

*TIDC Annual Meeting 2024
on Nov/22nd, 2024*

COMPUTING REPORT

*Kai-Feng Chen
National Taiwan University*



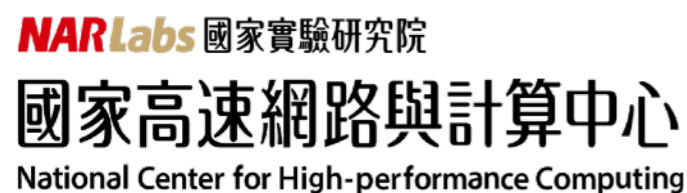
INTRODUCTION

- **Computing is an essential service for HEP** — no matter what kind of experiments or detectors, we always need sufficient computing power to process, to store, and to analyze data!
 - Resources and knowledge required for modern system operations are non-trivial — need to consider space/power/cooling/knowhow/*people*.
 - Optimal is to have a centralized system instead of clusters running individually, not to add lots of management loads to each group.
- Thanks to the supports from ASGC, now our **TIDC cluster** is operating smoothly too!

This talk includes a lot of materials from **Eric Yen & Felix Li (ASGC)** and **Chun-Yu Lin (NCHC)**. Many thanks for the contributions as well as the support team in the back!

WHAT DO WE HAVE NOW?

- **ASGC** serves as the computing arm of TIDC :
 - ASGC was serving as a WLCG Tier-1 center from Dec 2005 to Oct 2023.
 - Migrated to WLCG Tier-2 center for ATLAS after Q3 2023.
 - CMS Tier-3 initiated in 2022, in collaboration with TIDC, NTU/NCU.
 - Supporting multiple current and future HEP/GW projects.
- **NCHC** supports fundamental science with dedicated or shared resources:
 - 2015 WLCG Tier-2 for CMS .
 - 2022 GW Network (KAGRA/LIGO/Virgo) via OSG.



STATUS OF CMS TIER2 @ NCHC

► Operations is aligned with WLCG and IT community for continuous software upgrade:

- Migration to token-based authentication for both computing&storage (still on-going)
- Oversea networking thru TWAREN/Internet2 and v4/v6 dual-stack
- TWAREN has three >10 gbps thru Chicago, LA, and Singapore
- OS upgrade to Alma Linux 9

CPU models:

- 10 AMD EYPC 7713 (128c Milan @2023)
- 24 Intel E5-2670v2 (10c Ivy Bridge @2014)
- 120 Intel E5-2630v3 (8c Sandy Bridge @2013)
- +400 vcore on NCHC's internal cloud

partially shared with OSG



STORAGE

- **2PB capacity based on dCache.v9** and distributed over three branch of NCHC.
 - Support access via WebDAV, XROOT and deprecate SRM.
 - Now (2024 Nov), **~300 TB used by domestic users** (~150TB used by chkuo and zhenggan)
- Utilizing (internal) cloud storage is under evaluation.

	Total (TB)	Free (TB)	Free%
Hsinchu (NTU 2021)	404	169	42%
Taichung (2022)	1,344	847	63%
Tainan (NTU 2015, NCU 2017)	328	85	26%
Total	2,076	1,101	53%

SITE AVAILABILITY

➤ Operations under regular monitoring with metric based on computing, storage, and networking.

– On-going token authentication on-going and trigger WARNINGS, still mainly reply on X509.

➤ **Storage are fairly stable** – have to prepare to move Tainan’s storage out.

➤ **More computing nodes** are gathering.

➤ Many helps from TWAREN teams for resolving oversea networking.

