

LHCC

15th June 2011

LHC Performance

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2011 LHC schedule

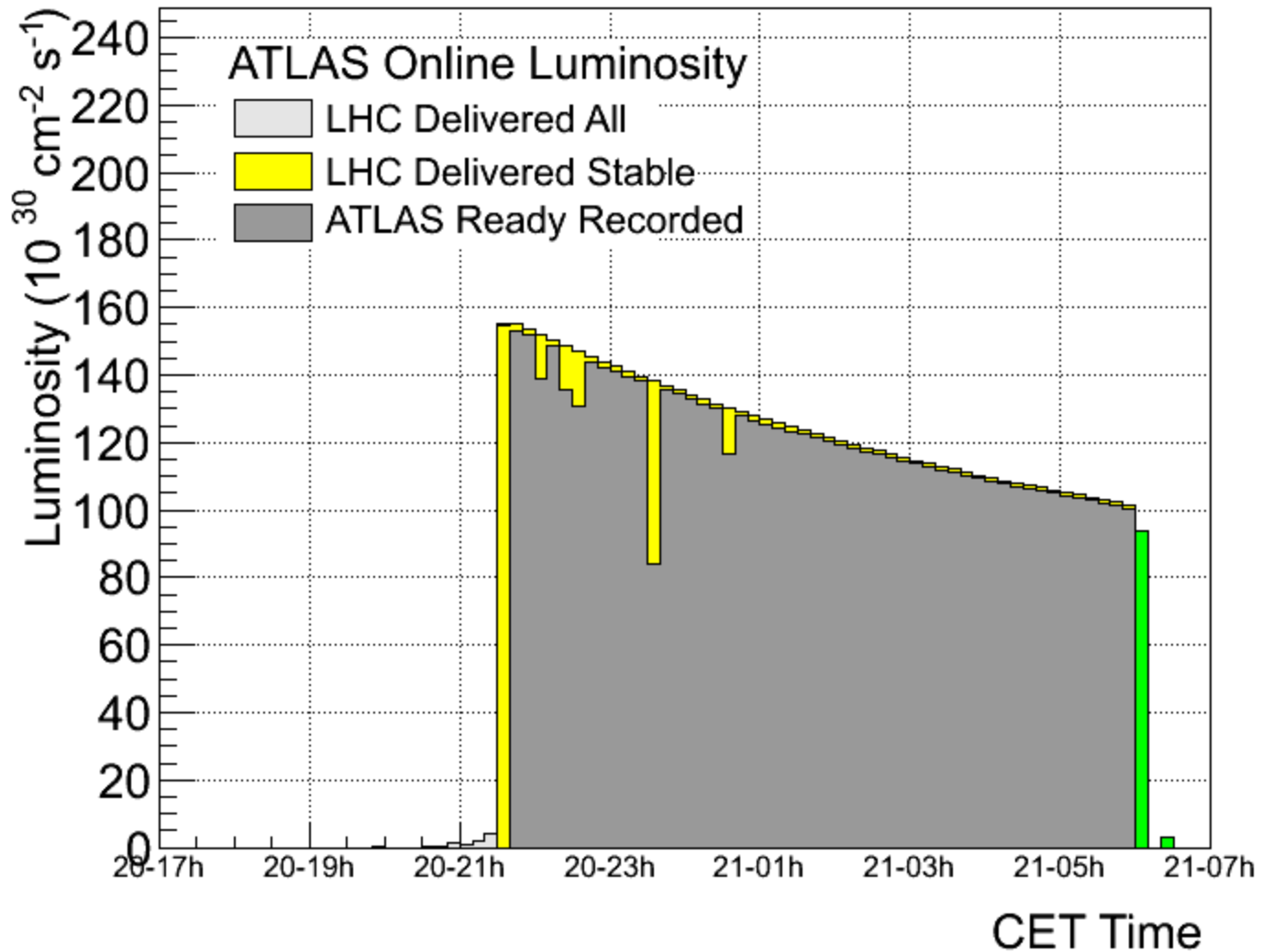
	Jan				Feb			Mar					
Wk	52	1	2	3	4	5	6	7	8	9	10	11	12
Mo		3	10	17	24	31	7	14	21	28	7	14	21
Tu													
We													LHCC
Th		Technical stop			Hardware commissioning								
Fr													
Sa	1												
Su													

Re-commissioning with beam (pointing to Mar 8)
 Close ring (pointing to Feb 7)

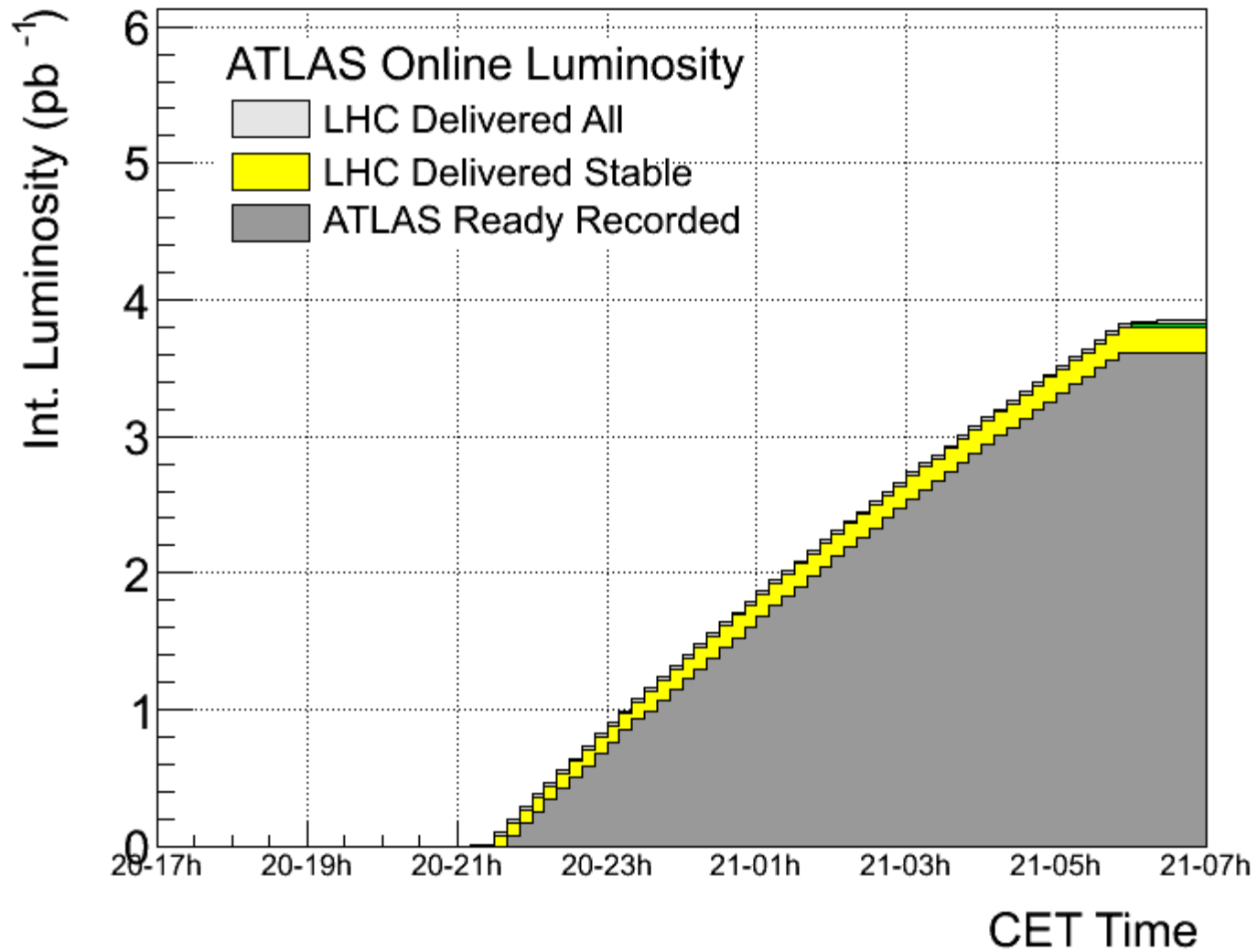
	Apr			May				June						
Wk	13	14	15	16	17	18	19	20	21	22	23	24	25	
Mo	28	4	11	18	Easter	2	9	16	23	30	6	Whit	13	20
Tu														
We												LHCC		
Th										Ascension				
Fr				G. Friday										
Sa														
Su					1st May									

Intermediate energy run (date t.b.c.) (pointing to Apr 13)
 Scrubbing run (date t.b.c.) (pointing to Apr 14)
 Start full non-LHC physics program (pointing to Apr 15)

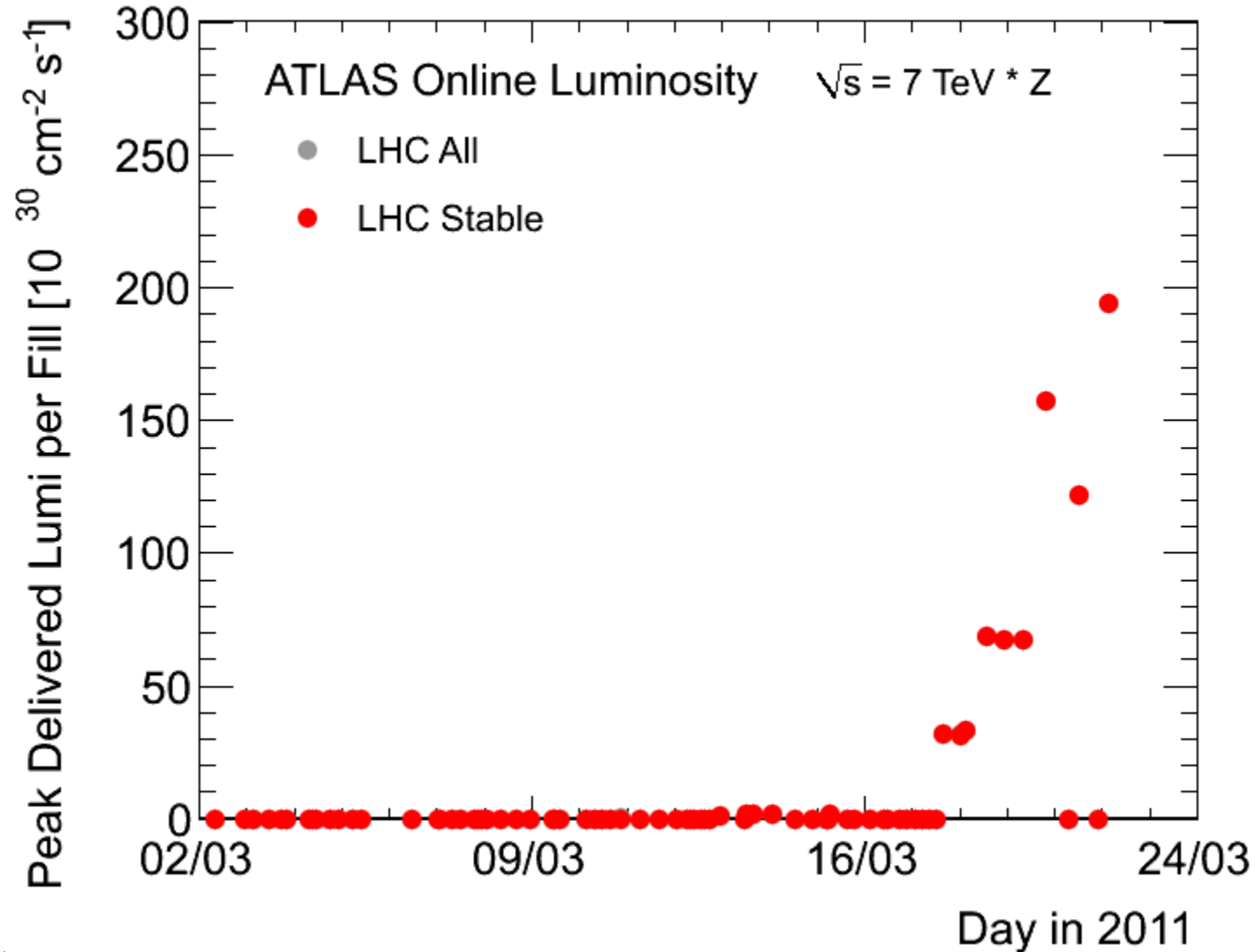
Best Fill THEN



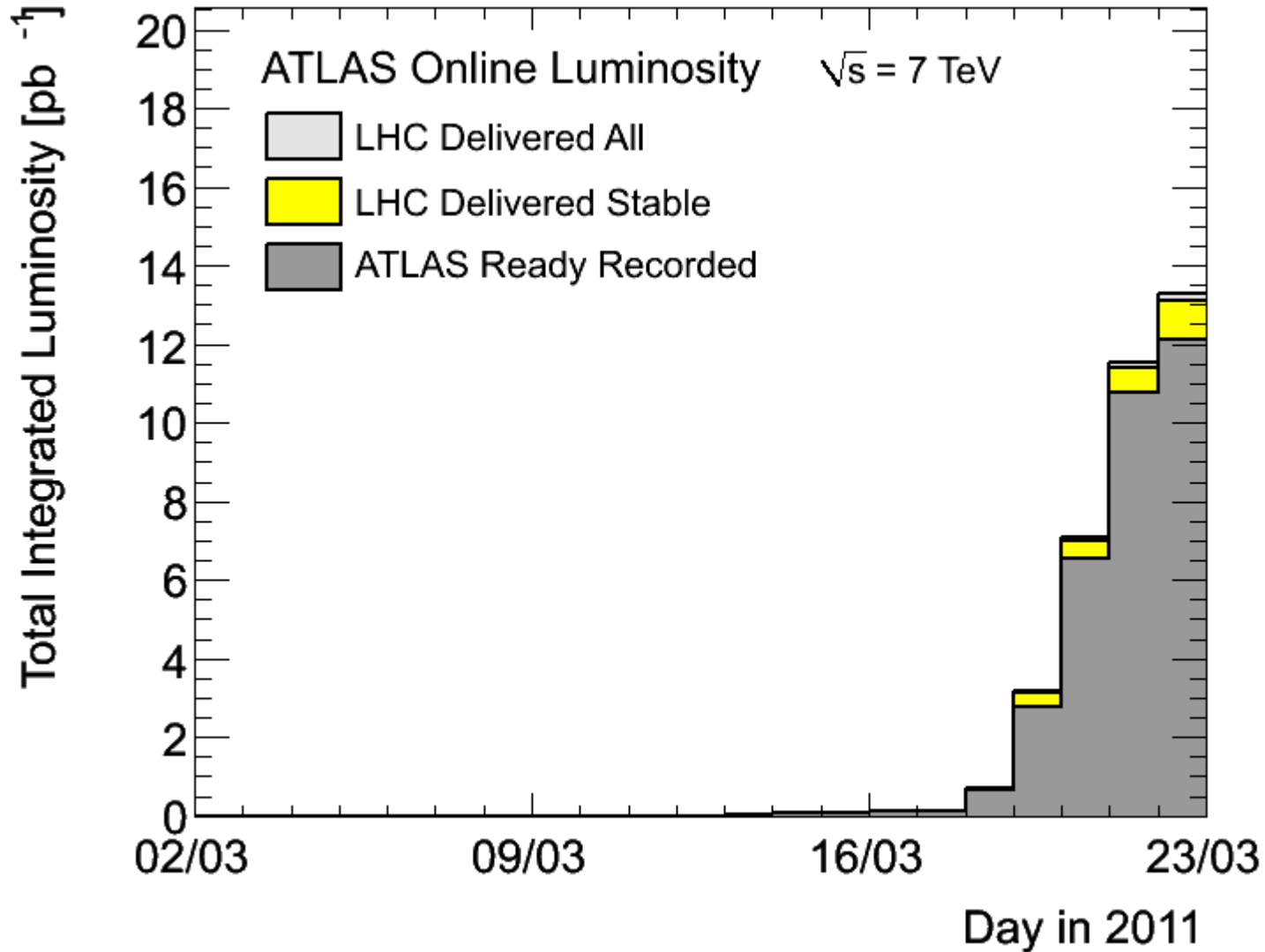
Best Fill



Peak Luminosity



Integrated Luminosity



The 2 periods

1. Intermediate energy run at 1.38 TeV/beam + Scrubbing Run

2. Start of going by steps towards 900b + TS + (MD)

Wk	52	1	2	3	4	5	6	7	8	9	10	11	12
Mo		3	10	17	24	31	7	14	21	28	7	14	21
Tu													
We													LHCC
Th		Technical stop			Hardware commissioning								
Fr													
Sa	1												
Su													

Intermediate energy run (Weeks 8-10)

Wk	13	14	15	16	17	18	19	20	21	22	23	24	25
Mo	28	4	11	18	Easter	2	9	16	23	30	6	Whit	13
Tu													
We												Today	
Th										Ascension			
Fr				G. Friday		MD				1st May comp.			
Sa													
Su					1st May								

Scrubbing run (Weeks 13-14)

Start full non-LHC physics program (Weeks 15-23)

1st Period (a)

Intermediate Energy Run at 1.38TeV/beam

Accomplished without too much bother;

Done in 4 days 25th March – 28th March
BEFORE the Technical stop

1st Period (b)

Scrubbing Run at 450 GeV/beam.

