Elens commissioning

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Goals and parameters

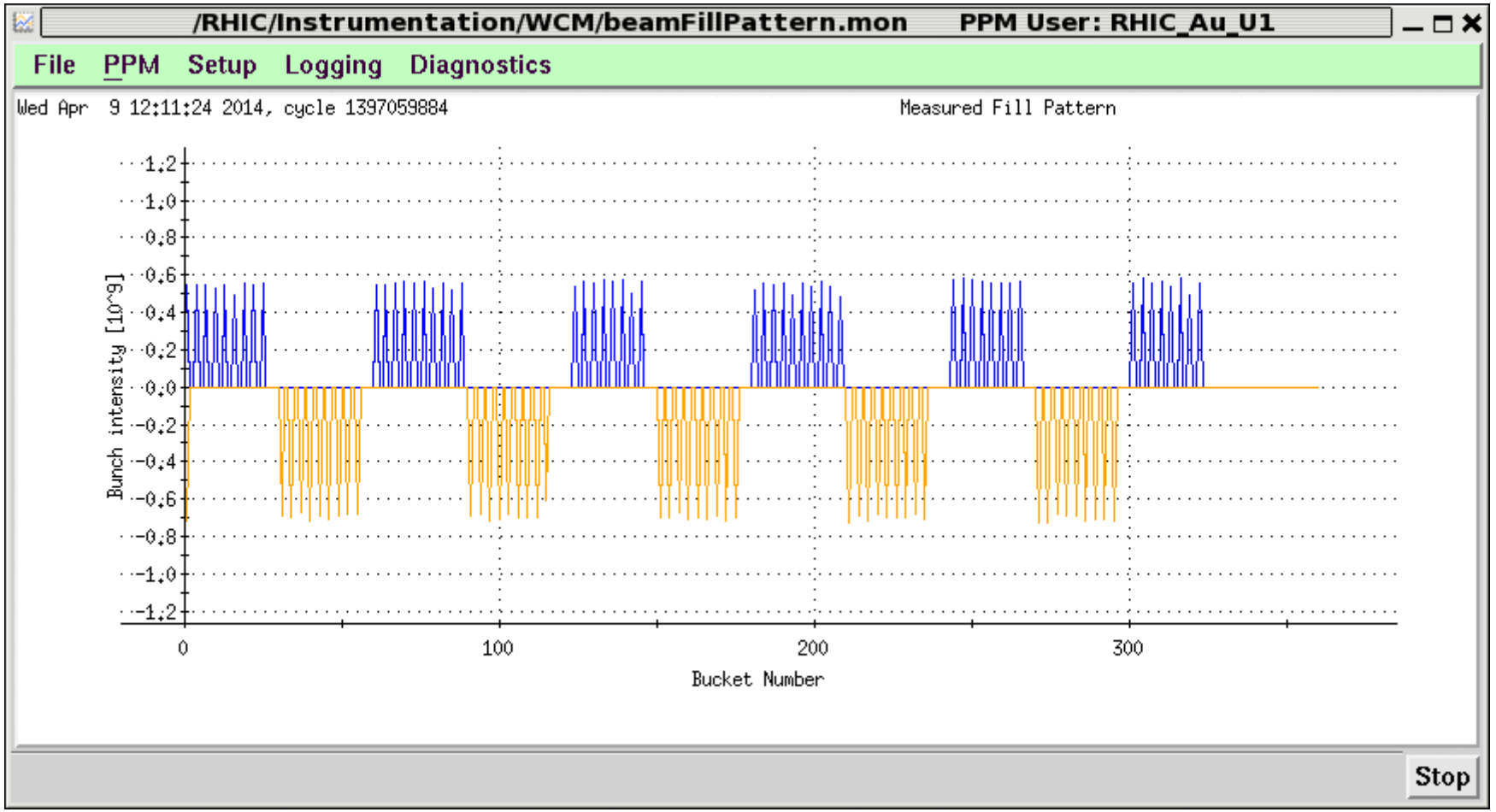
- Goal - transverse alignment of electron and ion beams
  - displacement using the elens corrector magnets
  - Initially planned for both beams but 2h were lost due to machine unavailability → only yellow could be done

- Relevant parameters:
  - Ions: σ~0.35-0.25mm, β=8m
  - Electrons: N~2.2e11 (1.0A), σ~0.5mm, β_{rel}~0.2

- Beam-beam parameter seen by the ions:

