2012 Priorities

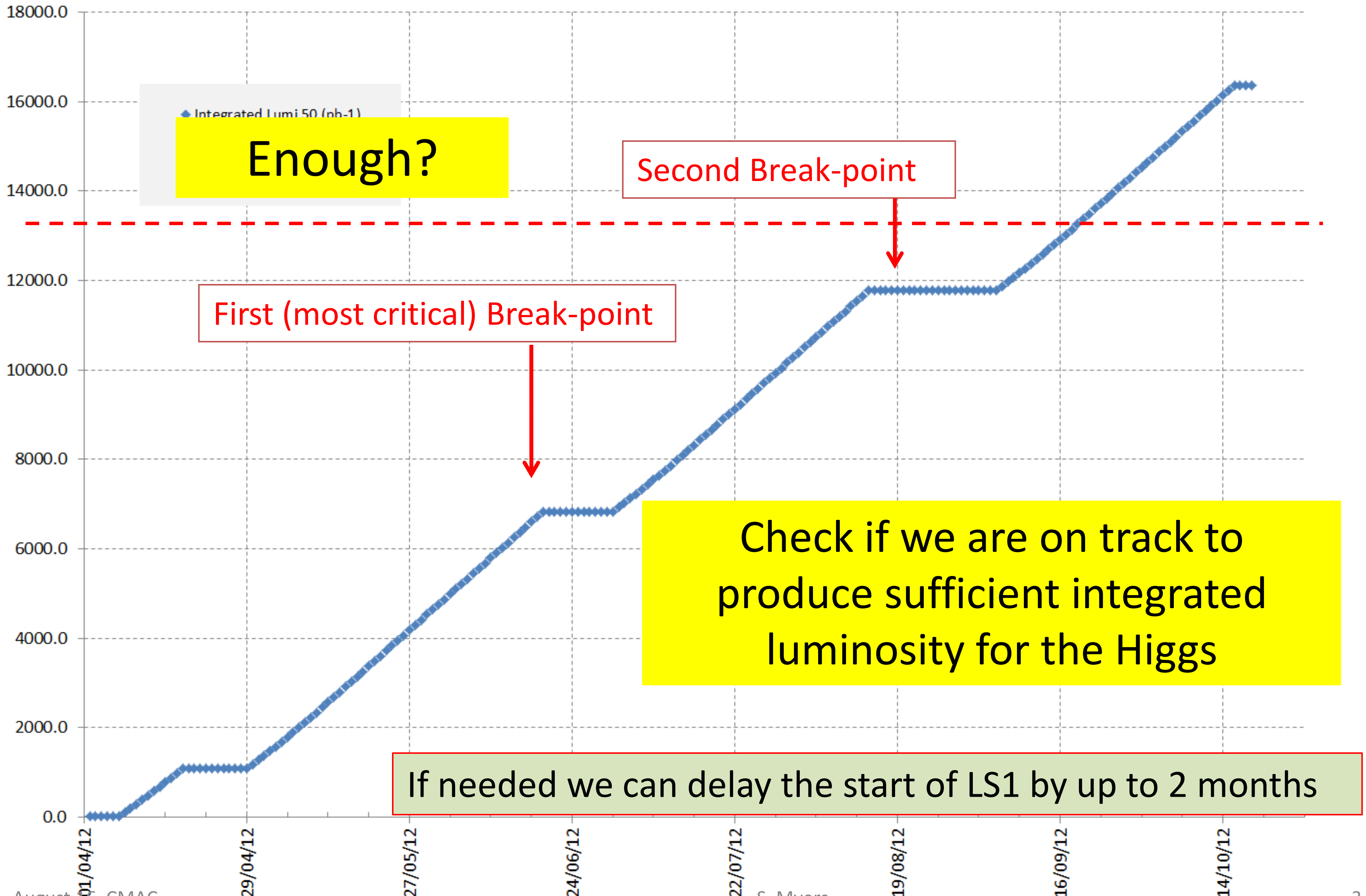
1. The LHC machine **must** produce enough integrated luminosity to allow ATLAS and CMS to **independently** discover the Higgs before the start of LS1.

2. We must also … run at the end of the year.

What is enough!

3. We must (in 2012) do the necessary machine experiments to allow high energy, useful high luminosity running after LS1.

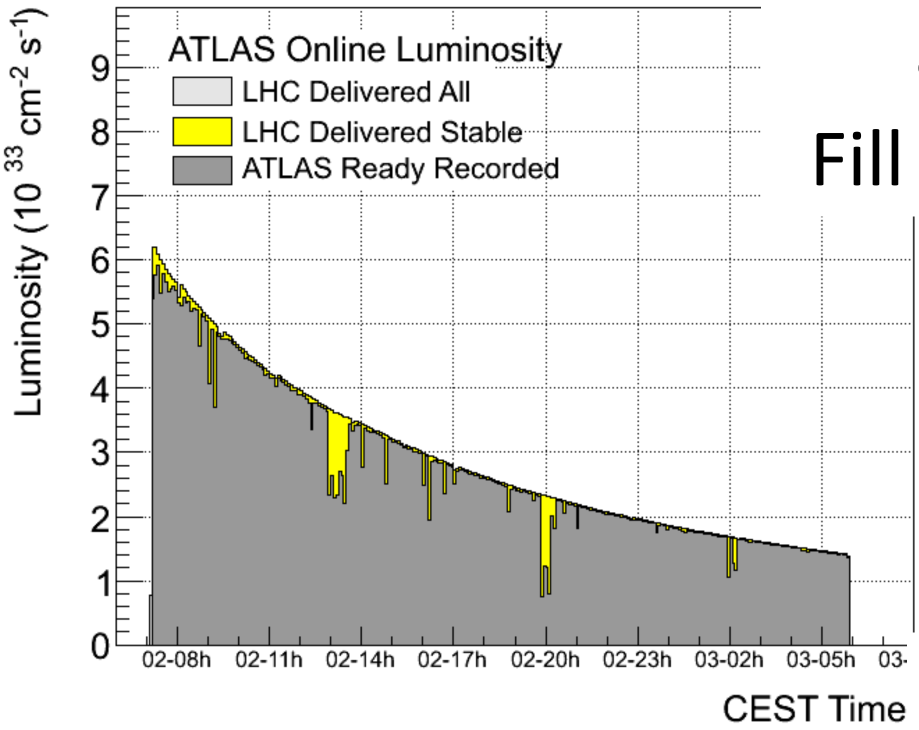
2012 Measured vs Predicted Integrated Luminosity

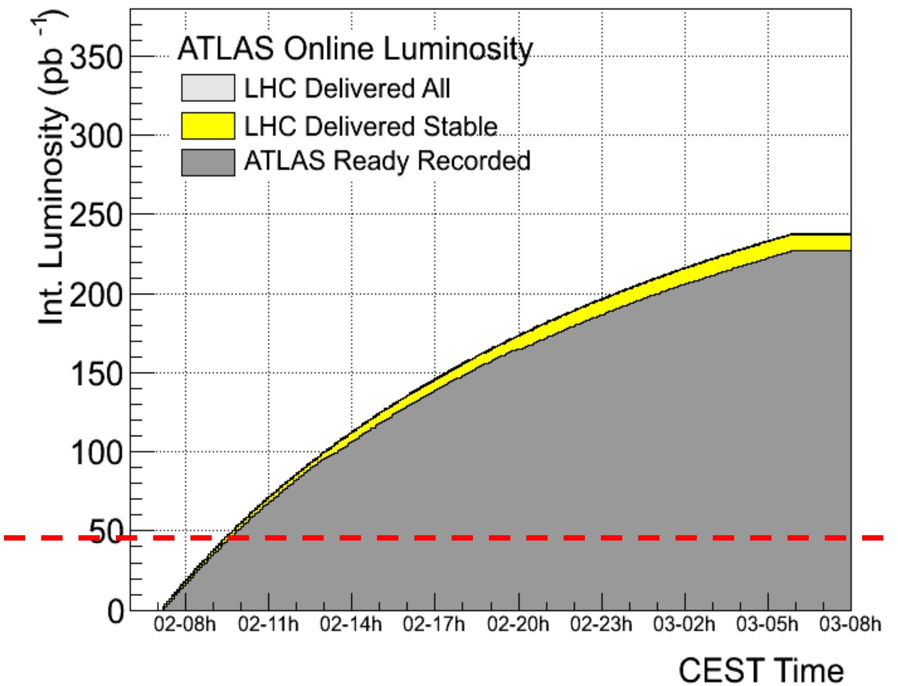


Performance in 2012

Saturday 2nd June

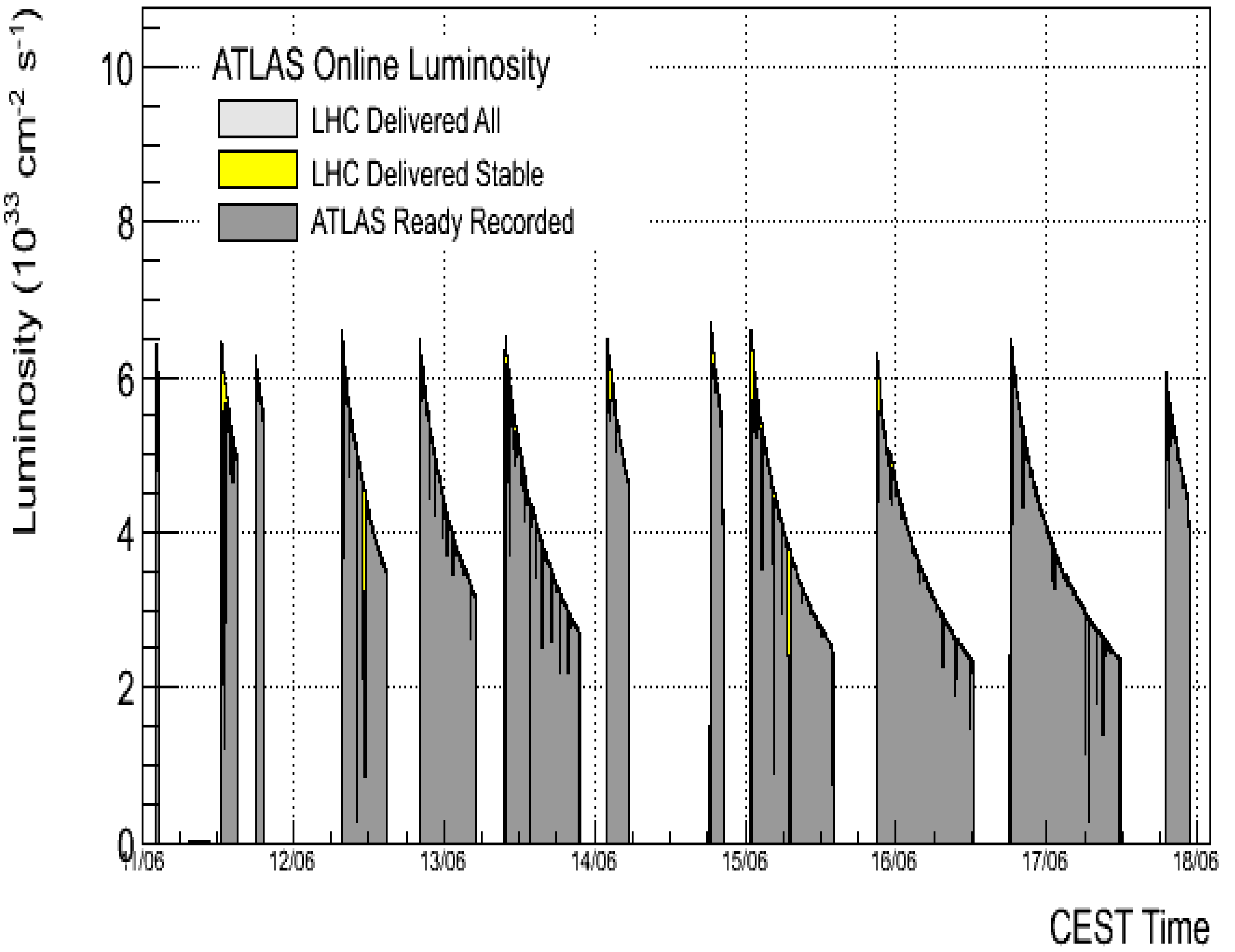
Fill 2692 (238pb-1 in 23 hours)



