



How CMS Reports to the C-RSG Board at CERN

2020 FCRSG (Formerly SCPMT) Review
04. May 2020

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2020 VO requests

| Tier | Pledge Type | Year | ALICE Required | ATLAS Required | CMS Required | LHCb Required | Required Sum |
|------|-------------|------|----------------|----------------|--------------|---------------|--------------|
| 0 | Tape | 2020 | 44200 | 94000 | 99000 | 36100 | 273300 |
| 0 | Disk | 2020 | 31200 | 27000 | 26100 | 17200 | 101500 |
| 0 | CPU | 2020 | 350000 | 411000 | 423000 | 98000 | 1282000 |
| 1 | CPU | 2020 | 365000 | 1057000 | 650000 | 328000 | 2400000 |
| 1 | Disk | 2020 | 44000 | 88000 | 68000 | 33200 | 233200 |
| 1 | Tape | 2020 | 37700 | 221000 | 220000 | 55500 | 534200 |
| 2 | Disk | 2020 | 39000 | 108000 | 78000 | 7200 | 232200 |
| 2 | CPU | 2020 | 376000 | 1292000 | 1000000 | 185000 | 2853000 |
| Tier | Pledge Type | Year | ALICE Required | ATLAS Required | CMS Required | LHCb Required | Required Sum |

- **Worldwide LHC Computing Grid (WLCG):** <https://wlcg.web.cern.ch>
 - Global collaboration of around 170 computing centres in more than 40 countries
 - Linking up national and international grid infrastructures.
- **Mission of the WLCG**
 - Provide global computing resources to store, distribute and analyse the data of operations from the LHC
- **Collaboration with WLCG:** <https://wlcg.web.cern.ch/mou>
 - Institutes/national funding agencies are required to sign a Memorandum of Understanding with WLCG
 - Set up the framework of agreements regarding resources and services provided.

Scientific Committees

Home

List all
Calendar all
Secretariat

SPC - Scientific Policy Committee. (A subsidiary body to the CERN Council, see Council webpages)

Approval of Experiments at CERN

Research Board

Experiment Committees

All submit recommendations to the Research Board for approval
INTC - ISOLDE and Neutron Time-of-Flight Experiments Committee
LHCC - LHC Experiments Committee
SPSC - SPS and PS Experiments Committee
REC - Recognized Experiments Committee
ISAB-G - Advisory Committee for Generic Detector R&D and pre R&D (IdeaSquare)

Resources and Finance Review

RRB - LHC and WLCG Resources Review Boards
Ad-hoc Financial Review Committees (FRG):
CAST
CLOUD
COMPASS
Scrutiny Groups:
- LHC Resources Scrutiny Group
- LHC Computing Resources Scrutiny Group
GBAR
NA62

+ Former Experiment Committees

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<http://committees.web.cern.ch>

Scientific Committees

Home RRB

Mandate

Calendar next meetings
Minutes past meetings
Agenda (Indico)
Documents (CDS)

LHC Resources Review Boards (LHC-RRB)

The Resources Review Board (RRB) comprises the representatives of each Experiment's Funding Agencies and the managements of CERN and of each Experiment's Collaboration. It is chaired by the CERN Director for Research and Computing.

The role of the RRB includes :

- reaching agreement on the Memorandum of Understanding
- monitoring the Common Projects and the use of the Common Funds
- monitoring the general financial and manpower support
- reaching agreement on a maintenance and operation procedure and monitoring its functioning
- endorsing the annual construction and maintenance and operation budgets of the detector.

The management of the Collaboration reports regularly to the RRB on technical, managerial, financial and administrative matters, and on the composition of the Collaboration.

Chairperson: CERN Director for Research and Computing
Scientific secretary: W. Funk (EP)
Secretariat: P. Mage-Granados (EP)

All information about meetings, including Agenda and documents can be found in the Indico pages.

Archive: *list of Documents of past meetings (until 2005). Please use the CERN Document Server (CDS) collection as from 2006.*

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<http://committees.web.cern.ch/LHCRRB/welcome.html>

Computing Resources Scrutiny Group

The purpose of the C-RSG is to inform the decisions of the Computing Resources Review Board (C-RRB) for the LHC experiments.

According to the WLCG, MoU the starting point of the scrutiny is the request information presented at the spring C-RRB meeting and any guidance that the C-RRB cares to give. From that moment the CRSG enters into a sustained dialogue with each experiment seeking to understand to what extent the computing resource requests are well motivated. The recommendations are presented in the RRB autumn meeting.

Every year the CRSG should scrutinize

- The resource accounting figures for the preceding year
- The use the experiments made of these resources
- The overall request for resources for every experiment for the following year and forecasts for the subsequent two years
- The CRSG shall also examine the match between the refereed requests and the pledges from the Institutions.
- The CRSG shall make recommendations concerning apparent under-funding This is the first time that such an independent and detailed scrutiny of the computing yearly request is carried out.