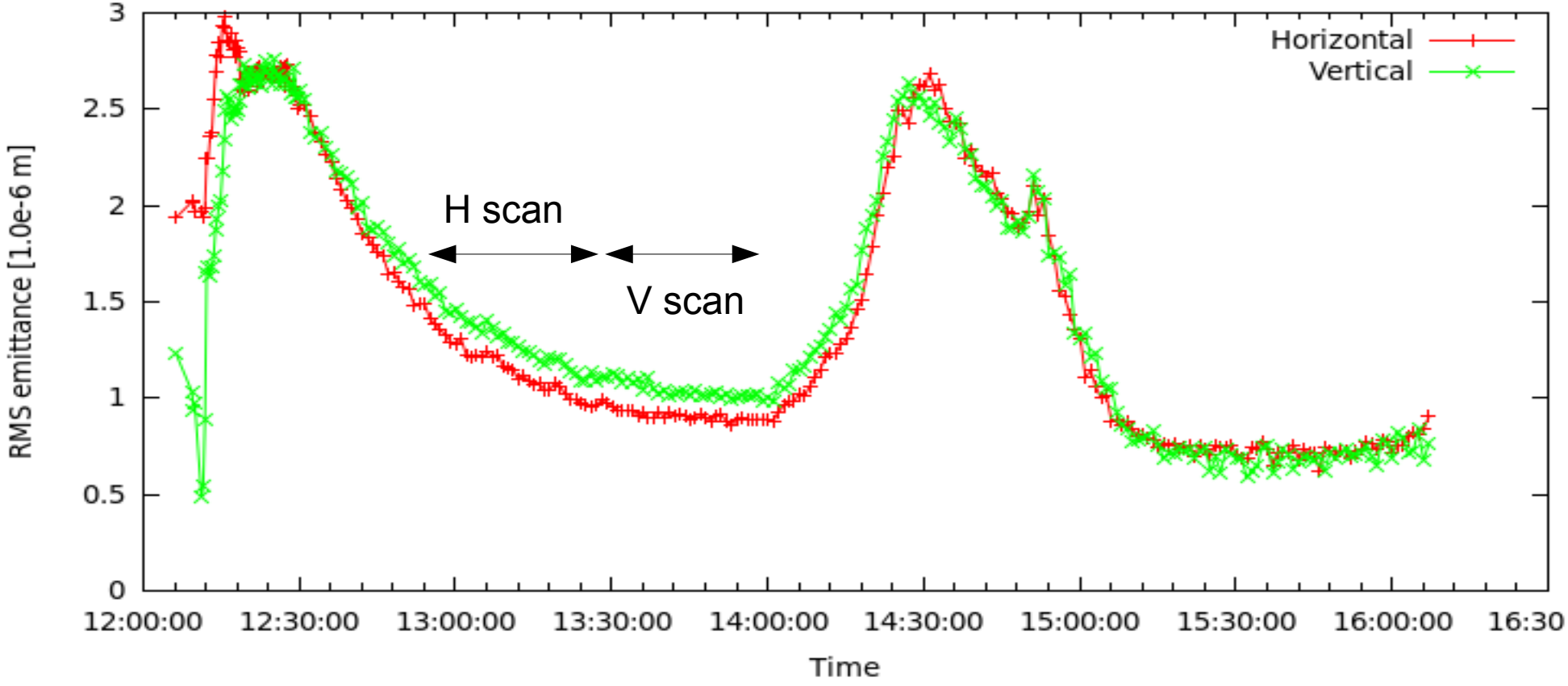
$$\xi = \frac{Z}{A}\frac{N_e r_p \beta}{4\pi\gamma_p\sigma_e^2}(1+\beta_e) \approx 0.004$$

Fill pattern



→ Only bunch 1 colliding in PHENIX
→ Other bunches do not see each other anywhere (included elens)
→ Low intensity due to issues with AGS extraction