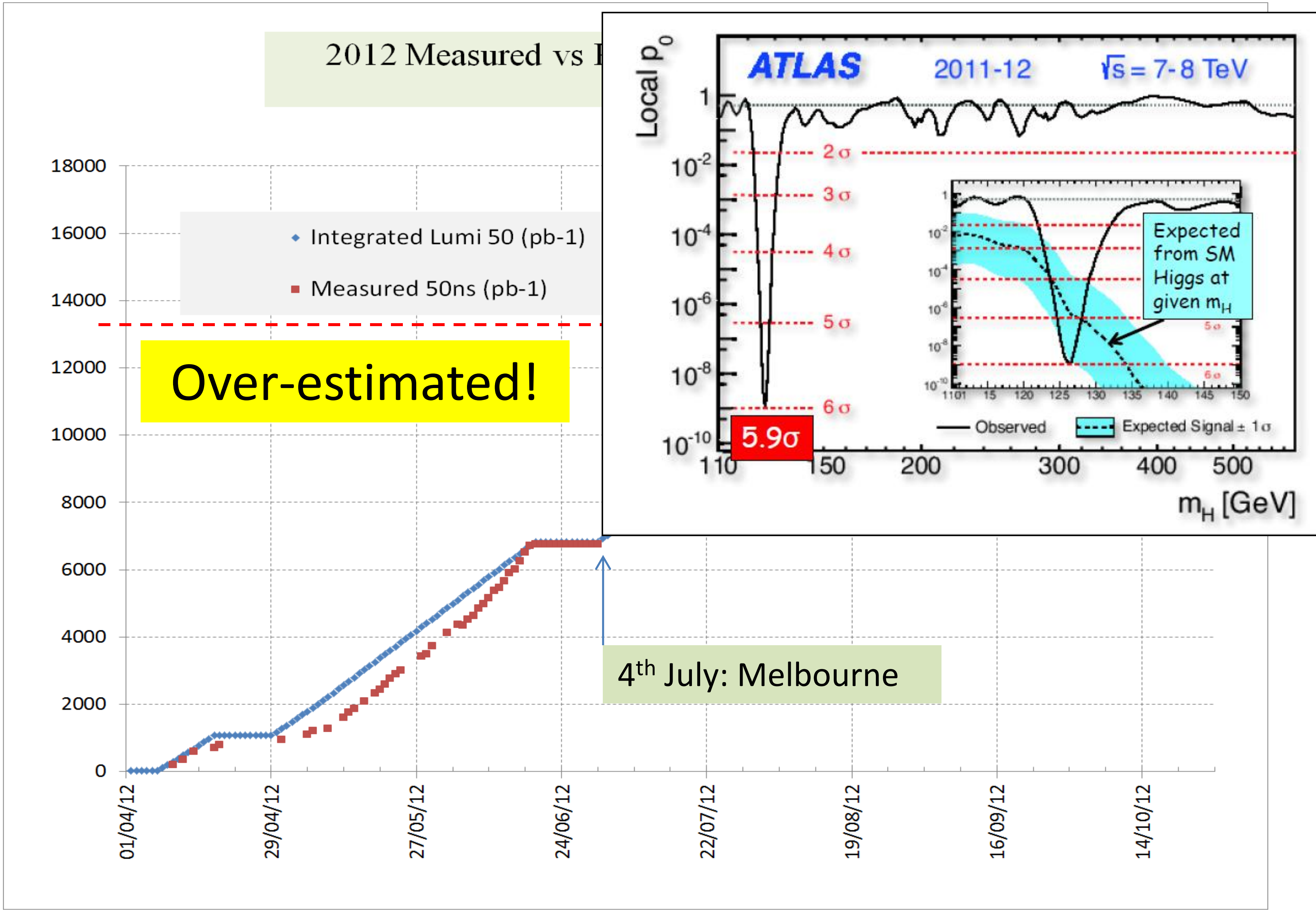


Integral of all of 2010
now in 2.5 hours

7 Days of production (1.35fb^{-1}) (June 10—16)

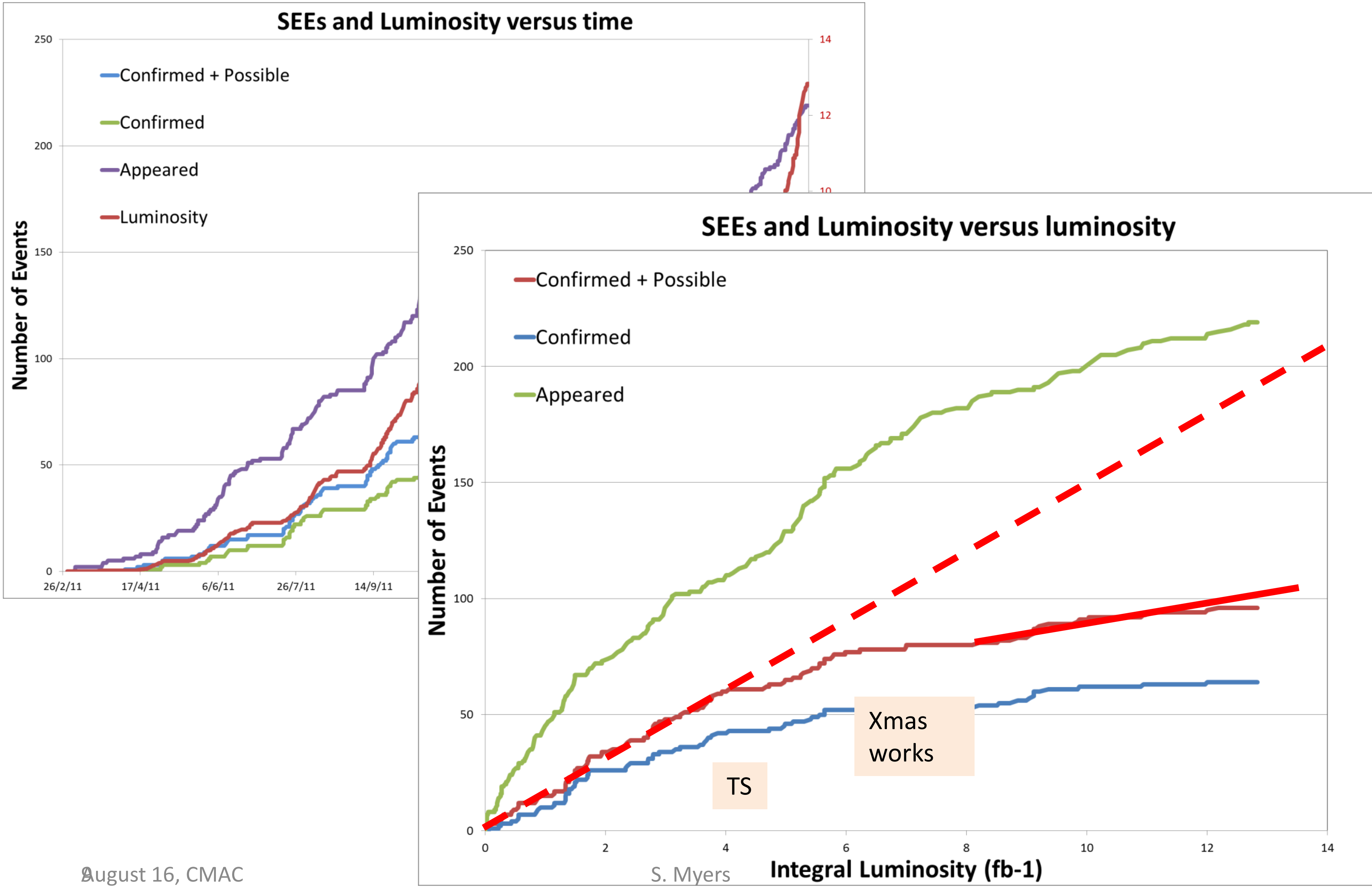


With Respect to estimates



Some Issues since the "Melbourne" Technical Stop

SEE Failures



Fills lost before stable beams

Elias Metral and Werner Herr

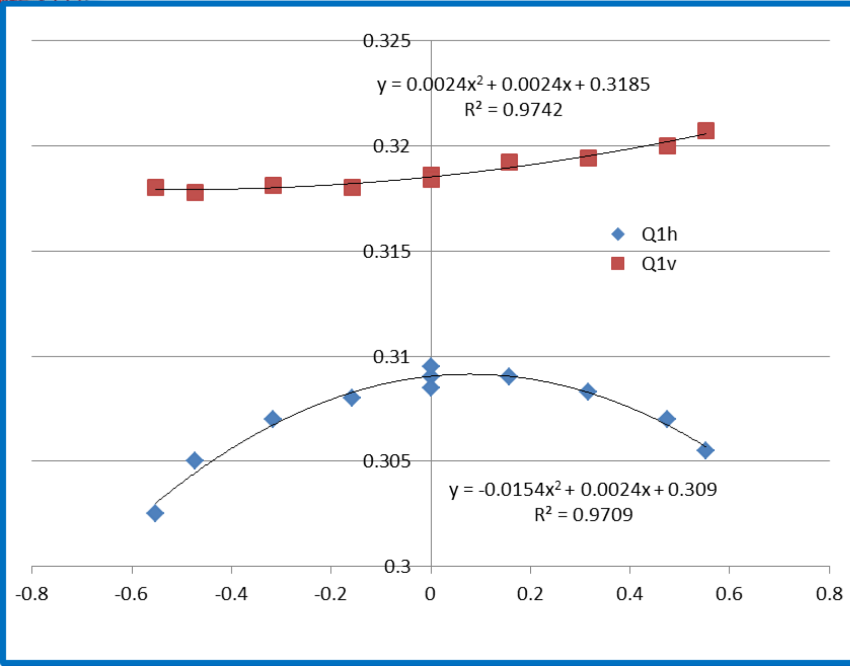
Fill	Comment
2857	RQ6.R7 trip (QPS) SUE?
2859	B2H instability at the end of the [illegible]
2860	B2H instability when going [illegible]n
2862	B2H instability when [illegible]ollision
2863	QFB dragged B2[illegible]ay.
2865	Heavy loss[illegible]cted B2 bunches.
2866	Insta[illegible] at the end of the squeeze
2883	[illegible]y B1H at the end of the squeeze
2897	In[illegible]ability B1H when going in collision

- Losses came with activity on H plane.
- After fill 2866 (4^{th} lost in a row) → intensity down to 1.35E11 ppb and slowly ramped up afterwards

Main loss categories at 4 TeV

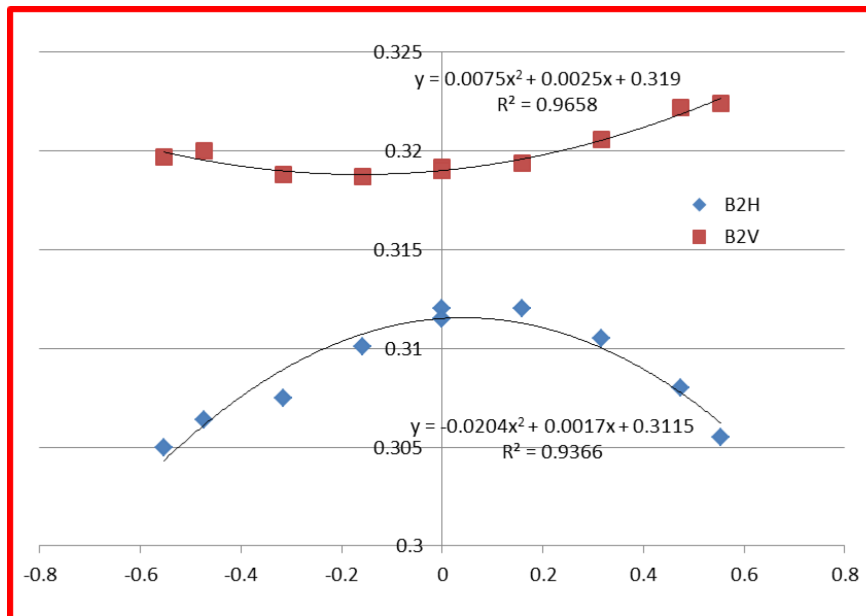
Phase	Type	Affected bunches	Comment
Squeeze	incoherent	~ all	Dominant problem after TS1. Tail losses with tight collimators. Also from bad tune at end of ramp.
Squeeze	coherent oscillations	subset	Rather rare events, but frequent loss cause during week-end week 29.
Adjust	coherent oscillations	subset	Occurs frequently in the phase where LHCb V crossing is ramped up or during pre-collapse of the separation in IP1/5?

Standard octupoles +417 A ROD

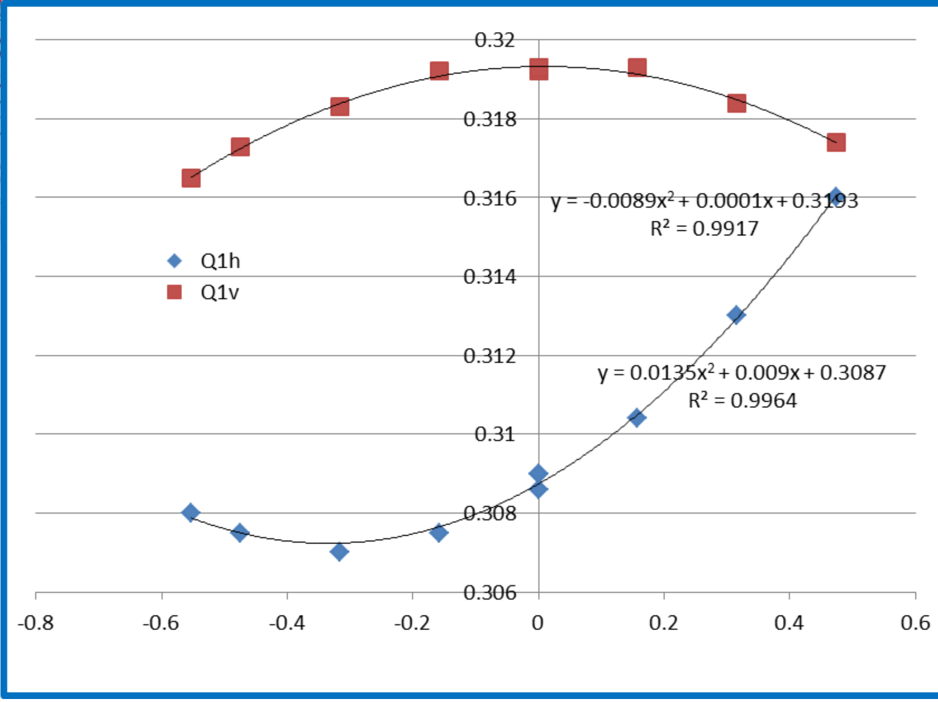


Beam	Plane	Q’
1	H	2.4
1	V	2.4
2	H	1.7
2	V	2.5

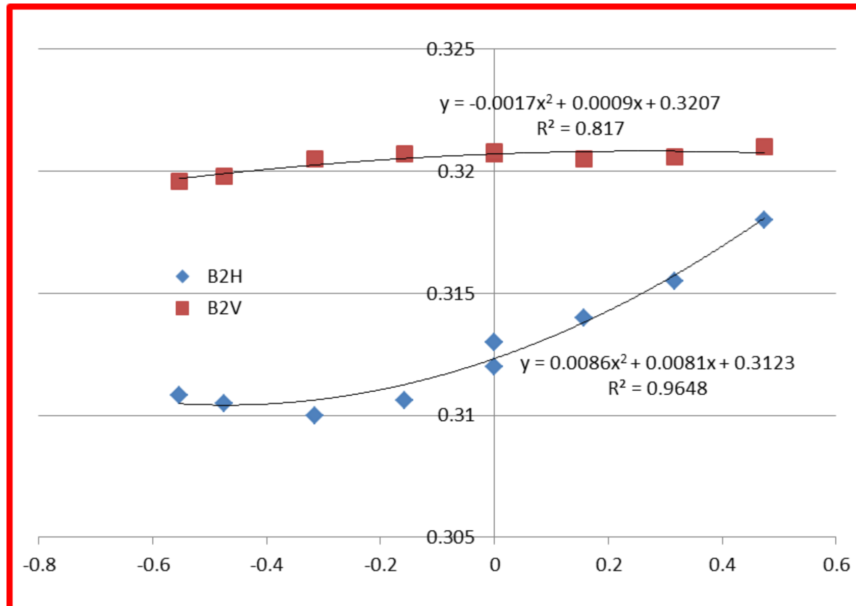
- Strong non linearity ➔ another reason to run with low octupoles (on top of the fact that this would not work at 7 TeV)



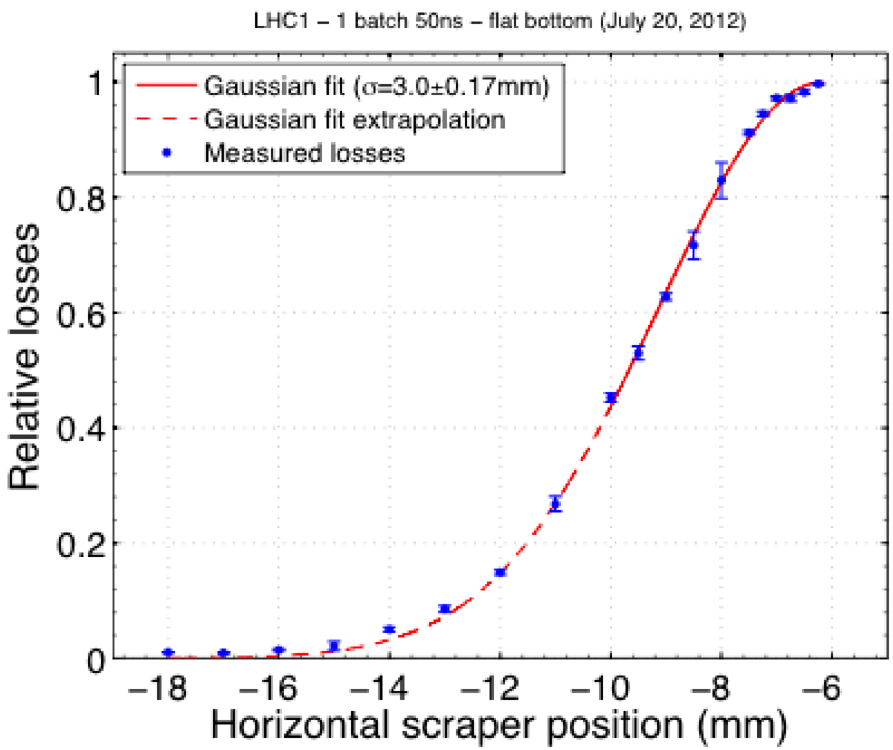
Octupoles (reversed polarity) -417 A ROD

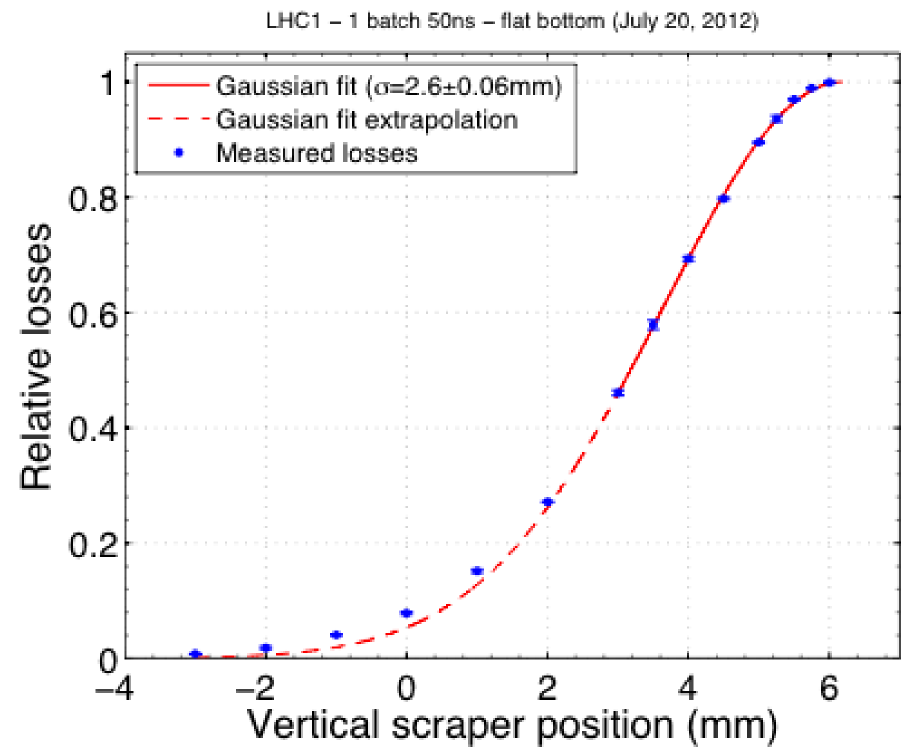


Beam	Plane	Q’
1	H	9.0
1	V	0.1
2	H	8.1
2	V	0.9

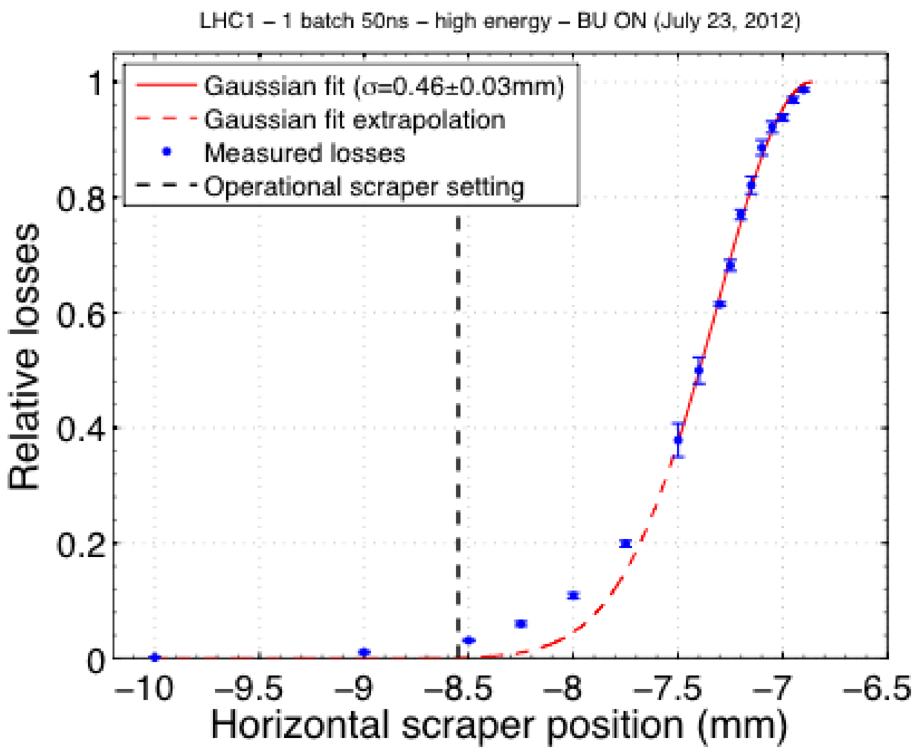


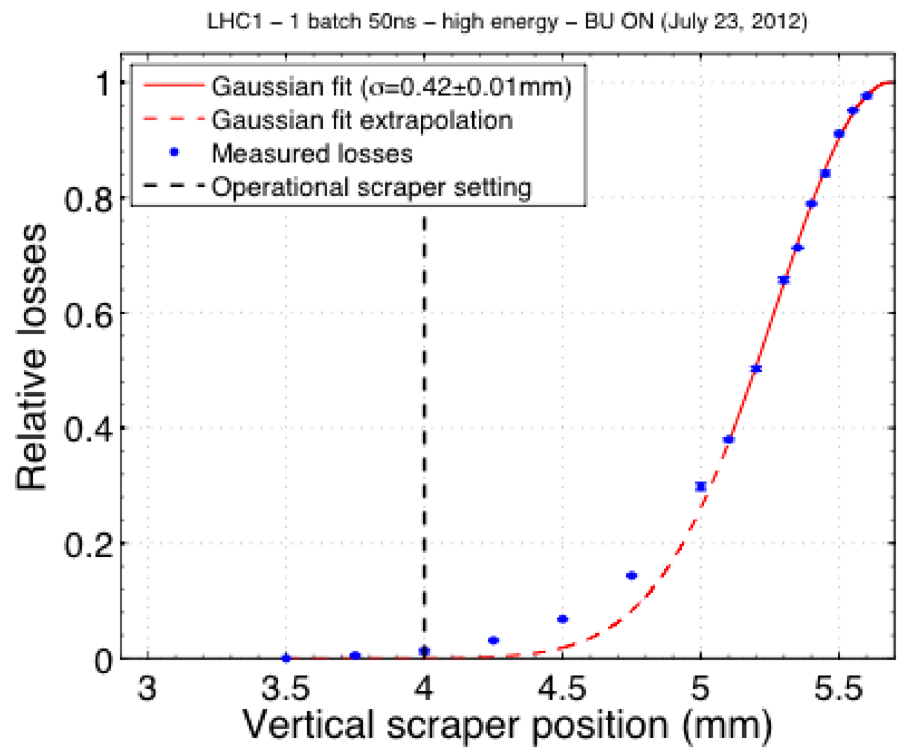
SPS tails: flat bottom (@2s)





