RUN II preparation

Federico Ronchetti

CERN, November 20th, 2014

ALICE Offline Week

Executive Summary

http://cds.cern.ch/journal/**CERNBulletin**/2014/47/News%20Articles/1969382?ln=it

- Integration Status
- Detector Status
- Re-commissioning activity and plans

Re-Commissioning

Integration

ALICE Integration

Detector	DAQ/TRG	DCS	Detector	DAQ/TRG	DCS
TRD	*on-going*	*on-going*	SSD	done	done
ZDC	done	*on-going*	FMD←TPC	*on-going*	*on-going*
EMCAL	*on-going*	*on-going*	T0←TOF	done	done
TPC	done	done	HMPID	done	done
PMD←MCH	*on-going*	*on-going*	PHOS←EMCAL	*on-going*	*on-going*
ACO	done	*on-going*	CPV←HMPID	*on-going*	*on-going*
SDD	done	done	SPD	*on-going*	done
MCH	*on-going*	done	TOF	done	done
MTR	done	done	V0→AD	done	*on-going*

DAQ/TRG integrated → capable of 100 trigger classes and new run recovery sequences
DCS integrated → migrated to WinCC and under the central DCS system control

Work in progress: ECS/TRG → ~53% DCS → ~47%

HLT Status

- **Framework**
  - **CDHv3 integration on going: some bugs and open issues**
  - **Implementation of the AD detector**
  - **Interface to C-RORC, proto type written under test**
- **DCS/ECS integration**
  - **Physical connection missing**
  - **Connection to DCS DIM_DNS to be established**
  - **Connection to ECS FSM to be established**
  - **ECS proxy partially rewritten, under commissioning**
  - **TPC RCU2: integration missing**
  - **Open issued with mixed mode RCU1/2 setup and TPC mapping/branch**
- **C-RORC**
  - all 74 C-RORCs installed, up and running
  - DDL fibres between DAQ HLT installed, links are up, stress tests needed
- **FPGA firmware**
  - raw DDL readout FW for detectors ready for commissioning, DDL1 + DDL2
  - raw DDL readout FW for TPC \w FastClusterFinder: DDL1 FW ready for commissioning DDL2 FW under development!
  - raw DDL output FW ready for commissioning, DDL1+DDL2
  - CDHv3 implemented in each FW, but needs testing!
  - C-RORC Interface to HLT Framework: work in progress
- **HLT integration into ECS/CTP → from January 2015**

DQM Status

after 2 global run tests (table refers to the two tests done in Sept and Oct):

- ✓ all production agents running
- ✓ DQM histograms ok for all the participating systems
- ✓ 9 systems OK, 15 systems to be checked (waiting for CDH v3)

	ACO	AD	CPV	EMD	FMD	HMP	MCH	MTR	PHO	PMD	SDD	SPD	SSD	T0	TOF	TPC	TRD	V0	ZDC	Vtx	DAQ	HLT	LHC	Trg
running																								
agents	√					√					√		√	√	√						√		√	√

- ✓ new Event Display in place (increase in stability and tools wrt Run1)
- ✓ in general DQM system is in good shape and the new implemented features (i.e. web tools) are working
- ✓ first training class (DQM/Offline/Event Display) done in October (30 trained people)
- ✓ likely other 60 people will be trained by the end of 2014

- ✓ revision of plots and documentation with system experts ongoing (done for 8 systems)

Detectors

Status Overview

RUN2 Full Baseline

6.5 TeV/beam is confirmed as startup energy

Year	System	E [TeV]	Lumi [$cm^{-2}s^{-1}$]	R [kHz]	LL	Weeks	Trig	Time
2015	**pp 50ns**	**13**	**10^{29} – 10^{32}**	10-600	YES	3	MIX	*pp*
	pp	**13**	**$5x10^{29}$ – $3x10^{30}$**	50-300	YES	**13.5**	MIX	*pp*
	PbPb	**5.1**	**10^{27}**	8	YES	4	MB	*HI*
	pp-ref	**5.1**	**10^{29} – $2x10^{30}$**	10-200	YES	**1?**	MIX	***pp***
2016	**pp**	**13**	**10^{31}**	500	YES	22+2	MIX	*pp*
	pPb	**5.1**	**10^{28}**	10-20	YES	**4**	MB	*HI*
YETS	**pp-ref**	**5.1**	**10^{29} – $2x10^{30}$**	10-200	YES	**1?**	MIX	***pp***
2017/8	**pp**	**13**	**10^{31}**	500	YES	22+2+N	MIX	*pp*
	PbPb	**5.1**	**10^{27}**	8	YES	4	MB	*HI*
	pp-ref	**5.1**	**10^{29} – $2x10^{30}$**	-	-	**1?**	MIX	***pp***
				LS2 (1/7/18→ 18 months)				

