Booster Tune Measurement and Bunch Cleaning Upgrade Ideas

February 7th 2003

Nick Sereno

Booster Tune Measurement/Bunch Cleaning System Upgrade

- Purpose :
  - Bunch cleaning at injection (< 3 GeV) needed for direct injection/subharmonic capture to insure bunch purity
  - Dedicated dsp based tune measurement will eliminate the need for VSA/extraction kicker pinger system
- Status (Near to Mid term)
  - Bunch cleaning demonstrated in studies but inefficient (only keep single 352 MHz bucket out of 10 ns rf gun pulse)
  - Integrate tune measurement/bunch cleaning systems

Booster Tune Measurement/Bunch Cleaning System Upgrade

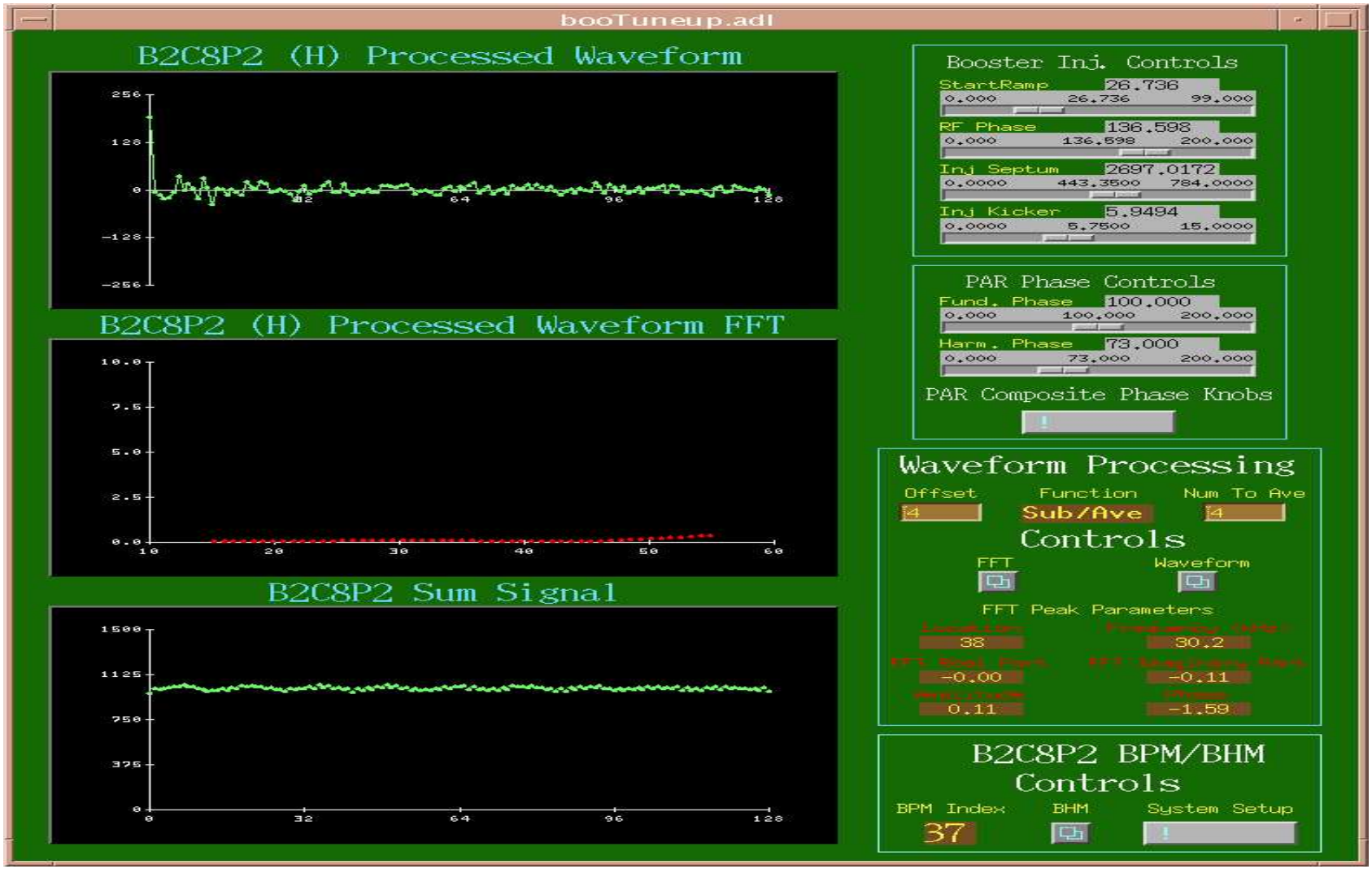
- Components:
  - Low level prototype rf switch and controls exist for bunch cleaning
  - Need two 100 W, 352 MHz cf, 10 MHz BW amplifiers for bunch cleaning
  - Need four 25 -50 W 352 MHz cf, 10 MHz BW amplifiers for tune measurement
  - Need to ramp the drive power for tune measurement amplifiers (use spare AFGs)

