Upgrade of the DYPB racks :

the Organization and the Logistics

… and few other things which have to be mentioned

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Purpose of the project

Upgrade of 1232 Local Protection Units for Dipole Magnets

to integrate the enhanced quench heater supervision

and adapt to redundant UPS powering :

- **Implement DQHDS discharge voltage measurements**
- **Enhance the heater circuit supervision**
- **Implement redundant powering**
- **Replace the interconnection crate**

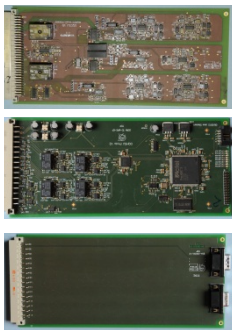
- **… produce, test them individually, assemble and test them all together.**

Related designs and productions

☞ *see Vincent's talk related to DQLPU crate and boards*

New Electronics crate (DQLPU)

New Electronics boards (DQCSU, DQHSU & DQIPF)



5200 units

New Precision **Current measurement Transformer**

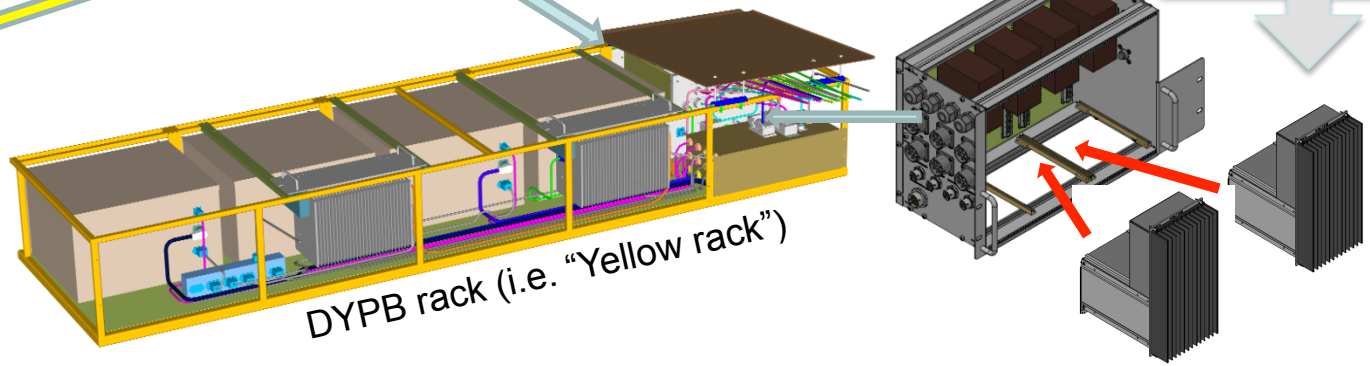
x4

1300 units

New intercon-nection crate (DQLIM)

2600 units

New Redundant P.S. (DQLPR)



Main parts ordered separately: due to limitations of the finance committee, order costs need to be diluted to keep below 700kCHF

Logistics

- **1232 racks (i.e. 200 tons)** moved out from the tunnel and stored in ISR area

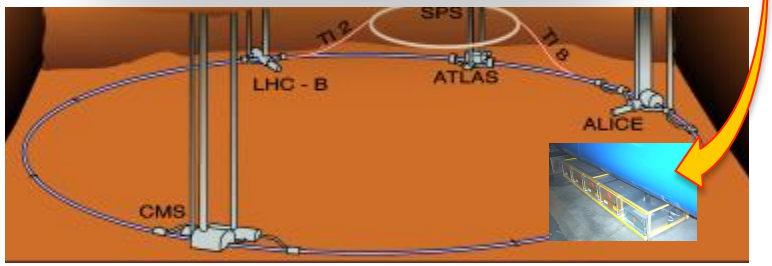
- Massive production with:
  - **~8000** electronic boards produced
  - **2700** power modules produced
  - **5200** current transformers produced
  - **Several thousands** of dedicated cables made

- Individual Tests of the different items
- Assembly, HV tests
  & Global tests in b281
  ~ 2.5 weeks to get quantity needed for 1 sector