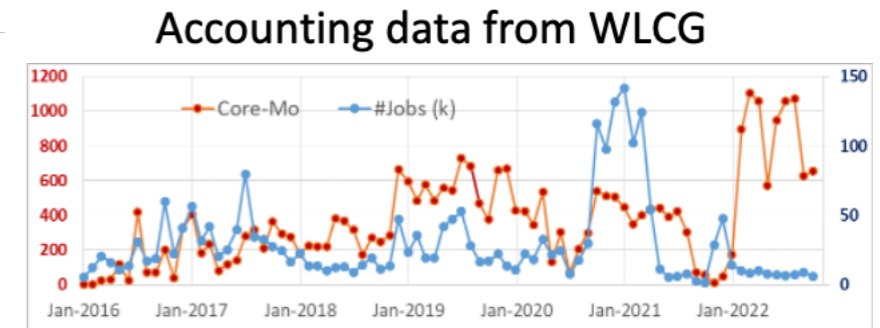
Services of Host se01.grid.nchc.org.tw

State	Service	Icons	Status detail	Age	Checked F
OK	org.cms.SE-WebDAV-1connection	🟢	OK - Endpoint reachable on all addresses	266 m	73 m
OK	org.cms.SE-WebDAV-2ssl	🟢	OK - SSL access to endpoint	266 m	73 m
OK	org.cms.SE-WebDAV-3crt_extension	🟢	OK - WebDAV protocol extension supported at endpoint	2024-10-17 14:24:57	73 m
OK	org.cms.SE-WebDAV-4crt-read	🟢	OK - file read access test successful	8 h	73 m
OK	org.cms.SE-WebDAV-6crt-access	🟢	OK - file open-access test successful	8 h	73 m
OK	org.cms.SE-WebDAV-7crt-write	🟢	OK - file write access test successful	9 h	72 m
OK	org.cms.SE-WebDAV-8crt-directory	🟢	OK - directory operation test successful	8 h	72 m
OK	org.cms.SE-WebDAV-10macaroon	🟢	OK - Macaroon support test successful	8 h	72 m
OK	org.cms.SE-WebDAV-14tkn-read	🟢	OK - file read test successful	264 m	71 m
OK	org.cms.SE-WebDAV-16tkn-access	🟢	OK - file access restricted	264 m	71 m
OK	org.cms.SE-WebDAV-17tkn-write	🟢	OK - file write test successful	264 m	71 m
OK	org.cms.SE-WebDAV-18tkn-directory	🟢	OK - token directory operation test successful	264 m	71 m
OK	org.cms.SE-WebDAV-99summary	🟢	OK - WebDAV probe successful	267 m	13 m
OK	org.cms.SE-XRootD-1connection	🟢	OK - Endpoint reachable on all addresses	281 m	74 m
OK	org.cms.SE-XRootD-3version	🟢	OK - version test successful	2024-10-17 14:25:17	74 m
OK	org.cms.SE-XRootD-4crt-read	🟢	OK - file read test successful	8 h	73 m
OK	org.cms.SE-XRootD-5crt-contain	🟢	OK - foreign files inaccessible	8 h	73 m
OK	org.cms.SE-XRootD-6crt-access	🟢	OK - file access restricted	8 h	73 m
UNKN	org.cms.SE-XRootD-7crt-write	🟡	UNKNOWN - Skipping write test, no write target	2024-09-23 19:00:44	73 m
UNKN	org.cms.SE-XRootD-8crt-directory	🟡	UNKNOWN - Skipping directory test, no write target	2024-09-23 19:00:44	73 m
OK	org.cms.SE-XRootD-9federation	🟢	OK - files reachable via federation	8 h	73 m
OK	org.cms.SE-XRootD-14tkn-read	🟢	OK - file read test successful	280 m	73 m
OK	org.cms.SE-XRootD-15tkn-contain	🟢	OK - foreign files inaccessible	280 m	73 m
OK	org.cms.SE-XRootD-16tkn-access	🟢	OK - file access restricted	280 m	73 m
UNKN	org.cms.SE-XRootD-17tkn-write	🟡	UNKNOWN - Skipping write test, no write target	2024-09-23 19:01:12	73 m
UNKN	org.cms.SE-XRootD-18tkn-directory	🟡	UNKNOWN - Skipping directory test, no write target	2024-09-23 19:01:12	73 m
OK	org.cms.SE-XRootD-99summary	🟢	OK - XRootD probe successful	281 m	13 m

Services of Host ce01.grid.nchc.org.tw

State	Service	Icons	Status detail
PEND	org.cms.WN-01basic-/cms-ce-token	🟡	
PEND	org.cms.WN-02cvrfs-/cms-ce-token	🟡	
PEND	org.cms.WN-03siteconf-/cms-ce-token	🟡	
PEND	org.cms.WN-05apptainer-/cms-ce-token	🟡	
PEND	org.cms.WN-21squid-/cms-ce-token	🟡	
PEND	org.cms.WN-22frontier-/cms-ce-token	🟡	
PEND	org.cms.WN-25dataaccess-/cms-ce-token	🟡	
PEND	org.cms.WN-99summary-/cms-ce-token	🟡	
OK	org.cms.WN-analysis-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-basic-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-cvrf-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK, cvrfs vers 2.11.5 (probe 1.3-pre2)
OK	org.cms.WN-env-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-frontier-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-isolation-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-mc-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-psst-test-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK, sufficient cache quota
OK	org.cms.WN-squid-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-xfce-access-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.cms.WN-xfce-fallback-/cms/Role=lcgadmin	🟢	amd14.grid.nchc.org.tw: OK
OK	org.sam.ARC-JobState-/cms/Role=lcgadmin	🟢	OK - Job was successfully submitted (https://ce01.grid.nchc.org.tw/)
OK	org.sam.CONDOR-JobState-/cms-ce-token	🟢	OK - Existing Job (106217) was found in status IDLE
CRIT	org.sam.CONDOR-JobSubmit-/cms-ce-token	🔴	CRITICAL - Job (1067422) has failed with status: HELD
OK	org.sam.CONDOR-JobSubmit-/cms/Role=lcgadmin	🟢	OK - Job successfully completed

TIMELINE



Totally ~2k core / 1+ PB, managed by HTCondor/ARC-CE and dCache distributed storage.

- 2023 Jun: Transit from TWAREN/Internet2 (PacWave) to CERN/LHCONE and IPv6 dual-stack start to work.
- 2023 Mar: Join OSG for IGWN computing via NCloud (~500 vcores, thanks to CNSu).
- 2022 Oct: Several old ASUS nodes and 5 EPYC nodes installed in K4. IPv6 deadline for T2.
- 2022 Mar: 1.2PB disk nodes in Taichung (Thanks to Spiraea).
- 2021 Nov: NTU 500TB storage (K4); Taichung 1PB storage; Tainan storage relocation (P4->L04 south).
- 2021 Jun: CMS PhedEX transit to Rucio, ARC accounting migrate from ActiveMQ to EGI ARGO messaging service
- 2020 Feb: **F5** ⇒ **Bravo cluster (C7)**; **MoST project (~800k NTD for 2y)**
- 2019 Jan : **IBM1350A** ⇒ **Formosa 5**; CREAM CE migrate to ARC+Condor
- **2016 Jan: WLCG CMS Tier-2 MoU (WLCG Collaboration Board)**
- 2015 Aug: NTU 512TB MSA2040 installed; **MoST project (~1M NTD for 2y)**
- 2015 Feb-Jul: **Phase-2 project (480k)** w/ 512-core. Join Belle-2 MC campaign.
- 2014 Nov-2015 Jan: **Phase-I init project (50k)** w/ **60-core @ IBM1350A**
- 2013 Mar: Initial request from CMS community

Thanks to **Chun-Yu** for long term commitment and operation!