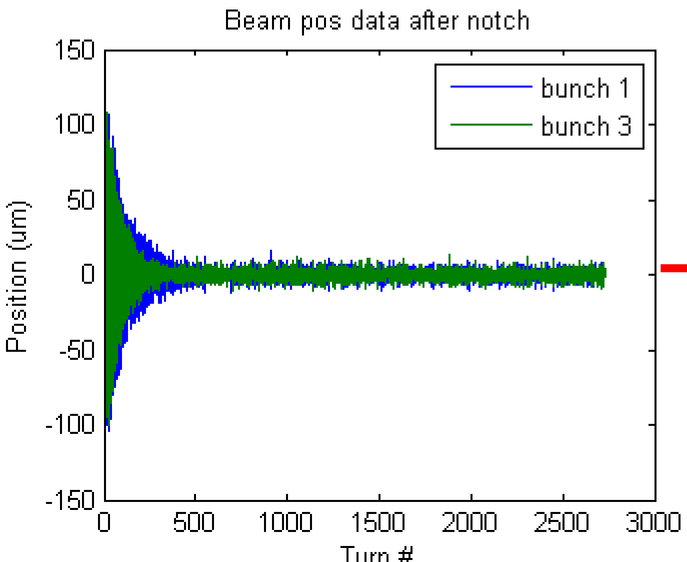
SPS tails: high energy (operational timing)

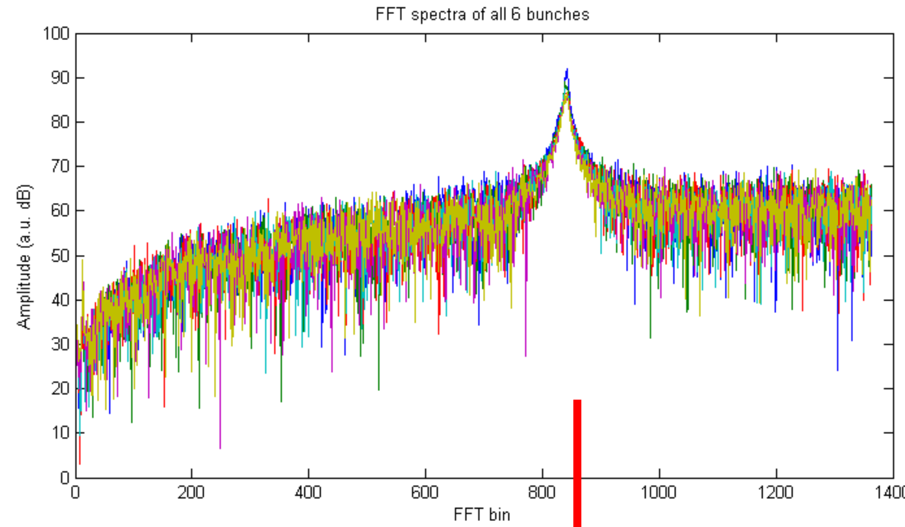


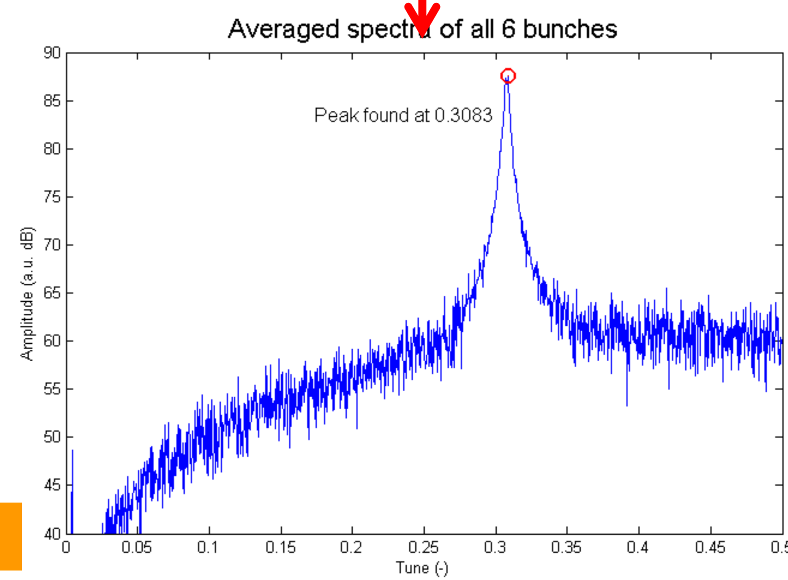


H. Bartosik, K. Cornelis, Y. Papaphilippou

ADT tune measurement test



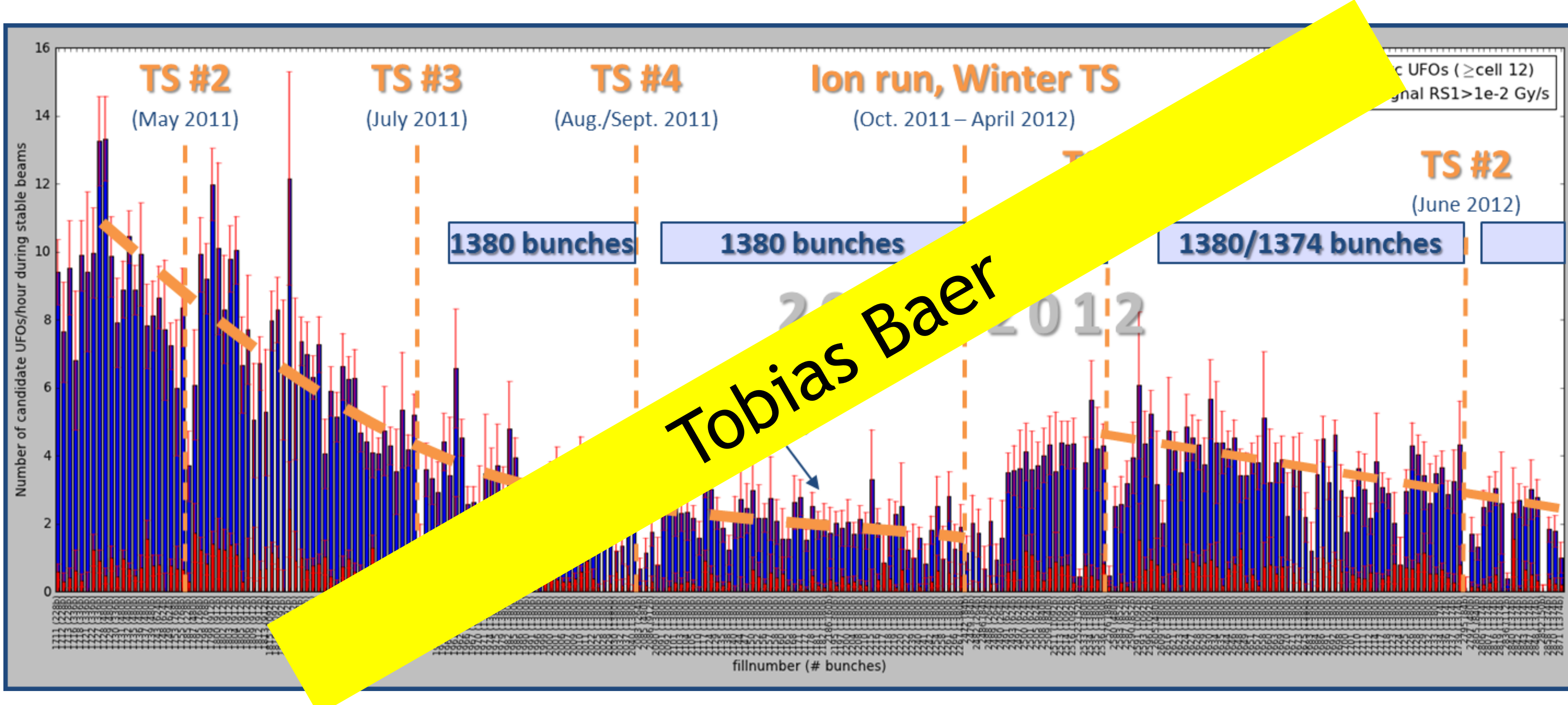




- Test tune measurement by selective excitation of 6 bunches.
- FFT of data for each observed bunch, average the spectra, find the peak
- Very successful test. Validation during a ramp required (including emittance blow-up measurement) + operational implementation

W. Höfle, D. Valuch

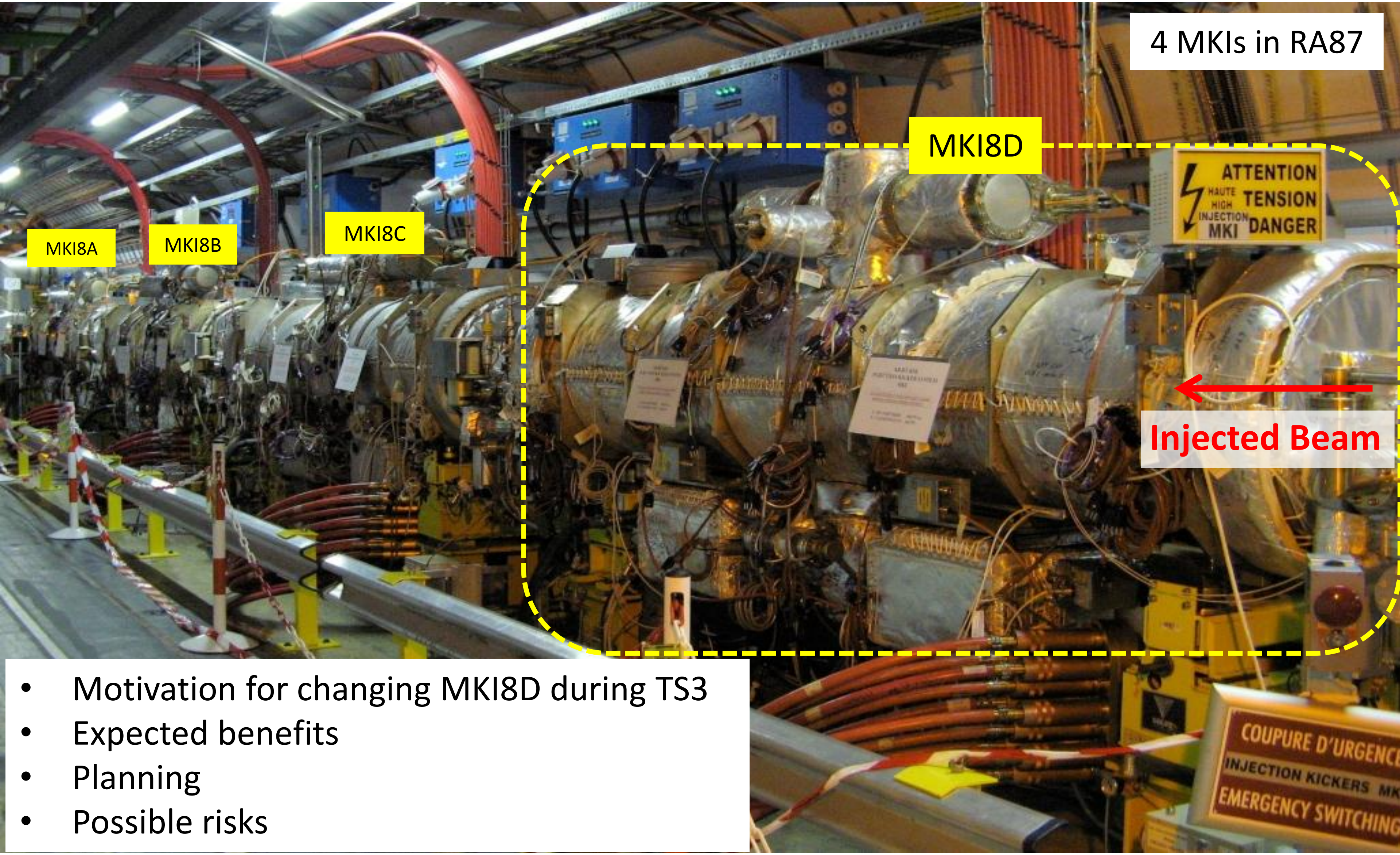
Arc UFO Rate



- 2011: Decrease from **≈10 UFOs/hour** to **≈2 UFOs/hour.**
- 2012: Initially, about **2.5 times higher** UFO rate compared to October 2011. **UFO rate decreases** since then.

7535 candidate arc UFOs during stable beams between 14.04.2011 – 23.07.2012. Fills with at least 1 hour stable beams are considered. Signal RS04 > 2·10^{-4} *Gy/s.*