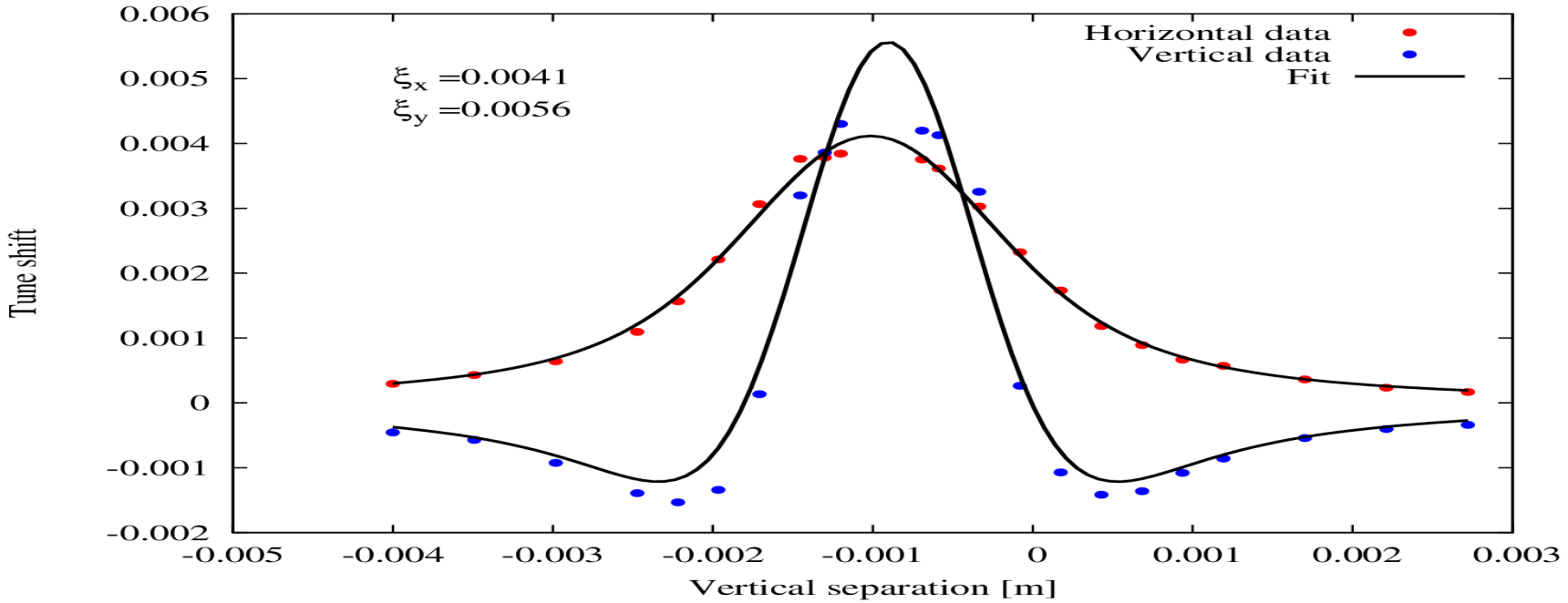
Emittance



→ Measurements started around 12:50

→ Horizontal data to be corrected for emittance variations, vertical almost constant

