CMS: feladatok és kilátások 2016-ra

Siklér Ferenc

MTA Wigner FK RMI, Budapest

A magyar CMS csoport megbeszélése
2016. február 15.
### 2016 beam parameters (nominal 25 ns)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>6.5 TeV</td>
</tr>
<tr>
<td>Bunch spacing</td>
<td>25 ns</td>
</tr>
<tr>
<td>Bunch population</td>
<td>~1.25e11</td>
</tr>
<tr>
<td>Max bunches/injection</td>
<td>288</td>
</tr>
<tr>
<td>Max. number bunches</td>
<td>2748</td>
</tr>
<tr>
<td>Nc GPDs</td>
<td>2736</td>
</tr>
<tr>
<td>Emittance exit SPS</td>
<td>2.7 mm.mrad</td>
</tr>
<tr>
<td>Emittance into SB</td>
<td>3.4 mm.mrad</td>
</tr>
<tr>
<td>Beta* GPDs</td>
<td>40 or 50</td>
</tr>
<tr>
<td>Crossing angle GPDs</td>
<td>185 or 165</td>
</tr>
</tbody>
</table>

*Note the limit of around 1.3e11ppb from the SPS*
### Phase Duration

<table>
<thead>
<tr>
<th>Phase</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Commissioning</td>
<td>28</td>
</tr>
<tr>
<td>Scrubbing: 4 days initially and then as required during ramp-up</td>
<td>7</td>
</tr>
<tr>
<td><strong>Proton physics 25 ns</strong></td>
<td>152</td>
</tr>
<tr>
<td>Special physics runs (high beta*; VdM)</td>
<td>8</td>
</tr>
<tr>
<td>Machine development</td>
<td>22</td>
</tr>
<tr>
<td>Technical stops</td>
<td>15</td>
</tr>
<tr>
<td>Technical stop recovery</td>
<td>6</td>
</tr>
<tr>
<td>Ion setup/proton-lead run</td>
<td>4 + 24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>266 days (38 weeks)</td>
</tr>
</tbody>
</table>
Draft Schedule Jan-June

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td>4</td>
<td>11</td>
<td>17</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

**LHC Schedule 2016**
Approved by the Research Board, December 2015

**MC Datasets**

**ICHEP data top-up**

**MC Datasets**

**for ICHEP**
### Draft Schedule Jul-Dec

#### July

<table>
<thead>
<tr>
<th>Wk</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
<th>31</th>
<th>32</th>
<th>33</th>
<th>34</th>
<th>35</th>
<th>36</th>
<th>37</th>
<th>38</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MD 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- *beta* 2.5 km dev.

#### August

<table>
<thead>
<tr>
<th>Wk</th>
<th>30</th>
<th>31</th>
<th>32</th>
<th>33</th>
<th>34</th>
<th>35</th>
<th>36</th>
<th>37</th>
<th>38</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Ions setup

#### September

<table>
<thead>
<tr>
<th>Wk</th>
<th>35</th>
<th>36</th>
<th>37</th>
<th>38</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- *beta* 3.5 km data taking
- Jeune G

#### October

<table>
<thead>
<tr>
<th>Wk</th>
<th>40</th>
<th>41</th>
<th>42</th>
<th>43</th>
<th>44</th>
<th>45</th>
<th>46</th>
<th>47</th>
<th>48</th>
<th>49</th>
<th>50</th>
<th>51</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- MD 4

#### November

<table>
<thead>
<tr>
<th>Wk</th>
<th>45</th>
<th>46</th>
<th>47</th>
<th>48</th>
<th>49</th>
<th>50</th>
<th>51</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Ion run (p-Pb)

#### December

<table>
<thead>
<tr>
<th>Wk</th>
<th>50</th>
<th>51</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Extended year end technical stop
- Lab closed
- Xmas
- New Year

---

Legend:
- **Green**: Technical stop
- **Blue**: Machine development
- **Light green**: Re-commissioning with beam
- **Orange**: Special physics runs - schedule to be established
- **Coral**: Scrubbing (indicative - dates to be established)
L1 trigger

