

# DETECTOR CONTROL SYSTEM FOR THE ALICE EXPERIMENT AT CERN -LHC

ICTDHEP JAMMU  
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Special Thanks to the ALICE CONTROLS COORDINATION

Based on slides given by Peter Chochula, Andre Augustinus  
and ALICE DCS TRAINING SLIDES

## • ALICE experiment

- 18 sub-detectors, 2 magnets
- 1200 members, 90 institutes, 30 countries
- Completely installed and fully commissioned



HMPID

TOF

TRD

PMD

SPD  
SDD  
SSD

TPC

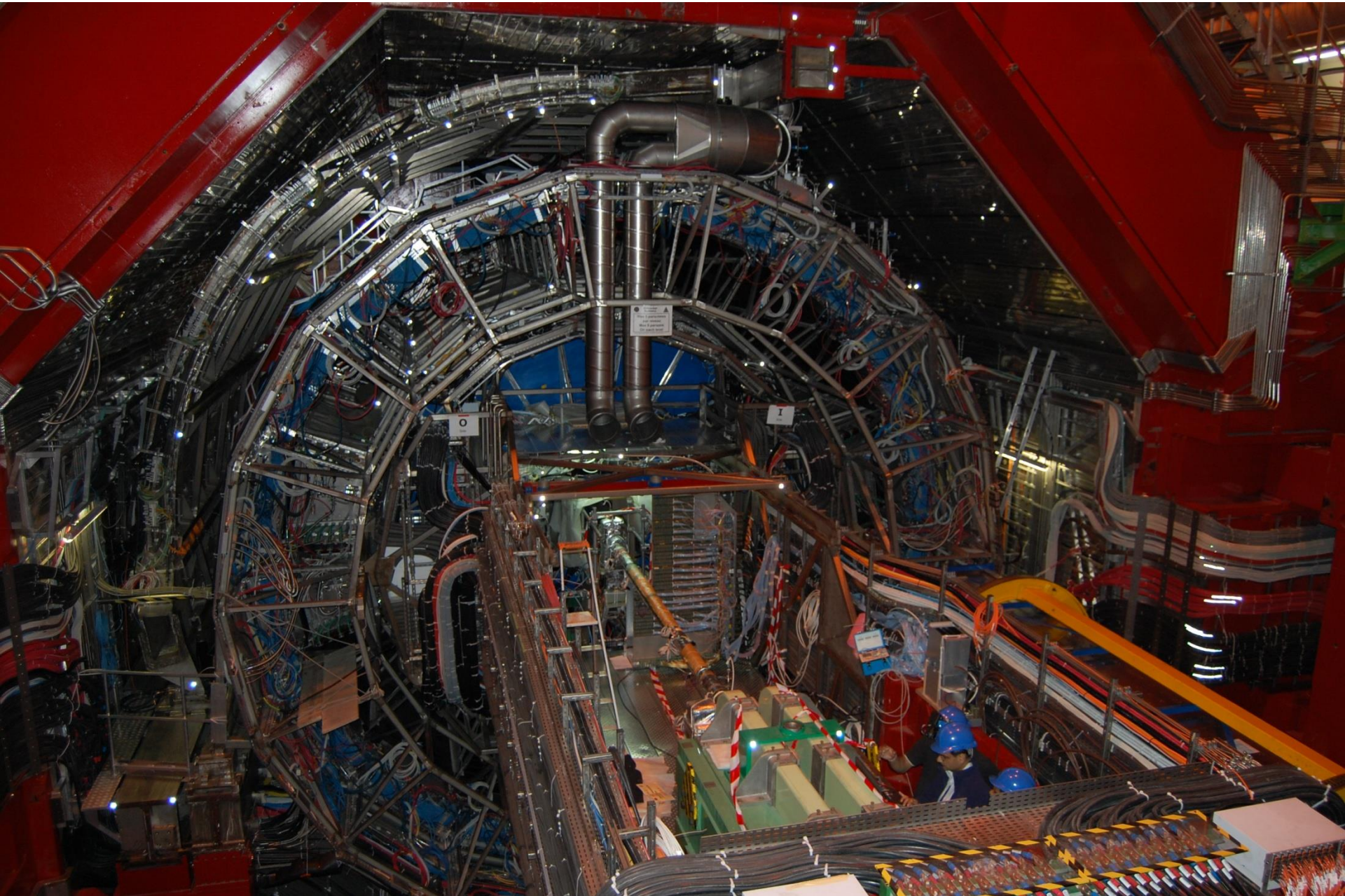
PHOS

Detectors not shown  
FMD , VO, TO, ZDC,  
EMC, CPV, ACO

MUON - SPECTROMETER

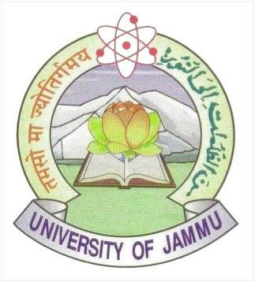
## ◆ ALICE Controls

- ◆ Started 12 years ago
- ◆ Small(Very Important) central team
  - ◆ Detector groups & LHC experiments (JCOP)
  - ◆ In total ~100 people involved



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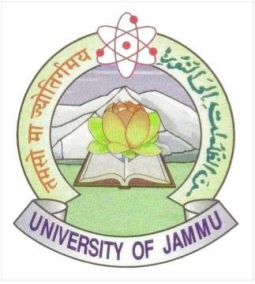
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# ALICE DCS



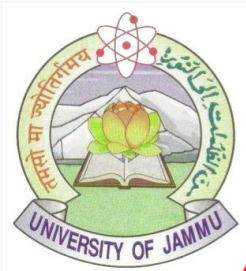
- The two main tasks of the ALICE Detector Control System (DCS) are
  - To assure maximum protection such that detector equipment cannot be damaged by adverse beam conditions
  - To assure that, whenever beam conditions allow, the detector is in optimal condition to take physics data



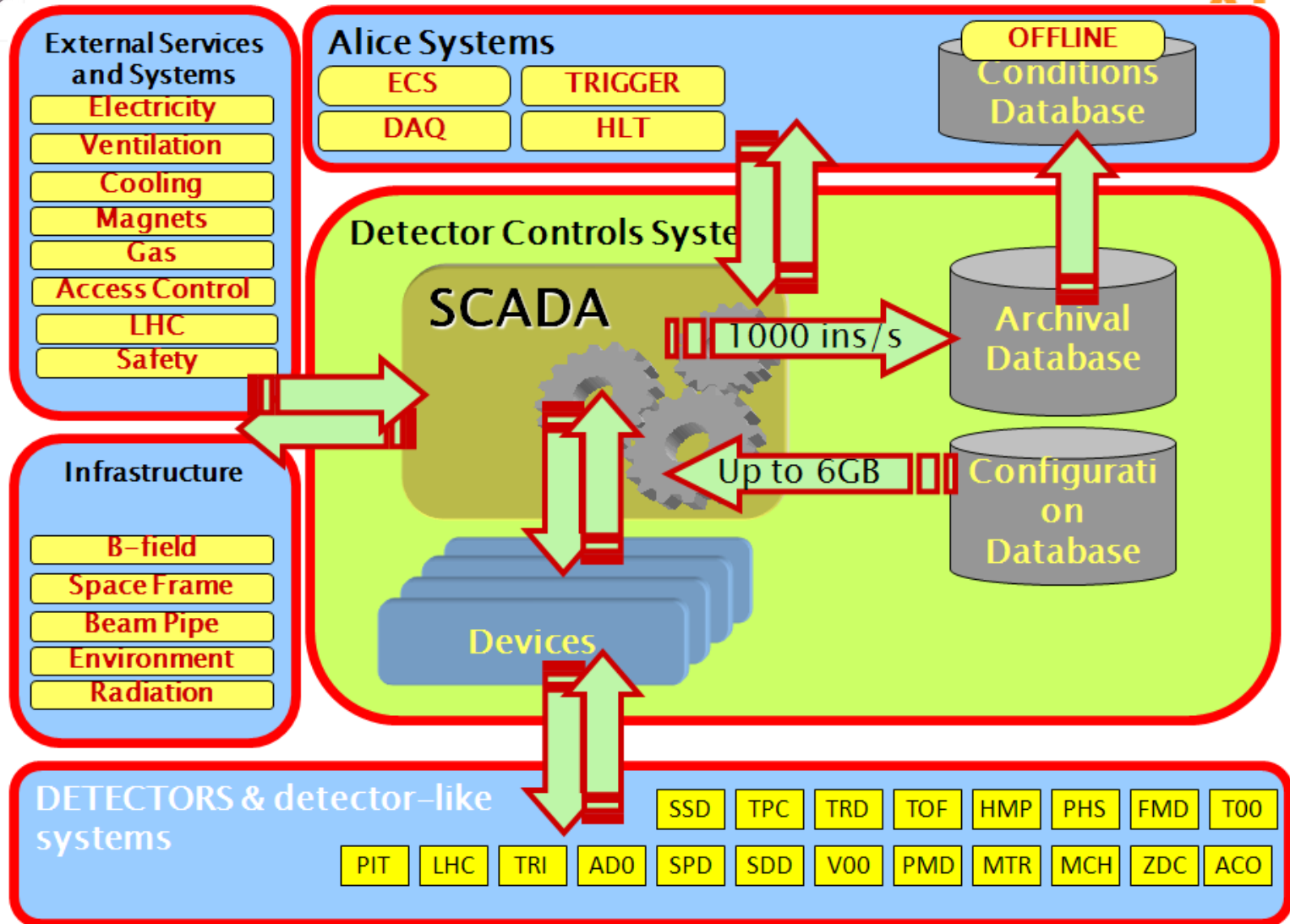
# ALICE DCS

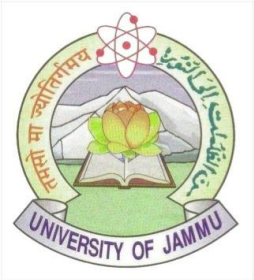


- To achieve this, the ALICE DCS
  - controls all relevant detector equipment,
  - maintains the synchronization with the LHC machine operation,
  - monitors and controls the experiment infrastructure and services,
  - provides reliable communication with LHC and other online systems,
  - has adopted the PVSSII SCADA as main tool ( a CERN-wide standard for control systems)
    - PVSSII has recently be re-branded as “WinCC Open Architecture” after purchase by Siemens



# The DCS Context



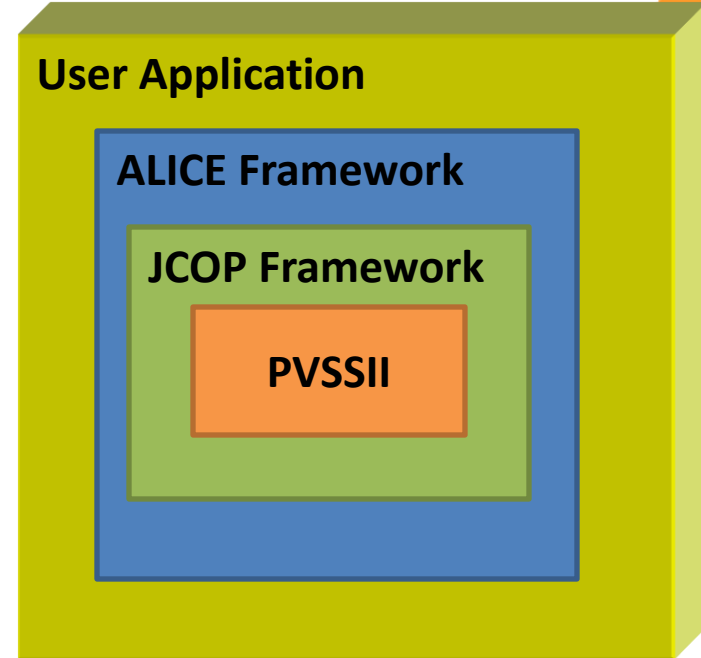
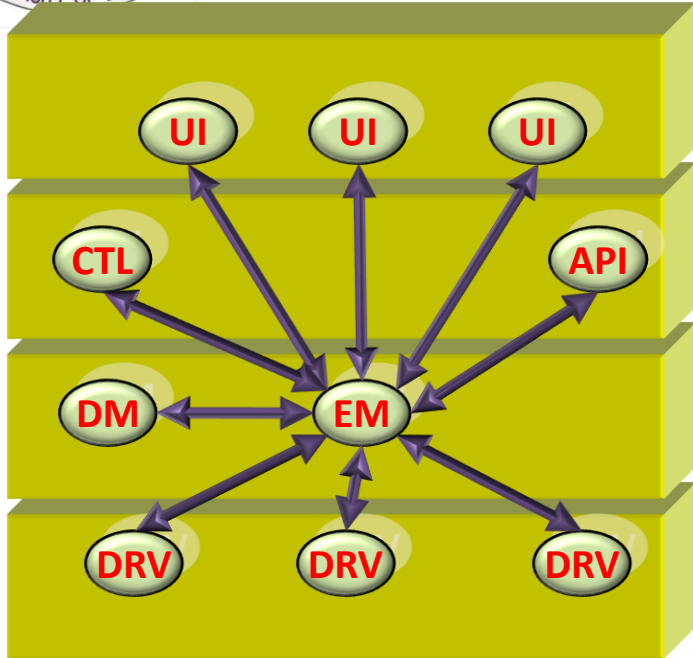


# ALICE DCS



- Detector systems are responsibility of detector projects
  - Detector experts implement the local detector controls
- DCS central team (6 people):
  - provides standards, guidelines, infrastructure and support
  - supervises implementation of detector systems
  - implements the overall control of all local control systems
  - implements the interfaces with external systems and the other ALICE online systems
  - assures smooth operation during data taking campaigns

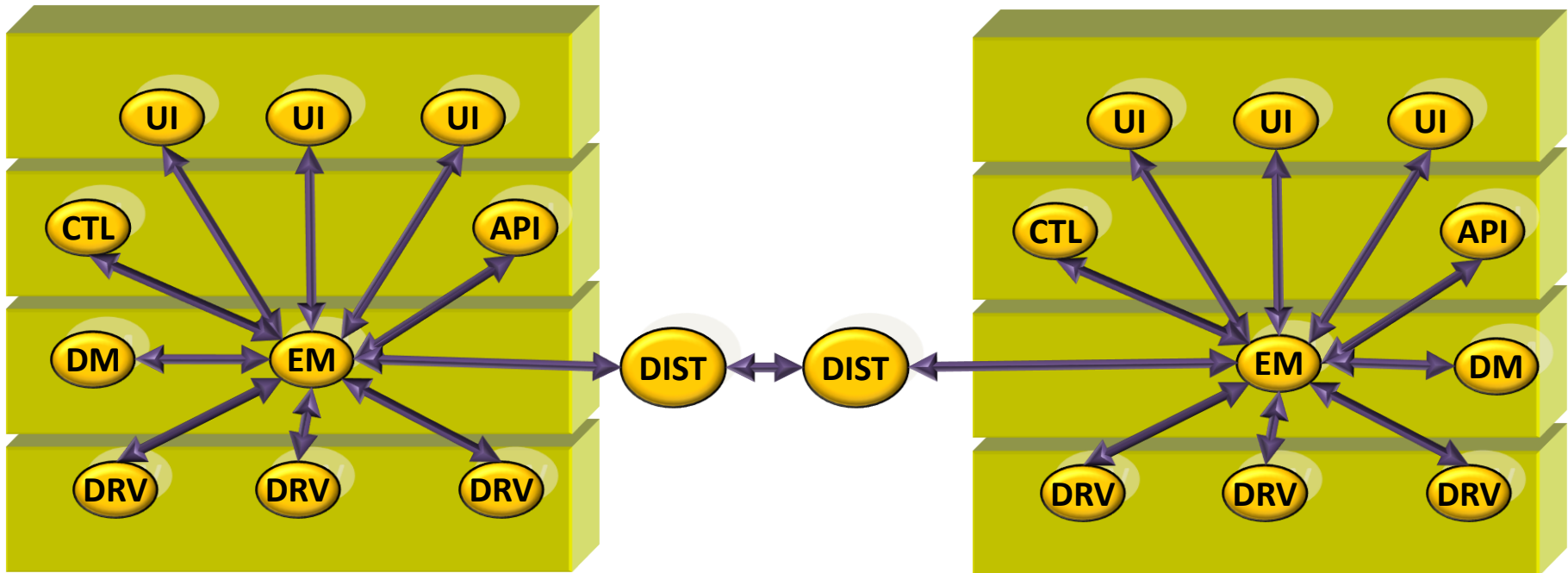
# PVSSII Architecture



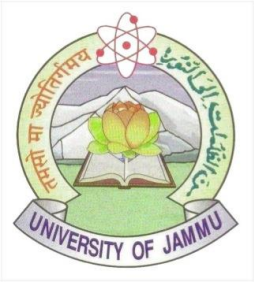
- ❑ PVSSII system is composed of specialized program modules (managers)
- ❑ Managers communicate via TCP/IP
- ❑ ALICE DCS is built from 100 PVSS systems composed of 900 managers
- ❑ PVSSII is extended by JCOP and ALICE frameworks on top of which User applications are built



# Distributed PVSS System



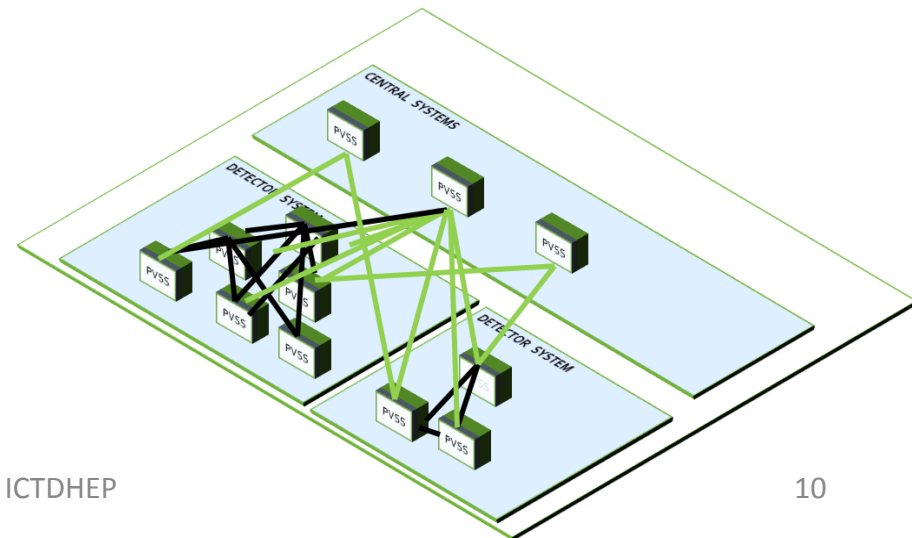
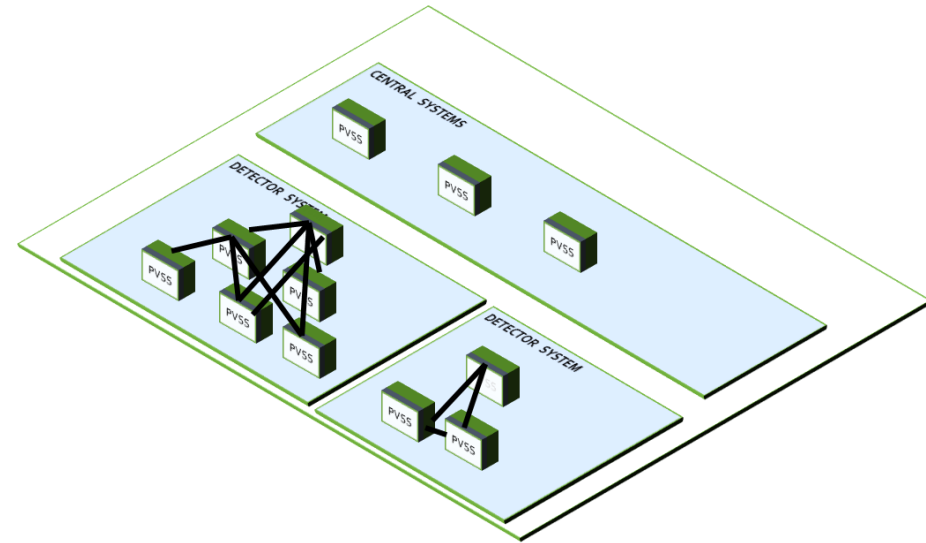
- Several PVSSII systems can be connected into one distributed system using a specialized manager (DIST)
- The ALICE distributed system consists of over 100 individual systems

