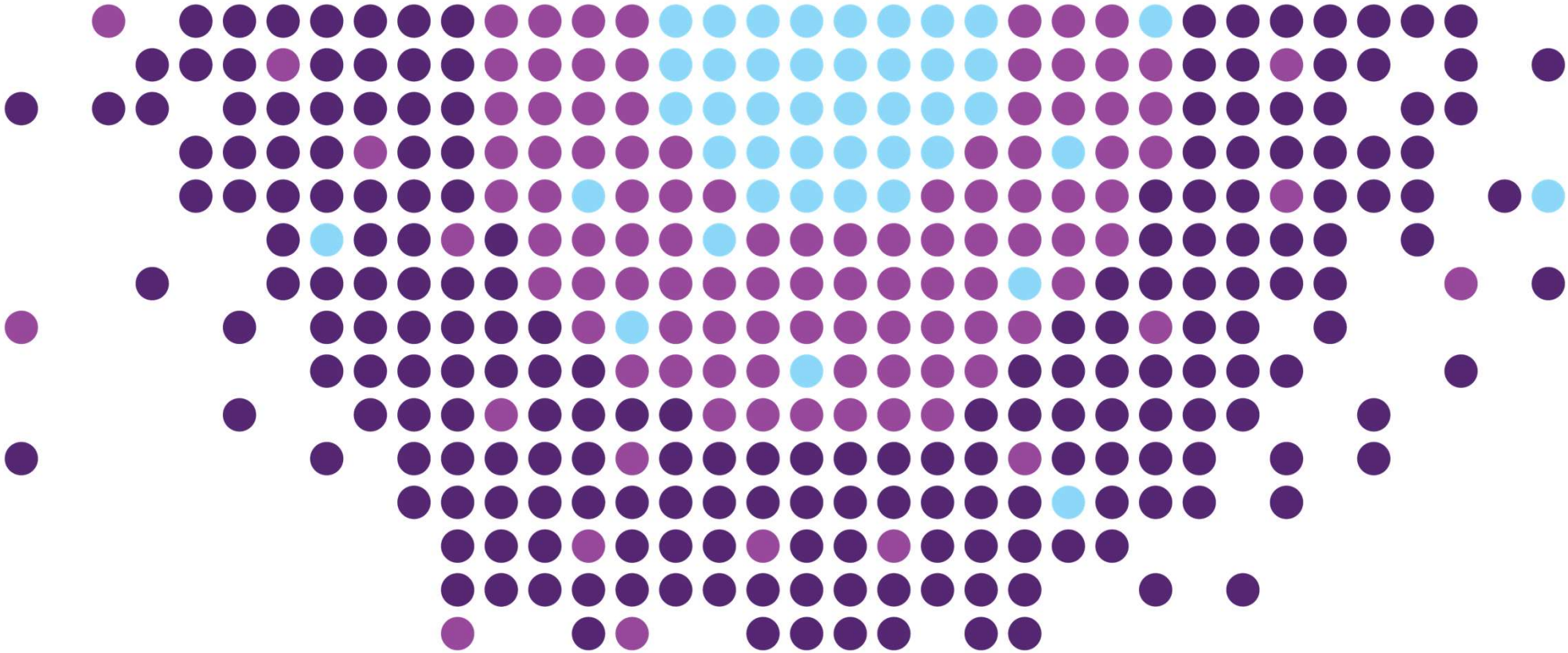


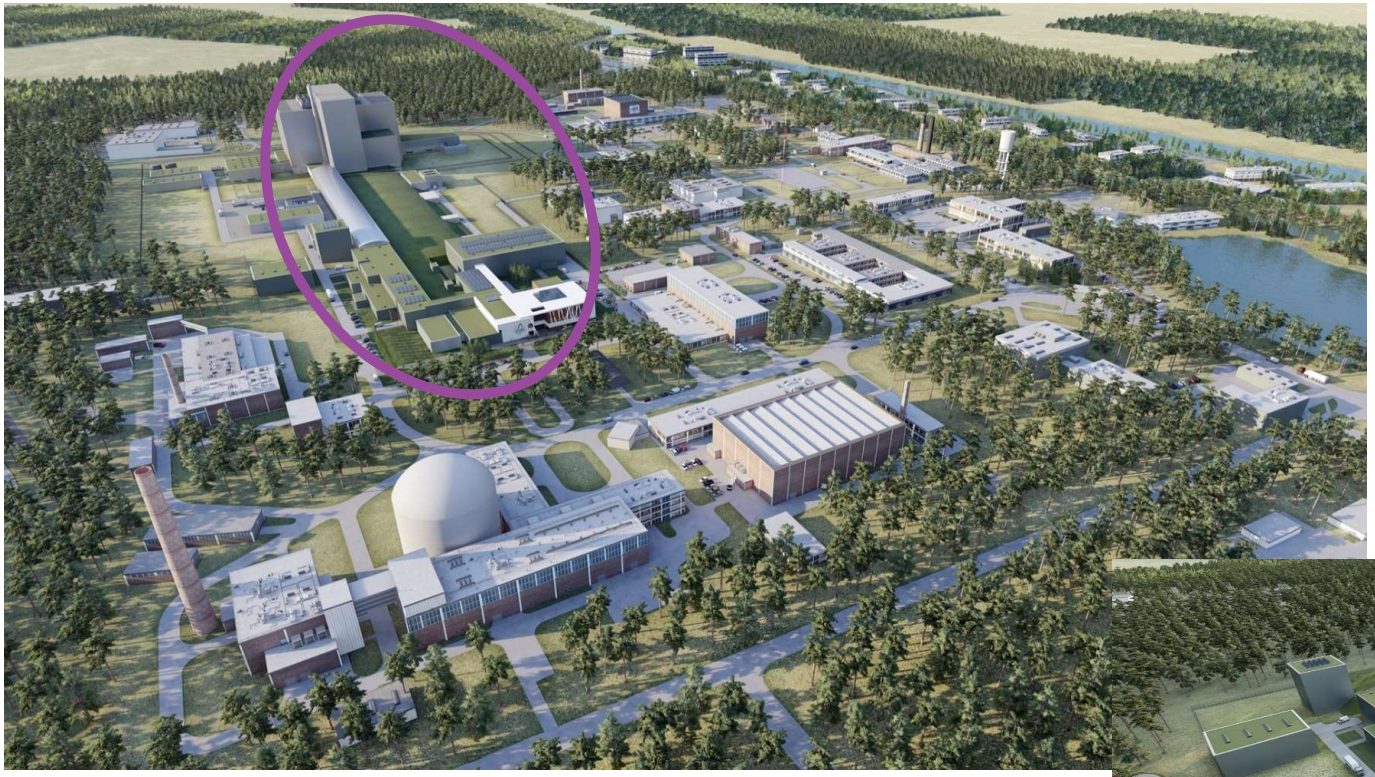
sck cen

Belgian Nuclear Research Centre

Angélique Gatera (angelique.gatera@sckcen.be)

