

Demonstrate 10:1 Emittance Ratio in RHIC for EIC

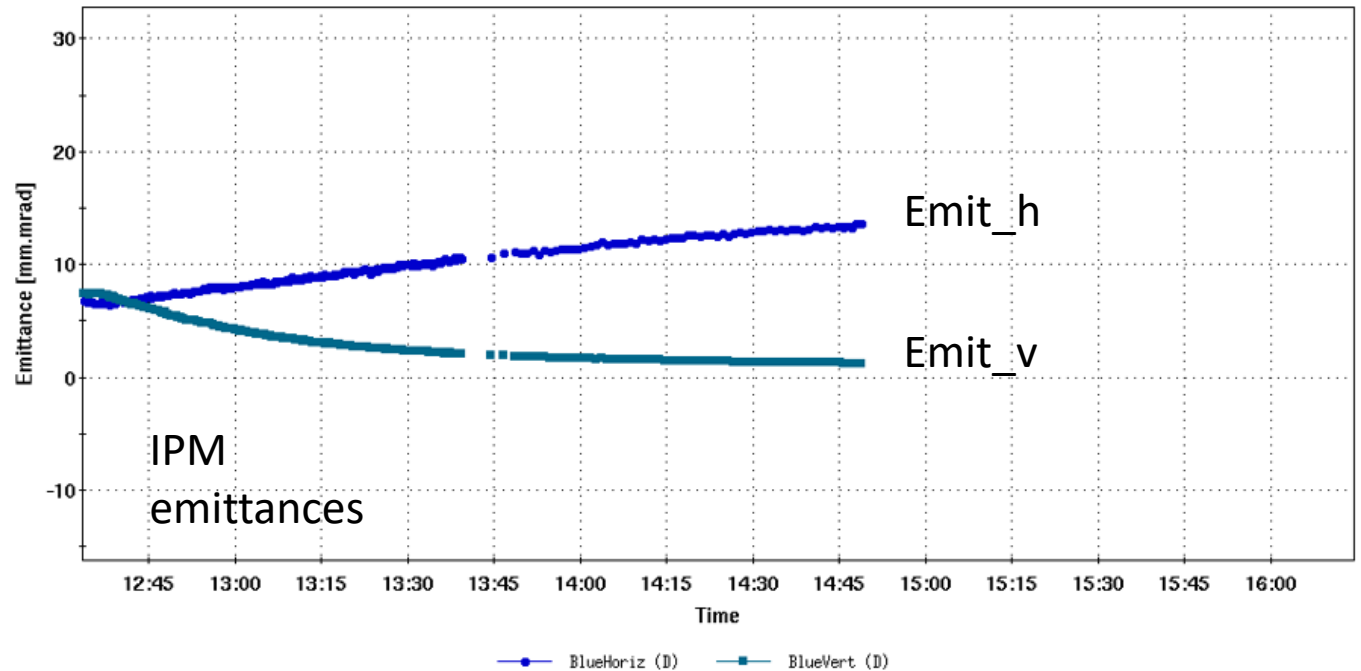
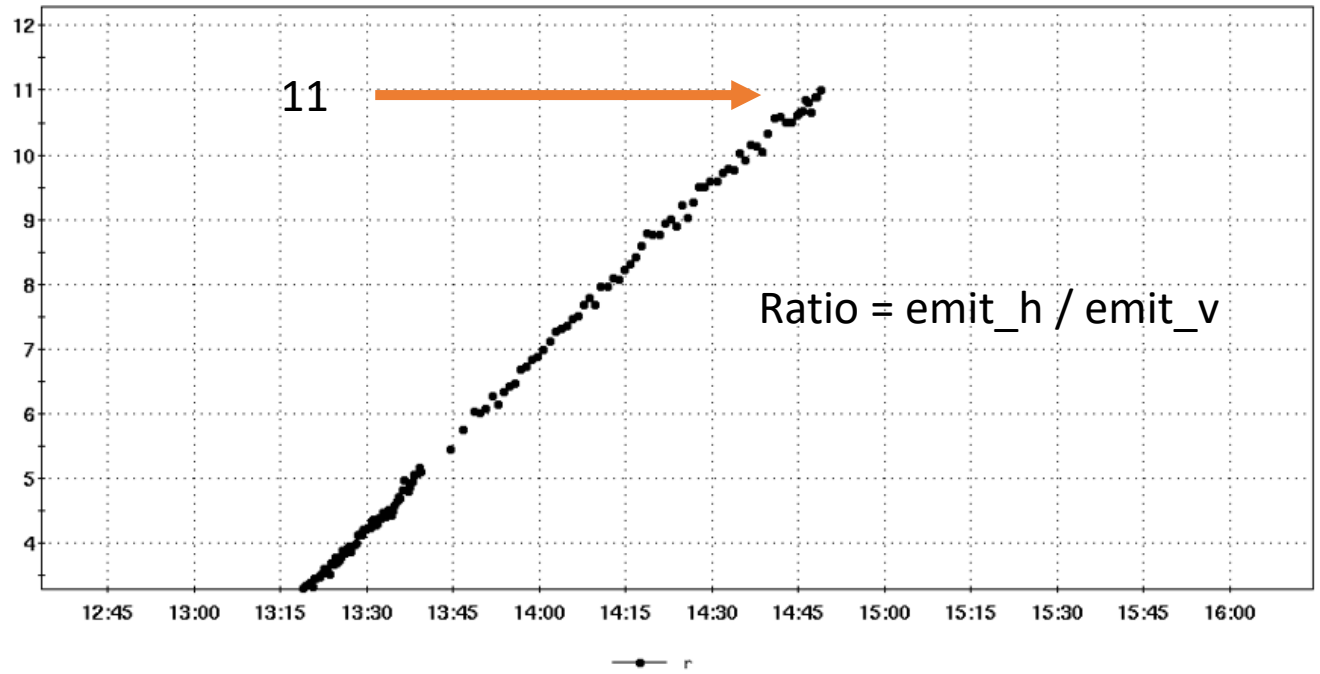
