OPERATION AND FAILURES

23RD OCTOBER 2012

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OUTLINE

- LHC operational parameters
- Failure observed during 2012
- List per equipment
- Comparison with 2011
- Conclusions

LHC operational parameters

- Settings changed for the collimators → higher load at point 7
- TCL collimators closed→ lower load in the RRs in P1/5
- Increase of the beam gas effects at point 4
- Increase of the beam intensity (~1.7e11 p/bunch)
- 25 ns operation: Effect to be analysed after the runs at the end of the year
- Ion operation

LHC operational parameters

- 25 ns operation: Effect to be analysed after the runs at the end of the year
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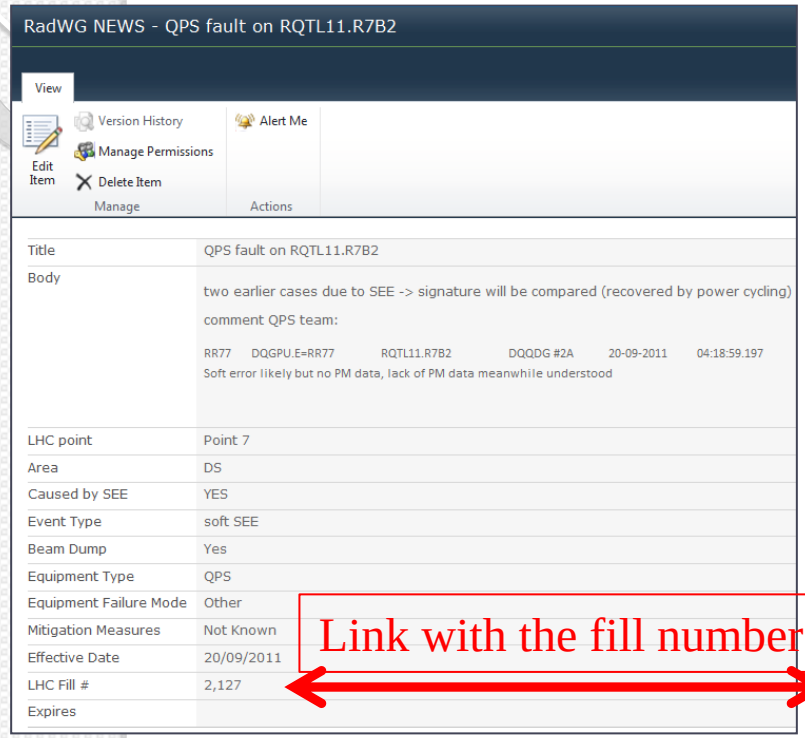
SEE update

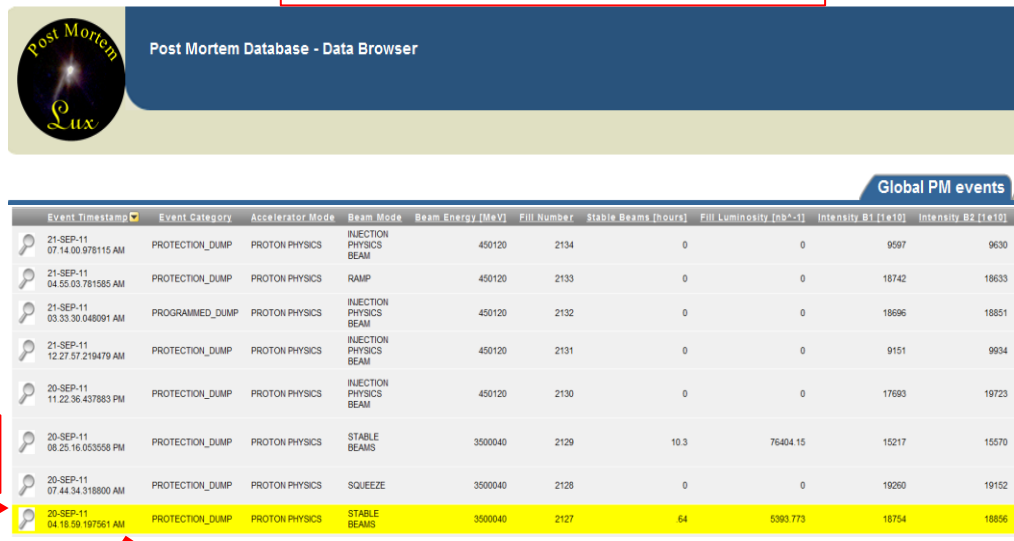
- **R2E weekly shift to collect information**
- **First information source: e-logbook, 8h30 LHC meeting**
- **TE/MPE, TE/CRG, TE/EPC, EN/STI have assured a continuous follow-up**
- **What we store:**
  - **Location**
  - **Date-Time failure**
  - **Equipment/Component**
  - **Consequence of the failure**
  - **Beam fill** BC means To Be Confirmed

