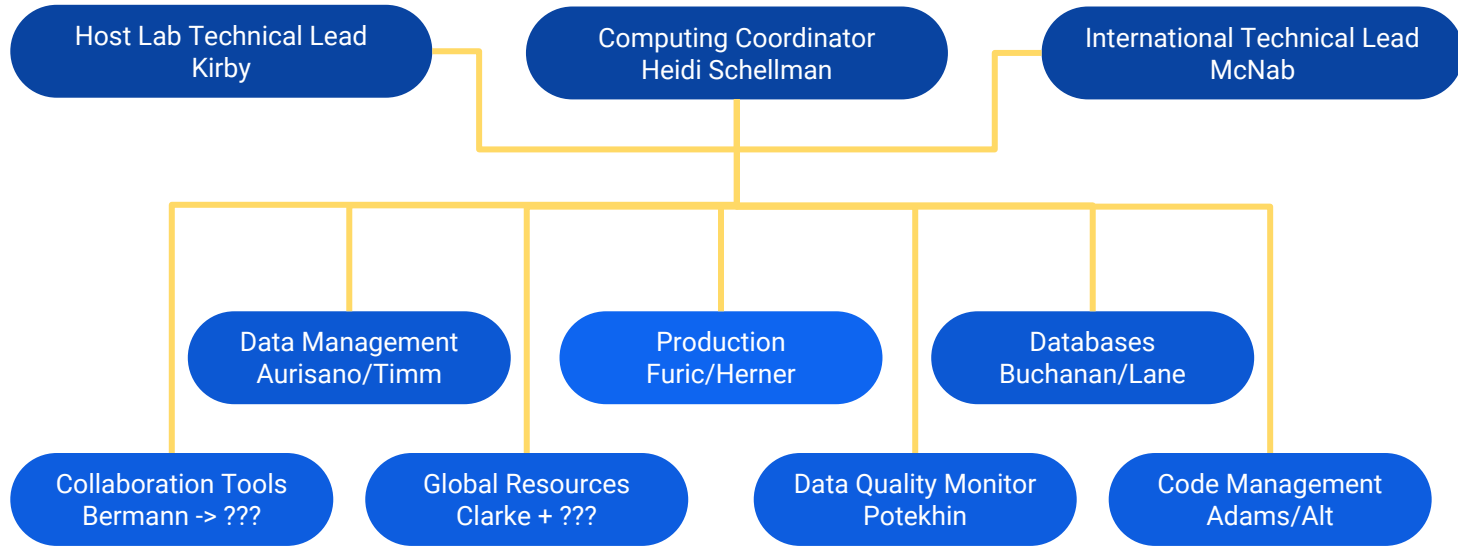# DUNE SCPMT 2019

Work in progress - delete these comments when complete and ready for presentation
Needed:
- Experiment updates
- SCD: all 2018 info has been updated (this comment can be deleted for presentation)