10 days or real scrubbing foreseen,
but because of technical hiccups
took 12 days of calendar time

Scrubbing: only 5 effective days

- Intensity progression – 50 ns
 - Above 600 bunches beam stability became an issue and slowed down temporarily (many dumps) the progression.
 - Tune shifts with intensity, RF tuning...
 - All dumps well captured by MPS.
 - No issues with HOM power for RF.

Date	Bunches B1+B2
Tue 5 th April	300+300
Wed 6 th April	408+336
Sat 8 th April	588+588
Sun 9 th April	804+804
Mon 10 th April	1020+1020

Summary of week 14 & part of 15

372 372 **Stubbing run**
hoven, J. Wenninger,
ni
er, R. Assmann

588 588

73

8

516 516

660 660

Decision: Continue physics with 50ns



948 948

1020 1020

A screenshot of the 'LHC Beam Quality Monitor' software interface. The main display area is a large red rectangle with the number '1020 1020' in blue and white text. Below this, there is a 'History' section with a graph showing beam quality metrics over time. The graph has a y-axis labeled 'Beam Quality' and an x-axis labeled 'Time'. The interface includes various control buttons like 'Start Monitoring', 'Stop', 'Save', and 'Continuous Saving'.

2nd Period: Increasing the number of bunches

Issues encountered with Higher Intensities

- Requires much finer control of the beam parameters
 - Chromaticity, gain of feedback and use of Landau octupoles
 - Injection quality
- Many more UFOs
- Many more SEUs

UFO's: 90 in 90 minutes

[file](#) [LHC Control](#) [Favorites](#) [HWC](#) [General](#) [Observation](#) [Print...](#) [WorkingSet](#) [Screenshot](#) [Active Tasks](#)
Context 1: PLS_LINE=LHC.USER.LHC 1

RBA: lhcop

Acquisition

Concentrator Acquisition ▼

Settings

Found UFOs

UFO BLM	Losses_RS05 [Gy/s]	Time (local)	Losses_RS01 [Gy/s]	Losses_RS04 [Gy/s]	L	L	L	L	L	L	L	L	L	L	L
BLMQI.25L8.B1E10_MQ	1.03E-4	2011-04-13 14:06...	9.05E-4	3.39E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.13R3.B1110_MQ	3.25E-5	2011-04-13 14:06...	3.62E-4	1.19E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.27L8.B2110_MQ	6.41E-4	2011-04-13 14:06...	2.53E-3	1.49E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.13R2.B2E10_MQ	3.82E-4	2011-04-13 14:06...	2.44E-3	1.17E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.18L5.B1110_MQ	7.49E-5	2011-04-13 14:08...	9.05E-4	2.72E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.26L1.B2E30_MQ	1.73E-4	2011-04-13 14:11...	1.18E-3	6.05E-4	...	...	...	...	...	...	...	...	...	...	...
BLMEI.05R8.B2E20_MKI.D5R8.B2	8.56E-4	2011-04-13 14:11...	3.08E-3	2.13E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.19R3.B1110_MQ	1.48E-4	2011-04-13 14:11...	3.17E-3	5.94E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.07L2.B1E10_MQM	2.12E-4	2011-04-13 14:12...	6.34E-4	3.73E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.18L6.B2110_MQ	2.18E-4	2011-04-13 14:13...	1.36E-3	6.56E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.19R3.B1110_MQ	2.77E-4	2011-04-13 14:13...	1.27E-3	6.56E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.07L1.B1110_MQM	6.93E-5	2011-04-13 14:14...	1.09E-3	2.72E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.29L6.B1E10_MQ	5.15E-4	2011-04-13 14:15...	7.51E-3	1.97E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.16L3.B2E10_MQ	6.66E-4	2011-04-13 14:18...	4.07E-3	1.86E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.10R5.B2110_MQML	4.94E-4	2011-04-13 14:21...	4.52E-3	1.91E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.10R8.B1110_MQML	7.85E-4	2011-04-13 14:22...	3.98E-3	2.63E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.28R2.B1110_MQ	9.33E-5	2011-04-13 14:23...	5.43E-4	3.05E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.25R8.B2E10_MQ	4.41E-4	2011-04-13 14:25...	3.08E-3	1.51E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.26L3.B1110_MQ	8.91E-5	2011-04-13 14:26...	5.43E-4	2.94E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.19R2.B2E10_MQ	2.83E-4	2011-04-13 14:27...	1.09E-3	6.22E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.09L7.B1E10_MQ	7.58E-4	2011-04-13 14:29...	3.53E-3	1.67E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.26L1.B1110_MQ	9.05E-5	2011-04-13 14:29...	6.34E-4	3.00E-4	...	...	...	...	...	...	...	...	...	...	...
BLMEI.05R8.B2E20_MKI.D5R8.B2	9.05E-5	2011-04-13 14:29...	1.18E-3	3.11E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.31R3.B1110_MQ	5.24E-3	2011-04-13 14:29...	1.23E-2	7.46E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.19R3.B1110_MQ	2.25E-4	2011-04-13 14:30...	1.90E-3	7.81E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.14R2.B1110_MQ	8.06E-4	2011-04-13 14:30...	8.78E-3	3.17E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.14L4.B2E30_MQ	5.37E-5	2011-04-13 14:31...	3.62E-4	3.10E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.14R7.B1E10_MQ	5.12E-4	2011-04-13 14:36...	3.26E-3	1.41E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.25R8.B2E10_MQ	1.60E-4	2011-04-13 14:39...	1.18E-3	4.92E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.25R8.B2E10_MQ	1.75E-4	2011-04-13 14:41...	9.96E-4	5.32E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.12L4.B2E10_MQ	6.55E-4	2011-04-13 14:43...	2.26E-3	1.24E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.28R7.B2110_MQ	4.51E-4	2011-04-13 14:44...	2.99E-3	1.43E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.08L3.B1110_MQ	1.13E-3	2011-04-13 14:46...	1.72E-2	4.33E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.25R7.B1E10_MQ	1.20E-4	2011-04-13 14:47...	1.18E-3	4.52E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.31R5.B2110_MQ	2.67E-4	2011-04-13 14:47...	1.90E-3	9.16E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.18R8.B1110_MQ	3.96E-4	2011-04-13 14:48...	3.17E-3	1.44E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.24R8.B2E10_MQ	3.01E-4	2011-04-13 14:50...	2.26E-3	1.05E-3	...	...	...	...	...	...	...	...	...	...	...
BLMQI.21L6.B2110_MQ	2.53E-4	2011-04-13 14:51...	2.72E-3	9.79E-4	...	...	...	...	...	...	...	...	...	...	...
BLMQI.14R2.B1110_MQ	5.19E-4	2011-04-13 14:51...	6.06E-3	2.03E-3	...	...	...	...	...	...	...	...	...	...	...

Algorithm

Optimized Algorithm ▼

Settings

Threshold for BLMs 1.0E-4

Use running sum: 4

Threshold for ratio of RS2/1 0.55

Threshold for ratio of RS3/2 0.45

Threshold for ratio of RS4/3 0.55

Get Set

Action

autosave

Remove Remove all Show data save load

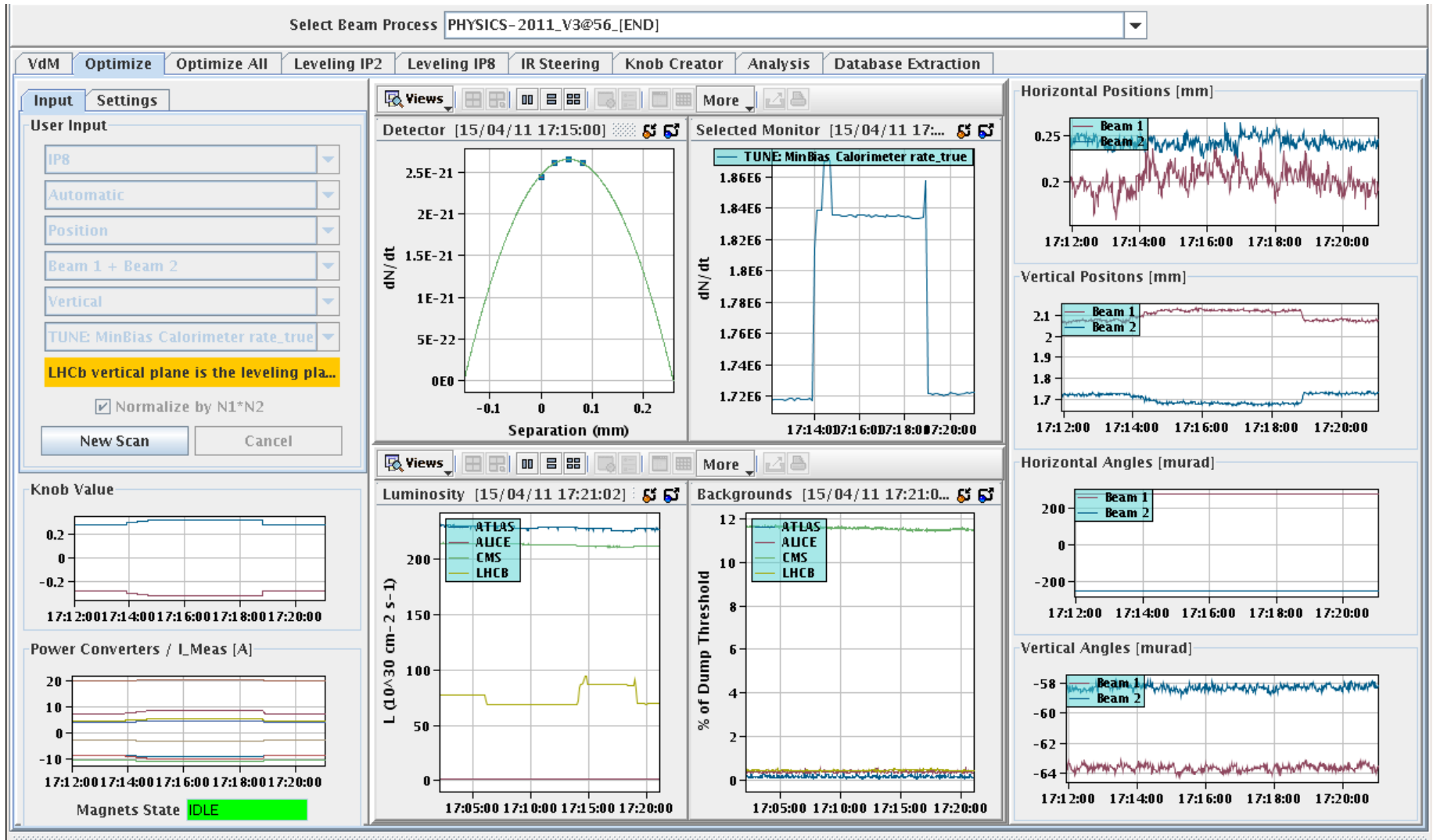
14:47:47 - New RBA Token was set to CMW: RBA-Token[serial=0xd7f7b4dd;authTime=2011-04-13@14:34:48;endTime=2011-04-13@22:33:48;application=AppPrincipal[name=UFO Buster, critical=false, timeout=1];locatio...

2nd Period: Increasing the number of bunches

Issues with Machine Protection

1. Collimation loss of hierarchy at 450 GeV
 - Due to order in which the loss maps were performed
2. 72 (108/144) bunches
 - Last bunch of previous injection got kicked; low intensity and higher emittance
 - BPMs position calibration is sensitive to bunch intensity
 - Dump interlock measures local position of all bunches
3. **HTS quench (7th April) quench of 11 sc magnets**
4. **Injection Kicker Flashover (18th April)**

Lumi leveling test 15th April: now operational



LHCb

MD1

Some highlight ...

- MDs prove excellent performance potential of LHC:
 - No head-on beam-beam limit encountered with 3 times nominal brightness. Total tune shift: 0.03 with ATLAS/CMS collisions.
 - ATS injection optics with different integer tunes fine to 3.5 TeV.
 - Collimation system reached tighter settings with better cleaning efficiency.
 - Impedance and instabilities under control.
- Operational improvements:
 - 90m optics for ALFA and TOTEM works fine.

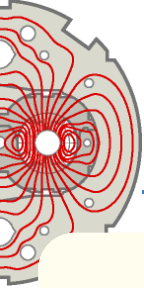
43% of design

Beam-beam limit

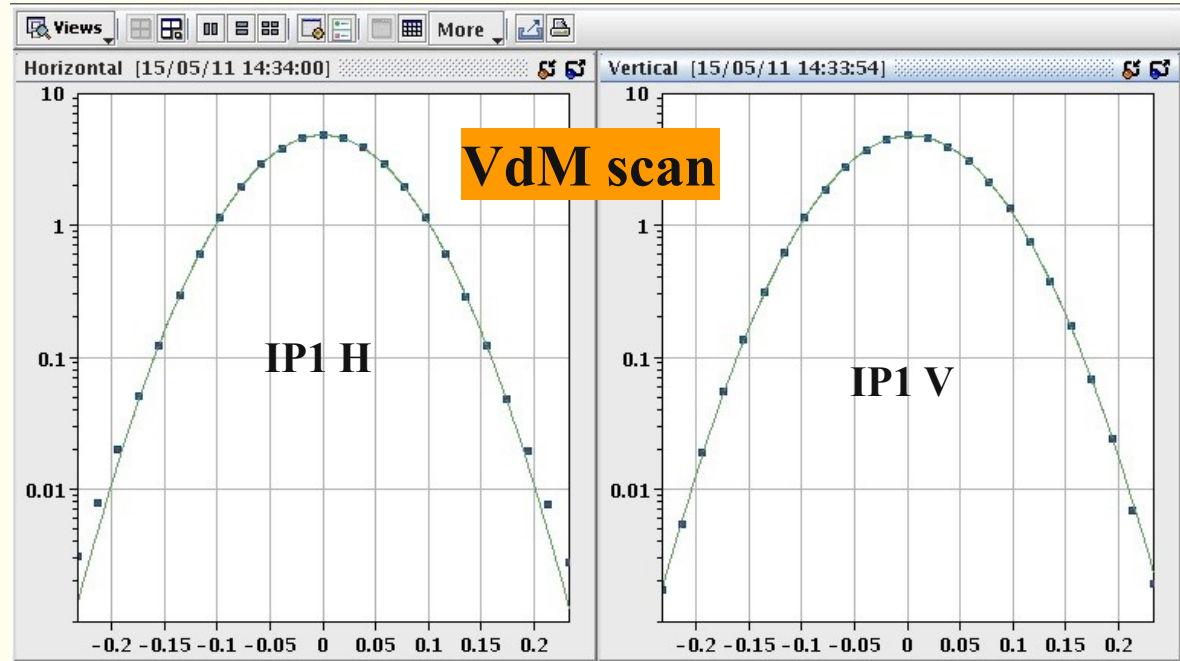
50% above design

- Collided high intensity beams (**1.7 E11**) and small emittances (smaller than **1.5 um**) in IP1 and IP5.
- First attempt achieved **tune shifts 0.01 per IP**, vertical blowup of emittance.
 - Blowup most likely due to 10th order resonance.
- In final attempt reduced vertical tune to end up below 10th order after putting beams in collision. No more blowup observed, **tune shifts per IP in excess of 0.015** (with initial emittance below 1.2 um).
 - ↑ Factor of 4.5 above design
- Collisions in IP1 and IP5, optimized and no more blowup.
- No limit found for head-on beam-beam effects for the intensities investigated so far (no long range yet).

