SPS High Bandwidth Transverse Feedback System MD

J. M. Cesaratto

Feb. 6, 2013

1. Last attempt at data collection before the long shutdown.
2. We've been seeing an artifact in the spectrograms at tune 0.175, very close to the betatron tune. Try to determine what is causing this, by performing a series of tests.
 - (a) Record pickup (Ch1 - sigma, Ch2 - delta) and kicker load (Ch3) signals at 10 ns/div, 10 GS/s. 130206_210149. Process, produce spectrogram of delta signal. Line at 0.175 visible.
 - (b) Record strobe 4 Fiducial trigger in Ch2, 200 MHz clock in Ch3, use scope trigger Ch4 as usual to trigger scope. 213346. Process, produce spectrogram of strobe 4. Artifact visible.
 - (c) Wolfgang asks to have the SPS cycle changed to MD2 – SFTMD – MD1. Record sigma in Ch1, delta in Ch2, and kicker load in Ch3 as usual. 214405. Process, produce spectrogram of delta signal. Artifact visible at 0.174.
 - (d) Wolfgang asks to have MD1 removed from super cycle, MD2 – SFTMD – zero. 215355. Process, produce spectrogram of delta signal. Artifact visible at 0.174.
 - (e) Look at DAC out with 200 MHz burst, no modulation signal. Trigger scope with scope trigger, bunch setting 1302. Ch1 and Ch3 are still recording sigma and kicker load respectively, but will record nothing since bunch setting has changed. They are recorded, just to make processing easier. 220430. Artifact still at 0.174.
 - (f) John F. and Wolfgang find a loose cable on the 200 MHz distribution. Monitor pickup and kicker load signals. 220956. Artifact visible.
 - (g) Previously, static triggers for frev and scope trigger were on different 200 MHz distributions. Now they are on the same source. Monitor pickup and kicker load signals. 222322. Artifact visible.
 - (h) Record only sigma in Ch1 and delta in Ch2 at 20 GS/s. 223004. Artifact moved to 0.35!!
 - (i) Repeat at 5 GS/s. 223207. Many artifact lines!
 - (j) It seems that the scope is producing these artifacts. To avoid spectra contamination at our betatron tune, record only pickup signals for no on at 20 GS/s.
3. Time system as usual. Excite with 200 MHz burst signal, no modulation, monitor kicker load. Bunch delay 4088, Programmable delay 4.05 ns. 224611.
 - (a) 224808, 4.00 ns
 - (b) 224920, 4.00 ns
 - (c) 225206, 3.95 ns
 - (d) 225428, 3.90 ns

- (e) Timing appears to be different by about 100 ps as compared with yesterday. Use 3.95 ns on programmable delay.
4. Match feedback backend to excitation backend. Monitor superposition of signal on scope, maximize amplitude of the signal. 423 mV_{pp}. Feedback fiducial delay 4081. Programmable delay 0.8 ns. This matches yesterday's setting.
 5. Look at signal level of equalized delta. Wolfgang adjusts orbit to 0.2 mm. Adjust front end padding to 9 + 4 dB, for a signal of 320 mV_p.
 6. Time align front end to back end. ADC fiducial delay 26, Programmable delay 5.15 ns. Very close to yesterday's settings.
 7. Start measurements. See table 1. For these measurement, feedback is on continuously for all recorded turns.

Table 1: Data files acquired during feedback tests on Feb. 6 - 7, 2013.

