Update on the new optics for off-momentum beating

16/Dec/2008 LCU section meeting Masamitsu Aiba Thanks to Massimo, Stephane and Thys

Introduction

- Study was initiated to have π/2 phase advance between two main collision points and arrives π/2 for the right side (IP5-IP1) in H and the left side (IP1-IP5) in V
 LCU 26th Aug., 6th Oct. and 4th Nov.
- For the off momentum beta-beating, $\pi/2$ for the left side in both planes is preferable
- Flexibility of horizontal phase advance in IRs is not enough to have $\pi/2$ for the left side \rightarrow Use the arcs
- Additional improvements
 - Eliminating beam1-2 phase advance split
 - Zero dispersion in IR7 LSS
 - Aperture as much as possible
 - Cleaning up IR phase advances not to have fractional later than 4th digit, for example 2.272000, except for IR4 and IR7



	V6.503s	2 colisior	۱										
	Bcam1									MUX I	MUY		
	IR1	IR2	IR3	IR4	IR5	IR6	IR7	IR8	IP1	0.00	0.00		0.75
MUX	2.633	2.986	2.260	2.12940	2.633	2.015	2.49060	3.059	IP5	32.06	29.75	0.25	
MUY	2.649	2.809	1.990	1.95787	2.649	1.780	2.01413	2.782	IP1L	64.31	59.32		0.57
	Beam2												
	IR1	IR2	IR3	IR4	IR5	IR6	IR7	IR8	IP1	0.00	0.00		0.75
MUX	2.633	2.986	2.260	2.12860	2.633	2.015	2.49140	3.059	IP5	32.06	29.75	0.25	
MUY	2.649	2.809	1.990	1.95713	2.649	1.780	2.01487	2.782	IP1L	64.31	59.32		0.57

- Never touch IR1 and IR5
- Minimize the changes in IR2 and IR8
- Increase hor. phase advance 0.19 in the left side (32.06+0.19=32.25)
 - -0.02 in IR7, +0.02 in the left side with IR3 and/or 4
 - +0.085 in Arc23,34 and -0.85 in Arc67,78

