y' [π.mm.mrad]	0.3537	0.4	11.56

Phase scan

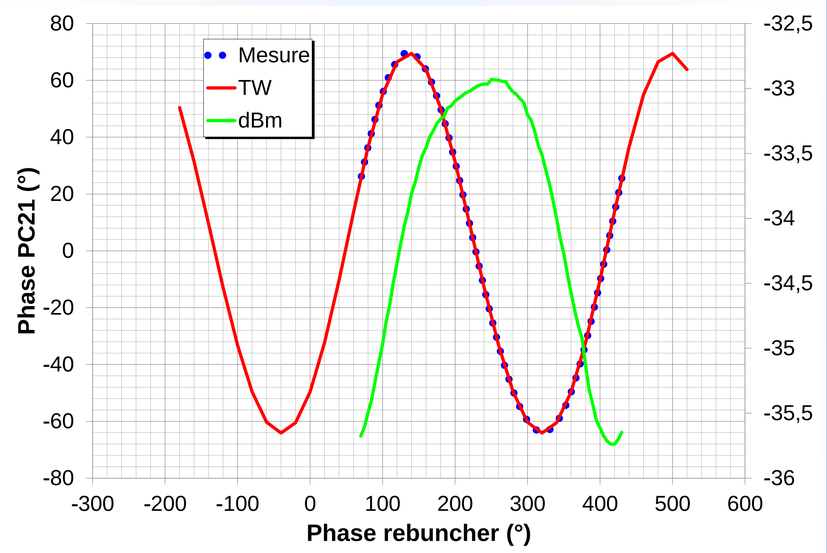

Figure 4. Comparison between simulated and measured phase scan in MEBT .

Envelopes, current and transmission

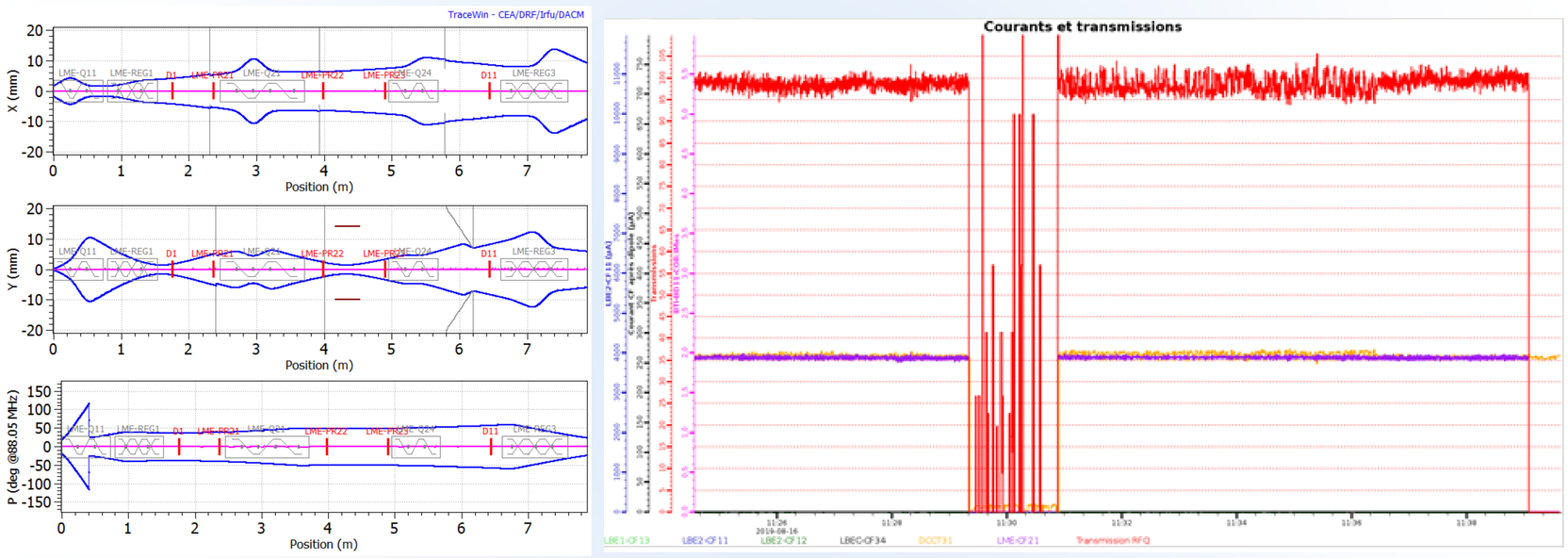

Fig 5. Envelopes [left] and currents (yellow: before RFQ, purple: end of the MEBT) and transmission measured (red) [right] for a 210 µA proton beam using the same tuning used for a 5 mA proton in the MEBT.

Preliminary conclusions and future work

- ✓ Fine-tuning for solenoids, quadrupoles and steerers.
- ✓ The transmission in the MEBT is ~100%.
- ✓ Tuning of the rebuncher has been done.
- ✓ Validation of the BPM ellipticity measurement.
- ✓ The emittance simulated and measured are similar.
- Actual work in order to understand the sensibility of the beam phase in the MEBT to the beam parameters at the entrance of the RFQ.
- Last work before to send the beam to the LINAC: study the beam dynamics around the fast chopper.

References

[1] P. Bertrand and R. Ferdinand, “SPIRAL2 Accelerator Construction Progress”, in *Proc. LINAC'12*, Tel Aviv, Israel,Sep. 2012, paper TH2A02, pp. 773-777.
[2] D. Uriot and N. Pichoff, “Status of TraceWin Code”, in Proc. IPAC'15, Richmond, VA, USA, May 2015, pp. 92-94, doi:10.18429/JACoW-IPAC2015-MOPWA008.