MIPP Beamline status

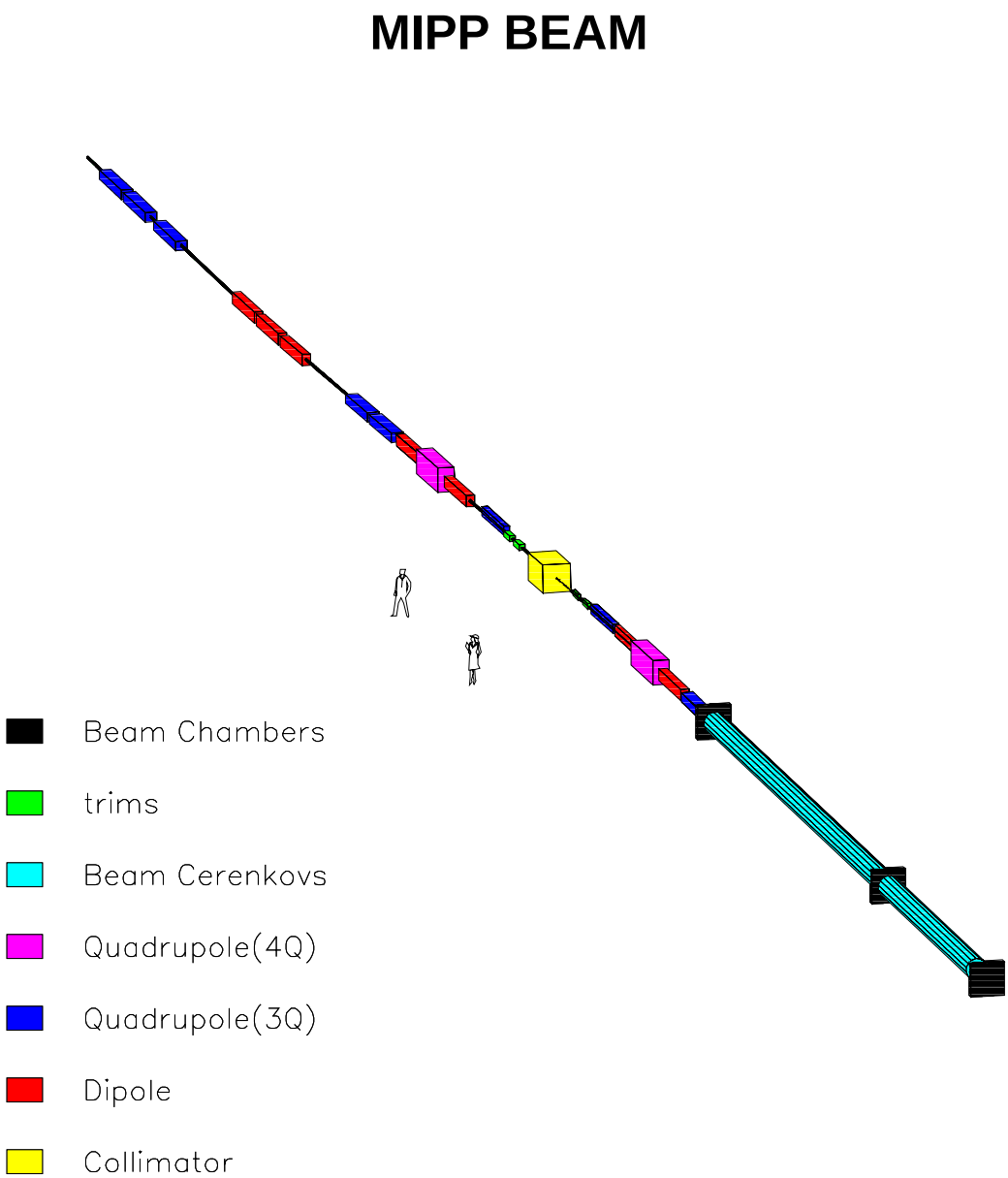
Rajendran Raja

10-May-2003

MIPP beamline

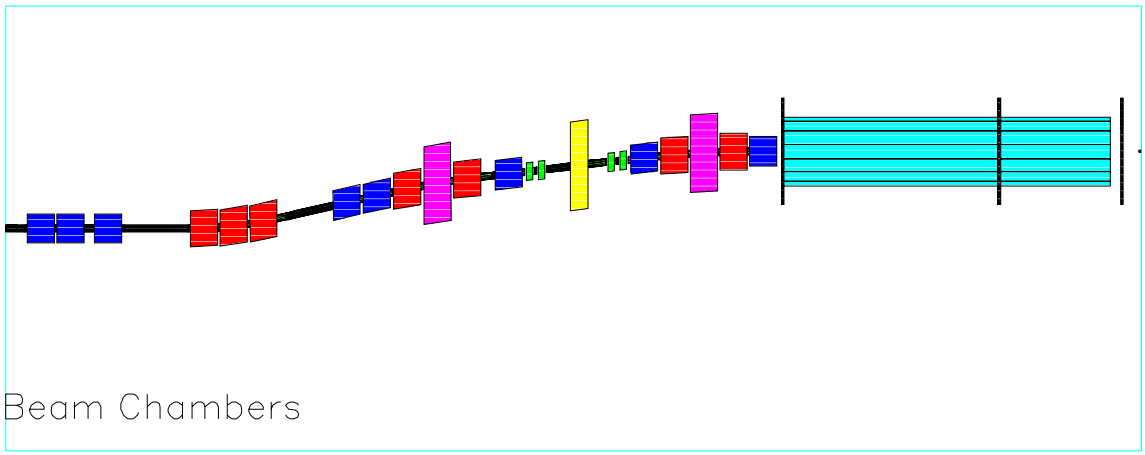
- Complete redesign of old design.
- Design team Dave Carey, Carol Johnstone, Mikhail Kostin—Chuck Brown and RR interacting constructively.
- Criteria for design-
- Small divergence at beam cerenkov (.6mr to 0.3 mr)
- No dispersion at secondary (MIPP) target (Dispersion=0)
- Large dispersion at momentum selection collimator Dispersion=0.25meters at momentum selection collimator. Spot size at momentum slit = 1.8mm where as 3%dp/p moves the beam by 7mm.
- Large angle between beam entering collimator and final beam=11mrad. Good to restrict background.
- Total length between primary and secondary target a little longer. 5 GeV Kaon decay probability in the old design =6.3GeV in the new longer design.

