Pixel Geometry Studies

Penny Kasper , 20-Feb-2001

I have studied the reconstruction efficiency, trigger efficiency and time resolution for various geometry configurations. These studies were done for a 4-prong final state ($B_s \to D_s K$) and a 2-prong final state $B^0 \to K\pi$).

- As the trigger does not look for external triplets in the X-planes we expect that we can reduce the size of the X-planes wrt the Y-planes.

  To study this, the number of stations is fixed at 31, the size of the Y-planes is varied from 8.0 to 10.0 cm, and for each Y-plane size the size of the X-planes is varied so the ratio R=Xsize/Ysize varies from 0.4 - 1.0. Figs 1-6 show the number of reconstructed events, number of reconstructed and triggered events and time resolution for R between 0.4 and 1.0. There is no loss in efficiency or time resolution for R>0.7

- To optimze the number of pixel stations the size of the Y-planes is fixed at 10 x 10cm, the ratio Xsize/Ysize is fixed at 0.7 and the number of stations is varied from 31 to 47. The results are shown in Figs. 7-12.

- To optimize the transverse size of the pixel planes the number of stations is fixed at 31, the ratio Xsize/Ysize is fixed at 0.7 and then the tranverse size of the Y-planes is varied from 9.0 to 14.0 cm. The results are shown in Figs. 13-18.

The studies presented so far have assumed that each pixel plane has a material budget equivalent to 900 microns of silicon (=1% radiation length). It may not be possible to make the planes this thin. In particular, if the fuzzy carbon support structure cannot be made to work reliably we will need to use a different material. I have repeated the studies above doubling the thickness of the pixel planes. The results are pesented in Figs. 19-30

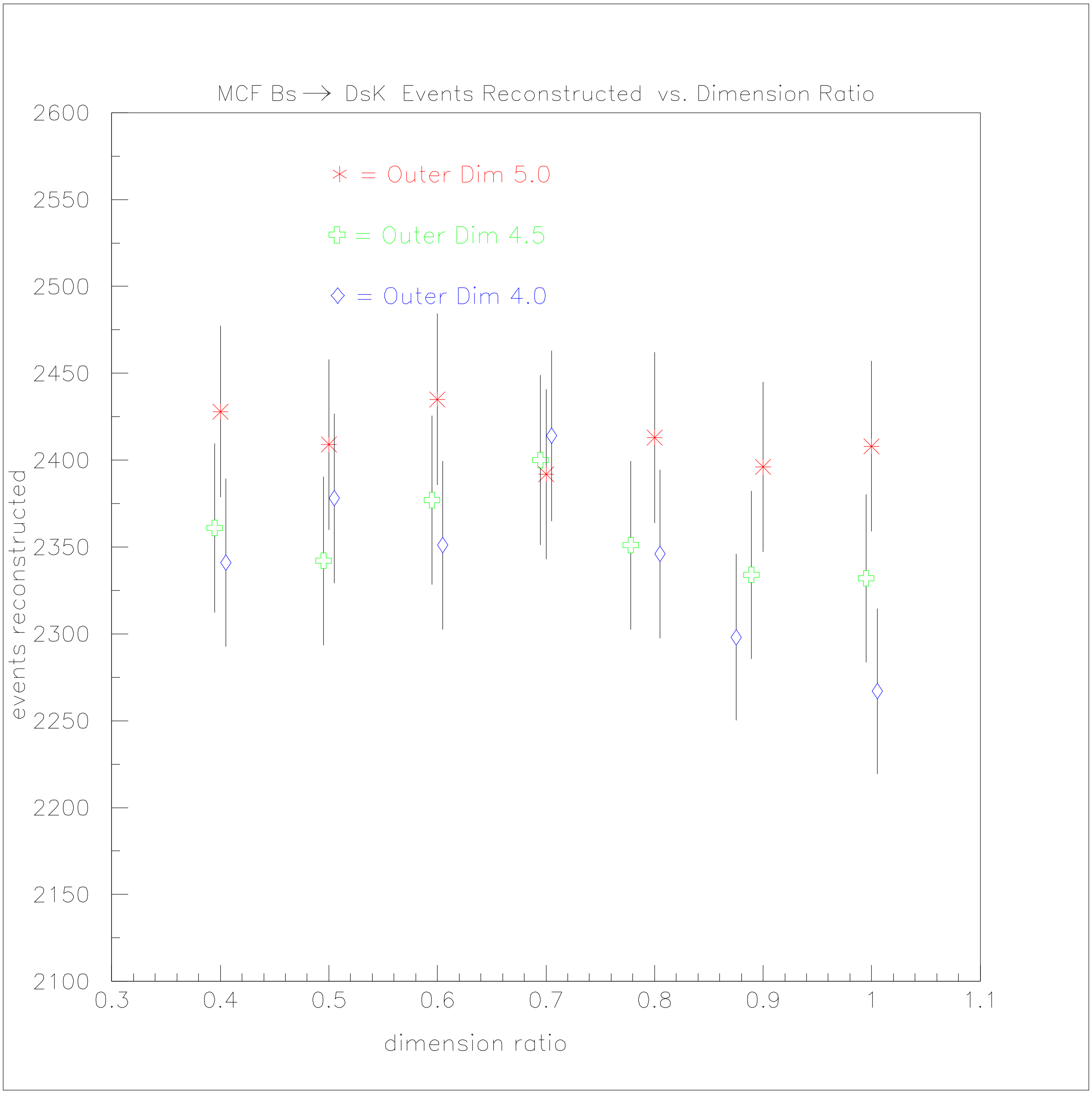
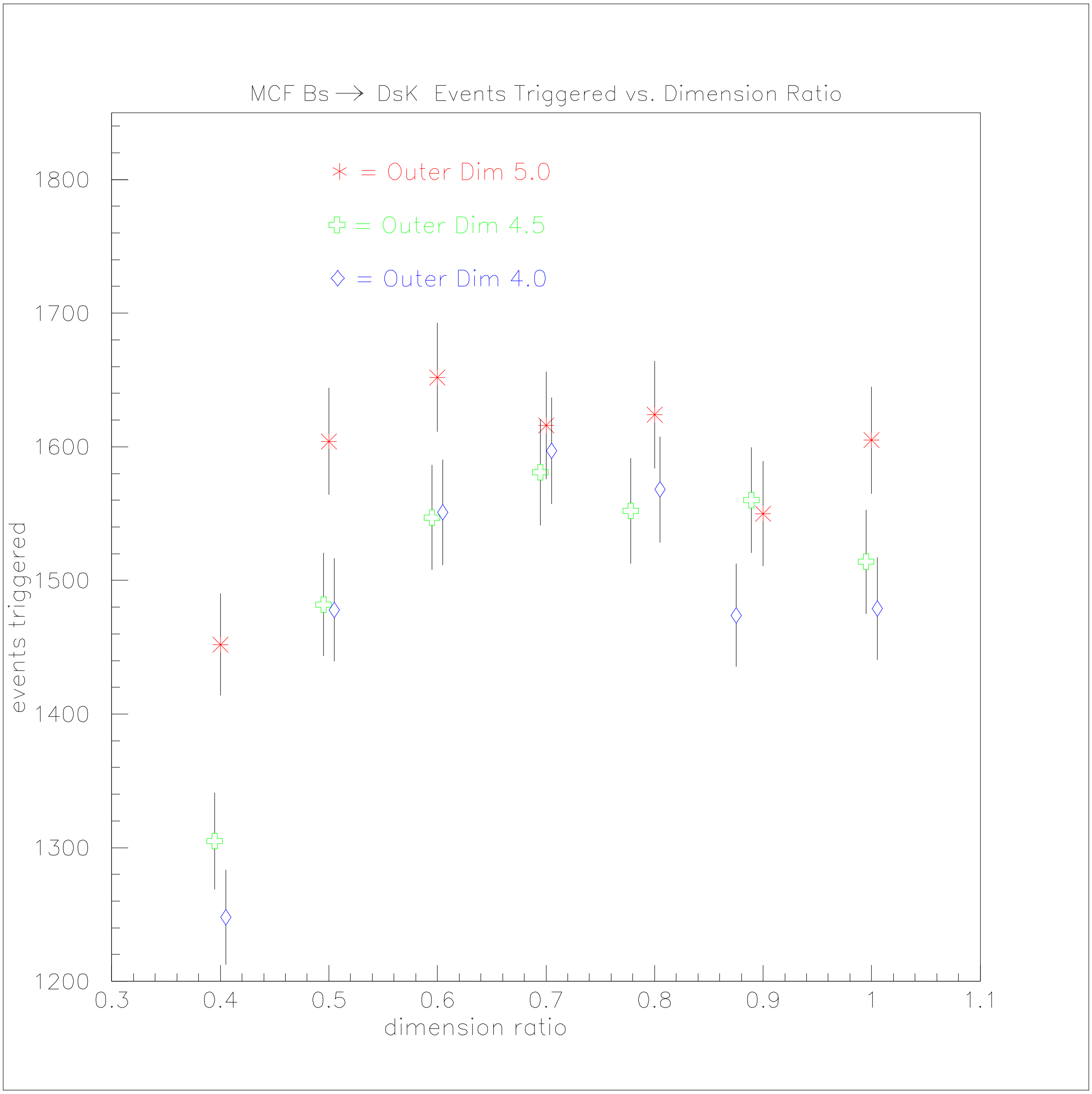

MCF Bs → DsK Events Reconstructed vs. Dimension Ratio
∗ = Outer Dim 5.0
✢ = Outer Dim 4.5
◇ = Outer Dim 4.0
events reconstructed
2100
2150
2200
2250
2300
2350
2400
2450
2500
2550
2600
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
dimension ratio

Fig. 1



MCF Bs → DsK Events Triggered vs. Dimension Ratio
* = Outer Dim 5.0
✚ = Outer Dim 4.5
◇ = Outer Dim 4.0
events triggered
dimension ratio
1200
1300
1400
1500
1600
1700
1800
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1

Fig. 2

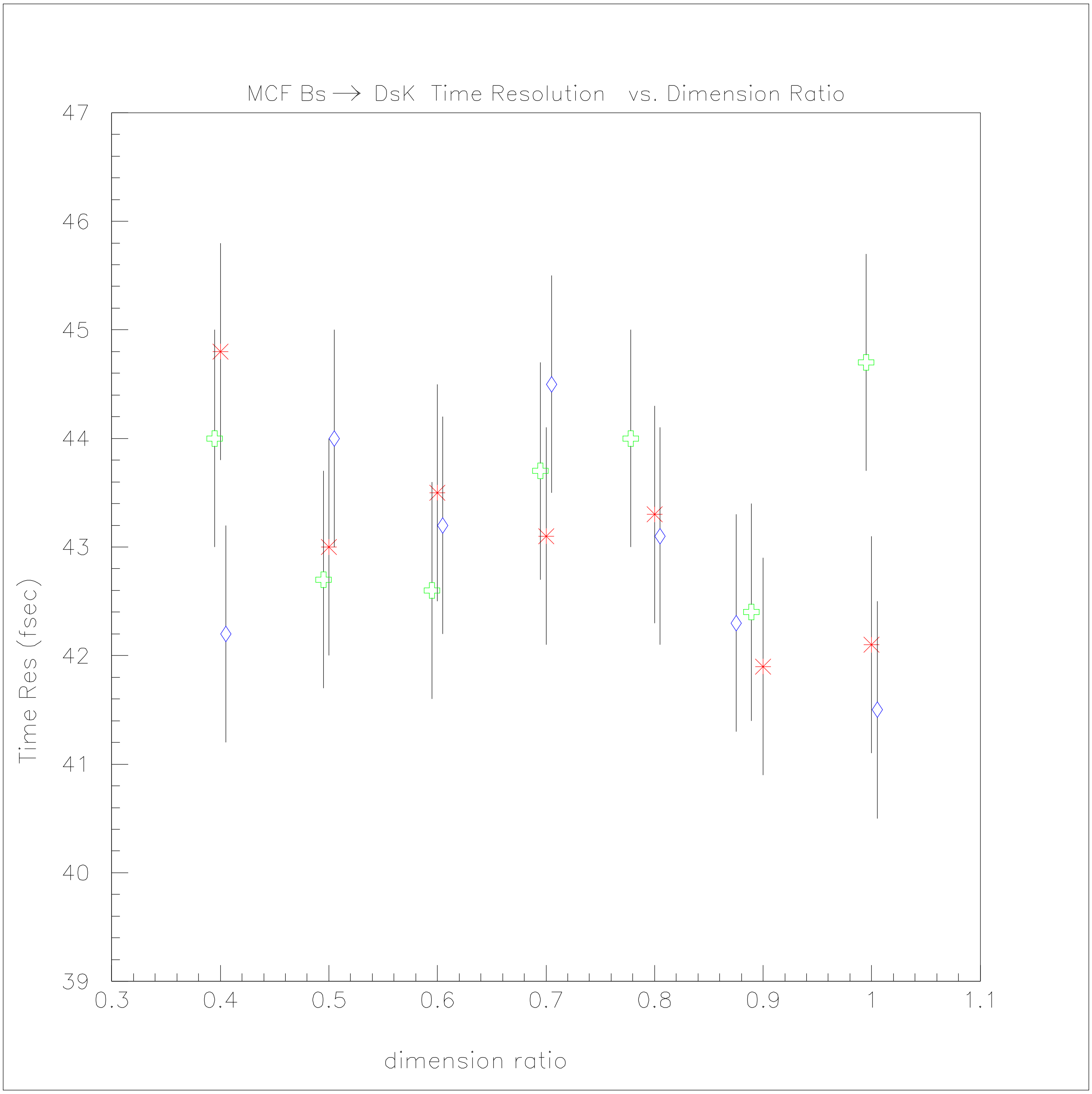
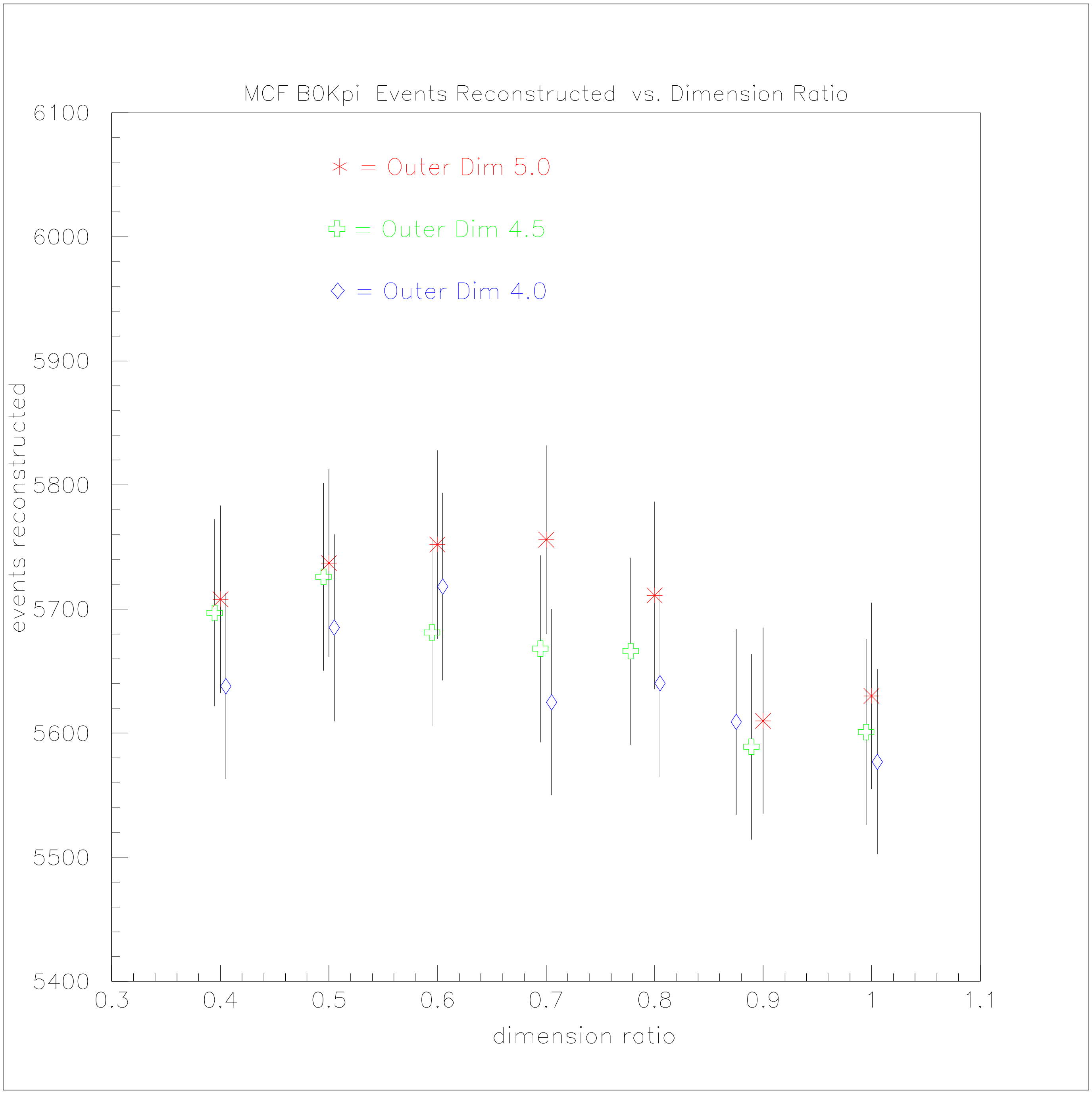

