

Computing Consortium Organization

H Schellman

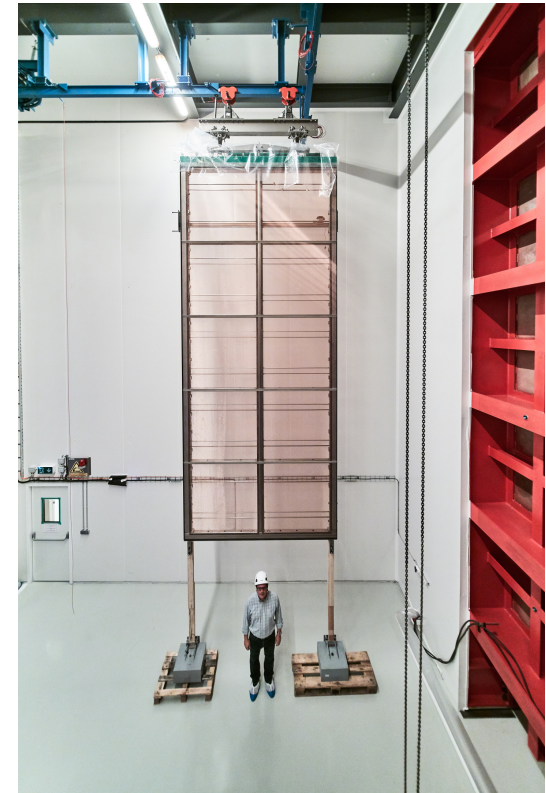
December 14, 2021

What problems are we trying to solve

- LAr TPC's have very large trigger records (200 MB for protoDUNE vs. < 10 MB for ATLAS/CMS)
- possible SuperNova -> 460 TB of data
- New detector technologies
- Many subsystems in ND
- We're supposed to use 75% non-DOE computing

LAr TPC data volumes

- The first far detector module will consist of 150 **Anode Plane Assemblies (APAs)** which have 3 planes of wires with 0.5 cm spacing. Total of **2,560 wires per APA**
- Each wire is read out by 12-bit ADC's every 0.5 microsecond for 3-6 msec. Total of **6-12k samples/wire/readout**.
- Around 40 MB/readout/APA uncompressed with overheads → **6 GB/module/readout**
- 15-20 MB compressed/APA → **2-3 GB/module/readout**
- Read it out ~5,000 times/day for cosmic rays/calibration → **3-4PB/year/module (compressed)**
- **VD modules are similar -> longer drift**
(x 4 modules x stuff happens x decade) =



1 APA – 2,560 channels
150 of these per FD module

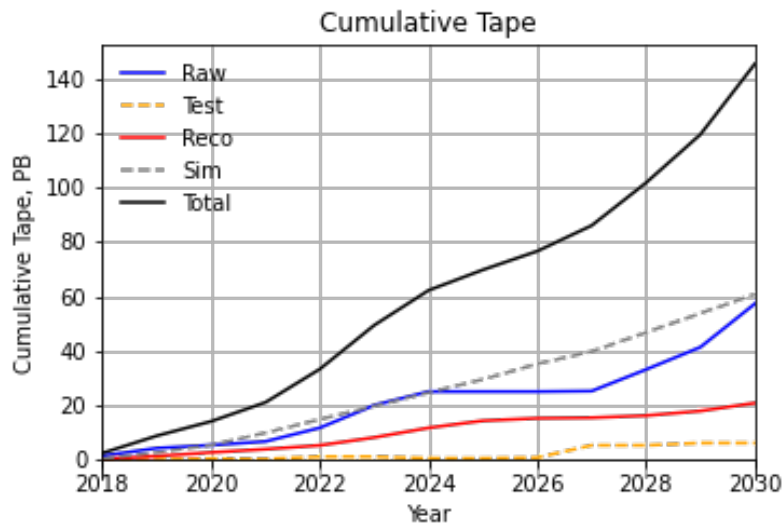
DUNE FD-Data for Supernova



Pack 150 5 ms APA readouts
into a 6 GB file

Ship 20,000 time slices (x 4 modules)





CDR - Resource estimates to 2030

2 copies of raw data on tape (6 months on disk)

