2016
the first year it all came together

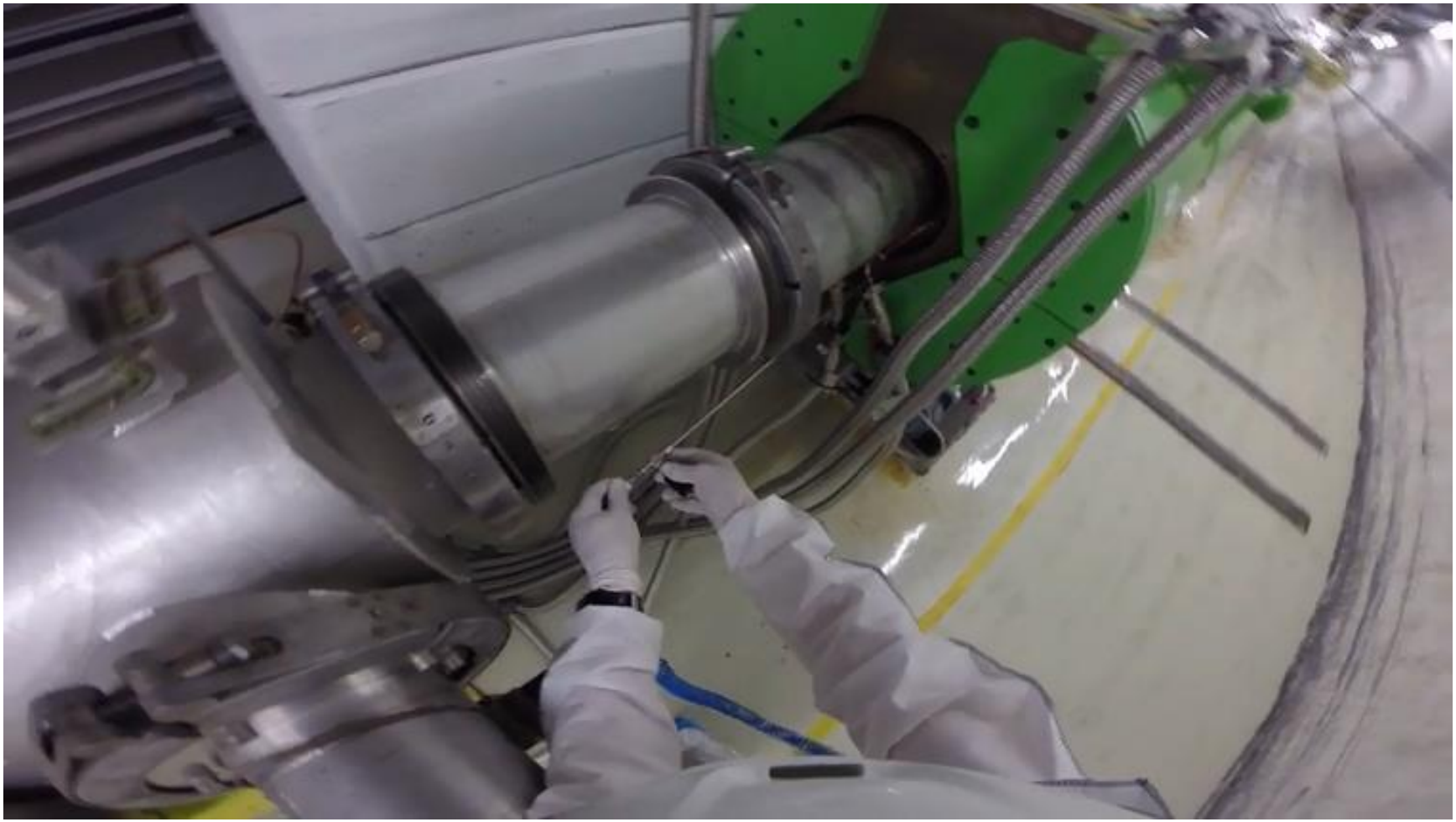
- Injectors
- Operational efficiency
- Understanding and control
- Availability

A very calm hardware commissioning

Usual high level of interest for first circulating beams

First stable beams 2016 – four hitch hikers

Manual leak detection April 28th



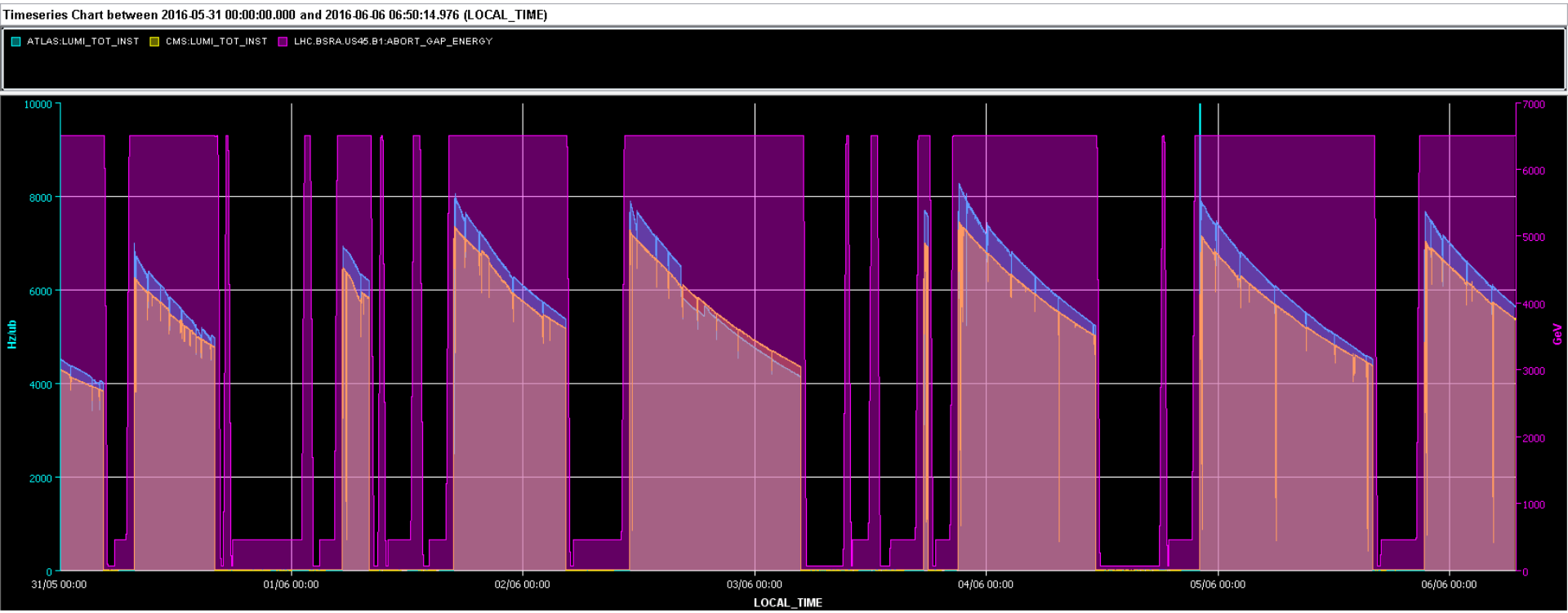
Marco Calviani and Simone Gilardoni

F….G WEASEL !!!

