DUNE Computing Requests for 2024

Computing Contributions Board Meeting

Heidi Schellman and Michael Kirby

DUNE Computing Requests for 2024

Computing Contributions Board Meeting
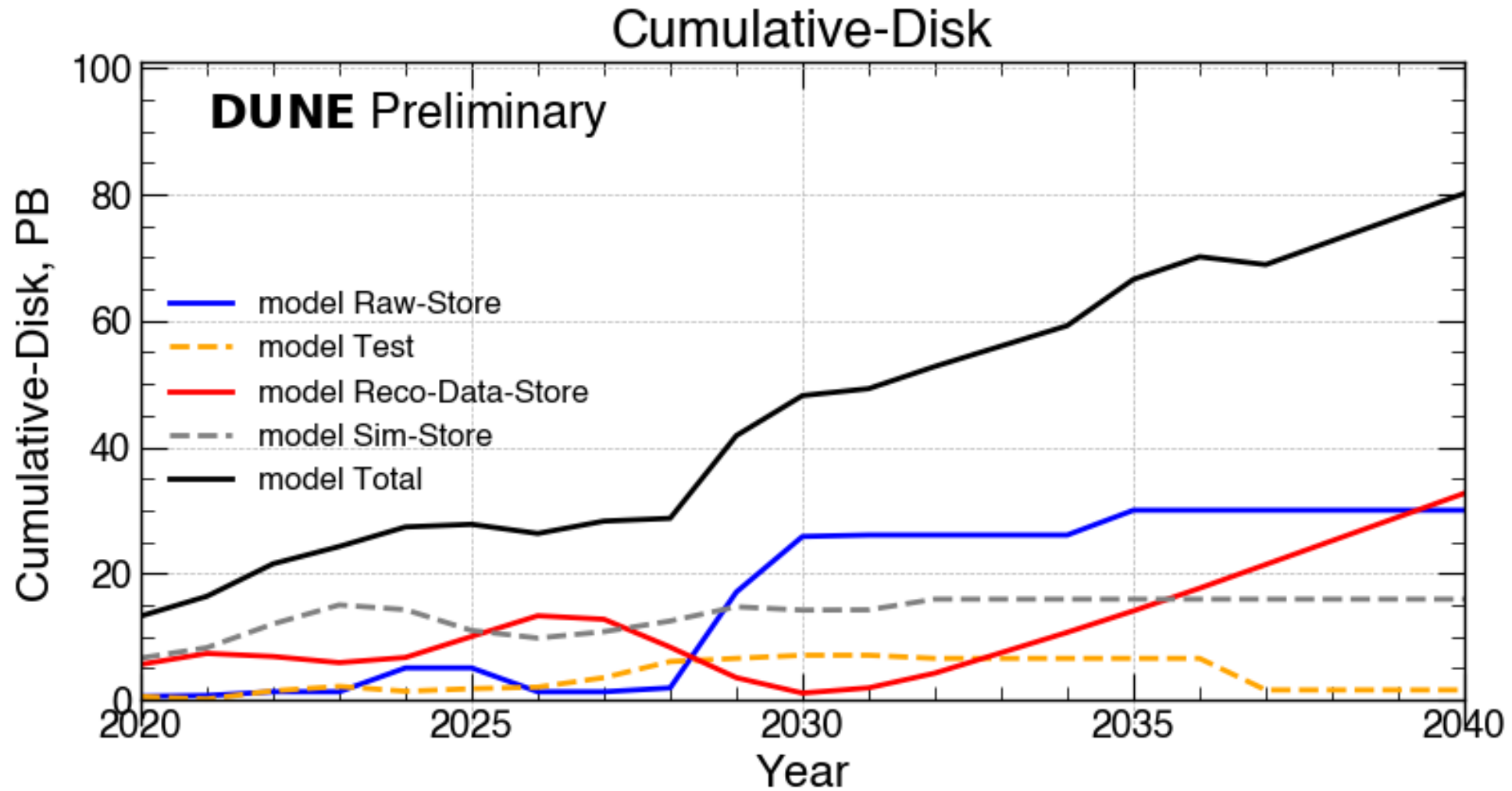
Heidi Schellman and Michael Kirby

DRAFT

Basics of the resource model

- Keep raw data on disk for 1 year, on tape to end of expt.
  - For protoDUNE – 1 copy each at CERN/FNAL
  - For DUNE 1 copy at FNAL, 1 copy at other institutions
- Reconstruct full sample every year (protoDUNE for 4 years, DUNE to end of expt.)
- Do new simulation campaigns each year
- Keep simulation and reconstructed data on disk for 2 years (always have 2 versions)
  - One copy in Americas, one in Europe where possible (model assumes 1.5 copies)
  - No need to stage from tape until it ages out
- One copy of reconstruction/simulation -> tape as it can be redone if necessary.