LHC precision front

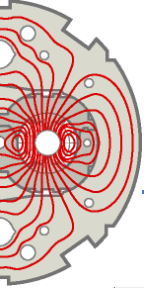


- **absolute luminosity normalization**
- **low, well understood backgrounds**
- **precision optics for ATLAS-ALFA and TOTEM**

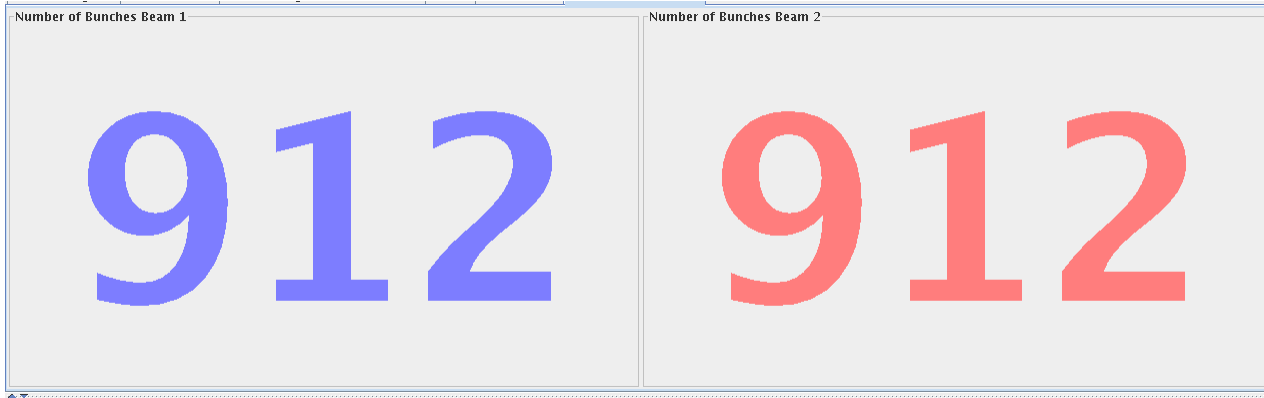


precise measurement of the luminous region + beam intensity --> absolute luminosity and cross section calibration

currently ~ 5 % level, already better than Tevatron

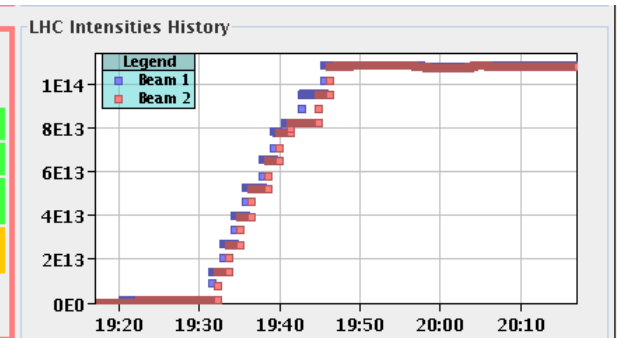


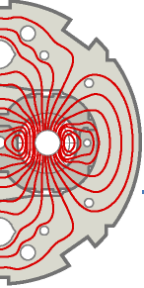
21 May: 912 bunches at 3.5TeV



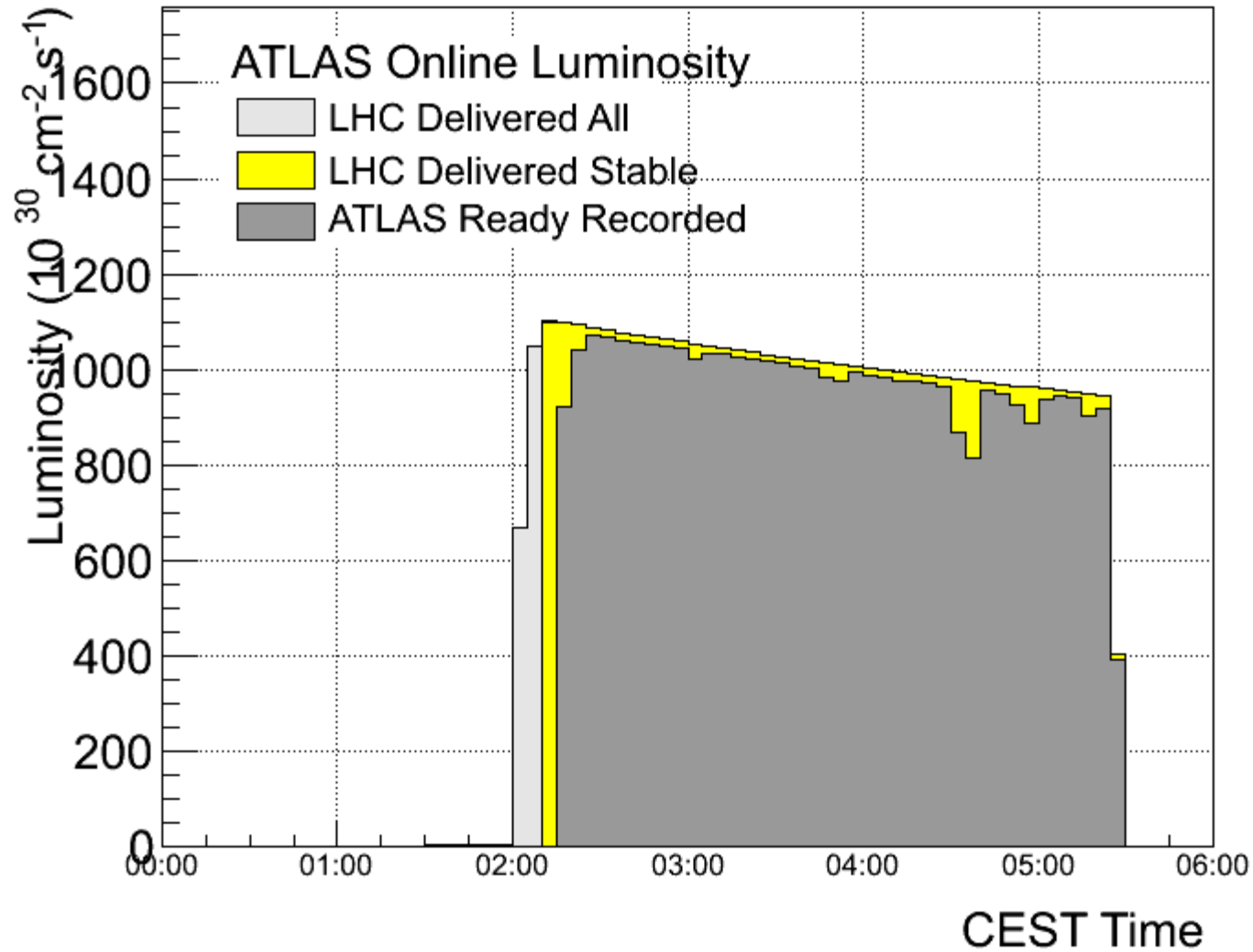
LHC Beam 1	
Energy [GeV/c]	3500
FBCT	1.09E14
Number of Bunches	912
Energy [MJ]	61.1

LHC Beam 2	
Energy [GeV/c]	3500
FBCT	1.09E14
Number of Bunches	912
Energy [MJ]	60.9





Sunday morning May 22: $1.1 \times 10^{33} \text{cm}^{-2}\text{s}^{-1}$



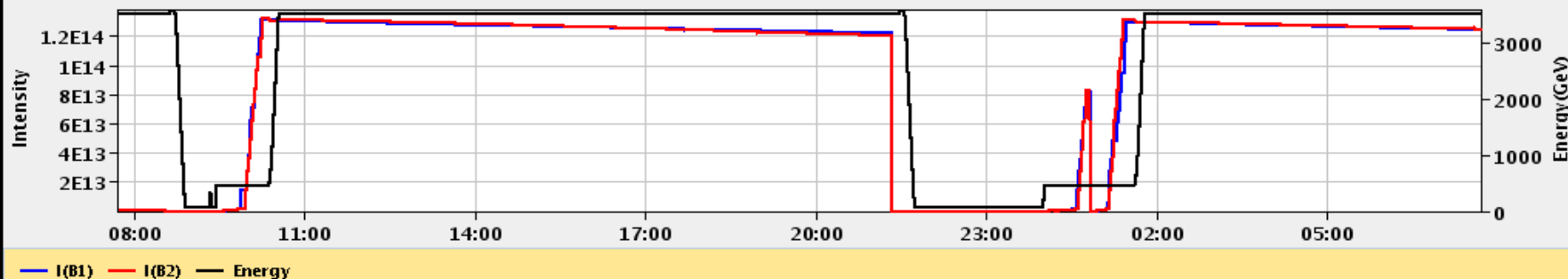
Back to back fills with 1092 bunches

30-May-2011 07:41:43 Fill #: 1816 Energy: 3500 GeV I(B1): 1.24e+14 I(B2): 1.25e+14

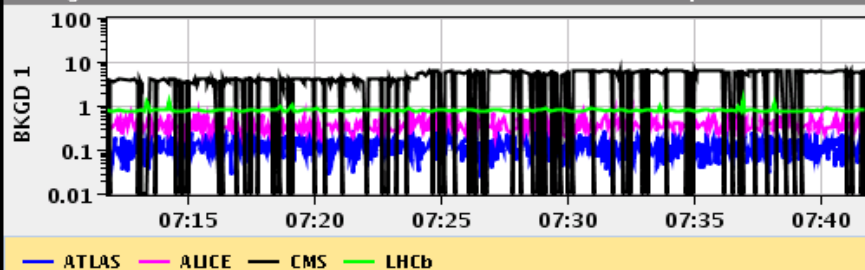
	ATLAS	ALICE	CMS	LHCb
Experiment Status	PHYSICS	PHYSICS	NOT_READY	PHYSICS
Instantaneous Lumi (nb s ⁻¹)	957.572	0.574	945.849	296.325
BRAN Luminos	Luminosity $1.2-1.3 \times 10^{33} \text{cm}^{-2}\text{s}^{-1}$			83.206
Fill Luminos				5766.5
BKGD 1	0.179	0.392	6.482	0.779
BKGD 2	17.508	1.174	0.002	0.381
BKGD 3	8.419	1.398	3.268	1.087

LHCb VELO Position **IN** Gap: -0.0 mm STABLE BEAMS TOTEM: **STANDBY**

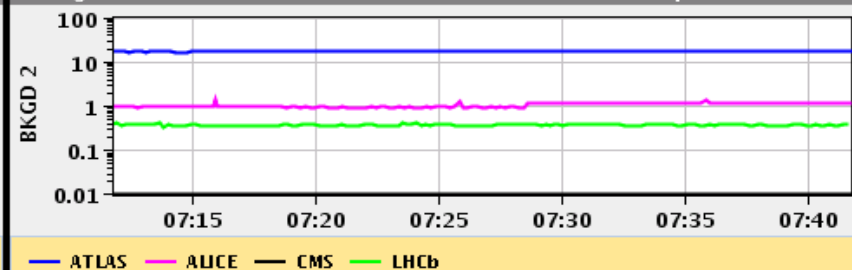
Performance over the last 24 Hrs Updated: 07:41:41



Background 1 Updated: 07:41:42



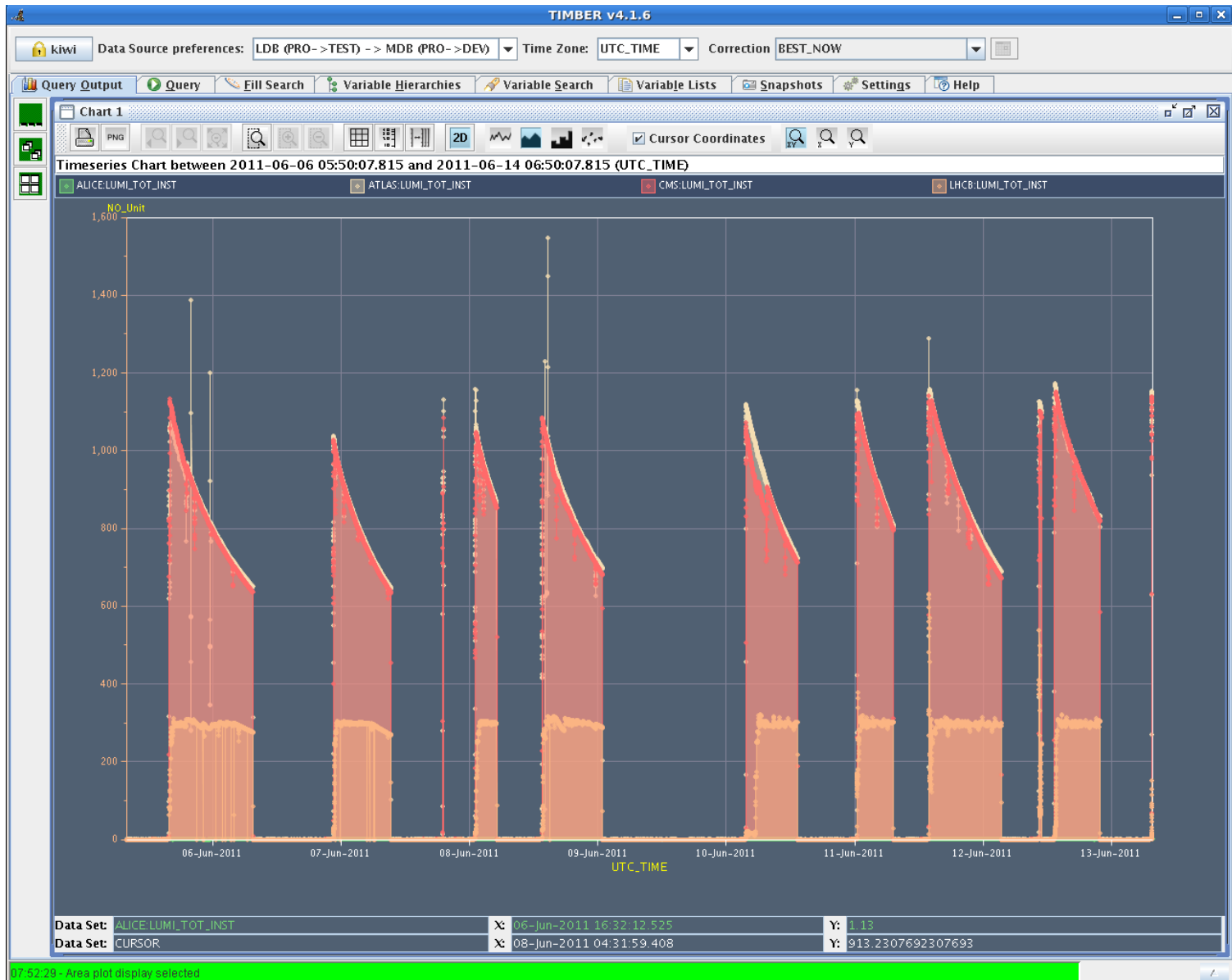
Background 2 Updated: 07:41:41





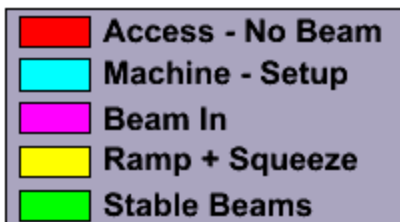
Week 23

Date	Fill number	Time in stable beams	Int. lumi [pb ⁻¹]	Cause of dump
Mon 6 th	1854	9m	.59	trip of RQ6.L2
Mon-Tues	1855	14h21m	41.3	RTQX2.R1 - FGC
Tue-Wed	1856	10h50m	31.0	Alice dipole trip
Wed	1858	0		Big UFO IP2
Wed-Thu	1859	3h56m	13.4	Electrical glitch
Thu	1862	11h12m	32.4	Trip RSQSX 400 V PS
Thu - Sat	1863	9h43	30.8	PLC DFB-cyro MS L1
Sat - Sun	1864	6h48	23.1	D2.L1 bus bar quench
Sun - Mon	1865	13h36m	42.6	Collimator controls
Mon	1866	20m	1.3	RF Total Voltage Intlk B1
Mon 14 th	1867	8h14m	28.8	RF module trip
Mon 14 th	1868			





