Intensity effects

CASES:

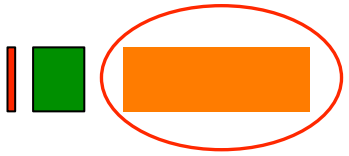
1. 1 + 12 + 36 bunches injections intensity $6*10^{10}$
2. 1 + 12 + 36 bunches injections intensity $8*10^{10}$
3. 1 + 12 + 36 bunches injections intensity $10\text{-}11*10^{10}$

Observations and Conclusions:

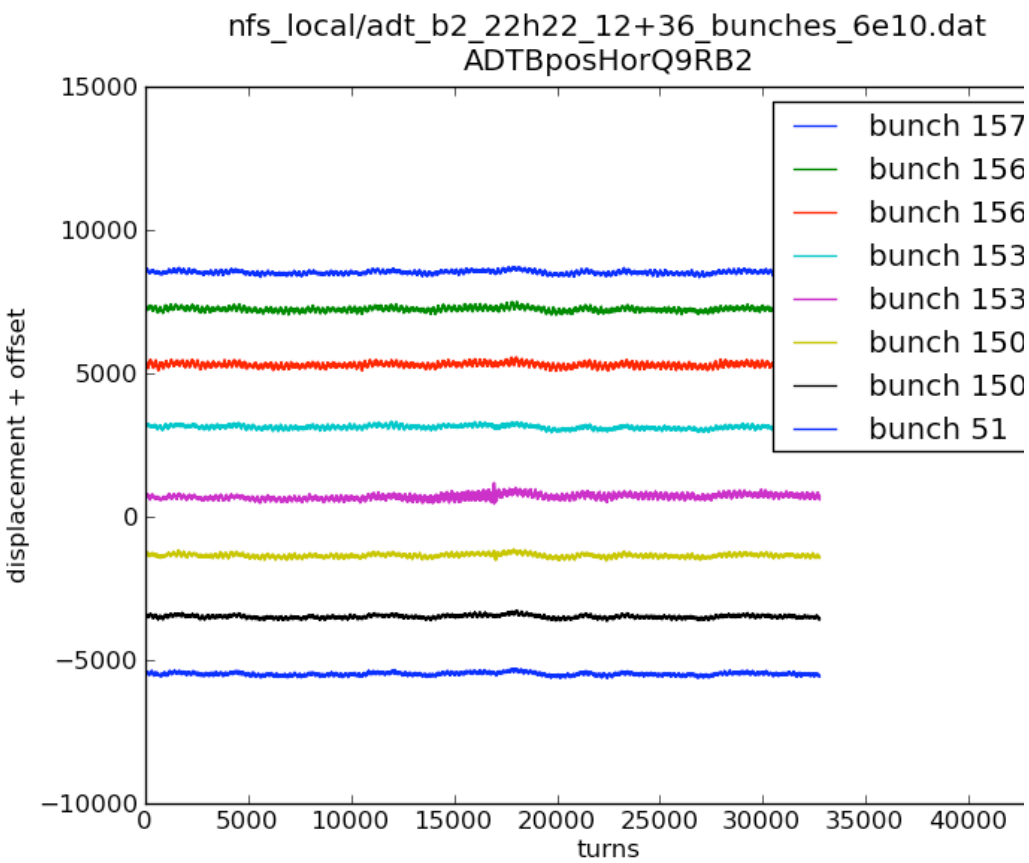
- Coherent oscillations on tail bunches
- Oscillations are damped after injection
- Damping time of the oscillation increases for higher intensities

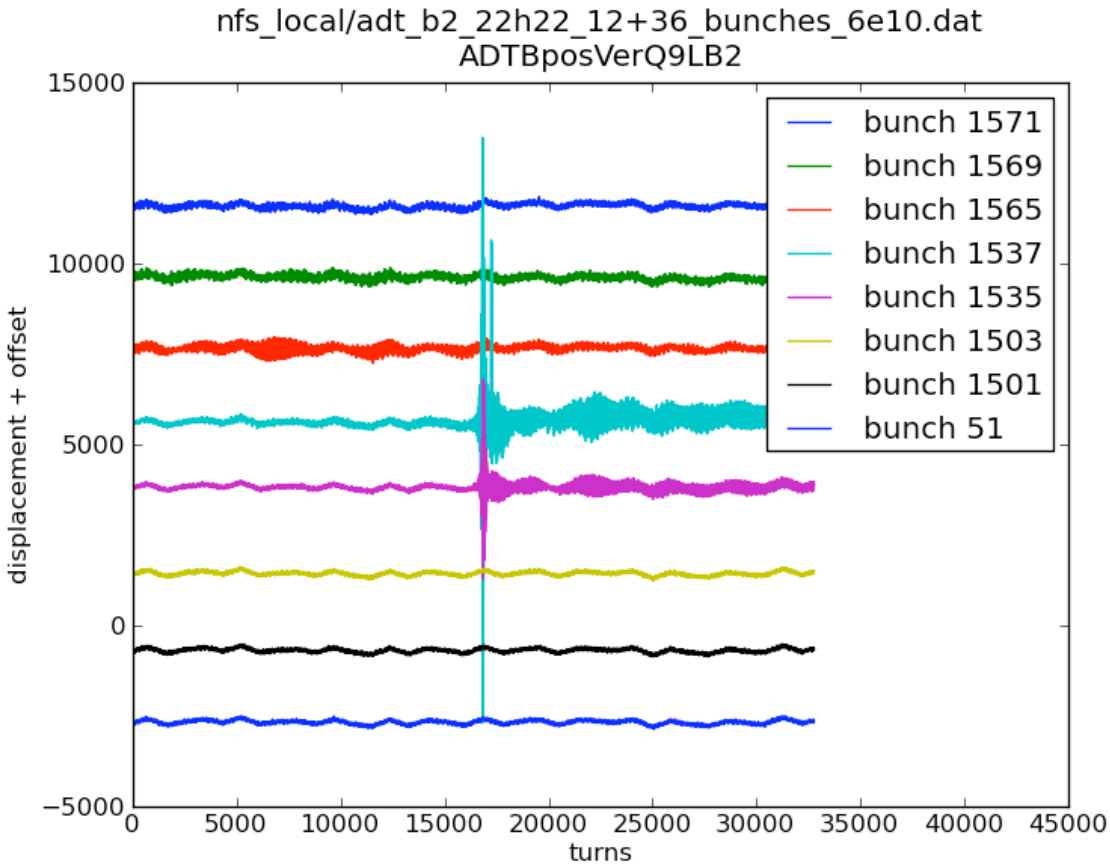
1) 1+12+36 at slot 1501 Intensity $6*10^{10}$

B1



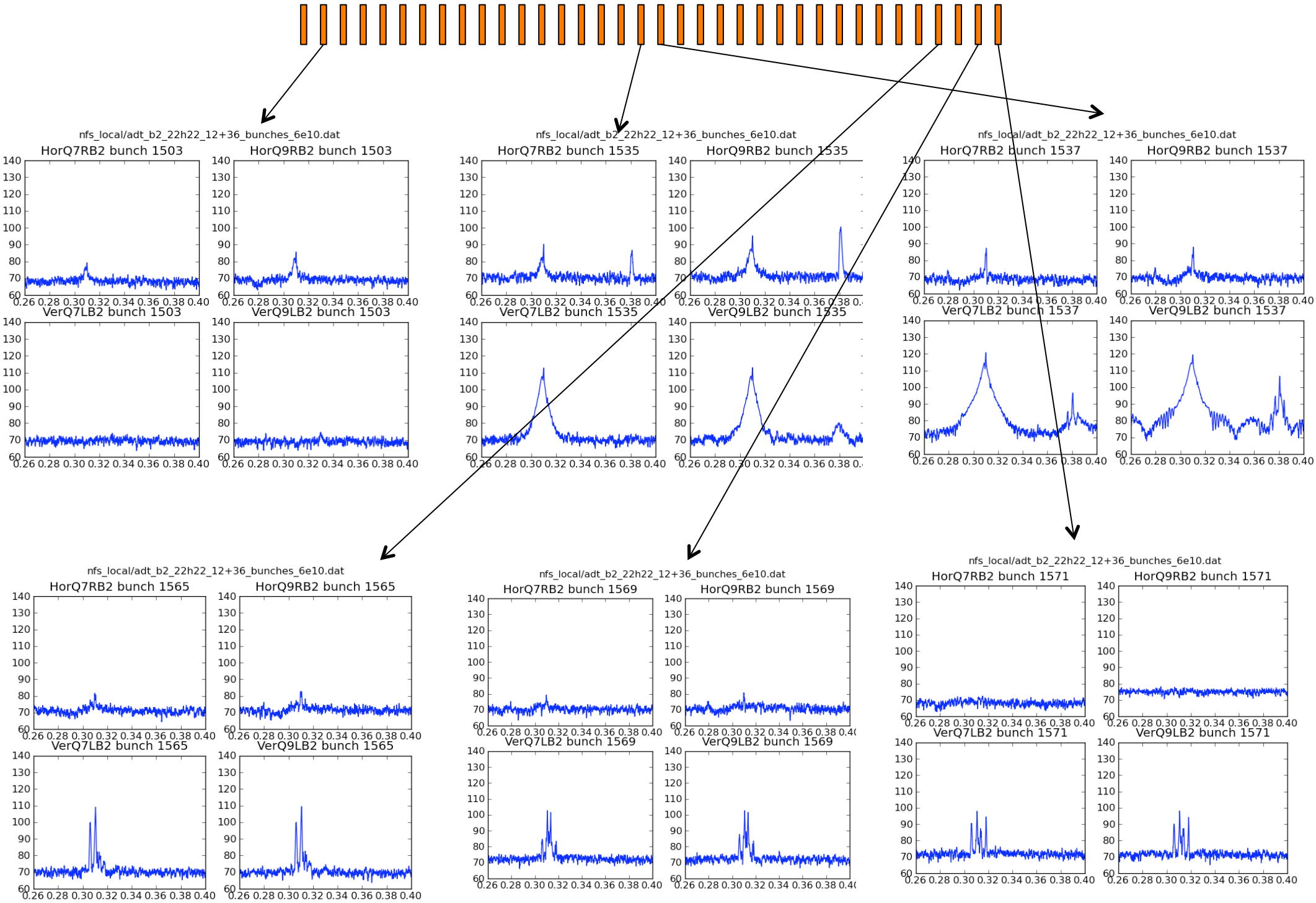
File b2 22h22_12+36 1Nov.
-First 3 bunches nothing visible.
-Slots 1535 and 1537 show an external transverse kick in vertical plane.
-Tail bunches show coherent motion before and after the kick on central ones





In time domain:

In frequency domain:



Previous measurements corresponds to emittance measurements from federico:

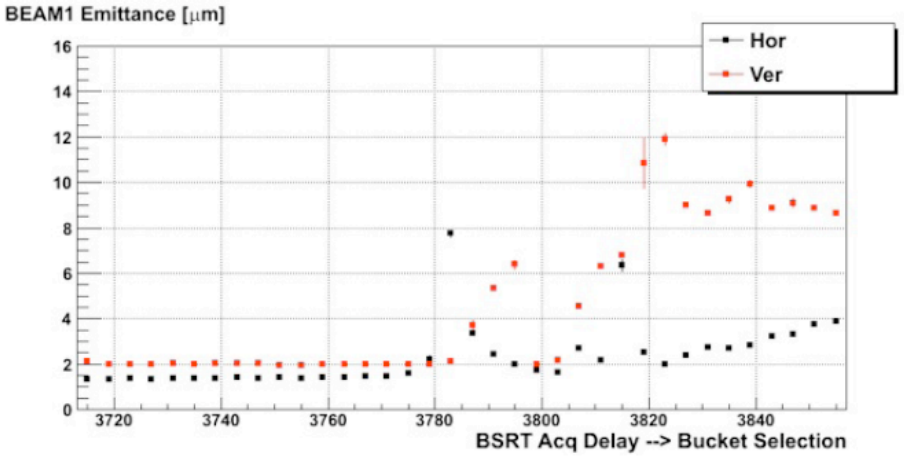
01-11-2010 - scrubbing

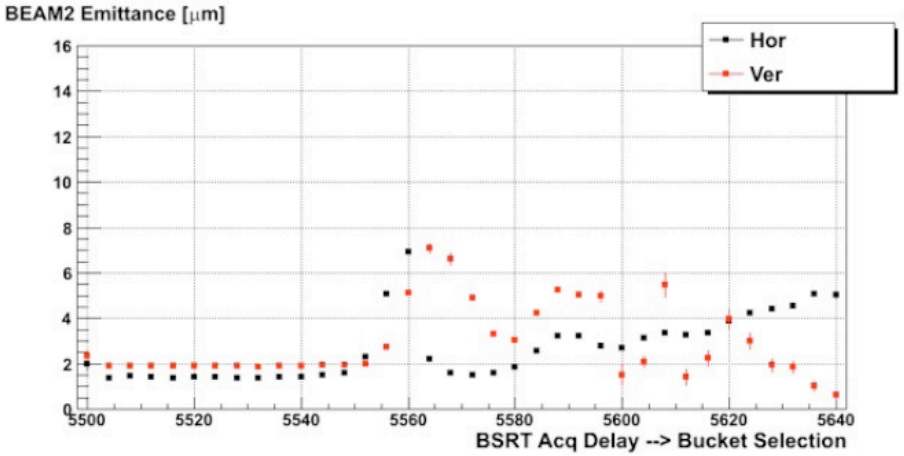
BSRT emittances bunch per bunch over the train of **36 bunches**. (first B1 and then B2 injections from 21:30 to 23:00)

Hor axis:
BSRT acquisition gate delay --> bucket # **from 15001 to 15701**

Each point:
-average over ~10seconds two times per bunch, with a gap of ~3minutes between acquisitions on the same bunch
--> small error bars say that first bunches in the train did not change after 3 min

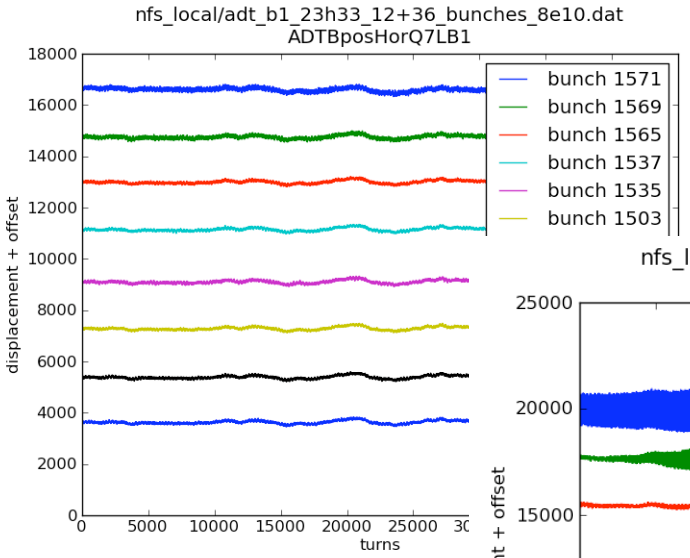
B1:
from bunch 18: blow up in HOR and VER (Vertical fit very bad)
B2:
same as B1, from Bunch 15

