Ramping near the 2/3 resonance

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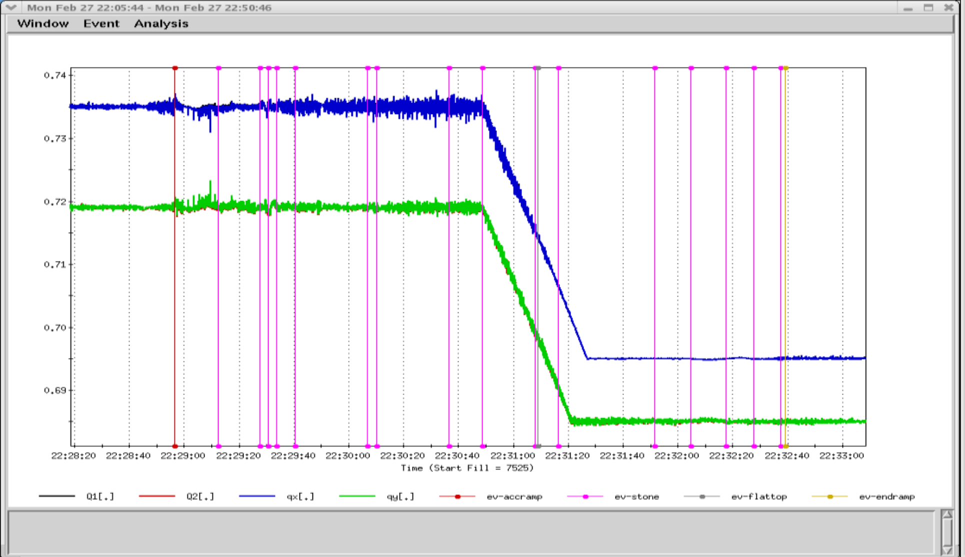
APEX Workshop 2009

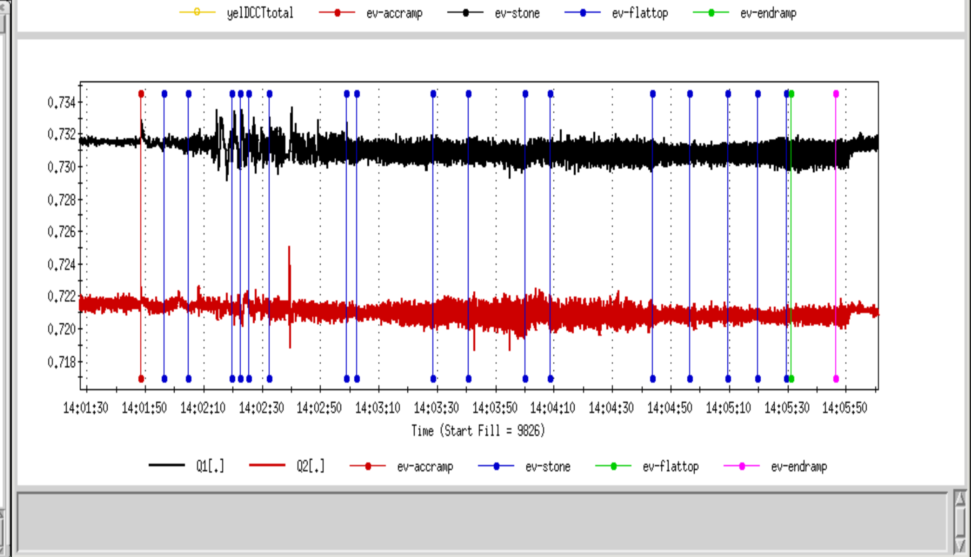
Motivation

- Why?
  - Ramping near the 2/3 resonance has proved to be a stable area of tune space from the polarization standpoint. Above 100 GeV, polarization loss is suspected to occur crossing resonances when the tune is too close to 7/10.
  - Beam transmission is good near, but not close to, the 2/3 fractional tune; this limit needs further characterization.
- Why now?
  - Demonstrating this ability prior to the next long proton run is important.
  - A switch of species to investigate a small set of issues is not feasible.
    - A switch of species is a prohibitive cost of operating time.
    - Polarization cannot be maintained in the yellow ring, which prohibits other pp activities.
    - Beam dynamics is independent of species.

Background: various run notes

- 100 GeV Physics, Run 6 pp
  - Store lifetime deteriorated at tunes outside 0.68 - 0.695 box
    - <0.68, luminosity; >0.695, polarization
  - Beams placed on opposite sides of $Q_x=Q_y$ diagonal for optimal store lifetime.
  - Ramp tunes swing from (0.735, 0.72) to (0.695, 0.685)
- APEX, Run 6 pp
  - Measure and correct third-order at injection
    - S/N proved insurmountable
    - See AP note 287
- 100 GeV Physics, Run 8 pp
  - Near-integer working point tested and discarded
  - Ramp tunes swing from (0.73, 0.72) to (0.69, 0.68)
  - No tune swing during feedback
- 250 GeV Physics, Run 9 pp: polarization improved with tunes below 0.68
  - Ramp tunes (0.69, 0.68); store tunes (0.695, 0.685)
- 100 GeV Physics, Run 9 pp:
  - Ramp tunes swing from (0.73, 0.72) to (0.695, 0.685)



