

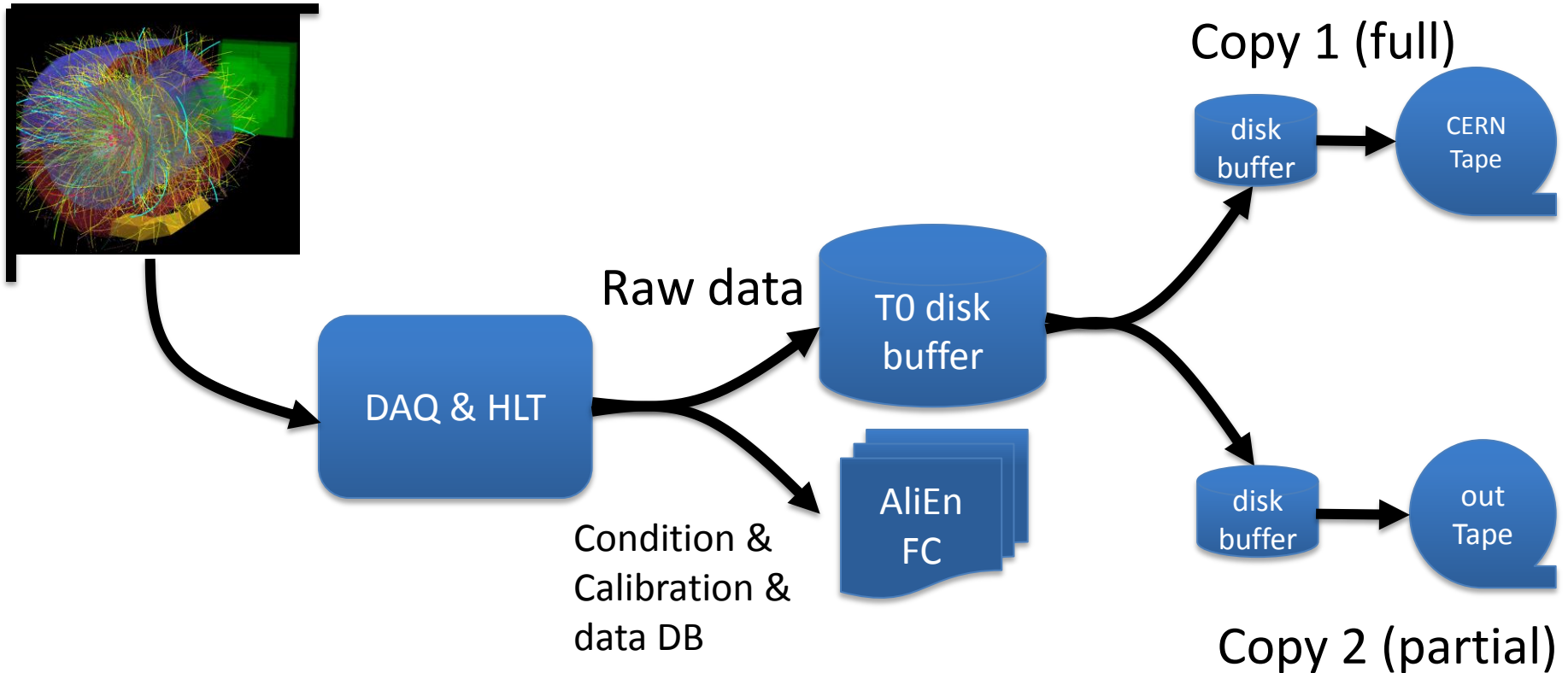


ALICE
A JOURNEY OF DISCOVERY