Updated optics

	V6.503 (Beam1	collision											MUX	MUY			
	IR1	IR2	ARC23	IR3	ARC34	IR4	IR5	IR6	ARC67	IR7	ARC78	IR8	IP1	0.00	0.00		
MUX	2.633	2.986	5.499	2.261	5.527	2.045	2.633	2.015	5.499	2.450	5.527	3.183	IP5	31.98	29.65	0.98	0.65
MUY	2.649	2.809	5.098	1.905	5.073	1.941	2.649	1.780	5.099	1.924	5.074	2.974	IP1L	64.31	59.32		
	Beam2	100		102		104	100	IDC	40007	107	40070	IDO	104	0.00	0.00		
	IR1	IR2		IR3		IR4	IRS	IRO	ARC67	IR/	ARC/0	IRO	IP1	0.00	0.00		
MUX	2.633	2.991	5.527	2.260	5.499	2.125	2.633	2.015	5.527	2.489	5.499	3.059	IP5	32.06	29.76	0.06	0.76
MUY	2.649	2.844	5.074	1.990	5.099	1.934	2.649	1.780	5.073	2.003	5.098	2.782	IP1L	64.31	59.32		
	V6.503s Beam1	3 collisio	n														
	Deann													MUX	MUY		
	IR1	IR2	ARC23	IR3	ARC34	IR4	IR5	IR6	ARC67	IR7	ARC78	IR8	IP1	MUX 0.00	0.00		
MUX	IR1 2.633	IR2 2.986	ARC23 5.583	IR3 2.272	ARC34 5.612	IR4 2.13830	IR5 2.633	IR6 2.015	ARC67 5.415	IR7 2.46974	ARC78 5.442	IR8 3.059	IP1 IP5	MUX 0.00 32.25	MUY 0.00 29.75	0.25	0.75
MUX MUY	IR1 2.633 2.649	IR2 2.986 2.809	ARC23 5.583 5.098	IR3 2.272 1.990	ARC34 5.612 5.073	IR4 2.13830 1.95797	IR5 2.633 2.649	IR6 2.015 1.780	ARC67 5.415 5.099	IR7 2.46974 2.01403	ARC78 5.442 5.074	IR8 3.059 2.782	IP1 IP5 IP1L	MUX 0.00 32.25 64.31	MUY 0.00 29.75 59.32	0.25	0.75
MUX MUY	IR1 2.633 2.649 Beam2	IR2 2.986 2.809	ARC23 5.583 5.098	IR3 2.272 1.990	ARC34 5.612 5.073	IR4 2.13830 1.95797	IR5 2.633 2.649	IR6 2.015 1.780	ARC67 5.415 5.099	IR7 2.46974 2.01403	ARC78 5.442 5.074	IR8 3.059 2.782	IP1 IP5 IP1L	MUX 0.00 32.25 64.31	MUY 0.00 29.75 59.32	0.25	0.75
MUX MUY	IR1 2.633 2.649 Beam2 IR1	IR2 2.986 2.809 IR2	ARC23 5.583 5.098 ARC23	IR3 2.272 1.990 IR3	ARC34 5.612 5.073 ARC34	IR4 2.13830 1.95797 IR4	IR5 2.633 2.649 IR5	IR6 2.015 1.780 IR6	ARC67 5.415 5.099 ARC67	IR7 2.46974 2.01403 IR7	ARC78 5.442 5.074 ARC78	IR8 3.059 2.782 IR8	IP1 IP5 IP1L IP1	MUX 0.00 32.25 64.31 0.00	MUY 0.00 29.75 59.32 0.00	0.25	0.75
MUX MUY MUX	IR1 2.633 2.649 Beam2 IR1 2.633	IR2 2.986 2.809 IR2 2.986	ARC23 5.583 5.098 ARC23 5.612	IR3 2.272 1.990 IR3 2.272	ARC34 5.612 5.073 ARC34 5.583	IR4 2.13830 1.95797 IR4 2.13749	IR5 2.633 2.649 IR5 2.633	IR6 2.015 1.780 IR6 2.015	ARC67 5.415 5.099 ARC67 5.442	IR7 2.46974 2.01403 IR7 2.47052	ARC78 5.442 5.074 ARC78 5.414	IR8 3.059 2.782 IR8 3.059	IP1 IP5 IP1L IP1 IP5	MUX 0.00 32.25 64.31 0.00 32.25	MUY 0.00 29.75 59.32 0.00 29.75	0.25	0.75

Off momentum beta-beating



Off momentum beta-beating is confined in the left side

Off momentum beta beating in IR3B1



Phase advance between the primary and secondary collimator ~0.5 Same phase for the beta-beating ~1.0

Off momentum beta beating in IR3B2



IR7 optics



Zero dispersion in LSS for both B1 and B2, thanks to the new phase advance and the new boundary condition

Summary

- IP1-IP5 phasing $-\pi/2$ for the left side (IP1 to IP5) in both planes
 - Off momentum beta-beating is confined to the left side
 - Quite good for IR7 (betatron collimation)
 - Acceptable for IR3 (momentum collimation) ??
- Additional improvements
 - Eliminating beam1-2 phase advance split
 - Zero dispersion in IR7 LSS
 - Cleaning up IR phase advances not to have fractional later than 4th digit, for example 2.272000, except for IR4 and IR7
- Detailed check and finalizing will be done
 - Aperture check (OK with quick look), optimization as much as possible
 - Q strength check (OK with quick look)
 - Avoid very weak excitation (less than \sim 5 A) in trim quads and warm quads in IR3 and 7
 - Pre-squeezing and Squeezing for IR2 and 8
 - etc...