RADWG and PM web page

Rad WG web site-Detail



Post Mortem Database



Link with the fill number

Details on radiation failure

Mps Expert Comment	Mps Dump Cause	Mps First Detection	Seu Dump	Seu Appeared Other Than Dump	Radwg Entry
Suspected SEU on QPS. Dump clean.	QPS	PIC	Possible	YES	RadWG link1 RadWG link2

SEE Failures

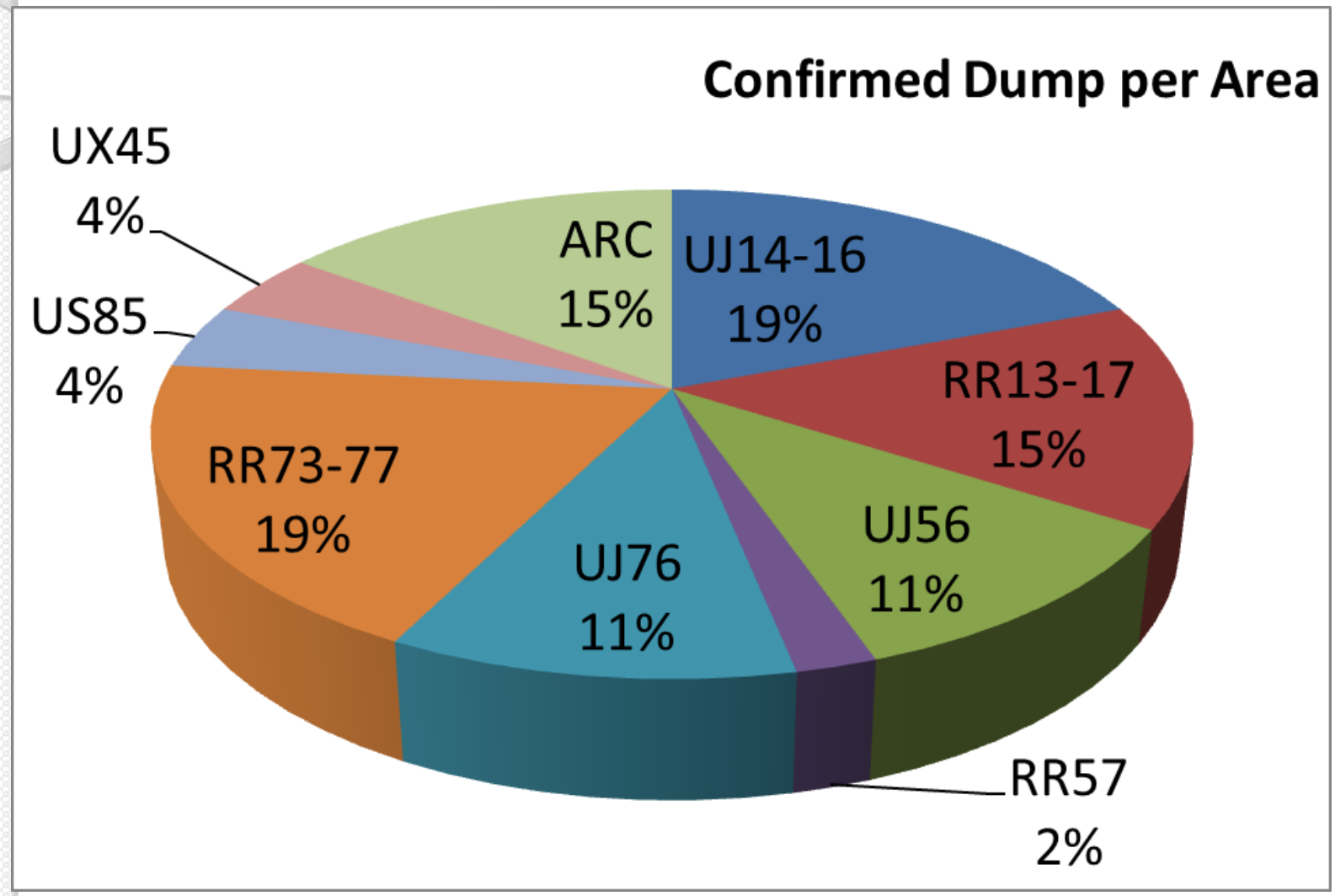
TBC: To be confirmed

- Data from March 2012 to 10 October
- TBC means events To Be Confirmed, not sure if the failure cause is due to radiations