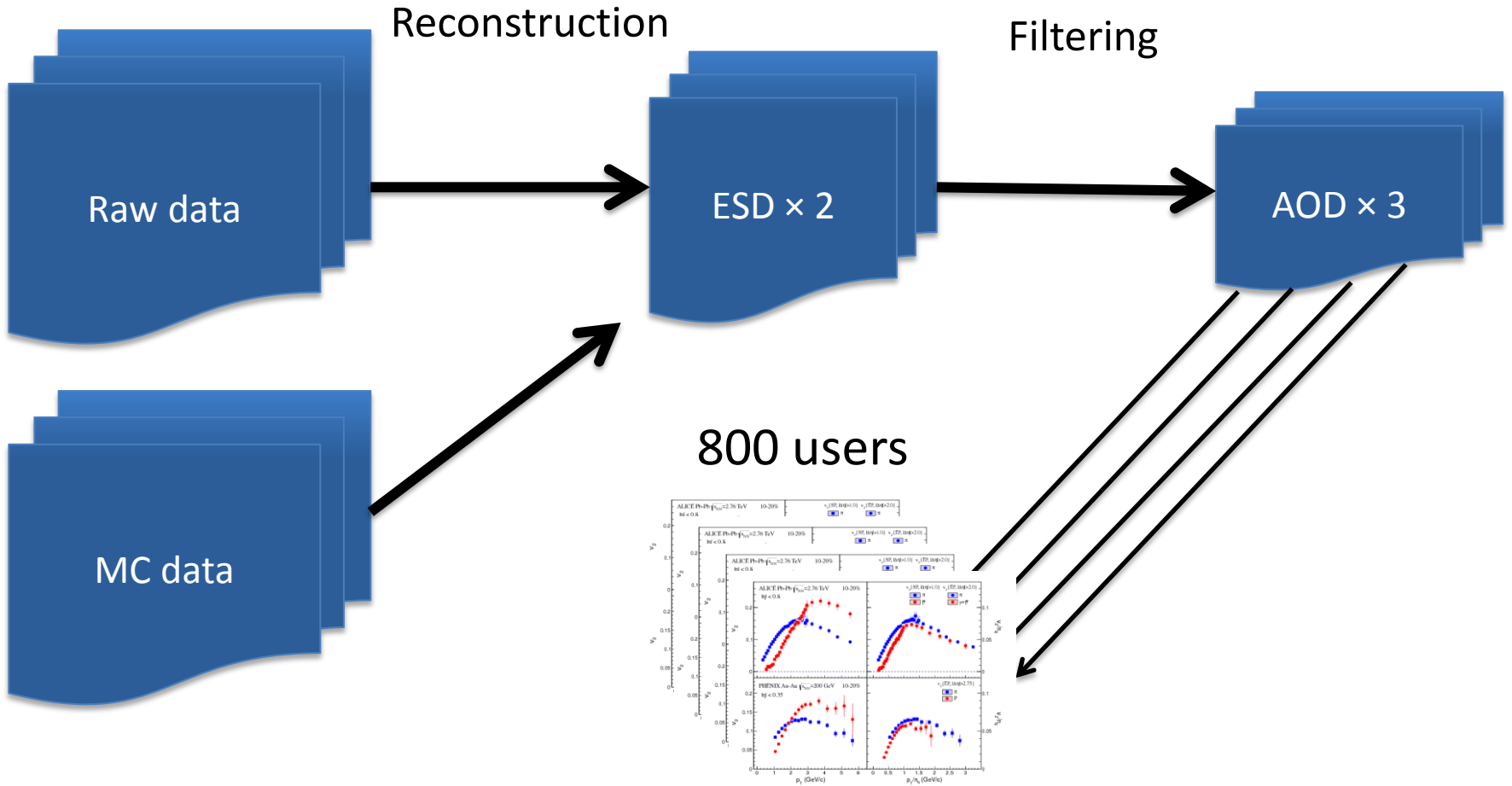
T1 at LBL/NERSC/OAK RIDGE

General principles

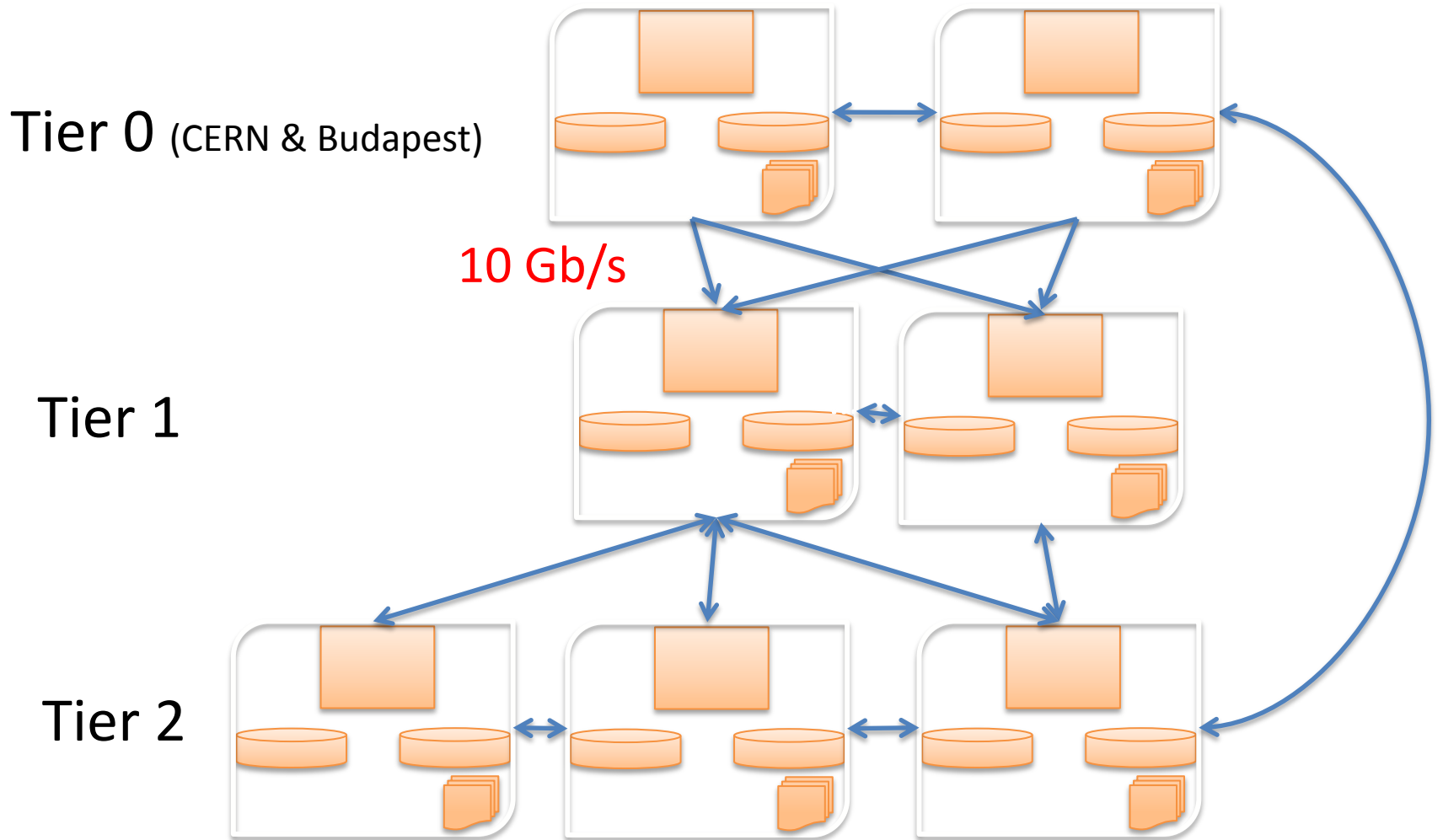
