SPS High Bandwidth Transverse Feedback System MD

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Feb. 3, 2013

1. Power was cycled on both the excitation and feedback chassis. Check timing of system in usual manner.
 - (a) Load excitation file Jan-22-932 to excitation system FPGA. Bunch delay 4088. Monitor kicker load
 - (b) Scan programmable delay. 4.10 ns - 130203_183223.
 - (c) 4.00 ns - 183336, looks good, set point.
 - (d) Feedback fiducial delay 4082, prog. delay 0.95 ns, matched to 4.00 ns of excitation prog. delay
 - (e) Monitor pickups
 - i. 183735, tune 0.172
 - ii. 183821, tune 0.173, see mode 0, 1, and 2. nice beam motion
 - iii. 183912, tune 0.182, less intensity but can see tune in spectrogram
 - (f) A series of lost cycles. Hannes increases chromaticity to stabilize beam, cycle lost again for LHC filling
2. John F. adds back end equalizer to on feedback DAC chain, just before the H9 hybrid. Observe the H9 sum signal of both DACs with a 200 MHz non modulated burst signal. Max level is 423 mV. Equalizer adds about 950 ps of delay, so adjust feedback back end programmable delay from 0.95 ns to 0.1 ns. Sum of DAC signals maximized ensures synchronization of excitation and feedback back ends.
3. Monitor beam motion on pickups once again.
 - (a) 201652, tune 0.175. see beam motion
 - (b) 201742
 - (c) 201833
4. Had trouble with the feedback system's USB not responding turning a snap shot acquisition. Reboot the feedback system, which means the system needs to be retimed again.
5. Retiming the system
 - (a) Excitation back end: bunch delay - 4088, Prog. delay 4.0 ns
 - (b) Feedback back end: fiducial delay - 4081, Prog. delay 5.15 ns
 - (c) Feedback front end: fiducial delay - 25, Prog. delay 3.2 ns
6. Monitor beam with pickups

(a) 215150, tune 0.17, sigma -35V

(b) 215436

7. Feedback USB still not running properly.

8. Excite measurements, save pickups and kicker load. See Table 1

Table 1: Data files acquired during beam excitation on Feb. 3, 2013.

Tek File (130203_)	Notes
220537	200 MHz (Mode 1) AM burst, chirp 0.17 – 0.19, Feb-3-2200
220642	
220806	
220924	
221031	
221147	
221906	Rectangular (Mode 0) AM burst, chirp 0.17 – 0.19, Feb-3-2213
222033	
222236	
222401	
222603	
222808	Records with no excitation
222858	
222947	
223037	
223129	

9. The problem with the feedback system's USB persists and is preventing us from acquiring snap shot data. We take data without it. Retime system again.

(a) Feedback back end: fiducial delay - 4081, Prog. delay - 3.9 ns

(b) Feedback front end: fiducial delay - 26, Prog. delay - 4.5 ns

(c) Record kicker load to ensure proper timing. Looks good. 231214

10. Start feedback measurements. Constant resistive feedback at 90° phase with various gain settings. See Table 2.

Table 2: Data files acquired during beam observation of pickups on Feb. 5, 2013.

Tek File (13020X_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ (°)	
231745			feedback OFF, excitation OFF			Tune 0.177
232400		1.3				
232513		1.8				
232605		1.8				
232720			15k	8	70	3k warm up turns, resistive damping, excitation OFF
232816		1.7				

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Tek File (130203_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ ($^{\circ}$)	
232927						
233156		1.6				
233251		1.6				
233609		1.8	15k	8	70	excitation ON with mode 1 drive, 3k warmup turns
233659		1.5				
233749		1.3				
233840		1.3				
233930		1.7				
234021		1.2	15k	16	70	3k warm up turns
234112		1.7				
234201		1.8				
234252		1.4				
234342	26466	1.4				
234433	26468	1.2	15k	32	70	
234523	26470	1.8				
234613	26472	1.8				
234704	26474	1.9				
234755	26476	1.5				
234845	26478	1.6	15k	4	70	
234935	26480	1.4				
235025	26482	1.7				
235116	26484	1.7				
235206	26486	1.9				
235256	26488					

11. Various feedback measurements. See Table 3

Table 3: Data files acquired during beam observation of pickups on Feb. 5, 2013.

Tek File (13020X_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ ($^{\circ}$)	
130203_235814			8k/500/end	8/8/8	70/250/70	excitation OFF, no warmup turns
235939			8k/1k/end			
130204_000007						
000121	26508	1.6				
000403	26515		3k/8k/end	8/16/8	70/250/70	
000508	26517	1.7				
000558	26519	1.7				
000648	26521	1.4				
000741	26523	1.8				
000855	26525	NB				No beam
001035	26530	1.7	3k/8k/end	16/16/16	70/250/70	
001125	26532	1.4				
001216	26534	1.7				

