



# TI major events – Impacting LHC



- BE/OP/TI who are we ?
- What is a major event ?
- Are thunderstorms still a big issue?
- What are our biggest ways of improvement?
- Is our data good, can we do better?

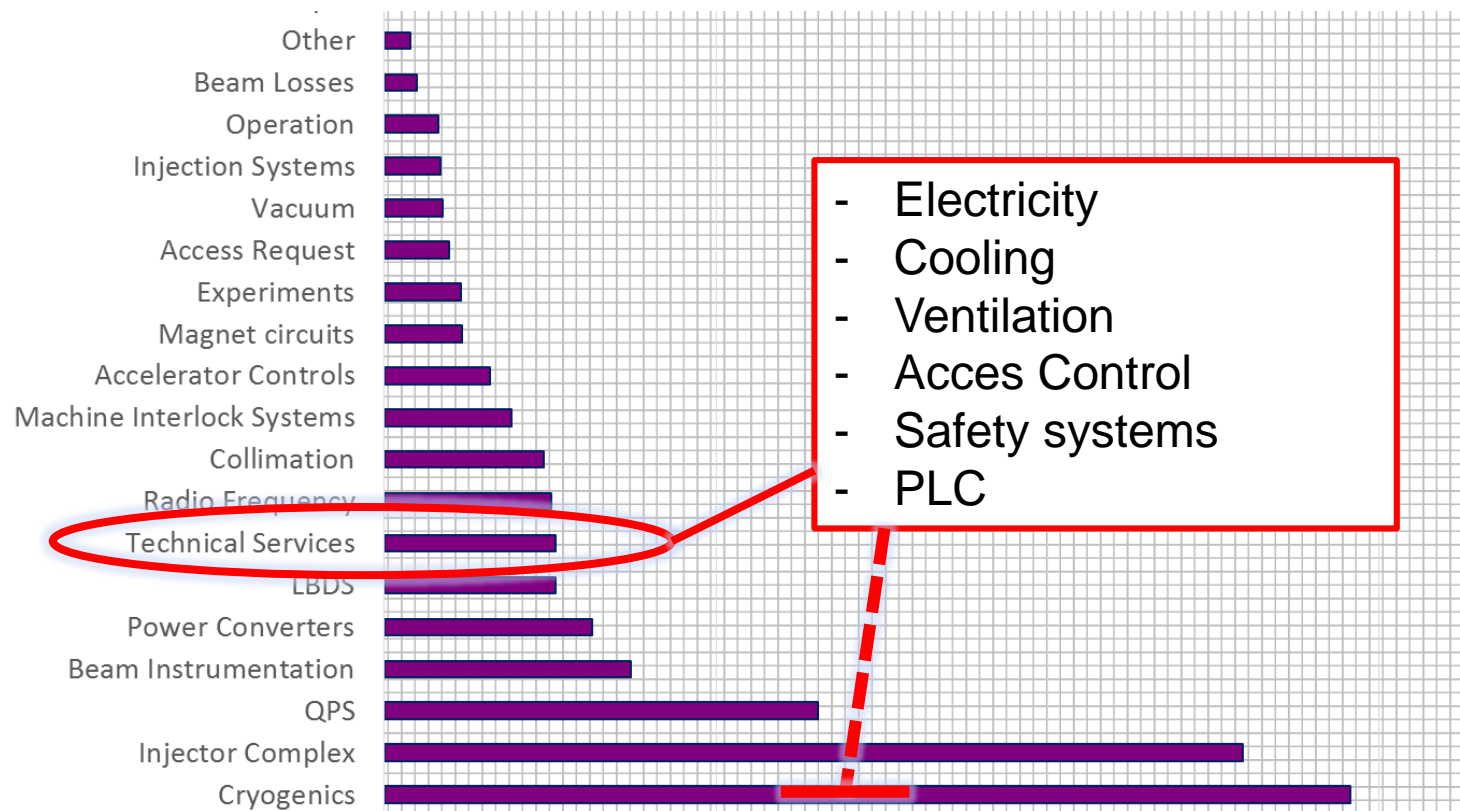
# BE/OP/TI – who are we

- Technical infrastructure operator monitors  