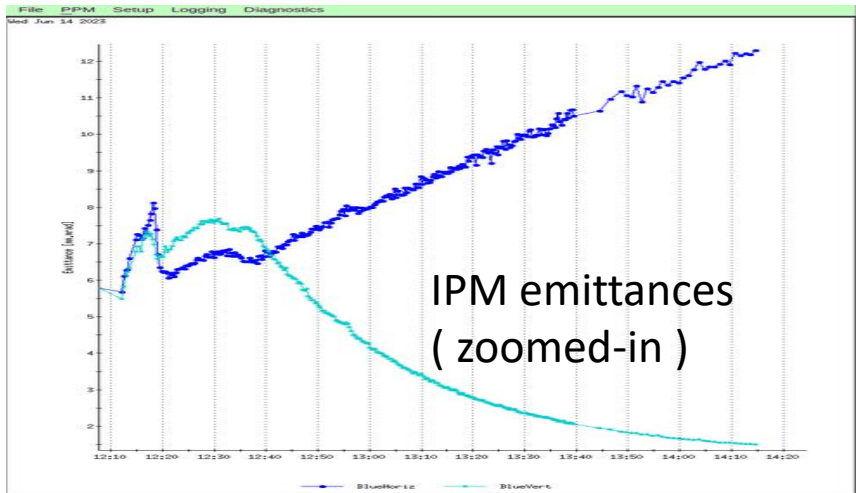
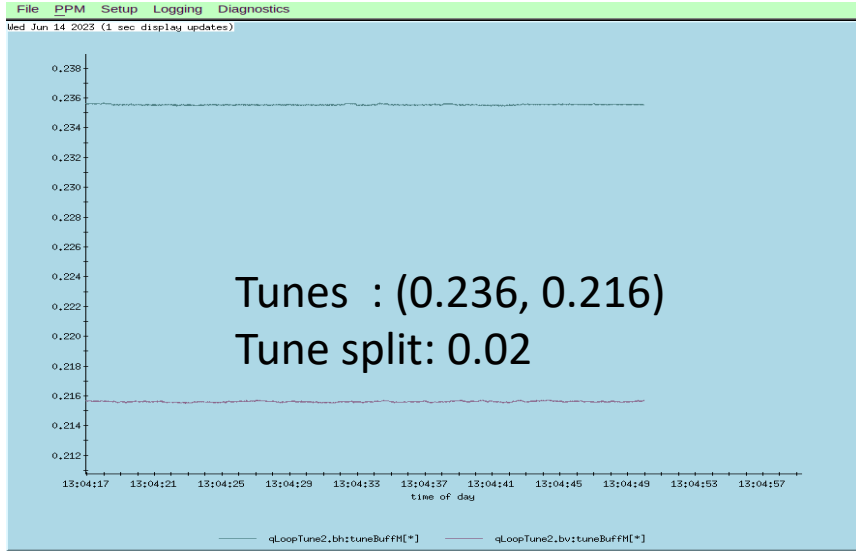
Yun, Derong, Brendan, Andrew, Kevin M., Travis

