New SL training course
General contents

1) Introduction on the LHC
2) SL role and tasks
3) New ARC
4) Run procedure
5) New operational features
6) SL tools
7) General operational procedures
The LHC

- Particles –protons or heavy ions- are injected as trains of bunches into 2 rings, and circulate in opposite directions.
- All bunches cross, and some of them collide (Bunch Crossings) at the Interaction Points (IP1, IP2, IP5, IP8).
- The filling scheme determines the timing and bunches that collide in each IP.
- Beam 1 is injected near IP2 with permission of ALICE.
- Beam 2 in injected near IP8 with permission of LHCb.
CERN Accelerator Complex

<table>
<thead>
<tr>
<th>System</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linac 2</td>
<td>50 MeV</td>
</tr>
<tr>
<td>PSB</td>
<td>1.4 GeV</td>
</tr>
<tr>
<td>PS</td>
<td>25 GeV</td>
</tr>
<tr>
<td>SPS</td>
<td>450 GeV</td>
</tr>
<tr>
<td>LHC</td>
<td>14 TeV</td>
</tr>
</tbody>
</table>
Injections and Extractions

- A septum dipole magnet is used to bring the injected beam close to the circulating beam.
- A fast pulsing dipole magnet ('kicker') deflects the injected beam onto the circulating beam path. → ‘Stack’ the injected beams one behind the other.
- At the LHC the septum deflects in the horizontal plane, the kicker in the vertical plane (to fit to the geometry of the tunnels).

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**Injection (P2)**

- From SPS

**Extraction (P6)**

- To beam dump
This is the **ONLY** element in the LHC that can withstand the impact of the full beam!

The block is made of graphite (low Z material) to spread out the hadronic showers over a large volume.

It is actually necessary to paint the beam over the surface to keep the peak energy densities at a tolerable level!
TED → Transfer Line beam dumper (BEAM = out, DUMP = in)
   If the beam is dumped on it → no big impact on ALICE

TDI → Injection protection device (4.5m long), beam dumper along the LHC beam pipe. If the beam is dumped on it → big splash on ALICE that can provoke big troubles to the detectors.
The filling scheme

Guideline for naming the filling scheme:

<spacing>_Nb_b_<IP1/5>_<IP2>_<IP8>_code

I II III IV V VI

I) Single → single bunches are injected into the LHC
200ns 150ns or 75ns or 50ns or 25ns etc. → group of bunches (batch) are injected and the bunch spacing in each batch is 200ns or 150ns etc.

II) Total number of bunches per beam (identical for both beams)
III) Expected number of colliding bunch pairs in IP1 (IP5)
IV) Expected number of colliding bunch pairs in IP2
V) Expected number of colliding bunch pairs in IP8
VI) A free suffix to encode variants of a filling scheme
Examples of filling scheme

Single_6b_3_3_3

Pb filling scheme
200ns_170b_168_168_0_24bpi9inj_IONS
500ns_137b_129_130_0_8bpi18inj_IONS