Muon trigger: change of approach, from Detector based to regional

Work in progress:
HW: connection of Link fibers through TwinMUX ongoing. Expect two barrel wheels to be available for the second MWGR to test out the whole chain
FW: major progress in recent weeks to fit within latency constraints, will maintain for 2016 legacy RPC-PAC for the RPC readout
SW: Emulators of Track finders ready, being integrated to produce trigger menu
Injection of person-power in DPG / and online SW in order to be ready for beam start
L1 trigger performance will be presented by Trigger DPG on Wednesday plenary
Accelerating the CT-PPS planning

• The CMS-TOTEM common project aims to explore among other things the $\gamma-\gamma$ interactions through elastic PP scattering


• Already at the time of the Jamboree I have discussed with Joao Varela (CT-PPS PM) what would be the possibilities to advance the actual ‘Physics operation’ (foreseen for 2017 in the original CTPPS TDR)
Pixel Phase 1 Upgrade

- **Mechanics**
  - **BPIX**
    - All pieces for the (first half of) the detector mechanics ready by February
      - Bending and welding of the cooling loops is the most time critical item
    - First half of the service mechanics ready by February
  - **FPIX**
    - 10 (out of 14) disks ready for the cooling pipe installation
    - 2 (out of 4) service cylinders ready
    - Revision of the Quality Assurance of the cooling pipe welding procedure is on the critical path
      - Micro-cracks observed in early test samples

- **Service Electronics**
  - All components will be available by February

- **Integration plans:**
  - BPIX module integration planned to start in April
  - FPIX module integration planned to start in March
Pixel Phase 1 Upgrade

- **DAQ**
  - μTCA firmware development ongoing
    - α-version of the 24-ch FED f/w under test
    - tk-FEC f/w ~ready
    - px-FEC f/w: α-version for GLIB, migration to FC7 in progress
    - Procurement of final FC7 boards and mezzanine underway

- **Pilot system in CMS**
  - System (with VME) ran stably during last 3 days of HI run
    - Errors investigated on lab test-bench
  - Migration to μTCA FED/FEC for 2016 run
    - cDAQ outputs and TTS function being integrated into prototype FED f/w

- **CO₂ cooling plants at P5 are operational**
  - Solution of the vacuum insulated transfer line issue being applied this month
Priorities in the near future

• Preparations for the 2016 startup
• Start planning towards analysis of 2016 data [and ICHEP]:
  – CMSSW8 release, validation and deployment
  – Computing resources for MC production
• Work with CERN management in preparing RRB
  – First impressions will be very important.
• Phase 1 Upgrades: both HCAL and Pixel have a challenging time ahead.
  – Review plans for each project. Never too early to plan EYETS 2016/17.
• Prepare first comprehensive reviews of Upgrade Phase II projects
  – This is an internal CMS event, which will also help us prepare for the LHCC and eventually the RRB.
THE X(750000) OR JUST S

CERN - 08 February 2016

CMS Run Coordination prediction
2016 peak inst. lumi evolution

Machine Development (MD) #1 and Technical Stop (TS) #1 and recovery...

Increase # protons/bunch (shrink emittance?)

Limited by e-cloud

MD#2

MD#3 and TS#2
CMS Run Coordination prediction
2016 integrated lumi profile

Integrated luminosity (fb⁻¹)

Date

1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1 Nov

Integrated luminosity (pb⁻¹)

0 5 10 15 20 25 30 35000

Data to be used for ICHEP?

MD #1 and TS#1
MD#2
MD#3 and TS#2

3 Aug
ICHEP
CMS Run Coordination prediction
2016 average pileup

Blue = Start of fill
Red = End of fill

Increase # protons/bunch (shrink emittance?)

Short fills
w/low # bunches

Increase # bunches

Date
1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1 Nov

Average pileup
0 5 10 15 20 25 30 35

MD #1 and TS#1
M D # 2
MD#3 and TS#2

Increase # bunches
2016 L1 Trigger: completely new

- Major re-commissioning will be needed at start of 2016...
  - ... including re-checking rates, timing, efficiencies...