Beam line Geant plots



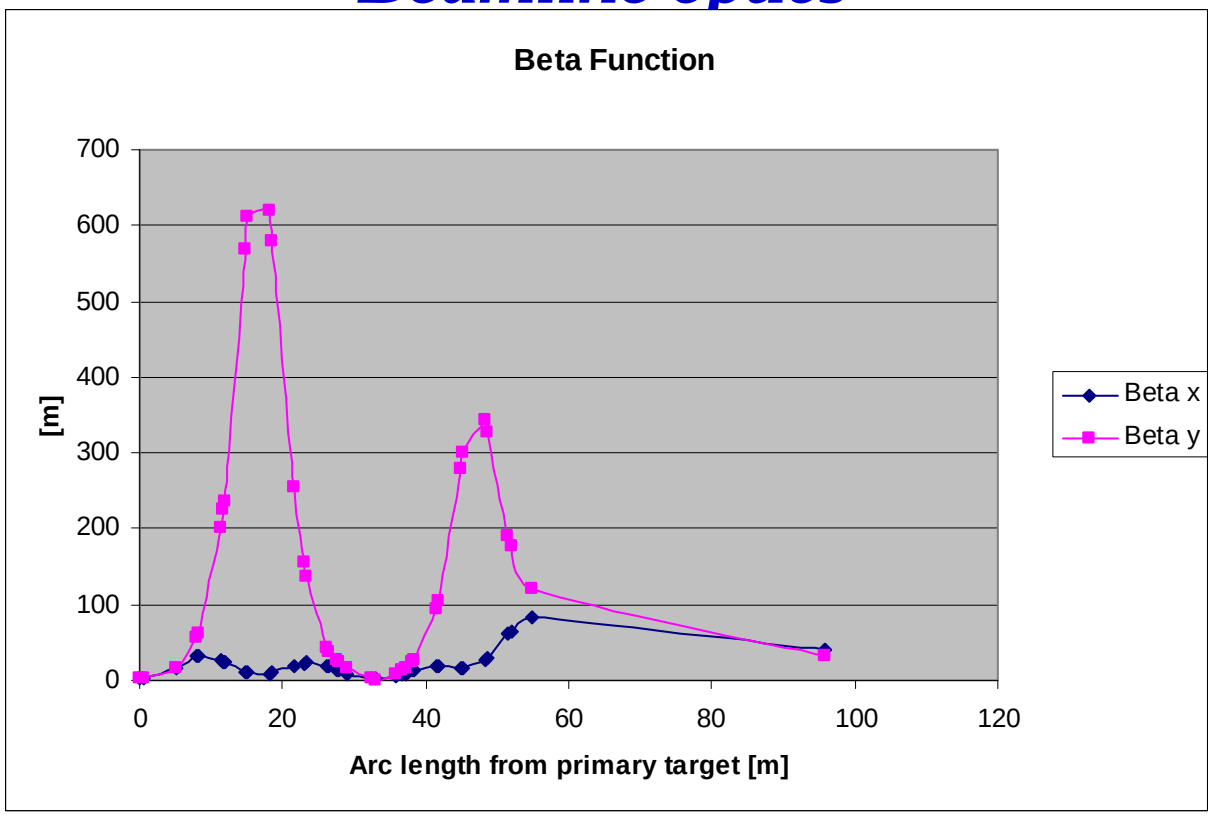
Beamline Geant plots

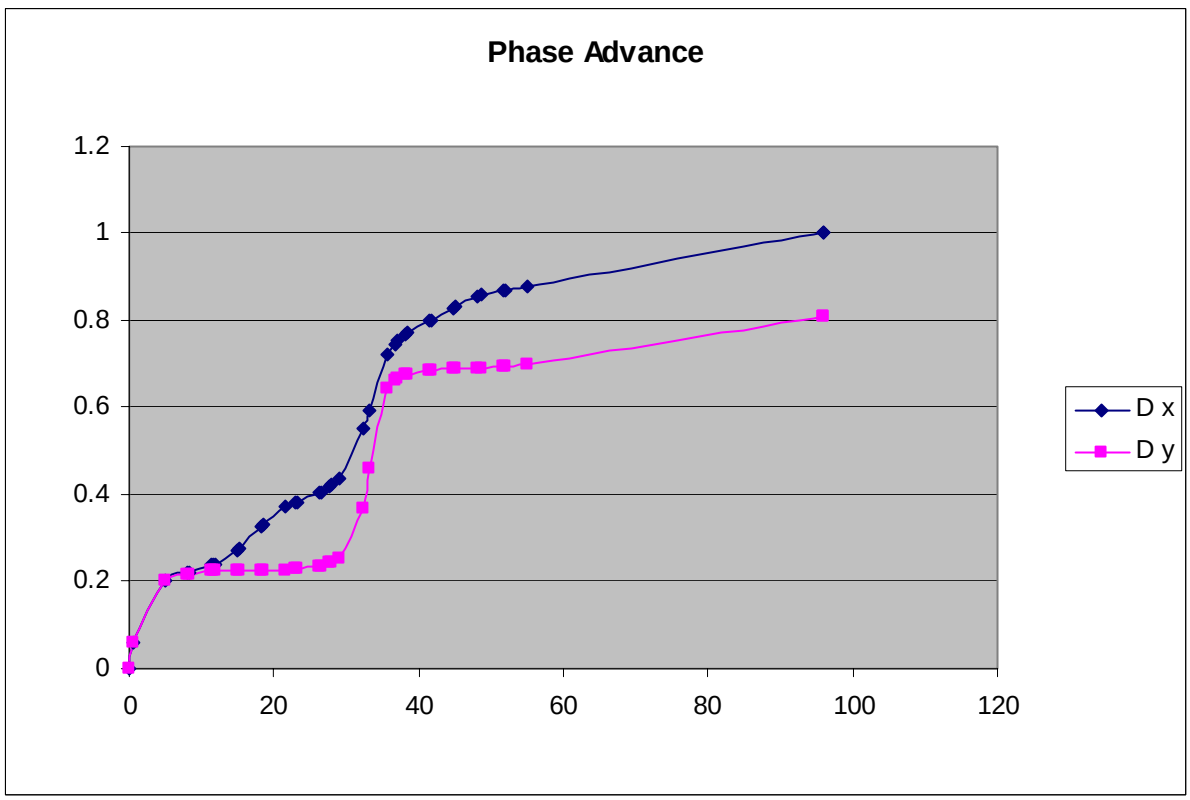
MIPP BEAM



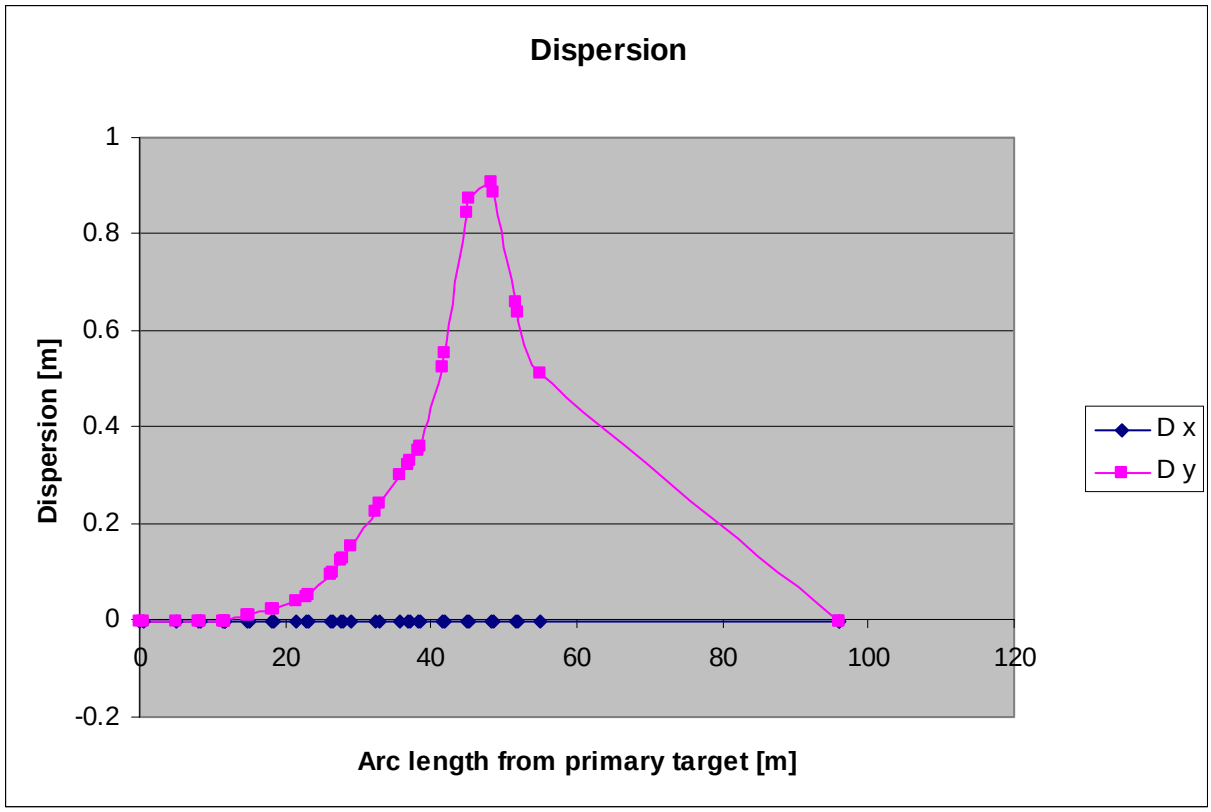
- Beam Chambers
- trims
- Beam Cerenkovs
- Quadrupole(4Q)
- Quadrupole(3Q)
- Dipole
- Collimator