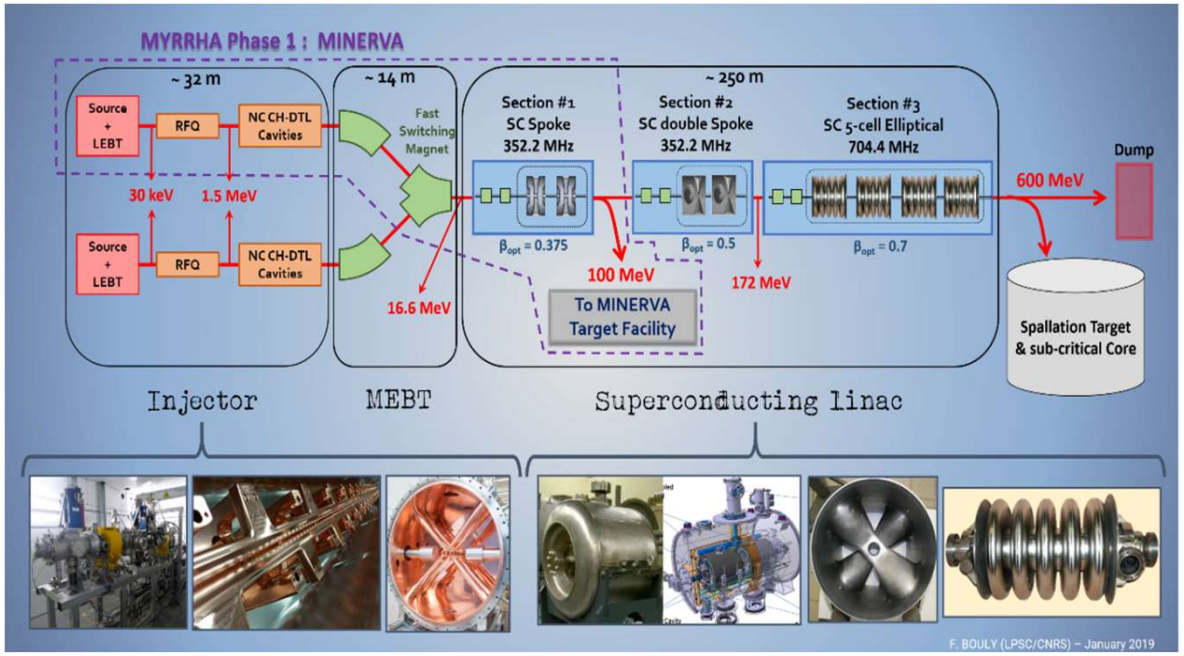
MYRRHA-MINERVA linac status and commissioning

