M&O — Change Management
Technical Change Control and Procedures

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NSF Mid-Term Review
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IceCube
South Pole Neutrino Observatory

NSF

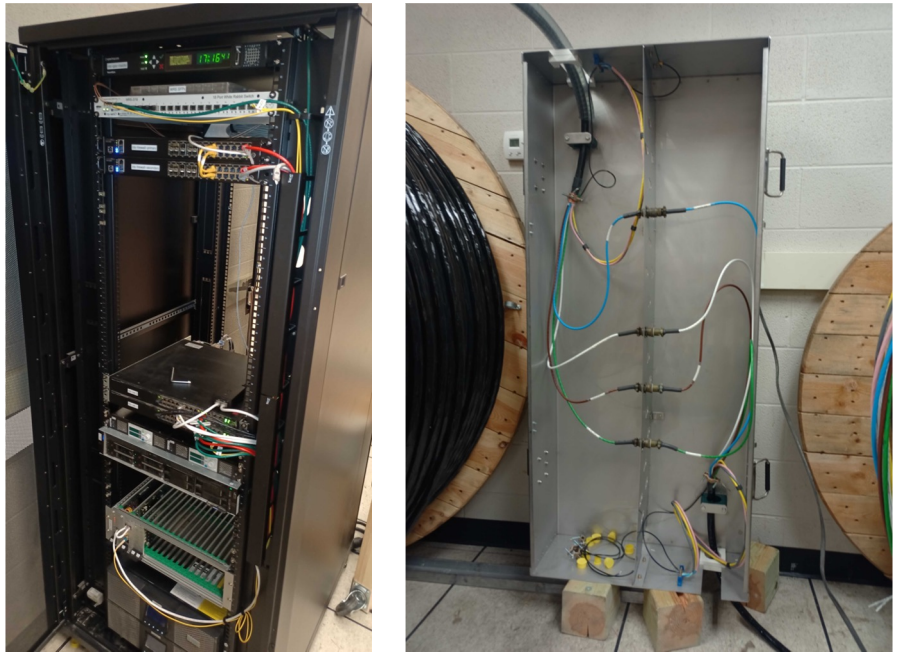
Deliverables

Provide stable and well-understood hardware, software, and detector configurations via:

- Effective change control, testing, and release procedures
- Well-defined operations procedures providing oversight and ensuring data quality
- Detector configuration change review and management plan that balances the needs of science working groups and operations team

Testing Resources

SPTS test setup - computers, “string” of DOM mainboards



NTS - Upgrade cabling systems

South Pole Test System (SPTS)

- scaled-down replica of ICL hardware and software
- small number of real DOMs, full string of DOM mainboards
- ability to “replay” hitspool data through entire system

Northern Test System (NTS) - Upgrade

- Upgrade-specific test site for hardware/software validation
- Will host all types of Upgrade hardware modules deployed
- Seamlessly integrated into SPTS - Gen1+Upgrade integration testing

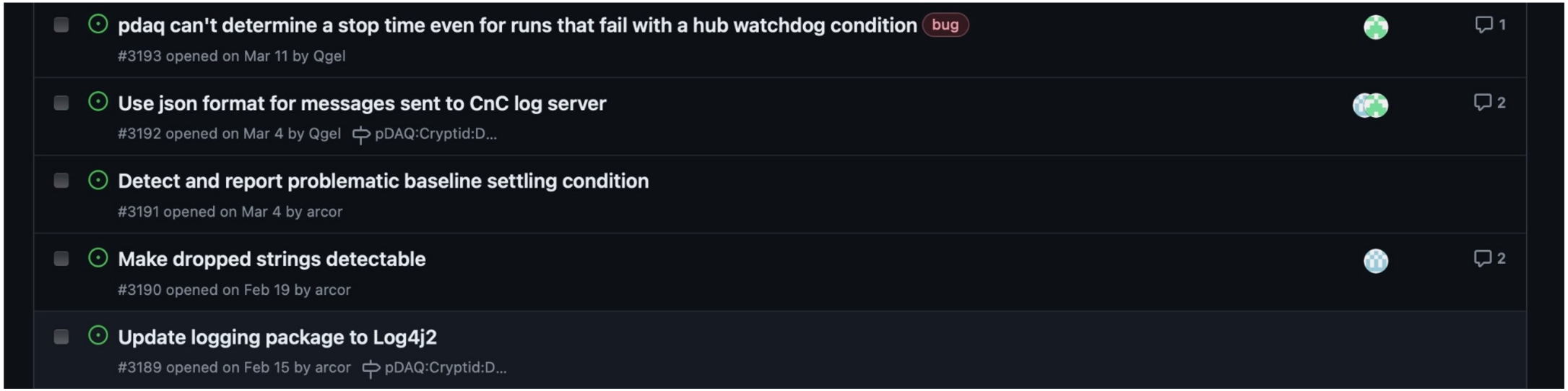
- **PSL Cable Test System (PCTS)**
  - Full-length Gen1 cable for communications testing
- **PSL Modular Dark Freezer Labs (mDFLs)**
  - Walk-in freezers for hardware cold-testing