RAW data flow



Data processing

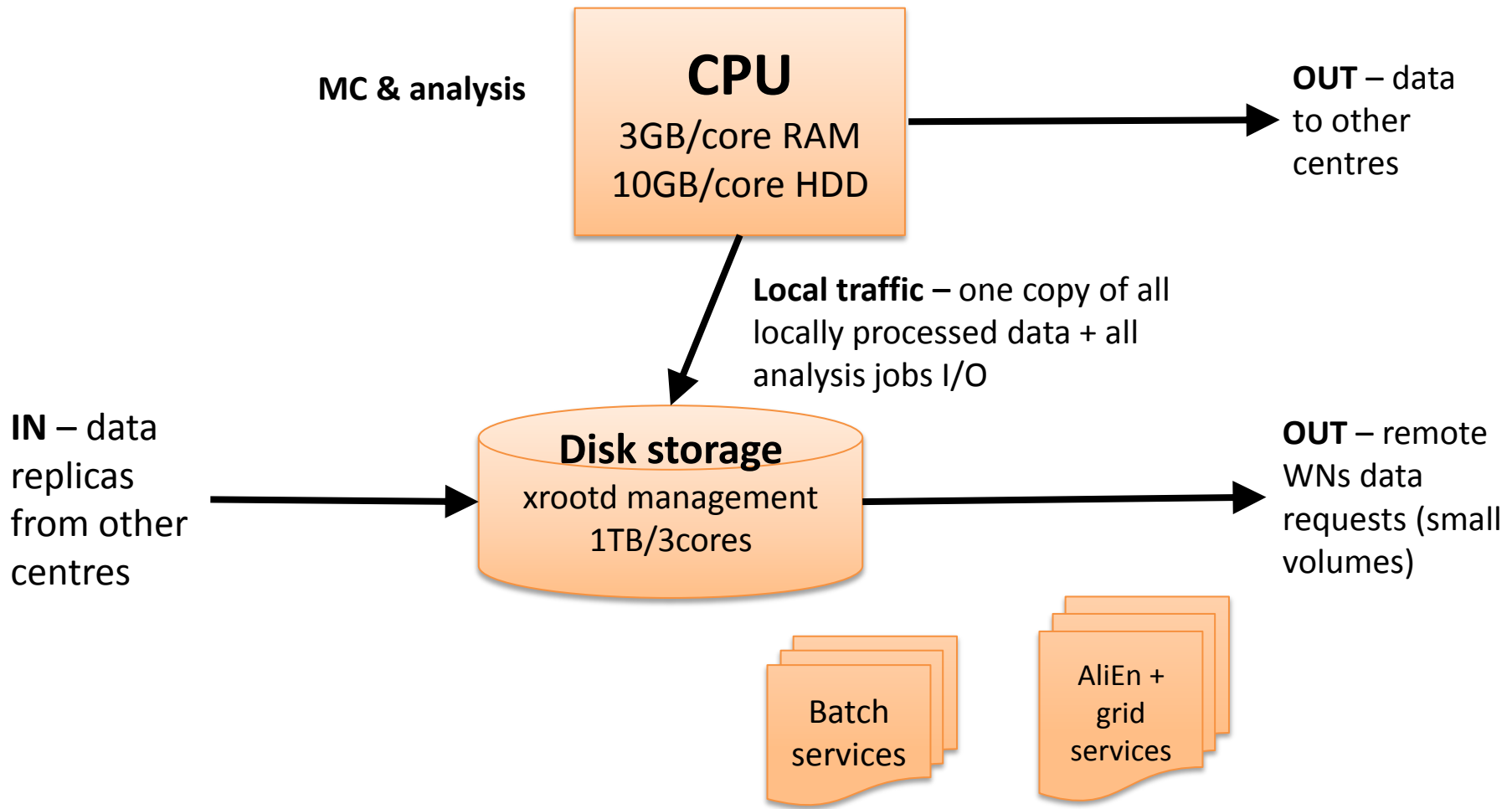


Hierarchy



Connectivity – anyone to anyone, T0 \leftrightarrow T1 is 10GB/sec (LHCOPN)