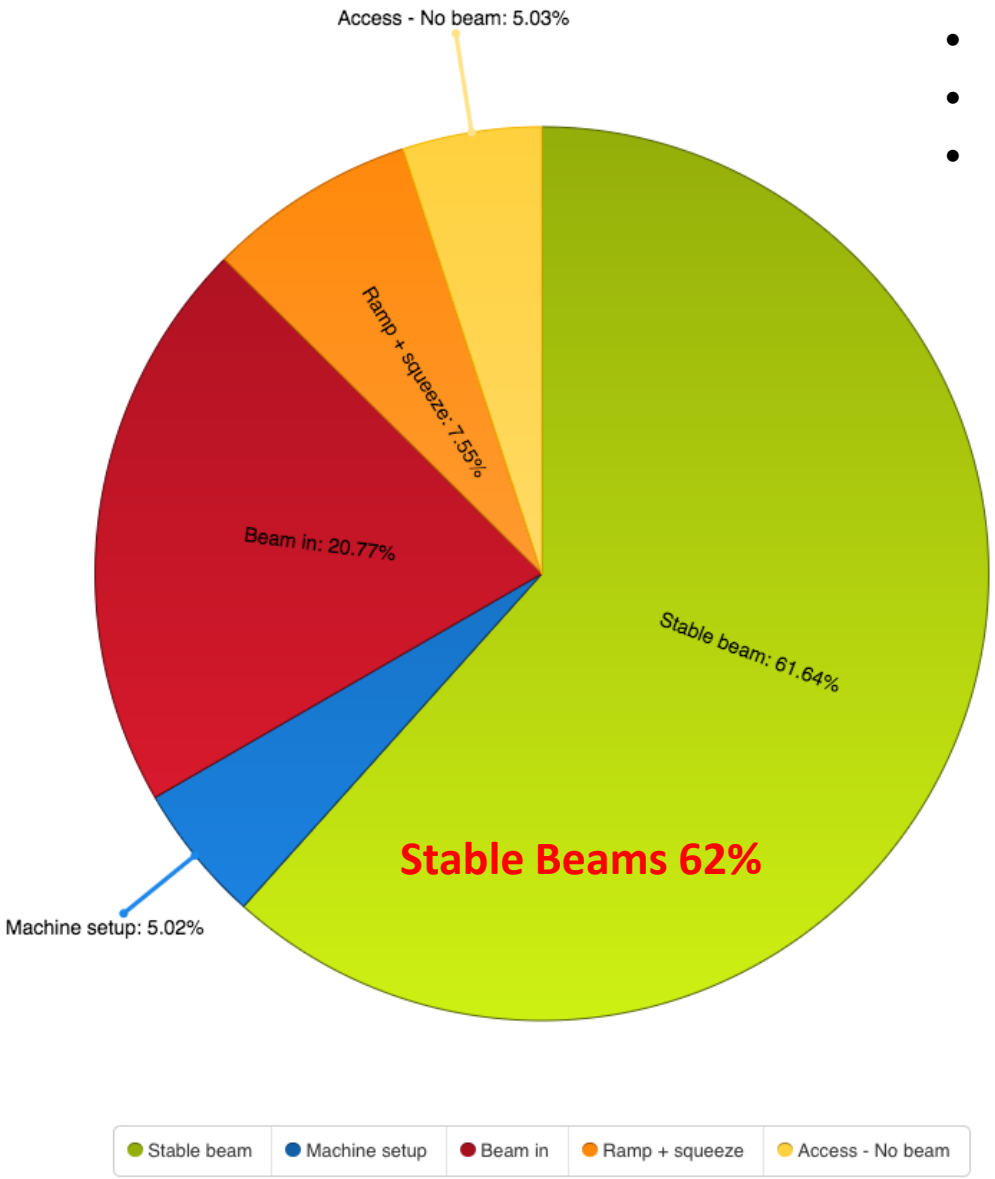
ML

Since POPS recovery

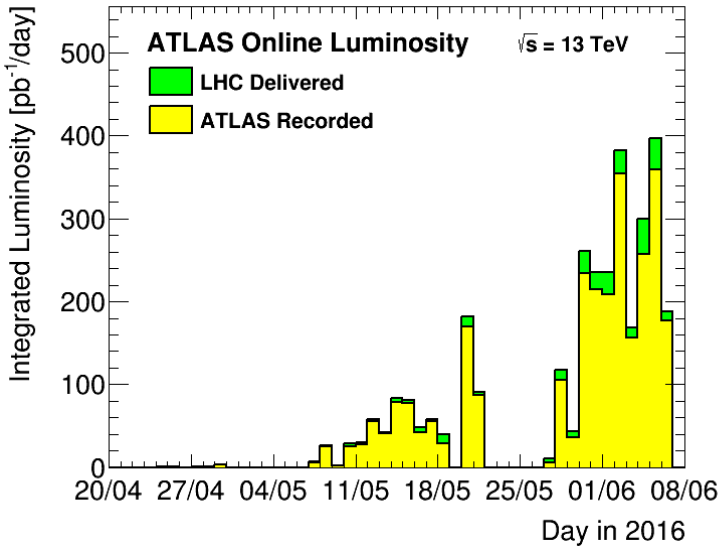
- Ramped up number of bunches to 2040 per beam
  - Maximum with 72 bunches per injection
  - Bunch population 1.1×10^{11}
- Peak luminosity ~8×10^{33} $cm^{-2}s^{-1}$
- Excellent availability



Mon 30th May – Sun 5th June



- Record luminosity in fill: 380 pb^{-1}
- Record luminosity per day: 390 pb^{-1}
- Record luminosity per week: 1.98 fb^{-1}



Design luminosity reached

Reduced beta* and lower transverse beam sizes from the injectors compensating the lower number of bunches

Jean-Francois Comblin

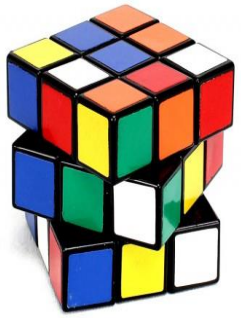
Beams

ISOGPS	ISOHRS	TOF	AD	EAST_North	EAST_Irrad	SFTPRO

- Intensity of Isolde beam up to 3.6e13 ppp.
- Staggered beam on both target at the same time.