1 copy of "test" data stored for 6 months

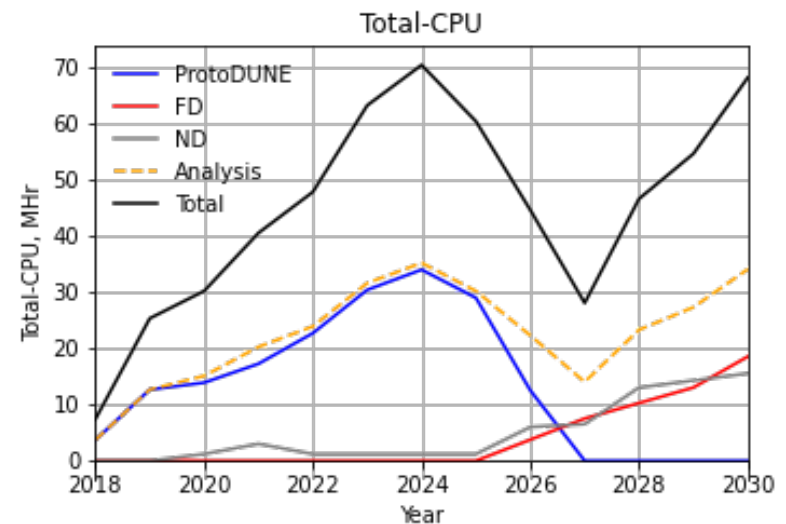
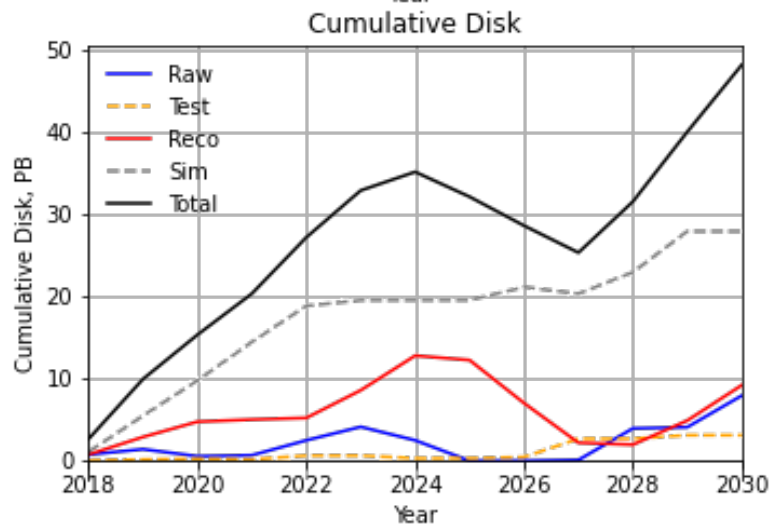
1 copy of reco/sim on tape

