

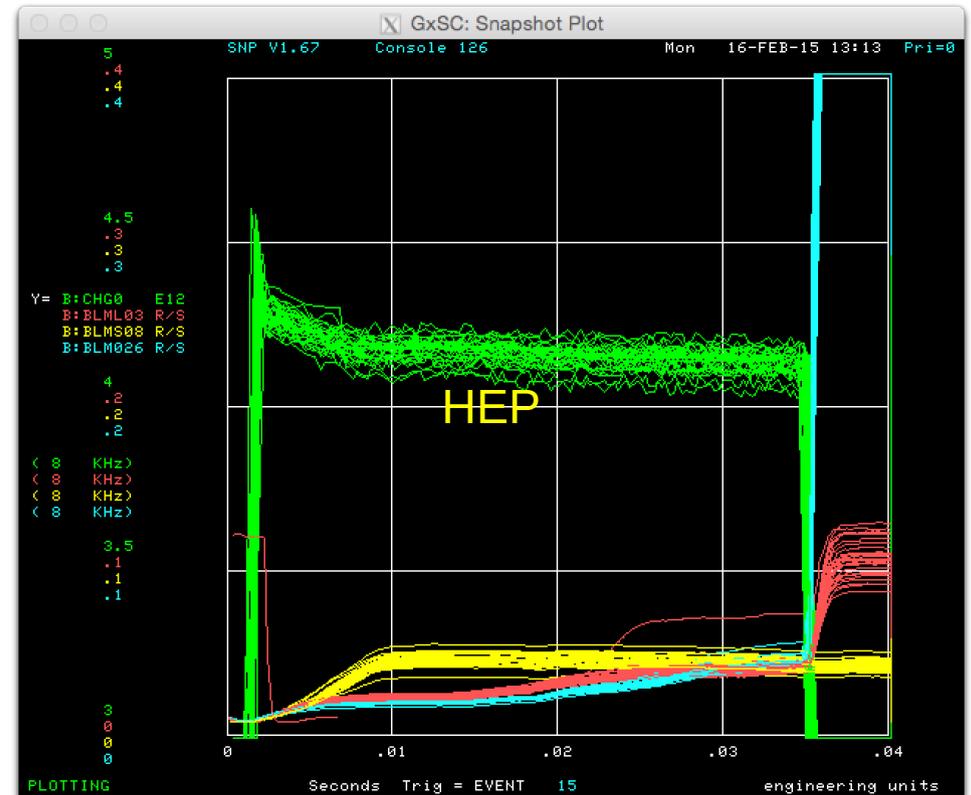
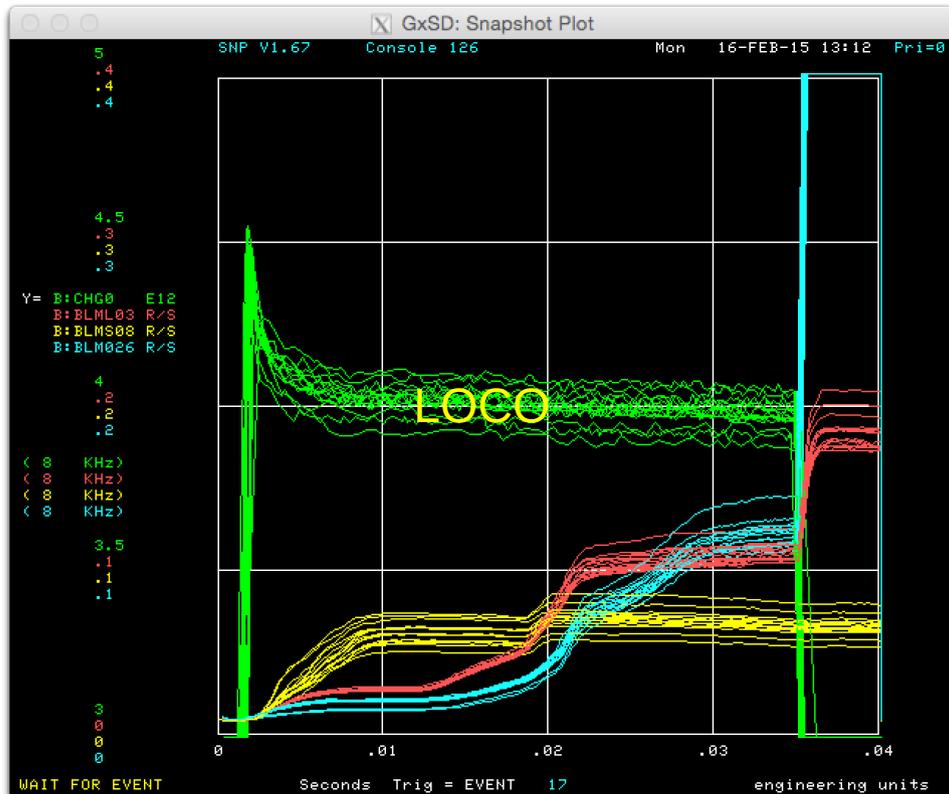
# LOCO