- **CPU estimates** are based on measurements from ProtoDUNE data and existing simulations and **for the FD/ND have large uncertainies**.

Updates to the model

- Delayed ProtoDUNE II operations until Spring 2024

- With the large scale simulation campaigns, we have considerably better understanding of both our processing time expectations and our simulation needs

- not all of that additional information has been included in the model just yet (minor tweaks)

- Fixed a bug in the retention and reprocessing of events and lifetime of output on disk

- new estimates for FD processing time based upon multithreaded processing and subsequent smaller memory footprint

- updated files sizes for reconstruction and simulation output – no longer estimate based upon retention of the raw waveforms in data or rawdigits in the simulation

- still working on understanding the GPU requirements for 2x2 and ND-LAr and how those estimates can be translated

- We are transitioning from MWC to HEPScore23 (HS23) as the metric for CPU resources

Projected Disk Needs

Cumulative-Disk

DUNE Preliminary

- model Raw-Store
- model Test
- model Reco-Data-Store
- model Sim-Store
- model Total

Request from Dec 2022

	2021 Pledge (PB)	2021 Disk Actual	2022 Pledge (PB)	2022 Disk Alloc (PB)	2022 Disk Used	2023 Standard Request	2023 Modified Request
BR	0.00						
CA				0.05	0.05		
CH	0.20		0.20				
CZ	0.30		1.00	1.13	0.51		
ES	0.50		0.72	0.72	0.01		
FR	0.50		0.50	0.50	0.13		
IN	0.75		0.75	0.10	0.00		
IT							
NL	1.90		1.90	1.90	0.42		
RU			0.50	0.50	0.50		
UK	4.00		4.00	3.83	3.12		
US BNL	0.50		0.50	1.00	0.50		
US - other							
National	8.65	0.00	10.07	9.73	5.24	15.40	12.94
CERN	2.20		3.00	4.00	2.50	2.60	4.00
FNAL	2.20		7.60	8.86	8.85	7.80	8.86
Total	13.05	0.00	20.67	22.59	16.59	25.80	25.80

Table 4: Summary of disk pledges, allocations and usage for 2021-2022 with model request for 2023. This is based on the 2022 CCB tables which are available in indico [2, 3]. These numbers are derived from the rucio reports in Table 3 and may not be complete.
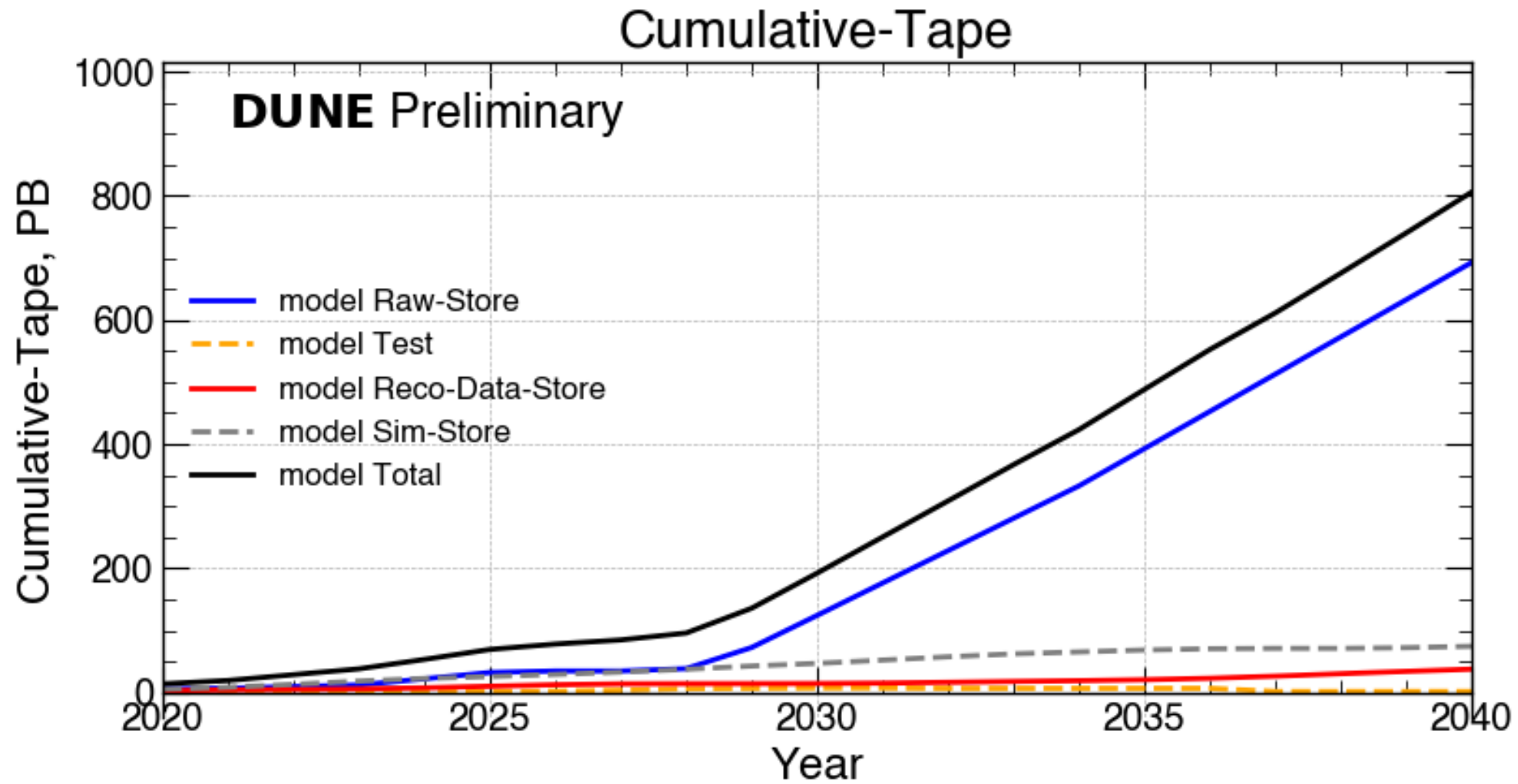
Draft - Update for the next two years

