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
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 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
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
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)
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

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**DATA ACCESS**: SAM or local files

**COMMON FRAMEWORK**: Take reconstruction output, transform to common output tuple
Common tools available for physics object selections and MC corrections

**USER CODE OUTSIDE OF FW**: Physics selections, outputs, plots
Inputs for final statistical tests
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
• 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
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
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
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 infrastructure 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