Baseline pp trigger strategy in 2015-2017

year (wks.)	wks.	LHC	wks.	ALICE	trigger, statistics
2015 (22)	~~3~~ **4**	ramping-up 50 ns (May, Jun.)	1 1 ~~1~~ 2	UD (low-bkg & low pile-up) MB (while rate is low) MUON 600 kHz = 10 $\mu b^{-1}s^{-1}$	SD,DD(MBOR w. AD) 100M CD(!V0, SPD) 10M MB CENT 140M MUON (80% live) 2.2 pb^{-1}
	~~18~~ **13**	pp 25 ns (Jul.-Oct.)	~~3~~ 2 ~~5~~ 4 ~~10~~ 7	MUON 600 kHz = 10 $\mu b^{-1}s^{-1}$ MB <200 kHz = 3.3 $\mu b^{-1}s^{-1}$ RARE 300 kHz = 5.0 $\mu b^{-1}s^{-1}$	MUON (80% live) 2.2 pb^{-1} MB FAST(CENT) 1.1 (0.6)G all rare (70-100% live) 3.4-4.9 pb^{-1}
	1	TOTEM, vdM	1	vdM + to be considered	
2016 (24)	22	pp 25 ns	7 15	MB <200 kHz = 3.3 $\mu b^{-1}s^{-1}$ RARE 300 kHz = 5.0 $\mu b^{-1}s^{-1}$	MB FAST(CENT) 2.0(1.0)G all rare (70-100% live) 7.4-11 pb^{-1}
	2	misc.	2	vdM + ?	
2017 (24)	22	pp 25 ns	7 15	MB <200 kHz = 3.3 $\mu b^{-1}s^{-1}$ RARE 300 kHz = 5.0 $\mu b^{-1}s^{-1}$	MB FAST(CENT) 2.0(1.0)G all rare (70-100% live) 7.4-11 pb^{-1}
	2	misc.	2	vdM + ?	
2018		not count			

rates correspond to VBAND rate with 60 mbarn as cross section

Total achievements by end of 2017
- MB-FAST (CENT): 5.1 (2.6) x10^9
- RARE: 18-27 pb^{-1} TRD: 2.6 pb^{-1} @ 30 kHz

MB+RARE phase in 2015

- Total 15 weeks
  - share it with MB-oriented and RARE-oriented modes
  - keep basically the same trigger setup all the time

- **MB-oriented mode (5 weeks)**
  - simply control downscaling factor of the MB in the same trigger setup so that trigger goes to >95% saturation
  - the mode is activated at the low background condition (ex. towards end of fill?)
    - **automatic using the rate governor and TriCo (preset) strategy**
  - target interaction rate: 200 kHz or below (depends on bkg; keep good purity)
  - target FAST data taking rate: 1 - 2kHz (depends on RCU2 situation)

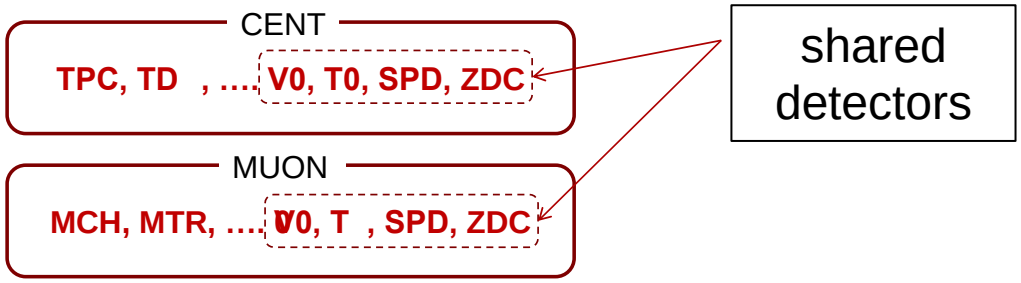
- **RARE-oriented mode (10 weeks)**
  - increase MB downscaling factor and keep rate so that MEB is effective
  - target interaction rate: 300 kHz - 400 kHz
  - target live-time: 70% … 250-500 Hz central barrel triggers (depends on RCU2 situation)

- making trigger menu just started (backup slides)

Requested cosmic data taking w/o beams

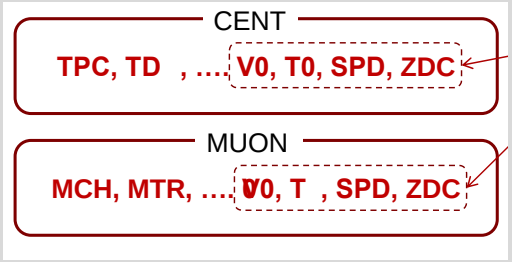
- Following requests are given for each B=0, B=+, and B=-
  - PWG-PP for alignment [R. Shahoyan]
    - TOF back-to-back (C0OB3) 16 days at ~90 Hz (0.035 Hz good rate)
    - TOF + TRD (CTRDCO2) 16 days at ~ 6 Hz (0.013 Hz good rate)
  - SSD for timing adjustment using SPD FO and noise study using TPC tracks [P. Kuijer]
    - SPD FO trigger with ITS readout for 15k ev (5 shifts)
    - TOF trigger with ITS+TPC readout for 100k ev (4 shifts)
- Majority is PWG-PP request and SSD one is in shadow
- Total 16days(B=0), 16days(B=+), 16days(B=-) → 48 days
- TRD might be available only from January for cosmics and alignment due to several known factors (last module connected in Dec., then gas conditioning, DCS integration, LM preparation, DDL2, etc) [J. Mercado]
- B=0 serious data taking may possible only from January?