Hardware Procedures

- Candidate hardware always installed first at SPTS/NTS
  - Full system testing using replay data
  - Validation and documentation of upgrade procedures
- Testing coordinated via operations group
  - Important/impactful upgrades presented at collaboration-wide teleconferences
- Hardware upgrades at pole typically staged
  - e.g. 50% server upgrade in 1st year, 50% next year
  - Old hardware typically remains at pole over winter
- All hardware changes recorded to logbook (logbook@icecube.wisc.edu)

Online Software Development

- All source code under revision control (**GitHub** has replaced Subversion)
  - Includes: DAQ, SNDAQ, Experiment Control, Online Filtering System, Data Handling system…
- Bugs / feature development tracked in issue tracking system (GitHub Issues)
  - Track: severity, impact, owner, detailed description, etc.
  - Issue numbers referenced in code check-ins and release notes
- Changes discussed on weekly development teleconferences



Software Testing + Release

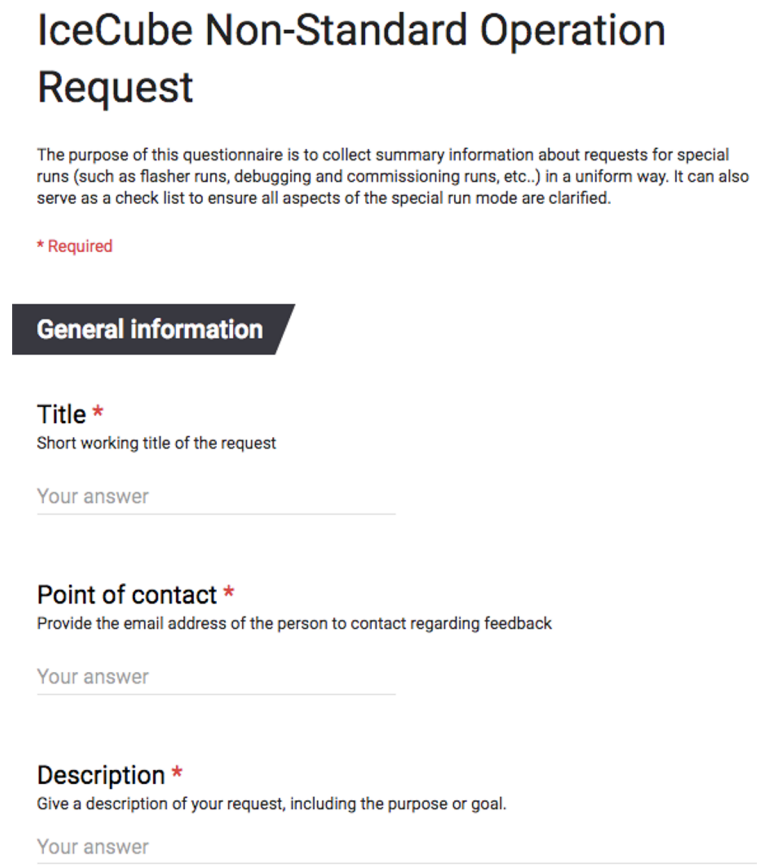
- Testing emphasized in development
  - Unit tests for individual components / functionality
  - Integration and system testing at SPTS
- Releases named, numbered, and tagged in version control system
- All major changes (DAQ, DOM mainboard software, Filtering) reviewed at collaboration-wide teleconference before deployment
- 8- to 24-hour test runs of release candidates at pole
  - Return to previous version until vetted
  - Data quality vetted by operations group

