

Continuous and fast calibration of the CMS experiment

Design of the automated workflows and operational experience

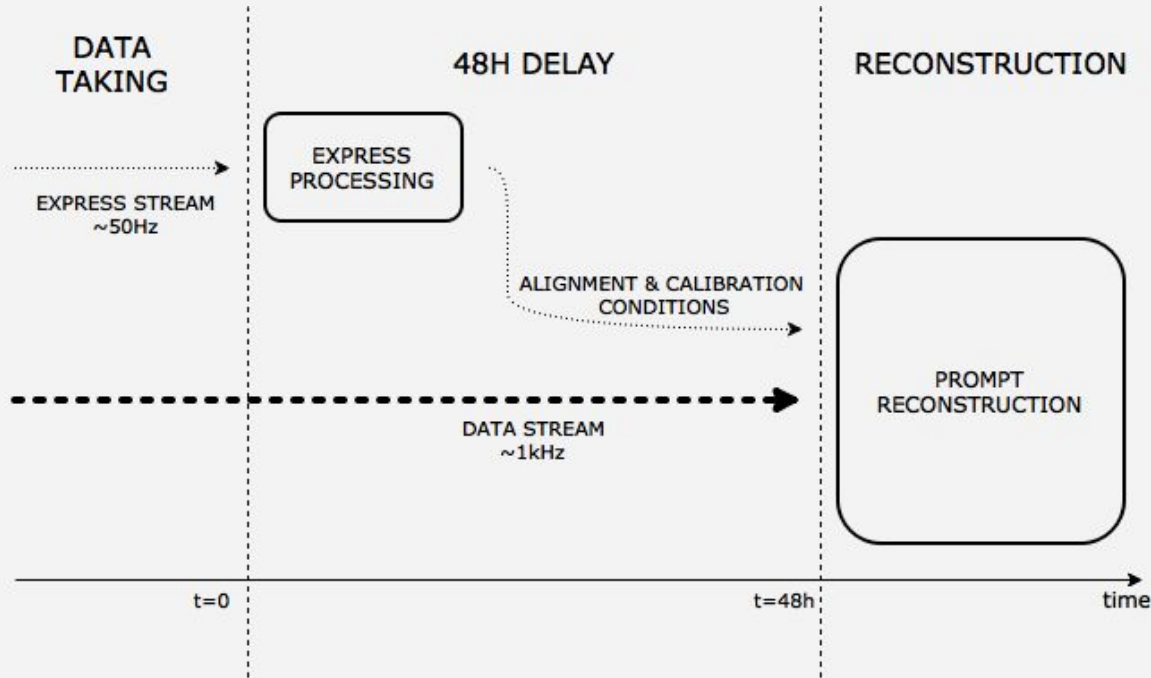
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on behalf of

CMS Collaboration

Prompt calibration concept and data processing



Alignment & Calibrations run promptly

What we do:

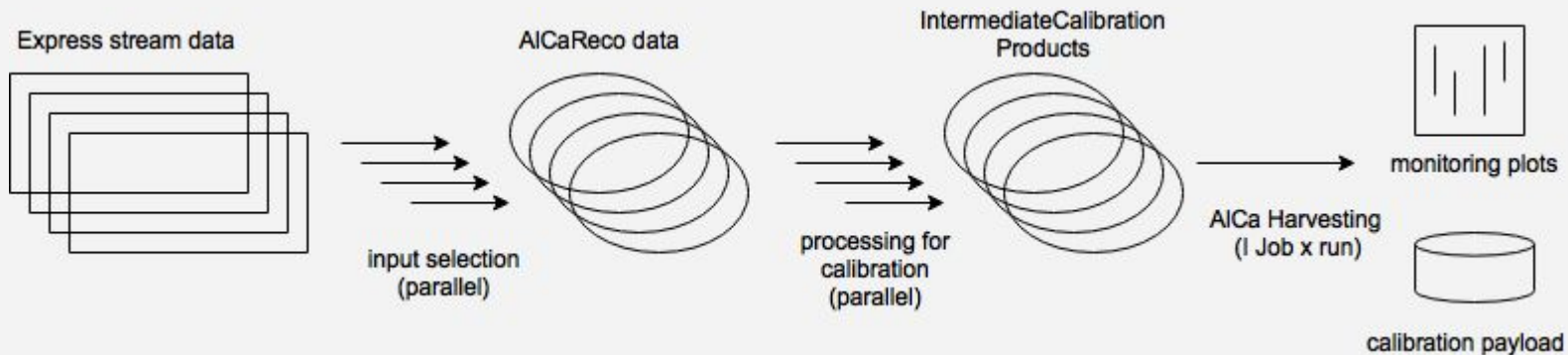
- fit of the luminous region position and width (using tracks)
- identification of Silicon Strip tracker problematic channels
- determination of charge gains of the Silicon Strip tracker
- track-based alignment of Silicon Pixel inner tracker mechanical supports structures