Experiment Organization Chart for Offline Computing

Physics drivers 2019-2021

Support for the Far Detector TDR's in 2019

Support for the Near Detector TDR's in 2019-2020

Computing CDR in late 2019-early 2020

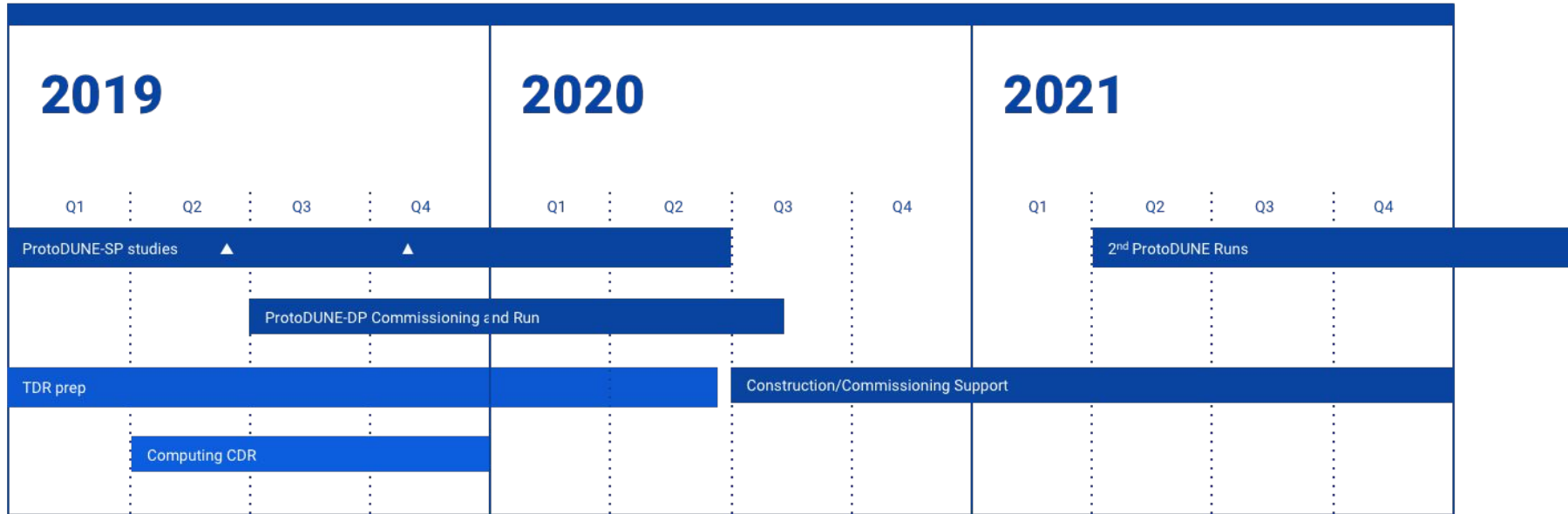Commissioning and cosmic running for Protodune DP (Dual Phase)

Cosmic running and studies for Protodune SP (Single Phase)

Reconstruction with improved algorithms for DP and SP

Test beam runs for DP and SP in 2021 if approved by the SPC
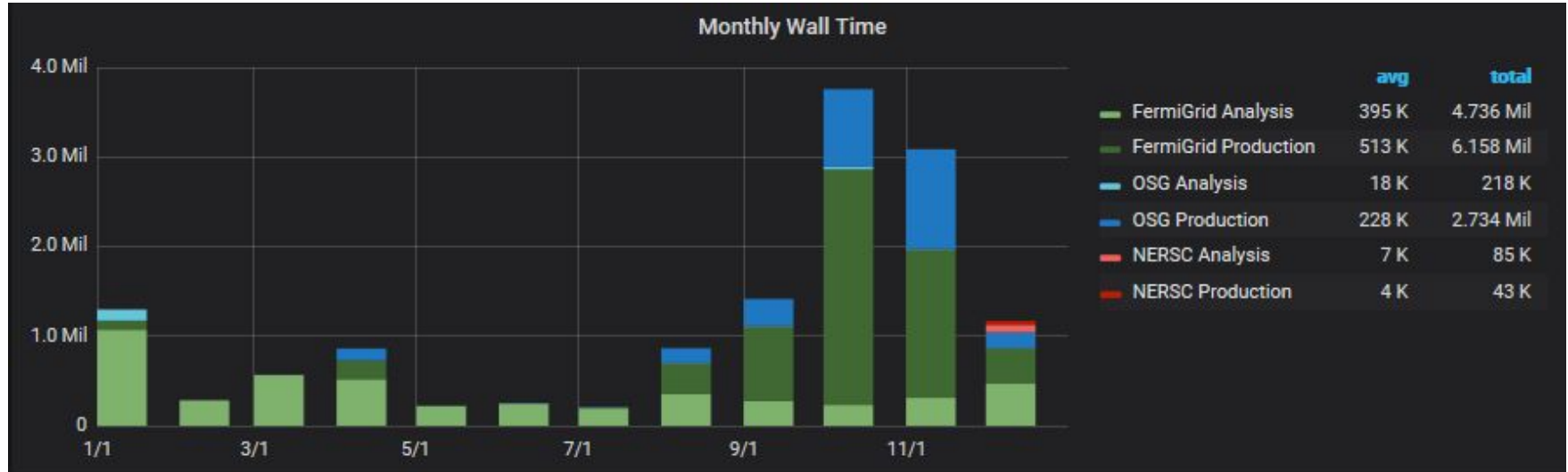
Important Dates to Remember

DUNE CPU - Experiment Usage Over the Last Year

FermiGrid total capacity ~ 160M hours / year, Average used ~ 10M hours / month

Total wall hours = 14.0 M FermiGrid: 10.9 M OSG: 2.9 M NERSC: 0.1 M	Total CPU hours = 10.2 M FermiGrid: 8.2 M OSG: 1.9 M NERSC: 0.1 M	Avg CPU Efficiency on FermiGrid 75%