Booster Tune Measurement Idea

- Do waveform and DSP processing for tune measurement similar to longitudinal synchrotron tune using beam histories
- Effectively recreate functionality of HPVSA is the idea.
- Need to break up time domain waveform into equal pieces, FFT, then display tune peak vs time.

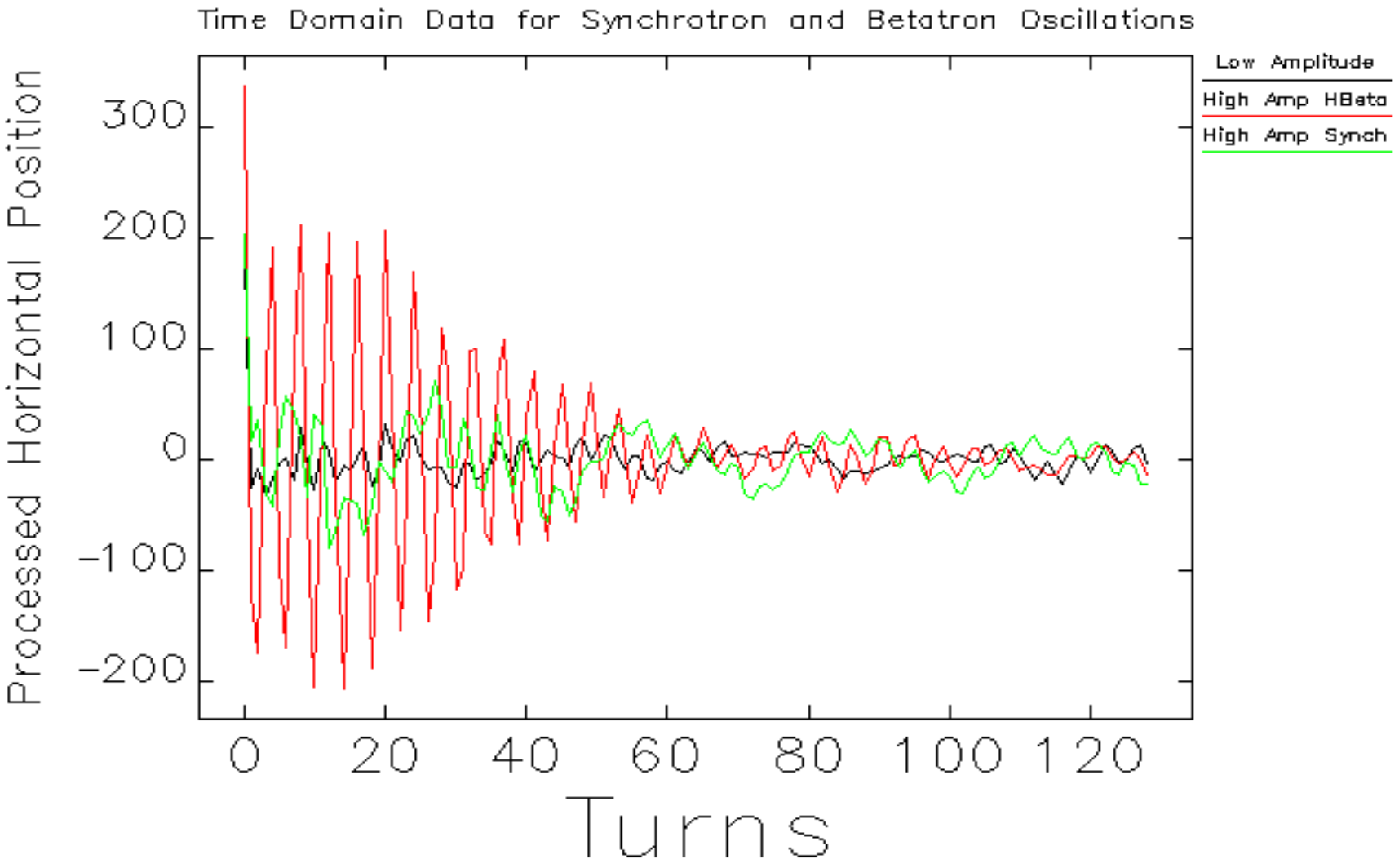
Booster Longitudinal Controllaw

- Operations Screen:



