Beam life time study for low energy run

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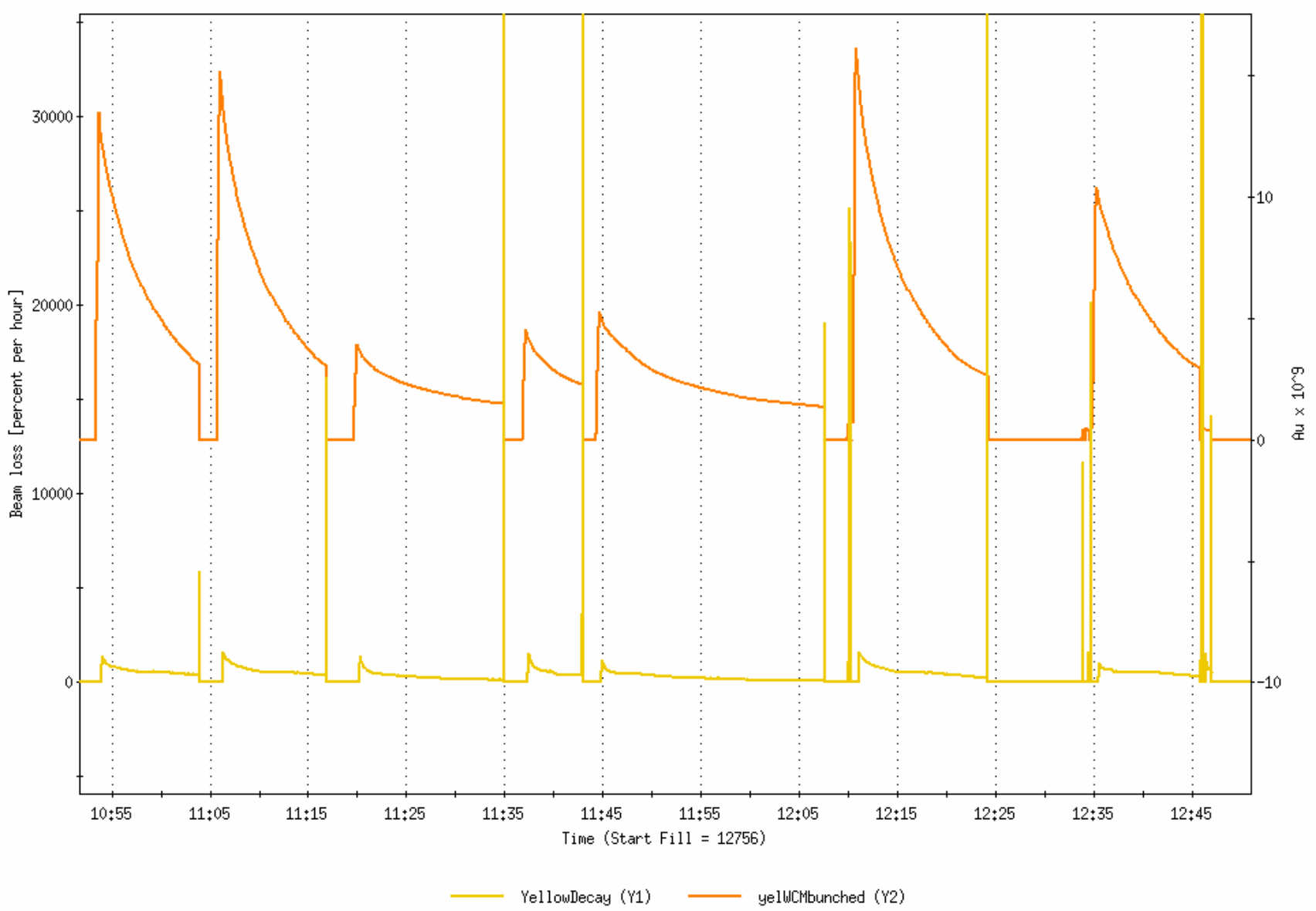
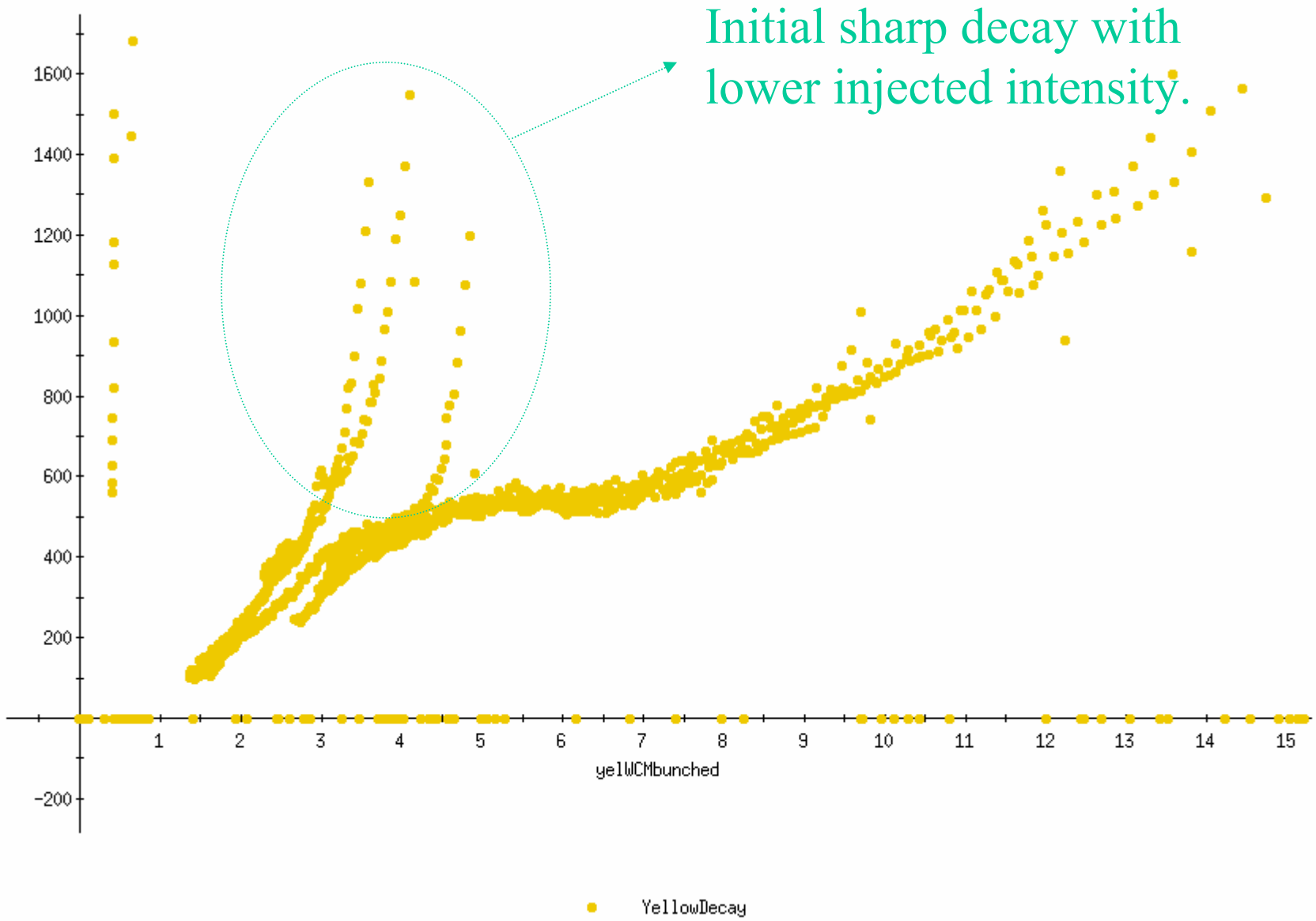
Plan

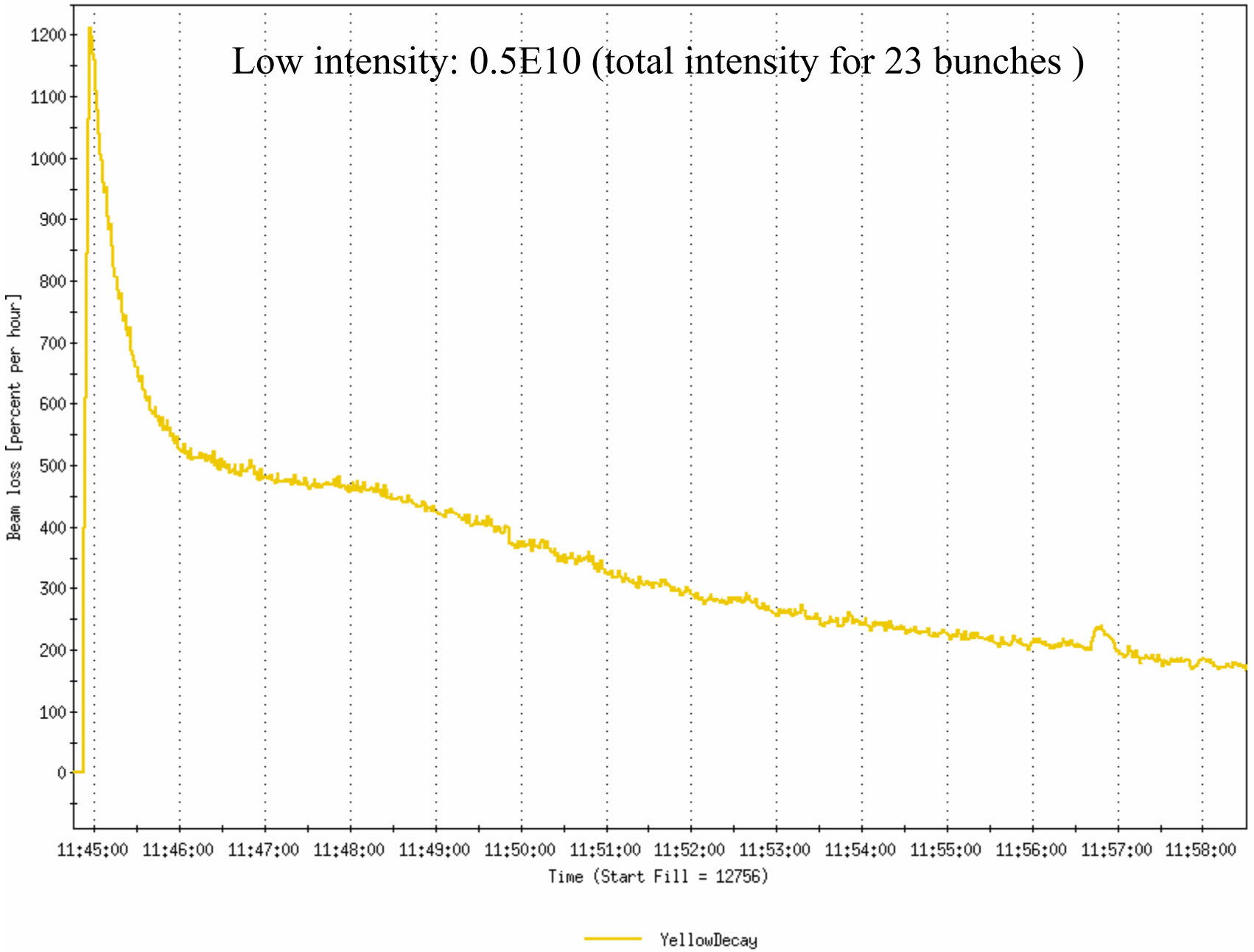
- Verify intensity dependant beam loss in yellow ring.
- Verify space charge effects via octopoles in blue ring.

