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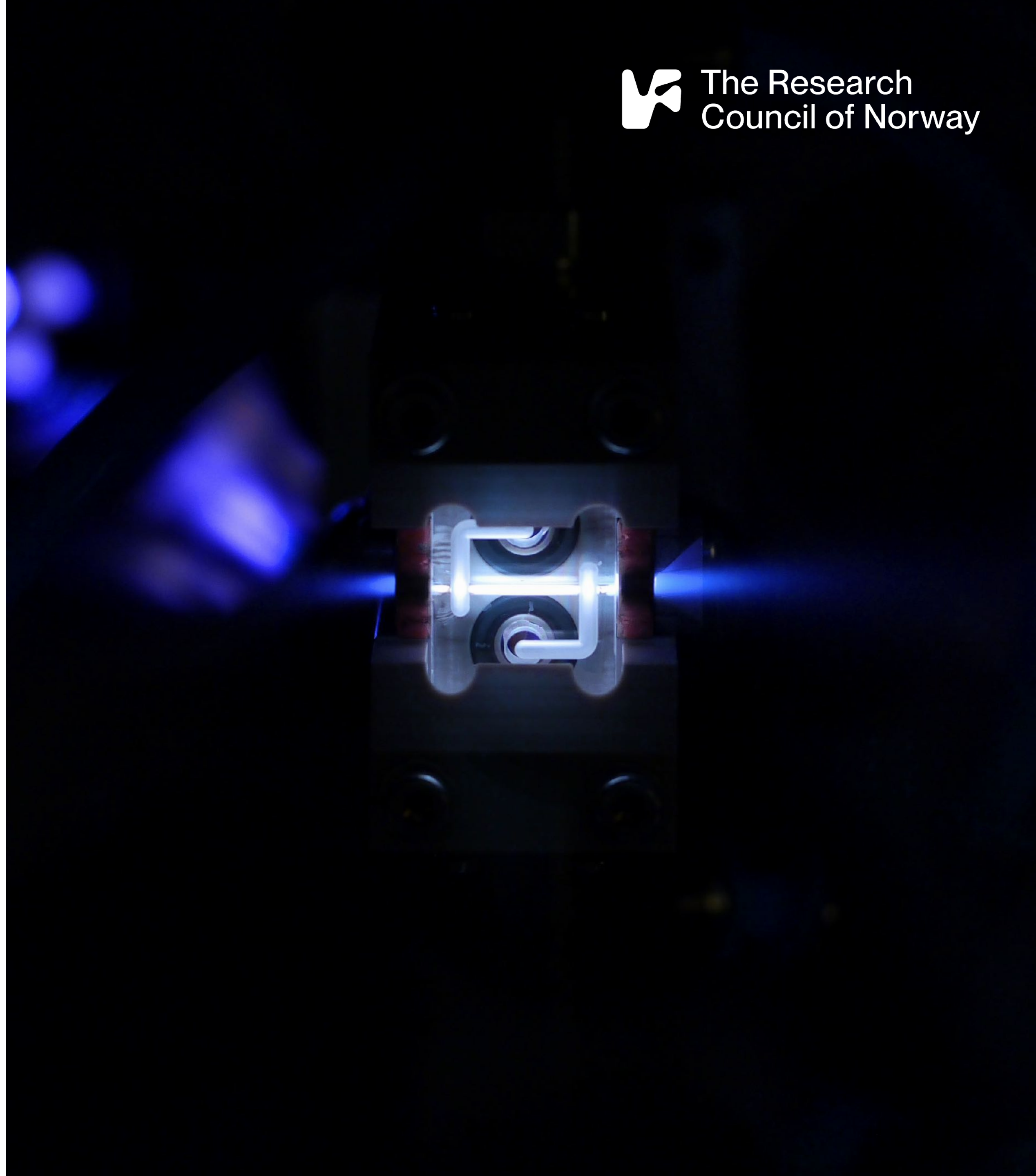
Jitter tool at FACET

BPM analysis

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Outline

- > Connecting jitter phase space to the beam.
- > Method.
- > Comparisons to imaging spectrometer.
- > Collimating to obtain energy dependent twiss parameters.
- > Discussion.

Connecting jitter phase space to the beam

Paper: Matching small β functions using centroid jitter and two beam position monitors

<https://journals.aps.org/prab/abstract/10.1103/PhysRevAccelBeams.23.052802>

- > The jitter-phase-space ellipse gradually expands while it rotates to acquire a similar shape to the beamphase-space.
- > Similar beam and jitter-phase-space ellipses can therefore be expected in any well-commissioned machine where such dominant jitter sources have been removed.