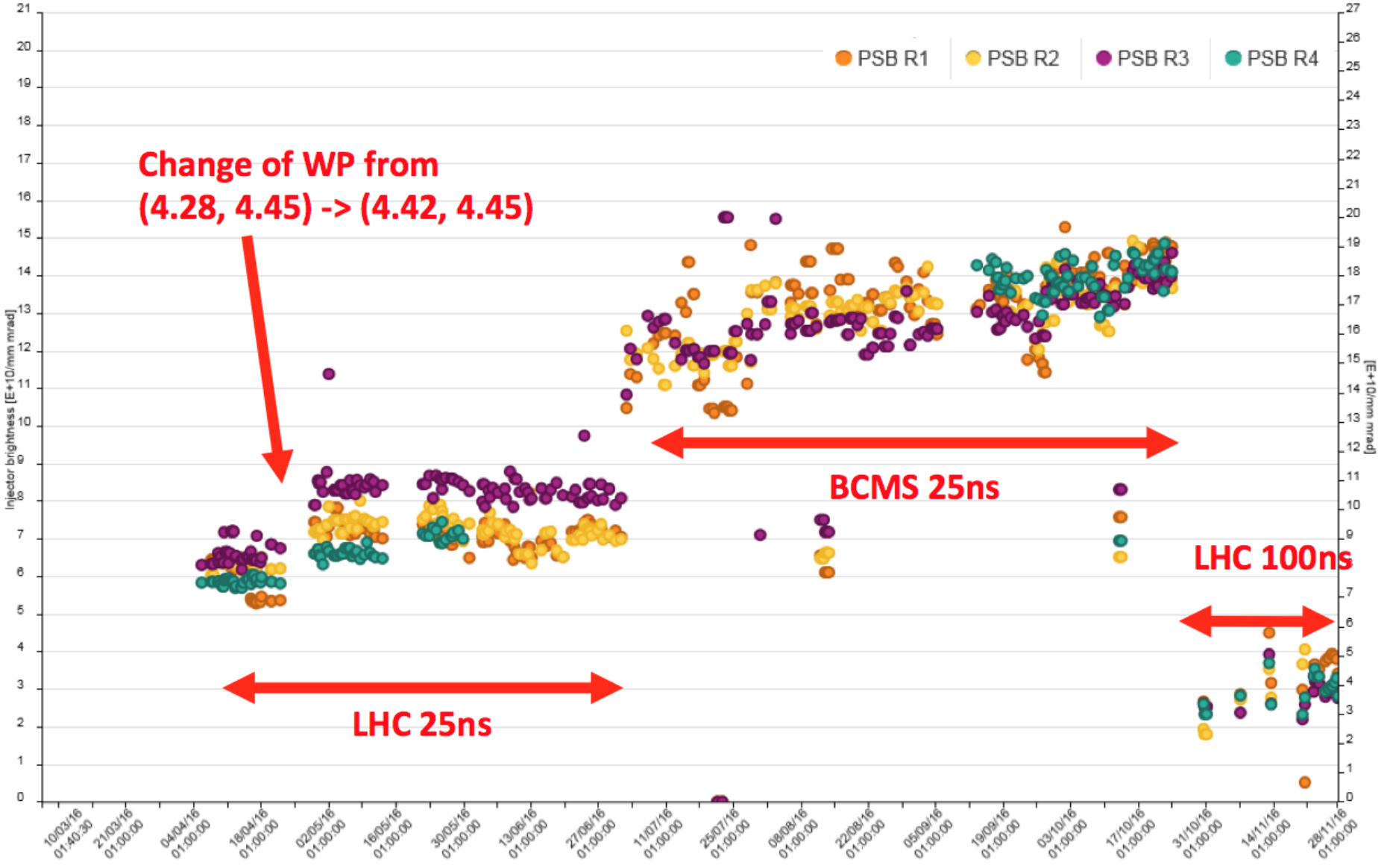
LHC 25ns	LHC Indiv	LHC probe	BCMS 25ns	LHC 100 ns

+ All the variants:
Indiv: VdM, Hi int., Hi emit., Low long. Emitt., Hi brightness, …
BCMS: Hi int., Low brightness, …, …
25 ns: Hi int., Scrubbing, Long. Emitt. blow-up, …



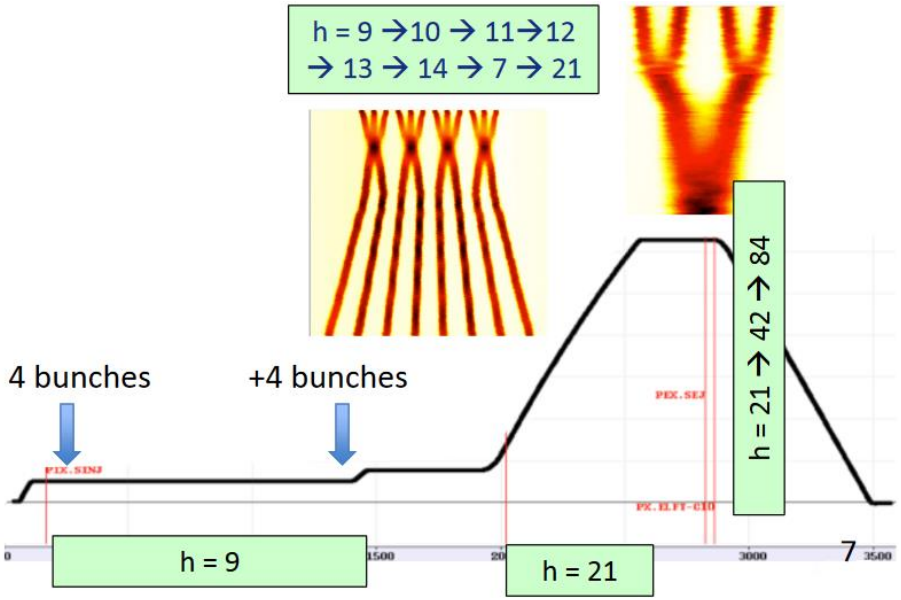
New recrutiment processs

LHC beams brightness



New LHC (BCMS type) beam

- In July, PS started to deliver BCMS beam to LHC.
- Peak luminosity of around +20% and a new record of 1.2 x 10^34 $cm^{-2}s^{-1}$.