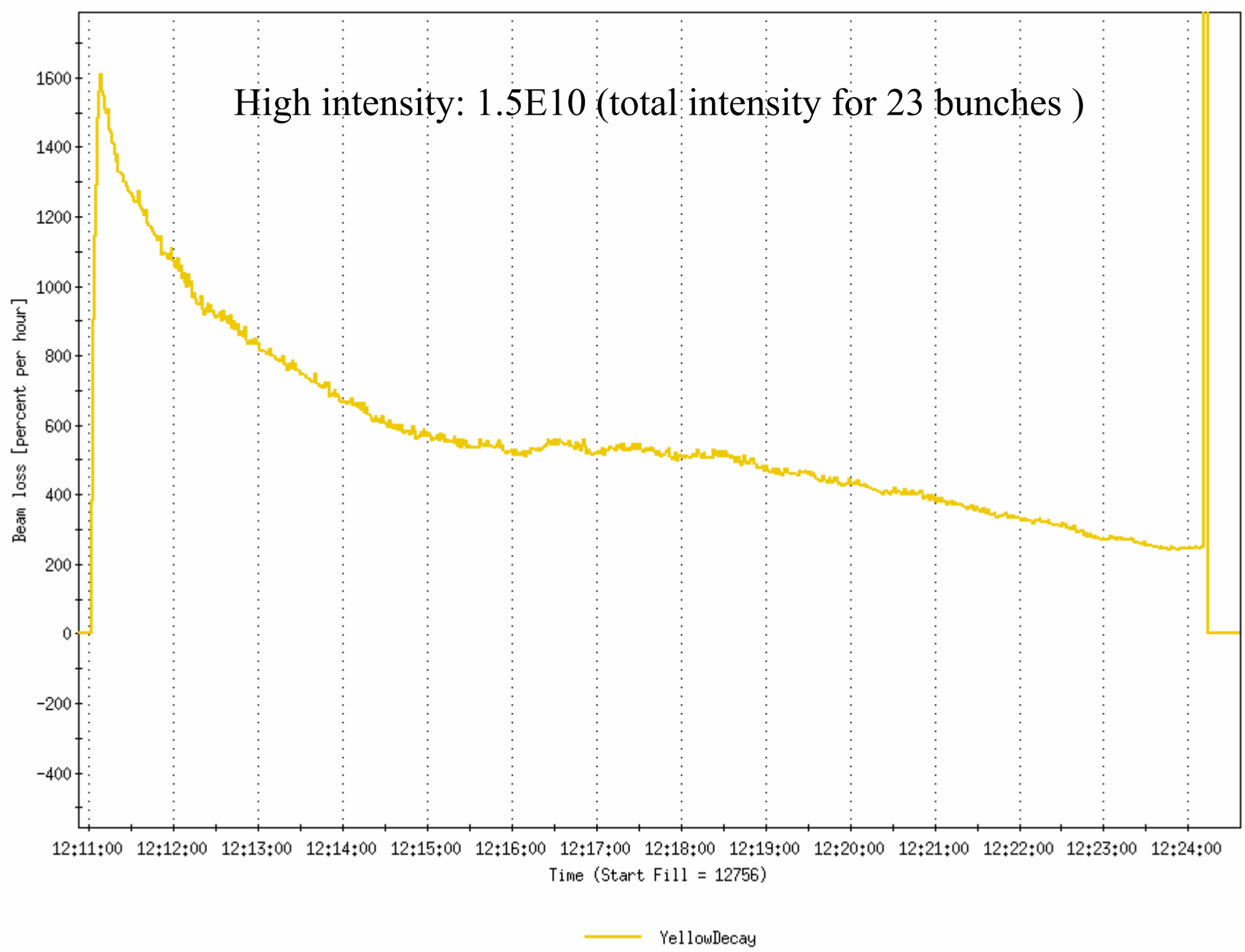
Yellow beam life time study



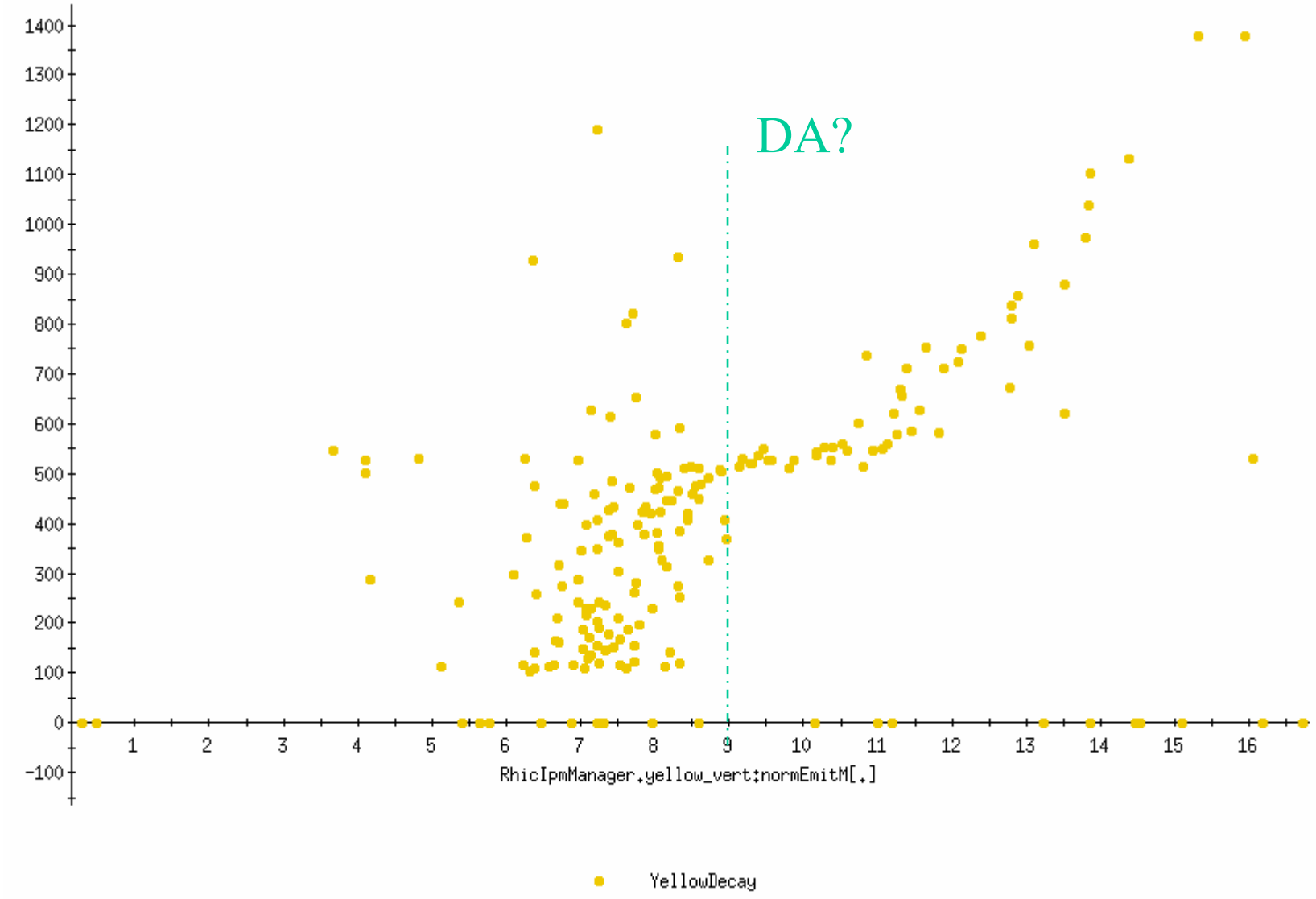
Beam Decay v.s. Beam Intensity (WCM.bunched)



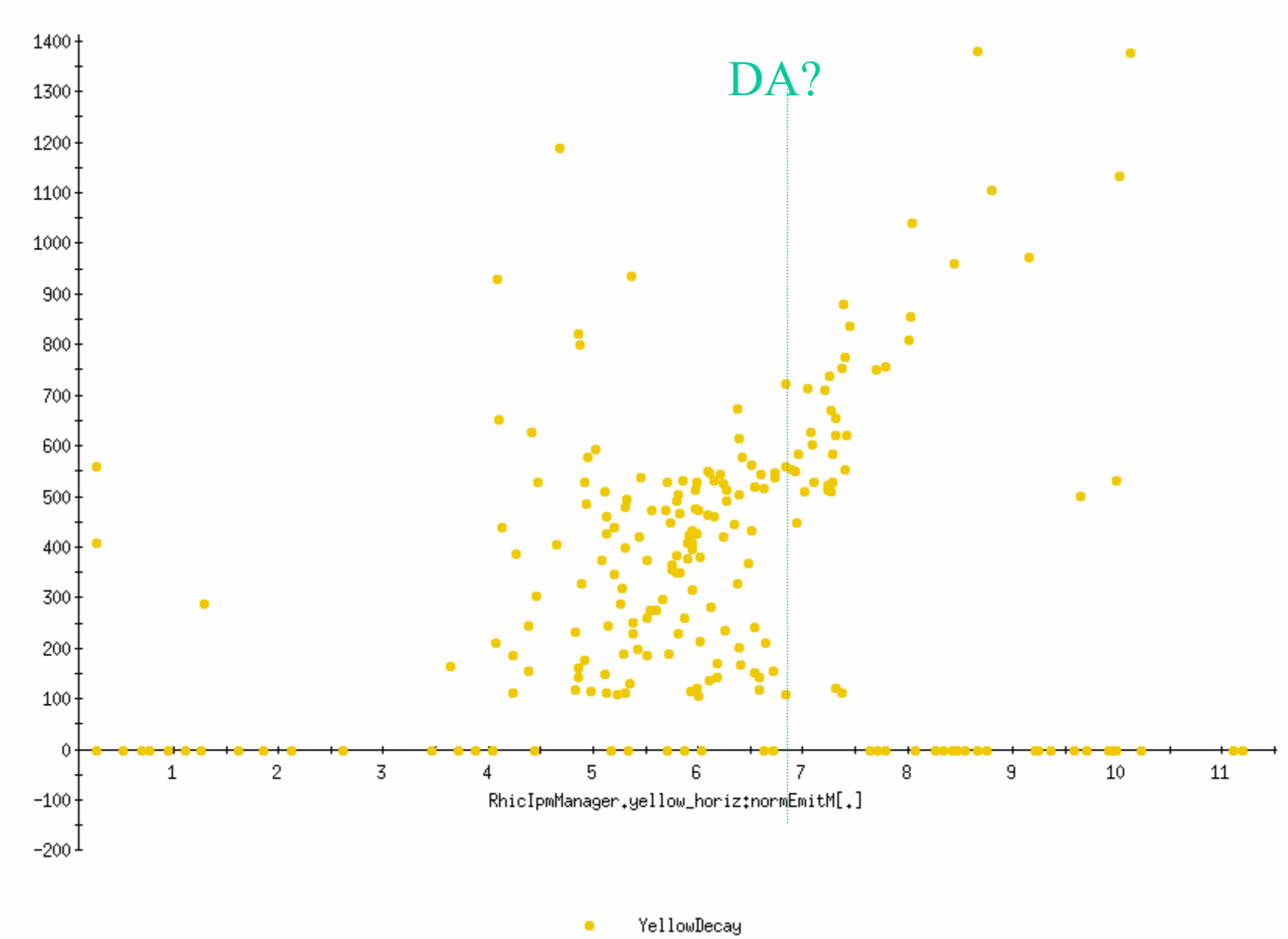

Low intensity: 0.5E10 (total intensity for 23 bunches)
Beam loss [percent per hour]
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
11:45:00
11:46:00
11:47:00
11:48:00
11:49:00
11:50:00
11:51:00
11:52:00
11:53:00
11:54:00
11:55:00
11:56:00
11:57:00
11:58:00
Time (Start Fill = 12756)
YellowDecay


High intensity: 1.5E10 (total intensity for 23 bunches)
Beam loss [percent per hour]
1600
1400
1200
1000
800
600
400
200
0
-200
-400
12:11:00
12:12:00
12:13:00
12:14:00
12:15:00
12:16:00
12:17:00
12:18:00
12:19:00
12:20:00
12:21:00
12:22:00
12:23:00
12:24:00
Time (Start Fill = 12756)
YellowDecay