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04 Mar 2015

# Status

- Optics have been corrected. Last measurement in 26 Jan 2015.
  - Optics is quite stable so don't need to do it all the time.
    - Changes are small between LOCO corrections.
  - Quick check is to look at coupling which is always good.
- New devices have been created to support LOCO
  - dQ\* devices that add current to the QL and QS devices.
    - Example:  $QL01 + dQL$ ,  $QL02_{total} = QL02 + dQL$  etc.
    - Previously every QL has its own offset,
      - i.e.  $QL01 + offset01$ ,  $QL + offset02$  etc.
      - Cannot do it this because adding different offsets to each quad distorts corrected optics.
- Presently tuning quads and sextupoles to get tunes and chromaticities correct.
  - Very sensitive to these values!

# Efficiencies

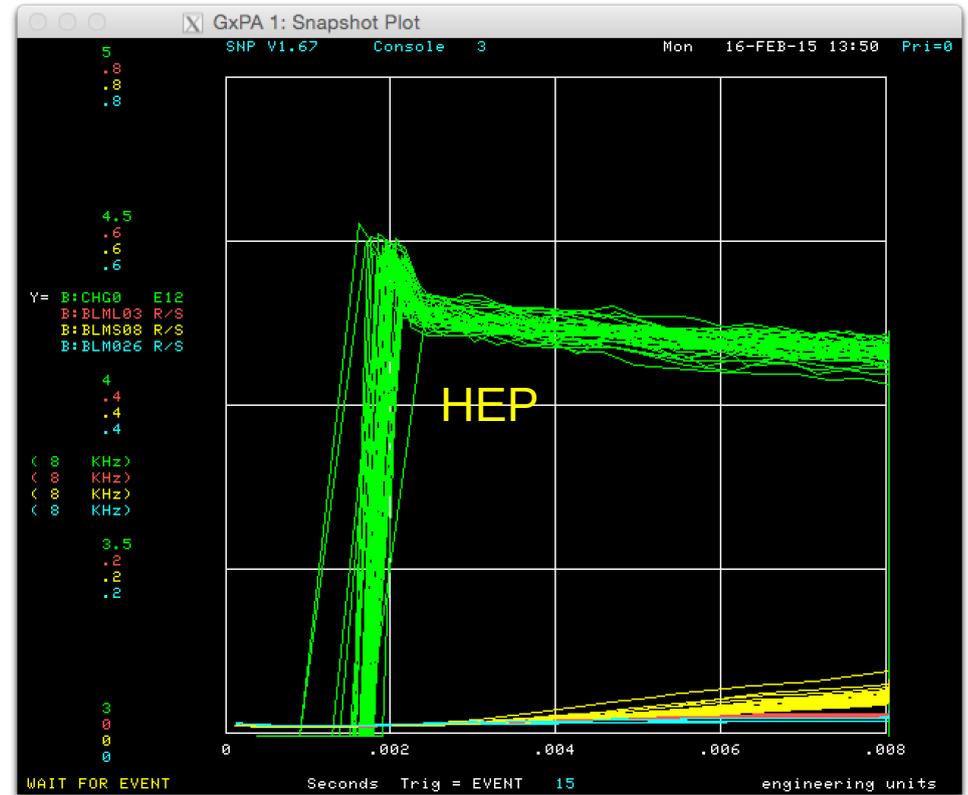
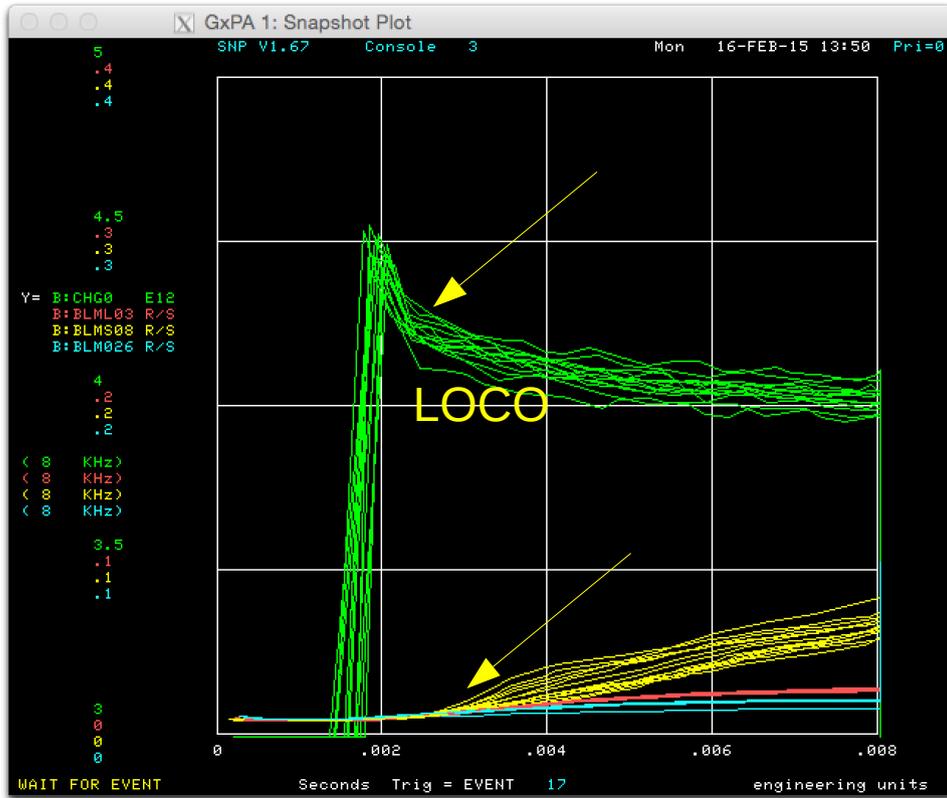


~2 – 3% lower than HEP, i.e. 89 – 90% rather than 91 – 92% for normal HEP.  
Most of the losses are the start of ramp.

Capture and start of ramp is critical!

Losses are higher also at various locations.

