

# 2x2 operations update

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# 2x2 status

- Yesterday, for the first time, 2x2 began taking neutrino data with full visibility across the drift volume!
  - Multiple recent cryo breakthroughs to enable good purity + level
- Ramp-up continues today to full nominal HV
  - Full HV previously reached (with dirty argon)
- All systems running smoothly
- Plan is to continue running like this until beam shuts down Thursday night

# Data rates; underground storage

- Data rates (beam physics runs)
  - Minerva: 1.3 GB / 2hr file = 15 GB/day
  - Charge: 250 MB / 10min file = 35 GB/day
    - Should switch to >1 hour subruns to produce larger files
  - Light: 4.3 GB / 5min file = 1.2 TB/day
    - Can be double in beam-off (cosmics trigger) mode
- Underground storage: 70 TB
  - 7 servers (DAQs etc.), 10 TB RAID10 each
  - 40 TB currently available

# Data transfer

- xrootd configured on underground machines
- Recent test: ~1 TB of light data copied by ingestD from daq01, now in Rucio
  - DUNE\_US\_FNAL\_DISK\_STAGE, FNAL\_DCACHE
- Ready for continuous Rucio operations?
  - ~250 MB charge files a problem? Merge them?
- Data also being rsync'd directly to NERSC
  - Prompt processing, short-term backup
- Policy: Delete data from underground after verification of Rucio and rsync copies

Backup

# DAQ

- Each subsystem (charge, light, MINERvA) has its own DAQ software with a dedicated machine underground:
  - Charge: crs\_daq, built on larpix-control (Python)
  - Light: afi-daq (custom C++ DAQ from developers of readout HW) + Python control server
  - MINERvA: minervadaq (C++) + mnvrncontrol (Python)
- Combined run control software for coordinated run start/stop
  - Each DAQ responsible for starting/stopping subruns

# Underground services

- Various DBs (PostgreSQL, InfluxDB, Prometheus) for slow controls, server monitoring, data quality monitoring
- Services that fill the above
- Grafana for the above
- Mostly in Podman containers
- noVNC remote desktops for things that aren't web-based (Ignition, camera)

# Data flow

- Charge/light data continuously copied to NERSC via rsync loop
  - Enables low-latency prompt processing (nearline DQM plots, etc.)
  - These files are temporary; long-term replicas to be Rucio-managed
- All 3 systems able to produce MetaCat-compliant metadata
- xrootd server on charge DAQ machine recently tested (for ingest daemon)
- Plan is for all 3 data streams to go through MetaCat and Rucio
  - Replicas on dCache and at NERSC
- Tuning subrun lengths to ensure file sizes good for tape system



# Nearline processing

- At NERSC, rsync'd charge/light files automatically run through series of prompt processing stages
  - Calibrated files for analysis
  - Nearline DQM plots (available on NERSC portal)
- MINERvA running nearline jobs underground
  - Gaudi-based, SL7 container (porting to AL9 planned)
  - Plots pushed to Grafana

# Runs / conditions DB

- Schema has been defined to enable matching of subruns across the 3 systems
- Also included: Slow control summaries, detector/DAQ configuration, etc.
- DB-independence via sqlalchemy. Currently sqlite. Eventually postgres (DUNE ConDB)
- Scripts aggregate data from slow controls, DAQs etc. to produce JSON blobs for upload to UConDB'
  - Currently read blobs off disk, fill sqlite
  - Eventually read them from UConDB, fill ConDB