

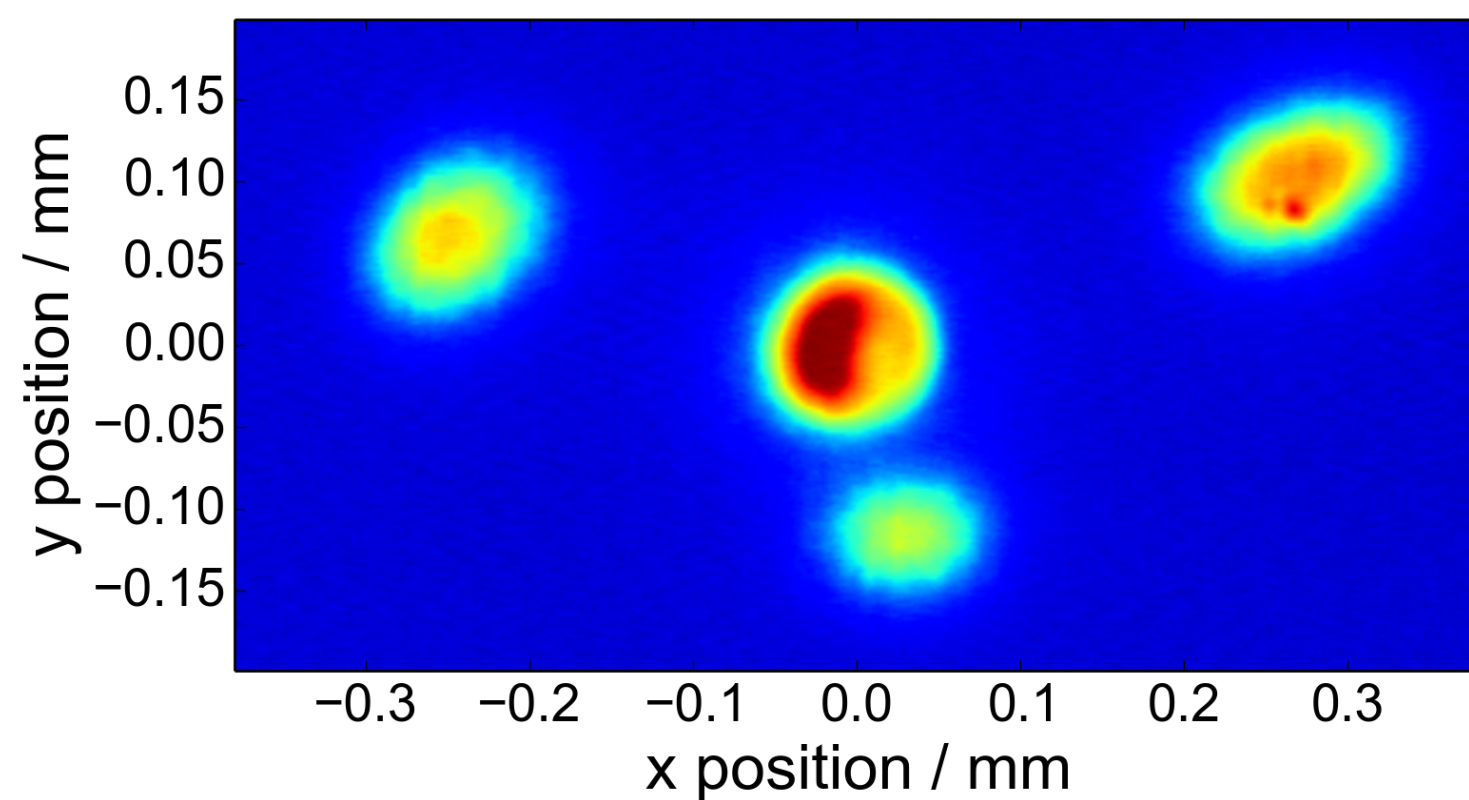
# Tune and Chromaticity Optimization at BESSY II for the Transverse Resonance Island Bucket Optics

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TUPGW013

## Motivation

- TRIBs enable Bunch separation by beamline adjustment
- Enables simultaneous fulfillment of few bunch and multi bunch user demands
- Filling gap becomes obsolete thus reduction of beam loading
- Tune and chromaticity optimization gives island emittance increase for TRIBs optics of  $\sim 2\%$