	2022 Pledge (PB)	2022 Disk Alloc (PB)	2022 Disk Used	2023 Standard Request	2023 Modified Request
		0.05	0.05		
	0.20				
	1.00	1.13	0.51		
	0.72	0.72	0.01		
	0.50	0.50	0.13		
	0.75	0.10	0.00		
	1.90	1.90	0.42		
	0.50	0.50	0.50		
	4.00	3.83	3.12		
	0.50	1.00	0.50		
	10.07	9.73	5.24	15.40	12.94
	3.00	4.00	2.50	2.60	4.00
	7.60	8.86	8.85	7.80	8.86
	20.67	22.59	16.59	25.80	25.80

Cumulative-Disk	2024	2025
National(PB)	10.5	10.5
FNAL(PB)	11.6	11.8
CERN(PB)	5.3	5.5
Total(PB)	27.4	27.8

Cumulative-Disk	2024	2025
Raw-Store(PB)	5.0	5.0
Test(PB)	1.4	1.8
Reco-Data-Store(PB)	6.7	10.0
Sim-Store(PB)	14.3	11.0
Total(PB)	27.4	27.8

DU(VE) DEEP UNDERGROUND NEUTRINO EXPERIMENT

Projected Tape Needs

Cumulative-Tape

DUNE Preliminary

- model Raw-Store
- model Test
- model Reco-Data-Store
- model Sim-Store
- model Total