MCF Bs ⟶ DsK Time Resolution vs. Dimension Ratio
Time Res (fsec)
dimension ratio
47
46
45
44
43
42
41
40
39
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1

Fig. 3



MCF B0Kpi Events Reconstructed vs. Dimension Ratio
∗ = Outer Dim 5.0
✣ = Outer Dim 4.5
◇ = Outer Dim 4.0
events reconstructed
dimension ratio
6100
6000
5900
5800
5700
5600
5500
5400
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1

Fig. 4

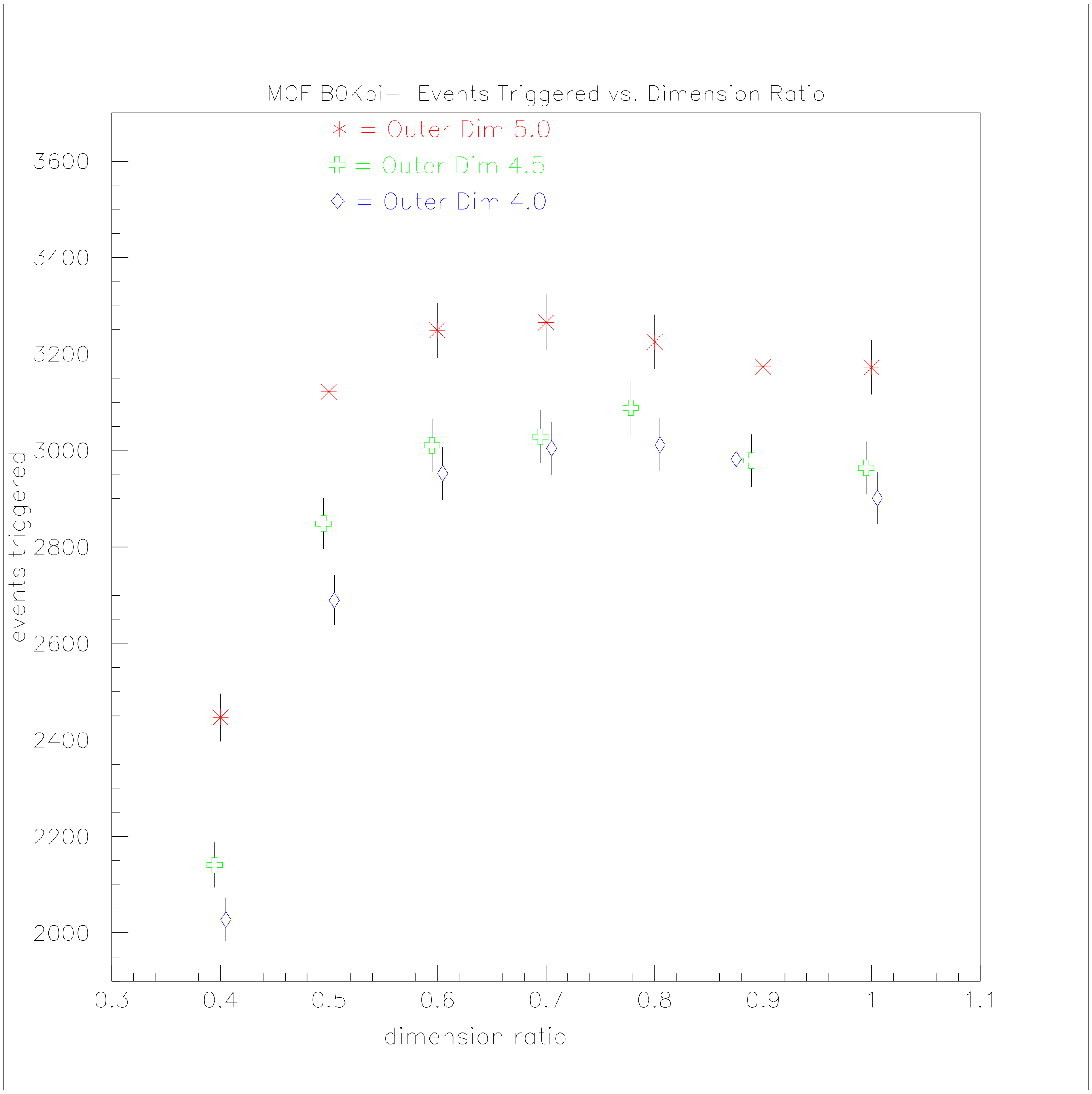
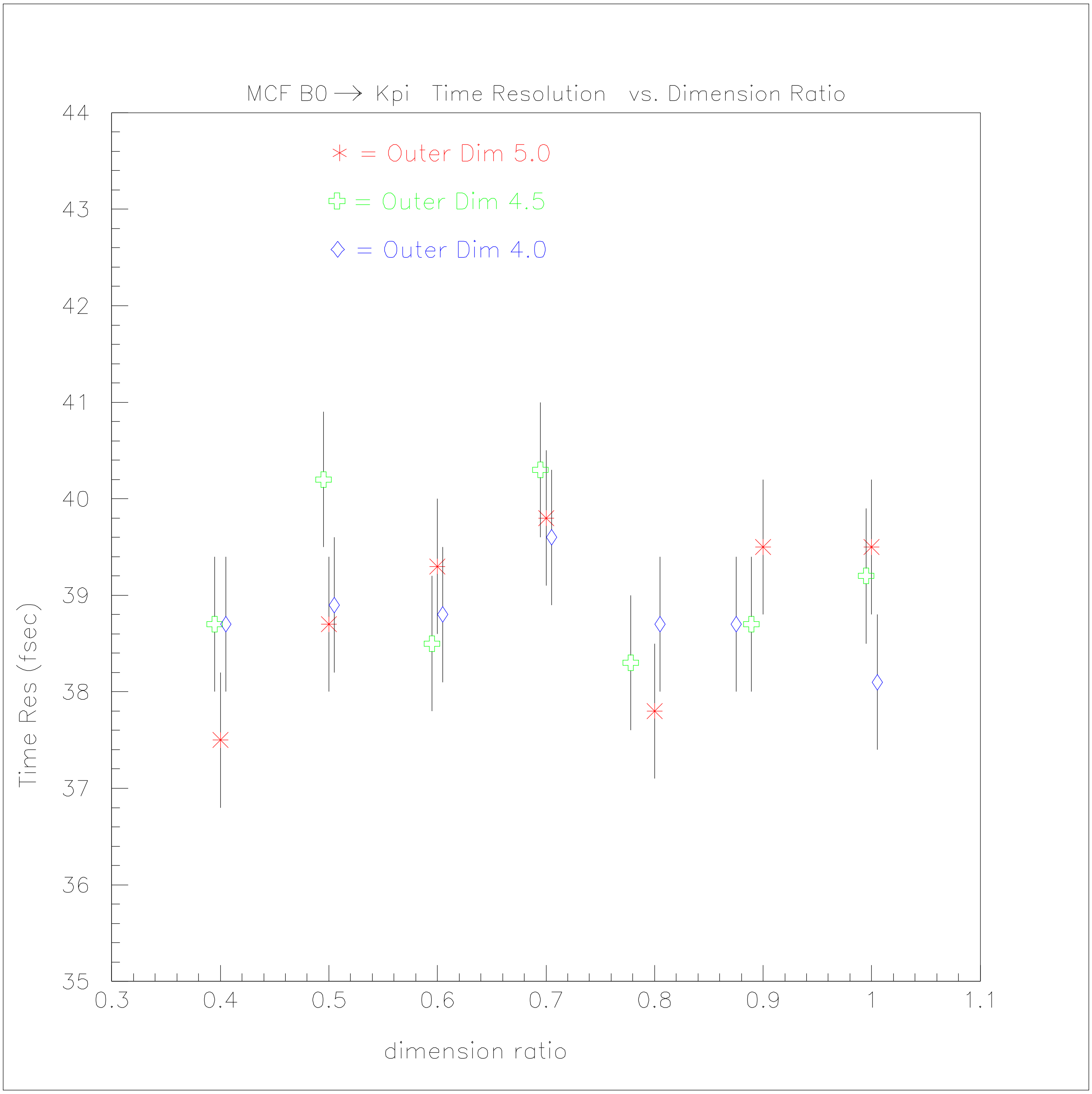
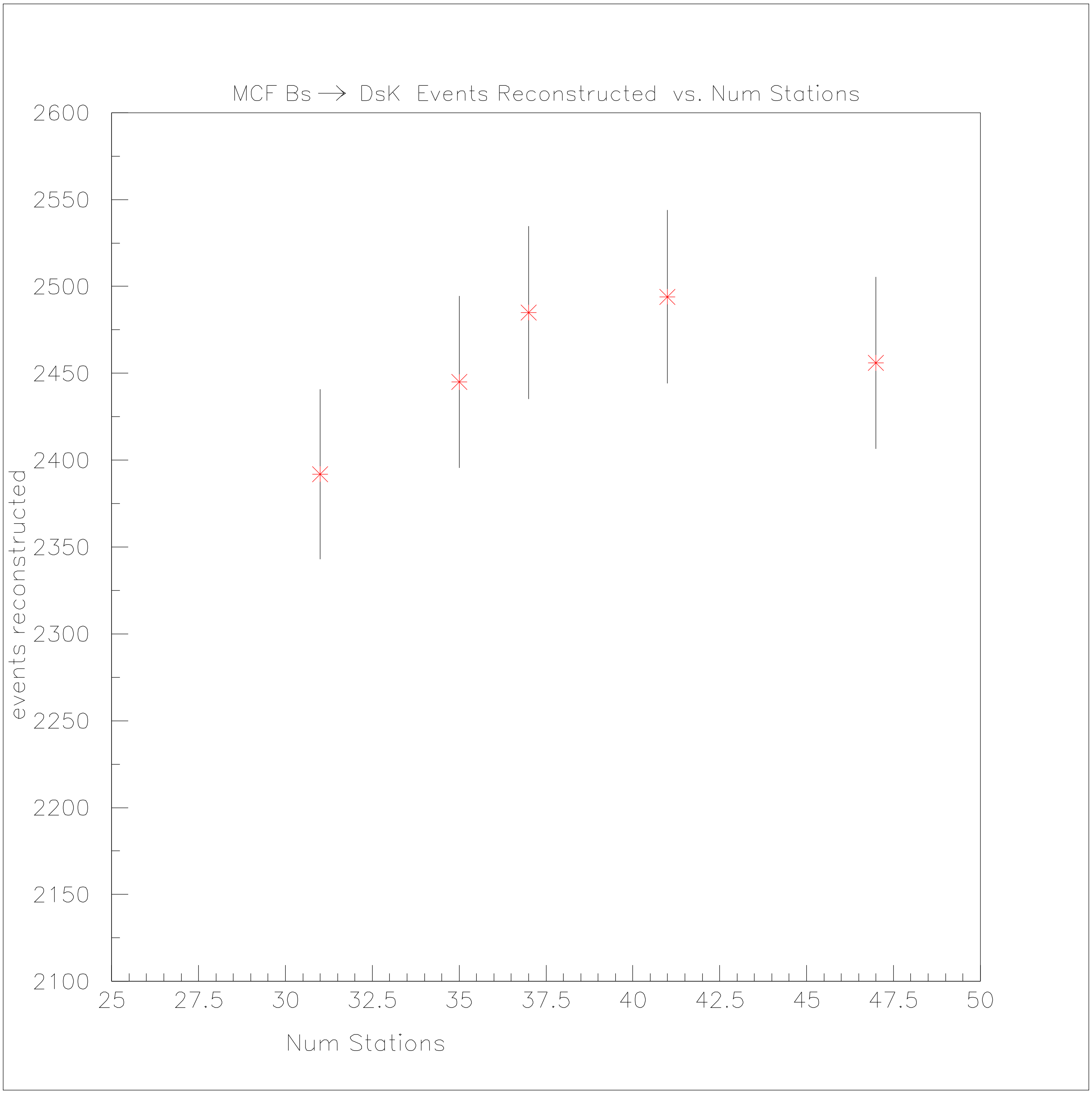

MCF B0Kpi- Events Triggered vs. Dimension Ratio
* = Outer Dim 5.0
= Outer Dim 4.5
◊ = Outer Dim 4.0
events triggered
dimension ratio
3600
3400
3200
3000
2800
2600
2400
2200
2000
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1

Fig. 5



MCF B0 → Kpi Time Resolution vs. Dimension Ratio
= Outer Dim 5.0
= Outer Dim 4.5
= Outer Dim 4.0
Time Res (fsec)
dimension ratio
35
36
37
38
39
40
41
42
43
44
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1

Fig. 6



MCF Bs → DsK Events Reconstructed vs. Num Stations
events reconstructed
2600
2550
2500
2450
2400
2350
2300
2250
2200
2150
2100
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50
Num Stations

