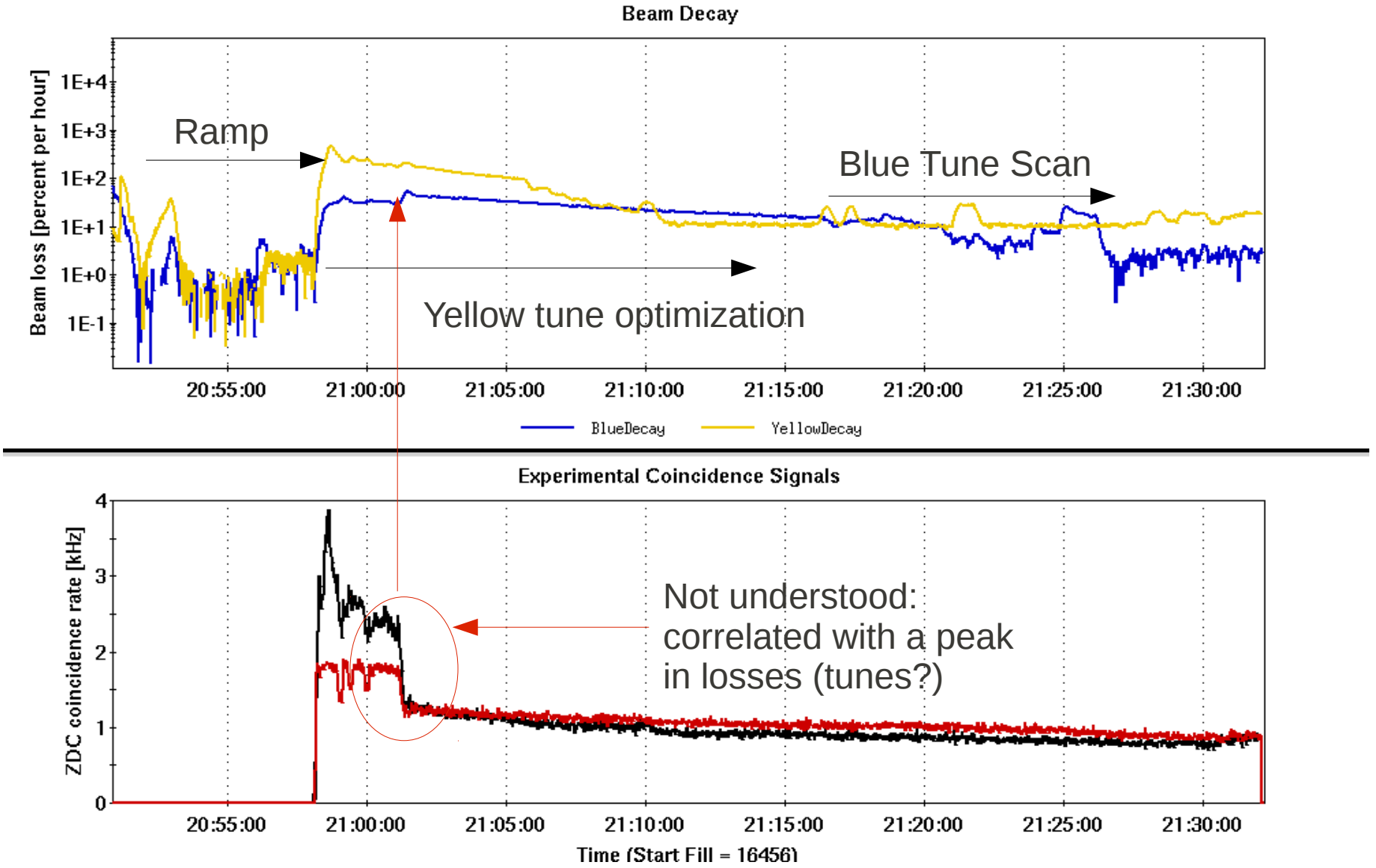