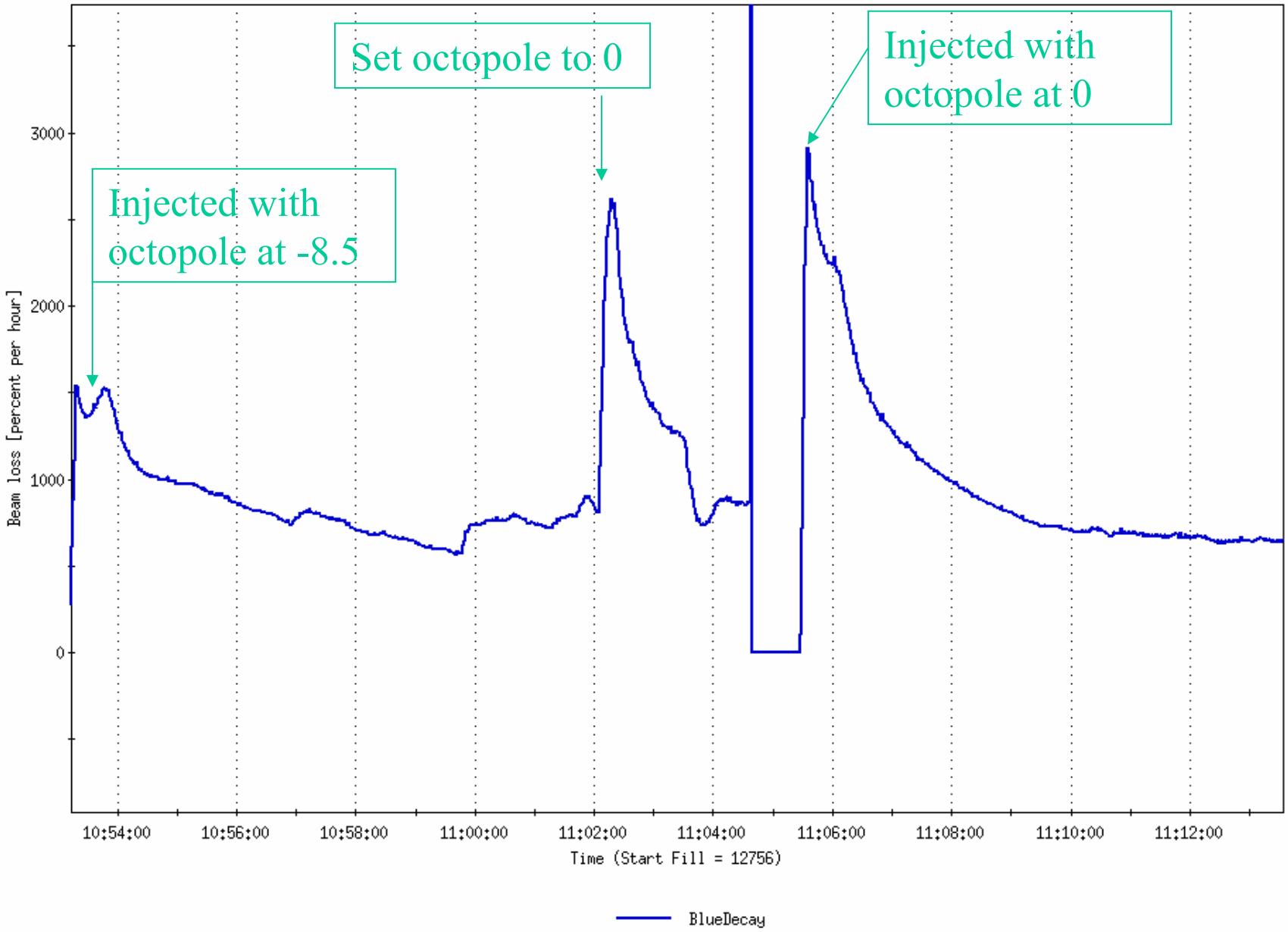
Beam Decay v.s. Vertical Emittance



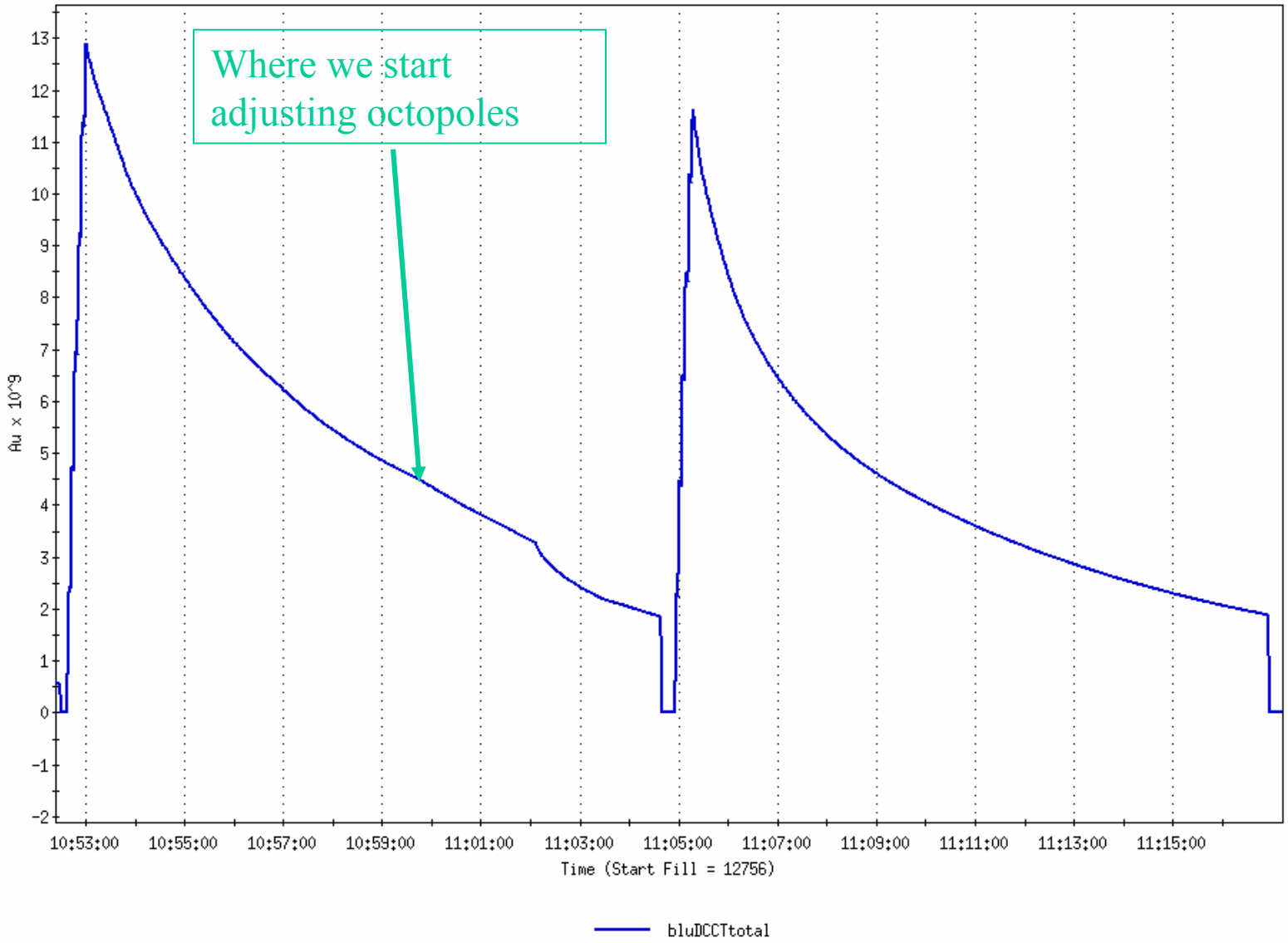
Beam Decay v.s. Horizontal Emittance



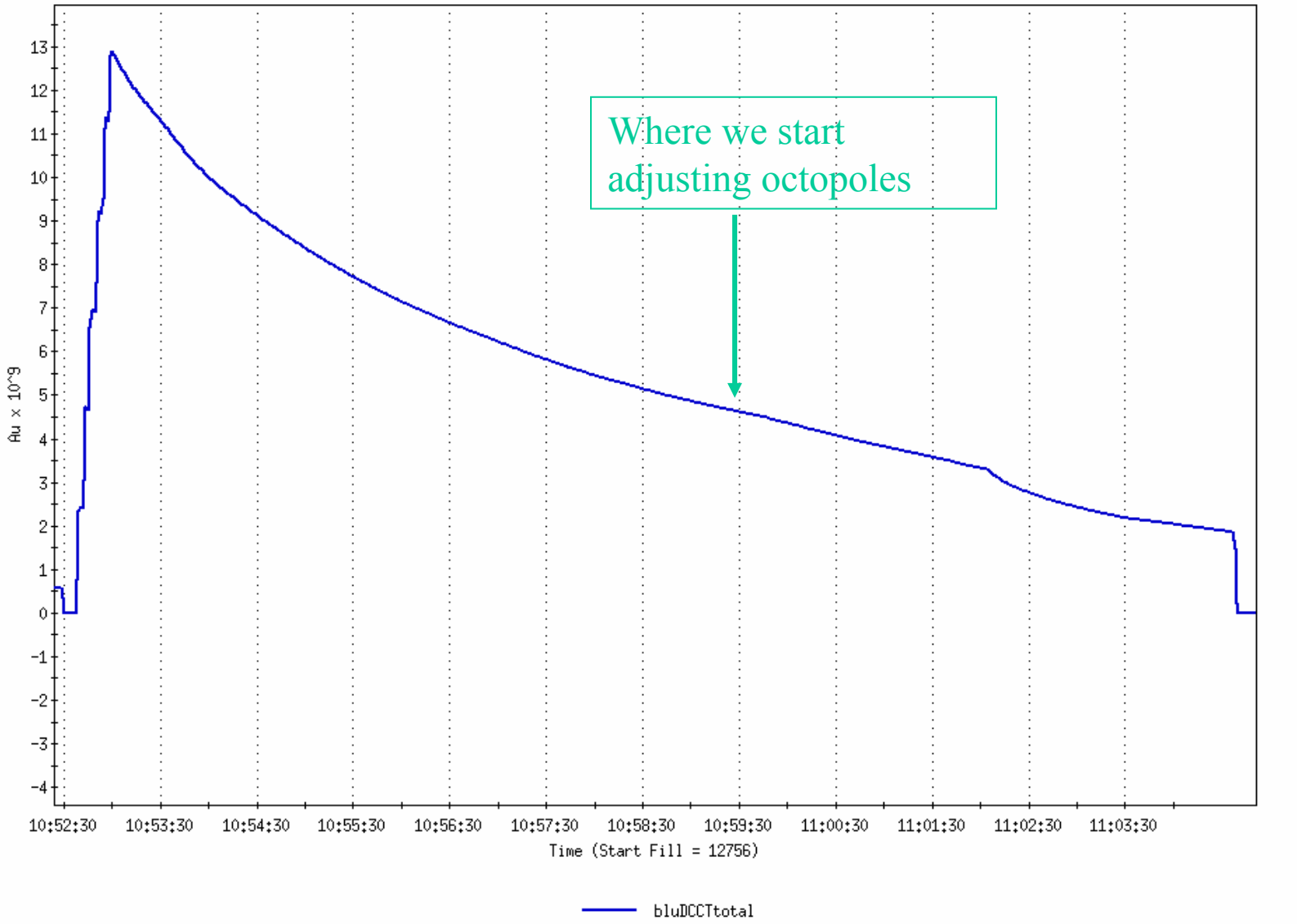
Blue beam life time study



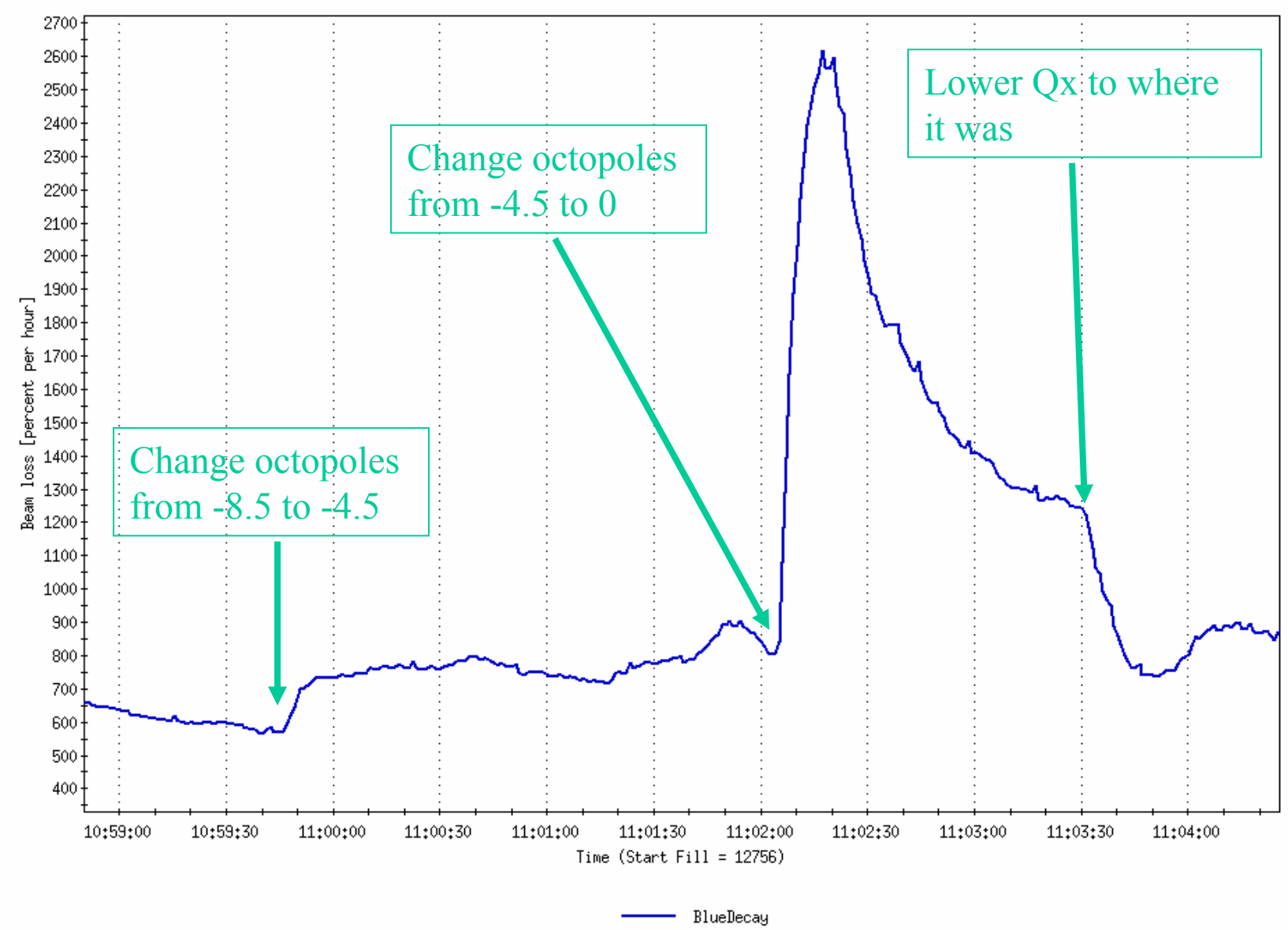
Beam intensity



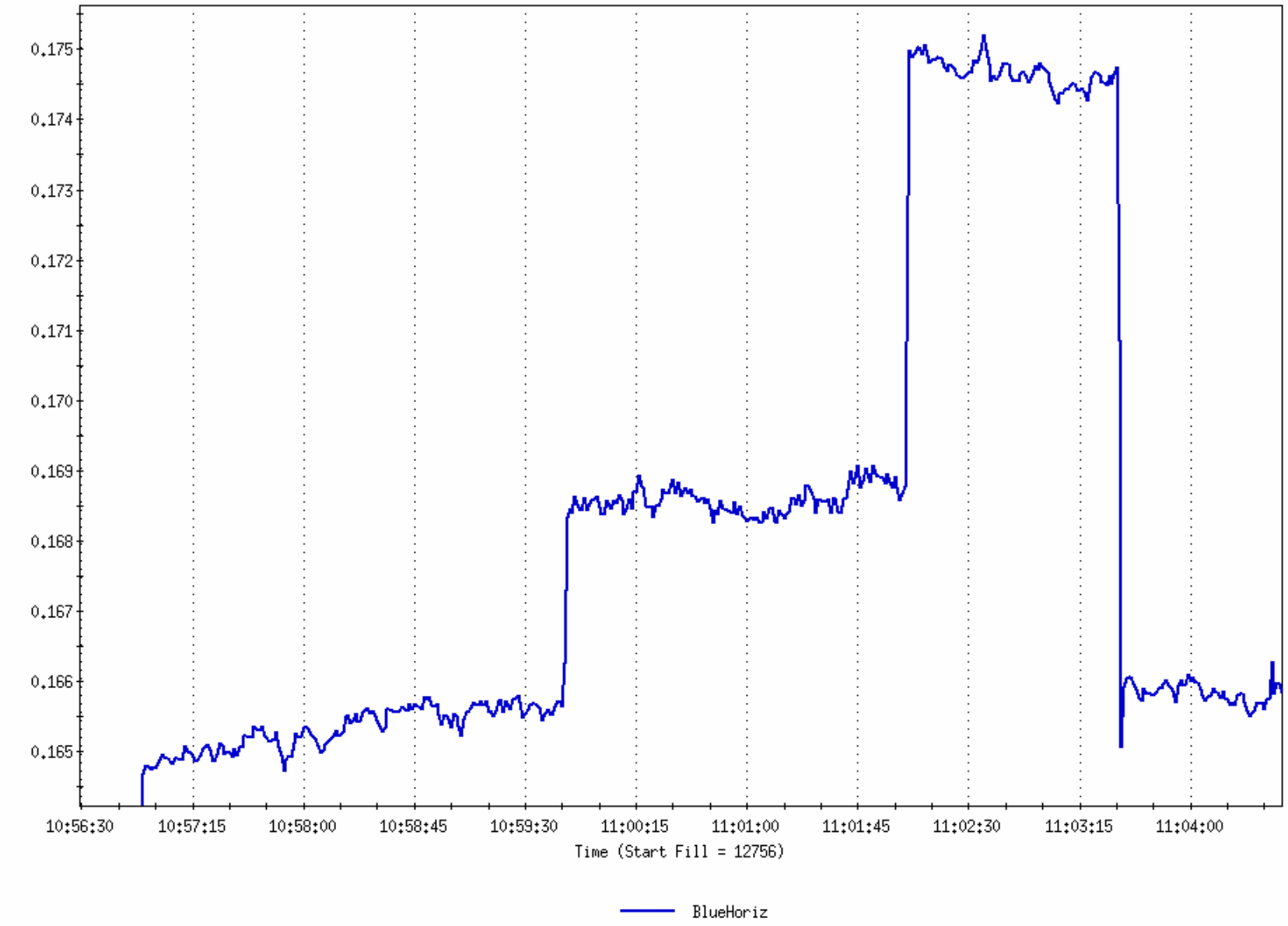
Blue beam life time study