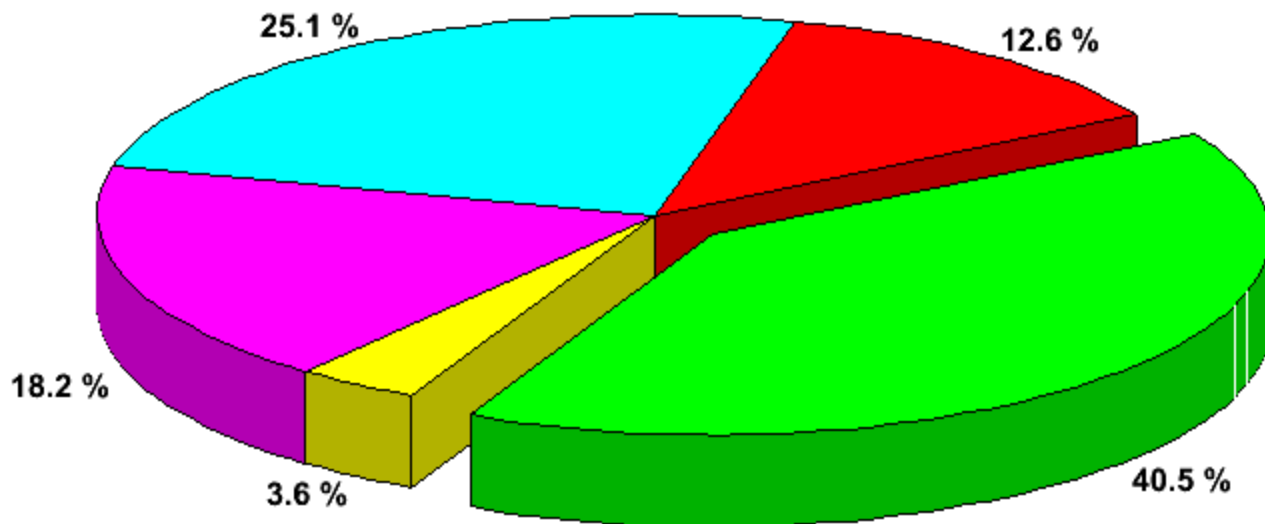
LHC Efficiency: Last 10 fills

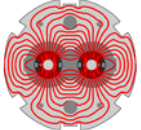


Statistics for fills 1857 to 1867

Total Time Duration [hh:mm:ss]: 132:27:04

Time in Stable Beams [hh:mm:ss]: 53:40:15



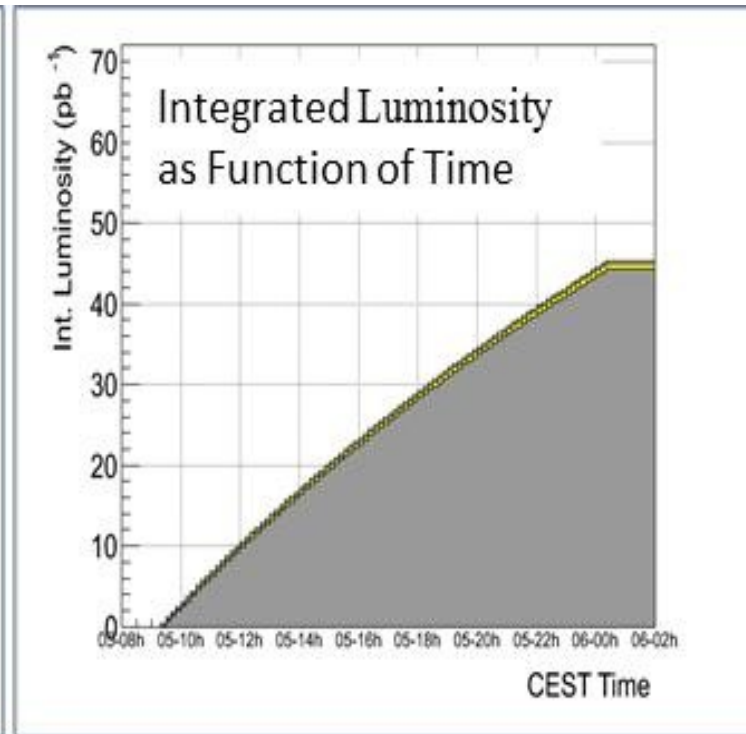
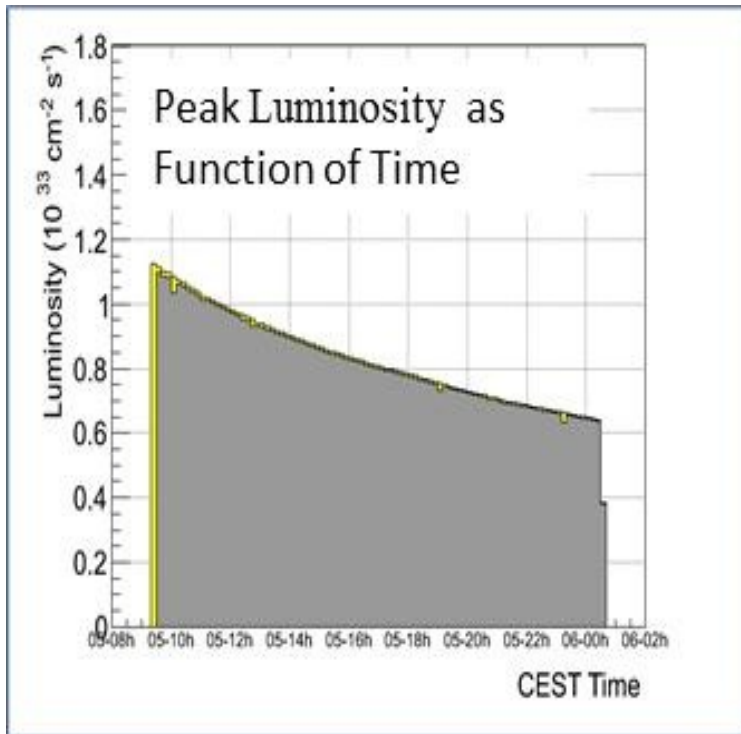


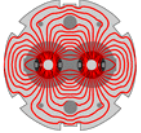
Summary of Peak Performances

Peak Performances					
Fill Number	Date	Bunch Spacing	Number of Bunches	Peak Luminosity ($10^{33} \text{cm}^{-2} \text{s}^{-1}$)	Total Number of protons per beam (10^{14})
1635	18 March 2011	75	32	0.030	0.038
1637	19 March 2011	75	64	0.064	0.074
1644	22 March 2011	75	136	0.167	0.164
1645	22 March 2011	75	200	0.252	0.243
1712	15 April 2011	50	228	0.237	0.285
1716	16 April 2011	50	336	0.353	0.423
1739	26 April 2011	50	480	0.514	0.579
1749	30 April 2011	50	624	0.716	0.756
1755	02 May 2011	50	768	0.826	0.925
1809	27 May 2011	50	912	1.099	1.150
1815	29 May 2011	50	1092	1.268	1.330