Technical services 24/365



# Major events for technical services

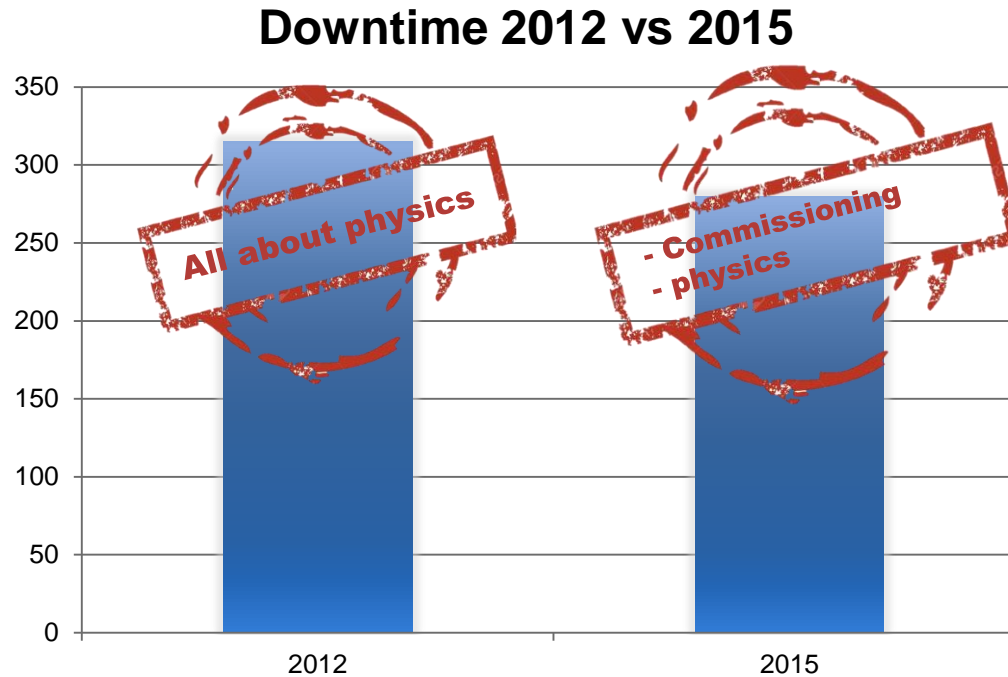
TI operator creates Major Event when technical service problem stops accelerator



# This data is based on major events from TI logbook

- 57 Major events with impact on LHC in 2015 (101 in total)
- A total of 280 hours of downtime of LHC