# Zoomed in view

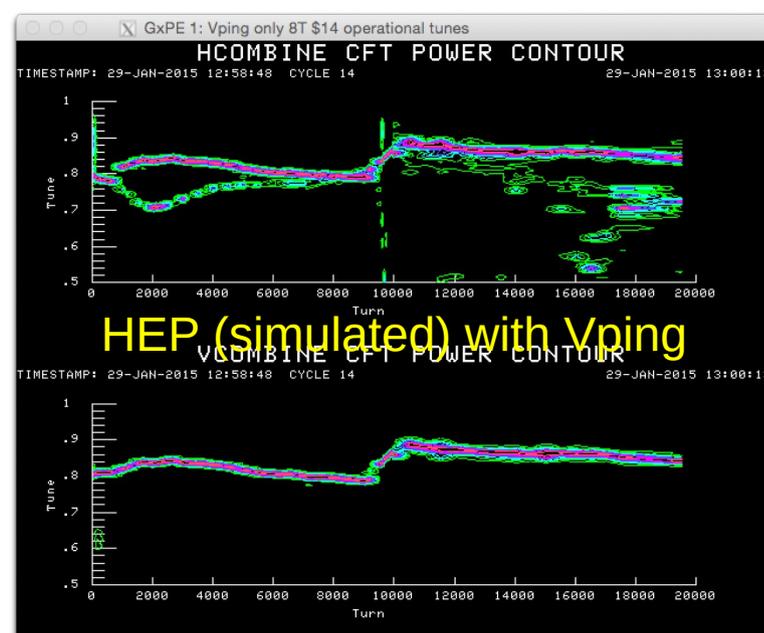
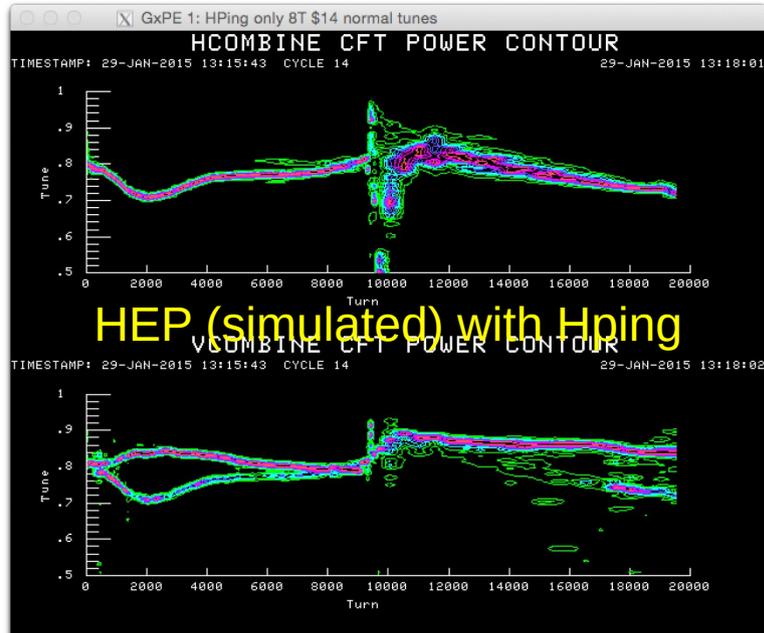
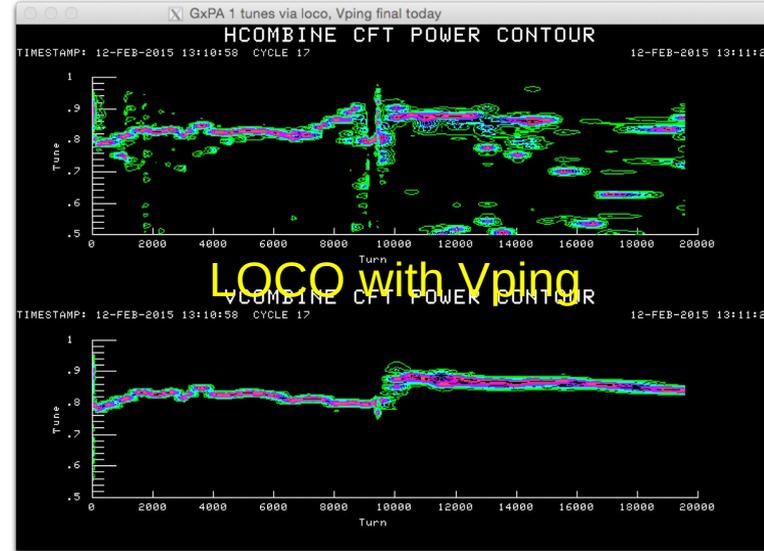