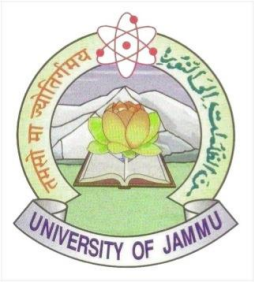


# ALICE DCS Distributed System

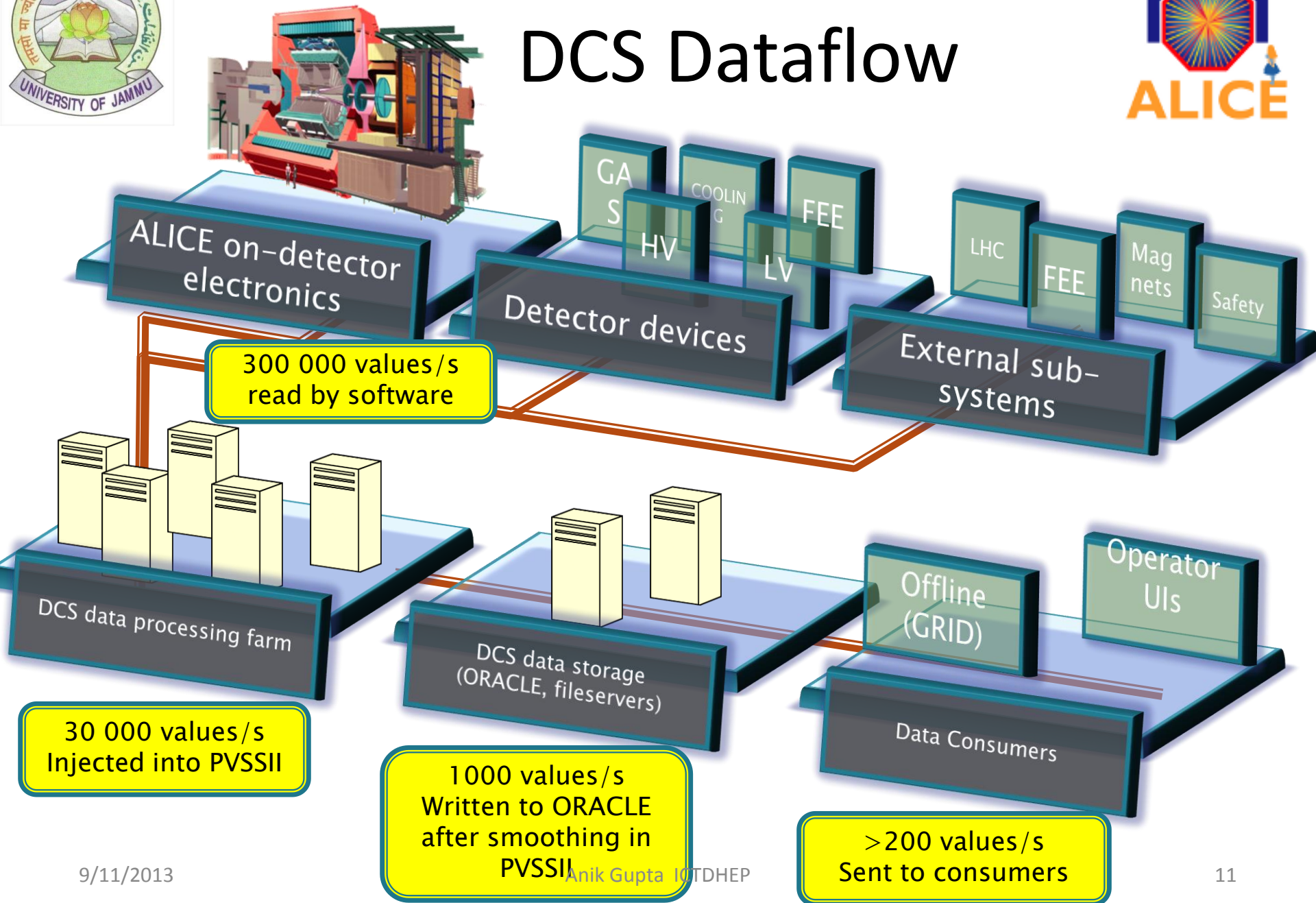


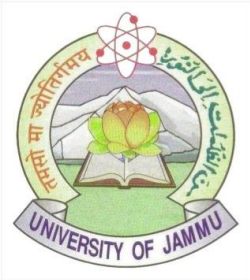
- Each detector provides an autonomous distributed system
- Central servers connect to all detectors providing one large distributed system





# DCS Dataflow

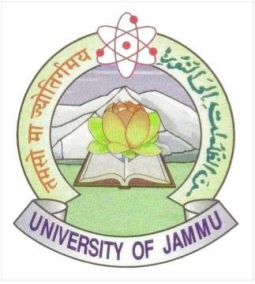




# DCS Computing



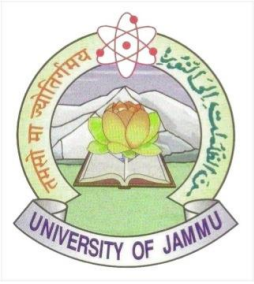
- 170 servers
- 700 embedded computers
- Oracle DB with 144TB raw storage
- 1200 network attached devices



# Challenges



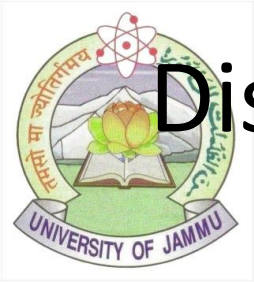
- The DCS project in ALICE has been launched relatively late, when many of the detector developments were in advanced stage, and technology choices already made
- The ALICE experiment consists of 18 different detectors
  - Compared to  $\sim 5$  for ATLAS/CMS
- In order to guarantee a smooth integration a huge effort went into hiding complexity and diversity, and standardization on all levels



# Challenges - standardization



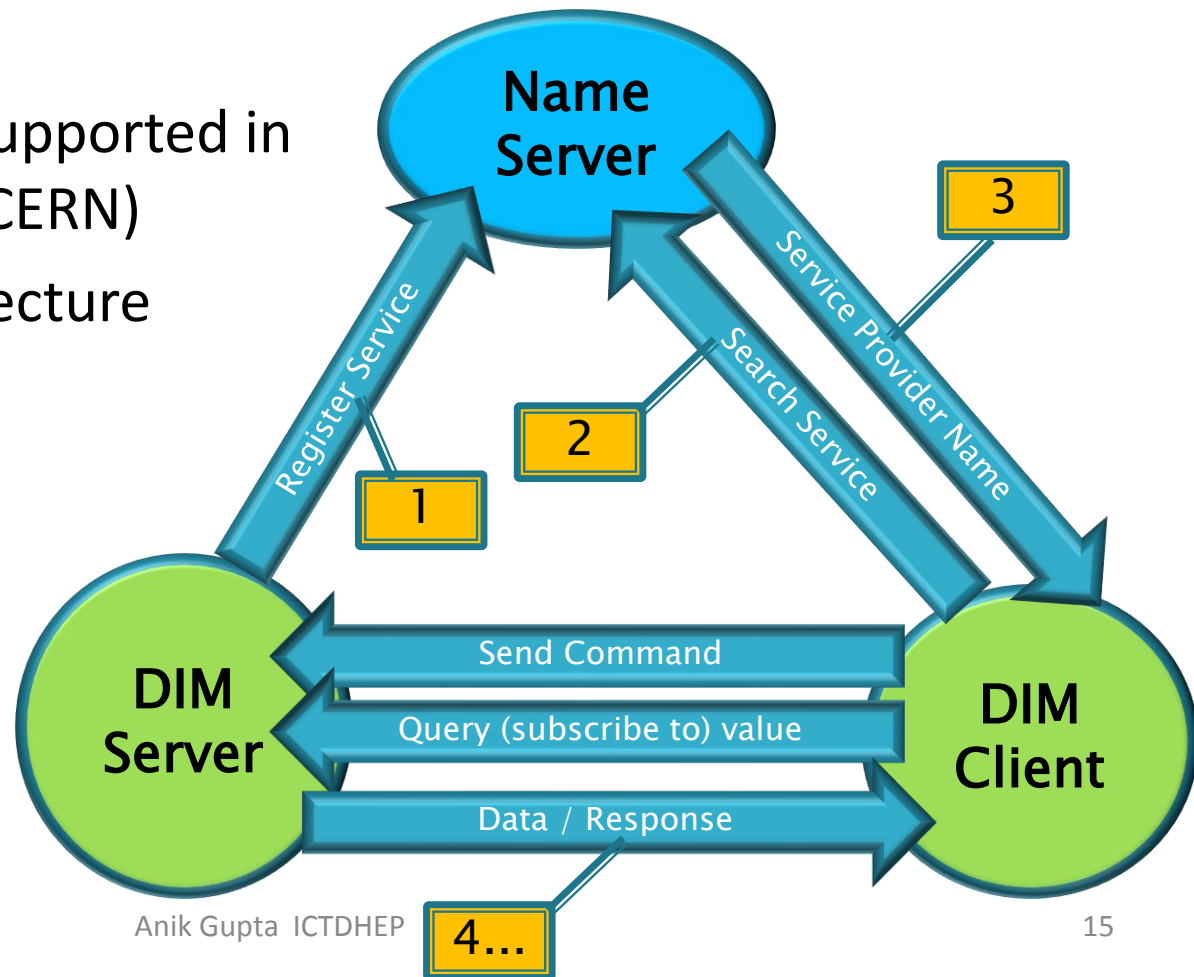
- 😊 High level of standardization achieved for power supplies and services (cooling, PLC based applications...)
  - Limited number of device models, supported centrally at CERN
  - Accessed by standard interfaces: CANbus, Profibus or Ethernet
  - OPC technology used as software interface
    - industry standard, supported in PVSSII
- 😞 Large diversity in the front-end part
  - Different architectures and requirements
  - Variety of control buses (JTAG, CANbus, Profibus, RS232, Ethernet, custom buses – Easynet, DDL ...)
  - DIM technology used to hide diversity



# Distributed Information Management (DIM)



- CERN DIM used for command and data transfer
  - Implemented and supported in PVSSII and C++ (by CERN)
  - Client/server architecture
  - Robust and stable
  - Proven technology already in LEP era



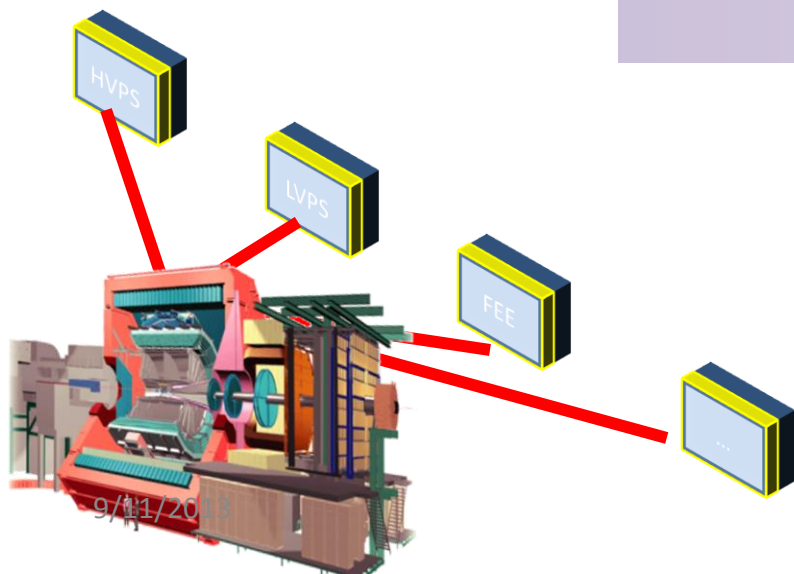


# Building blocks of ALICE DCS

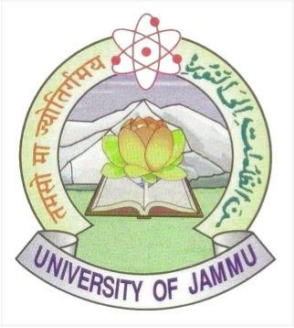


1200 network-attached devices  
270 crates (VME and power supplies)  
4 000 controlled voltage channels

- 18 detectors with different requirements
  - Effort to device standardization
  - Still large diversity mainly in FEE part
    - Large number of busses (CANbus, JTAG, Profibus, RS232, Ethernet, custom links...)



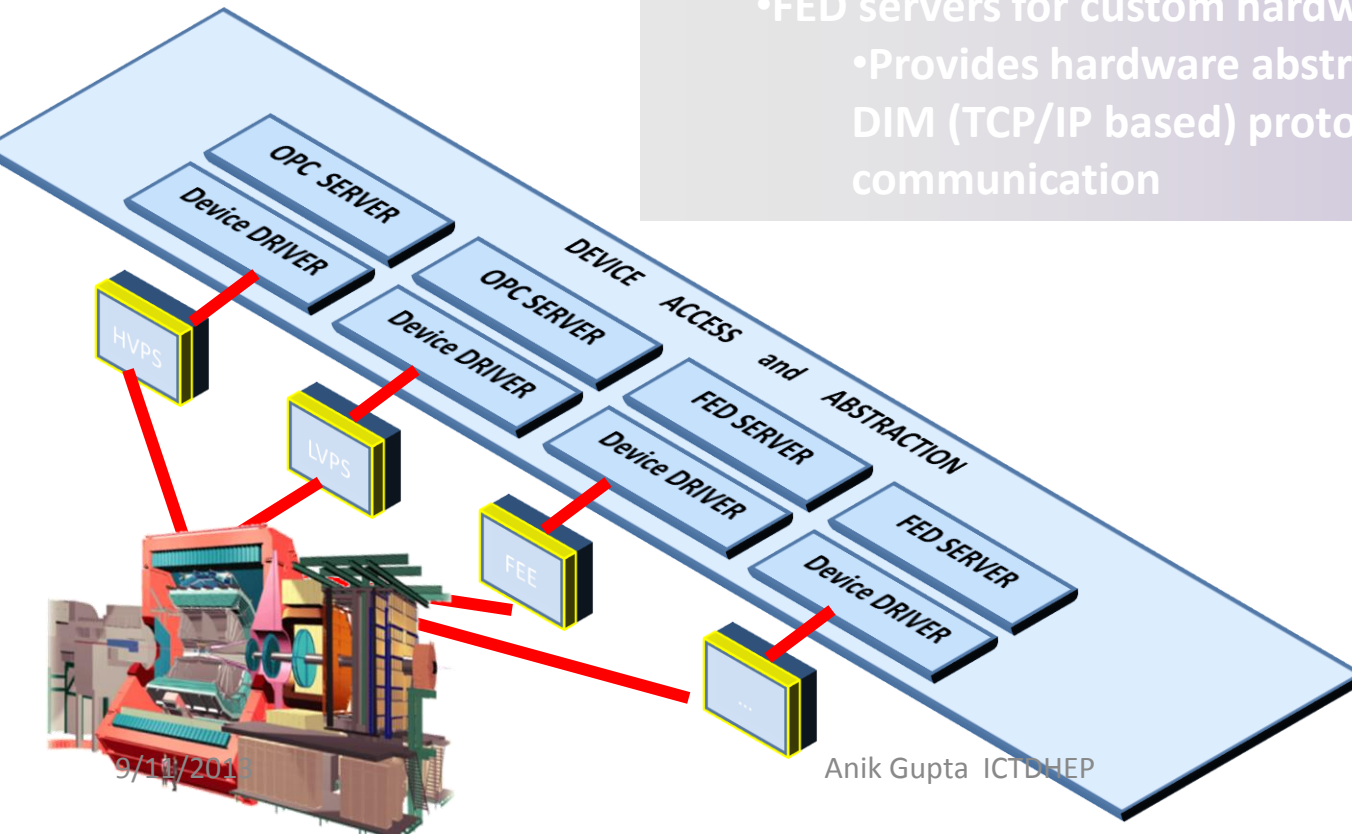




180 000 OPC items  
100 000 Front-End (FED) services  
1 000 000 parameters supervised by the DCS  
Monitored at typical rate of 1Hz

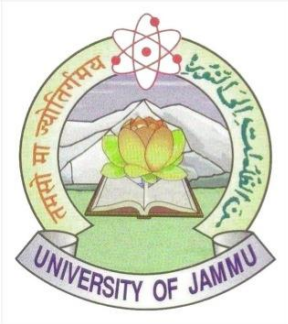


- Hardware diversity is managed through standard interfaces
  - OPC servers for commercial devices
  - FED servers for custom hardware
    - Provides hardware abstraction, uses CERN DIM (TCP/IP based) protocol for communication