Towards MYRRHA ADS



- **MYRRHA Phase 1 Implementation**
  - Also referred to as MINERVA

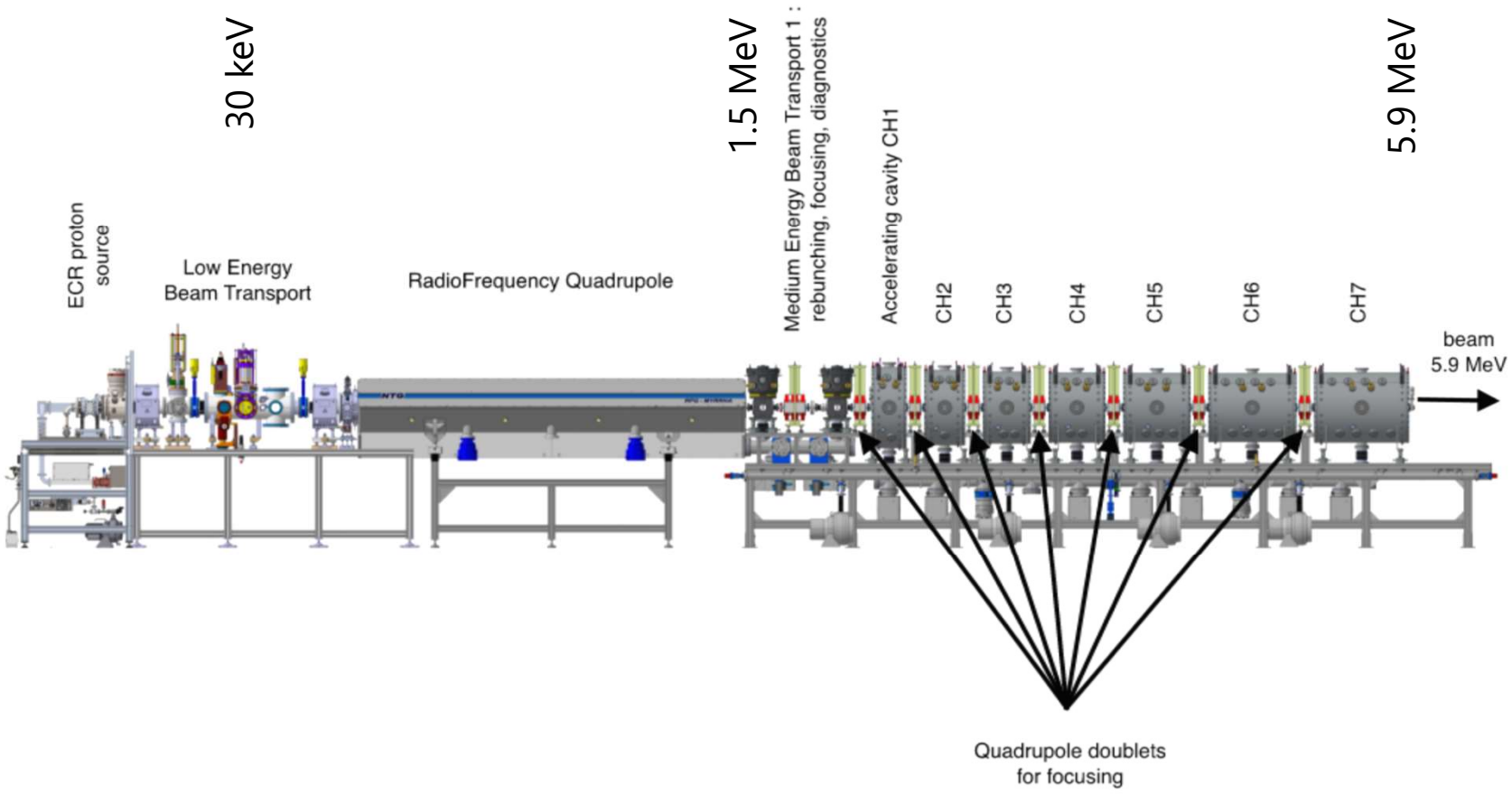
MYRRHA versus MINERVA LINAC



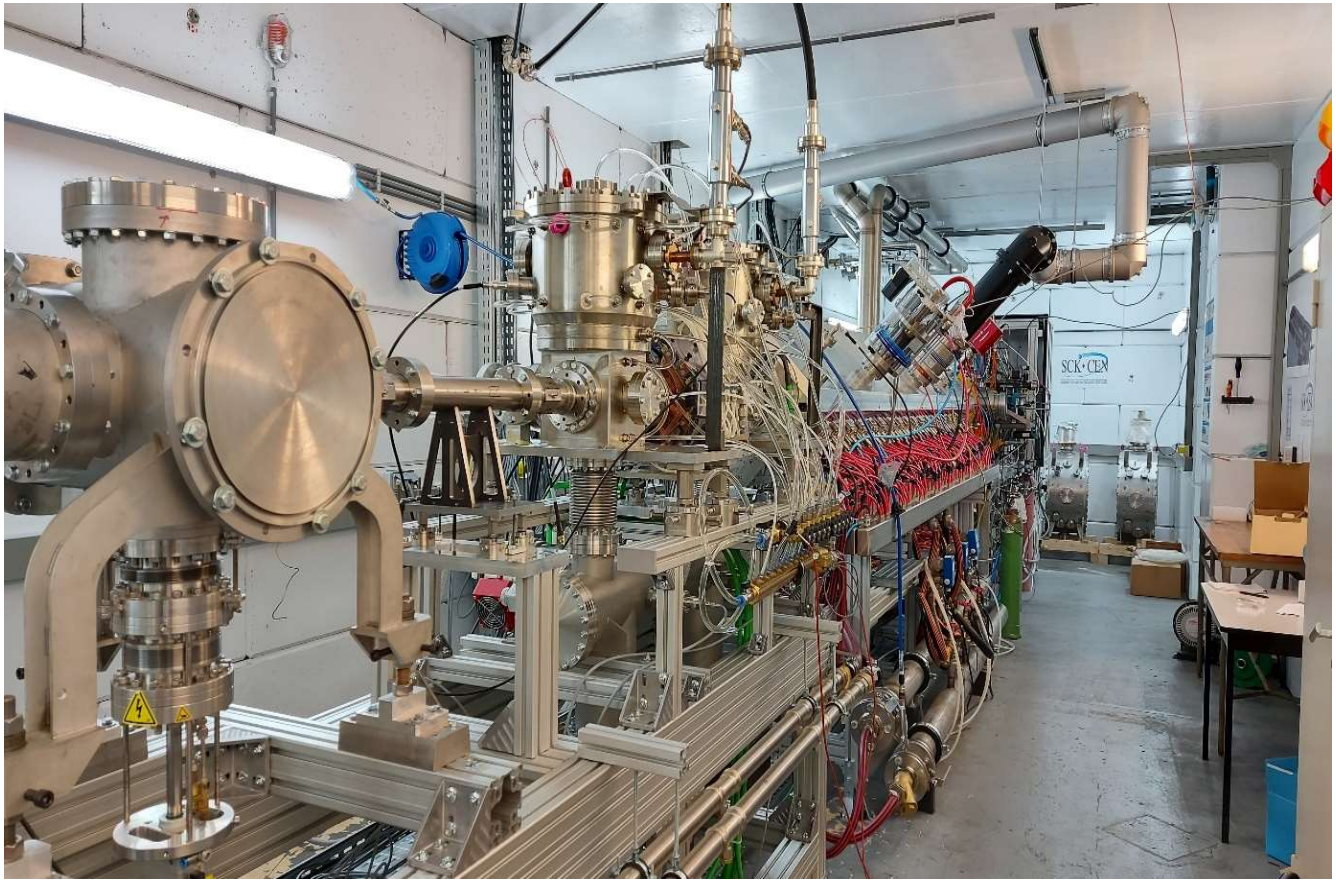
- beam particle : protons
- beam energy : 600 / 100 MeV
- beam intensity : 4 mA
- beam delivery : 2.4 / 0.4 MW CW (with regular holes)
- beam MTBF : 250 hours, a failure = a beam trip > 3 s