Tune shift vs vertical separation

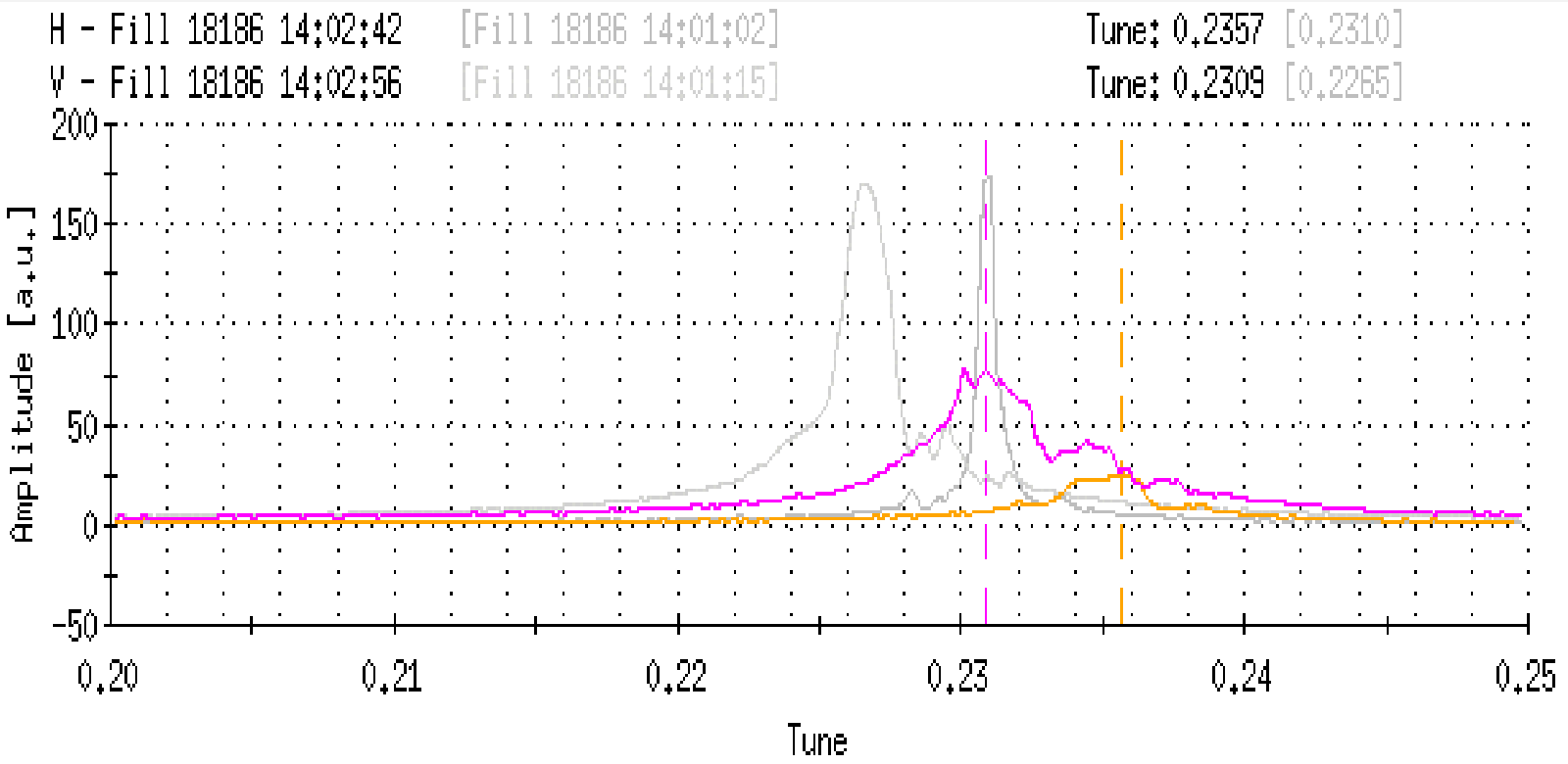


→ Horizontal data fits the theory very nicely

→ Vertical data doesn't: used Gaussian distribution, could the electron have “flat” density in the center?

→ Good enough to find the center. First beam-beam amplitude detuning measurement?