Grid node



Processing principles

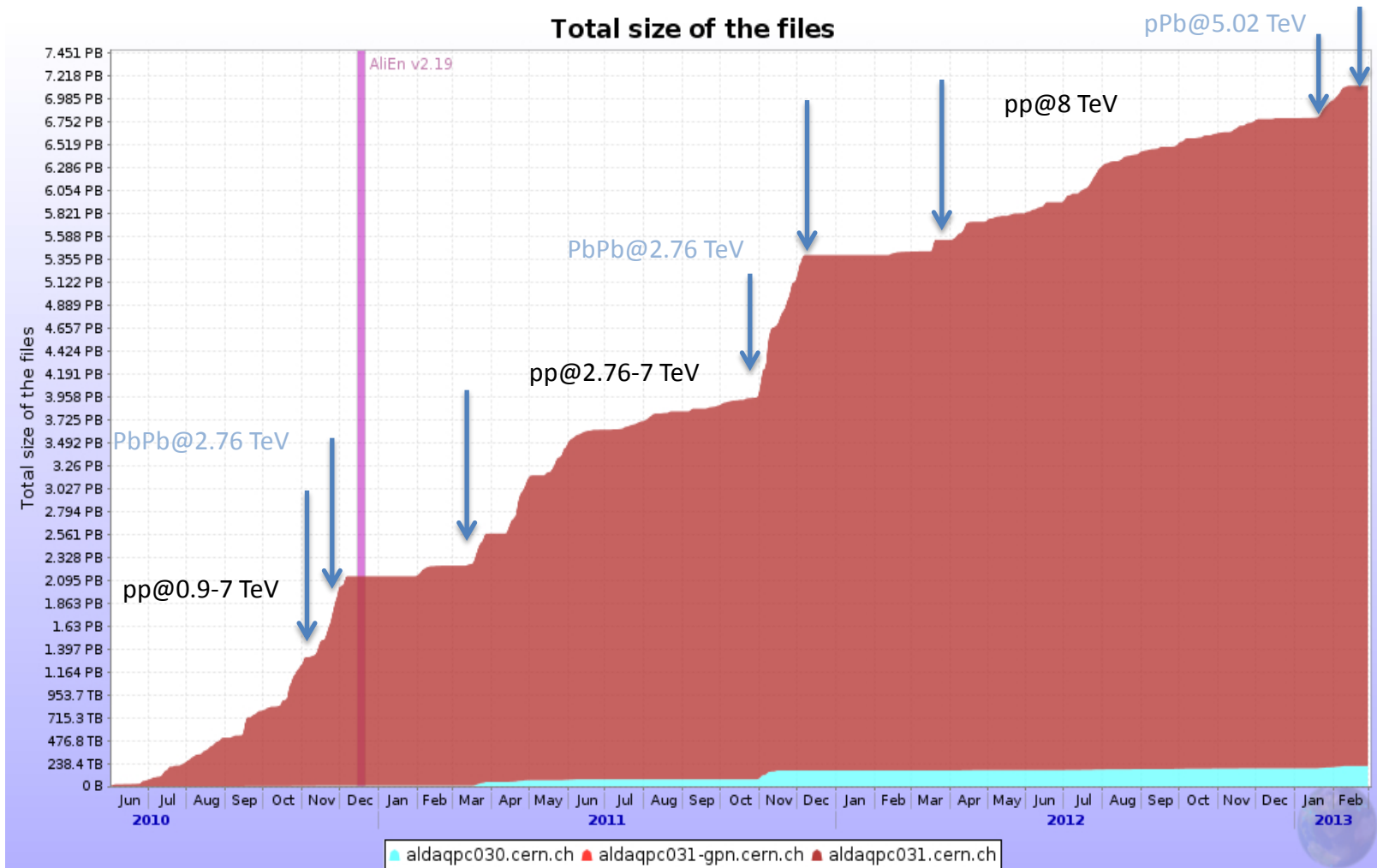
- *All resources are pooled together*
- Any site performs any kind of tasks (except RAW data access limited to T0 & T1s)
 - Even this is not 'a rule'
- Data placement guided by topological location of sites
 - Storage auto discovery
- Job goes to the data
- Network scales with #users and amount of data

Some numbers

ALICE has been collecting data since 2010

- 2010: pp @ 0.9 – 7 TeV
Pb-Pb @ 2.76 TeV (MB); $L_{\text{int}} = 3 \mu\text{b}^{-1}$
- 2011: pp @ 2.76 – 7 TeV (MB & rare)
PbPb @ 2.76 TeV (MB & rare); $L_{\text{int}} = 80 \mu\text{b}^{-1}$
- 2012: pp @ 8 TeV (rare)
p-Pb @ 5.02 TeV (MB & rare); $L_{\text{int}} = 30 \text{nb}^{-1}$