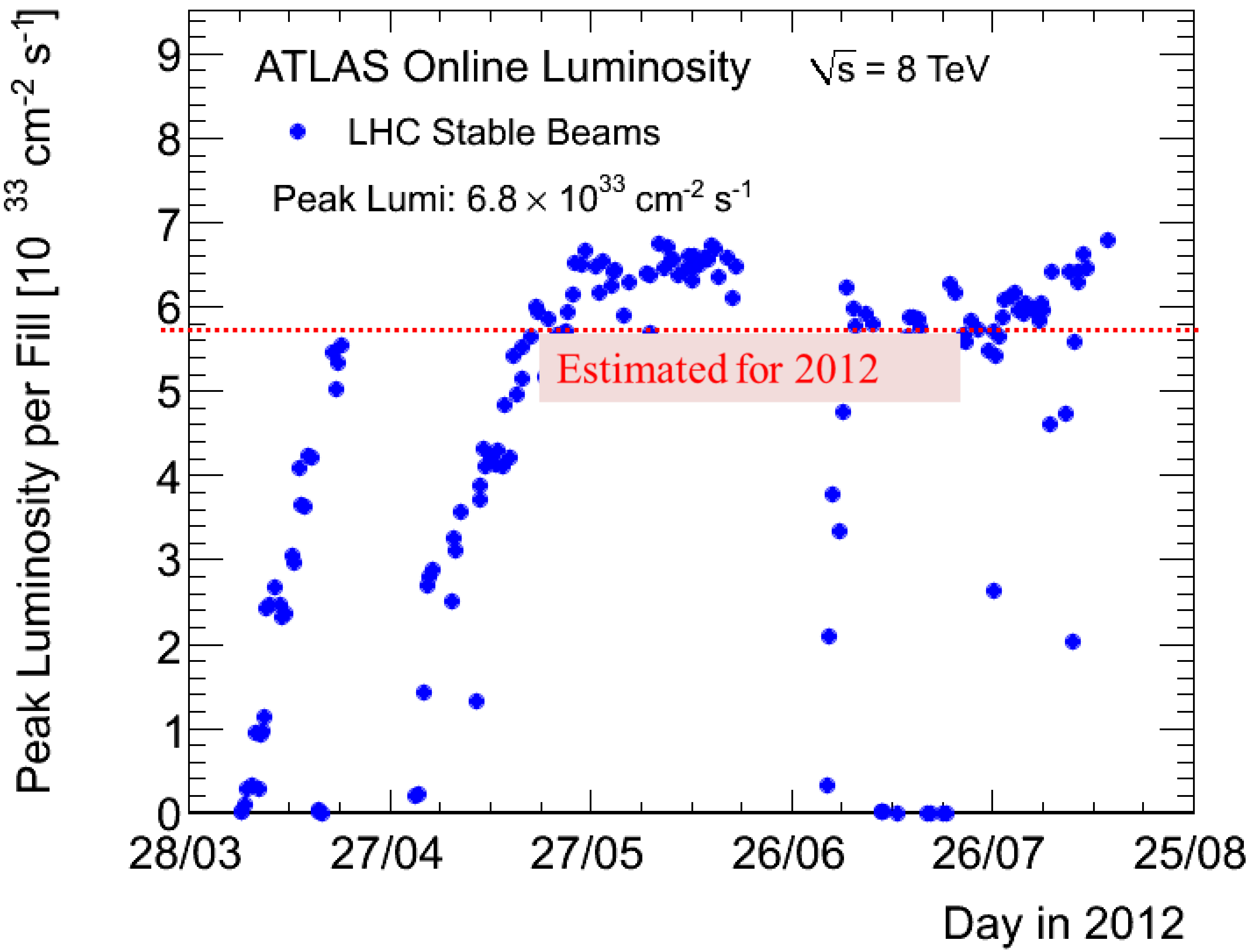
Outline



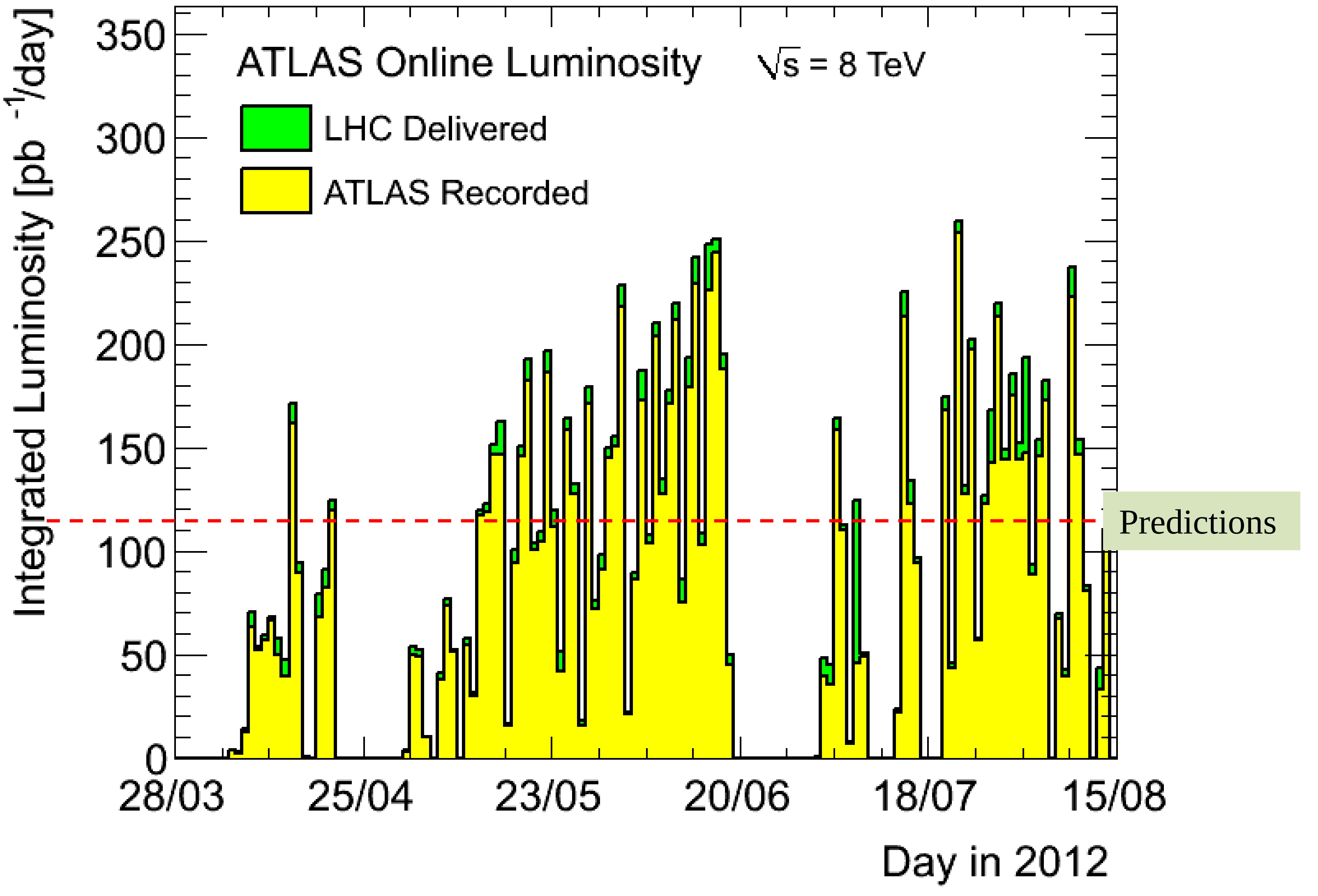
- Motivation for changing MKI8D during TS3
- Expected benefits
- Planning
- Possible risks

Up to the Minute Status

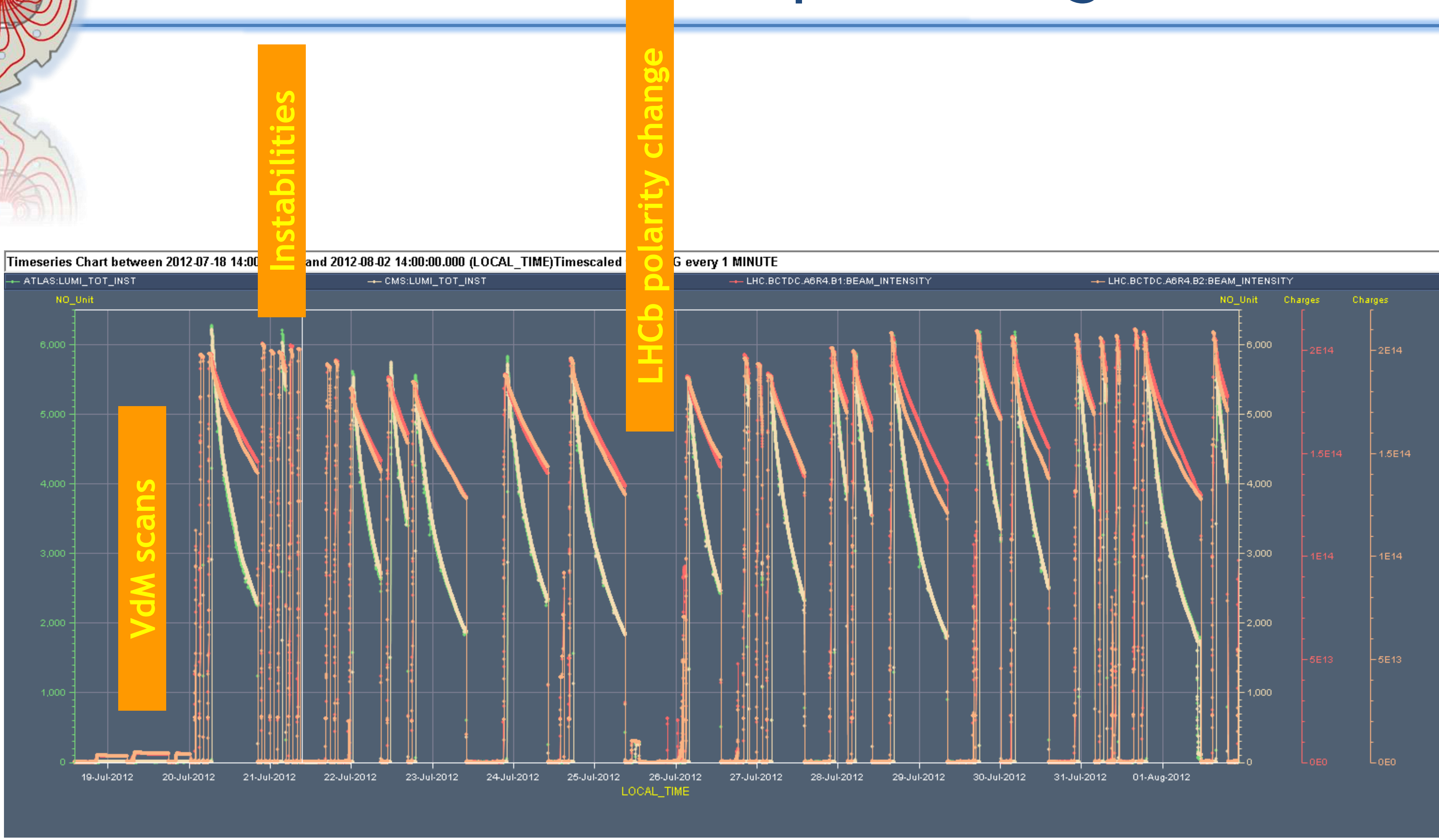
Peak Luminosity (August 16)



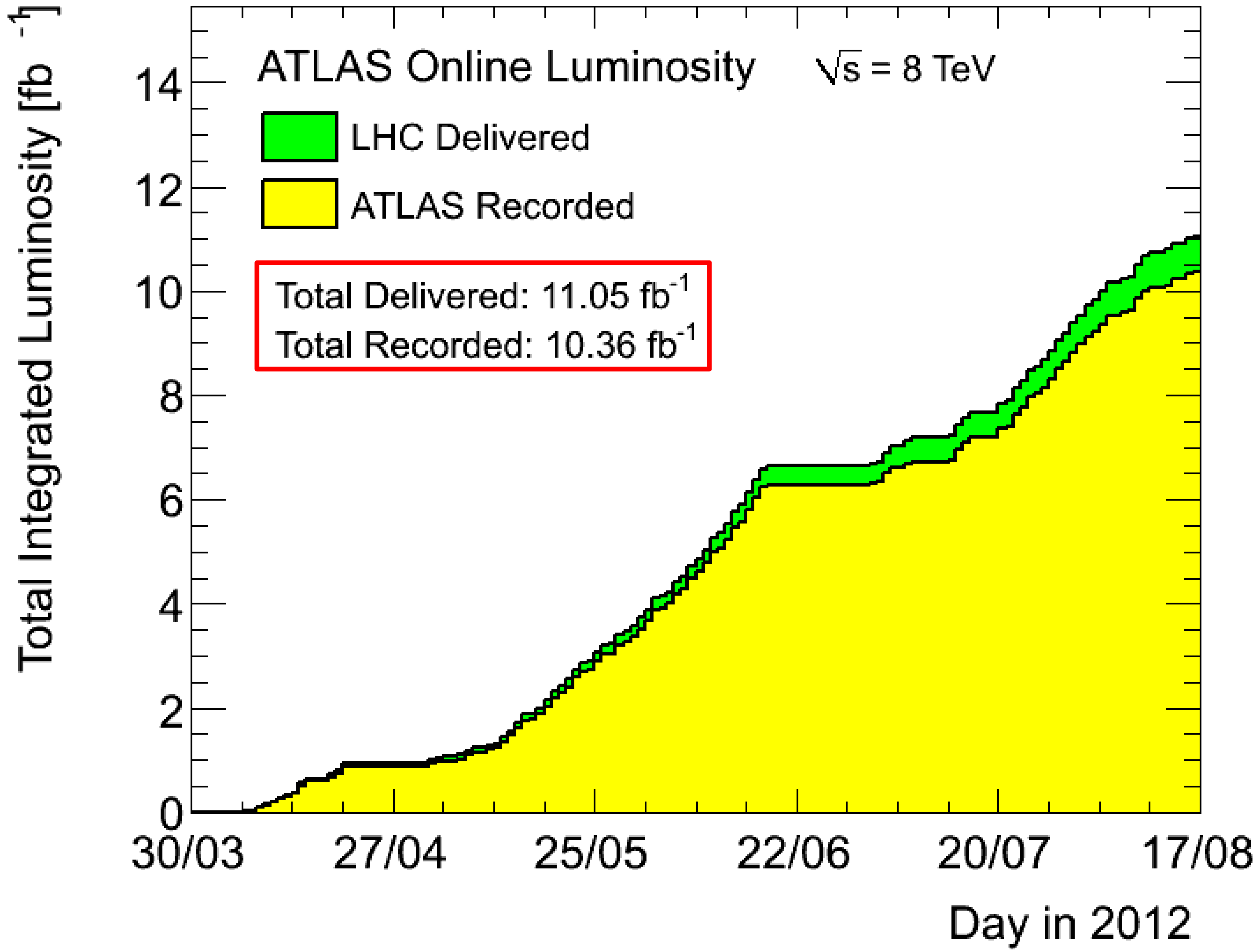
Integrated Luminosity per Day



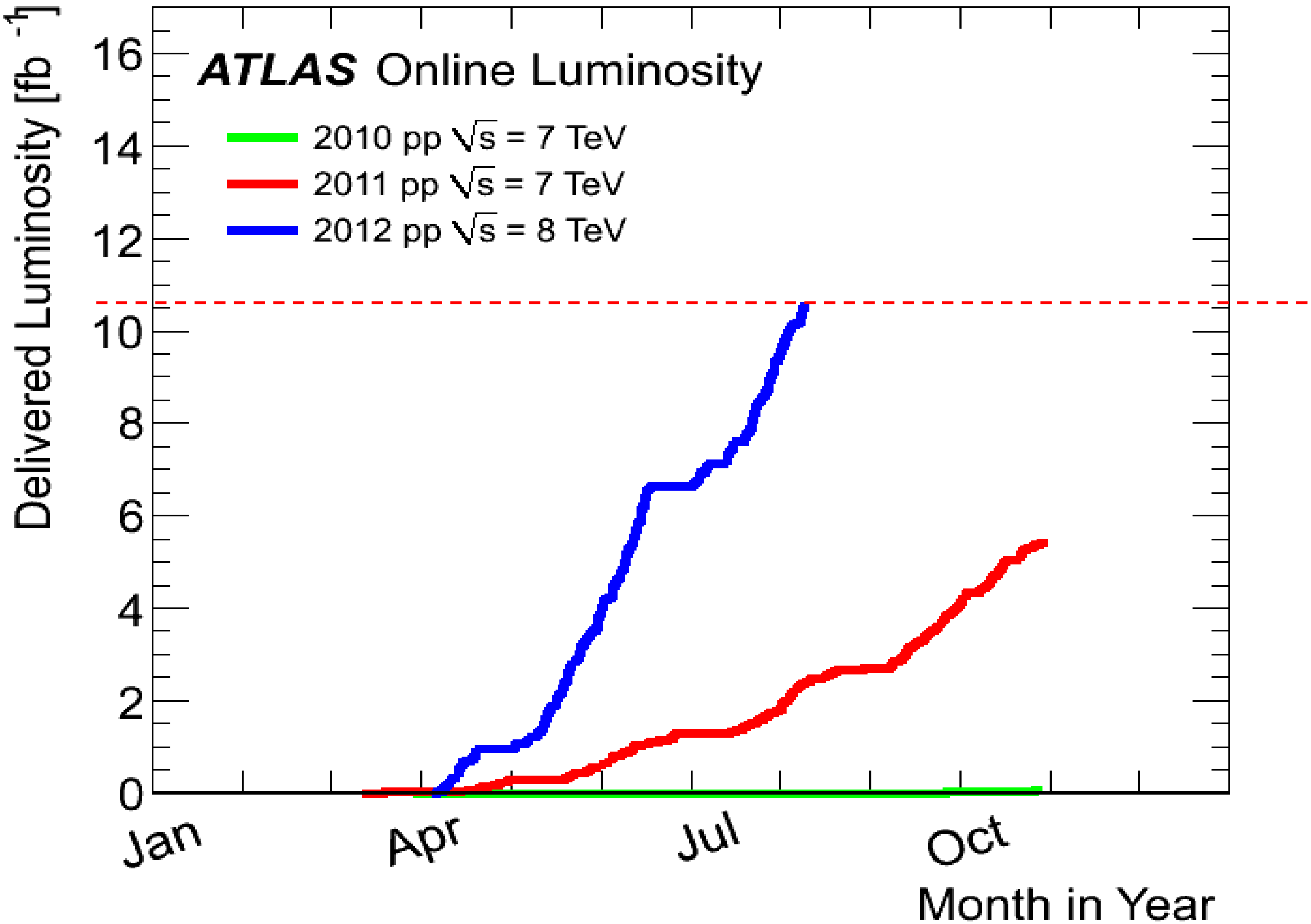
2 weeks up to 2 August



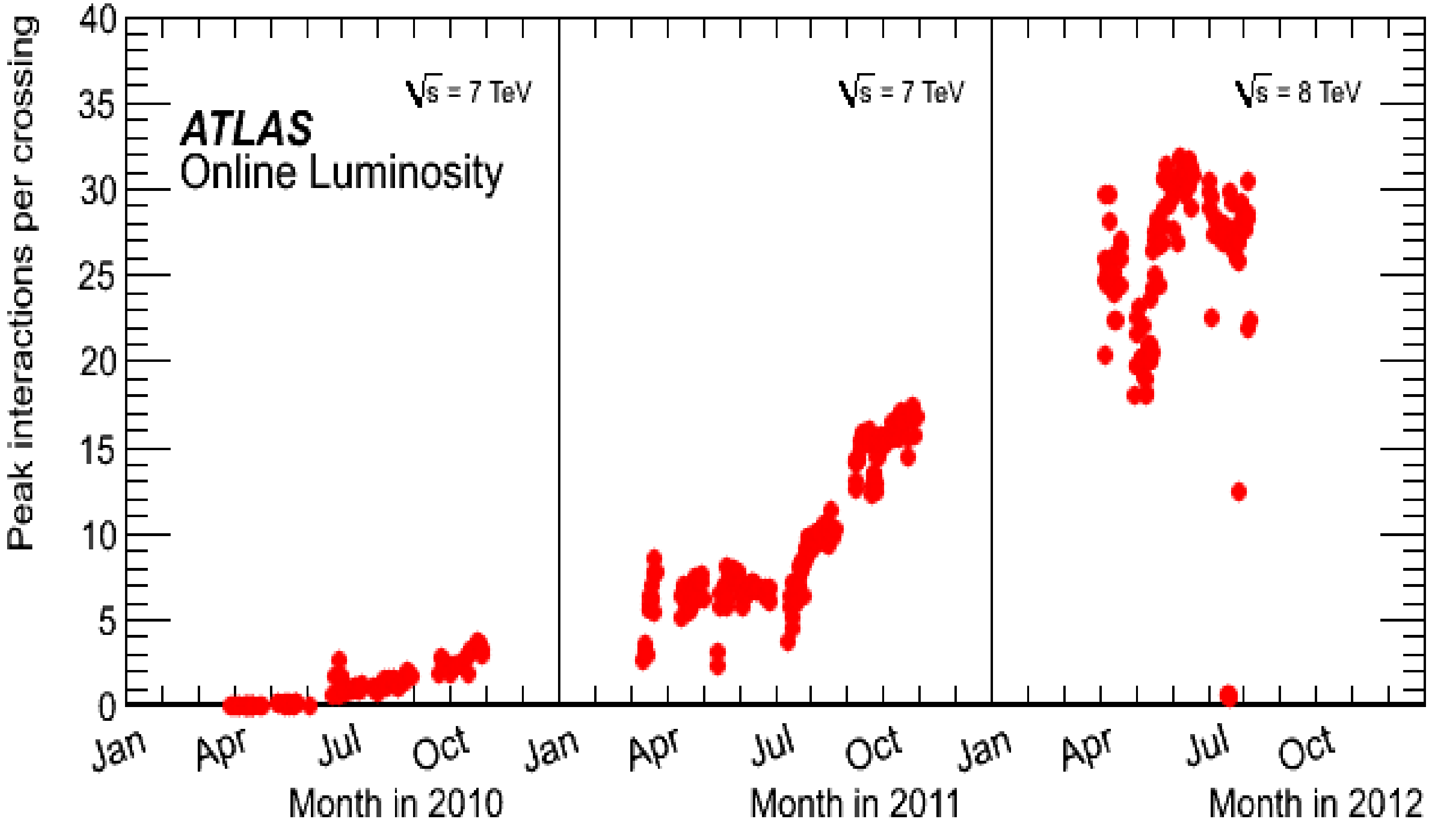
Integrated from ATLAS (August 16)



