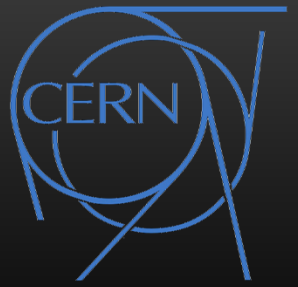
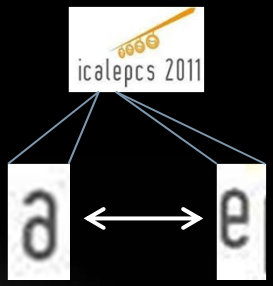


THE WONDERLAND OF OPERATING THE ALICE EXPERIMENT

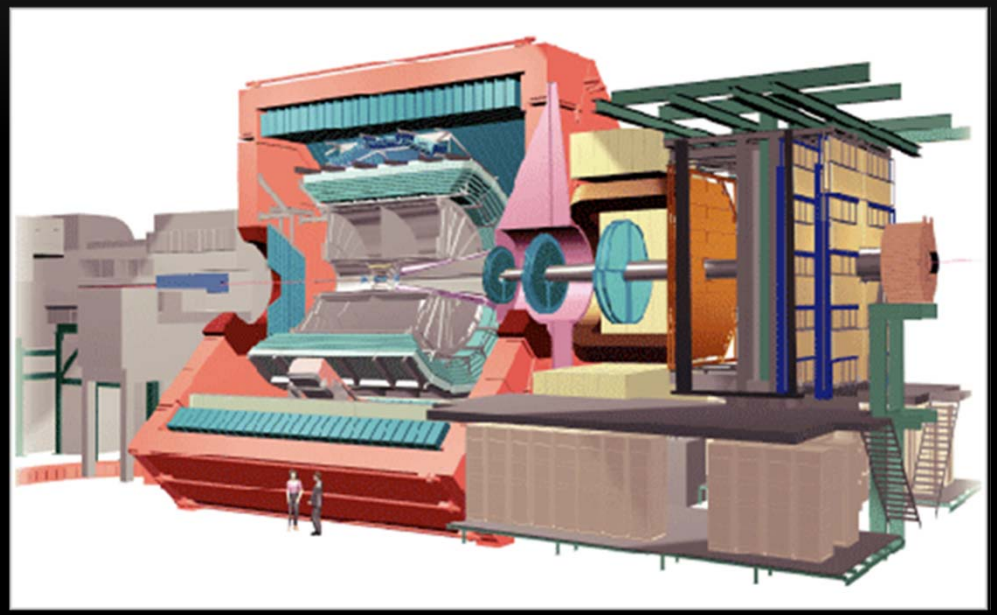
The Challenges of Operating a Large Physics Experiment

OUTLINE

- Introduction and context
- The evolution of the experiment
- The challenges and how to master them
  - How these challenges are different between experiments and accelerators
  - Justify the ‘a’ and ‘e’ in ICALEPCS…

