Tevatron Run II Data Preservation, Part II

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Outline

- D0 Activities through 2016
- Job submission at D0 after 2016
- D0 software validation on future DP platform
- CDF and D0 data access
- Future CDF and D0 database access and potential issues

D0 Preservation Activities to 2016

- First period of D0 DP Project: Shutdown (2011) + 5 years
- Two main goals of this phase
  - Maintain full analysis capability in current forms
  - Complete documentation preservation
- Aim to confirm that analysis capability for first period has no major issues after minor software changes ☐
- Goals for documentation preservation include:
  - Move internal notes and memos to INSPIRE ☐
  - Move meeting agenda server to Indico ☐

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D0 Job Submission post-2016

- D0 has a PBS-based job submission system
  - Almost all user analysis jobs to go a Central Backend (CAB) managed by FNAL or Linux cluster at D0 (contrib. from all institutions)
  - Some MC production runs on the Grid
- As machines are retired and resources dwindle, we must find an alternative
  - D0-specific/custom systems no longer an option
- Considering two options: GRID-based submission system, or virtual CAB-like machines hosted on a FNAL-centric cloud (dynamically spawned by scheduler?)
  - Pros and cons to both
  - Plan to converge and be testing new system by end of year

D0 Software Infrastructure

- Goal is Level 4 preservation; ability to do full analysis + generate specialized MC if needed
- After 2016, requires full chain to work on a future OS (SL6)
- Current software release is already built in SL6
  - Most machines are running 64-bit OS now; though framework will remain 32-bit
- D0's plan is to bring along any needed compatibility libraries within software release (rewriting everything for native SL6 compilation is a large and at present unnecessary effort)
- **Have verified that there are no issues with building and running release software and common analysis tools within SL6**

Software environment within jobs

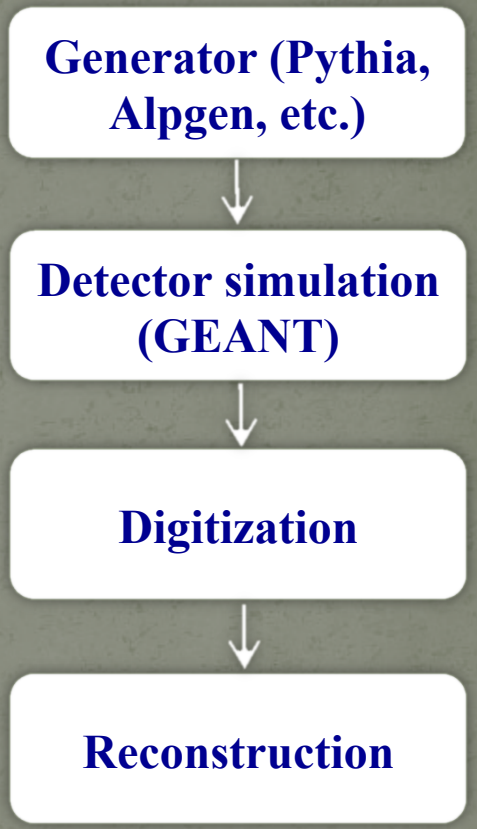
- Need to ensure that all necessary runtime environment products available on worker nodes
- **Exploring CVMFS for this purpose**
- Have test server set up at FNAL
- Lots of attractive features:
  - Easy for a user to set up client at home institute,
  - Less memory/disk space intensive on worked node (only grabs what it needs)
  - Can draw on support from other users
- D0 framework and scripts may have many hidden hard-coded paths or certain expectations for file locations
  - A few strategically placed symlinks should do the trick

D0 Analysis Software Chain Validation

- Some things will have to change after 2016 (computing resources, databases—more later)
- How can we be sure that the full software chain works?
  - Two aspects to test: MC chain and user analysis chain
- Have had robust validation suites for MC chain and reconstruction software for many years, will continue this
  - Could be run when there is a future OS or 3rd party product (e.g. Oracle) change
- Have a common Ntuple format for most physics groups; ensure that D0 software at least works up to creating these tuples