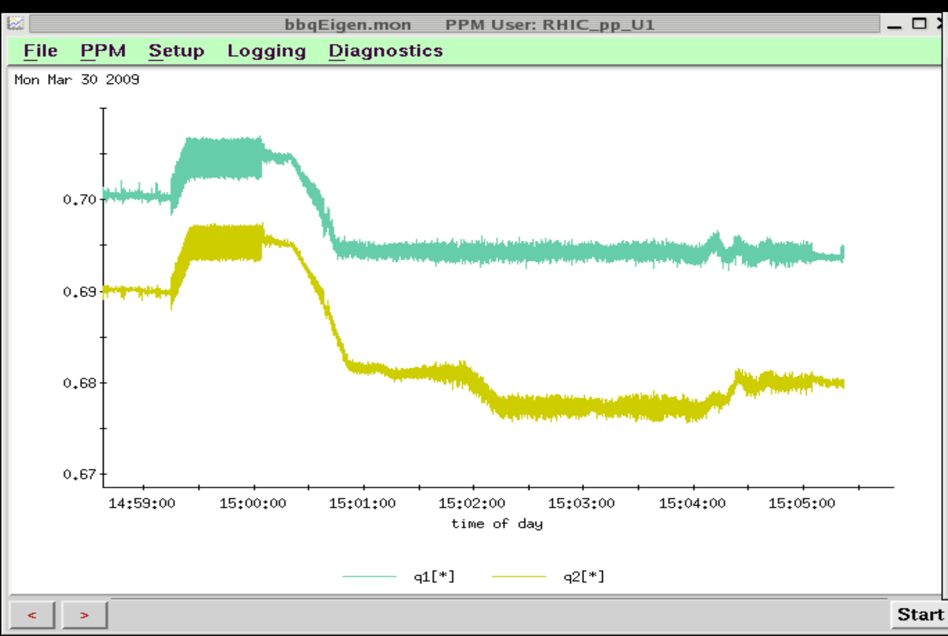


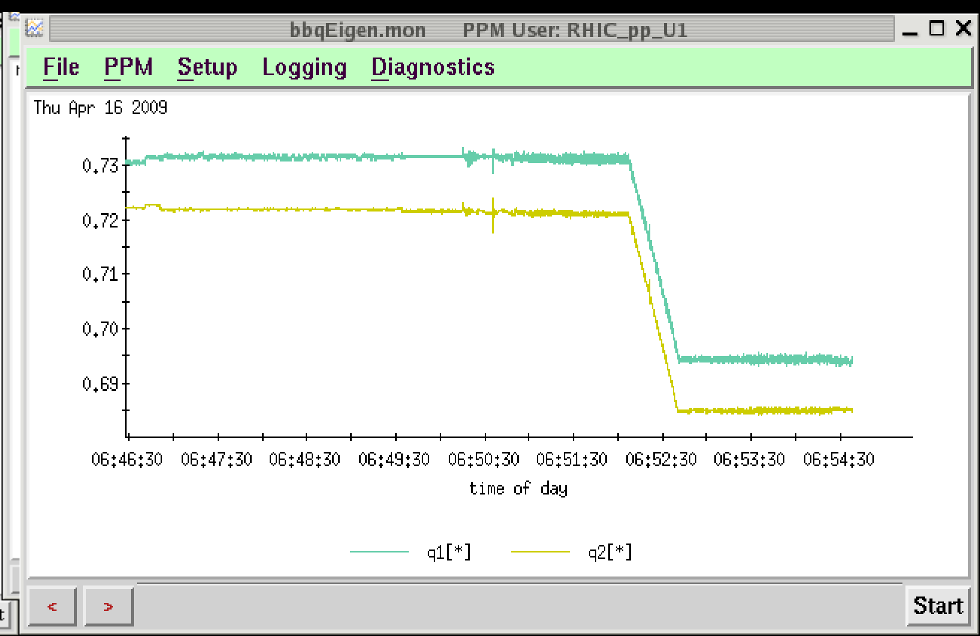
Run 6 100 GeV

Run 8 100 GeV

Run 9 250 GeV

Run 9 100 GeV





Remaining Issues

- Ramping near 2/3 at low energy is still not possible due to beam losses at flattop→ramp main supply switchover.
  - Tune swing from >0.7 to <0.7 is still necessary but should not affect polarization if swing occurs below 100 GeV.
- No clear path for tuning to reduce 2/3 resonance strength.
- How close to 2/3 is sufficient?
  - $0.67<Q_y<0.675$?

APEX requisites

- Develop a new ramp
  - Au beam at fractional tune of 0.67
  - Use tune swing equivalent to pp ramp, in order to avoid power supply transients early in ramp
- Commission new ramp
  - Evaluation by power supply group?
- Experiments require multiple ramps over one or more sessions

Goals

- Establish feedback ramp
- Repeat feedback/replay
  - Move targets progressively closer to 2/3
- Attempt to tune the resonance strength?
  - Empirical tuning on successive ramps
  - Continuous function on ramp to find optimal setpoints?