Operations: Day-to-Day

- Non-standard procedures (including software releases) require a **Non-Standard Operations Request** form
  - reviewed / approved by the Run Coordinator (W. Thompson)

- All changes to the detector / online systems recorded in the logbook (logbook@icecube.wisc.edu)

- Changes affecting data-taking also recorded in IceCube Live with associated run number



IceCube Non-Standard Operation Request

The purpose of this questionnaire is to collect summary information about requests for special runs (such as flasher runs, debugging and commissioning runs, etc..) in a uniform way. It can also serve as a check list to ensure all aspects of the special run mode are clarified.

* Required

General information

Title *
Short working title of the request

Your answer

Point of contact *
Provide the email address of the person to contact regarding feedback

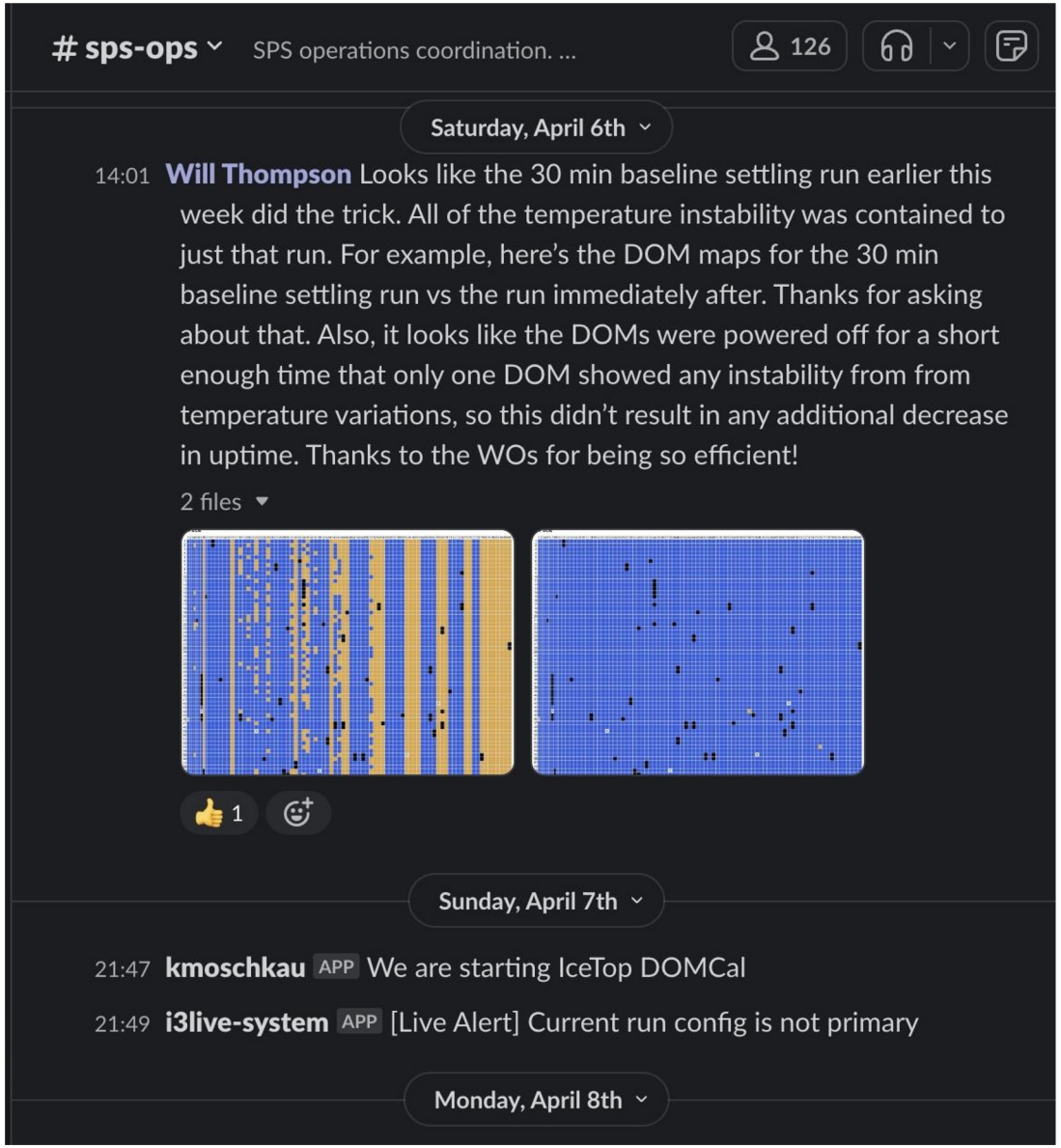
Your answer

Description *
Give a description of your request, including the purpose or goal.

Your answer

138618	2023-11-29 13:03:48	8:00:05	2835.36	-	sps-IC86-2023-slc-triggers-V314	Cyclops1+trig-instr	dark	SR	PP	★★★★★	munland	GOOD	GOOD	+
138617	2023-11-29 05:03:39	8:00:09	2831.90	-	sps-IC86-2023-slc-triggers-V314	Cyclops1+trig-instr	dark	SR	PP	★★★★★	jvara	GOOD	GOOD	+
138616	2023-11-28 21:03:40	7:59:59	2827.39	-	sps-IC86-2023-slc-triggers-V314	Cyclops1+trig-instr	dark	FS	PP	★★★★★	jvara	GOOD	GOOD	1 unfiltered event +
138615	2023-11-28 20:52:12	0:10:42	2828.96	-	sps-IC86-2023-slc-triggers-V314	Cyclops1+trig-instr	dark	FS	PP	★★★★★	wthompson	GOOD	GOOD	baseline settling run IC86-2023 run start new baselines: baselin... new spe corrections: h... new domcals: domcal-20... new noise rates: rates... new i3live: v4.7.2 (Hy... new PnF: V23-11-00 new PnF toolset: pnf-p... +