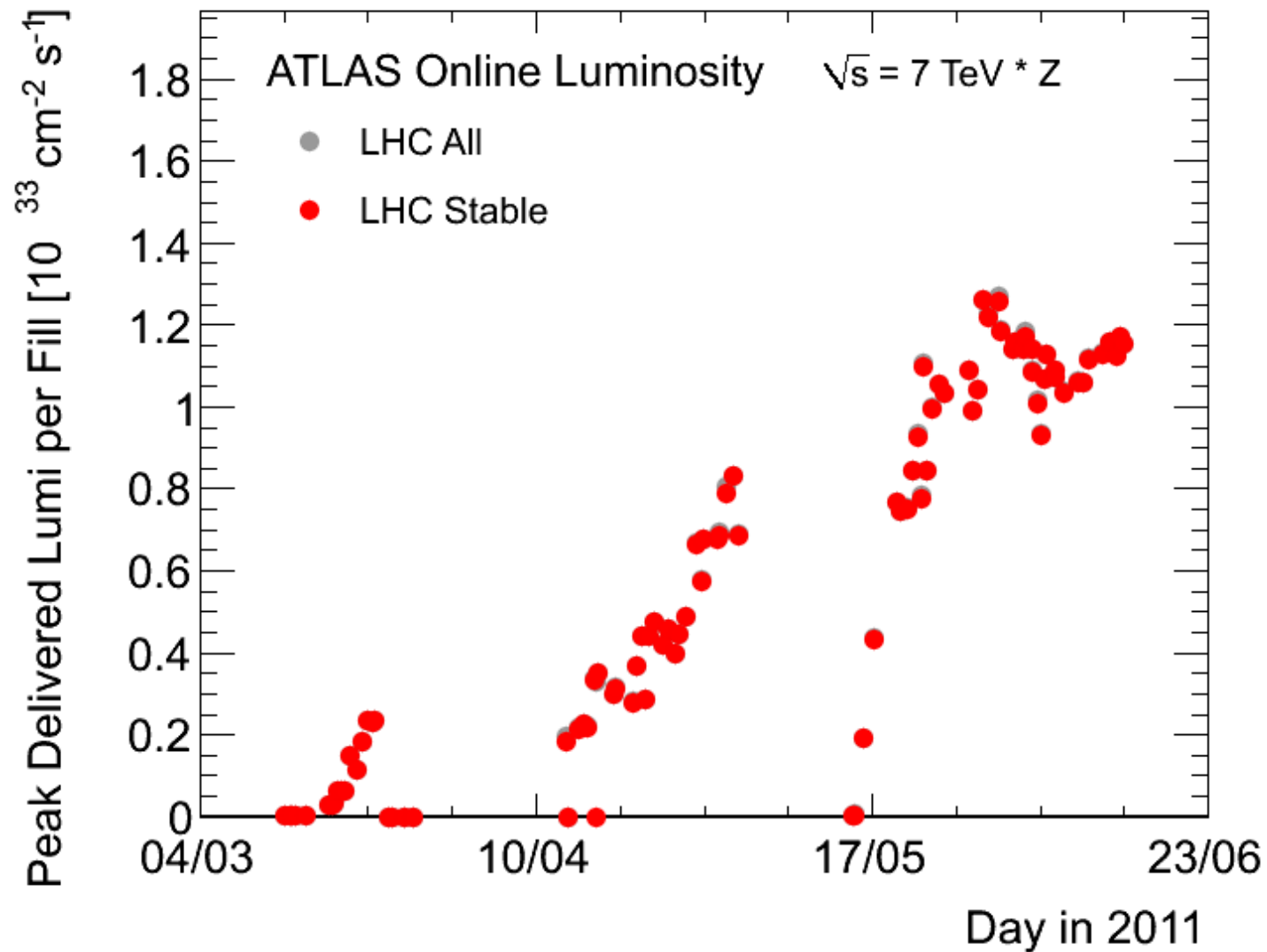


Best Fill as of June 14



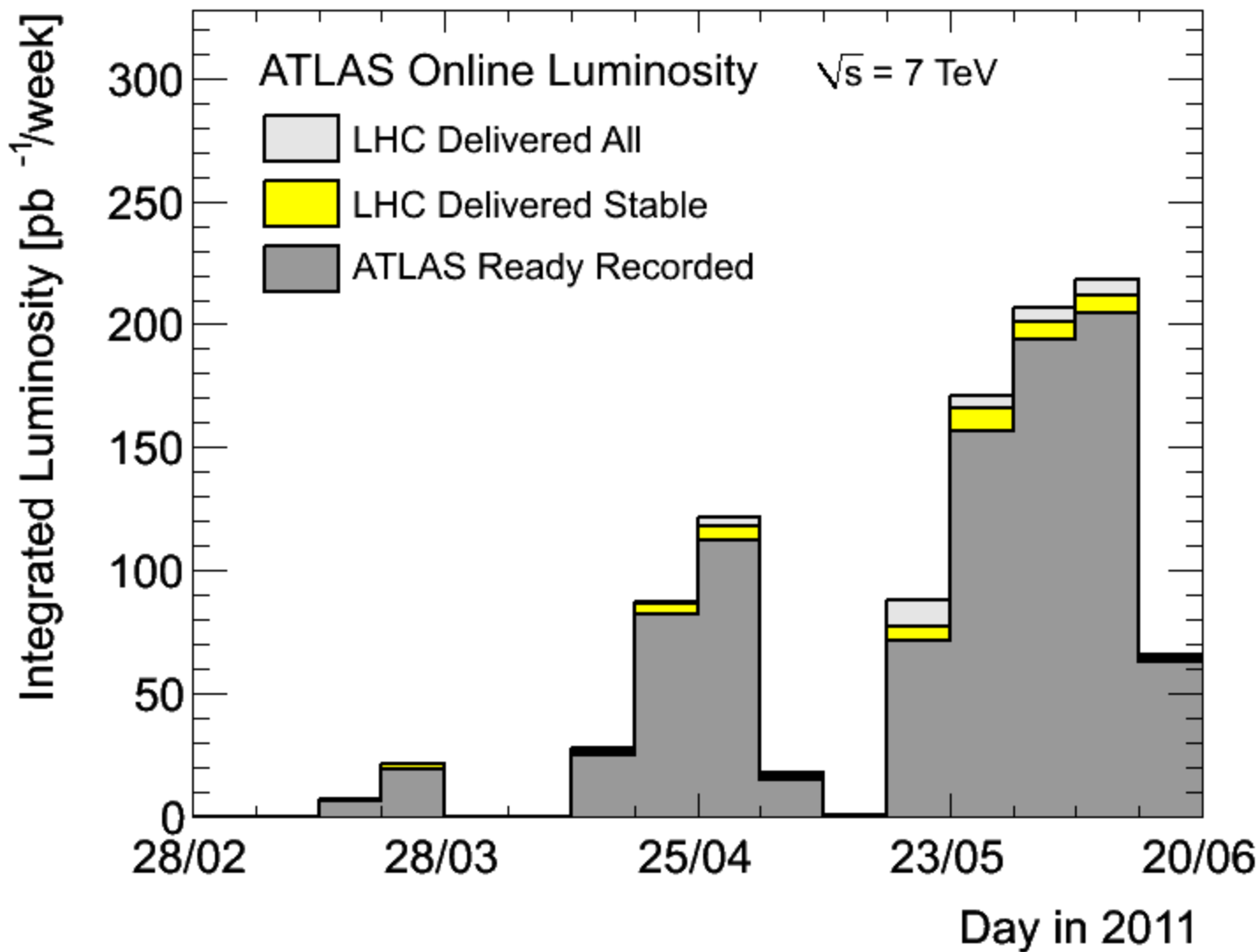


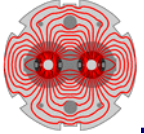
Peak Luminosity



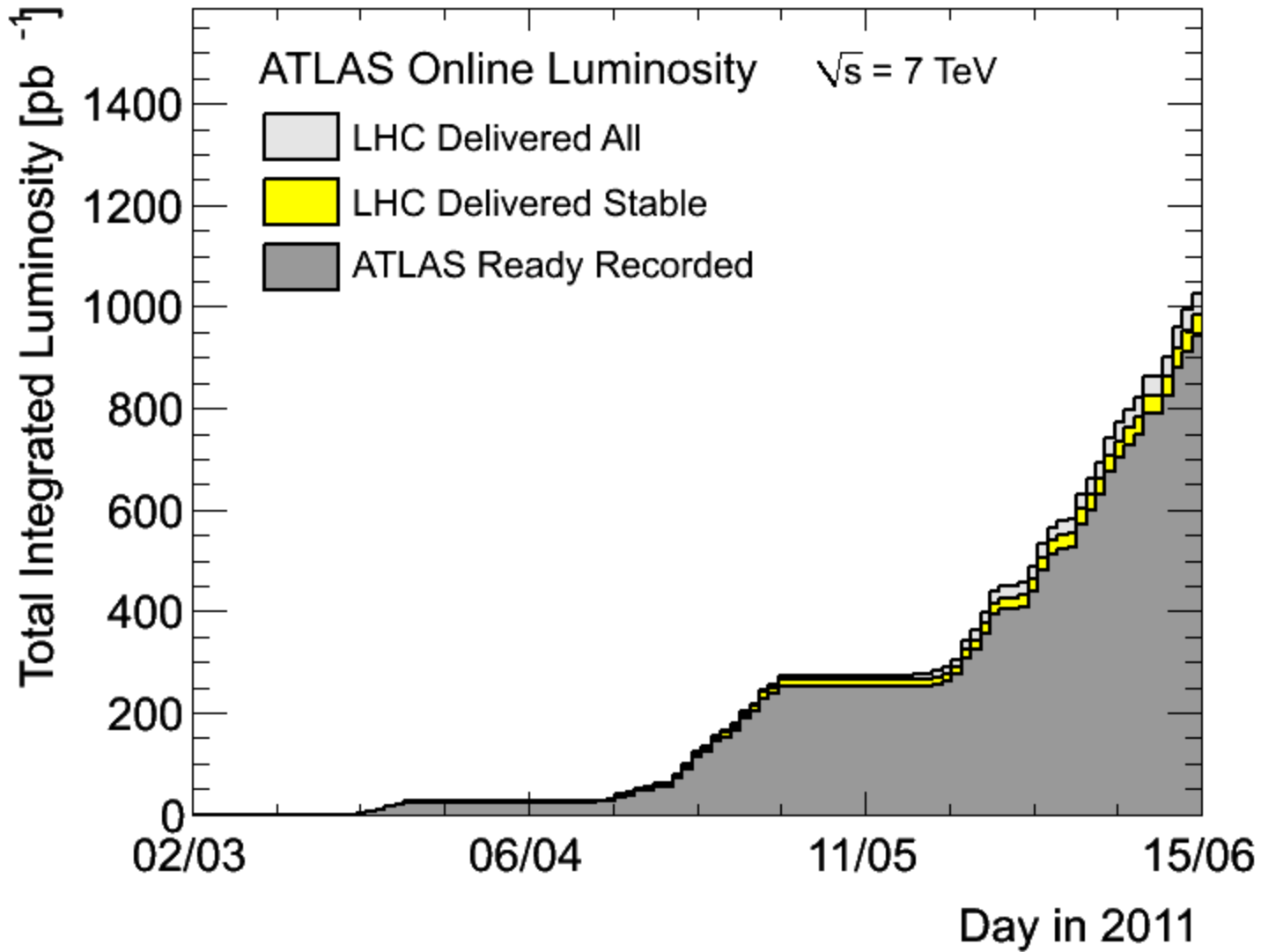


Weekly





Integrated daily





Records as of 11 June

Peak Stable Luminosity Delivered	1.26x10 ³³	Fill 1815	11/05/29, 06:41
Maximum Luminosity Delivered in one fill	46.61 pb ⁻¹	Fill 1836	11/06/01, 18:49
Maximum Luminosity Delivered in one day	46.84 pb ⁻¹	Thursday 02 June, 2011	
Maximum Luminosity Delivered in 7 days	229.64 pb ⁻¹	Thursday 02 June, 2011 - Wednesday 08 June, 2011	
Maximum Colliding Bunches	1042	Fill 1815	11/05/29, 06:41
Maximum Peak Events per Bunch Crossing	14.01	Fill 1732	11/04/23, 05:47
Maximum Average Events per Bunch Crossing	8.93	Fill 1644	11/03/22, 02:20
Longest Time in Stable Beams for one fill	17.9 hours	Fill 1732	11/04/23, 10:25
Longest Time in Stable Beams for one day	19.7 hours (82.1%)	Sunday 27 March, 2011	
Longest Time in Stable Beams for 7 days	93.0 hours (55.4%)	Thursday 21 April, 2011 - Wednesday 27 April, 2011	
Fastest Turnaround to Stable Beams	2.4 hours	Fill 1718	11/04/16, 22:56



It is not always easy! A day in June.

Cryo S56

Injection preparation for 144b
Cryo S34

UFO IR2

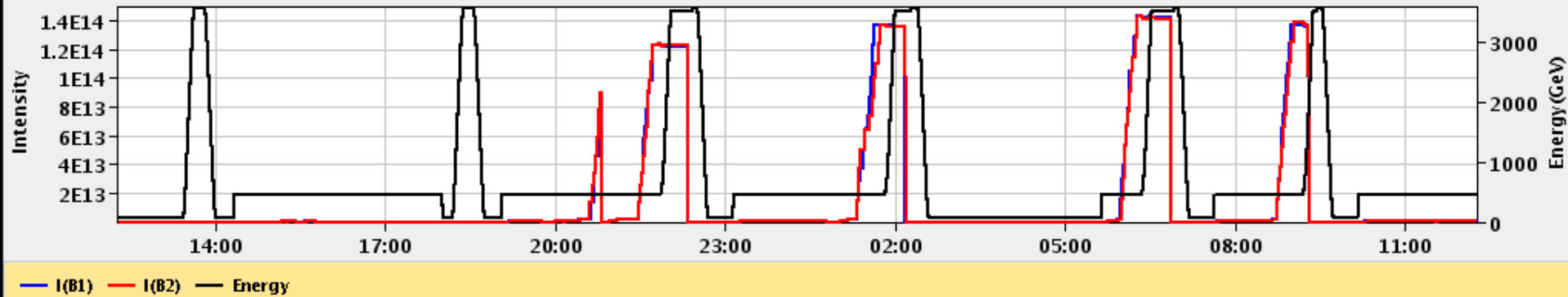
QPS noise → quench

RF arc

Collimator temperature

Performance over the last 24 Hrs

Updated: 12:15:29



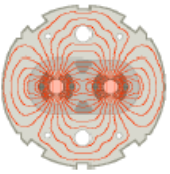


Present “Problems”

- UFOs (not intensity dependent)
- SEUs (dependent on total intensity and luminosity)
- RF Power Couplers (total beam current: present limitation)
- RF wave-guide flashover (linked to UFOs)
- HOM heating of Injection kickers, cryo, collimators.. (total intensity and bunch length dependence)



Future: Short term



Physics data-taking until end of 2012

- Implementation of the performance possibilities indicated during the machine studies (July 2011 performance review, following MD2)
 - beam beam, aperture, emittance, intensity (pile-up)
- Following measurements of the copper stabilizers resistances during the Christmas stop, we will re-evaluate the maximum energy for 2012 (Chamonix 2012)

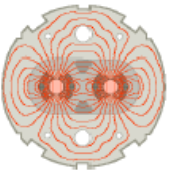
Summary



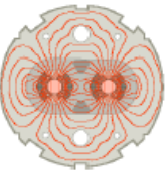
- On Track
- Intensity, peak and Integrated luminosity still going up **(quite)** rapidly
- Successfully implemented luminosity leveling for LHC luminosity calibration (vdM scans)
- Recently a few “near misses” causing sleepless nights
 - HTS protection fault for DFBs
 - Injection kicker flashover
- We must remain vigilant!!
- **We have reached our target integrated luminosity, with >16 weeks still to go (best week >200pb⁻¹)**
- Conclusions

Strong reminders





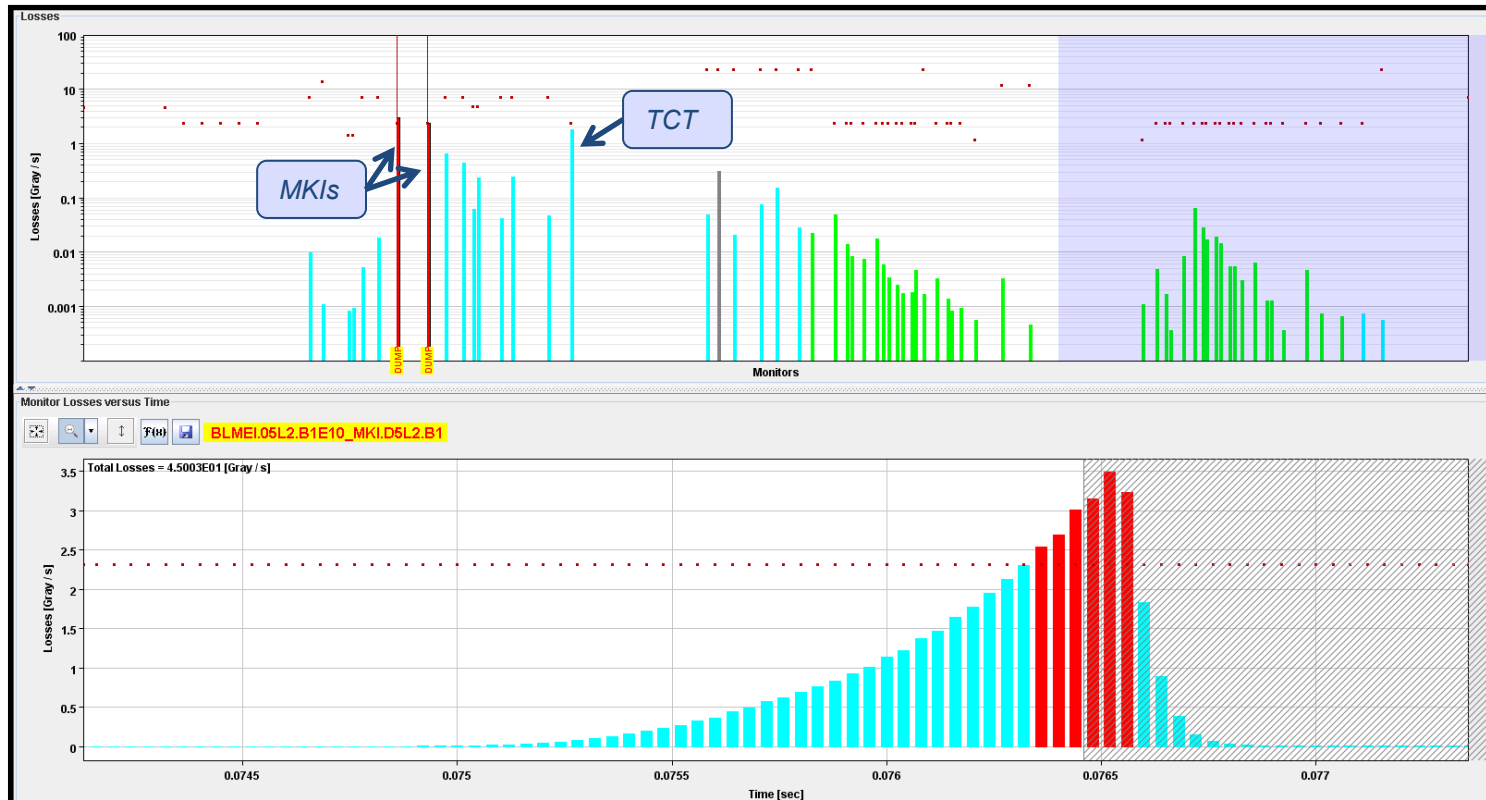
Thank you for your attention



UFOs

UFO related Beam Dumps

- Beam dumps until now: **18 in 2010, 10 in 2011**
2011: 7 in injection region (2010: 2)
1 dump at 450 GeV (06.06.2011):



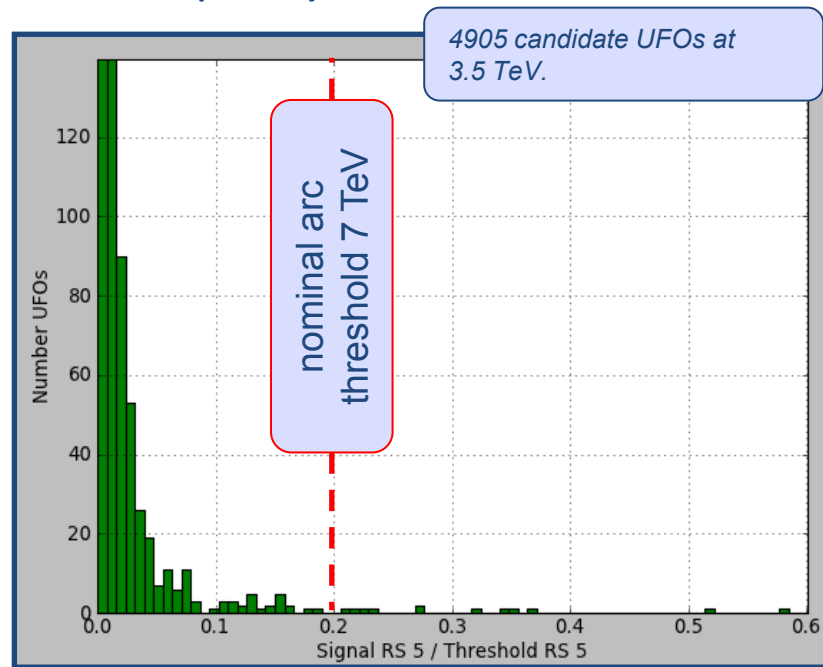
UFO Detection

- For 2010: 113 UFOs below threshold found in logging database. (E. Nebot)

- For 2011: Online UFO detection by **UFO Buster**.
Detects UFOs in BLM concentrator data (1Hz).

