

# Commissioning of the RAON Linear Accelerator

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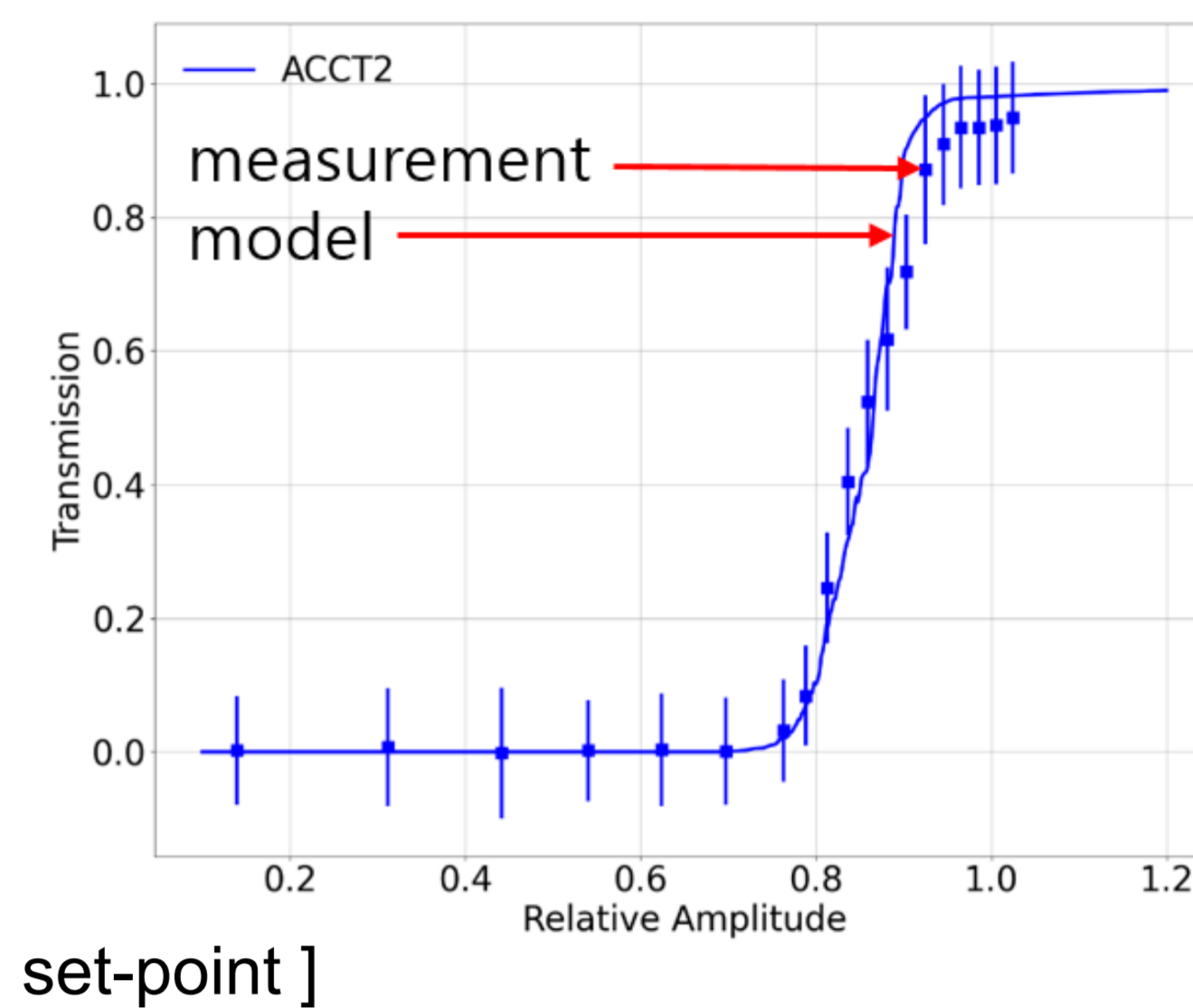
## Abstract

Beam commissioning of the low energy superconducting linac (SCL3) was carried out with  $^{40}\text{Ar}^{9+}$  beam. RF set-points of each cavities were measured with phase scan. 3 QWRs (out of 22) and 7 HWRs (out of 102) were off and nearby cavities of the off cavities were rephased to compensate mismatch effects. Transverse beam profiles were taken with wire scanners installed at the SCL3, measuring the beam parameters.