ASGC OVERVIEW & STATUS

- ▶ **ASGC is providing big data analysis and computing services for the R&E communities in Taiwan as a core facility:**
 - Funded by both Academia Sinica and National Science and Technology Council
 - Primary scientific collaborations: WLCG (ATLAS, CMS), AMS, Gravitational Wave, ICECube/ Neutrino, EIC, QCD, CryoEM, condense matter, etc.
 - Based on the core technologies of WLCG
- ▶ **System efficiency as well as AI-enabled analytics are the new focus.**



Neutrino/MHEP	CryoEM
Quantum Materials Physics	Bioimaging
Physics of Active & Living Matter	Drug Discovery
Astrophysics	Computational Chemistry
Earth Science	Biodiversity & Ecology

WLCG ATLAS TIER2 IS RUNNING SMOOTHLY

- **Site has been in production since July 2024 with helpful and careful investigation of USATLAS**
 - Connection with LHCONE was reestablished, efficiency was also affirmed
 - Local storage was reconfigured.
 - Passed test jobs on 10 July.
- Supporting MC Simulation jobs and analysis jobs mainly afterwards
- **Pledge in 2024:**
 - **CPU: 30K HEPscore23**
 - **Disk: 5 PB, managed by EOS**
- Job slots: 2,208, ~839 job slots are available now because of OS migration.

Current Status:

>55,219 CPU Core-Days (2024)

Transfer efficiency: > 90%

CPU Efficiency: > 82%

12% User Analysis - 74% eff.

49% MC Simulation - 83% eff.

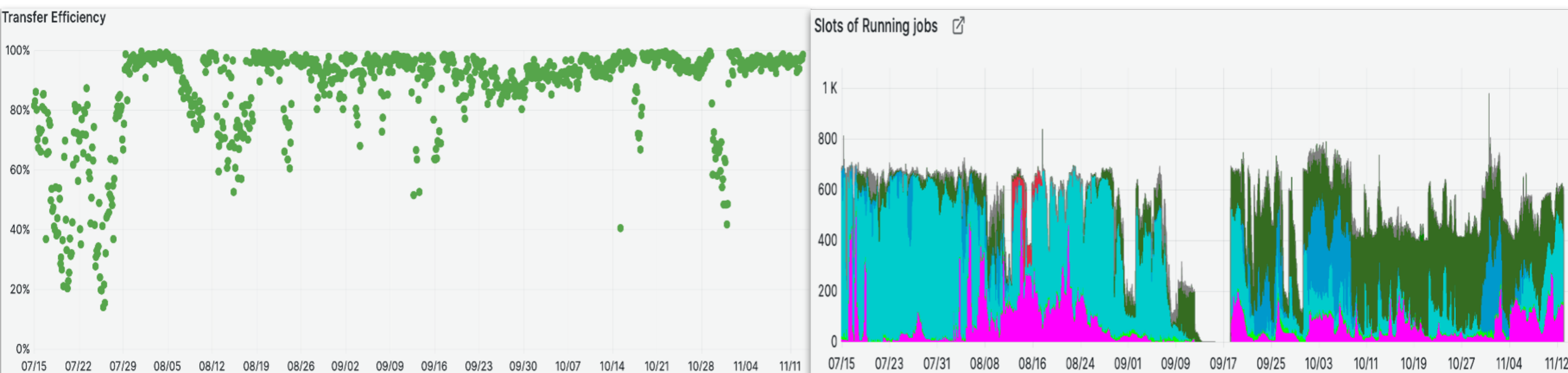
39% Event Generation - 100% eff.

Storage used: > 1.1 PB

Issue: limited network bandwidth (3Gbps) connecting to LHCONE

WLCG ATLAS TIER2 IS RUNNING SMOOTHLY (II)




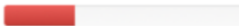

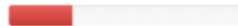

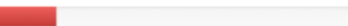

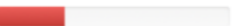



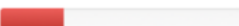

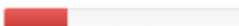

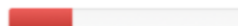



















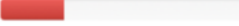



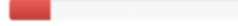



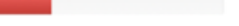

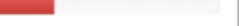

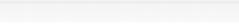

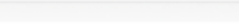

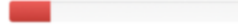







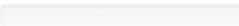

























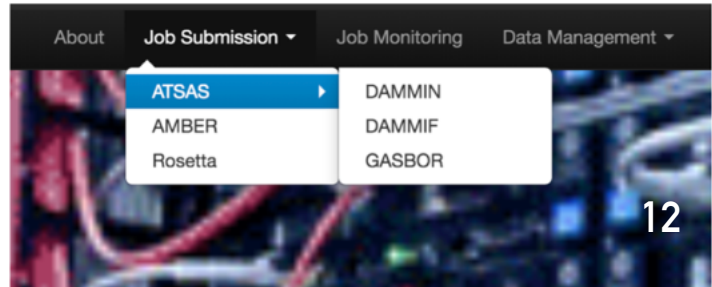








- Next steps:
 - **Making better use of ASGC resource**, e.g, pre-stage for analysis jobs
 - Will take USATLAS operation shift in Asia time zone in 2025
- Migration to AlmaLinux 9 - will be accomplished before end of 2024
 - 2-stage: ~ 1,370 job slots in AlmaLinux online in Sep.
 - HTCondor and ARC-CE also need to be upgraded