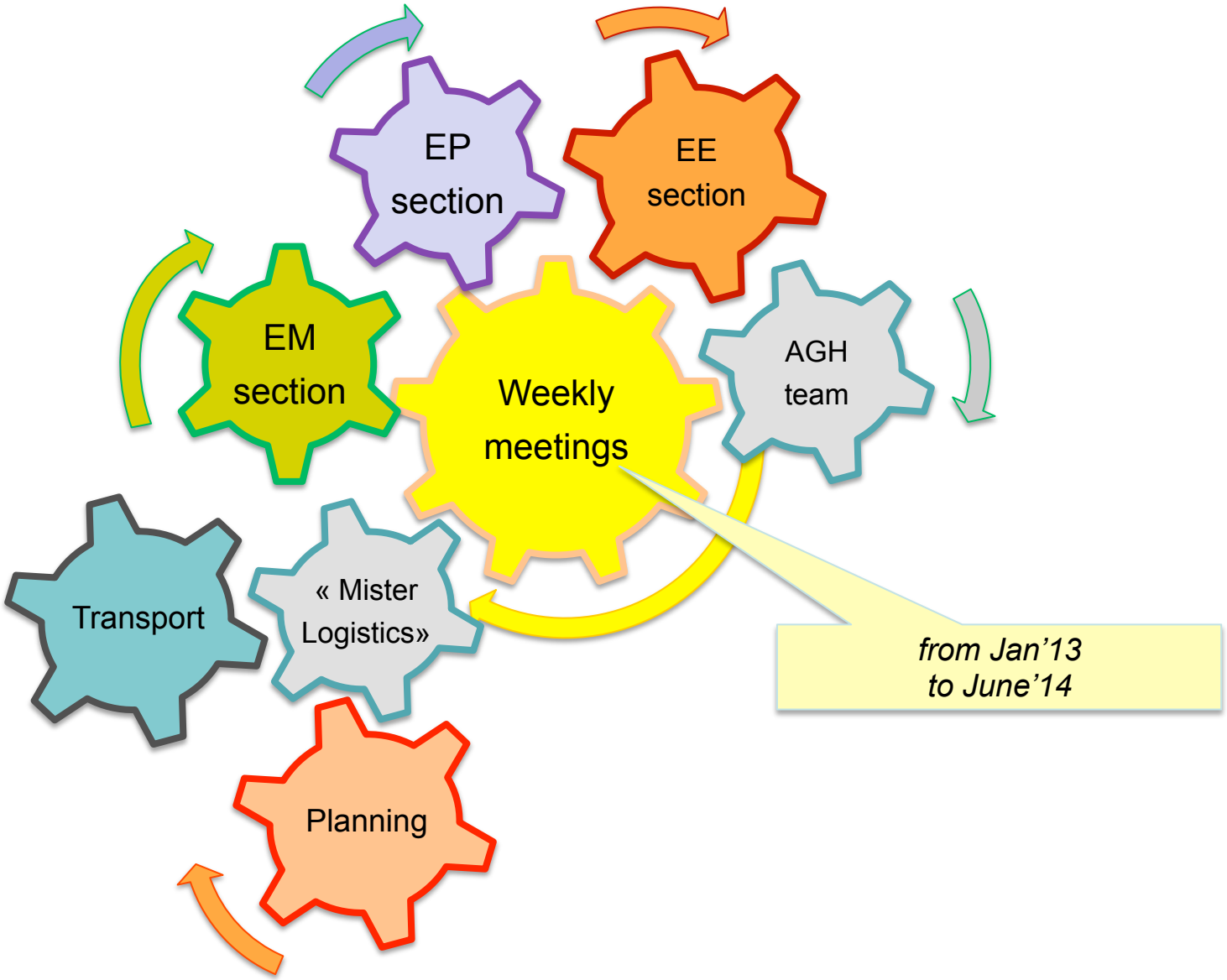
12 racks/day

- DYPB racks stored after upgrading in ISR area

- Re-installation of DYPB racks in the tunnel
  (performed in few days)
  (in accordance with LS1 schedule)
- Re-connection and Tests



Organisation



What went well?

One exemple: the Transport of the DYPB racks

- According to Serge Pelletier:

  Interfaces with Transport activities prepared in advance:
  - Needed storage space identified in time
  - Handling capacity identified (including special forklift truck) and bought in time (despite annoying CERN administrative formalities)
  - Required resources : good estimation from MPE but it worked well mainly due to flexibility of the contracting party

Serge Pelletier : *<< J'ai particulièrement apprécié l'écoute et la confiance dont TE/MPE a fait preuve pour la mise a disposition de ces moyens logistiques que nous vous avons proposés pour la réalisation de ces travaux et la collaboration dans le suivi tout au long du chantier >>*

