



# View from EN-MEF

TE-MPE LS1 Review

3<sup>rd</sup> June, 2015

Marzia Bernardini



# Contents

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- Feedback from coordination team
  - Preparation phase
  - Implementation phase
  - Baseline vs Reality
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- Conclusions



# Once upon a time....

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...LS1 preparatory meeting on 21<sup>st</sup> June 2012:

<https://edms.cern.ch/document/1227916/1>



## LS1 ACTIVITIES FOR TE/MPE

Bruno Puccio

Acknowledgements to R.Denz, G.D'angelo, K. Dahlerup-Petersen & A.Siemko

LS1 Coordination meeting #8

21 June 2012

# Once upon a time....




## ELQA activities




- New HV qualification tests @ cold
- RT reference test @ warm
- ELQA tests @ during cool-down
- ELQA tests @ cold after cool-down
  
- ELQA tests during splices consolidation
- ELQA tests for replaced magnets
  - Created by TE-MSC ?
  
- Upgrade of instrumentation for 120A DCF powered via DFBs
  - TE-CRG or TE-MSC (t.b.d.) for the modification and change of the "C50" connectors used for the instrumentation
  
- TT891 and TT893 exchangeability upgrade for the 13kA circuits
  - TE-CRG for the replacement of the connectors

# Once upon a time....







## Activities related to DYPB racks



- Exchange of 1232 Local Protection Units for Dipole Magnets
  - ❖ to integrate the enhanced quench heater supervision and adapt to redundant UPS powering.
  
- Improvement and Extension Plan for the 4928 Quench Heater Power Supplies:
  - ❖ Introduction of a discharge current measurement associated with each Quench Heater Power Supply through the insertion of a new Transducer module (replacement of the "Crawford box")

- EN/HE for transport of 1232 racks from tunnel => surface, surface => Meyrin site, and back to tunnel.
- EN/EL for re-cabling.



B.PUCCIO (TE/MPE)

LS1 Coordination Meeting#8 21 June 2013

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# Once upon a time....

## Activities related to Energy Extraction switches

- Consolidation of the 606 Extraction Breakers for the 600A circuits

- ❖ improved fixation of the "Holding" coil
- ❖ Mitigation Package
  - ❖ This activity requires the development and deployment of 202 DAQ systems type DQAMS600



- Installation of Snubber Capacitor Banks in RQF/RQD circuits

- EN/HE for transport

- Replacement of the Arc Chutes on Quadrupoles

- EN/HE for transport



- DQRB Dump Resistors

- EN/EL for removing concrete blocks which prevent us to access (during the work) in 7L and 7R
- EN/CV: in order to move the dump resistor as water emptying is needed (only in 1R, 1L, 5R, 5L, 7R and 7L)



- Upgrade and ELQA of cabling for IPQs and IPDs (to improve EMC immunity)

- EN/EL for re-cabling

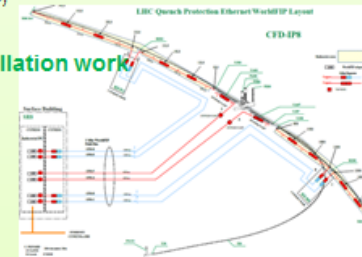
# Once upon a time....

## Activities related to Quench Detection systems

- **Reconfiguration of the existing Field-Bus**

*This activity involves re-wiring, a doubling (from 2 to 4 per sector) of the tunnel Gateways, a doubling of the number of repeaters and some infrastructural changes.*

- **BE/CO** for supplying more WorldFIP gateways and for supervising the installation work (see activity created by BE/CO as the Plan Item #11950)
- **EN/EL** for new cables and fibers
- **EN/ICE** for more PVSS servers



- **Extension of the Distributed Busbar Splice Monitoring System**

- **EN/EL** for re-routing the cables around Q10, Q9 and Q8

- **Extension/Completion of the "Voltage-to-Ground" measurement system**

*(nQPS - DQQDE board, Phase II: in total ~1300 cards)*

- **Maintenance of the protection of the 600A circuits.**

*work performed in MPE workshop =>114 crates have to be pull-out and  
Same activity for the Quench Loop Controllers (16 units)*



# Once upon a time....

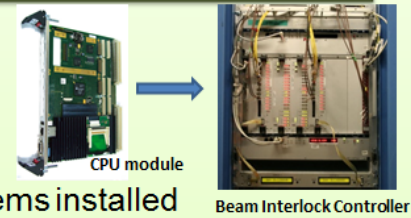
## Activity related to Powering Interlock System

- Additional interface with the LHC Access system
  - ❖ Modification/extension of existing access interlock (Vs Powering)
  - ❖ Mainly SW activity with using a Standard BE/CO system as gateway
    - EN/ICE: contribution for the PLC program and for the PVSS SCADA
    - GS/ASE for SW contribution to get internal information of Access system



## Beam Interlock System & Safe Machine Parameters system

- Upgrade of the CPU module of all VME systems installed
  - (in total, ~24 front-ends have to be upgraded)*
  - BE/CO for supplying the module and for giving support in case of non-compatibility with existing HW