Dump	Dump TBC	No Dump	No Dump TBC
47	15	29	5

Destructive failures			
Dump	Dump TBC	No Dump	No Dump TBC
14	1	3	0

Failures per area



List of Failures

QPS			
Dump	Dump TBC	No Dump	No Dump/ TBC
26	2	19	0

- Location: UJ14/16, UJ56, RRs P1/P7, DS
- Failure type: Digital DAQ systems for nQPS and 600A protection, uFIP comm
- Mitigations:
  - New DAQ system under design (FPGA)
  - BricoFip (mid-term)/NanoFip (long-term)

List of Failures

EPC			
Dump	Dump TBC	No Dump	No Dump/ TBC
10	7	7	1

- Location: UJ56, UJ16, RRs P1/P7, Arc
- Failure type: Aux Power Supply, FGC-COD (CPLD)
- Mitigations:
  - New design of the FGC Lite and of the power converters
  - AC/DC power supply problem understood

List of Failures

CRYO			
Dump	Dump TBC	No Dump	No Dump/ TBC
3	1	1	0

- Location: UJ56, UJ76, UX45, US85
- Failure type: Mecos driver, Profibus communications
- Mitigations:
  - Mecos case (UX45, US85) is under study (deport electronics)
  - Relocation from UJs

List of Failures

VACUUM			
Dump	Dump TBC	No Dump	No Dump/ TBC
4	3	0	0

- Location: UJ76 (all confirmed), IR7 (TBC), Point 4 (TBC), Point6 (TBC)
- Failure type: Loss of the PLC control (soft), power supply (destructive failures)
- Mitigations:
  - Relocation from UJ76

List of Failures

EN/EL			
Dump	Dump TBC	No Dump	No Dump/ TBC
1	0	0	0

- Location: US85
- Failure type: IGBT failure (destructive)
- Mitigations:
  - Relocation to UA83
  - Use of the *Borri* version

List of Failures

COLLIMATION CONTROL			
Dump	Dump TBC	No Dump	No Dump/ TBC
1	0	2	0

- Location: UJ16, UJ56
- Failure type: loss of communication
- Mitigations:
  - Relocation

List of Failures

RF Equipment			
Dump	Dump TBC	No Dump	No Dump/ TBC
1	1	0	0

- Location: UX45
- Failure type: Not clear
- Mitigations:
  - Not known

Comparison with 2011

	2011	2012 Expectation		2012 Data
	Dump	Without mitigation actions	With mitigation actions	Dump
Collimation	4	45	1	1
Cryo	30	82	1	3
EN/EL	2	6	1	1
EPC	11	25	15	10
QPS	22	45	20	26
Other			5	6
TOTAL	69	150	45	47

