

Continuous and fast calibration of the CMS experiment

Design of the automated workflows and operational experience

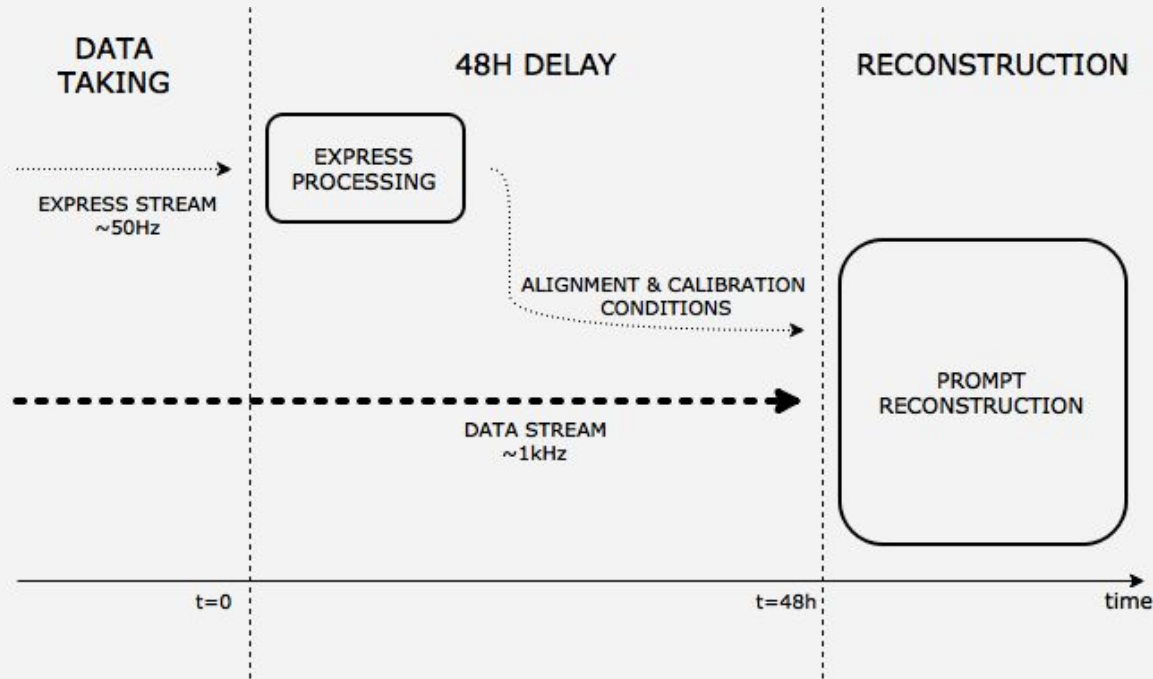
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on behalf of

CMS Collaboration

Prompt calibration concept and data processing



Alignment & Calibrations run promptly

What we do:

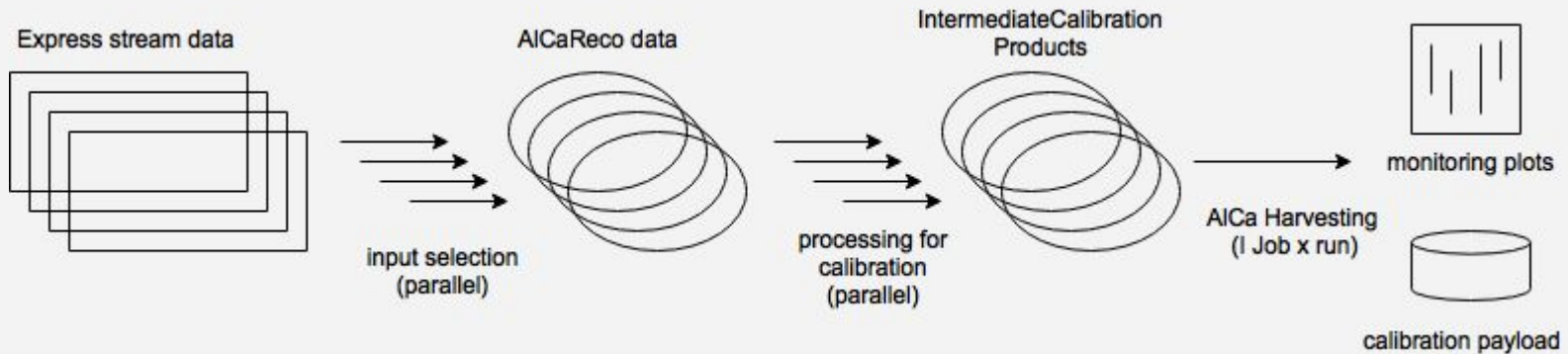
- fit of the luminous region position and width (using tracks)
- identification of Silicon Strip tracker problematic channels
- determination of charge gains of the Silicon Strip tracker
- track-based alignment of Silicon Pixel inner tracker mechanical supports structures