Fig. 7

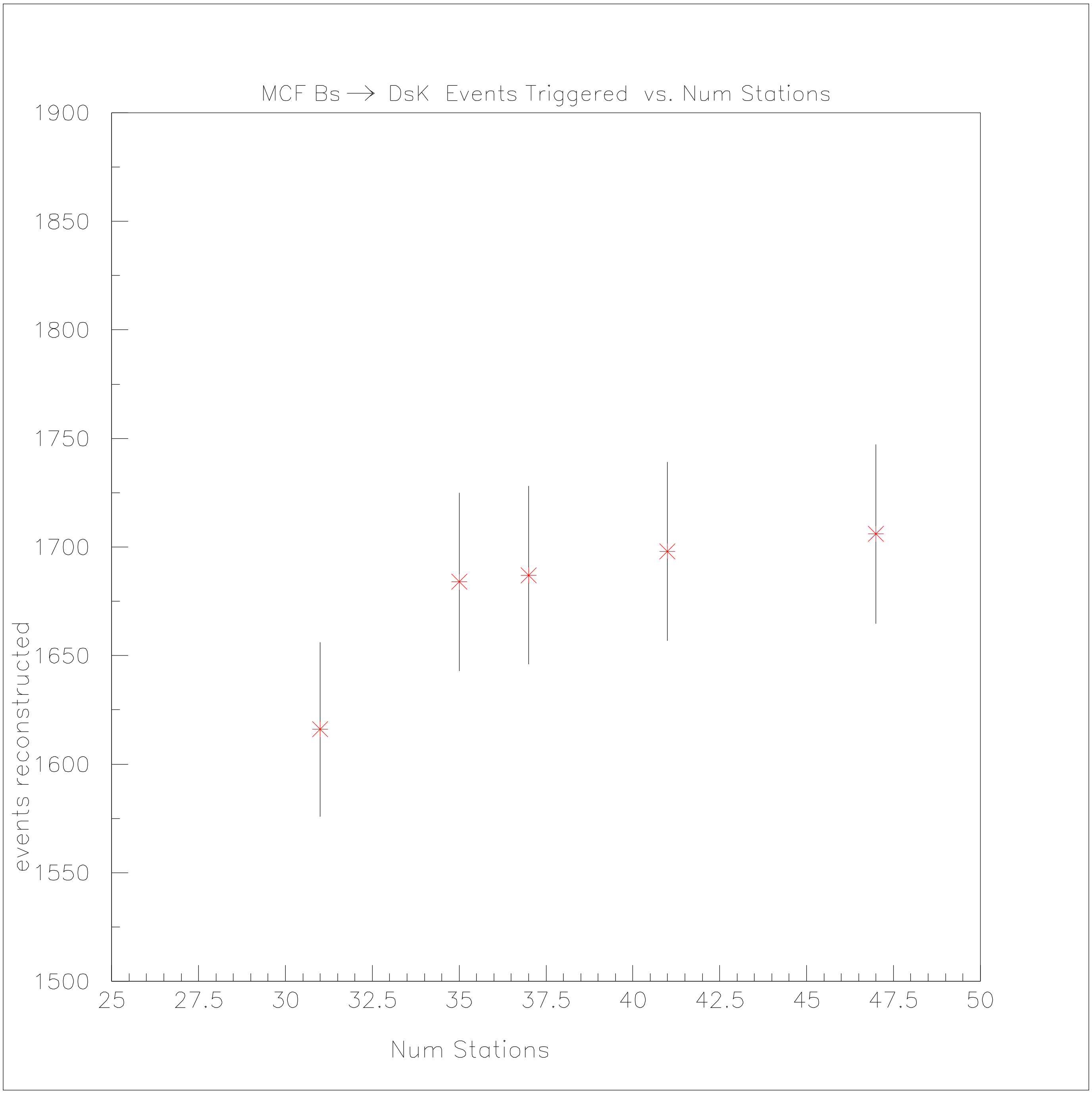

MCF Bs → DsK Events Triggered vs. Num Stations
events reconstructed
Num Stations
1900
1850
1800
1750
1700
1650
1600
1550
1500
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 8

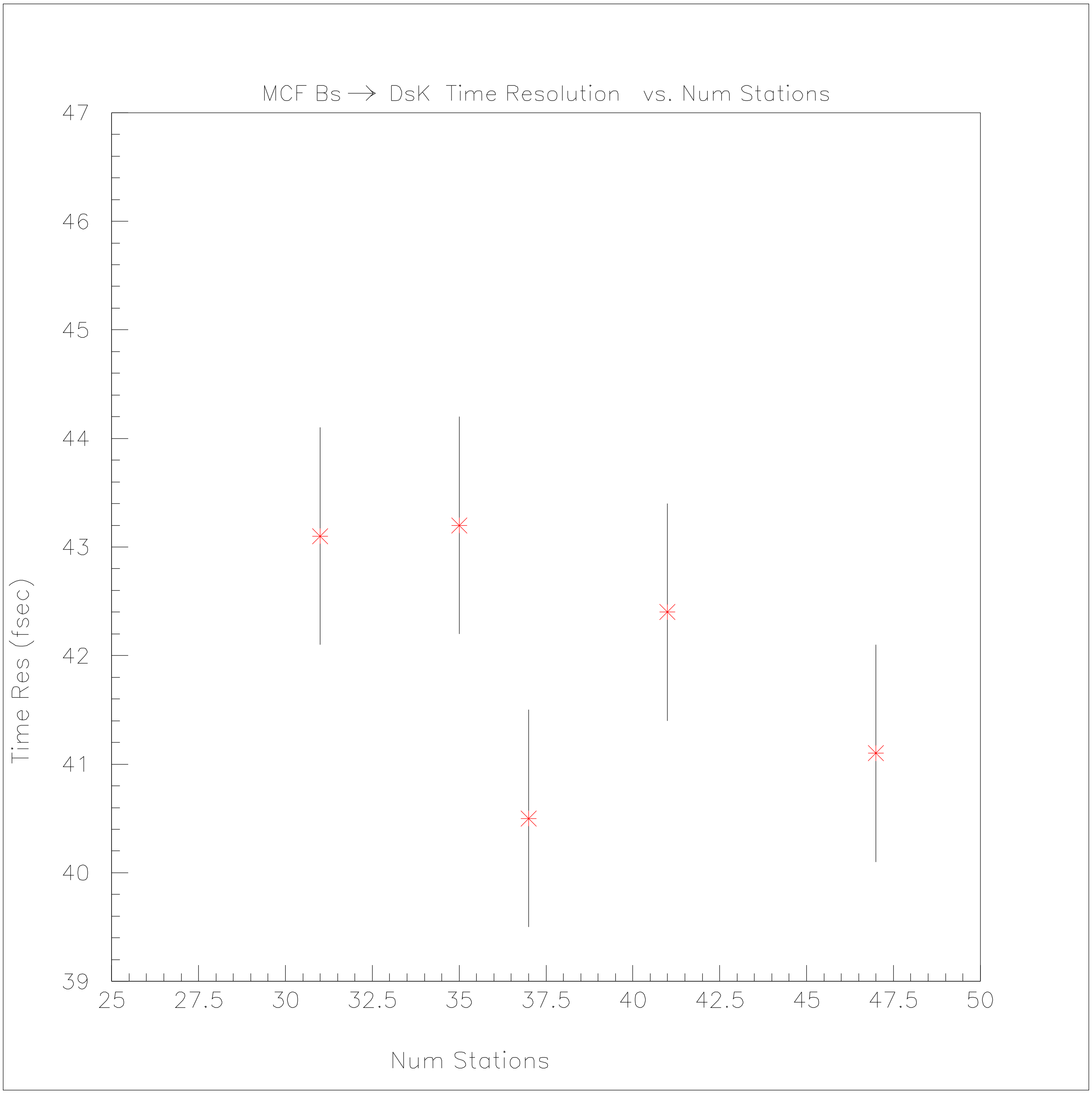

MCF Bs → DsK Time Resolution vs. Num Stations
Time Res (fsec)
Num Stations
47
46
45
44
43
42
41
40
39
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 9

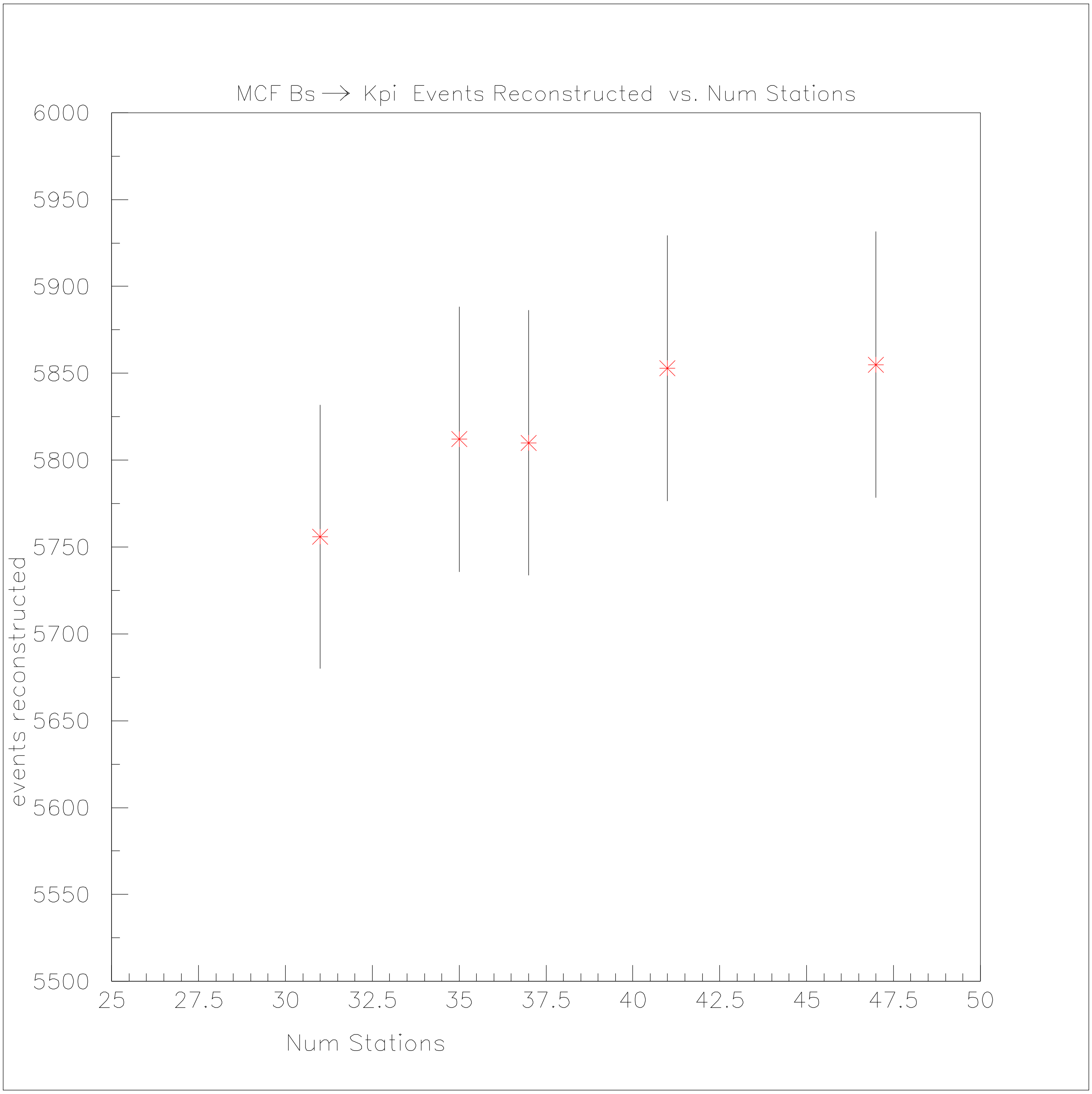

MCF Bs → Kpi Events Reconstructed vs. Num Stations
events reconstructed
6000
5950
5900
5850
5800
5750
5700
5650
5600
5550
5500
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50
Num Stations

Fig. 10

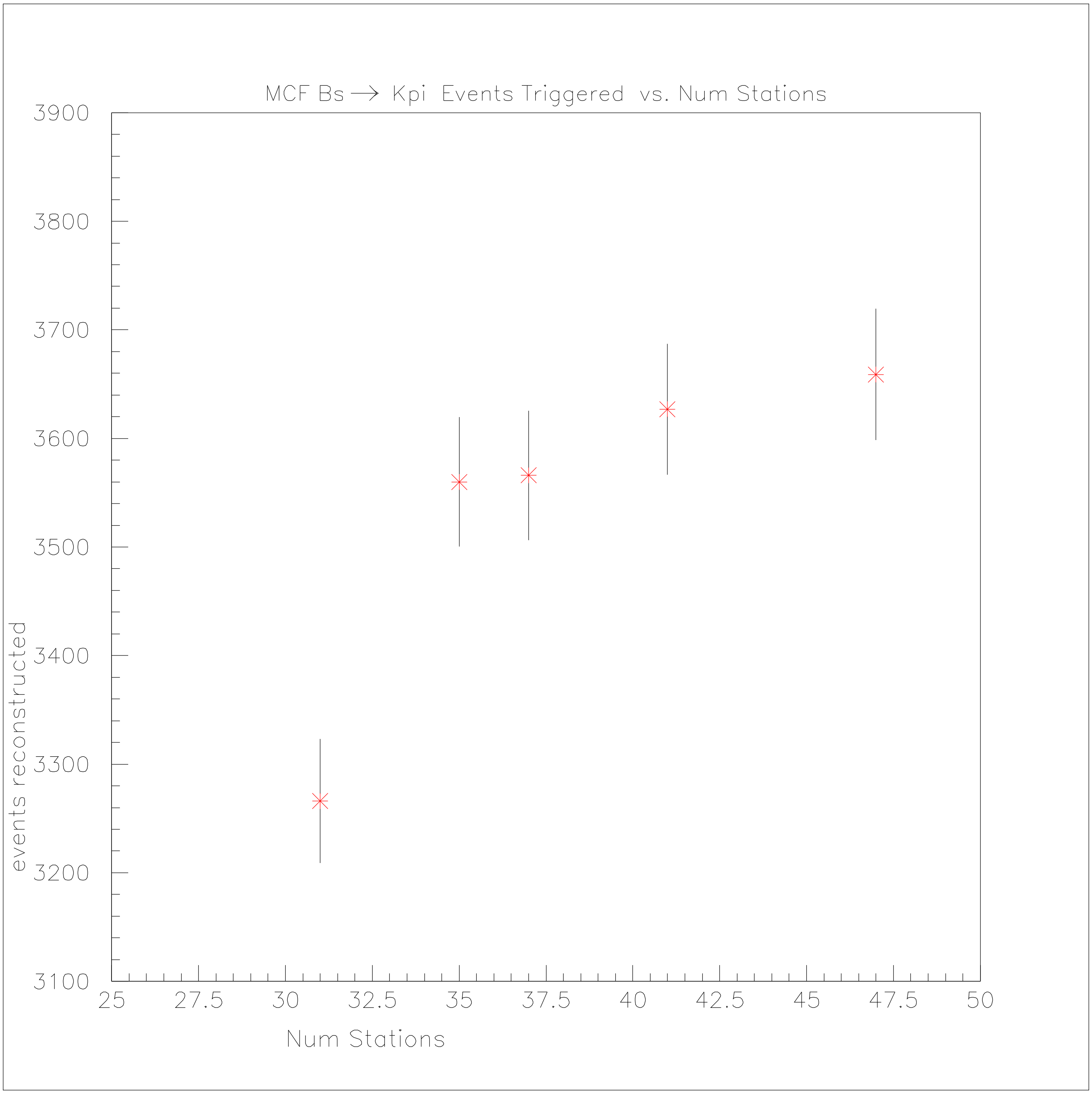

MCF Bs ⟶ Kpi Events Triggered vs. Num Stations
3900
3800
3700
3600
3500
3400
3300
3200
3100
events reconstructed
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50
Num Stations