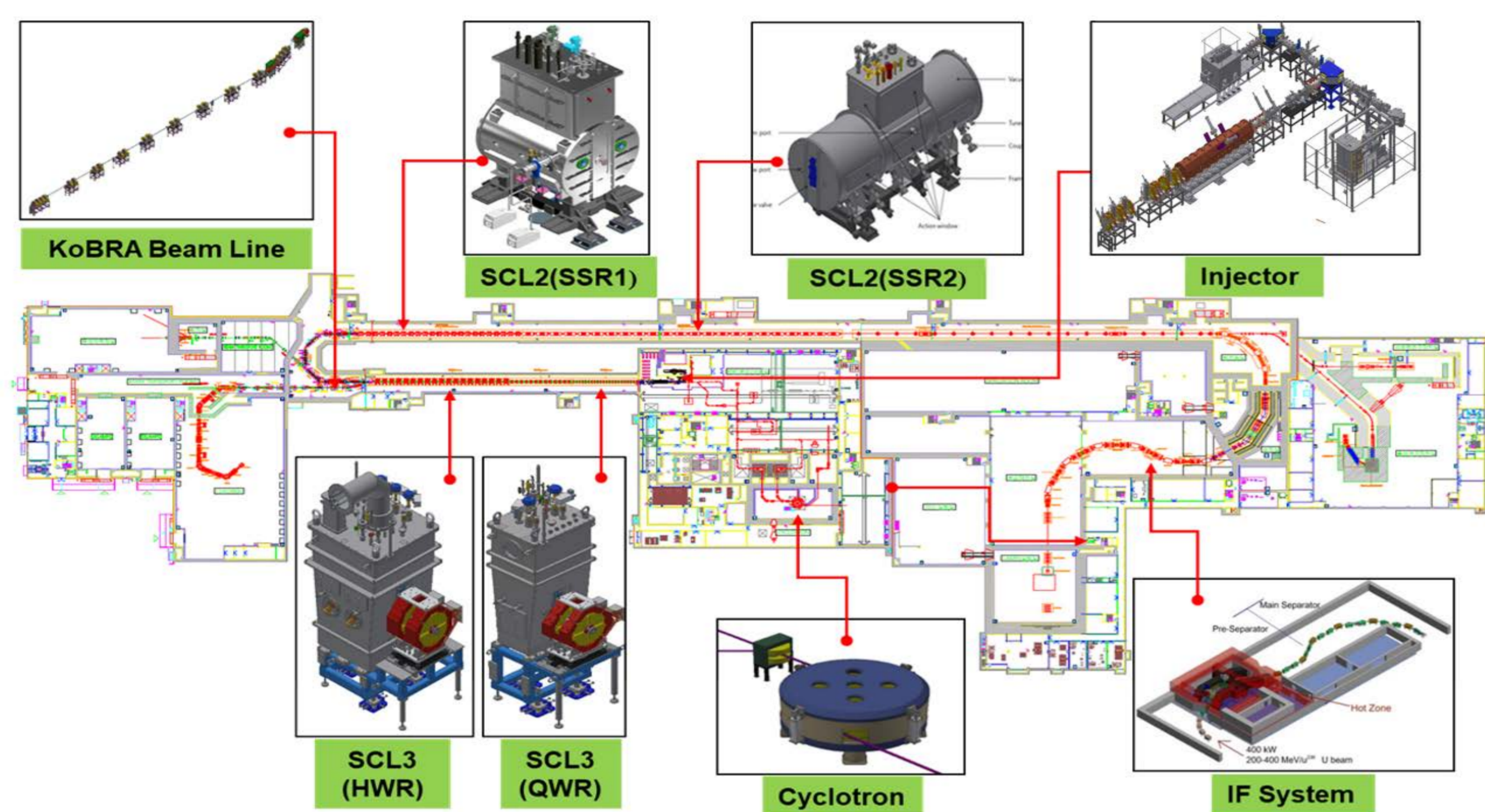
## The RAON

- Unique facility that has
  - the IF system (driven by 200-MeV/u, 400-kW superconducting linac)
  - the ISOL system (driven by 70 MeV, 1-mA cyclotron)