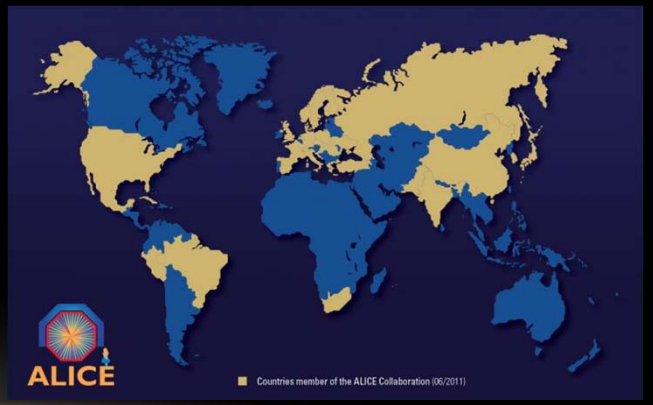


INTRODUCTION

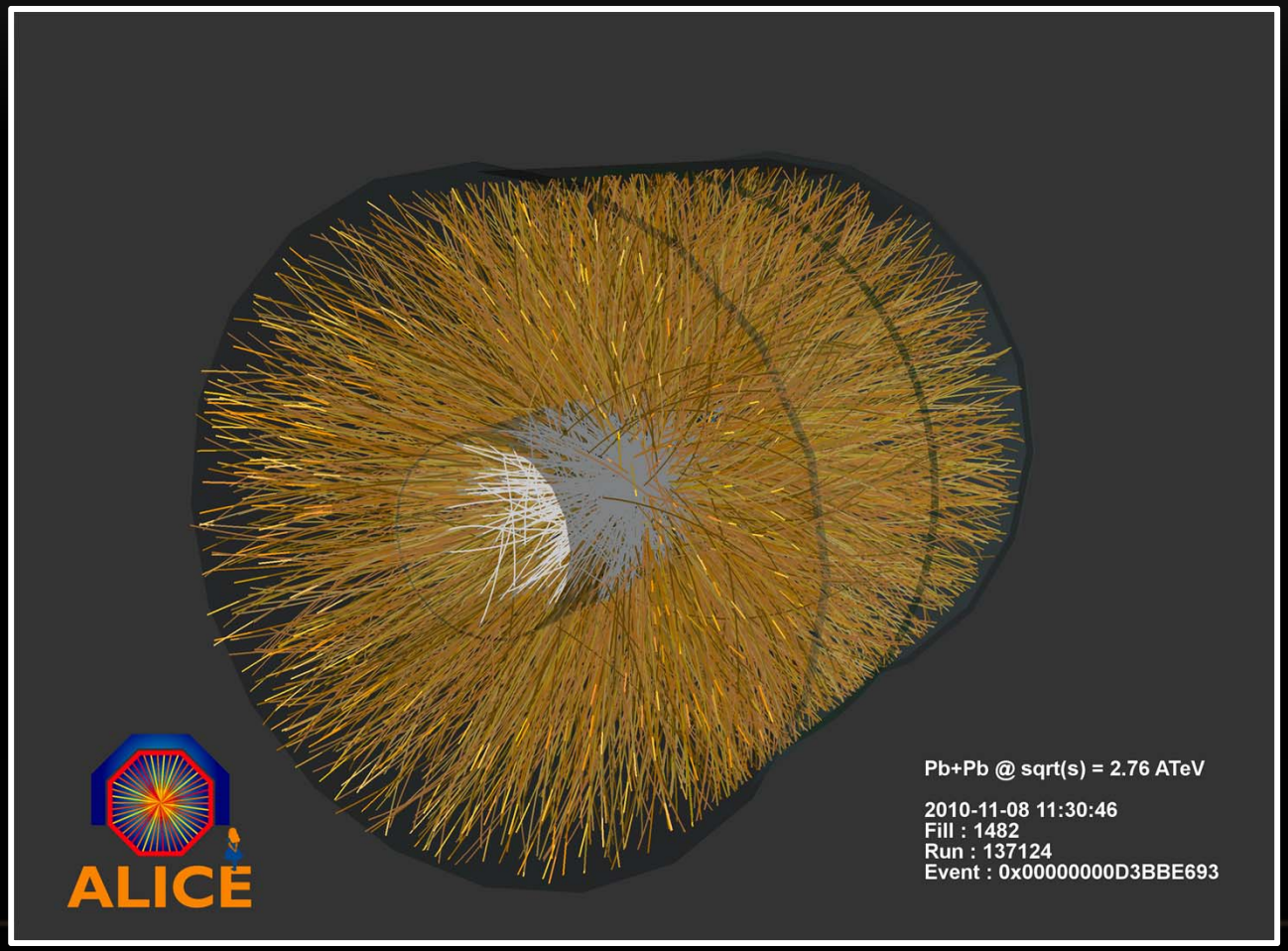


- Heavy Ion experiment
- 20 sub-detectors
- 16 x 16 x 26 m
- 10 000 tons

- 1300 collaborators
- 116 institutes, 33 countries

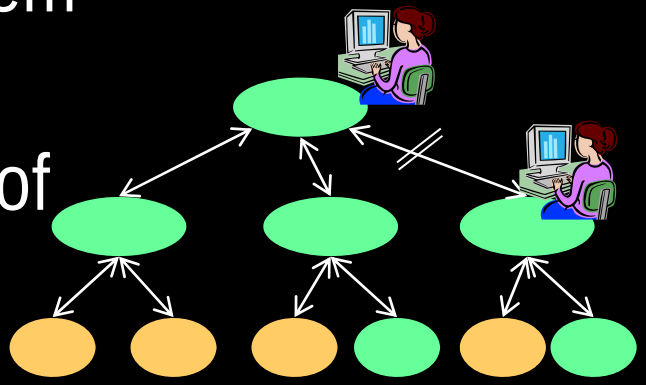


Pb – Pb Event


ALICE
Pb+Pb @ sqrt(s) = 2.76 ATeV
2010-11-08 11:30:46
Fill : 1482
Run : 137124
Event : 0x00000000D3BBE693