Fig. 11

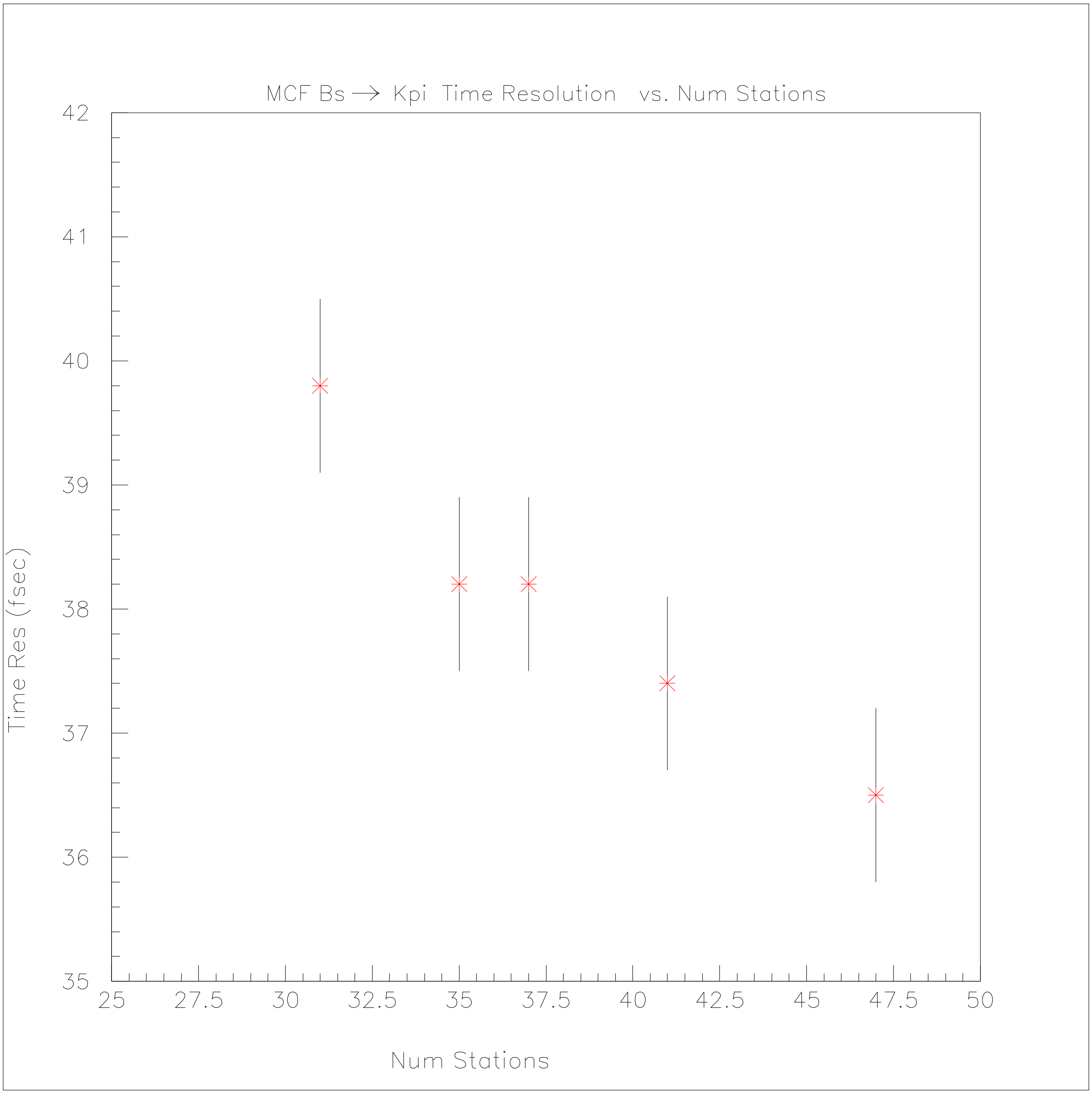

MCF Bs $\longrightarrow$ Kpi Time Resolution vs. Num Stations
Time Res (fsec)
42
41
40
39
38
37
36
35
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50
Num Stations

Fig. 12

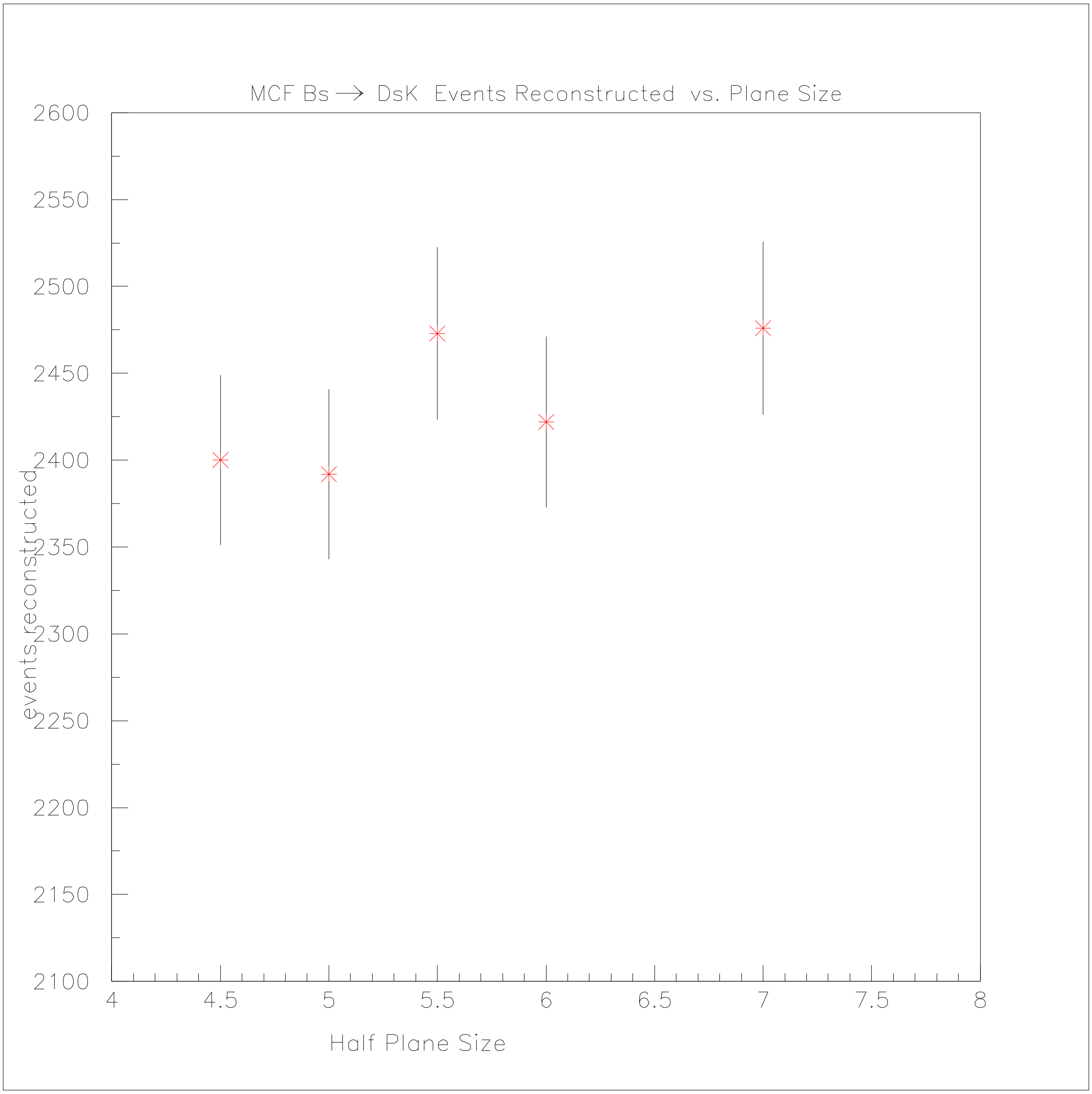

MCF Bs → DsK Events Reconstructed vs. Plane Size
events reconstructed
2600
2550
2500
2450
2400
2350
2300
2250
2200
2150
2100
4
4.5
5
5.5
6
6.5
7
7.5
8
Half Plane Size

Fig. 13

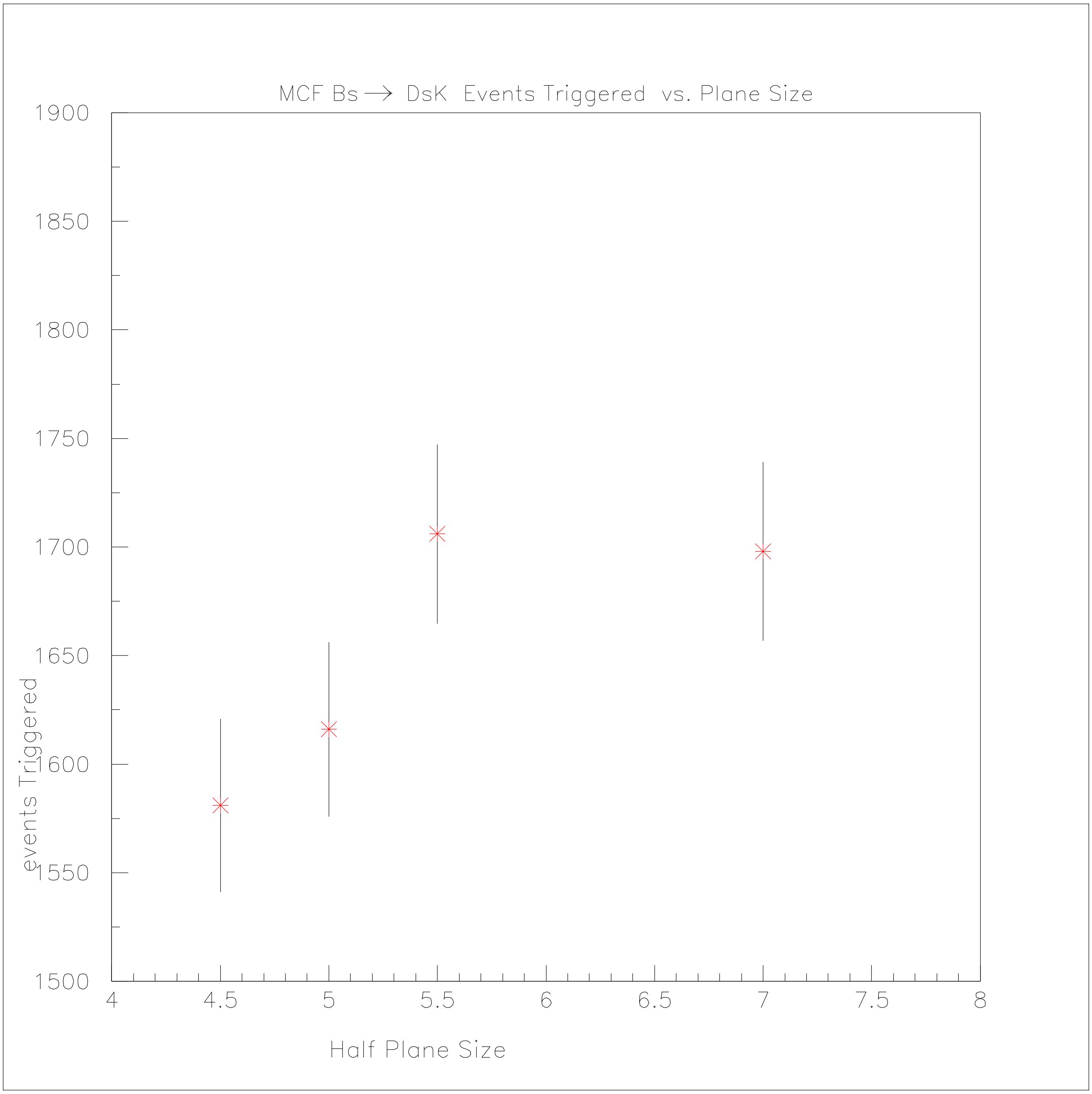

MCF Bs → DsK Events Triggered vs. Plane Size
1900
1850
1800
1750
1700
1650
1600
1550
1500
events Triggered
4
4.5
5
5.5
6
6.5
7
7.5
8
Half Plane Size

Fig. 14

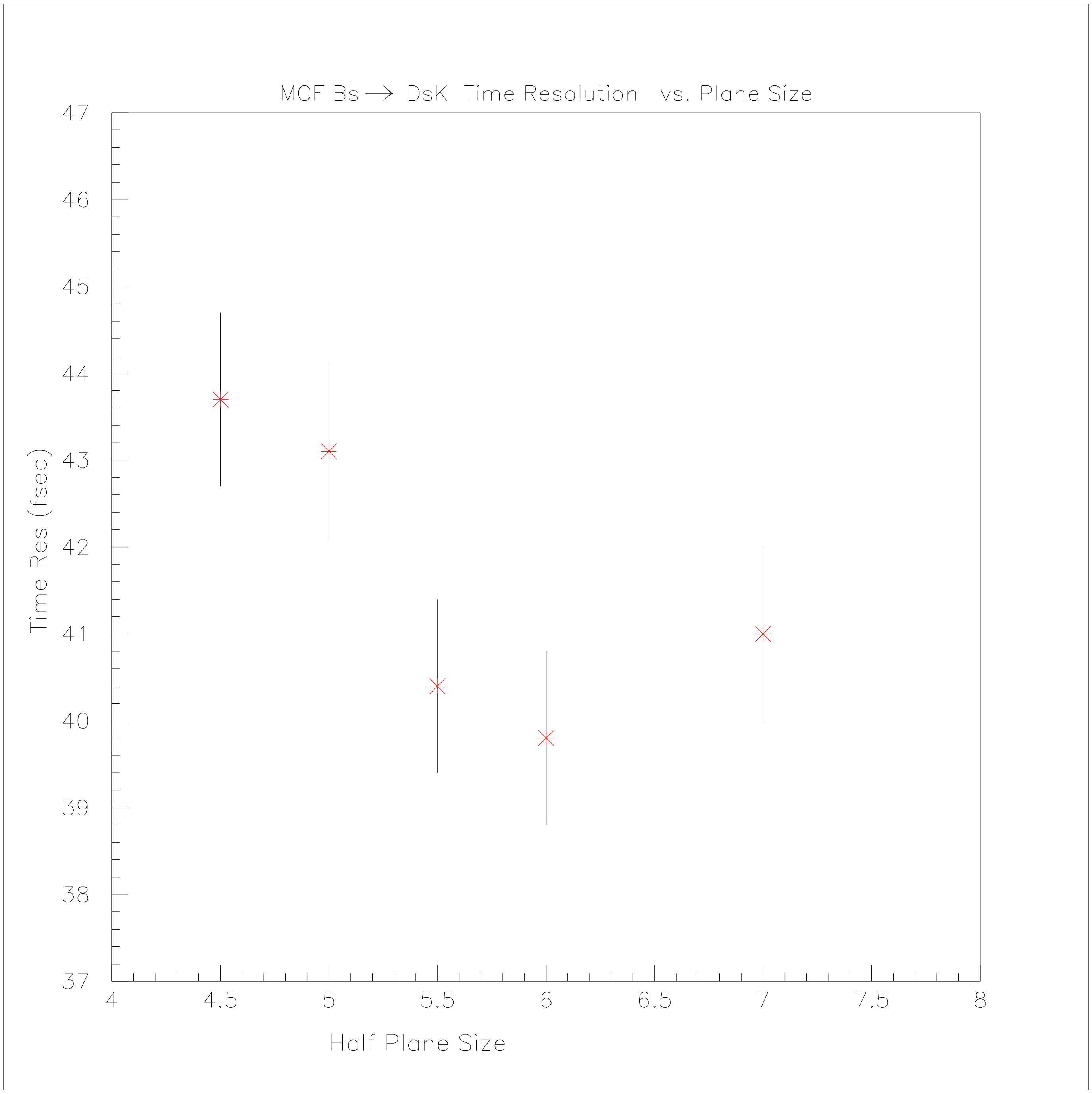

MCF Bs → DsK Time Resolution vs. Plane Size
Time Res (fsec)
47
46
45
44
43
42
41
40
39
38
37
4
4.5
5
5.5
6
6.5
7
7.5
8
Half Plane Size