Proton filling scheme
50ns_1236b+1small_1180_37_1152_144bpi13inj
75ns_200b_194_178_188_24bpi9inj
Accelerator Modes
<table>
<thead>
<tr>
<th>Accelerator mode name</th>
<th>Description</th>
<th>Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHUTDOWN</td>
<td>Usual winter status</td>
<td>NO</td>
</tr>
<tr>
<td>COOLDOWN</td>
<td>After the shutdown. Cryo related activity (simultaneous cool down of the sectors)</td>
<td>NO</td>
</tr>
<tr>
<td>MACHINE CHECKOUT</td>
<td>Following the yearly shutdown. Final test of the subsystems in the final configuration before the injection of the first beam. This include dry runs to test all the application software and machine protection systems culminating in a complete machine cycle.</td>
<td>NO</td>
</tr>
<tr>
<td>ACCESS*</td>
<td>Preparation and access</td>
<td>NO</td>
</tr>
<tr>
<td>MACHINE TEST</td>
<td>Operations’ tests during normal running period</td>
<td>NO</td>
</tr>
<tr>
<td>CALIBRATION</td>
<td>Power converter calibration to condition RBAC</td>
<td>NO</td>
</tr>
<tr>
<td>WARM-UP</td>
<td>One or more sectors warming up for repair</td>
<td>NO</td>
</tr>
<tr>
<td>RECOVERY</td>
<td>Typically quench recovery or recovery from cryo problems</td>
<td>NO</td>
</tr>
<tr>
<td>SECTOR DEPENDENT</td>
<td>Different sectors of the machine can be in different states at the same time (especially during hardware commissioning and cool down period. A sector mode (subset of the previous modes) is defined to cover the various possible states.</td>
<td>NO</td>
</tr>
<tr>
<td>Accelerator mode name</td>
<td>Description</td>
<td>Beam</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>BEAM SETUP</td>
<td>Machine setup with one or both beams. This mode includes beam commissioning from the injection to the collision phase (with single bunches or train). In this mode all the subsystem of the machine are tested within each relevant Beam Mode (INJECTION, RAMP...). It also includes ad hoc test with beam during normal running periods (ramp development, high Beta* commissioning...)</td>
<td>YES</td>
</tr>
<tr>
<td>PROTON PHYSICS</td>
<td>Beam based operation aimed at proton Physics</td>
<td>YES</td>
</tr>
<tr>
<td>ION PHYSICS</td>
<td>Beam based operation aimed at ion Physics</td>
<td>YES</td>
</tr>
<tr>
<td>MACHINE DEVELOPMENT</td>
<td>Beam based machine development</td>
<td>YES</td>
</tr>
</tbody>
</table>
Beam Modes
<table>
<thead>
<tr>
<th>Beam mode name</th>
<th>Description</th>
<th>ALICE</th>
<th>SUPERSAFE</th>
<th>SAFE (SS on request)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETUP</td>
<td>Possibly beam in the transfer lines with transfer line dumps in. Includes pre-injection and injection plateau. No beam in the ring.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABORT</td>
<td>Recovery mode following beam permit drop. This mode can be entered from any state if there is no beam in the machine.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INJECTION PROBE BEAM</td>
<td>If either ring 1 or ring 2 is injected with or have safe beam circulating. Some checks are done for different subsystems before injecting higher intensities. The aim is to establish a circulating safe beam with a given lifetime.</td>
<td></td>
<td></td>
<td>SAFE (SS on request)</td>
</tr>
<tr>
<td>INJECTION SETUP BEAM</td>
<td>This mode can be used in order to make more precise measurements before filling for Physics.</td>
<td></td>
<td></td>
<td>SAFE (SS on request)</td>
</tr>
<tr>
<td>INJECTION PHYSICS BEAM</td>
<td>At this stage the machine has been optimized. The machine is able to have circulating beam with appropriate lifetime and it is ready to accept higher intensities needed for Physics. Before to inject high intensity beam a pilot beam is injected since the accelerator is empty when this mode is reached.</td>
<td></td>
<td></td>
<td>SAFE (SS on request)</td>
</tr>
<tr>
<td>PREPARE RAMP</td>
<td>Injection completed, preparing the ramp of the current in the magnets.</td>
<td></td>
<td></td>
<td>SAFE (SS on request)</td>
</tr>
<tr>
<td>Beam mode name</td>
<td>Description</td>
<td>ALICE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAMP</td>
<td>Ready to ramp or ramping or immediate post ramp</td>
<td>SAFE (SS on request)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLAT TOP</td>
<td>Ramp finished, pre-squeeze checks</td>
<td>“</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQUEEZE</td>
<td>Preparing for or squeezing Beta* setting.</td>
<td>“</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADJUST</td>
<td>Adjusting beams after the squeeze and preparing for collisions.</td>
<td>“</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STABLE BEAMS</td>
<td>Stable conditions with collisions in the Experiments. Small adjustment of beam parameters permitted (i.e. orbit correction)</td>
<td>READY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNSTABLE BEAMS</td>
<td>Emergency mode entered from stable beams in case of sudden beam degradation (without prior warning).</td>
<td>SAFE (SS on request)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAM DUMP WARNING</td>
<td>This mode can be used before a programmed dump at the end of the stable beam period. Bypassed in case of emergency dump.</td>
<td>READY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAM DUMP</td>
<td>Programmed or emergency dump.</td>
<td>“</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAMP DOWN</td>
<td>Ramps down and cycling after a dump at the end of Physics fill</td>
<td>“</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CYCLING</td>
<td>Pre-cycle before the injection following access, recovery etc. Reset and prepare the machine for a new cycle.</td>
<td>SAFE (SS on request)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beam mode name</td>
<td>Description</td>
<td>ALICE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECOVERING</td>
<td>Following emergency dump, post mortem, quench etc. Within this mode the reason of the problem is diagnosed by the post mortem analysis system.</td>
<td>SAFE (SS on request)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INJECT AND DUMP</td>
<td>Dump after small number of turns following injection. This mode may be used during the first commissioning or for injection studies (check injection TL parameters or setting up dampers, kickers, etc.).</td>
<td>SUPERSAFE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIRCULATE AND DUMP</td>
<td>Dump after large number of turns following injection (check machine parameters).</td>
<td>SAFE (SS on request)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ALICE has to react in different ways to the beam operations, it has to stay SAFE or SUPERSAFE during activities that could be dangerous for the detectors, such as machine development (MD), loss maps, dump tests and more.**