138614	2023-11-28 14:53:44	5:56:12	2804.20	-	sps-IC86-2022-DM...310-supersaver-2	Cyclops1+trig-instr	dark	FS	PP	★★★★★	munland	GOOD	GOOD	+
138613	2023-11-28 06:52:50	8:00:09	2802.13	-	sps-IC86-2022-DM...310-supersaver-2	Cyclops1+trig-instr	dark	SR	PP	★★★★★	munland	GOOD	GOOD	manually set events an... +
138612	2023-11-27 22:52:40	8:00:10	2802.48	-	sps-IC86-2022-DM...310-supersaver-2	Cyclops1+trig-instr	dark	SR	PP	★★★★★	munland	GOOD	GOOD	+

Operational Communications



- Real-time communications with pole is mission-critical
  - facilitated by Iridium satellite link
  - winterovers can send/receive e-mail 24/7
  - IceCube Live / Slack chat integration for real-time messaging
- Emergency contact list provides mobile phone numbers for subject-matter experts for onsite Winterovers

Run Metadata

- Detector **G**eometry, **C**alibration, and **D**etector status metadata stored in GCD database
  - Mirrored from pole to northern data center
- Calibration results vetted on operations calls before insertion into database
  - Monthly cadence for IceTop calibrations
- Metadata tagged with validity dates
- These data used online and offline for data calibration and reconstruction in data processing, as well as a basis for simulating detector data.

Operations: Week-to-Week

- Weekly operations teleconference
  - Report by rotating monitoring shifter (typically grad student) on data quality
  - Discussion of pending non-standard operations or operational issues
  - Minutes / action items recorded