Fig. 15

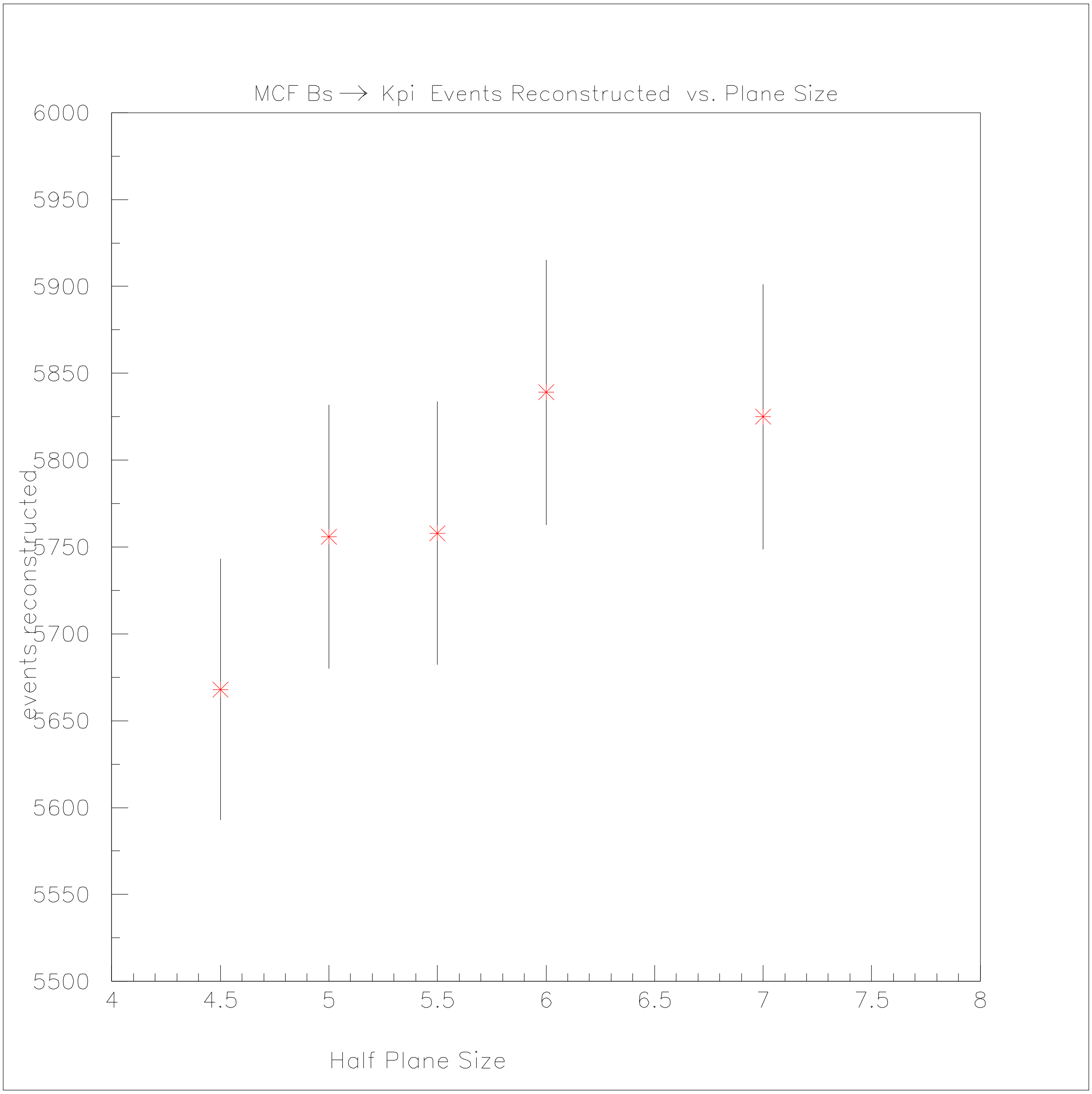

MCF Bs → Kpi Events Reconstructed vs. Plane Size
events reconstructed
Half Plane Size
6000
5950
5900
5850
5800
5750
5700
5650
5600
5550
5500
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 16

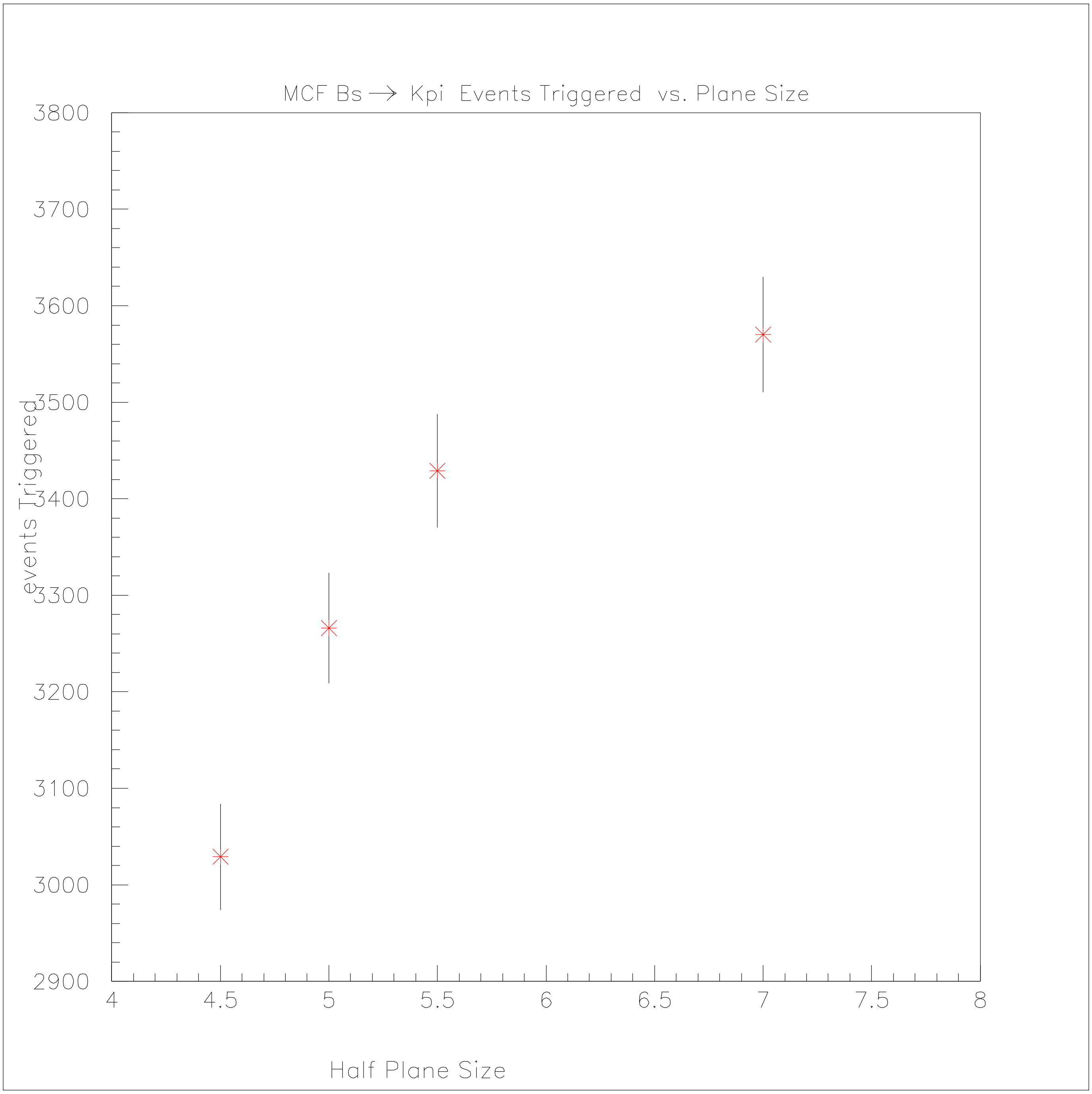

MCF Bs → Kpi Events Triggered vs. Plane Size
events Triggered
Half Plane Size
3800
3700
3600
3500
3400
3300
3200
3100
3000
2900
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 17

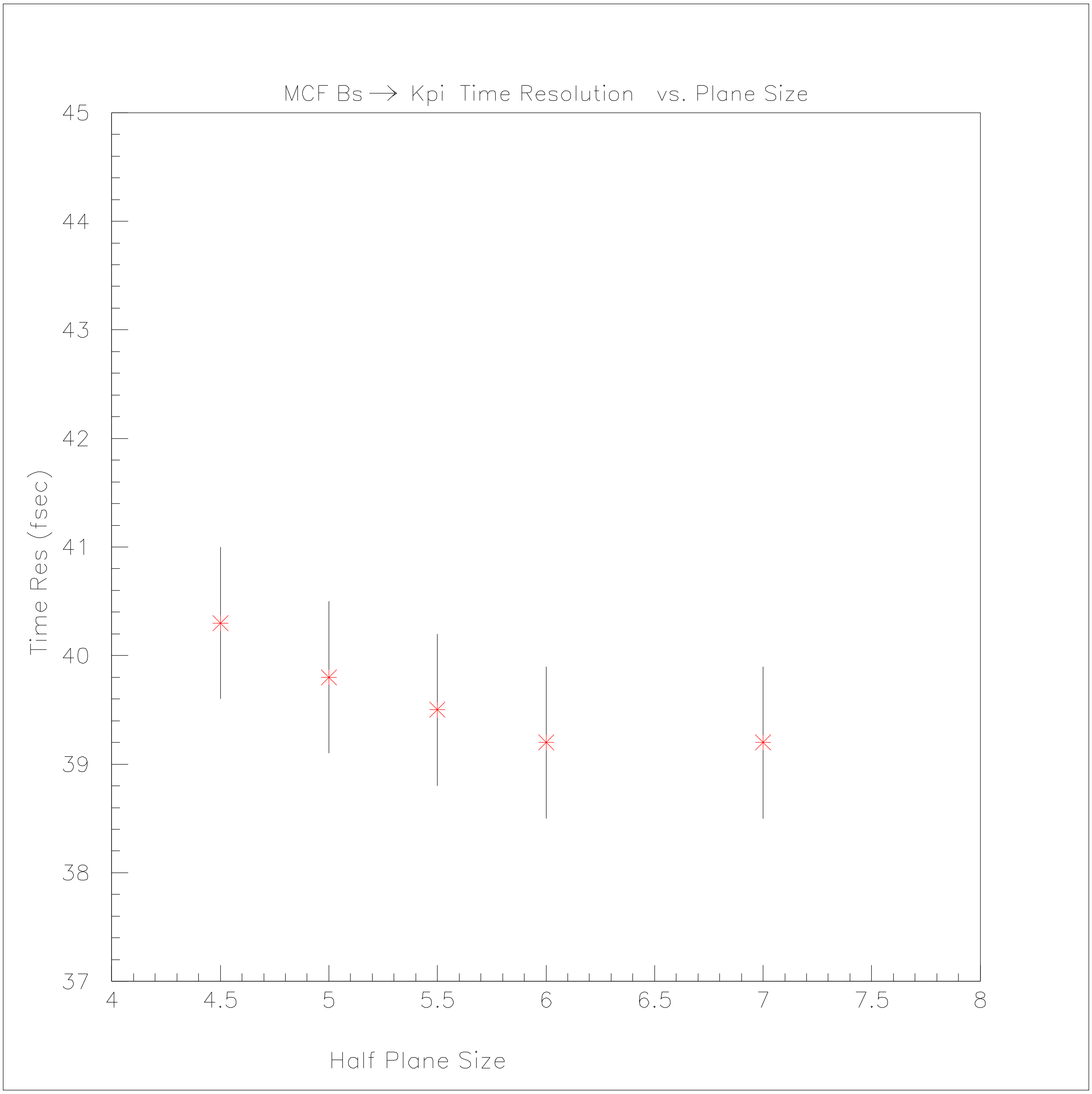

MCF Bs → Kpi Time Resolution vs. Plane Size
Time Res (fsec)
45
44
43
42
41
40
39
38
37
4
4.5
5
5.5
6
6.5
7
7.5
8
Half Plane Size

