



## **Tevatron Run II Separator Settings**

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### **Introduction**

The settings of the Tevatron separators have changed during the course of Collider Run II as we have gained experience with beam-beam effects and have modified the helical orbit. Most recently a new set of vertical separators were installed at D17 and will be used in part to modify the collision helix. During this installation all of the separators were fitted with polarity switches and the naming convention was changed slightly.

This note provides some documentation on the polarity conventions for the separators and the design values for the strengths of the separators as of November 2004.

### **Polarity Conventions**

The sign convention for the Tevatron separators is such that:

- A separator with a Positive polarity kicks protons upward or radial inward.
- The sign convention for the separators is the same as the Tevatron DFGs.
- Note that the horizontal polarity convention for the Tevatron is opposite of the MAD convention for the horizontal separators. In the MAD convention a Positive value for the strength of a horizontal separator will kick protons to the radial outside.
- The readback voltages for the Tevatron separators are always a positive value. The polarity of the kick is determined by the polarity switch.

## Separator Polarities

Table of Separator Polarities for Collider Run II

Location	ACNET Name <sup>1</sup>	Polarity at Injection <sup>2</sup>	Polarity at Collisions
B11 HORZ	C:B1SHx	Positive	Negative
B17 HORZ	C:B7SHx	Negative	Positive
C49 HORZ	C:C4SHx		Negative
D11 HORZ	C:D1SHx		Positive
D48 HORZ	C:D4SHx		Positive
A49 HORZ	C:A4SHx		Negative
B11 VERT	C:B1SVx	Negative	Positive
C17 VERT	C:C7SVx	Negative	Negative
C49 VERT	C:C4SVx		Positive
D11 VERT	C:D1SVx		Positive
D17 VERT	C:D7SVx		Negative
A17 VERT	C:A7SVx		Negative
A49 VERT	C:A4SVx		Negative

<sup>1</sup> x is M or P for the plus and minus supplies on the separator.

<sup>2</sup> Positive Polarity kicks protons upward or radial inward.

The only separators that change polarity during the shot setup are the B11 Horizontal, the B17 Horizontal, and the B11 Vertical.

- The B17 Horizontal changes polarity at Low Beta Step 12 of the squeeze where the transition is made from the injection helix to the collision helix.
- The B11 Horizontal and B11 Vertical change polarity at Low Beta Step 12 but are actually a zero voltage from Low Beta Step 4 until Low Beta Step 12.

## Design Separator Settings

These tables show the design separator settings for the Tevatron Collider Run II as of November 5<sup>th</sup> 2004. The actual separator settings used in the Tevatron may vary from these settings as the helix is tuned up. In particular, the strengths of the separators at injection are often adjusted in a trade-off between larger separations which reduces beam-beam effects and smaller separations which improves beam aperture. The separator settings at collisions are also adjusted empirically in the Tevatron to ensure a head on collision at the D0 and B0 interaction regions.

As of November 5<sup>th</sup> 2004 the design separator settings at injection and through the low beta squeeze (sequences 1 through 25) are the same as the separator settings used in the Tevatron according to the C49 program.

**Design Strengths for the Horizontal Separators at Injection, During the Squeeze, and at Collisions.**

**Units are MV/m in the MAD program convention.**

State or Low Beta Sequence	Lattice Step	B11H (Mv/m)	B17H (Mv/m)	C49H (Mv/m)	D11H (Mv/m)	D48H (Mv/m)	A49H (Mv/m)	
Injection	1	-1.403	2.443	----	----	----	----	
1	1	-0.095	4.757	----	----	----	----	
2	2	-0.880	4.757	----	----	----	----	
3	3	-0.543	4.757	----	----	----	----	
4	4	0.0	4.757	----	----	----	----	
5	5	0.0	4.757	----	----	----	----	
6	6	0.0	4.757	----	----	----	----	
7	7	0.0	4.757	----	----	----	----	
8	7	0.0	4.757	----	----	----	----	
9	8	0.0	4.757	----	----	----	----	
10	9	0.0	4.757	----	----	----	----	
11	10	0.0	4.757	----	----	----	----	
12	11	0.0	4.757	----	----	----	----	
13	12	0.0	4.757	----	----	----	----	
14	12	0.0	4.757	----	----	----	----	
15	12	0.0	4.627	----	----	----	----	
16	12	1.168	3.370	2.702	-3.245	0.0	0.0	
17	12	0.232	0.0	4.176	-3.906	-0.389	0.0	
18	12	0.232	0.0	4.176	-3.906	-0.389	0.0	
19	12	0.523	-1.547	3.739	-3.456	-0.325	0.0	
20	13	0.553	-1.658	3.696	-3.430	-0.381	0.0	
21	13	0.553	-1.658	3.696	-3.430	-0.381	0.0	
23	14	0.591	-1.762	3.658	-3.411	-0.457	0.0	
24	16	0.610	-1.875	3.336	-3.639	-0.546	0.0	
25	16	0.610	-1.875	3.336	-3.639	-0.546	0.0	
Collisions		4.000	-1.903	3.719	-3.470	-0.603	4.000	

**Design Strengths for the Vertical Separators at Injection, During the Squeeze, and at Collision.**

**Units are MV/m in the MAD program convention.**

State or Low Beta Sequence	Lattice Step	B11V (Mv/m)	C17V (Mv/m)	C49V (Mv/m)	D11V (Mv/m)	D17V (Mv/m)	A17V (Mv/m)	A49V (Mv/m)
Injection	1	-0.858	-2.234	0.0	----	----	----	----
1	1	-0.838	-4.757	2.505	----	----	----	----
2	2	-0.648	-4.757	1.157	----	----	----	----
3	3	-0.328	-4.757	1.303	----	----	----	----
4	4	0.0	-4.757	1.147	----	----	----	----
5	5	0.0	-4.757	1.195	----	----	----	----
6	6	0.0	-4.757	1.258	----	----	----	----
7	7	0.0	-4.757	1.320	----	----	----	----
8	7	0.0	-4.757	1.320	----	----	----	----
9	8	0.0	-4.757	1.377	----	----	----	----
10	9	0.0	-4.757	1.377	----	----	----	----
11	10	0.0	-4.757	1.377	----	----	----	----
12	11	0.0	-4.757	1.377	----	----	----	----
13	12	0.0	-4.757	1.377	----	----	----	----
14	12	0.0	-4.757	1.377	----	----	----	----
15	12	0.0	-4.627	1.377	----	----	----	----
16	12	1.616	-4.175	1.644	0.0	0.0	0.0	-2.191
17	12	3.350	-4.175	0.198	0.602	0.0	0.0	-2.620
18	12	3.350	-4.175	0.198	0.602	0.0	0.0	-2.620
19	12	3.917	-1.823	0.0	0.343	0.0	0.0	-3.344
20	13	3.917	-2.010	0.0	0.267	0.0	0.0	-3.296
21	13	3.917	-2.010	0.0	0.267	0.0	0.0	-3.296
23	14	3.917	-2.201	0.0	0.191	0.0	0.0	-3.239
24	16	4.077	-2.526	0.285	0.125	0.0	0.0	-3.311
25	16	4.077	-2.526	0.285	0.125	0.0	0.0	-3.311
Collisions	16	4.00	-1.936	3.321	4.000	-2.353	-2.203	-4.000