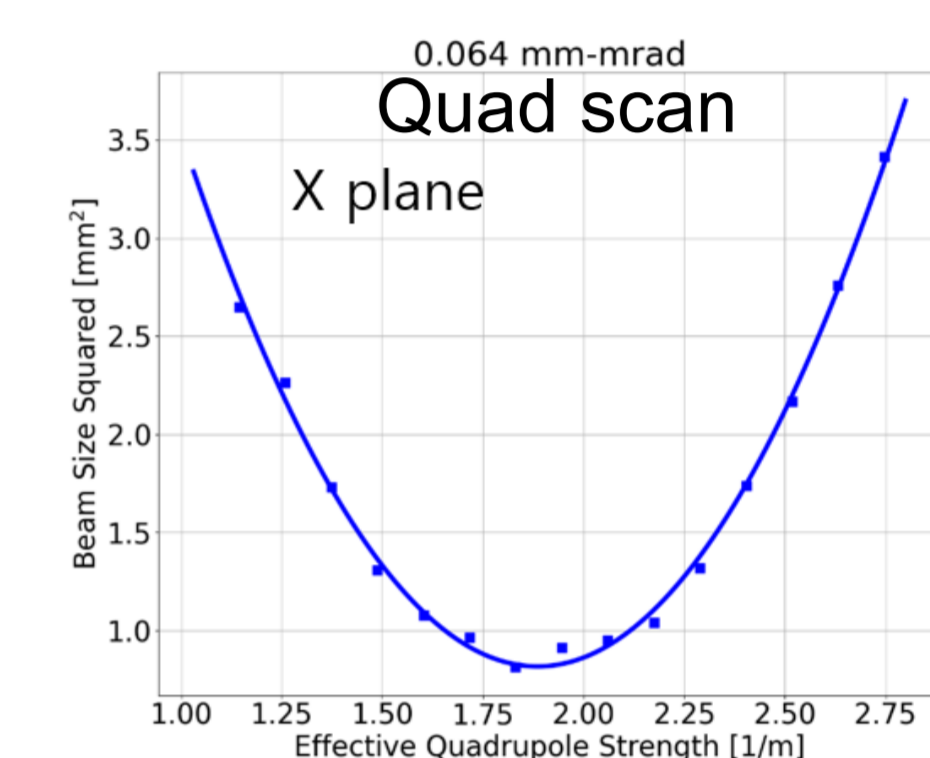
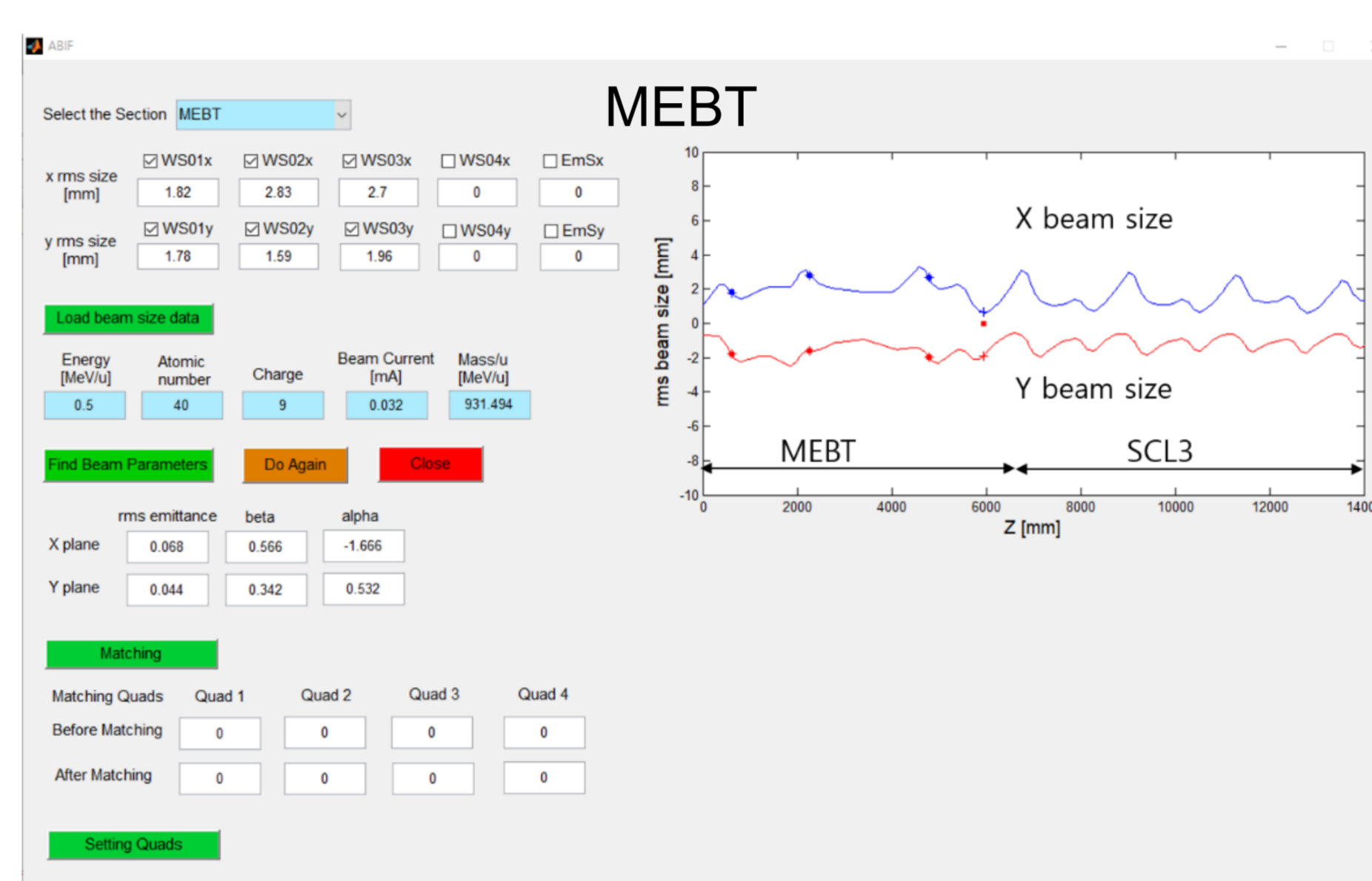
Driver Accelerator	SCL3 (ECR/ISOL)	SCL3 + SCL2	Cyclotron
Beam Energy	80 MeV (p), 18 MeV/u (U)	600 MeV (p), 200 MeV/u (U)	< 70 MeV (p)
Experiment Facility	KoBRA, NDPS	In-flight Fragment Muon facility	ISOL
RIB Energy	< tens of MeV/u	< hundreds of MeV/u	< a few keV/u