**ALICE has to stay SAFE also from the beam injection phase to the Stable Beams declaration.**
The LHC time unit: a Fill

1) INJECTION
2) PREPARE FOR RAMP
3) RAMP UP
4) FLAT TOP
5) SQUEEZE
6) STABLE BEAM
7) DUMP
8) RAMP DOWN
PROTON PHYSICS: STABLE BEAMS


FBCT Intensity and Beam Energy

Instantaneous Luminosity

Comments 15–06–2012 06:26:03:

BIS status and SMP flags

<table>
<thead>
<tr>
<th>Status</th>
<th>B1</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link Status of Beam Permits</td>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>Global Beam Permit</td>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>Setup Beam</td>
<td>false</td>
<td>false</td>
</tr>
<tr>
<td>Beam Presence</td>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>Moveable Devices Allowed In Stable Beams</td>
<td>true</td>
<td>true</td>
</tr>
</tbody>
</table>

PM Status B1: ENABLED  PM Status B2: ENABLED

AFS: 50ns_1380b_1377_0_1274_144bpi12inj
BEAM SETUP: INJECTION PROBE BEAM

BCT TI2: 0.00e+00  I(B1): 2.18e+09  BCT TI8: 0.00e+00  I(B2): 3.83e+08
TED TI2 position: BEAM  TDI P2 gaps/mm  up: 19.97  down: 20.04
TED TI8 position: BEAM  TDI P8 gaps/mm  up: 19.97  down: 19.98

FBCT Intensity and Beam Energy

Comments 22-03-2012 21:04:22:
next: TCDQ and inj protection setup

BIS status and SMP flags

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>false</td>
<td>false</td>
</tr>
<tr>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>true</td>
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<td>false</td>
<td>false</td>
</tr>
<tr>
<td>false</td>
<td>false</td>
</tr>
</tbody>
</table>

AFS: alternating R1 R2 pilot

PM Status B1: ENABLED  PM Status B2: ENABLED
2) SL role and tasks
SL tasks

The SL is responsible of the activities in ARC during his/her shift:

- the SL makes sure that data taking runs efficiently and maximizes the data quality

- the SL follows the program decided by the Run Coordination

- the SL guides and monitors the performance of the other shifters

- the SL makes sure that the shift crew is concentrated and follow the procedures during the fill

- the SL has to be SLIMOS
Communication flow

Run Coordination (PRC and RC)

Shift Leader

CCC  Shifters  Experts
3) New ACR
Detector Control System

**Magnets**
- Dipole: off, negative -0 A, 0 mT
- Solenoid: off, negative 17 A, 0 mT

**ALICE Permit**
- ALICE injection supersafe
- Beam permit
- Injection permit 1
- Injection permit 2
- Dipole beam permit