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Tek File (13020X_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ ($^{\circ}$)	
001306	26536	1.8				
001357	26538	1.5				
001538	26542	1.8				
001924	26551			feedback OFF		Prepare more unstable beam
002015	26553	1.8	continuous	8	70	Stable
002110	26555	1.8				Unstable
002220	26558	1.6				Stable
002311	26560	1.2				Unstable
002402	26562	1.2				Stable-ish
002517	26565	1.8	8k/2k/8k	8/2/8	70/250/70	Stable
002607	26567	1.3				Stable
002658	26569					Stable
002749	26571		8k/3k/8k	8/2/8	70/250/70	Stable
002839	26573	1.8				Unstable
002929	26575	1.8				Unstable
003020	26577	1.3				Stable
003111	26579	1.2				Stable
003315	26584	1.8	8k	8	70	Unstable, resistive feedback ON for 8k turns, then OFF
004617	26615		8k/3k/end	8/2/8	70/250/70	Chromaticity sweep negative at 1471 ms after injection, which corresponds to a change within the first 8k turns
004708	26617	1.4				Stable
004758	26619	1.6				Stable
004848	26621	1.5				Stable
004939	26623	1.7				Stable
005029	26625	1.0				Stable
005209	26629	1.5	8k/3k/end	16/2/16	70/250/70	Unstable
005301	26631	1.7				Unstable
005350	26633	1.5				Stable
005441	26635	1.5				Stable
005540	26637	1.6				Stable
005944	26647	1.7	continuous	8	70	excitation ON with 200 MHz (mode 1) AM drive, chirp, injection delay 2k turns. Try to place excitation at chroma sweep
010034	26649	1.8				Unstable
010125	26651	1.0				Stable
010214	26653	1.8				Stable
010306	26655	1.0				Stable
010356	26657	1.8				Unstable, DSP saturated
010447	26659	1.7				Unstable, DSP saturated

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Tek File (13020X_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ ($^{\circ}$)	
010537	26661	NB				No beam
010627	26663	1.7				Unstable, DSP saturated
010717	26665					Stable
010808	26667	1.6	continuous	16	70	Stable
010902	26669	1.2				Stable
011013	26672	1.8				Unstable, DSP saturated
011104	26674	1.7				Stable
011219						
011335	26679	1.3	continuous	4	70	Unstable
011426	26682	1.8				Unstable
011516	26684	1.8				Stable
011607	26686	1.8				Unstable
011657	26688	1.5				Unstable
012340	26704	1.8	continuous	8	70	excitation ON with 300 MHz (mode 1.5) AM drive, chirp 0.195 – 0.18, Feb-4-0121, injection delay 2k turns. Same feedback filter as mode 1 drive above. Unstable
012430	26706	1.1				Stable
012520	26708	1.3				Stable
012612	26710	NB				No beam
012702	26712	1.8				Unstable
012752	26714	1.0				Unstable
012842	26716	1.6				Unstable
012933	26718	1.0				Stable
013049	26721	1.3				Chromaticity increased, close to 0. Stable. Modes 0,1,2 seen in bbq
013139	26723	1.8				Stable
013229	26725	1.7				Stable
013320	26729	1.7				Stable
013410	26731	NB				No beam
013501	26731	NB				No beam. Something weird happening with super cycle number, a repeat.
	26735					Change of cycle to fill LHC.
025100	26835		continuous	8	70	Our cycle returns after LHC fill, resume measurements. Cool transient.
025151	26837	NB				No beam
025240	26839					Stable
025331	26841					Stable
025421	26843	1.8				
025536	26846	1.7				Stable

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Tek File (13020X_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ ($^\circ$)	
025717	26850	1.1	continuous	4	70	Stable
025808	26852	1.4				Stable
025923	26855					Stable
030004	26857					
030130	26860	1.7				Stable
030245	26863					Stable
030426	26867	1.4	continuous	8	70	Stable
030516	26869	1.5				Stable
030632	26872	1.8	continuous	16	70	Unstable, DSP saturated.
030722	26874	1.7				Unstable, DSP saturated.
030812	26876	1.2				Unstable
030903	26878	1.7				Unstable, DSP saturated
030954	26880	1.5				Unstable, DSP saturated
031224	26886	1.7	8k/2k/end	8/2/8	70/250/70	Unstable
031314	26888	1.8				Unstable, interesting bbq
031405	26890	1.7				Stable
031456	26892	1.3				Unstable
031548	26894					
031703			continuous	2	70	
031817	26900	1.5				
031933	26903					Stable
032024	26905	1.7				Unstable
032114	26907	1.8				Stable
032204	26909					Unstable
032822	26924	1.1	continuous	8	70	excitation ON with 400 MHz (mode 2) AM drive, chirp 0.205 – 0.18, Feb-4-324, injection delay 2k turns.
032913	26926	NB				No beam
033003	26928	1.6				Unstable
033053	26930	1.4				Unstable
033143	26932	1.9				Unstable, DSP saturated
033234	26934	1.8				Unstable, DSP saturated
033507	26940	1.7	feedback OFF			4 consecutive shots have been stable with feedback OFF, and excitation ON. With feedback ON and excitation OFF beam is unstable. It seems that the system is behaving opposite of the way it should.
035721			feedback OFF			excitation ON with phase modulation, chirp 0.17 – 0.19, Feb-4-354
035837	26995					

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Tek File (13020X_)	Cycle #	Intensity ($\times 10^{11}$ p)	Filter Information			Notes
			# Turns	Gain	ϕ ($^{\circ}$)	
035952	26999					
040044	27001					
040134	27003					
040248	27006		continuous	8	70	Unstable
040404	27008					Unstable
040609	27014	1.8				Unstable, DSP saturated
040702	27016	NB				No beam

12. Not sure what was happening with the last set of measurement from about 03:30 on. The beam was unstable with feedback on, and stable with feedback off. Need to look into this more closely.