Currently assume 1 reco pass over all data and 1 sim pass/year

Assume reco/sim resident on disk for 2 years

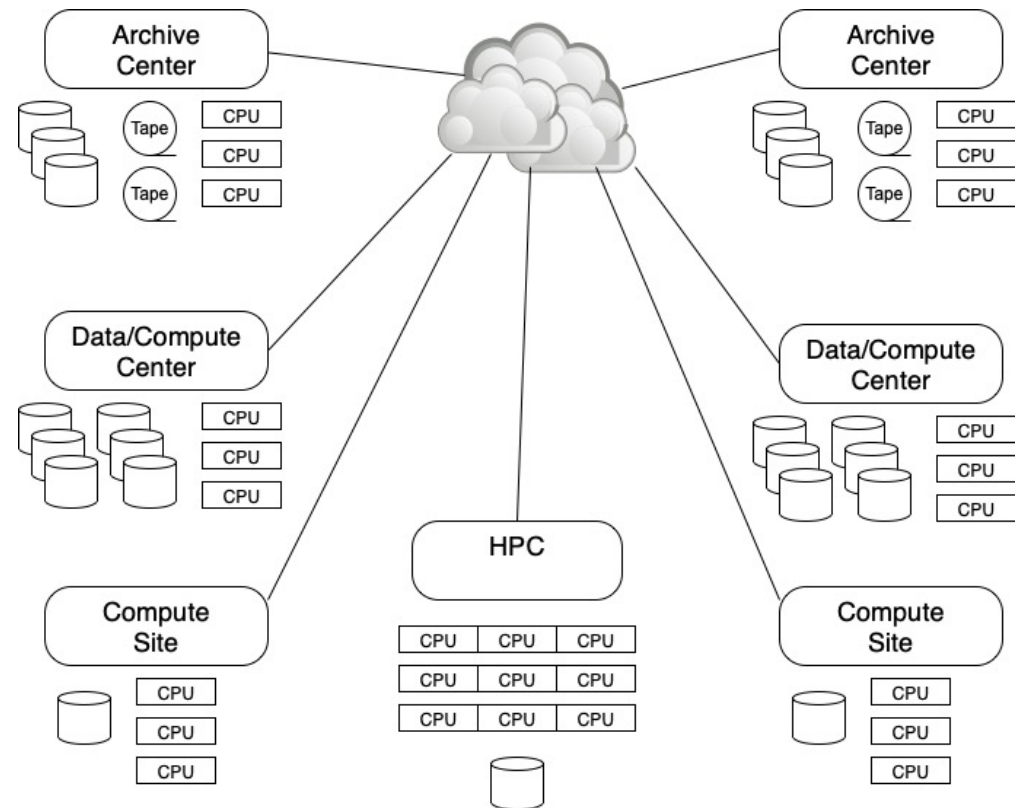
Assume 2 disk copies of reco and sim

impose shorter lifetimes on tests and intermediate sim steps.