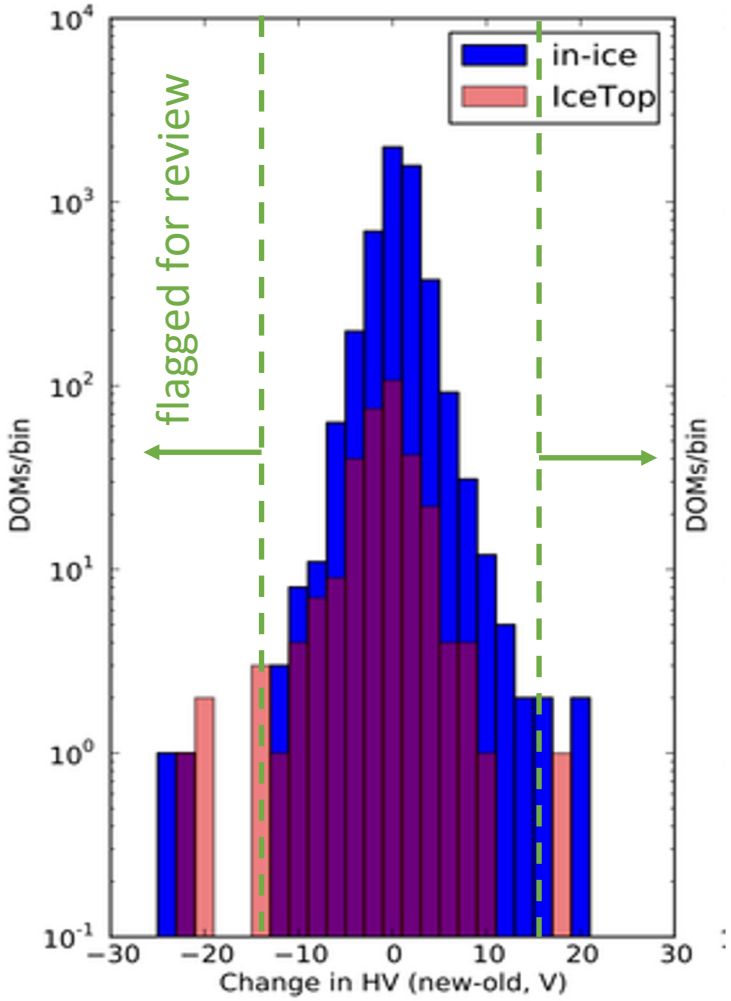
- Review of weekly data quality triggers “Good Run List snapshot”
  - Run coordinator makes final decision on run goodness
  - Recorded in IceCube Live database
  - snapshot triggers further offline data processing
  - Generally, data ready for working group use 1.5–2 weeks after data-taking

Good Run List

131910	GOOD	+
131909	GOOD	baseline settling run +
131908	GOOD	blessed ARA pulsing on 01 and 22 partial I3 +
131907	GOOD	stopped for ARA pulser... new PnF:
131906	GOOD	stopped to update PnF +
131905	GOOD	+
131904	GOOD	+
131903	GOOD	+
131902	GOOD	+
131901	GOOD	+
131900	GOOD	baseline settling run full detector sc
131899	BAD	down +
131898	GOOD	DOMCal IT +
131897	GOOD	DOMCal IT +
131896	GOOD	stopped for DOMCal IT +
131895	GOOD	+