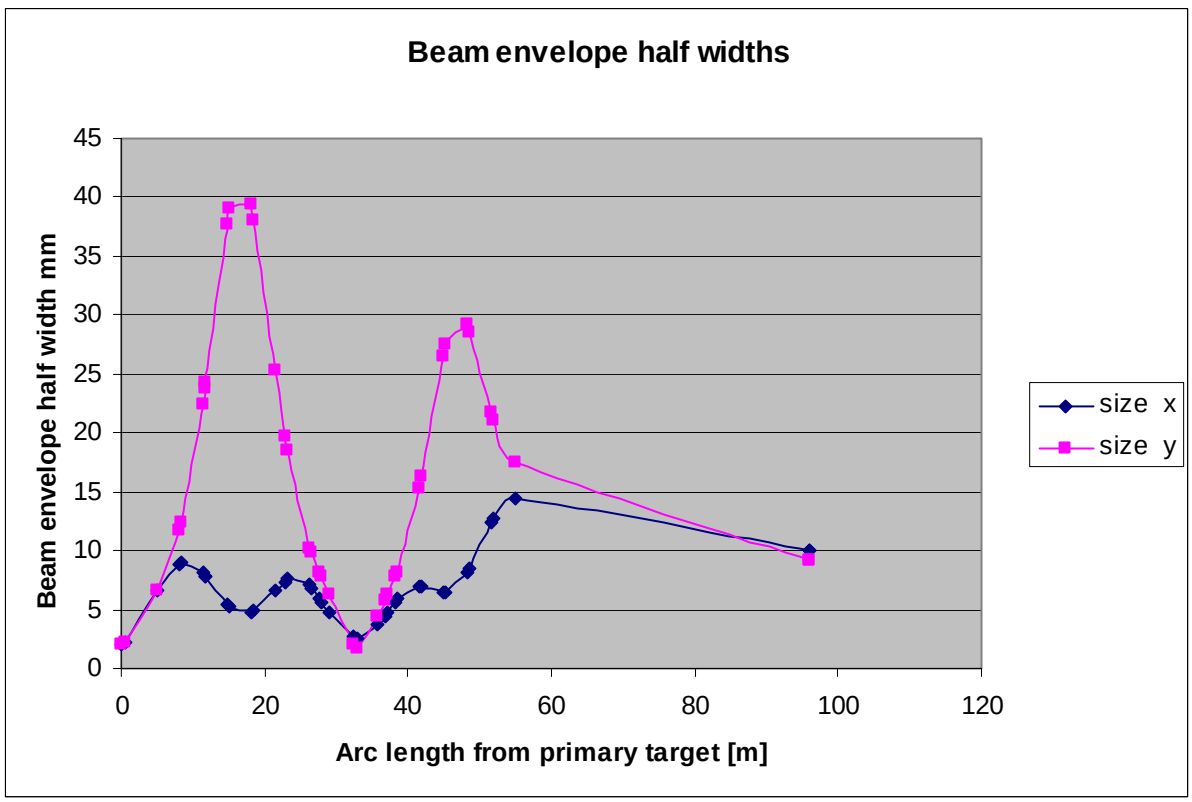
Beamline optics



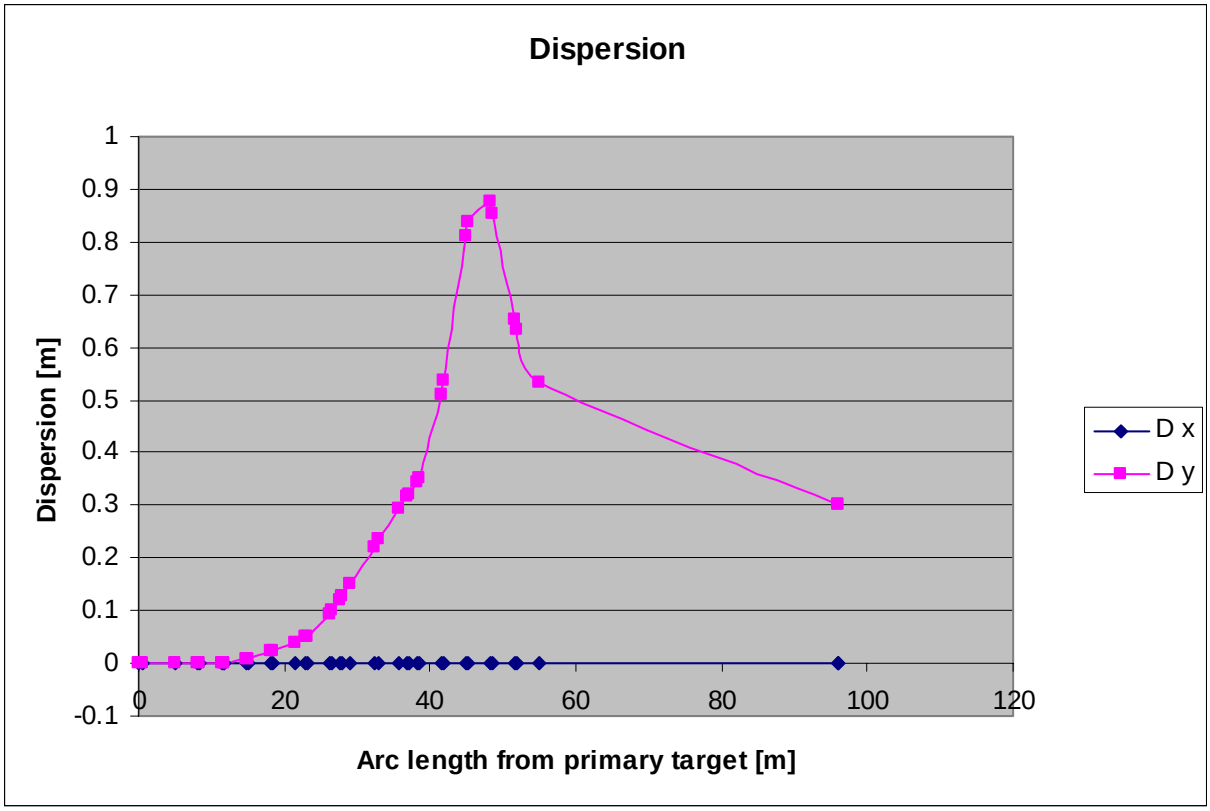


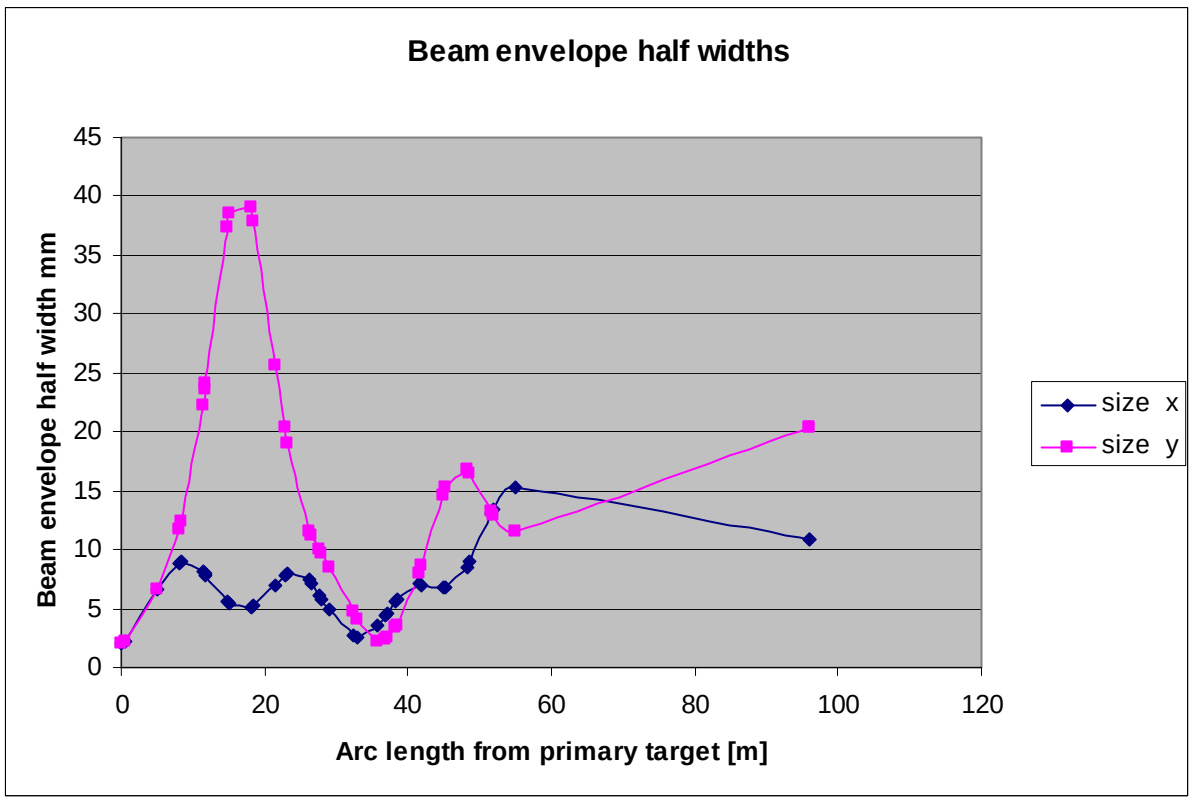
Beamline optics



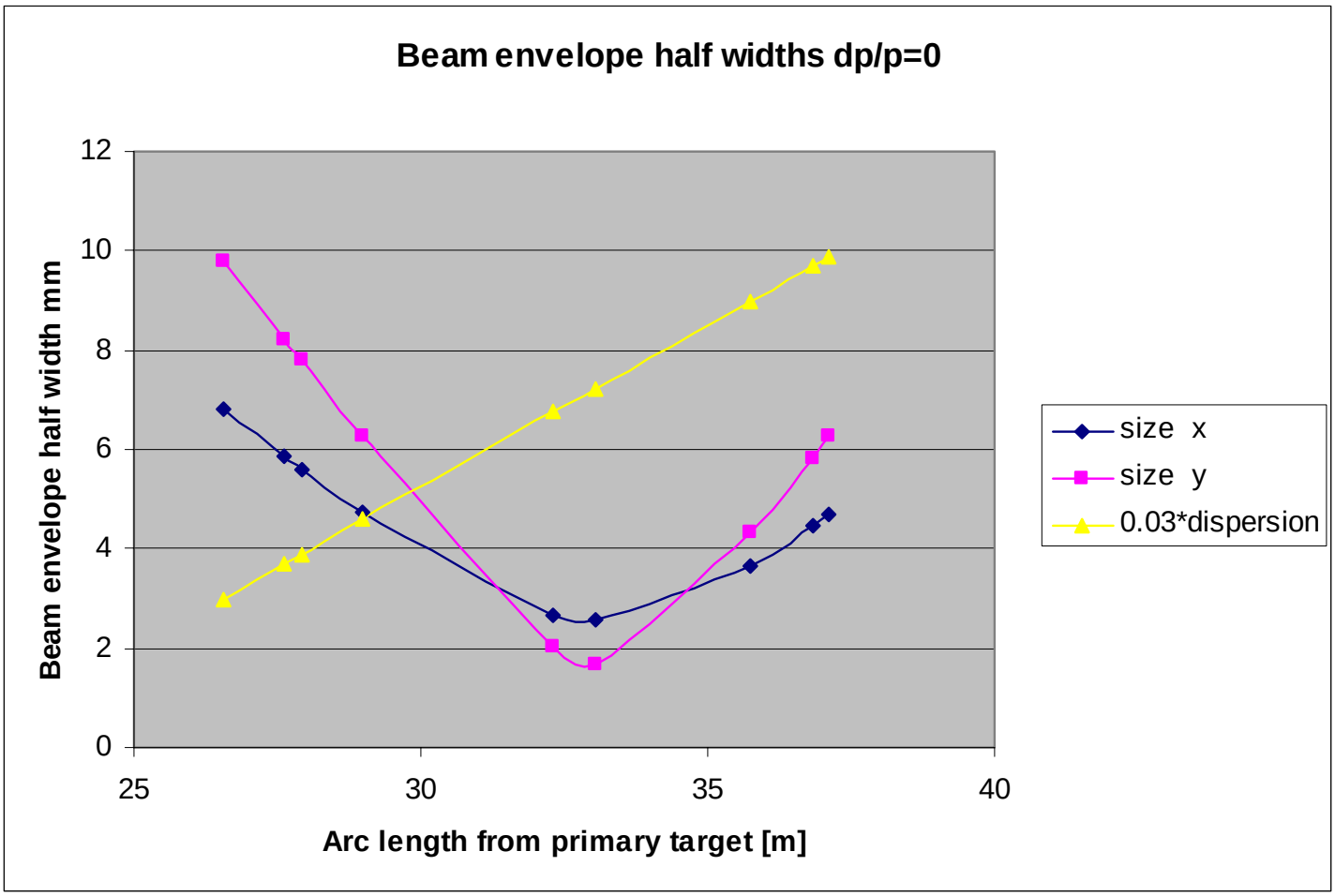


Optics Non linearities dp/p=+0.02





Dispersion and beam spotsize at momentum slit/



Status of Magnets for MIPP Secondary beamline

Magnet Type	TD Numbers	FRD Numbers	Currently At	Status	Needed by MIPP	Mechanical Status	Beamline element	Comment
4Q		FRD-11527	Meson Bay	At TD	2+1 spare		MC6Q2	
4Q		FRD-11741	Meson Bay	At TD			MC6Q5	
4Q		FRD-20316	Meson Bay	At TD				
3Q-old		FRD-11901	M05		8+1 spare		MC5Q1	Installed in primary line
3Q-old		FRD-11903	M05				OFF	Installed in primary line
3Q-old		FRD-11904	M05				MC5Q2	Installed in primary line
3Q-new		FRD-11909	Meson-not in bay				MC6Q1-1	