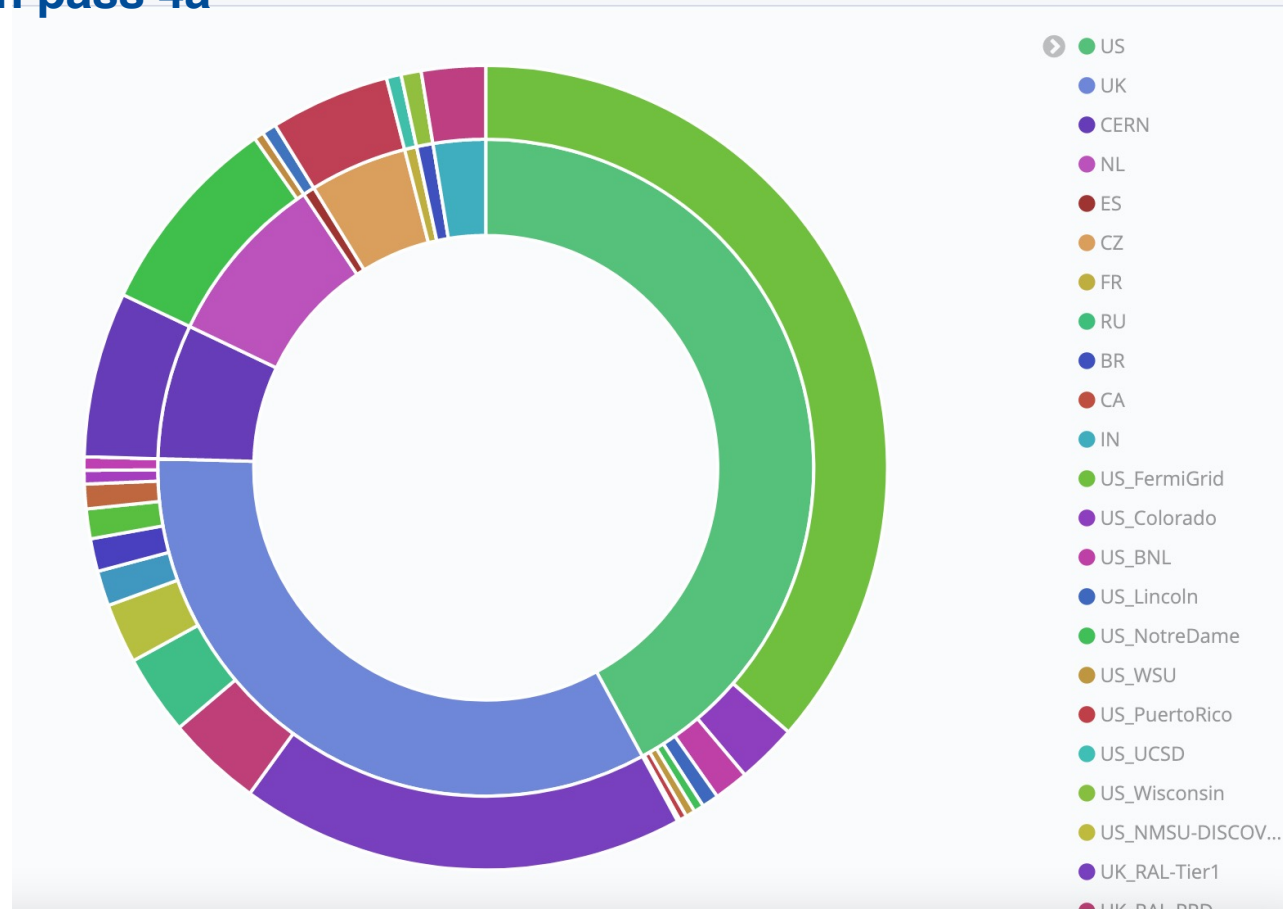
Distributed computing model

- Less “tiered” than current WLCG model → **DOMA**
- Collaborating institutions (or groups of institutions) provide significant disk resources (~1PB chunks)
- **Rucio** places multiple copies of datasets
- **We likely can use common tools:**
 - **But need our own contribution system**
 - **And may have different requirements for dataset definition and tracking**