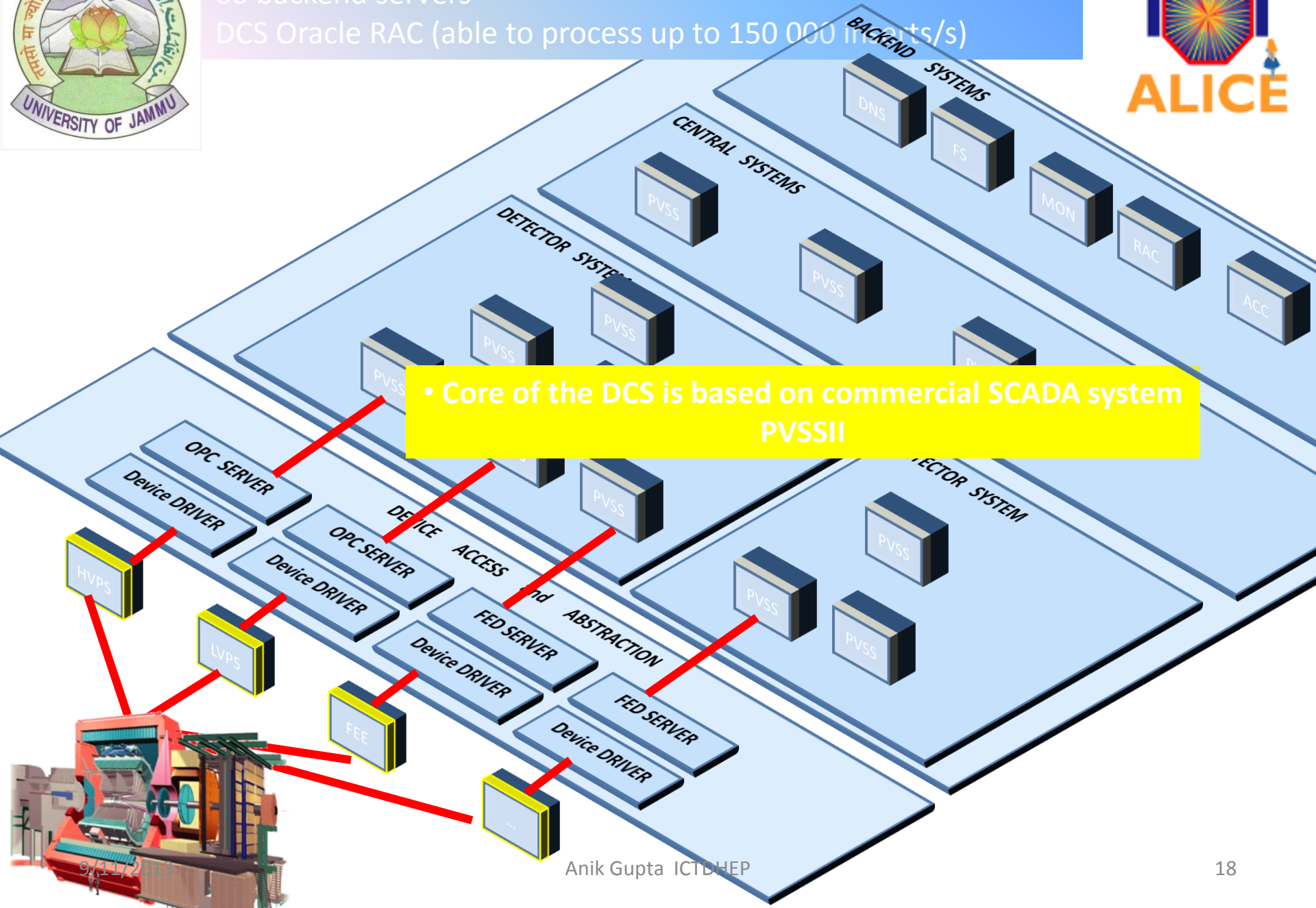


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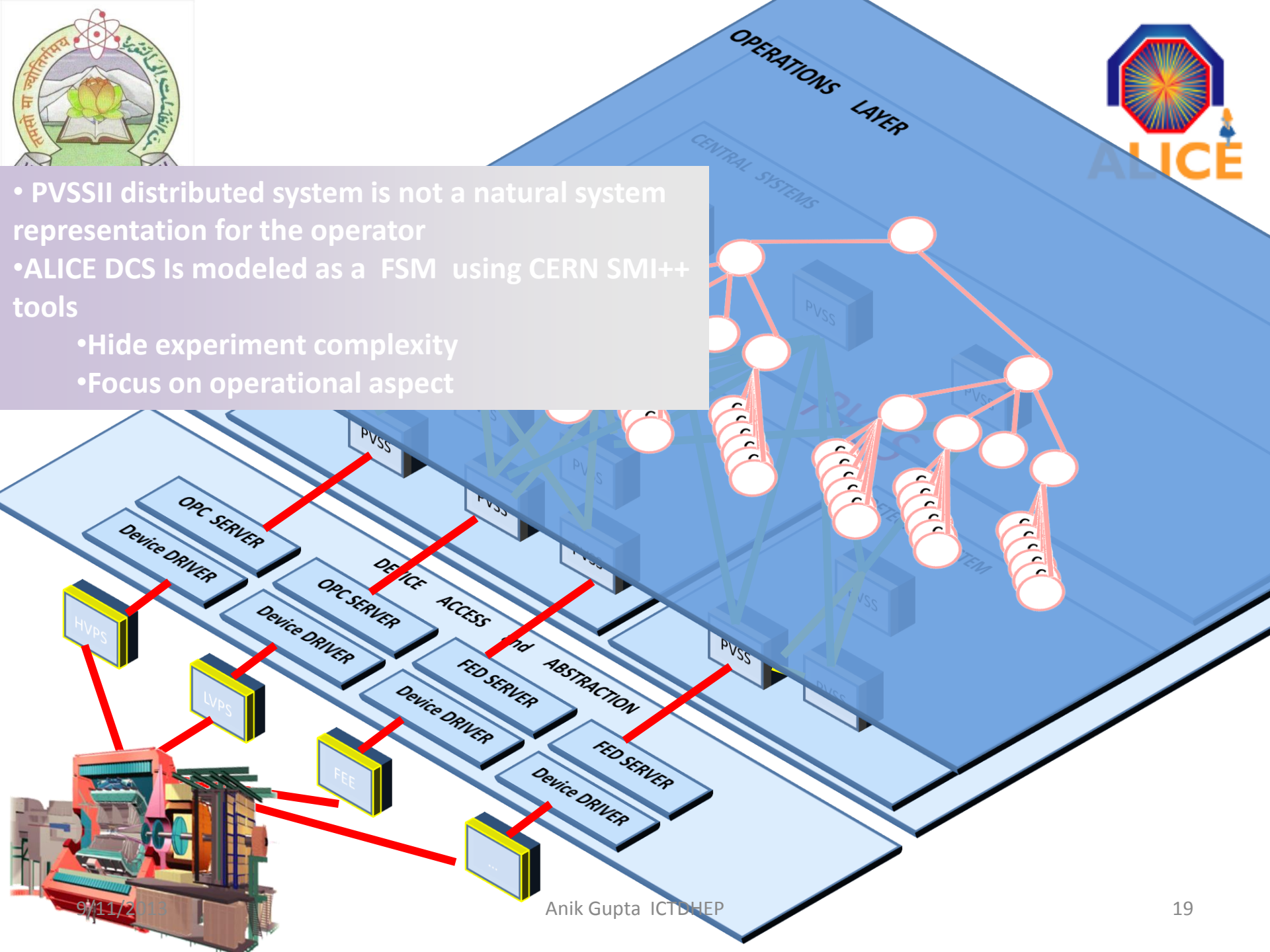
110 detector computers  
 60 backend servers  
 DCS Oracle RAC (able to process up to 150 000 in/s)



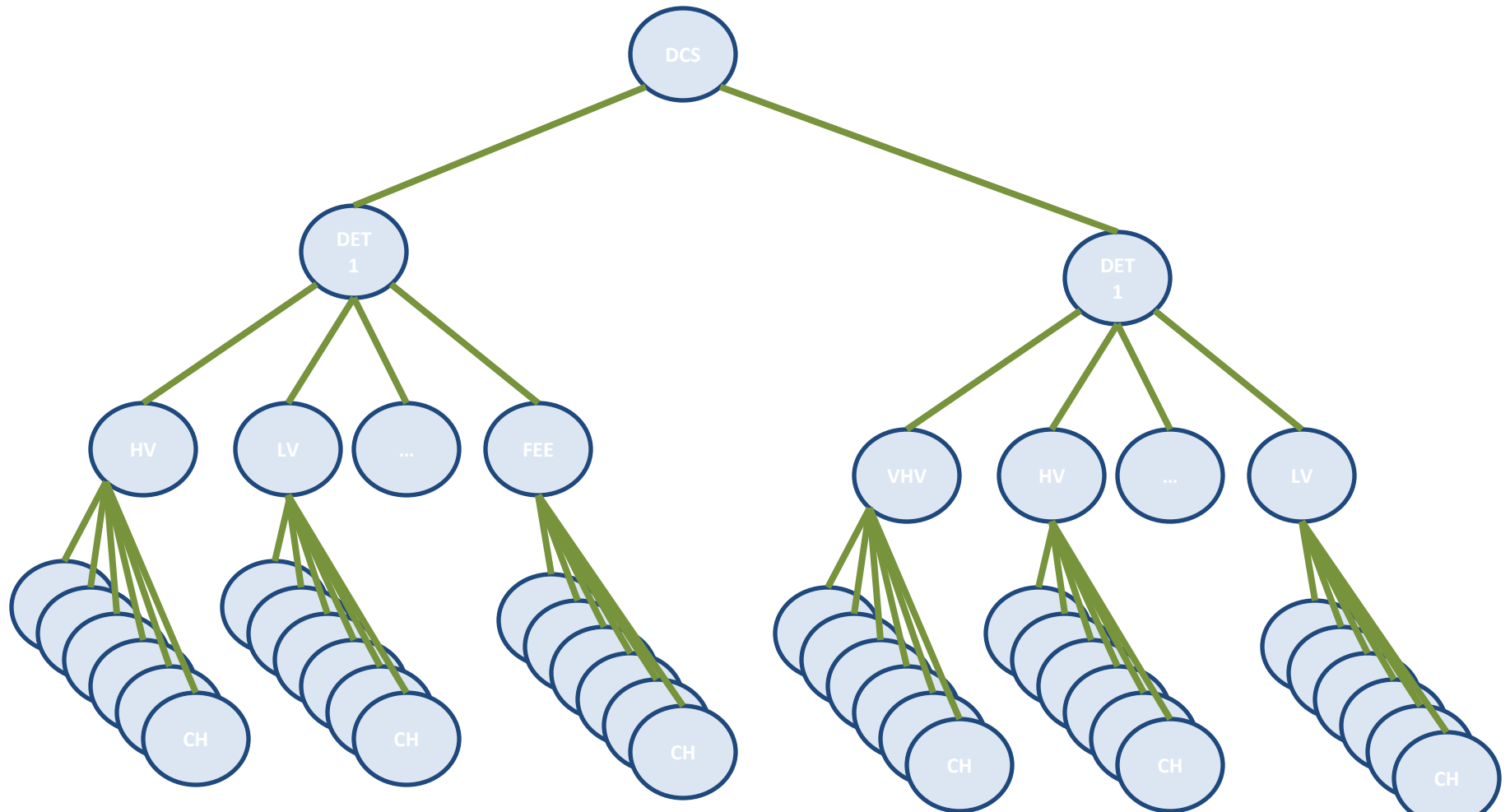
• Core of the DCS is based on commercial SCADA system PVSSII



- PVSSII distributed system is not a natural system representation for the operator
  - ALICE DCS Is modeled as a FSM using CERN SMI++ tools
- Hide experiment complexity
- Focus on operational aspect

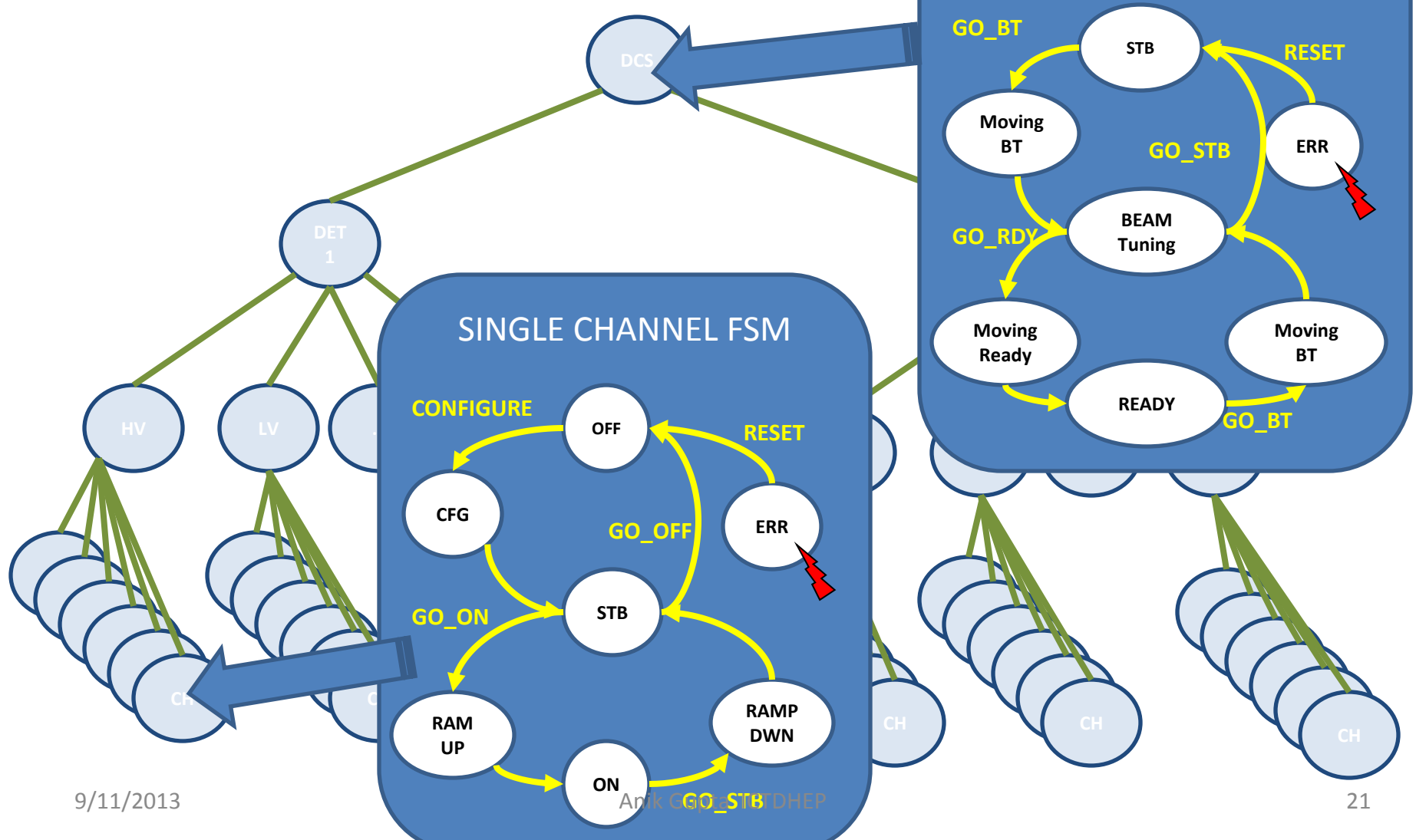


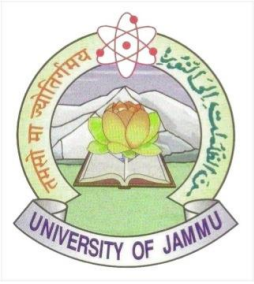
- Hierarchical approach:
  - ALICE DCS is represented as a tree composed of detector systems
  - Each detector system is composed of subsystems
  - Subsystems are structured to devices (crates, boards) and channels





- DCS devices are described as FSM
- State diagrams are standardized for channels and devices of the same type
- Top level DCS takes into account status of all leaves

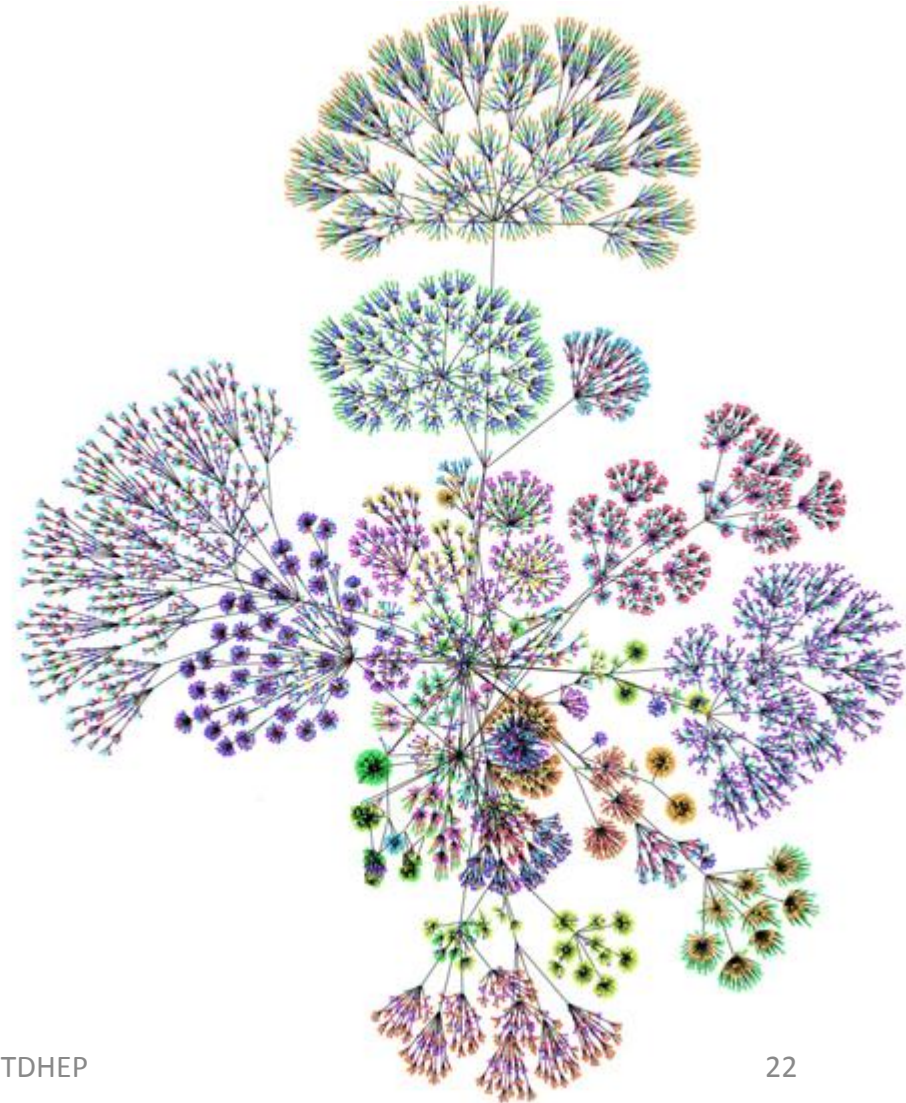




# ALICE Central FSM Hierarchy

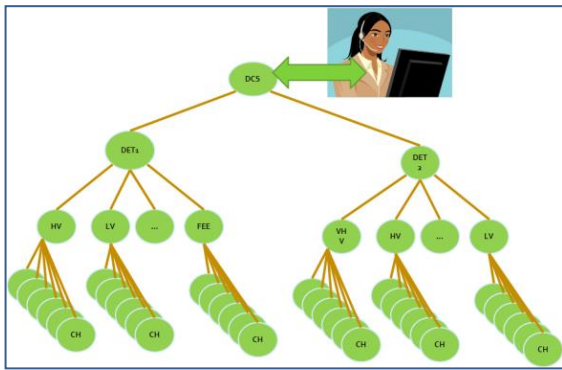


- Scale:
  - 1 top DCS node
  - 19 detector nodes
  - 100 subsystems
  - 5 000 logical nodes
  - 10 000 devices (leaves)
  - Each leaf can represent a complex unit containing many channels

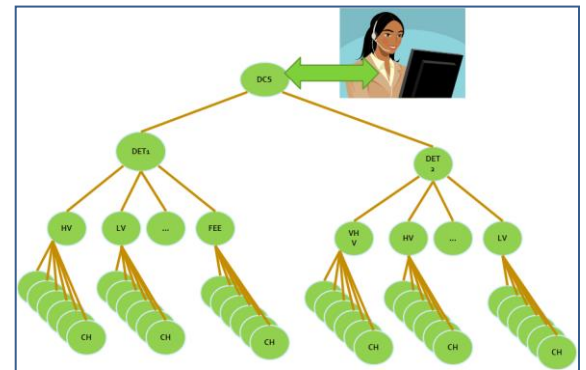
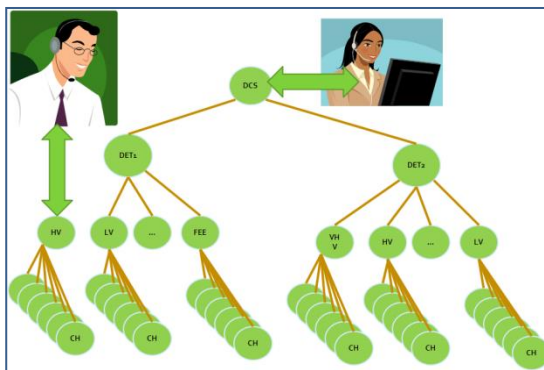
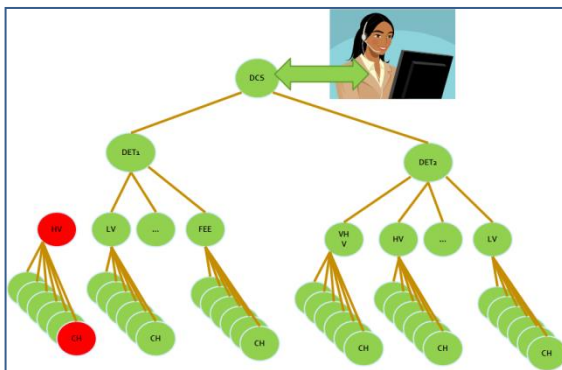
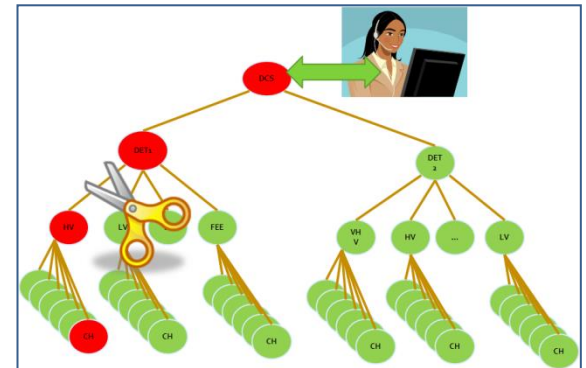


# Hierarchy Partitioning

- Partitioning allows for concurrent operation



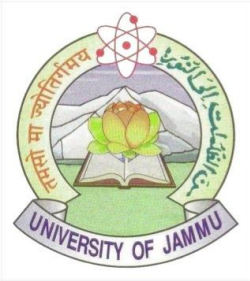
A single channel error can put overall DCS into error



Operator excludes the affected part

Remote expert cures the problem

Operator includes the repaired part



# User Interface



MONITORING PANEL TITLE

ALICE Status: NOT SAFE

DCS groups: Group A, Group B, Group C, Group D, Group E, Group F, Others

| Group   | IS READY  |
|---------|-----------|
| Group A | IS READY  |
| Group B | IS READY  |
| Group C | IS READY  |
| Group D | IS READY  |
| Group E | IS READY  |
| Group F | NOT READY |
| Others  | UNKNOWN   |

VO rate and thresholds (kHz): 1000, 400, 350, 300, 250, 200, 150

MONITORING PANEL TITLE

ALICE safe condition: NOT SAFE

ALICE supersafe condition: NOT SUPERSAFE

Global actions disabled (default)

- enable GO\_SAFE/DUPERSAFE (normal procedures)
- enable FORCE\_GO\_SAFE/DUPERSAFE (emergency procedure)

SPD Status: READY

Detector Monitoring Zone

Side A: HSector 1 to HSector 9

Side C: HSector 10 to HSector 12

High level user interfaces allow to issue 'meta commands' to ease operator tasks

Auxiliary Monitoring Zone

| Component | Status   |
|-----------|----------|
| Acc       | safe     |
| Emc       | safe     |
| Fnd       | not_safe |
| Hmp       | not_safe |
| Mch       | not_safe |
| Mtr       | not_safe |
| Phs       | safe     |
| Pnd       | not_safe |
| Sdd       | not_safe |
| Spd       | not_safe |
| Tpc       | safe     |
| Tsd       | not_safe |
| V00       | not_safe |
| Zdc       | safe     |