When done promptly:

- efficient online event selection by HLT (Higher Level Trigger)
- ready for analysis datasets within a few hours from data taking

Workflows running at CERN Tier0

- Tier0 computing farm runs automated calibration and alignment workflows
- Computing alignment and calibration conditions on run#N allows to apply them on the same run#N in prompt reconstruction



An approach to multi-run harvesting

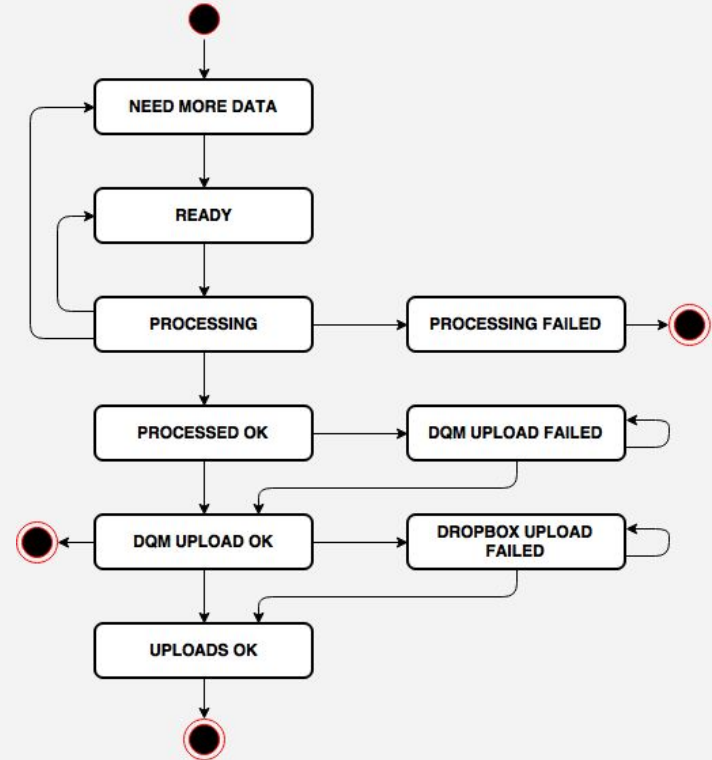
- Calibration algorithms become more complex
 - More statistics needed
 - Single runs not sufficient
- Idea: merge runs to have more data
 - selected runs have to have the same properties (dataset, magnetic field, etc.)
- Run AICa Harvesting step over multi-runs
 - when still too narrow extend multi-run and repeat
 - perform following uploads

Multi-runs assembling

- Discover new data when it is available through Run Registry (an external service)
- Get further information about the data from DBS (Dataset Bookkeeping System) and Tier0 API
- For runs with the same properties create exactly one multi-run
 - If cumulative number of events exceeds some threshold then the multi-run is ready to be processed
- Complications
 - Processing does not have to produce the alignment and calibration constants - multi-run has to be extended then
 - Runs data differ in length - do not always arrive in the same order as produced by detector

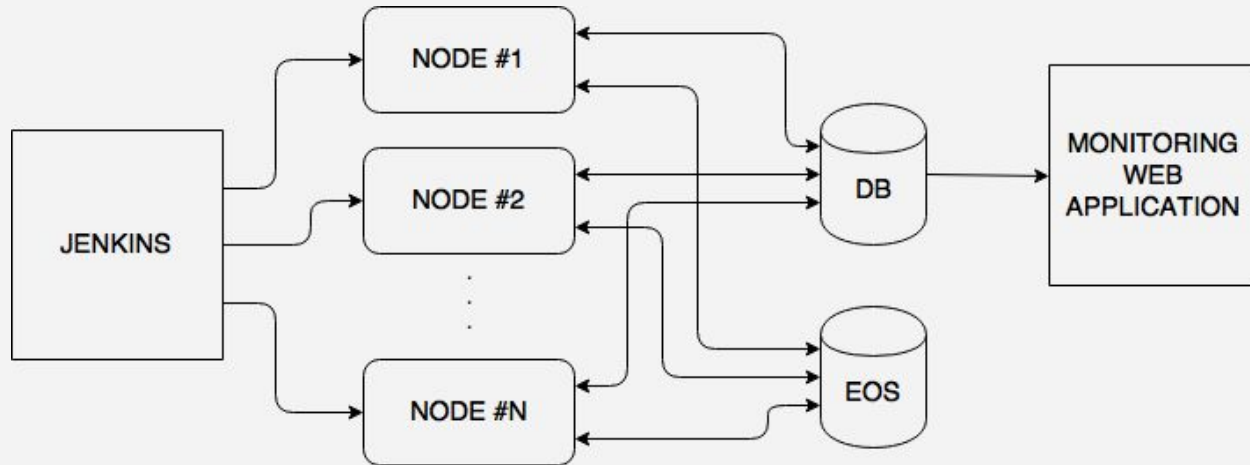
The State Machine

- Multi-run processing flow control
- Supports implementing resilience by:
 - Retrying processing in case of failures
 - Easy monitoring of the process
 - Running independent multi-run computations in parallel