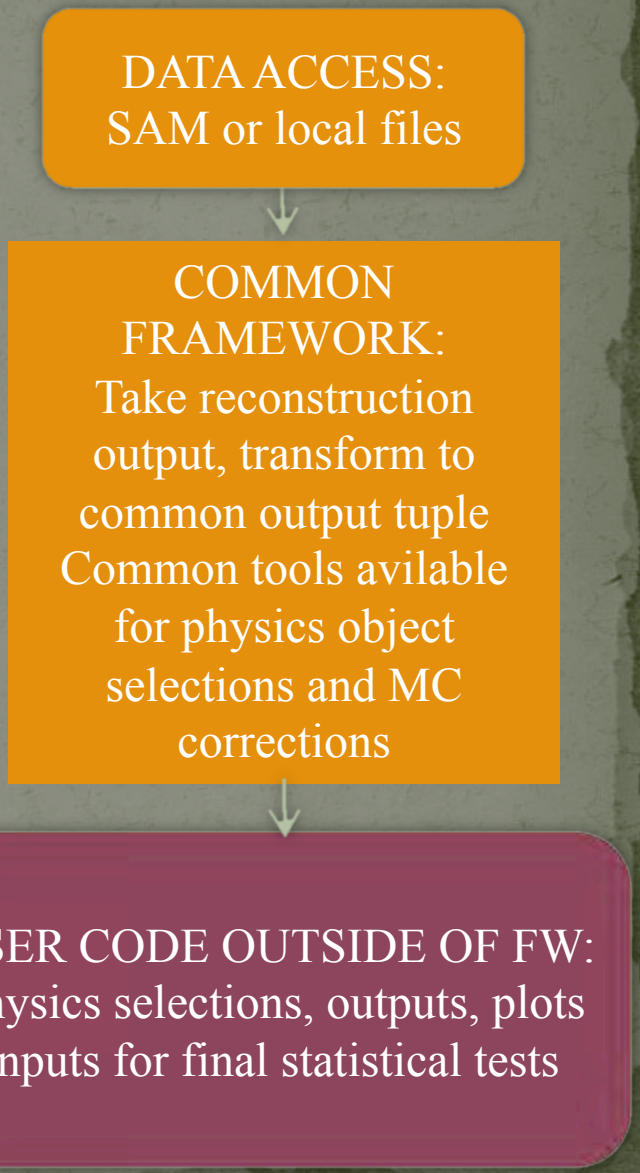
MC Software Chain Validation

- Four steps to MC production
- Critical to retain this capability
- Existing software has been verified to run on SLF6 machines (within D0 release environment)
- Support for newer generators and/or PDFs available (can run GEANT and onward with any LHA-formatted generator output)



User analysis chain validation

- Steps in orange: all code in CVS; DP project will guarantee that they work
- Purple: outside of project scope; has always been user's responsibility
- So far, we have verified reconstruction software, and processors in common framework work with SL6 (tested by comparing SL6-based output to SL5 on same files)
- Additional user code(s) may be incorporated into validation if requested by physics groups
- Note: some care required to make sure 32-bit libraries installed as needed



But that's not all…

- Computing resources, data access, analysis software only part of the story
- DOCUMENTATION Preservation is crucial
  - Internal analysis notes
  - Technical memos
  - Howto webpages
  - Detector and data taking conditions (logbooks, etc.)
  - Wiki pages (cover analysis, detector, algorithms)
- Records of discussions can be equally important
  - Mailing lists from physics and algorithm groups
  - Editorial Board discussions
- All of these are within the project's scope

Documentation

- Lots of progress here
- Internal Notes, Agenda server: moves completed
- Detector/online info: Migrating logbooks and DBs to supported software (read-only in some cases), underway
- Analysis documentation
  - Common frameworks: plan to consolidate documentation, provide concise tutorial
  - Validation analyses: work with physics groups to provide step-by-step instructions (extensible to users' own analysis) on how to run from beginning to end
- Mailing lists/discussions: catalog everything to be saved, work with FNAL listserv admins to make sure everything is ported to any future system (probably read-only)
- Wiki: convert to static pages once need for write access is gone

To INSPIRE and Indico

- Over 6,000 Inernal D0 notes and technical memos
  - Worked with INSPIRE technicians on login authentication system
  - Most will eventually be made public
  - More than 2,000 older notes did not exist electronically; large effort to scan them
- D0 agenda server was CDS-based
  - All items (18,000) moved to Fermi Indico
  - Challenges to convert some event records to suitable format (due to handling of special characters in record names)

Tevatron Data(Base) Access

Data Access

- Both CDF and D0 use SAM (Sequential Access via Metadata) for data access/file delivery to jobs
- System has served us well to this point, but:
  - Lots of complicated middleware and C++ APIs
  - No security
  - D0 example: uses CORBA middleware for access, some dated/unsupported 3rd party products, C++ interface
- Expect support for existing infrastructure to end in 2015, but SAM itself will continue for Intensity Frontier expts.
  - Files declared for Tevatron expts. will remain available
- CDF and D0 both need to update their SAM interfaces before this date

Data Access (2)

- Goal: leverage services developed for Intensity Frontier experiments
  - Modify our existing and/or incorporate new IF software if possible
- IF experiments using http-based infrastructure with SAM
  - No dependence on middleware/3rd party products
  - Security and portable C++ API available
  - D0 has already modified software release to use this functionality; tested and validated, side-by-side with traditional system (one extra command line option for the user on job submission)
  - CDF following suit soon

Plans for databases

- Both experiments need databases for data access (file metadata at CDF) and MC generation (detector calibrations, luminosity information, etc.)
- Most of these are Oracle-based DBs
  - Coming up with alternatives next to impossible given financial and personnel constraints
- Oracle versions now ~current, but what about in 2020?
- Oracle version may not be entirely within project's control
- Part of the validation suite needs to test DB access, find out if something breaks
- What if DB access breaks due to an Oracle version change?
  - **By far the biggest potential issue in the project!!!**

Database contingency plans

- What if something DB-related breaks at some point?
- First attempt to understand problem and effort required to fix on the experiment side
- If effort too great, could "freeze" Oracle at earlier version
- Could introduce security issues; would perhaps have to firewall system in some fashion
  - Unfortunately it isn't really an option to eliminate Oracle entirely at this point

Some Lessons Learned

- Document and date everything!!! Often tedious, but saves a lot of duplication of effort down the road
  - Keep the documentation up to date, and remove obsolete material, or at least mark it as such
- Enforce common coding practices and file formats wherever possible across the experiment, and don't rely on a specific version of a 3rd-party product if possible
- Constant validation of code with robust suite very advantageous
  - D0 has had excellent test suites for new software and MC releases for many years
  - Should weigh efforts required to change ifrastructure if needed against benefits of extending useful life of your expt (not always clear in short term)

Summary

- Tevatron experiments' preservation projects both progressing well
- Good progress on software verification through to 2020
- Developing plans to ensure continued ability to access data and run jobs in absence of experiment-specific resources in a few years' time
  - Adapting data access to leverage Intensity Frontier resources
  - Will also use IF resources where possible at FNAL in future job submission infrastructure
- Largest issue is future database access; developing contingency plans