[ RFQ RF set-point ]



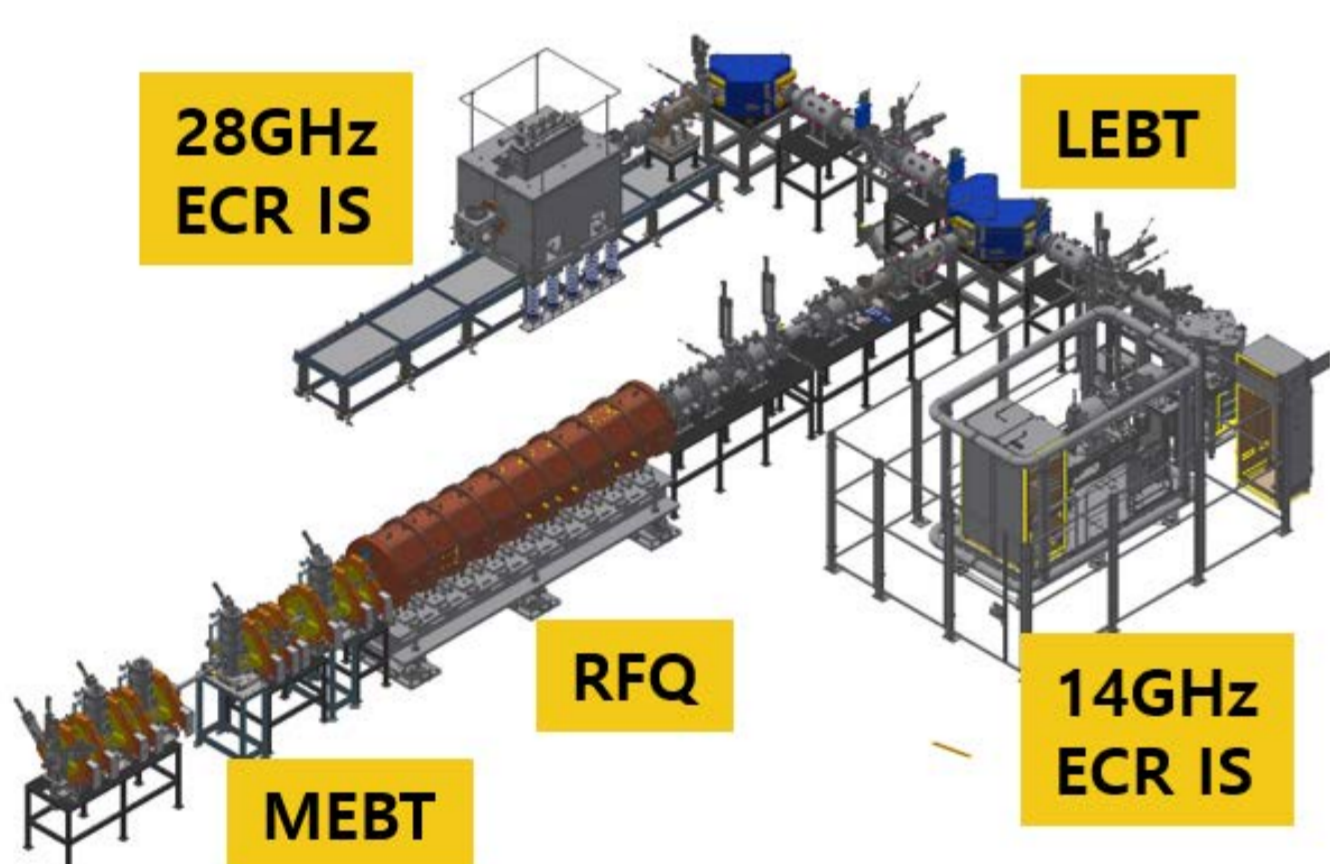
[ The layout of the RAON ]



	$\epsilon_x$ mm-mrad	$\epsilon_y$ mm-mrad
BIPAM	0.068	0.044
Quad Scan	0.064	0.049