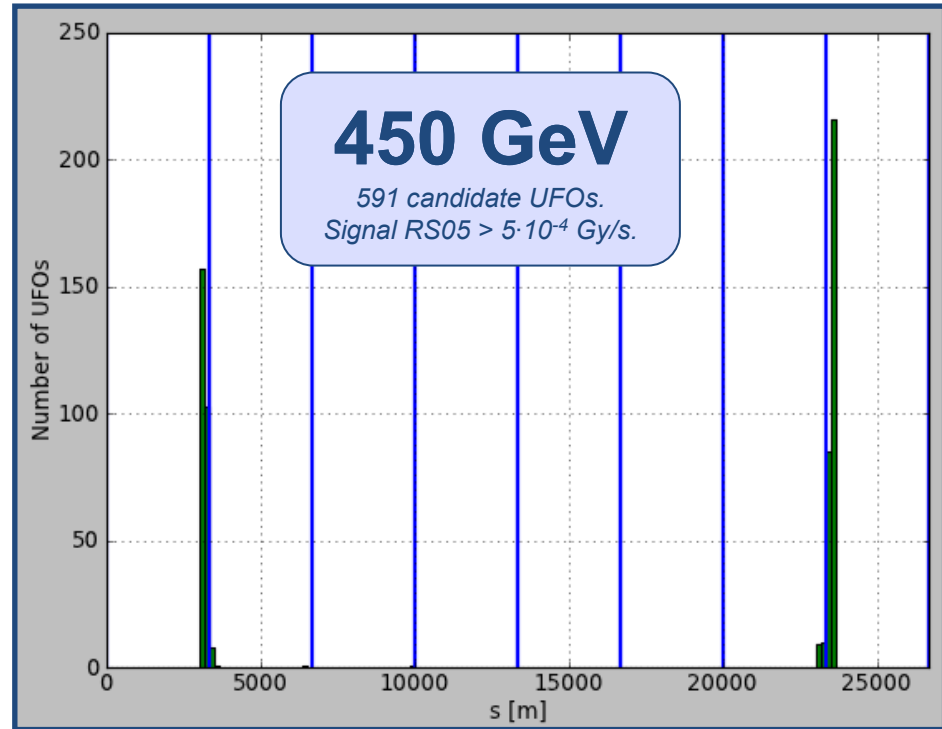
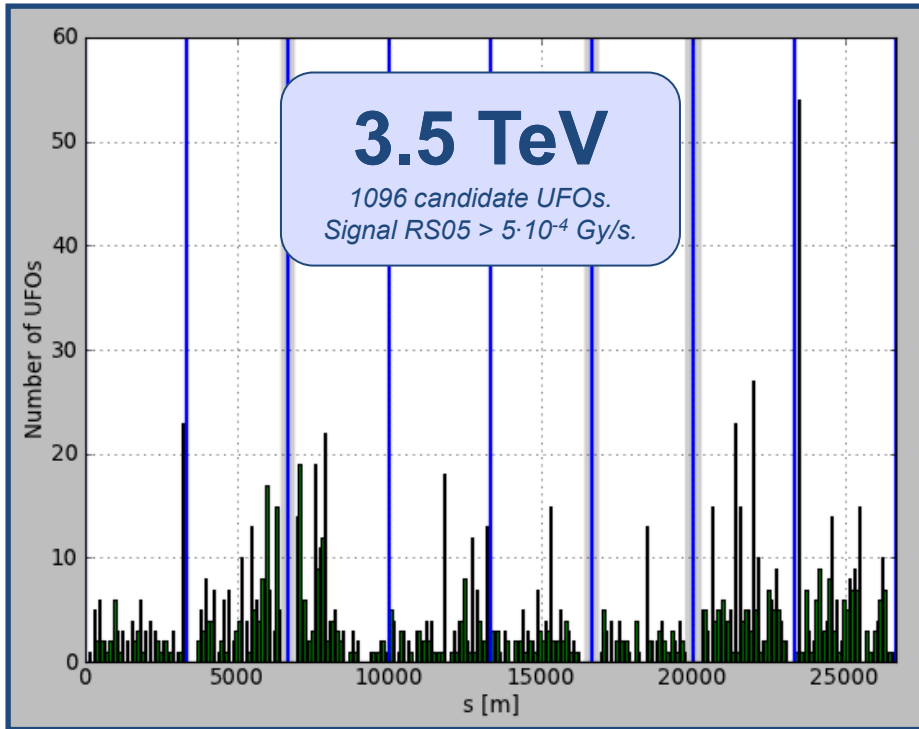
- **5000 UFOs** below threshold found so far.

Most events are much below threshold.



“threshold” = lowest threshold in standard arc cell.

Spatial UFO Distribution



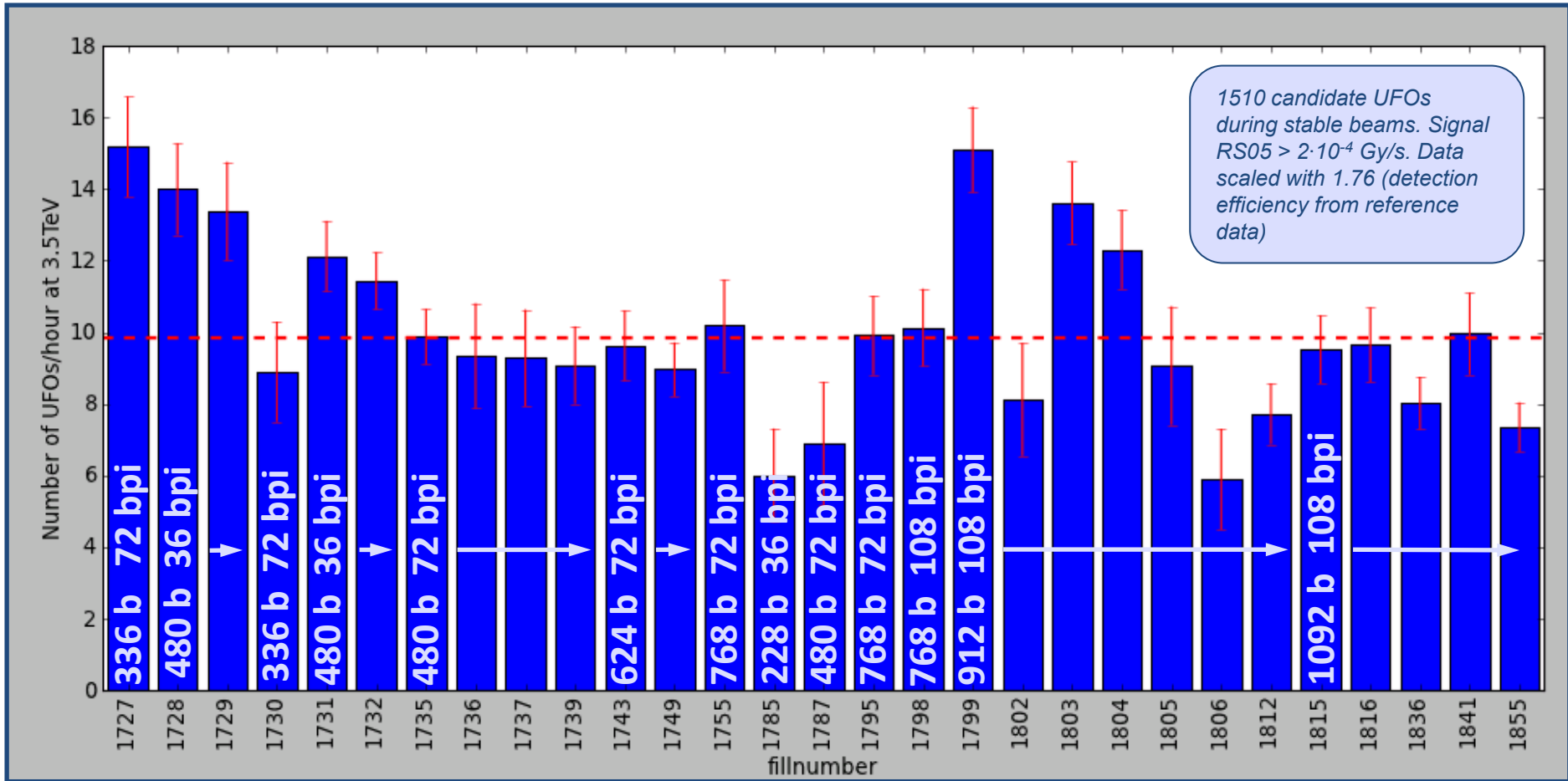
The UFOs are distributed all around the machine. About 7% of all UFOs are around the MKIs.

53 candidate UFOs at MKI for Beam 2.

gray areas around IRs are excluded from UFO detection.

Mainly UFOs around MKIs

UFO Rate in 2011



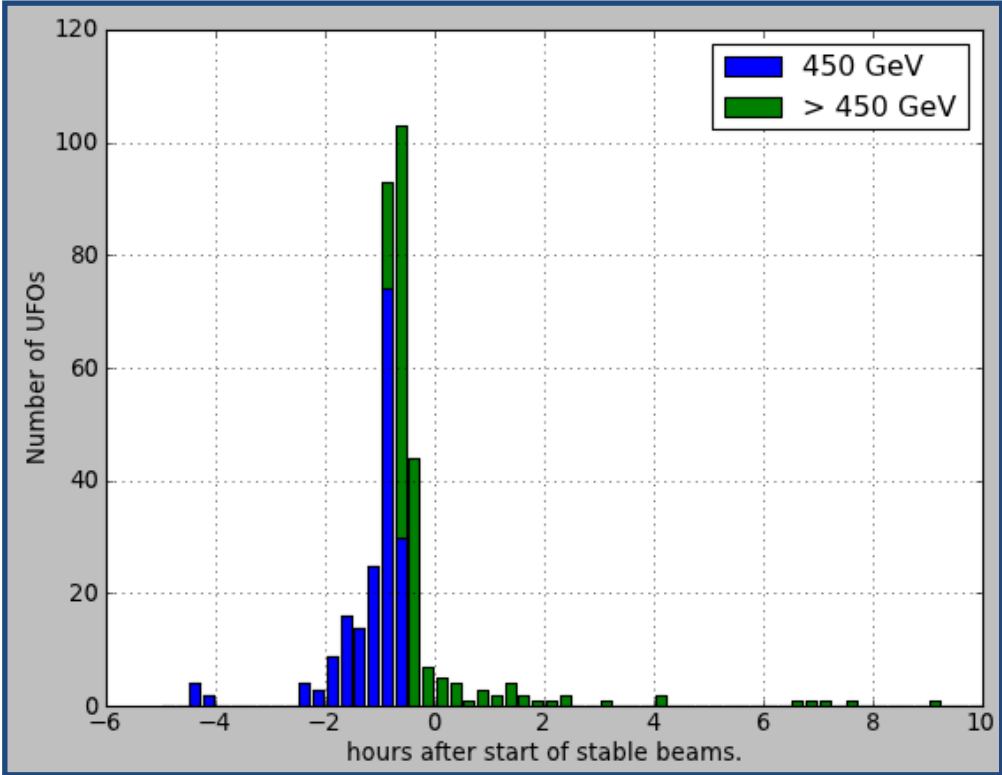
On average: **10 UFOs/hour**



UFOs around Injection Region

- **679 UFOs** around the MKIs caused **9 beam dumps**.

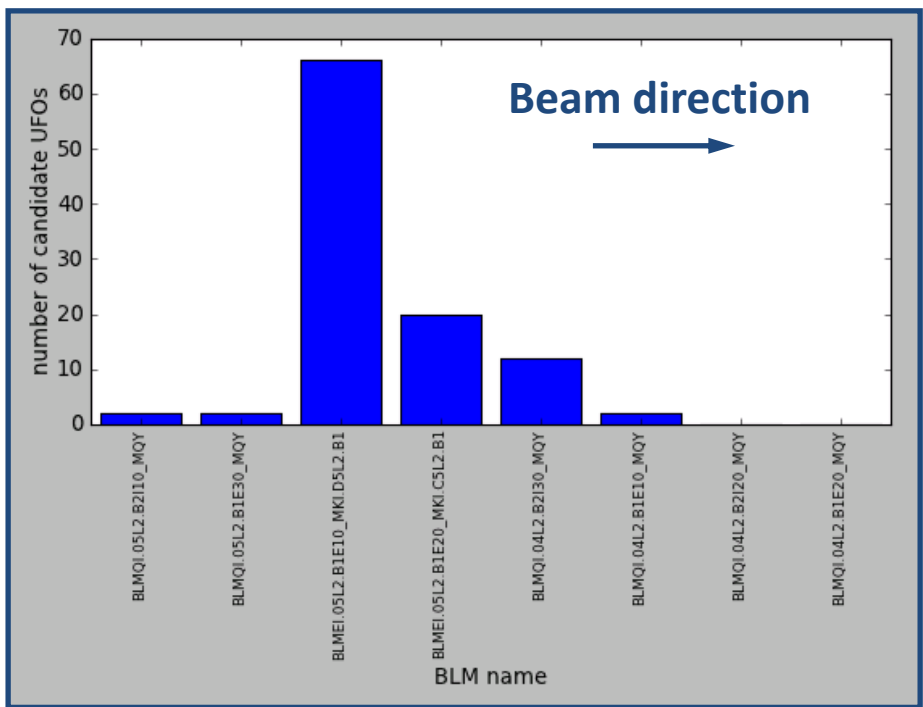
Most of the UFOs around the MKIs occur before going to stable beams.



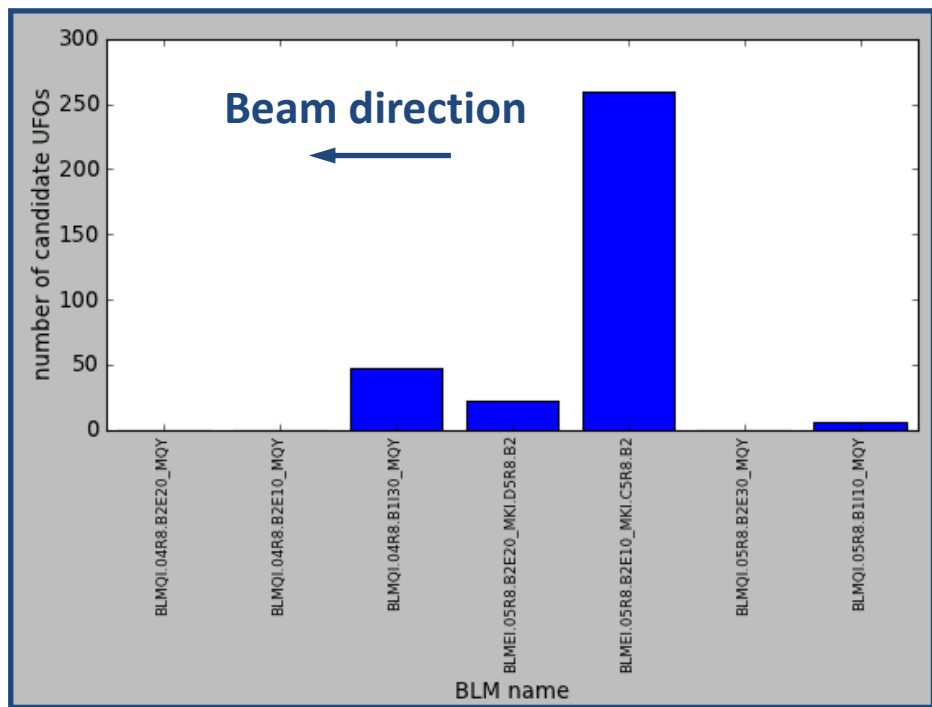
UFOs at MKIs

- 08.04. – 05.05. in total **460** fast loss events around MKIs. (**104** around MKI in IP2, **336** around MKI in IP8).