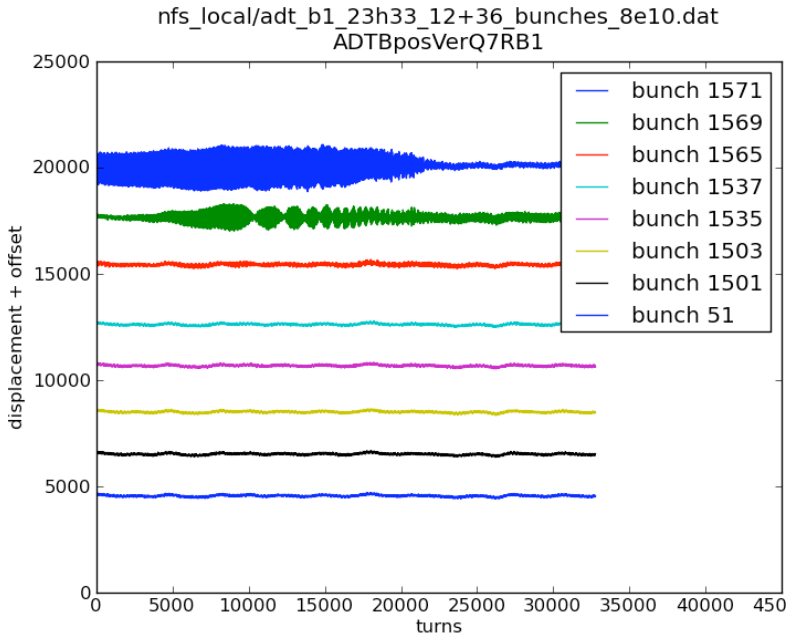


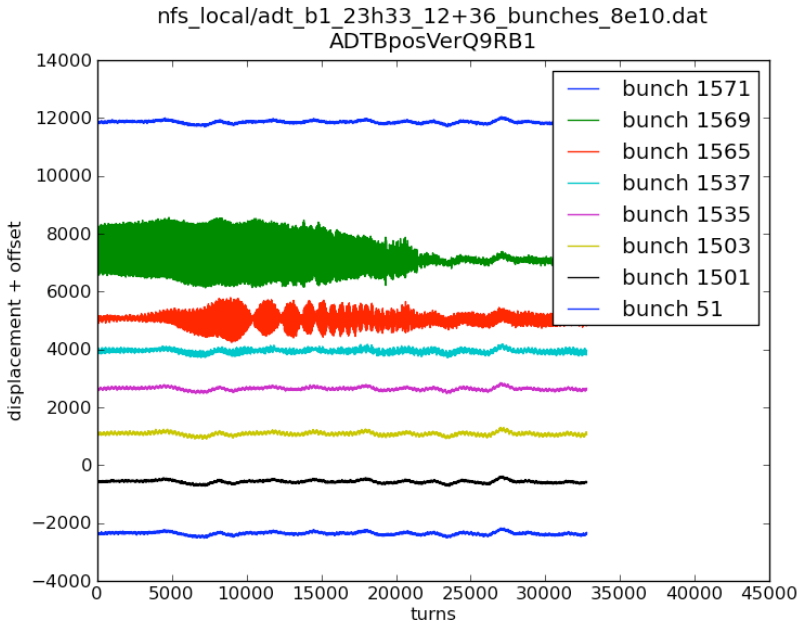


2)1+12+36 at slot 1501 Intensity $8*10^{10}$

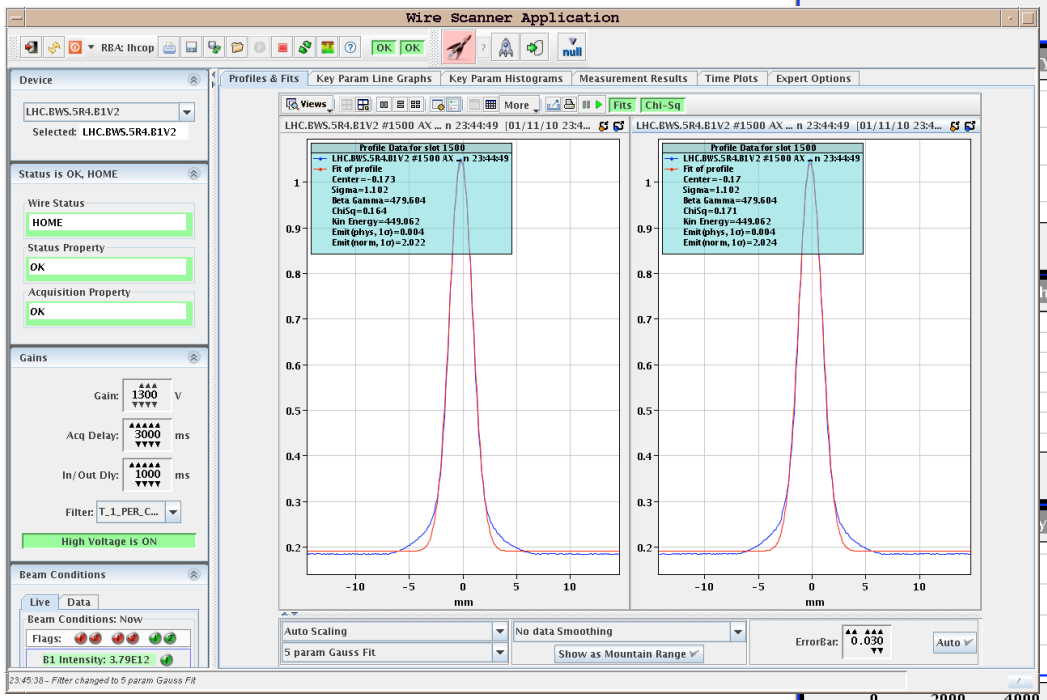
File b1 23h33_12+36 1Nov
-First 6 bunches nothing visible.
-Slots 1565,1569 and 1571 show “damped instability” in vertical on 1 BPM(Q7) only the second seems shifted(Q9) Instrument issue?

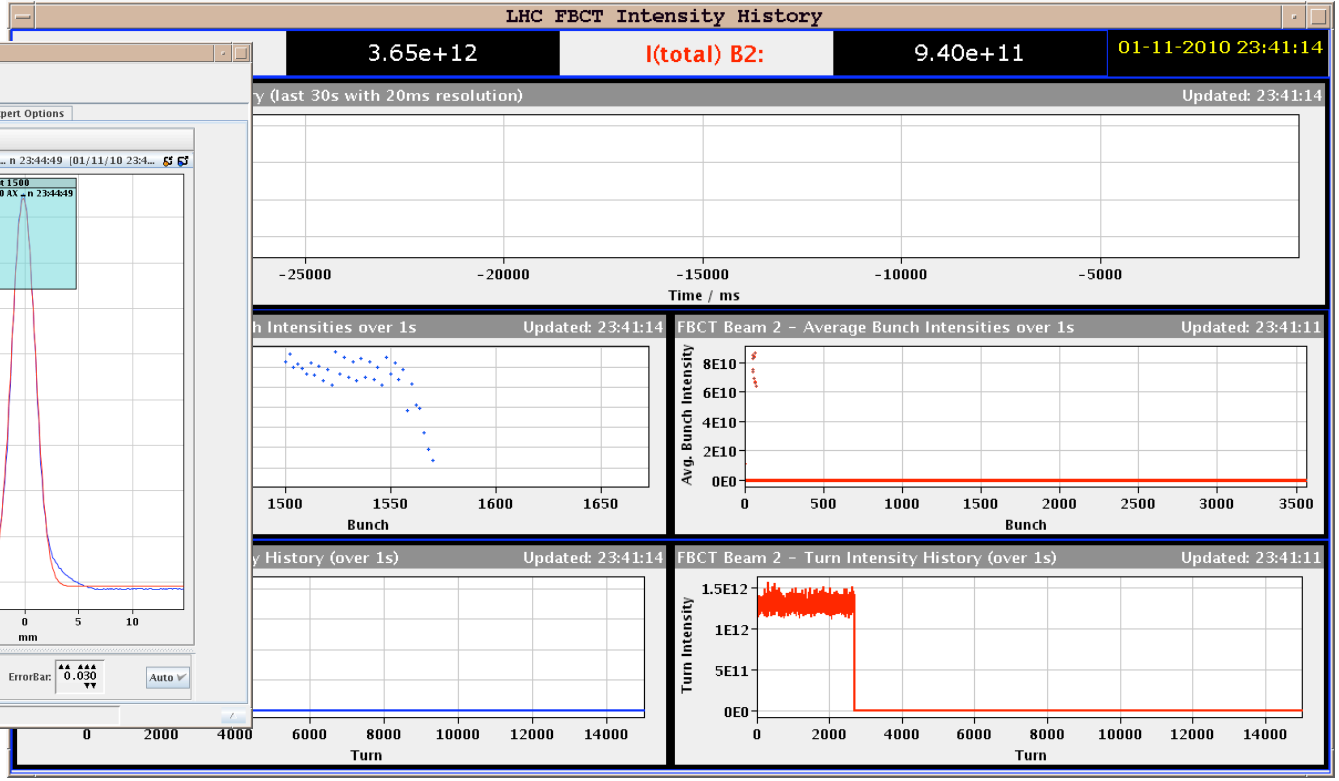


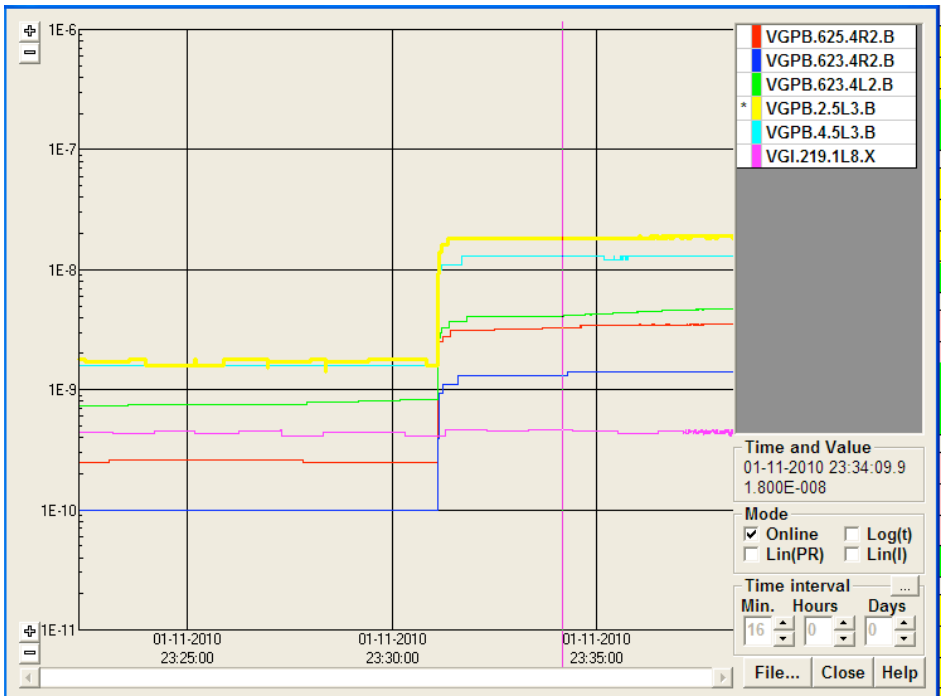


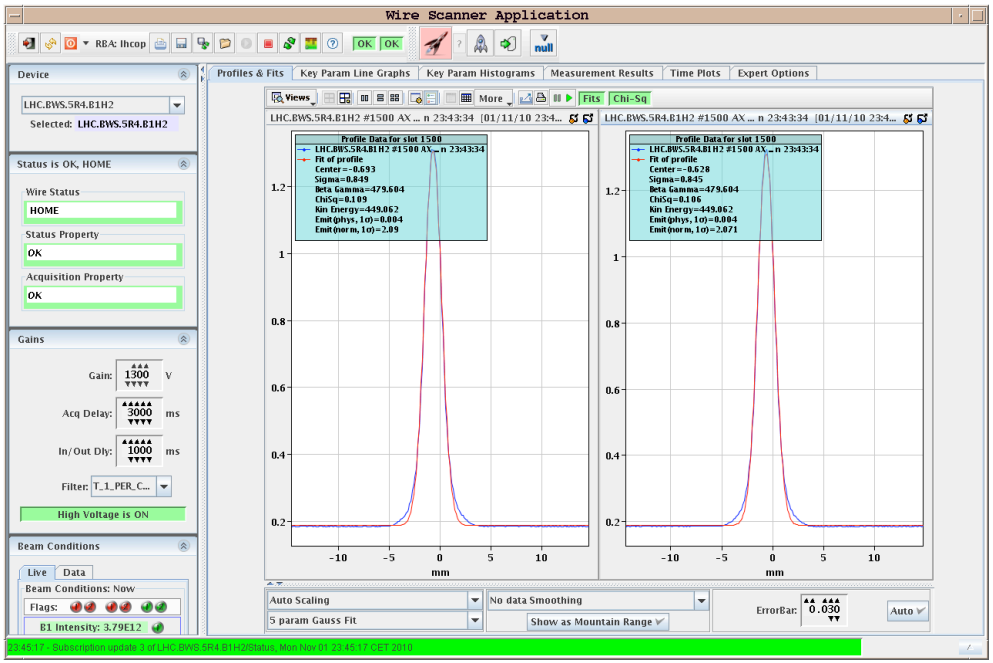


In time domain:


Wire Scanner Application
RBA: lhcop
OK
OK
null
Device
LHC.BWS.5R4.B1V2
Selected: LHC.BWS.5R4.B1V2
Status is OK, HOME
Wire Status
HOME
Status Property
OK
Acquisition Property
OK
Gains
Gain: 1300 V
Acq Delay: 3000 ms
In/Out Dly: 1000 ms
Filter: T_1_PER_C...
High Voltage is ON
Beam Conditions
Live
Data
Beam Conditions: Now
Flags:
B1 Intensity: 3.79E12
Profiles & Fits
Key Param Line Graphs
Key Param Histograms
Measurement Results
Time Plots
Expert Options
Views
More
Fits
Chi-Sq
LHC.BWS.5R4.B1V2 #1500 AX ... n 23:44:49 [01/11/10 23:4...
Profile Data for slot 1500
LHC.BWS.5R4.B1V2 #1500 AX ... n 23:44:49
Fit of profile
Center=-0.173
Sigma=1.102
Beta Gamma=479.604
ChiSq=0.164
Kin Energy=449.062
Emit(phys, 1σ)=0.004
Emit(norm, 1σ)=2.022
Center=-0.17
Sigma=1.102
Beta Gamma=479.604
ChiSq=0.171
Kin Energy=449.062
Emit(phys, 1σ)=0.004
Emit(norm, 1σ)=2.024
mm
Auto Scaling
5 param Gauss Fit
No data Smoothing
Show as Mountain Range
ErrorBar: 0.030
Auto
23:45:38 - Filter changed to 5 param Gauss Fit

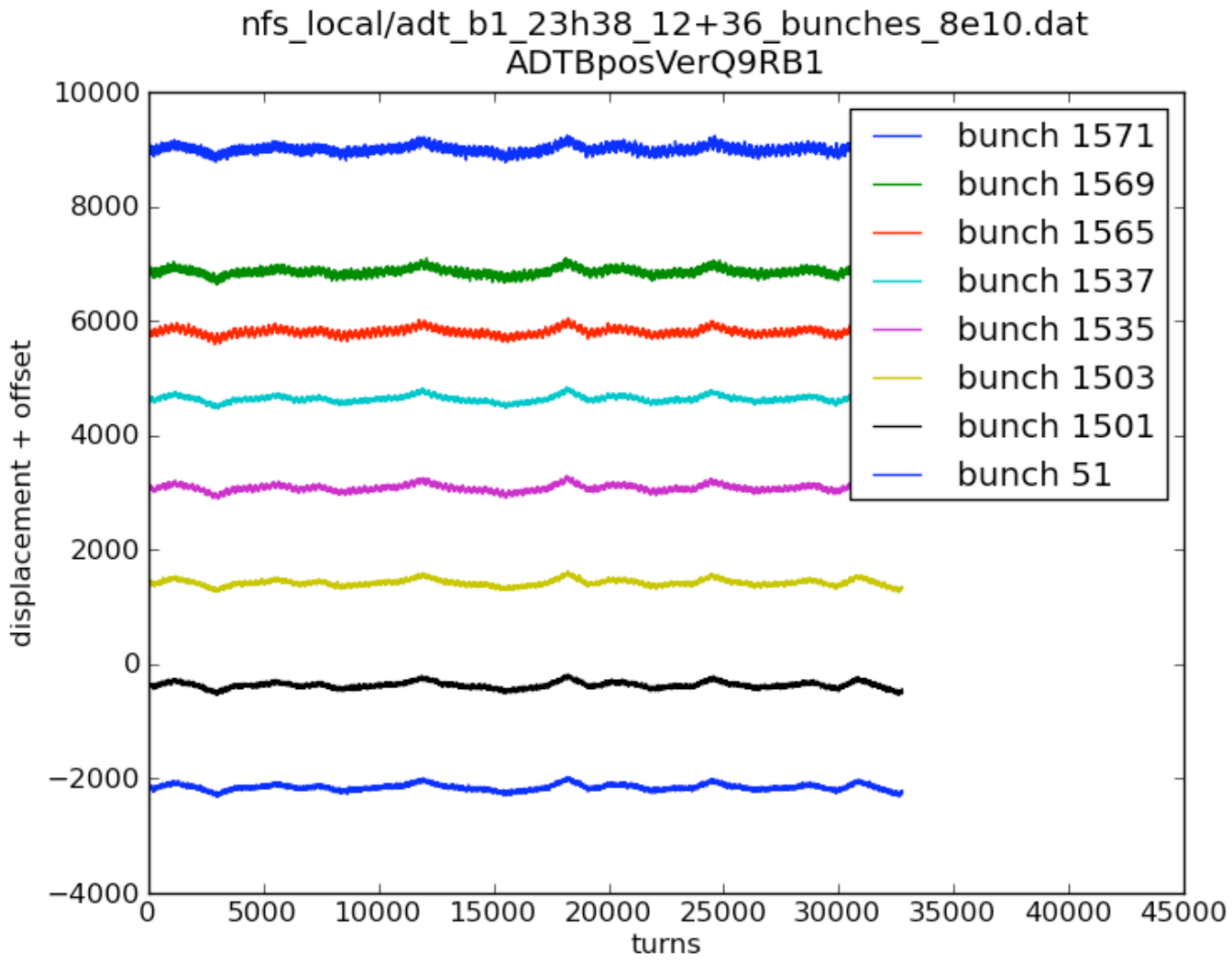

LHC FBCT Intensity History
3.65e+12
I(total) B2:
9.40e+11
01-11-2010 23:41:14
y (last 30s with 20ms resolution)
Updated: 23:41:14
Time / ms
h Intensities over 1s
Updated: 23:41:14
Bunch
FBCT Beam 2 - Average Bunch Intensities over 1s
Updated: 23:41:11
Avg. Bunch Intensity
Bunch
y History (over 1s)
Updated: 23:41:14
Turn
FBCT Beam 2 - Turn Intensity History (over 1s)
Updated: 23:41:11
Turn Intensity
Turn


VGPB.625.4R2.B
VGPB.623.4R2.B
VGPB.623.4L2.B
VGPB.2.5L3.B
VGPB.4.5L3.B
VGI.219.1L8.X
01-11-2010
23:25:00
01-11-2010
23:30:00
01-11-2010
23:35:00
Time and Value
01-11-2010 23:34:09.9
1.800E-008
Mode
Online
Log(t)
Lin(PR)
Lin(I)
Time interval
Min.
Hours
Days
File...
Close
Help