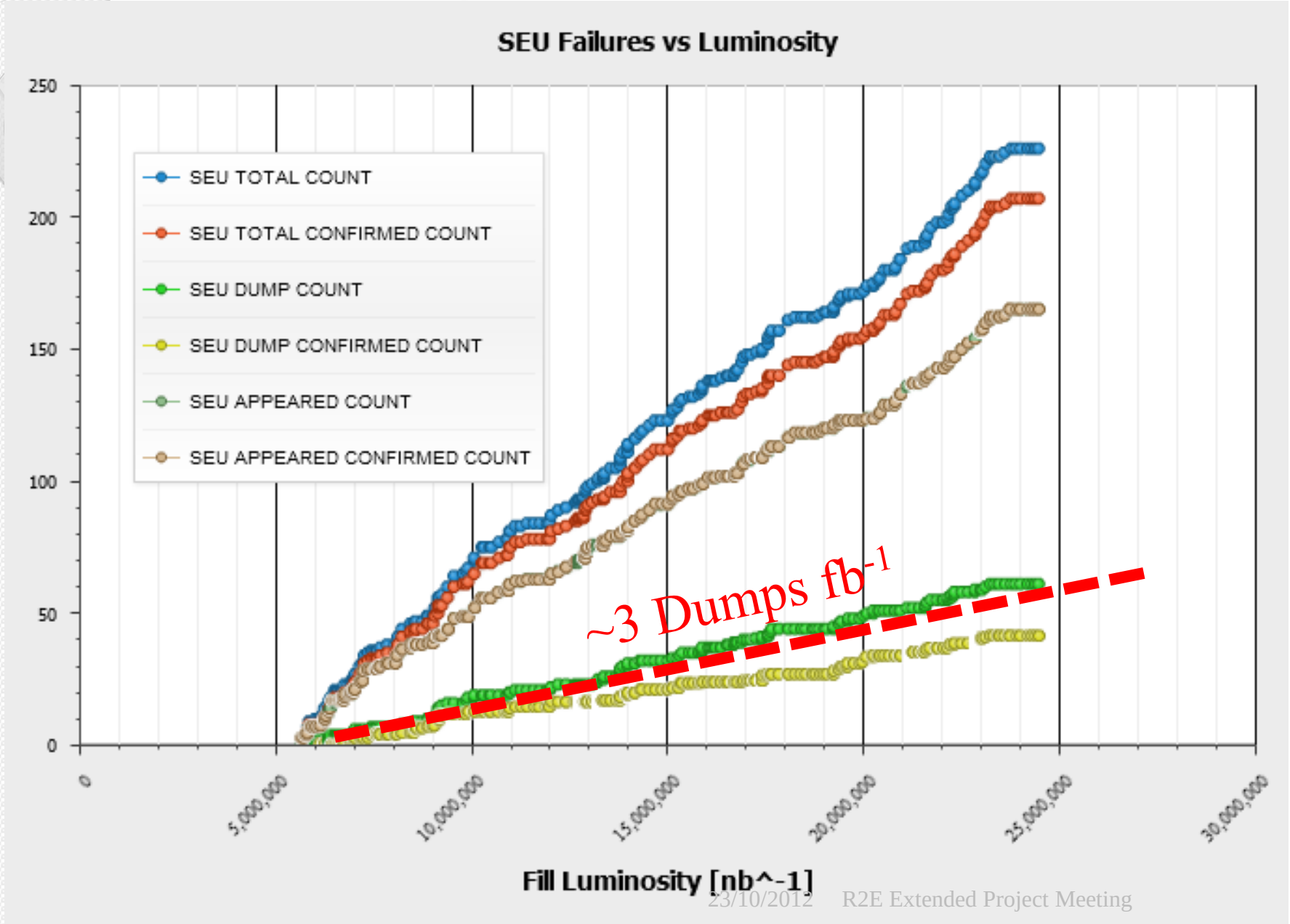
Mitigation measurements 2011

- **QPS – firmware upgrade (ISO150) almost 100 events avoided since then**
- **Cryo – PLC removed from US85**
- **Cryo (via EN/EL) – Replacement of power supply with old models**
- **Cryo – Automatic Reset of PLC (TE/CRG)**
- **P/W/BIC – Relocation of the equipment from UJ14/16**

Mitigation measurements –Xmas 2011

- **QPS – various hardware updates**
- **Cryo – Hardware modifications to fix the false temperature readings (5 events in 2011)**
- **Cryo (EN/ICE) – PLC relocation at point 4, 6, 8 (8 events in 2011)**
- **Collimation – Survey of stuck bits (3-5 events in 2011)**
- **B/P/WIC – Relocation of the equipment from UJ56 and US85 (5 events happened in 2011)**
- **Other relocation of Fire Detectors Equipment**
- **Shielding of the area UJ14/16 →radiation reduced by a factor 2 in 2012. The factor 2 takes into account Shielding efficiency and radiation level increase**

Summary


SEU Failures vs Luminosity
SEU TOTAL COUNT
SEU TOTAL CONFIRMED COUNT
SEU DUMP COUNT
SEU DUMP CONFIRMED COUNT
SEU APPEARED COUNT
SEU APPEARED CONFIRMED COUNT
~3 Dumps fb-1
250
200
150
100
50
0
0
5,000,000
10,000,000
15,000,000
20,000,000
25,000,000
30,000,000
Fill Luminosity [nb^-1]

Conclusions

- **2011: ~70 dumps events**
- **2012: ~50 dump events**
  - **In Agreement with predictions**
  - **Effectiveness of the mitigation actions**
  - **Failure estimation for the next has uncertainty factors**
    - **Beam gas effect**
    - **Collimation losses**
    - **Equipment failure types not yet appeared**
- **>LS1: relocation and shielding**

  + new developments

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