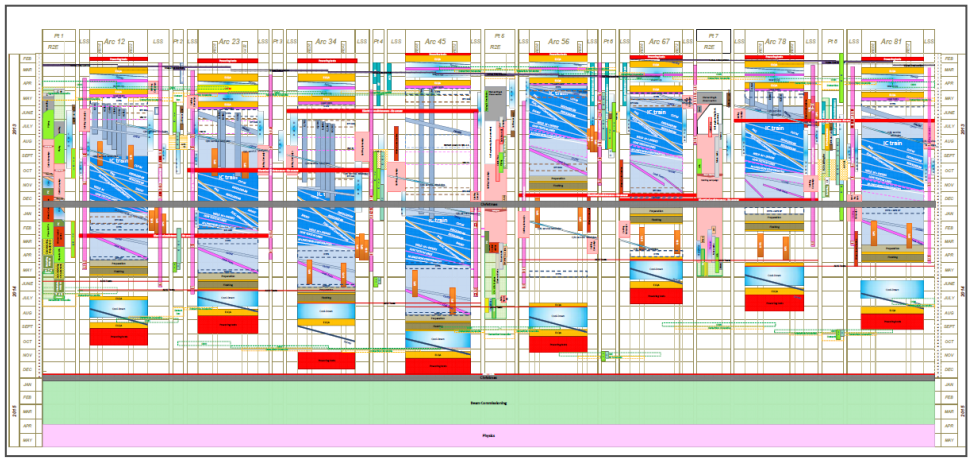
❖ What to be improved? Nothing

(except the poor quality of the wooden pallets)

✓ Advise for LS2 :

- The space storage was the key point. Do not wait to long to identify a equivalent space that will be required for the DYPQ racks

Scheduling : constraint from Global Schedule



LS1 Global Schedule v1.5 (Dec'12)

DYPB dismounting in 1st sector (S56) : April'13

… last sector (S23) : June'13

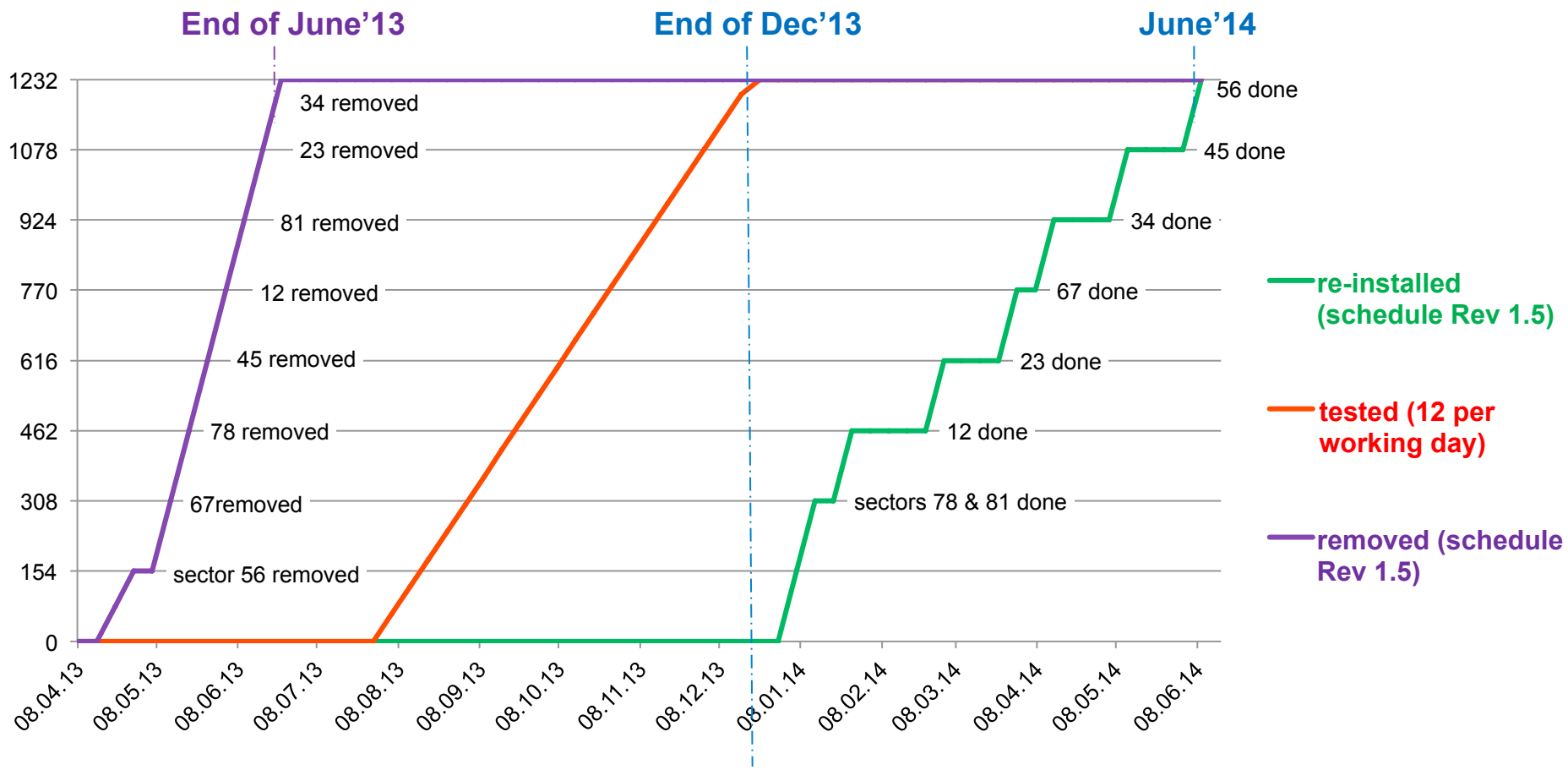
Time interval : 35 to 56 weeks
according to the chosen sector