RAW Data collection



Processing needs

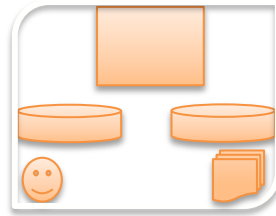
~ 10 HEP-Spec06 / core

~ 50 HEP-Spec06 × s / PbPb event

~ 1 TB / 50,000 PbPb events

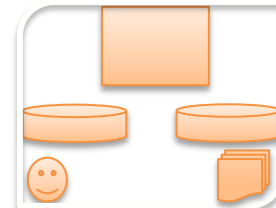
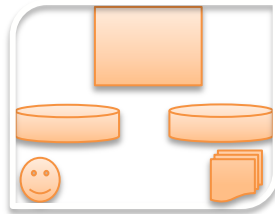
Processing capacities

Tier 0



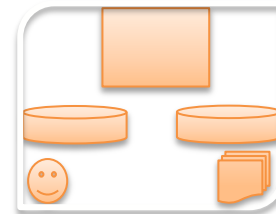
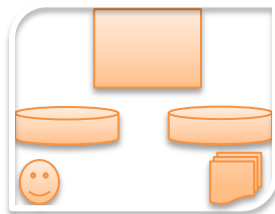
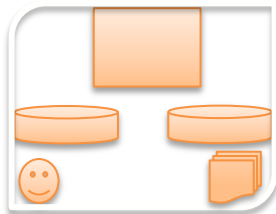
CPU	Disk	Tape
8-core	PB	PB
1,300	8.1	22.8
24%	28%	

