

APEX: electron-ion heating (studies description and time accounting)

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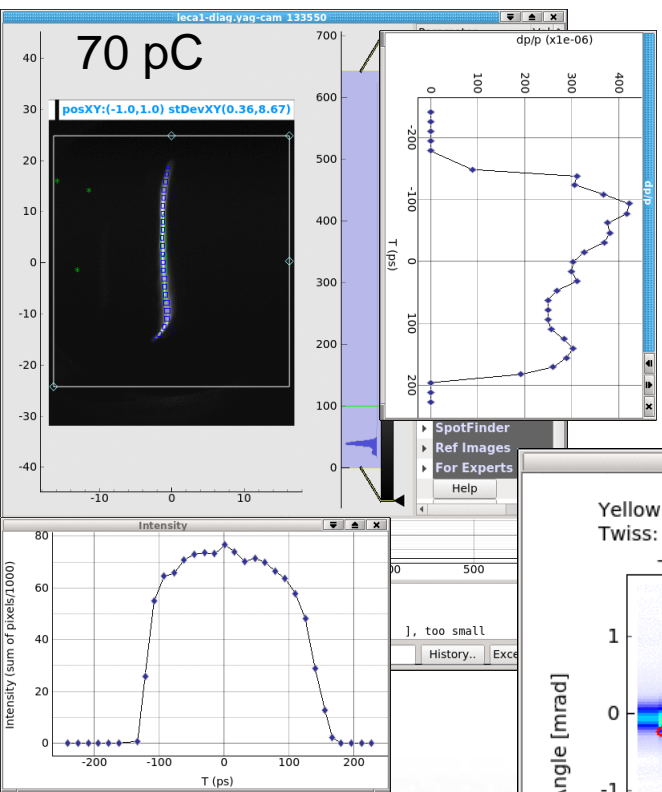
Studies performed on February 24, 2021

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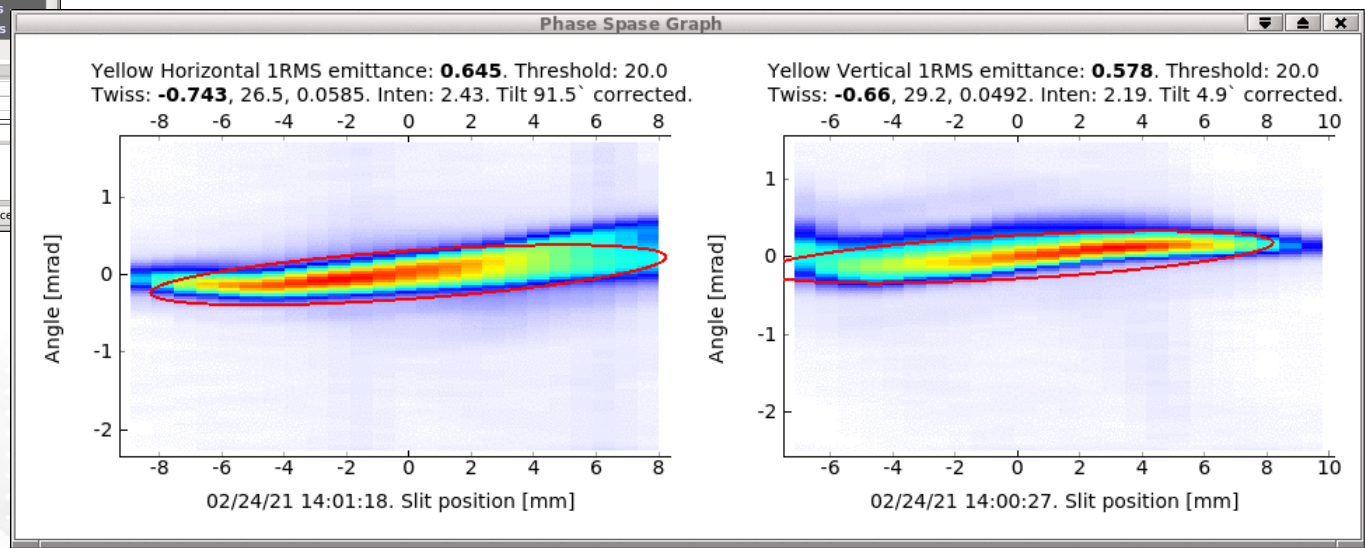
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ENERGY

Setup measurements (e-beam in a pulsed mode, no ions)

- Characterization of the e-bunches' 6-D phase space at four bunch charges (2 hr)
 - Longitudinal phase space measurements in RF diagnostic beamline
 - Emittance and Twiss parameters measurements at the entrance to the Yellow CS
 - Recording the transverse bunch profiles at the entrance and the exit of the Yellow CS and at the entrance to the Blue CS