Monthly Wall Time

	avg	total
FermiGrid Analysis	395 K	4.736 Mil
FermiGrid Production	513 K	6.158 Mil
OSG Analysis	18 K	218 K
OSG Production	228 K	2.734 Mil
NERSC Analysis	7 K	85 K
NERSC Production	4 K	43 K

Core weighted slot hours

> 50% of 800,000 jobs in Oct-Dec were run offsite

Visualize / New Visualization (unsaved)   Save   Share   Refresh   ◄ ⊘ October 1st 2018, 00:00:00.000 to December 31st 2018, 23:59:59.999 ►

Owner:dunepro AND Cmd:*fife_wrap*   Uses lucene query syntax   🔍

Add a filter ✚

fifebatch-history-*   ◄
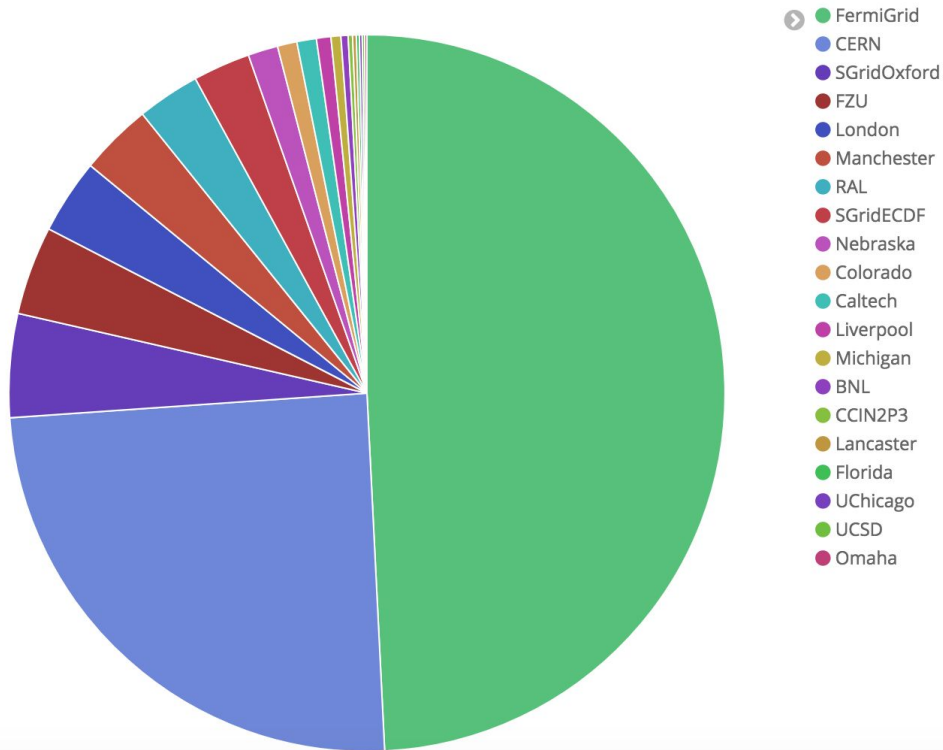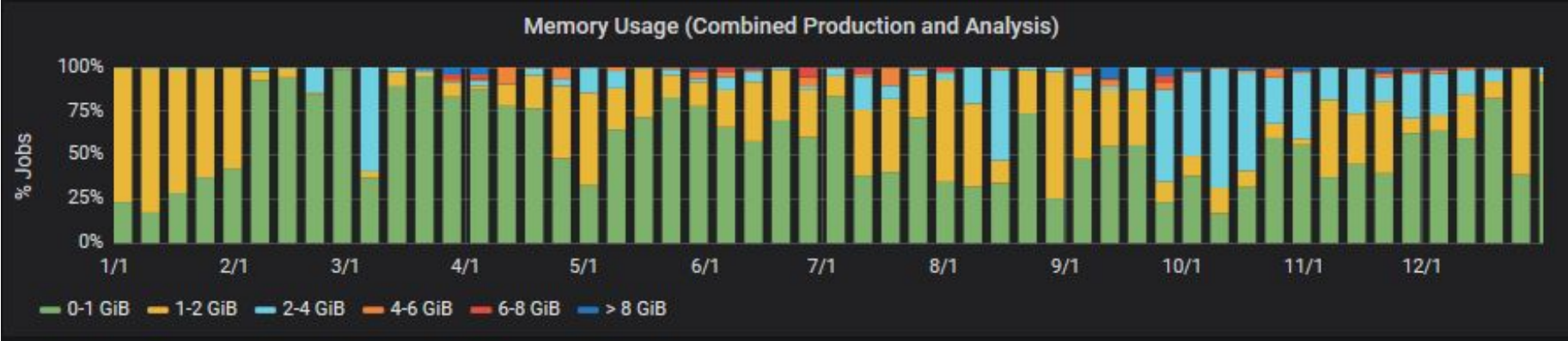
Data   Options   ▶ ✖