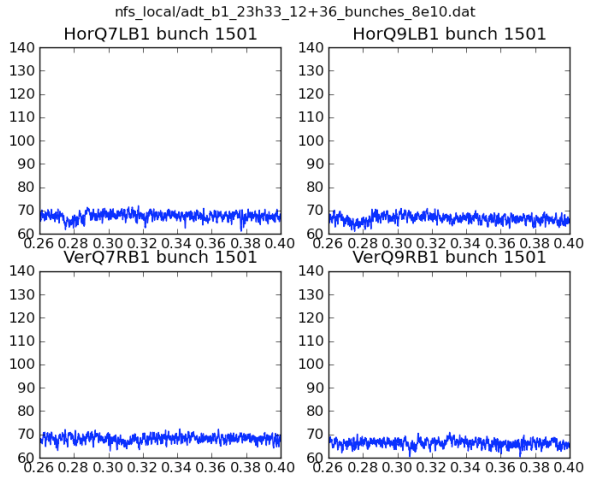

Wire Scanner Application
RBA: lhcop
OK
OK
null
Device
LHC.BWS.5R4.B1H2
Selected: LHC.BWS.5R4.B1H2
Status is OK, HOME
Wire Status
HOME
Status Property
OK
Acquisition Property
OK
Gains
Gain: 1300 V
Acq Delay: 3000 ms
In/Out Dly: 1000 ms
Filter: T_1_PER_C...
High Voltage is ON
Beam Conditions
Live
Data
Beam Conditions: Now
Flags:
B1 Intensity: 3.79E12
Profiles & Fits
Key Param Line Graphs
Key Param Histograms
Measurement Results
Time Plots
Expert Options
Views
More
Fits
Chi-Sq
LHC.BWS.5R4.B1H2 #1500 AX ... n 23:43:34 [01/11/10 23:4...
Profile Data for slot 1500
LHC.BWS.5R4.B1H2 #1500 AX ... n 23:43:34
Fit of profile
Center=-0.693
Sigma=0.849
Beta Gamma=479.604
ChiSq=0.109
Kin Energy=449.062
Emit(phys, 1σ)=0.004
Emit(norm, 1σ)=2.89
Center=-0.628
Sigma=0.845
Beta Gamma=479.604
ChiSq=0.106
Kin Energy=449.062
Emit(phys, 1σ)=0.004
Emit(norm, 1σ)=2.871
mm
Auto Scaling
5 param Gauss Fit
No data Smoothing
Show as Mountain Range
ErrorBar: 0.030
Auto
23:45:17 - Subscription update 3 of LHC.BWS.5R4.B1H2:Status, Mon Nov 01 23:45:17 CET 2010

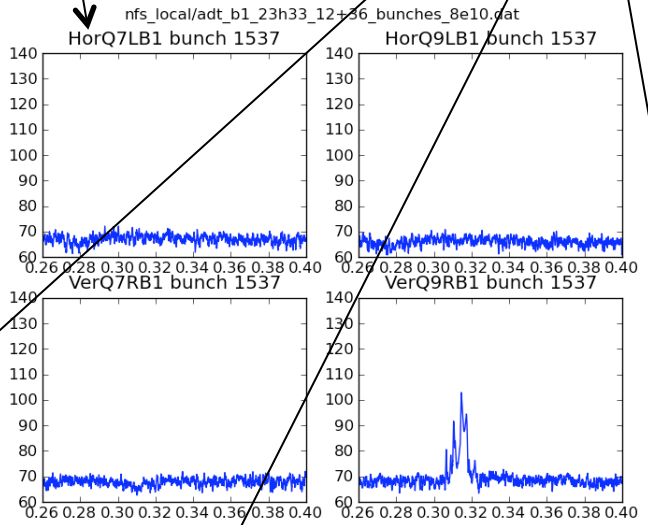
5 minutes after nothing

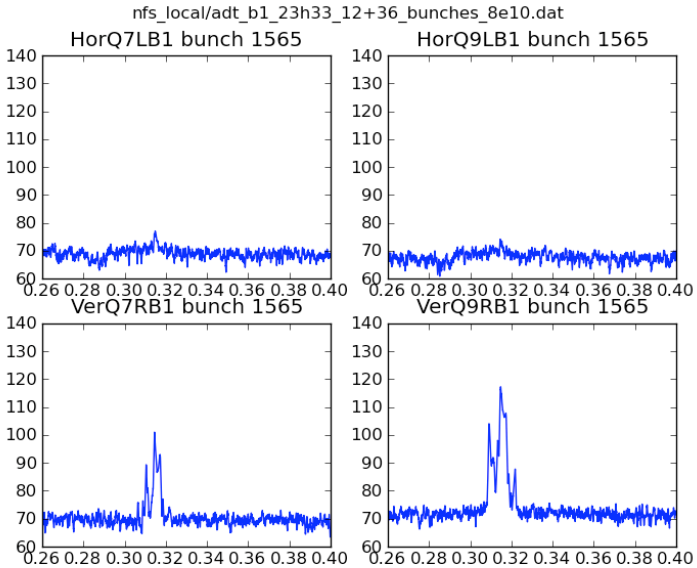
In time domain:

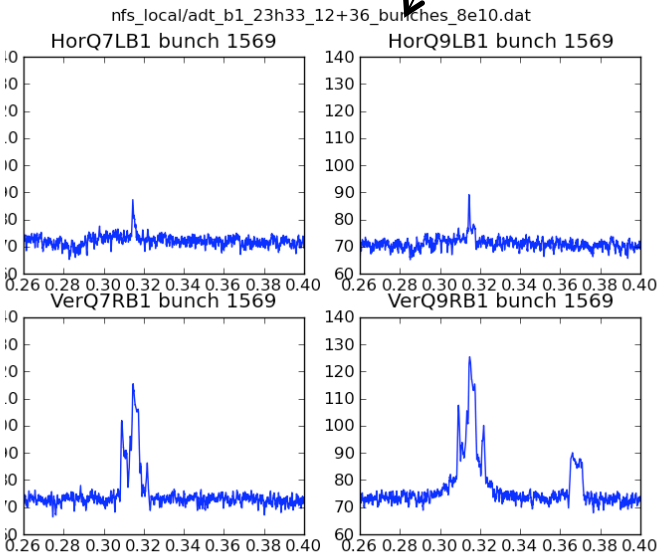


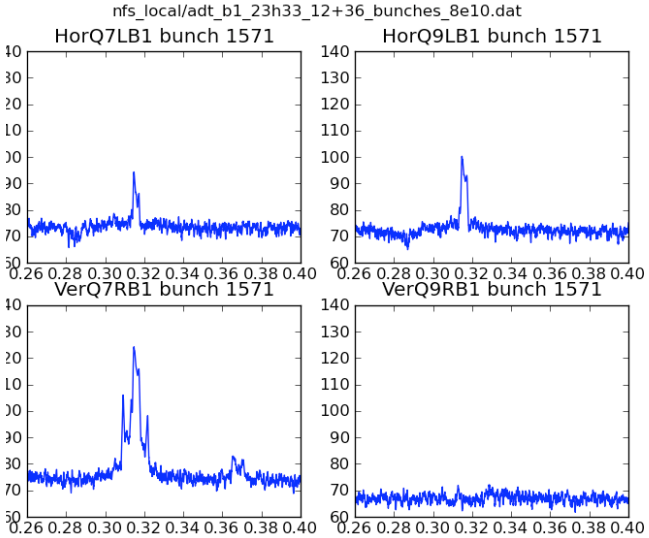
In frequency domain:





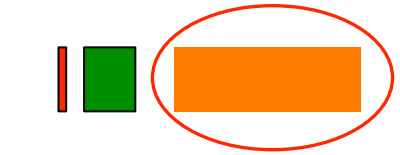




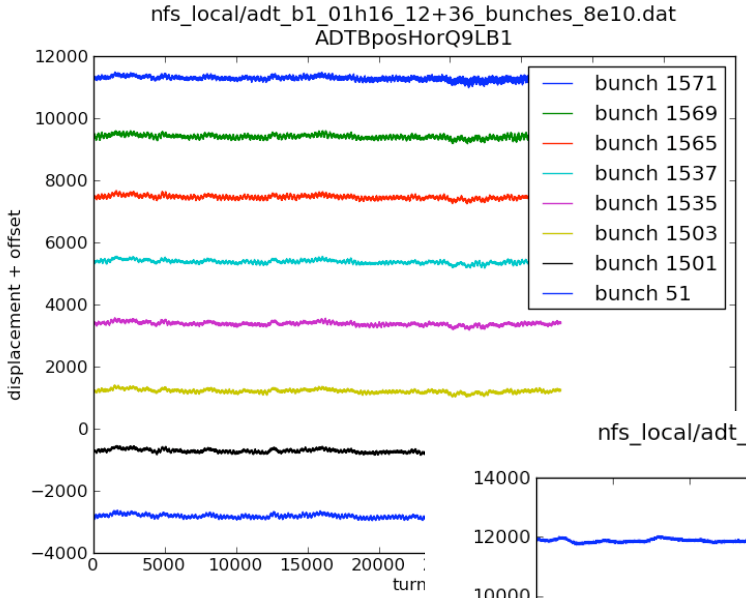


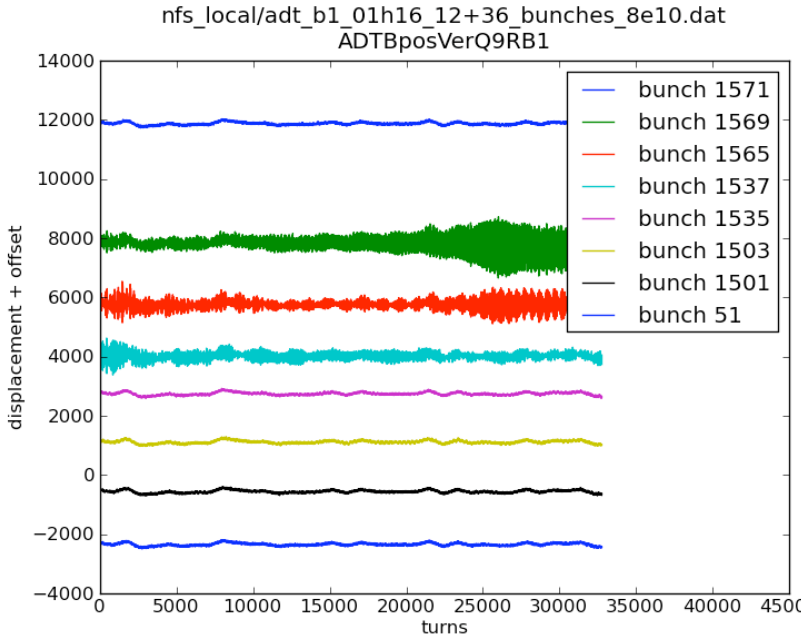
3) 1+12+36 at slot 1501 10-11*10^{10}

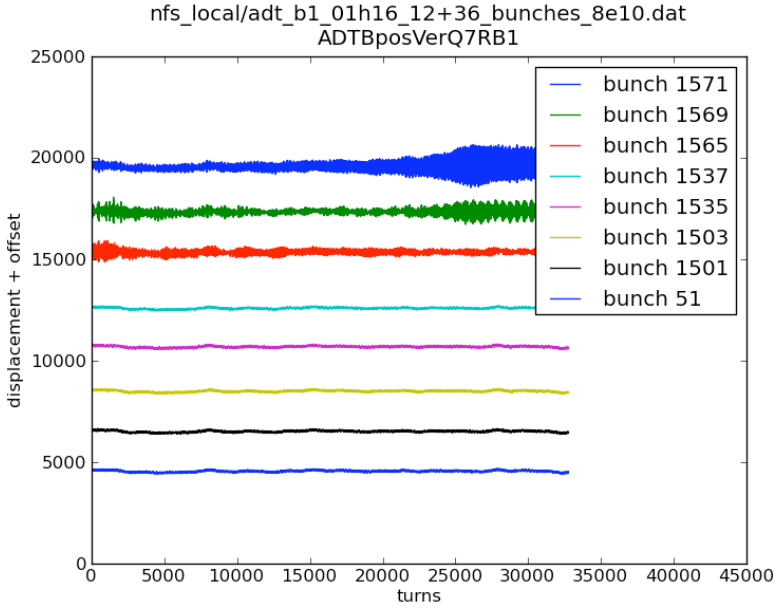
B1



Same as previous Q'= +10 both beams H/V planes
File b1 01h16_12+36 2 Nov
-First 6 bunches nothing visible.
-Slots 1565,1569 and 1571 show "growing oscillations" but saturating in vertical on 1 BPM(Q7) only the second seems shifted(Q9) Instrument issue again?

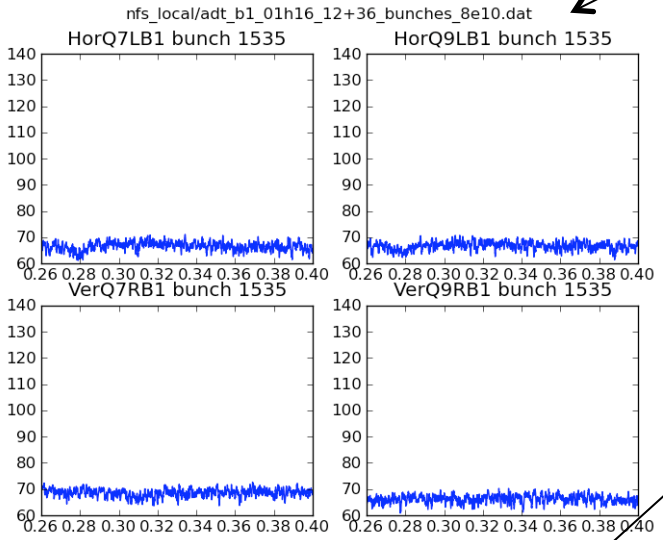


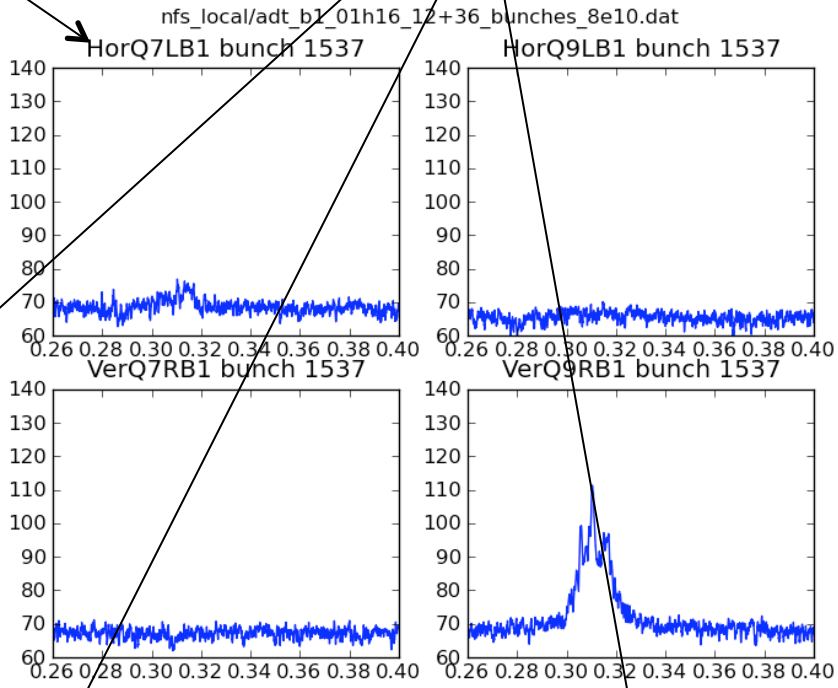


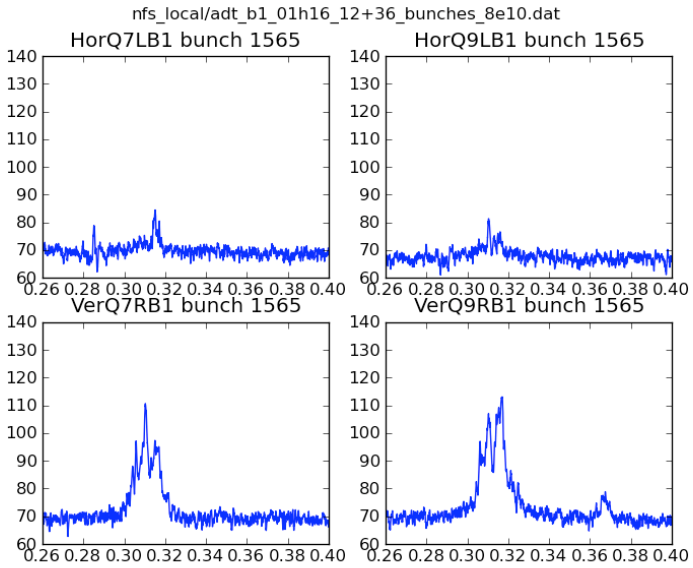


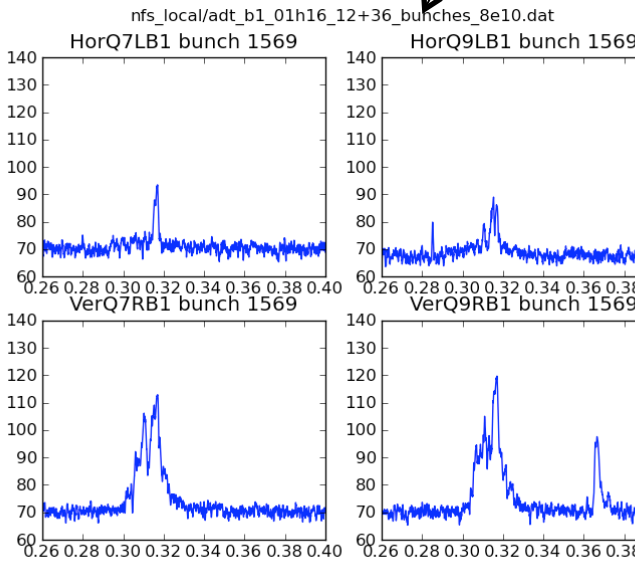
In time domain:

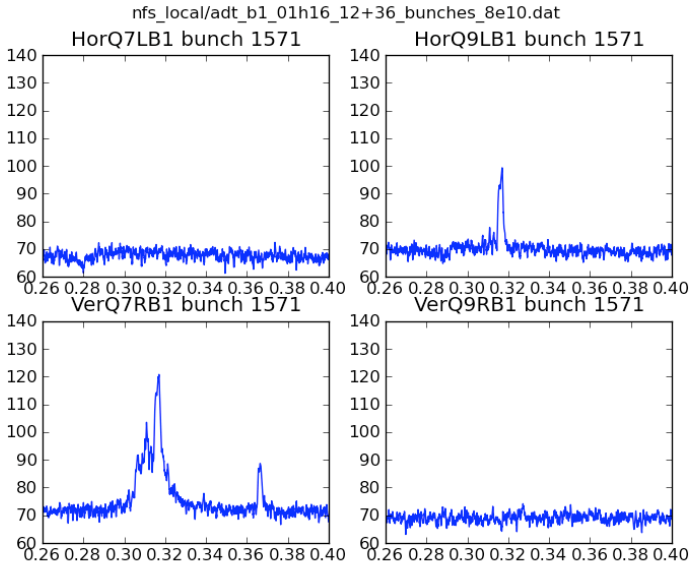
In frequency domain:

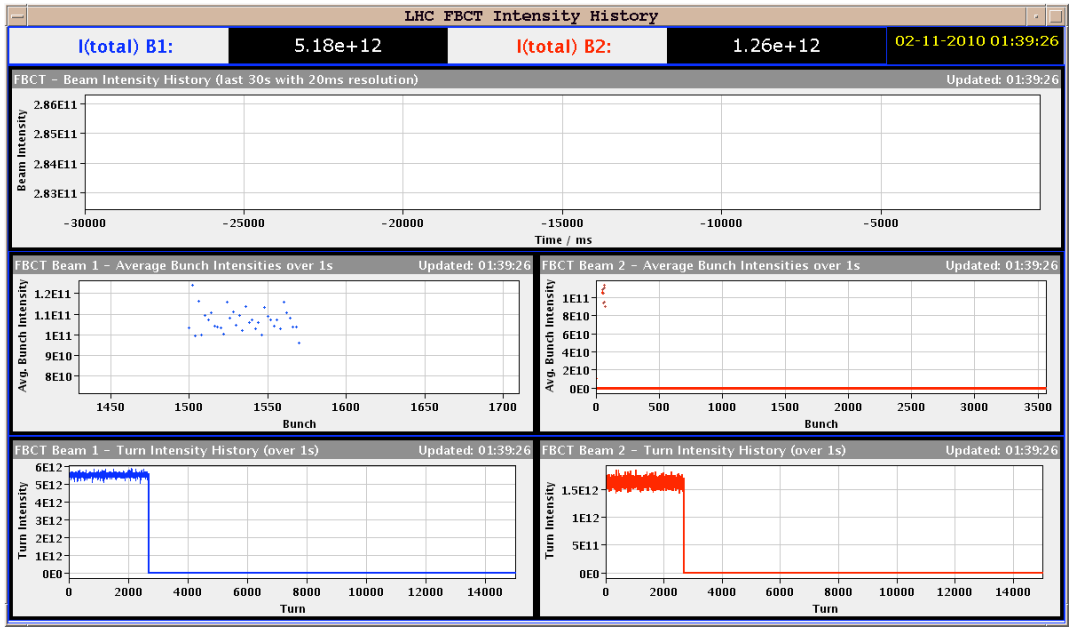


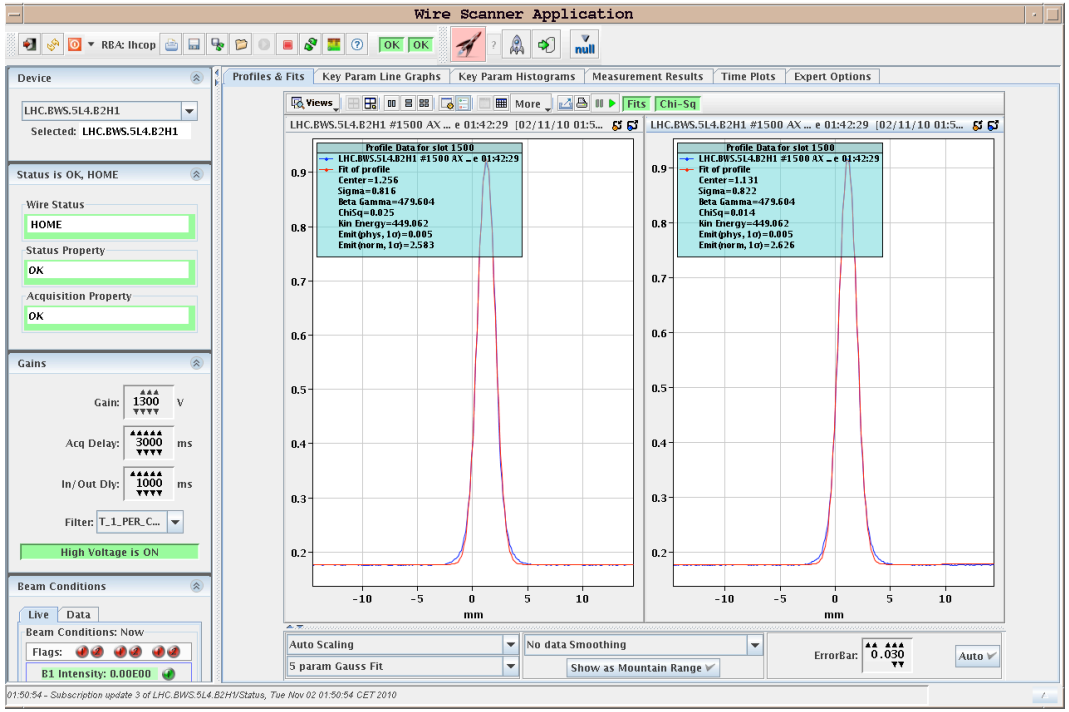


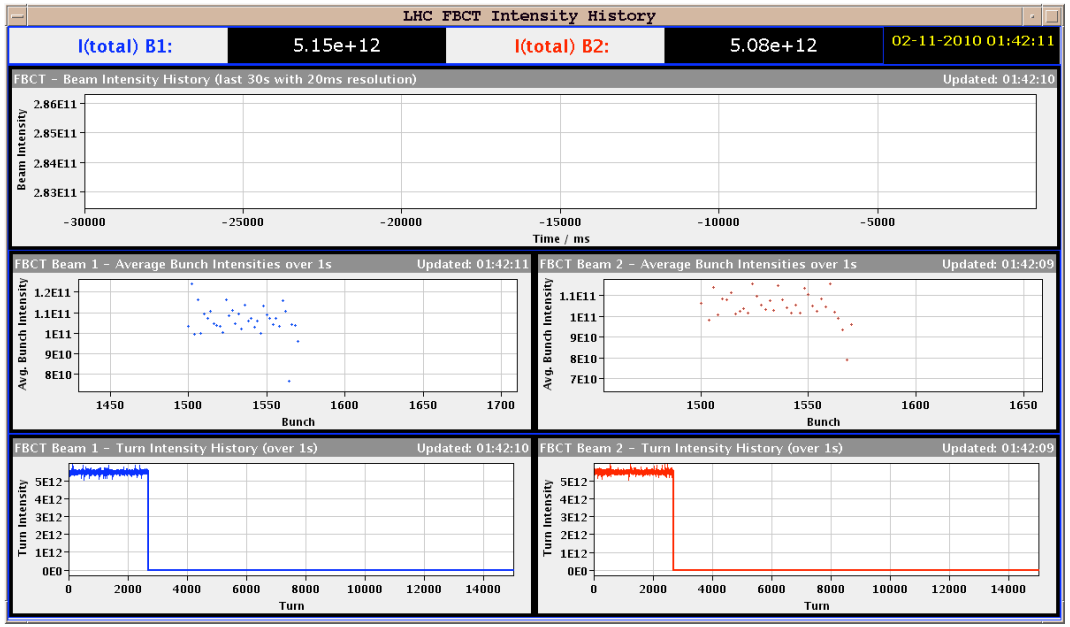


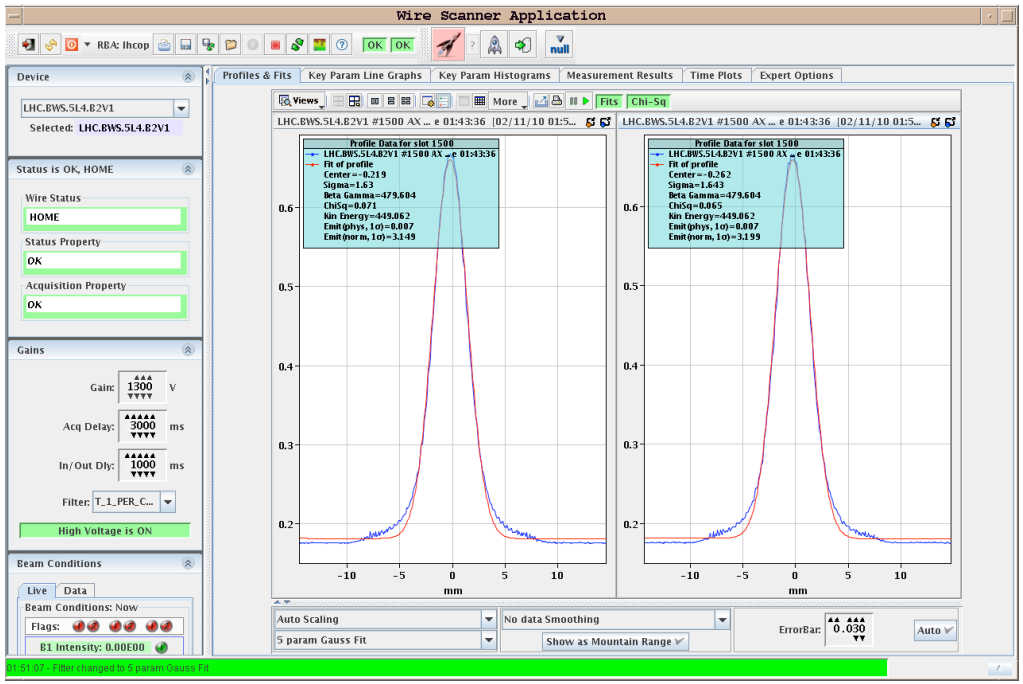





LHC FBCT Intensity History
I(total) B1:
5.18e+12
I(total) B2:
1.26e+12
02-11-2010 01:39:26
FBCT – Beam Intensity History (last 30s with 20ms resolution)
Updated: 01:39:26
Beam Intensity
Time / ms
FBCT Beam 1 – Average Bunch Intensities over 1s
Updated: 01:39:26
Avg. Bunch Intensity
Bunch
FBCT Beam 2 – Average Bunch Intensities over 1s
Updated: 01:39:26
Avg. Bunch Intensity
Bunch
FBCT Beam 1 – Turn Intensity History (over 1s)
Updated: 01:39:26
Turn Intensity
Turn
FBCT Beam 2 – Turn Intensity History (over 1s)
Updated: 01:39:26
Turn Intensity
Turn

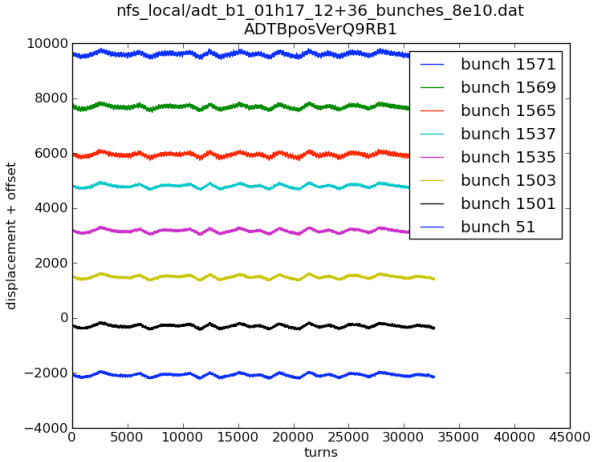

Wire Scanner Application
RBA: lhcop
Device
LHC.BWS.5L4.B2H1
Selected: LHC.BWS.5L4.B2H1
Status is OK, HOME
Wire Status
HOME
Status Property
OK
Acquisition Property
OK
Gains
Gain: 1300 V
Acq Delay: 3000 ms
In/Out Dly: 1000 ms
Filter: T_1_PER_C...
High Voltage is ON
Beam Conditions
Live
Data
Beam Conditions: Now
Flags:
B1 Intensity: 0.00E00
Profiles & Fits
Key Param Line Graphs
Key Param Histograms
Measurement Results
Time Plots
Expert Options
Views
More
Fits
Chi-Sq
LHC.BWS.5L4.B2H1 #1500 AX ... e 01:42:29 [02/11/10 01:5...
Profile Data for slot 1500
LHC.BWS.5L4.B2H1 #1500 AX ... e 01:42:29
Fit of profile
Center=1.256
Sigma=0.816
Beta Gamma=479.604
ChiSq=0.025
Kin Energy=449.062
Emit(phys, 1σ)=0.005
Emit(norm, 1σ)=2.583
Center=1.131
Sigma=0.822
Beta Gamma=479.604
ChiSq=0.014
Kin Energy=449.062
Emit(phys, 1σ)=0.005
Emit(norm, 1σ)=2.626
mm
Auto Scaling
5 param Gauss Fit
No data Smoothing
Show as Mountain Range
ErrorBar: 0.030
Auto
01:50:54 - Subscription update 3 of LHC.BWS.5L4.B2H1/Status, Tue Nov 02 01:50:54 CET 2010


LHC FBCT Intensity History
I(total) B1:
5.15e+12
I(total) B2:
5.08e+12
02-11-2010 01:42:11
FBCT – Beam Intensity History (last 30s with 20ms resolution)
Updated: 01:42:10
Beam Intensity
Time / ms
FBCT Beam 1 – Average Bunch Intensities over 1s
Updated: 01:42:11
Avg. Bunch Intensity
Bunch
FBCT Beam 2 – Average Bunch Intensities over 1s
Updated: 01:42:09
Avg. Bunch Intensity
Bunch
FBCT Beam 1 – Turn Intensity History (over 1s)
Updated: 01:42:10
Turn Intensity
Turn
FBCT Beam 2 – Turn Intensity History (over 1s)
Updated: 01:42:09
Turn Intensity
Turn

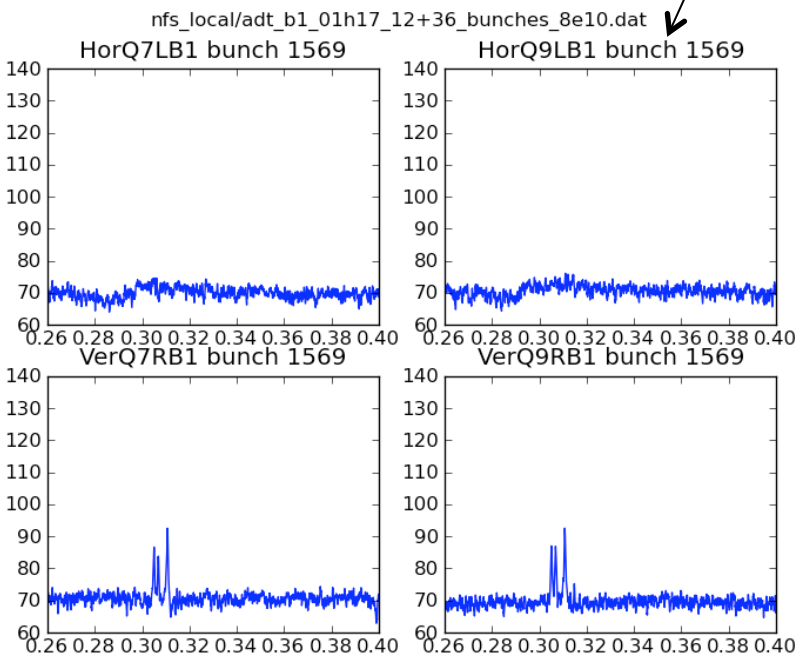

Wire Scanner Application
RBA: lhcop
Device
LHC.BWS.5L4.B2V1
Selected: LHC.BWS.5L4.B2V1
Status is OK, HOME
Wire Status
HOME
Status Property
OK
Acquisition Property
OK
Gains
Gain: 1300 V
Acq Delay: 3000 ms
In/Out Dly: 1000 ms
Filter: T_1_PER_C...
High Voltage is ON
Beam Conditions
Live
Data
Beam Conditions: Now
Flags:
B1 Intensity: 0.00E00
Profiles & Fits
Key Param Line Graphs
Key Param Histograms
Measurement Results
Time Plots
Expert Options
Views
More
Fits
Chi-Sq
LHC.BWS.5L4.B2V1 #1500 AX ... e 01:43:36 [02/11/10 01:5...
Profile Data for slot 1500
LHC.BWS.5L4.B2V1 #1500 AX ... e 01:43:36
Fit of profile
Center=-0.219
Sigma=1.63
Beta Gamma=479.604
ChiSq=0.071
Kin Energy=449.062
Emit(phys, 1σ)=0.007
Emit(norm, 1σ)=3.149
Center=-0.262
Sigma=1.643
Beta Gamma=479.604
ChiSq=0.065
Kin Energy=449.062
Emit(phys, 1σ)=0.007
Emit(norm, 1σ)=3.199
mm
Auto Scaling
5 param Gauss Fit
No data Smoothing
Show as Mountain Range
ErrorBar: 0.030
Auto
01:51:07 - Filter changed to 5 param Gauss Fit