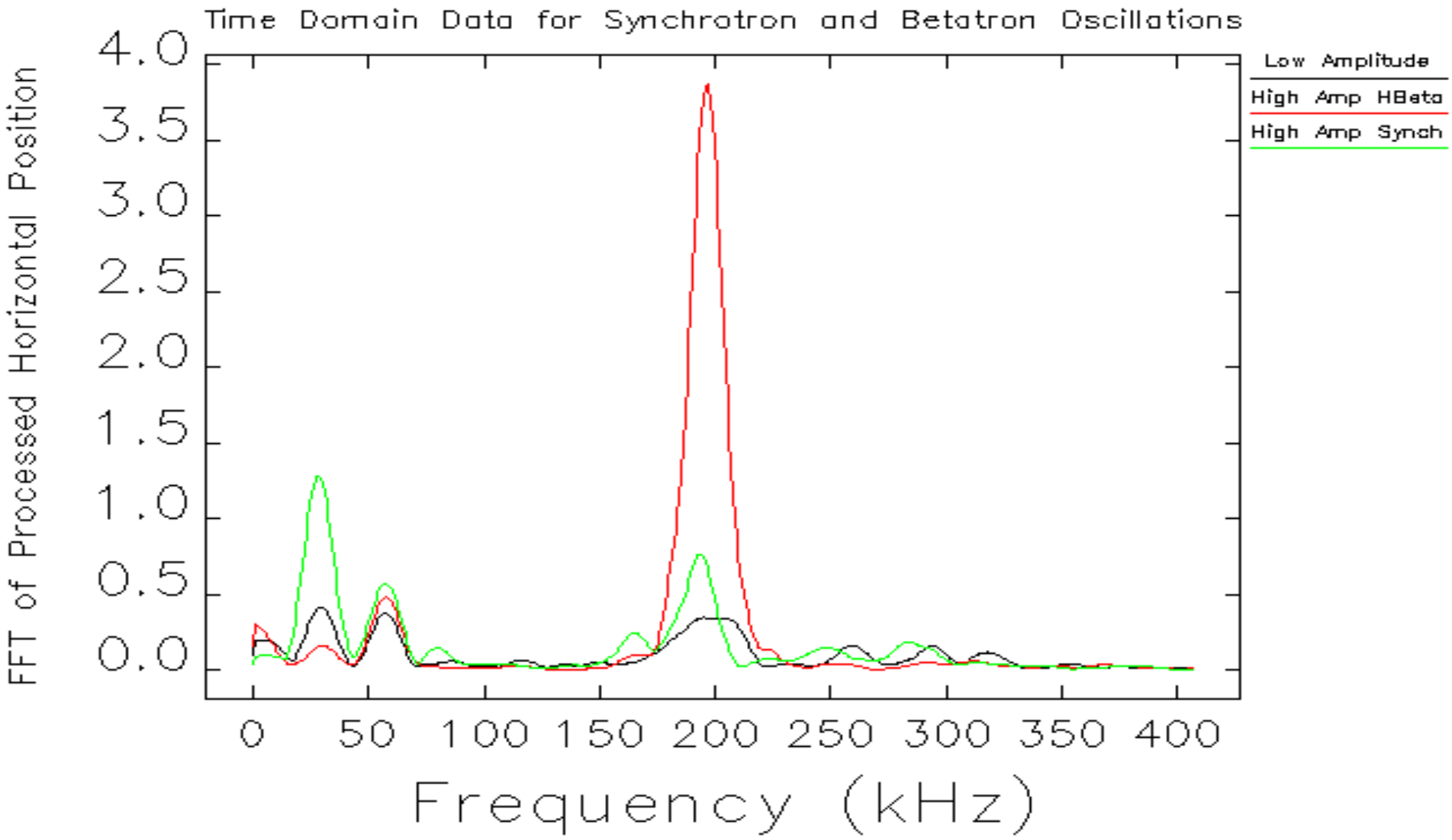
Longitudinal Controllaw Data

- Time domain tune data:



Longitudinal Controllaw Data cont.

- Frequency domain tune data:



Conclusion

- With existing synchrotron tune DSP based measurement also get horizontal tune information.
- Extend the idea:
  - Use existing tune measurement/driver striplines
  - Develop front end electronics/digitizer/DSP processing to acquire all 186000 booster turns
  - Have adjustable time domain waveform record length
  - Use processed tune signal to drive bunch cleaner
- Need to find out using beam histories betatron amplitude vs drive power as a function of energy (ramp time). Probably need to ramp the drive power.