metrics

▶ Slice Size   Count

buckets

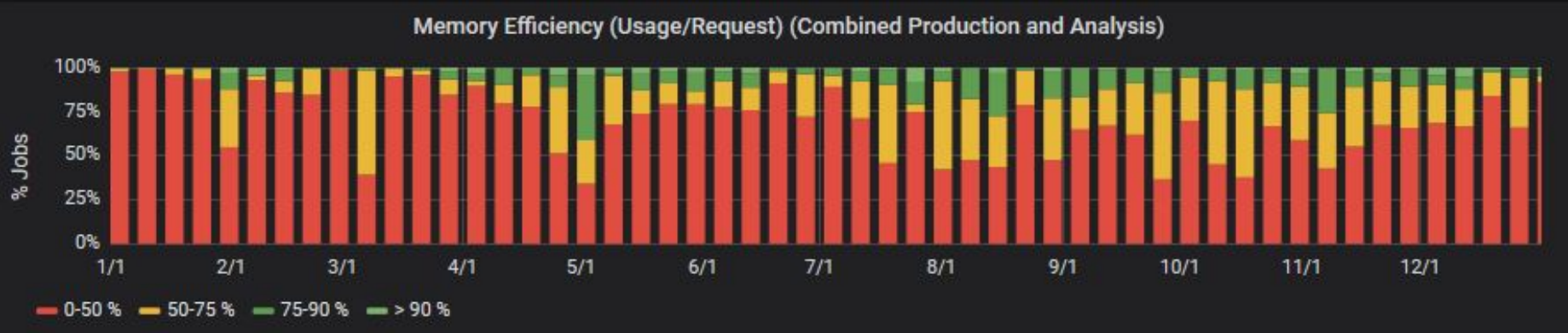▶ Split Sli...   MachineAttrGLIDEIN_Site0:   ⊙ ✖
                Descending

        Add sub-buckets

- 🟢 FermiGrid
- 🔵 CERN
- 🟣 SGridOxford
- 🔴 FZU
- 🔵 London
- 🔴 Manchester
- 🔵 RAL
- 🔴 SGridECDF
- 🟣 Nebraska
- 🟠 Colorado
- 🔵 Caltech
- 🟣 Liverpool
- 🟡 Michigan
- 🟣 BNL
- 🟢 CCIN2P3
- 🟠 Lancaster
- 🟢 Florida
- 🟣 UChicago
- 🟢 UCSD
- 🔴 Omaha

Memory Footprint Over the Last Year

CPU and Memory Efficiency Over the Last Year

CPU Efficiency (CPU time / Wall time) (Combined Production and Analysis)

Memory Efficiency (Usage/Request) (Combined Production and Analysis)
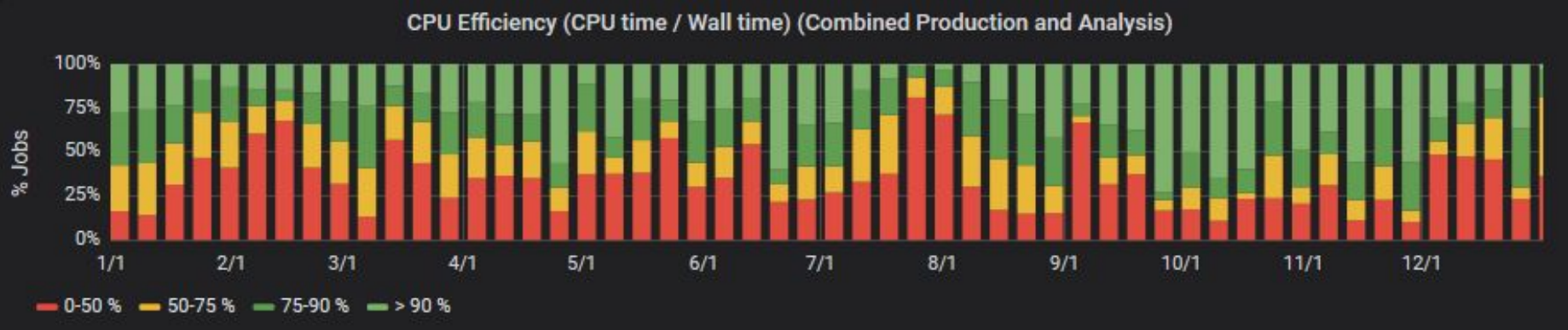
FermiGrid CPU
Prediction Going Forward and Accuracy of Prior Predictions
Units of Million (1 CPU, 2GB) wall hours per CY