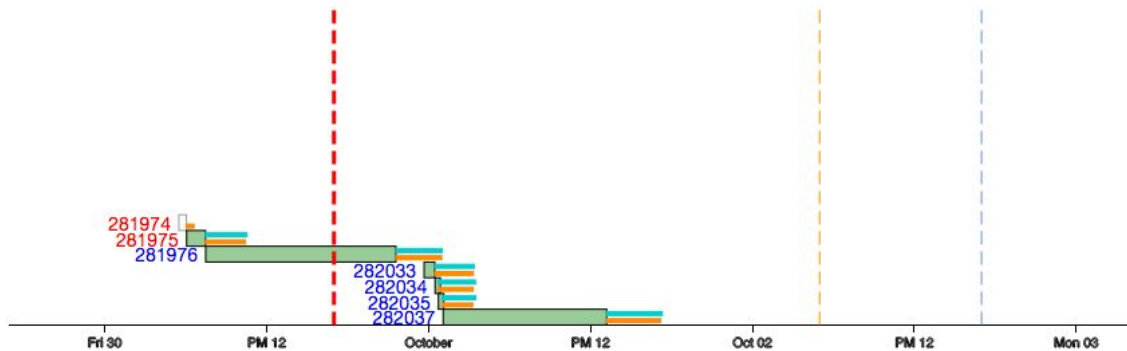


Multi-run harvesting architecture

- Tier0 runs all the calibration and alignments workflows (including CPU-intensive jobs) while the multi-run datasets are used only for computing AICa Harvesting step in a minimal environment prepared on top of the CMSSW and Tier0 implementation

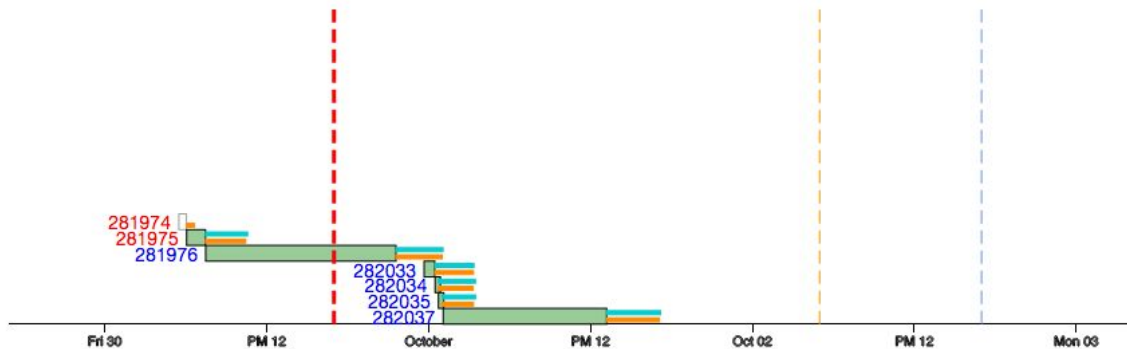


Problematic runs:



SiStripBadStrip_pcl

Problematic runs:



Monitoring infrastructure - multi-run based workflows

PromptCalibProdSiPixelAli

	ID	State	Dataset	Events
+	319411	Processing	/StreamExpress/Run2016H-PromptCalibProdSiPixelAli-Express-v2/ALCAPROMPT	2494763
+	308517	DQM upload OK	/StreamExpress/Run2016H-PromptCalibProdSiPixelAli-Express-v2/ALCAPROMPT	2321249
+	293798	DQM upload OK	/StreamExpress/Run2016H-PromptCalibProdSiPixelAli-Express-v2/ALCAPROMPT	4527685
+	263850	Processing failed	/StreamExpress/Run2016H-PromptCalibProdSiPixelAli-Express-v2/ALCAPROMPT	4371469
+	258321	DQM upload OK	/StreamExpress/Run2016H-PromptCalibProdSiPixelAli-Express-v2/ALCAPROMPT	121061
+	254975	DQM upload OK	/StreamExpress/Run2016H-PromptCalibProdSiPixelAli-Express-v2/ALCAPROMPT	754431
+	236331	Need more data	/StreamExpress/Run2016G-PromptCalibProdSiPixelAli-Express-v1/ALCAPROMPT	3454511

Current status and future plans

- Currently
 - Run-based workflows computed on Tier0 farm
 - Multi-run workflows computed in pre-production environment
 - Monitoring infrastructure established

- In the future
 - Testing of new multi-run framework
 - Further development of monitoring infrastructure
 - Adding more calibrations to the multi-run system in RunII

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