# Downtime 2012 similar to 2015

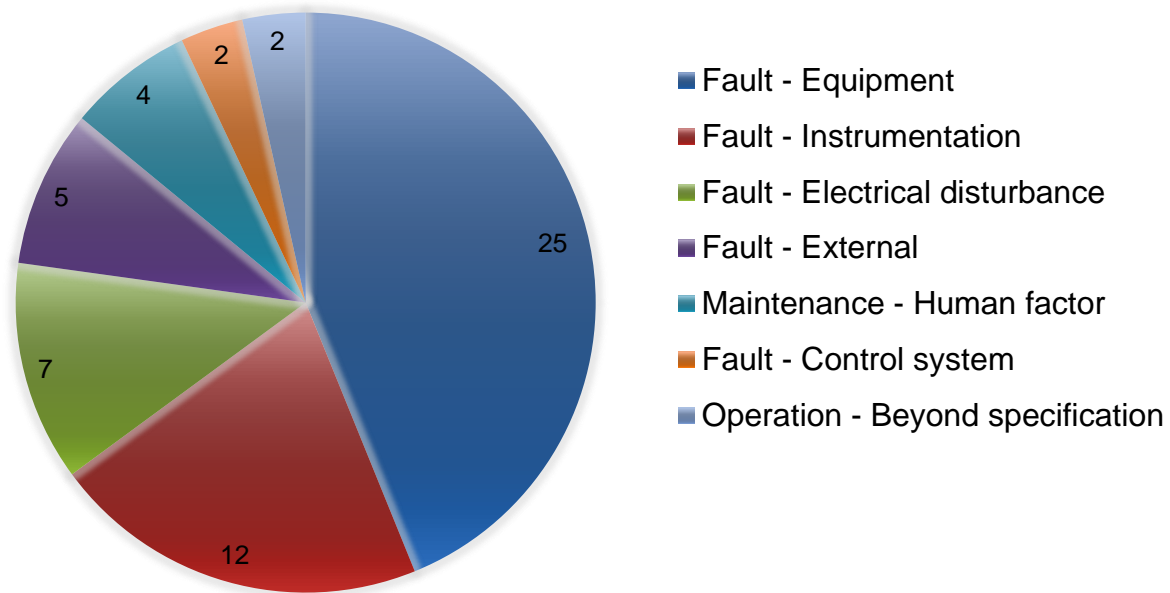


Run 1 all about physics

Run 2 Commissioning and physics

# Major Events in 2015 – per category

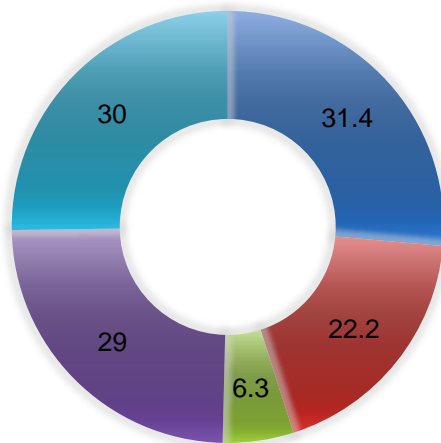
Events per category



# Equipment faults

Split in 5 categories

- Level sensors not working optimally 31,4 hours
- Equipment simply failed 30 hours
- Short circuits 29 hours
- Leaks on valves, pipes, purgers 22,2 hours
- Bad connections 6,3 hours



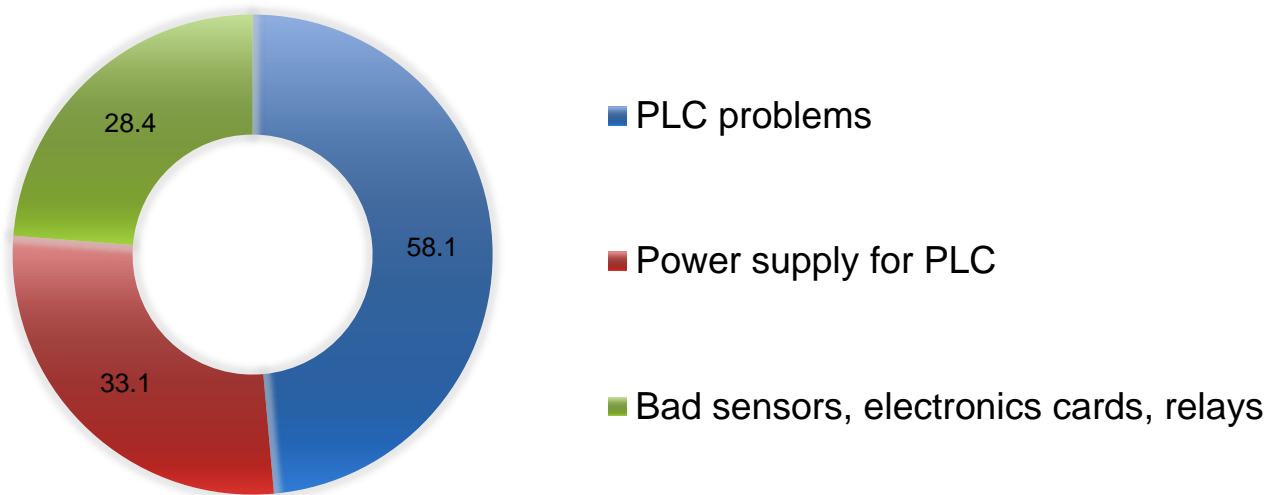
- Level sensors not working optimally
- Leaks on valves, pipes, purgers
- Bad connections
- Short circuits
- Equipment simply failed