Key : Reliability

Integrated prototyping : Injector test platform

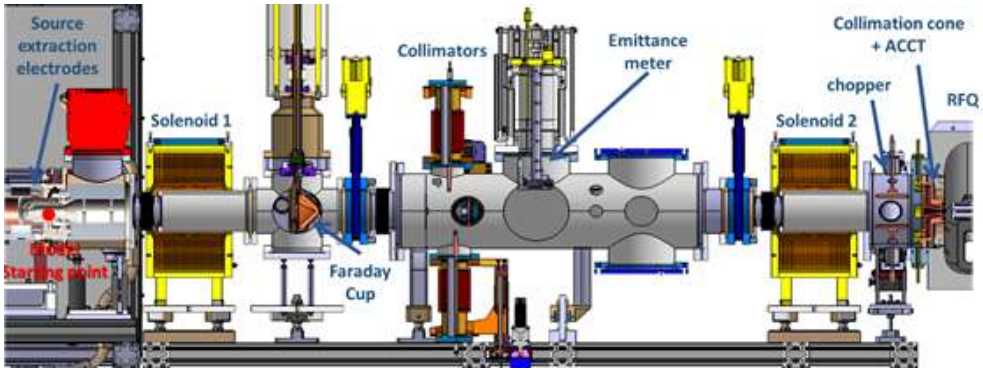


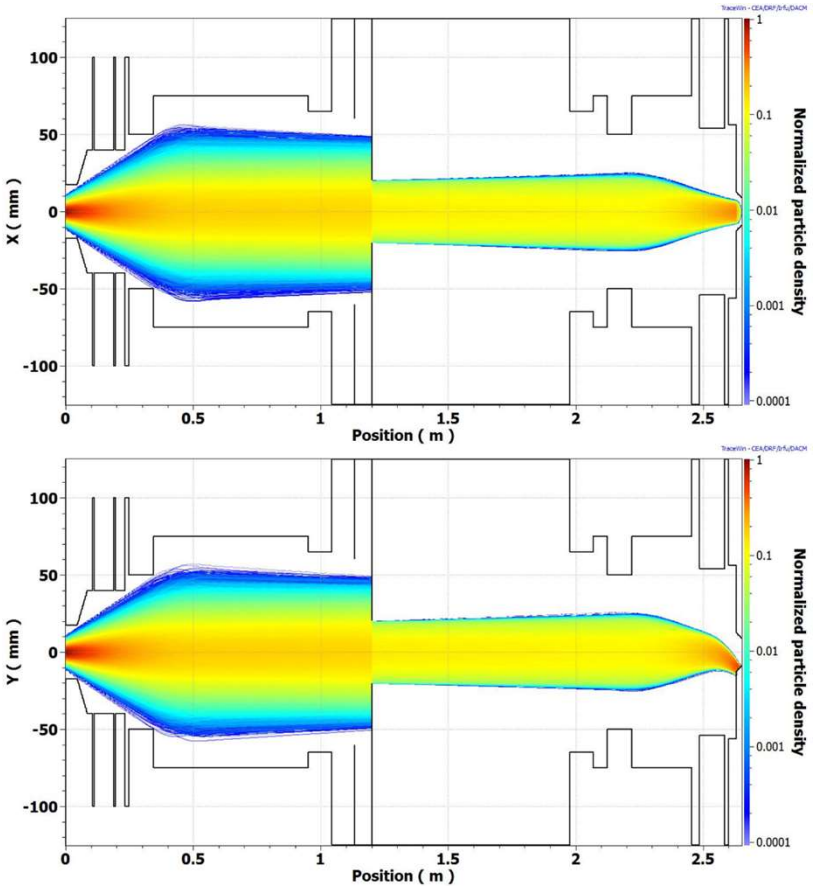
Injector installation today



Source & LEBT commissioning

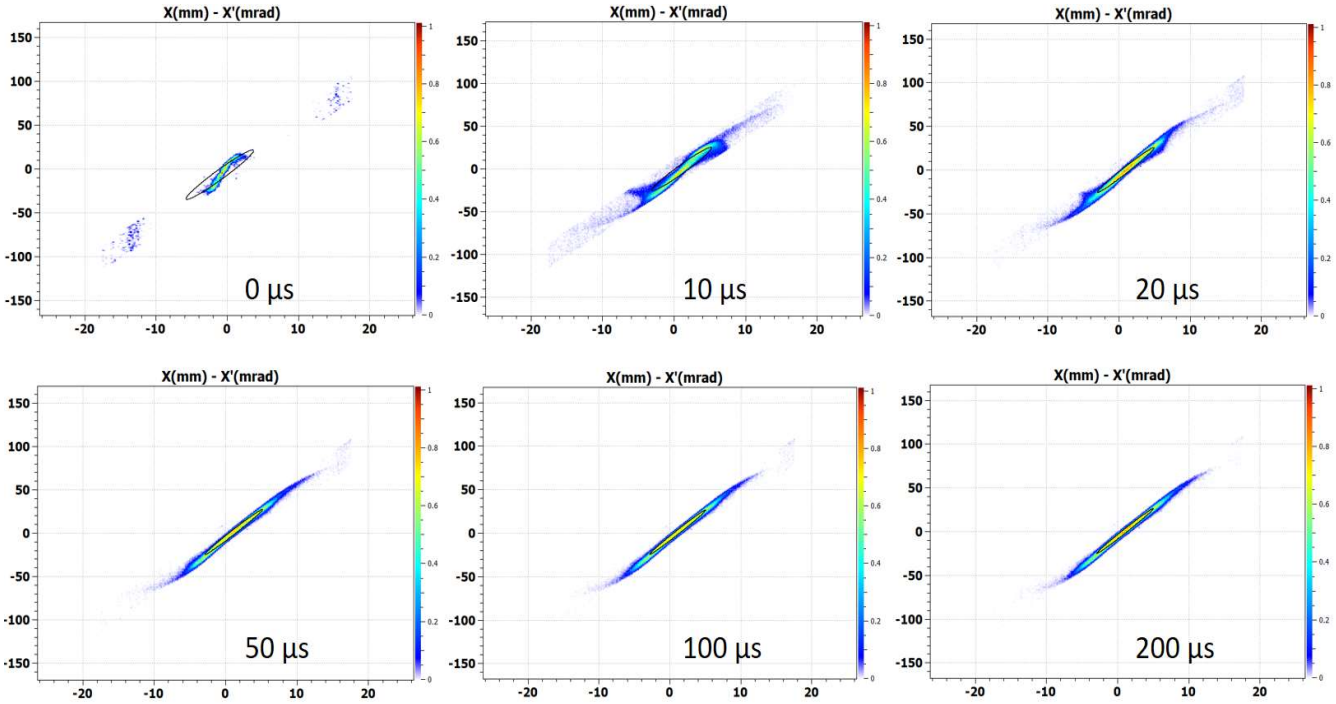
- Beam transmission
- Beam stability
- Beam matching
- Space charge compensation studies