Detector Graphic View

BEAM TUNING

Rich 1-6: BEAM TUNING

Rich 1-6: BEAM TUNING

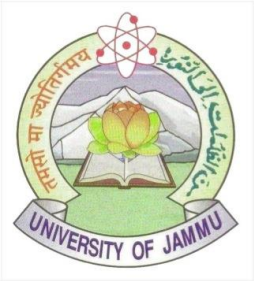
Rich 1-6: BEAM TUNING

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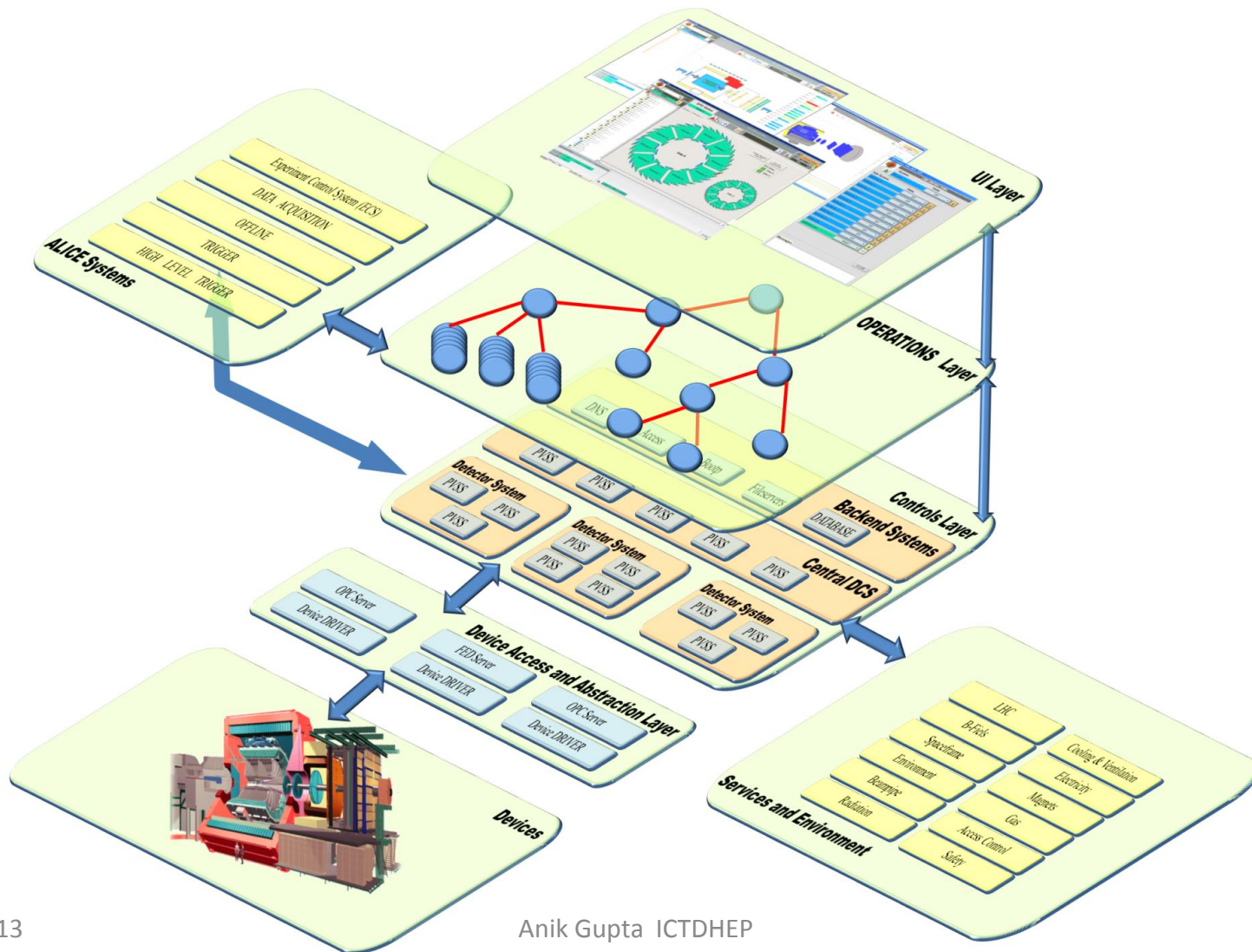
Rich 1-6: BEAM TUNING

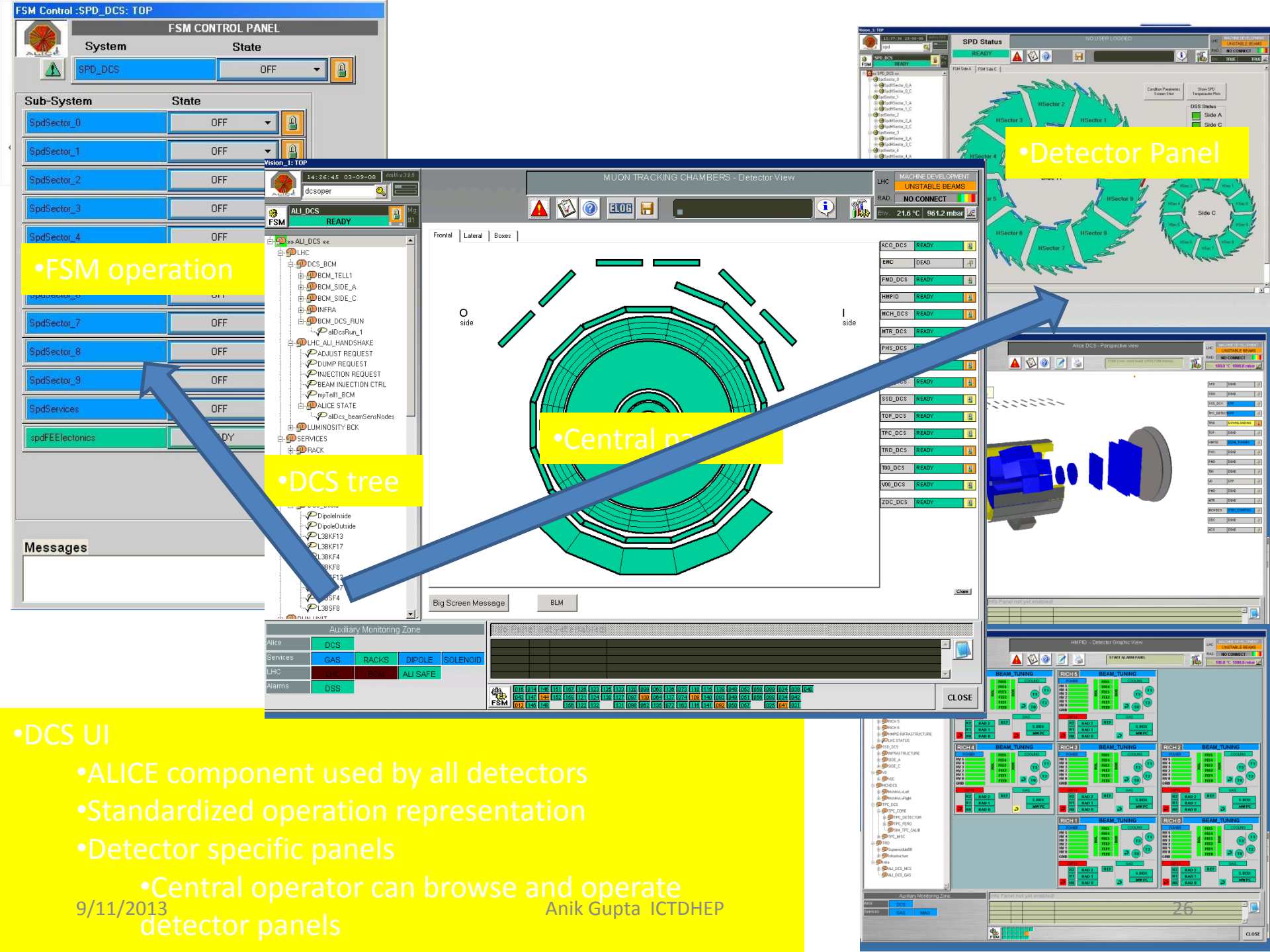
Rich 1-6: BEAM TUNING





# Putting pieces together





•FSM operation

•DCS tree

•Central panel

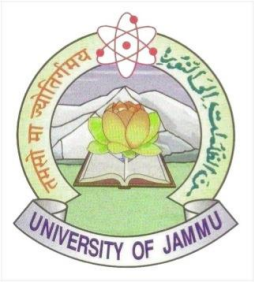
•Detector Panel

•DCS UI

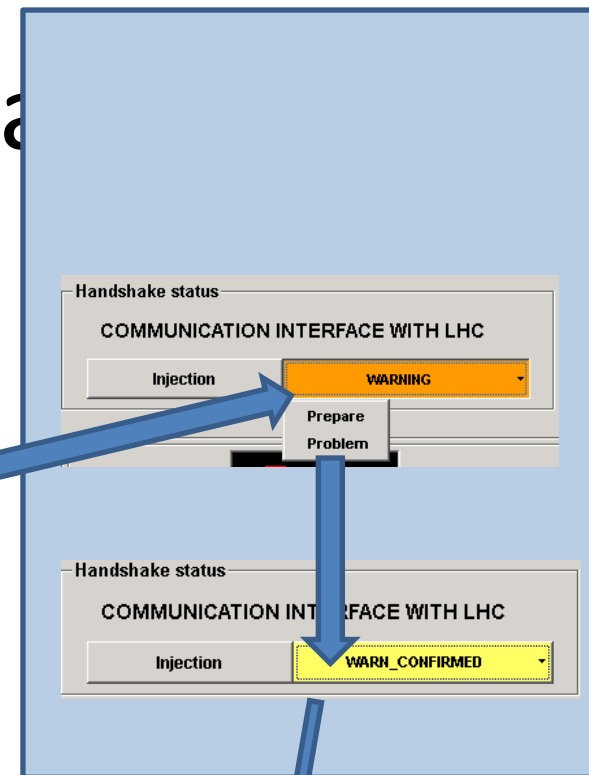
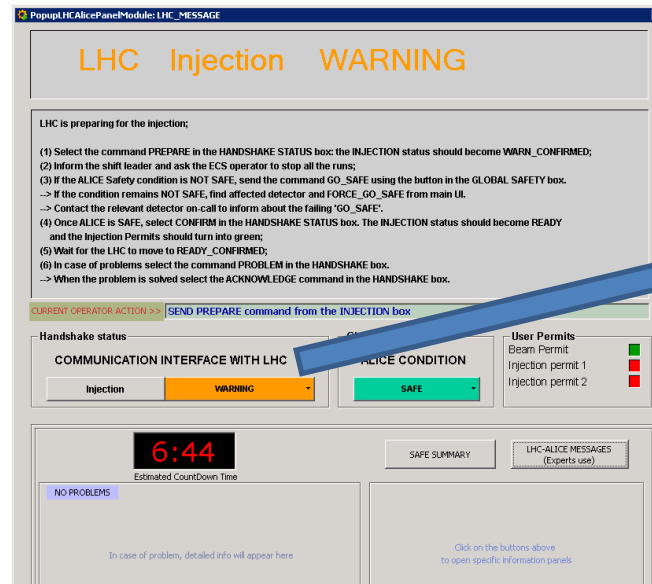
- ALICE component used by all detectors
- Standardized operation representation
- Detector specific panels
- Central operator can browse and operate detector panels

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# High Level Pa



- Critical actions use high level panels
- All tools needed for the task are available on the panel
- Expert system guides the operator

19:34 13-10-10 dcsoper

ALICE Status **SAFE**

CSAM DimDns  
DSS FieldMapAv

Big Screen Settings

FSM **PMD\_DCS** STBY CONFIGURED

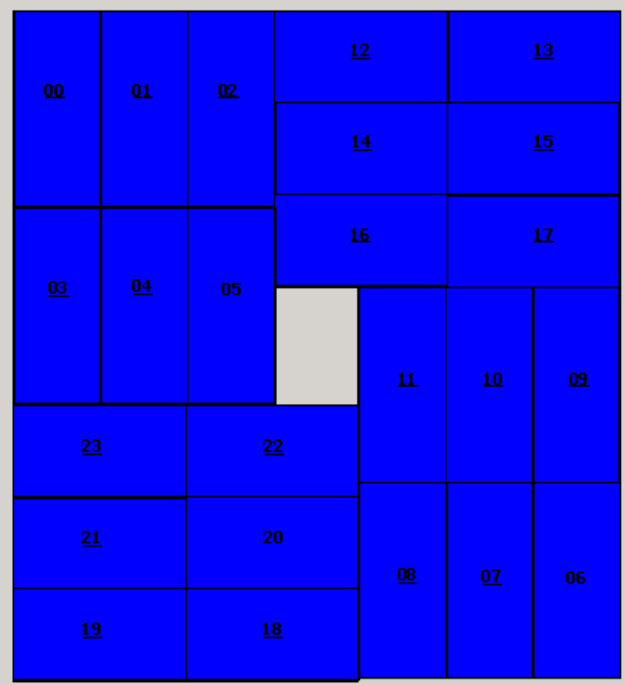
MONITORING PANEL TITLE

FSM Tree : end load!

LHC **BEAM SETUP**  
INJECTION SETUP BEAM

Env. 20.7°C 964.5mbar

- ALI\_DCS
  - LHC
  - SERVICES
  - RUN UNIT
  - ACO\_DCS
  - EMC\_DCS
  - FMD\_DCS
  - HMP\_DCS
  - MCH\_DCS
  - MTR\_DCS
  - PHS\_DCS
  - >> PMD\_DCS <<
  - PMD\_CPV
  - PMD\_INFRA
  - PMD\_PRE
  - PMD\_DCS\_RUN
  - pmdConfDev
  - SDD\_DCS
  - SPD\_DCS
  - SSD\_DCS
  - TO0\_DCS
  - TOF\_DCS
  - TPC\_DCS
  - TRD\_DCS
  - V00\_DCS
  - ZDC\_DCS
  - PIT\_DCS
  - TRI\_DCS
- 9/11/2013



PRE SHOWER

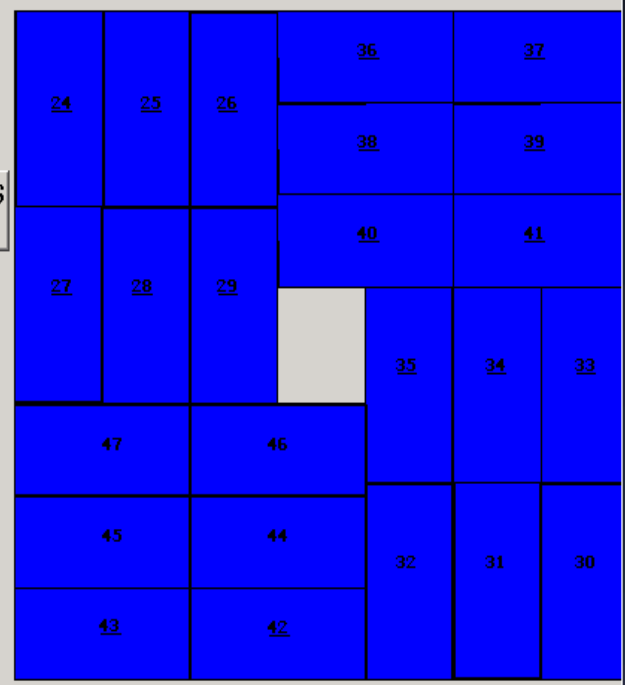
PMDGoSafe

LOCKED

SAFE

Is SuperSafe

TEMPERATURES



CPV

# PMD CONTROLS USER INTERFACE

The screenshot displays the PMD Controls User Interface, which is a complex control system for the LHC. The interface is divided into several main sections:

- Top Bar:** Shows the system name 'alipmwn001' and a status 'NO USER LOGGED'. On the right, there are status indicators for 'LHC' (purple) and 'LHC UNSAFE!' (red).
- Left Panel:** Contains a navigation tree for 'PMD\_DCS' and a 'FSM CONTROL PANEL' with sub-systems like 'PMD\_CPV', 'PMD\_INFRA', and 'PMD\_DCS\_RUI'. The 'PMD\_DCS' sub-system is currently in 'STBY\_CONFIGURED' state.
- Center Panel:** Displays 'EASY CHANNELS LV' with voltage and current monitors (Vmon, Imon) and power status indicators. It shows values for -2.5 and +2.5 channels.
- Right Panel:** Features a grid of blue boxes representing different channels or components, numbered 31 through 41.
- Bottom Panel:** Shows 'VME Crate Control' with a 'GAS SYSTEM' section. The gas system includes input/output channels and a ratio section for ARGON and CO2. It also displays 'BACK IN CRA', 'O-SIDE RACK A00', and 'I-SIDE RACK A00' with board status indicators.

Additional details include a system clock showing '08:28:53 12-10-10', a user name 'anik', and a 'VME Crates' control panel with 'On/Off' buttons and a 'SURREST' button.

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08:28:53  
anik

PMD\_DCS  
FSM STBY CONF

Alarm Sc...

Print alarms:

Unacknowledged Individual/Group acknowledged

Mode: Current Al... Histori...

Alarm Filters

Systems

- PMD\_DCS <<
- PMD\_CPV
- PMD\_INFRA
- PMD\_PRE
- PMD\_DCS\_RUN
- pmdConfDev

| Device Name | Logical Name | Device Type | Device Description | State |
|-------------|--------------|-------------|--------------------|-------|
| dc_s_ui     | *            | *           | *                  |       |
| dc_s_alerts | *            | *           | *                  |       |
| dc_s_ui2    | *            | *           | *                  |       |
| nmd.d       | *            | *           | *                  |       |

| Sh | Device DP element                      | Logical name | Alarm text          | Dir. | Value    | Ack | Time                    | Co |
|----|--|--------------|---------------------|------|----------|-----|-------------------------|----|
| W  | pmd_pre:AnalogDigital/fcAnaloginput.va |              | COLD                | CAME | 0        | xxx | 2007/12/04 12:33:45.372 |    |
| W  | dc_s_ui:SERVICES DCS_GAS DCS_GA        |              | FSM Re...           | CAME | TRUE     |     | 2008/08/19 08:55:02.191 |    |
| W  | dc_s_ui:SERVICES DCS_GAS DCS_GA        |              | FSM Su...           | CAME | TRUE     |     | 2008/08/19 08:55:02.191 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.066148 |     | 2009/11/18 20:58:57.013 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.064927 |     | 2009/11/18 21:35:12.985 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.063249 |     | 2009/11/18 21:35:12.985 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.061571 |     | 2009/11/18 21:35:12.985 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.063096 |     | 2009/11/18 21:35:12.985 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.059129 |     | 2009/11/18 21:35:12.985 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.066606 |     | 2009/11/18 21:51:05.973 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.067064 |     | 2009/11/18 21:53:11.971 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.064775 |     | 2009/11/18 22:06:37.961 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.062944 |     | 2009/11/18 22:06:37.961 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.066911 |     | 2009/11/18 22:06:37.961 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 36 CHAIN TRIPP | CAME | 5.066538 |     | 2009/11/18 22:06:37.961 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.064012 |     | 2009/11/19 22:31:07.909 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.06669  |     | 2009/11/19 22:31:07.909 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.063707 |     | 2009/11/19 22:31:07.909 |    |
| E  | pmd_pre:ELMB/my_lbdbusO/ELMB59/        |              | MOD. 38 CHAIN TRIPP | CAME | 5.063707 |     | 2009/11/19 22:31:07.909 |    |

PMD Au

|             |         |
|-------------|---------|
| Detector    | CPV     |
| PW Racks    | MAIN PW |
| AUXILIARIES | GAS     |

Alarms Displayed: 19 Unacknowledged: 0

Deselect Rows Manage Display... Close

Status of alarm Warning, Error or Fatal

Alarm text associated with the Alarm

Value of the datapoint

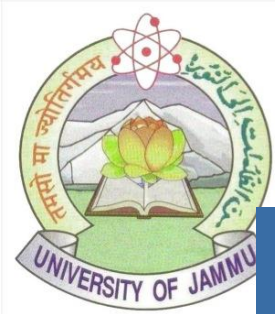
LHC

LHC UNSAFE !

Env. 100.0 °C 1000.8 mbar

|    |    |
|----|----|
| 36 | 37 |
| 38 | 39 |
| 40 | 41 |
| 35 | 34 |
| 32 | 31 |

CPV



Vision\_1: JCOP Alarm Screen

Module Panel Scale Help

en\_US.iso88591

Alarm Screen

Acknowledgement: Unacknowledged, Acknowledge, x, xxx, Individual/Group acknowledged

Mode: Current Alarms, Historical Alarms, Select Time Range...