Tek File (130207_)	Snapshot File	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
				# Turns	Gain	ϕ ($^\circ$)	
001053		33499		feedback OFF, excitation OFF			Measure tune, tune at 0.178
001134							
001221							
001302							
001342							
001712		33509	1.6	feedback OFF, excitation ON			Excite file: Feb-6-2342, 200 MHz AM chirp 0.19 - 0.17, see mode 1, minimal mode 0 excitation
001751		33510					
001836		33511	1.6				
001917		33512	1.7				
002006		33513	1.2				
002533		33521	1.8				Wolfgang lowers chroma slightly, $\Delta\xi = -0.01$.
002616		33522					
002659		33523	1.5				
002752		33524					No beam
002907		33526	1.7				Motion not as clear as before, set chroma back to original setting
003110		33529	1.6				Don't see much beam motion
003151		33530					About 20 dB range in spectrogram, can work with this

Continued on next page

Table 1 – continued from previous page

Tek File (130207_)	Snapshot File	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
				# Turns	Gain	ϕ ($^{\circ}$)	
004455	0044	33549	1.6		2	70	John F creates filter file Feb-7-042 recorded at 10 GS/s, no beam
004649	0046	33552					
004848	0048	33555					
005008							
005206	0052	33560	1.7		8	70	
005326	0053	33562					
005445	0054	33564	1.7				
005603	0055	33566					
010240	0102	33576	1.6		16	70	
010438	0104	33579					
010558	0106	33581					
010757	0107						
	0109	33587	1.6		32	70	Tek file not recorded, memory on scope full. DSP saturated
	0111	33589	1.6				
	0112	33591	1.5				
	0117	33598			1	250	No beam. Positive feedback on beam. 250 $^{\circ}$ at tun3 0.18. Feb-7-114
	0118	33600	1.6				
	0119	33602	1.6				
	0121	33604					
	0122	33606	1.5				No beam.
	0124	33609			2	250	
	0125	33611	1.7				
	0127	33613	1.5				
	0128	33615					
	0130				4	250	
	0131						
	0132	33622	1.2				
	0134	33624	1.5				Unstable Stable Stable Delayed unstable Stable
	0136	33627			8	250	
	0137	33629	1.6				
	0138	33631	1.7				
	0140	33633	1.7				
	0141	33635	1.5				Stable Unstable Unstable Stable
	0143	33638	1.5		16	250	
	0144	33640					
	0146	33642					
	0147	33644	1.5				

Continued on next page

Table 1 – continued from previous page

Tek File (130207_)	Snapshot File	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
				# Turns	Gain	ϕ ($^{\circ}$)	
	0148	33646	1.5				Unstable, this is when I realized the scope was not saving any-more data.
0158 48		33661	1.5	feedback OFF, excitation OFF			Take a few recordings with the scope
015925		33662	1.4				Stable
020005		33663	1.7				Stable
020124		33665		feedback OFF, excitation ON			Stable
020203		33666	1.7				Stable
020243		33667	1.6				Stable
020442		33670	1.7		16	250	Excitation on, Unstable
020523		33671	1.5				Unstable
020710							40 mV/div delta
020951							
021039							
021158		33681			16	250	
021236		33682	1.7				Excitation off, unstable
021316		33683	1.7				unstable
							Stable

8. Grow/Damp tests. See table 2. Turns correspond to the duration in turns in which negative feedback is applied, then positive feedback, then negative feedback. Negative feedback corresponds to a phase of 70° at 0.18 and positive feedback corresponds to 250° at 0.18.

Table 2: Data files acquired for grow/damp tests.

Tek File (130207_)	Snapshot File	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
				# Turns	Gain	ϕ ($^{\circ}$)	
021754	0217	33690	1.6	4k/4k/end	16/16/16	70/250/70	Excitation OFF
021913	0219	33692					No beam
022033	0220	33694					
022151	0221	33696	1.5				
022501	0224	33700		4k/8k/end	16/16/16	70/250/70	
022630	0226	33703	1.6				
022753	0227	33705	1.7				
022921	0229						
023106	0231			4k/8k/end	16/16/16	70/250/70	Excitation ON
023225	0232	33712					
023504	0234	33716	0.7				
025054	0250	33740		4k/8k/end	16/64/16	70/250/70	Excitation ON
025213	0252	33742					
025531	0255	3374					
025650	0256						

Continued on next page

Table 2 – continued from previous page

Tek File (130207_)	Snapshot File	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
				# Turns	Gain	ϕ ($^{\circ}$)	