WLCG-BASED COMMON INFRASTRUCTURE

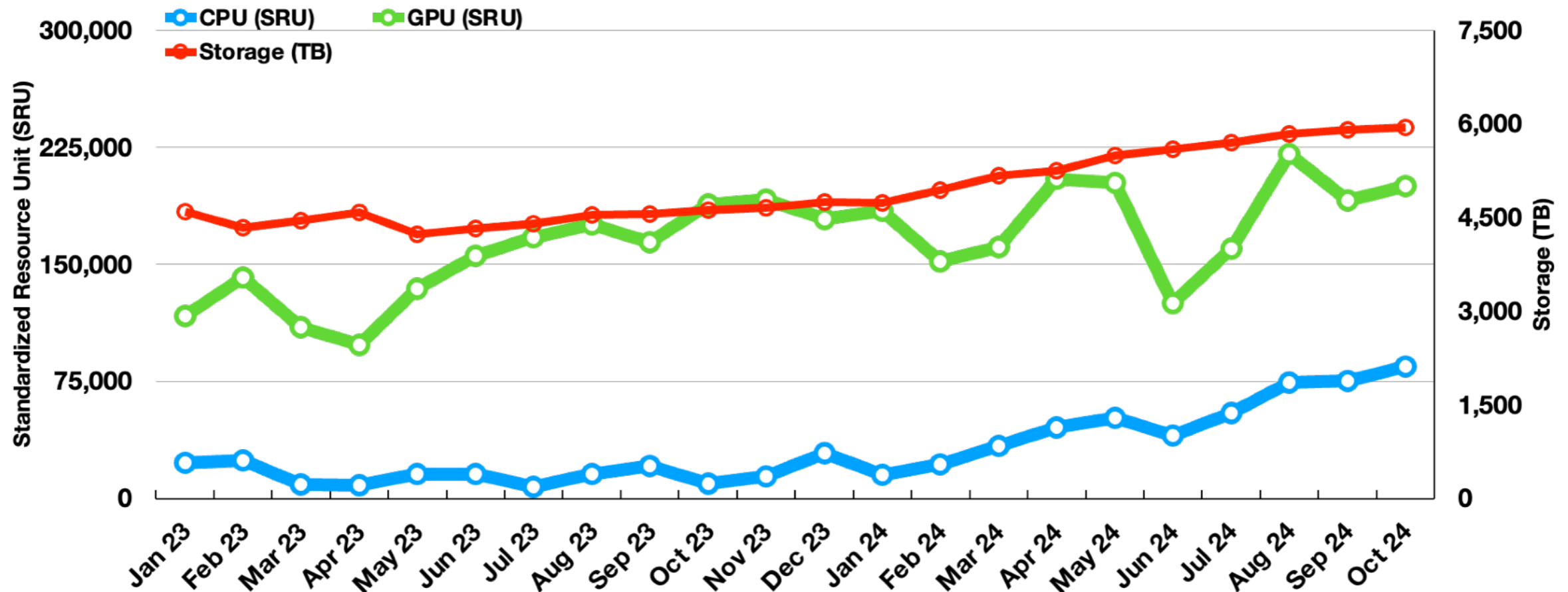
- **PanDA + RUCIO** serves as the core of the common distributed infrastructure
 - Federation of distributed institute resources
 - Federation of core facilities (including CryoEM, NSRRC, NMR, computing centre, etc.)
- **Web-based Cloud services & Slurm clusters** are provided for various computing models
 - **VM for core services and on-demand worker nodes** managed by OpenStack
 - Containerized resources managed by Kubernetes framework for software on-demand services and part of core services
 - ✓ **Batch and interactive GUI jobs: Jupyterlab, virtual desktop**
 - ✓ **GPU Cloud**
 - ✓ **SaaS: web-based application environment with microservices**

73+ WEB APPLICATIONS PROVIDED (SOFTWARE-AS-A-SERVICE)

 CryoSPARC 32 P100 Version: 3.2 Resources: 83%  <input type="button" value="Launch"/>	 CryoSPARC 1080ti Version: 3.3.2 Resources: 29%  <input type="button" value="Launch"/>	 CryoSPARC RTX3090 Version: 3.3.2 Resources: 26%  <input type="button" value="Launch"/>	 spyder cpu/eman2 Version: Resources: 17%  <input type="button" value="Launch"/>	 Octave Version: V5.2 Resources: 29%  <input type="button" value="Launch"/>	 Transfer Data Version: Resources: 86%  <input type="button" value="Launch"/>
 CryoSPARC RTX3090 Version: 4.0.2 Resources: 26%  <input type="button" value="Launch"/>	 CryoSPARC RTX3090 Version: 4.1.1 Resources: 26%  <input type="button" value="Launch"/>	 CryoSPARC RTX3090 Version: 4.4.1 Resources: 26%  <input type="button" value="Launch"/>	 cisTEM Version: Resources: 86%  <input type="button" value="Launch"/>	 Ovito Version: Resources: 86%  <input type="button" value="Launch"/>	 OpenACC Version: GPU P100 Resources: 83%  <input type="button" value="Launch"/>
 AlphaFold Version: GPU with A100 Resources: 75%  <input type="button" value="Launch"/>	 AlphaFold (Full DB) Version: GPU with A100 Resources: 75%  <input type="button" value="Launch"/>	 IMOD Version: GPU with 1080ti Resources: 29%  <input type="button" value="Launch"/>	 Triton Version: 22.01-py3 (GPU P100) Resources: 83%  <input type="button" value="Launch"/>	 AlphaFold Version: GPU with RTX3090 Resources: 26%  <input type="button" value="Launch"/>	 AlphaFold Version: GPU with V100 Resources: 17%  <input type="button" value="Launch"/>
 RoseTTAFold Version: GPU with rtx3090 Resources: 26%  <input type="button" value="Launch"/>	 Dynamo Version: GPU with 1080ti Resources: 29%  <input type="button" value="Launch"/>	 MATLAB Version: R2018b on GPU V00 Resources: 17%  <input type="button" value="Launch"/>	 Jupyter Lab Version: CPU with Tensorflow v1 Resources: 86%  <input type="button" value="Launch"/>	 Jupyter Lab gpu 3090 Version: GPU with Tensorflow 3090 Resources: 26%  <input type="button" value="Launch"/>	 Jupyter Lab GPU 1080ti Version: GPU with Tensorflow v2 Resources: 29%  <input type="button" value="Launch"/>
 RFDIFFUSION Version: 2023 on GPU V00 Resources: 17%  <input type="button" value="Launch"/>	 diffdock Version: 2023 on GPU V00 Resources: 17%  <input type="button" value="Launch"/>	 EvoDiff Version: V100 Resources: 17%  <input type="button" value="Launch"/>	 Jupyter Lab GPU V100 Version: GPU with Tensorflow V100 Resources: 17%  <input type="button" value="Launch"/>	 Jupyter Lab GPU A100 Version: GPU with Tensorflow A100 Resources: 75%  <input type="button" value="Launch"/>	 Jupyter Lab Cryocare GPU Version: GPU with 1080ti Resources: 29%  <input type="button" value="Launch"/>
 QIIME2 Version: Genome Resources: %  <input type="button" value="Launch"/>	 Scipion3 Version: P100 Resources: 83%  <input type="button" value="Launch"/>	 Phenix Version: Resources: 86%  <input type="button" value="Launch"/>	 Jupyter Lab GPU A100 Version: GPU with Tensorflow v2.6 Resources: 75%  <input type="button" value="Launch"/>	<ul style="list-style-type: none"> • Web Portal • Application over Cloud • Jupyterlab • Web Terminal 	
 MorphoGraphX Version: GPU with P100 Resources: 83%  <input type="button" value="Launch"/>	 Deepmd-kit Version: GPU with A100 Resources: 75%  <input type="button" value="Launch"/>	 Deepmd-kit Version: GPU with V100 Resources: 17%  <input type="button" value="Launch"/>	 MAML Version: GPU with A100 Resources: 75%  <input type="button" value="Launch"/>	 LabVIEW Run-Time Engine Version: 2019  <input type="button" value="Launch"/>	
 Warp Version: rtx4090 Resources: 700%  <input type="button" value="Launch"/>	 MAML Version: GPU with V100 Resources: 17%  <input type="button" value="Launch"/>	 Pvserver Version: 5.8.0 (GPU 1080Ti) Resources: 29%  <input type="button" value="Launch"/>	 Paraview Client Version: 5.8.0 Resources: 86%  <input type="button" value="Launch"/>	 <p>DiCOS-BioSAXS Platform</p> <p>Navigation: About Job Submission Job Monitoring Data Management</p> <p>Application List:</p> <ul style="list-style-type: none"> ATASAS AMBER Rosetta DAMMIN DAMMIF GASBOR 	
 R studio Version: 10 CPU Cores Resources: 54%  <input type="button" value="Launch"/>	 PyRoot Version: GPU with 1080ti Resources: 29%  <input type="button" value="Launch"/>	 qiskit Version: Resources: 86%  <input type="button" value="Launch"/>	 NVIDIA CUDA-Quantum A100 Version: Resources: 100%  <input type="button" value="Launch"/>		