3Q-new		FRD-11910	Meson-not in bay				MC6Q1-2	
3Q-new		FRD 11596	Meson -in bay				MC6Q3	
3Q-new		FRD 11417	Meson -in bay				MC6Q4-1	
3Q-new		FRD 11415	Meson -in bay				MC6Q4-2	
3Q-new		FRD-10372	Meson-in bay					
3Q-new		FRD-11416	Meson-in bay					
EPB		FRD-11447	M05		7+1 spare		MC5U-1	Installed in primary line
EPB		FRD-MH203-17	M05				MC5U-2	Installed in primary line
EPB	EDBB009-1	FRD-MH203-9	AT TD				MC5U-3	
EPB	EDBB012-1	FRD-10801	AT TD				MC6D-1	
EPB	EDBB013-1	FRD-20147	AT TD				MC6D-2	
EPB		FRD-11244	Meson-not in bay				MC6D-3	
EPB		FRD-20018	Meson-not in bay				MC6D-4	
EPB					Spare shared with NUMI			
Trim		FRD-11413	M05				MC5HT1	Installed in Primary line
Trim			At TD		4+1 spare		MC6VT1	
Trim			At TD				MC6HT1	
Trim			At TD				MC6VT2	
Trim			At TD				MC6HT2	
Trim					Spare at TPL			