Operations: Year-to-Year

yearly high voltage change



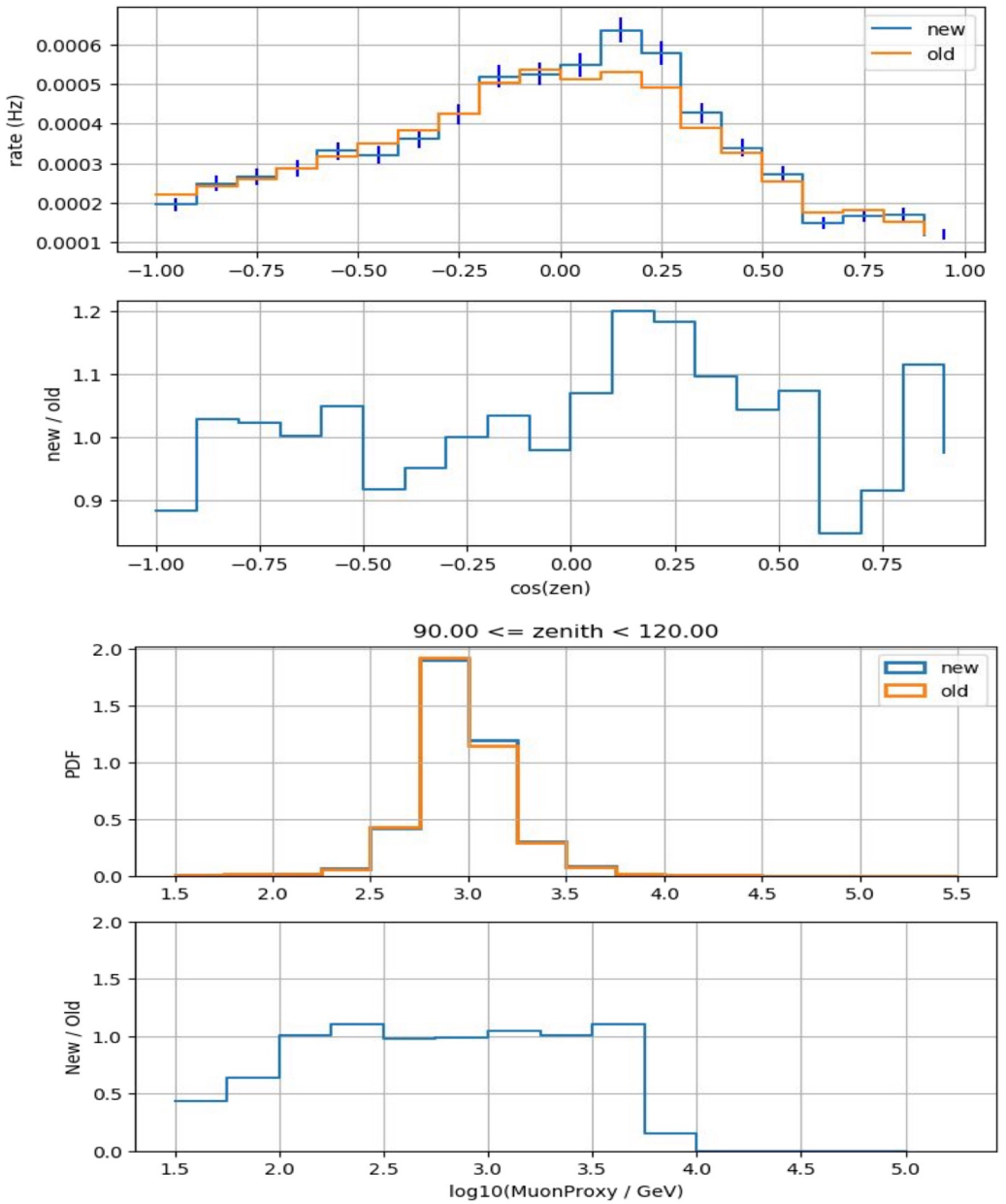
- Major detector configuration is constant for an entire year (physics run)
  - DOM settings (high voltage, threshold, etc.)
  - DAQ triggers
  - PnF filters
- Configuration changes validated with automated tests and review by calibration group
- Configuration XML files are named, numbered, and version-controlled in repository
  - never changed after use in data-taking
  - run configuration information tracked in IceCube Live

TFT Board

- Trigger and filter change requests managed by the Trigger Filter Transmission Board
  - balance competing needs for CPU and satellite bandwidth
- Proposals for trigger / filter changes submitted to TFT for yearly review
  - Science case justification
  - Resource requirements
- TFT presents physics run season plan to collaboration
  - Implemented by operations group
- Move to Pass3 processing online driven by this board
  - Updated Online Filtering proposed, test run taken and vetted, run started Nov. 2023
  - Updates to Offline Filtering in support of Pass3 in progress

Physics Run Start

- Calibration runs performed, vetted, and used to tune configuration
- SPTS used to validate trigger and filter changes
- 24-hour test run data reviewed and approved by working groups
  - Reviewed regardless of major changes to filter selections



Online Point Source Comparison 2022 vs 2023

Summary

- Testing procedures and validation on test systems contribute to high uptime
- Traceable, reproducible data flow in online software and detector configuration
- Operations procedures balance stability with year-to-year flexibility in physics runs
  - Critical for support of continued science expansion

Thank you!

M. Wolf / NSF