Print alarms: [Print icon]

Alarm Filters: Systems (dcs\_globals, dcs\_ui, dcs\_alerts, end\_dcs), Device Name, Logical Name, Alarm Text, Alarm State, Device Type, Device Description, Quick Filters: W, E, F

| Sh | Device DP element                     | Description                           | Alarm text                            | Dir. | Value        | Ack | Time                    | Co |
|----|---------------------------------------|---------------------------------------|---------------------------------------|------|--------------|-----|-------------------------|----|
| E  | tri_dcs:Wiener/CAN9/Crate6.General.St |                                       | TRI VME CRATE 6 SYS                   | WENT | TRUE         | !!! | 2010/04/26 16:25:58.459 |    |
| E  | tri_dcs:IDlev                         | D:/PVSS_Projects/trg_dim_uj/panels/cr | FSM Summary                           | CAME | TRUE         | !!! | 2010/04/26 16:26:42.584 |    |
| E  | tri_dcs:IDlev.temp                    | IDtemp:842:IO:G:ctp                   | VME ID BOARD TEMP                     | CAME | 257889 °C    | !!! | 2010/04/26 16:26:42.584 |    |
| E  | spd_c.spdTempBusDSS102                |                                       | FSM Summary                           | WENT | TRUE         | !!! | 2010/04/28 14:54:45.874 |    |
| E  | spd_c.spdTempBusDSS097                |                                       | FSM Summary                           | WENT | TRUE         | !!! | 2010/04/28 17:17:19.109 |    |
| E  | spd_a.spdTempBusDSS039                |                                       | FSM Summary                           | WENT | TRUE         | !!! | 2010/04/28 17:17:31.156 |    |
| E  | spd_c.spdTempBusDSS098                |                                       | FSM Summary                           | WENT | TRUE         | !!! | 2010/04/30 15:09:07.068 |    |
| E  | spd_c.spdTempBusDSS097                |                                       | FSM Summary                           | WENT | TRUE         | !!! | 2010/04/30 15:20:57.890 |    |
| E  | spd_c.spdTempBusDSS098                |                                       | FSM Summary                           | WENT | TRUE         | !!! | 2010/04/30 23:22:39.912 |    |
| E  | spd_c.spdTempBusDSS097.Readings.T     |                                       | Half-Stage Hot (Turned c              | WENT | 37.835998635 | !!! | 2010/04/30 23:31:37.075 |    |
| E  | spd_c.spdTempBusDSS098.Readings.T     |                                       | Half-Stage Hot (Turned c              | WENT | 35.433998107 | !!! | 2010/05/02 14:29:37.090 |    |
| E  | hmp_lcs:HMPID_DEVICES/hmp_gaslv       |                                       | MWPC CH4 GAS Delta                    | WENT | 1            | !!! | 2010/05/03 00:50:16.274 |    |
| F  | tpc_dcs:TPC_SERVICE_BUSY_BOX.R        |                                       | not running                           | WENT | TRUE         | !!! | 2010/05/03 08:16:39.193 |    |
| F  | tpc_dcs:TPC_SERVICE_BUSY.FSM.State    |                                       | NO CONTROL                            | WENT | 34           | !!! | 2010/05/03 08:16:41.052 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board09/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:09:34.483 |    |
| E  | tof_hv:CAEN/alitofcaehv1/board04/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:14.921 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board01/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:18.483 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board07/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:18.499 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board05/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:18.499 |    |
| E  | tof_hv:CAEN/alitofcaehv1/board08/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:22.483 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board07/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:22.499 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board04/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:22.499 |    |
| E  | tof_hv:CAEN/alitofcaehv2/board00/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:10:24.937 |    |
| E  | tof_hv:CAEN/alitofcaehv1/board04/cham |                                       | OverCurrent                           | WENT | FALSE        | !!! | 2010/05/03 09:28:20.785 |    |
| F  | tpc_laser:TPC_SERVICE_SHUTTER.Ru      |                                       | not running                           | WENT | TRUE         | !!! | 2010/05/03 09:28:23.535 |    |
| F  | tpc_laser:TPC_SERVICE_MIRROR.Rur      |                                       | not running                           | WENT | TRUE         | !!! | 2010/05/03 12:04:05.348 |    |
| E  | dcs_sysmon:SystemOverview/ALIDCSC     | lhc_instrumentation                   | Instrumentation Manager Abnormally St | CAME | 10           | !!! | 2010/05/03 12:05:05.130 |    |
| E  | dcs_sysmon:SystemOverview/ALIDCSC     | lhc_instrumentation                   | Instrumentation Manager Abnormally St | CAME | 10           | !!! | 2010/05/03 12:05:05.130 |    |
| F  | tpc_laser:TPC_SERVICE_EKSPLO.Due      |                                       | not running                           | WENT | TRUE         | !!! | 2010/05/03 12:14:02.943 |    |
| E  | hmp_lcs:HMPID_DEVICES/h               |                                       | MWPC CH4 GAS Delta                    | WENT | 1            | !!! | 2010/05/03 13:56:16.495 |    |

Alarms Displayed: 45 Unac Trend 28

Deselect Rows Manage Display... Close

Right click and select ALERT HELP

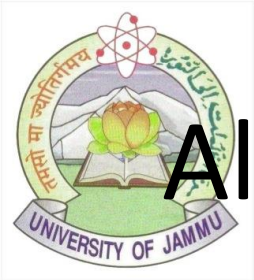


# Getting help on Alerts

The screenshot shows the Vision\_1: JCOP Alarm Screen interface. A window titled 'TPC Alarm Instruction' is open, displaying details for an 'AHTPC\_DIM\_SERVICE' alarm. A blue callout box points to this window with the text 'Window with specific instructions opens'. The alarm details include a 'Fatal' status, a description of the alarm source and datapoint, and contact information for Christian Lippmann.

| Sh | Device DP element     | State       | Alarm     | Time                    |
|----|-----------------------|-------------|-----------|-------------------------|
| E  | tri_dcs:Wiener/CAN9/C | not running | WENT TRUE | 2010/05/03 09:28:23.535 |
| E  | tri_dcs:IDlev         | not running | WENT TRUE | 2010/05/03 12:04:05.348 |
| E  | tri_dcs:IDlev.temp    | not running | WENT TRUE | 2010/05/03 12:05:05.130 |
| E  | spd_c:spdTempBusDS    | not running | WENT TRUE | 2010/05/03 12:14:02.943 |
| E  | spd_c:spdTempBusDS    | not running | WENT TRUE | 2010/05/03 13:56:16.495 |





# Alice-LHC handshake procedure



- This procedure is always executed before the LHC changes the operational mode
- The goal is to ring ALICE to safe mode and confirm this to LHC
- Handshake is initiated on LHC request and the DCS operator follows the instructions given at the operational panels (see following slides)



# Handshake

## Injection WARNING



PopupLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:9 s:44

### LHC INJECTION WARNING

- Send INJECTION\_PREPARE command on the LHC\_ALI\_HANDSHAKE node;
- Ask the ECS operator to stop all the runs;
- If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
If it remains NOT SAFE check the responsible detector and call the DCS expert.  
If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;
- Wait until the blinking message LHC INJECTION IMMINENT appears;
- In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |                |
|-------------------|----------------|
| LHC_ALI_HANDSHAKE | INJECT_WARNING |
| ALICE STATE       | NOT_SAFE       |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Detector Emergency buttons and beam SAFE state monitoring**

|     |            |     |            |     |            |
|-----|------------|-----|------------|-----|------------|
| ACD | ● NOT SAFE | PHS | ● SAFE     | TPC | ● SAFE     |
| EMC | ● SAFE     | PMD | ○ NOT SAFE | TRD | ○ SAFE     |
| FMD | ○ SAFE     | SDD | ○ SAFE     | T00 | ● SAFE     |
| HMP | ○ NOT SAFE | SPD | ○ SAFE     | V00 | ● NOT SAFE |
| MCH | ○ SAFE     | SSD | ● NOT SAFE | ZDC | ● NOT SAFE |
| MTR | ○ NOT SAFE | TOF | ○ NOT SAFE |     |            |

**Alice State**

NOT SAFE

**FSM Nodes**

|                   |                |
|-------------------|----------------|
| LHC_ALI_HANDSHAKE | INJECT_WARNING |
| ALICE STATE       | INJECT_PREPARE |

Release FSM

REPORT\_PROBLEM

**FSM Nodes**

|                   |                  |
|-------------------|------------------|
| LHC_ALI_HANDSHAKE | INJECT_WARN_CONF |
| ALICE STATE       | NOT_SAFE         |

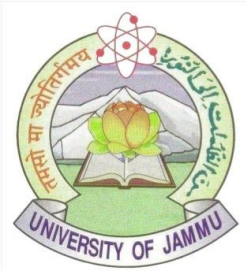
Release FSM

FORCE\_BEAM\_SAFE

**FSM Nodes**

|                   |                  |
|-------------------|------------------|
| LHC_ALI_HANDSHAKE | INJECT_WARN_CONF |
| ALICE STATE       | SAFE             |

Release FSM



# II: Injection Imminent



PopupLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:1 s:41

## LHC INJECTION IMMINENT

- 1) If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
If after 2 minutes it remains NOT SAFE check the responsible detector and call the DCS expert.  
If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;
- 2) Ask the TRI shifter to switch on the LHC clock;
- 3) Once ALICE is in beam SAFE state send CONFIRM\_INJECT on the LHC\_ALI\_HANDSHAKE node;
- 4) Wait for the blinking message LHC INJECTION STARTED;
- 5) In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |                  |  |
|-------------------|------------------|--|
| LHC_ALI_HANDSHAKE | INJECT_IMMINEENT |  |
| ALICE STATE       | SAFE             |  |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Detector Emergency buttons and beam SAFE state monitoring**

|     |  |          |     |  |          |     |  |      |
|-----|--|----------|-----|--|----------|-----|--|------|
| ACD |  | NOT SAFE | PHS |  | SAFE     | TPC |  | SAFE |
| EMC |  | SAFE     | PMD |  | SAFE     | TRD |  | SAFE |
| FMD |  | SAFE     | SDD |  | SAFE     | T00 |  | SAFE |
| HMP |  | SAFE     | SPD |  | SAFE     | V00 |  | SAFE |
| MCH |  | SAFE     | SSD |  | NOT SAFE | ZDC |  | SAFE |
| MTR |  | SAFE     | TOF |  | SAFE     |     |  |      |

**Alice State**

SAFE

**FSM Nodes**

|                   |                  |  |
|-------------------|------------------|--|
| LHC_ALI_HANDSHAKE | INJECT_IMMINEENT |  |
| ALICE STATE       | REPORT_PROBLEM   |  |
|                   | CONFIRM_INJECT   |  |

Release FSM

**FSM Nodes**

|                   |                  |  |
|-------------------|------------------|--|
| LHC_ALI_HANDSHAKE | INJECT_IMMINEENT |  |
| ALICE STATE       | REPORT_PROBLEM   |  |
|                   | CONFIRM_INJECT   |  |

Release FSM



# III: Injection READY



PopUpLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:0 s:0

## LHC INJECTION READY

- 1) The INJECTION is under way;
- 2) Wait until the blinking message INJECTION COMPLETED appears;
- 3) In case ALICE flip in NOT SAFE state send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node, click SEND in the confirm popup panel. Be aware: the permits are false and the the injection is interrupted! Please, inform CCC at 77600. Once the problem is solved send the command ACKNOWLEDGE then LHC\_ALI\_HANDSHAKE node will move in IMMINENT. Once ALICE is SAFE, please send the command CONFIRM INJECT;

**FSM Nodes**

|                   |                  |  |
|-------------------|------------------|--|
| LHC_ALI_HANDSHAKE | INJECT_CONFIRMED |  |
| ALICE STATE       | SAFE             |  |

Release FSM

**User Permits**

Beam Permit

Injection permit 1

Injection permit 2

**Detector Emergency buttons and beam SAFE state monitoring**

|     |  |          |     |  |          |     |  |      |
|-----|--|----------|-----|--|----------|-----|--|------|
| ACD |  | NOT SAFE | PHS |  | SAFE     | TPC |  | SAFE |
| EMC |  | SAFE     | PMD |  | SAFE     | TRD |  | SAFE |
| FMD |  | SAFE     | SDD |  | SAFE     | T00 |  | SAFE |
| HMP |  | SAFE     | SPD |  | SAFE     | V00 |  | SAFE |
| MCH |  | SAFE     | SSD |  | NOT SAFE | ZDC |  | SAFE |
| MTR |  | SAFE     | TOF |  | SAFE     |     |  |      |

Alice State

SAFE



# IV: injection Completed

Estimated Countdown Time: m:0 s:0

## LHC INJECTION COMPLETED

1) LHC INJECTION completed. Please, inform the shift leader the INJECTION is completed;

3) To close this panel wait until the Close button appears at the bottom right;

**FSM Nodes**

|                   |         |   |
|-------------------|---------|---|
| LHC_ALL_HANDSHAKE | STANDBY | 🔒 |
| ALICE STATE       | SAFE    | 🔒 |

Release FSM

**User Permits**

|                    |   |
|--------------------|---|
| Beam Permit        | 🟢 |
| Injection permit 1 | 🔴 |
| Injection permit 2 | 🔴 |

**Detector Emergency buttons and beam SAFE state monitoring**

|     |            |     |            |     |        |
|-----|------------|-----|------------|-----|--------|
| ACO | 🟢 NOT SAFE | PHS | 🟢 SAFE     | TPC | 🟢 SAFE |
| EMC | 🟢 SAFE     | PMD | 🟢 SAFE     | TRD | 🟢 SAFE |
| FMD | 🟢 SAFE     | SDD | 🟢 SAFE     | T00 | 🟢 SAFE |
| HMP | 🟢 SAFE     | SPD | 🟢 SAFE     | V00 | 🟢 SAFE |
| MCH | 🟢 SAFE     | SSD | 🟢 NOT SAFE | ZDC | 🟢 SAFE |
| MTR | 🟢 SAFE     | TOF | 🟢 SAFE     |     |        |

Alice State: SAFE

Estimated Countdown Time: m:0 s:0

## LHC INJECTION COMPLETED

1) Please, ask the run coordinator to launch ACT;

2) INJECTION completed: Please close the panel by using the Close button at the lower right.

**FSM Nodes**

|                   |         |   |
|-------------------|---------|---|
| LHC_ALL_HANDSHAKE | STANDBY | 🔒 |
| ALICE STATE       | SAFE    | 🔒 |

Release FSM

**User Permits**

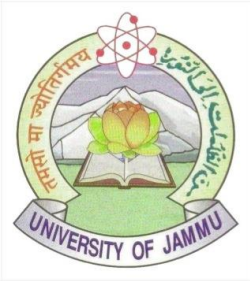
|                    |   |
|--------------------|---|
| Beam Permit        | 🟢 |
| Injection permit 1 | 🔴 |
| Injection permit 2 | 🔴 |

**Detector Emergency buttons and beam SAFE state monitoring**

|     |            |     |            |     |        |
|-----|------------|-----|------------|-----|--------|
| ACO | 🟢 NOT SAFE | PHS | 🟢 SAFE     | TPC | 🟢 SAFE |
| EMC | 🟢 SAFE     | PMD | 🟢 SAFE     | TRD | 🟢 SAFE |
| FMD | 🟢 SAFE     | SDD | 🟢 SAFE     | T00 | 🟢 SAFE |
| HMP | 🟢 SAFE     | SPD | 🟢 SAFE     | V00 | 🟢 SAFE |
| MCH | 🟢 SAFE     | SSD | 🟢 NOT SAFE | ZDC | 🟢 SAFE |
| MTR | 🟢 SAFE     | TOF | 🟢 SAFE     |     |        |

Alice State: SAFE

Close



# Handshake I: Dump WARNING



PopUpLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:9 s:34

## LHC DUMP WARNING

- Send DUMP\_PREPARE command on the LHC\_ALI\_HANDSHAKE node;
- Ask the ECS operator to stop all the runs;
- If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
If it remains NOT SAFE check the responsible detector and call the DCS expert.  
If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;
- Wait until the blinking message LHC DUMP IMMINENT appears;
- In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |              |   |
|-------------------|--------------|---|
| LHC_ALI_HANDSHAKE | DUMP_WARNING | 🔒 |
| ALICE STATE       | NOT_SAFE     | 🔒 |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1

READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |            |     |            |     |            |
|-----|------------|-----|------------|-----|------------|
| ACD | ⊙ NOT SAFE | PHS | ● SAFE     | TPC | ● NOT SAFE |
| EMC | ● SAFE     | PMD | ● SAFE     | TRD | ⊙ NOT SAFE |
| FMD | ● NOT SAFE | SDD | ● SAFE     | T00 | ● SAFE     |
| HMP | ● SAFE     | SPD | ⊙ NOT SAFE | V00 | ● SAFE     |
| MCH | ● SAFE     | SSD | ⊙ NOT SAFE | ZDC | ⊙ SAFE     |
| MTR | ● SAFE     | TOF | ● NOT SAFE |     |            |

Alice State

NOT SAFE

**FSM Nodes**

|                   |              |   |
|-------------------|--------------|---|
| LHC_ALI_HANDSHAKE | DUMP_WARNING | 🔒 |
| ALICE STATE       | DUMP_PREPARE | 🔒 |

Release FSM

**FSM Nodes**

|                   |                |   |
|-------------------|----------------|---|
| LHC_ALI_HANDSHAKE | DUMP_WARN_CONF | 🔒 |
| ALICE STATE       | NOT_SAFE       | 🔒 |

Release FSM

FORCE\_BEAM\_SAFE

**FSM Nodes**

|                   |                |   |
|-------------------|----------------|---|
| LHC_ALI_HANDSHAKE | DUMP_WARN_CONF | 🔒 |
| ALICE STATE       | SAFE           | 🔒 |

Release FSM



# II: DUMP Imminent



PopupLHC AlicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:1 s:42

## LHC DUMP IMMINENT

- 1) If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
If after 2 minutes it remains NOT SAFE check the responsible detector and call the DCS expert.  
If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;
- 2) Ask the TRI shifter to switch on the CTP clock;
- 3) Once ALICE is in beam SAFE state send CONFIRM\_DUMP on the LHC\_ALI\_HANDSHAKE node;
- 4) Wait for the blinking message LHC DUMP STARTED;
- 5) In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |               |
|-------------------|---------------|
| LHC_ALI_HANDSHAKE | DUMP_IMMINENT |
| ALICE STATE       | SAFE          |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1

READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |            |     |            |     |        |
|-----|------------|-----|------------|-----|--------|
| ACO | ● NOT SAFE | PHS | ● SAFE     | TPC | ● SAFE |
| EMC | ● SAFE     | PMD | ● SAFE     | TRD | ● SAFE |
| FMD | ● SAFE     | SDD | ○ SAFE     | T00 | ● SAFE |
| HMP | ● SAFE     | SPD | ● NOT SAFE | V00 | ○ SAFE |
| MCH | ○ SAFE     | SSD | ● NOT SAFE | ZDC | ○ SAFE |
| MTR | ● SAFE     | TOF | ● SAFE     |     |        |

**Alice State**

SAFE

**FSM Nodes**

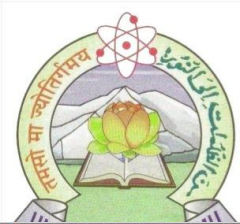
|                   |                |
|-------------------|----------------|
| LHC_ALI_HANDSHAKE | DUMP_IMMINENT  |
| ALICE STATE       | REPORT_PROBLEM |
|                   | CONFIRM_DUMP   |

Release FSM

**FSM Nodes**

|                   |                |
|-------------------|----------------|
| LHC_ALI_HANDSHAKE | DUMP_IMMINENT  |
| ALICE STATE       | REPORT_PROBLEM |
|                   | CONFIRM_DUMP   |

Release FSM



# III: Dump READY



PopupLHCAlicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:1 s:35

## LHC DUMP IMMINENT

1) If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
 If after 2 minutes it remains NOT SAFE check the responsible detector and call the DCS expert.  
 If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;  
 2) Ask the TRI shifter to switch on the CTP clock;  
 3) Once ALICE is in beam SAFE state send CONFIRM\_DUMP on the LHC\_ALI\_HANDSHAKE node;  
 4) Wait for the blinking message LHC DUMP STARTED;  
 5) In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
 When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |            |  |
|-------------------|------------|--|
| LHC_ALI_HANDSHAKE | DUMP_READY |  |
| ALICE STATE       | SAFE       |  |

Release FSM

**User Permits**

Beam Permit

Injection permit 1

Injection permit 2

**Tell1 Status**

TELL 1

READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |  |          |     |  |          |     |  |      |
|-----|--|----------|-----|--|----------|-----|--|------|
| ACQ |  | NOT SAFE | PHS |  | SAFE     | TPC |  | SAFE |
| EMC |  | SAFE     | PMD |  | SAFE     | TRD |  | SAFE |
| FMD |  | SAFE     | SDD |  | SAFE     | T00 |  | SAFE |
| HMP |  | SAFE     | SPD |  | NOT SAFE | V00 |  | SAFE |
| MCH |  | SAFE     | SSD |  | NOT SAFE | ZDC |  | SAFE |
| MTR |  | SAFE     | T0F |  | SAFE     |     |  |      |

Alice State

SAFE

PopupLHCAlicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:0 s:0

## LHC DUMP READY

1) The DUMP is under way;  
 2) Wait until the blinking message DUMP COMPLETED appears;  
 3) In case ALICE flip in NOT SAFE state send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node, click SEND in the confirm popup panel. Please, inform CCC at 77600.  
 Once the problem is solved send the command ACKNOWLEDGE then LHC\_ALI\_HANDSHAKE node will move in IMMINENT.  
 Once ALICE is SAFE, please send the command CONFIRM DUMP;

**FSM Nodes**

|                   |                |  |
|-------------------|----------------|--|
| LHC_ALI_HANDSHAKE | DUMP_CONFIRMED |  |
| ALICE STATE       | SAFE           |  |

Release FSM

**User Permits**

Beam Permit

Injection permit 1

Injection permit 2

**Tell1 Status**

TELL 1

READY

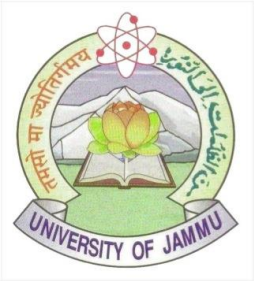
**Detector Emergency buttons and beam SAFE state monitoring**

|     |  |          |     |  |          |     |  |      |
|-----|--|----------|-----|--|----------|-----|--|------|
| ACQ |  | NOT SAFE | PHS |  | SAFE     | TPC |  | SAFE |
| EMC |  | SAFE     | PMD |  | SAFE     | TRD |  | SAFE |
| FMD |  | SAFE     | SDD |  | SAFE     | T00 |  | SAFE |
| HMP |  | SAFE     | SPD |  | NOT SAFE | V00 |  | SAFE |
| MCH |  | SAFE     | SSD |  | NOT SAFE | ZDC |  | SAFE |
| MTR |  | SAFE     | T0F |  | SAFE     |     |  |      |

Alice State

SAFE





# IV: Dump Completed

PopupLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:0 s:0

## LHC DUMP COMPLETED

- 1) Please, inform the shift leader that the handshake is over;
- 2) DUMP completed: Please close the panel by using the Close button at the lower right.