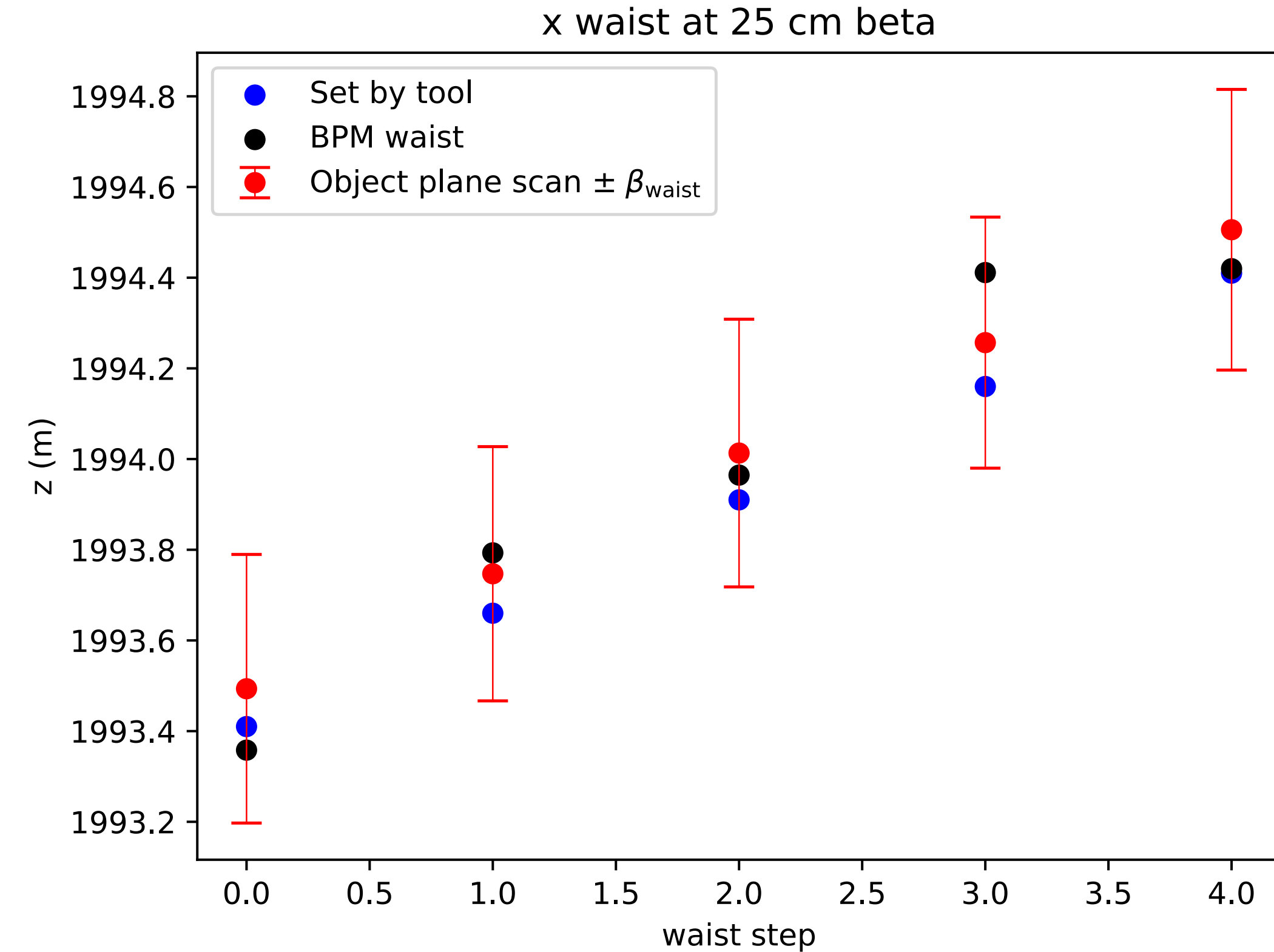
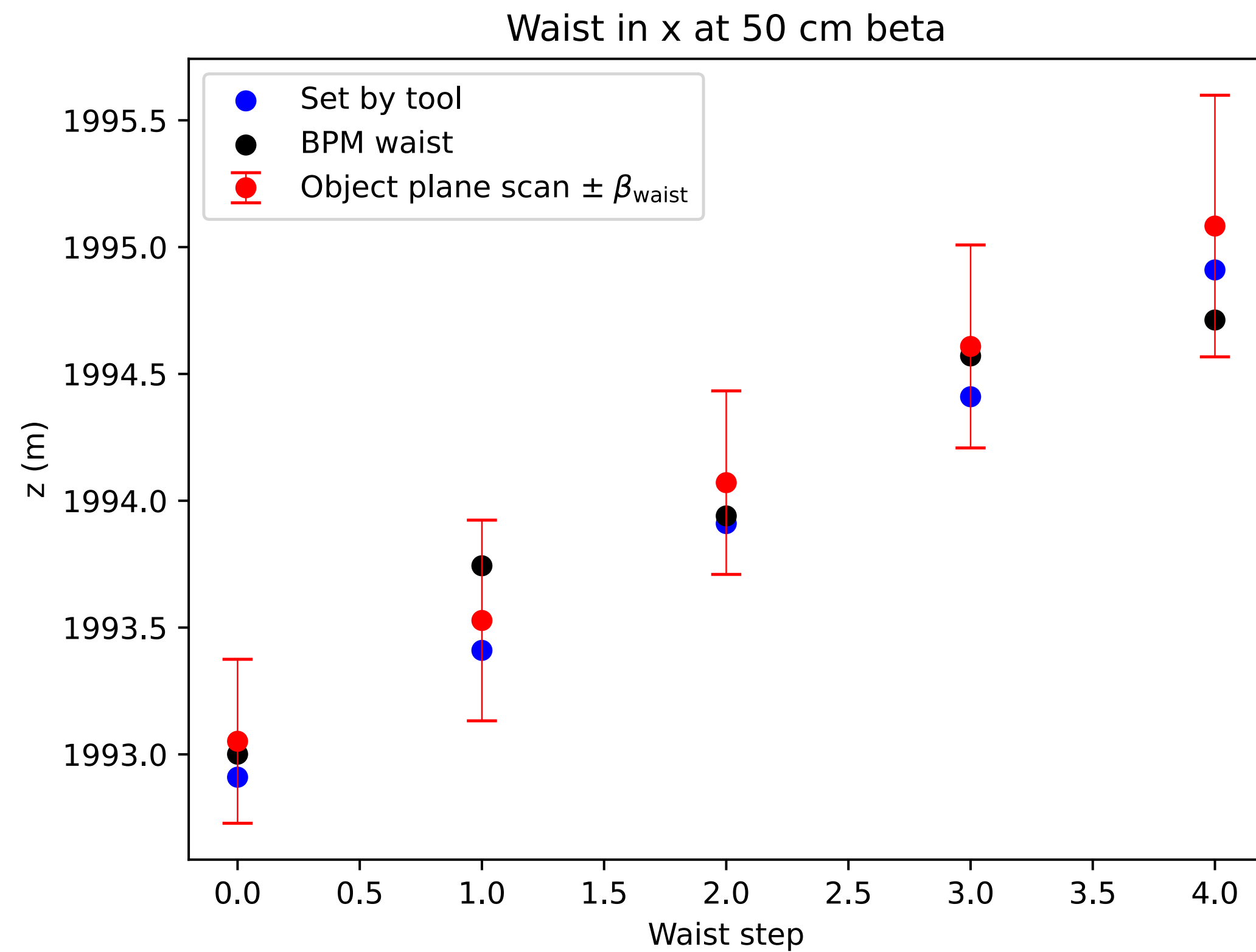
- >
$$\delta s_w = \frac{\beta_0}{B^2} \left(\frac{\tilde{\alpha}_e \cos 2\psi + \frac{1}{2}(\tilde{\beta}_e - \tilde{\gamma}_e) \sin 2\psi}{\tilde{\alpha}_e \sin 2\psi + \tilde{\beta}_e \sin^2 \psi + \tilde{\gamma}_e \cos^2 \psi} \right) \quad \beta_w = \frac{\beta_0}{B^2} \left(\frac{1}{\tilde{\alpha}_e \sin 2\psi + \tilde{\beta}_e \sin^2 \psi + \tilde{\gamma}_e \cos^2 \psi} \right)$$