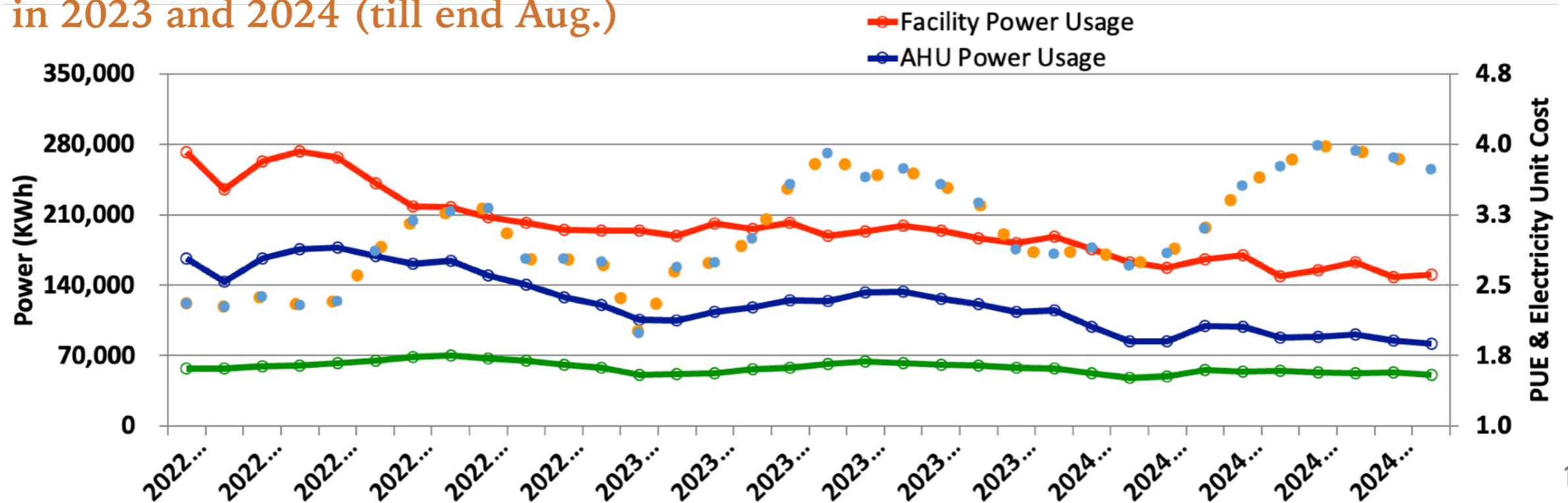
ASGC SCIENCE CLOUD RESOURCE USAGE

- **>98% reliability in 2024**
- Supporting O(1M) CPU jobs from O(100) users a year by +2K CPU Cores annually
 - With larger memory/core configuration
- **Demands of high-end GPU keep increasing:**
 - Scientific computing: Lattice QCD, Neutrino, HEP experiment and analysis, Astronomy, Life Science, etc.
 - ML/AI applications including (smaller scale) LLM



ENERGY EFFICIENCY IMPROVEMENT

- **Reliability enhanced by intelligent monitoring and control is the key approach**
- Retirement of legacy hardware
- Improvement of AHU efficiency, including the replacement by top-flow cold air
 - Anomaly detection
 - Well-prepared backup plan
- Energy-sensitive operation:
 - Plan for power efficient hardware: e.g., non-X86 CPUs
 - Power saving - shutdown some idle WNs when the waiting queue is quite short
 - ✓ **20% power usage reduction in 2023 - Effective on 3 CPU clusters (> 3,000 CPU Cores) from May 2023**
- **Overall, DC power usage achieves around 20% reduction rate achieved per annum in 2023 and 2024 (till end Aug.)**