Tier 1



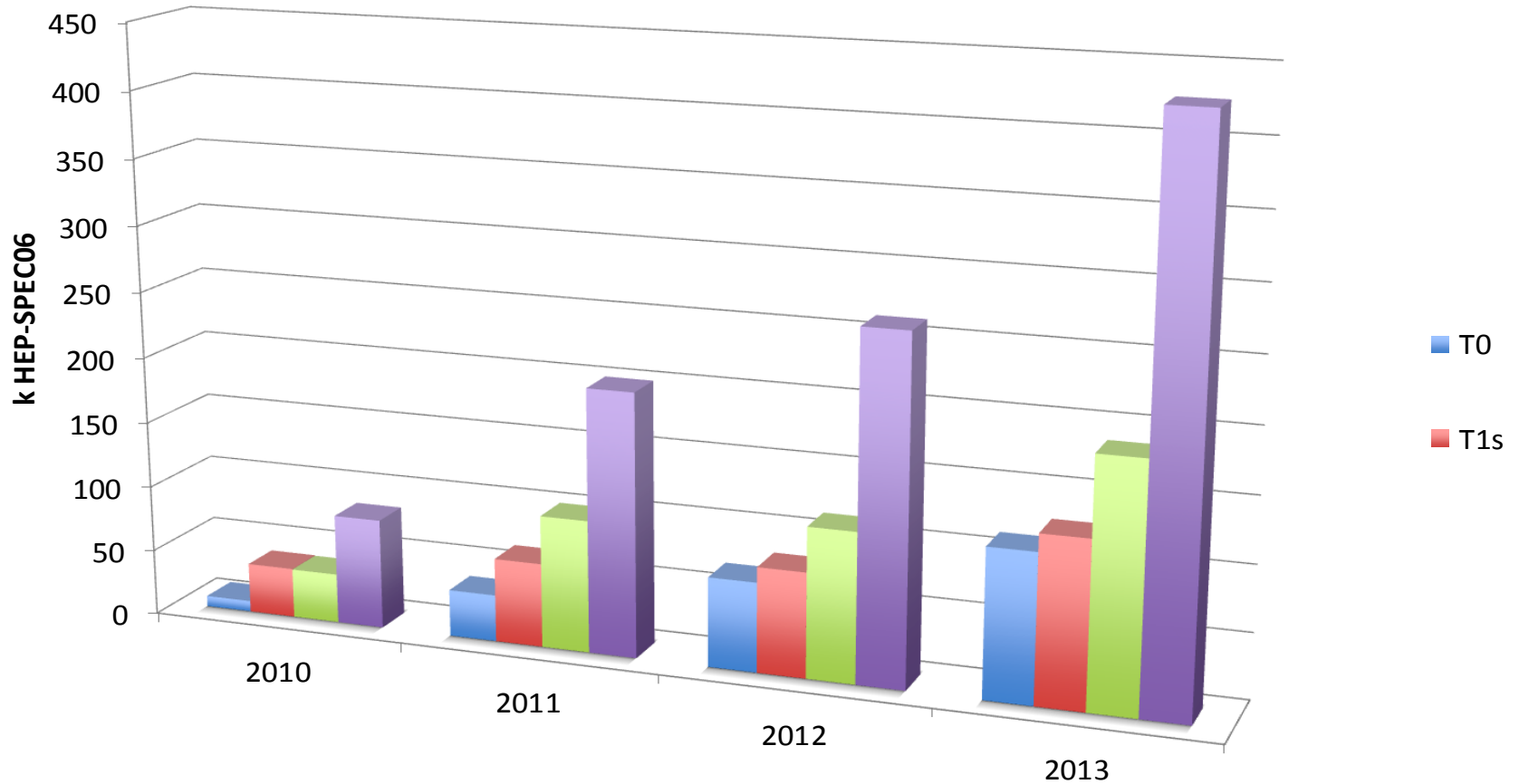
1,500	7.8	13.1
27%	29%	

Tier 2



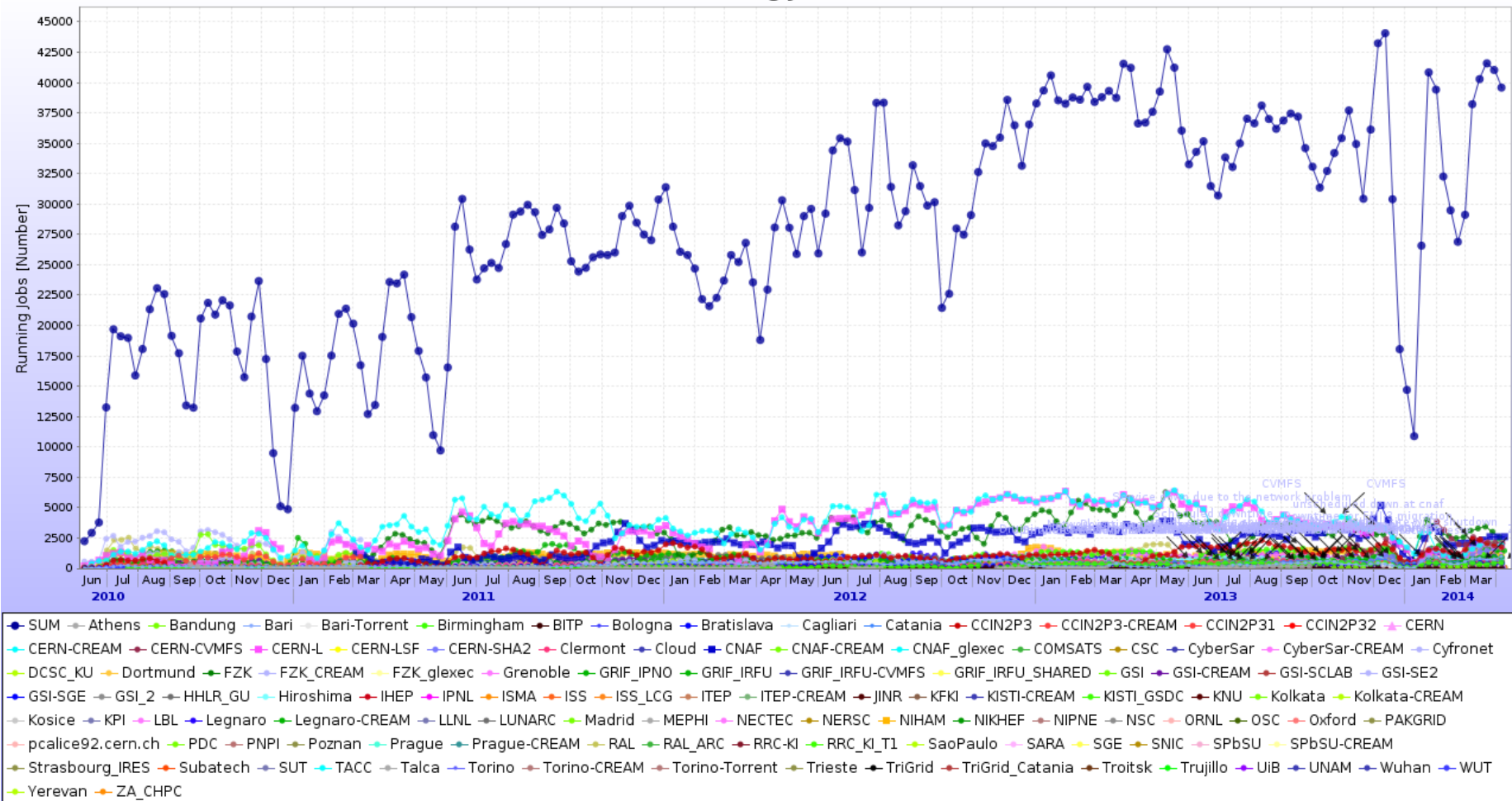
2,700	12.8	
49%	45%	

Capacity evolution



Capacity evolution (2)

Running Jobs



T1 definition

From [WLCG MoU](#)

- acceptance of an agreed share of raw data from the Tier0 Centre, keeping up with data acquisition;
- acceptance of an agreed share of first-pass reconstructed data from the Tier0 Centre;
- acceptance of processed and simulated data from other centres of the WLCG;
- recording and archival storage of the accepted share of raw data (distributed back-up);
- provision of managed disk storage providing permanent and temporary data storage for files and databases;
- provision of access to the stored data by other centres of the WLCG and by named AF's;
- operation of a data-intensive analysis facility;
- provision of other services according to agreed Experiment requirements;

T1 services

- Ensure high-capacity network bandwidth and services for data exchange with the Tier0 Centre, as part of an overall plan agreed amongst the Experiments, Tier1 and Tier0 Centres;
- Ensure network bandwidth and services for data exchange with Tier1 and Tier2 Centres, as part of an overall plan agreed amongst the Experiments, Tier1 and Tier2 Centres;
- Administration of databases required by Experiments at Tier1 Centres.
- All storage and computational services shall be “grid enabled” according to standards agreed between the LHC Experiments and the regional centres.