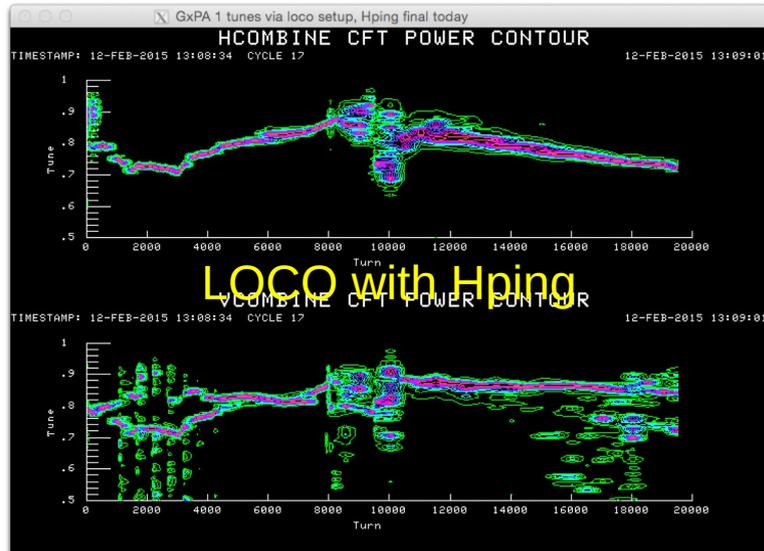


This clearly shows the problem is really at the start of ramp.