Fig. 18

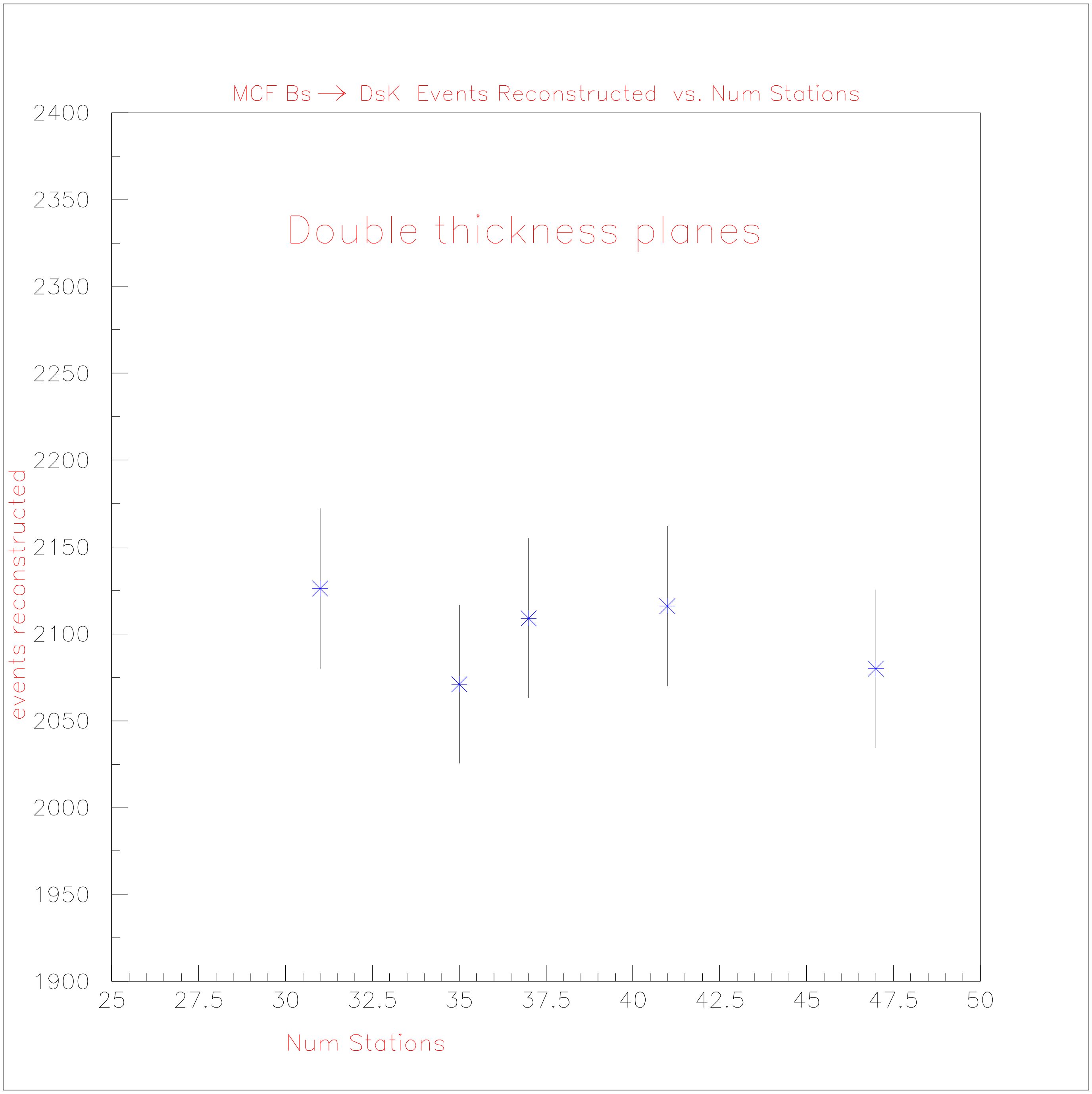
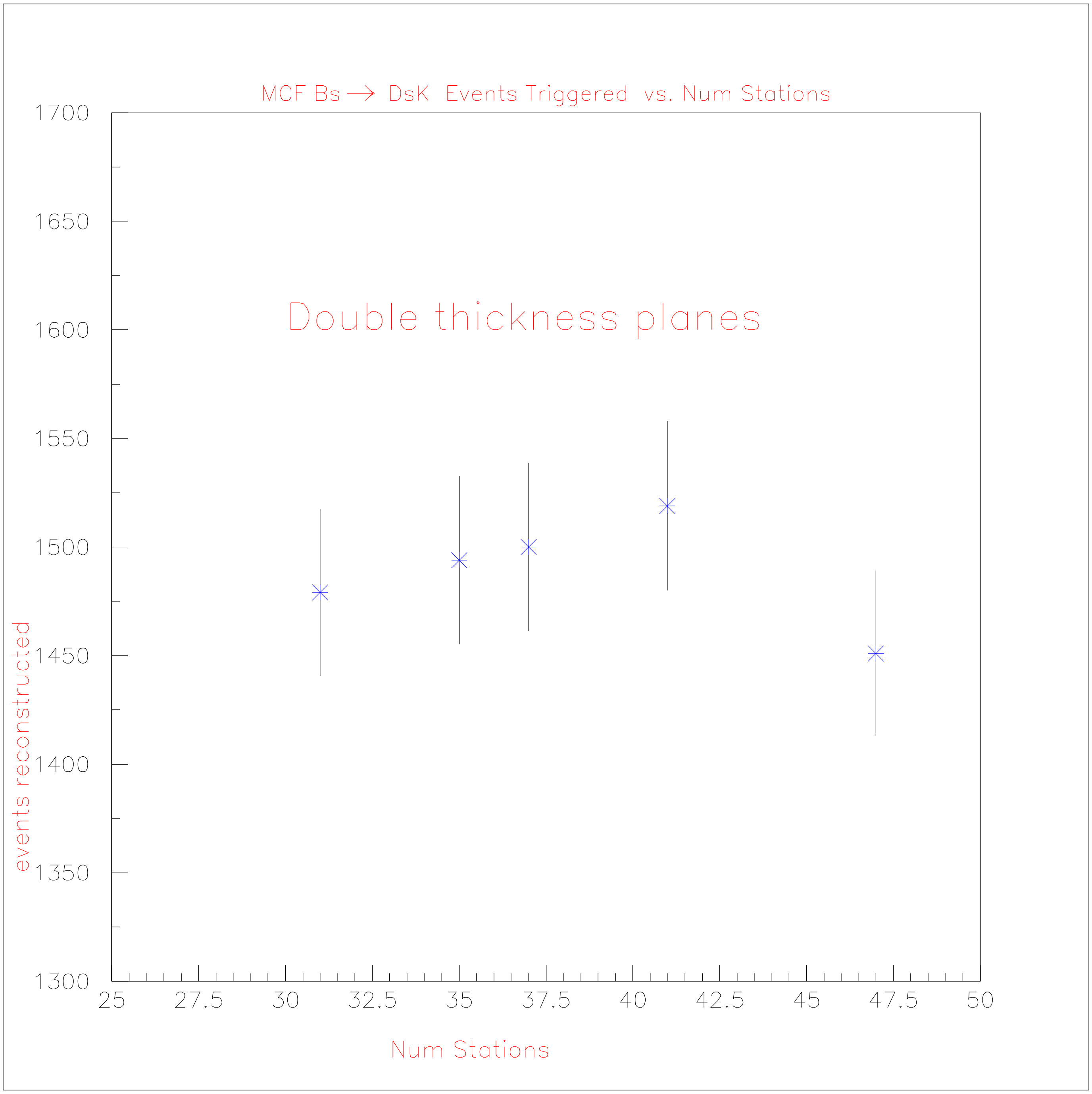

MCF Bs ⟶ DsK Events Reconstructed vs. Num Stations
Double thickness planes
events reconstructed
Num Stations
2400
2350
2300
2250
2200
2150
2100
2050
2000
1950
1900
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 19



MCF Bs → DsK Events Triggered vs. Num Stations
Double thickness planes
events reconstructed
Num Stations
1300
1350
1400
1450
1500
1550
1600
1650
1700
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 20

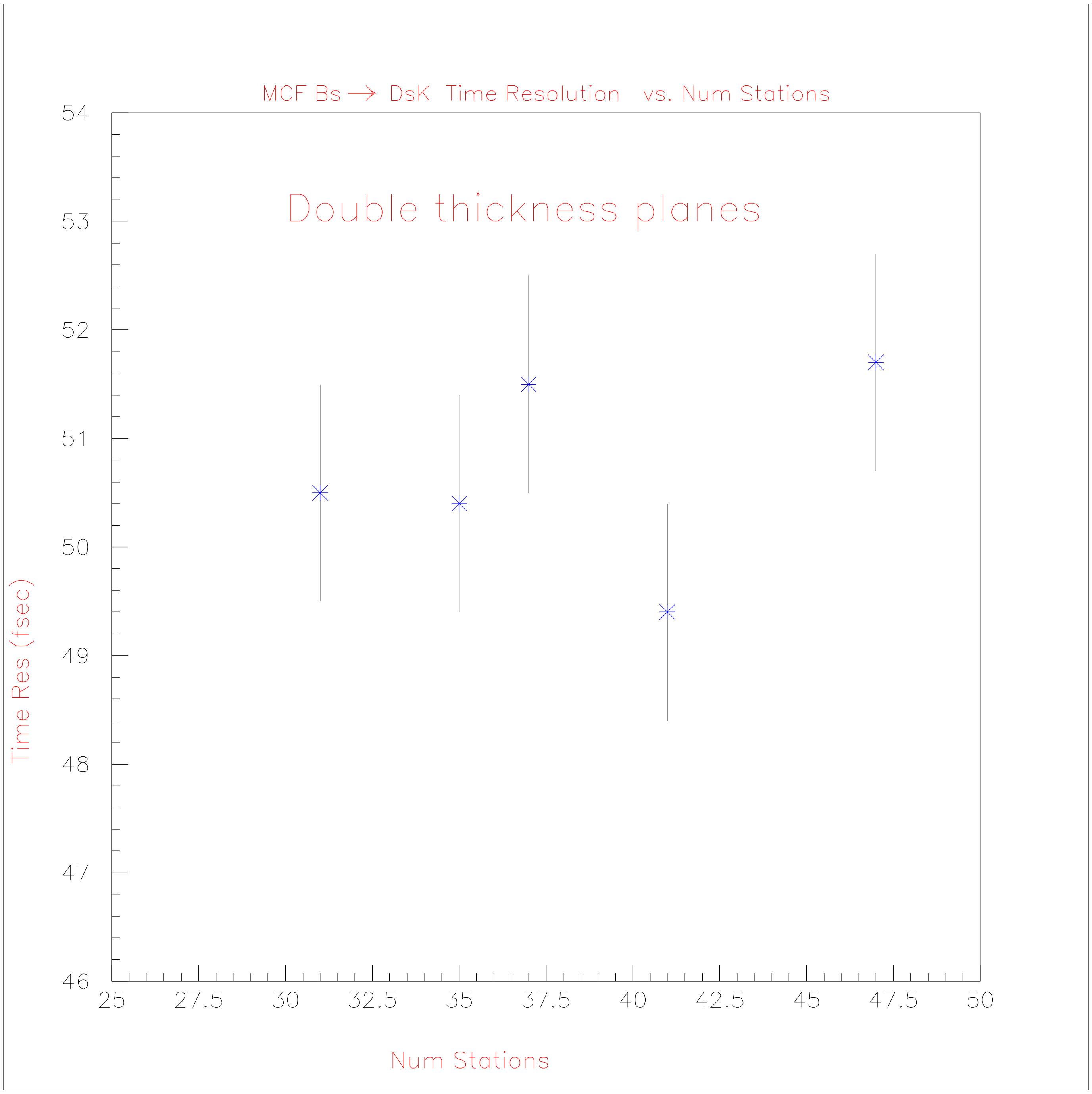

MCF Bs → DsK Time Resolution vs. Num Stations
Double thickness planes
Time Res (fsec)
Num Stations
54
53
52
51
50
49
48
47
46
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 21

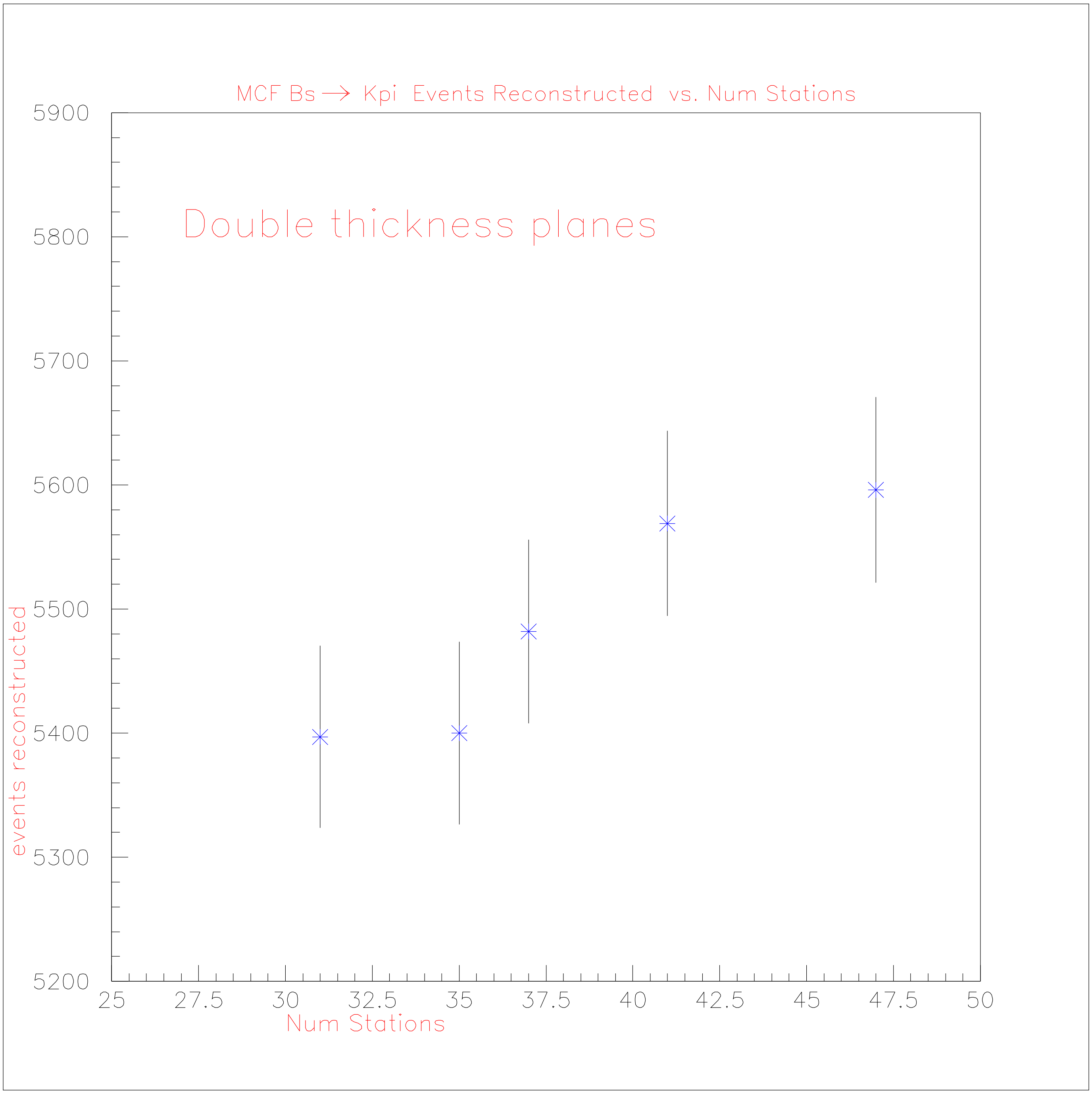

MCF Bs → Kpi Events Reconstructed vs. Num Stations
Double thickness planes
events reconstructed
Num Stations
5900
5800
5700
5600
5500
5400
5300
5200
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 22