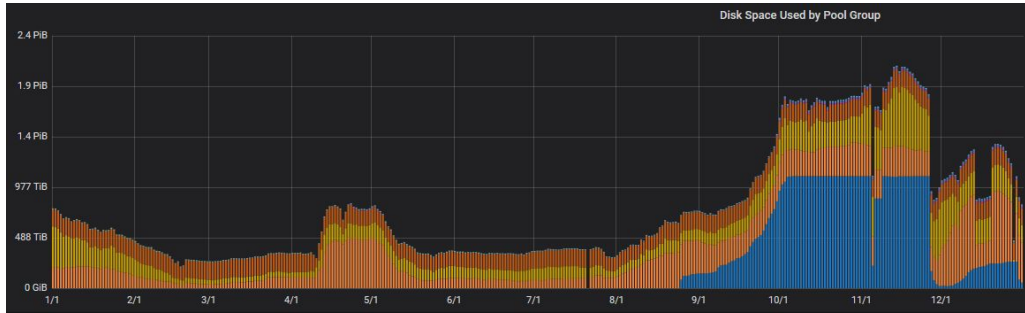|		Used in 2017	Used in 2018	Used in 2019	Used in 2020	Used in 2021
Requested	2 years prior 1 year prior Same year	10.90 11.40 7.00	24.40 29.00 9.25	29.00 28.62 20.00	12.45 20.00	30.00
Actual Used	(SCD provides)	8.18	10.9		Fermigrid #'s are dominated by analysis. Production/simulation assumed to run mainly offsite.	
CPU Usage Efficiency	(SCD provides)	70%	75%	80%		

CPU Adaptations Going Forward

How can DUNE use OSG/HPC/HEPCloud going forward?

- Already using > 50% offsite computing
- OSG/HEPCloud should be integrated reasonably easily as we use common tools.
- HPC still requires significant R+D - probably most useful for simulation, ML training and hypothesis testing as:
  - Expt. data processing requires IO, fast turnaround, db access and frequent code updates
  - Analysis is IO intensive and involves 100's of unique users.
- NOvA experience indicates training ML algorithms and final hypothesis testing is well suited to HPC's
- Parallelization of geant would be a big step forward
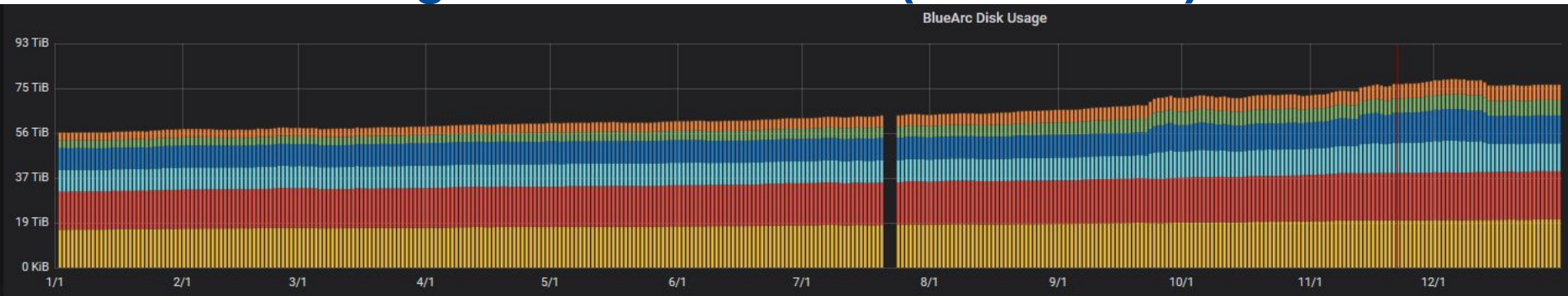
Disk: dCache Usage and Predictions (in TB)