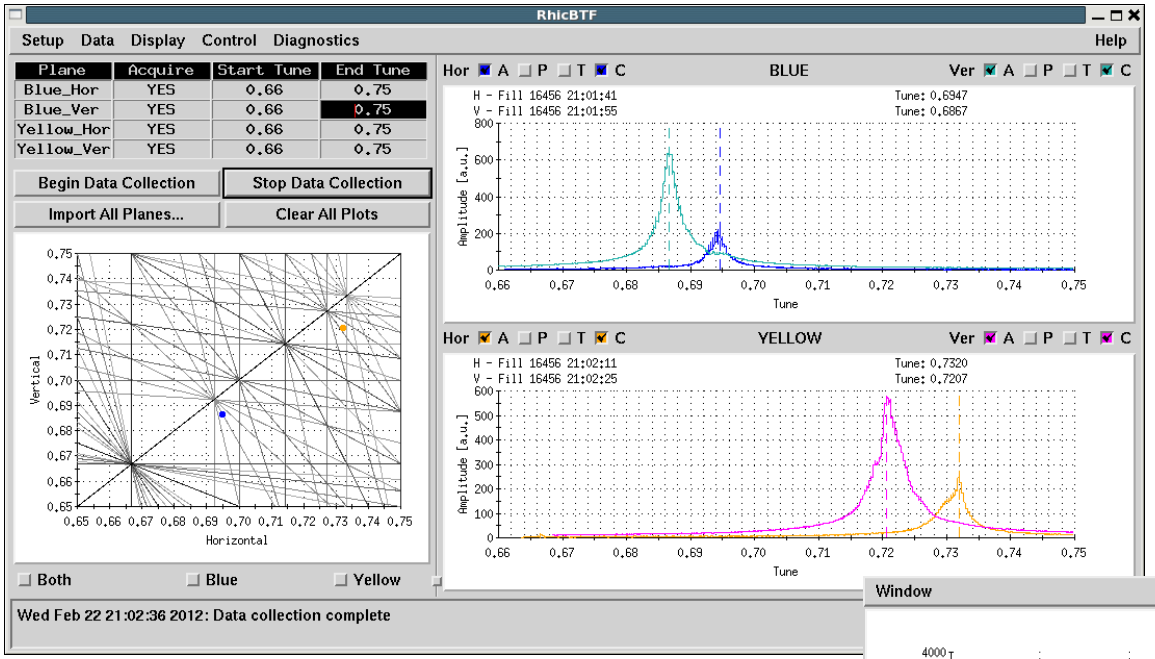
Tune Scans / Pi-mode suppression