## Pinhole Measurements

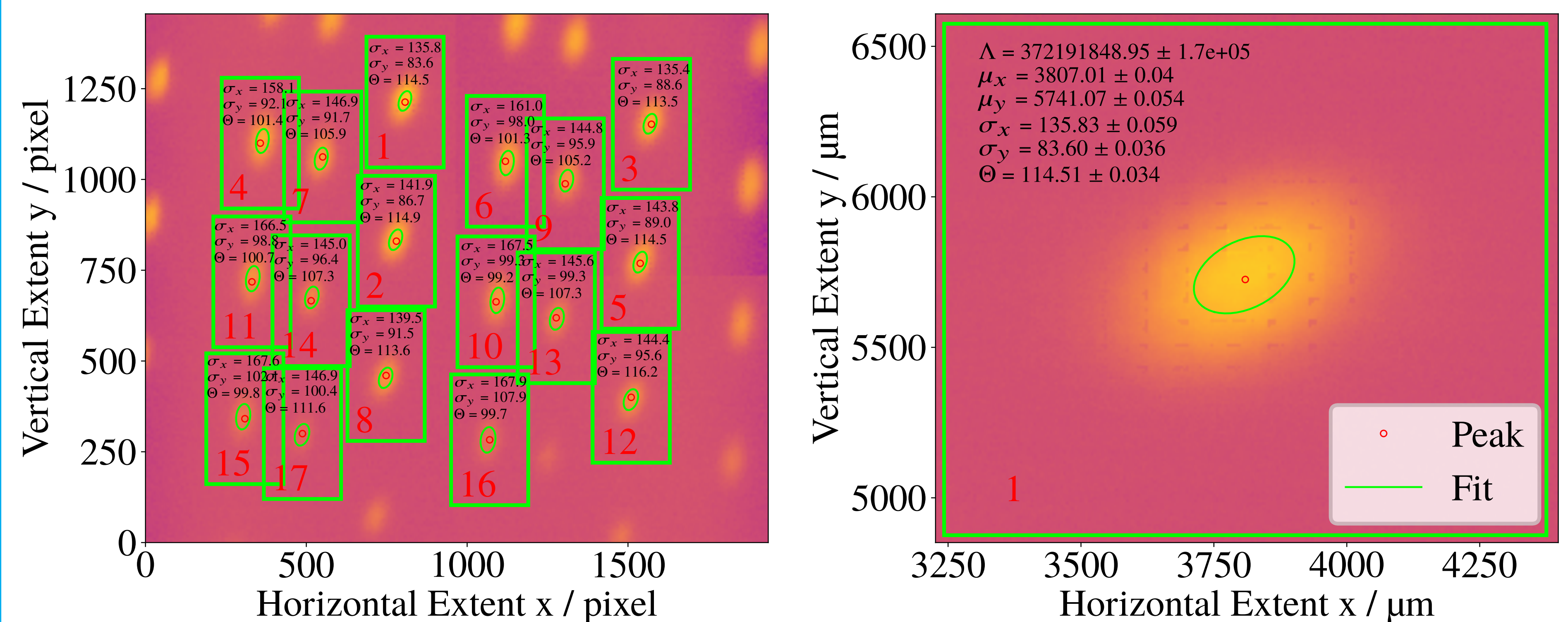


Figure 1: Pinhole Image with TRIBs optics and all current on the second orbit. Raw Image with all identified ROI's (left) and exemplary zoom on ROI 1 with 2D Gauss Fit (right).