- Online: new online software and monitoring tools at P5
  - E.g., online DQM, possibly adapt WBM, rate monitoring tools

- Offline: new unpackers, emulators, L1 algorithms, HLT-related code, DQM → Need new release cycle 800

- New trigger menus with corresponding updates of HLT paths by DPGs/POGs/PAGs

- See dedicated talk in Wednesday plenary
  - [https://indico.cern.ch/event/489596/session/0/contribution/40/attachments/1226224/1795340/20160210_L1T_DPG.pdf](https://indico.cern.ch/event/489596/session/0/contribution/40/attachments/1226224/1795340/20160210_L1T_DPG.pdf)
2016 Pixels: lumi dependent efficiencies

- Recall: lumi dependent inefficiencies measured in 2012
  - (mostly layer 1)

Inefficiencies smaller in 2015: hit efficiency > 99% on all layers
(some dependency on filling scheme)

Current estimates for 2016 hit efficiency (layer 1): 97.5% @ 35 PU (96.5% @ 50 PU)

Data needed in new regime to update simulation
2016 Strips: lumi dependent efficiencies?

- ‘Unexpected’ hit inefficiency in SiStrips found in 2015
  - Lower efficiency in TOB L1–2, TIB L1–2
  - Correlation with Luminosity

- Primary suspect: High Ionizing Particles
  - Saturate the APV front end chip affects collected cluster charge
  - (and some deadtime)

- Tracking efficiency affected also due to cluster charge cut
- Mitigation in Tracking software in place for 800
- Investigation ongoing at hardware level, as well...

https://indico.cern.ch/event/450121/ and https://indico.cern.ch/event/489596/
Commissioning runs ongoing

- 10-12 Feb: Mid-Week Global Run #1 (MWGR#1) → ongoing!
  - Trigger with legacy L1 trigger and stress system
- 24-26 Feb: MWGR#2
  - Trigger with new L1 trigger
- 7-11 Feb: MWGR#3, or Cosmic Run at Zero Tesla (CRUZET)...
  - Progress on ease of use of L1 trigger
  - Collect cosmic rays for Tracker alignment with B=0T
- 21-24 Feb: MWGR#4
  - ~Last chance for dedicated commissioning without beams...
- Note: no specific period dedicated to CRAFT (Cosmic Rays At ~Four Tesla) in current schedule
  - Aim to collect comics muons during interfills
L1 Trigger upgrade

Run1 L1 trigger would have not survived to 2016 LHC conditions

**L1 Trigger has been completely upgraded** for 2016 run

- 3 muon track finders (Endcap, Overlap, Barrel)
- layer-1 calorimeter trigger
- layer-2 calorimeter trigger
- global muon trigger
- global trigger

Layer2 Stage1 already in 2015 run

All components have been installed at p5
The L1T upgrade - in very short

General
✦ New more flexible and powerful electronics (more obj in same proc. unit, larger LUT)
✦ Larger data bandwidth using optical links (10Gb/s)

Muons
✦ Higher resolution in pT assignment
✦ Accepting more inputs (Calo, GEMs) - not for 2016

Calorimeter
✦ using tower level information
   ♦ better energy and position resolution
✦ pileup subtraction for L1 objects (Jets, Energy sums, EGamma, Taus)

Global Trigger
✦ Larger bandwidth and flexibility in the algorithms
   ♦ anyone can suggest its own algorithm - not limited at 128
Muons performance

- First version of the emulator ready in 800_pre6
- Tuning is necessary and ongoing
- Performance similar to legacy trigger but new gear
- Expecting additional rate reduction from
  - BMTF new pT assignment (already private results)
  - Optimisation of muon quality from EMTF (~weeks)
- Expecting improvement in efficiency from
  - Optimisation of treatment of boundary region (~week)
  - Inclusion of RPC hits in EMTF (~August)
- These should bring back muons to 2015 efficiency
Draft of L1 menu

From Chamonix outcome we are working on three possible scenarios:

✦ **relaxed**
  ✦ 2736 colliding bunches
  ✦ pileup 26
  ✦ luminosity \( \sim 1.0 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1} \)

✦ **nominal**
  ✦ 2736 colliding bunches
  ✦ pileup 30
  ✦ luminosity \( \sim 1.15 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1} \)