Method

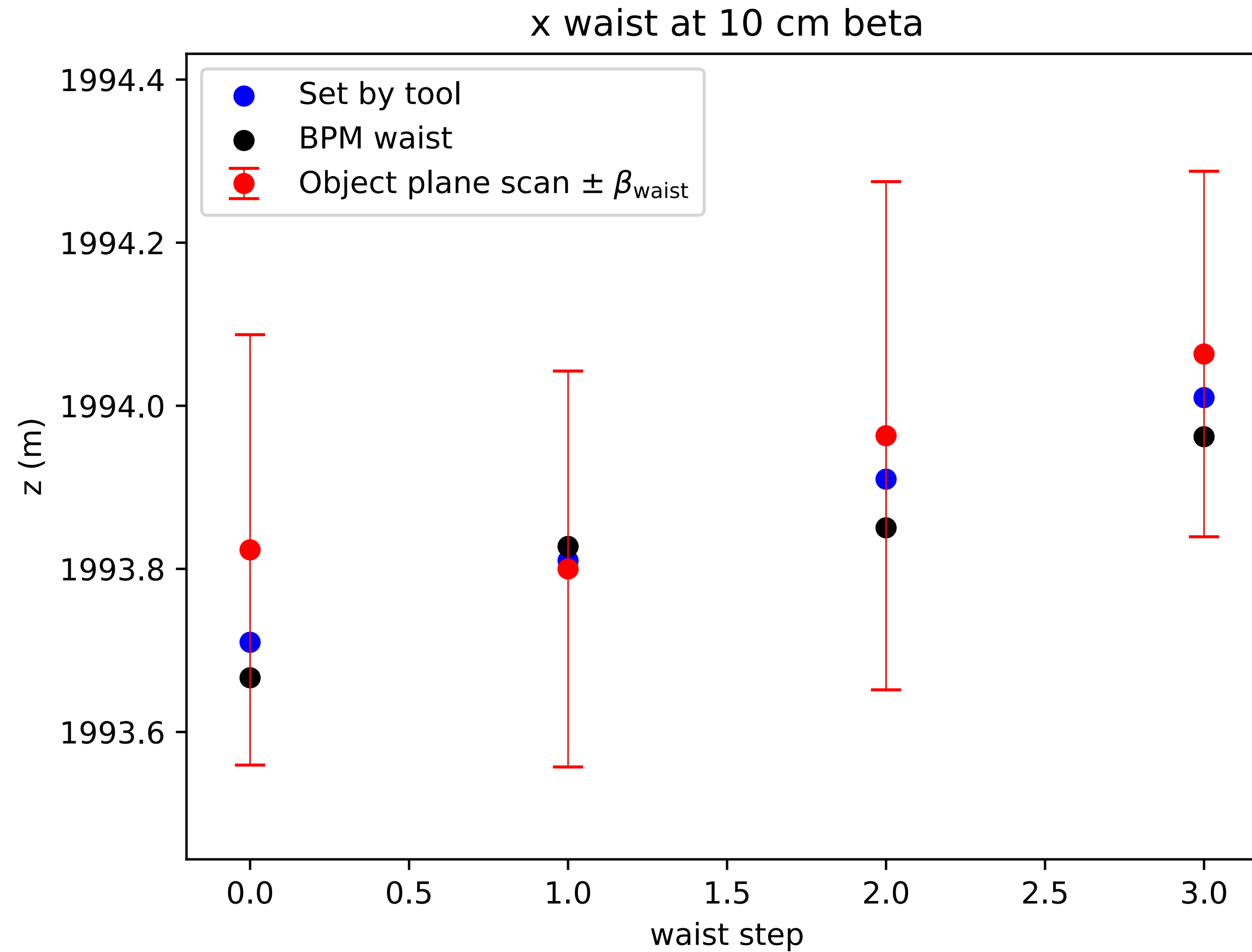
- > We use two BPMs (3156) and (3218)
- > We have x_0 (3156) and x_1 (3218)
- > We know the transport matrix from 3156 to 3218
- > Therefore, we can get the angle at 3156, x'_0 .