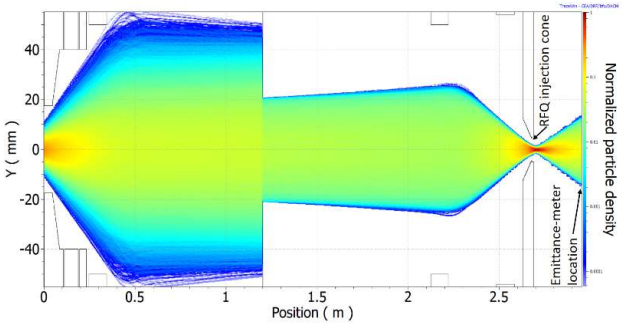


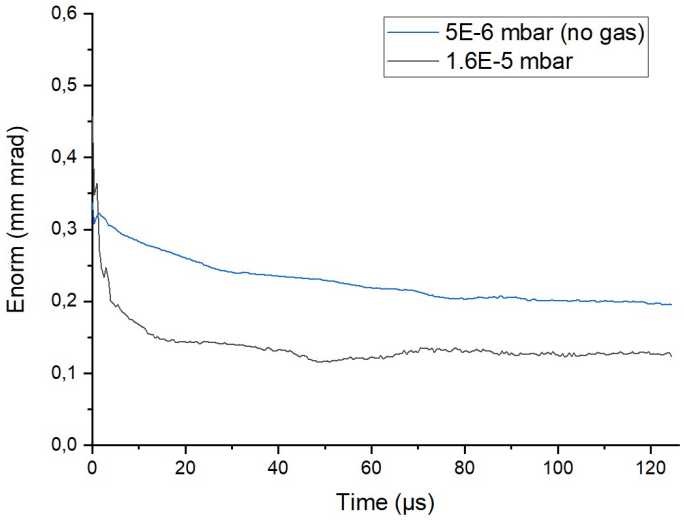


LEBT commissioning : RFQ beam matching and SCC transients

- Transverse emittance measurements with Allison scanners

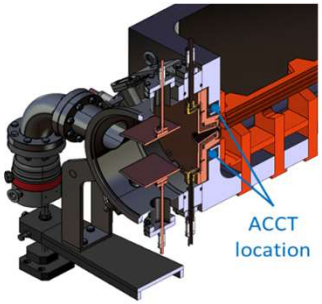


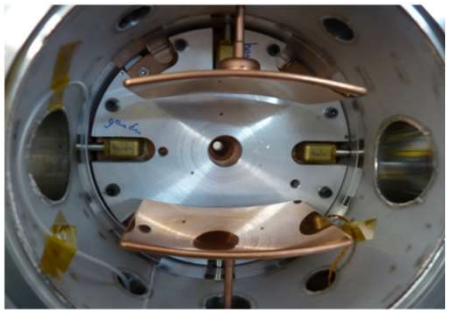




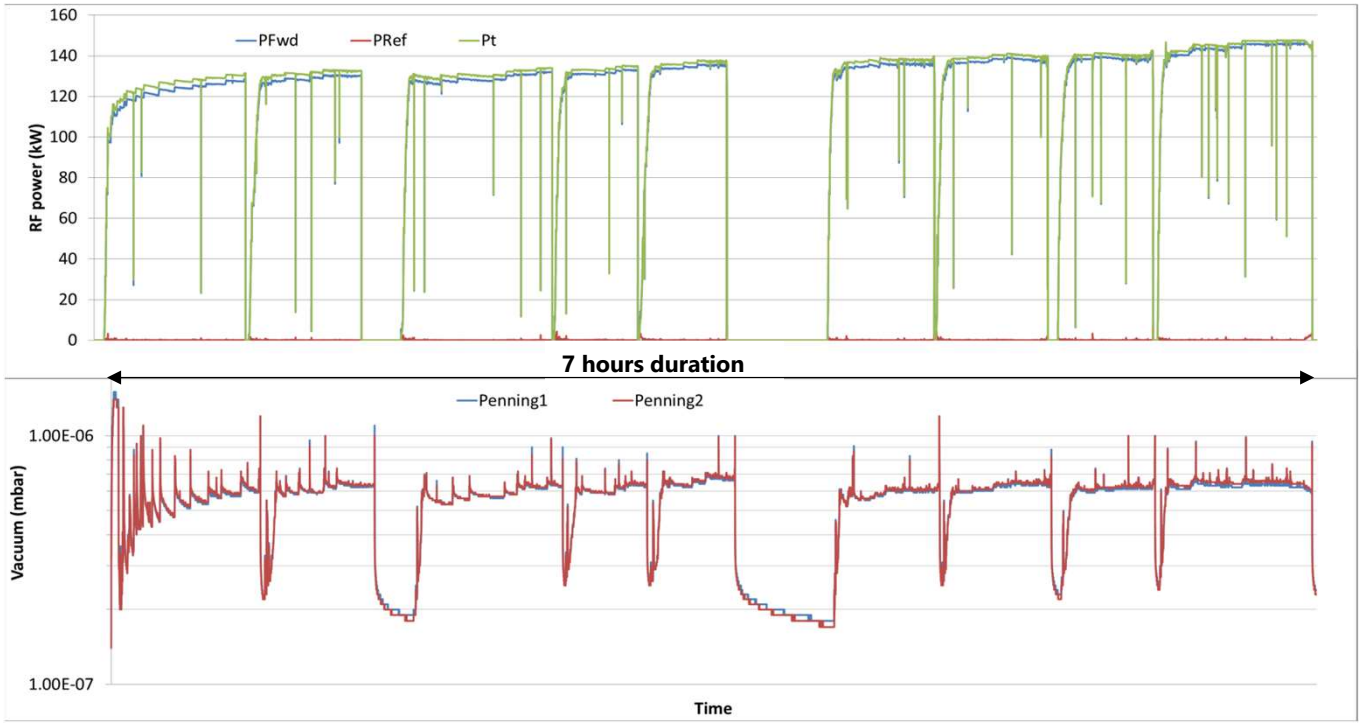
MYRRHA's RFQ

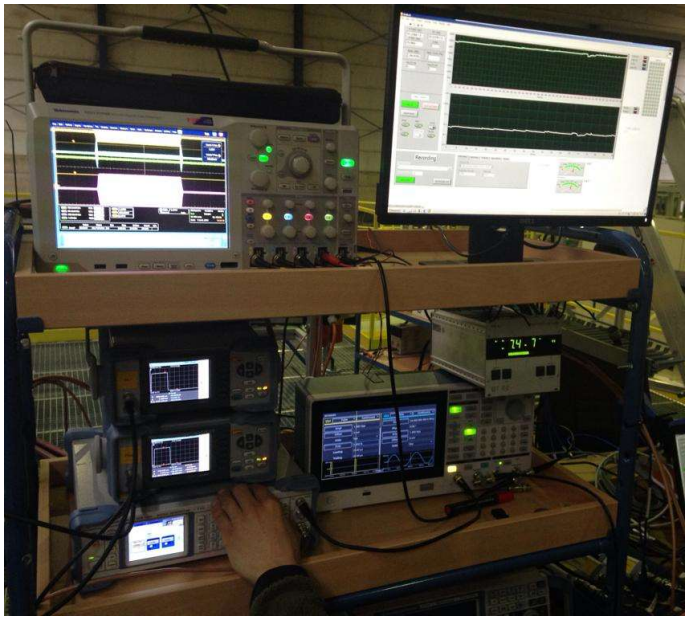
Parameter	Unit	Value
RFQ type	---	4-Rod RFQ
Frequency	MHz	176.1
E_{in}	keV	30
E_{out}	MeV	1.5
Length	m	4
Beam current	mA	5
Voltage	kV	44
R_p	kΩm	73
Power losses	kW	106
Specific power loss	kW/m	26.5
Kilpatrick factor	---	1.05
m_{max}	---	2.2
a_{min}	cm	0.31
Cell number	---	244
Transmission	%	98.6
$\varepsilon_{out,rms,100\%,N}$ (x)	π mm mrad	0.21
$\varepsilon_{out,rms,100\%,N}$ (y)	π mm mrad	0.21
$\varepsilon_{out,rms,100\%,N}$ (z)	keV deg	0.41