Beam Sheet For MIPP Beamline-- Carol J design 8 4-May-03

Z CENT. [ft]	X CENT. [ft]	Y CENT. [ft]	Position Code	Element Code	Power Supply	100 GeV B/G KG or KG/in	Amps
1224.921	0.000	3.939	MC5WC1				
1225.421	0.000	3.939	MC5LM1				
1232.980	0.000	3.939	MC5Q1				
1243.980	0.000	3.939	OFF				
1257.917	0.000	3.939	MC5Q2				
1263.348	0.000	3.939	MC5HT1				
1293.214	0.000	3.958	MC5U-1			7.848	838.450
1304.214	0.000	4.042	MC5U-2			7.848	838.450
1315.212	0.000	4.210	MC5U-3			7.848	838.450
1323.389	0.000	4.379	MC6IC1				
1323.881	0.000	4.390	MC6WC1				
1324.819	0.000	4.411	MC6T1				
1328.428	0.000	4.404	MC6TC				
1337.924	0.000	4.620	MC6ABS				
1345.922	0.000	4.895	MC6Q1-1			3.390	65.000
1356.919	0.000	5.147	MC6Q1-2			3.390	65.000
1368.322	0.000	5.394	MC6D-1			5.886	628.789
1379.320	0.000	5.598	MC6Q2			-5.760	1230.000
1390.319	0.000	5.772	MC6D-2			5.886	628.689
1405.599	0.000	5.962	MC6Q3			5.560	106.000
1413.337	0.000	6.051	MC6VT1			0.000	0.000
1417.814	0.000	6.102	MC6HT1			0.000	0.000
1427.911	0.000	6.215	MC6WC2				
1431.692	0.000	6.261	MC6CY				
1443.536	0.000	6.397	MC6VT2			0.000	0.000
1448.013	0.000	6.448	MC6HT2			0.000	0.000
1455.752	0.000	6.537	MC6Q4-1			4.660	89.000
1466.751	0.000	6.648	MC6D-3			5.886	628.789
1477.751	0.000	6.726	MC6Q5			5.160	1102.000
1488.751	0.000	6.775	MC6D-4			5.886	628.789
1499.751	0.000	6.789	MC6Q4-2			2.880	55.000
1506.001	0.000	6.789	MC7HD1				
1506.917	0.000	6.789	MC7BC1				
1546.921	0.000	6.789	MC7CR1				
1586.924	0.000	6.789	MC7BC2				
1607.742	0.000	6.789	MC7CR2				
1636.098	0.000	6.789	MC7BC3				
1637.182	0.000	6.789	MC7HD2				
1638.015	0.000	6.789	MC7WC1				
1639.265	0.000	6.789	MC7T1				

MIPP Secondary Beam line Survey Sheet Carol 8 design R.Raja 5-May-03

Element	Upsteam y [ft]	Downstream y [ft]	Upstream Z [ft]	Downstream Z [ft]	Element
MC5WC1	3.939	3.939	1224.671	1225.171	Swic
MC5LM1	3.939	3.939	1225.171	1225.671	Loss Monitor
MC5Q1	3.939	3.939	1226.863	1236.863	3Q
OFF	3.939	3.939	1237.843	1247.843	3Q
MC5Q2	3.939	3.939	1248.848	1258.848	3Q
MC5HT1	3.939	3.939	1260.848	1265.848	Horizontal trim
MC5U-1	3.939	3.977	1288.214	1298.214	EPB dipole
MC5U-2	3.985	4.099	1299.214	1309.213	EPB dipole
MC5U-3	4.115	4.306	1310.213	1320.211	EPB dipole
MC6IC1	4.379	4.379	1323.389	1323.389	Ionization Chamber
MC6WC1	4.390	4.390	1323.881	1323.881	Swic
MC6T1	4.404	4.419	1324.491	1325.147	Copper Target
MC6TC	4.404	4.404	1324.327	1332.529	Steel Target cage
MC6ABS	4.574	4.666	1335.924	1339.924	Copper absorber
MC6Q1-1	4.781	5.010	1340.924	1350.921	3Q
MC6Q1-2	5.033	5.262	1351.921	1361.918	3Q
MC6D-1	5.294	5.495	1363.323	1373.321	EPB dipole
MC6Q2	5.512	5.684	1374.321	1384.320	4Q
MC6D-2	5.701	5.844	1385.320	1395.318	EPB dipole
MC6Q3	5.905	6.019	1400.599	1410.598	3Q
MC6VT1	6.031	6.071	1411.598	1415.076	Vertical Trim
MC6HT1	6.082	6.122	1416.076	1419.553	Horizontal trim
MC6WC2	6.215	6.215	1427.661	1428.161	Swic
MC6CY	6.223	6.299	1428.411	1434.973	Collimator
MC6VT2	6.377	6.417	1441.797	1445.275	Vertical trim
MC6HT2	6.428	6.468	1446.274	1449.752	Horizontal trim
MC6Q4-1	6.479	6.594	1450.752	1460.751	3Q
MC6D-3	6.605	6.691	1461.751	1471.751	EPB dipole
MC6Q5	6.697	6.754	1472.751	1482.751	4Q
MC6D-4	6.760	6.789	1483.751	1493.751	EPB dipole
MC6Q4-2	6.789	6.789	1494.751	1504.751	3Q
MC7HD1	6.789	6.789	1505.751	1506.251	Mipp beam hodoscope
MC7BC1	6.789	6.789	1506.417	1507.417	Mipp beam chamber
MC7CR1	6.789	6.789	1507.751	1586.091	Mipp long cerenkov
MC7BC2	6.789	6.789	1586.424	1587.424	Mipp beam chamber
MC7CR2	6.789	6.789	1587.757	1627.727	Mipp short cerenkov
MC7BC3	6.789	6.789	1635.598	1636.598	Mipp beam chamber
MC7HD2	6.789	6.789	1636.932	1637.432	Mipp beam hodoscope
MC7WC1	6.789	6.789	1637.765	1638.265	Swic
MC7T1	6.789	6.789	1639.265	1639.265	Mipp target