Good peak performance

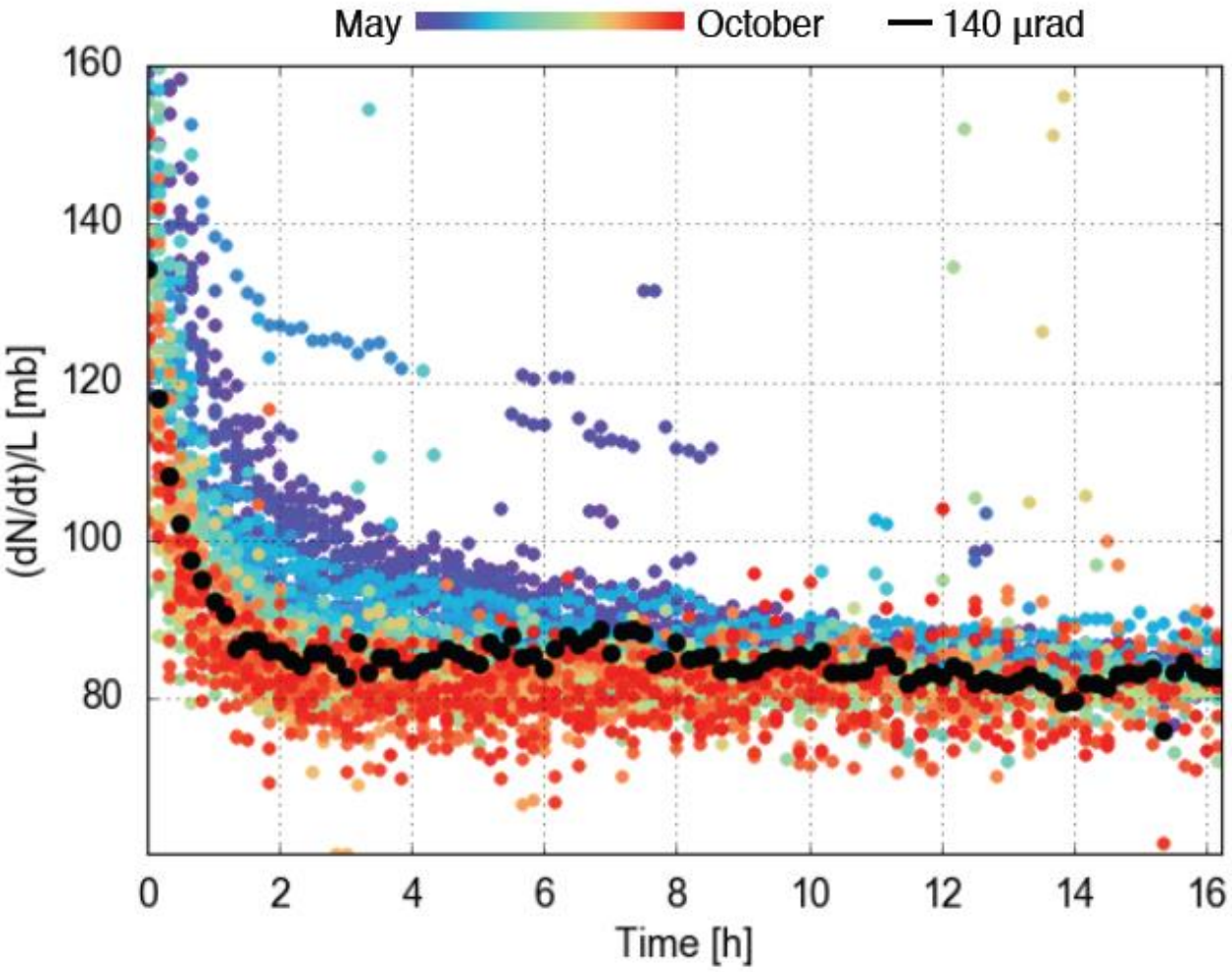
- Beta* = 40 cm
- BCMS
- Reduced crossing angle, bunch length
- Limited in number of bunches
- Limited in bunch intensity (injection kicker vac.)

Crossing angle reduced end September

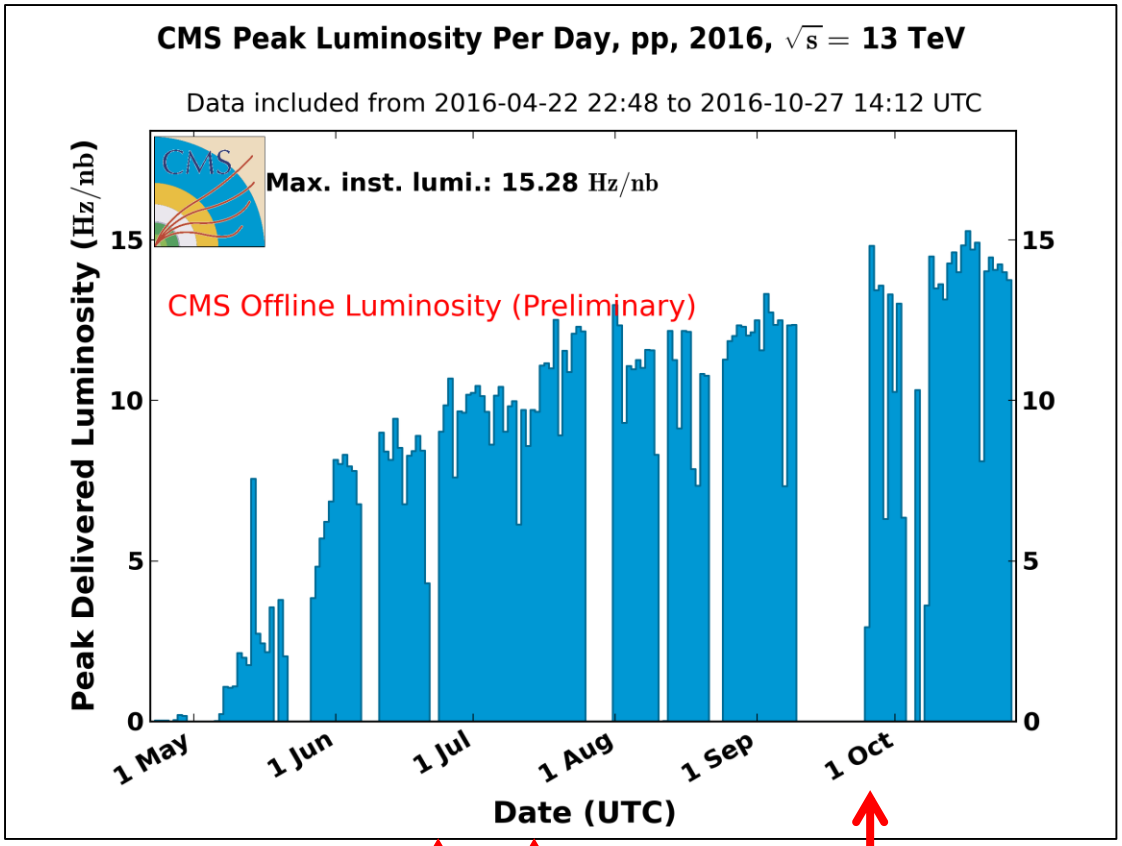
X-angle [urad]	F
370	0.59
280	0.7

Bunch population	~1.1e11
Number of bunches	2220
Beta*	40 cm
Crossing angle	280 urad
Emittance (BCMS)	~2.0 um
Peak (CMS)	**~1.5e34 $cm^{-2}s^{-1}$**