- Replace the CIBF units by an upgraded version
  - ❖ *Internal resources are used.; no needs from other groups.*



- Install remote monitoring for the Beam Permit Loops
  - ❖ *Internal resources are used.; no needs from other groups.*





# Once upon a time....

Individual System Tests

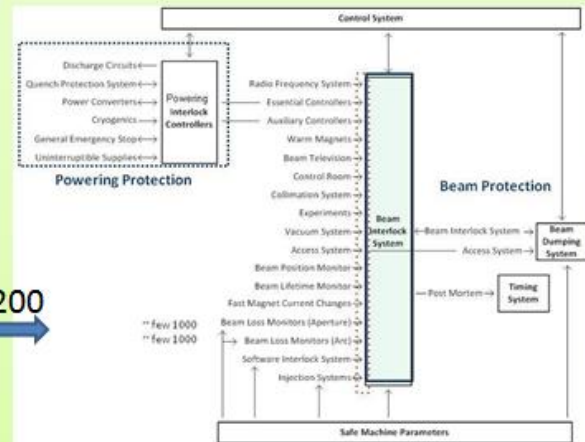
## And finally....before the LHC restart

- IST for Energy Extraction systems
- IST for Quench Protection systems
- IST for Powering Interlock systems
- IST for Warm Magnet Interlock systems
- IST for Safe Machine Parameters system
- IST for Beam Interlock systems
- BIS: Re-commission with systems who will make changes during LS1