The Central Trigger Processor



Reduction of leakage busy among trigger clusters
due to shared detectors
→ **Implement MEB**
zero dead time contribution

Pause of individual trigger clusters:



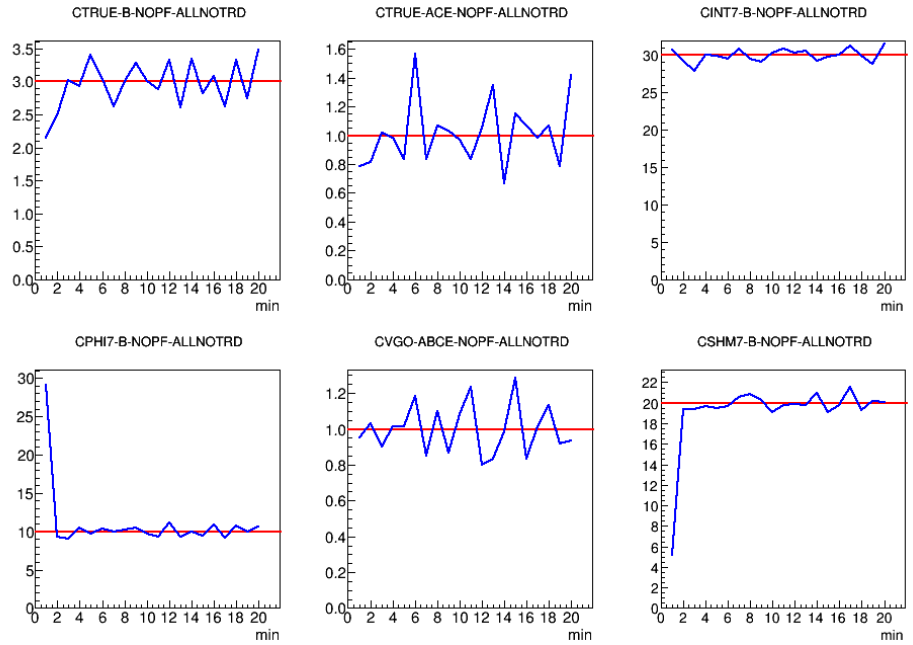
PAUSE to recover TRIP in TPC

MUON keeps going

Impact on offline trigger simulation

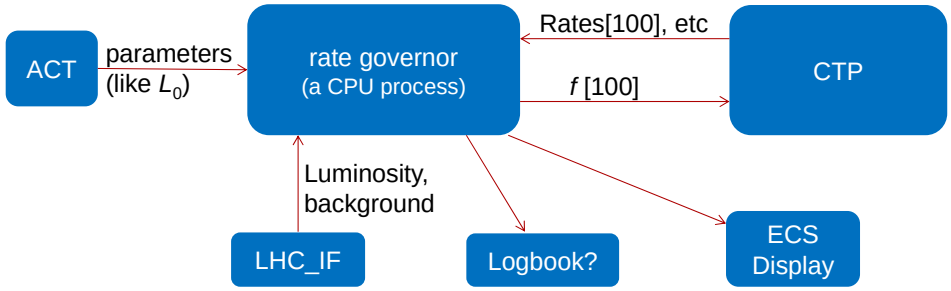
1. If CENT(MUON) stopped → other will continue however without BW saturation
2. If CENT(MUON) stopped → other will continue however with BW saturation

Trigger Tools Development



$L0a^i(t) = f^i(t) * L0b^i(t) * LT^i(t) = L(t) * f^i(t)\ \sigma^i * LT^i(t)$

LT=LiveTime, i=trigger class, f=downscaling factor



Rate Governor algorithm

- For each trigger class (i):
  define target L2a (readout) rate and keep it constant during the fill
  → $L2a(t_1) = L2a(t_2)$
- OR have the target rate follow a function
  → $L2a(t) = fun(t)$

Current approach $L(0) * f^i(0) = const$

So is always $f^i(t) = f^i(0)$

- RND prototype from Evgeny
- needs full development

Monitoring tools and interfaces

- Status display (similar to ECS)
- Trigger time alignment plot
  (SMAQ-like only for 50ns remains for expert)
- CTP inputs rates with extended time trend (as in ECS)
- BUSY status (integrated in ECS)
- Auto-downscaling status and alarms
  (fromDQM agent to ECS monalisa)