## Chromaticity Optimization

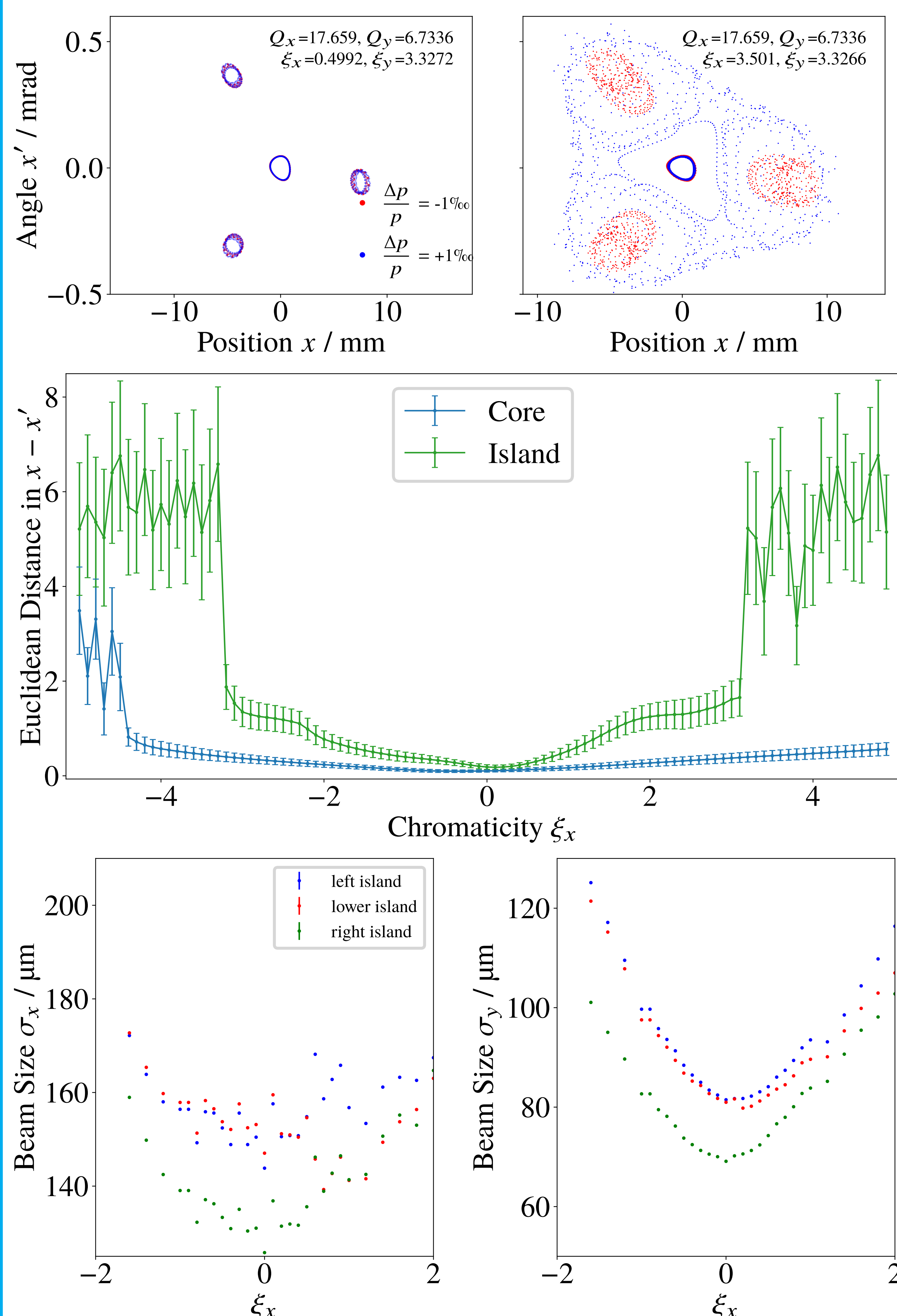


Figure 2: Simulated trajectory of particles with initially identical  $(x, x')$  but  $\delta = \pm 1\%$ , for different  $\xi_x$ . (example in 1<sup>st</sup> row, average over 1000 revolutions in 2<sup>nd</sup> and measured  $\sigma_{x,y}$  in 3<sup>rd</sup>)