- **Experimental set-up:**
- Two ramps of 12x12 with 2e11 p/bunch
- **First ramp with split tunes:** no coherent beam-beam modes
- **Second ramp with nominal tunes:** coherent beam-beam effects
- For both ramp drive the beams onto the 2/3rd resonance to understand the tune space gained from the absence of coherent modes

First Ramp


Beam Decay
Beam loss [percent per hour]
1E+4
1E+3
1E+2
1E+1
1E+0
1E-1
Ramp
Blue Tune Scan
Yellow tune optimization
20:55:00
21:00:00
21:05:00
21:10:00
21:15:00
21:20:00
21:25:00
21:30:00
BlueDecay
YellowDecay
Experimental Coincidence Signals
ZDC coincidence rate [kHz]
4
3
2
1
0
Not understood:
correlated with a peak
in losses (tunes?)
20:55:00
21:00:00
21:05:00
21:10:00
21:15:00
21:20:00
21:25:00
21:30:00
Time (Start Fill = 16456)

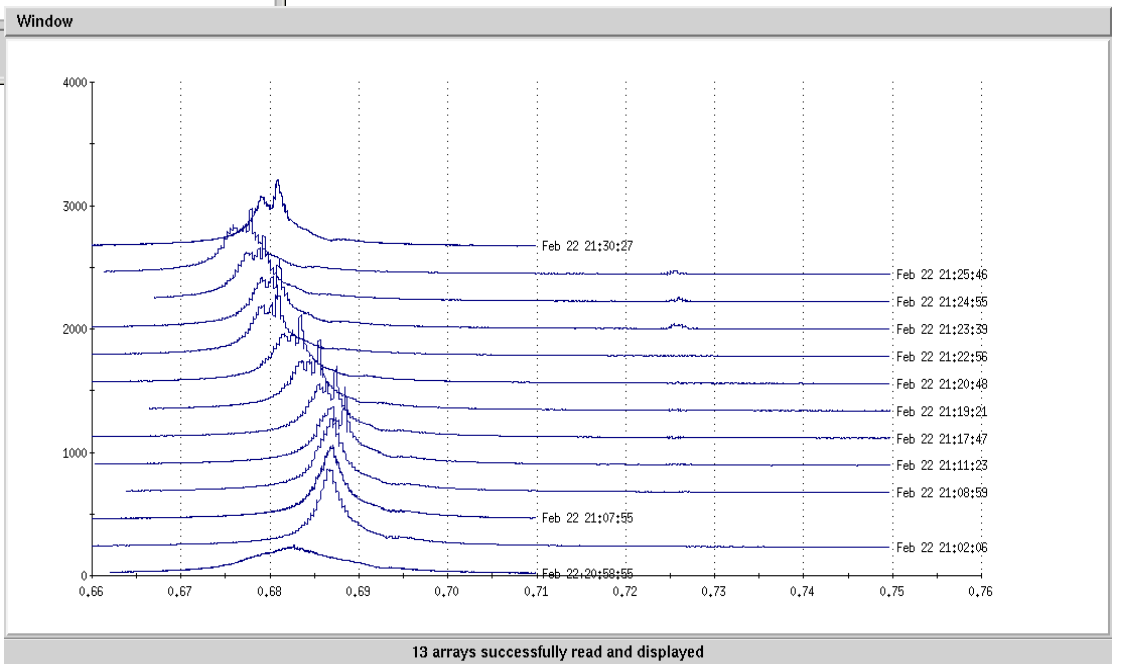
BTF Measurements



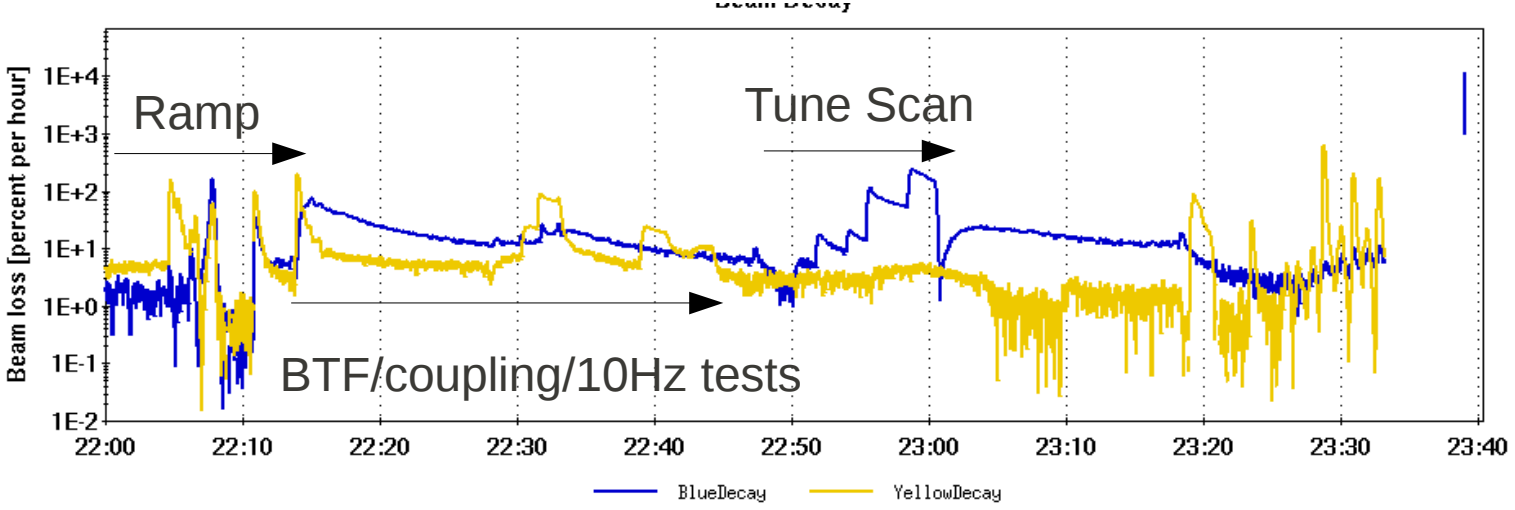
Tune split of ~0.03 – 0.04
Much larger than the beam beam Parameter (~0.015)
→ As expected no coherent modes