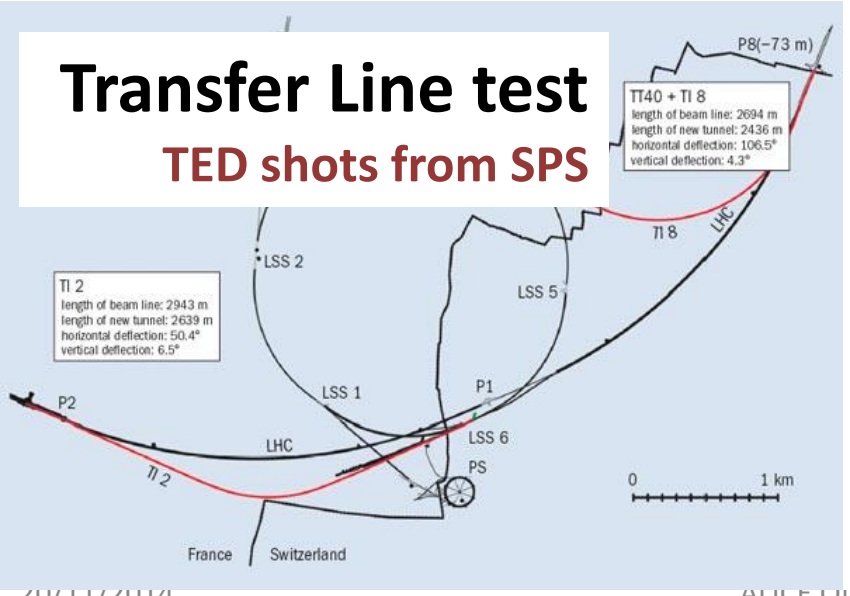
TL and Sector Tests

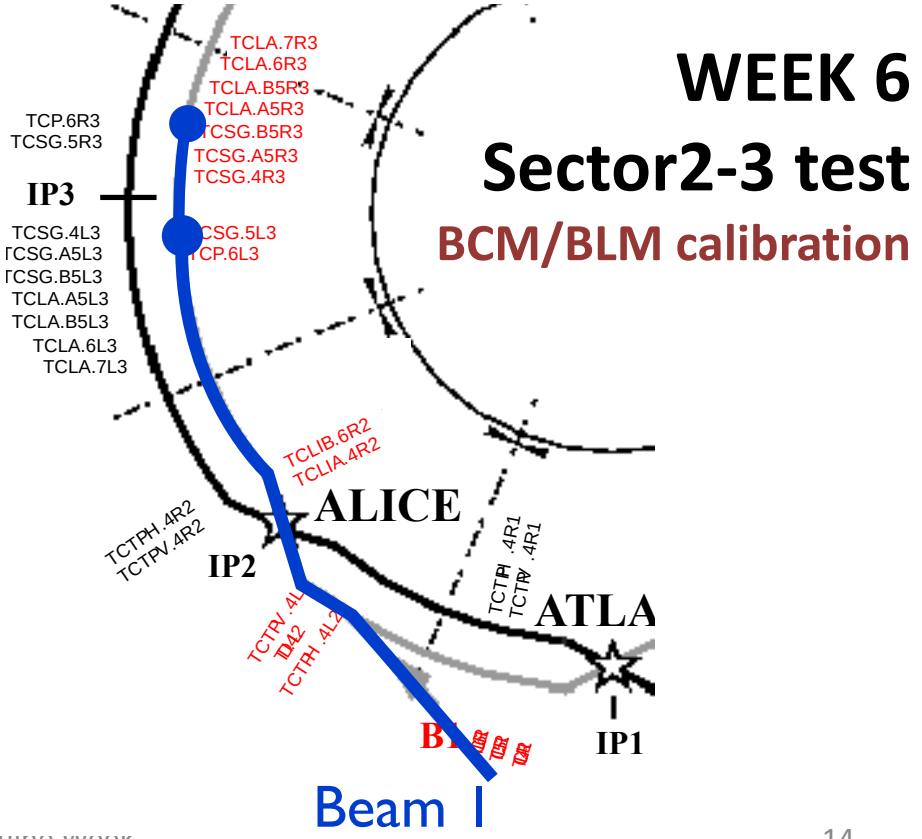
SCHEDULE Num. 2

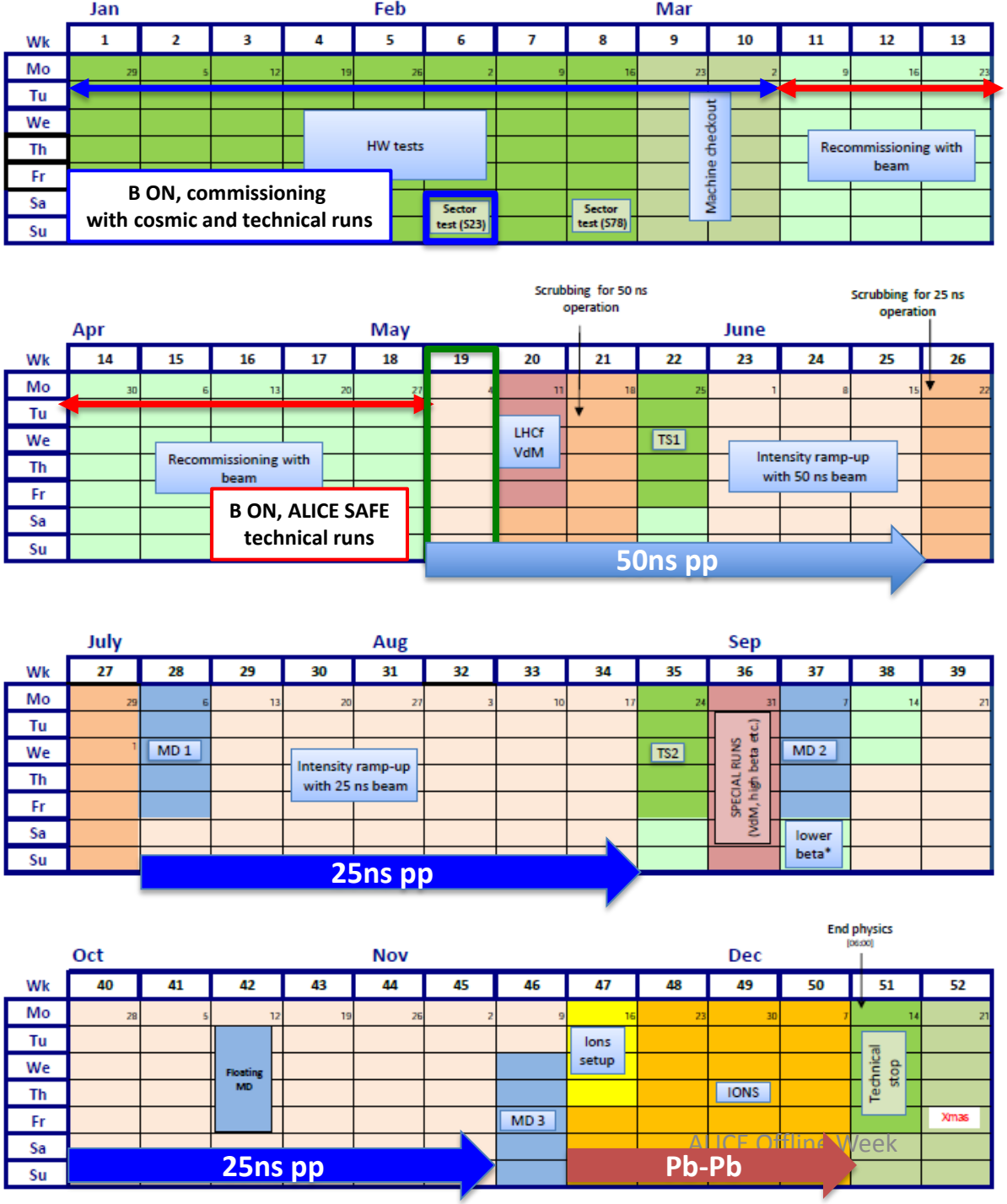
https://lhcsectortest2014.web.cern.ch/content/schedule-num-2

Due to the re-schedule of the powering test and other commissioning items in LHC, the sector tests, transfer line test, access system commissioning and DSO test have been re-schedule accordingly. The following dates are now on the machine calendar:

1. Access Commissioning: 8-9 November **2014**
2. DSO Test: 15-16 November **2014**
3. Transfer Line Tests (TI2&TI8): 22-23 November **2014**
4. Sector Test S23 (B1): 7-8 February **2015**
5. Sector Test S67-S78 (B2): 21-22 February **2015**







LHC 2015 Schedule

ACCESS TO CAVERN POSSIBLE

- **Jan- Feb: HW tests**
  - **S23 test W6**
- **First beams: W11 (Mar 9th)**
- **Re-commissioning with beam until W18 (Apr 30th)**

- **May 4th ALICE READY**
- **TS1 W22 (end of May)**

- **50ns beam W23 (Jun 1st)**
- **25 ns beam W28 (Jul 11th)**
- **TS2 W35 (Aug 24th)**
- **IONS W47 (Nov 16th)**

ALICE 2014 Re-commissioning

Week	System	Activity