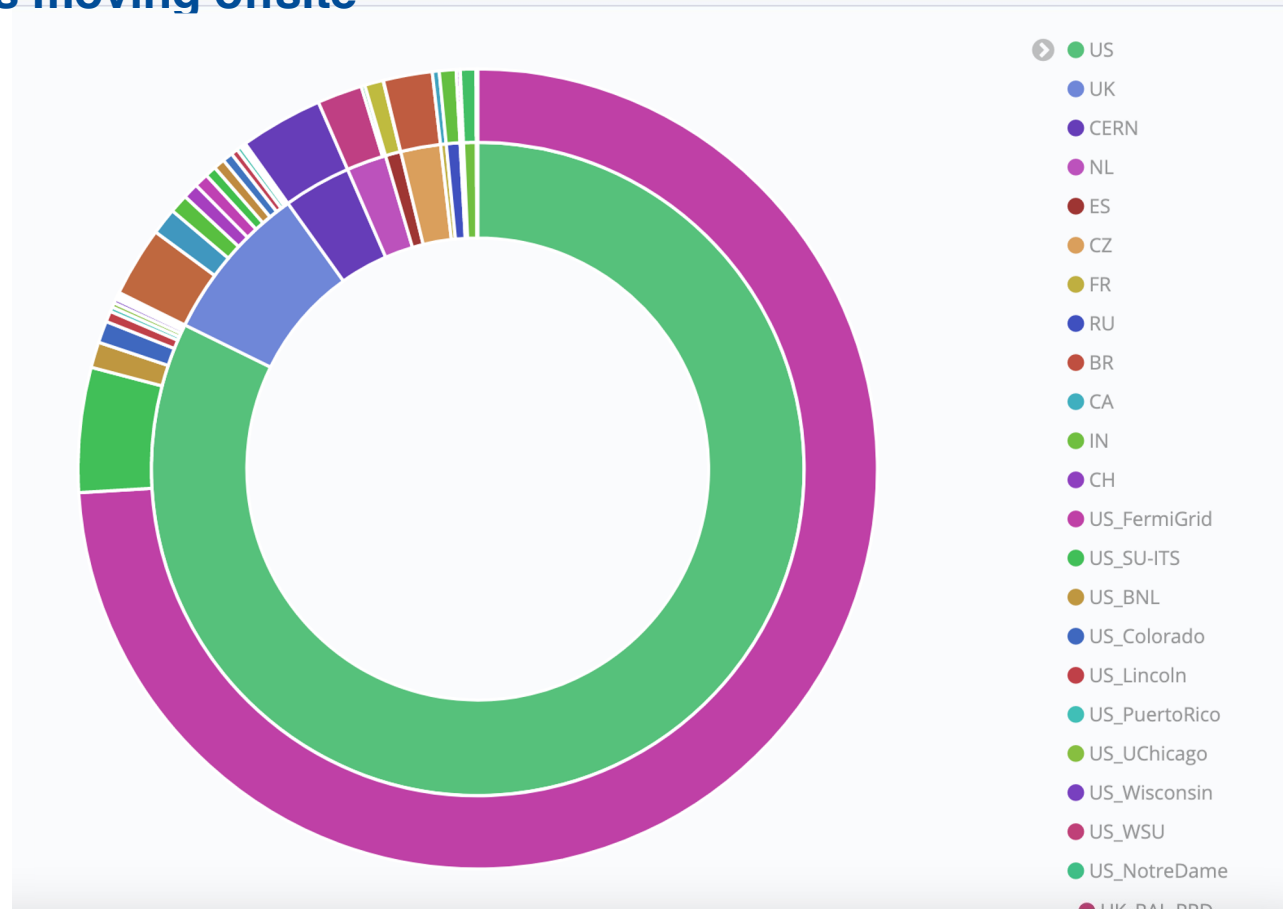
Where we are now: Production pass 4a

- This shows August 2021 contributions to production
- Production team now led by
 - Ken Herner and Elisabetta Pennacchio
 - Team from OSU (US), UNICAMP and UNIFESP (BR), York U. (CA) and Cambridge (UK)
- Each MC pass generates ~1.5 PB of detsim and 1.3 PB of reconstructed events.
- Actual reco data is only ~300 TB



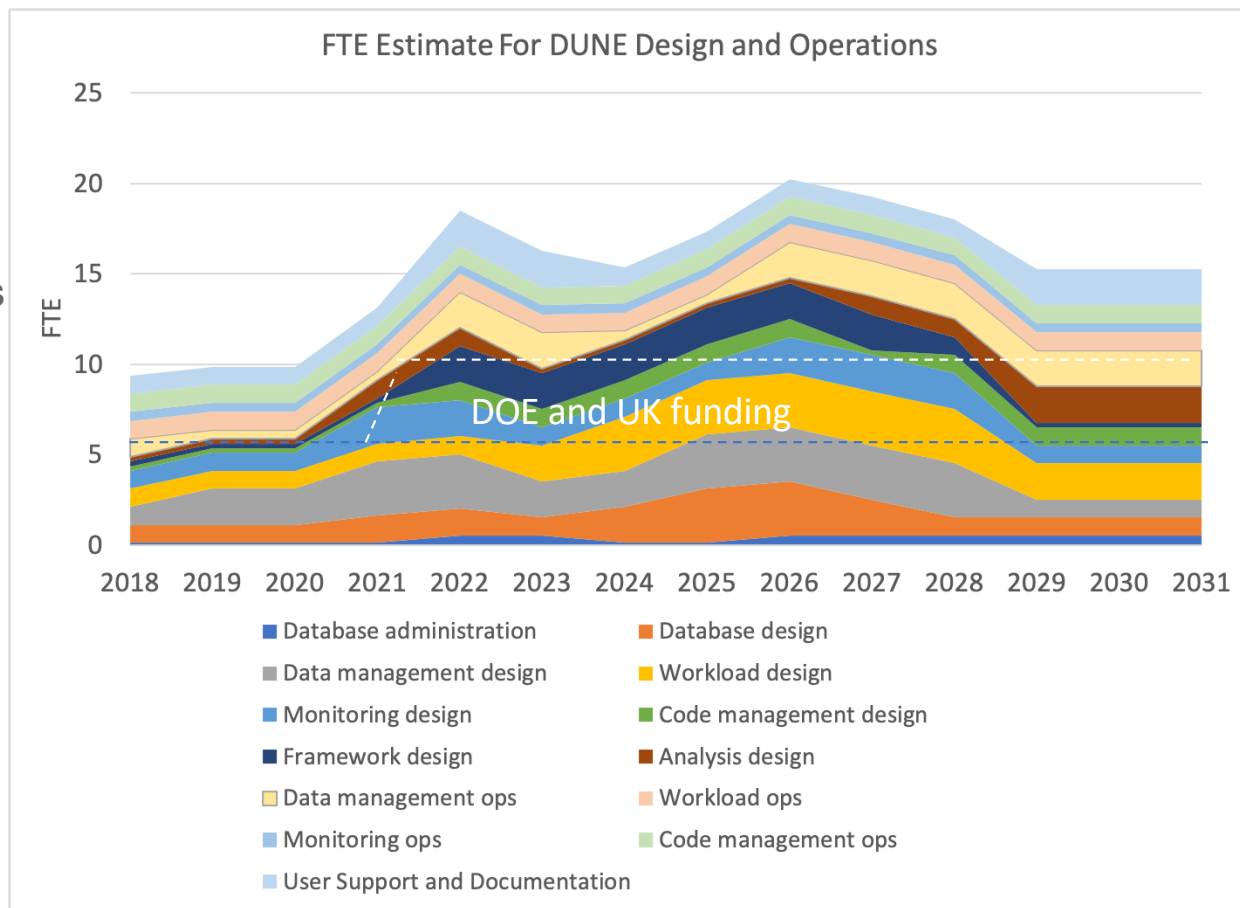
Where we are now: Analysis is moving offsite