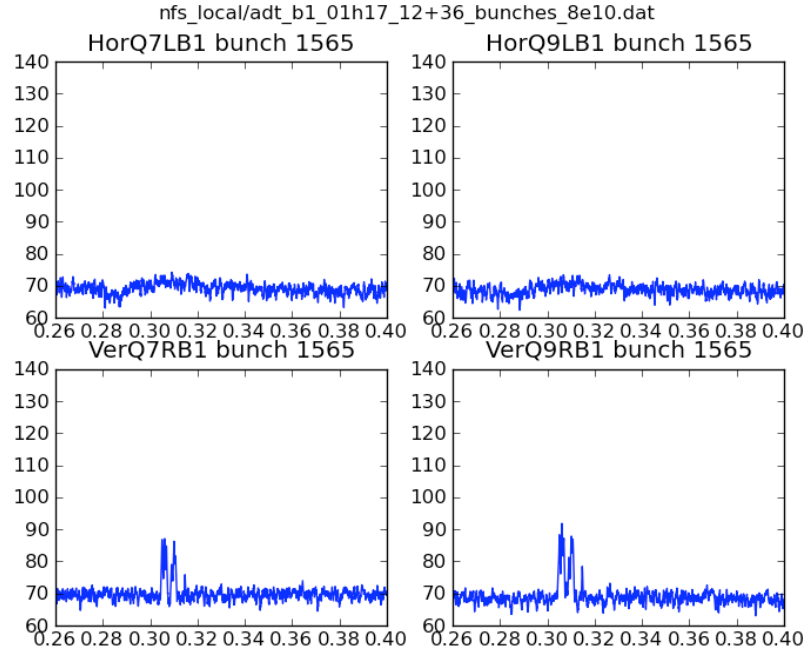
2 minutes after still something
15 minutes after nothing left

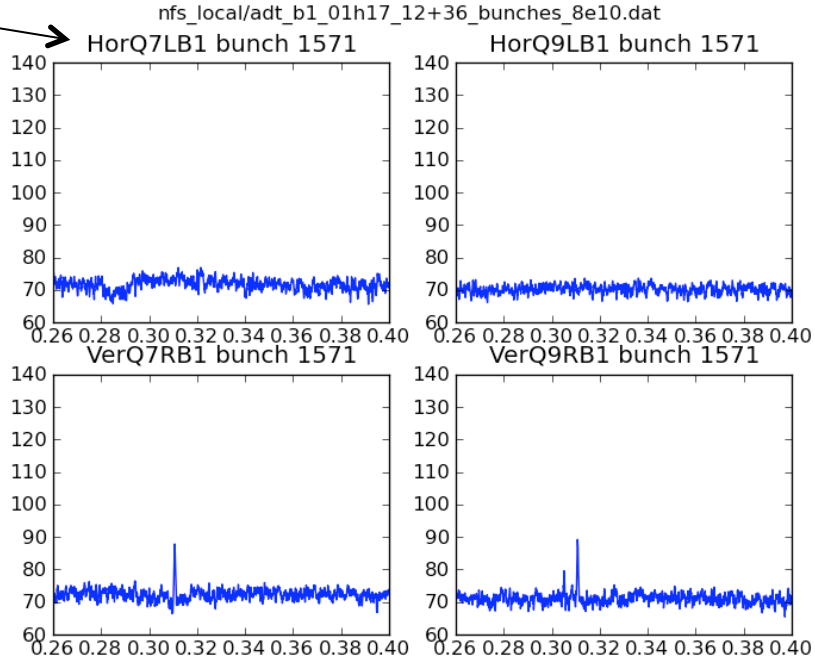
Nothing so visible in time domain:



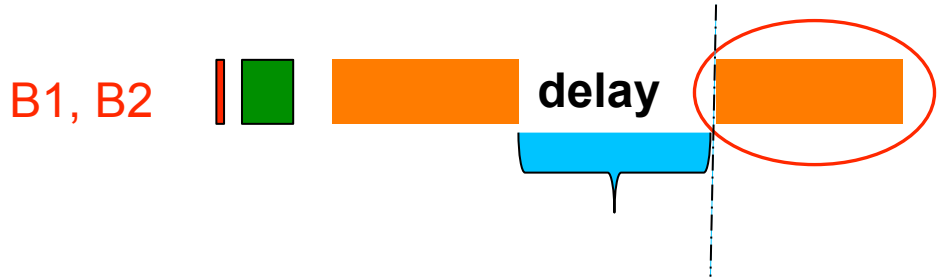
In frequency domain:







Train spacing



CASES:

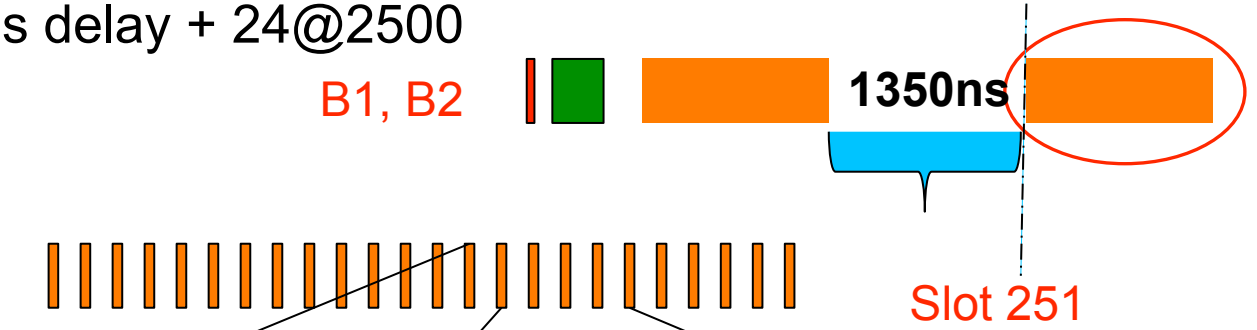
1. 1+ 12@501 +24 @1500 + 1350ns delay + 24@2500
2. 1+ 12@501 +24 @1500 + 1000ns delay + 24@2370
3. 1+ 12@501 +24 @1500 + 1850ns delay + 24@2700

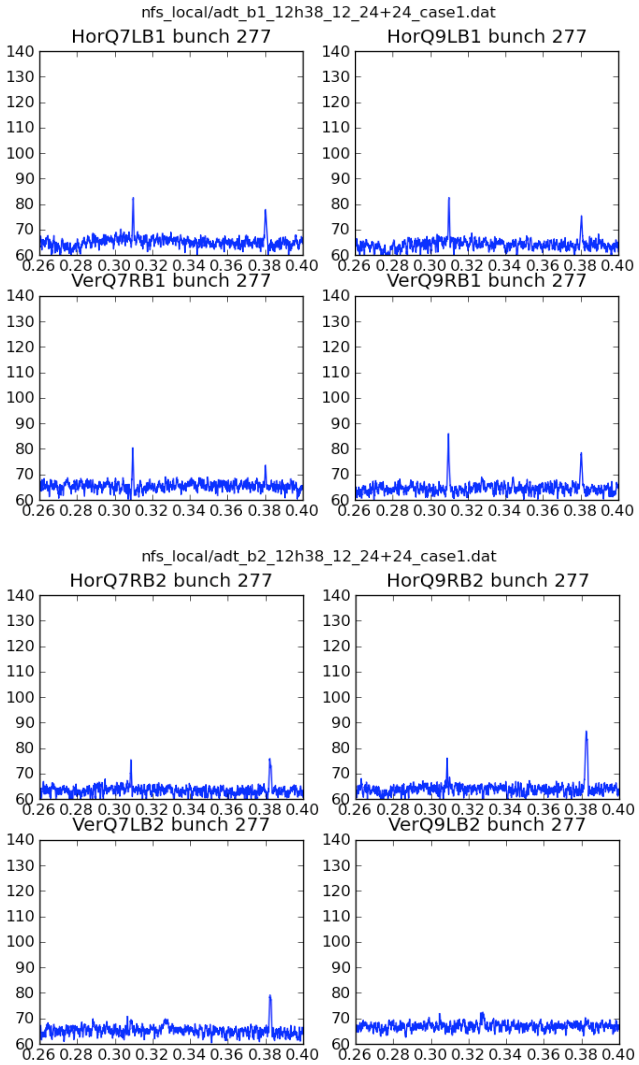
Observations and Conclusions:

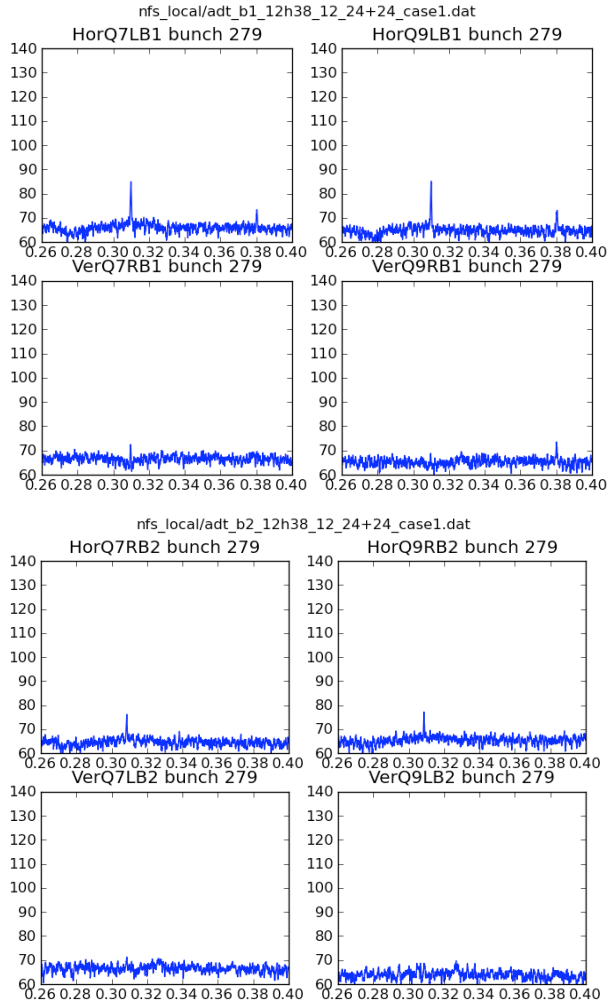
- Coherent oscillations on tail bunches only when second beam in!
- Oscillations are damped after some minutes from injection
- Multiple picks for case with 1000ns spacing

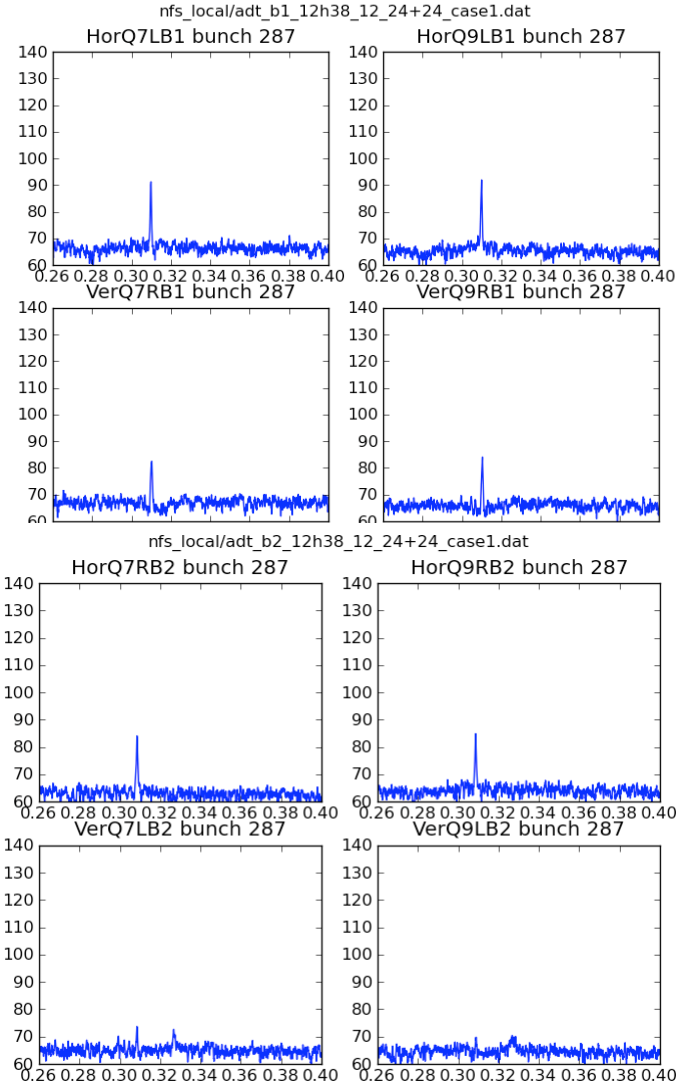
1) 1+ 12@501 +24 @1500 + 1350ns delay + 24@2500

File b1/b2 case 1... 2Nov.
-First bunch no signal
-Vertical oscillations



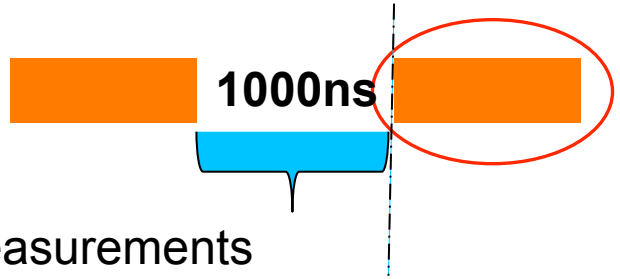




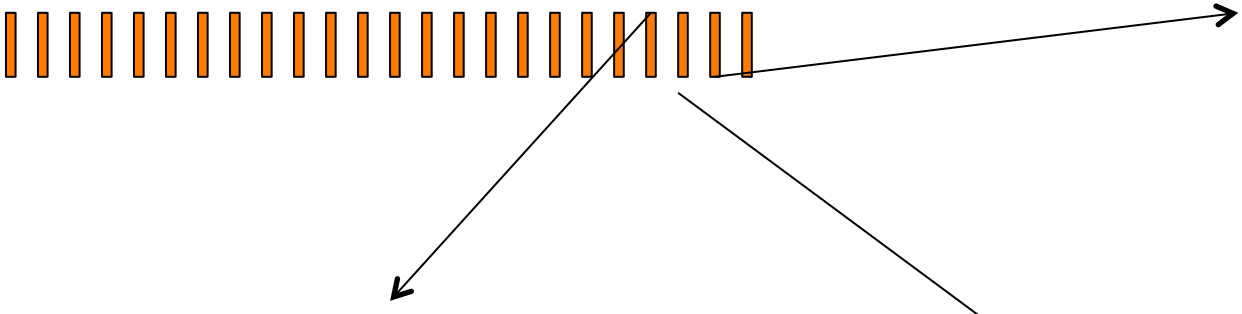


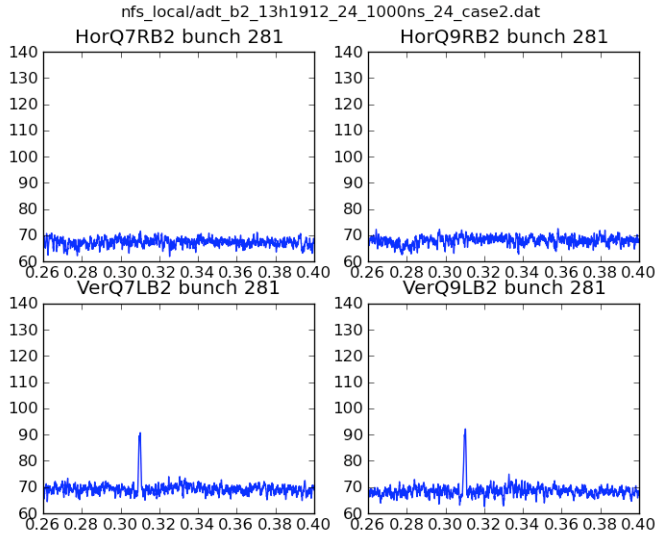
2) 1+ 12@501 +24 @1500 + 1000ns delay + 24@2370