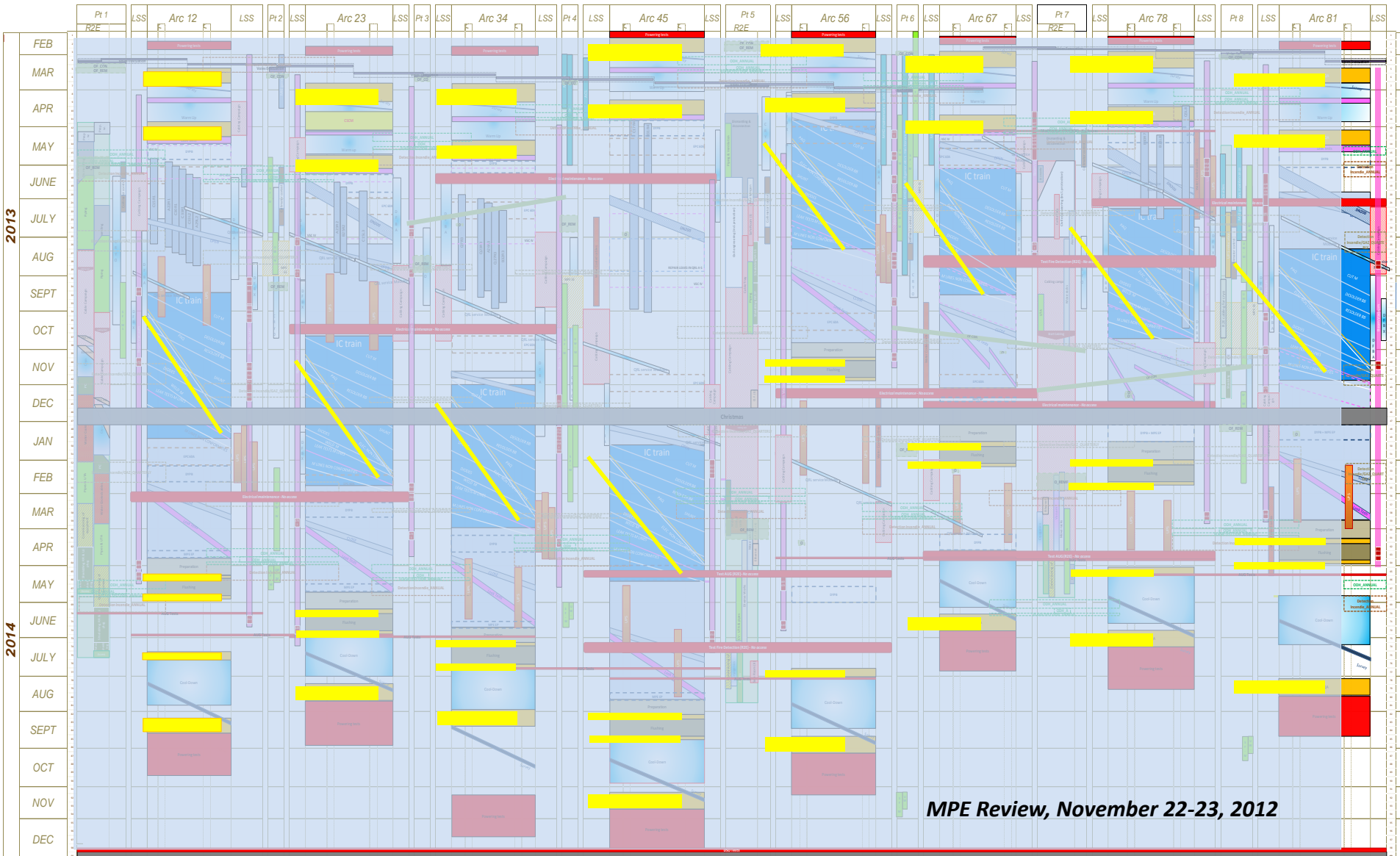
CIBU unit

x ~200



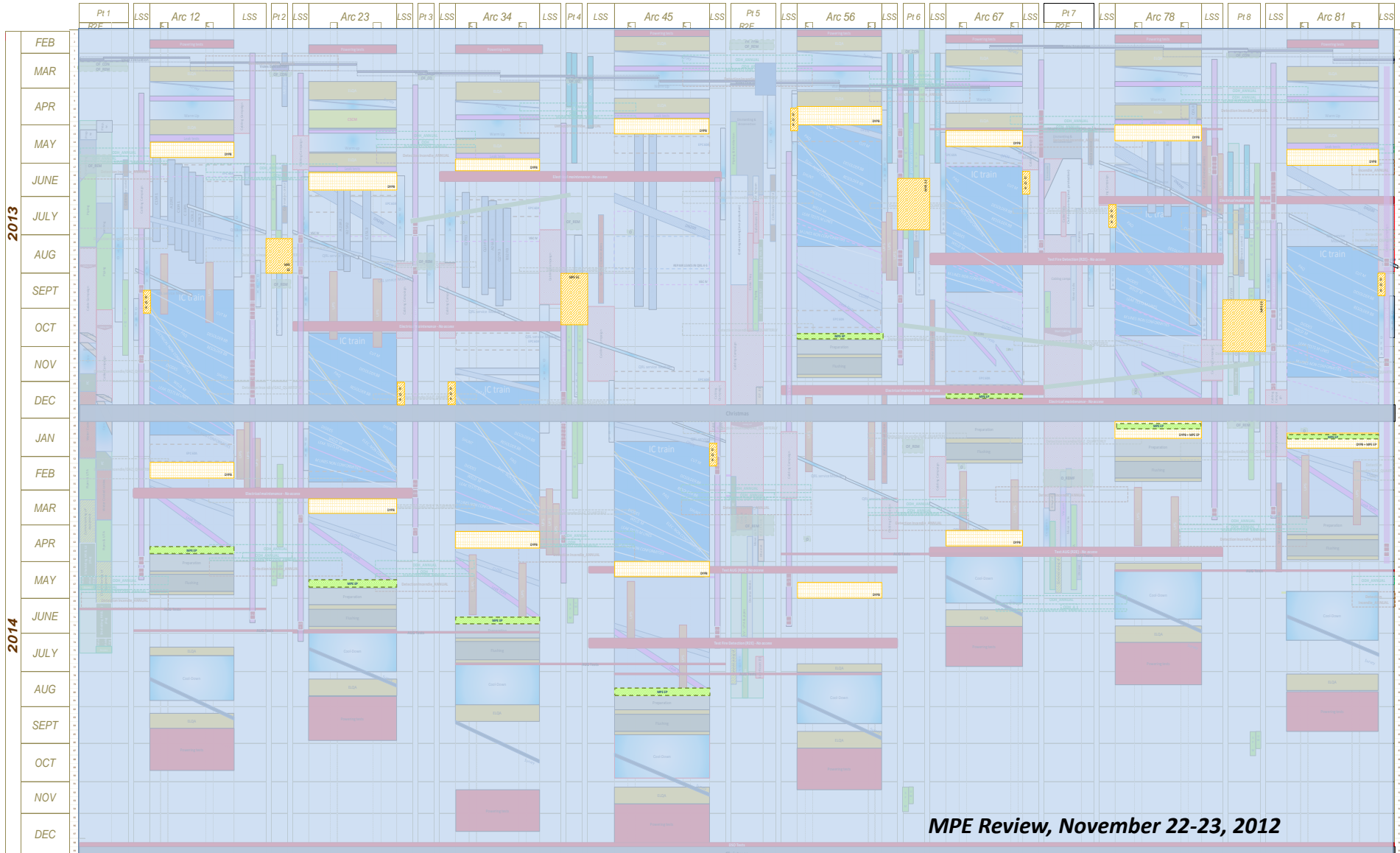


# MPE in the LS1 Baseline: ELQA





# MPE in the LS1 