38	**TOF, HMPID, ACO, SDD**	***LHC RF ramps, global run with CTP1 board***
39	Reinstall CTP2 into the pit	*global running with CTP2 and DAQ_TEST detector*
40	Standalone runs with CDHv2 detectors	
41	CTP2	*Development of LM functionality in CTP2 board*
42	Standalone runs with CDHv2 detectors	
43	**TOF, HMPID, ACO, SDD**, SSD, T0	***global run (test of DAQ sequences and CTP classes definitions)***
44	Standalone runs with CDHv2 detectors	
45	CTP, DAQ, ECS, V0, T0, TRD	*Deploy LM logic, re-test online chain with LM*
46	**TOF, HMPID, ACO, SDD**, SSD, T0, MTR, ZDC	***Start of commissioning shifts / Daily Meetings***
47	Global technical runs	***Stability tests***
48	Beam events: test trigger detectors (+LM)	***Transfer line test / TED splashes***
49	**Validation Run**	***Stress tests DAQ+OFFLINE***
50	Cosmic B=0 / technical runs	***RCU2 prototype installation in 1 TPC sector***
51	Cosmic B=0 /technical runs	***Stability tests***
3	technical runs	***RCU2 in mixed mode testing***
4	technical runs	***TPC Kr run (tentative), ramp up magnets***
5	technical runs	***TRD Kr run (tentative) then start of astrophysics trigger (cosmic)***
6	Beam through IR2	***Sector Test***