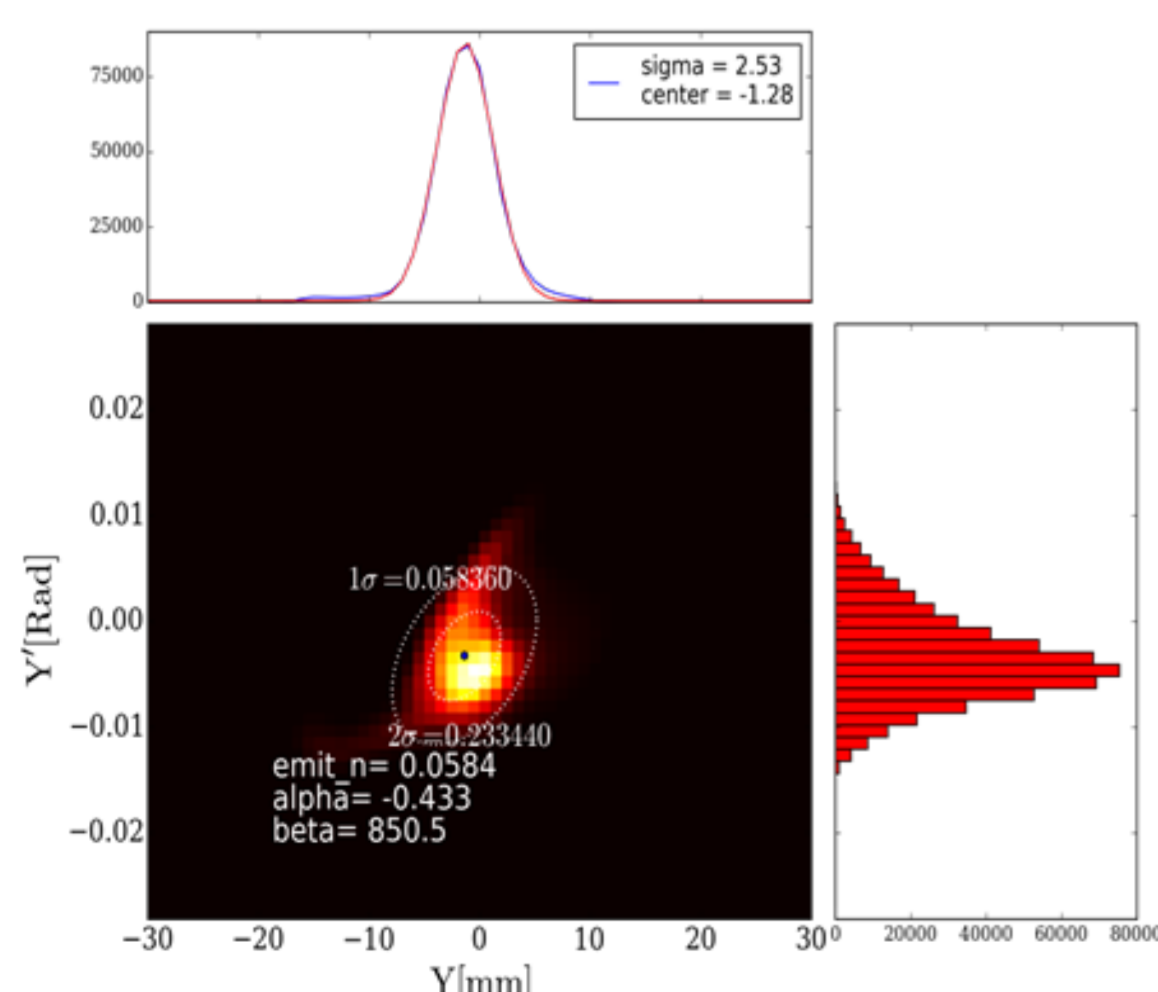
[ MEBT beam parameter measurement ]