Detector Control System

- Control & Monitoring 20 sub-detectors, 2 magnets, various services
  - 1 000 000 *channels*
- Designed as strict hierarchical system
  - Strict separation between sub-detectors
- Behaviour modelled with hierarchy of Finite State Machines
  - Commands going down, states coming up
  - *Partitioning* feature



Detector Control System

- Implemented with commercial SCADA (PVSSII)
  - With CERN and ALICE specific extensions
- Applications developed by detector teams
- Over 150 controls PCs, 1200 networked devices

Experiment Evolution:
From Installation to Routine Operation

- 2006: installation, debugging
- 2008: first collisions
- 2009: cosmics data, restart
- 2010: first full year of operation, first HI
- 2011: ‘routine’ operation

The Evolution Challenge

- The Detector Control System has to
  - follow the evolution of the experiment equipment
  - follow the evolution of the use of DCS
  - follow the evolution of the users of DCS

The Evolution Challenge

Experiment Equipment

- The experiment is a very dynamic object
  - Squeeze in more detectors at each opportunity
  - Devices to control (or the way to access them) is changing
- Likely to be more dynamic than the accelerator environment
  - If only because of 20 different, independent detector groups

The Evolution Challenge

Use and Users of DCS

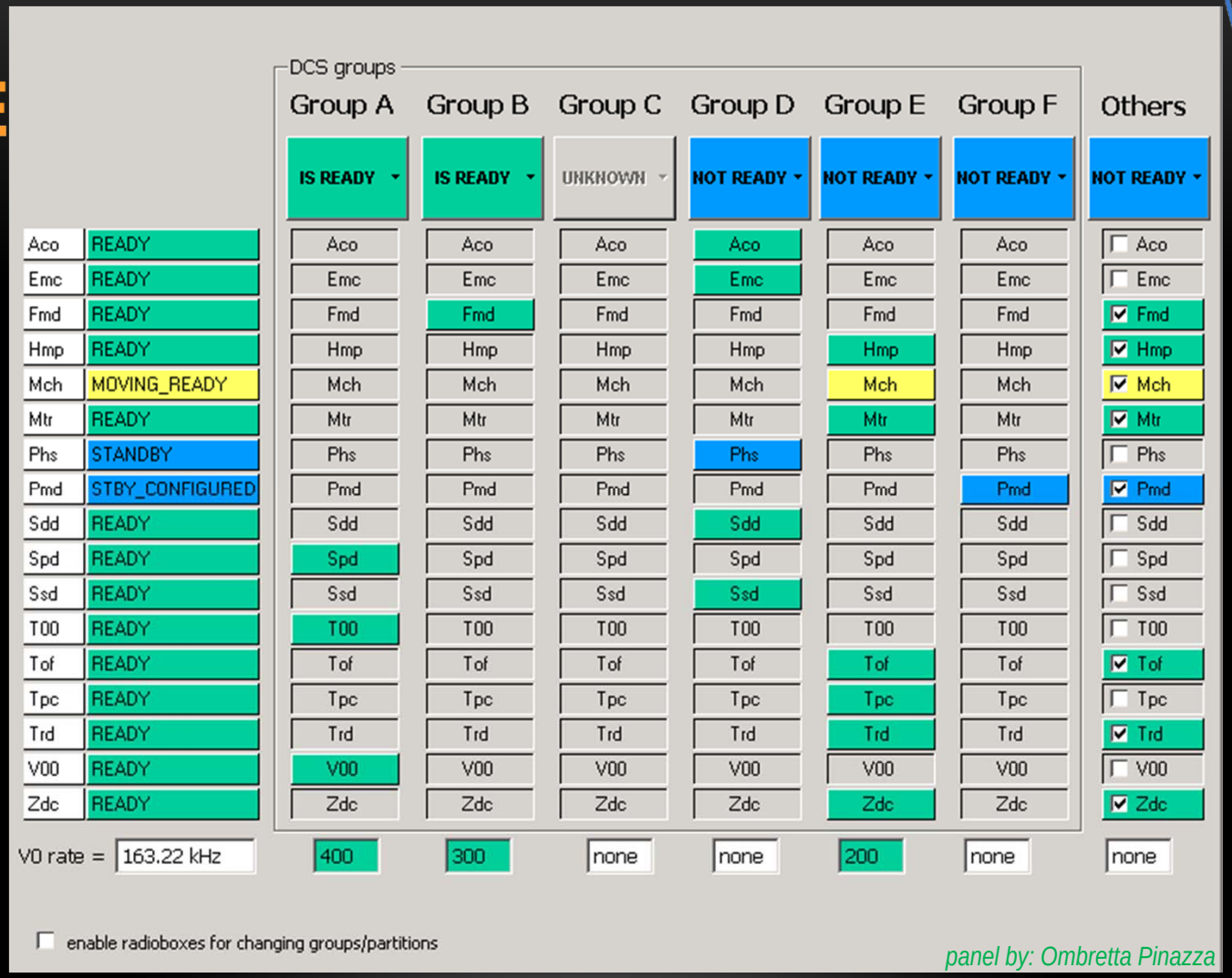
- Evolution of the use of DCS
  - Started off with debugging
  - Moved from local operation to central operation
- Evolution of the users of DCS
  - Started off with developers and experts
  - Evolution to detector experts to non-expert users