Services must be provided on a long-term basis, with excellent reliability, a high level of availability and rapid responsiveness to problems.

QoS

<i>Service</i>	<i>Maximum delay in responding to operational problems</i>			<i>Average availability² measured on an annual basis</i>	
	Service interruption	Degradation of the capacity of the service by more than 50%	Degradation of the capacity of the service by more than 20%	During accelerator operation	At all other times
Acceptance of data from the Tier-0 Centre during accelerator operation	12 hours	12 hours	24 hours	99%	n/a
Networking service to the Tier-0 Centre during accelerator operation	12 hours	24 hours	48 hours	98%	n/a
Data-intensive analysis services, including networking to Tier-0, Tier-1 Centres outwith accelerator operation	24 hours	48 hours	48 hours	n/a	98%
All other services ³ – prime service hours ⁶	2 hour	2 hour	4 hours	98%	98%
All other services ³ – outwith prime service hours ⁶	24 hours	48 hours	48 hours	97%	97%

Approval process (KISTI T1)

- Preparation/running of CPU, disk storage, local networking – existing
- Setting up tape copy through xrootd – 3 months
- RAW data replication/reconstruction tests – 2 months

Summary

- Being T1 is the only reasonable choice for a large computing centre
- Most of the components are already in place, additional elements add expertise
 - Important for the progress of the centre itself
 - Can be a source of substantial R&D programme
- The 'prestige' factor should not be ignored – there are 150+ T2 and only 8 T1s