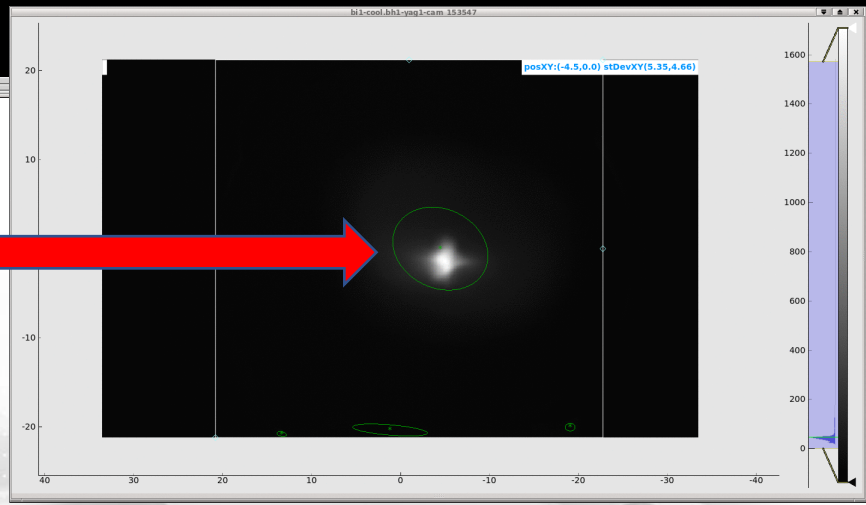
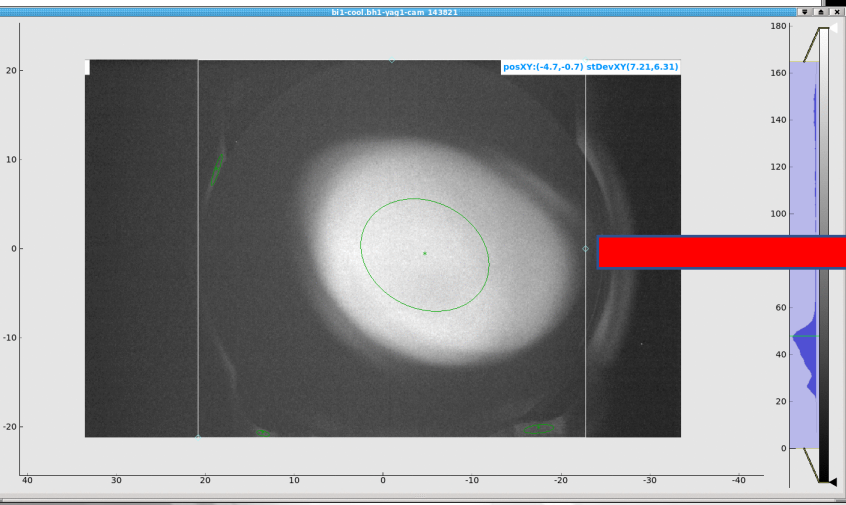
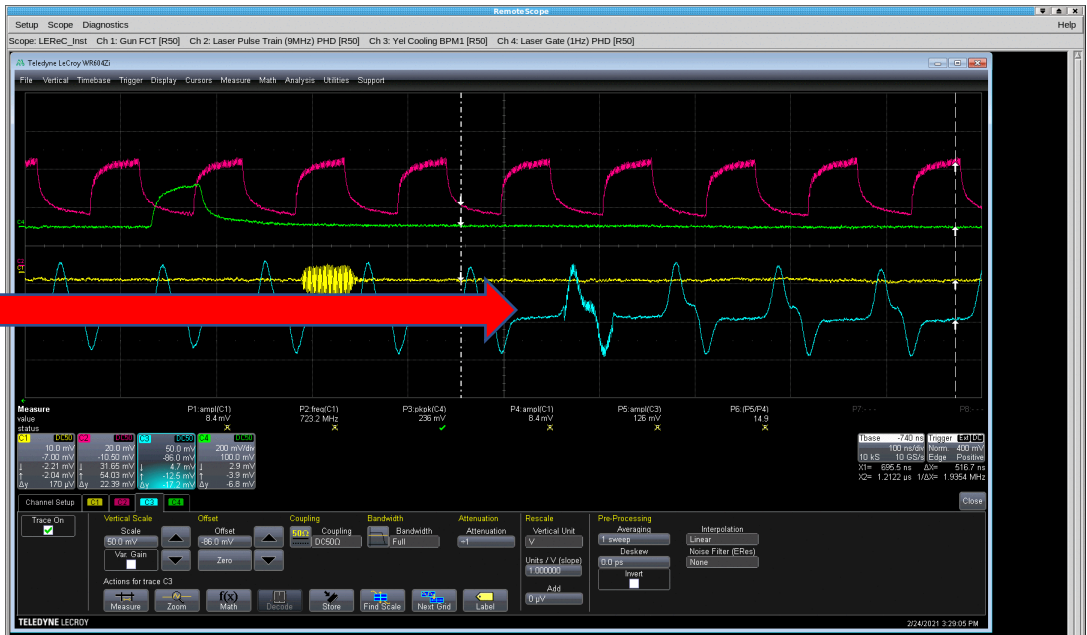