Lifetime in Stable Beams



Courtesy
F.Antoniou, G. Iadarola, Y.Papaphilippou



$1.5 \times 10^{34}\ cm^{-2}s^{-1}$

10^{34}

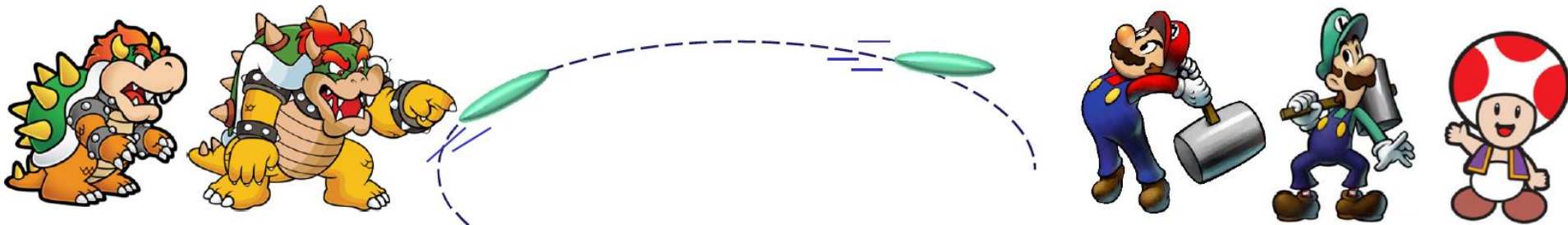
BCMS

Reduced crossing angle

Machine status - summary

- Excellent and improved system performance
- Magnets behaving well at 6.5 TeV
- Good beam lifetime through the cycle
- Operationally things well under control
- Magnetically reproducible as ever
- Optically good, corrected to excellent
- Aperture is fine and compatible with the collimation hierarchy.
- Collimation can take anything that's thrown at it