Baseline: Maintenance & Consolidation



*MPE Review, November 22-23, 2012*

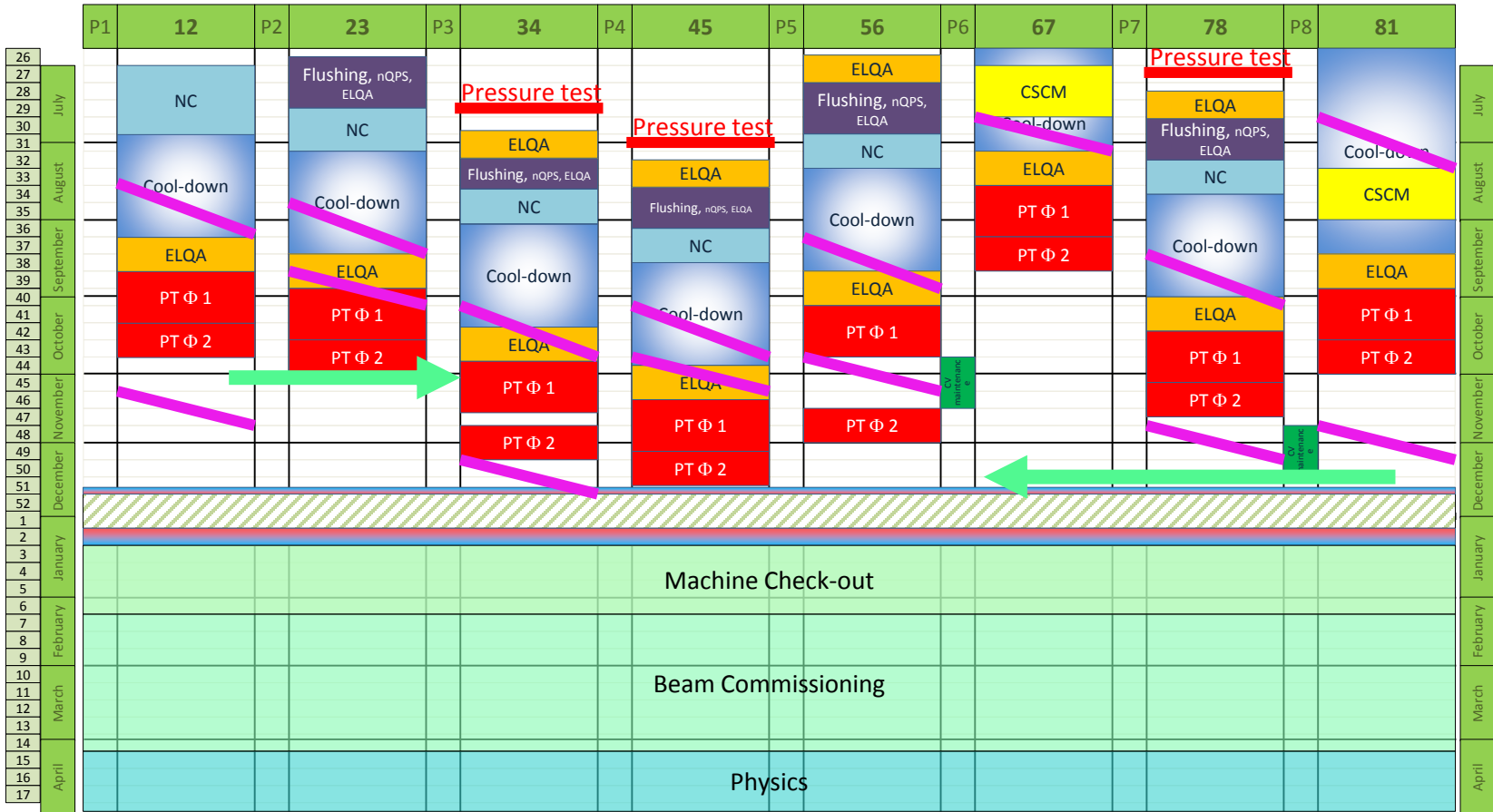
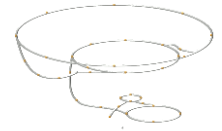