Experiment on June 14, 2023

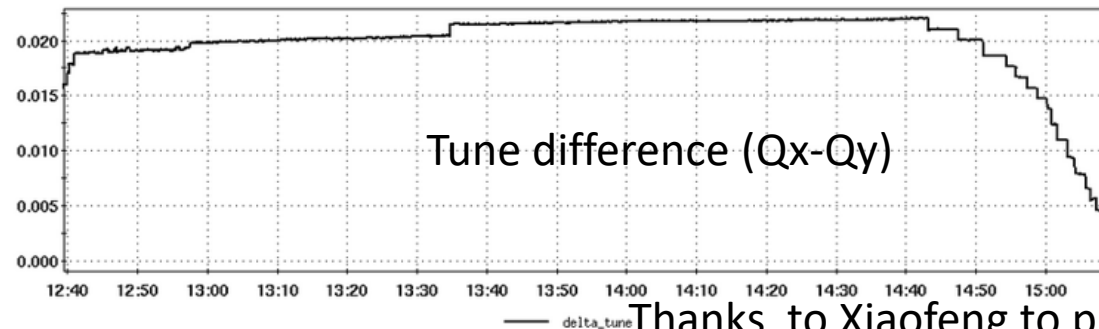
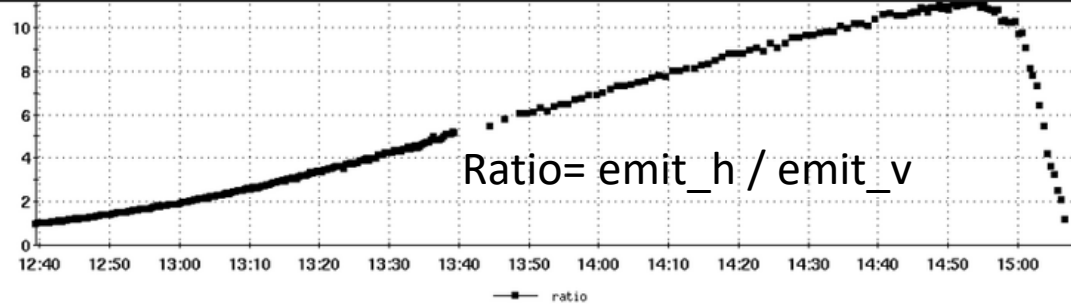
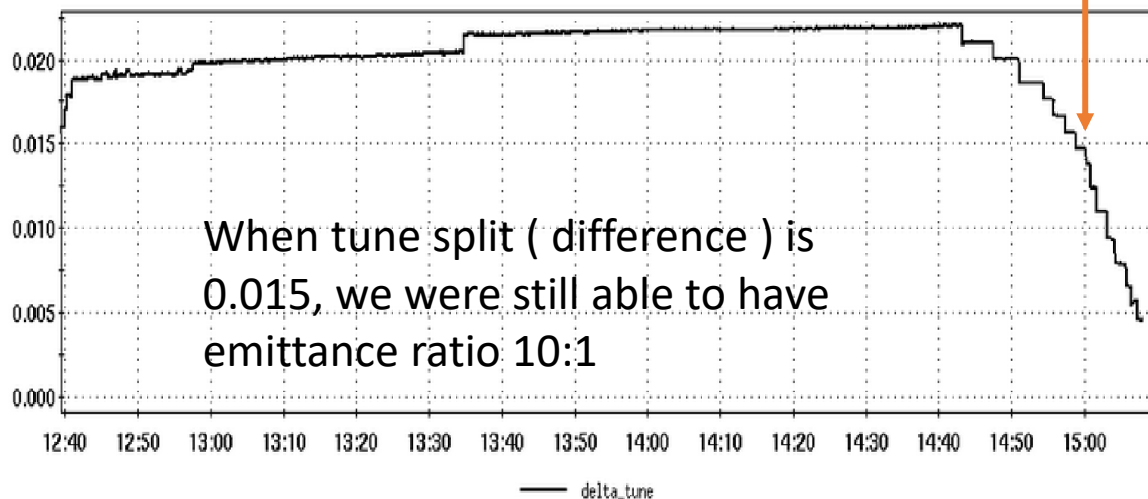
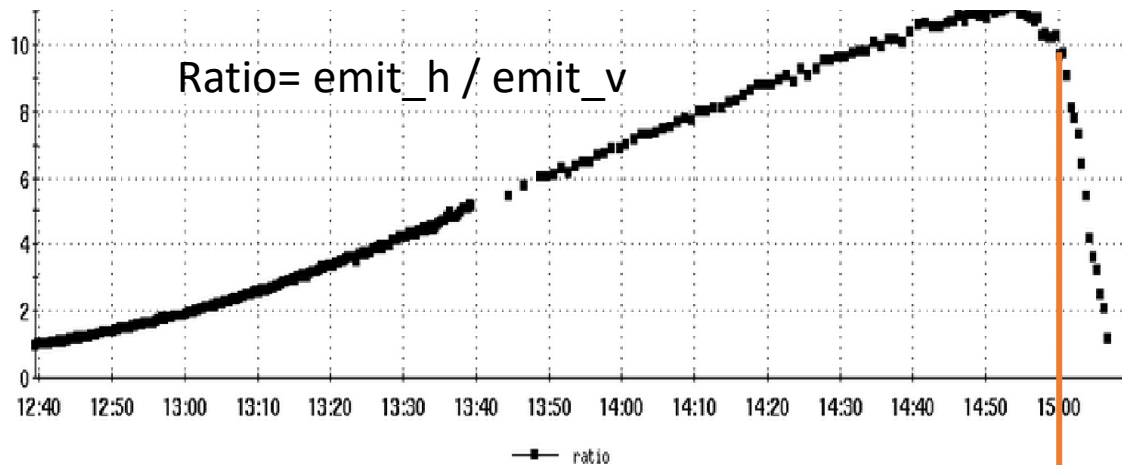
General remarks:

- Per schedule: 11am-16pm for this experiment
- We lost the first store when we were trying to insert separation bump at IR6 and IR8. It may be caused by large vertical orbit along the ring. **1 hour lost for 1st fill**
- We had a second fill and successful beam condition for this experiment.
- We had to **cut short 30-40mins** since STAR wanted to ramp up their detector solenoid before 4pm (since no worker on site after 4pm? This should be well planned and can't take or interrupt APEX beam time in future)
- We adjust the tune split, increased it to 0.018, 0.020. Did some coupling tuning based on BBQ monitor but no much improvement to decoupling.
- We leave vertical cooling cool vertical plane emittance and let IBS grow horizontal emittance to maximize the ratio of transverse emittances.
- At the end of experiment, we pushed vertical tune close to horizontal tune to check when the two emittance began to mix and what the dQmin was in the machine.