Distribution of first BLM which sees the loss:

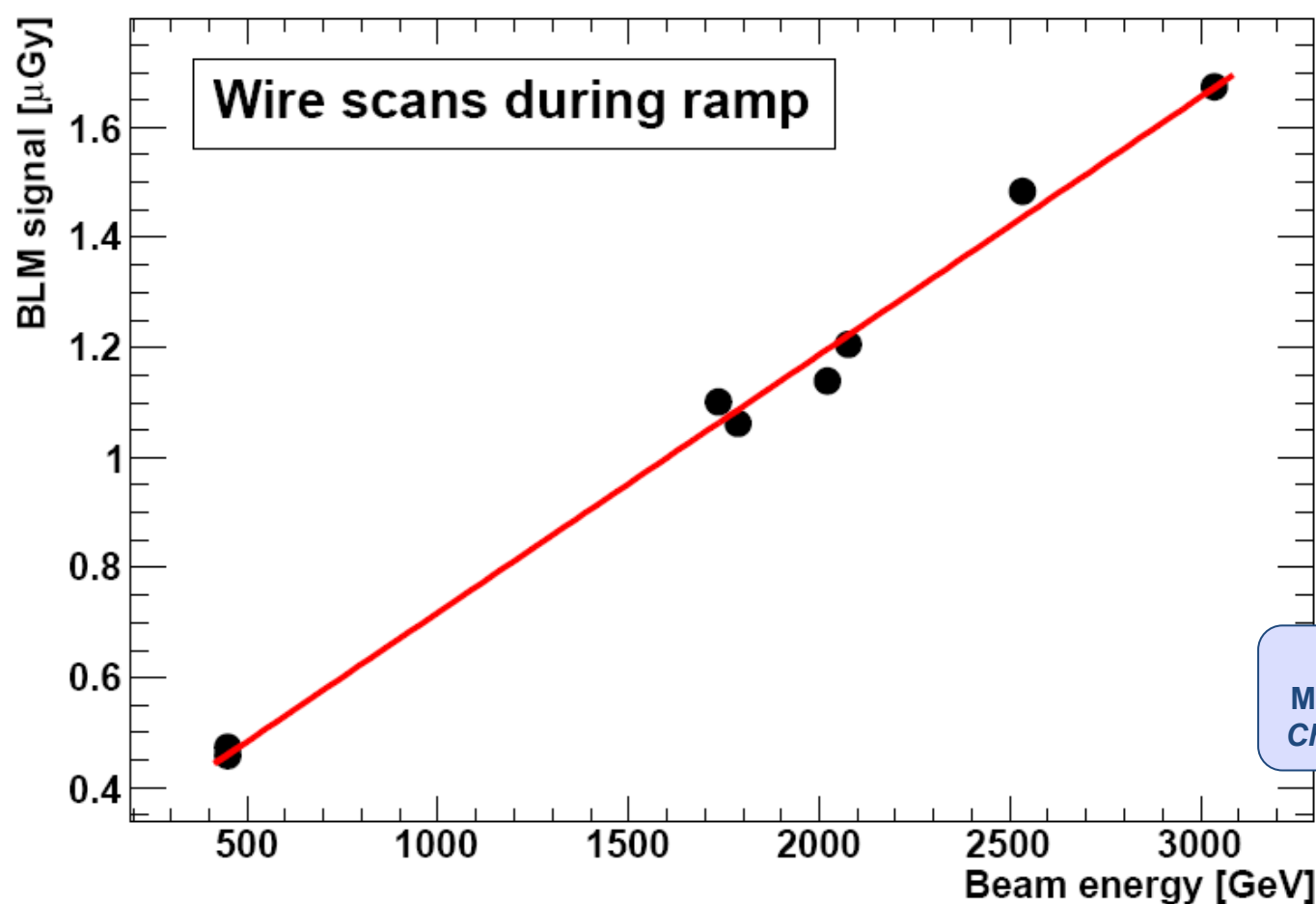


Left of IP2



Right of IP8

Correlation with Wire Scanner



From wire scans: linear dependency of BLM signal on beam energy



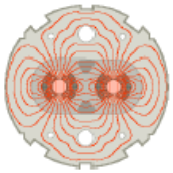
Summary

- **10 UFO related beam dumps** in 2011 so far (18 in 2010).
- **Over 5000 UFOs** below dump threshold detected in 2011 so far.
Most events at 3.5 TeV.
UFO rate constant at 10 UFOs/hour at 3.5 TeV.
- Many UFOs around injection kicker magnets
During scrubbing: increased UFO rate after each injection.
- Next steps: Improve the diagnostics, better understanding of quench limits, learn from simulations.

BLM Threshold has been increased by x5



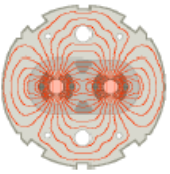
Event of 7th April



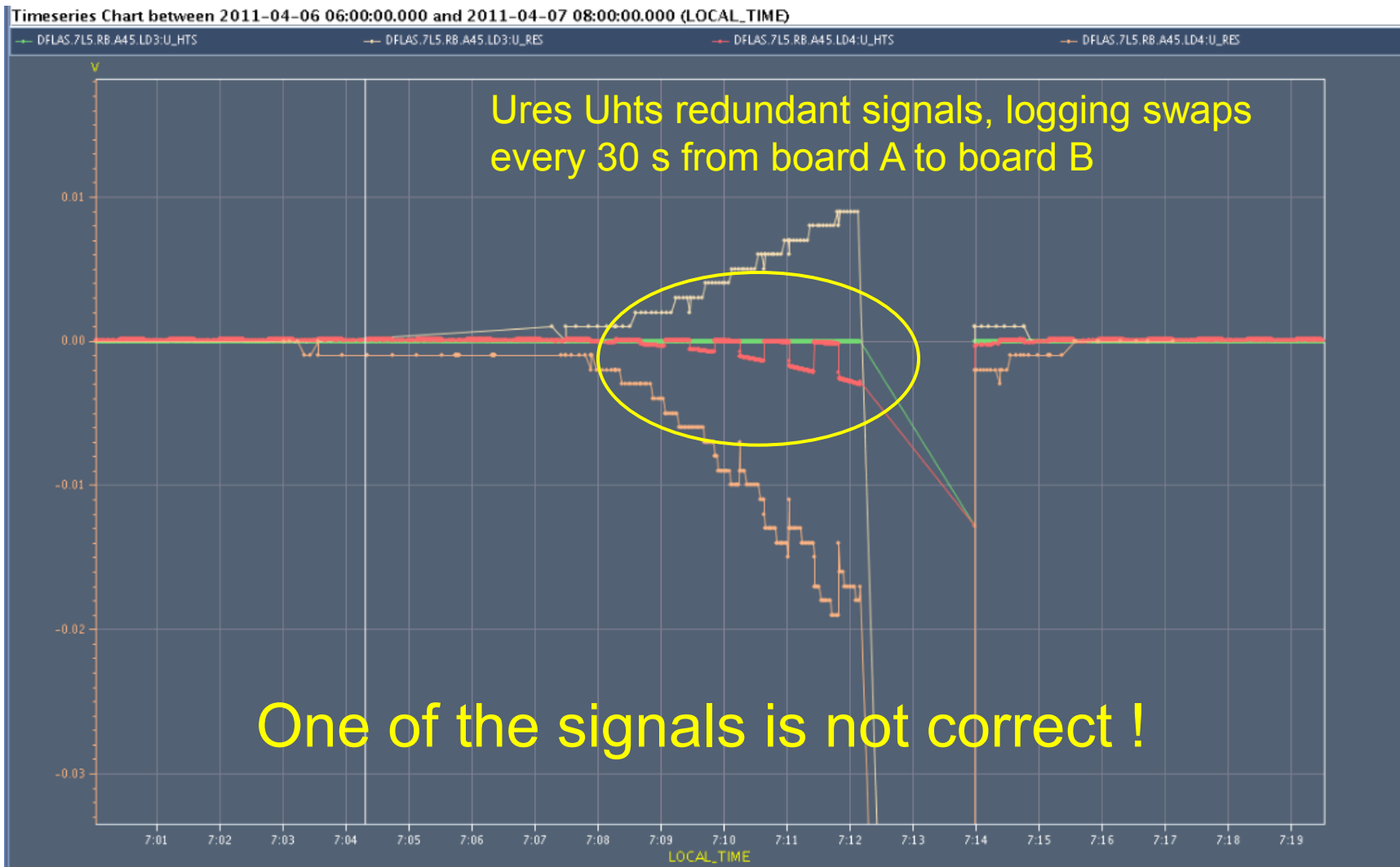
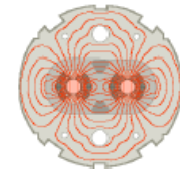
- Thursday afternoon (7th April) all **powering was stopped** in the LHC following the discovery of a worrying cabling problem affecting the QPS system protecting the HTS current leads.
- Followed by an extensive verification campaign.
- Lost about 2 days.

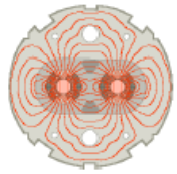


HTS quench (sc link)- what happened



- QPS tripped the RB circuit in sector 45 on Thursday around 07:00.
First time ever quench of HTS current lead
- The HTS quenched due to a lack of cooling in the DFB
 - Faulty electronics board corrupted the temperature feedback loop
- Protection by the QPS monitoring the current leads.
 - Logging of the two HTS signals showed that only one of the two measurements was correct, the other was measuring a short circuit
- **An identical fault on the redundant signal would have left the system unprotected and could lead to beyond repair damage to the DFB. No spares**
- **Decided to stop powering magnets**
 - To validate other circuits





What was swapped...?

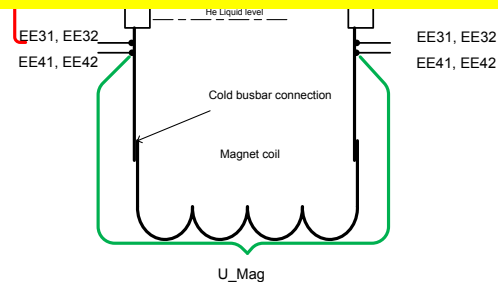
- What was found swapped in RB.A45, Lead#2 on DFBAI (L5)?
EE22 (pin 15) and EE42 (pin16)
of cable between PE and QPS controller

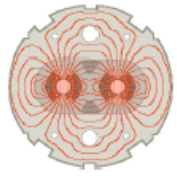


This connection had been like this since 2005

Are all connections like this?

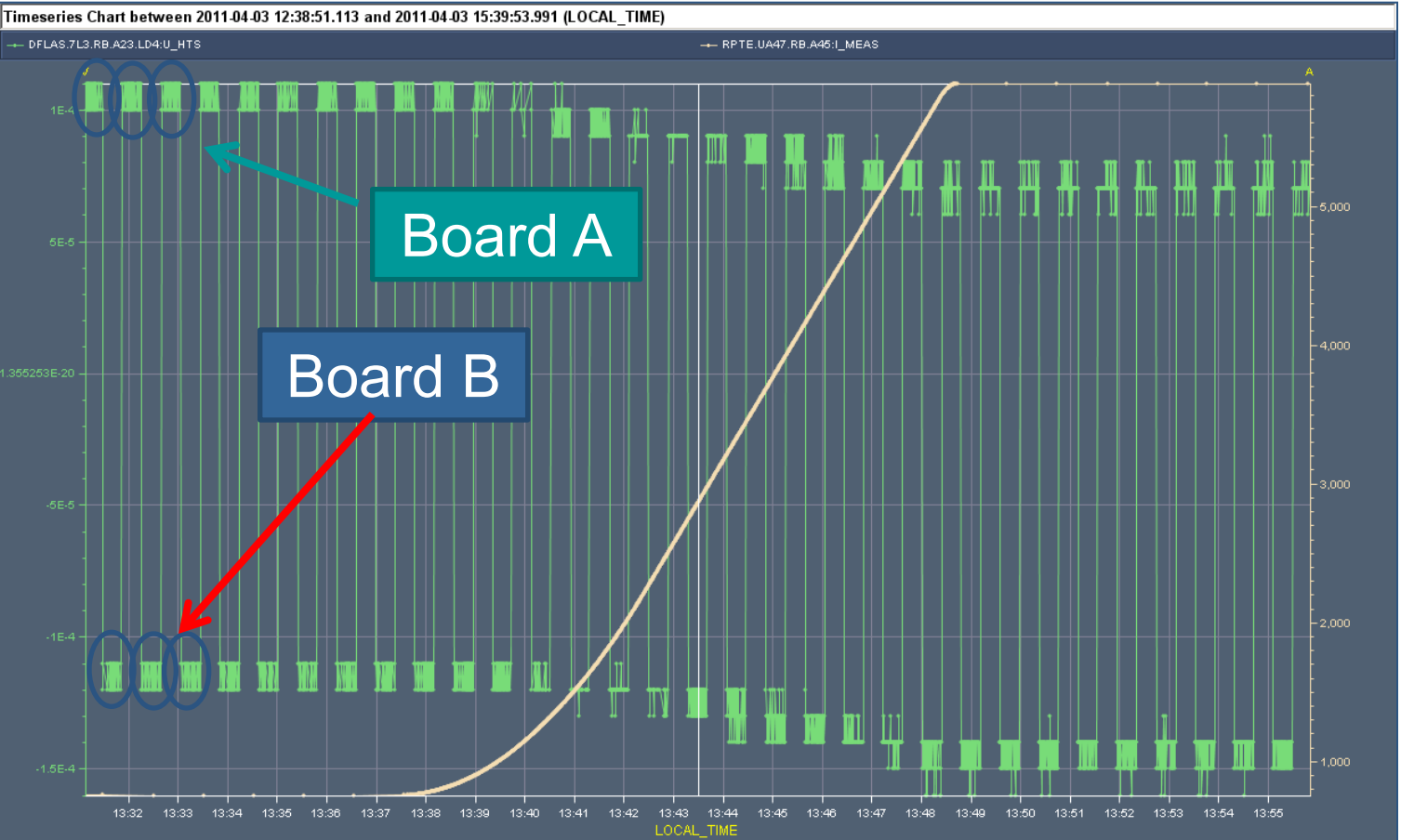
Stop operation until all connections are verified





From the logging

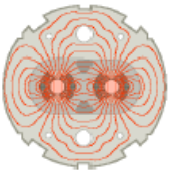
- Analysis of the logging data from old ramps allowed the QPS team to verify the correctness of the signals for other 13 kA circuits
- Verification of U_RES & U-HTS on all IPQs, IPDs, ITs using dedicated powering cycles by the QPS team
 - **Verification of boards A & B**



Example of a healthy channel: both boards move in unison during a ramp



Verification - Friday 8th April



- In the late afternoon all high current circuits except the 600 A circuits had been checked.
 - Acceptable risk for 600 A circuits.
- All tests showed the presence of the expected signals.
- **Green light for powering from TE/MPE in the evening.**

Among all the high current circuits we happen to quench exactly the one circuit with a cabling problem !!

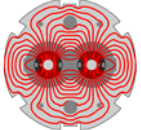
Event of 18th April

- **Flashover (high voltage breakdown) on B2 MKI magnet D (first one seen by the beam) while injecting 72b**
- **Extensive beam losses through P8 and arc 78: result**
 - **Kicker interlocked off**
 - **Quench heaters fired on 11 magnets**
 - **Vacuum valves closed**
 - **Several very anxious hours....**



Beam Dumps at > 450 GeV – I

Date	Time	State	Reason
30/05	11h08	Stable beams	QPS trigger circuit detector of RCBXH2.L1. SEU?
	15h43	Adjust	New RF interlock not masked
	20h20	Adjust	FMCM. Electrical glitch
31/05	06h22	Stable beams	UFO IR2L
	10h38	Stable beams	Communication with DFBAJ. SEU?
	22h20	Squeeze	UFO IR2L
01/06	02h10	Squeeze	QPS trigger (Quench of Q9R5 ?)
	06h53	Adjust	RF trip (radiation-induced arc detector signal?)
	09h17	Ramp	Collimator temperature
	20h37	Stable beams	Collimation crate IR5R failure (PRS)
02/06	16h58	Beam dump	EIC
	21h50	Stable beams	UFO IR8
03/06	00h28	Squeeze	Trip of RQTF.A23B2
	13h30	Stable beams	Loss of I_meas reading
	18h24	Squeeze	UFO in IR8R
	21h17	Stable beams	Trip undulator IR4.



Beam Dumps at > 450 GeV – II

Date	Time	State	Reason
04/06	07:56	Stable beams	QPS FIP communication lost, close to IR1. S12 tripped.
	16:19	Stable beams	Power converter fault.
	20:20	Flat top	UFO IR2L
05/06	00:15	Stable beams	RF trip
	03:48	Adjust	LHCb magnet trip
	06:56	Stable beams	UFO IR2L
06/06	00:31	Stable beams	QPS trigger on RQTL11.R7B1.
	07:39	Stable beams	PC failure of RQ6L2.
07/06	07:28	Stable beams	Bad current reading on RTQX2.R1
08/06	09:22	Stable beams	Alice dipole trip

26 beam dumps at > 450 GeV, only one dumped by OP.

