

ICARUS Analysis

Production and Resource Management

Tracy Usher (SLAC) ICARUS Collaboration Meeting October 14, 2024

Overview

- Continuation of a discussion started at the recent SBN Workshop
 - See Giuseppe's presentation <u>here</u> (much here borrowed from that!)
- General idea here is to briefly present some baseline information:
 - Overview of Release Management
 - Overview of FNAL resources
 - Overview of the Production system
- Then move to a list of potential discussion topics
- Bottom line: we need to have a discussion on how to solve current problems/issues in order to successfully achieve future analyses

Release Management

Brief Reminder of ICARUS Software

- Detailed presentation at last collaboration meeting <u>here</u>
- Hierarchical structure to code:
 - $\circ \quad \text{Dependencies} \rightarrow \text{LArSoft} \rightarrow \text{SBN code} \rightarrow \text{ICARUS code}$
- ICARUS maintains four code repositories in github
 - icarus_signal_processing, icarusalg, icarusutil, icaruscode
- Generally manage the code along branches
 - Code development meant to be solely along the main develop branch
 - Production running meant to be on production branches which are "maintained"
- The main develop branch is meant to be frequently updated to keep pace with LArSoft "keep up" releases

Brief Reminder of Github tools

- Not only does Github provide a nice code repository, it also...
 - Provides Wiki pages for documenting our code (current icaruscode wiki)
 - Provides "Pull Requests" for integrating code updates into branches
 - With extensive ability to document, test, etc.
 - Provides "Issues" which are useful for
 - Reporting and tracking bugs in the code
 - Future planning (see Projects)
 - Provides "Projects" for overall management
 - Can track issues, pull requests, set timelines, etc.
 - Powerful tool which is underutilized by us
- The bottom line:
 - Github provides a rich set of tools for managing our code and releases
 - We do not need to supplement with external tools, rather we need to fully exploit the provided tools!

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20 O Move to Refactored LArG4 #684	鲗 bear-is-asleep, cer.				SBNSoftware/icaruscode		

General Comments on Release Management

- Matthew Rosenberg has done excellent job as release manager!
 - But he is leaving us and we need to a replacement ASAP!
- Github provides excellent tools for managing our releases
 - Code repository, Pull Requests, Branching, Issue Tracking, Project Management, Wiki, etc.
 - We need to make better use of them!
- In the past we have not been as disciplined in production releases as we need to be
 - \circ \quad We did not have an official branch for production this year
 - We have had issues with using different code releases to run simulations
 - A recent example used different detector simulation fcl files which led to significant differences when comparing the two samples
- We need to correct this going forward (see discussion)

Resources

Current FNAL Resources

- Disk Space
 - 2 PB in data pool 1, 1 PB in data pool 2 shared with SBND
- Tape Allocation
 - Currently ~36 PB of which we have used ~28 PB (with some caveats)

• FermiGrid Allocation

- o 2000 "slots"
 - 1 CPU with 2GB memory
 - Slots allocated by memory needed, e.g. 8 GB memory request requires 4 slots
- \circ 50% of allocation given priority to the "icaruspro" account
 - "Keep up" data processing, production jobs
- Can exceed quota if FermiGrid is otherwise idle
- Can run "opportunistically" on the Open Science Grid

Monitoring

There is a nice summary grafana page here

CPU Wall clock time

- "Production" is from production team

- "Analysis" is from users

Disk Space Usage - Orange is pool 1 (2 PB quota) - Blue is pool 1 (1 PB quota)

Tape Usage - As of this month just over 28 PB!



Disk Space Used by Pool Group





Monthly Wall Time

Other Resources

- CNAF
 - Current disk space allocation is 1.6 PB
 - Using just under 1.3 PB now (including Run 1 data on disk)
 - Tape Allocation is 4 PB to keep a second copy of ICARUS beam data
 - Using just under 2.5 PB now
 - Computing Allocation is 3.5M CPU hours
 - Generally, CNAF can be utilized for smaller scale and/or specialized productions

• SLAC

- Using GPUs there to process SPINE reconstruction
- NERSC
 - \circ $\hfill Have standing allocation for CPU time but not disk space$
 - Need demonstration of ability to run icaruscode at this site?
- Polaris
 - U Chicago has an allocation for processing including 3 PB of disk nominally for SBND
 - But could be considered SBN resource?

General Comments on Resources

• Data on disk at FNAL

- Data pool 1 (2 PB) has ~150 TB free, data pool 2 (1 PB) has ~300 TB free
- Breakdown:
 - 0.8 PB for recompressed Run 2 raw data with the rest taken by
 - Stage0 (ICARUS)/Reco0(SBND) and Stage1/Reco1 artroot files needed by analyzers
 - CAFs/FlatCAFs, Calibration tuples and SBND commissioning data
 - Shared with SBND yet we are dominating usage!
- Estimate the Run 3 raw data (already compressed) at ~0.5 PB
- Primary problem:
 - Currently ICARUS simulation Stage 1 artroot output ~300 MB/event
 - A 10M v+cosmics sample would fill entire disk allocation!
- How to address?
 - Can the Stage 1 files be "slimmed" enough to work?
 - Can we convert to CAFs as final output of production?