✦ **emergency**
  ✦ 2736 colliding bunches
  ✦ pileup 34
  ✦ luminosity \( \sim 1.3 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1} \)

**Total rate budget unchanged compared to 2015:** \(~90\text{kHz}\)
Draft of L1 menu

Developing menu for nominal scenario

This is work in heavy progress - take it with a grain of salt

Thresholds for first attempt of menu in short

✦ muons, jets, and sums as in 2015
✦ electron higher cut at L1 + sharper turn-on = lower rate, same single efficiency
✦ tau as in 2015 with sharper turn-on offline

Caveats

✦ ETT, ETM waiting for tower level calibration (ETA ~2 weeks)
  ✦ from studies on 2015 menu their contribution is ~10% of the total menu
✦ HF jets waiting for tower level calibration (ETA ~1week)
  ✦ educated guess is ~10% if the total rate (including ETM w/ HF)
✦ Assuming 10kHz ZeroBias - probably could go down to ~1kHz

Full menu ready beginning of March
CV273 valve replacement: UXC

J. Bremer, C. Fabre, O. Pirotte

Repair started 22 Jan (once mechanical prep of CB finished)
Tank casing lowered, MLI removed
Cu heat shield cut open

CV273 removed 27 Jan
replaced 03 Feb

Pipe thicker than expected
-needed new weld procedure

Leak test this week
Cold Box: endoscope check inside heatex’s’s

Clean except for

v. small metal chips

One small piece of soft material (few mm) - likely MLI.

NO OIL POOLS

B. Cure, W. Zeuner
Cleaning Machine

J. Bremer, C. Fabre, O. Pirotte

2000l Vertrel XF solvent purchased (leased)

Commissioning finished 25 Jan.
and fluid circulation in circuit 1 started.
(HP end including Heatex 1 & turbine shunts)

Dryer/condenser next to cold box

Clean & dirty solvent tanks, pumps & distillation plant.
Experience of cleaning the circuits

Excellent teamwork between TE-CRG and TE-VSC with EN-MME support

1st circuit - high pressure or warm side, including heat exchangers and the turbine circuit
> 100mg/litre of Breox detected in draining solvent from 1st circulation
-after 4 cycles of filling & flushing, Breox below detectable limit of 10mg/l
- circuit emptied on 29 Jan. Preliminary drying ~ complete 01 Feb

Estimated distillation residue of Breox: 350g
(Note that a few 100mg appeared sufficient to block the turbine input filters)

[N.B. Turbines T1 & T2 (at manufacturer for overhaul) show heavy Breox contamination]

2nd circuit (the largest) – low pressure (or cold) side.
- just > 10mg/l Breox in draining solvent, close to lowest detectable threshold
- circuit emptied on 5 Feb. Drying underway

Estimated distillation residue of Breox: 10g

3rd circuit: will comprise originally planned circuits 3 & 4 in series

Overwhelming evidence that: -contaminant in cold box was Breox compressor oil
-v. little contamination reached the low pressure (20K) part
-the action-line since June has been correct.
Water leaks seen near end of HI run

Leading to 18hr shutdown of detector & re-start with YE+1 inoperable

- 2x lowest ME1/1 +
- YB0 and YB-2 leak detection cables
- RE4 +
- Puddles on X1 floor

Refill rate of yoke-endcap circuit buffer tank increasing
Search for leak on 1\textsuperscript{st} endcap disk YE+1

Diagnosis/repair required an unforeseen opening of both endcaps with b.p.in place

Leak from a braise in Ni-coated Cu pipework of internal cooling network, chamber ME1/1/13

ME1/1/13 removed on Sat 23 Jan
Water exit below nose: corrosion, sediment

Plate sent to Chem group for analysis
ME1/1 internal pipework: braized joints

Design & metallurgical analysis

φ8 ……thanks to Dubna colleagues for v. rapid feedback
Fluxless braising solder
Cu : 89%
P : 06%
Sn : 04%
Zr : 0.03%
~730 deg

Tests:
- Visual inspection
- P test: 25bar H₂O
> 10 mins no visible leak

Met EDR requirement, which was:
QA/QC to hydraulic standards
(All ccts tested at 24 bar pre-op).