DYPB re-installation in 1st sector (S78) : Jan.'14

… last sector (S56) : 30 May'14

Scheduling : DYPB Progress Dashboard

(as foreseen in May'13)



The aim was to complete the assembly and global tests <u>before</u> the re-installation

Was it properly planned, how much in advance?

(1 of 2)

Well, we cannot reply positively. One example to illustrate this:

Have a look on the situation by May'13 :

The DYPB racks for first sectors have been already removed and stored.

The date of re-installation in 1st sector is in 7 months time but…

- The production of DQLIM (mechanical parts) is about to be launched
- The prototype of the DQLIM Motherboard is even not yet validated
- We have huge delay to get " Souriau © " connectors
- Final assembly of DQLIM: company not yet selected (Public tender just sent)
- Pre-series (30 units) of DQLPR not yet received (it will done 2 months later)

  (we are already preparing a 'plan-B' for an internal fabrication of 500 units)
- Precision Current Transformators: Company recently validated, production tester is on-going, pre-series expected by June'13
- DQLPU Motherboard still at level of prototyping…
- Same for DQCSU board
- ….

Was it properly planned, how much in advance?

(2 of 2)

… **most of the items were already at this time on the critical path !**

Not easy to give explaination. Different cases, not a unique cause to point out

Lessons to be drawn (to embark on a project of this scale) :

- Nominate a Project Leader 2.5 years before the start of the final assembly and global tests

  Note: in some way, the weekly meetings played this role

Nevertheless, in May'13 we were far away from the other surprises discovered later on, mainly :

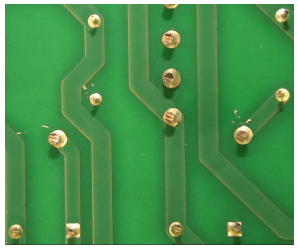
- "Tropicalisation" of most of the DQLPR units
- Fuse replacement for each DQHS

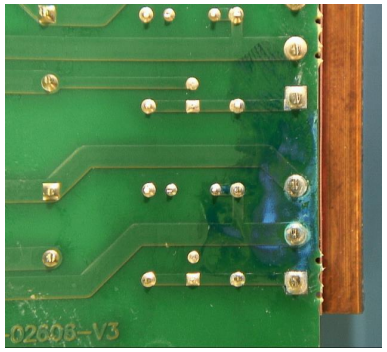
Things off on the wrong foot : Tropicalisation of the DQLPR printed circuits

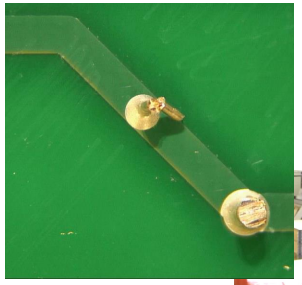
To mitigate the quality problem of DQLPR units produced by the selected company,

it has been decided to buy a coating machine

and to apply (after a dismounting of the P.S. unit) the so-called “Tropicalisation” of the PCB, it means a surface coating of the printed circuit.







Thanks to Sylvain Kaufmann (EM) one machine has been selected, bought and quickly set to an operational state.

Later on, the process has be applied on the 4 first batches (out of the 6 produced)
It lasted 2 months of daily efforts to process 1800 units.

As a reminder: the company was selected after Market survey (lowest bidder principle)

Lessons to be drawn:

- The company choice must be validated by real Experts (namely EM) in the domain

Note: Can we request to get around the lowest bidder rule when contracts imply Safety items?