FUTURE WORKS

- **Supporting the high-performance data analysis needs of TIDC groups by making better use of ASGC resources.**
- **Both the capacity of users and ASGC are growing according to collaborations**
 - Extended from local ATLAS/CMS groups, to other TIDC experiments and to broader scientific communities
 - Providing ASGC service training and thematic training/workshop
 - **Collaboration platform: ISGC annual event since 2002**
- **Upcoming Services:**
 - Data efficiency and reliability: enrich backup and archive services by integration of disk & tape storages
 - Two Factor Authentication service will be delivered by end of 2024



ACCESS TO USER ANALYSIS RESOURCES

COMPUTING SERVICES @ ASGC

- Currently ASGC is operating the **NSTCCore** services to support general HPC users & applications:
 - 2,944 CPU cores + 2,176 CPU cores (by end 2024)
 - 24x A100 GPU, 16x4090, 48xV100, 56x3090 (+ 12x L40S soon)
 - Working space: Ceph filesystem > 10PB is online (+2.5PB by end 2024)
 - Batch jobs: Slurm management system, with the entry UI: slurm-ui.twgrid.org.
 - Interactive jobs with web-based UI via dicos.grid.sinica.edu.tw

It is possible to start a Jupyter notebook with GPU supports.

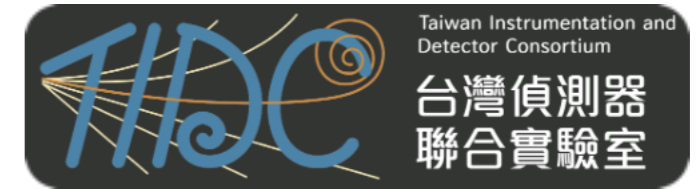
The screenshot displays the DiCOS website's Jupyter Lab interface. The navigation bar includes links for Resources, Policy, About, Documentation, Apps, Contact, and Live Chat. Below the navigation, the title "Jupyter" is prominently displayed. The main content area features a grid of six Jupyter Lab environment cards, each with a Jupyter logo, a title, a version description, resource usage, a progress bar, and a "Launch" button.

Environment Name	Version	Resources	Progress Bar
Jupyter Lab	Version: CPU with Tensorflow v1	Resources: 100%	Full green
Jupyter Lab gpu 3090	Version: GPU with Tensorflow 3090	Resources: 58%	Partial green
Jupyter Lab GPU 1080ti	Version: GPU with Tensorflow	Resources: 14%	Partial red
Jupyter Lab GPU V100	Version: GPU with Tensorflow V100	Resources: 28%	Partial green
Jupyter Lab GPU A100	Version: GPU with Tensorflow A100	Resources: 75%	Partial green
Jupyter Lab Cryocare GPU	Version: GPU with 1080ti	Resources: 14%	Partial red

COMPUTING SERVICES @ ASGC (II)

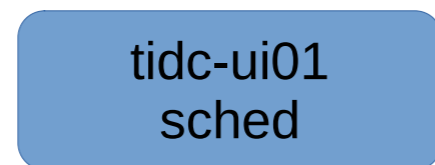
- ASGC is welcoming new users — in order to use the resources, **group PI has to create a group account first** and then ask the users to register;
 - PI has the privilege to monitor the user activities (*and will receive the cost bill monthly.*)
- Group/user accounts creation:
 - <https://canew.twgrid.org/ApplyAccount/groupcreate.php>
 - <https://canew.twgrid.org/ApplyAccount/ApplyAccount.php>
- TIDC cluster is managed under the same dicos system — if you would like to use TIDC CPU/storage, you have to apply the same accounts too.
 - At this moment people affiliated to NTU and NCU should fill Kai-Feng Chen and Chia-Ming Kuo as PI.

TIDC CLUSTER OVERVIEW

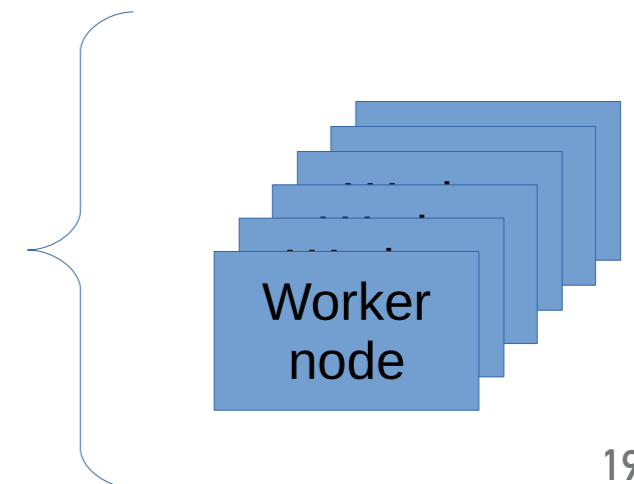
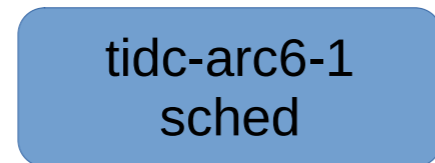


- Seeding cost allocated under TIDC project with equipments injected from individual grants (George's ASP, budget from Ming & myself, etc).
- Configured as separated **Condor clusters** for grid/local usage:
 - CPU: 768 cores (AMD EPYC 7713) + 768 cores (Intel CPU E5- 2650 v4)
 - EOS storage: 650 Tb (60% reserved for grid) + 400 Tb
 - Shared user/group working space (the same as NSTCCore services mentioned earlier).
 - UI: tidc-ui01.grid.sinica.edu.tw, accessible via SSH.
(also tidc-ui03 now!)
 - CE: tidc-arc6-1.grid.sinica.edu.tw, accessible with grid certificate.

*Local condor jobs
(up to 50%)*



*Grid jobs
(up to 50%)*



TIDC CLUSTER OVERVIEW (II)

➤ Software access:

- CVMFS is available — so basically all the CERN related libraries/tools should be accessible directly.
- We have only tested CMS software (CMSSW) and analysis frameworks (RDataFrame/Coffea) so far, but the general analysis flow should be similar for other HEP projects too.