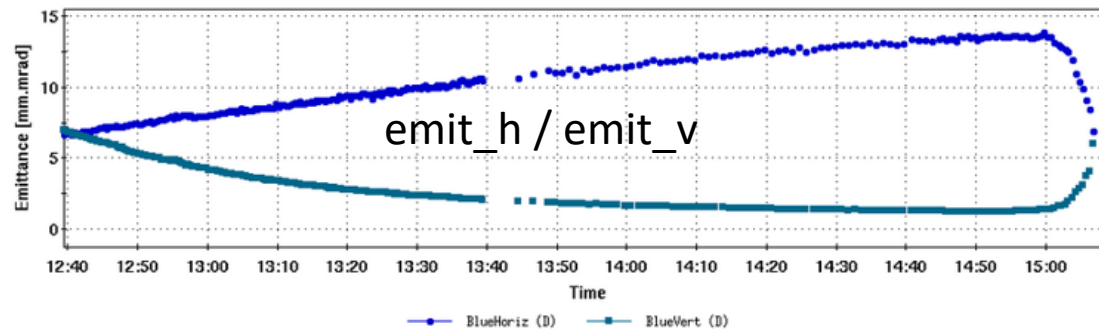
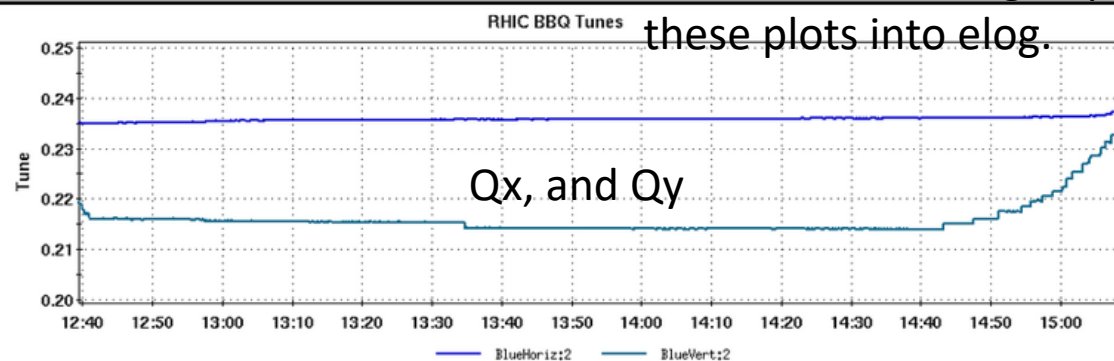
Emittance Ratio Measured