Comparing waist from BPMs to imaging spectrometer

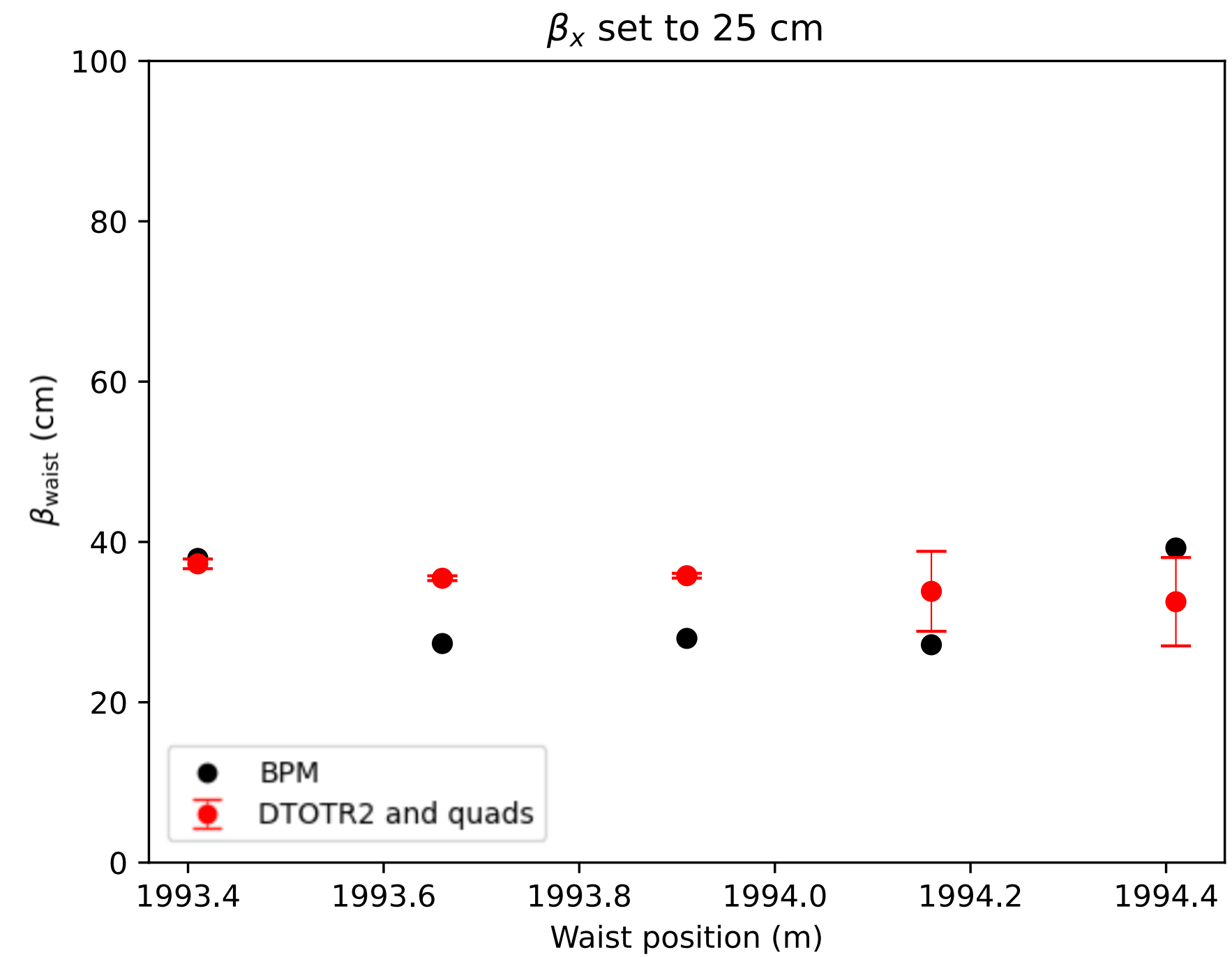
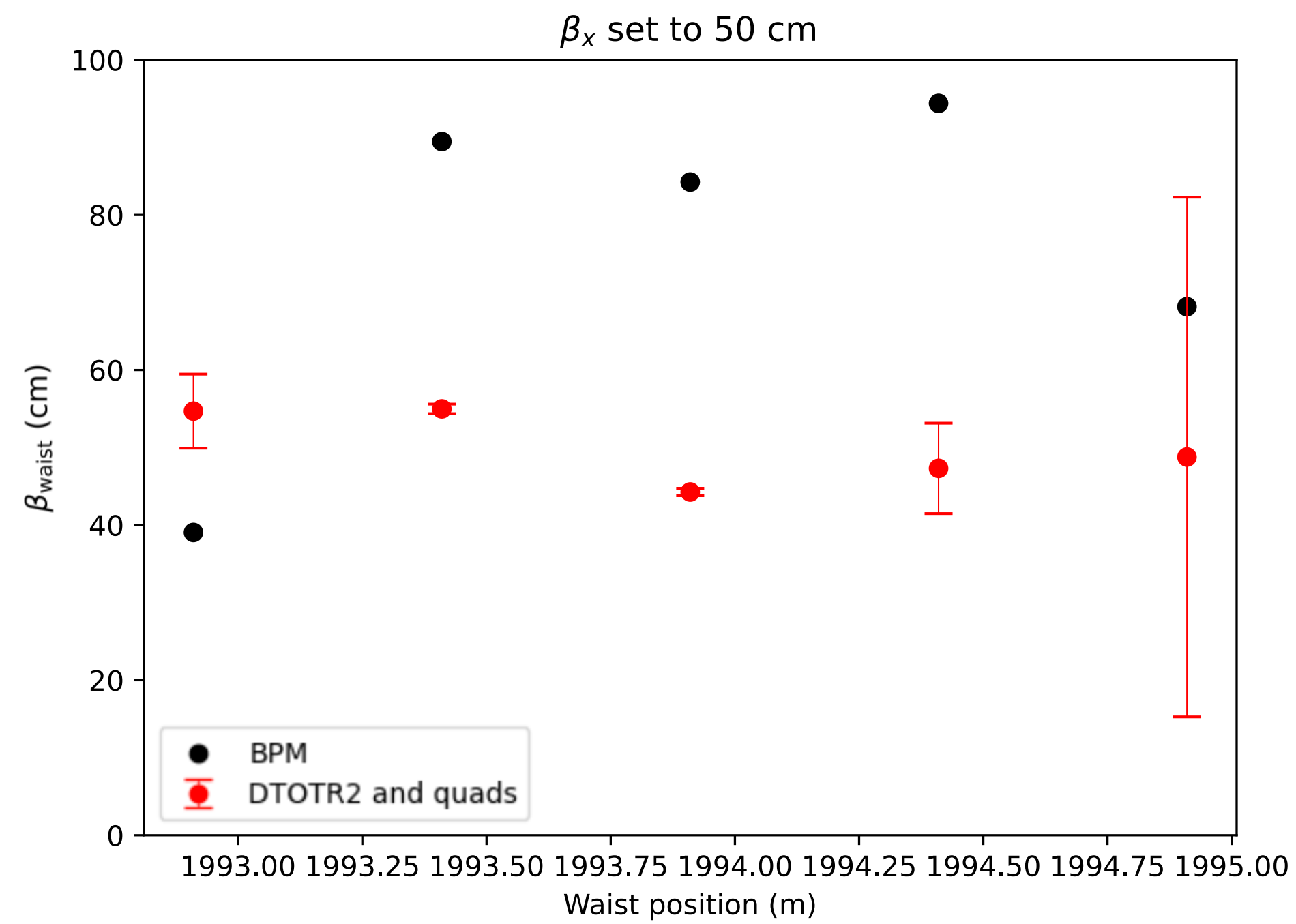
- > We scan the object plane of the spectrometer lattice.
- > We can then fit the transverse size of the beam on DTOTR2 against m12 and m11 and obtain the twiss parameters of the beam.