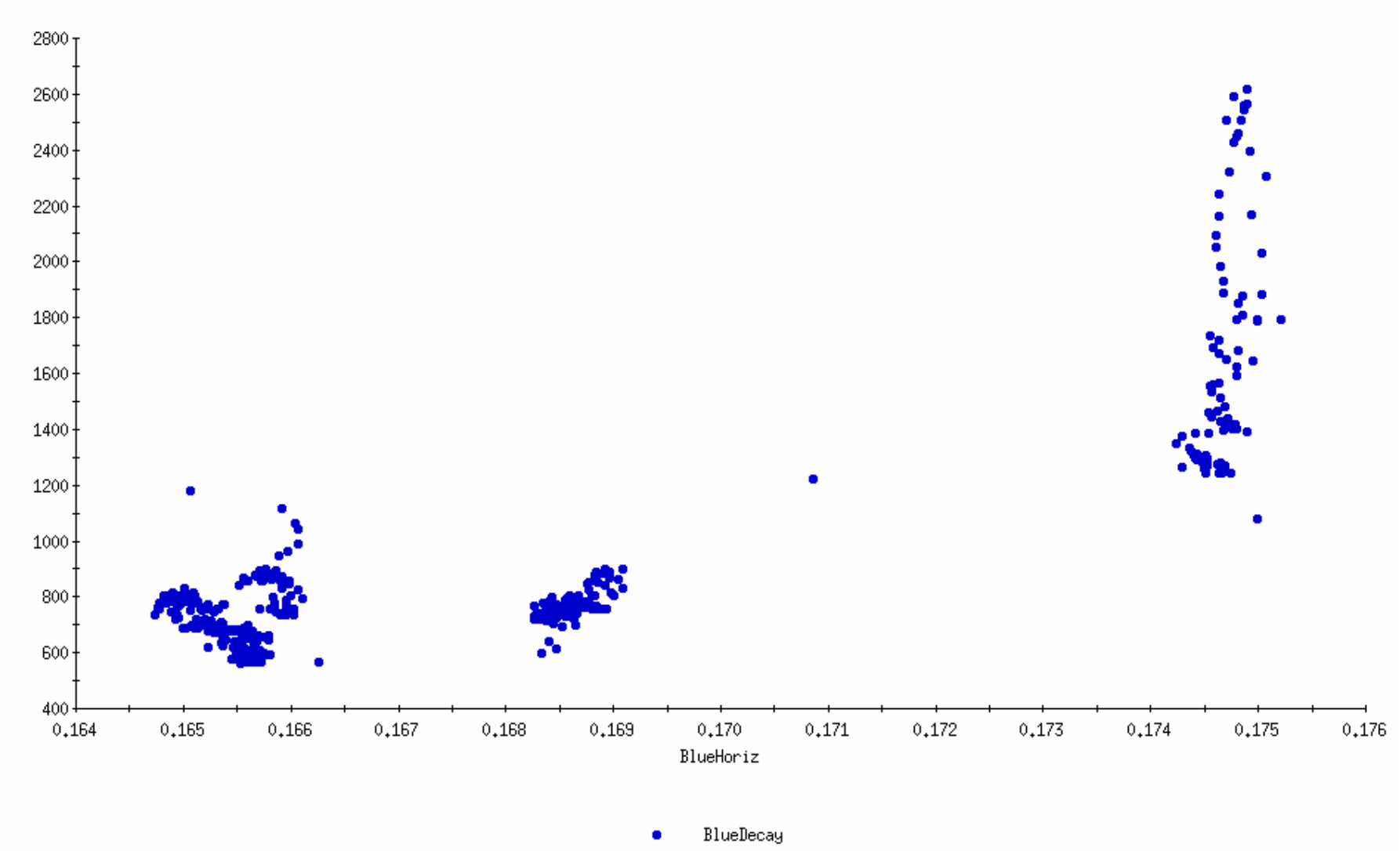
Beam Decay


Change octopoles from -8.5 to -4.5
Change octopoles from -4.5 to 0
Lower Qx to where it was
Beam loss [percent per hour]
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
10:59:00
10:59:30
11:00:00
11:00:30
11:01:00
11:01:30
11:02:00
11:02:30
11:03:00
11:03:30
11:04:00
Time (Start Fill = 12756)
BlueDecay