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 n -th run allows to apply them on the same n -th run in prompt reconstruction



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

1. Discover new data when it is available through Run Registry (an external service)
2. Get further information about the data from DBS (Dataset Bookkeeping System) and Tier0 API
3. For runs with the same properties create exactly one multi-run
 - Ready when $n_{events} > threshold$

Complications:

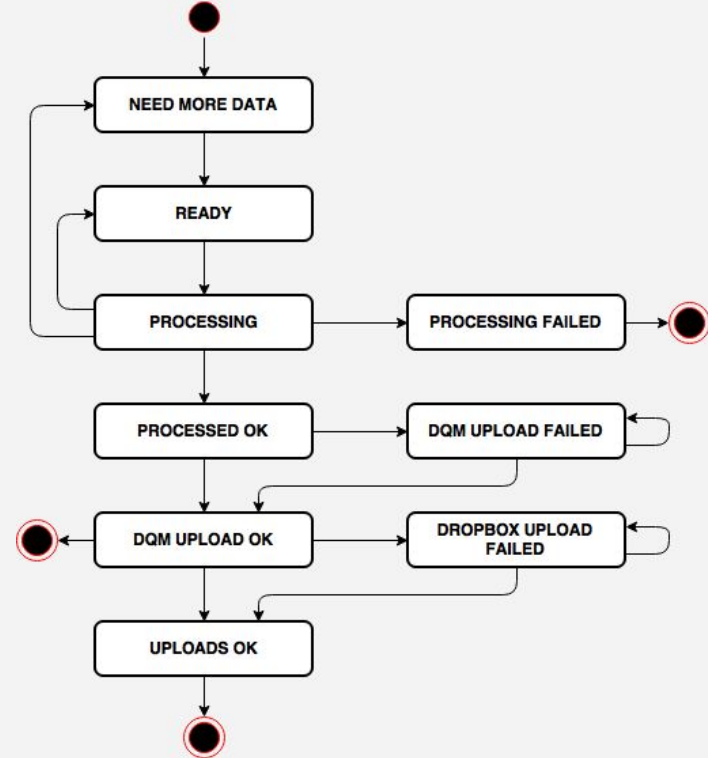
- Processing does not have to produce the alignment and calibration constants - multi-run has to be extended then
- Runs data differ in length - do not always arrive in the same order as produced by detector