# What's the problem?

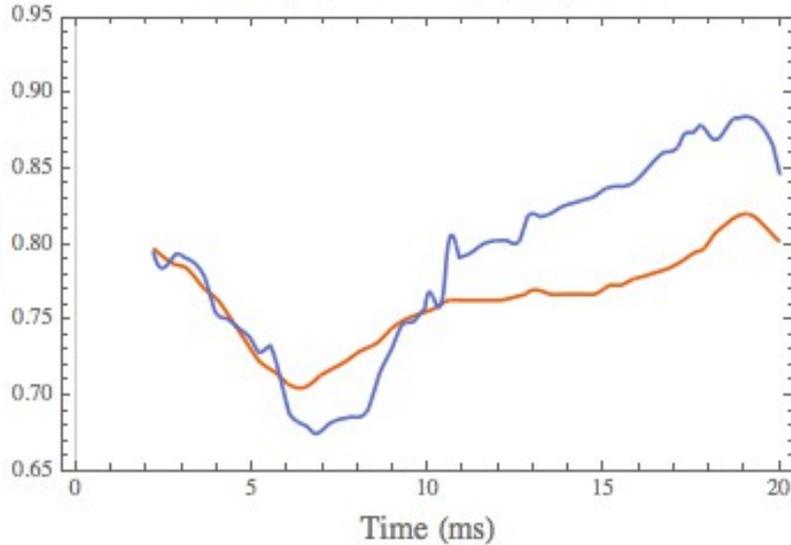
- Efficiency is **extremely** sensitive to tunes and chromaticity at the start of ramp. First 2 to 3 ms!
- We have used B15 to set the tunes.
  - Not very efficient way to do this.
    - No quick way to see effect of tune changes.
      - B100 doesn't report horz tunes.
        - Also got tricked because it doesn't see tunes in certain vertical slots.
      - For trustworthy tune measurement, use B38 TBT to reconstruct tunes from orbit motion from horz and vert pinger, i.e. destructive measurement.
  - I have written a Mathematica program to calculate the tune changes required.
    - It works but not quite accurate enough.
    - Have to do this offline to “measure” the tune and then calculate the correction.