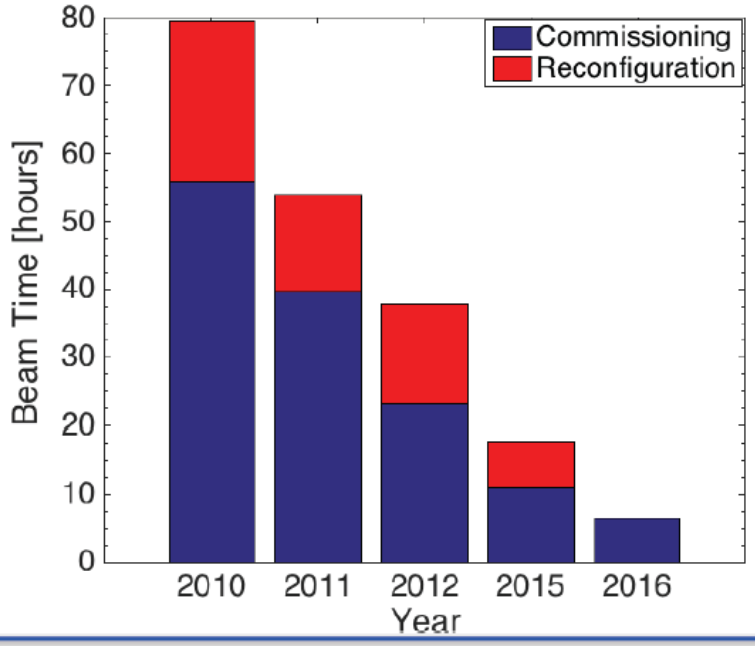
UNDERSTANDING AND CONTROL

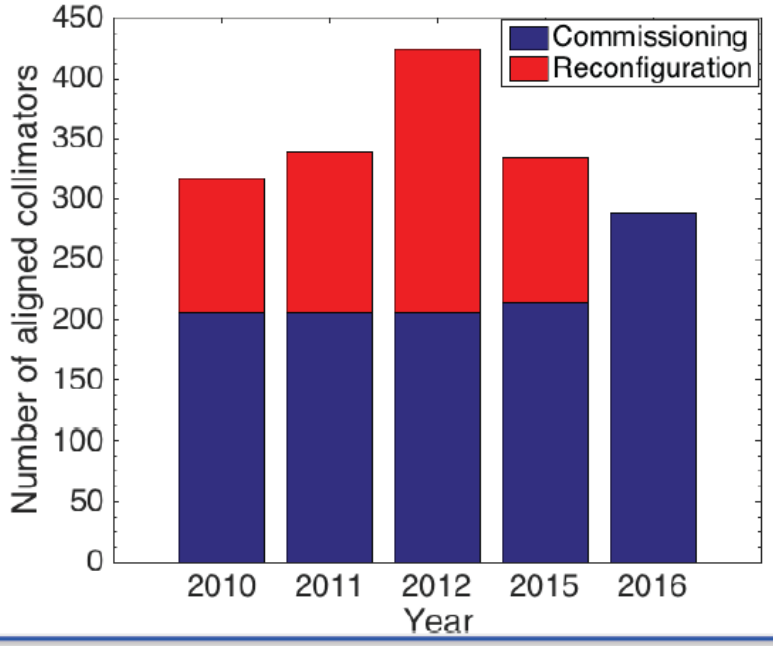


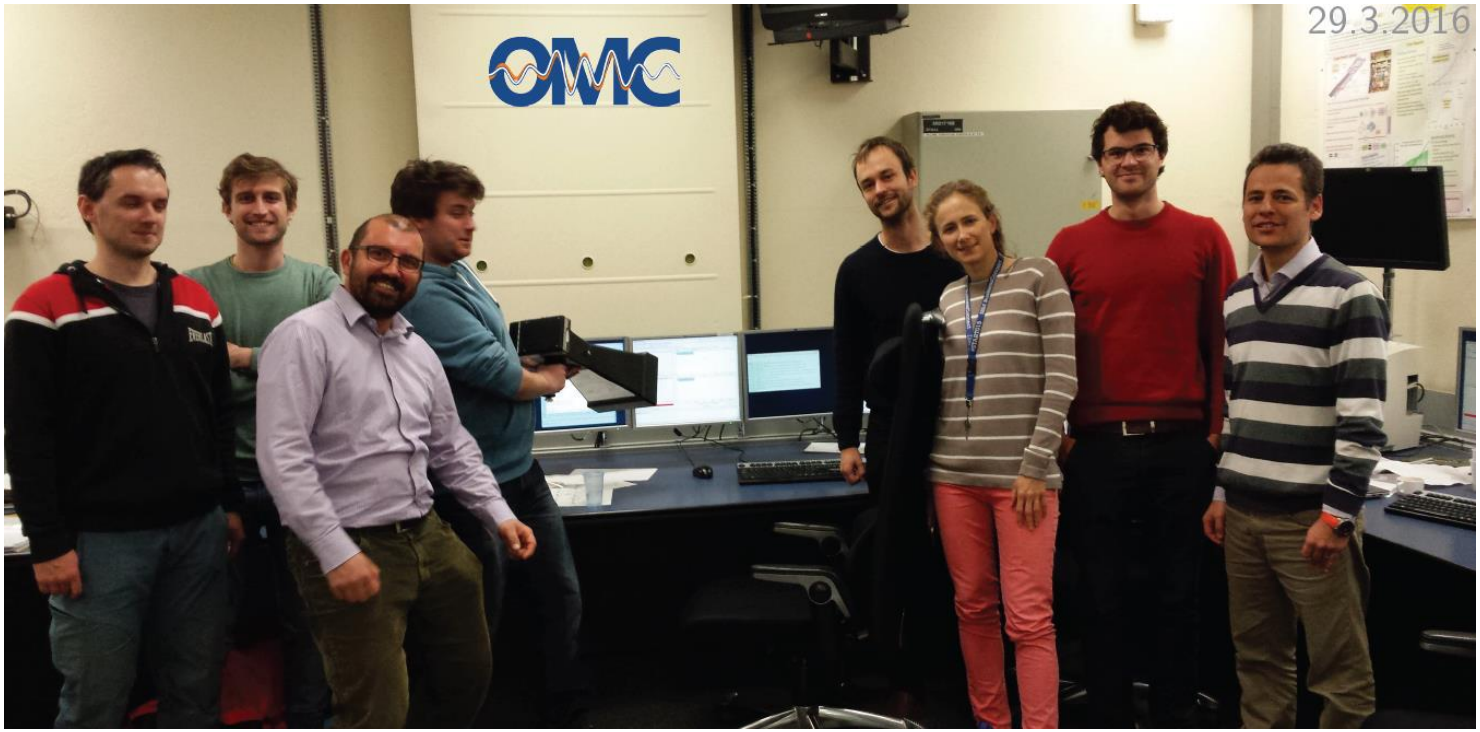
Collimator alignment

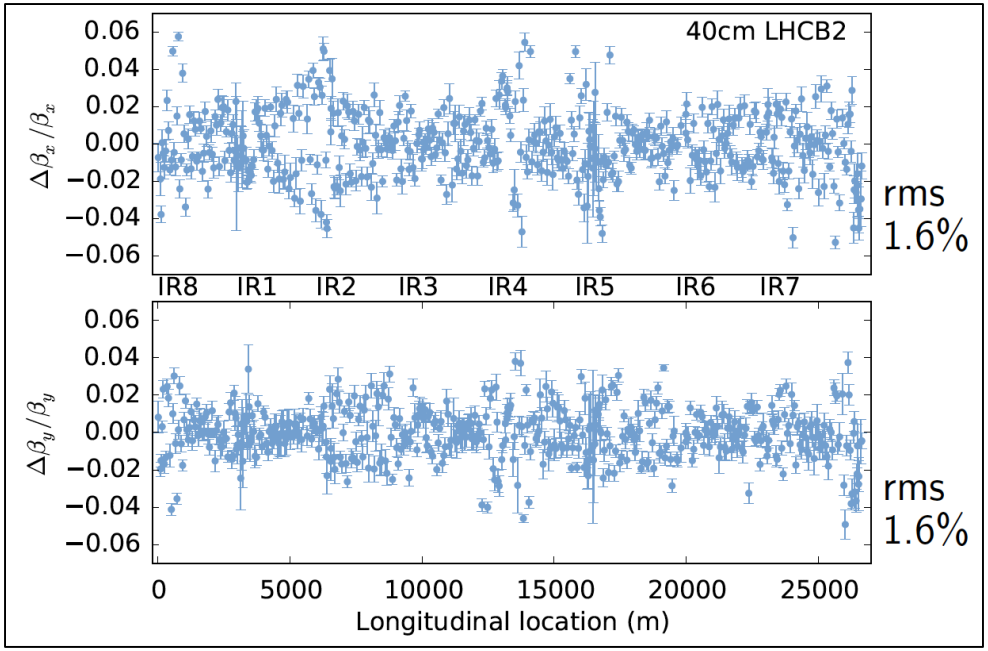
- **Injection:** 80 collimators incl. inj. prot -> 02/04/2016
- **Flat top:** 76 collimators -> 06/04/2016
- **End of squeeze:** 16 TCTs -> 10/04/2016
- **Collisions:** 16 x 3 TCTs + 12 TCLs -> 10/04/2016 (wo IR1 bump) + 19/04/2016 (w IR1 bump)

- Deployment of alignment feedback @ 50 Hz was successful, except for some delays observed in sending the alignment command (due to removed rotatable collimator from control system).









2016: 1% rms beta-beating, C- of 0.0002 and lot more to celebrate!