Projected CPU needs updated to HS23
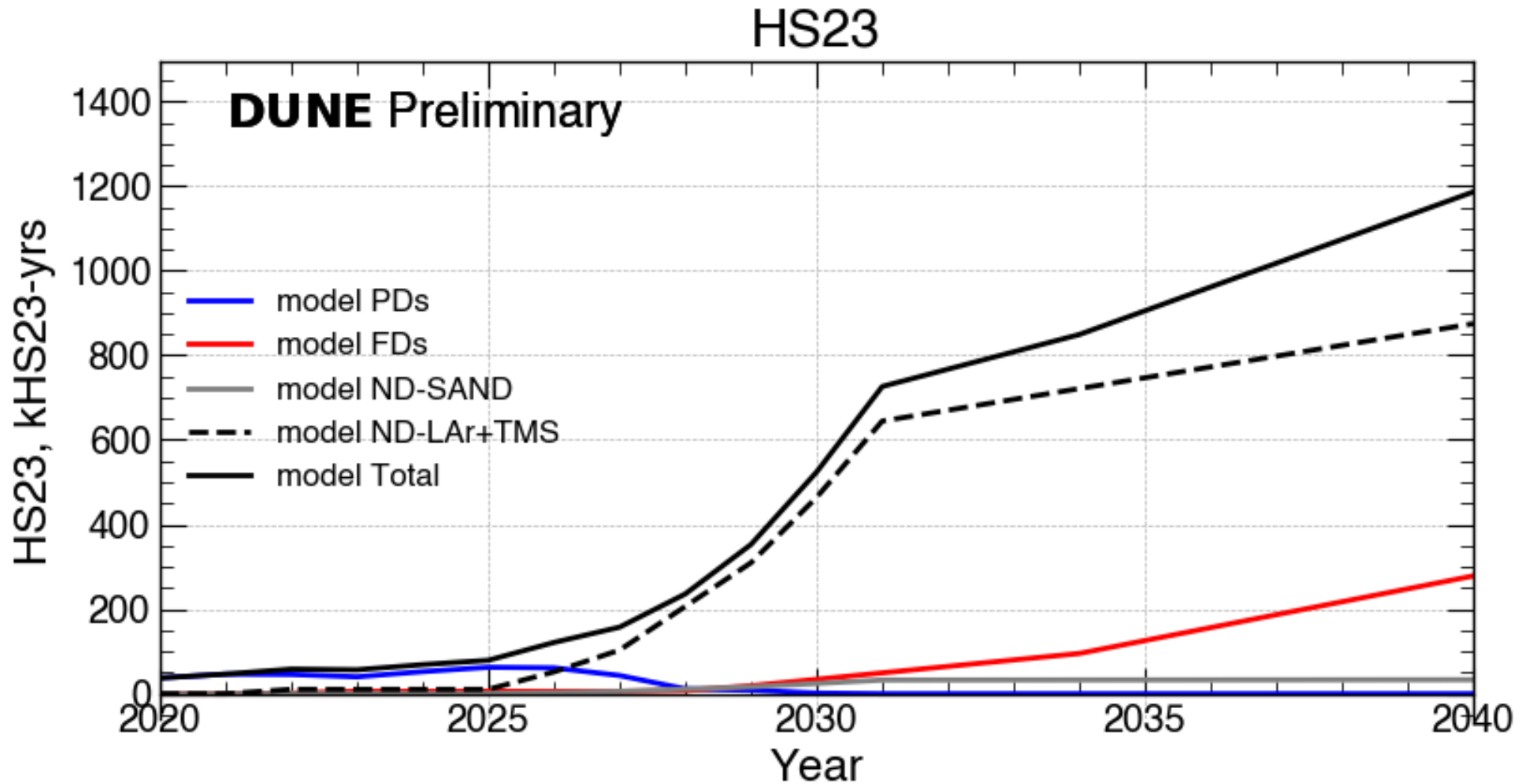
Important point on CPU usage in DUNE jobs

- DUNE differs from other HEP experiments in **frequently requiring more memory/core** than is available at particular sites.

- For example an 8-core pilot with 16 GB of available memory may only accommodate four reconstruction processes. As a result, we make our requests in terms of **memory-weighted-core wall time (MWC)** with the base memory being 2000 MB.

- The wall-time estimates in the model are created by estimating the number of simulated and raw events taken and then scaling by the measured CPU time on a gpvm corrected to wall-time by the estimated efficiency (default 70%) and for a memory utilization factor that takes into account the differing memory needs for different applications. Here we assume that **analysis takes 3000 MB**, **reconstruction takes 4000MB**, and **simulation takes 6000MB**.

- **Contributions** are **can be requested in units of MWC-time** which is wall-time×2000 MB units.

- But in the future we are planning to change to the HS23 (or equivalent as updated) to be more inline with WLCG operations practice.

DUNE DEEP UNDERGROUND NEUTRINO EXPERIMENT

Summary of DRAFT request for 2024

HS23	2024	2025
FNAL (kHS23-yrs)	27	31
CERN (kHS23-yrs)	6	7
National (kHS23-yrs)	34	39
Total (kHS23-yrs)	68	79

Cumulative-Disk	2024	2025
National(PB)	10.5	10.5
FNAL(PB)	11.6	11.8
CERN(PB)	5.3	5.5
Total(PB)	27.4	27.8

Cumulative-Tape	2024	2025
National(PB)	0.0	0.0
FNAL(PB)	41.5	52.3
CERN(PB)	11.6	16.9
Total(PB)	53.1	69.2

- Disk request includes existing FNAL and CERN contributions
- Tape request reduced to 100 TB from National sites for testing, will increase in later years.
- CPU request is no-longer memory-weighted, assumes data taking in 2024.

DU(NE DEEP UNDERGROUND NEUTRINO EXPERIMENT