**Detectors**

**Alarms**
- DSS: Ok
- CSAM: Ok

**LHC status**
- NO BEAM
- no handshake active

**DCS on Fri 25/04/2014, 11:26**
Detectors are released, experts can take the control

**LHC on Tue 28/10/2014, 15:40**
### SHUTDOWN: NO BEAM

#### BEAM INFO
- **Particles Type**: PB82 - PB82
- **Int. Bunches (IP2)**: 0
- **Displaced Coll.**: 0
- **B1 Non-Int.**: 0
- **B2 Non-Int.**: 0

#### LHC LUMINOSITY
- **BRAN L2**: $0.00\times10^0$ Hz/ubarn
- **BRAN R2**: $0.00\times10^0$ Hz/ubarn

#### ALICE STATUS
- **Beam Intensity**
  - B1: $0.00\times10^0$
  - B2: $0.00\times10^0$
- **ALICE TRIGGER RATES**
  - V0 AND: 0 (Hz)
  - IR_V0AND: 0 (Hz)
  - T0 VX: 0 (Hz)
  - ZNA or ZNC: 0 (Hz)
- **ALICE LUMINOSITY**
  - Target Instant.: $2.00\times10^0$ Hz/ubarn
  - Instantaneous: $0.00\times10^0$ Hz/ubarn
  - Delivered Stable: $0.00\times10^0$ pbarn
- **ALICE BACKGROUND**
  - BKG1 (%/DumpThresh): 0.15
  - BKG2 (%MaxBKGD): 77414.16
  - BKG3 (%/DumpThresh): 0.03

#### LUMINOMETERS
- **Beam Ints. - Trigger Rates**
  - **Beam 1**
    - IR V0 AND: 0
    - ZNA OR ZNC: 0
    - T0 VX: 0
  - **Beam 2**
    - IR V0 AND
    - ZNA OR ZNC

#### BACKGROUND
- **BKGD1**
- **BKGD2**
- **BKGD3**
- **V0 TOT**
### Busy status screen

**clock:** BEAM1  

14.09.2011  
**12:46:35**  
**Last minute**

<table>
<thead>
<tr>
<th>Cluster</th>
<th>SPD</th>
<th>SDD</th>
<th>SSD</th>
<th>TPC</th>
<th>TRD</th>
<th>TOF</th>
<th>HMPID</th>
<th>PHOS</th>
<th>CPV</th>
<th>FMD</th>
<th>MUON_TRK</th>
<th>MUON_TRG</th>
<th>FMD</th>
<th>T0</th>
<th>V0</th>
<th>ZDC</th>
<th>ACORDE</th>
<th>EMCAL</th>
<th>DAQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS_1</td>
<td>0</td>
<td>1023</td>
<td>265</td>
<td>835</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>158</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>116</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>Run: 161133</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Av. busy [usecs]**: 0, 1023, 265

**Busy time/L2**

Clustering: 1 2 3 4 5 6  
**busy** slowest in the cluster **BUSY** internal error
Run procedure
Remember!!!!

→ The start of a new fill is announced by the Injection Handshake. Starting from that moment be focused on the procedures to be followed during each step.