**FSM Nodes**

|                   |         |  |
|-------------------|---------|--|
| LHC_ALI_HANDSHAKE | STANDBY |  |
| ALICE STATE       | SAFE    |  |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1

READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |                                      |          |     |                                      |          |     |                                      |      |
|-----|--------------------------------------|----------|-----|--------------------------------------|----------|-----|--------------------------------------|------|
| ACD | <span style="color: green;">●</span> | NOT SAFE | PHS | <span style="color: green;">●</span> | SAFE     | TPC | <span style="color: green;">●</span> | SAFE |
| EMC | <span style="color: green;">●</span> | SAFE     | PMD | <span style="color: green;">●</span> | SAFE     | TRD | <span style="color: grey;">●</span>  | SAFE |
| FMD | <span style="color: green;">●</span> | SAFE     | SDD | <span style="color: green;">●</span> | SAFE     | T00 | <span style="color: grey;">●</span>  | SAFE |
| HMP | <span style="color: green;">●</span> | SAFE     | SPD | <span style="color: green;">●</span> | NOT SAFE | V00 | <span style="color: green;">●</span> | SAFE |
| MCH | <span style="color: green;">●</span> | SAFE     | SSD | <span style="color: grey;">●</span>  | NOT SAFE | ZDC | <span style="color: grey;">●</span>  | SAFE |
| MTR | <span style="color: green;">●</span> | SAFE     | TOF | <span style="color: green;">●</span> | SAFE     |     |                                      |      |

**Alice State**

SAFE

**Close**

41



# Handshake I: Adjust WARNING



PopUp.LHCalicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:9 s:35

## LHC ADJUST WARNING

- Send ADJUST\_PREPARE command on the LHC\_ALI\_HANDSHAKE node;
- Ask the ECS operator to stop all the runs;
- If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
If it remains NOT SAFE check the responsible detector and call the DCS expert.  
If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;
- Wait until the blinking message LHC ADJUST IMMINENT appears;
- In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |                |  |
|-------------------|----------------|--|
| LHC_ALI_HANDSHAKE | ADJUST_WARNING |  |
| ALICE STATE       | NOT_SAFE       |  |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1 READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |  |          |     |  |          |     |  |          |
|-----|--|----------|-----|--|----------|-----|--|----------|
| ACD |  | NOT SAFE | PHS |  | SAFE     | TPC |  | NOT SAFE |
| EMC |  | SAFE     | PMD |  | SAFE     | TRD |  | NOT SAFE |
| FMD |  | NOT SAFE | SDD |  | SAFE     | T00 |  | SAFE     |
| HMP |  | SAFE     | SPD |  | NOT SAFE | V00 |  | SAFE     |
| MCH |  | SAFE     | SSD |  | NOT SAFE | ZDC |  | SAFE     |
| MTR |  | SAFE     | TOF |  | NOT SAFE |     |  |          |

**Alice State**

NOT SAFE

**FSM Nodes**

|                   |                |  |
|-------------------|----------------|--|
| LHC_ALI_HANDSHAKE | ADJUST_WARNING |  |
| ALICE STATE       | ADJUST_PREPARE |  |

Release FSM

**FSM Nodes**

|                   |                  |  |
|-------------------|------------------|--|
| LHC_ALI_HANDSHAKE | ADJUST_WARN_CONF |  |
| ALICE STATE       | NOT_SAFE         |  |

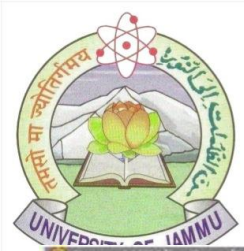
Release FSM

FORCE\_BEAM\_SAFE

**FSM Nodes**

|                   |                  |  |
|-------------------|------------------|--|
| LHC_ALI_HANDSHAKE | ADJUST_WARN_CONF |  |
| ALICE STATE       | SAFE             |  |

Release FSM



# II: Adjust Imminent



PopUpLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:1 s:38

## LHC ADJUST IMMINENT

1) If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
 If after 2 minutes it remains NOT SAFE check the responsible detector and call the DCS expert.  
 If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;  
 2) Once ALICE is in beam SAFE state send CONFIRM\_ADJUST on the LHC\_ALI\_HANDSHAKE node;  
 3) Wait for the blinking message LHC ADJUST STARTED;  
 4) In case of problems send the command REPORT PROBLEM on the LHC\_ALI\_HANDSHAKE node.  
 When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALI\_HANDSHAKE node;

**FSM Nodes**

|                   |                 |
|-------------------|-----------------|
| LHC_ALI_HANDSHAKE | ADJUST_IMMINENT |
| ALICE STATE       | SAFE            |

Release FSM

**User Permits**

Beam Permitt ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1 READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |            |     |            |     |        |
|-----|------------|-----|------------|-----|--------|
| ACD | ● NOT SAFE | PHS | ● SAFE     | TPC | ● SAFE |
| EMC | ● SAFE     | PMD | ● SAFE     | TRD | ● SAFE |
| FMD | ● SAFE     | SDD | ● SAFE     | T00 | ● SAFE |
| HMP | ● SAFE     | SPD | ● NOT SAFE | V00 | ● SAFE |
| MCH | ● SAFE     | SSD | ● NOT SAFE | ZDC | ● SAFE |
| MTR | ● SAFE     | T0F | ● SAFE     |     |        |

**Alice State**

SAFE

**FSM Nodes**

|                   |                 |
|-------------------|-----------------|
| LHC_ALI_HANDSHAKE | ADJUST_IMMINENT |
| ALICE STATE       | REPORT_PROBLEM  |

Release FSM

CONFIRM\_ADJUST

**FSM Nodes**

|                   |                 |
|-------------------|-----------------|
| LHC_ALI_HANDSHAKE | ADJUST_IMMINENT |
| ALICE STATE       | REPORT_PROBLEM  |

Release FSM

CONFIRM\_ADJUST



# III: Adjust READY



PopUpLHC AlicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:1 s:26

## LHC ADJUST IMMINENT

- 1) If ALICE STATE node is NOT SAFE send the command FORCE\_BEAM\_SAFE.  
If after 2 minutes it remains NOT SAFE check the responsible detector and call the DCS expert.  
If she/he is not reachable right click on the button indicating the name of the detector to unlock the emergency button of the NOT SAFE detector then left click on the same button to force the detector into its beam SAFE state;
- 2) Once ALICE is in beam SAFE state send CONFIRM\_ADJUST on the LHC\_ALL\_HANDSHAKE node;
- 3) Wait for the blinking message LHC ADJUST STARTED;
- 4) In case of problems send the command REPORT PROBLEM on the LHC\_ALL\_HANDSHAKE node.  
When the problem is solved send the ACKNOWLEDGE command on the LHC\_ALL\_HANDSHAKE node;

**FSM Nodes**

|                   |              |
|-------------------|--------------|
| LHC_ALL_HANDSHAKE | ADJUST_READY |
| ALICE STATE       | SAFE         |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1 READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |          |     |          |     |      |
|-----|----------|-----|----------|-----|------|
| ACD | NOT SAFE | PHS | SAFE     | TPC | SAFE |
| EMC | SAFE     | PMD | SAFE     | TRD | SAFE |
| FMD | SAFE     | SDD | SAFE     | T00 | SAFE |
| HMP | SAFE     | SPD | NOT SAFE | V00 | SAFE |
| MCH | SAFE     | SSD | NOT SAFE | ZDC | SAFE |
| MTR | SAFE     | TOF | SAFE     |     |      |

Alice State SAFE

PopUpLHC AlicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:0 s:0

## LHC ADJUST READY

- 1) The ADJUST is under way;
- 2) Wait until the blinking message ADJUST COMPLETED appears;
- 3) In case ALICE flip in NOT SAFE state send the command REPORT PROBLEM on the LHC\_ALL\_HANDSHAKE node, click SEND in the confirm popup panel. Please, inform CCC at 77600.  
Once the problem is solved send the command ACKNOWLEDGE then LHC\_ALL\_HANDSHAKE node will move in IMMINENT.  
Once ALICE is SAFE, please send the command CONFIRM ADJUST;

**FSM Nodes**

|                   |                  |
|-------------------|------------------|
| LHC_ALL_HANDSHAKE | ADJUST_CONFIRMED |
| ALICE STATE       | SAFE             |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

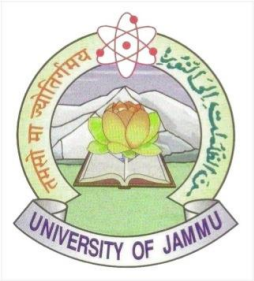
**Tell1 Status**

TELL 1 READY

**Detector Emergency buttons and beam SAFE state monitoring**

|     |          |     |          |     |      |
|-----|----------|-----|----------|-----|------|
| ACD | NOT SAFE | PHS | SAFE     | TPC | SAFE |
| EMC | SAFE     | PMD | SAFE     | TRD | SAFE |
| FMD | SAFE     | SDD | SAFE     | T00 | SAFE |
| HMP | SAFE     | SPD | NOT SAFE | V00 | SAFE |
| MCH | SAFE     | SSD | NOT SAFE | ZDC | SAFE |
| MTR | SAFE     | TOF | SAFE     |     |      |

Alice State SAFE



IV

PopupLHCALicePanelModule: LHC\_MESSAGE

Estimated Countdown Time: m:0 s:0

# LHC ADJUST COMPLETED

1) Please, inform the shift leader that the handshake is over;

2) ADJUST completed: Please close the panel by using the Close button at the lower right.

**FSM Nodes**

|                   |         |  |
|-------------------|---------|--|
| LHC_ALI_HANDSHAKE | STANDBY |  |
| ALICE STATE       | SAFE    |  |

Release FSM

**User Permits**

Beam Permit ■

Injection permit 1 ■

Injection permit 2 ■

**Tell1 Status**

TELL 1

READY

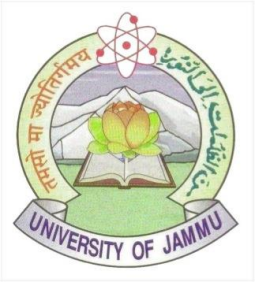
**Detector Emergency buttons and beam SAFE state monitoring**

|     |                                       |     |   |     |                                       |
|-----|---------------------------------------|-----|---|-----|---------------------------------------|
| ACO | <input type="radio"/> NOT SAFE        | PHS | <input checked="" type="radio"/> SAFE     | TPC | <input checked="" type="radio"/> SAFE |
| EMC | <input checked="" type="radio"/> SAFE | PMD | <input type="radio"/> SAFE                | TRD | <input checked="" type="radio"/> SAFE |
| FMD | <input type="radio"/> SAFE            | SDD | <input type="radio"/> SAFE                | T00 | <input checked="" type="radio"/> SAFE |
| HMP | <input type="radio"/> SAFE            | SPD | <input type="radio"/> NOT SAFE            | V00 | <input type="radio"/> SAFE            |
| MCH | <input type="radio"/> SAFE            | SSD | <input checked="" type="radio"/> NOT SAFE | ZDC | <input checked="" type="radio"/> SAFE |
| MTR | <input type="radio"/> SAFE            | TOF | <input type="radio"/> SAFE                |     |                                       |

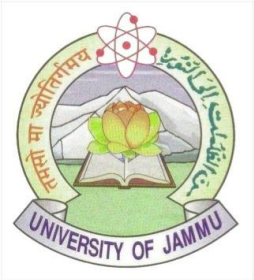
**Alice State**

SAFE

**Close**



# ALICE Safety

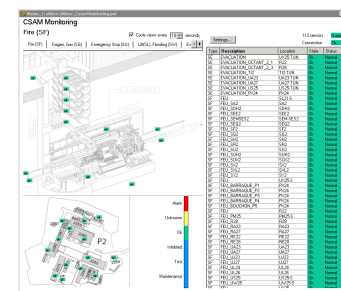
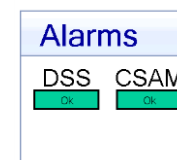
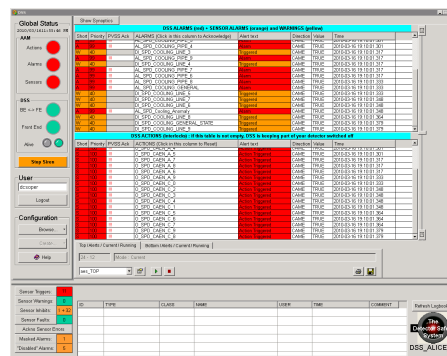


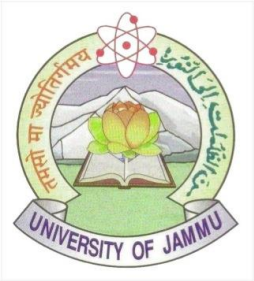
# Safety



• The DCS receives safety related information:

- DSS
- Sniffer
- CSAM





# CSAM

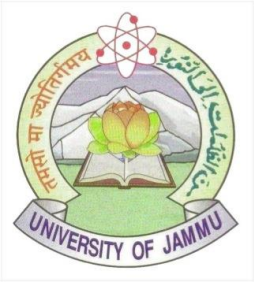


- CSAM (CERN Safety Alarm Monitoring)
  - Collects, transmits and presents all safety alarms
  - UI in ALICE presents all level 3 alarms relevant to point 2
- Experiment, neighboring tunnel

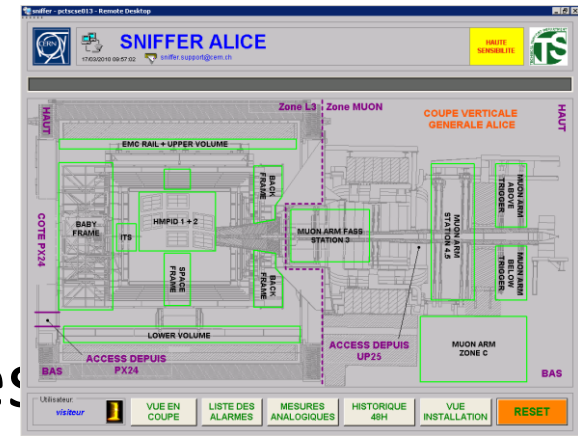
The screenshot shows the CSAM Monitoring software interface. On the left, there is a 3D model of the L3 magnet structure with various sensors marked. On the right, there is a table listing the status of 112 sensors. The table has columns for Type, Description, Location, State, and Status. All sensors listed are in a 'Normal' state.

| Type | Description           | Location | State | Status |
|------|-----------------------|----------|-------|--------|
| SE   | EVACUATION            | UX25-TUN | Ok    | Normal |
| SE   | EVACUATION_OCTANT_2_1 | R22      | Ok    | Normal |
| SE   | EVACUATION_OCTANT_2_3 | R28      | Ok    | Normal |
| SE   | EVACUATION_T12        | T12-TUN  | Ok    | Normal |
| SE   | EVACUATION_UA23       | UA23-TUN | Ok    | Normal |
| SE   | EVACUATION_UA27       | UA27-TUN | Ok    | Normal |
| SE   | EVACUATION_US25       | US25-TUN | Ok    | Normal |
| SE   | EVACUATION_PX24       | PX24     | Ok    | Normal |
| SF   | FEU                   | SL21-S   | Ok    | Normal |
| SF   | FEU_SA2               | SA2      | Ok    | Normal |
| SF   | FEU_SDH2              | SDH2     | Ok    | Normal |
| SF   | FEU_SEE2              | SEE2     | Ok    | Normal |
| SF   | FEU_SEMSES2           | SEM-SES2 | Ok    | Normal |
| SF   | FEU_SEQ2              | SEQ2     | Ok    | Normal |
| SF   | FEU_SF2               | SF2      | Ok    | Normal |
| SF   | FEU_SG2               | SG2      | Ok    | Normal |
| SF   | FEU_SH2               | SH2      | Ok    | Normal |
| SF   | FEU_SR2               | SR2      | Ok    | Normal |
| SF   | FEU_SU2               | SU2      | Ok    | Normal |
| SF   | FEU_SUH2              | SUH2     | Ok    | Normal |
| SF   | FEU_SUX2              | SUX2     | Ok    | Normal |
| SF   | FEU_SX2               | SX2      | Ok    | Normal |
| SF   | FEU_SXL2              | SXL2     | Ok    | Normal |
| SF   | FEU_SY2               | SY2      | Ok    | Normal |
| SF   | FEU_UX25S             | UX25S    | Ok    | Normal |
| SF   | FEU_BARRAQUE_P1       | PX24     | Ok    | Normal |
| SF   | FEU_BARRAQUE_P2       | PX24     | Ok    | Normal |
| SF   | FEU_BARRAQUE_P3       | PX24     | Ok    | Normal |
| SF   | FEU_BARRAQUE_P4       | PX24     | Ok    | Normal |
| SF   | FEU_BOUCHON_P5        | PX24     | Ok    | Normal |
| SF   | FEU                   | R22      | Ok    | Normal |
| SF   | FEU_PM25              | PM25S    | Ok    | Normal |
| SF   | FEU_R28               | R28      | Ok    | Normal |
| SF   | FEU_RA23              | RA23     | Ok    | Normal |
| SF   | FEU_RA27              | RA27     | Ok    | Normal |
| SF   | FEU_RE22              | RE22     | Ok    | Normal |
| SF   | FEU_RE28              | RE28     | Ok    | Normal |
| SF   | FEU_UA23              | UA23     | Ok    | Normal |
| SF   | FEU_UA27              | UA27     | Ok    | Normal |
| SF   | FEU_UJ23              | UJ23     | Ok    | Normal |
| SF   | FEU_UJ27              | UJ27     | Ok    | Normal |
| SF   | FEU_UL24              | UL24     | Ok    | Normal |
| SF   | FEU_UL26              | UL26     | Ok    | Normal |
| SF   | FEU_US25              | US25S    | Ok    | Normal |
| SF   | FEU_UW25              | UW25S    | Ok    | Normal |



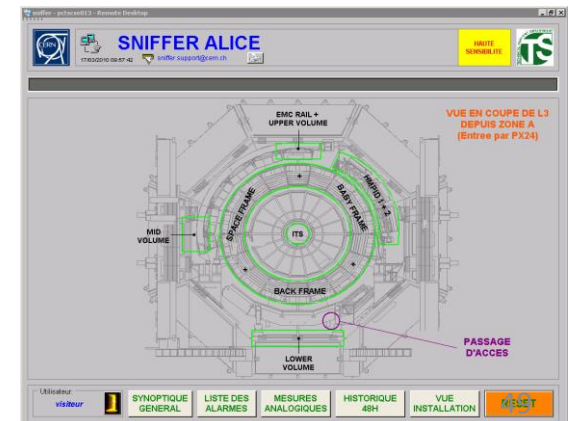


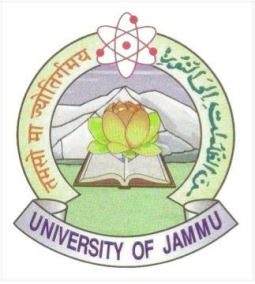
# Sniffer



- Sniffer system monitors gas samples solenoid volume and around/below muon arm

- Detection of smoke, flammable gas and ODH
- Alarm list view (default) and synoptic views

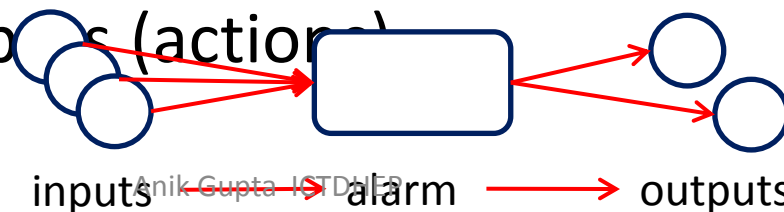


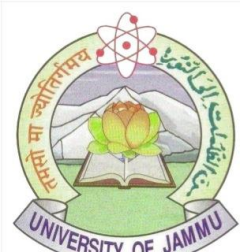


# DSS



- DSS (Detector Safety System)
  - Robust, redundant part of DCS, PLC based
  - Shared by experiment safety and environment monitoring and detector interlocks
  - Can take pre-programmed actions
- Basic concept:
  - A logical (and, or) combination of (triggered) inputs can raise an alarm. An alarm can trigger one or more outputs (actions)





# DSS



Global Status

2010/03/16 11:55:46 PM

**AAM**

Actions: ●

Alarms: ●

Sensors: ●

**DSS**

BE <-> FE: ●

Front End: ●

Alive: ●

**Stop Siren**

**User**

dcsoper

Logout

**Configuration**

Browse...