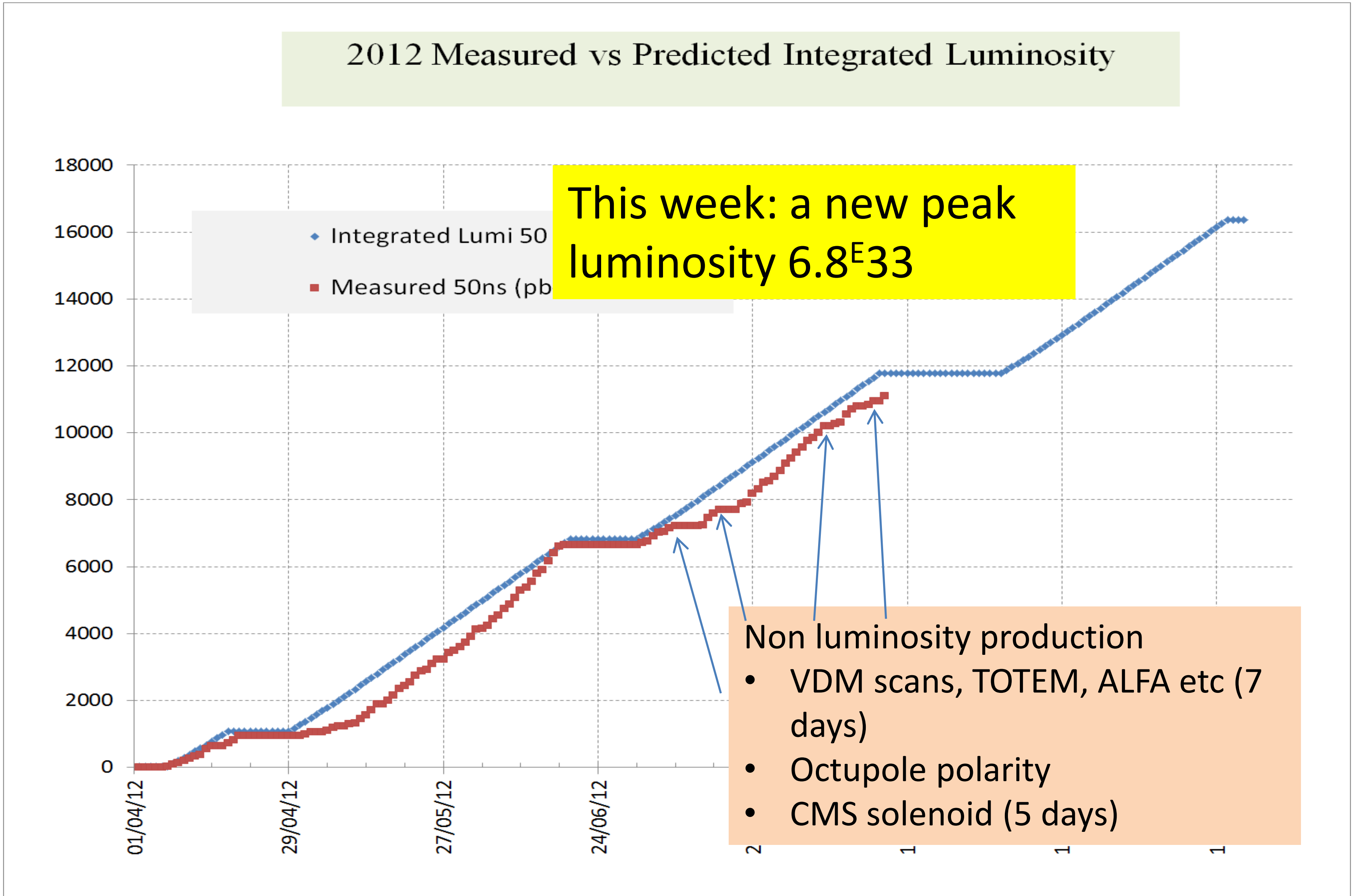
Evolution of Integrated Luminosity (August 16)



Pile Up


ATLAS
Online Luminosity
√s = 7 TeV
√s = 7 TeV
√s = 8 TeV
Peak interactions per crossing
0
5
10
15
20
25
30
35
40
Jan
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Month in 2010
Month in 2011
Month in 2012

Where are we on Aug 16



Q3/Q4 2012 New schedule 8th August

Scrubbing run

July | Aug | Sep

Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	2	9	VdM scans [48 h]	23	30	6	13	20	27	3	Floating MD [pA]	17	24
Tu		Floating MD [48 h]									500+ m [24 h]		
We											Pilot pA run	TS3	
Th		90 m [24 h]								J. Genevois			
Fr	90 m [24 h]												
Sa												ALICE flip	
Su													

96 days to go

Oct | Nov | Dec

Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	1	8	15	22	29	5	12	19	26	3	10	17	24
Tu													Xmas
We				[24 h]									
Th				Floating MD [24 h]								Christmas technical stop	
Fr													
Sa													
Su													

Scrubbing and 25ns: Miguel Jimenez and Brennan Goddard

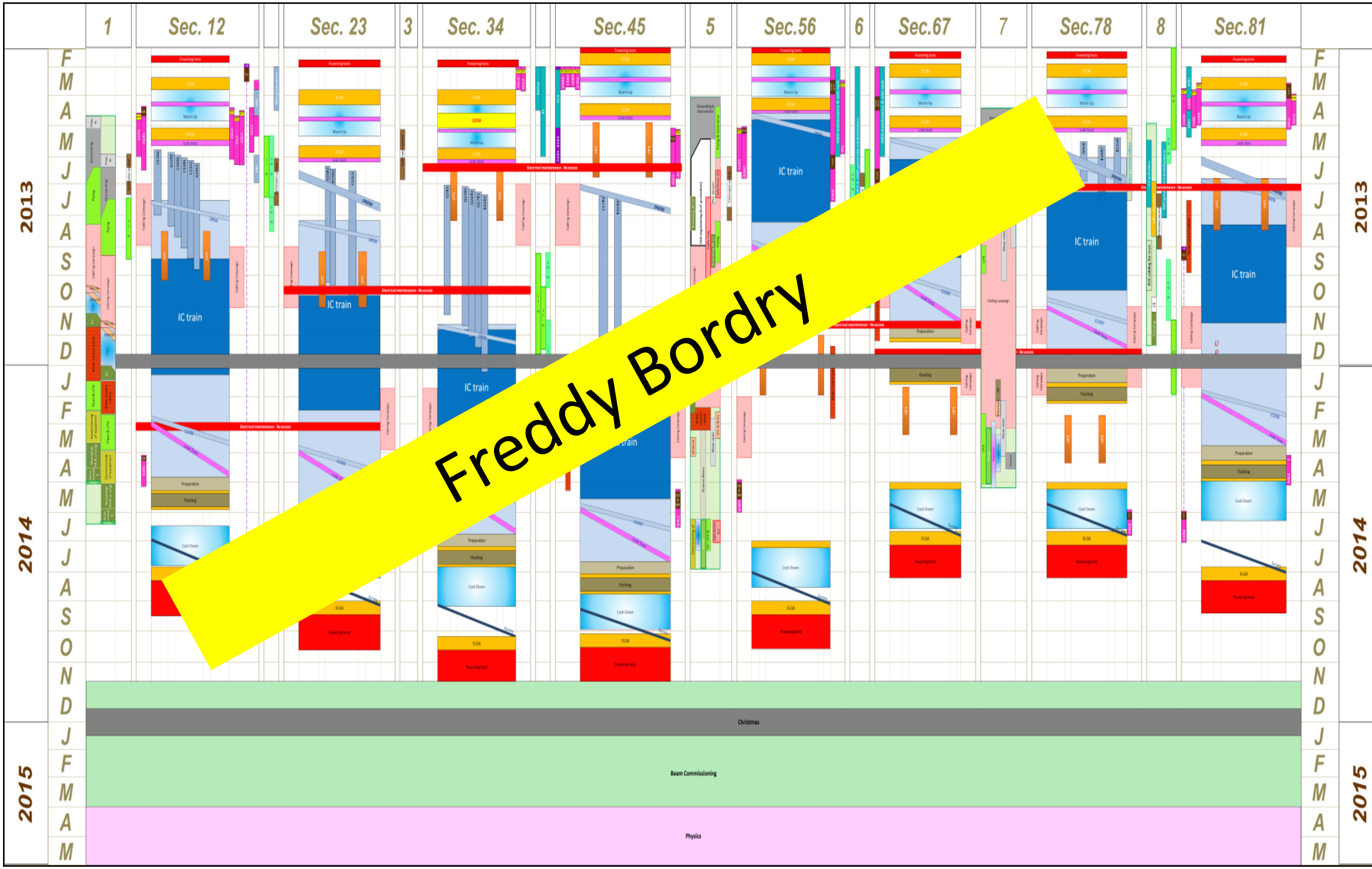
FUTURE

LS1 then operation around 7TeV/beam

LS1 Work

- Repair defectuous interconnects
- Consolidate all interconnects with new design
- Finish off pressure release valves (DN200)
- Bring all necessary equipment up to the level needed for 7TeV/beam

Linear schedule



EDMS 1227656 (rev1.0, July 26th, 2012)

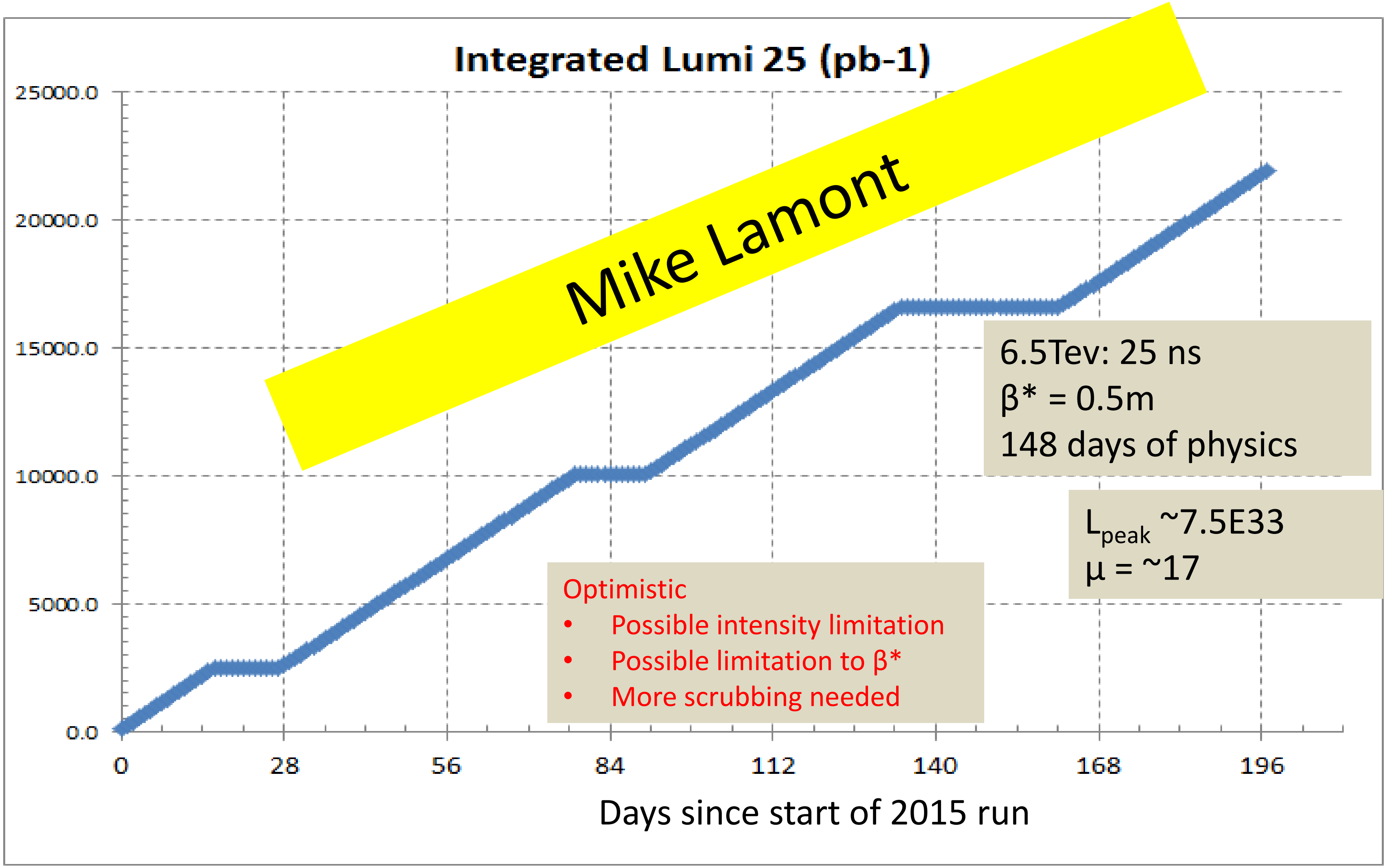
No contingency

Then operation at 6.5TeV per beam

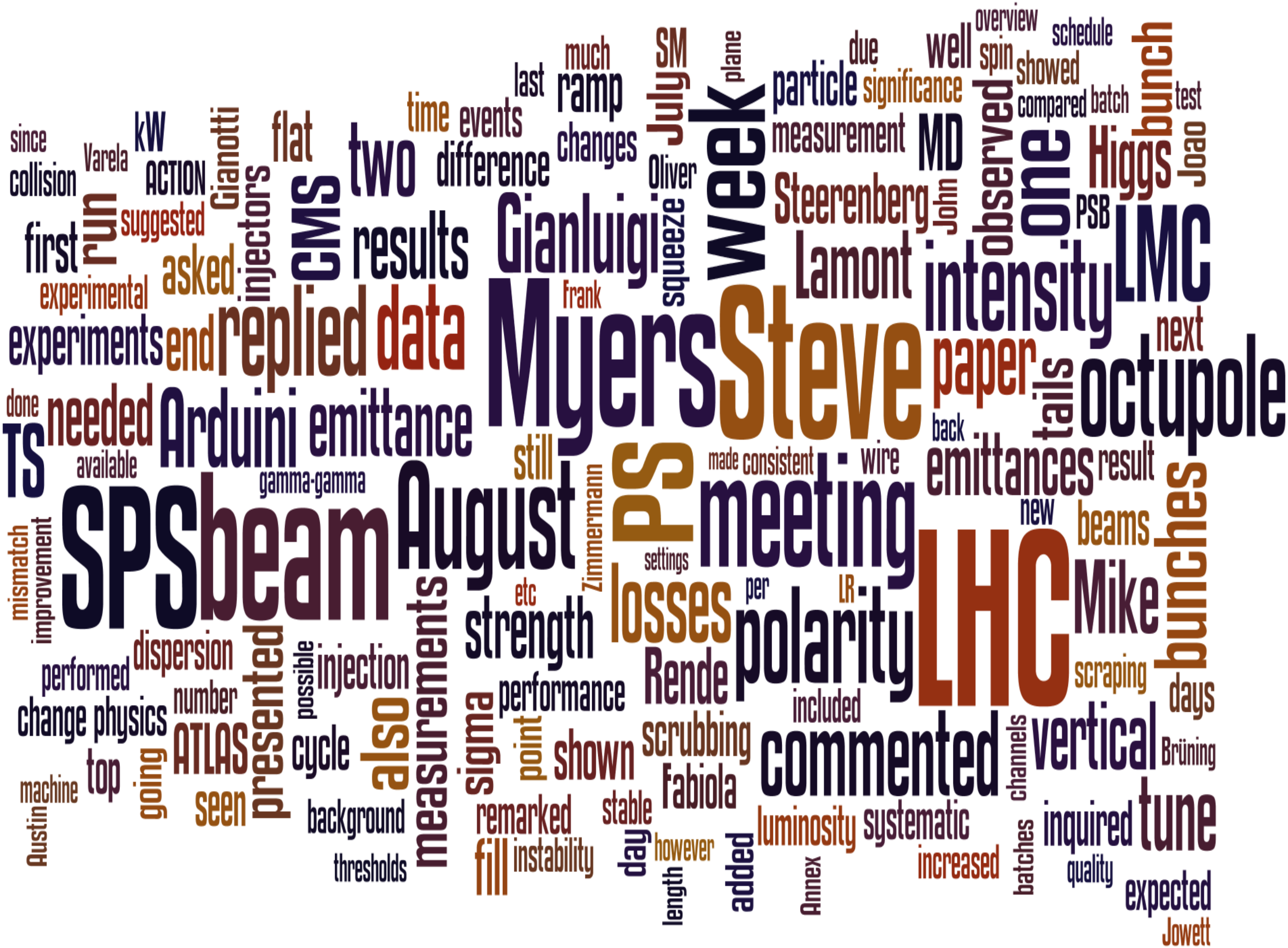
Assumptions

- E=6.5TeV
- β^* = 0.5m
- All other conditions as in 2012 i.e. no improvement (yet ??) in injector brightness, LHC availability same etc