→ Don’t hesitate and don’t lose time

→ Your crucial task is to run with high efficiency
<table>
<thead>
<tr>
<th>LHC phase</th>
<th>DCS action</th>
<th>DAQ action</th>
<th>SL action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before injection</strong></td>
<td>Take all DCS locks and move ALICE SAFE</td>
<td>Stop all the runs</td>
<td></td>
</tr>
<tr>
<td><strong>INJECTION</strong></td>
<td>NOTE: TRD automatically goes to SUPERSAFE</td>
<td></td>
<td>Check the clock. With beam → BEAM 1 clock</td>
</tr>
<tr>
<td><strong>PREPARE RAMP</strong></td>
<td></td>
<td>TOF (BEAM_TUNING):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Noise</td>
<td></td>
</tr>
<tr>
<td><strong>RAMP</strong></td>
<td></td>
<td>HMPID (BEAM_TUNING):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Calibration SSD (READY):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pedestal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCH (BEAM_TUNING):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pedestal</td>
<td></td>
</tr>
<tr>
<td>**FLAT TOP/ SQUEEZE/ ADJUST *</td>
<td>* Move the Luminomiter ON (T0 or V0). If possible move SDD READY and move TRD to SAFE</td>
<td></td>
<td>Load the proper TRG configuration via ACT. Check if the filling scheme is correct. Set the target Lumi</td>
</tr>
<tr>
<td><strong>STABLE BEAMS</strong></td>
<td>Move detectors READY if the BGD is lower than the limit and according to the settings of the restore READY panel.</td>
<td>Start a run (without SDD). mStreamRecording: ON</td>
<td>Check the collision rate and BGD. Write down in the report the values for collision rate and instantaneous luminosity</td>
</tr>
<tr>
<td>LHC phase</td>
<td>DCS action</td>
<td>DAQ action</td>
<td>SL action</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>STABLE BEAMS</td>
<td></td>
<td>SDD: After 25 min from READY → injector run (from PHYSICS_2 partition). At the first occasion include SDD.</td>
<td>Check the busy time of the detectors. Check the SL-UI</td>
</tr>
<tr>
<td>DUMP HANDSHAKE</td>
<td>Confirm the handshake but don’t move ALICE</td>
<td>Continue to take data</td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td></td>
<td>The run stops automatically due to the clock transition.</td>
<td></td>
</tr>
</tbody>
</table>
| RAMP DOWN       | Move ALICE to SAFE after the MTRG calibration run. | - MTRG (READY) calibration  
- MCH (BEAM_TUNING) pedestal*  
- EMCAL (READY) pedestal  
- TPC (BEAM_TUNING)  
  • pulser  
  • pedestal |                                                          |

* Repeat if FERO is NOT READY
## EXAMPLE from 2012

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Group E</th>
<th>Group F</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY @410kHz</td>
<td>READY @260kHz</td>
<td>READY @400kHz</td>
<td>READY @350kHz</td>
<td>Always READY</td>
<td>Always SAFE</td>
</tr>
<tr>
<td>• SDD</td>
<td>• V0</td>
<td>• FMD</td>
<td>• TRD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• SPD</td>
<td></td>
<td>• HMPID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• T0</td>
<td></td>
<td>• MCH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MTRG</td>
<td></td>
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<td></td>
<td></td>
<td>• TOF</td>
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<td></td>
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<td>• TPC</td>
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</tr>
</tbody>
</table>

### General CTP settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>/CTP/aliases.txt</td>
<td>pp12 (v15)</td>
</tr>
<tr>
<td>/CTP/ctp.cfg</td>
<td>pp12 (v11)</td>
</tr>
<tr>
<td>/CTP/CTP.SWITCH</td>
<td>pp12 (v13)</td>
</tr>
<tr>
<td>/CTP/L0.INPUTS</td>
<td>pp12 (v16)</td>
</tr>
<tr>
<td>/CTP/VALID.CTPINPUTS</td>
<td>pp12 (v30)</td>
</tr>
<tr>
<td>/CTP/VALID.DESCRIPTORS</td>
<td>pp12 (v38)</td>
</tr>
</tbody>
</table>

### V0TOT

<table>
<thead>
<tr>
<th>Value</th>
<th>CTP Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤400 kHz</td>
<td>/CTP/ctp.cfg: • pp12 (v12)</td>
</tr>
<tr>
<td></td>
<td>/CTP/filter: • noTRD (v2)</td>
</tr>
</tbody>
</table>

### PHYSCIS_1

<table>
<thead>
<tr>
<th>Value</th>
<th>CTP Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤250 kHz</td>
<td>/CTP/ctp.cfg: • pp12 (v12)</td>
</tr>
<tr>
<td></td>
<td>/CTP/filter: • empty</td>
</tr>
</tbody>
</table>
## During the injection