ADT offers a complete solution for virtually any measurements in the transverse plane across the whole machine:

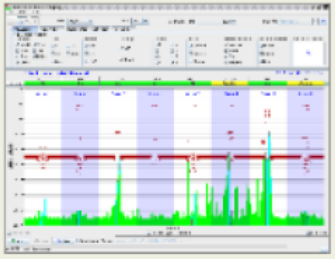
- Excitation synchronous with the beam
- Can target anything from individual bunches within a 25ns train to a full turn
- Coherent excitation by sin/cos and modulated sin/cos signals
- Noise-like signals, ADT-AC dipole, DC dipolar kick, skipping turns
- Excitation strength from very gentle to very powerful
- A dedicated bunch by bunch observation system (ADTObsBox)
- Machine-wide synchronization and triggering through timings or instability trigger network

```
0.4 ADT gain
exciting again 6 trains = 144 bunches

last point before dump on the power load 14.7 kW

~steady state power load estimated: 12.4 kW

Quench!
```



name: 20151213220919.png
desc:

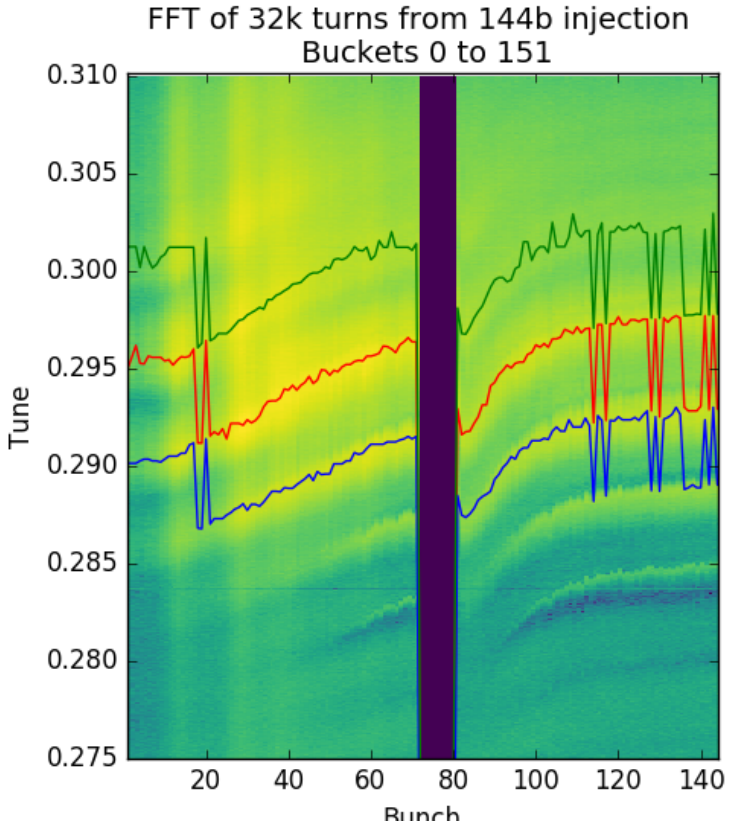
Courtesy Daniel Valuch

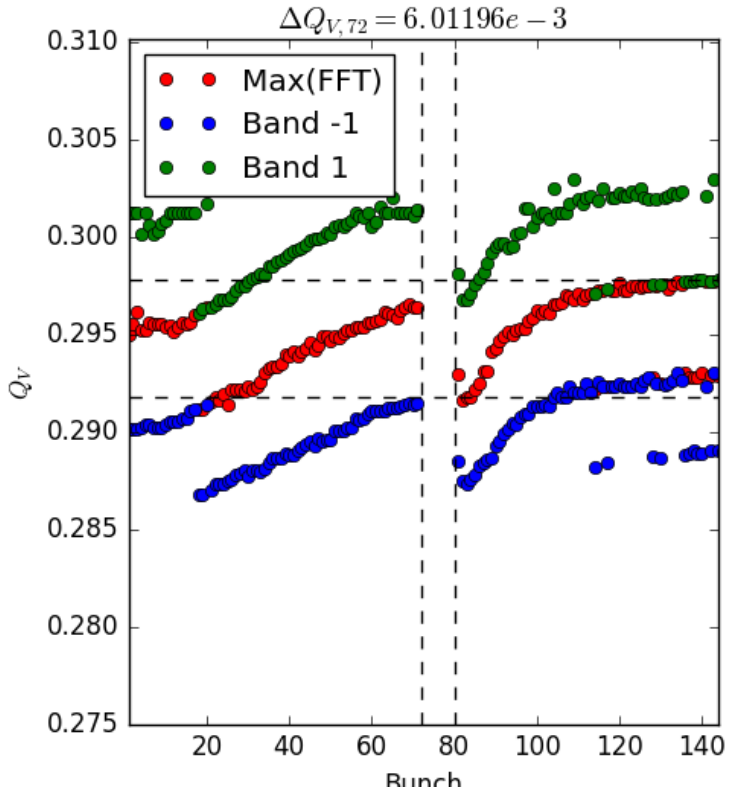
Tune Shifts at Injection & Corresponding E-Cloud Densities

- The electron cloud builds up within a few turns, so we can use the data from the injection oscillation to calculate the tune shift along the batch and infer a local e-cloud density.

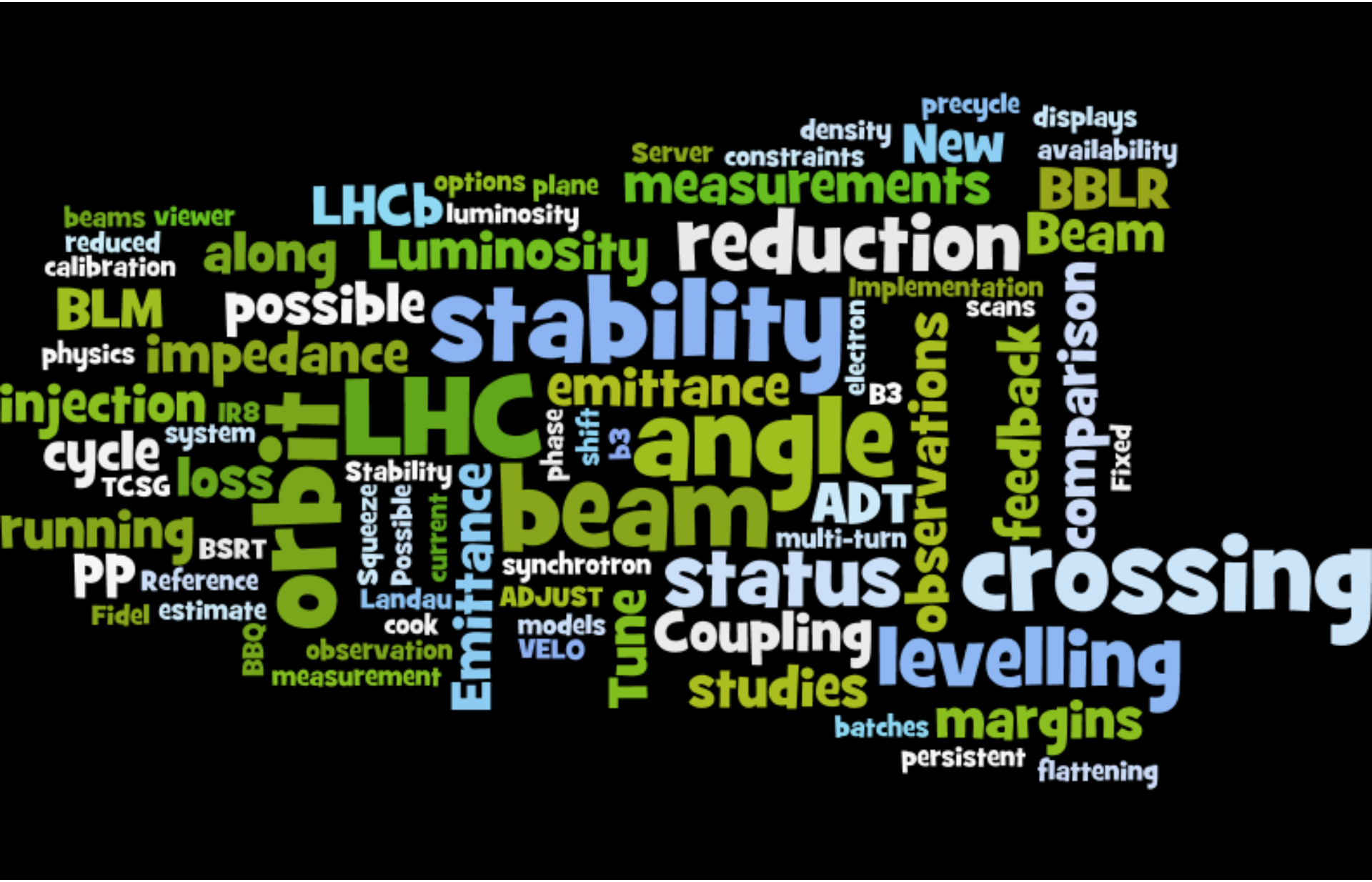
- We can save 32,000 turns from the ADTObsBox synced with injection (but 2/3 of the following methods can be done with 4,000 turns).