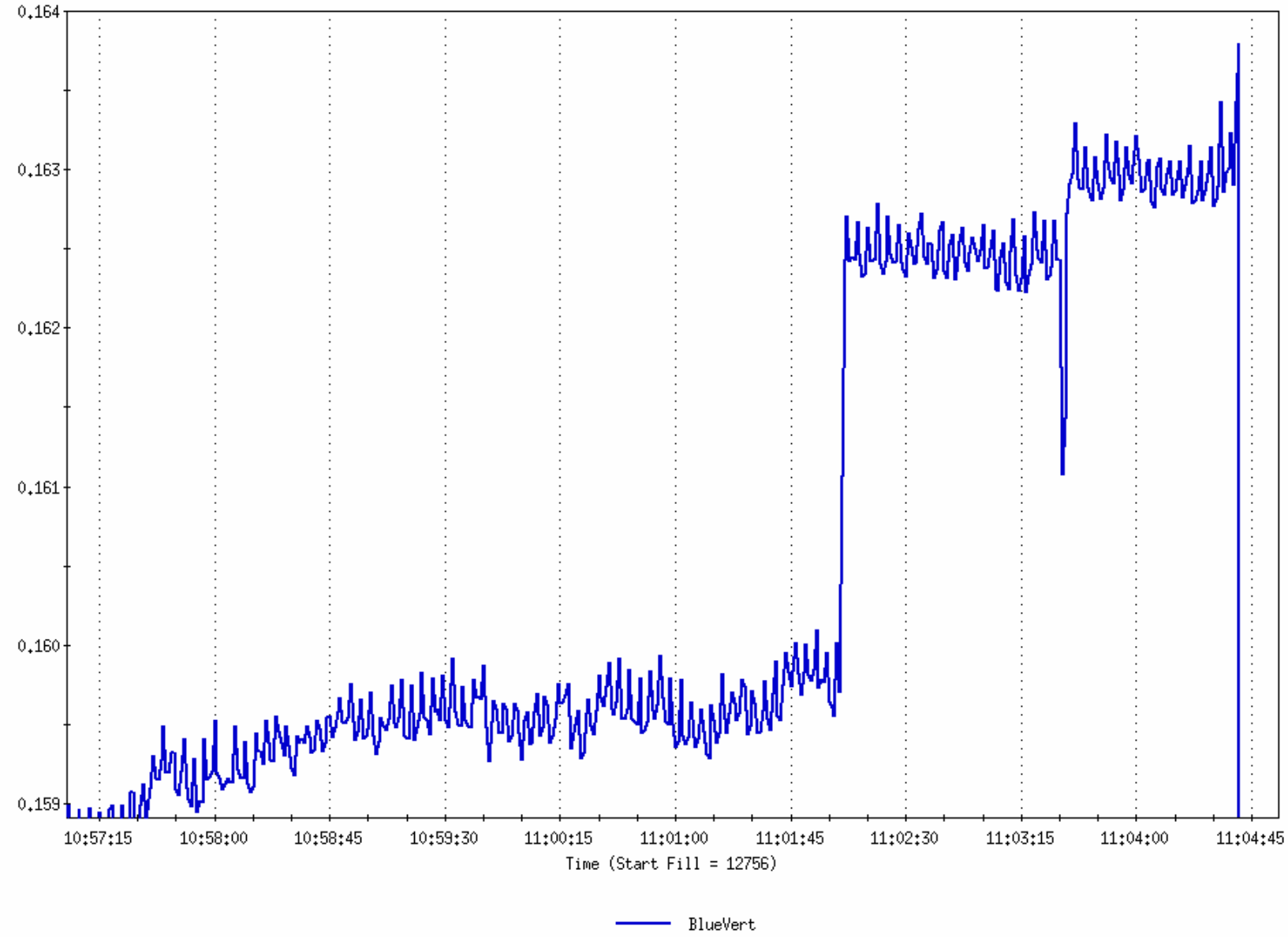
Blue horizontal tune



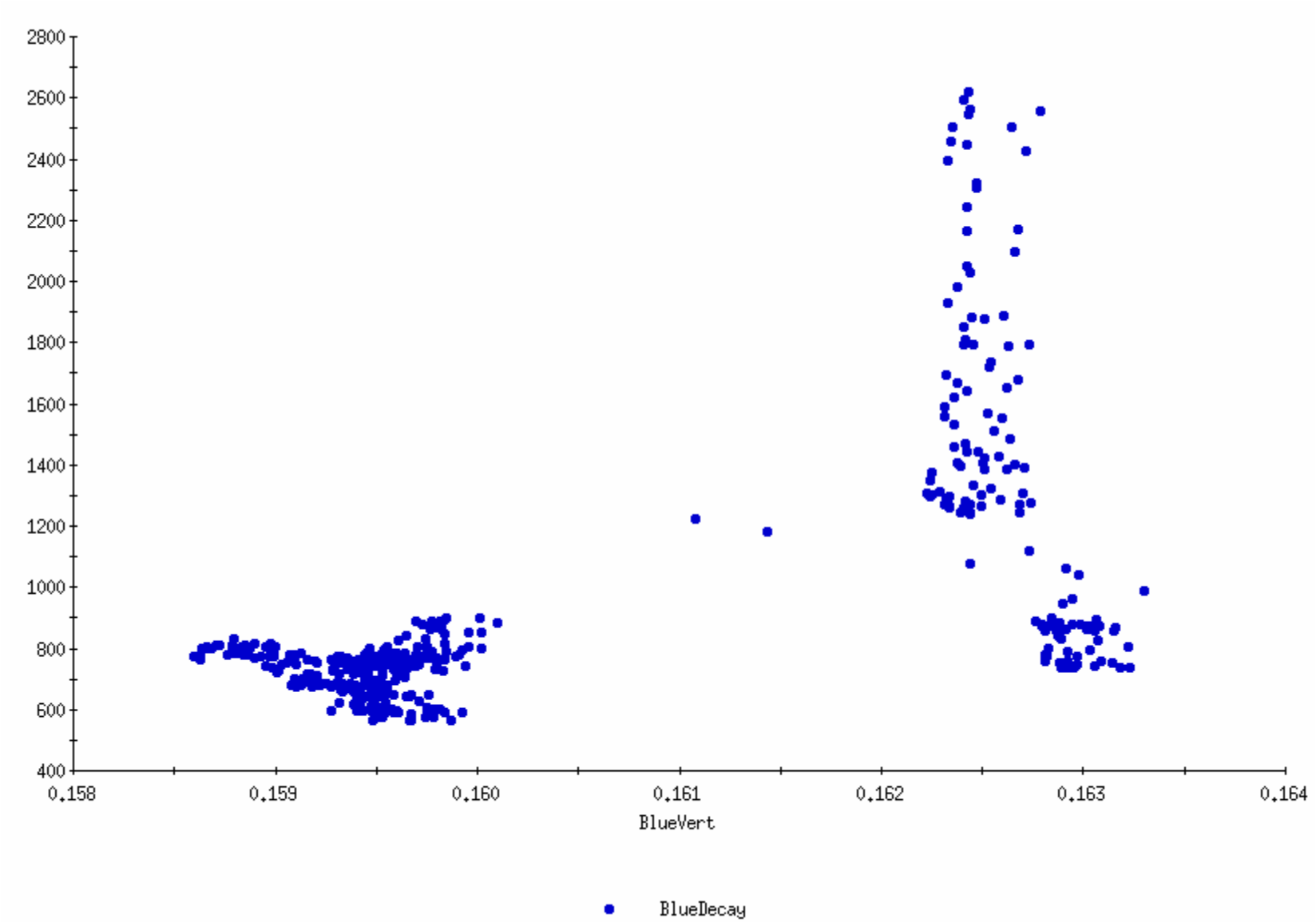
Correlation of beam decay vs. Qx



Blue vertical tune



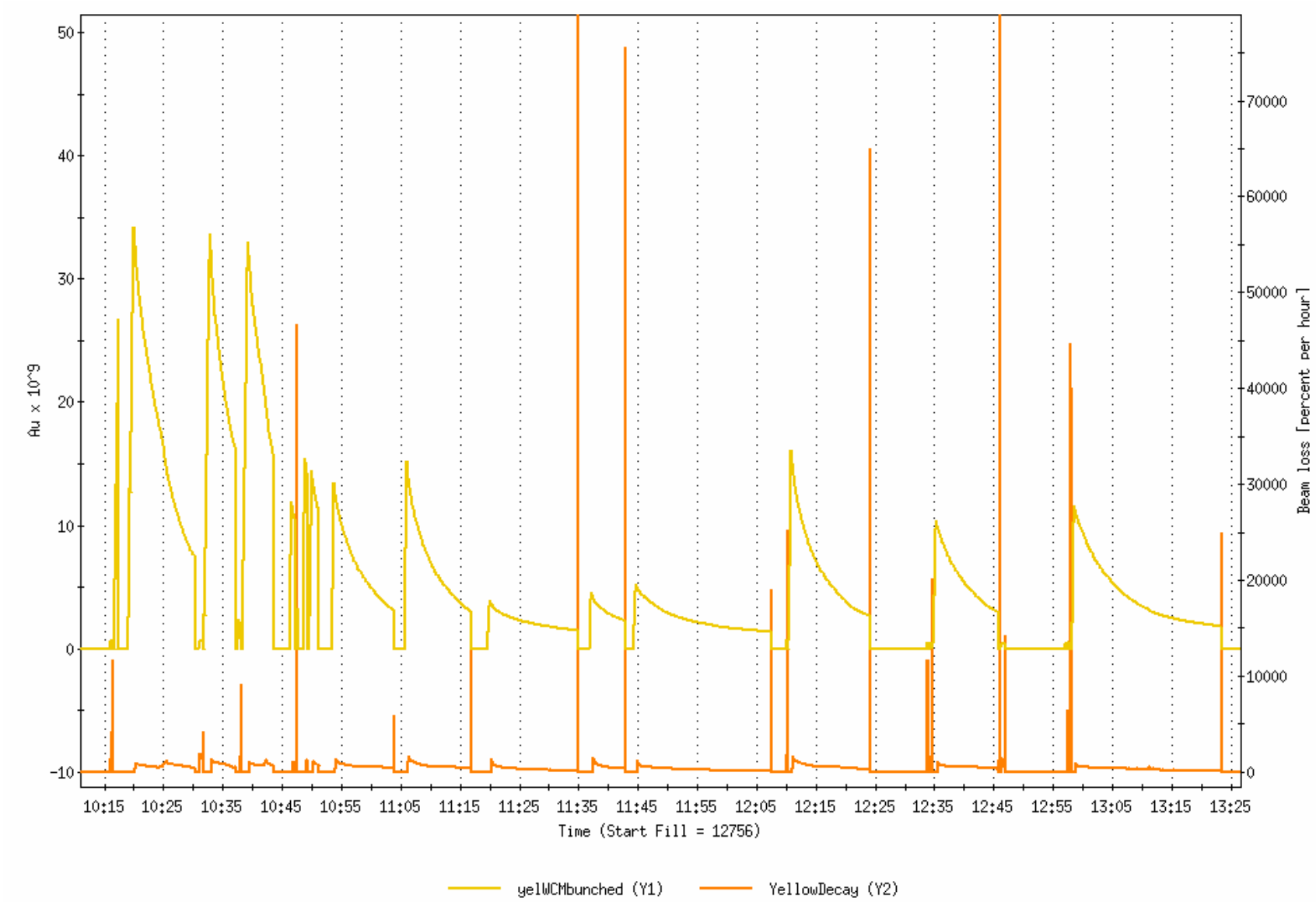
Correlation of beam decay vs. Qy



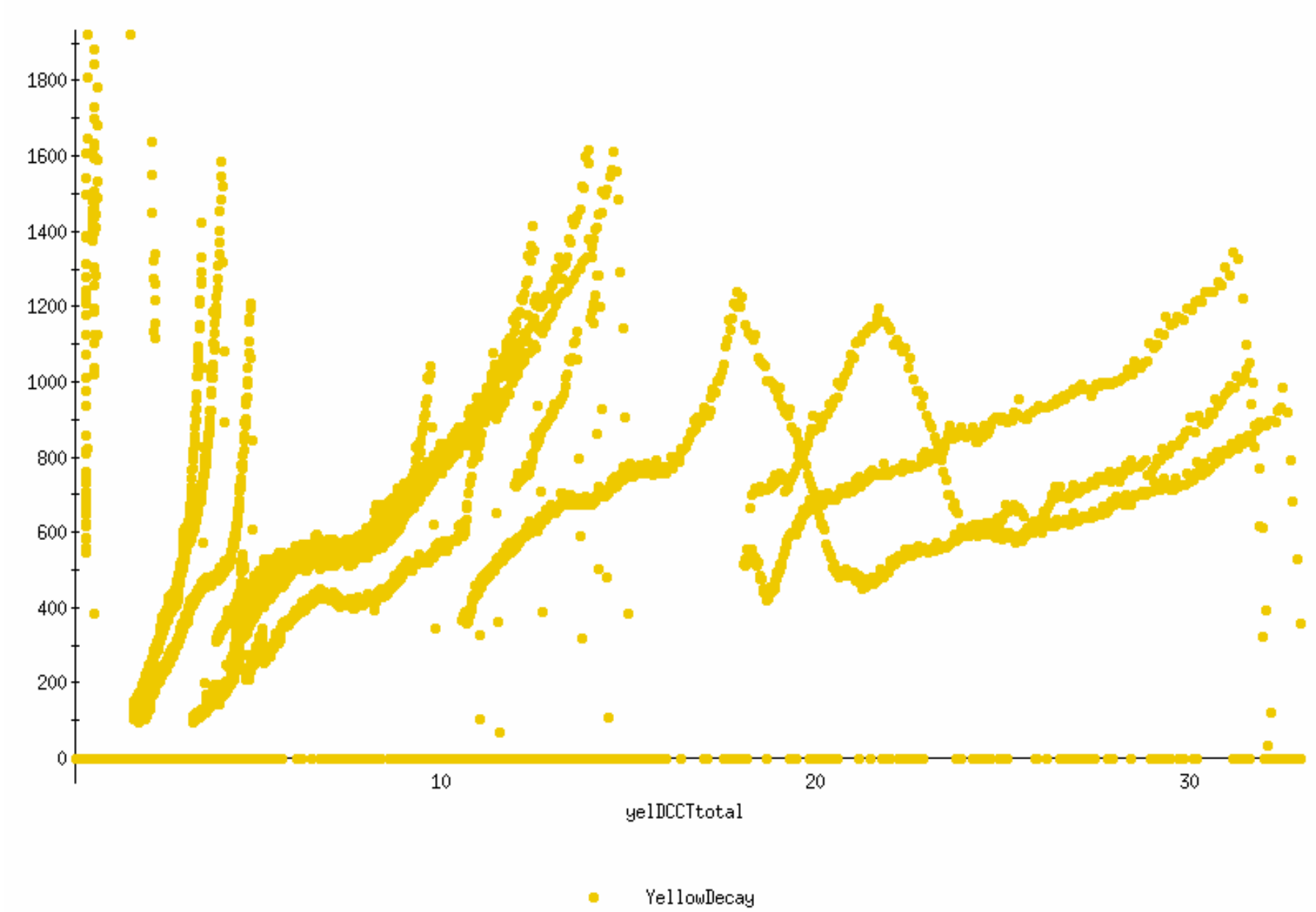
Summary

- Yellow beam loss was correlated with beam intensity for the analyzed 7 sets of ‘good’ data.
- For injection with low intensity (0.2E9/bunch) , an initial fast beam decay lasted for ~1 minute.
- The effects of octopoles to blue beam life time is not conclusive as tune/chrom were also changed when adjusting octoples’ strengthes. However, some of the observation might be explained by the compensation of space charge incoherent tune spread with octopoles.
- We did not observe coherent line from low frequency schottky spectrum and the space charge effects remains unclear.