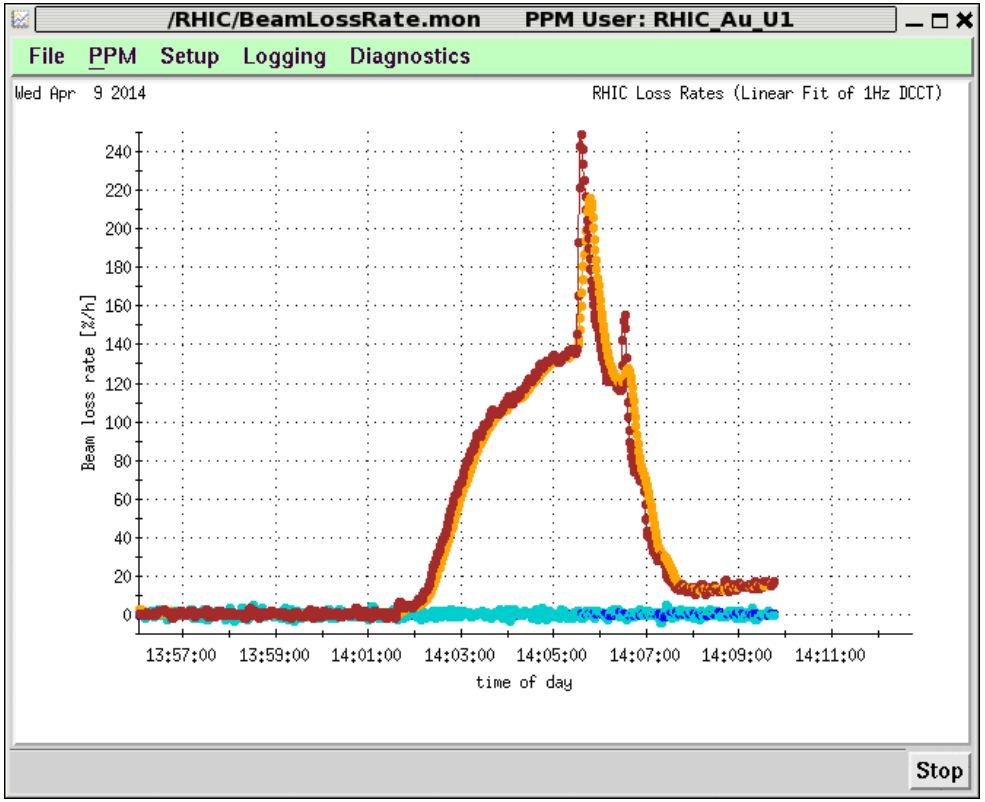
BTF elens ON/OFF

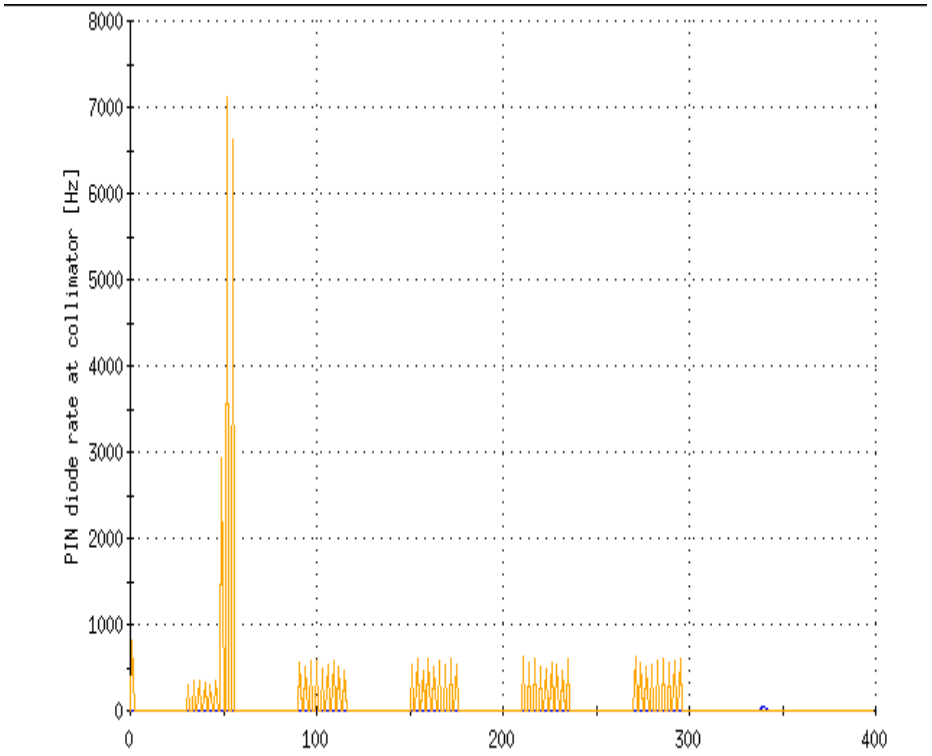


→ BTF with elens ON (colored) / OFF (grey)