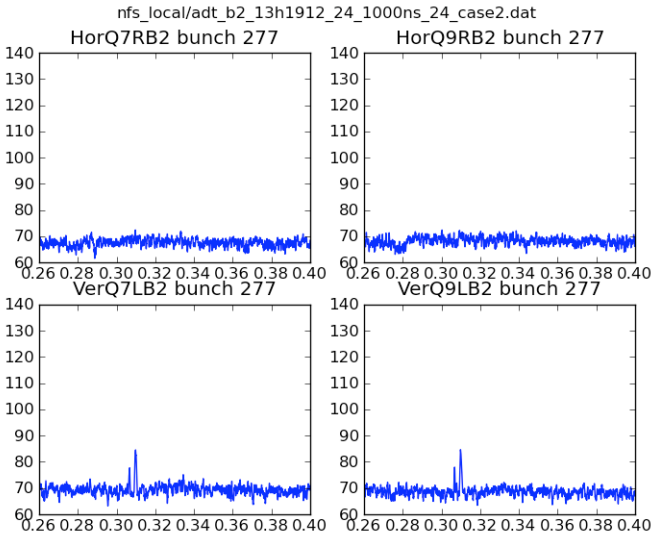
B1, B2

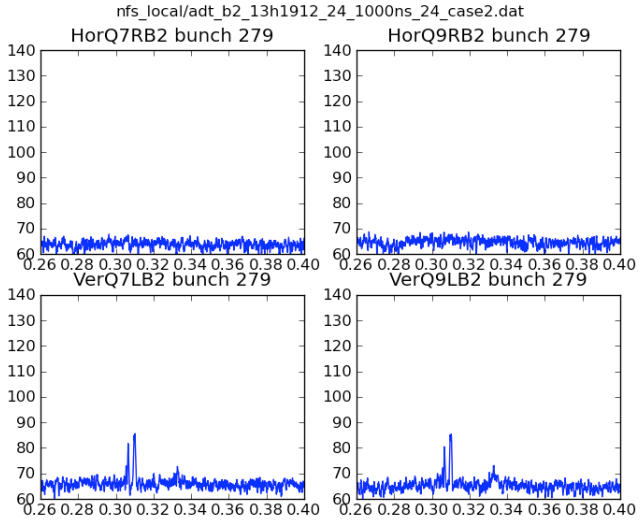


File b2 12h38_12_24+24... 2Nov.
-First bunches no signal
-Vertical oscillations only when beam 2 injected on beam 2 (no measurements of beam1)
-coherent transverse oscillation damped after approx 4 minute

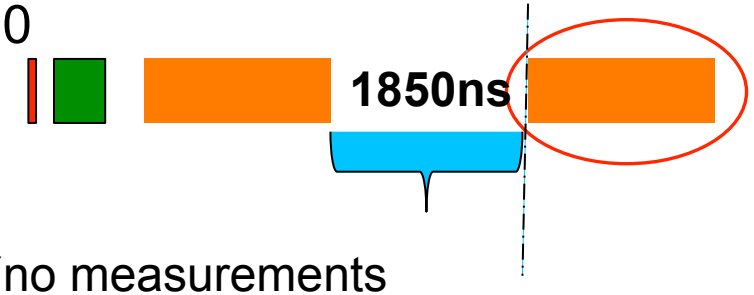




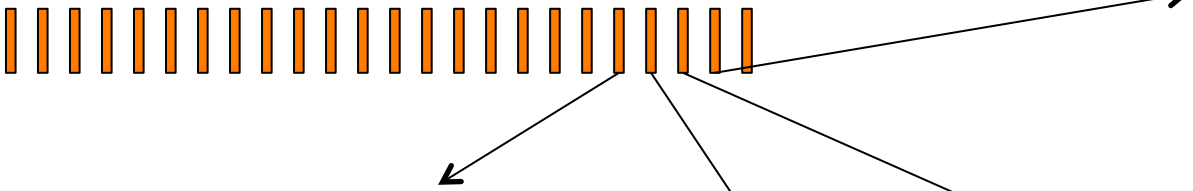


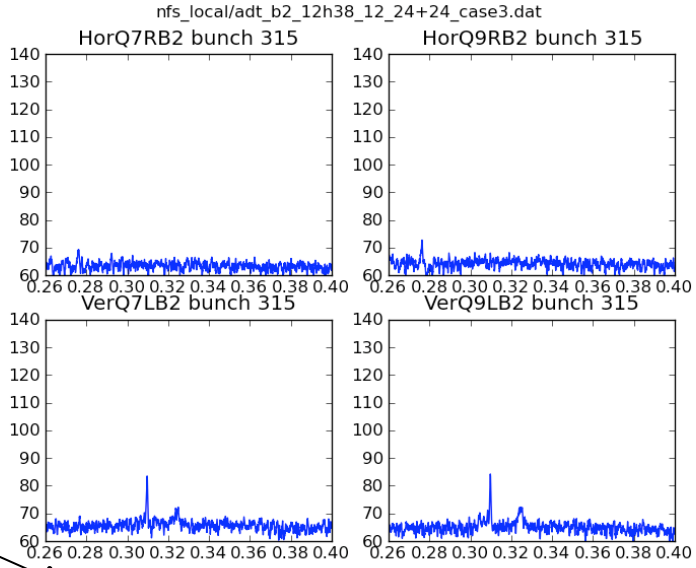


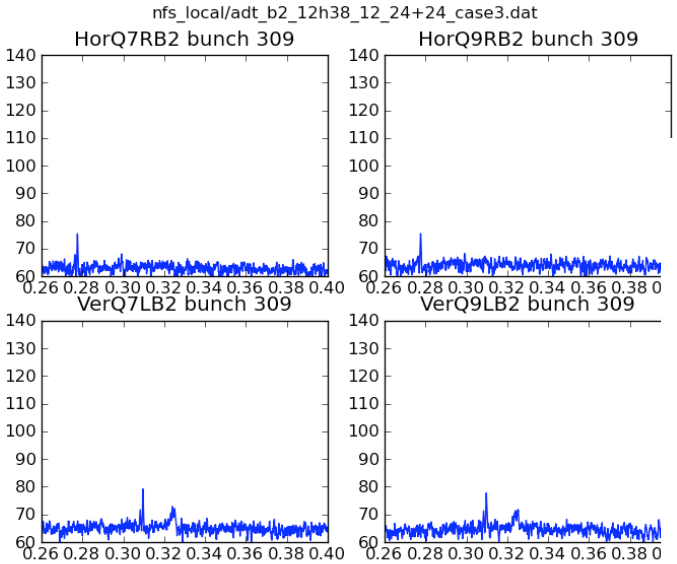
3) 1+ 12@501 +24 @1500 + 1850ns delay + 24@2700

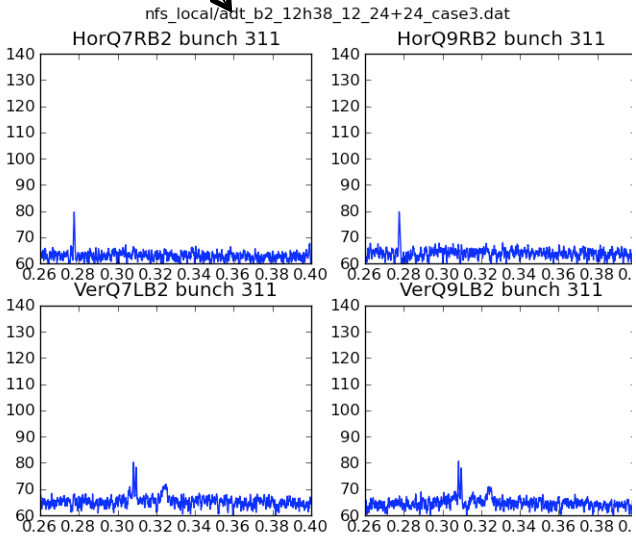


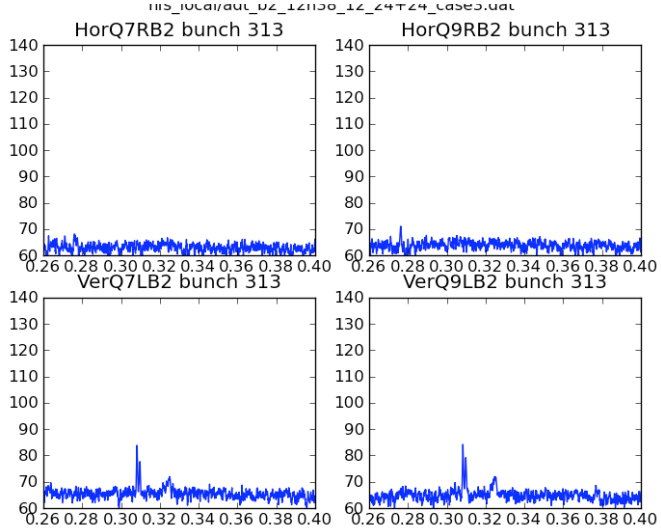
File b2 case3.. 2Nov.
-First bunches no signal
-Vertical oscillations only when beam 2 injected on beam 2 (no measurements of beam1)



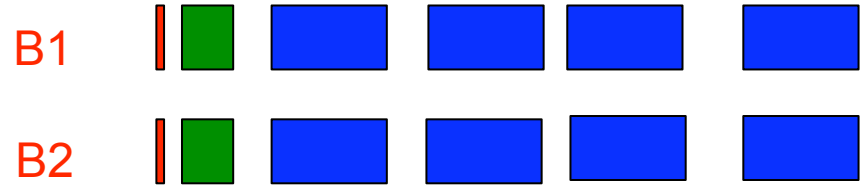








24 bunch trains effects of number of trains



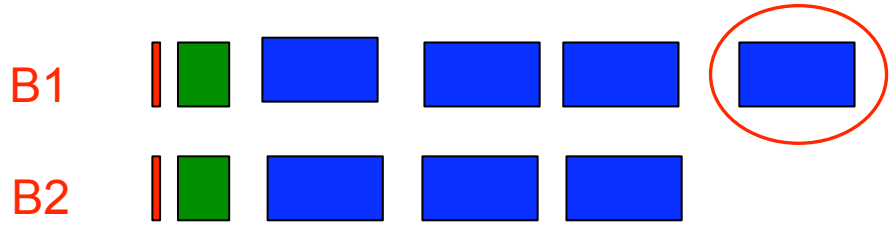
CASES:

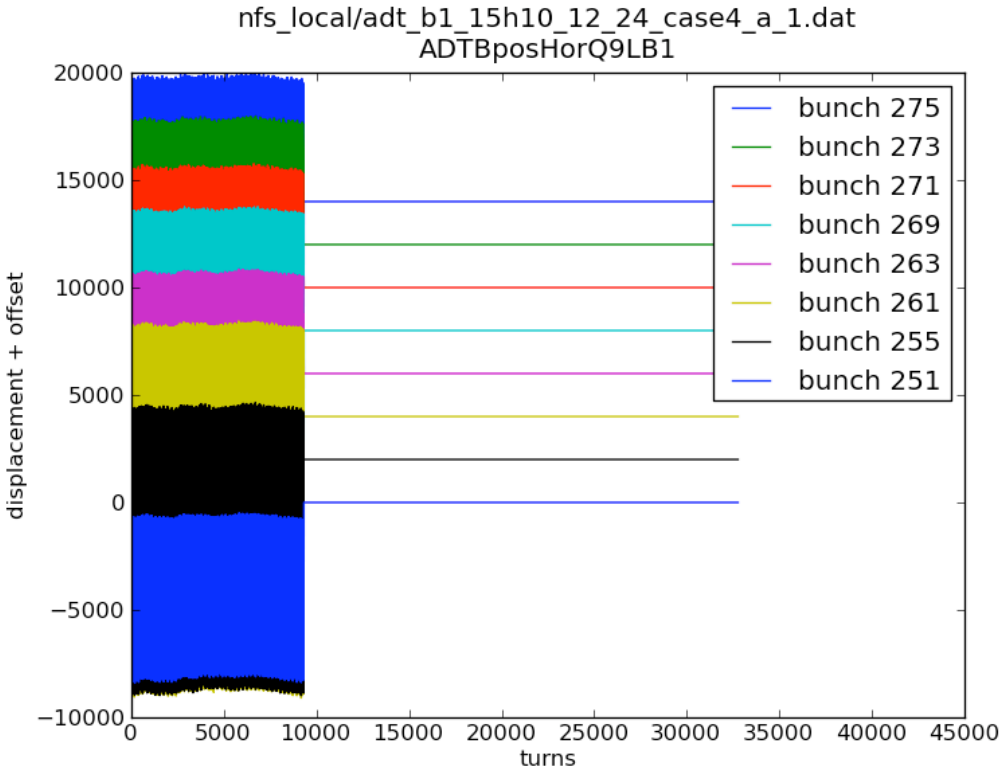
1. 1+ 12@501 + 4 trains of 24 bunches B1 + 3 in B2 DAMP
2. 1+ 12@501 + 4 trains of 24 bunches B1 + 4 in B2 losses

Observations and Conclusions:

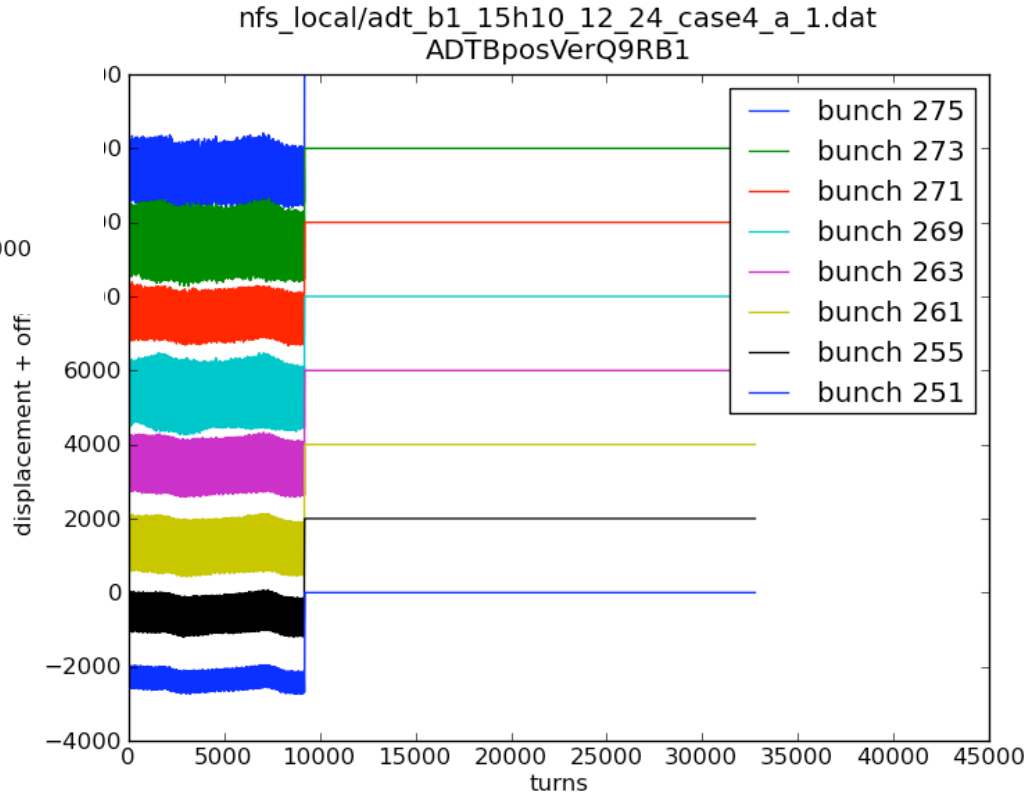
- First attempt to inject 4th train B1 beam Damped
- Injected 4th train B1 no problem and when injected B2 losses started on both beams on 3rd and 4th trains
- B2 Vertical Coherent oscillations on tail bunches when injected
- Oscillations are damped after some minutes from injection
- Tune shift?