# Instrumentation faults

Split in 3 categories

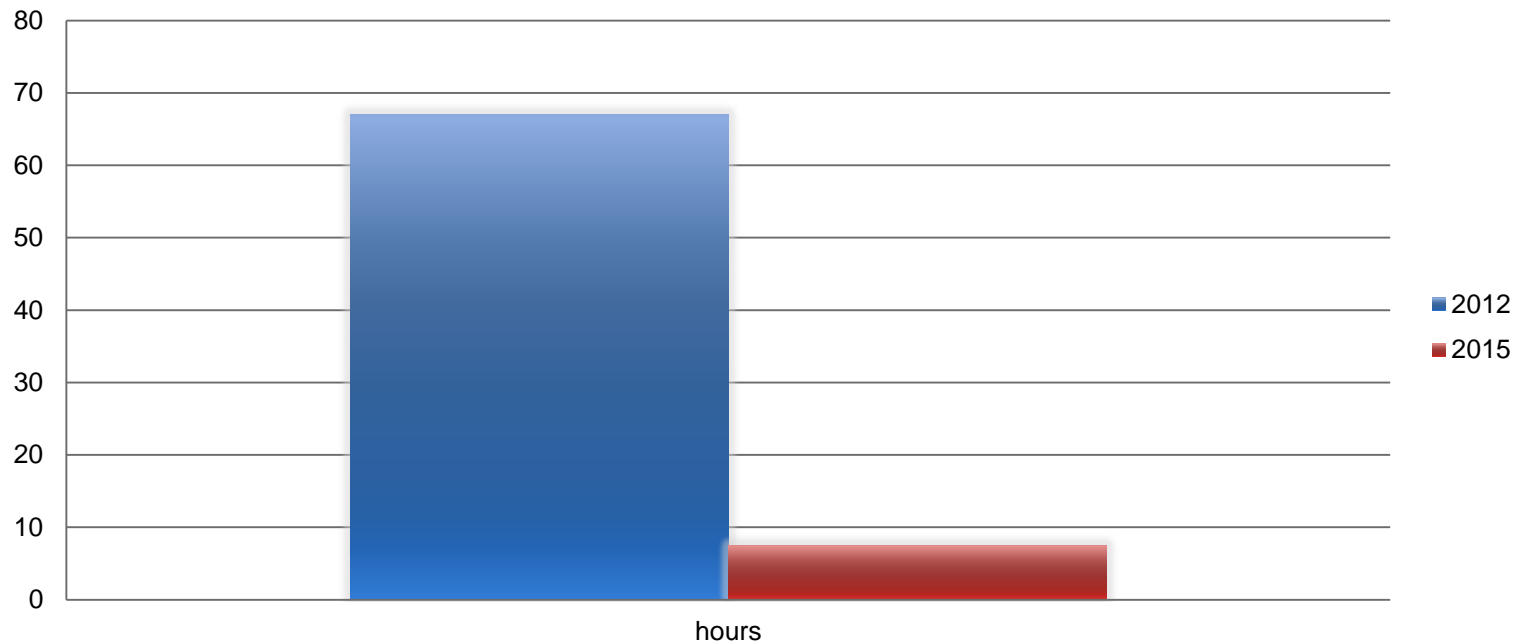
- PLC problems 58,1 hours
- Power supply for PLC 33,1 hours
- Bad sensors, electronics cards, relays 28,4 hours



# Electrical Disturbances

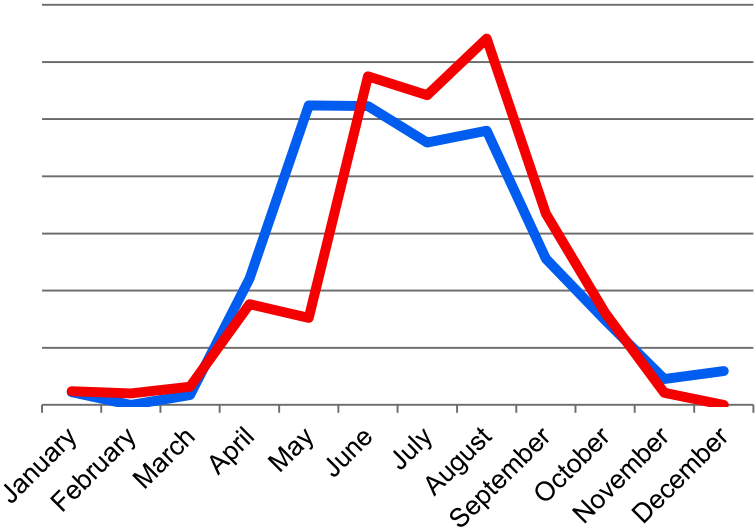
Big efforts were made in LS1 to make equipment less sensitive to perturbations