## Tune Optimization

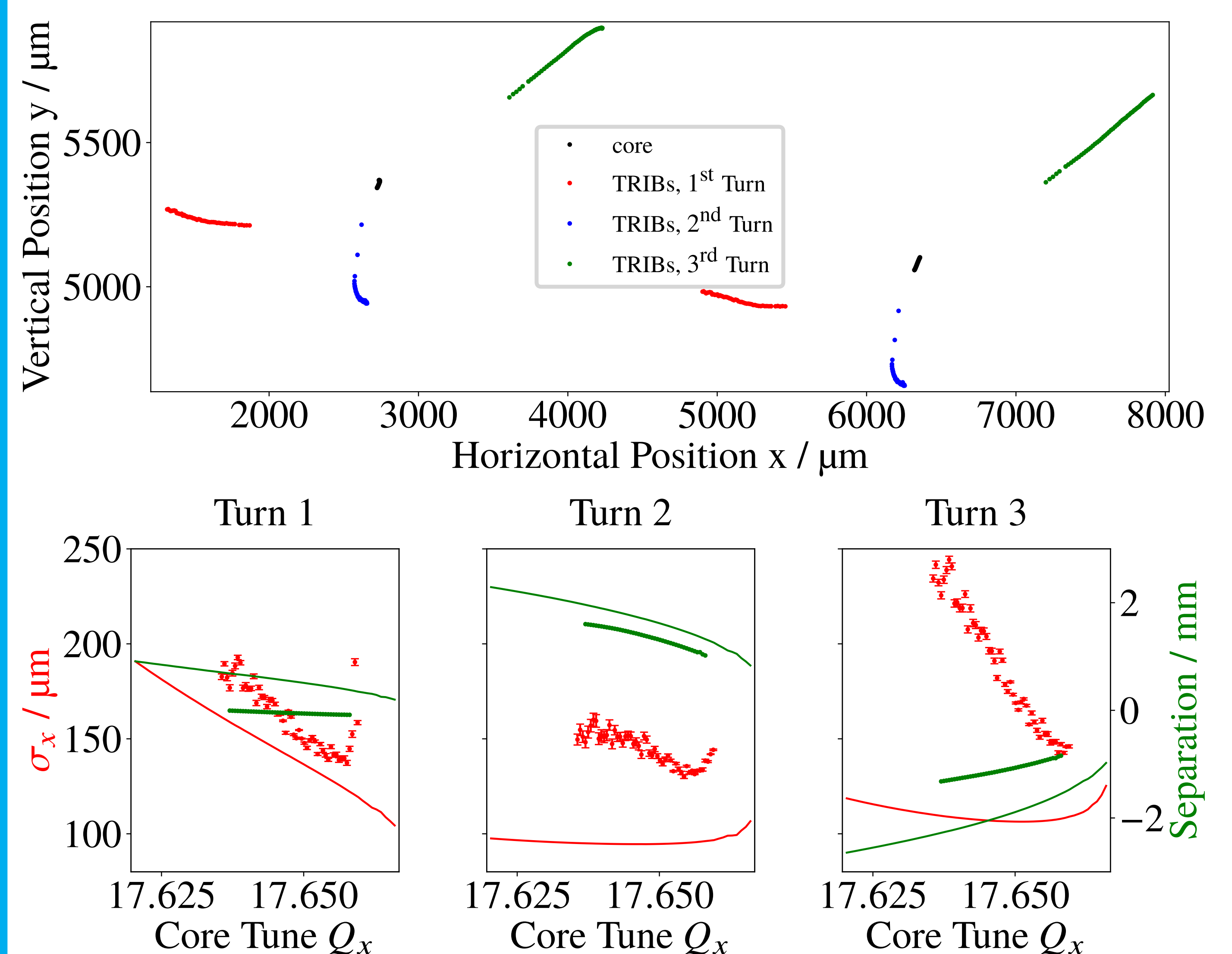


Figure 3: The upper plot shows the measured island and core bucket position over a  $Q_x$  tune ramp. Below the simulated (red lines) and measured (red dots) transverse beam sizes  $\sigma_x$  are shown as a function of the horizontal core tune  $Q_{x,core}$  together with the corresponding separation (green). The simulation is based on our measured linear optics from closed orbits and nonlinear optics fitted to match the chromaticity and tune shift with amplitude measured at the machine in 2018.

## Outlook

- Look into effects of path length difference between each island and core
  - Visible in Simulations
  - Could be cause of longitudinal / transverse coupling effects
  - Optimize on island orbit for more stability and less diffusion
- Repeat beam size measurements with low energy photon filter
  - Higher resolution
  - Compensate lower intensity with longer exposure times

## KEY REFERENCES

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- [4] M. Ries *et al.*, "Transverse Resonance Island Buckets at the MLS and BESSY II", *IPAC'15*, Richmond, USA, MOPWA021.
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## AKNOWLEDGEMENT AND PARTNERS



## MORE INFORMATION



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