# Reality vs Baseline...

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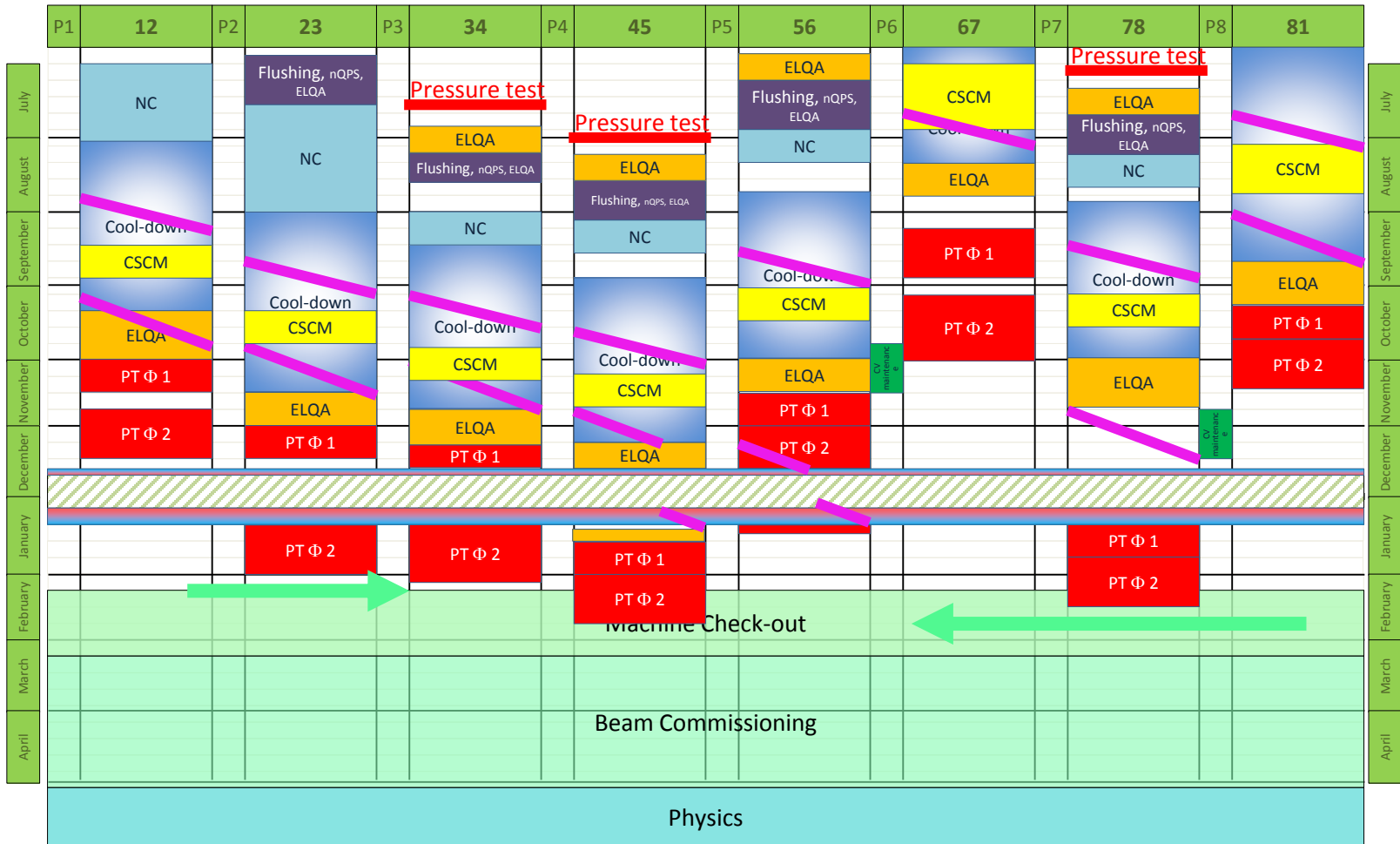
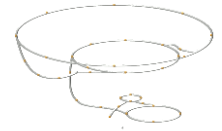
- **During warm up:**
  - ✓ Warm busbar measurement during warm up and cool down;
- **During the LS1:**
  - ✓ SCT on the WCC;
  - ✓ CSCM @ 20K, in all sectors – August 2014:
    - ✓ Re-engineering of the QPS cards → mQPS;
    - ✓ Issues on the cards → Impact on ELQA conditions;
    - ✓ Delay on DYPB racks installation;
    - ✓ Accrual contingency related to the mQPS cards deployment;
  - ✓ Energy Extraction Cleaning and Measurement.

# CSCM: impact on schedule



v3.3 (presented in LMC on 23/07/2014)