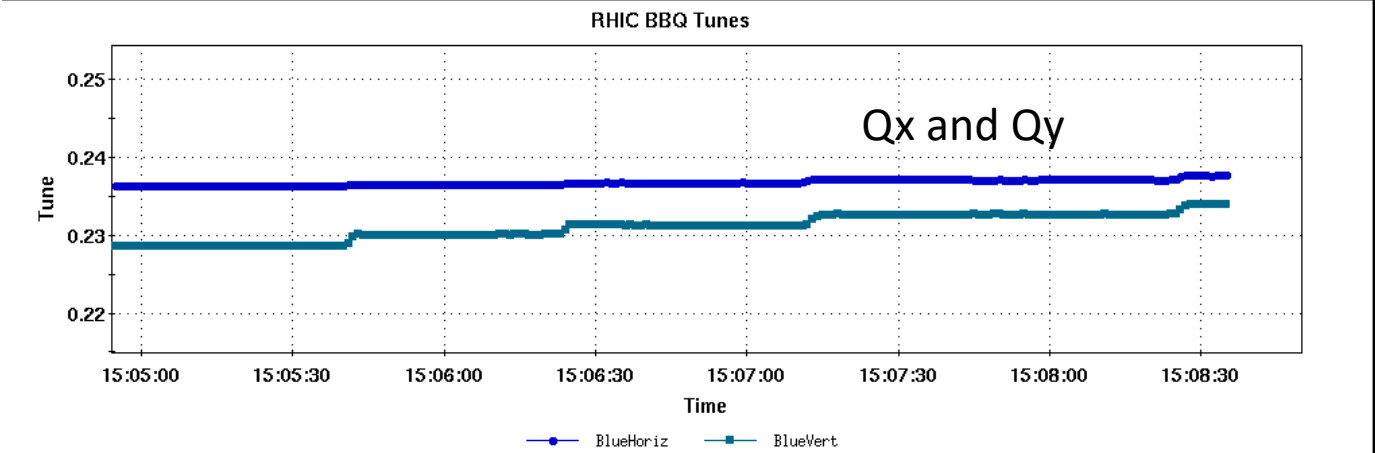
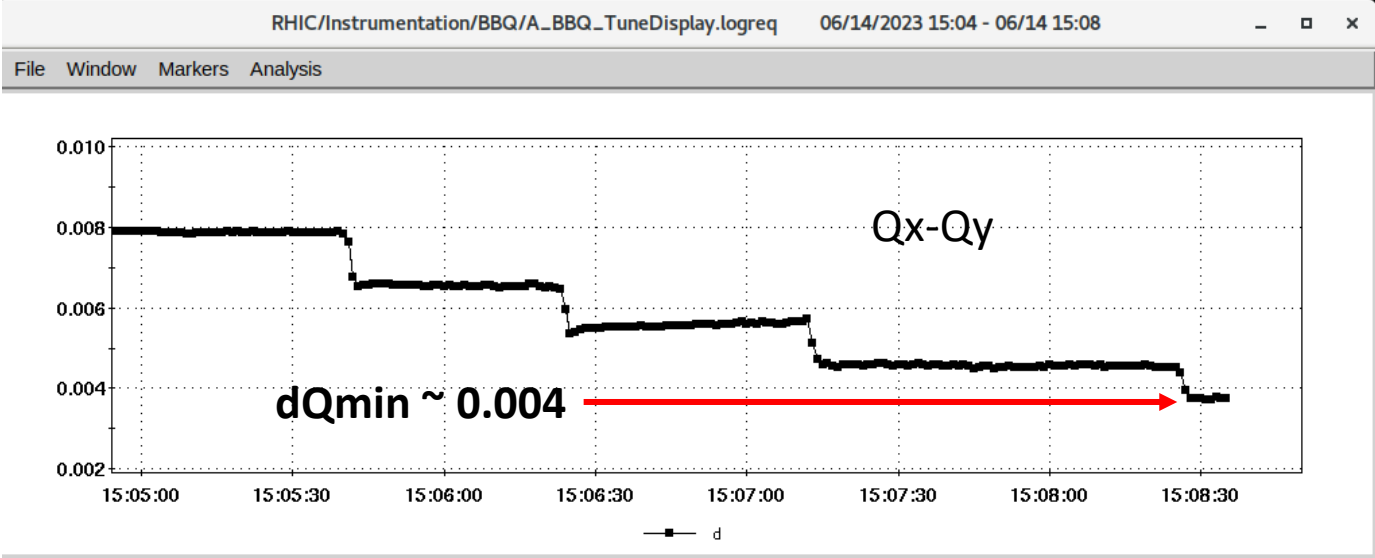
Pushing Tunes Closer