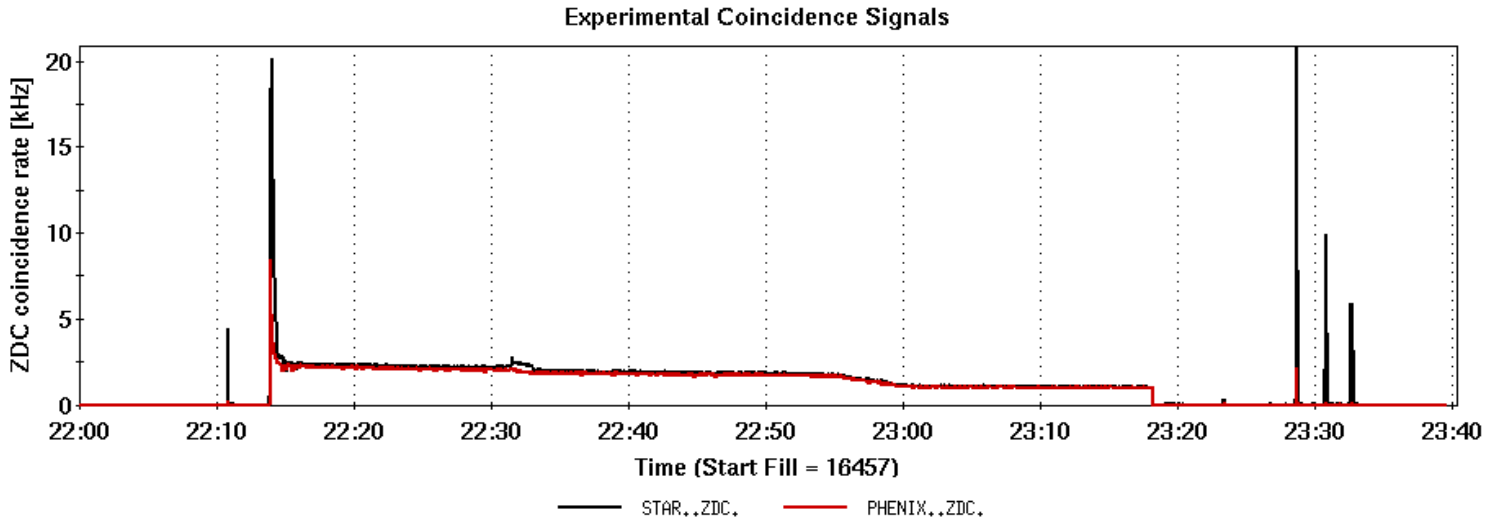
Tune scan: drive the blue beam onto the 2/3rd resonance
Could go as far as 0.6839/ 0.6819 (bare lattice tunes estimated from quad changes) without losses.

0.682-0.015=0.667 (2/3rd resonance)