## Downtime in hours for perturbations

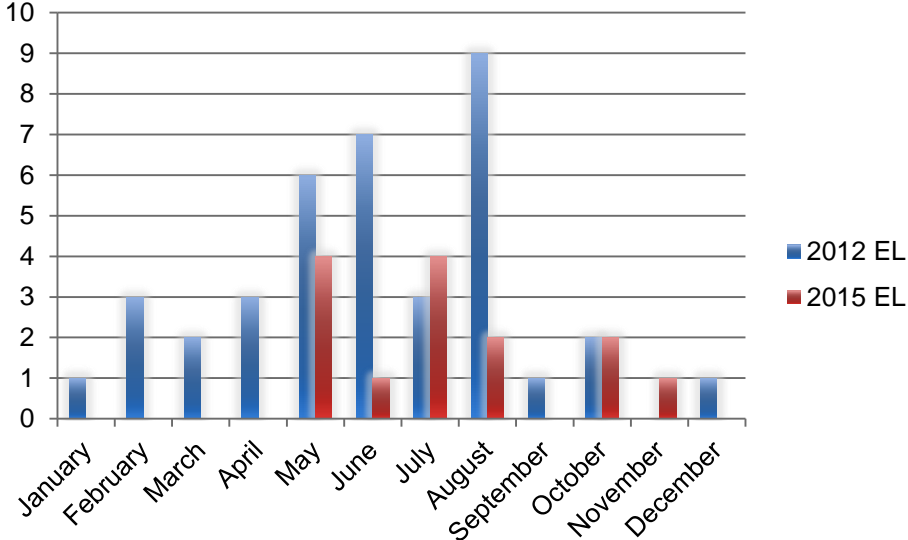


# Electrical disturbances

Now we are less sensitive



Data: <http://www.keraunos.org/>



Data: B. Mouche EN-EL



# Data quality is key

- Link to data from the machine
- Associate the fault to a precise location (Computerized Maintenance System)
- Determine fault category from predefined list
- Major events are reviewed by Technical Infrastructure Operations Committee weekly

Fault - Elect	▼	Location
Operation - Human factor		
Operation - Procedure		
Operation - Beyond specification		
Maintenance - Human factor		
Maintenance - Procedure		
Fault - Instrumentation		
Fault - Control system		
Fault - Equipment		
Fault - Electrical disturbance		
Fault - External		

# New TI Logbook - Connected

Facility stops <sup>1</sup>						
Source	Facility	Description	Begin	End	Duration	Status
eLogbook	LHC	RQ4.LR3	Nov 17, 2015 07:31	Nov 17, 2015 09:32	2h 1m 14s	Run