Production

Production Team Organization



A Few Tools Used By Production Team

- POMS (Production Operations Management System)
 - A software package allowing "production teams and analysis groups across multiple Fermilab experiments to launch, modify and monitor large scale campaigns of related Monte Carlo or data processing jobs"
 - It can be fairly complex to operate... but is generally stable now
- RUCIO
 - Transfer of daq data to CNAF for archiving to tape
 - Transfer of larcv format data to SLAC for running ML processing on GPUs
- Github
 - Hosts wiki pages that collaboration members can access to submit and view requests
 - Hosts Project page for tracking various requests, issues, etc.

Basic Workflow for Production



https://sbnsoftware.github.io/sbn/sbnprod wiki/Wiki SBN Production Sample Request tracy.usher@gmail.com Switch account \odot 🔉 🥜 Improve this page * Indicates required question Email * SBN Production wiki Your email Wiki for SBN Production DATA, MC or Other (ex. Overlays)?* O MC O DATA O Other: Production Guidelines for SBN-wide Data and MonteCarlo Production Available Samples Name/tag of the request * Production Sample requests Production Monitoring Your answer ICARUS data Keepup processing 100 Contributing to this wiki SBN Production Page Here you will found how to make production sample requests as well as (comming soon) instructions and documentation Production Guidelines for SBN-wide Data and MonteCarlo Production The SBN Production Guidelines document outlines the SBN-wide production process, which governs produc on and data processing for SBN joint and individual SBND and ICARUS analyses. Comments can be added to the document or brought to your gro **Available Samples** A table with information about the official available samples can be found at the SBN Prod n Available Samples Page **Production Sample requests** The SBN Production Group is reponsible for MC sample productions for SBND and ICARUS, as well as eventual Data processing. To submit a request to production, please fill for SBN Production Request Form responsible parties should be automatically notified but you can official group email address: sbn-mc-prod@fna The form is also a checklist of the needed information. If you need help answering any num s on the survey, please contact your gro and/or production group conveners. Status of open requests can be checked at the SBN Production Requests Databa answers to the form. **Production Monitoring** SBN Production Wiki has a number of useful links.

not only for submitting production requests but also

for available data sets, monitoring, status of

processing, etc.

Production requests are submitted through the SBN request form so the shared resources can be managed between SBND and ICARUS.

This also enables the production team to assign production requests according to priority and availability of campaign managers.

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	trai.gov	New compression	Reprocess all Run2 RAW data on disk and replace with files produced with the new compression algorithm	ICARUS	AL	Giuseppe Cerali (ceratid?tnal.gov)	45331	3	icaruscode v09_82_02_01	compression
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				 So, wrote to Daniel and he in RUCIO is turned off. 	formed me that SLAC people are doing some debugging tests v	vith RUCIO and that's the reason			
				5. This means RUCIO will get to	rned ON and OFF till the time they do tests with it.	tests and PLICIO is up and			
				running properly.	iz reprocessing campaign when SLAC people are done doing an				
			 ⊘ request #70 #40 ⊘ request #71 #41 	7. Latest update: Daniel told m 8. I am done running the stage	iel told me they will not shut down ours anymore. I will run a test campaign again to confirm it. the stage0 for all the datastreams, the next step is to run stage1_caf_larcv which needs RUCIO to run				
			⊘ request #72 #42	property on SLAC.					
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		23	⊘ request #14 #3	Dan confirmed that we can keep	the larcy files in Fermilab and then he will transfer them to SLAC	C. So, I will start doing this by			

General Comments on Production

- The Production Team are well organized and utilize an excellent set of tools to enable production requests, track progress, track issues, etc.
- There have been issues encountered this past year impacting production:
 - POMS has had setup, AL9 upgrade, support, etc., issues in last year 0
 - Hopefully crossing the line now
 - The RUCIO connection to SLAC was having stability problems (better now) Ο
 - Disk space constraints impacted campaigns (and continue to be an ongoing problem) Ο
 - Many problems require expertise in highly specialized areas to diagnose and address issues Ο
 - etc. 0
- Given constraints production team has done good job to get a lot processed!
- Biggest issue currently is need for more people to get involved here
 - In particular, we will lose Promita (who has should red much of the load) at the end of year Ο

Discussion?

An Unordered Incomplete List of Discussion Topics I

- General need to staff Release Management and Production
 - See Bob Wilson's presentation on Wednesday
- Release Management
 - Need to do better job of branching our code for analysis
 - Need to do better job of documenting our releases
- Production cycles
 - Currently large production cycles are not tied to regular timelines, tend to run "when ready"
 - Typically try to set a target date but let that slide as we address issues
 - This can result in smaller "ad-hoc" productions from different releases
 - Proposal from Giuseppe to move to a regular production cycle system
 - Regular schedule of release planning, CI validation, then data/MC production
 - If code integration issues then leave out to next cycle
 - Can track things with Github tools

An Unordered Incomplete List of Discussion Topics II

- Disk Space Management
 - Do we want to store Run 2 and Run 3 raw data on disk to facilitate reprocessing?
 - For how long?
 - Do we need to keep Stage 1 output on disk?
 - Yes: how can we slim to get to acceptable output size?
 - No: Are CAFs ready to be the final analysis product?
 - Available disk space is shared with SBND
 - Should we consider utilizing potential external resources?
 - Polaris, NERSC, SLAC, etc.
 - Potential data transfer issues? (e.g. RUCIO uptime at SLAC)
 - Data access issues if offsite?
 - Coordination with the SBN AI group critical
 - In particular we need common solutions with SBND