<table>
<thead>
<tr>
<th>LHC phase</th>
<th>DCS action</th>
<th>DAQ action</th>
<th>SL action</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETUP</td>
<td>Take all DCS locks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INJECTION</td>
<td>NOTE: TRD automatically</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>goes to SUPERSAFE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREPARE RAMP</td>
<td></td>
<td>SMAQ plot: OBPA [22]</td>
<td></td>
</tr>
<tr>
<td>RAMP</td>
<td></td>
<td>TOF (BEAM_TUNING):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HMPID (BEAM_TUNING):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Calibration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSD (READY):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pedestal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCH (BEAM_TUNING):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pedestal</td>
<td></td>
</tr>
<tr>
<td>SQUEEZE/ADJUST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STABLE BEAMS</td>
<td>T0, V0 to READY</td>
<td></td>
<td>Take the first rate sample with</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Write down the values for</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0TVX rate and instantaneous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>luminosity</td>
</tr>
</tbody>
</table>

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### STABLE BEAMS

<table>
<thead>
<tr>
<th>V0TOT rate (LHC interface)</th>
<th>DCS action</th>
<th>DAQ action</th>
<th>SL action</th>
<th>DAQ action</th>
</tr>
</thead>
</table>
| **< 440 kHz**             | Group A READY  
  • SDD  
  • T0  
  • SPD  
  → +V0 | SDD:  
  • Pedestal  
  • Pulser | Call CCC to optimize luminosity, when done, ask to move SAFE V0 detector |  |
| **≤ 410 kHz**             | - Move READY TOF (use TOF FSM command)  
- FMD FSM commands:  
  CONFIGURE  
  GO_BEAM_TUNING | • MCH pedestal run |  |  |
| **≤ 400 kHz**             | Move READY Group  
  FMD  
  HMPID  
  MCH  
  MTRG  
  TPC | SDD:  
  • Injector*  
  • After 25’ in READY  
  SMAQ plot: 0TVX [4]  
  SMAQ plot: OMSL [13]  
  Press “RESET SHIFT” on CTP MiclockGUI | ACT config: PHYSICS_1  
  • pp12_rate_t0 (v9)  
  Ctp.cfg:  
  • pp12 (v12)  
  /CTP/filter:  
  • noTRD(v2) or noEMCAL_TRD(v1) if EMCAL cannot trigger | Start: PHYSICS_1 with:  
  • HLT: C  
  • mStream recording  
  • Detectors: All except TRD, V0, PMD and ZDC |
<p>| <strong>= 360 kHz</strong>             | Call the TRD on-call, when OK WITH them include TRD in the partition removing the CTP filter in ACT. |  |  |  |</p>
<table>
<thead>
<tr>
<th>V0TOT rate (LHC interface)</th>
<th>DCS action</th>
<th>DAQ action</th>
<th>SL action</th>
<th>DAQ action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 260 kHz</td>
<td>Group B READY •V0</td>
<td>- Stop RARE_T0 data taking. - include V0</td>
<td>ACT config: PHYSICS_1 (ALL) •pp12_rare (v35) Ctp.cfg: •pp12 (v12) /CTP/filter: •noEMCAL (v2) if EMCAL cannot trigger</td>
<td>Start: PHYSICS_1 run with: •HLT: C •mStream recording •Detectors: All except PMD and ZDC</td>
</tr>
<tr>
<td>&lt; 250 kHz</td>
<td>- Stop RARE_T0 data taking. - include V0</td>
<td>SMAQ plot: OMSL [13]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## DUMP

<table>
<thead>
<tr>
<th>LHC phase</th>
<th>DCS action</th>
<th>DAQ action</th>
<th>SL action</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUMP</td>
<td>SAFE/SUPERSAFE panel Global GO_SAFE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAMP DOWN</td>
<td>Move MTR to READY (for calibration)</td>
<td>MCH (BEAM_TUNING)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• pedestal*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EMCAL (READY)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• pedestal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MTR (READY)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• calibration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• TPC (BEAM_TUNING)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• pulser</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• pedestal</td>
<td></td>
</tr>
</tbody>
</table>

* Repeat if FERO not ready
Technical runs

During periods with no beam (less than 3 hours) or no stable beams, SL organizes for TECHNICAL runs → this allow to check if the experiment is ready for data taking.

