FNAL Intensity Frontier Workflow
Management
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DUNE Computing
Oct. 9, 2018
Workflow management for the IF experiments

• In the past Fermilab Intensity Frontier experiments generally hacked together their own solution for workflow management
  – Problems with support, extensibility, etc
• We aimed to implement a common solution that would build on existing tools and be flexible enough for all the IF experiments
• This is POMS - Production Operations Management System
What is POMS?

• The Production Operations Management System (POMS) is a workflow management system designed to provide a service to assist production teams and analysis groups of experiments in their MC production and data processing.

• POMS provides a web service interface that enables automated job submission on distributed resources according to customers’ requests and subsequent monitoring and recovery of failed submissions, debugging and record keeping.
• Has to be flexible enough to accommodate different workflows of different experiments
• The focus has been on Fermilab IF experiments, so some aspects are oriented to their needs
  – In particular, data management is based on data-to-jobs, and a SAM catalogued centralized data store
  – Outside Fermilab, mostly opportunistic usage; few sites store data locally
• A note on terminology
  – Everyone uses terms like “campaign” in different ways
  – A POMS campaign is a specific experimental workflow
• Based as much as possible on existing services

• Batch jobs are submitted via Jobsub tool
  – GlideinWMS/HTCondor runs the jobs
  – Since there are multiple experiments this must be done with the correct credentials
  – A custom submission script is normally required (set up the experiment specific environment)

• Primary data source is FIFEMon for job info, SAM for data locations
  – Does not track batch job state info independently
  – Minimize duplicated info
Experimental Workflow – Set Of Stages/Steps

Simulation
- Event Generation
- Physics Interactions
- Detector Response

MC Production

Data Processing

Workflow variations

Example

(Gen+G4+Detsim) + Reco + Mergeana
Experimental Workflow into POMS

Experimental workflow
(Gen+G4+DetSim) + Reco + Mergeana

POMS Campaign
mcc9_gen_G4_detsim_protoDune_beam_cosmics_p6GeV
Submissions 1 Located 1

mcc9_reco_protoDune_beam_cosmics_p6GeV
Submissions 2 Located 2

mcc9_mergeana_protoDune_beam_cosmics_p6GeV
Submissions 2 Located 2
• Query, view and edit the experiment’s campaigns.
• Controlling/monitoring the campaign from this form is coming.
• Edit/view the entire campaign from one screen.
### Campaign Stages

<table>
<thead>
<tr>
<th>Select</th>
<th>Campaign Name</th>
<th>Campaign Stage</th>
<th>Active</th>
<th>Hold By</th>
<th>Creator</th>
<th>Created</th>
<th>Updater</th>
<th>Updated</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>mcc11_RITM0719099</td>
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<td>kherer</td>
<td>2018-09-22 00:18:33</td>
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</tbody>
</table>

- List of stages comprising a specific campaign.
- Selecting a stage will provide details, actions and status for that stage. (Shown in next slide.)
Reports and actions for a specific stage are available from this page.
The same page also provides access to other detail data, such as log files, jobsub status and timebar plots.
POMS uses campaign stages to generate SAM datasets and job submissions to:

- launch keepup jobs periodically
  - via cron functionality
- launch next partition of large campaigns
  - dataset splitter code generates subsets
- launch submissions in dependent campaigns
  - dataset of select generated child files
- launch recovery jobs for submissions
  - dataset of unprocessed files, etc
- Job Types specify how many recoveries to try
- The Shifter's report lists summary data on all campaigns/stage submissions which have been run in the past specified timeframe for the indicated experiment.
- Shifters can drive down further on individual stages for more detail.
Currently handling up to 80k submissions = 6 million jobs per month for 5 active experiments / about \( \frac{3}{4} \) of non-CMS production computing at Fermilab.

With our latest release, we think POMS could easily handle at least another factor of 20 times as many submissions.
Analysis users

• Currently only production jobs
  – Limited set of users

• Would like to extend to analysis jobs
  – Lots of users
  – More complex authentication/authorization
  – More variety in tasks (but probably simpler workflow)
  – More user friendly interfaces (but production users probably want that too)

• Some development work required
Future:

- Continuing to improve the capacity and adapt to experiment requirements

- Improve integration with data management and Rucio as FNAL moves to that.
  - Broader variety of approaches: not just sending data to jobs, but jobs to data, and a mixture of both