Summary

Summary

Integration and Commissioning

- Started regular activity at P2 from November 10th
- Continuous technical runs for stability tests
- ECS and DCS integrations are top priority
- Prepare for TL test (22-23/1)
- Attempt cosmic runs with B=0 (2014)
- Install RCU2 in 1 TPC sector and start first tests (no HLT)

2015

- Plan is to open FULL shifts from January 12th
  - Prepare program for physics cosmic data taking → nights preferred
  - Continue stability test via technical run and stress test
  - TRD and TPC Kr runs
  - Commission HLT
  - TPC running in mixed mode ....
  - Commission full LM logic

UD+MB phase in 2015

- Total 2 weeks
  (1 week with mainly UD, and 1 week with MBAND, depending on background and luminosity)
- Target rate: 10-50 kHz

trigger	setup	cluster	livetime or rate	target
ADOR	V0A | V0C | ADA | ADC | SPD	ALL	1kHz	100M
DG	!V0A & !V0C & SPD	ALLNOTRD	1kHz	10M +subset of ADOR
MBAND	V0A & V0C	ALL	1kHz	140M +subset of ADOR
all rare	-	-	0%	0

MUON phase in 2015

- Total 4 weeks (1 week in 50 ns, 3 weeks in 25 ns, depending on luminosity development)
- Target rate: 600 kHz = 10 $\mu b^{-1}s^{-1}$, delivered lumi ~ 5.5 pb^{-1}
- Analysis feasibility/strategy of CALO triggers w/o TPC to be shown

trigger	setup	cluster	livetime or rate	target
MSL	MBAND & MSL (dsc / 20)	MUON		
MSH	MBAND & MSH	MUON	80%	4.4 pb^{-1}
MUL	MBAND & MUL	MUON	80%	4.4 pb^{-1}
MLL	MBAND & MLL (dcs /10)	MUON		
0EMC	MBAND & 0EMC	CALO	90%	5.0 pb^{-1}
0PHO	MBAND & 0PHO	CALO	90%	5.0 pb^{-1}
0DCAL	MBAND & 0DCA	CALO	90%	5.0 pb^{-1}
HMS / HMV	MBAND & SPDHM / V0HM	UFAST VFAST	100% <1%	5.5 pb^{-1}
HMMSL	MBAND & SPDHM & MSL	UFAST VFAST	100% 80%	5.5 pb^{-1} 4.4 pb^{-1}

Ken O.

Trigger Tools Development

Several possible strategies:

implement RND dynamical downscaling (was static in RUN1)

type (description)	configuration	dynamic inputs	dynamic output to CTP
RND (random selection)	L_0: luminosity const. or R: target rate f_0: initial scale factor	L0b, L1b, L2b, L0a, L1a, L2a ← CTP Lumi. ← LHC_IF	f: scale factor
AG (using abort gap, for TRD etc)	R: target rate n_0: initial open mask	L0b, L1b, L2b, L0a, L1a, L2a ← CTP FillScheme[] ← LHC_IF?	BCMask[]
LMU (select low μ bunches, for MB, HM etc)	R: target rate	L0b, L1b, L2b, L0a, L1a, L2a ← CTP IR[] ← CTP or BbyB-lumi[] ← LHC_IF?	BCMask[]
PFP (ITS, TPC pile-up control, for MB etc)	t_{before}, t_{after}: protection time before & after n_{before}, n_{after}: max allowed pile-up before & after	not dynamic during run?	PFP params.

Backup

Run2 HI Baseline

HI program baseline:

- ALICE priority is to collect 1 nb^{-1} of PbPb data.
  - **pPb run is seen as reference data**
  - **MB (leveled) running at same collision energy as of PbPb: 5.1 TeV**
- ALICE favors 2016 as pPb run slot. Otherwise 2017/18

Machine setup for PbPb

- ALICE favors minimal setup time scenarios
  - No optics change
  - No B* leveling (also some impact on LR)

pp-Reference runs

- ALICE baseline is that pp-ref data is taken from pp time budget
- **Possible pp-ref sequence: O(1) week per HI block**