MC Main Injector MIPP-E907 5-May-2003

Primary Beamline beamsheet resurrected from HyperCp sheet by Rajendran Raja

Z Cent.	X Cent.	Y Cent.	Position Code	Element Code	Power Supply	120GeV B/G(KG) or
-1326.630	0.000	-11.120	MCTRIM	M00H S.Y.TRIM 2X4X40 ENCL.F2		0.000
-1322.130	0.000	-11.070	MCTRIM	M00V VERNIER 4X4X30 ENCL.F2		0.000
-1318.880	0.000	-11.040	MCCUPL			
-1317.880	0.000	-11.030	MCF2ND			
-1084.620	0.000	-8.570	MCD23			
-851.370	0.000	-6.120	MCF3ST			
-850.120	0.000	-6.110	MCCUPL			
-815.870	0.000	-5.750	MCPIPE			
-782.120	0.000	-5.390	MC00WC	VAC. BAYONET SWIC D2-G	M00WC	
-779.870	0.000	-5.370	MCPIPE			
-568.210	0.000	-3.140	MCD3M			
-346.300	0.000	-0.810	MC01WC1	VAC. BAYONET SWIC F1-G	M01WC1	
-339.050	0.000	-0.740	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-328.060	0.000	-0.640	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-317.060	0.000	-0.550	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-306.060	0.000	-0.480	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-295.060	0.000	-0.420	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-284.060	0.000	-0.370	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-273.060	0.000	-0.340	MC1D1	M01D-1-7 MW/MC/ME 10FT.MOD.B1		-1.698
-267.060	0.000	-0.330	MC01WC2	VAC. BAYONET SWIC F1-G	M01WC2	
-260.560	0.000	-0.320	MCSHLD	DUMMY 3-WAY LAMBERTSON		
-249.560	0.000	-0.310	MCB0	ME1E/MW1W MW/MC/ME 3-WAY LAMBERTSON		0.000
-238.560	0.000	-0.290	MCB0	ME1E/MW1W MW/MC/ME 3-WAY LAMBERTSON		0.000
-227.560	0.000	-0.270	MCB0	ME1E/MW1W MW/MC/ME 3-WAY LAMBERTSON		0.000
-216.560	0.000	-0.260	MCB0	ME1E/MW1W MW/MC/ME 3-WAY LAMBERTSON		0.000
-205.560	0.000	-0.240	MCB0	ME1E/MW1W MW/MC/ME 3-WAY LAMBERTSON		0.000
-194.560	0.000	-0.230	MCB0	ME1E/MW1W MW/MC/ME 3-WAY LAMBERTSON		0.000
-46.750	0.000	-0.010	MC1WC	VAC. BAYONET SWIC D1-G	MC1WC	
-40.500	0.000	0.000	MC1D2	MODIFIED B1	MC1D	-1.921
180.000	0.000	0.000	MC2LM	SEALED LOSS MONITOR		
281.250	0.000	0.000	MC2Q1	QUAD 3Q120	MC2Q1	0.000
368.250	0.000	0.000	MC2Q2	QUAD 3Q120	MC2Q2	0.000
378.750	0.000	0.000	MC2WC	VAC. BAYONET SWIC D1-G	MC2WC	
382.250	0.000	0.000	MC2H	HORIZONTAL TRIM 5.5-2.87-60	MC2H	0.000
406.750	0.000	0.000	MC2V	VERTICAL TRIM 5.5-2.87-60	MC2V	0.000
413.940	0.000	0.000	MC400	400' AREA		
627.640	0.000	0.000	MCDR			
641.340	0.000	0.000	MC600	600' AREA		
641.340	0.000	0.000	MC3CV	VERTICAL COLLIMATOR		
641.490	0.000	0.000	MC3LM1	SEALED LOSS MONITOR		
653.690	0.000	0.000	MC3CH	HORIZONTAL COLLIMATOR		
653.840	0.000	0.000	MC3LM2	SEALED LOSS MONITOR		
691.790	0.000	0.000	MCDR			
999.090	0.000	0.000	MCDR			
1002.940	0.000	0.000	MC1000	1000' AREA		
1002.940	0.000	0.000	MC4WC	VAC. BAYONET SWIC D1-G	MC4WC	
1002.940	0.000	0.000	MC4LM1	SEALED LOSS MONITOR		
1005.440	0.000	0.000	MC4LM2	SEALED LOSS MONITOR		
1224.260	0.000	0.000	MC1224C	1224C ALIGNMENT BRASS		
1224.921	0.000	3.939	MC5WC1	VAC. BAYONET SWIC D1-G	MC5WC	
1225.421	0.000	3.939	MC5LM1	SEALED LOSS MONITOR		
1232.980	0.000	3.939	MC5Q1	QUAD 3Q120	MC5Q1	0.000
1243.980	0.000	3.939	OFF	QUAD 3Q120	MC5Q1	0.000
1257.917	0.000	3.939	MC5Q2	QUAD 3Q120	MC5Q2	0.000

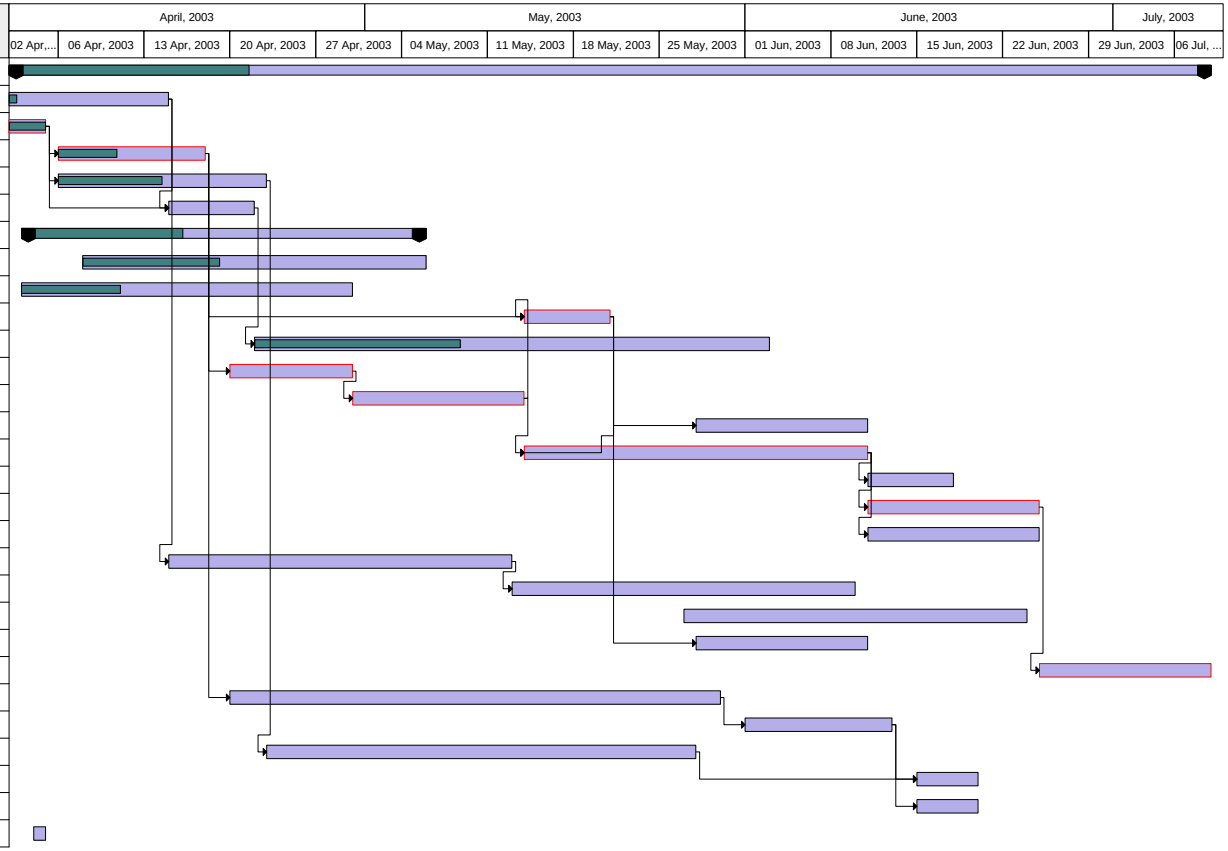
1263.348	0.000	3.939	MC5HT1	HORIZONTAL TRIM
1293.214	0.000	3.958	MC5U-1	
1304.214	0.000	4.042	MC5U-2	
1315.212	0.000	4.210	MC5U-3	
1323.389	0.000	4.379	MC6IC1	ION CHAMBER
1323.881	0.000	4.390	MC6WC1	SWIC
1324.819	0.000	4.411	MC6T1	PRIMARY TARGET