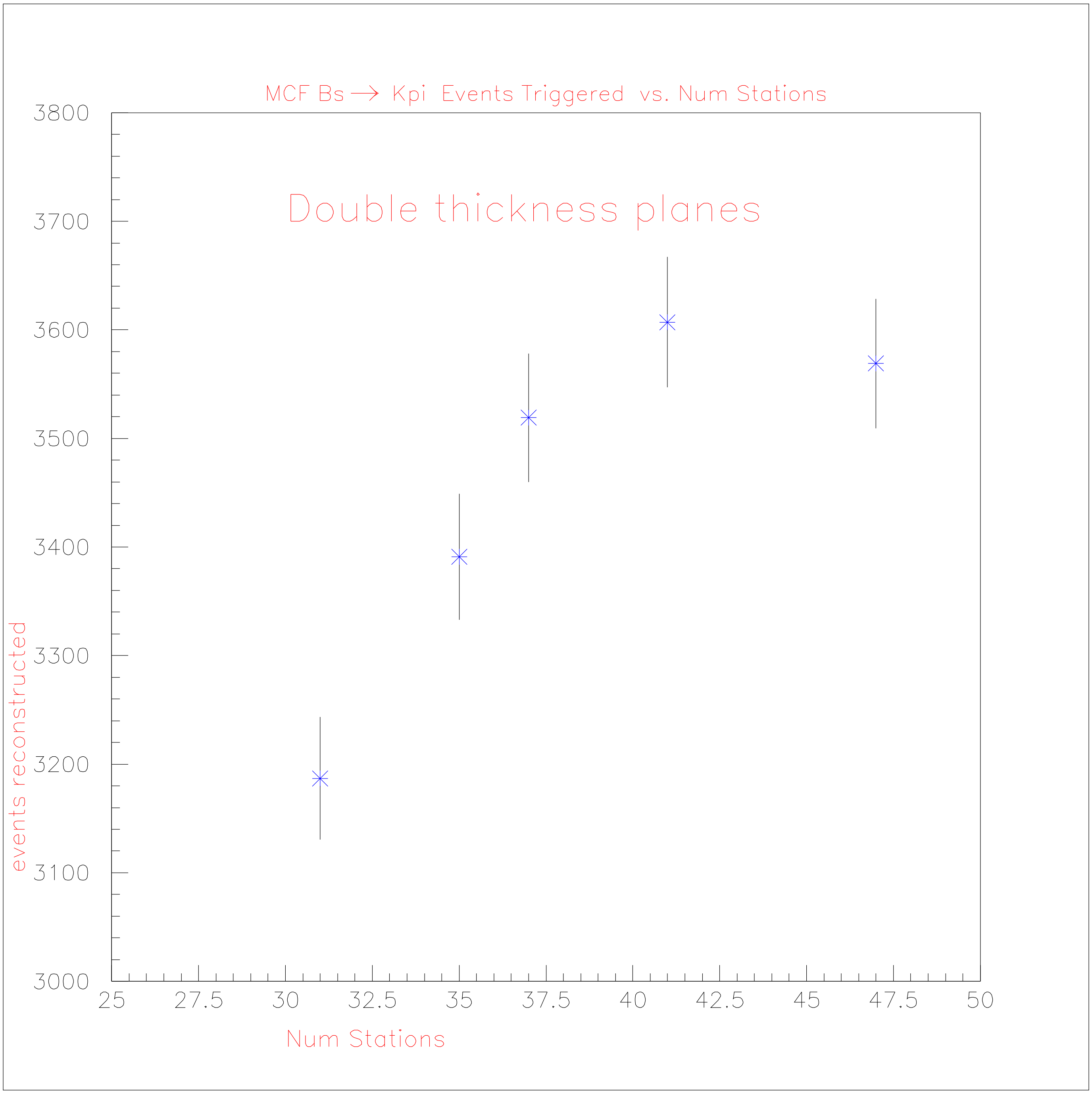
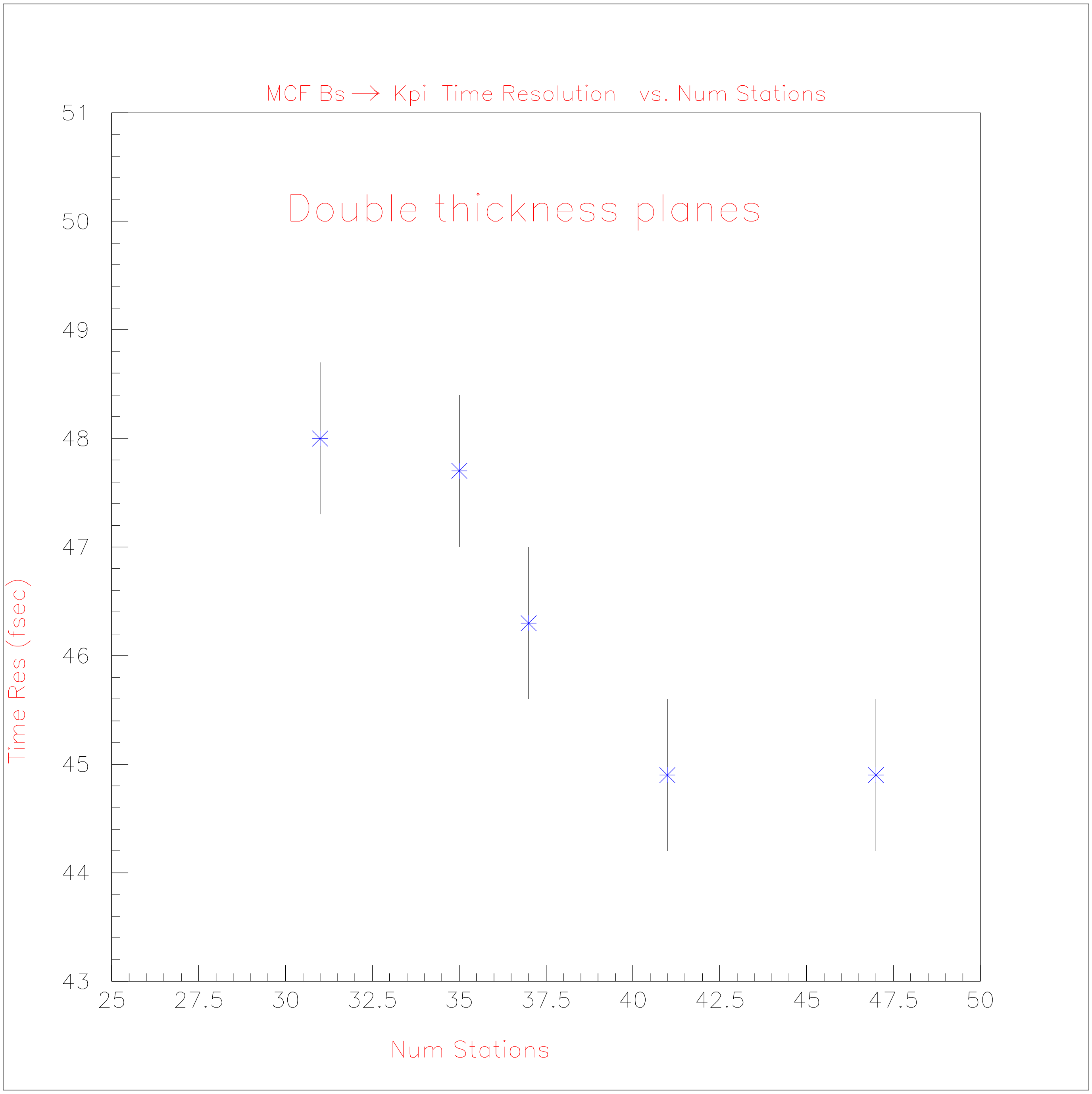
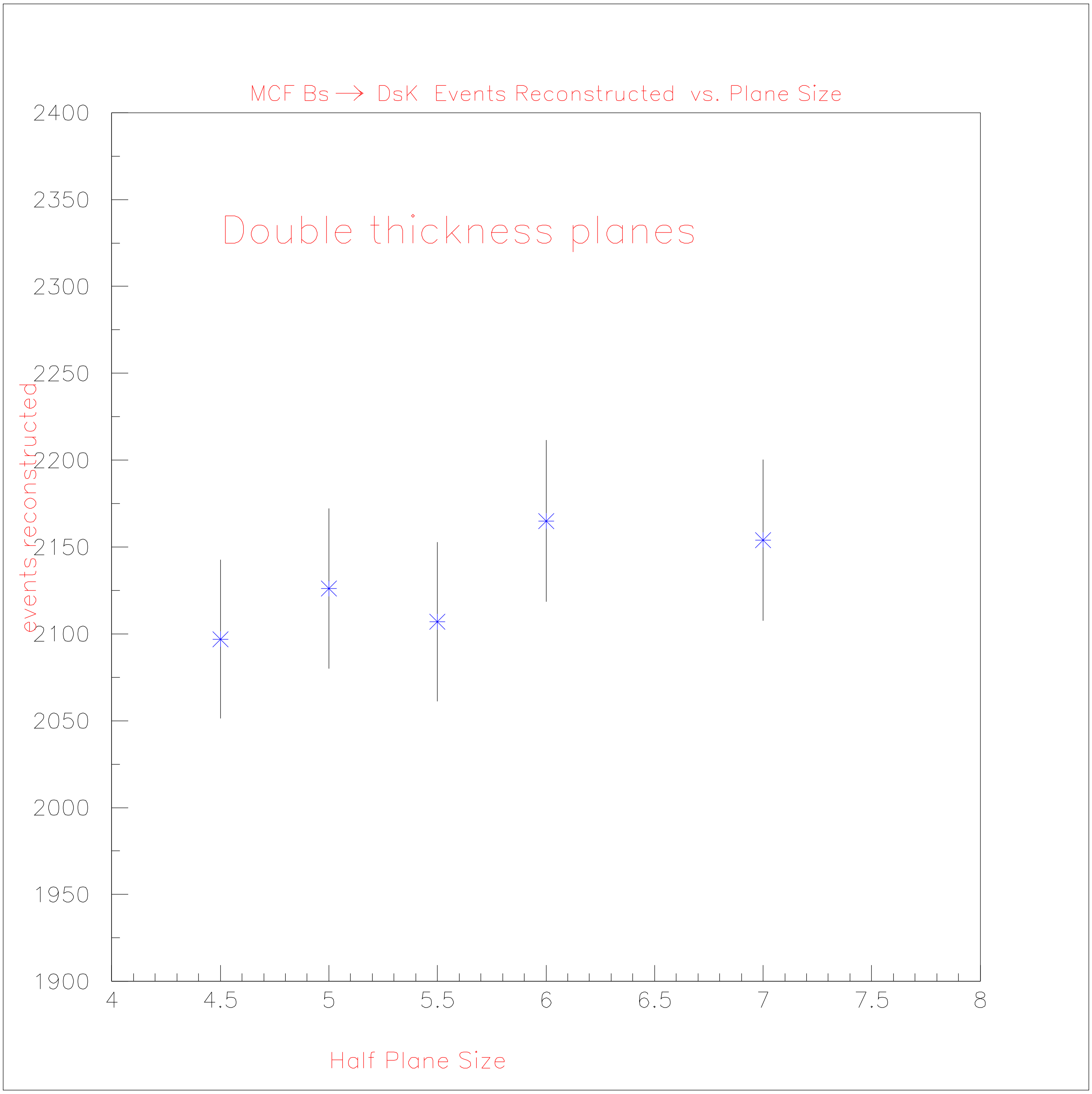

MCF Bs → Kpi Events Triggered vs. Num Stations
Double thickness planes
events reconstructed
Num Stations
3000
3100
3200
3300
3400
3500
3600
3700
3800
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 23



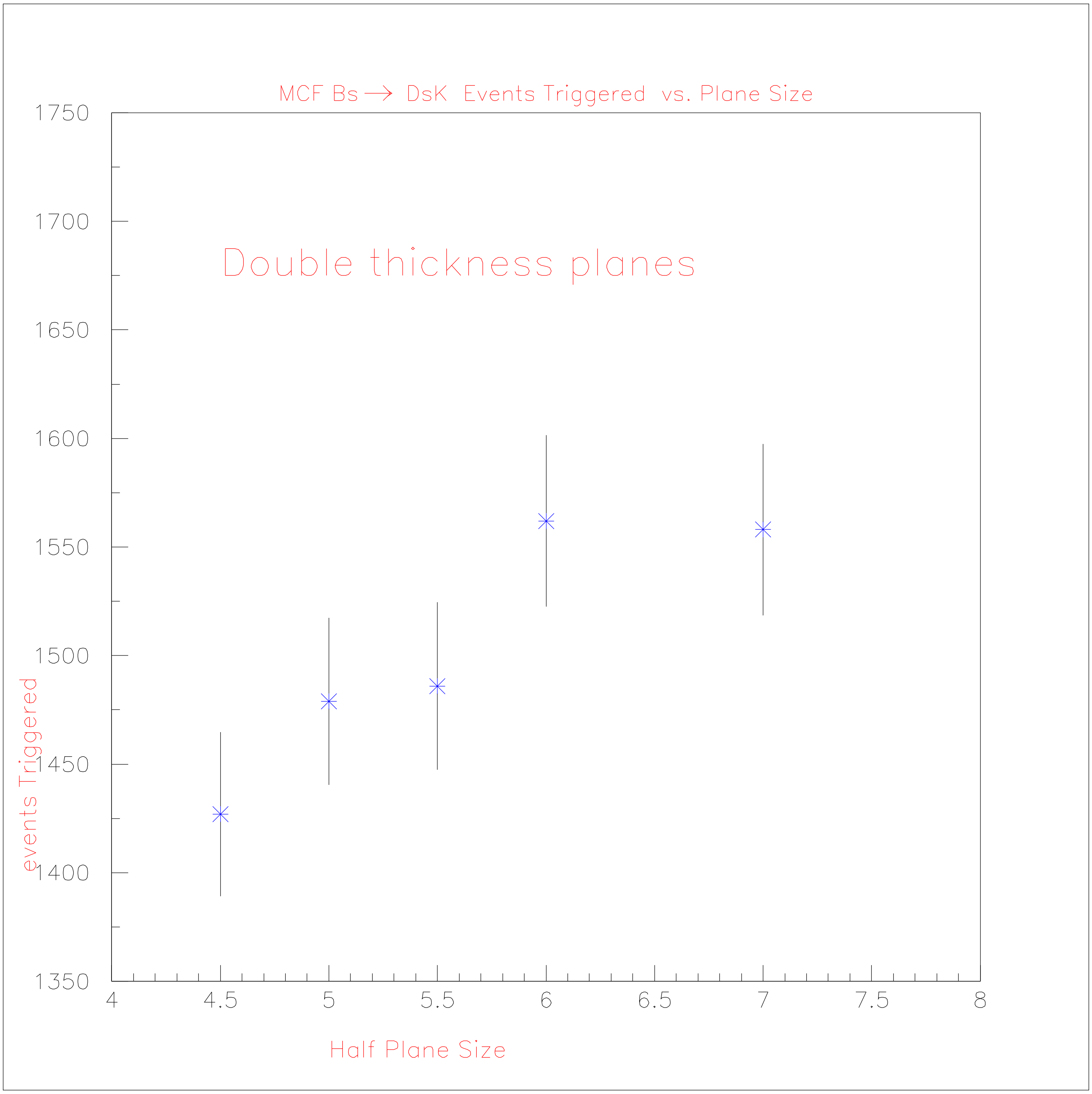
MCF Bs → Kpi Time Resolution vs. Num Stations
Double thickness planes
Time Res (fsec)
Num Stations
51
50
49
48
47
46
45
44
43
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Fig. 24



MCF Bs → DsK Events Reconstructed vs. Plane Size
Double thickness planes
events reconstructed
Half Plane Size
2400
2350
2300
2250
2200
2150
2100
2050
2000
1950
1900
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 25



MCF Bs ⟶ DsK Events Triggered vs. Plane Size
Double thickness planes
events Triggered
Half Plane Size
1750
1700
1650
1600
1550
1500
1450
1400
1350
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 26

