SPS High Bandwidth Transverse Feedback System MD

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1. First MD of 2013.
2. Check trigger levels to determine thresholds
 - (a) Injection trigger
 - i. Excitation: 600 mV_p, 11 μ s
 - ii. Feedback: 600 mV_p, 11 μ s
 - (b) Revolution trigger
 - i. Excitation: 600 mV_p, 5 ns
 - ii. Feedback: 600 mV_p, 5 ns
 - (c) Synchronized clock
 - i. Excitation: 153 mV_{pp}
 - ii. Feedback: 160 mV_{pp}
 - (d) Thresholds
 - i. Injection: 0.6 mV
 - ii. Revolution: 0.35 mV
3. Check back end bunch/signal synchronization (timing) on excitation system
 - (a) Monitor kicker load, excitation ON with 200 MHz non modulated signal, 2k warmup turns, 15k turns signal applied, Jan-22-932. Bunch delay 4089. Cycle to cycle there seems to be a 1 turn delay present after the 2k warmup turns. The signal is played out either on turn 2001 or 2002. Why is this? See Table 1 for kicker load measurements.

Table 1: Data files acquired during back end synchronization of the excitation system, monitoring the kicker load on Jan. 22, 2013.

Tek File (130122_)	Prorammmable delay (ns)	Turn (signal on)	Notes
100018	2.55	2002	
100524	2.65	2001	
101007	2.75	2001	
101324	2.85	2002	Good synchronization between bunch and excitation signal. Use this delay setting

4. Note that the programmable delay setting is different from yesterday's by 2.20 ns (was 5.05, now 2.85) we set during setup.
5. Measure beam response with pickups to check timing. excitation signal 200 MHz amplitude modulated chirp 0.175 – 0.195, 2k warmup turns, 15k signal turns, Jan-22-1018. See Table 2.

Table 2: Data files acquired during beam response measurements, monitoring the pickups on Jan. 22, 2013.

Tek File (130122_)	Prorammmable delay (ns)	Notes
113143	2.85	excitation ON
113254		
113342		
113425		
113508		
113621	2.75	For all data up to this point, the tune was too low, now things should be ok. restart the scan
114318	2.85	
114447		
114531		Cannot see beam motion in the spectrograms, ask for chromaticity to be reduced
114615		
114705		Super cycle changed
131022	2.85	Lower chromaticity beam, lower tune, strong mode 0
131422		Recorded with excitation OFF, to observe natural beam motion
132015		tune 0.184
132211		tune 0.175, 0.0025 increase in chromaticity from unknown absolute value, $\frac{\Delta Q/Q}{\Delta P/P} = 0.05$, $Q' = \frac{\Delta Q}{\Delta P/P} = 1.3$. excitation ON
132504		
133112		create new 200 MHz AM file, chirp 0.165 – 0.195, Jan-22-1326
133314		
133403		

6. Timing looks off by about half of a bucket. Check kicker load again. See Table 3.

Table 3: Data files acquired during back end synchronization of the excitation system, monitoring the kicker load on Jan. 22, 2013.

Tek File (130122_)	Prorammmable delay (ns)	Turn when signal on	Notes
133918	2.85	2002	
134123	0.35	2002	
134527	1.35	2002	
134846	1.00	2002	

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Tek File (130122_)	Prorammmable delay (ns)	Turn when signal on	Notes
135108	0.80		
135209	0.90		
135629	0.95		Good synchronization, use this delay setting

7. Monitor pickups for beam motion again. See Table 4

Table 4: Data files acquired during beam response measurements, monitoring the pickups on Jan. 22, 2013.

Tek File (130122_)	Prorammmable delay (ns)	Notes
140125	0.95	
140225		
140323		
140418		
140524		

8. It appears that the synchronization of the system is lost. Possible causes could be on a super cycle switch, or something strange is happening during the ion ramps. Not a good sign since our cycle is changed every time the LHC needs to be refilled. Match feedback system back end with excitation system back end. Programmable delay 0.6 ns.
9. Front end signal level through receiver chain is 300 mV_p.
10. Time up front end. generate a 5 ns rectangular signal with the excite system to simulate the ADC sampling window. Acquire pickup signal with the ADC. Set filter to pass through mode. Monitor pickup signal from feedback back end. Measure on scope if pickup signal and rectangular wave are coincident. Move rectangular wave 10 ns and measure from the peak of the pickup signal to the near edge of the rectangular wave, should be 7.5 ns for proper alignment. ADC fiducial delay 30, programmable delay 3.78 ns. Acquire several scope recordings of this: 163209, 163342.
11. Timing settings
 - (a) Excitation back end
 - i. Bunch delay 4089
 - ii. Programmable delay 0.95 ns
 - (b) Feedback back end
 - i. Fiducial delay 4081
 - ii. Programmable delay 0.6 ns
 - (c) Feedback front end
 - i. Fiducial delay 30
 - ii. Programmable delay 3.7 ns
12. Check timing of back end once more by monitoring the kicker load, adjust slightly
 - (a) Excitation back end, 1.00 ns

(b) Feedback back end, 0.65 ns

13. Observe pickups quickly again. With excitation OFF 173043, 173345, With excitation ON 173854, tune 0.173
14. Close the loop! 5 tap filter. 2000 warmup turns See Table 5

Table 5: Data files acquired during closed loop measurements on Jan. 22, 2013.

Tek File (130122_)	Feedback applied (turns)	gain	phase	Notes
175229	50	1	3	No kick visible since wide band gate was not enabled
175451	100	1	3	
175649	100	2	3	
175911	100	4	3	
180059	100	8	3	See amplifier response in kicker load
180208	100	16	3	
180311	100	1	3	
180436	100	2	3	
180726	100	8	3	
180841	200	8	3	
181004	400	8	3	
181057	500	8	3	
181305	100	16	3	
184336	250	16	3	
184507	500	16	3	Flip sign of filter, no amplifier response
185041	100	1	183	
185206	100	2	183	
185314	100	4	183	
185420	100	8	183	See amplifier response
185541	250	8	183	
185647	500	8	183	
190002	500	16	183	
190228	200	32	183	Increased amplifier response
190302	200	32	183	
190518	200	32	3	
190824	100	1	93	
191000	250	2	93	
191414	250	4	93	
191517	250	16	93	
191623	500	16	93	
191807	250	32	93	Increased amplifier response
192152	100	1	273	
192250	250	4	273	
192359	250	16	273	
192524	500	16	273	
192658	500	32	273	Increased amplifier response
192757	500	32	273	
192937	500	32	273	

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Tek File (130122_)	Feedback applied (turns)	gain	phase (°)	Notes
193308	500	32	93	
193501	1000	32	93	Timing shifted!
193815	1000	32	93	
194045	1000	32	93	John D. disconnects and reconnects sample clock, no effect.