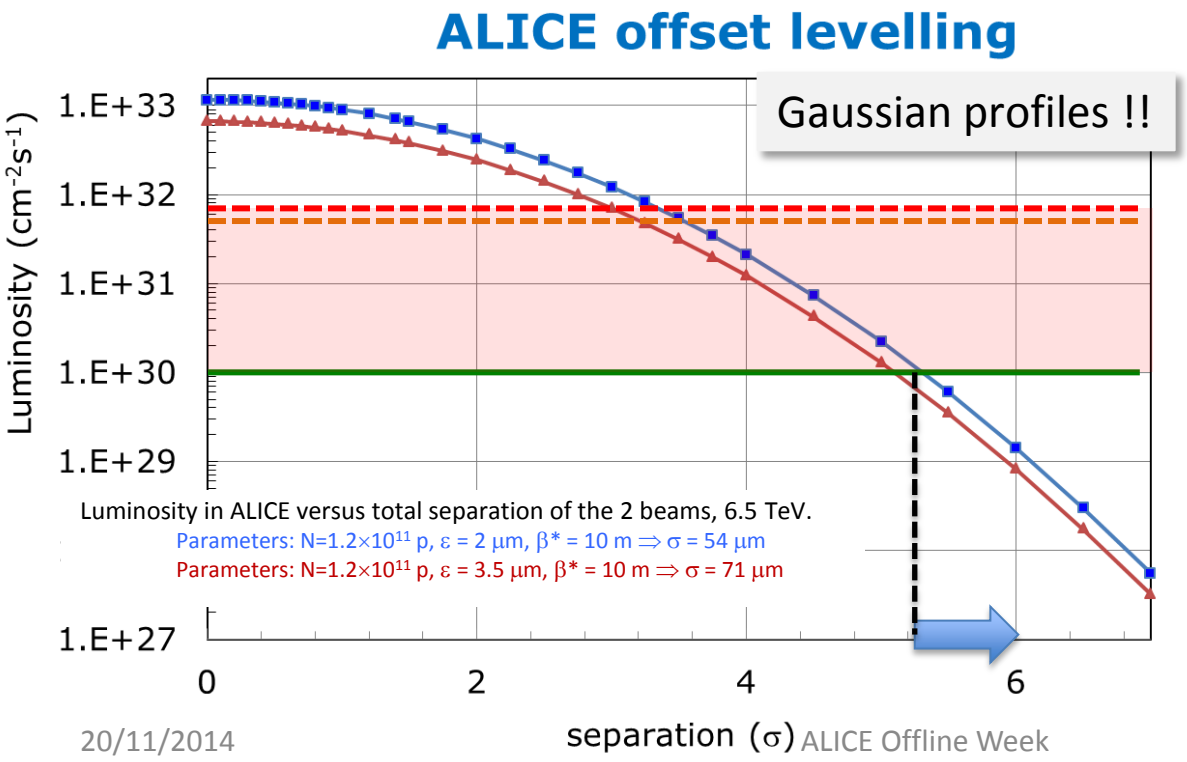
Leveling: LHC can deliver up to 3.7E27 Hz/cm2

Alice leveled at 1E27 Hz/cm2 (8 kHz)

- alternative leveling scenarios including the 3 experiments are under evaluation based on the machine potential for peak luminosity and turnaround times

2015 Low Luminosity pp Operation

- 25 ns pp operation: **no main-satellite collisions**
  - Expect order of 2400 colliding bunches
- Luminosity range: $5x10^{29}$ – $3x10^{30}$ Hz/cm^2
  - Operation at 6s separation → **collisions from (non gaussian) tails**



Present dump thresholds

- **SB → 4.2x10^{31} Hz/cm^2**
- **BT → 6.8x10^{31} Hz/cm^2**

BxB fluctuations: 1 o.m.

Review our dump thresholds ?

Proposed collision procedure during beam commissioning

- **ALICE gaseous detector SSAFE/OFF**
- **Raise BPM thresholds**
- **Start from very large separation**
- **Look for lumi (2-3 steps)**
- **Reproduce the procedure**
- **Restore BCM thresholds**
- **Commissioned procedure to be run in SB – not to penalize peak lumi for others**

RUN2 Data Taking Sequences

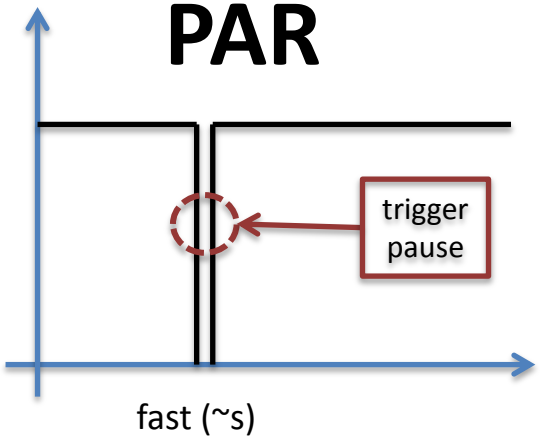
- **Analysis of pPb data taking at high rate in 2013 showed a major impact on the number of started runs on the running efficiency**
- **So new tools have been developed to start less runs, faster.**

1. **Optimization of the normal (FULL) SOR/EOR sequence**
2. **Introduction of a FAST EOR/SOR sequence to allow a "run over error" technique in case detector performance changes during the run.**
   Example: a new run number can be quickly generated to mark the intervals where a detector has undergone a HV trip
3. **Introduction of individual detector in-run recovery procedure for electronics hick-ups which includes trigger pause and DCS actions via ECS (PAR = Pause And Recover)**
4. **Independent trigger cluster pauses**

To be able to properly process the above actions (and the augmented CTP triggering capabilities to 100 classes) the detector readout FW needs to be reprogrammed to implement the appropriate Common Data Header (v3)