6.5TeV: 25ns



Integrated Lumi 25 (pb-1)
Mike Lamont
25000.0
20000.0
15000.0
10000.0
5000.0
0.0
0
28
56
84
112
140
168
196
Days since start of 2015 run
6.5Tev: 25 ns
β* = 0.5m
148 days of physics
L peak ~7.5E33
μ = ~17
Optimistic
• Possible intensity limitation
• Possible limitation to β*
• More scrubbing needed


since
collision
Varela
kW
ACTION
Gianotti
first
run
suggested
asked
experimental
injectors
CMS
flat
two
time
events
last
much
ramp
changes
difference
results
Gianluigi
squeeze
Oliver
SM
July
plane
week
due
particle
significance
well
overview
spin
showed
schedule
compared
batch
test
bunch
measurement
MD
observed
one
Higgs
Joao
Steerenberg
John
PSB
Lamont
intensity
LMC
Frank
Myers
Steve
experiments
end
replied
data
paper
next
tails
octupole
done
needed
Arduini
emittance
TS
available
still
back
gamma-gamma
made
consistent
wire
emittances
result
SPS
beam
August
PS
meeting
Zimmermann
new
beams
bunches
mismatch
improvement
settings
etc
losses
per
LR
LHC
Mike
strength
polarity
dispersion
performed
number
presented
possible
injection
measurements
Rende
scraping
change
physics
performance
included
days
ATLAS
cycle
also
sigma
point
shown
scrubbing
commented
vertical
channels
Brüning
top
machine
going
seen
Fabiola
tune
background
remarked
stable
luminosity
systematic
inquired
Austin
day
however
thresholds
fill
instability
added
increased
batches
quality
expected
length
Annex
Jowett

Thank you for your attention

120810 CameliaDemoHiggs.avi

European Organization for Nuclear Research
Organisation Européenne pour la Recherche Nucléaire

update on UFOs:
2012 Observations, Studies and Extrapolations

LMC 143

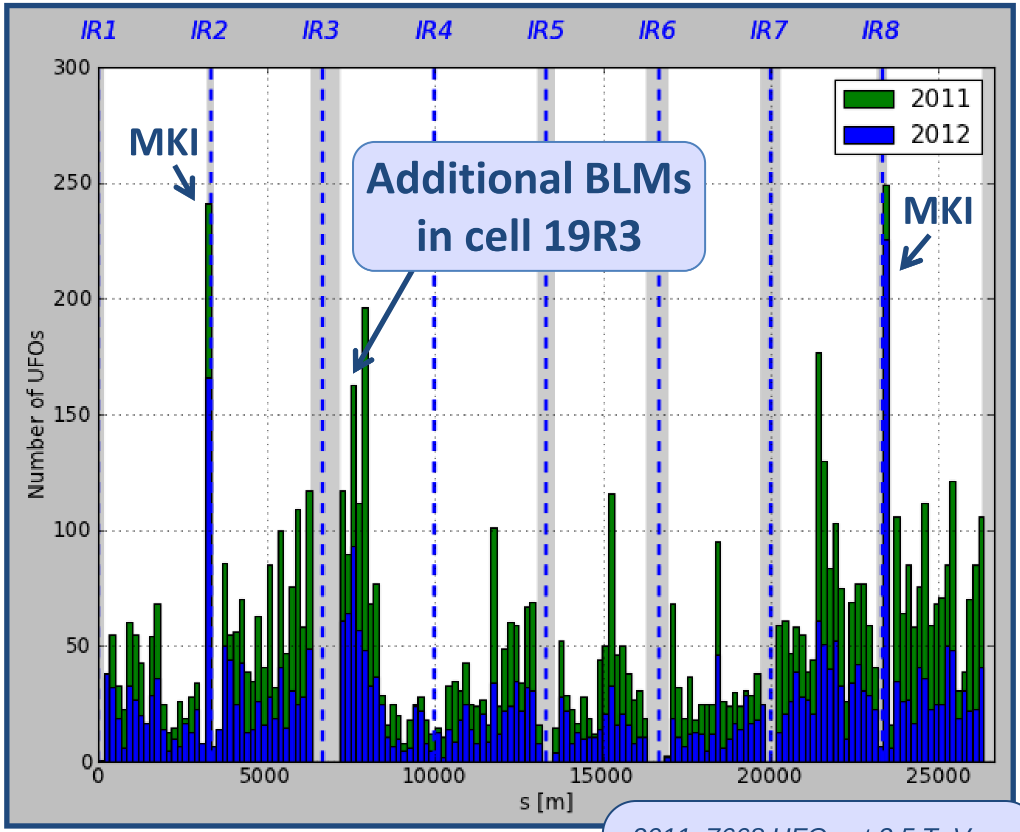
Tobias Baer
August, 2nd 2012

Acknowledgements: M.J. Barnes, C. Bracco, F. Cerutti, B. Dehning, L. Ducimetière, A. Ferrari, N. Fuster Martinez, N. Garrel, A. Gerardin, B. Goddard, M. Hempel, E.B. Holzer, S. Jackson, M.J. Jimenez, V. Kain, A. Lechner, V. Mertens, M. Misiowiec, R. Morón Ballester, E. Nebot del Busto, A. Nordt, S. Redaelli, J. Uythoven, B. Velghe, V. Vlachoudis , J. Wenninger, C. Zamantzas, F. Zimmermann, …

Spatial UFO Distribution

- **Distribution very similar to 2011.**
- Many UFOs around MKIs.
- Some arc cells with significantly increased number of UFOs:

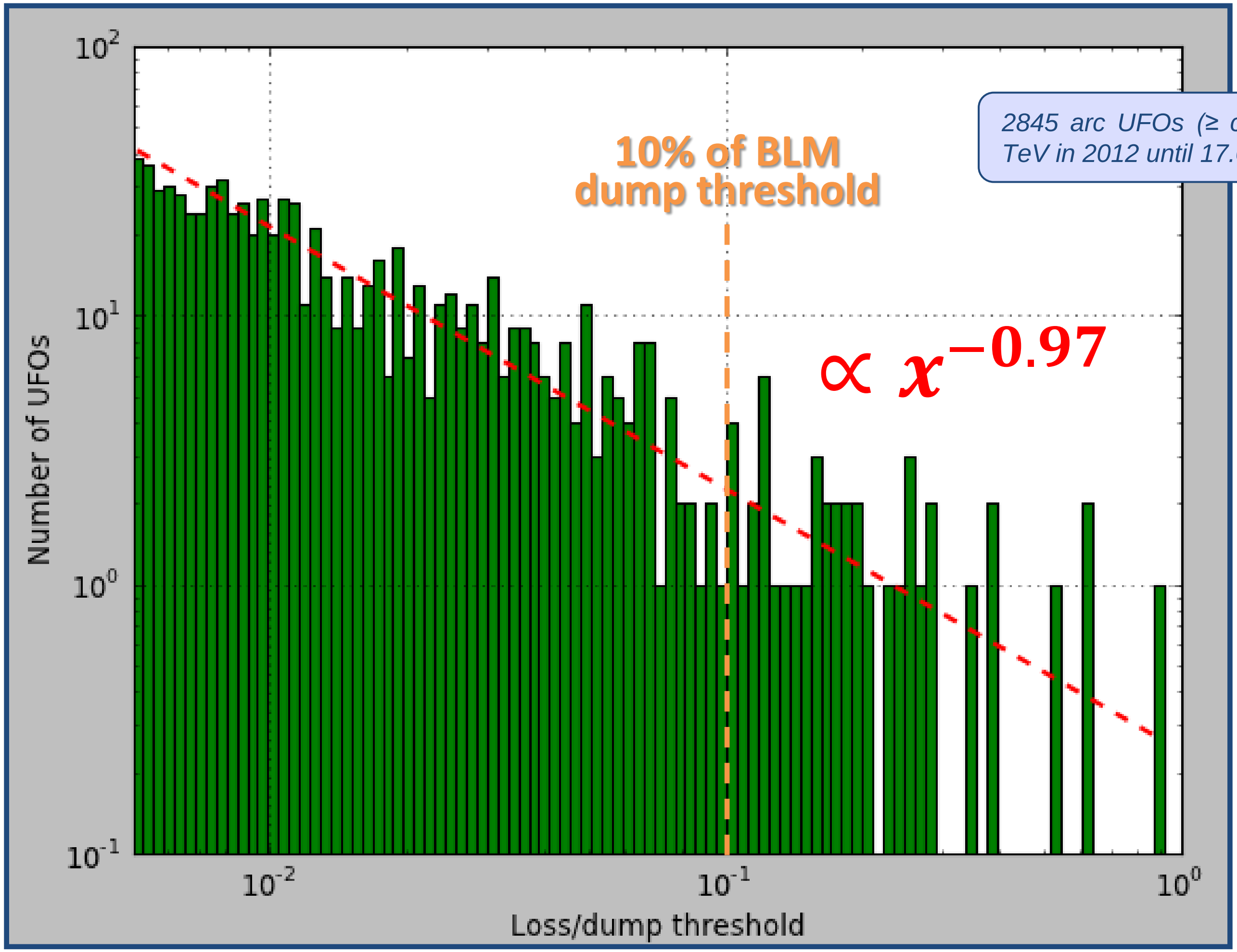
  19R3 B1, 25R3 B2, 28L6 B2, 28R7 B2, …



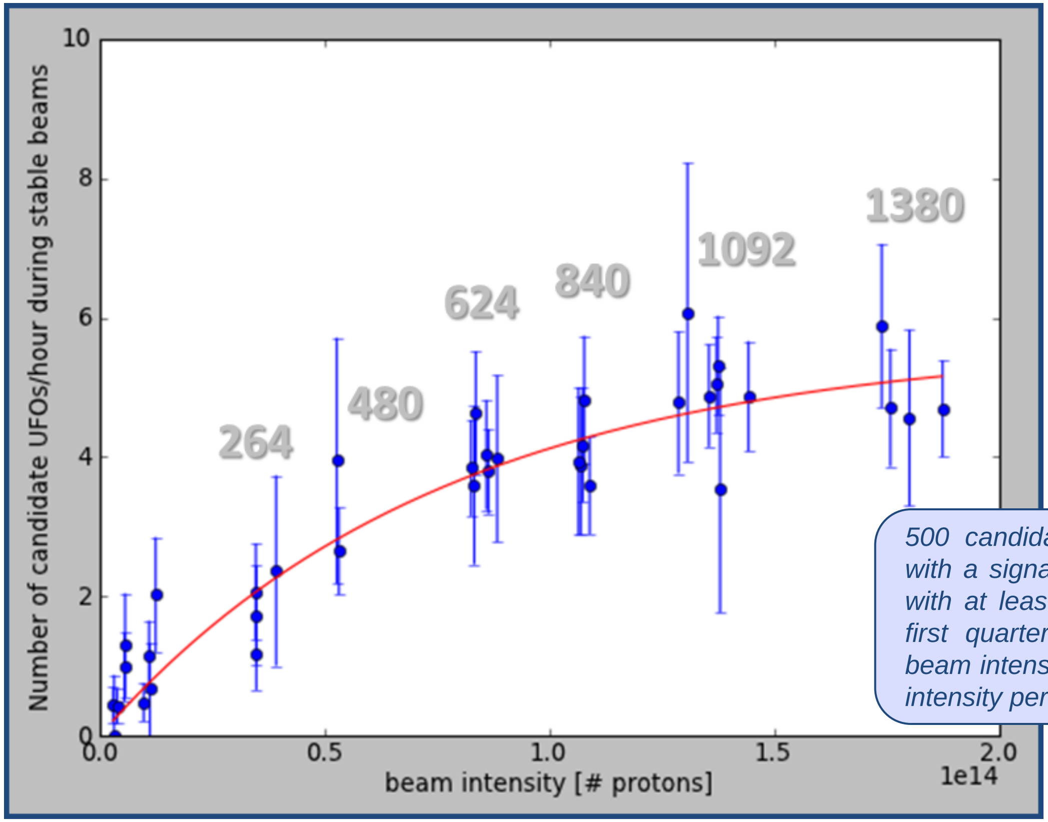
2011: 7668 UFOs at 3.5 TeV.
2012: 3719 UFOs at 4 TeV.
Signal RS04 > $2 \cdot 10^{-4}$ Gy/s.
Gray areas around IRs are excluded from the analysis.

Arc UFO Size

- **44 UFOs over 10% of dump threshold** in 2012 so far (at 4 TeV).



Intensity Dependency

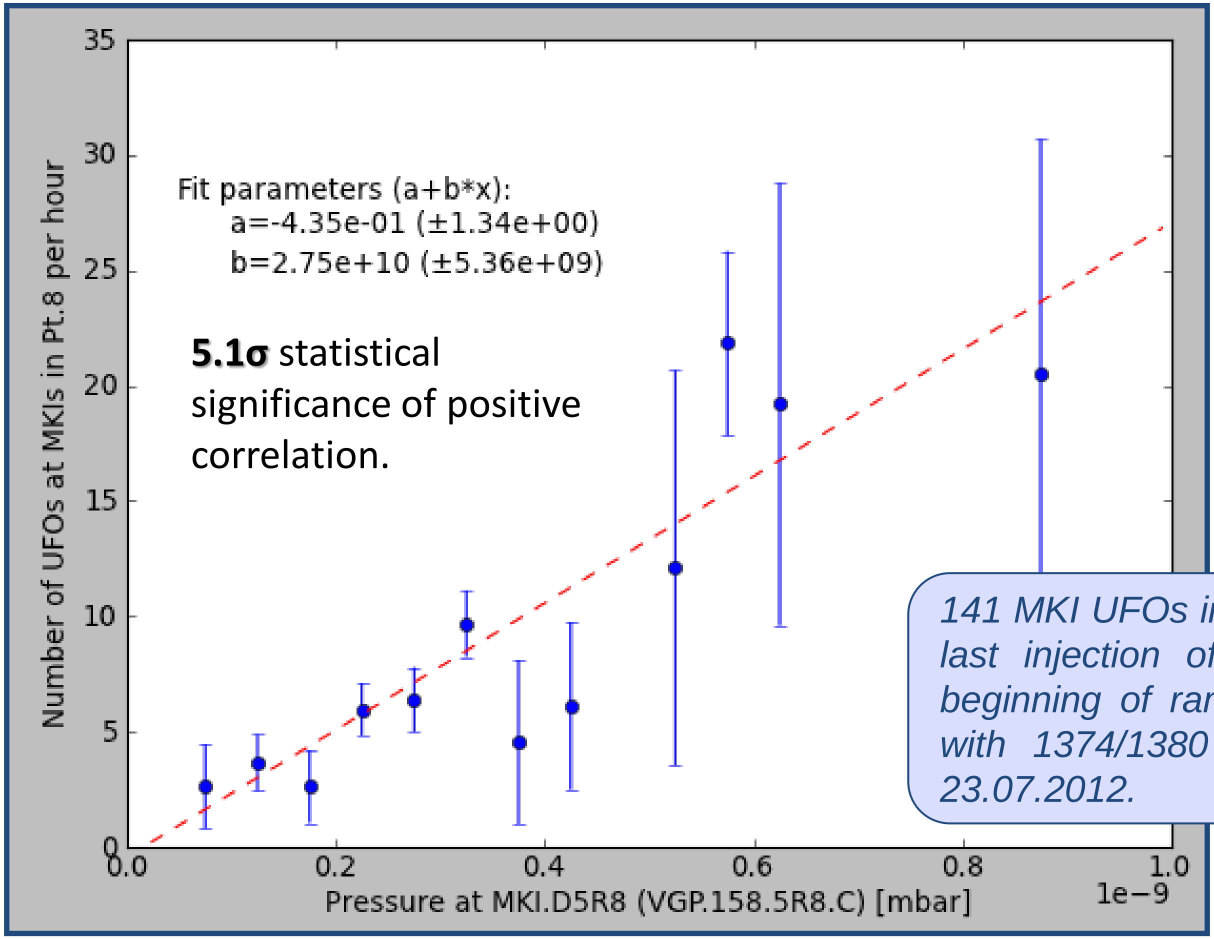


500 candidate UFOs during stable beams with a signal in RS04 > $2\cdot10^{-4}$ Gy/s. 28 fills with at least 1 hour in stable beams in the first quarter of 2012 are considered. The beam intensity is computed as the maximum intensity per fill, averaged over both beams.

For low intensities: **UFO rate ∝ Intensity,** saturates at high intensities.

consistent with previous analysis (cp. E. Nebot, IPAC'11).

Vacuum Correlation



141 MKI UFOs in Pt. 8 between last injection of beam 2 and beginning of ramp for 178 fills with 1374/1380 bunches until 23.07.2012.

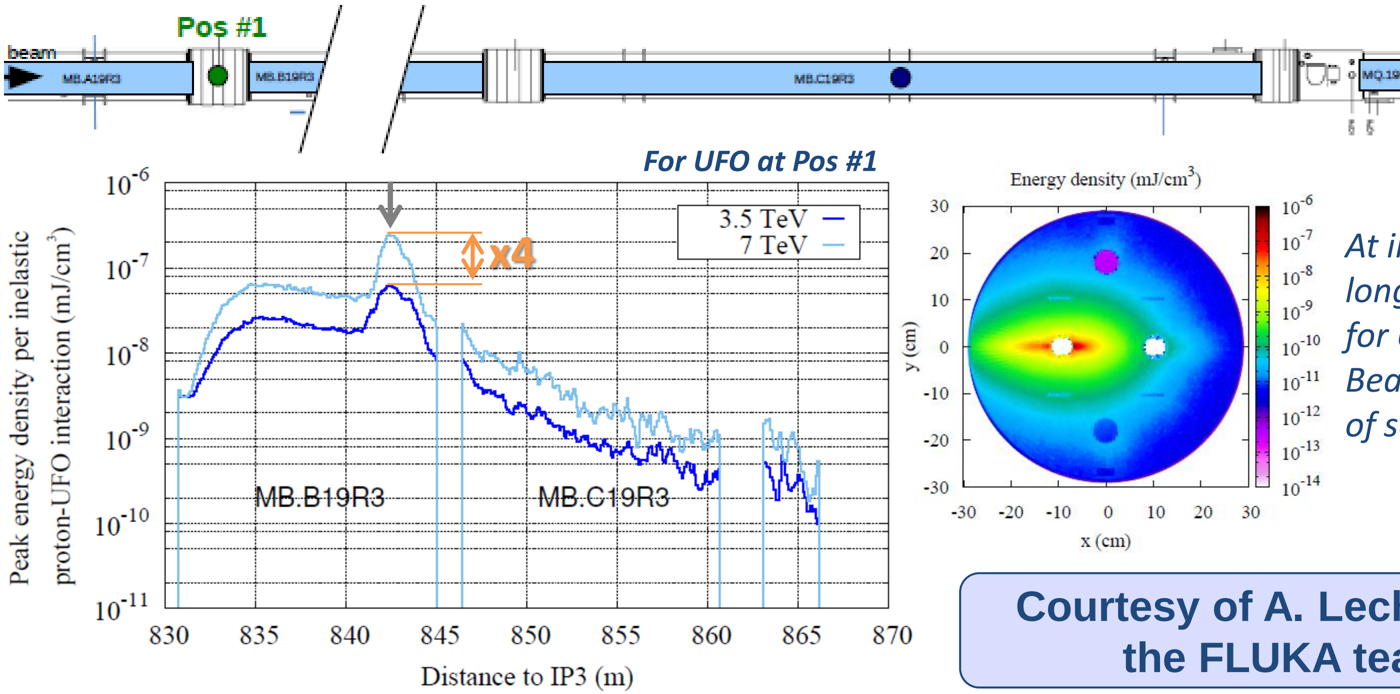
Positive correlation between pressure at MKI and MKI UFO rate.