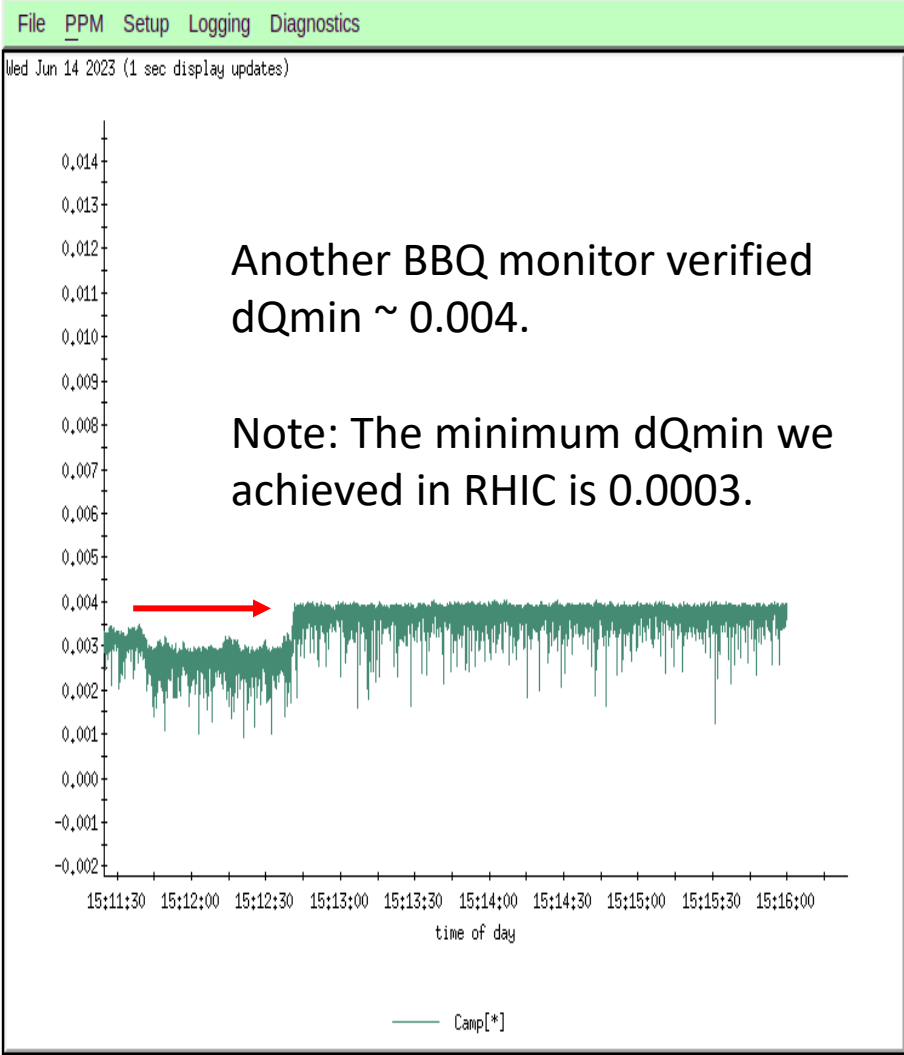
Thanks to Xiaofeng to put these plots into elog.



Measure dQmin (Minimum tune split)



Blue ring was decoupled with existing RHC decoupling feedback.



Summary

- We used about 4.5 hours for this experiment. 0.5 hours taken away by STAR. We lost first store which cost us 1 hour.
- With mighty vertical cooling and decent decoupling in Blue, we were able to demonstrate 10:1 transverse emittance ratio. The maximum ratio demonstrated was 11:1. If we stay longer at store, a larger ratio can be obtained certainly.
- Next:
 - redo this experiment with fine decoupled machine: 5-6 hours
 - if possible, collide flat beams, need check beam-beam parameter
 - if possible, do this with radial shift lattice

Appendix: IPM measurements for Fill 33871