Create...

Help

---

**DSS ALARMS (red) + SENSORALARMS (orange) and WARNINGS (yellow)**

| Short | Priority | PVSS Ack | ALARMS (Click in this column to Acknowledge) | Alert text | Direction | Value | Time                    |
|-------|----------|----------|--|------------|-----------|-------|-------------------------|
| A     | 99       | III      | AL SPD COOLING PIPE 2                        | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.301 |
| W     | 40       |          | DI SPD COOLING PIPE 3                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| A     | 99       | III      | AL SPD COOLING PIPE 9                        | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| W     | 40       |          | DI SPD COOLING LINE 4                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| A     | 99       | III      | AL SPD COOLING PIPE 7                        | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| A     | 99       | III      | AL SPD COOLING PIPE 6                        | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| A     | 99       | III      | AL SPD COOLING PIPE 8                        | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.333 |
| A     | 99       | III      | AL SPD COOLING GENERAL                       | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.333 |
| W     | 40       |          | DI SPD COOLING LINE 5                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.333 |
| W     | 40       |          | DI SPD COOLING LINE 7                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| W     | 40       |          | DI SPD COOLING LINE 6                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| A     | 99       | III      | AL SPD Cooling Anomaly                       | Alarm      | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| W     | 40       |          | DI SPD COOLING LINE 8                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.364 |
| W     | 40       |          | DI SPD COOLING GENERAL STATE                 | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.379 |
| W     | 40       |          | DI SPD COOLING LINE 9                        | Triggered  | CAME      | TRUE  | 2010-03-16 19:10:01.379 |

---

**DSS ACTIONS (interlocks) : if this table is not empty, DSS is keeping part of your detector switched off**

| Short | Priority | PVSS Ack | ACTIONS (Click in this column to Reset) | Alert text       | Direction | Value | Time                    |
|-------|----------|----------|---|------------------|-----------|-------|-------------------------|
| S     | 100      | III      | O SPD CAEN A 4                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.301 |
| S     | 100      | III      | O SPD CAEN A 5                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.301 |
| S     | 100      | III      | O SPD CAEN A 7                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| S     | 100      | III      | O SPD CAEN A 8                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| S     | 100      | III      | O SPD CAEN A 6                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| S     | 100      | III      | O SPD CAEN A 9                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.333 |
| S     | 100      | III      | O SPD CAEN C 0                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.333 |
| S     | 100      | III      | O SPD CAEN C 2                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| S     | 100      | III      | O SPD CAEN C 3                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| S     | 100      | III      | O SPD CAEN C 4                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| S     | 100      | III      | O SPD CAEN C 1                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.348 |
| S     | 100      | III      | O SPD CAEN C 5                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.364 |
| S     | 100      | III      | O SPD CAEN C 6                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.364 |
| S     | 100      | III      | O SPD CAEN C 7                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.364 |
| S     | 100      | III      | O SPD CAEN C 9                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.379 |
| S     | 100      | III      | O SPD CAEN C 8                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.379 |

---

Sensor Triggers: 11

Sensor Warnings: 0

Sensor Inhibits: 1 + 32

Sensor Faults: 0

Ackno Sensor Errors

Masked Alarms: 1

"Disabled" Alarms: 5

Refresh Logbook

The Detector Safety System

DSS\_ALICE\_V

DSS inputs and alarms

DSS outputs (actions)

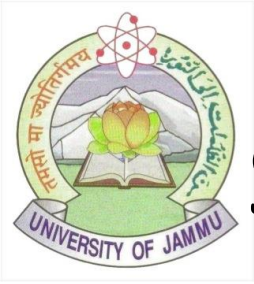
Alarms are acknowledged, and actions are reset by single click on the name (first alarm, then action)

|   |    |     |                              |           |      |      |                         |
|---|----|-----|------------------------------|-----------|------|------|-------------------------|
| A | 99 | III | AL SPD Cooling Anomaly       | Alarm     | CAME | TRUE | 2010-03-16 19:10:01.348 |
| W | 40 |     | DI SPD COOLING LINE 8        | Triggered | CAME | TRUE | 2010-03-16 19:10:01.364 |
| W | 40 |     | DI SPD COOLING GENERAL STATE | Triggered | CAME | TRUE | 2010-03-16 19:10:01.379 |
| W | 40 |     | DI SPD COOLING LINE 9        | Triggered | CAME | TRUE | 2010-03-16 19:10:01.379 |

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**DSS ACTIONS (interlocks) : if this table is not empty, DSS is keeping part of your detector switched off**

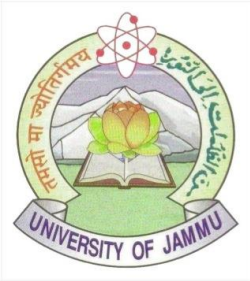
| Short | Priority | PVSS Ack | ACTIONS (Click in this column to Reset) | Alert text       | Direction | Value | Time                    |
|-------|----------|----------|---|------------------|-----------|-------|-------------------------|
| S     | 100      | III      | O SPD CAEN A 4                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.301 |
| S     | 100      | III      | O SPD CAEN A 7                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.317 |
| S     | 100      | III      | O SPD CAEN A 8                          | Action Triggered | CAME      | TRUE  | 2010-03-16 19:10:01.317 |



# Services and Environment



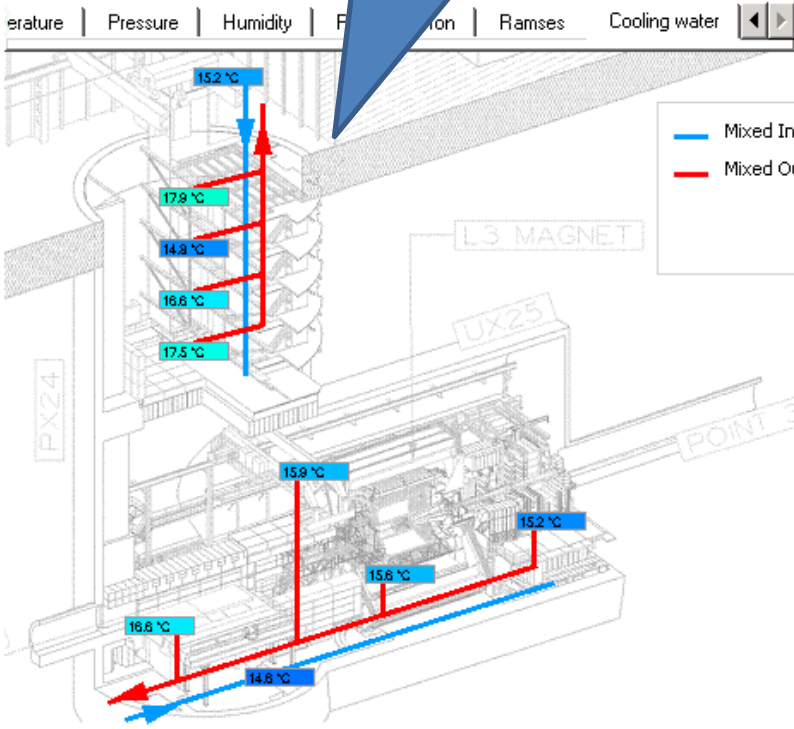
- To run the experiment, services are needed:
  - Power (electricity)
  - Cooling (water)
  - Magnet (solenoid, dipole)
  - Gas
- The DCS monitors the status of these services
- The DCS monitors the environment of the experiment
  - Temperatures, atmospheric pressure, humidity
  - Radiation
  - Magnetic field



# Services and

Rack power distribution status

Cooling water temperatures



Vision 1: rck\_Panels\RackPanel.pnl

Navigation: Cavern | Counting Rooms | Temperatures Cavern | Temperatures CRs

**Zone A**

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| A00 | A03 | A04 | A05 | A06 | A07 | A08 | A09 | A12 | A13 | A14 | A15 | A16 | A17 | A18 | A19 | A20 | A21 |
| █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   |

**Zone C**

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| C00 | C01 | C02 | C03 | C04 | C05 | C08 | C09 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 | C21 | C22 | C23 | C24 |   |
| █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █ |
| C25 | C26 | C27 | C28 | C29 | C30 | C31 | C32 | C36 | C37 | C38 | C39 |     |     |     |     |     |     |     |     |     |     |     |   |
| █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   |     |     |     |     |     |     |     |     |     |     |     |   |

**Zone I**

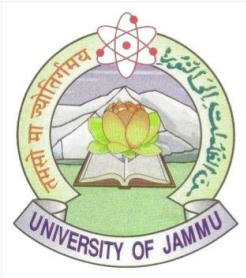
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| I00 | I01 | I02 | I03 | I04 | I05 | I06 | I07 | I08 | I16 | I17 | I18 | I19 | I20 | I21 | I22 | I23 | I24 | I25 | I26 | I27 | I28 | I29 |   |
| █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █ |
| I30 | I31 | I32 | I33 | I34 | I35 | I36 | I37 | I38 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| █   | █   | █   | █   | █   | █   | █   | █   | █   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |

**Zone O**

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| O02 | O03 | O04 | O05 | O06 | O07 | O08 | O12 | O13 | O14 | O15 | O16 | O17 | O18 | O19 | O20 | O21 | O22 | O23 | O24 | O25 | O26 | O27 |   |
| █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █   | █ |
| O28 | O29 | O30 | O31 | O32 | O33 | O37 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| █   | █   | █   | █   | █   | █   | █   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |

**Legend:**

- Rack name**
  - green - ON
  - white - OFF
  - grey - No Control
  - yellow - Drive Discon Fault
- Rack status LED**
  - green - remotely operable
  - yellow - manual mode
  - grey - No Control
- ELMB status LED**
  - green - no alarms
  - yellow - some alarms active
  - grey - ELMB not present



# Services and Environment




Magnet status

Gas systems status

Alice Magnet Control System

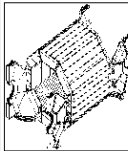
3/17/2010 00:43

### Dipole

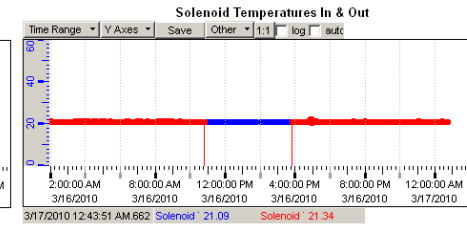
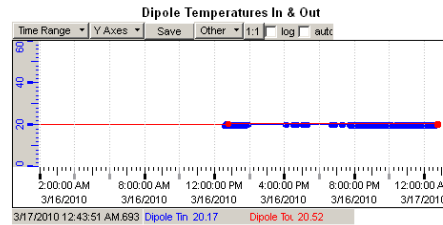
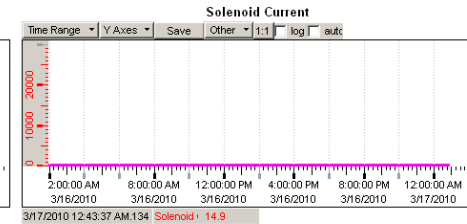
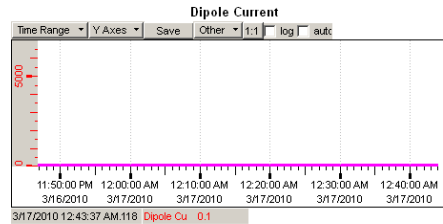


Current: 0.100 A    Emcy ShutDown: TRUE  
 Set Current: 0.000 A    Polarity: NEGATIVE  
 Temp In: 20.17 C    Ramping Sts: FALSE  
 Temp Out: 20.52 C    Steady Sts: FALSE  
 Status: **OFF**    PLC Watchdog: 23492

### L3 Solenoid

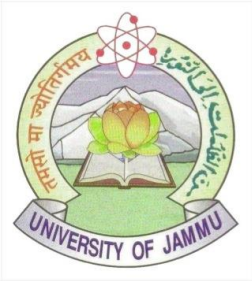


Current: 14.900 A    Emcy ShutDown: TRUE  
 Set Current: 0.000 A    Polarity: NEGATIVE  
 Temp In: 21.09 C    Ramping Sts: FALSE  
 Temp Out: 21.34 C    Steady Sts: FALSE  
 Status: **OFF**    PLC Watchdog: 23541



| DIP OK     | Mixer   | Pump  | Exhaust   | Distribution  | Purifier   | Others  |
|------------|---|---|---|---|--|---|
| <b>TOF</b> | RunStable<br>Line1Ratio: 93.0 %<br>Line2Ratio: 0.0 %<br>Line3Ratio: 7.0 %<br>TotalFlow: 25.7 l/h<br>Status: Run<br>Nominal                        | Run<br>InPressure: -10.0 mbar<br>OutPressure: 0.6 bar<br>PressureSetpoint: -10.0 mbar   | Recirculating<br>CirculationFlow: 0.9 Nm3/h<br>BufilePressure: 0.6 bar<br>CirculationPressu.: 0.6 bar | RunReady<br>[81] [82]   | Nominal Run<br>ColARunVolume: 0.2 m3<br>ColBRunVolume: 0.0 m3<br>ColAlnFlow: 0.6 m3/h<br>ColBlFlow: 0.0 m3/h |   |
| <b>TRD</b> | RunStable<br>Line1Ratio: 0.0 %<br>Line2Ratio: 100.0 %<br>TotalFlow: 0.2 l/h<br>Status: Run<br>Nominal   | Run<br>InPressure: -25.2 mbar<br>OutPressure: 1.0 bar<br>PressureSetpoint: -25.0 mbar   | Recirculating<br>CirculationFlow: 2.3 Nm3/h<br>BufilePressure: 1.0 bar<br>CirculationPressu.: 0.9 bar | RunReady<br>[83] [84] [85] [86] [87] [88] [89] [90] [91] [92] | Stop<br>ColARunVolume: 343.0 m3<br>ColBRunVolume: 0.0 m3<br>ColAlnFlow: 1.7 m3/h<br>ColBlFlow: 0.0 m3/h      | Stop<br>InFlowmeter: 0.0 l/h<br>OutFlowmeter: 0.0 l/h   |
| <b>TPC</b> | RunStable<br>Line1Ratio: 86.8 %<br>Line2Ratio: 9.0 %<br>Line3Ratio: 4.2 %<br>TotalFlow: 46.1 l/h<br>Status: Run<br>Nominal                        | Run<br>InPressure: 0.2 mbar<br>OutPressure: 2.2 bar<br>Pump1 CurrentLoad: 6.9 A<br>Pump1 CurrentSpeed: 42.9 speed<br>PressureSetpoint: 0.4 mbar | Recirculating<br>BufilePressure: 2.0 bar<br>CirculationPressu.: 1.4 bar                               | RunReady<br>[81]  | Stop<br>[83] [84]  | Membrane<br>ColARunVolume: 0.0 m3<br>ColBRunVolume: 0.0 m3<br>ColAlnFlow: 0.0 m3/h<br>ColBlFlow: 0.0 m3/h |
| <b>HMP</b> | RunStable<br>Line1Ratio: 100.0 %<br>Line2Ratio: 0.0 %<br>TotalFlow: 270.0 l/h<br>Status: Run<br>Nominal   |   |   | RunReady<br>[81]  |  | Absorber  |
| <b>MTR</b> | RunStable<br>Line1Ratio: 89.7 %<br>Line2Ratio: 0.0 %<br>Line3Ratio: 10.0 %<br>Line4Ratio: 0.3 %<br>TotalFlow: 171.1 l/h<br>Status: Run<br>Nominal |   |   | RunReady<br>[81]  |  | EvaporatorPressur.: 0.0 bar<br>Humidity: 6145.1 ppm   |
| <b>PMD</b> | RunStable<br>Line1Ratio: 70.0 %<br>Line2Ratio: 30.0 %<br>TotalFlow: 89.5 l/h<br>Status: Run<br>Nominal  |   |   | RunReady<br>[81]  |  | Humidifier  |
| <b>MCH</b> | RunStable<br>Line1Ratio: 80.0 %<br>Line2Ratio: 20.0 %<br>TotalFlow: 496.7 l/h<br>Status: Run<br>Nominal   |   |   | RunReady<br>[81] [82]   |  |   |
| <b>CPV</b> | Stop<br>Line1Ratio: 0.0 %<br>Line2Ratio: 0.0 %<br>TotalFlow: 0.0 l/h<br>Status: Stop<br>Not Ready   |   |   | Stop<br>[81]  |  |   |