- ALICE is SAFE (if needed) or SUPERSAFE (if requested).
- Configure for TECHNICAL runs via the ACT.
  → select the trigger configuration indicated in the SL instruction
  → ask to the ECS shifter to include all the detectors (remember that the FMD is unable to run in SuperSafe)
  → ask to the ECS shifter to set NO RECORDING
  → ask to the ECS shifter to select the run flag: BAD
- If one detector has problems (goes busy) inform the on-call and let him/her investigate before stopping the run.
- Remember to load the proper configuration before PHYSICS.
- Remember to ask to the ECS shifter to turn ON the mStreamRecording before PHYSICS.
Cosmics runs

During periods with no beam (more than 3 hours) SL organizes for COSMICs data taking.

- The SL checks on LHC-page1 that there is no beam and asks the CCC to confirm that they will not inject for at least 3 hours.
- Call the TRD on-call and ask to configure the detector for Cosmics.
- Configure the partition loading the right TRG configuration via ACT.
- Do the detector calibrations in the proper state and then move the needed detectors to READY.
- Ask to the ECS shifter to set:
  - Detectors (at least): ACORDE, MCH, MTRG, SDD, SPD, SSD, TOF, TPC, TRD
  - HLT mode: C
  - mStreamRecording: ON
  - Run flag: GOOD
- At the end of the Cosmics data taking ask to the TRD on-call to configure the detector for Physics and prepare the experiment for the injection.
- Load via ACT the right trigger configuration for PHYSICS data taking.
New operational features
1) FULL EOR/SOR run transition
   - a run is stopped and started according the standard procedure used in run 1
   - readout links are closed
   - configuration changes are possible as change TRG configuration and/or add and/or remove detectors
   - faster than during run 1
     SOR \(\rightarrow\) from 212 s to 68 s
     EOR \(\rightarrow\) from 54 s to 31 s

2) FAST EOR/SOR run transition
   - readout links are NOT closed
   - configuration changes are NOT possible \(\rightarrow\) list of active DDL remains the same
   - close a run under stable conditions
   - much faster than the FULL EOR/SOR
     FAST SOR \(\rightarrow\) 18 s (FULL SOR 68 s)
     FAST EOR \(\rightarrow\) 11 s (FULL EOR 31 s)
When is needed to use the FAST EOR/SOR?

Example: TPC RORC HV trip
- junk (black events) are produced
- affects the detector conditions and data quality
- a persistent HV trip may cause the exclusion of a chamber or a lowering of the HV in the problematic chamber
- change of acceptance/resolution

→ When one chamber trips a trigger pause is requested automatically
You call the on-call informing him about the trip

I. He can fix the problem and bring up the chamber at the nominal HV value

II. He can partially fix the problem and bring up the chamber at lower HV value

III. He cannot fix the problem and he needs to exclude a chamber

The run continues
A FAST EOR and a FAST SOR must be done
A FULL EOR is needed
New PAR (Pause And Recover)

RUN 1 → PAC (TPC, MCH and PMD)
- automatic procedure or under operator control
- in case of failure → FULL EOR/SOR

RUN 2 → PAR (All)
- automatic procedure or under operator control
- every detector has its own procedure
- in case of failure:
  I) FAST EOR/SOR if no variation in the DDL list
  II) FULL EOR/SOR if it’s needed to modify the DDL list or the FAST procedure doesn’t work

The PAR is invoked by:
- DCS ERROR_RECOVER → ECS → PAR
- Detector CDH → ECS → PAR
- Operator request → PAR → to be done to check the good status of all the detectors
- Operator request → FULL PAR → to be done to reset all detectors included in the partition.
5) SL Tools
The SL has a WS in ARC (tel. 77702) → automatic login
The SL has a portable phone: 167371

→ SL-UI

Remote Desktop: rdesktop -a16 -g 1900x1100 alidcscsom909
Login: use your NICE account
User: shifleader
P: alice.1234

→ Run Coordination page:

http://aliweb.cern.ch/Run_Coordination/Run/index.html

- Shifts (general information)
- Tools (SAMS, Logbook, ACT, LHC-page1)
4) General operational procedures
ALICE Magnets
ALICE DIPOLE