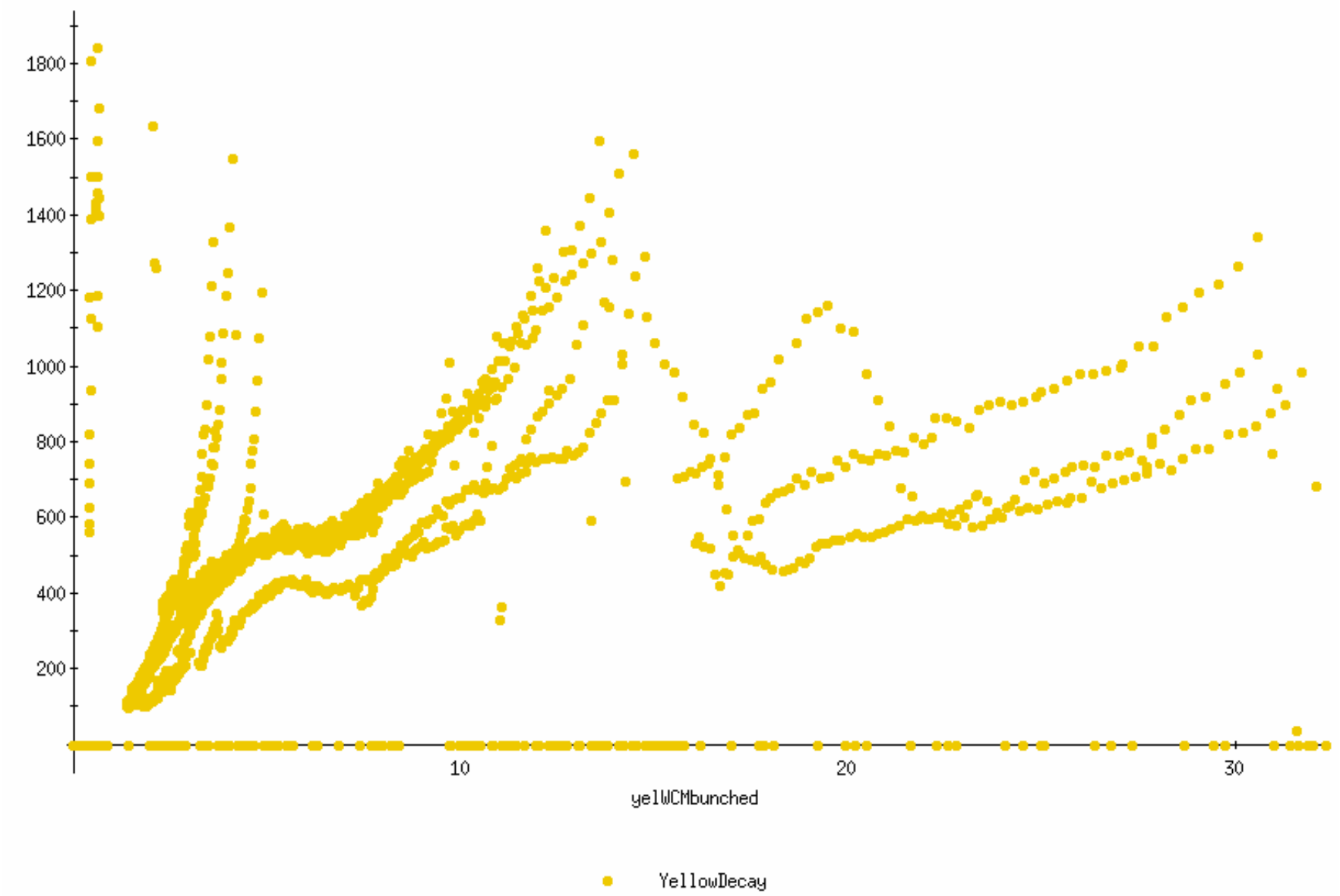
Back up slides


50
40
30
20
10
0
-10
Au x 10^9
70000
60000
50000
40000
30000
20000
10000
0
Beam loss [percent per hour]
10:15
10:25
10:35
10:45
10:55
11:05
11:15
11:25
11:35
11:45
11:55
12:05
12:15
12:25
12:35
12:45
12:55
13:05
13:15
13:25
Time (Start Fill = 12756)
yelWCMbunched (Y1)
YellowDecay (Y2)

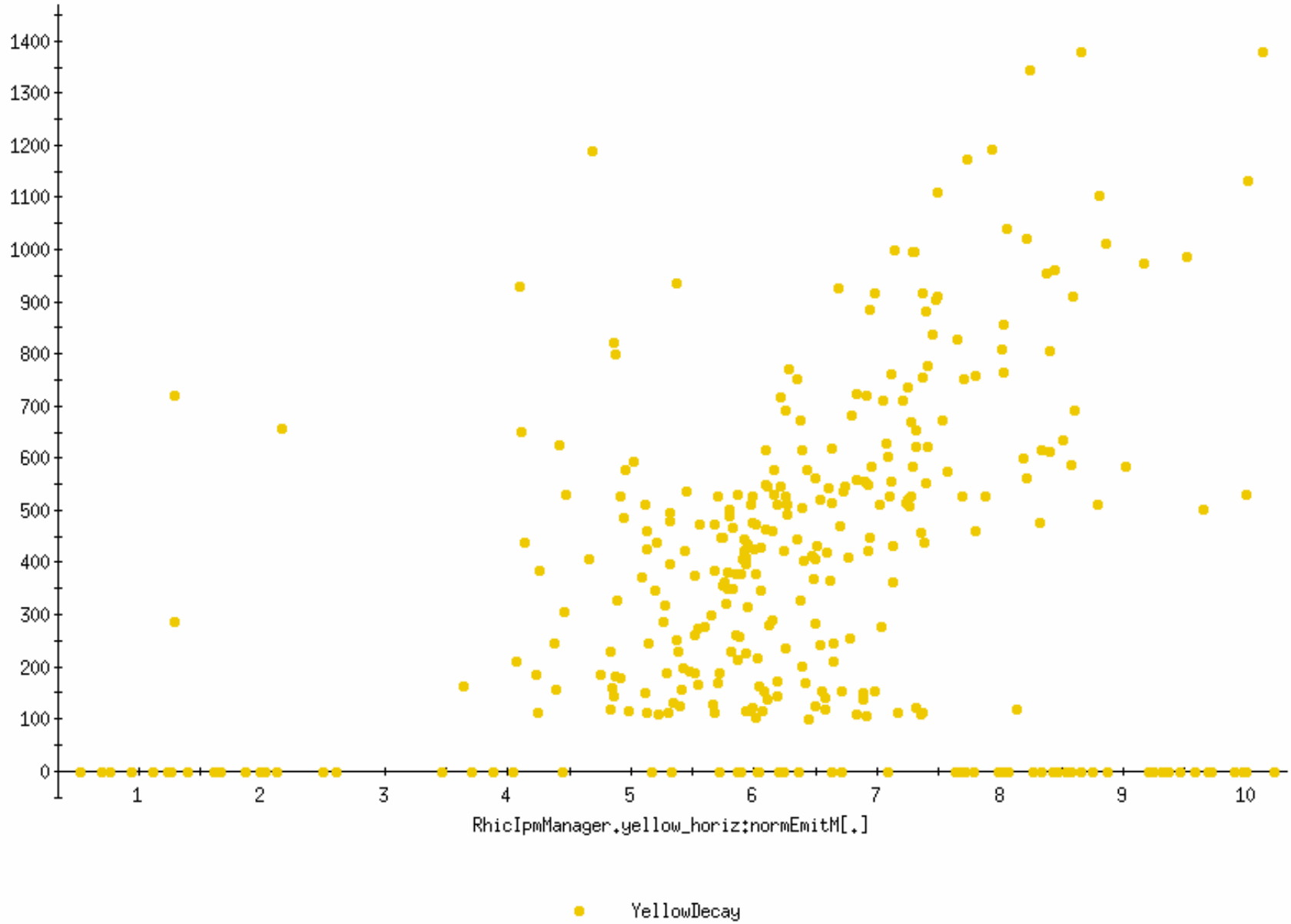
Beam Decay v.s. Beam Intensity (DCCT)



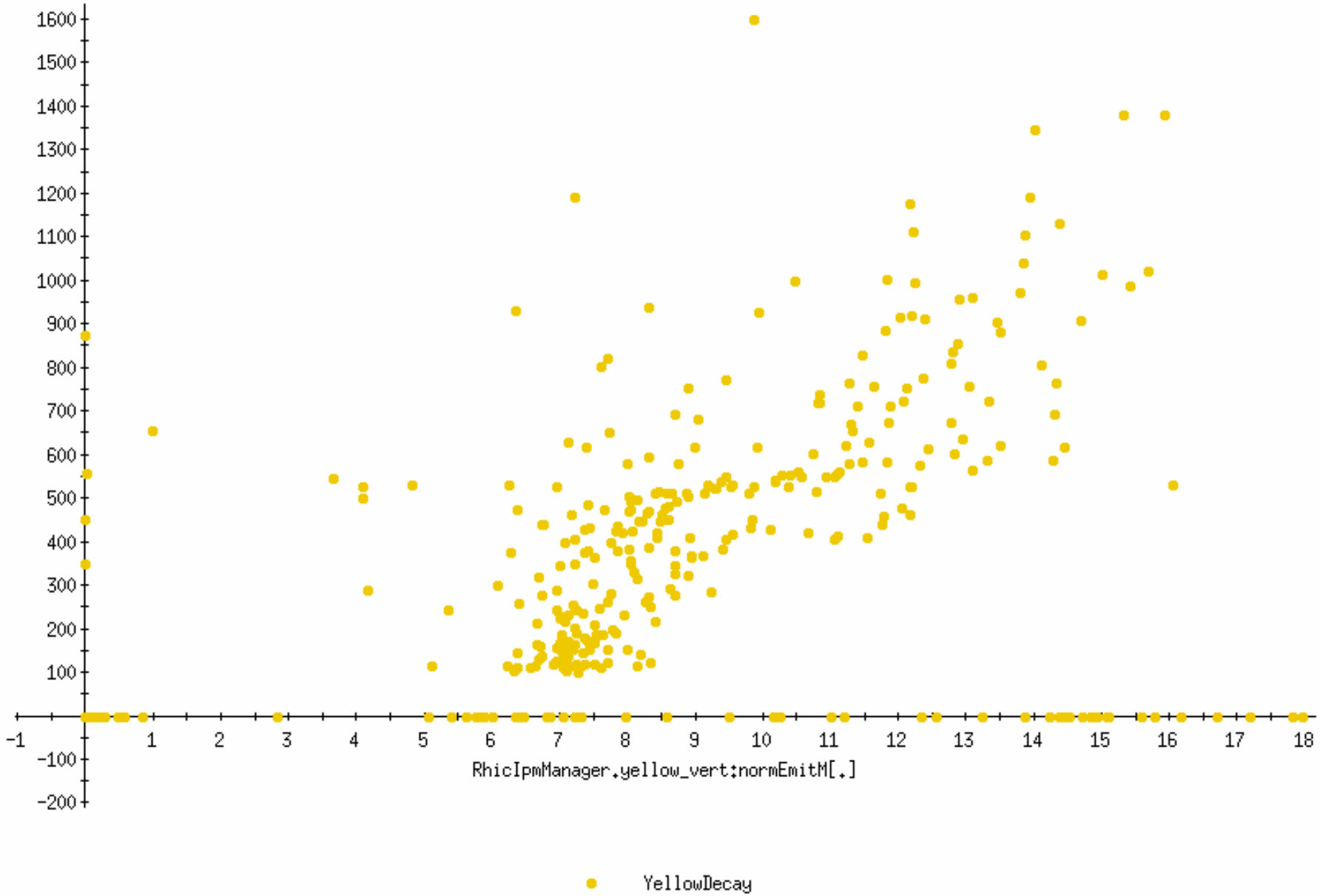
Beam Decay v.s. Beam Intensity (WCM.bunched)