Request (Avg/Peak)	Current Total	2019	2020	2021
R/W	5,587 Available	6000	6000	10000
Scratch	2,084 Available	(add here)	(add here)	(add here)
Analysis (Persistent)	200 Dedicated	400	400	800
Other	1,136 Dedicated	(add here)	(add here)	(add here)

protoDUNE raw data

Disk: NAS Usage and Predictions (in TB Units)

BlueArc Disk Usage

	min	max	
/lbne/data	15.77 TiB	20.04 TiB	17.69
/dune/data	15.77 TiB	20.04 TiB	17.69
/lbne/data2	8.96 TiB	13.19 TiB	9.91
/dune/data2	8.96 TiB	13.19 TiB	9.91
/lbne/app	3.18 TiB	6.37 TiB	4.52
/dune/app	3.18 TiB	6.37 TiB	4.52
/grid/fermiapp (dune)	72 GiB	119 GiB	101
/grid/fermiapp (lbne)	78 GiB	78 GiB	78
/grid/fermiapp (marslbne)	18 GiB	28 GiB	21
/grid/data (dune)	622 MiB	622 MiB	622

Ignore /lbne entries
(alias mount point)

	Current (TB)	2019	2020	2021
App	8.0	10	15	20
Data	60.0	50	50	50

We assume we migrate off fermiapp and that # of users
doubles in 2019 as analysis of protoDUNE starts.

Tape
Prediction Going Forward and Accuracy of Prior Predictions
Units of TB
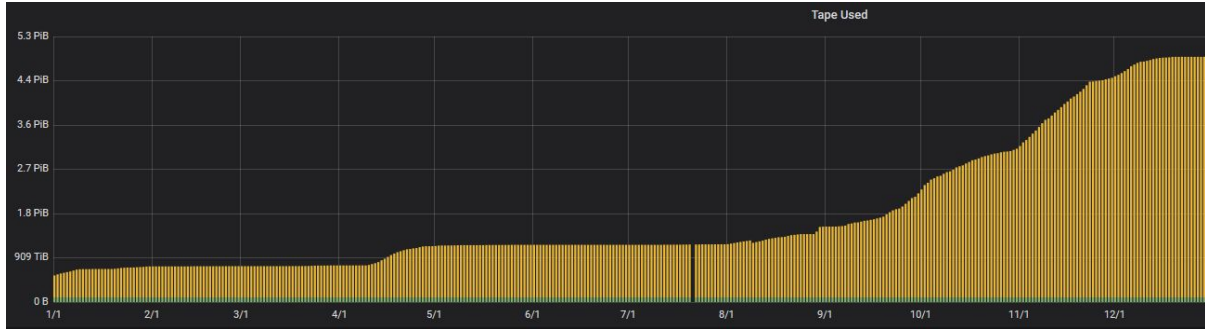
		Used in 2017	Used in 2018	Used in 2019	Used in 2020	Used in 2021
Increment Requested	2 years prior 1 year prior Same year	100 500 1,000	- 15,000 2,394	7,500 4,913 8000	393 4000	20,000
Increment Used	(SCD provides)	307	4,935	Large use in 2021 is long test beam runs for both SP and DP		
Integral Used			5,442			

Data Lifetimes

Dataset preservation strategy
- All raw data needs to be retained
- We plan to keep two recent reconstruction passes on tape and dispose of older versions (or not migrate to new media).
- Reconstruction passes are written to unique file families to facilitate later removal. Removals is based on code version, not creation date.

What Do You Want to Achieve in Computing Over Next Three Years

Goals	Where does the experiment need to contribute	Where does SCD need to contribute
Larsoft ability to run on extremely large events in finite memory	Define problem - adapt event format	SCD mods for Art/larsoft to allow processing of event fragments
Global access to DUNE computing resources	Provide external storage/CPU resources	Work with WLCG and others on uniform authentication/access methods
Geant parallelization	Part of intl. efforts	This goes beyond SCD to worldwide
Global batch systems	Evaluate/mod solutions	Evaluate/mod solutions
Improve Storage Latencies	Provide offsite storage	SCD support for storage - 1 example = better user info on status of files

Anything else?

We anticipate a doubling of users in 2019 as protoDUNE data becomes available for analysis. **This likely means a need for doubling of the # of interactive machines and the /app/ space.**

While we do have other sites, we expect the overall usage to scale up and the large FNAL-based community to grow.