- Warm dipole magnet:
  \[ \text{Imax} = 6000 \text{ A and } \frac{\text{Di}}{\text{Dt}} = 4 \text{ A/s} \]
- Creates a bump on the beam \( \rightarrow \) Compensator Magnets
- Have to follow the LHC ramp

\( \rightarrow \) In case of a failure (trip) the beams are dumped

\( \downarrow \)

\( \rightarrow \) Before CCC ramp up the Dipole, ALICE has to be moved to MAGNET SAFE (for Dipole)
ALICE SOLENOID

- Warm magnet: $I_{\text{max}} = 30000$ A and $\frac{\text{Di}}{\text{Dt}} = 15$ A/s
- Stays ON and at full current during beam operation
- Affects only the beam coupling → can be ramped any time → doesn’t need to follow LHC ramping

→ In case of a failure (trip) the beams are not dumped but the background level has to be monitored

Vacuum gauges at 22m

BGK reference detector (T0 or V0)

If $\text{VGs} \geq 10^{-8}$ mbar + BGK > threshold

ALICE in SUPERSAFE
ALICE Magnet Safe

In the DCS UI there is a table with the MAGNET SAFE state for each detector → http://espace.cern.ch/alicecontrols

If it is needed to ramp up or down one or both Magnets the SL has to ask to the DCS shifter to move ALICE to

- Magnet Safe (for Dipole) → if only the Dipole has to be ramped up or down
- Magnet Safe (for Solenoid) → if only the Solenoid has to be ramped up or down
- Magnet Safe (for both) → if both Magnets have to be ramped up or down

→ Only when the detectors are in the proper state the SL can give the green light to the CCC to ramp the Magnet/s
18kV filter
When being switched ON after a failure (trip), the filter generates fast transient on the powering network.

Perturbations on the experimental site (powering lines)
Procedure to switch on the 18kV filter @ P2

At the announcement of the filter switch-on by the CCC:

- bring ALICE to MAGNET SAFE (for both Magnets);
- if needed (tbd with the SRCs) call the experts (list of experts that want to be called) to inform them of the upcoming action. From this point the detector experts have 30 min. to act;
- ask the CCC to ramp down both Magnets;
- when both Magnets are down → give the green light to the CCC to switch-on the filter;
- when the filter is on (wait feedback from the CCC) → ask to ramp up both ALICE Magnets;
- when both Magnets are up → bring back the detectors from MAGNET SAFE to the original state;
Power glitch/cut
Procedure in case of power glitch/cut

In case of power glitch/cut the DCS shifter will receive million of alarms from all detectors and general systems.

The systems that can be affected are:
- Low voltage and High Voltage power supply
- Cooling systems
- Gas systems
- Racks
- Magnets
- Etc...

The SL has to call all the on-calls (General Systems and Detectors) and the PRC to inform them about the power glitch/cut and ask them to check the status of their equipment. To speed up this operation the SL can ask to the other shifters to share the calls.
Procedure in case of power glitch/cut

As soon as the detectors and the general systems are back

- SL asks to the DCS shifter to move the detector to the MAGNET SAFE state

- SL gives the green light to the CCC to ramp up the Dipole and the Solenoid

When both Magnets are up and according to the machine plan the SL can
- move READY the detectors and take cosmics if the machine recovery time is very long (at least 3 hours)
- restore ALICE to SAFE (and SS on request) and take technical runs if the machine recovery time is < 3 hours
Access
If an access (long enough) is announced in the LHC-page1, the SL has to:

- verify with the PRC if there is a request from one or more detectors
- inform the CCC that ALICE needs an access and specify how long it should be (remember you should not delay the machine)
- call the RP on-call asking to run to P2 because of an access
- call the on-call of the detector/s that needs the access and ask to run to P2
- when the RP has removed the veto → call back the CCC and ask to change the access mode in “restricted”
- inform the experts (RP + detectors) that they can access the cavern and give them a time duration for the intervention
- as soon as all the experts are back in ARC, inform the CCC that the access is finished and they can close the cavern.