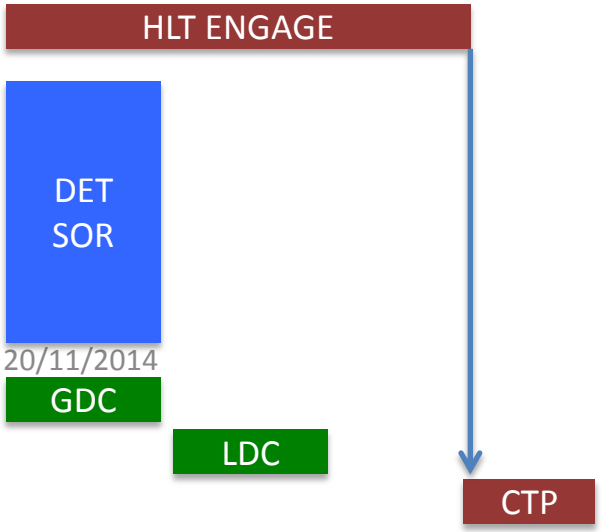
RUN2 Data Taking Sequences

PAR

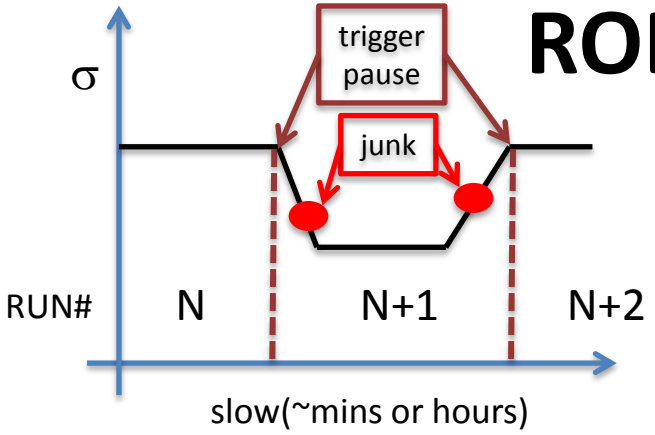


FULL SOR/EOR

(211 → 70– s)

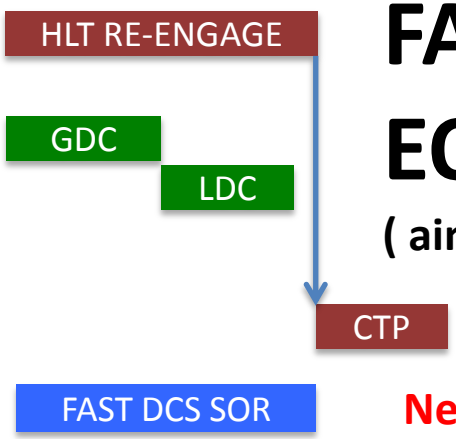


ROE



FAST EOR/SOR

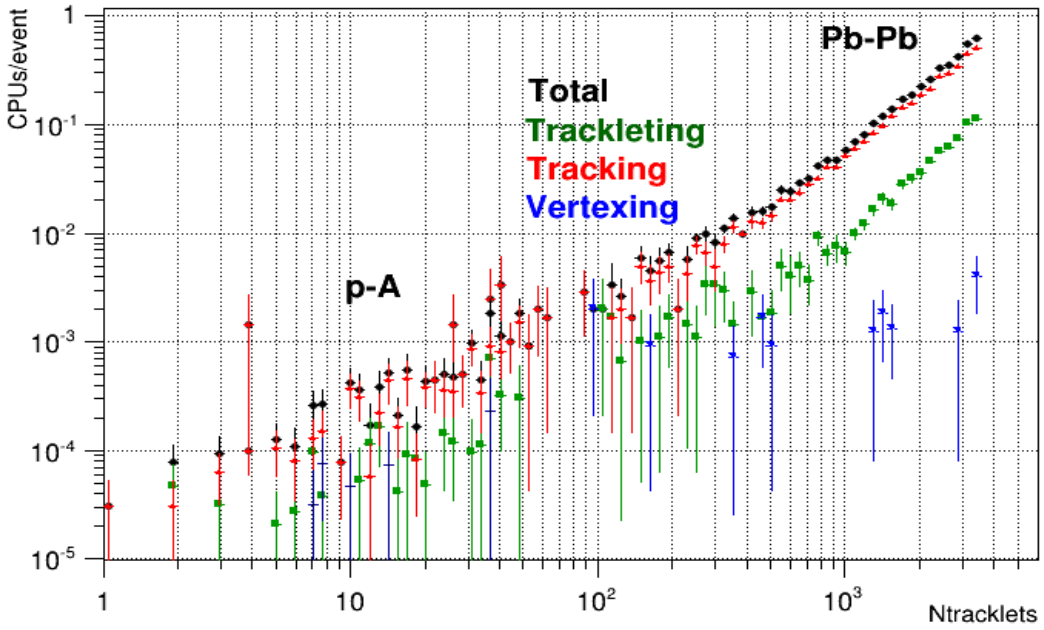
(aim to 18s)



Needs RCU2/1 "junk removal" FPGA code

Luminous Region in HLT

- **The code for standalone ITS reconstruction and vertexing is ready.**
- Needed for TPC V-drift calibration and VertexTracks reconstruction.
- **Tested offline: CPU speed and resolutions are OK** (detailed presentation in preparation)
- **Transferred to HLT group for adaptation to HLT-specific IO and full chain test**



- **Adaptation of the offline MeanVertex (e.g. LR) calibration code for HLT is underway.**
- **Progress is expected at HLT hands-on session (Sept. 22-23)**