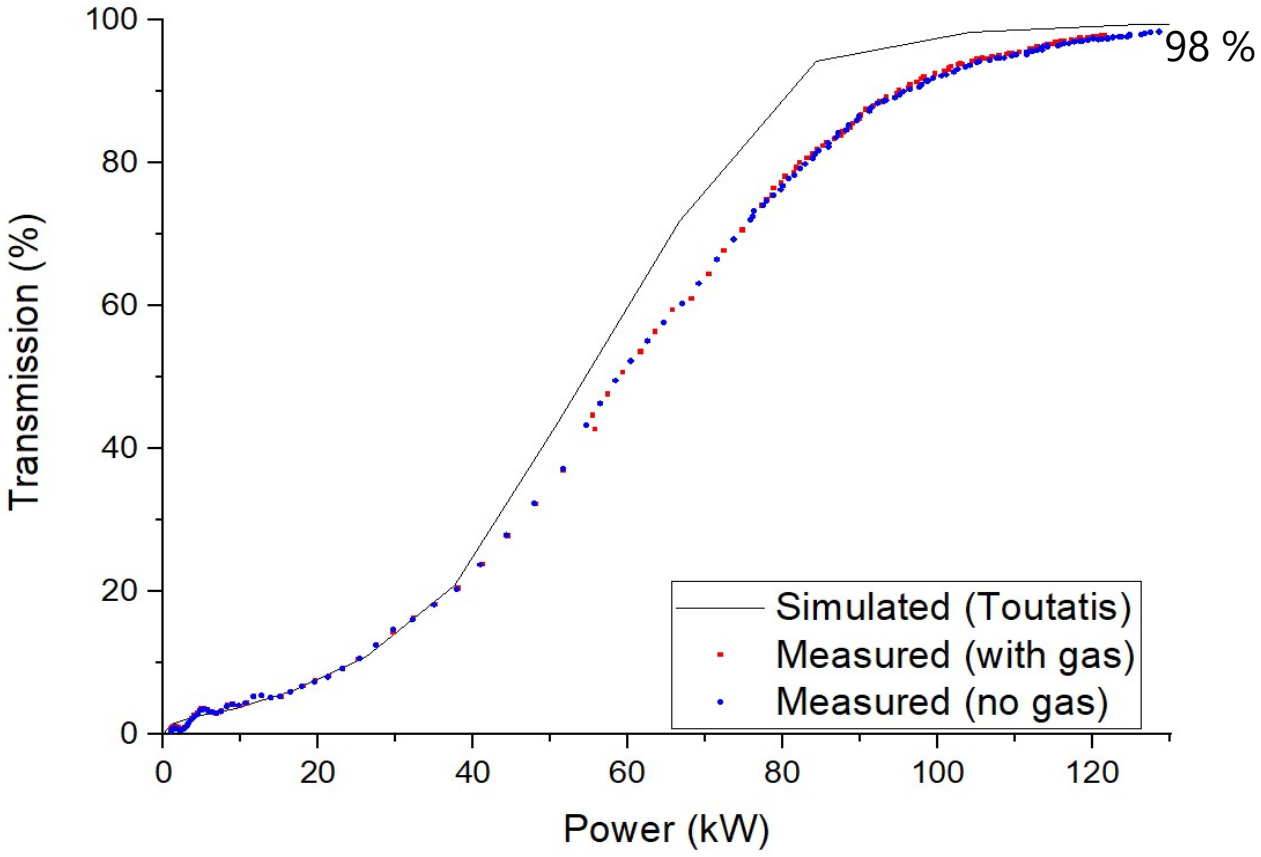


RFQ conditioning at a glance

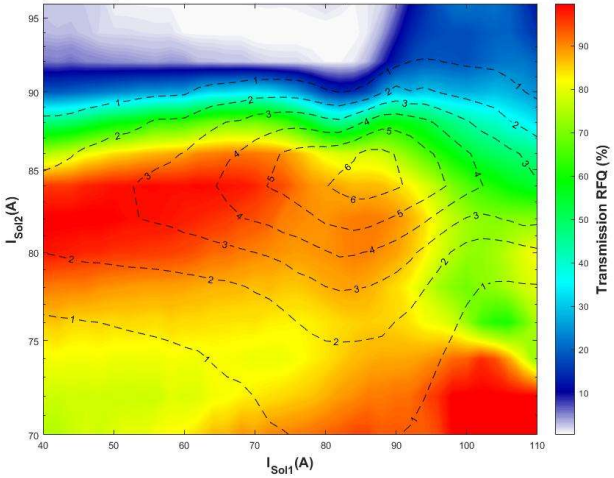




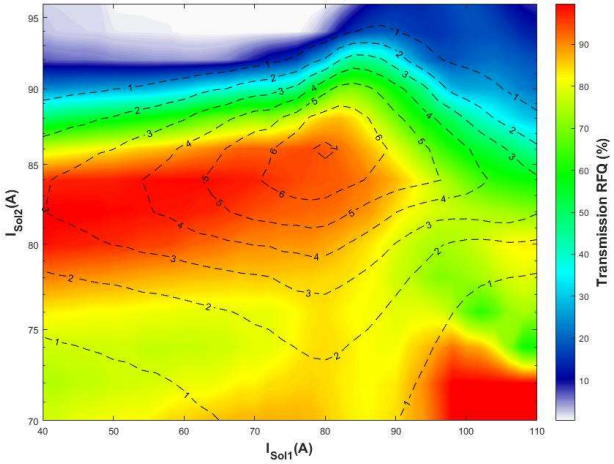
RFQ transmission measurement



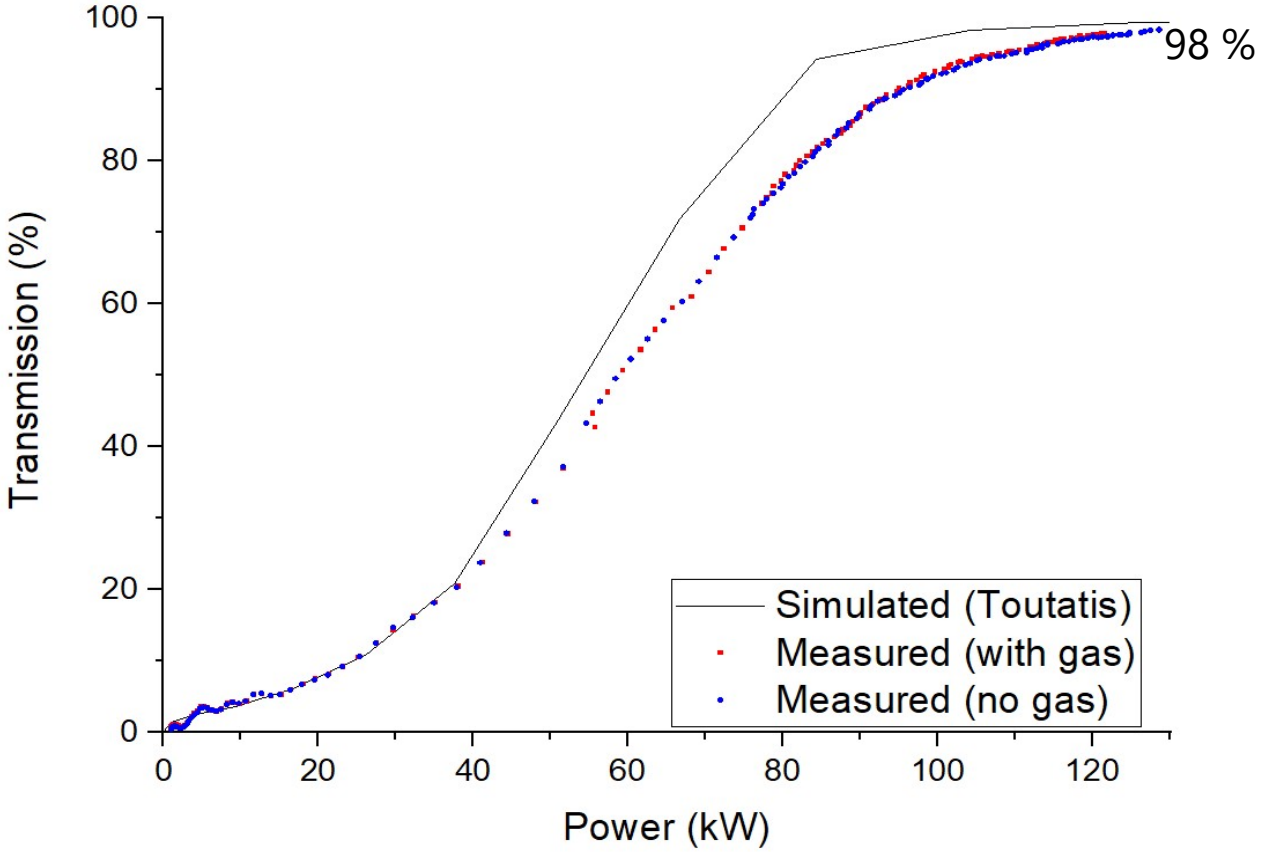
Residual gas

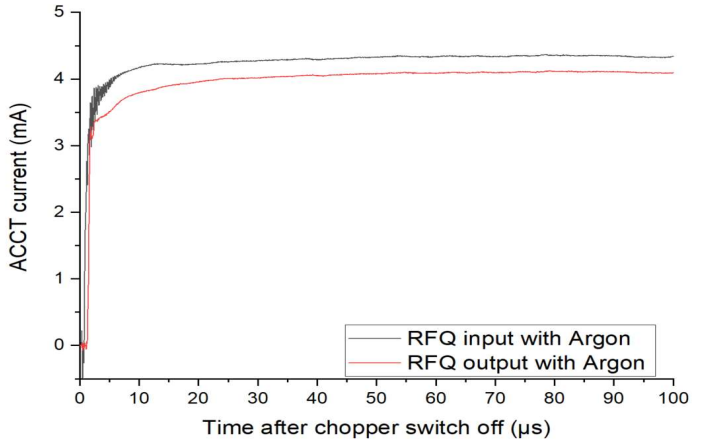