Leaky joint + 2 from same chamber sent to TE/MME for analysis. (secured top priority from CERN metallurgists).

Leaky joint: mis-alignment,
All : questionable filling and penetration.
**CMS & LHC schedules?**

Start closing week of 15 Feb to be ready on 21 Mar – CAN’T BE CLOSED 16 Mar!

### January

<table>
<thead>
<tr>
<th>Wk</th>
<th>Mo</th>
<th>Tu</th>
<th>We</th>
<th>Th</th>
<th>Fr</th>
<th>Sa</th>
<th>Su</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>11</td>
<td>18</td>
<td>25</td>
<td>1</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>29</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Feb**

<table>
<thead>
<tr>
<th>Wk</th>
<th>Mo</th>
<th>Tu</th>
<th>We</th>
<th>Th</th>
<th>Fr</th>
<th>Sa</th>
<th>Su</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>11</td>
<td>18</td>
<td>25</td>
<td>1</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>29</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mar**

<table>
<thead>
<tr>
<th>Wk</th>
<th>Mo</th>
<th>Tu</th>
<th>We</th>
<th>Th</th>
<th>Fr</th>
<th>Sa</th>
<th>Su</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>11</td>
<td>18</td>
<td>25</td>
<td>1</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>29</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apr**

<table>
<thead>
<tr>
<th>Wk</th>
<th>Mo</th>
<th>Tu</th>
<th>We</th>
<th>Th</th>
<th>Fr</th>
<th>Sa</th>
<th>Su</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>11</td>
<td>18</td>
<td>25</td>
<td>1</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>29</td>
<td>7</td>
<td>14</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Year end technical stop

- **21 Mar**
  - Beam

### Water leak repair:

- **11 Apr**
  - B=3.8T

- **21 Apr**
  - Scrubbing

- **25 Apr**
  - Physics

### Cryo system/cleaning/replacement:

- looking good….
- finish valve repair in UXC: mid Feb
- finish CB clean + oil removal: “cryo ready” end Mar

### Precautionary measures to mitigate another braize leak

- better estimate this week after parts arrive today
Reminder: Physics Organization in 2016

Phase II Upgrade
Performance Studies Group

Physics Coordinators
J. Olsen, J. Alcaraz

Physics Officers
MiniAOD+POG:
Giovanni Petruggiani
Andrea Rizzi

Physics Officers

Higgs
G. Gómez-Ceballos
A. David

SUSY
F. Moortgat
C. Campagnari

Exotica
D. Del Re
S. Valouev

Beyond 2 Gen.
A. Schmidt
R. Erbacher

MC generators
R. Covarelli
P. Govoni

B physics
N. Leonardo
S. Malvezzi

SM Physics
F. Cossutti
K. Theofilatos

Heavy Ions
Y. J. Lee
W. Li

Fwd & Small-x
QCD
R. Ulrich
A. Moraes

Tracking
V. Innocente
M. Rovere

B-tagging & vtx
P. van Mulders
C. Collard

Jets/ME_T
K. Kousouris
R. Schoefbeck

Taus
I. Ojalvo
M. Bluji

Luminosity
J. Salfeld
C. Palmer

e/γ
M. Sani
F. Couderc
456 papers submitted:
+23 CRAFT based
+55 ready for CWR or later

In review process (>= GoingToPreapp): 94
(38 on 13 TeV data)

13 TeV publications:
1 published
2 accepted (including first search on 13 TeV data)
1 processing Ref. comments
3 ready for LE or CWR

Jamboree results close to publication

- Many regions, defined by $H_T$, $H_T^{\text{miss}}$, $N_{\text{jet}}$(≥4), $N_b$
- Final sample, refined treatments, T5qqqqVV interpretation added
Jamboree results close to publication

SUS-15-003

PUB-Draft

T2tt, T2bb, T2qq

- Many regions, defined by $H_T$, $MT_2$, $N_{\text{jet}} (\geq 1)$, $N_b$, $p_T^{\text{jet}}$
- Final sample, refined treatments, T2tt/T2bb/T2qq interpretation added