70 pC



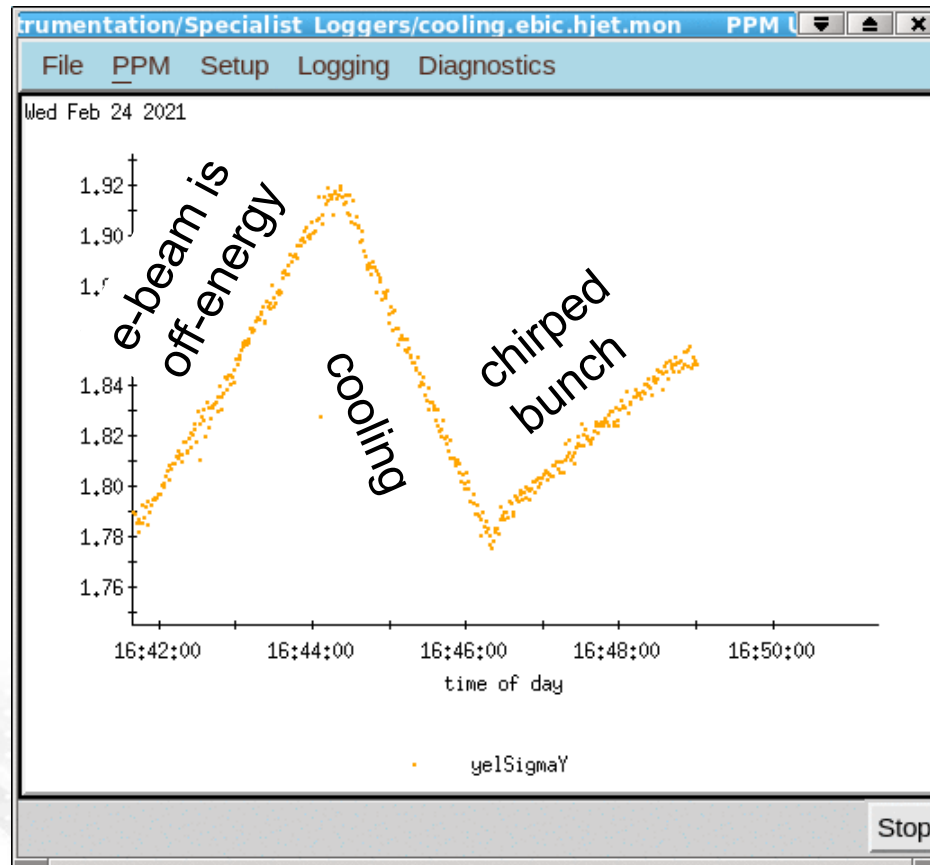
Setup measurements (e-beam in a pulsed mode, 111 i-bunches in the Yellow Ring)

- Characterization of the i-e focusing for the four e-bunch charges (1 hr)
 - Recording the transverse bunch profiles at the entrance to and in the middle of the Blue CS