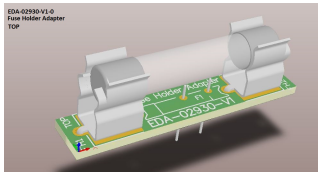
Things off on the wrong foot : The fuse replacement on each DQHDS

January 2014: to mitigate the potential issue with the grounding fuse of the Quench Heater P.S.

it has been decided to replace it by a new type of fuse…

The new fuse has been selected relatively quickly but…

as the size was different, a dedicated PCB with fuse holders have been designed and produced (5200 pieces) in a short notice.



As the decision came so late, many DYPB racks were already assembled and fully tested, therefore it has been necessary to retested them once more (after the replacement of the said fuse)

=> 24 racks tested per days in 2 shifts

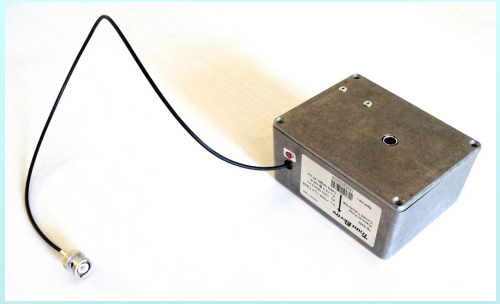
Picture of the “backlog” racks

Lessons to be drawn:

- *is it really needed to express it?*

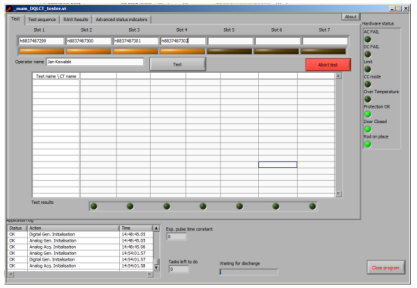
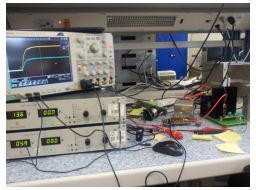
The Precision Current Transformers : a so long way to make it happen

Despite the technical specifications were already knew in 2012, it lasted more than 2 years to pass though the Market surveys, the prototyping phases, make the tester and finally get the expected quantity (5200 pieces)



Pictures of the prototypes (courtesy Mateusz)

As a reminder, the availability of the CTs was a show stopper for the DQLIM fabrication


Pictures of the CT tester (courtesy Mateusz)

One of the causes of the delay was the Market survey process and the choice of unbalanced countries.

Once more, it is for the time being not possible to get around this rule.

Conclusion

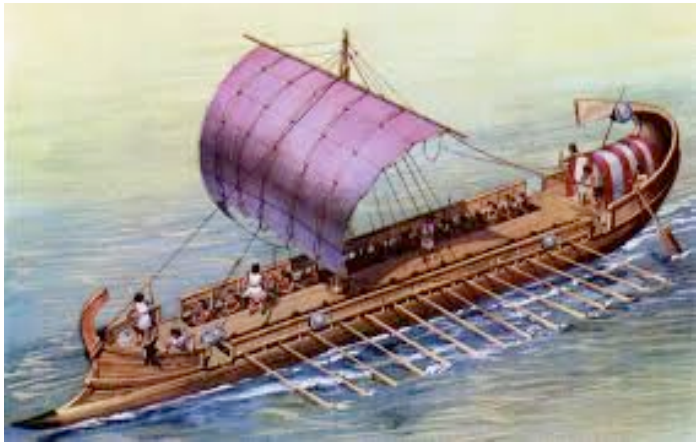
(1 of 2)

Yes, we make it !

- 1232 DYPB racks were move out, stored, modified, tested and re-installed in time
- Since LHC has correctely restarted, we can assume that we did correctly
- Nobody was hurt, no damaged equipment.

… we make it **thanks to the trementious efforts from the involved people.** We have to congratulate all of our colleagues for their flexibility and their comitments

… we also make it thanks to the weekly meetings



… we make it but it has been a permanent race against time !

- No time margin
- Always put out a fire, then another one, again and again…

Conclusion

(2 of 2)

" *The road to LS1* "

picture shown at the MPE workshop for LS1 organised in Dec'12…

- Logistics and Organisation (over the 2 last years) went smoothly but it doesn't balance my overall point of view about the project. I could not state that it has been a succesful one.
- With a better preparation we would have reached the same goal in consuming less ressources
- For a new large scale project, we will have to:
  - Anticipate the workload and the constraints (no more crash program!)
  - Improve procedures, documentation, communication…
  - Foresee time margin for the known bottlenecks (Market survey process, components procurements…)

For the coming DYPQ upgrade, a Project Leader is mandatory (as of now !)


Fin
Thank you for your attention!