## Injector

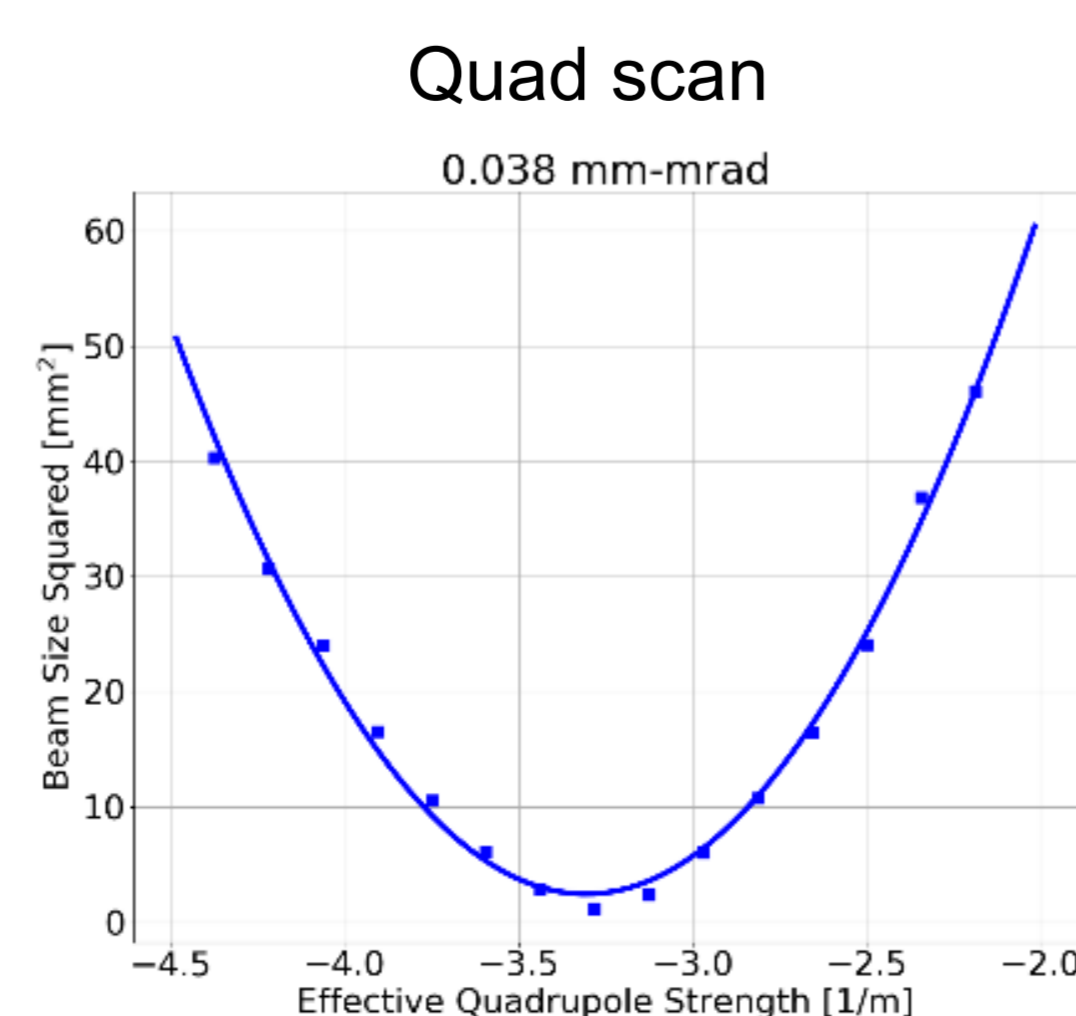
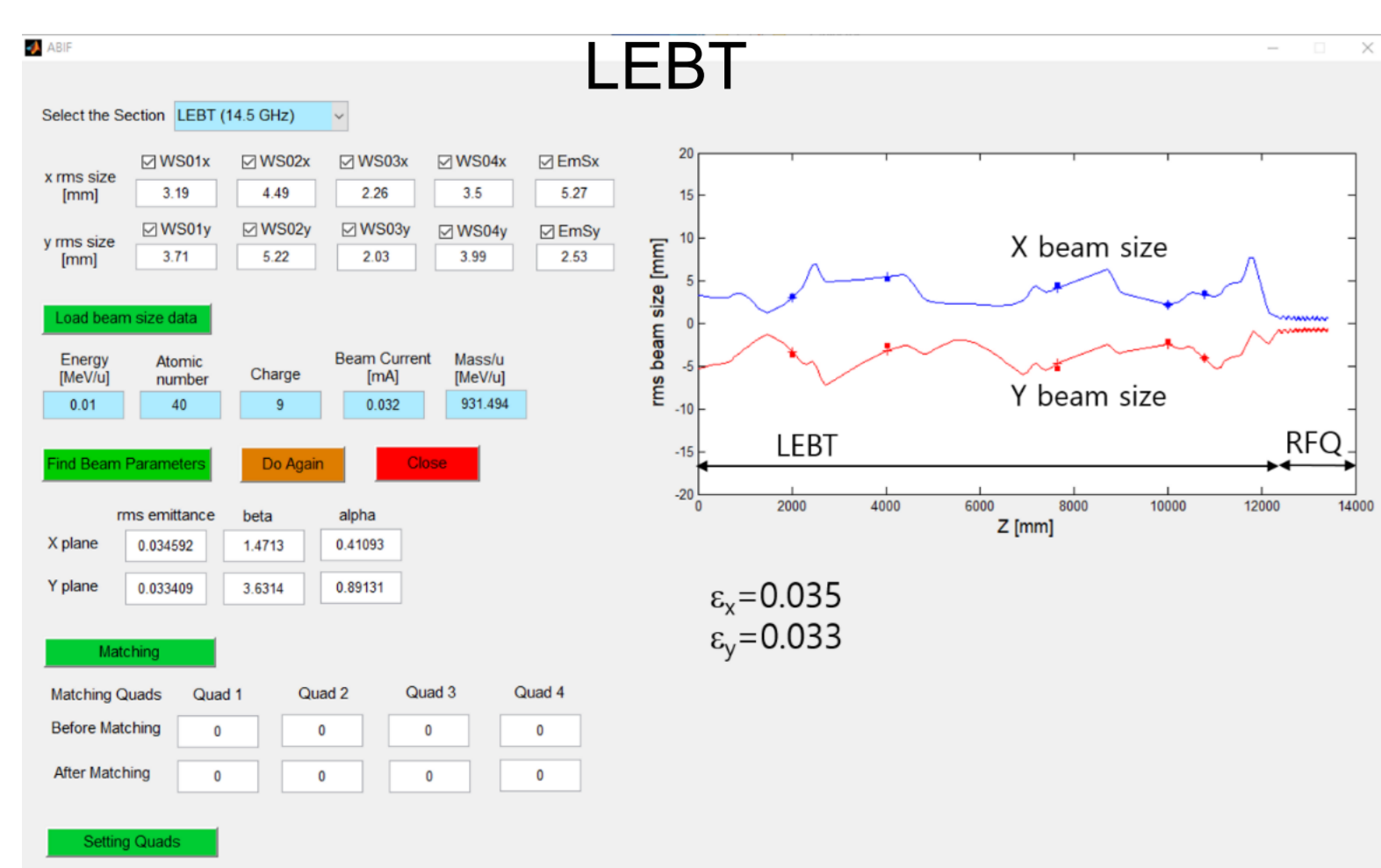