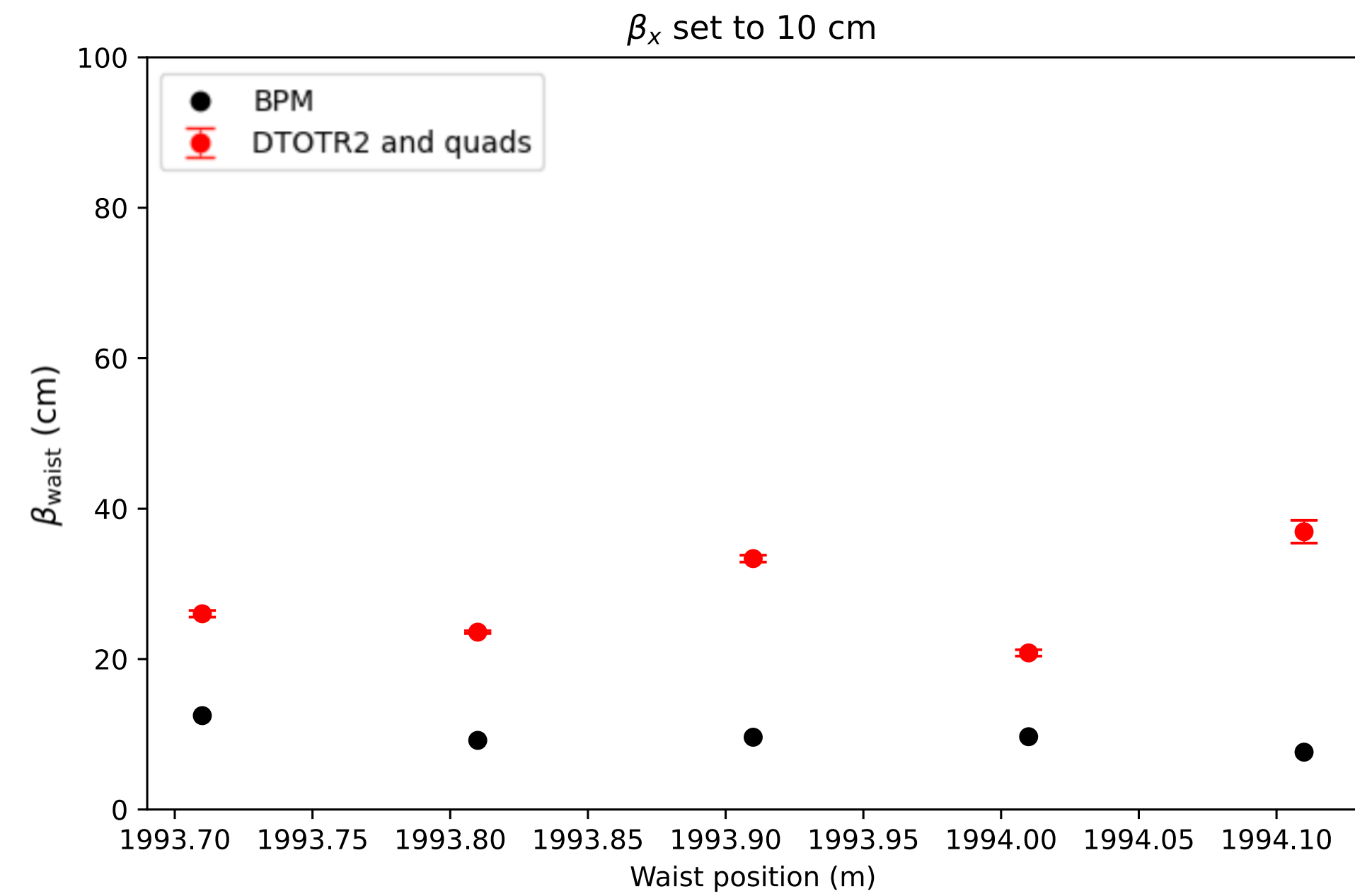
Comparing waist from BPMs to imaging spectrometer