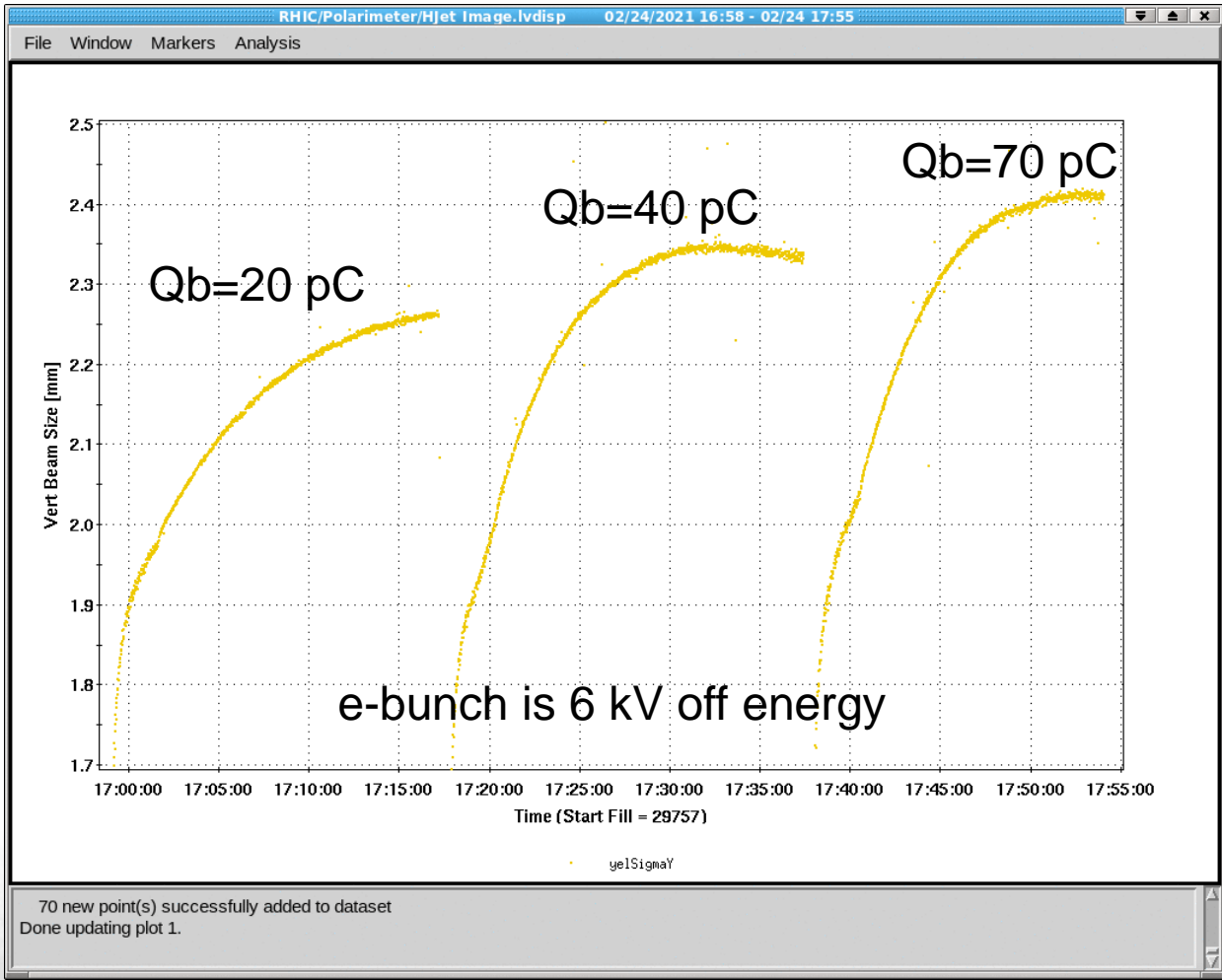
Setup measurements (e-beam in a CW mode, 111 i-bunches in the Yellow Ring)

- Exploring the best knob to “detune” the cooling (1 hr)
 - We concluded that the best way to kill the cooling is creating an energy offset of ~5-6 kV.
 - The chirp resulting in ~ 8-10 kV “head-tail” correlated energy spread is not as effective
 - The energy offset did not create an obvious disturbance in the longitudinal distribution of the ion bunches. The large offset we use most probably works as an extra source of beam losses (it’s an attractor at $dp/p=0.35\%$), but it must be a relatively slow loss (bunched ions see a “ 10σ -tail” of the longitudinal pulling force).



Heating studies (e-beam in a CW mode, 111 i-bunches in the Yellow Ring)

- Measurements on i-e heating rate for the four characterized bunch charges (2 hr)
 - Five 15 min stores (including one “pure IBS” store) with the flat RF bucket
 - Three 15 min stores (including one “pure IBS” store) with the parabolic RF bucket



Explored parameters

- e-bunch length: ~250-300 ps FWHM (short bunches)
- e-bunch charge: 20, 40, 55, 70 pC
- i-bunch intensity: $\sim 4e8$ at the start of the store, $2e8-3e8$ at the end of the store
- Heating rate for the flat RF bucket is measured for all four charges.
- Heating rate for the parabolic RF bucket is measured for 40&55 pC/bunch (for the purpose of comparison)

Data analysis

- Analysis is in progress

The next experiment

- e-bunch length: 400-450 ps FWHM (long bunches) with Q_b producing the similar bunch charge densities and with the same i-bunch conditions
- We ask for a 6 hr APEX