Fill 4867, B1, Date: 25_04_2016, Time: 212955





L. R. Carver, G. Iadarola, K. Li, E. Métral, A. Romano, G. Rumolo, D. Valuch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Coupling
levelling
BBQ
observation
VELO
Tune
measurement
studies
batches
margins
persistent
flattening

F. WEASEL II

Le 20 Novembre 2016…

Le retour

The come back


To infinity
and beyond...
10^{10}
2005
2007
2009
2015
2016
10^{11}
LEIR's Moore's Law:
The intensity of the Pb ion beam at extraction increases by one order of magnitude every 11 years.
5

Django

JOHN JOWETT

BIO **ACCELERATOR PHYSICIST, PROMOTING DIVERSITY: PB-PB, P-PB, PB-P, THEREBY GAMMA-GAMMA, A BIT OF P-P, FORMERLY E+E-, E-PB SOMETIME?; ALL OPINIONS ARE PERSONAL.**

LOKASYON **GENEVA**

TWEETS **1,7K**

FOLLOWERS **643**

FOLLOWING **193**

ACCOUNT CREATED **31-01-2009 06:11:28**

ID **19813240**

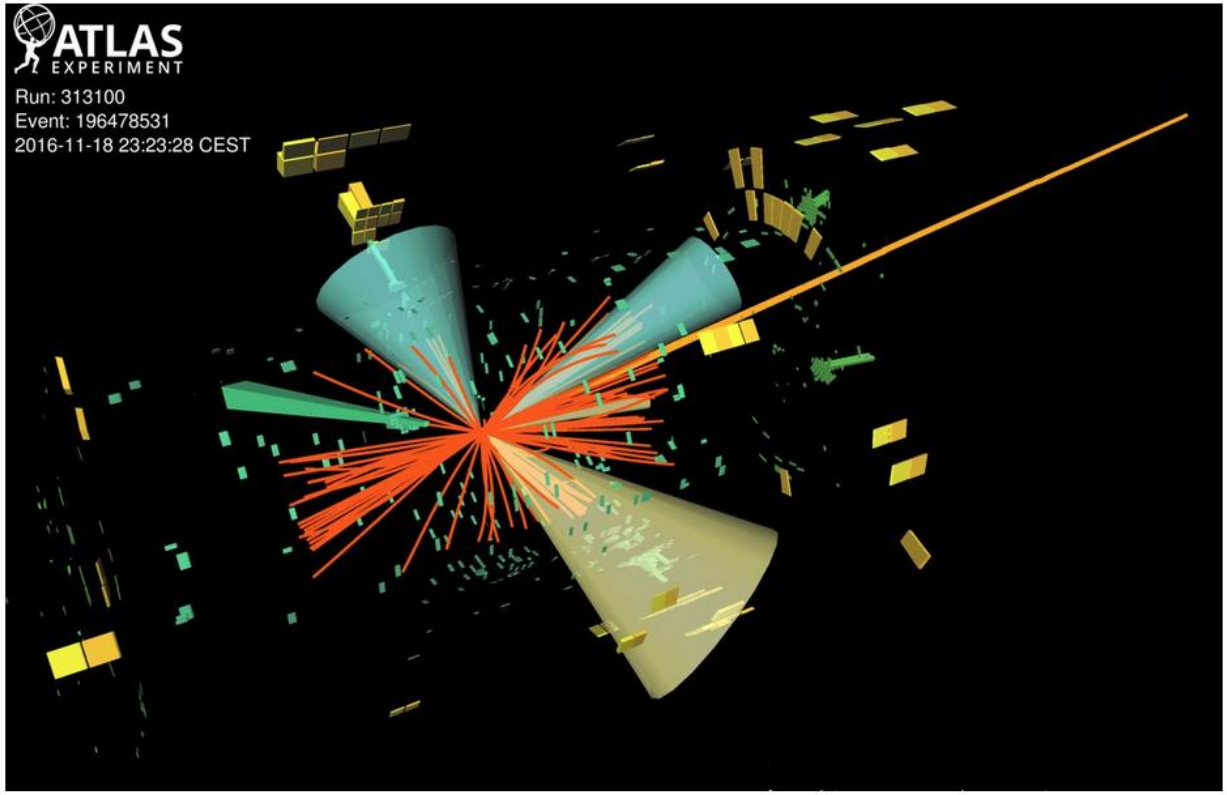
REPORT AS INAPPROPRIATE

CERN

DECEMBER 06, 2016

TWITTER WEB CLIENT : THE PARTICLES HAVE MADE THEIR LAST LAP OF THE #LHC FOR 2016 CERN.CH/GO/88CX

@CERN




2016