Comparing β_x magnitude between imaging spectrometer and BPMs.

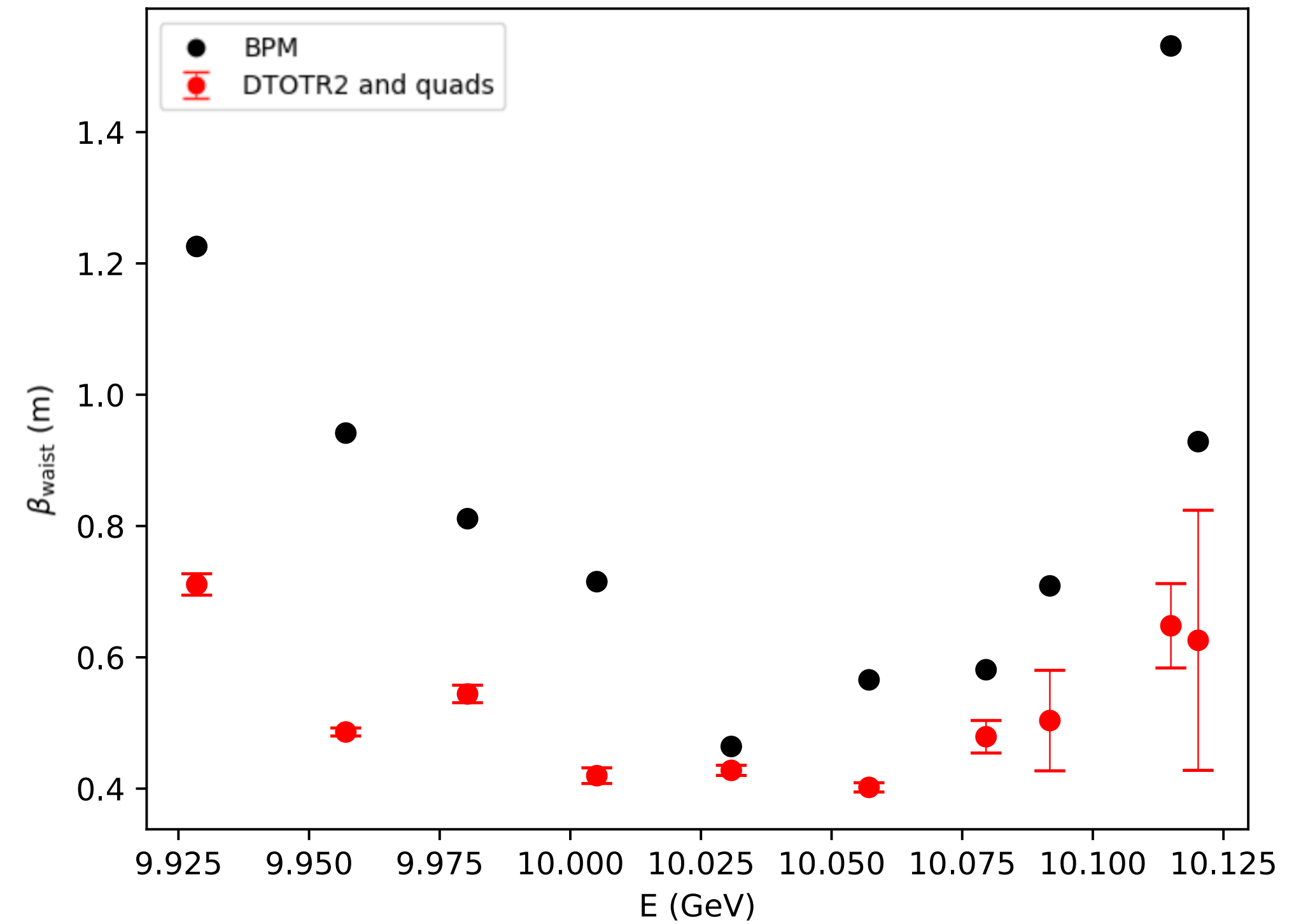
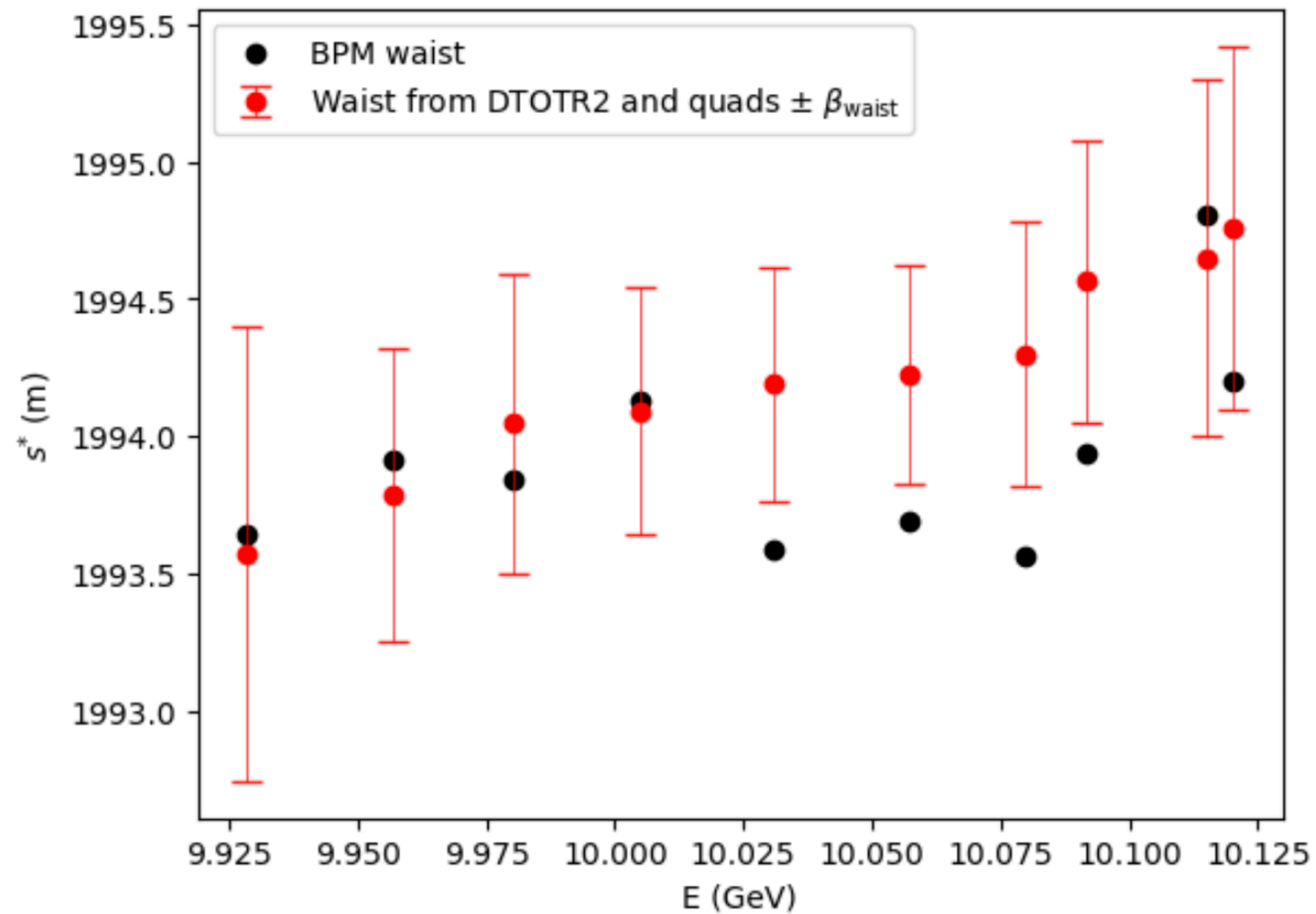