# Comparsion to HEP tunes

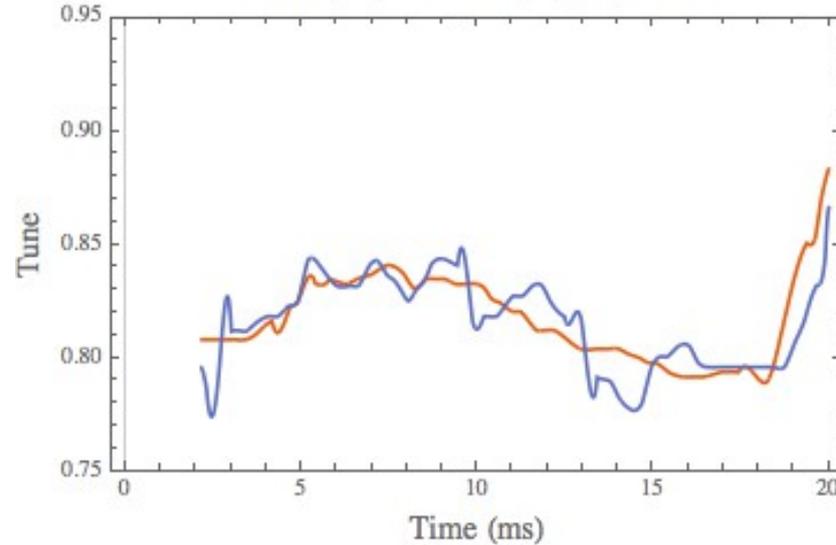


# Digitize (by hand) the measured and reference tunes

LOCO (blue) vs Reference (red) Qh Spectrum

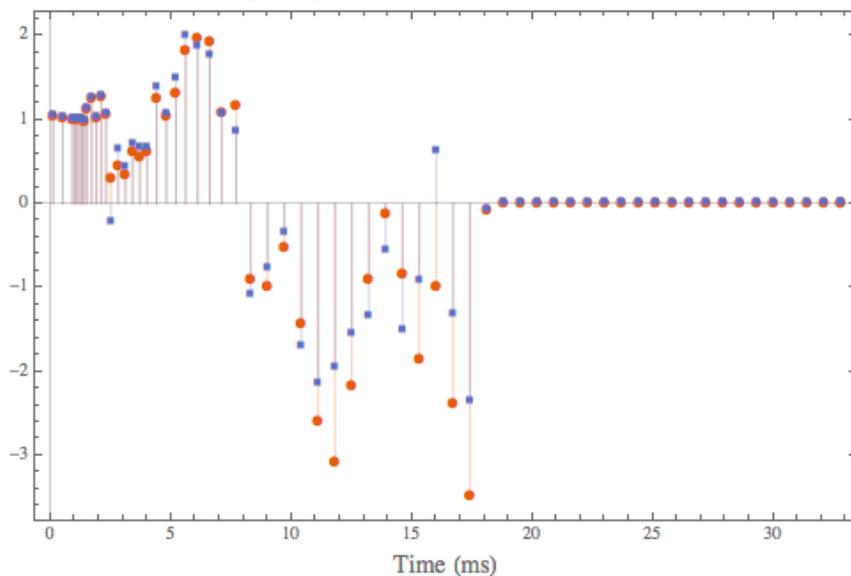


LOCO (blue) vs Reference (red) Qv Spectrum

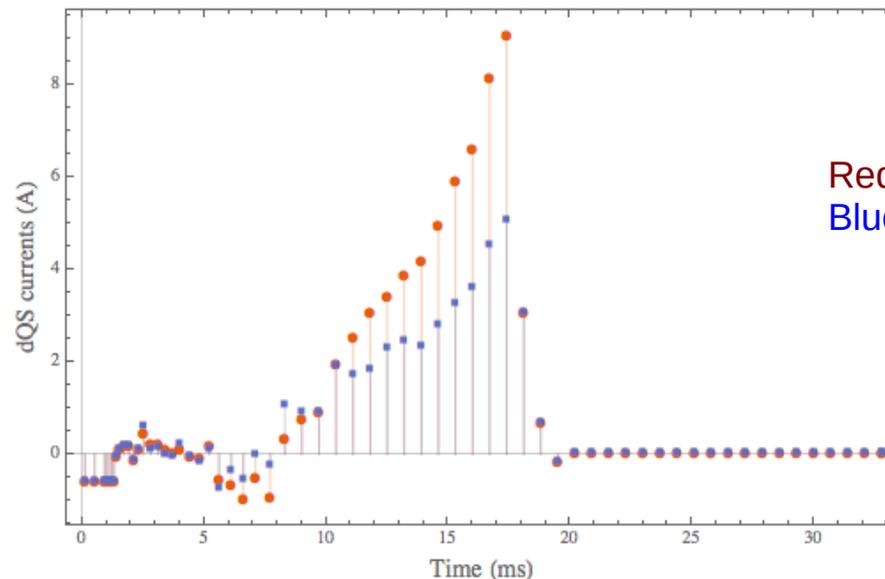


Red: HEP reference.  
Blue: LOCO

Comparing currents in dQL before and after



Comparing currents in dQS before and after



Red: Before  
Blue: After

# Todo

- Put in tune changes next studies
- Continue tuning to get to 90%.
  - Last 1 – 2% will require dedicated tuning.
  - Lower losses
    - Small tune and chromaticity changes at injection and capture should help.
- Are the tools mature enough to be used for operations?
- Do we transition to LOCO lattice for a few weeks to assess performance? Revert if necessary.