OLD, 8 TeV

NEW, 13 TeV
H→aa→μμττ search

- All tau decay channels considered. Discriminant analysis variable is the dimuon mass.
- Covering pseudoscalar masses above 20 GeV -> relevant for scenarios with b-quark BR suppressed (2HDM scenarios of Type3 and Type 4)
Example 2: DR 76x

Most of the work done in Dec 2015 and Jan 2016
✦ we should congratulate CompOps and submission infrastructure experts
✦ we did it because we could (i.e. T2 resources)

Campaign RunIIIFall15DR76 progress

Ad-hoc work to increase efficiency over Xmas resulted in stable increase of production throughput

# requests

# evts
Example of CMS use of commercial clouds

Exploiting the Amazon Web Services (AWS) grant (Jun 2015 - Mar 2016)

- **Goal:** demonstrate ability of executing any of the CMS centrally-organised workflows
- start-up at FNAL was intense and very successful, **stably running on >50k cores**
  - nearly completed the 4 production requests, agreed on with Physics, ~500M evts (ETA: tomorrow)
  - we may run more before Moriond, if needed
- already now contributing ~25% to the global CMS concurrent capacity
- lessons learned to be fully documented as a deliverable of the project

(source: FNAL HEP Cloud monitoring)
Our total reach today

>200k cores used by CMS are a reality, exploiting both WLCG pledges via Global Pool and commercial resources

✦ a great achievement in terms of scale and stability by the global Condor pool
✦ a snapshot from last week below
CMSSW release plans for 2016

**CMSSW_8_0_0**
- **Target**: 2016 pp run (GEN-SIM, DIGI-RECO)
- **Target date**: February 29 (so last open February ~1)

**CMSSW_8_1_0**
- **Target**: Possibly for 2016 HI end-of-year rereco (both if reco improvements needed) and GEN-SIM for 2017
- **Target date**: TBD (approximately September)

An additional release cycle during Summer of 2016 can be added given urgent needs
- Our thinking is that given no change in energy/bunch spacing, we do not need a middle of year cycle (which has created a lot of extra work to support in 2015)
Technical changes targeted for CMSSW_8_0_0

SIM, DIGI, RECO, HLT all running efficiently in multicore processing jobs

✦ **Achieved.** Primary accomplishment in 8_0_X is that the mixing module has been migrated to be thread-efficient

Move to GCC5.3 (from 4.9.3)

✦ First build in parallel. Evaluation of physics agreement and performance ongoing

Move to **ROOT 6.0.6** (from 6.0.2) is complete
### TDR planning goals:

- Overall Phase II Upgrade costs, responsibility and funding agreements approved by RRB end 2017 - early 2018
- Sign MoUs for major construction projects through 2018

<table>
<thead>
<tr>
<th>Month</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP/SD Approval</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalize plans for each TDR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comp. Reviews - cost and responsibility updates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update of overall cost, resources and responsibilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalize scope for TDRs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comp. Reviews - baseline Trigger Architecture - cost and responsibility agreements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update of overall cost, resources and responsibility agreements (including Trigger)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit Tracker TDR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit Muon and Barrel calorimeter TDR and interim Trigger/DAQ document</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit Endcap Calorimeter TDR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Also document Common Infrastructure upgrades - LS2-LS3 work in 2016-17
- TDRs for Trigger, DAQ, Bril in 2019-2020
Outer Tracker sensors

Full-size “2S-Long” sensors produced at INFINEON
- First production of n-in-p sensors
- First production on 8” with 200 μm thinning
- Very good quality (with some small defects)

Sensor development at INFINEON appears to be converging after 5 years of close collaboration with HEPHY

- Two sensors assembled with a 2-CBC2 hybrid and operated in the beam at CERN
- Results in February
Pixel readout electronics

Digital radiation test chip submission in March (RD53, MPA/SSA, LPGBT)
- Determine required transistor size for high radiation tolerance

Development of RD53A going at full speed
- Design team of ~15 people involving several groups
- Project plan aiming at submission at the end of the year

R&D on serial powering and data links continuing
- Dedicated Working Group formed for serial powering
- Encouraging results with flat Alu cable for data transmission