<https://wlcg.web.cern.ch/collaboration/management/computing-resources-scrutiny-group>

The C-RSG requests reports from CMS twice a year, then reports to the LHC-RRB.

CMS collaborators produce these reports using the monitoring available to CMS or writing own monitoring/analytics code

CMS maintains resource planning calculations (old: spreadsheet, new: python framework)



CMS Software/Computing Resource Utilization for 2018 and Resource Request for 2020 Spring 2019

Introduction

2018 was another excellent year for LHC operations and luminosity delivered to the experiments. CMS recorded 64 fb^{-1} of pp collisions during 2018, in addition to the 84 fb^{-1} collected during 2016 and 2017. This brings the total luminosity delivered in RunII to more than 150 fb^{-1} , and the total RunI + RunII dataset to more than 190 fb^{-1} . At the start of each fill, instantaneous luminosity at P5 exceeded $1.9 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$, corresponding to approximately 50-55 pileup interactions per bunch crossing. This corresponds to a lower average pileup condition (for events triggered during a fill) than the one seen at the end of 2017, when the LHC used the 8b4e filling scheme and the instantaneous luminosity was constant, with fewer bunches, at $1.9 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ for the first several hours of the fill. Still, the average 2018 pileup condition measured by CMS is roughly 5% larger than the one used to in the CMS resource plan for 2018 (37 vs 35).

- Spring report:
 - Resource Utilization of previous year
 - Resource Request for next year
- Fall Report:
 - Confirmation of Resource Request for next year
 - Resource request for next-to-next year

CMS Offline Software and Computing Resource Request for 2021 Fall 2019

| | |
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Introduction

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Resource Utilization for 2019 and Resource Request for 2021 v2



Reports not
released
publicly

CMS Offline Software and Computing

17 March 2020

Example:

- Spring 2019 → Report
 - Resource Utilization for 2018
 - Resource Request for 2020
- Summer 2019 → Estimate
 - First needs estimate for 2021
- Fall 2019 → Report
 - Confirmation Resource Request for 2020
 - Resource Request for 2021
- Winter 2020 → Estimate
 - Final needs estimate for 2021
- Spring 2020 Report
 - Resource Utilization for 2019
 - Updated Resource Request for 2021

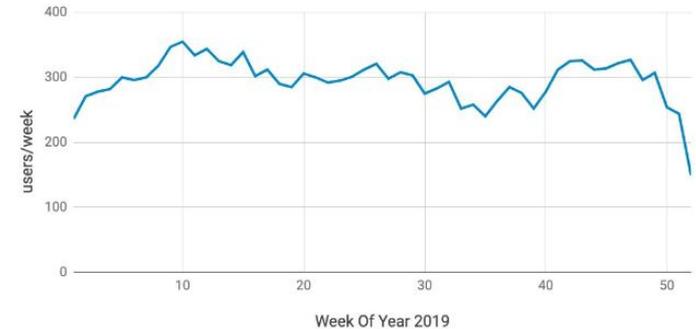
■ Content Categories

- CERN Resources
- Tier-1 Resources
- Tier-2 Resources
- The HLT farm and opportunistic resources
- Production and analysis activities
- Data Popularity and Disk Access
- Dynamic Data Management
- Data Transfers

■ Plots and explanations for all categories, for example:

- normalized wall clock work in kHS06 comparing used, pledged and requested
- disk and tape usage comparing used, pledged and requested
- Normalized CPU utilization fractions per tier
- Number of simulated events produced per month in 2019, for each data tier
- Number of raw and processed data events per month in 2019, for each data tier
- dataset popularity for year 2019 of CMS samples on the distributed CMS computing system in terms of dataset accesses over periods of 3, 6, and 12 months
- Dynamic Data Management subscription and deletion of least popular samples at Tier-1 disk-only areas and Tier-2 sites. Values shown are PB/month
- Weekly transfer rate between Tier-2 sites, by destination

CMS distinct Analysis users at Tier-2 sites



Resource Request - LHC input parameters



- Experiments work with LHC to establish input parameters for resource planning (differs sometimes from official projections as LHC is conservative publicly)
 - <http://lhc-commissioning.web.cern.ch/schedule/LHC-long-term.htm>
- Because 2019/2020 are shutdown years (LS2), we received preliminary estimates for the running scenario for 2021

2021 Running Conditions for Computing estimates including contingency



- ATLAS/CMS luminosity: 20/fb
- ATLAS/CMS average pile-up: 35
- LHCb luminosity: 3.5/fb
- ALICE luminosity: 45/pb
- Running time pp: 3×10^6 seconds
- Running time ions: 1.2×10^6 seconds