# CSCM: impact on schedule



v4.1 Sept. 2014



# CSCM: impact on schedule

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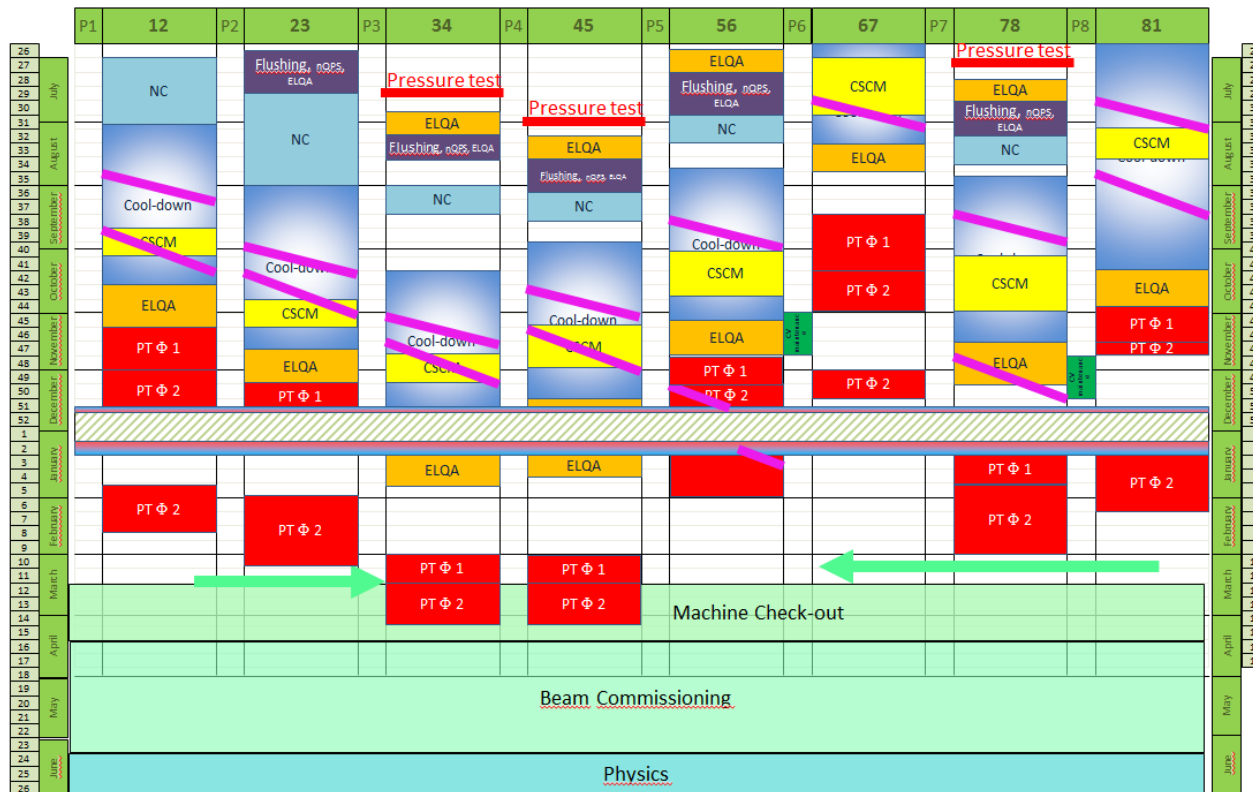
- Since the beginning of CSCM, in sector 67:
  - ✓ Contingencies in the QPS debugging;
  - ✓ Impact on the commissioning on the systems on other sectors.
- CSCM in sector 81:
  - ✓ Impact on the commissioning to prepare powering tests in other sectors;
- Lack of resources to follow up:
  - ✓ QPS commissioning on the whole machine;
  - ✓ CSCM;
  - ✓ Powering tests.

# MPE action plan: October 2014

- Detailed list of activities, managed by 1 focal person;
- Resources loaded schedule, including all the MPE activities.

## V4.1d – MPE levelled

+5 weeks







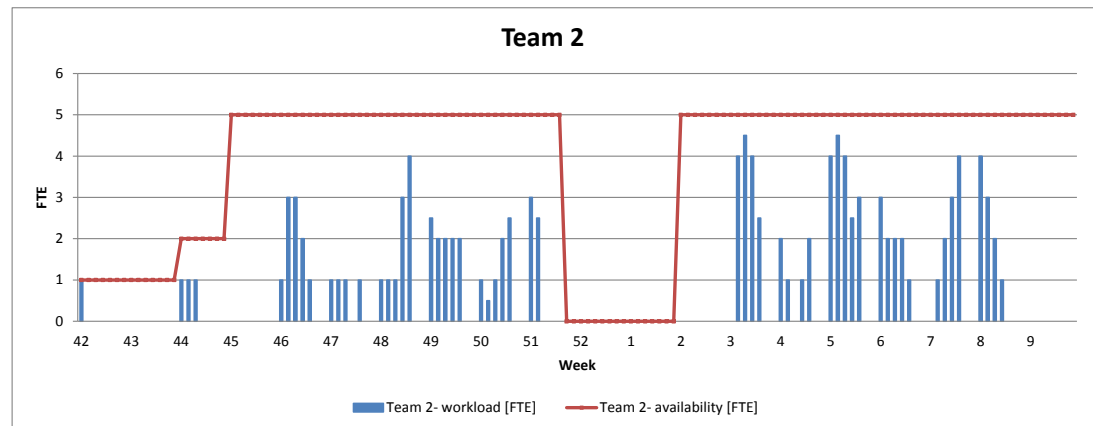
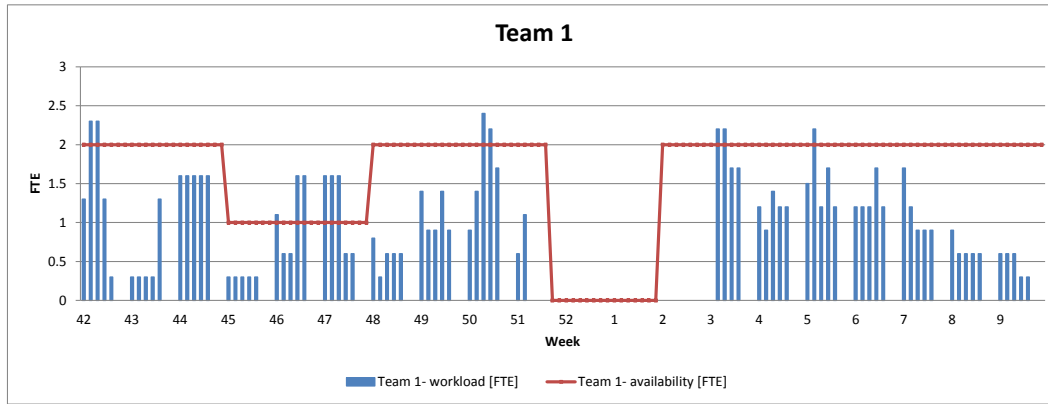
# October 2014 – crash program