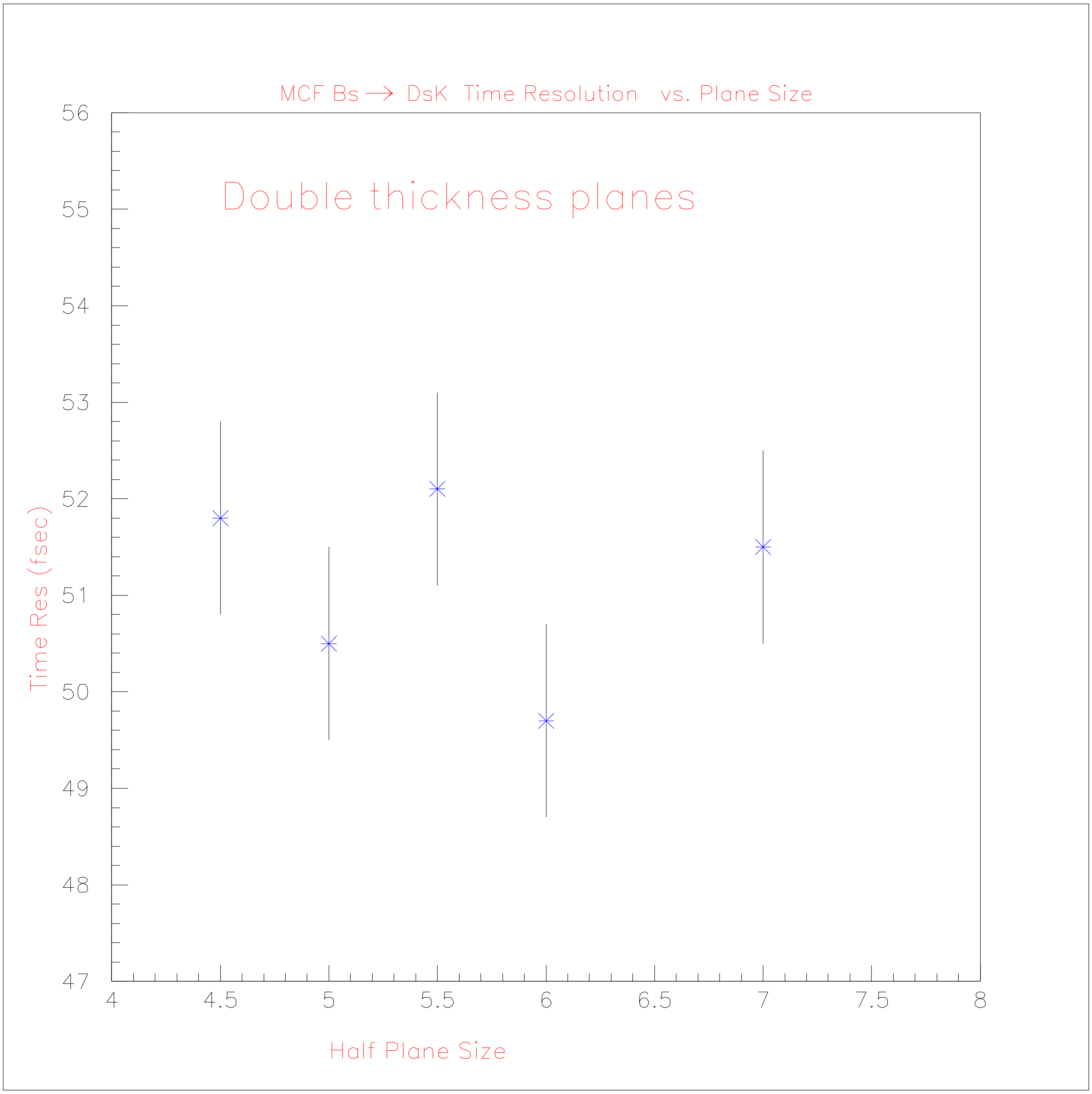

MCF Bs → DsK Time Resolution vs. Plane Size
Double thickness planes
Time Res (fsec)
Half Plane Size
56
55
54
53
52
51
50
49
48
47
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 27

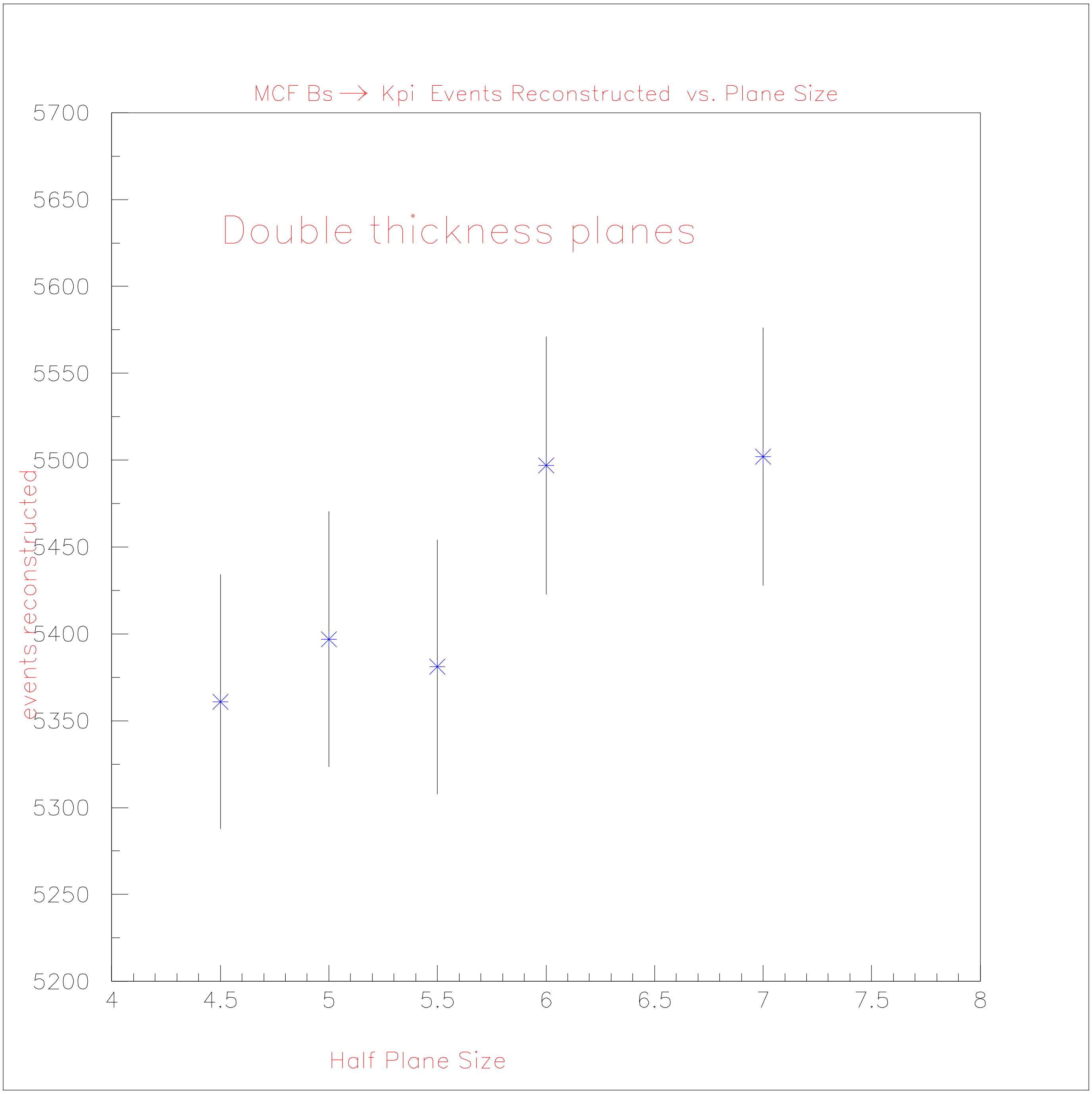

MCF Bs → Kpi Events Reconstructed vs. Plane Size
Double thickness planes
events reconstructed
Half Plane Size
5700
5650
5600
5550
5500
5450
5400
5350
5300
5250
5200
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 28

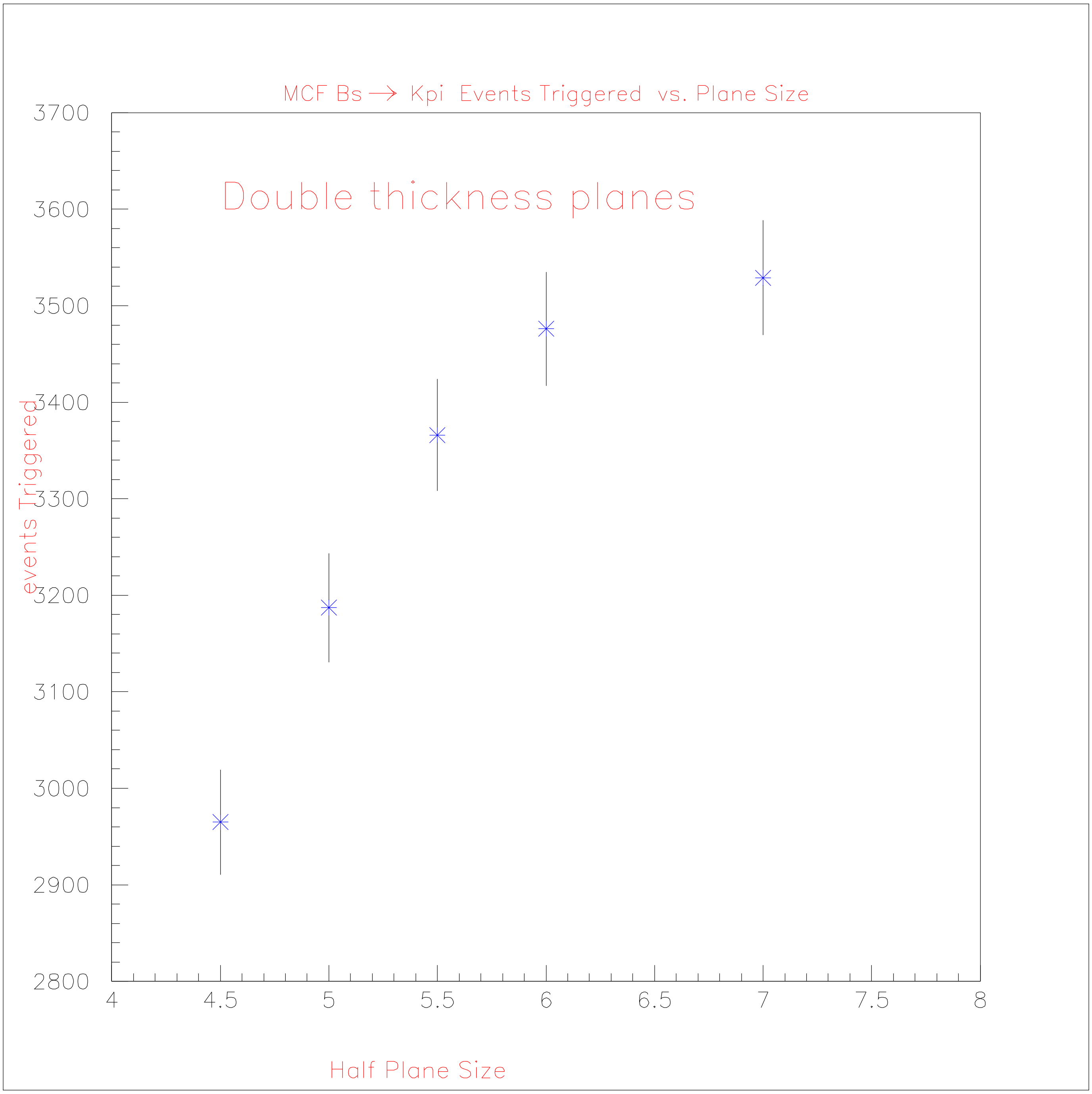

MCF Bs → Kpi Events Triggered vs. Plane Size
Double thickness planes
events Triggered
Half Plane Size
3700
3600
3500
3400
3300
3200
3100
3000
2900
2800
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 29

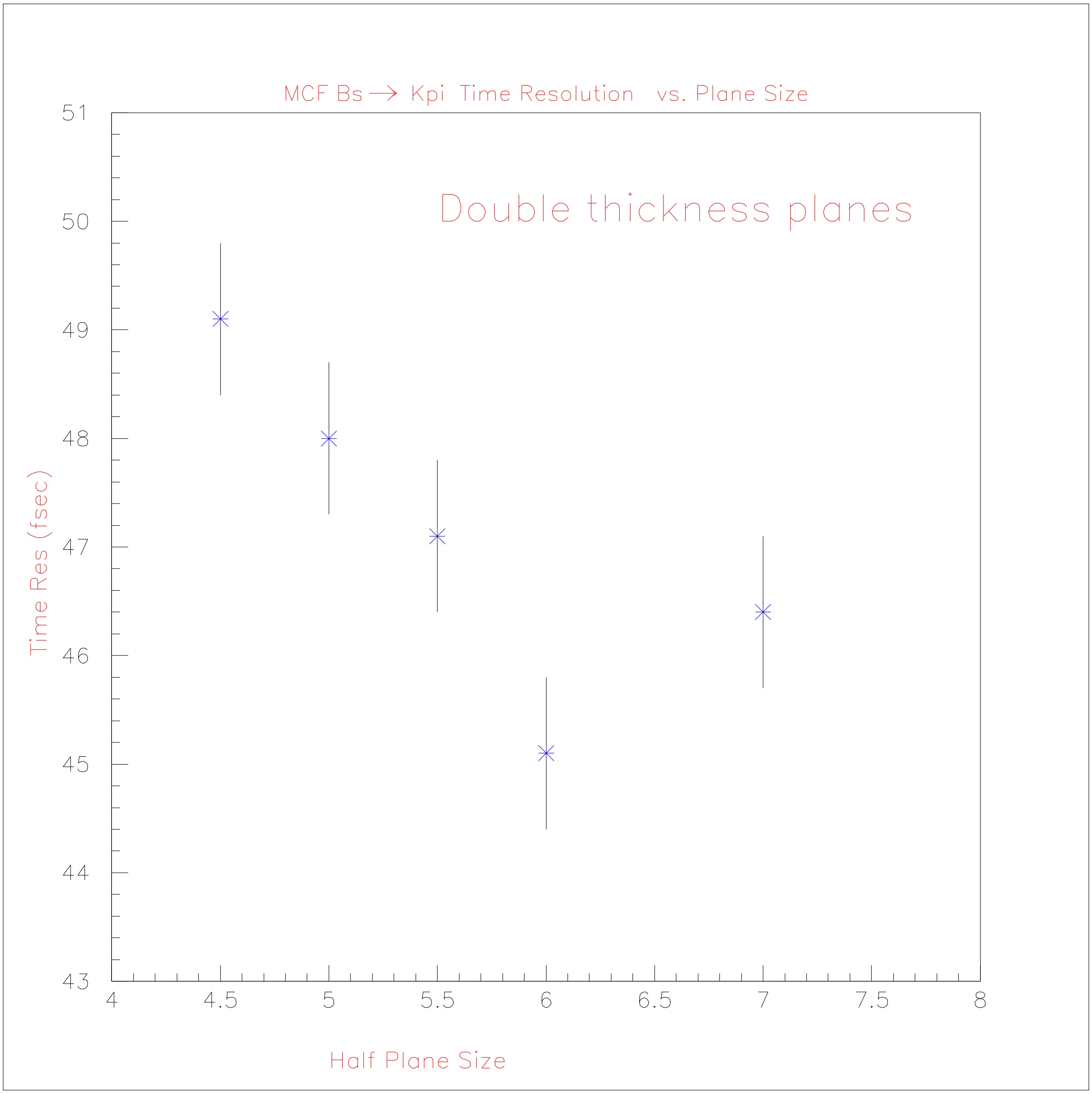

MCF Bs → Kpi Time Resolution vs. Plane Size
Double thickness planes
Time Res (fsec)
Half Plane Size
51
50
49
48
47
46
45
44
43
4
4.5
5
5.5
6
6.5
7
7.5
8

Fig. 30