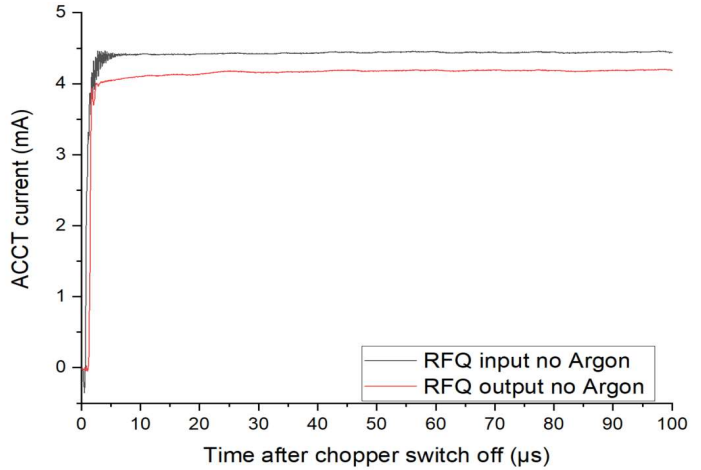
With Argon



RFQ transmission measurement: current rise time

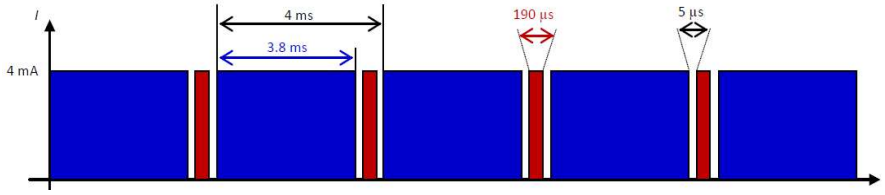






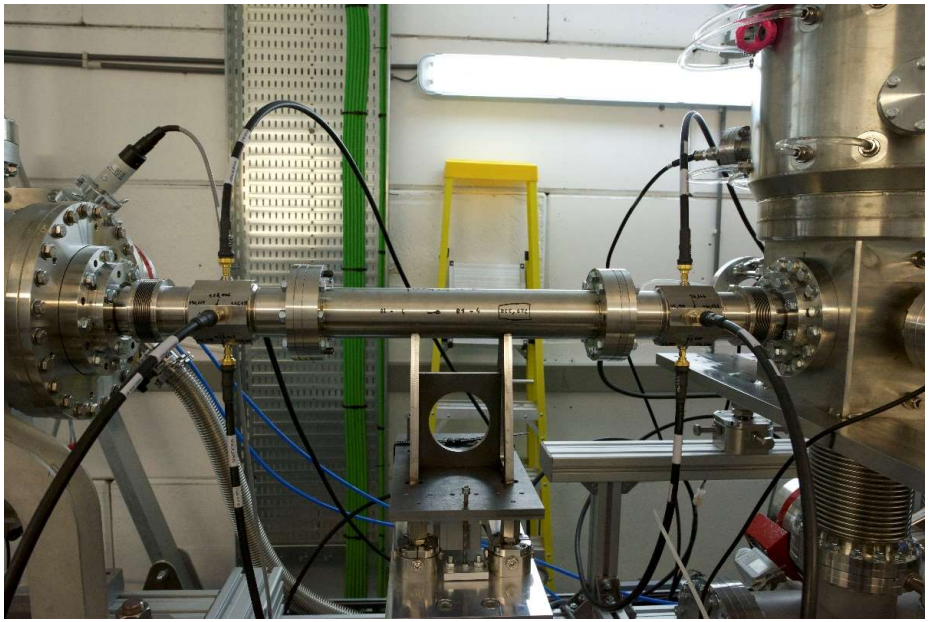
RFQ full power beam commissioning

- MYRRHA beam structure :
  - 3.8 ms pulses for reactor
  - short pulses for ISOL