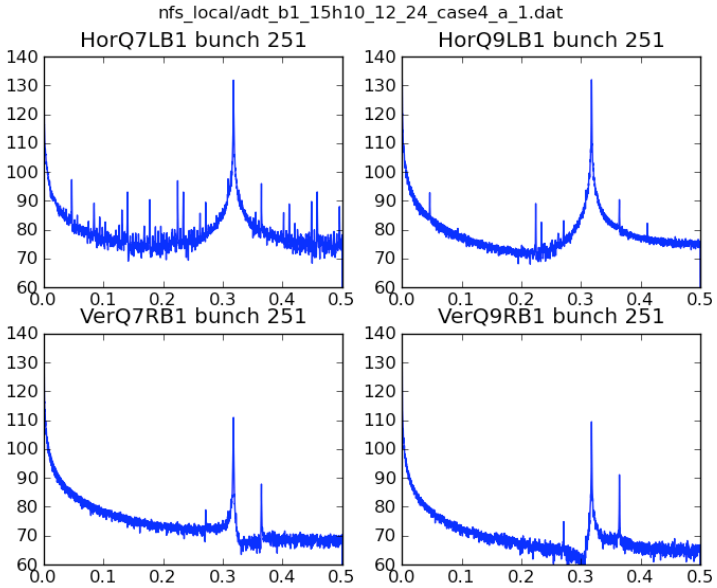
1st try injecting 4th train B1 beam was DAMPED

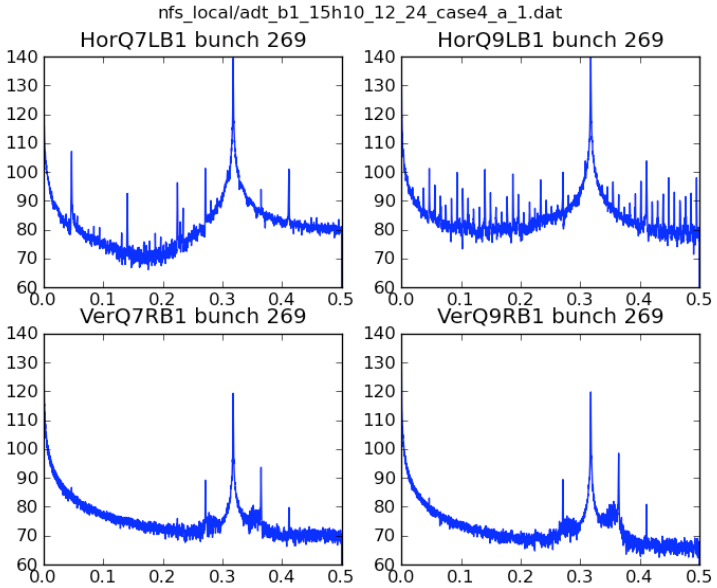




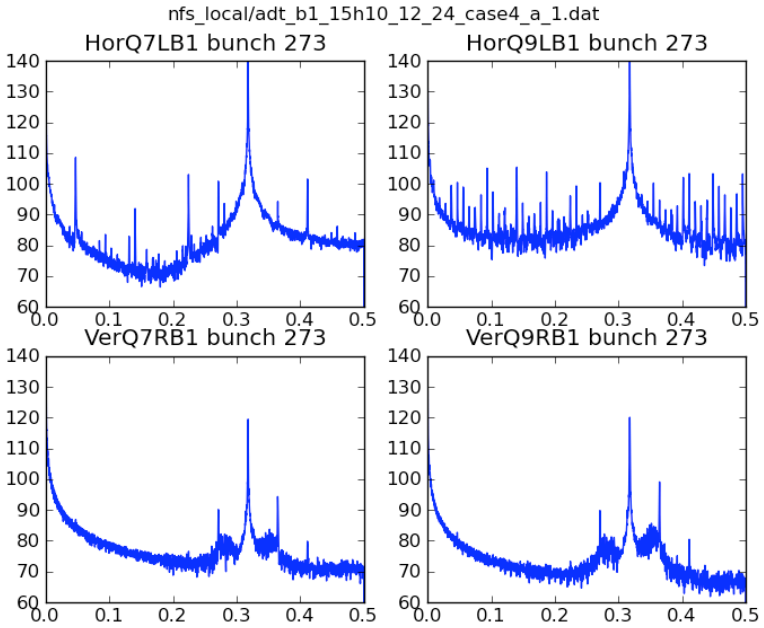
In time domain:

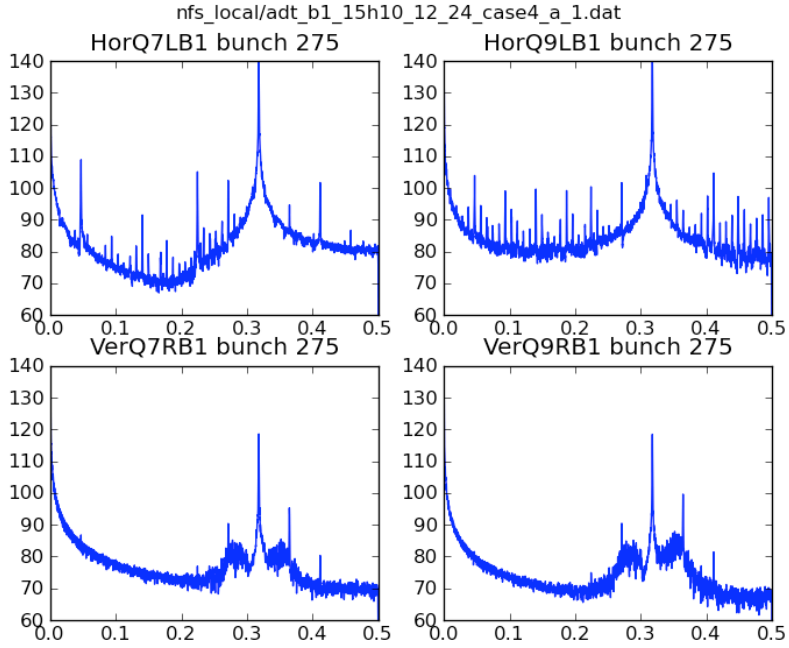




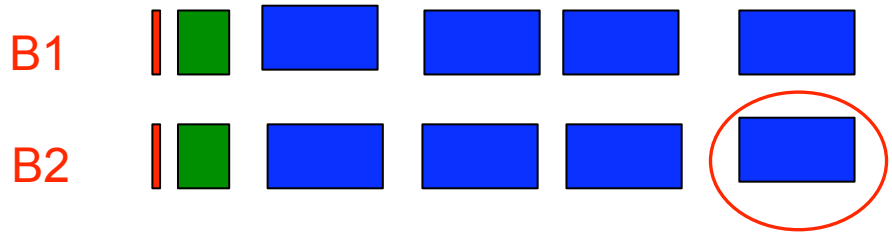


In frequency domain b1 4th train when injected and damped:





Same as previous Q'= +10 both beams H/V planes



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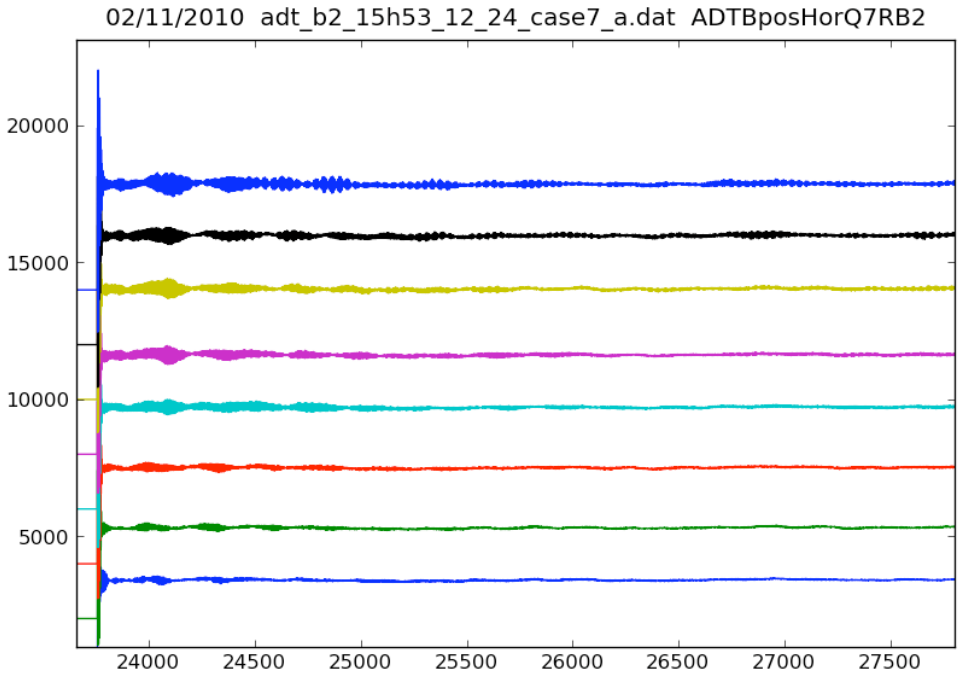
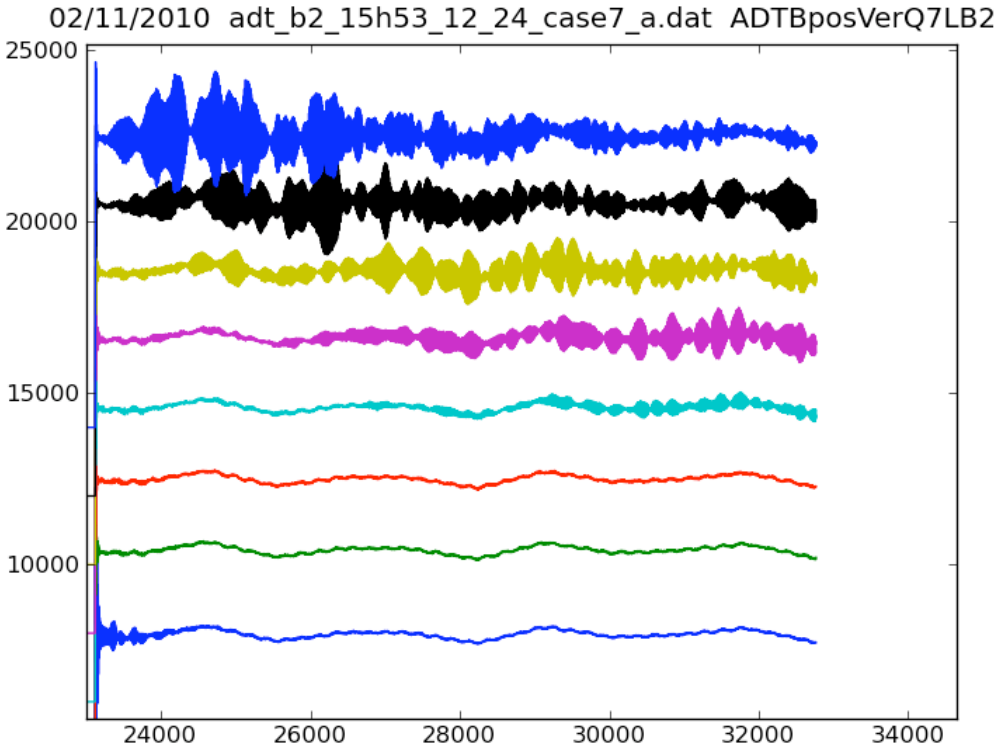
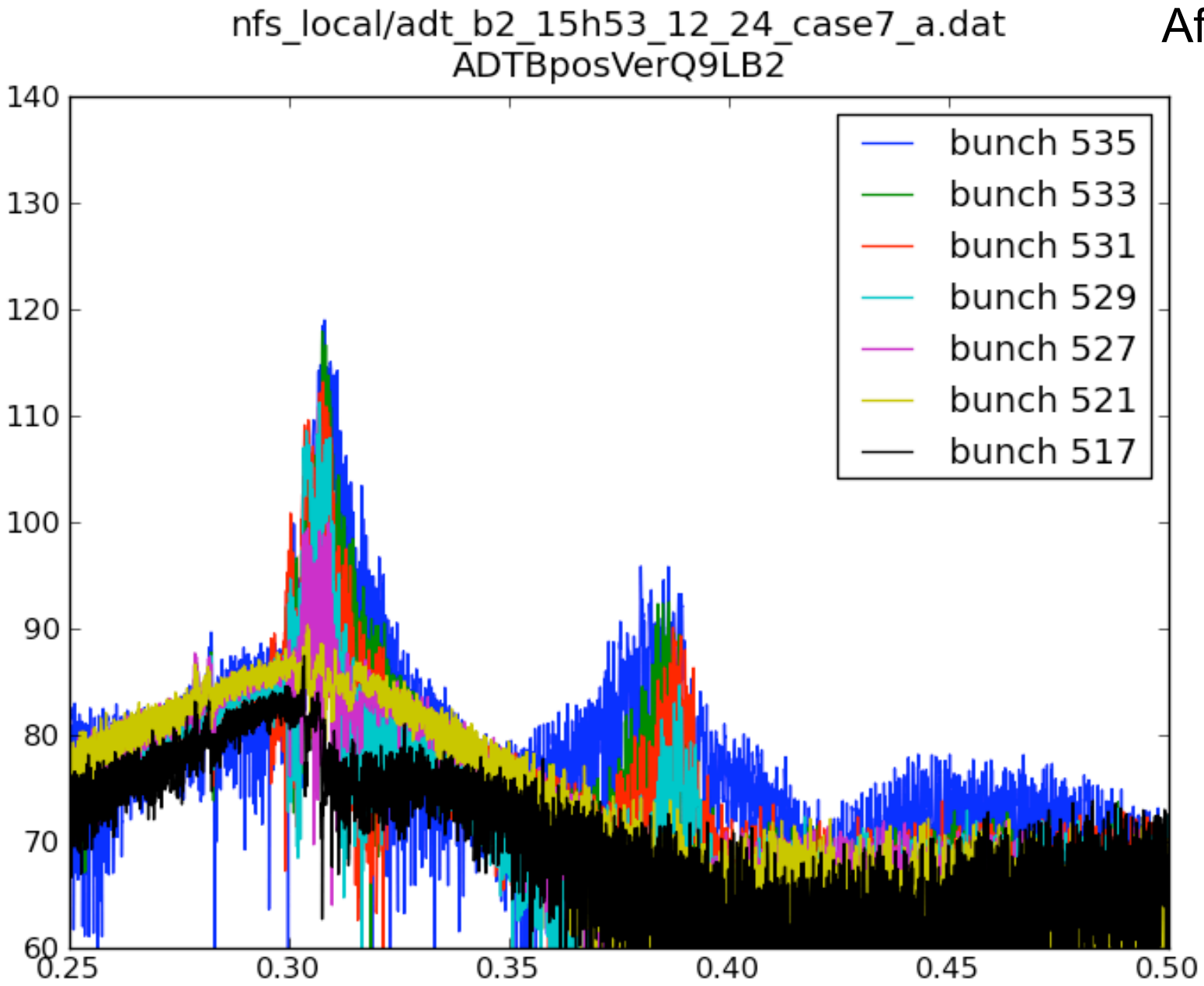
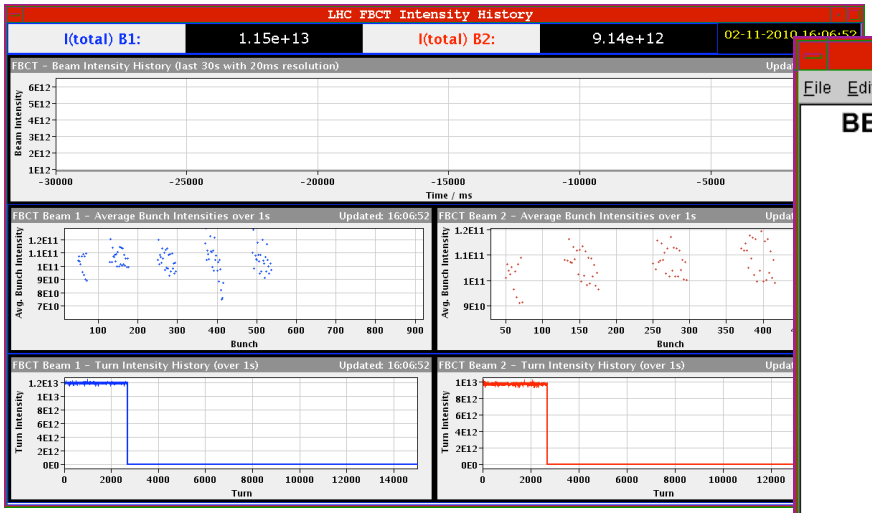


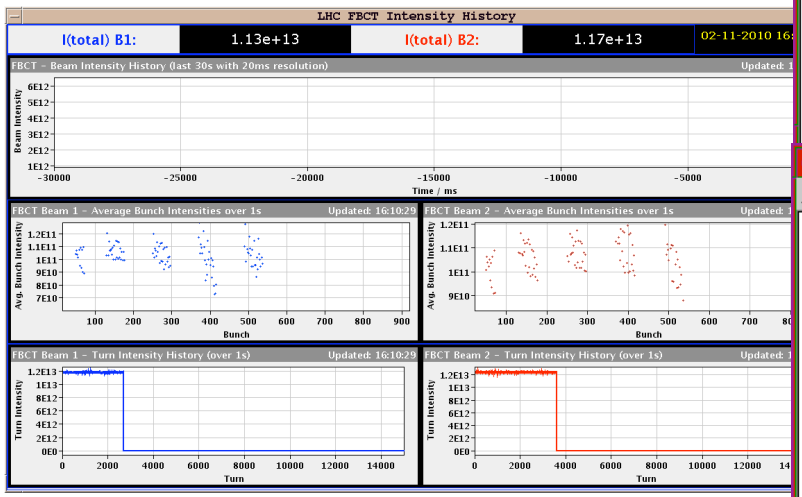


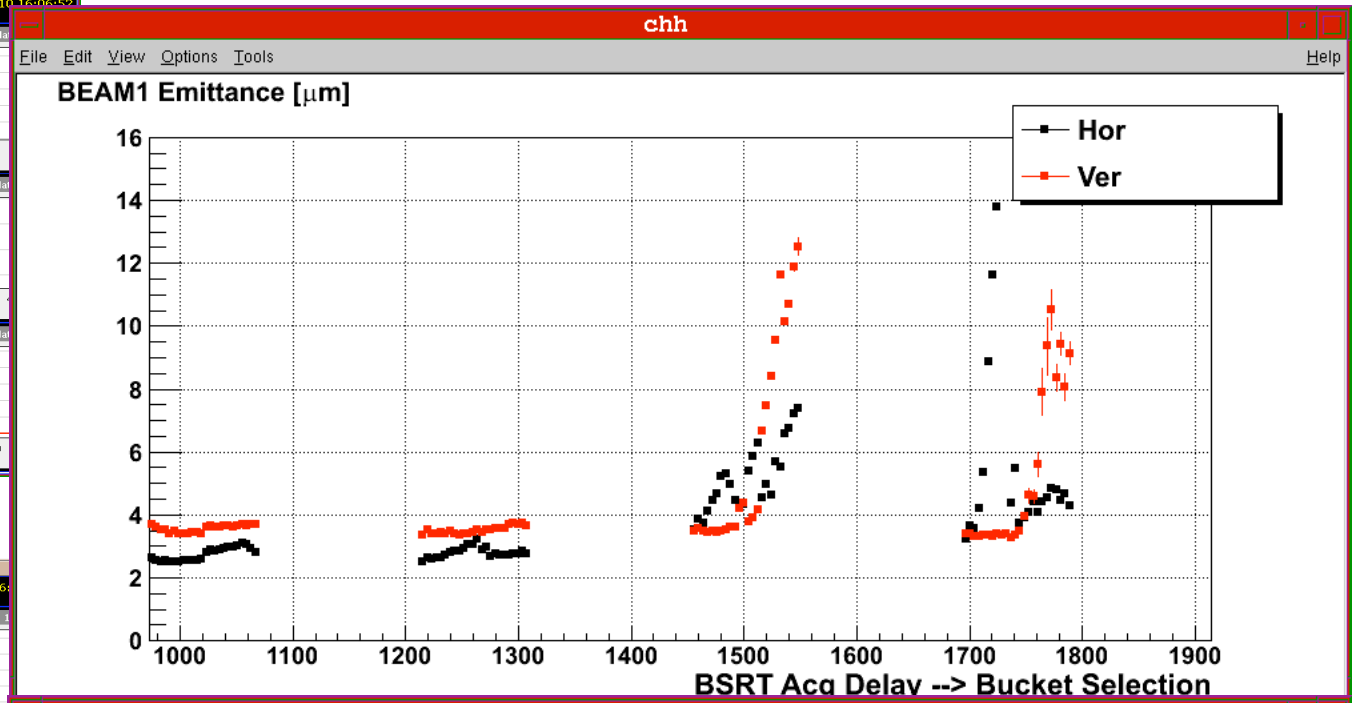
In frequency domain b2 when injected: tune shift??