Similar indications also from scrubbing runs and 2012 UFO MD.

Energy Dependence

- **UFO amplitude:** At 7 TeV about **3-4 times higher** than at 3.5 TeV.

  From FLUKA simulations and wire scans during ramp.



At indicated longitudinal position for UFO at 7 TeV. Beam direction: out of screen.

Courtesy of A. Lechner and the FLUKA team.

- **BLM thresholds:** Arc thresholds at 7 TeV are about a **factor 5 smaller** than at 3.5 TeV.
- **UFO rate:** No energy dependence assumed. *cp. E. Nebot et al., IPAC'11, TUPC136*

Energy Extrapolation Arc UFOs

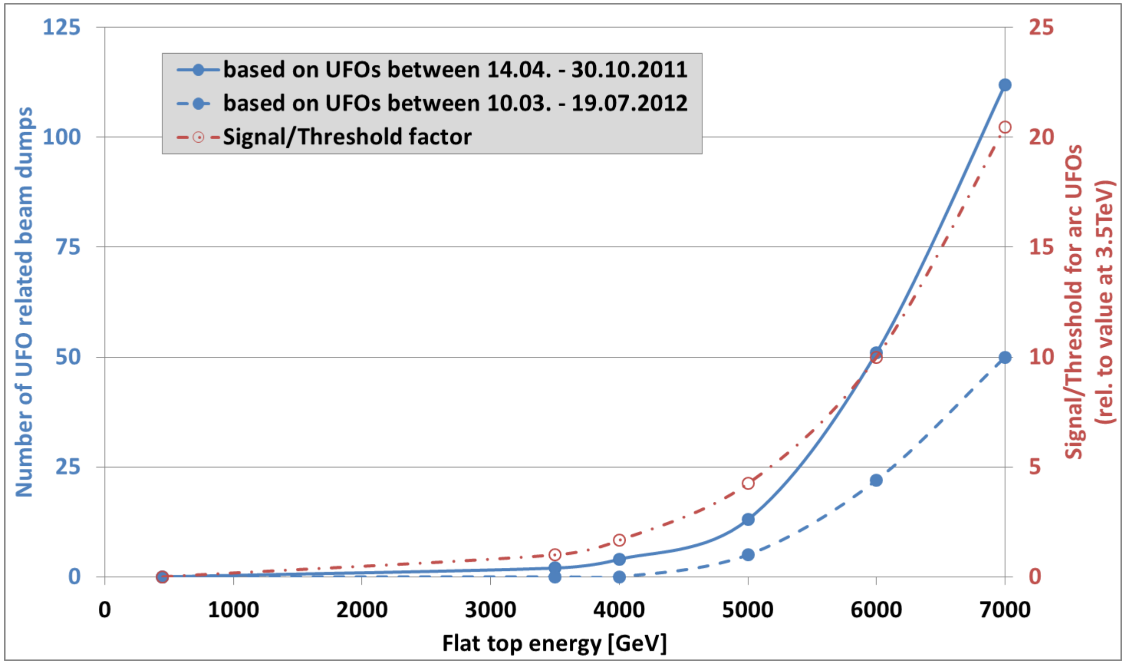
Extrapolation to 7 TeV:

*BLM Signal/BLM Threshold is about **20 times larger** than at 3.5 TeV.*

*Based on 2011 data: **112 UFO related beam dumps.***

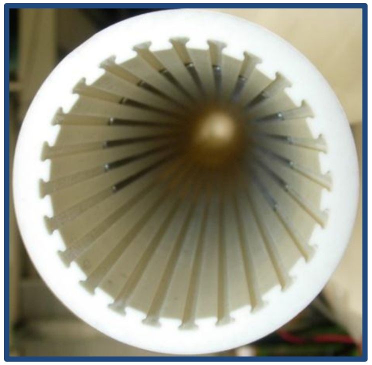
*Based on 2012 data: **50 UFO related beam dumps so far.***

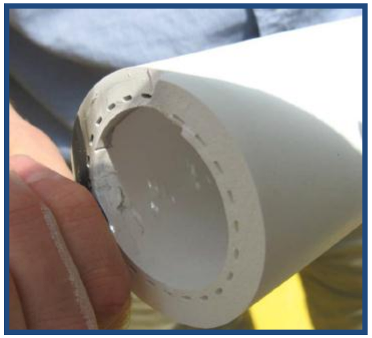
In total 2 dumps by arc UFOs observed (since 2011).



Based on the applied threshold table from 01.01.2012 (for 2011 data) and 19.07.2012 (for 2012 data). Apart from the beam energy, identical running conditions as in 2011/2012 are assumed. Several unknowns are not included: margin between BLM thresholds and actual quench limit, 25ns bunch spacing, intensity increase, beam size, scrubbing for arc UFOs, deconditioning after long technical stops.

Mitigation Strategies





- **MKI UFOs:**
  - **Change MKI.D5R8 in TS#3 (heating problems).**
    - *better cleaning, reduced E-field due to 19 screen conductors (instead of 15).*
  - **Cr_2O_3 coating.**
    - *reduces SEY, increased voltage hold-off, seals surface (?).*
  - **Screen conductor wires beyond surface (not feasible?).**
    - *very difficult to manufacture.*
- **Arc UFOs:**
  - **Increase BLM thresholds towards quench limit.**
    - ***Wire scanner quench test.***
    - ***ADT quench test.***
  - **Different BLM distribution.**
    - *could allow for increase of BLM thresholds.*

(A. Lechner et al., Quench Test Strategy Working Group, May 2012)

Summary

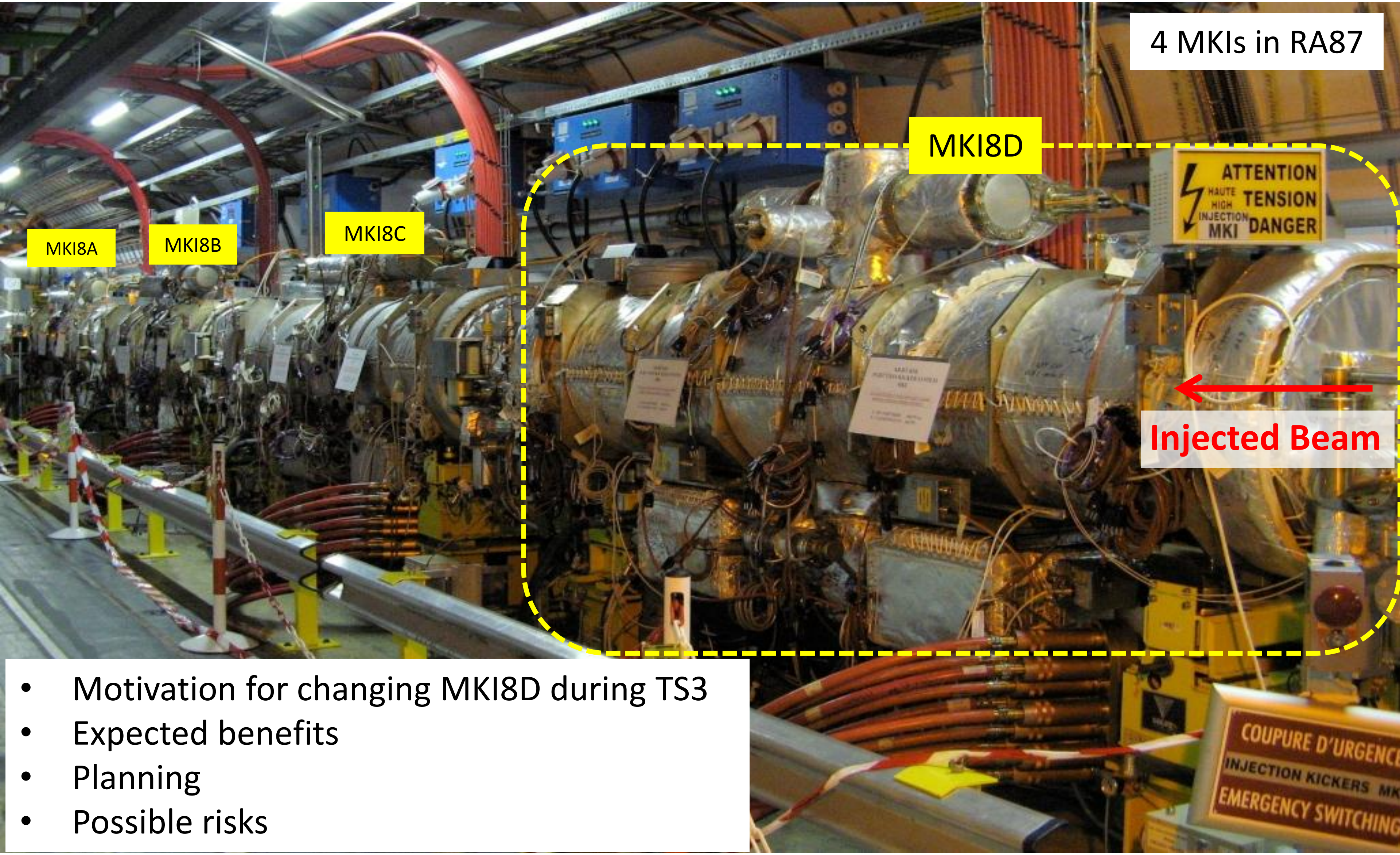
- **4 beam dumps** due to UFOs in 2012 so far.
  - *8,000 candidate UFOs below BLM dump thresholds observed in 2012 so far.*
- Arc UFO rate at beginning of 2012 **≈2.5 times higher** than in October 2011. Arc UFO rate decreases since then.
  - *No significant decrease of number of MKI UFOs per fill.*
- Energy extrapolation to 7 TeV:
  - ***2011 arc UFOs** would have caused **112 beam dumps.***
  - ***2012 arc UFOs** would have caused **50 beam dumps so far.***
- Plans for 2012/13:
  - ***Better understanding of quench limit.***
  - ***25ns studies.***
- Mitigation strategies for MKI UFOs under active investigation.
  - *Replace MKI.D5R8 in TS#3.*
  - *An **optimized BLM distribution** can mitigate impact of arc UFOs.*

Proposal to replace LHC injection kicker MKI8D during TS3

Mike Barnes

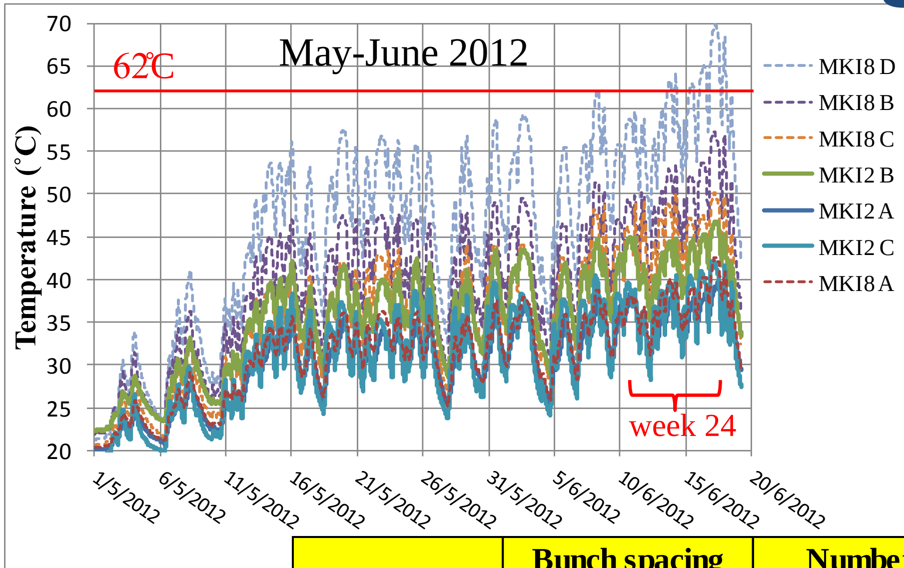
Acknowledgements:
Alessandro Bertarelli, Giuseppe Bregliozzi, Sergio Calatroni, Fritz Caspers, Hugo Day, Laurent Ducimetière, Marco Garlasche, Alexandre Gerardin, Brennan Goddard, Miguel Jimenez, Volker Mertens, Elias Métral, Benoit Salvant, Mauro Taborelli, Jan Uythoven, Wilhelmus Vollenberg, Wim Weterings

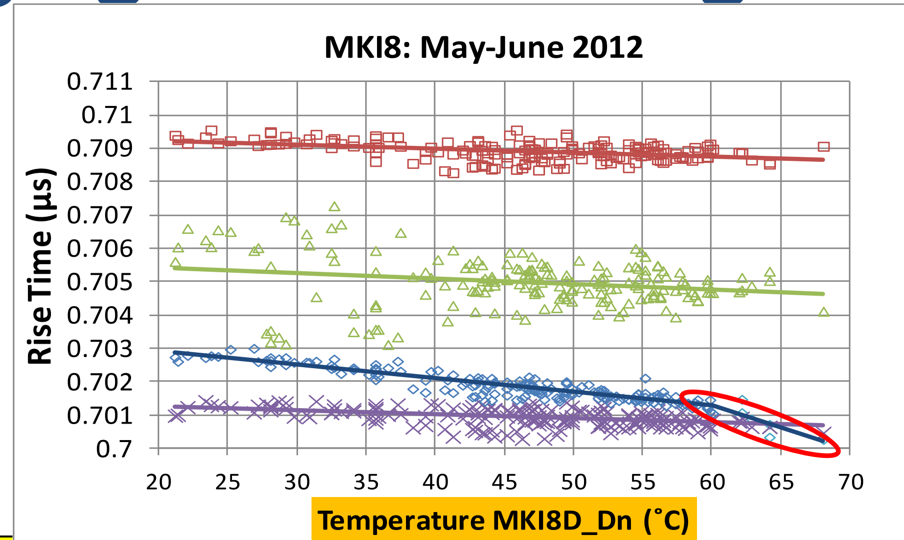
Outline



- Motivation for changing MKI8D during TS3
- Expected benefits
- Planning
- Possible risks

Motivation for changing MKI8D during TS3

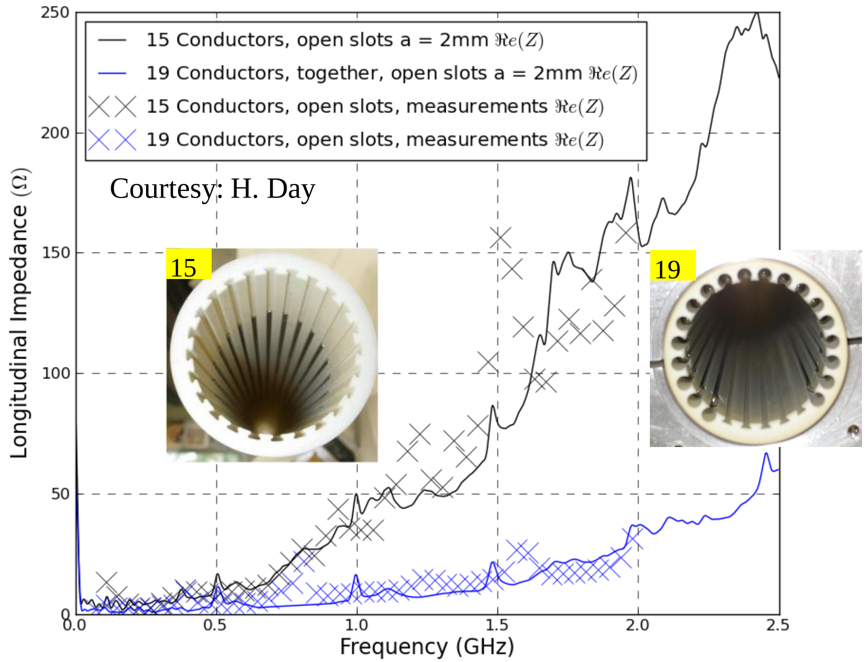


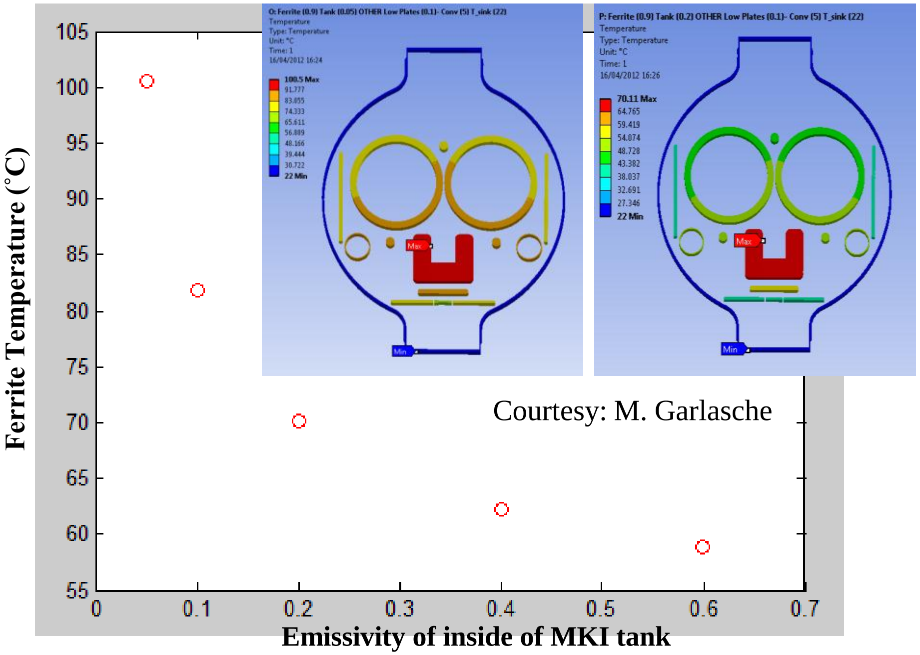


Protons/bunch	Bunch spacing (ns)	Number of bunches	Expected peak measured temp. (˚C)	Expected cooldown time to 62˚C
1.50E+11	50	1380	70 (measured)	4h 10min (measured)
1.70E+11	50	1380	98	15h

- The MKI8D ferrite yoke is the hottest, and started to (temporarily) loose its magnetic properties (approaching Curie Temperature). Behaviour is consistent with Oct. 2011.
- During week 24 injection was delayed by a total of 13 h 40 min, distributed over 5 fills, waiting for MKI8D to cool down. A simple model of ferrite heating and cooling, based on observations and simulations, has been used to forecast MKI heating and the waiting time for the ferrite to cool down to below the Curie temperature, for injection. The present MKI's are expected to significantly limit LHC availability, for injection, with increased intensity.
- An upgraded replacement of MKI8D has been under development (mentioned at Chamonix 2012 and LMC 129). The new MKI has measures to better limit ferrite temperature. It is important to validate these changes with high intensity proton beam, prior to LS1, in order to know if they can be implemented on other MKIs.