00:38 3/17/2010

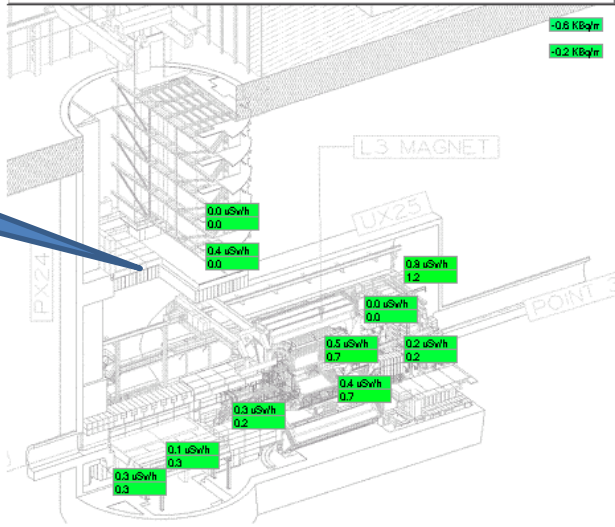


# Services and Environment



RAMSES radiation monitors

Temperature, pressure, humidity



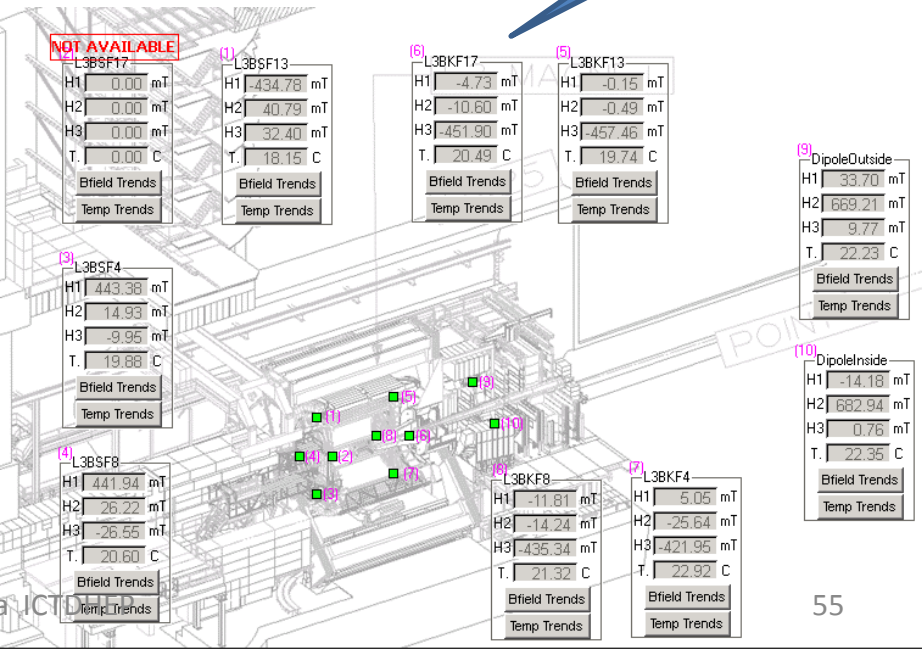
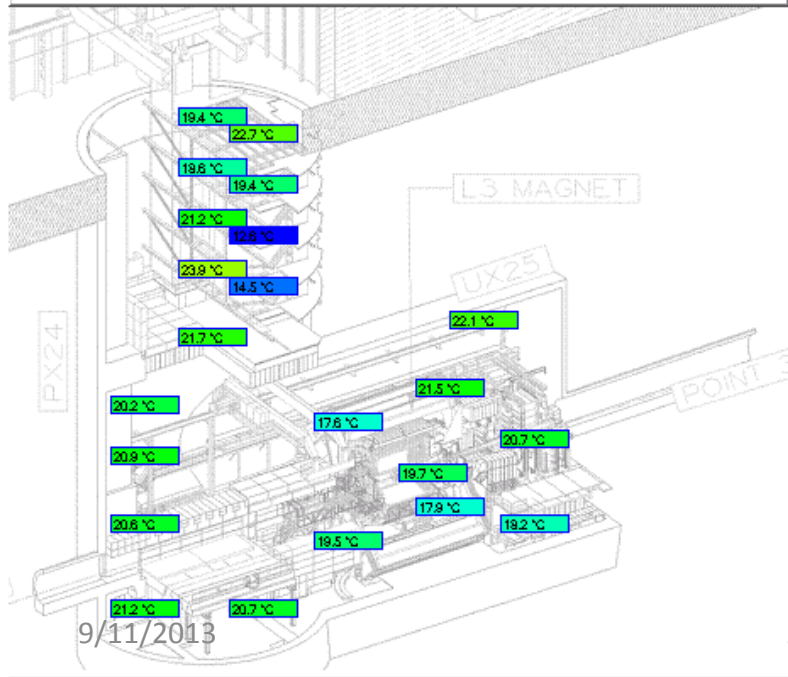
B-field probes

## Environment Monitoring

### Temperature

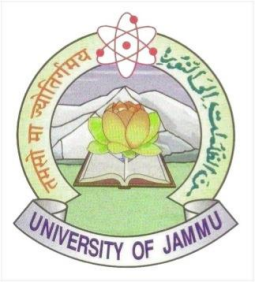
Cycle views every 10 seconds

Temperature | Pressure | Humidity | Radiation Mon | Ramses | Cooling



9/11/2013

Anik Gupta, ICTD, IITD

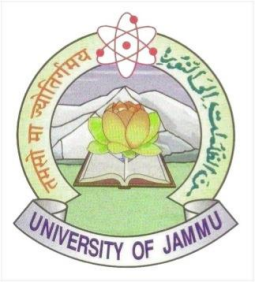


# Summary



- ALICE DCS is based on commercial SCADA system called WinCC Open Architecture hitherto known as PVSSII
- DCS has to assure efficient, yet safe operation
  - Standardize where possible; hide complexity and diversity
  - Modelling through finite state machines
  - Continuously Develop user interfaces to ease operator tasks
- Future
  - Exploit experience of last years of operations
  - Review state machines, simplify where possible
  - Improve user interface
  - Aim for further automation in the operation
  - Improve robustness of the communication with external systems





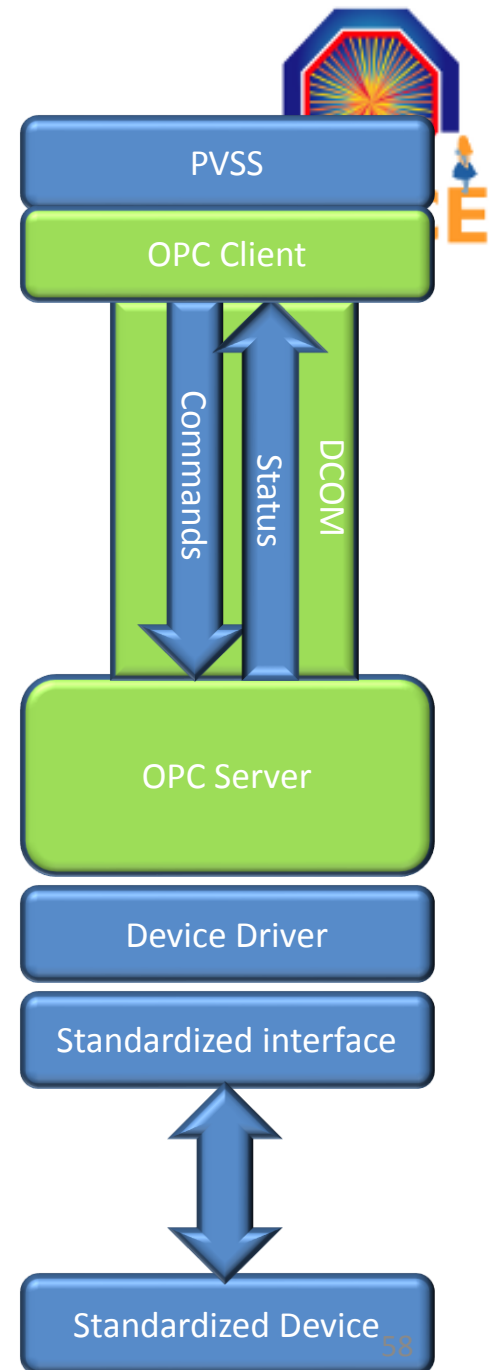
## BACKUP SLIDES

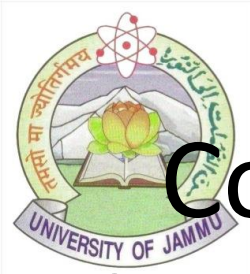


# OPC Technology



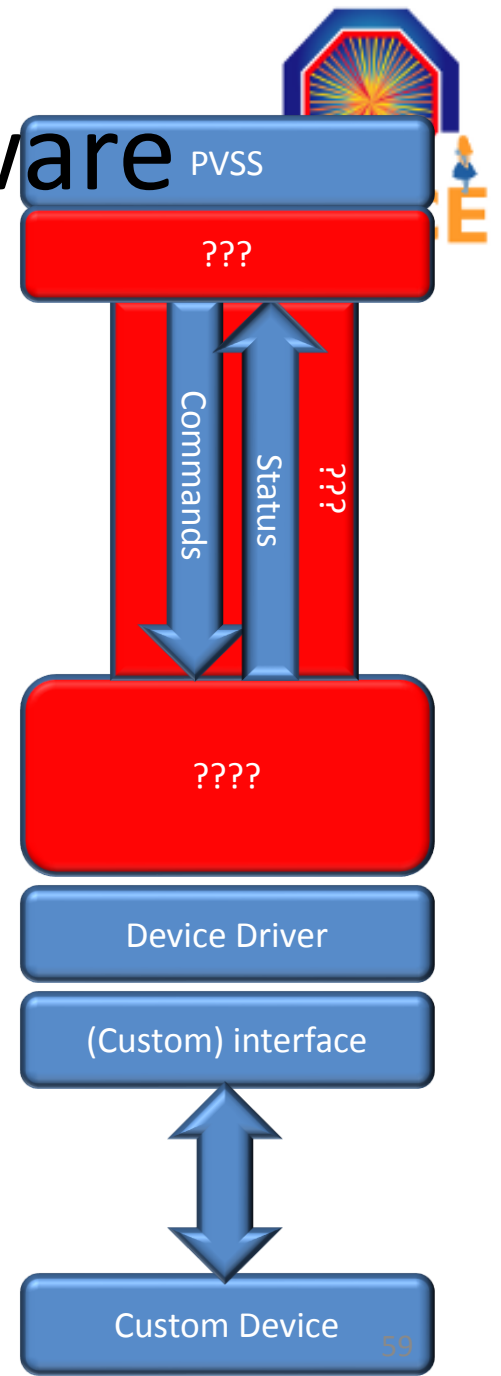
- OPC – industrial standard
- Implemented in PVSS as a manager providing generic interface
- In ALICE most commercial devices are controlled via OPC
- ~200 000 OPC items used in DCS

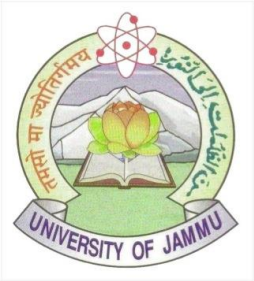




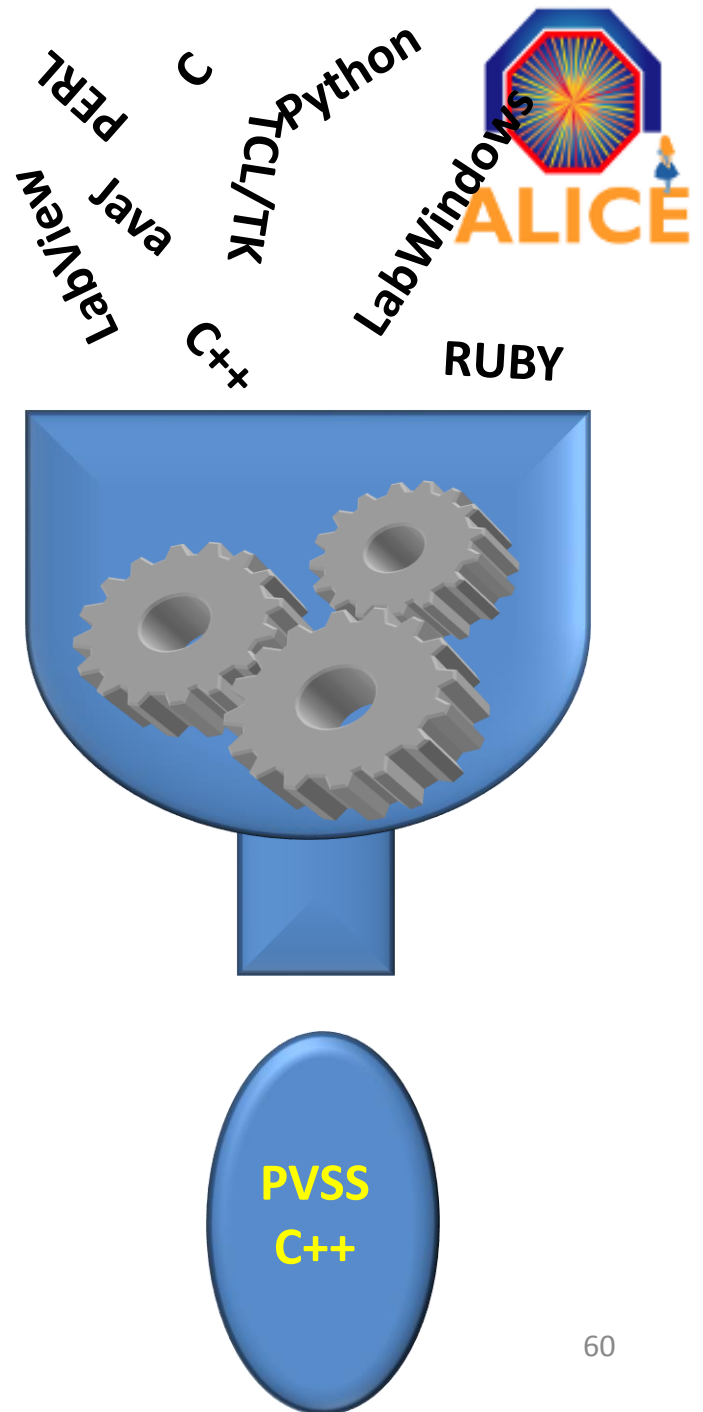
# Controlling Custom Hardware

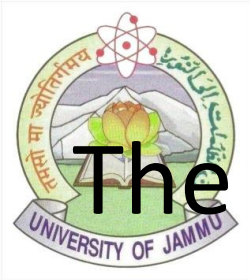
- Custom modules typically come with software packages developed by engineers
  - Incompatible with PVSS
- Missing link to PVSS
  - Transport protocol
  - Communication standard
- The main objective of ALICE DCS:
  - Hide the device complexity
  - Provide a generic communication protocol covering all custom architectures





- The tools supplied with the hardware were designed for laboratory environment
- First step:
  - PVSS and C++ imposed as the only platforms for the production system

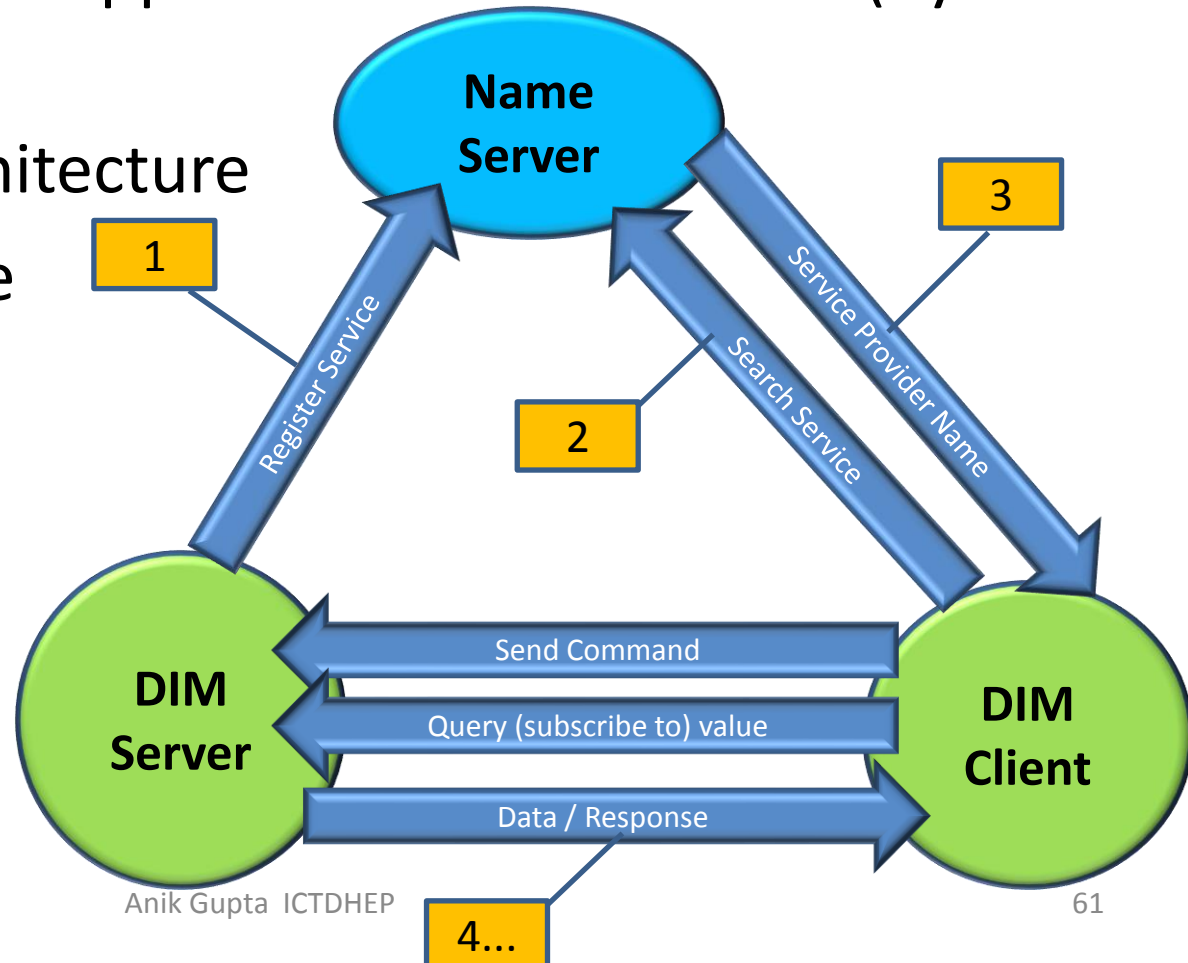




# The Choice of the Transport Protocol

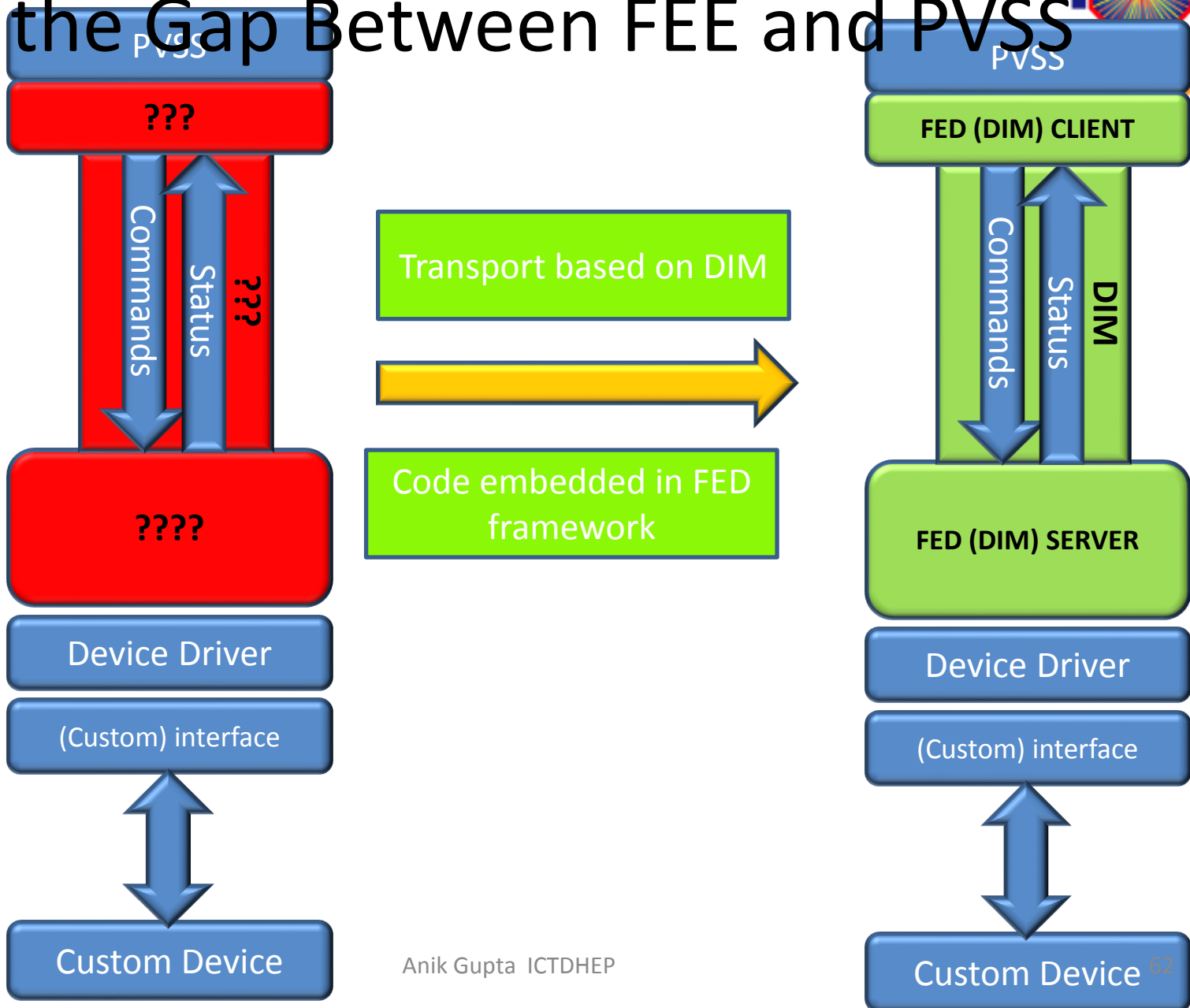


- CERN DIM used for command and data transfer
  - Implemented and supported in PVSS and C++ (by CERN)
  - Client/server architecture
  - Robust and stable





# Filling the Gap Between FEE and PVSS





# Generic Front-end Device (FED) Architecture

Generic client implemented as PVSS manager