SIMULATIONS

MEASUREMENTS
Other activities

Several submissions of pixels sensors ongoing or planned
- Soon material in hand to explore the relevant phase-space of options (planar, 3D)

Making progress with demonstrators of L1 track finding
- First fitted tracks out of hardware

Prototyping of Outer Tracker mechanical structures

Optimization of detector layout for rapidity extension
- Including boundary between Outer Tracker and Pixel
Muon detectors longevity test at GIF++

Stable irradiation started at GIF++ - parameters defined including a x 3 Safety Factor

\[ Q_{\text{GIF++}} = \left< q / \text{hit} \right> \times T_{\text{cms}} \times \Phi_{\text{cms}} \times \text{Sens}_{\text{detector}} \times SF \]

\[ T_{\text{GIF++}} = \frac{T_{\text{CMS}}}{\varepsilon_{\text{GIF++}} \times \text{AAF}} \]

- 1 DT: AAF = 28.5 \rightarrow T_{\text{GIF++}} \sim 1.6 \text{ months for } Q_{\text{GIF++}} \sim 0.06 \text{ C/cm}
- 2 CSCs: AAF = 3.8(1.7) ME11/ME21) \rightarrow T_{\text{GIF++}} \sim 2 \text{ years for } Q_{\text{GIF++}} \sim 0.55 \text{ C/cm}
- Several RPCs: AAF = 4(2) Bar./Endcap \rightarrow T_{\text{GIF++}} \sim 1.5 \text{ years for } Q_{\text{GIF++}} \sim 0.5 \text{ (1) C/cm}^2
- 1 GE1/1: AAF = 30 \rightarrow T_{\text{GIF++}} \sim 2 \text{ months for } Q_{\text{GIF++}} \sim 20 \text{ mC/cm}^2
CMS Rules & Code of Conduct

Important for all CMS members
(responsibility of Team Leaders to inform their team members)

These rules deal with several aspects, including confidentiality of CMS internal results prior to public dissemination, as well as the publication of interpretation & review papers by CMS members based on CMS results


The CMS Constitution describes procedures in case of violation of these rules

Example extract from Constitution (A3.2): “Should an individual be guilty of a serious violation of the rules of CMS, the Spokesperson shall bring the matter to the attention of the relevant group leader, who will be expected to take appropriate action. If the problem is not quickly resolved, the Spokesperson shall bring the matter to the Collaboration Board who will decide on further action.”
• According to the project and coordination areas all work, which could be approved has been approved.

• 74 + 8 (special treatment for new members in 2015) = 82 institutes have worked more than 100%

• 39 institutes contributed between 80% and 100%

• Started with the yearly cleaning of the waiting list of new authors for institutes, who have worked $\geq 100\%$ of their EPR due and admitted new members as authors. If you have a colleague, who can be included in the author list, please notify me.

• Started to resolve unclear situations and complains.

Please check the status of your EPR 2015 and notify the relevant managers for needed modifications.
Preliminary List!

Preliminary list of institutes fulfilling >= 100% of their EPR due


Thanks a lot!
Opening EPR 2016

• New EPR tool is open for pledges: [https://icms-epr.cern.ch](https://icms-epr.cern.ch)
• Notify [icms-support@cern.ch](mailto:icms-support@cern.ch) in case of access problems. Otherwise use the button in the footer: “Report an issue”
• Initial documentation on the new system can be found here: [https://cms-docdb.cern.ch/cgi-bin/DocDB/ShowDocument?docid=12808](https://cms-docdb.cern.ch/cgi-bin/DocDB/ShowDocument?docid=12808) and in the WGM presentation by Andreas Pfeiffer on 28th of Jan: [https://indico.cern.ch/event/472954/](https://indico.cern.ch/event/472954/)
• Since it is Feb already: please enter pledges promptly:
  
  **Deadline for initial pledges: Feb 29th 2016**

• At present only core tasks are visible for pledges. As soon as the core tasks are sufficiently pledged, the non-core tasks will be opened in the EPR tool. In the accounting of EPR as worked non-core tasks will be scaled down by a factor of four.

• Status today at noon: 135 pledges (in total 940 tasks, partially with multiple opportunities to pledge)