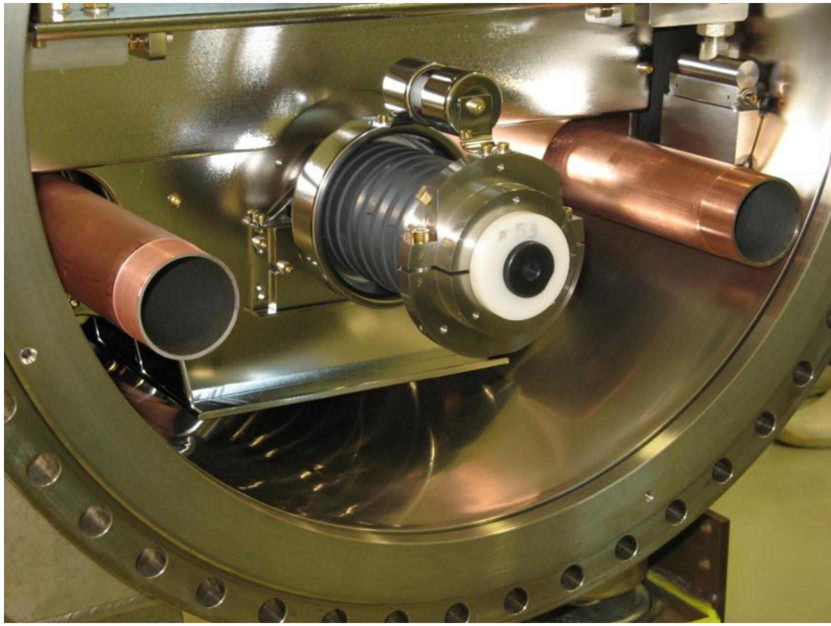
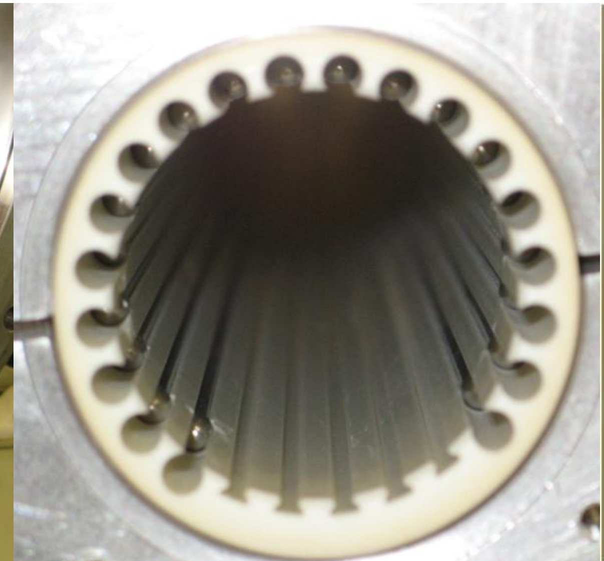
Expected benefits of replacement MKI (1)





- The replacement MKI has 19 screen conductors installed, compared with 15 in the present MKI8D – this modification is expected to reduce beam induced heating by a factor of between 2 and 2.5 – thus ferrite temperature will be reduced by ~30˚C (⇨~15˚C measured) for a given beam.
- The emissivity of the inside of the present MKI8D is thought to be relatively low (in the range 0.05 to 0.1), therefore greatly contributing to ferrite heating. The new MKI tank, after treatment, has a measured emissivity of ~0.18, which is expected to result in a reduction of the temperature of the ferrite yoke by more than 10˚C (⇨~5˚C measured), for a given power deposition.

Expected benefits of replacement MKI (2)


- The copper bypass tube, through which the counter-rotating beam circulates, is NEG coated in the new MKI: this should suppress electron-cloud in the bypass tube.
- The screen conductors, of the new MKI, have spheres on their capacitively coupled end: these will reduce electric-field strength, and thus reduce the probability of a flashover from the screen conductor to ground: this allows more screen conductors to be inserted.

LHC 1

ps

LEP Note 440

11.4.1983

PRELIMINARY PERFORMANCE ESTIMATES FOR A LEP PROTON COLLIDER

S. Myers and W. Schnell

ps

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PRELIMINARY PERFORMANCE ESTIMATES FOR A LEP PROTON COLLIDER

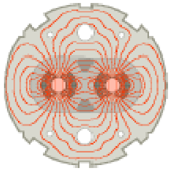
S. Myers and W. Schnell

1. Introduction

This analysis was stimulated by news from the United States where very large $p\bar{p}$ and pp colliders are actively being studied at the moment. Indeed, a first look at the basic performance limitations of possible $p\bar{p}$ or pp rings in the LEP tunnel seems overdue, however far off in the future a possible start of such a p-LEP project may yet be in time. What we shall discuss is, in fact, rather obvious, but such a discussion has, to the best of our knowledge, not been presented so far.

We shall not address any detailed design questions but shall give basic equations and make a few plausible assumptions for the purpose of illustration. Thus, we shall assume throughout that the maximum energy per beam is 8 TeV (corresponding to a little over 9 T bending field in very advanced superconducting magnets) and that injection is at 0.4 TeV. The ring circumference is, of course that of LEP, namely 26,659 m. It should be clear from this requirement of "Ten Tesla Magnets" alone that such a project is not for the near future and that it should not be attempted before the technology is ready.

The LHC Life cycle



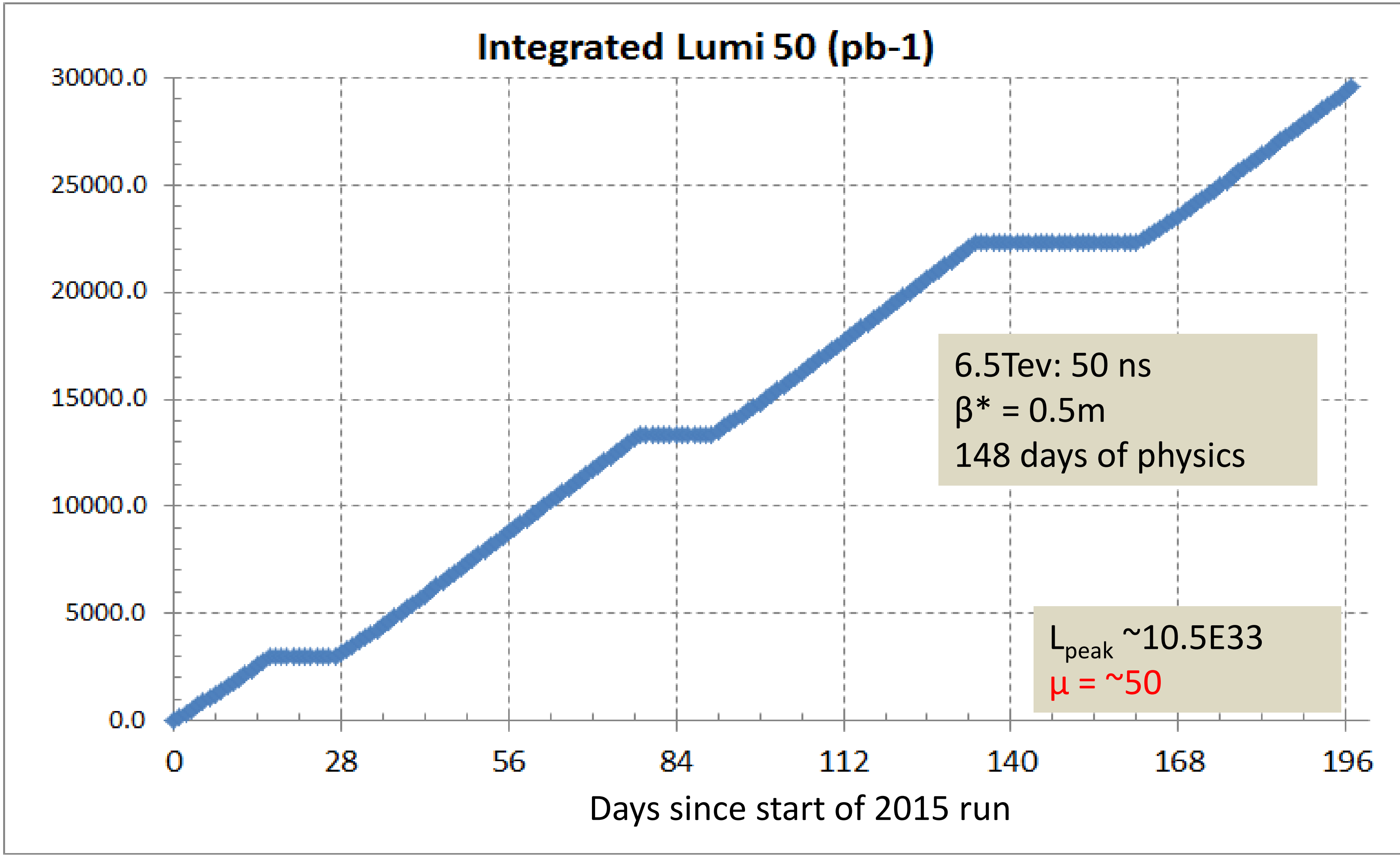
- 1983: Preliminary Performance Estimates for the LHC (S.Myers and W. Schnell, 11th April 1983)
- 1984: Kick off meeting to discuss ideas for an accelerator to co ... s at very high energy
- 1996: Final decision for the LHC, the most compl ... instrument ever constructed
- 10 September 2008: Start of commi ... th beam
- 19 September 2008: Serio ... and damage
- 19 November 200 ... beam operation
- Decemb ... collisions at 2.38 TeV

Toda ... sful operation, providing millions of particle collisions for the LHC experiments

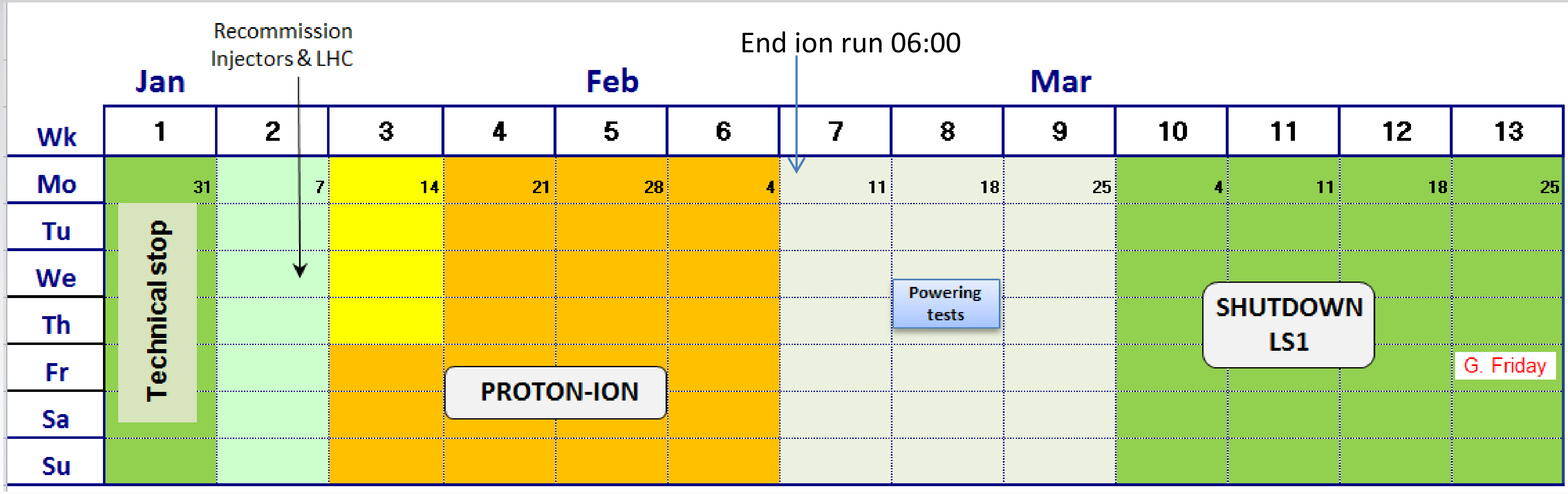
- About 2035: The LHC physics programme to be finished ?

A 50 Years Adventure

6.5TeV per beam with 50ns

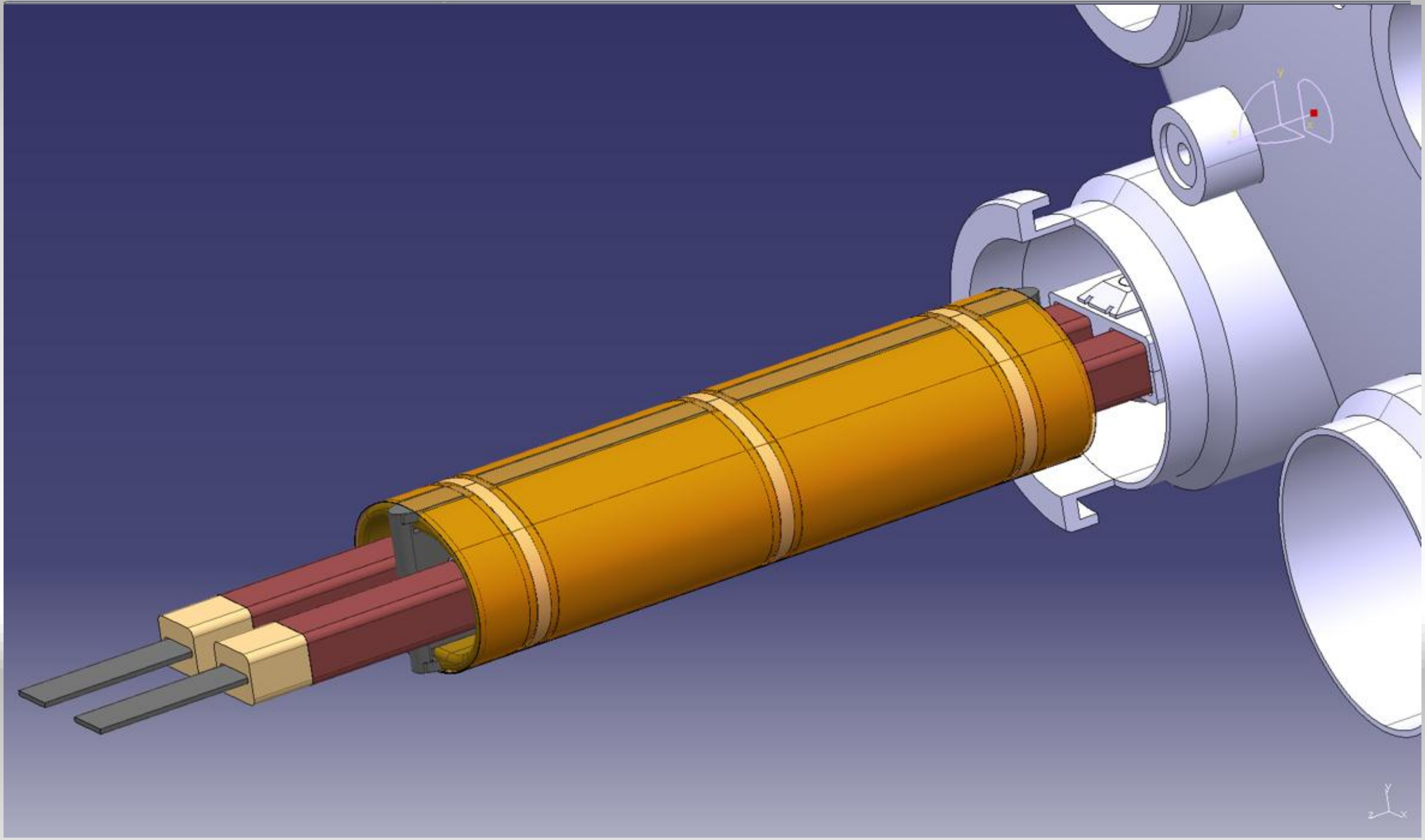


2013



- Minimum interventions before and during Xmas stop
- Need both protons and lead (i.e. ion source, LINAC3, LEIR in addition…)
- Non-LHC physics is not foreseen – flat line complex when beam not needed
- Should foresee doing maximum p-A preparation before Christmas (pilot run, aperture measurements, test squeeze…)

LHC MB circuit splice consolidation proposal



Phase III
Insulation between bus bar and to ground, Lorentz force clamping