Comparing β_x magnitude between imaging spectrometer and BPMs.



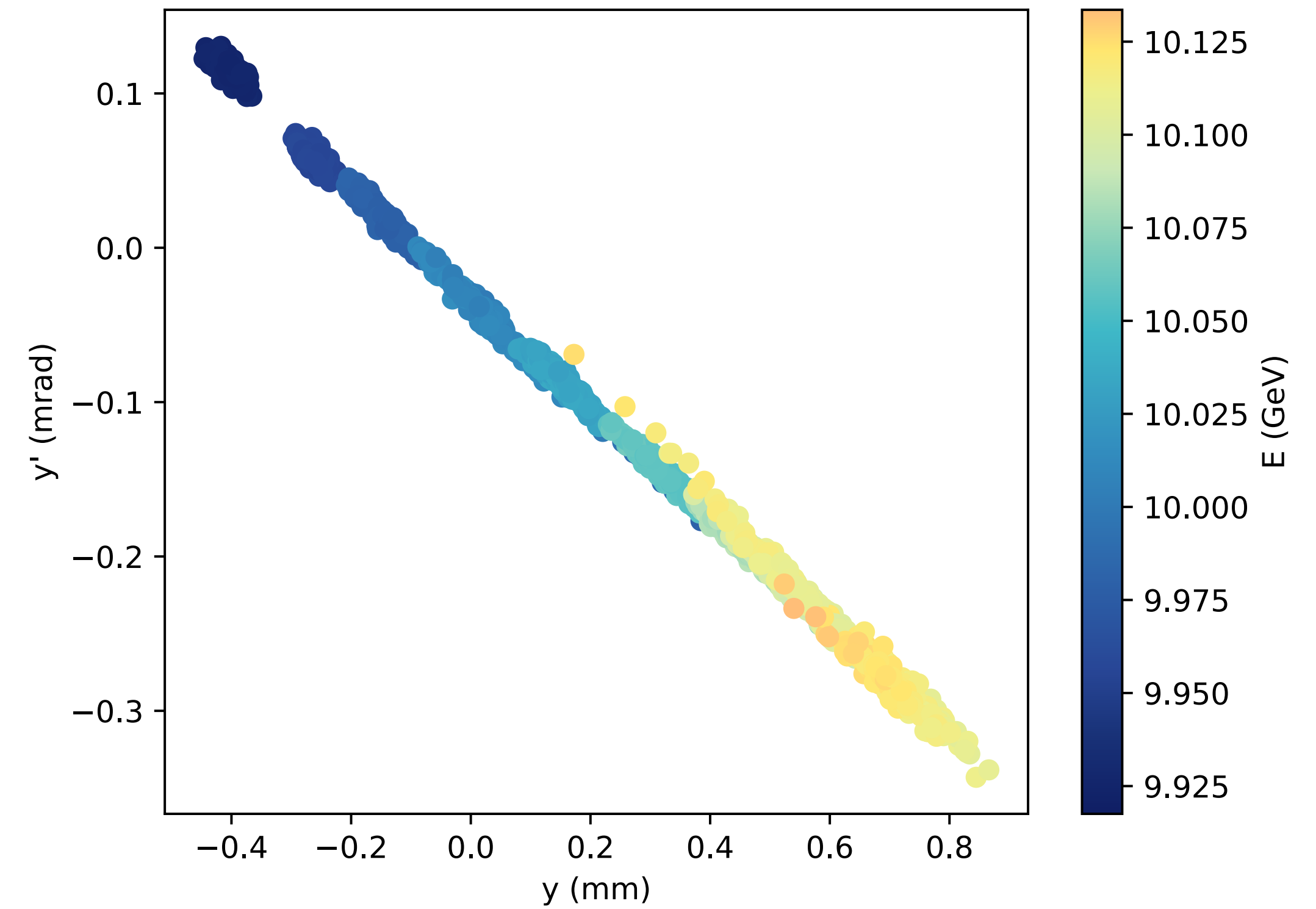
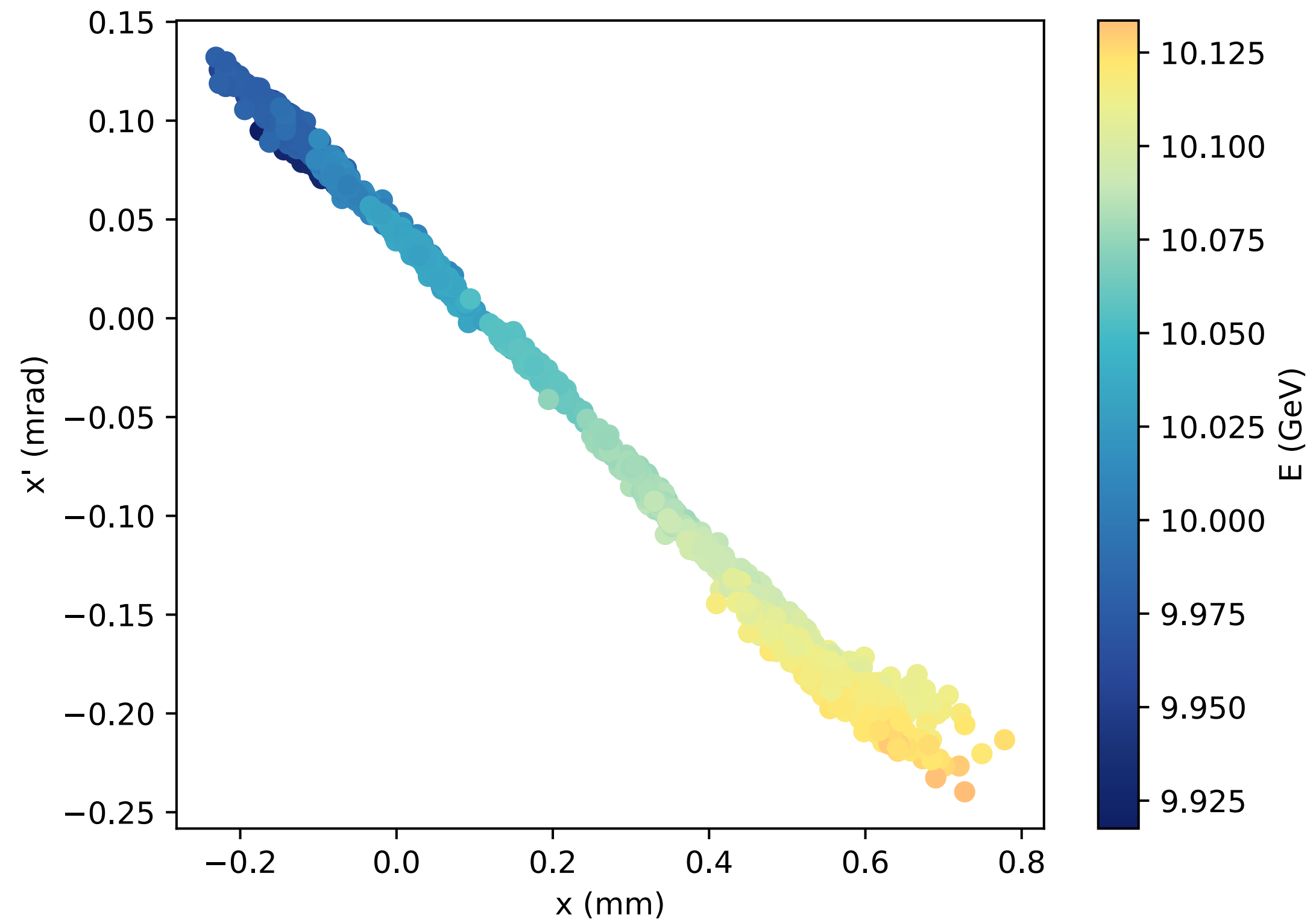
Collimating shift

- > Collimated out specific energies of the beam.
- > Comparison between imaging spectrometer and BPM data.



Collimating shift

> $x-x'$ and $y-y'$ phase-space sorted on energy.



Discussion

- > This tool can give us the waist in x and y to roughly a beta function accuracy.
- > The accuracy of the beta function is unclear.
- > There is a live tool on FACETHOME that people can use during shifts.
- > The tool is best suited to be used for live non-invasive transverse tuning during experiments.