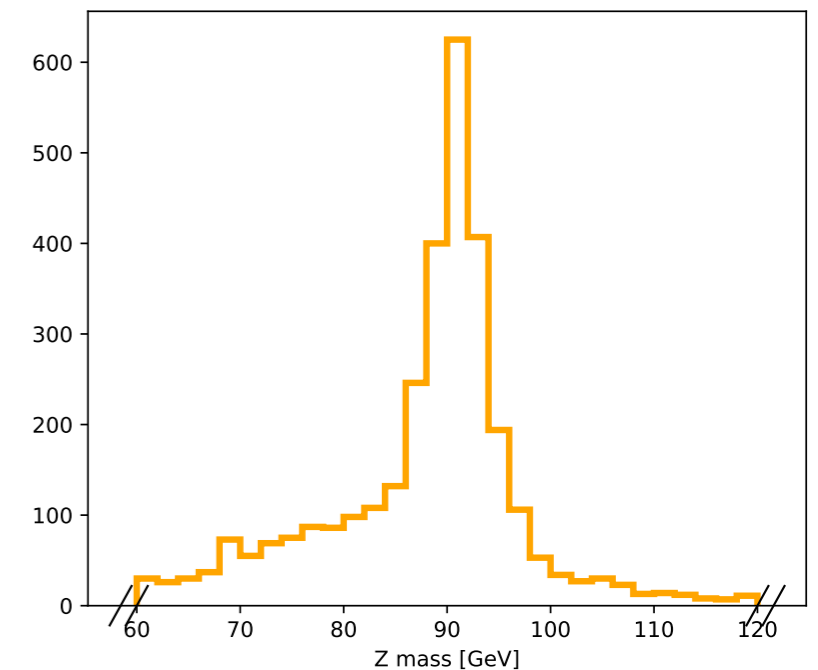
➤ Storage access:

- Grid EOS storage is accessible by xrootd:
<root://tidc-smstor1.grid.sinica.edu.tw/eos/>
- ➔ Or via fuse mount under UI: `/eos`
- Private EOS area: `/eos/tidc/<group_name>` (50 Tb / group)
- Working space: `/ceph/work/<group_name>` (3 Tb / group).

ps. This is basically too small for modern analyses, PI can ask for more when needed.

HOW TO USE?

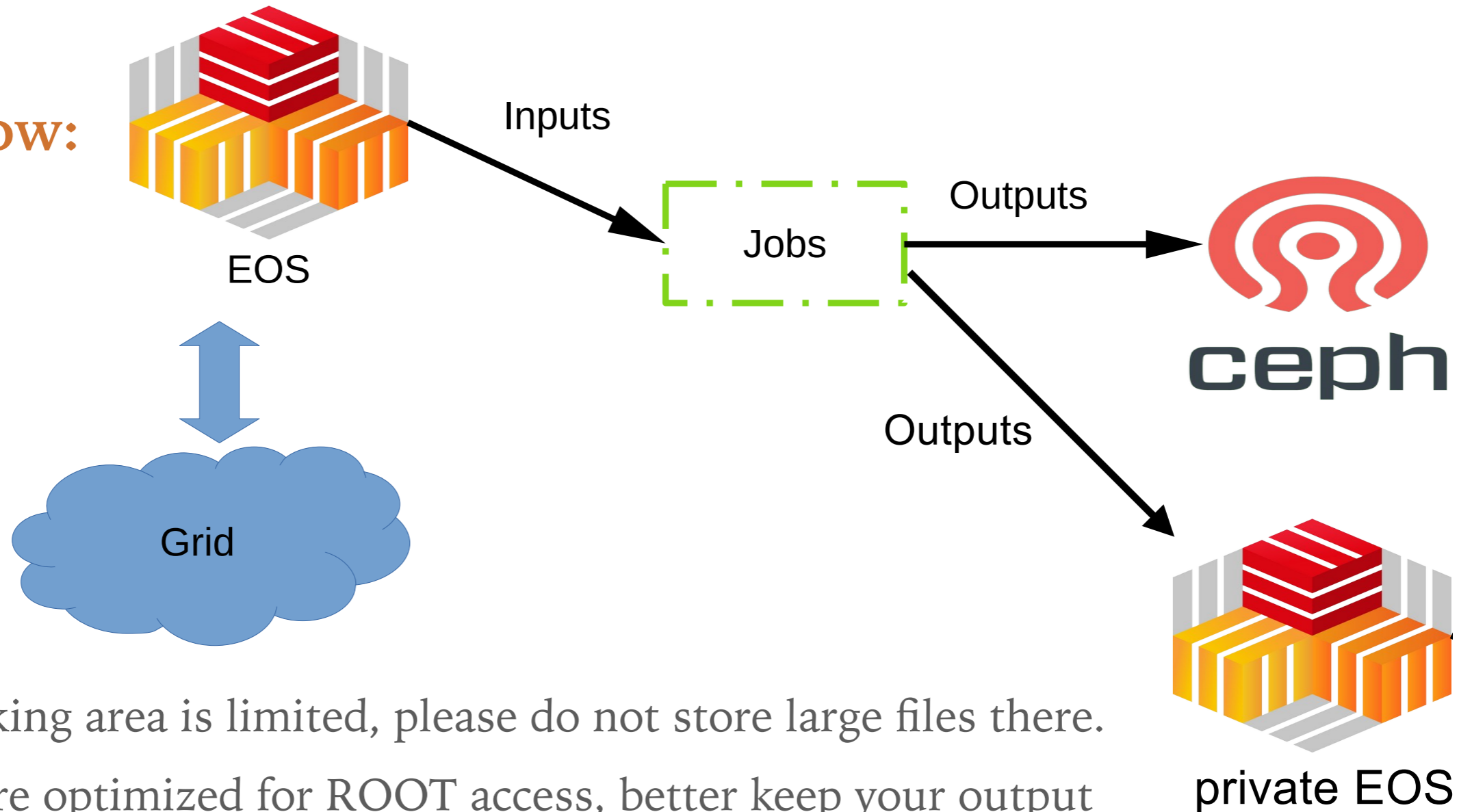
- **ASGC is running hands-on tutorials every 3 months.** A dedicated one held at NTU last year (*many thanks to ASGC & TIDC again!*):
<https://indico4.twgrid.org/event/35/>
with a special session for TIDC cluster.
- Topics of interests:
 - Access to TIDC & Condor scheduler (by Felix Lee):
<https://indico4.twgrid.org/event/35/#b-595-hands-on-computing-servi>
 - General CMS software setup & condor jobs (by You-Ying Li):
<https://indico4.twgrid.org/event/35/#b-597-hands-on-analysis-framew>
 - Running analysis with RDataFrame (by Cheng-Han Wu) & Coffea (by Yu-Hsuan Chou):
<https://indico4.twgrid.org/event/35/#b-587-computing-service-for-he>