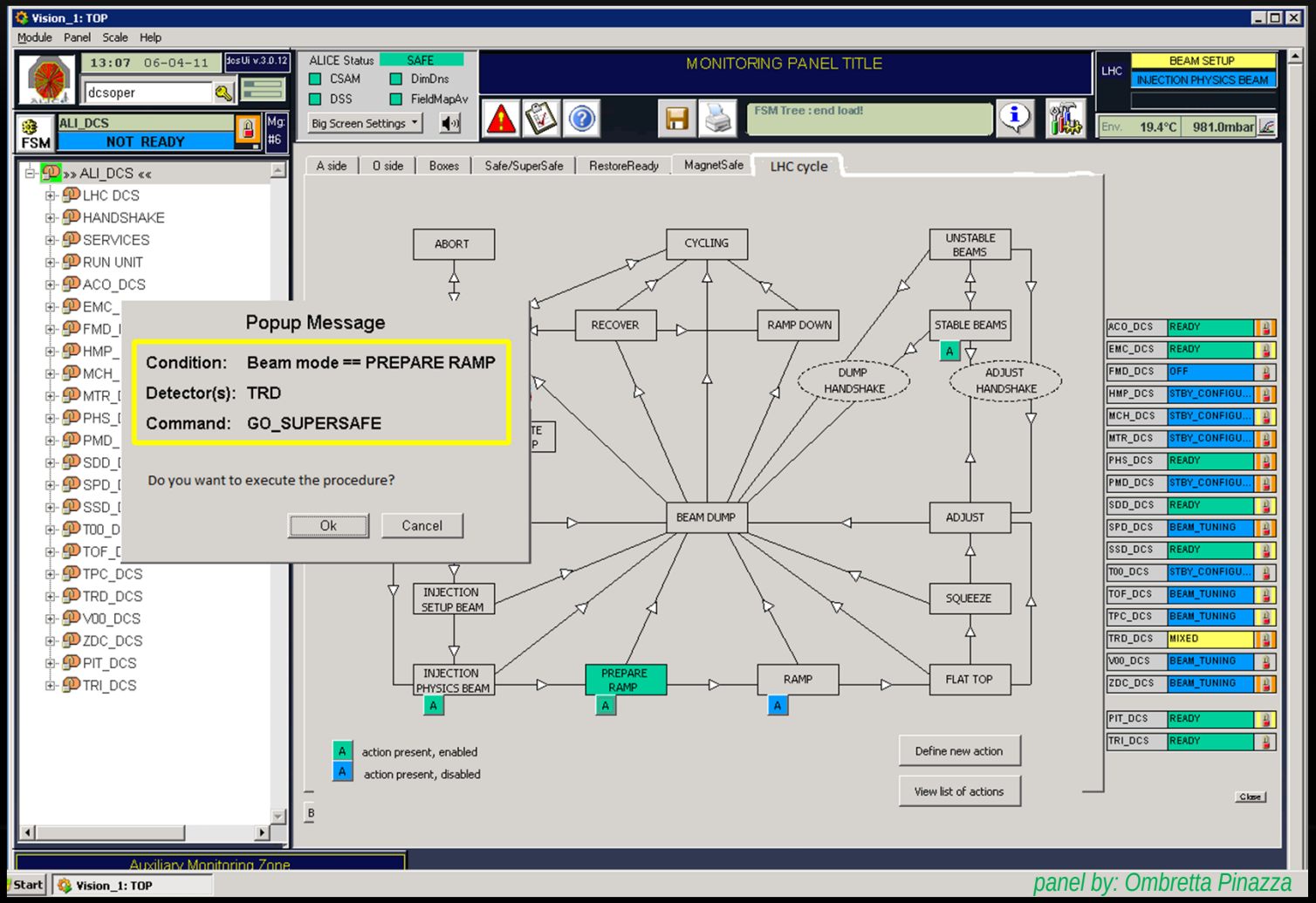
From local to central operation

- Reducing number of operators
  - From 25 local, detector, operators to 5 central operators
- DCS was designed with central operation in mind
- More a psychological than a technical issue
  - Convince detectors to transfer control of their baby to a central operator

The Single Operator Challenge

- The central operator needs dedicated tools
  - All sub-detectors need proper integration in central top level control system
    - Importance of homogeneous development upstream
    - Major coordination challenge
  - Tools to operate groups of detectors
  - Automation wherever possible
    - recurrent actions, actions that need to performed to guarantee safety of detector equipment e.g. on change of LHC beam mode


DCS groups
Group A
Group B
Group C
Group D
Group E
Group F
Others
IS READY
IS READY
UNKNOWN
NOT READY
NOT READY
NOT READY
NOT READY
Aco READY
Emc READY
Fmd READY
Hmp READY
Mch MOVING_READY
Mtr READY
Phs STANDBY
Pmd STBY_CONFIGURED
Sdd READY
Spd READY
Ssd READY
T00 READY
Tof READY
Tpc READY
Trd READY
V00 READY
Zdc READY
V0 rate = 163.22 kHz
400
300
none
none
200
none
none
enable radioboxes for changing groups/partitions
panel by: Ombretta Pinazza



panel by: Ombretta Pinazza

The Single Operator Challenge

- All these tools need to be flexible and configurable
  - Cope with changes in operation of the experiment
- Central operator need to react on anomalies in ALL sub-detectors
  - Tools to access procedures (and ensure they are valid)