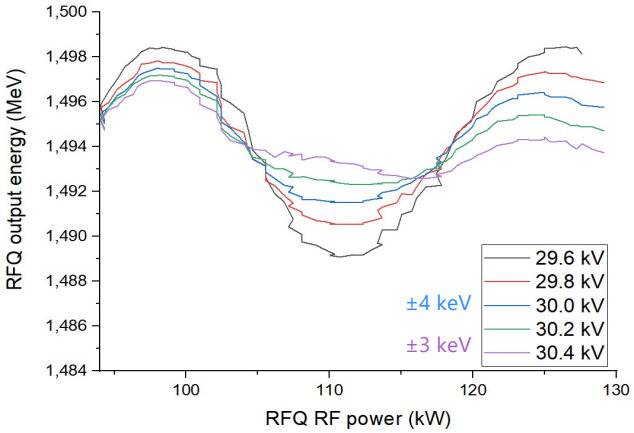


RFQ energy measurement by ToF

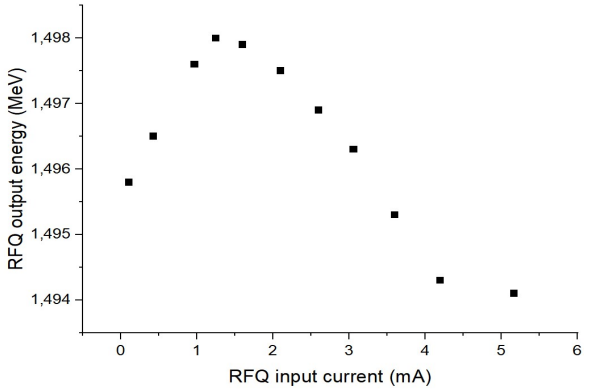
- Measurement setup



- Energy wrt RFQ input energy



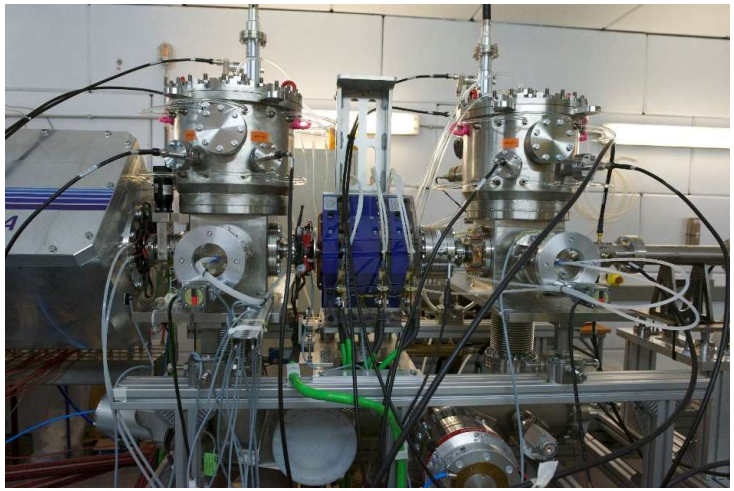
- Energy wrt beam current



➢ ***Nominal energy : 1.494 ± 0.003 MeV***

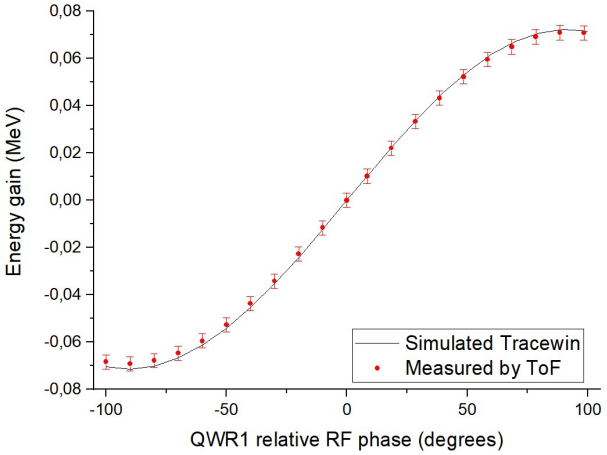
MEBT1 beam commissioning

- MEBT1 : 2 quarter wave resonators for bunching + quadrupole triplet

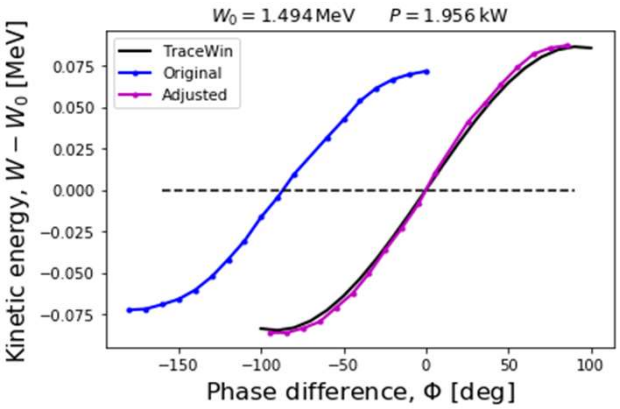


- RF phase and amplitude tuning

QWR1



QWR2

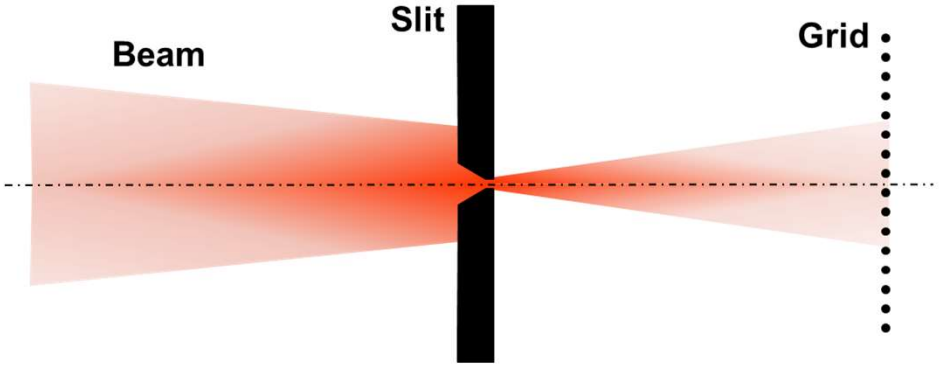


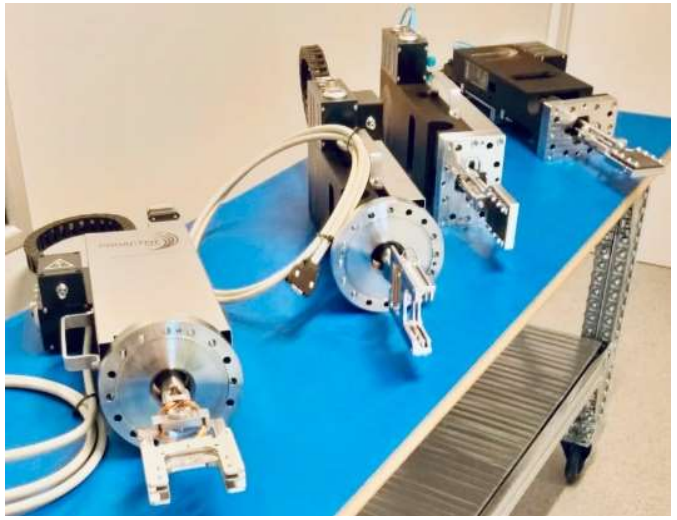
➢ Both QWR successfully tuned by ToF

Future activities: EMI and BSM integration

- EMI = Transverse emittance

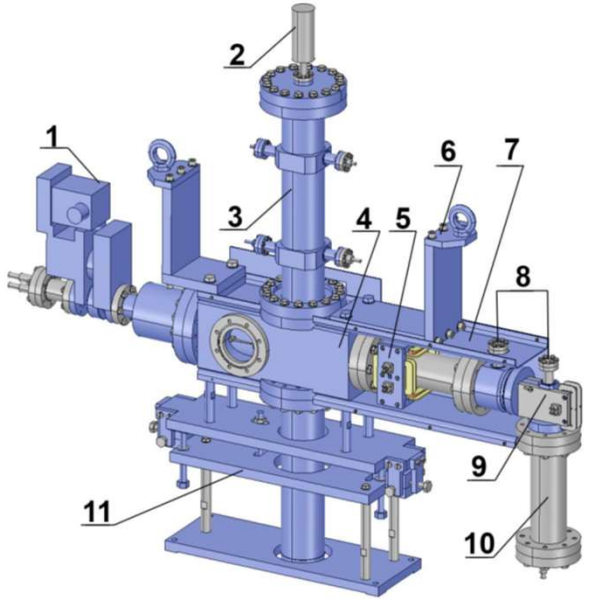
(delivery expected in the coming months from ESS Bilbao)





- BSM = Bunch shape monitor

(delivery expected in December from INR Russia)



SCK CEN
Belgian Nuclear Research Centre
Studiecentrum voor Kernenergie
Centre d'Etude de l'Energie Nucléaire

Foundation of Public Utility
Stichting van Openbaar Nut
Fondation d'Utilité Publique

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