→ Tune shift and increased tune spread observed

DC ebeam

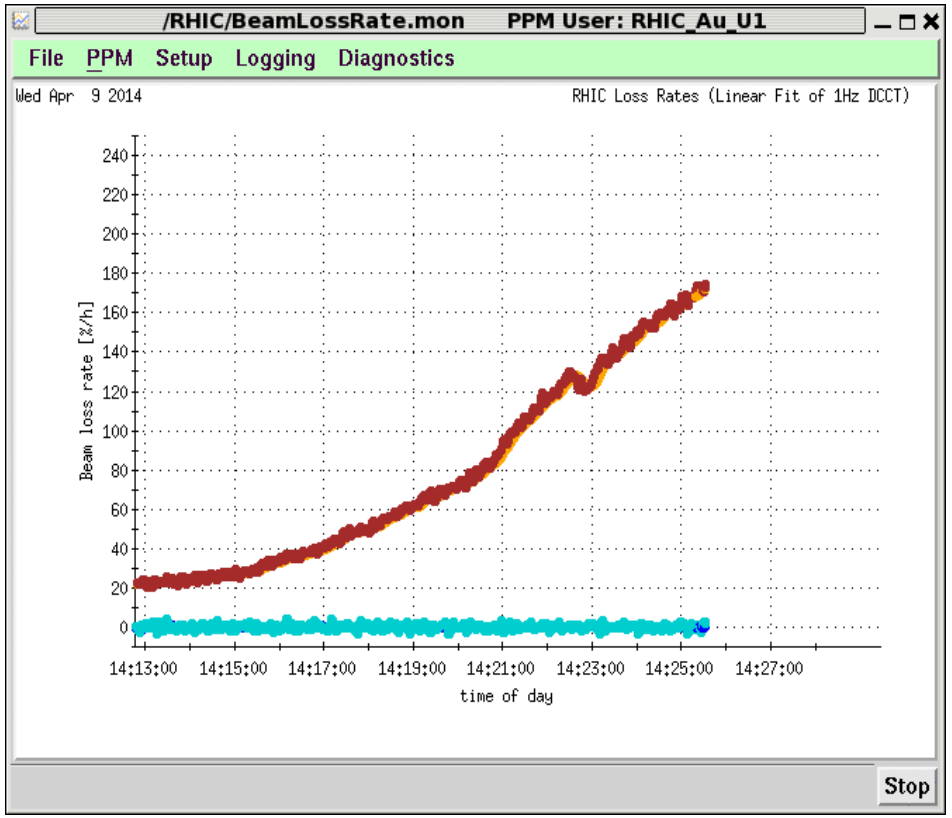


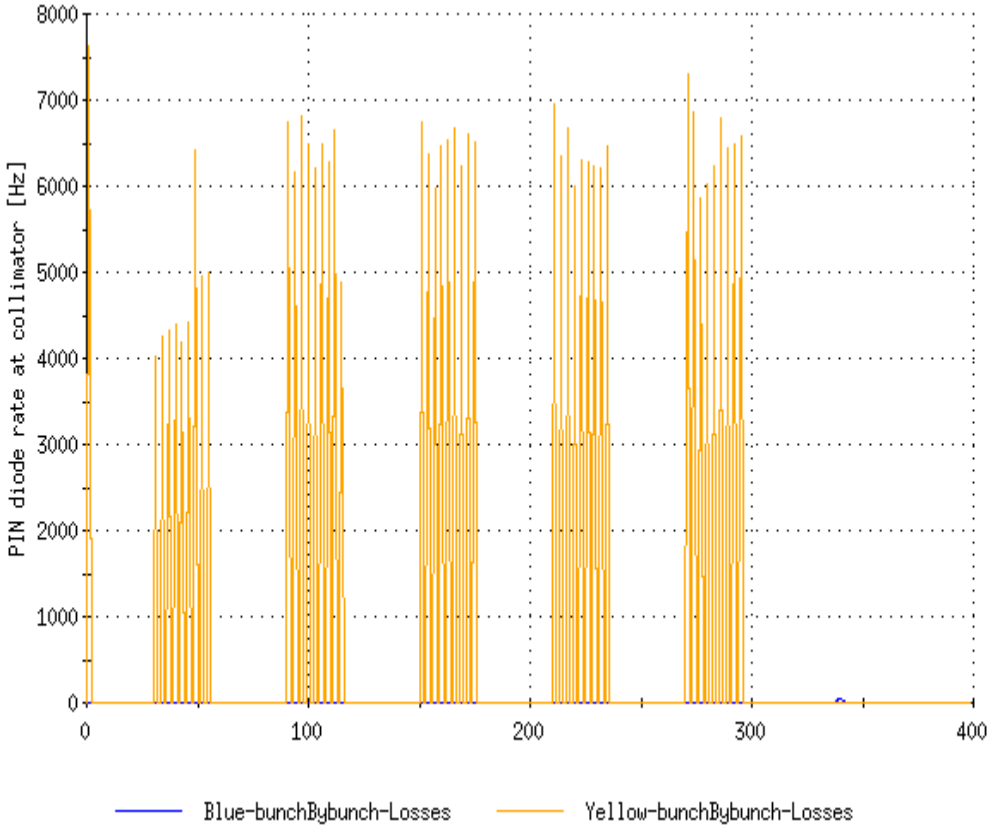


→ After tune correction of -0.004 to compensate for the beam beam tune shift beam losses down to ~20%/h

→ To be noted: here the ion are smaller than electron: almost linear beam beam force

Increased emittance





→ Emittance blown up by stochastic cooling system

→ Significant increase in loss rates

Summary

- Had only 2h (+30minutes thanks to Yun) of beam time over the 4h initially planned: could work only on yellow
- Beam alignment done using tune and orbit data (orbit to be analyzed)
- Unfortunately not data from the backscattered electron detector available online
- First test with DC beam:
  - Cooled ions good lifetime: it should be possible to make it almost transparent with finer tune adjustments
  - Matching the ion beam size to the electrons, clear degradation, could be due to tail generation: beam blown-up in an “uncontrolled” way