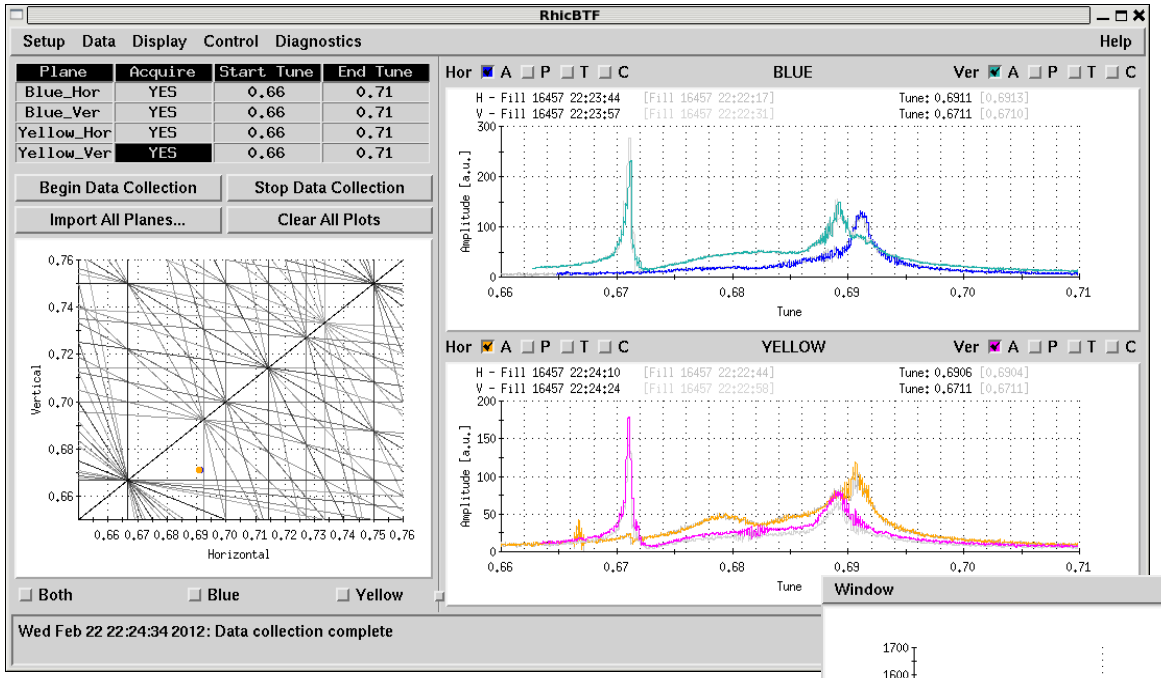


Second Ramp

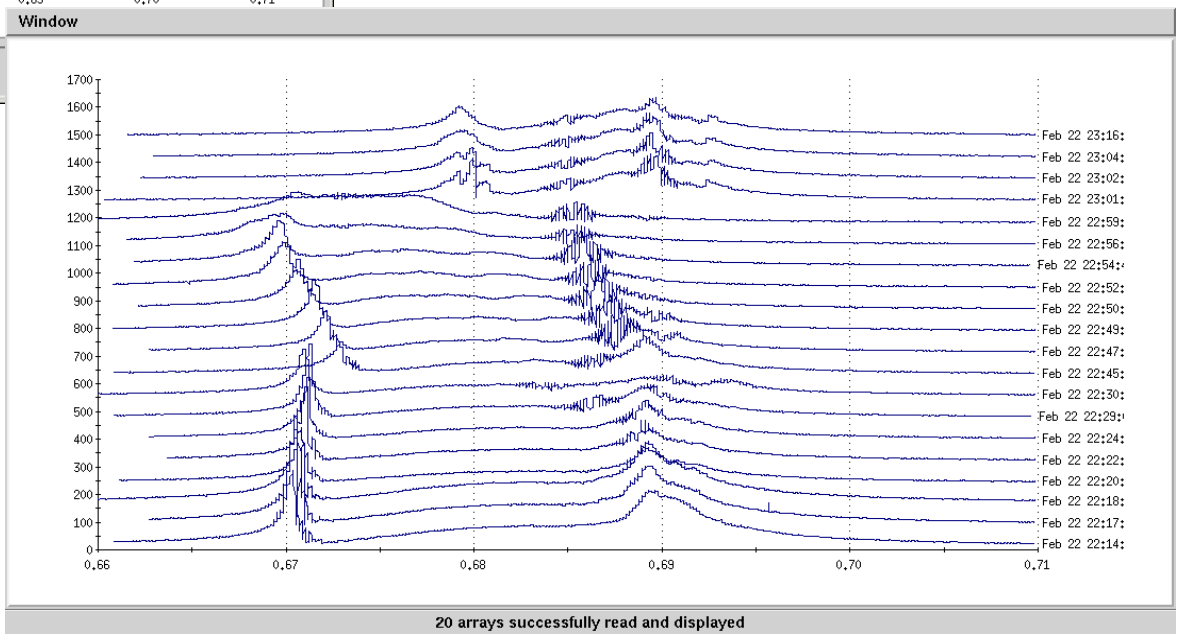

Beam loss [percent per hour]
1E+4
1E+3
1E+2
1E+1
1E+0
1E-1
1E-2
Ramp
Tune Scan
BTF/coupling/10Hz tests
22:00
22:10
22:20
22:30
22:40
22:50
23:00
23:10
23:20
23:30
23:40
BlueDecay
YellowDecay


Experimental Coincidence Signals