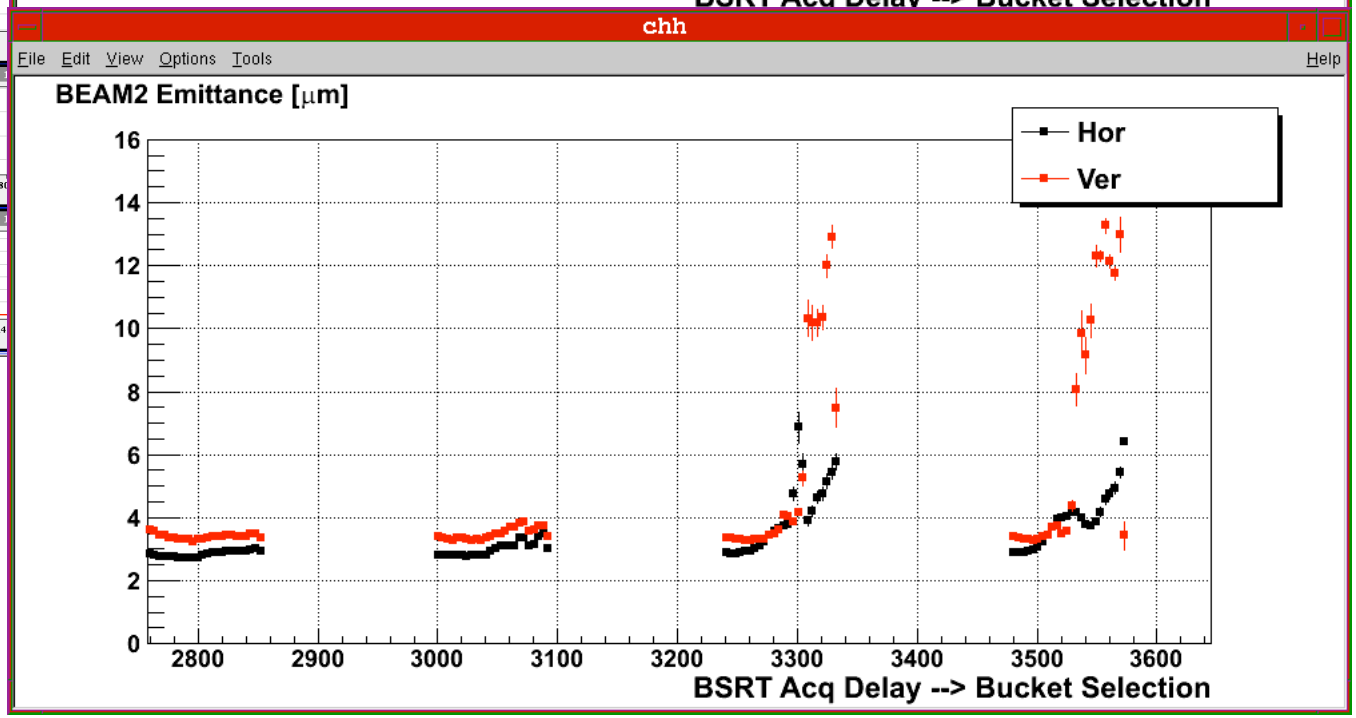


After 15 minutes



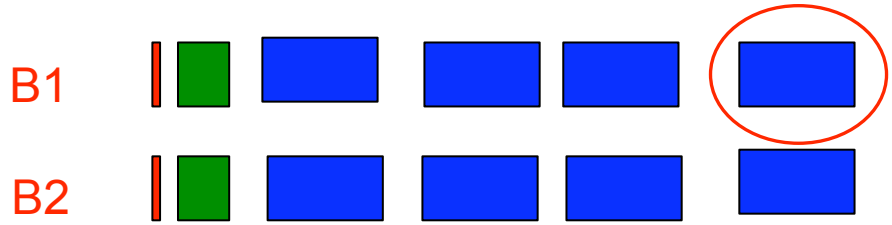




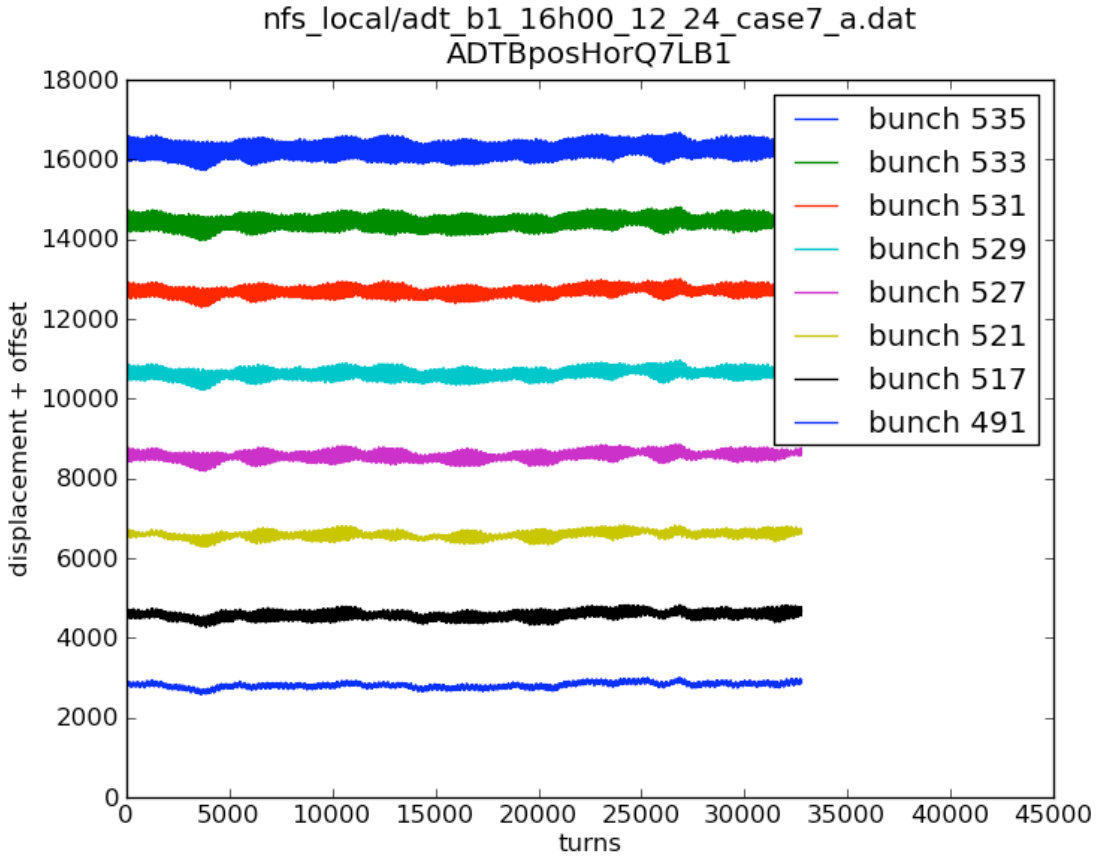


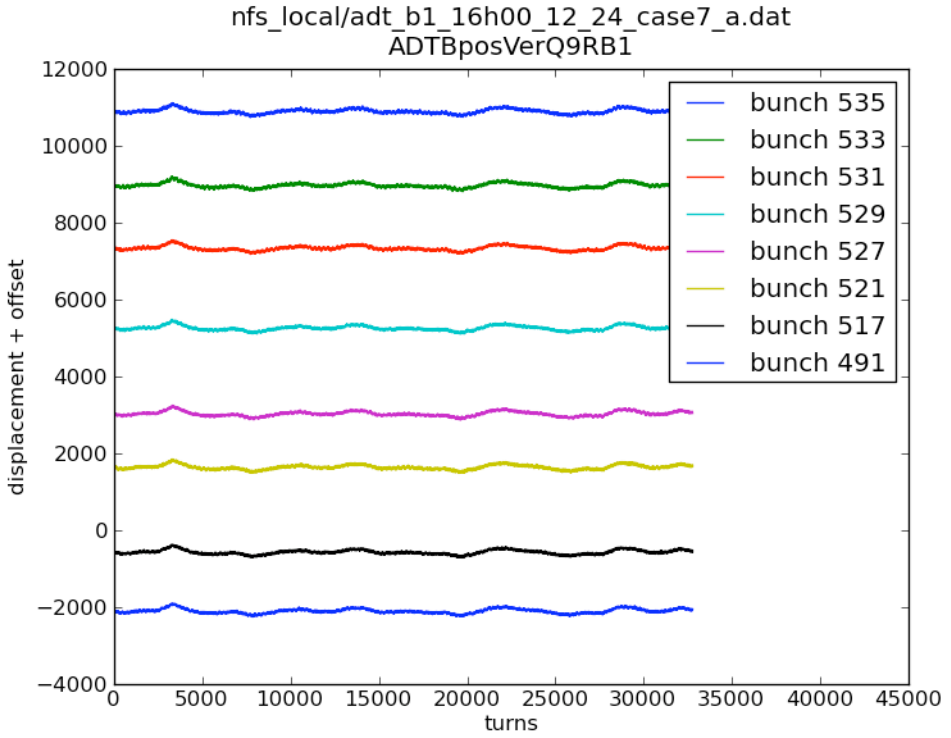
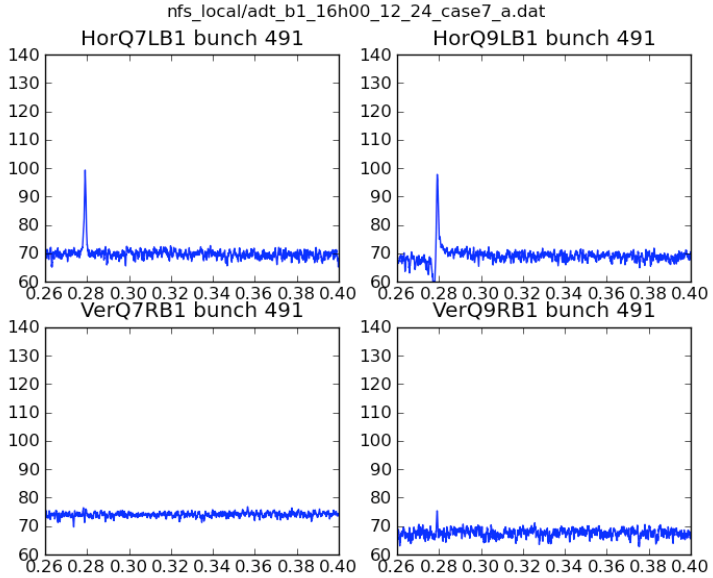
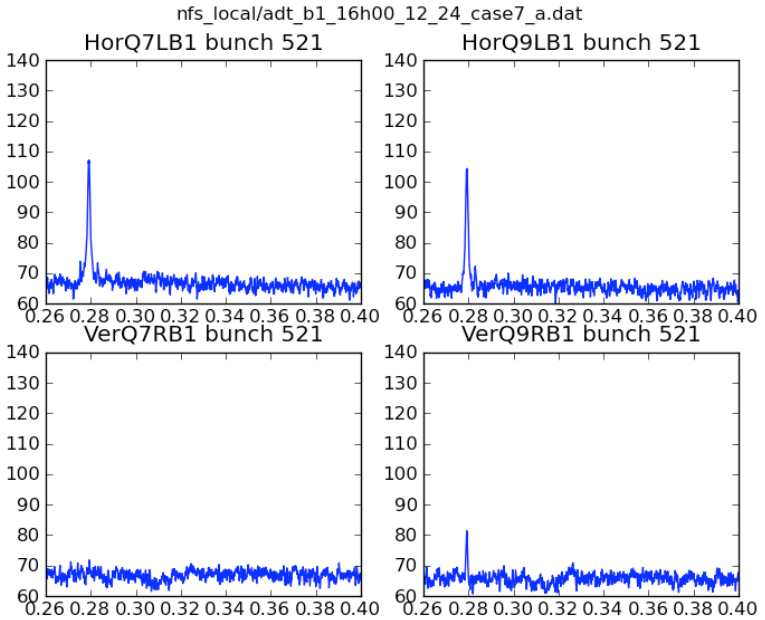
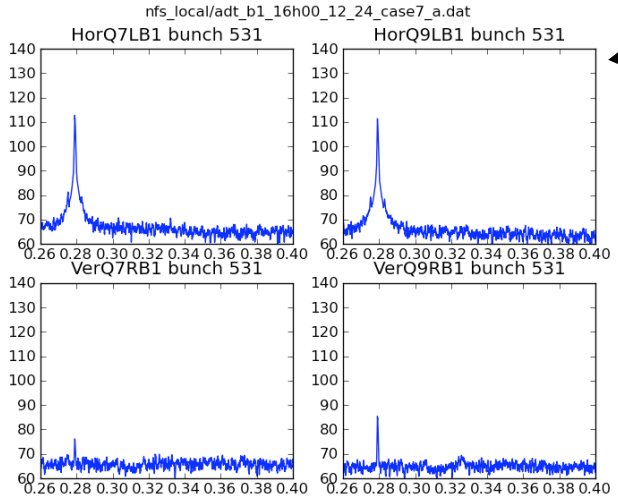
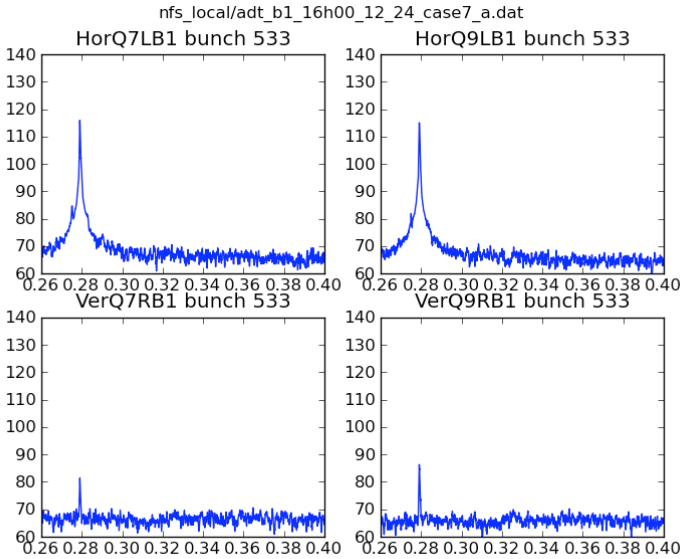
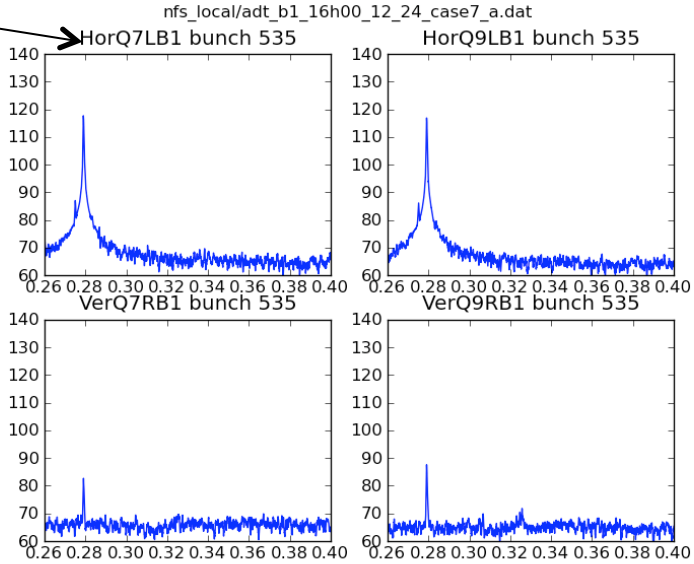
After injecting B2 4th train beams were loosing and emittances evolution as shown b2 mainly vertical b1 horizontal?

Since we keep loosing we checked on B1 scillations mainly in Horizontal plane



In time domain:





B1 in frequency domain while beam losses ongoing