  - Make sure only relevant messages reach the operator

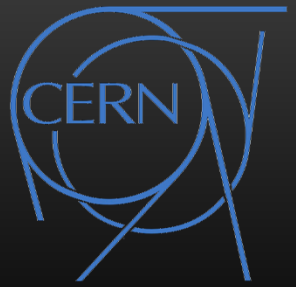
The Single Operator Challenge

- High turnaround of operators
  - Very specific to HEP culture
  - Many operators that only do few shifts
    - Not necessarily controls nor detector expert
  - As opposed to accelerator world
    - limited number of operators, that usually are controls or machine experts, that do many shifts
  - ALICE 2011: 926 shifts, more than 80 operators, on average only 11 days of operator shift work

The Single Operator Challenge

- Requires huge effort for training
  - and administration
- Requires clear, extensive documentation understandable for non-expert, and easily accessible

The Coordination Challenge



- Initial stage, development
  - To overcome cultural differences: Start coordinating early, strict guidelines
- During operation, maintenance and operation
  - Again, due to HEP culture, original developers tend to drift away
    - (apart for a few exceptions) very difficult to ensure continuity for the control systems in the projects
  - In many small detector projects, controls is done only part-time by a single person

Conclusions

- Experiment environment evolves rapidly
  - DCS design: think scalability, flexibility
- Central operation
  - Cope with large number of operators
  - Adequate and flexible operation tools, automation
  - Easily accessible, explicit procedures
- Experiment world is dynamic, volatile
  - Requires a major coordination effort