*Z → e⁺e⁻ peak generated
by Coffea running on
TIDC system, using
CMS open data.*

ANALYSIS WORKFLOW

➤ **Typical workflow:**

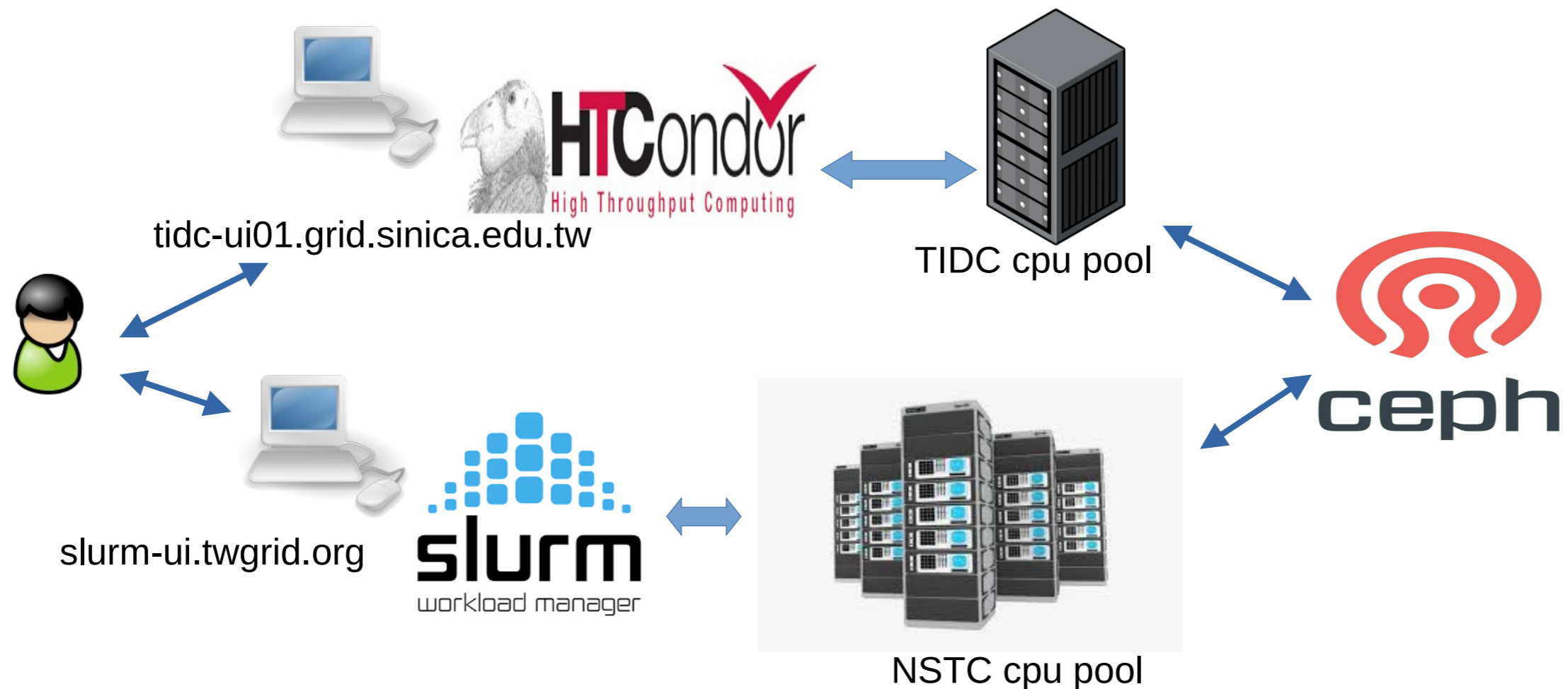


- **Ceph** working area is limited, please do not store large files there.
- **EOS** is more optimized for ROOT access, better keep your output ROOT files there if needed.
 - ➔ It is a bad idea to write your private files back to grid EOS (might be killed by global grid management), please use the private EOS area instead.

ANALYSIS WORKFLOW

► Integration with NSTCCore services:

- It is possible to use the CPU/GPU allocated under NSTCCore too (as the Dicos user area & Ceph workspace are shared).
- No direct access to experimental software but possible to run general analysis tasks (e.g. statistical studies, ML training, etc).



SUMMARY & PROSPECTS

- Many thanks to ASGC's support, now we have our **TIDC cluster up and running!**
 - Please apply group/user accounts to access the resources.
 - Now it is CMS compatible, but it should be able to run the analysis jobs for other experiments as well (*CERN projects should be straightforward*) — further integrations can be discussed!
- **Please be gentle to ui01 / not to overload it!**
More and stronger UIs are coming, converting from NCU machines! (e.g. ui03)
- Expected to double the specs based on the summit grant early next year.



**HAPPY RUNNING
ANALYSIS JOBS!**