ZDC coincidence rate [kHz]
20
15
10
5
0
22:00
22:10
22:20
22:30
22:40
22:50
23:00
23:10
23:20
23:30
23:40
Time (Start Fill = 16457)
STAR..ZDC.
PHENIX..ZDC.

BTF Measurements



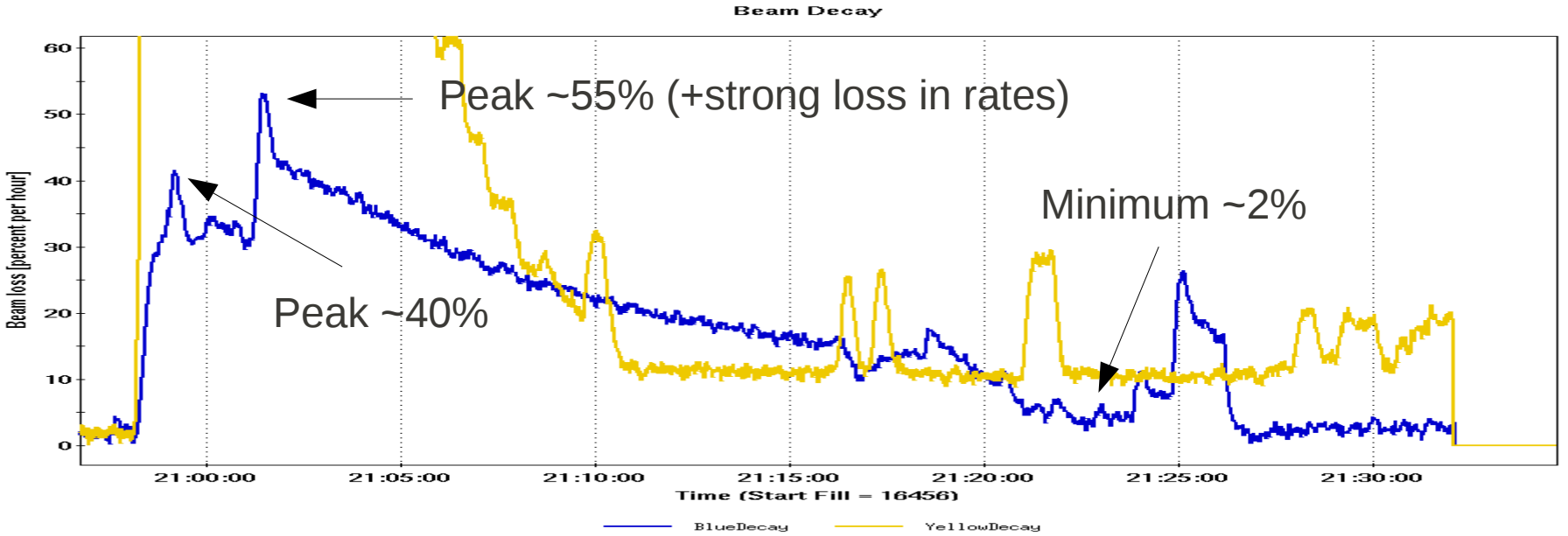
Nominal tunes
→ Clear coherent modes in the vertical plane
→ Modes not observed in the horizontal plane