- This shows August 2021 contributions to analysis
- US sites are contributing as are many sites worldwide



FTE estimate. Does not include shared facility (storage etc.) costs

- Some effort (mainly operations – pastels at top) can be trained collaboration physicists.
- Rest requires experts
- Currently have around 5 FTE experts (FNAL + collab), all in-kind contributions except UK DUNE funded personnel.
- Expert need is greatest for ProtoDUNE 2 and pre-operations in 2024-2028. 5-10 FTE > 50% US



US Consortium – (why we are here today)

- In March 2020 US collaborators submitted a proposal to DOE
 - “Essential computing and software development for the DUNE experiment”
- Originally 10 institutions, 3 were working on advanced pattern recognition and were not funded.
- Now have 7 – funding arrived at OSU 9/29/2021 – now going to Universities 2 months later
- Argonne, Brookhaven, Colorado State, Fermilab, Minnesota, Oregon State and Wichita State

DOE guidance

- Priority should be given to Task 1 (Data bases), within Task II (Frameworks and data structures) to data modeling, data discovery, and signal processing, and within Task III (Common Software, Training, Standards and Infrastructure) to build systems and code standards.

Task I - Databases

- BNL – Paul Laycock, Lino Gerlach, conditions database
- CSU = Norm Buchanan, Ana Paula Vizcaya Hernandez
- Minnesota – Hajime Muramatsu, Marvin Marshak + postdoc
- FNAL - Brandon White, Steve White, Igor Mandrichenko

Task II - Data model (large and small scale)

- Large Scale (FNAL and BNL)
 - MetaCat (Igor Mandrichenko)
 - Data Dispatcher (Igor M. , Steve Timm)
 - Hardware/production systems (Kirby, Ken Herner)
 - Rucio (Doug Benjamin, Steve Timm, Robert Illingworth, FNAL team)
- Small Scale (ANL, BNL, CSU, FNAL, OSU)
 - HDF5 and decoding -- Barnali Chowdhury, Amit Bashyal, Peter Van Gemmeren, Tom Junk, Kurt Biery, Saba, CSU postdocs, Jake Calcutt, David Adams, Brett Viren, Doug Benjamin

Frameworks

- This is intertwined with event model and with ND integration
 - FNAL (Kyle Knoepfel, Chris Jones, Andrew Norman and Tom Junk)
 - BNL (Paul Laycock, Brett Viren)
 - Argonne (Barnali Chowdhury and Amit Bashyal)
 - OSU (Jake Calcutt)
 - CSU
 - WSU (ND integration)
 - Wirecell people

Task III Code management/build systems/standards

- Code management and documentation
 - Tom Junk, Jake Calcutt, David Adams
- ND integration
 - Michael Muether
- Ongoing training and documentation work
 - Ken Herner, Claire David, Mike Kirby, Tom Junk ...