	LEBT	MEBT
Allison scanner	2 (X,Y)	-
Wire scanner	4	4
Faraday cup	4	2
ACCT	1	2
BPM	-	6
Beam viewer	2	1
Fast Faraday Cup	-	1

- Injector commissioning was done.
- Emittance and beam parameters were measured (Allison scanner, BIPAM and quad-scan method).



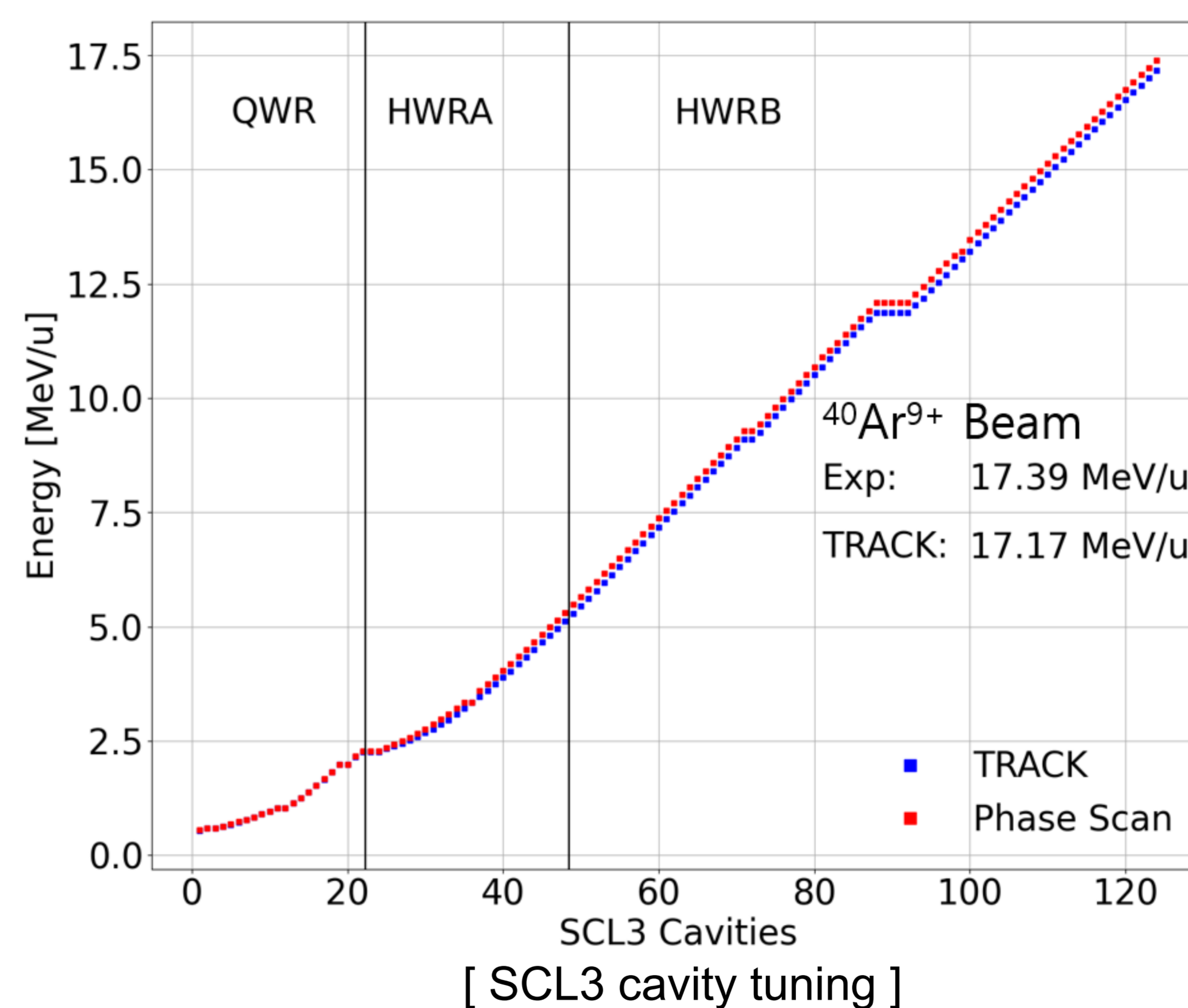
	$\epsilon_x$ mm-mrad	$\epsilon_y$ mm-mrad
Allison	0.048	0.067
Quad Scan	0.041	0.038