Increase of BLM dump threshold for Q4 (MQY) at MKI's by factor 2



Bunch length

- Important parameter for
 - Cryogenics stability
 - Collimator heating
 - Injection kicker heating
 - ...
- Work ongoing to improve blow-up control during the ramp by the RF-team
 - Better reproducible results -> test operation with longer bunches
 - Disadvantage is possibly more debunched beam when a cavity trips, but not an issue at the moment



LMC 94

1.6.2011

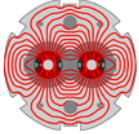
Week 21: J. Uythoven, J. Wenninger

Week 22: R. Assmann, B. Holzer



The problems of week 21

- RF arc detector in waveguide
 - Coupler arc detectors dumped 4 fills, of which 3 did not make it into stable beams
 - Became quiet again over the last days
- Various other problems
 - timing server A (CPU to be changed)
 - UPS US85.
 - UPS US85 not redundant any more BUT ONLY SERVES CRYOGENICS (mp)
 - QPS specialists in points 6 and 8
- But the main problem of the week
 - **Cryogenics**



Ahead

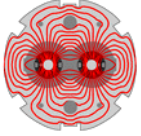
- Trying 144b injection.
- Physics fills over long weekend (1092 x 1092 bunches, 108b or 144b injections).
- Average bunch intensity: $\sim 1.2e11$ p
- End of fills (if any):
 - Try to reduce DS losses with TCL collimators (open now)
 - RF cavity switch off test



Weekend: Sat 11th – Mon 13th

**M Lamont Tuesday
14/6**

- Reasonably smooth running
- Saturday:
 - PS vacuum leak on wire scanner. No beam from ~8:30
 - Lost beams in LHC 13:00, beam back in PS around 21:00
 - Access for UPS in shadow
 - RB.81 tripped again – cooling problem on thyristor bridge
 - Beam back in LHC around 23:00
- Fills lost to:
 - PLC DFB-cyro matching section L1
 - D2.L1 bus bar quench – controls electronics
 - Collimator controls – power supply
 - RF voltage interlock – restarting tripped klystron



LOOK BACK ON WEEK 23

Mike Lamont, Jan Uythoven



Week Summary

■ Weeks results:

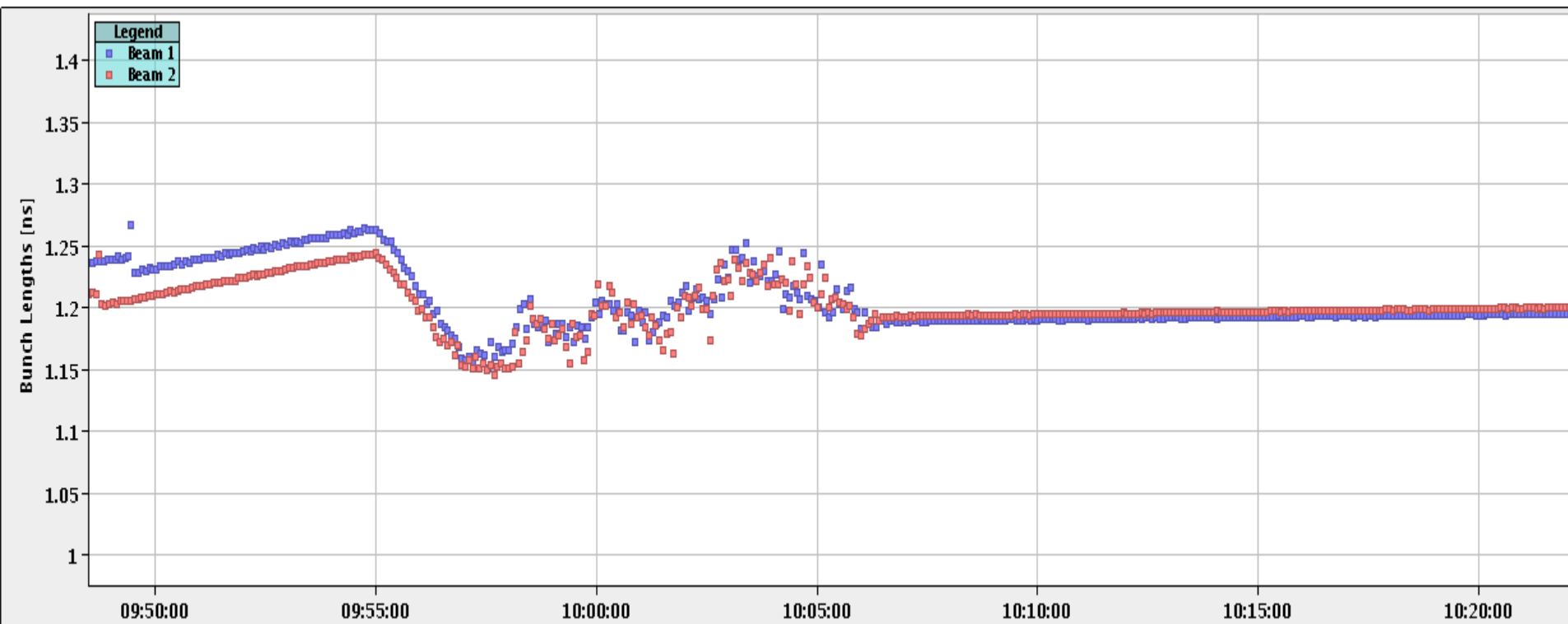
- Highest luminosity per fill: 46.61 pb⁻¹
- Highest luminosity in 1 day: 56.33 pb⁻¹
- Production in a week: 229.64 pb⁻¹
- Number of programmed dumps: 0
- Average bunch intensity: 1.2e11 (slightly lowered)
- Typical luminosity: 1.1e33 (slightly lowered)
- Number of bunches/beam: 1092 (from week 21)
- Number of stable beams: 11
- Average length stable beams: 4.2 h (mostly short fills)

■ > 1fb⁻¹ total if you count last year



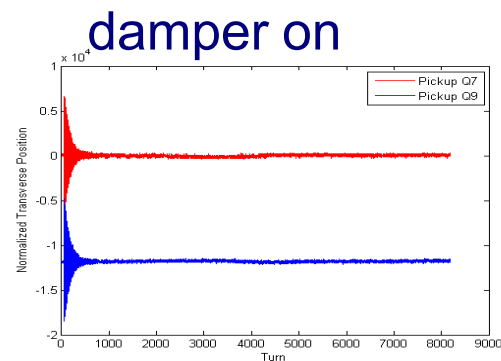
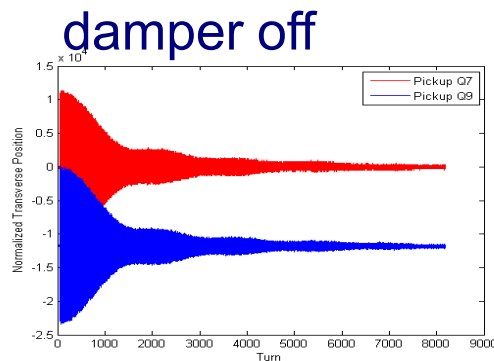
Bunch length control in the ramp

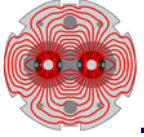
- Implementation, deployment and testing of new functionality for controlled blow-up in the ramp
- Followed by the Monte Carlo approach (Philippe, Themistoklis, Michael, Delphine)



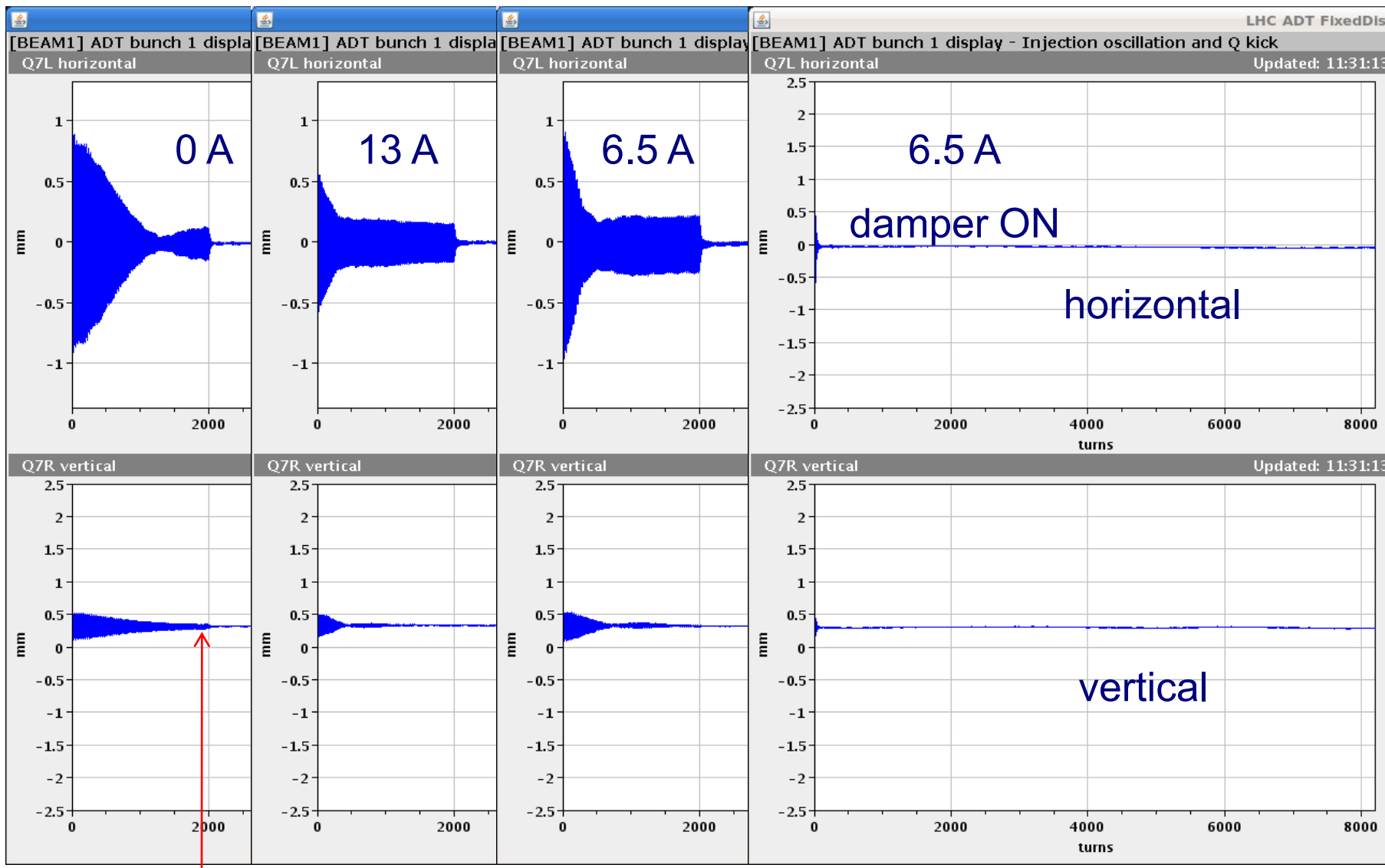


- INDIV beam at nominal intensity
 - emittances: ranged from 1.5 to 2.5 μm
- Check filamentation without damper, with octupoles on and off
- Method: disable damper for first 2000 turns
- Octupole polarities: de-focusing for OF & OD
- Additional de-coherence already seen 2010 with high bunch intensity \rightarrow tune spread associated with space charge (image space charge)





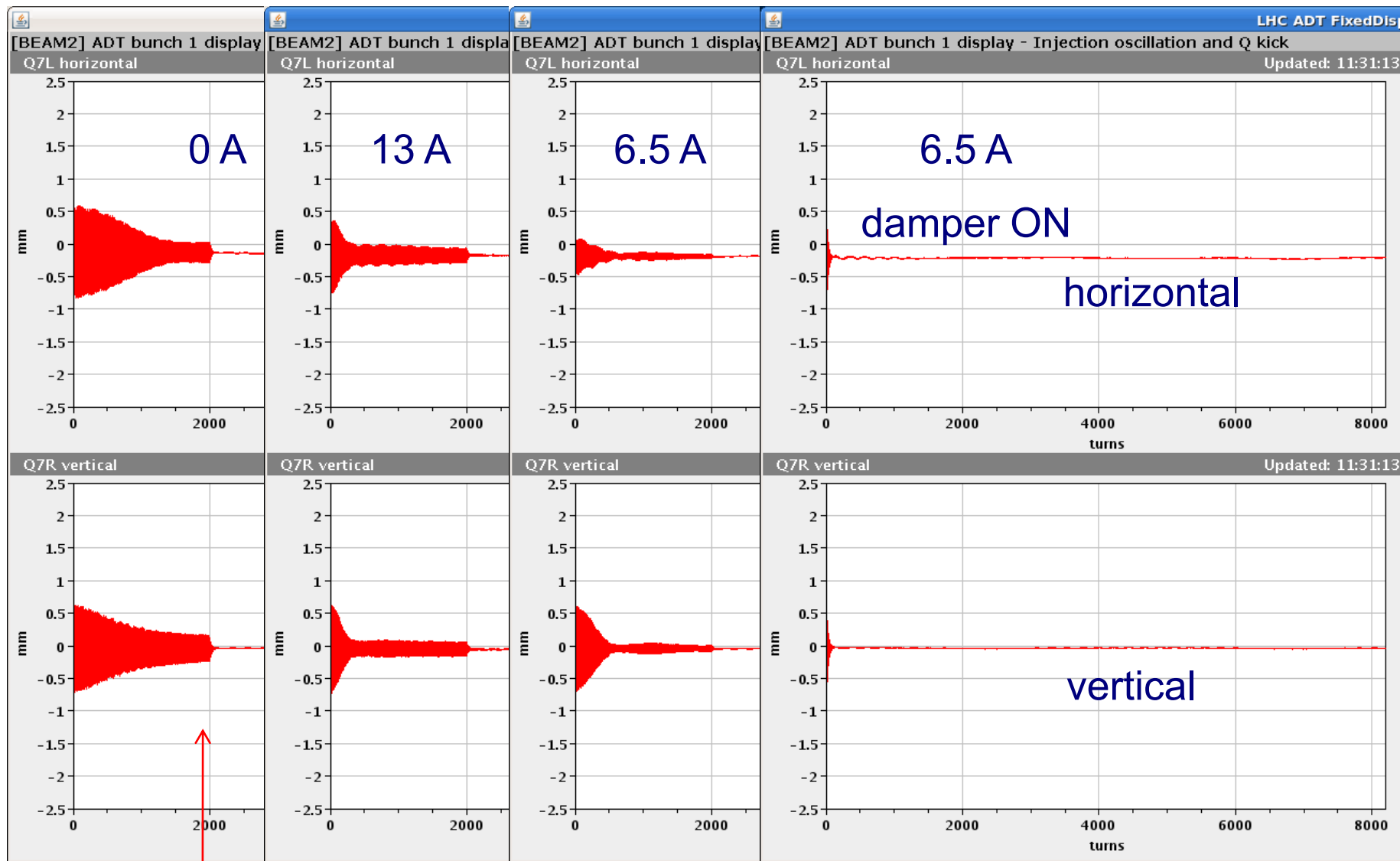
Beam 1



damper always switched on at turn 2000



Beam 2



damper always switched on at turn 2000



Octupoles - observations

- De-coherence time clear shorter with octupoles as expected
- 6.5 A in OF/OD decreases de-coherence time but leaves plenty of time for transverse damper to damp injection oscillations
- Note presence of linear hyper stable beam core which doesn't appear to filament.
- Octupoles now on at injection and in first part of ramp
- It works – 5 fills – no sign of blow-up



Week 22 Summary

■ Weeks results:

- Highest luminosity per fill: **46.5 pb⁻¹** (new record)
- Production in week: **200 pb⁻¹** (new record)
- Average bunch intensity: 1.2e11 (slightly lowered)
- Typical luminosity: 1.1e33 (slightly lowered)
- Number of bunches/beam: 1092 (from week 21)
- Number of stable beams: 14
- Average length stable beams: 4.2 h (mostly short fills)
- Bunch length blow-up: “1.25 ns” (plus 50 ps)
- Average turn around: **5.5 h** (**2.5 h best**)
- 144b injection: fully commissioned & tested
- TOTEM/ALFA: RP settings qualified for physics

■ Nice week but could have been even nicer...