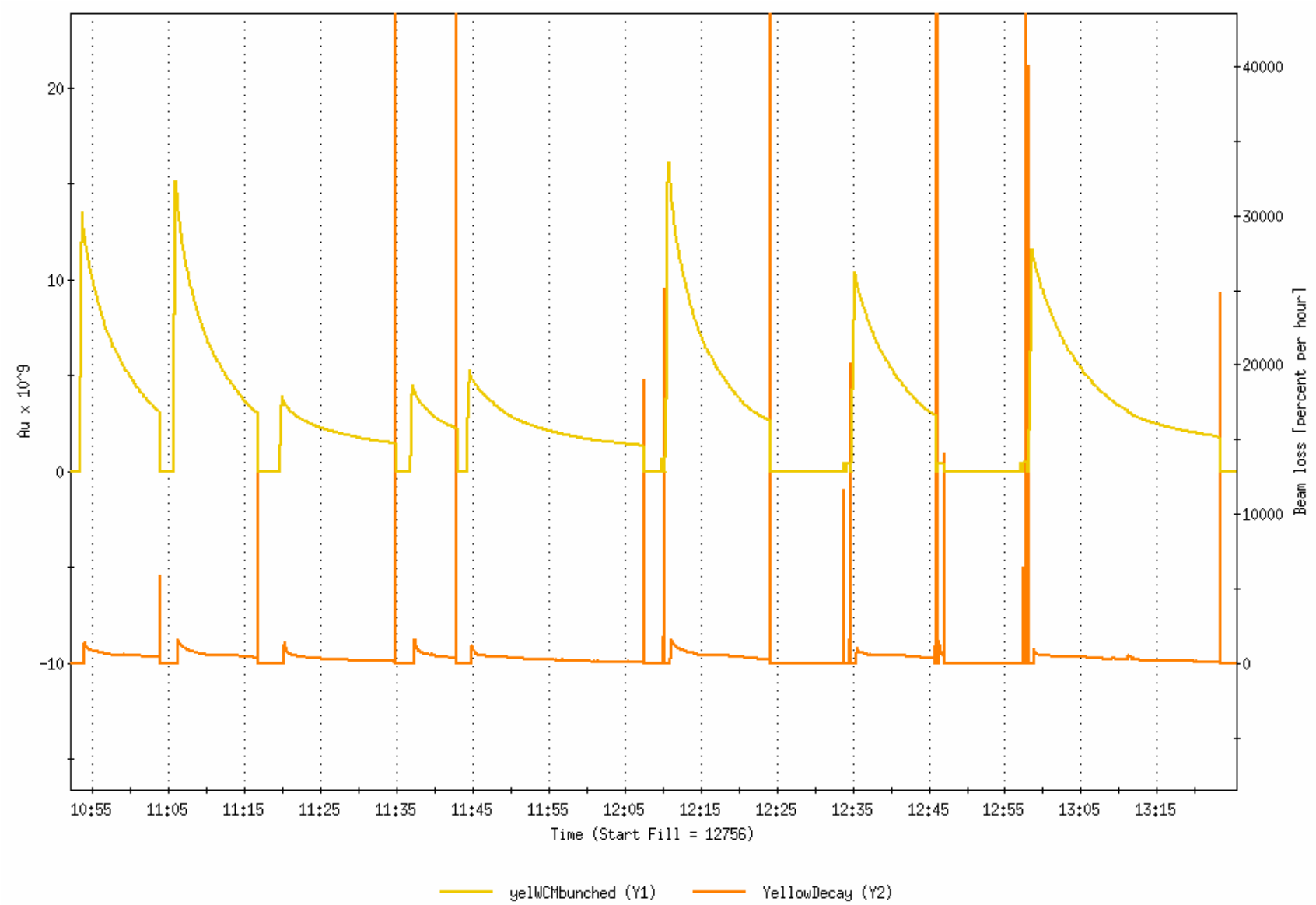


Beam Decay v.s. Horizontal Emittance

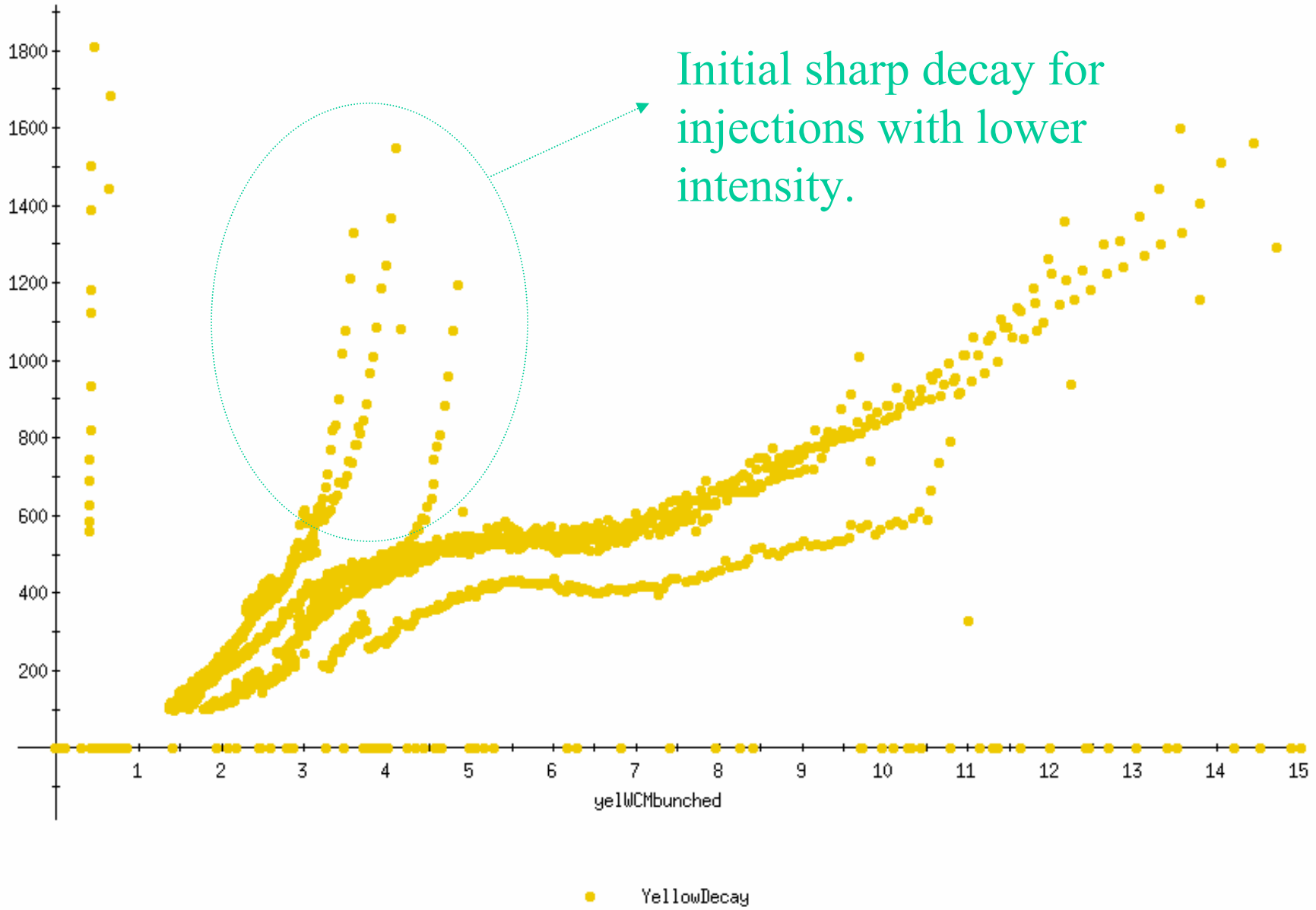


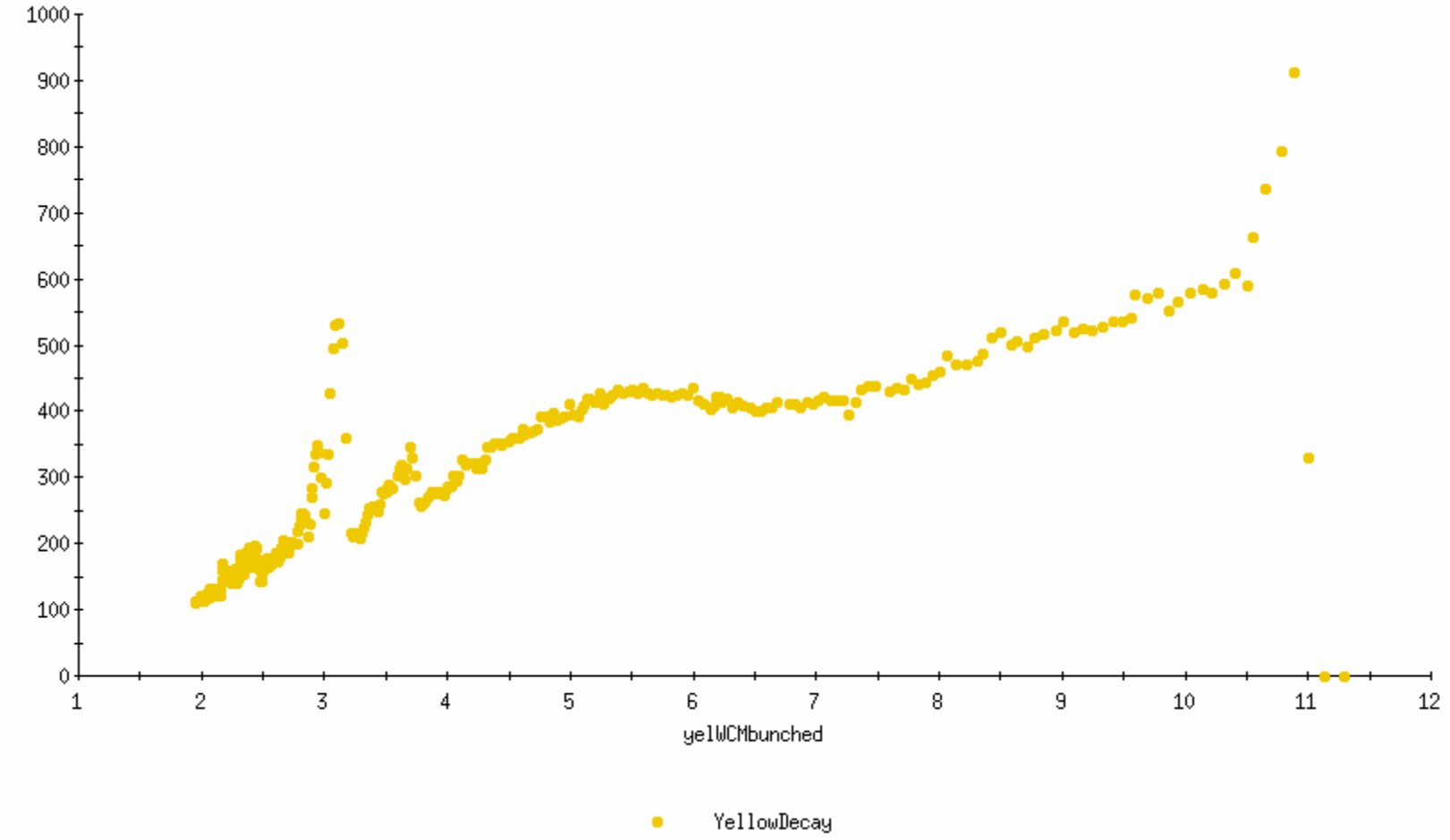
Beam Decay v.s. Vertical Emittance

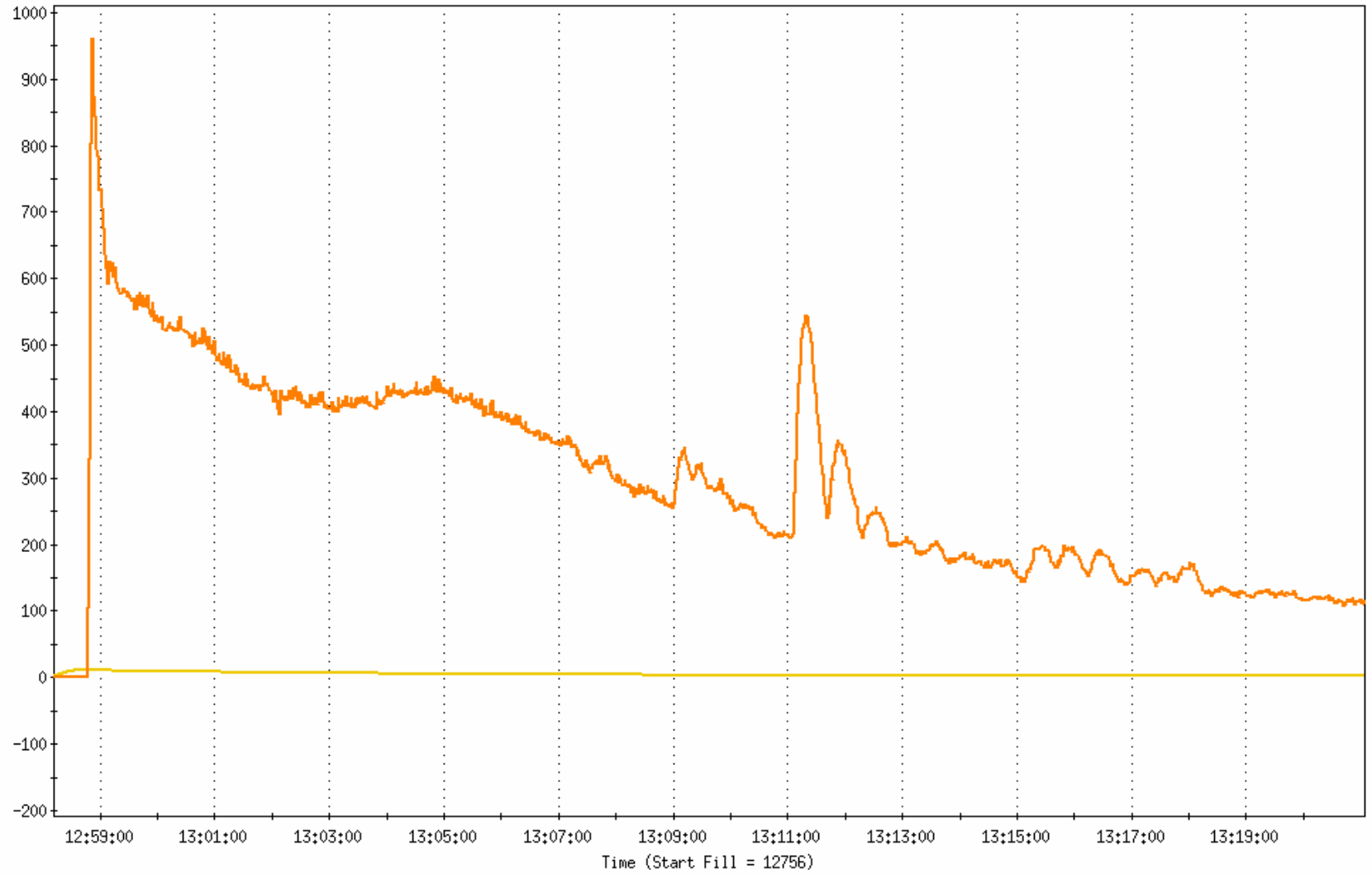



Au x 10^9
20
10
0
-10
40000
30000
20000
10000
0
Beam loss [percent per hour]
10:55
11:05
11:15
11:25
11:35
11:45
11:55
12:05
12:15
12:25
12:35
12:45
12:55
13:05
13:15
Time (Start Fill = 12756)
yelWCMbunched (Y1)
YellowDecay (Y2)

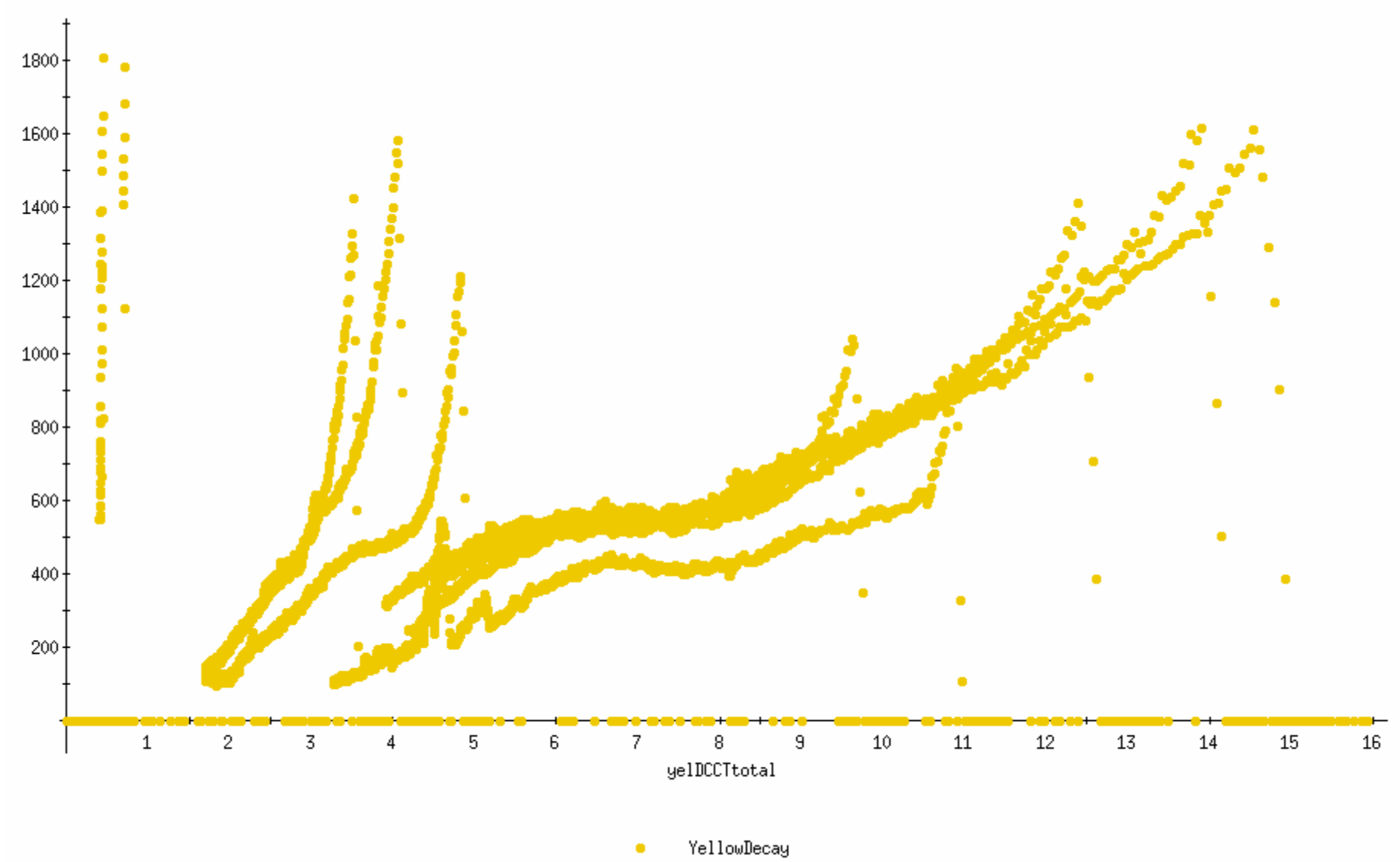
Beam Decay v.s. Beam Intensity (WCM.bunched)