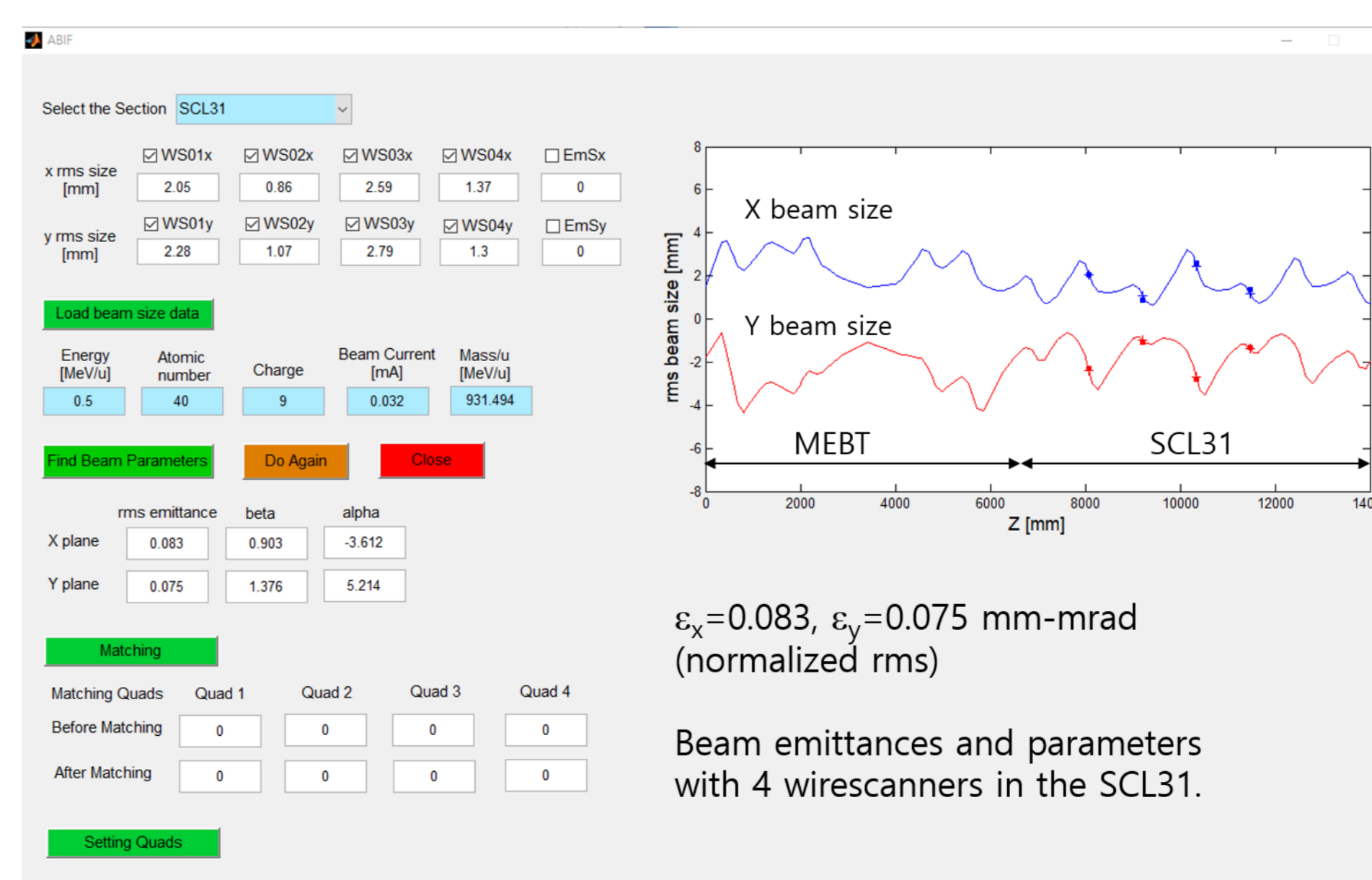
[ LEBT beam parameter measurement ]

## Superconducting Linac

- We set RF set-points and quadrupoles of the low energy superconducting linac SCL3, achieving  $\sim 17\text{MeV/u}$  beam energy for  $^{40}\text{Ar}^{9+}$  beam.
- RF set-points were determined using phase scan technique.
- 3 QWRs and 7 HWRs were off and compensation was made using adjacent cavities.
- Transverse beam profiles were measured and beam parameters
- Several issues such as couplers, BPMs, etc were identified.



[ SCL3 cavity tuning ]



$\epsilon_x=0.083$ ,  $\epsilon_y=0.075$  mm-mrad (normalized rms)

Beam emittances and parameters with 4 wire scanners in the SCL31.

[ SCL3 beam parameter measurement ]