Our logbook can read from e-logbook

It is also possible to access our logbook data from the e-logbook

Update or clone from the event Major fault ▾ Subtype ▾ Checklist ▾

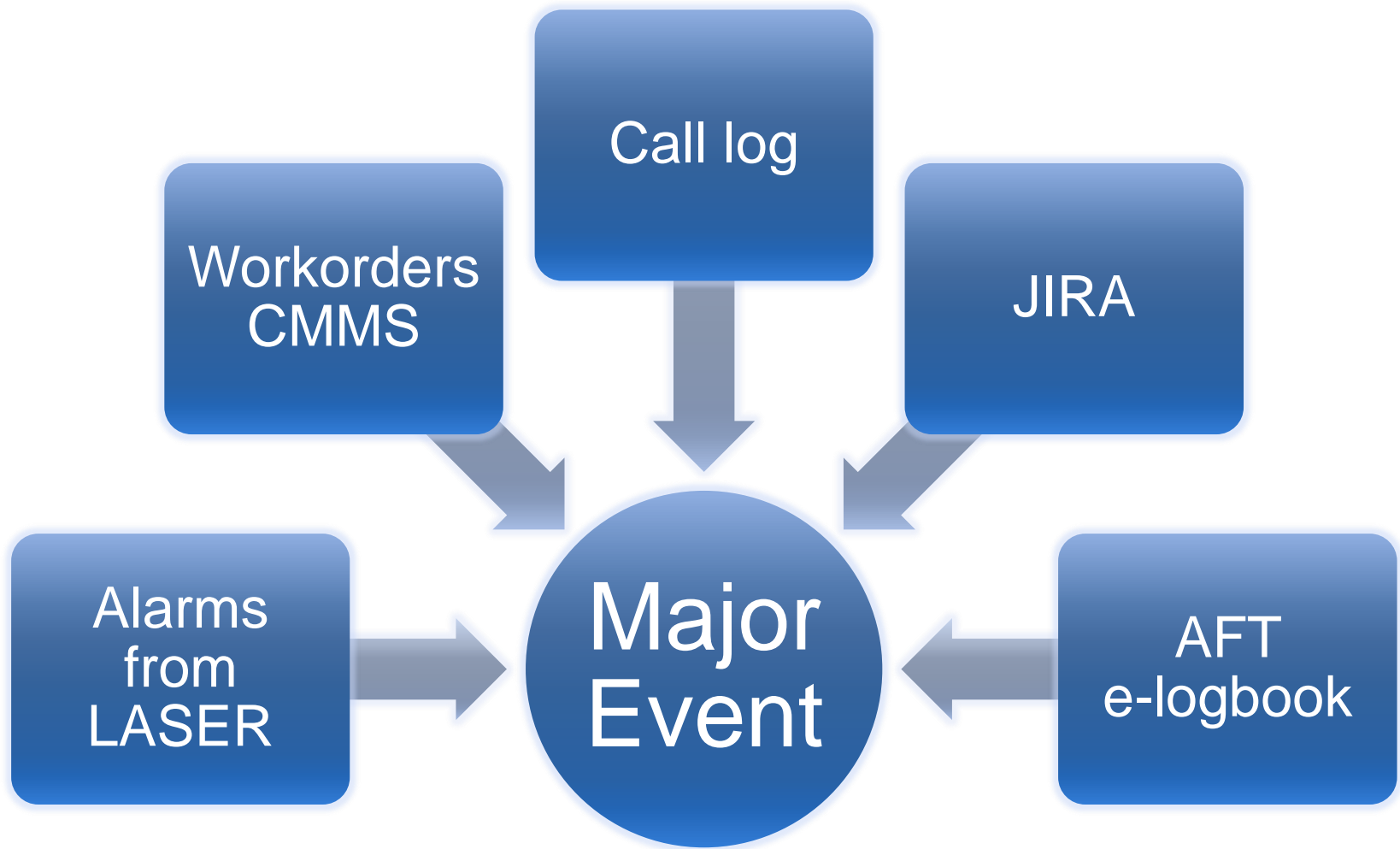
Source - Any ▾ 2015-11-17 06:00:00 2015-11-17 08:00:00 🔍

	Source	Group	Fault	Description	Begin	End	Duration	Status
<input type="checkbox"/>	eLogbook (LHC OP)	AFT	VOID	FMCM RD1.LR5	Nov 17, 2015 07:01	Nov 17, 2015 07:04	3m 12s	Status ▾
<input type="checkbox"/>	eLogbook (LHC OP)	AFT	VOID	RQ4.LR3	Nov 17, 2015 07:31	Nov 17, 2015 09:32	2h 1m 14s	Status ▾
<input type="checkbox"/>	eLogbook (SPS)	CPS	LEIR	Acceleration problem	Nov 17, 2015 07:03	Nov 17, 2015 08:00	56m 59s	Status ▾
<input type="checkbox"/>	eLogbook (SPS)	RF	Cavity and Powering	to be updated	Nov 17, 2015 07:03	Nov 17, 2015 08:14	1h 11m 16s	Status ▾

	Source	Facility	Description	Begin	End	Duration	Status
<input type="checkbox"/> <input type="edit"/>	eLogbook	LHC	RQ4.LR3	Nov 17, 2015 07:31	Nov 17, 2015 09:32	2h 1m 14s	Run

Close Select existing facility stops ▾ Add ▾

# Other connections?



# Conclusion

- TI records Major Events for the accelerators “technical services” more systems could be added
- Fewer Major events due to electrical perturbations in 2015, thanks to equipment's groups for the work during LS1
- TI has well established process to analyze and handle Major Events
- Data is exchanged with e-Logbooks and the Accelerator Fault Tracking system