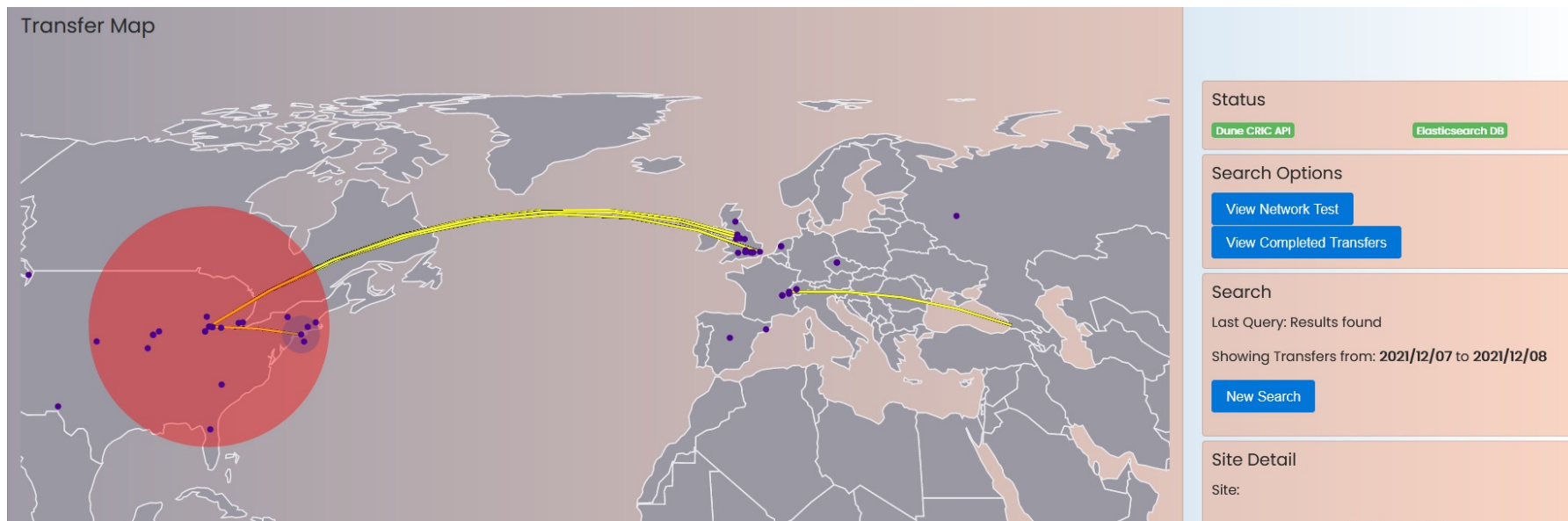
Today: ½ day workshop

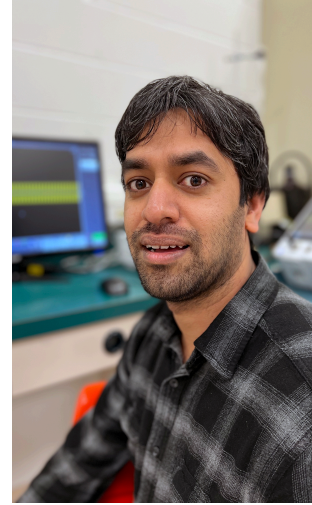
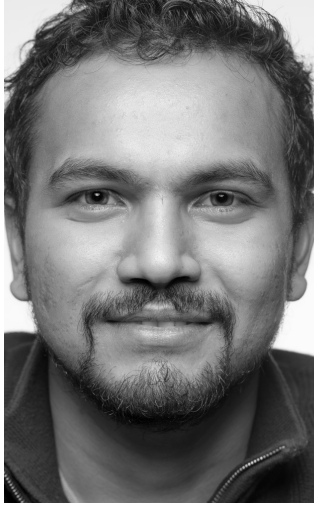
- <https://indico.fnal.gov/event/51971/>
- Introduce new people
- See where we are on multiple projects
- We need to report to DOE on what we are doing
 - Quarterly reports
- Further in the future
 - actual meeting (in Oregon? At the actual dunes?)
 - May time scale near the collab meeting.

Make a calendar

- We should document all the relevant meetings.
- HEPCCCE HDF5
- Data management
- Art stakeholders
- Code management (Tom)
- DAQ coldbox coordination
- CERN IT/FNAL coordination
- DB meetings
- production meetings

We need a logo. Maybe a globe with transfers on it.





Powerpoint can't handle more than 6 people



so here's more