Project Plan

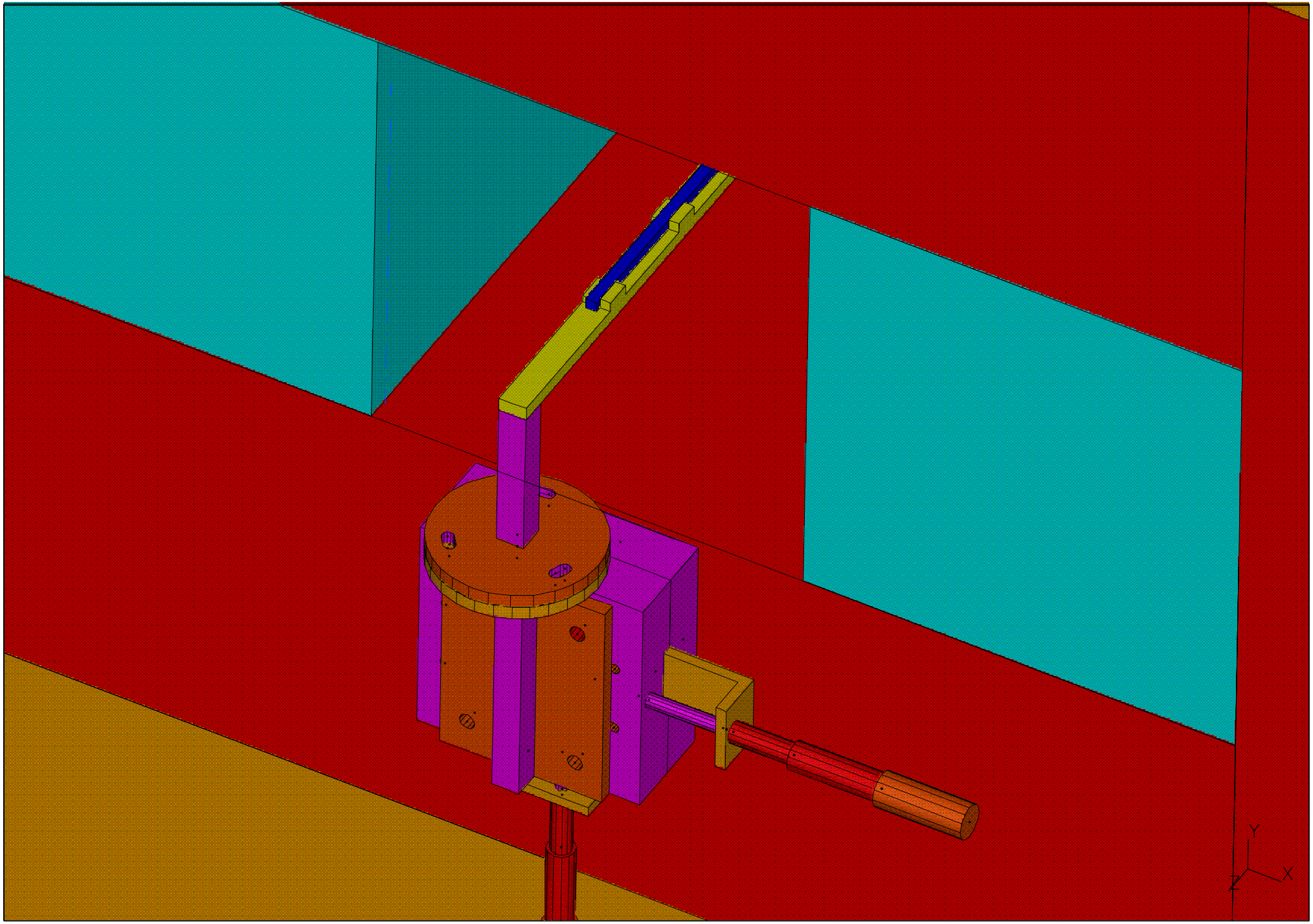
- Finish installation by end of June!!!
- Magnets acquired
- We need 5 EPB dipoles, 2 4Q quadrupoles , 5 3Q quadrupoles, 4 trims 1 Palmer collimator, target cage, target holder, 2 scrapers.
- Magnets will arrive from Tech Div (4Q's + trims + 3 EPB dipoles) by May 19th. We are hoping to start installation soon after.
- Show project graph.

Project ID : mippbeam
Start date : 02 Apr, 2003
End date : 09 Jul, 2003

ID	Task Name	Status	Owner
1	**Install MIPP Secondary Beamline**	**25% Complete**	
2	Design primary MCenter beamline from M01 to primary target in ...	Started	
3	Design and Generate survey co-ordinates of new beam	Complete	
4	Layout New beam and shielding nededin MC5,6,7	40% Complete	
5	Design Primary target and shielding	50% Complete	
6	Tag magnets, Power Supplies and Reversing switches	New Task	
7	**Renovate some of the magnets at Tech division**	**40% Complete**	
8	Test 4Q quadrupole at Tech division	40% Complete	
9	Test Dipoles, 3Q's and 4Q's at MC7	30% Complete	
10	Stake out secondary beamline	New Task	
11	Acquire/modify/design/build stands for magnets	40% Complete	
12	Complete Shielding Rearrangement of existing shielding	New Task	
13	Cleanup of resulting lead contamination	New Task	
14	Install primary target	New Task	
15	Install magnets	New Task	
16	Final survey of beamline elements	New Task	
17	Connect magnets to power supplies	New Task	
18	Install primary beam instrumentation	New Task	
19	Complete vacuum M02 to M05	New Task	
20	Complete vacuum from M05 to MC7	New Task	
21	Install secondary beam instrumentation	New Task	
22	ACNET database primary and secondary	New Task	
23	Complete MC6 shielding cave	New Task	
24	Complete SA	New Task	
25	Complete SAD	New Task	
26	Install/renovate interlocks in Mc5, Mc6, Mc7	New Task	
27	Test all interlocks and power supplies	New Task	
28	Get overall safety approval to run beam	New Task	
29	Contingency	New Task	