Numbers assume 50% stable beam time



Planning status as of January 2020



- Data taking rate in kHz
 - Any additional rate for example for scouting and/or parking
- Commissioning scenarios needing additional data on disk (in RECO format)
- Heavy Ion run estimates
- MC production needs
 - Run 2 analysis needs
 - Run 3 data taking:
 - Initial production for start of data taking
 - Physics analysis production: 5 billion events plus 0.2 billion events per fb^{-1} of data collected
 - HL-LHC MC needs

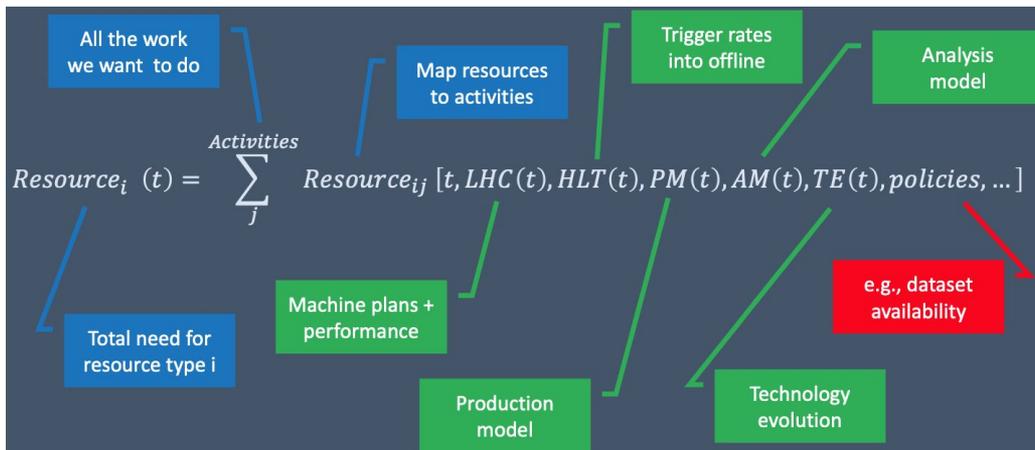
Quarterly activity planning

| Activity | Q1 | Q2 | Q3 | Q4 |
|--|----|----|----|----|
| Run 2 / 3 analysis | ■ | | | |
| Run 3 detector/physics objects commissioning | ■ | | | |
| Validation sample production | ■ | | | |
| Commissioning T0 operations | ■ | | | |
| Proton - Proton T0 operations | | ■ | | |
| Mid-year re-reconstruction | | ■ | | |
| End-year re-reconstruction | | | | ■ |
| Heavy ions T0 operations | | | ■ | |
| Heavy ions re-reconstruction | | | | ■ |
| 2021 Monte Carlo production | ■ | | | |
| Run 2 Monte Carlo production | ■ | | | |
| HL-LHC Monte Carlo production | ■ | | | |
| 2021 re-MiniAOD | | | | ■ |

Resource Request - CMS input parameters



| Parameter |
|--|
| RAW event size for data (MB) |
| RAW event size for MC (MB) |
| RECO event size for data (MB) |
| RECO event size for MC (MB) |
| AOD event size for data (MB) |
| AOD event size for MC (MB) |
| MiniAOD event size for data (kB) |
| MiniAOD event size for MC (kB) |
| NanoAOD event size for data (kB) |
| NanoAOD event size for MC (kB) |
| Repacker time (HS06s) |
| RECO time for data (HS06s) |
| Generator and detector simulation time (HS06s) |
| Digi/RECO Time MC (HS06s) |



- Plug in assumptions of
 - data/simulation production plans
 - Analysis activity, which previous year data in which reconstruction versions need to be kept available
 - Dataset distribution schemes
 - Conference schedule
 - Software release plan
 - etc.

| Resource | Site | 2020 CMS Approved Request (Spring 19) | 2021 CMS Request (Fall 19) | 2021 CMS Request (Spring 20) |
|-------------|--------------|---------------------------------------|----------------------------|------------------------------|
| CPU (kHS06) | T0+CAF | 423 | 517 | 500 |
| | T1 | 650 | 650 | 670 |
| | T2 | 1000 | 1200 | 1070 |
| | Total | 2073 | 2367 | 2240 |
| Disk (PB) | T0+CAF | 26.1 | 31 | 30 |
| | T1 | 68.0 | 77 | 77 |
| | T2 | 78.0 | 93 | 92 |
| | Total | 172.1 | 201 | 199 |
| Tape (PB) | T0+CAF | 99 | 144 | 120 |
| | T1 | 220 | 245 | 230 |
| | Total | 319 | 389 | 350 |

- All this is scrutinized by C-RSG
 - Detailed explanations of planned activities
 - Explanations of previous performance
- C-RSG is asking questions to the experiments that are answered in writing
 - In addition C-RSG is meeting with CMS
- C-RSG is iterating with the experiments on their requests
- In the end, C-RSG is recommending to the RRB to approve the requests