The State Machine

Multi-run processing flow control

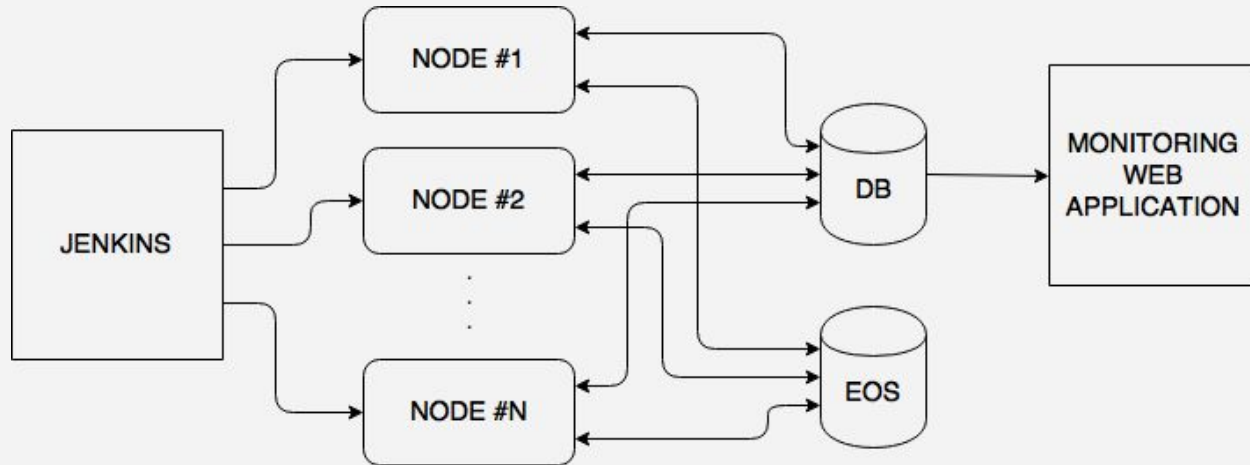
Supports implementing resilience by:

- Retrying processing in case of failures
- Easy process monitoring
- Running independent multi-run computations in parallel

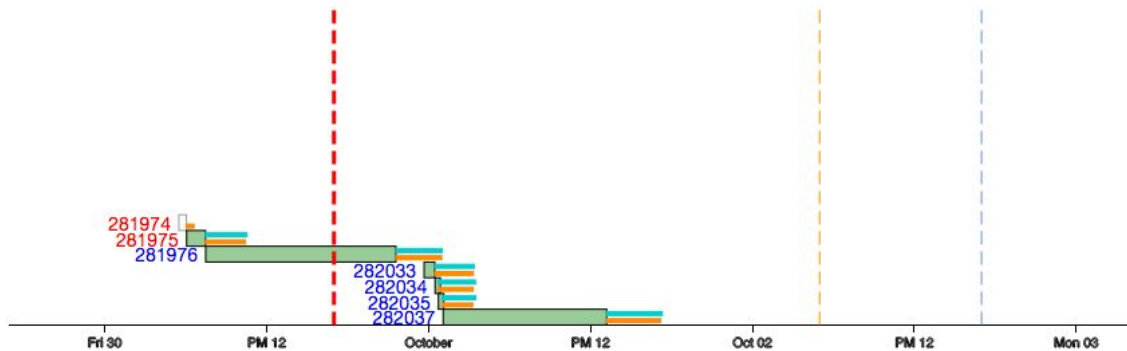


Multi-run harvesting architecture

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.

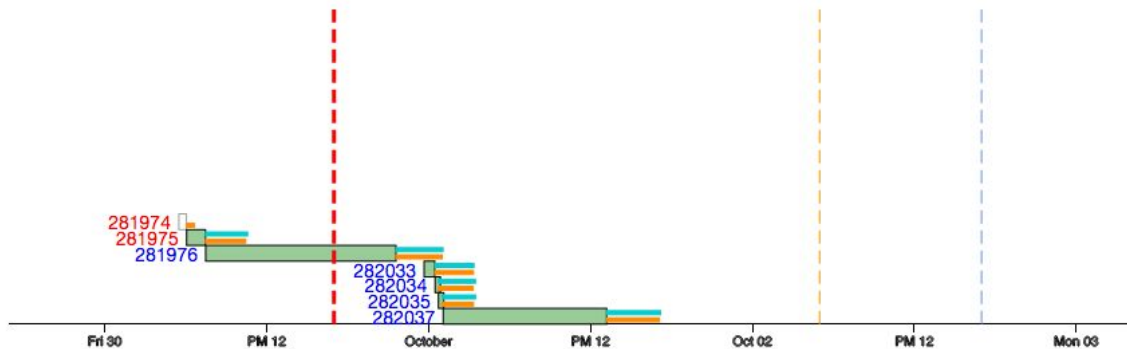


Problematic runs:



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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