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- Re-allocation of the resources inside the Group, to:
  - ✓ Support the critical tasks;
  - ✓ Support the experts.
- Resource Loaded Planning (personnel and material):
  - ✓ Permanent updating in order to anticipate potential/actual problems;
  - ✓ Anticipation of resources re-allocation.
- Follow up the activities inside the Group;
  - ✓ Track open issues;
  - ✓ Monitor progress;
  - ✓ Weekly meetings across MPE Sections and Group Leader Office (Friday meetings, regularly held every week, with minutes).
- Besides participation to the LS1 Coordination meetings, “only” MEF-MPE meetings weekly allowed for:
  - ✓ Preparation of the work plan for the next week per team (Team Planner);
  - ✓ Better coordination with other teams as co-activities information was directly available from MEF;
  - ✓ Anticipation as soon as changes would be applied to the general planning.

# Resources Loaded Schedule

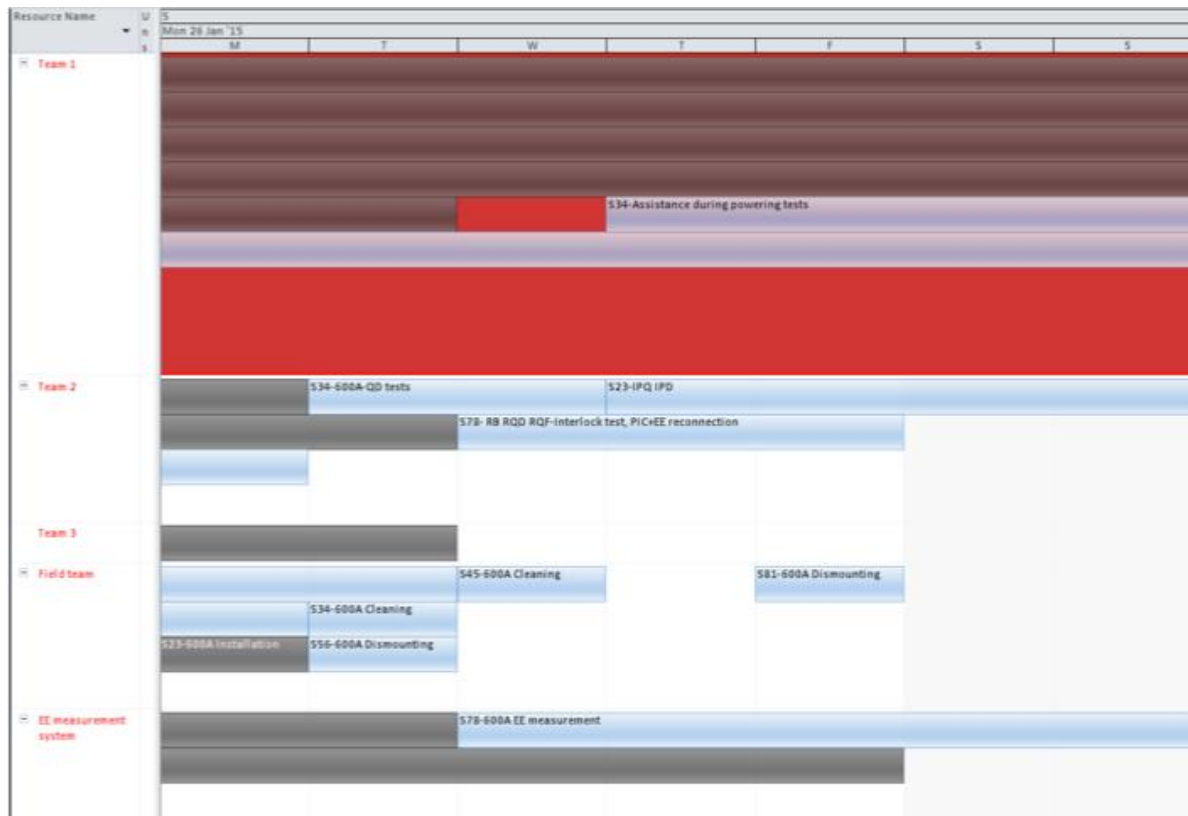
- MPE conducted an optimization of resources in order to cope with the challenging requirements given by the LHC General Schedule;
- Reallocation of TASKS and RESSOURCES