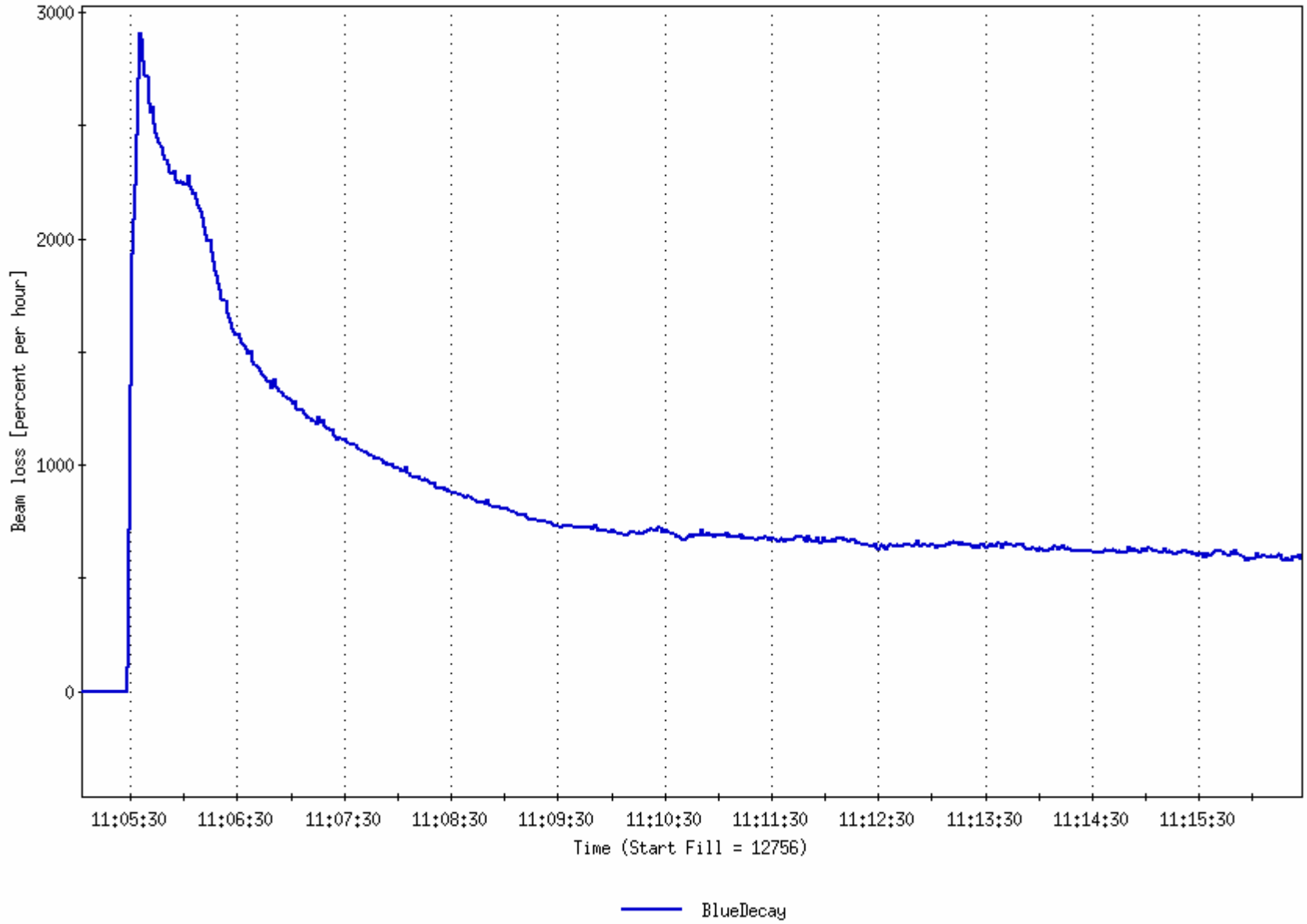



1000
900
800
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
11
12
yelWCMbunched
YellowDecay


1000
900
800
700
600
500
400
300
200
100
0
-100
-200
12:59:00
13:01:00
13:03:00
13:05:00
13:07:00
13:09:00
13:11:00
13:13:00
13:15:00
13:17:00
13:19:00
Time (Start Fill = 12756)

Beam Decay v.s. Beam Intensity (DCCT)




3000
2000
1000
0
Beam loss [percent per hour]
11:05:30
11:06:30
11:07:30
11:08:30
11:09:30
11:10:30
11:11:30
11:12:30
11:13:30
11:14:30
11:15:30
Time (Start Fill = 12756)
BlueDecay