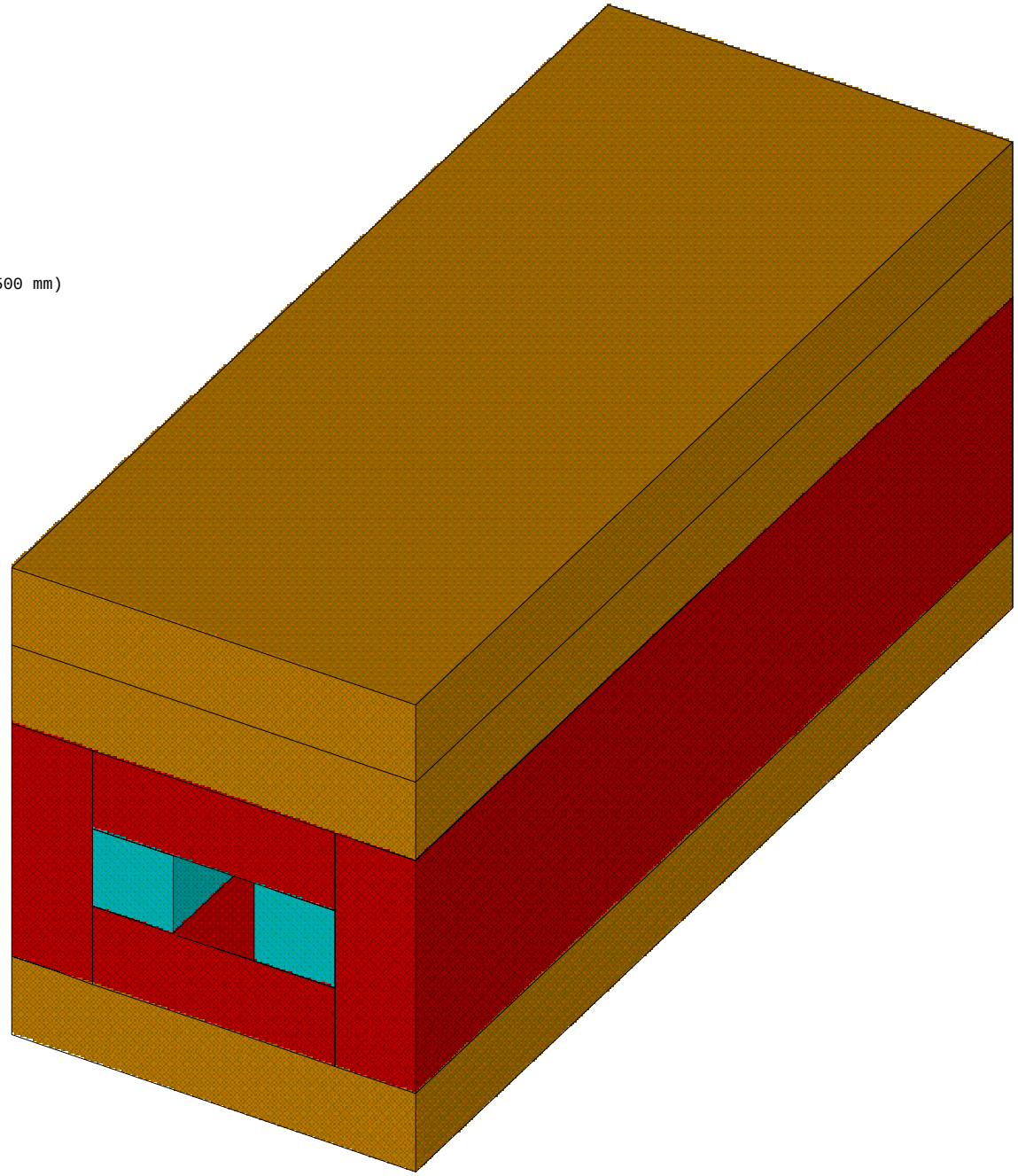
Task
Completed
Milestone
Critical
Summary

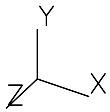


Plotted by edchi on 07-May-03 , File: assy-shield-050703.pff

Target Shield
(~26 tons)

x = 40"
Y = 48"
Z = 98 7/16" (~2,500 mm)





Plotted by edchi on 30-Apr-03 , File: assy-shield-043003.pff

Strawman Design of steel target cage and absorber

R.Raja 9-May-2003

We consider a scheme for steel target cage and absorber that takes into account the beam sizes and direction in MIPP.

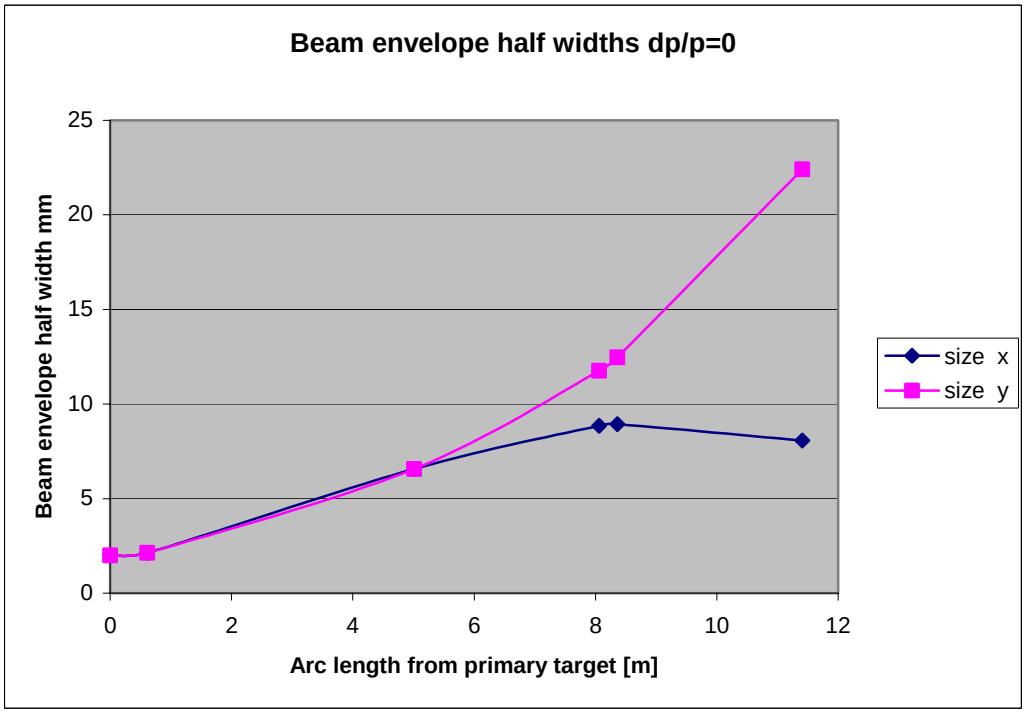


Figure 1 Beam Envelopes as a function of distance from target

The beam at target is 2mm in half-width. It is 5 mm in half width by the time it hits the end of the target cage assumed to be 2.5meters long as seen from Figure 1. The beam is at an angle 0.022921 radians to the horizontal. So it will be at a height of 5.7297cm above the point it entered the target cage. Now that we have determined that it is OK to have the scraper in the target pile, the following design suggests itself. We have a cylindrical hole of radius R cm, where R=3cm would be 6 sigma bigger than accepted beam that is at the right angle (0.022921 radians) in the target pile . The schematic is as follows. The passage way for the beam can be machined in several blocks of steel which are then stacked.

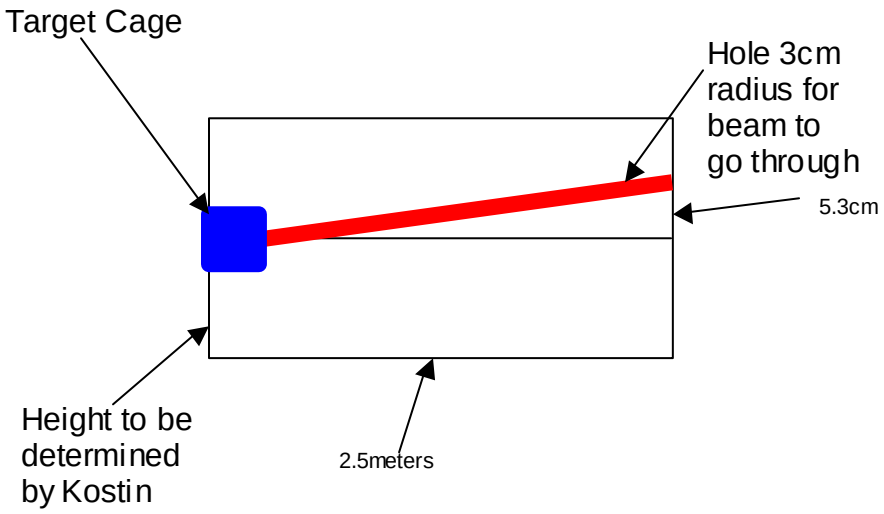


Figure 2 Schemtic of target cage and absorber

Mipp Beamline Status

- Work is being done by Jim Kilmer and Ed Chi (PPD) to do the Target cage + Holder.
- Great co-operation from Radiation Safety people (Roger Zimmermann and Bill Higgins).
- Chuck Brown continues to be a source of inspiration.
- I am confident we can have the beamline operational in July.