*Result of the reallocation of tasks among two of the Group's QPS Teams.*

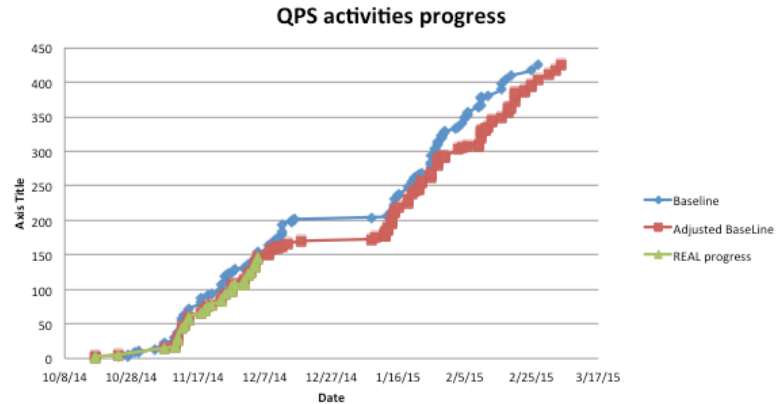
# Team Planner

- For reasons to be analysed, Team Planner was not strictly followed in reality, although prepared weekly from October'14 to March'15.
- It was used more like an asymptotic rule, to observe trends, but not as a strict plan that everyone should respect.



# Activity follow up: monitoring tools

Dashboards and Follow up tables... from November 2014!!!



RB/RQ			12	23	34	45	56	67	78	81
Installation of nQPS	T	1 3	1	1	1	1	1	1	1	1
Debugging-communication (BS boards running)		0.5 1	1	1	1	1	1	1	1	1
Warm BB measurements		2 2	1	1	1	1	1	1	1	1
Check loop controller - disconnect EE+PIC	T	0.5 1	1	1	1	1	1	1	1	1
Check C leads protection	T	0.5 1	1	1	1	1	1	1	1	1
Interlock tests (DS, BS, CL)		1 1	1	1	1	1	1	1	1	1
Configuration for CSCM (running a macro)		1 1	1	1	1	1	1	1	1	1
Reconnect EE+PIC	T	1 1	1	1	1	1	1	1	1	1
CSCM tests			1	1	1	1	1	1	1	1
After CSCM, disconnect PIC+EE	T	0.5 1	1	1	1	1	1	1	1	1
Reconfigure sector for normal operation (macro)		0.25 1	1	1	1	0	1	1	0	1
Detector settings by software		0.25 1	1	1	0	0	1	1	0	1
Heater trigger verification + voltage verification	T	3 1	1	0	0	0	1	1	0	1
Interlock tests IQPS		1 2	1	0	0	0	1	1	0	0.5
Interlock tests nQPS		1 2	1	0	0	0	1	1	0	0.5
Connect PIC+EE	T	1 2	1	0	0	0	0.5	1	0	0.5
<b>QD tested and ready</b>										
Switch ON HDS, Check heaters, unlatch nQPS trigger, 300 V test, analysis, 900 V test (triggered by IQPS), analysis	T	3 2	1	0	0	0	0	1	0	0
<b>HDS tested and ready</b>										
Update firmware IQPS		1 4	1	1	1	1	1	1	1	1
Update firmware nQPS		1 4	1	1	1	0	1	1	0	0
<b>UPS test done (heater redund. verified)</b>		1 1	1	0	0	0	0	1	0	0
Connection to PIC of QD and EE	T	0.5 1	1	0	0	0	0	1	0	0
Remote download of coeff (QPS)		0.5 1	1	0	0	0	0	1	0	0



# Lessons learned

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- ELQA was a great success!!!
  - ✓ Despite the huge workload;
  - ✓ Good preparation and reactivity;
  - ✓ Excellent team spirit;
  - ✓ Organised well in advance.
- Activities around energy extraction systems was very well prepared!!!
  - ✓ Despite the contingency → able to keep the target!
- The GLOBAL resource loaded schedule, inside MPE arrived too late...  
...to understand the delay. It should help to AVOID the delay!
- The resources loaded schedule:
  - ✓ Should be created before the shutdown starts;
  - ✓ Should be followed and adapted;
  - ✓ Help the decision around new activities;
  - ✓ Identify critical resources which generate the critical path.



# Lessons learned

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- The schedules HELP, they do not always constraint:
  - ✓ Planning, dashboards and follow up tables help you to be more effective.
- Need for EN-MEF to have a unique Contact Point for MPE, with sufficient authority inside the Group;
- Empowered MPE scheduling officer, to organise and follow up activities inside the Group; avoid fragmentation of the schedule, lack of effectiveness.
- Estimation of the duration of activities:
  - ✓ LS1 is a precious database, to use for the preparation of LS2.
- Contingency:
  - ✓ Avoid to OVER allocate resources and experts since the beginning of the shut-down.
- Experts availability was the critical path.
- The **IMPRESSIVE COMMITMENT** and FLEXIBILITY of MPE team was the key success factor of LS1 for MPE!!!

# Conclusion

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**Despite all the points of improvements  
mentionned, the LS1 was a success**

**And this is thank to you !!**