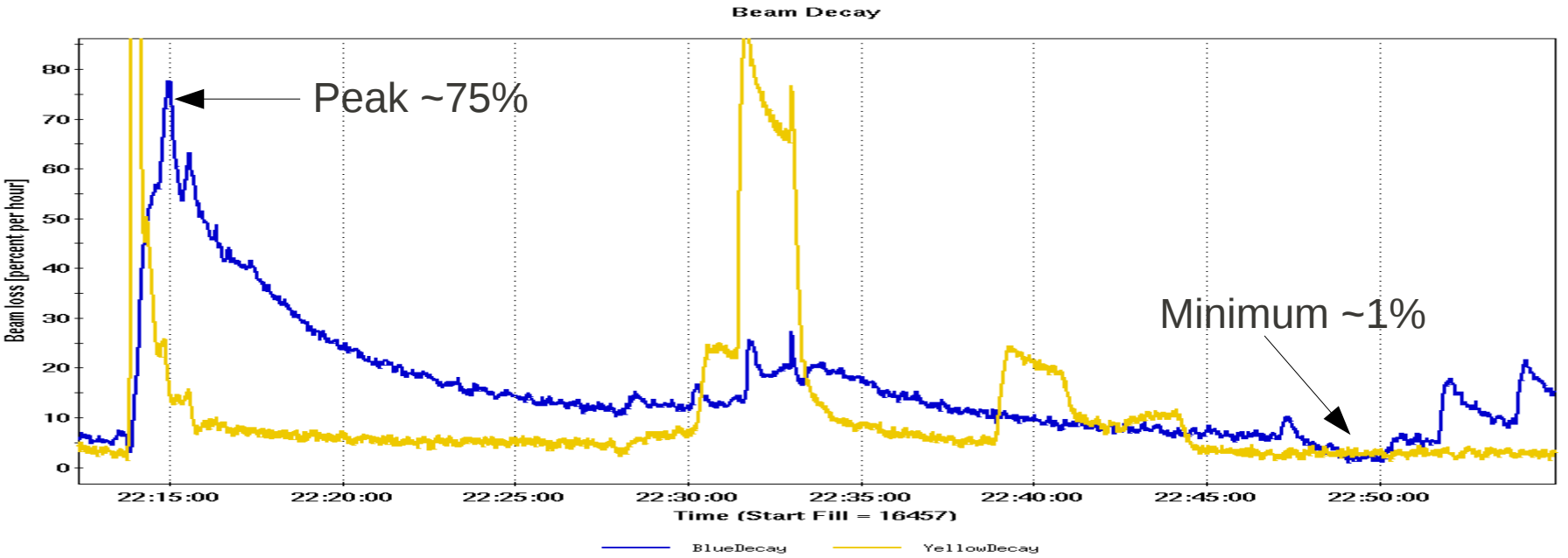


Tune scan: drive the blue beam onto the 2/3rd resonance
Could go as far as 0.6884/ 0.6865 (bare lattice tunes estimated from quad changes) without losses.

0.6865-0.015*1.3=0.667
(pi-mode on the 2/3rd resonance)

Beam Decay


Beam Decay
Peak ~55% (+strong loss in rates)
Minimum ~2%
Peak ~40%
Beam loss [percent per hour]
60
50
40
30
20
10
0
21:00:00
21:05:00
21:10:00
21:15:00
21:20:00
21:25:00
21:30:00
Time (Start Fill = 16456)
BlueDecay
YellowDecay


Beam Decay
Peak ~75%
Minimum ~1%
Beam loss [percent per hour]
80
70
60
50
40
30
20
10
0
22:15:00
22:20:00
22:25:00
22:30:00
22:35:00
22:40:00
22:45:00
22:50:00
Time (Start Fill = 16457)
BlueDecay
YellowDecay

Summary

- Ramp with split tunes successful – losses actually look better
- It seems that going into collisions without coherent modes is better → to be confirmed with optimized yellow tunes
- Lifetime at store similar (working point should lowered anyway – too close to 0.7)
- The coherent modes are sensitive to betatron resonances → gain of tunes space without the modes