LHCb Current Understanding of Italian Tier-n Centres

Domenico Galli, Umberto Marconi

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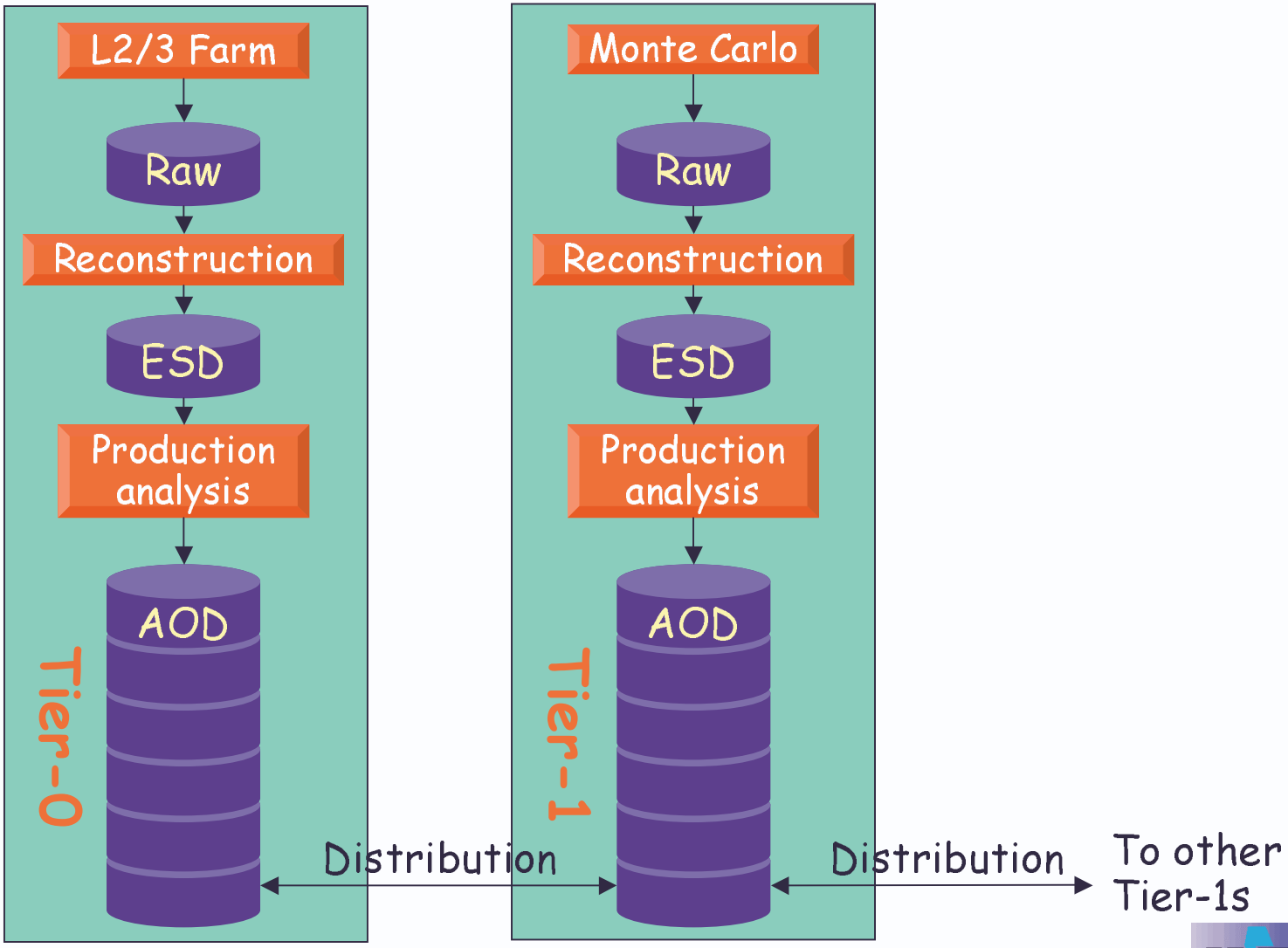
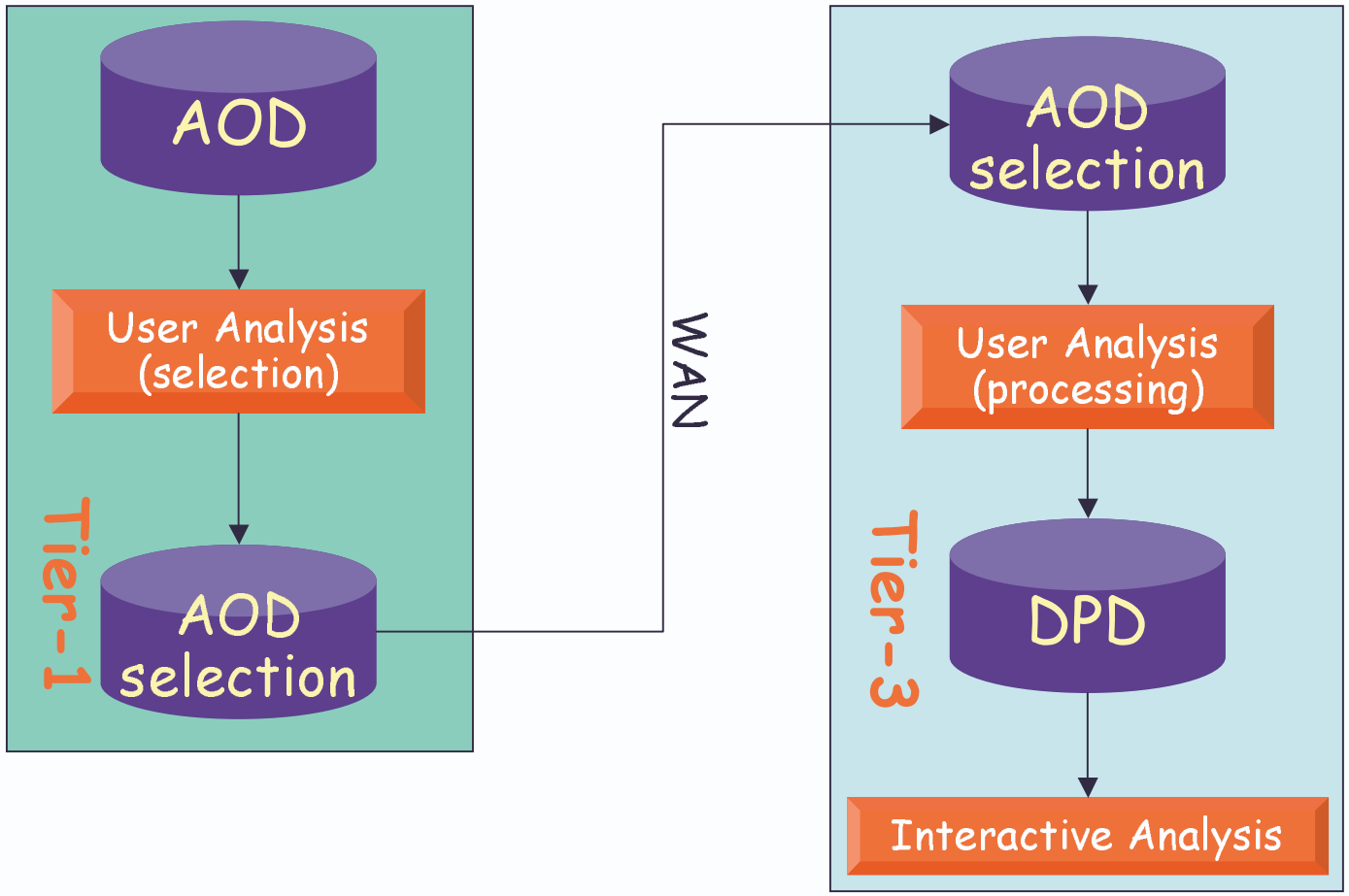
LHCb Difference With Respect to Other LHC Experiments

- The **first stage in the analysis** (**ESD → AOD**, **final state reconstruction** and **event classification**) in LHCb experiment is performed **in common** for all the analyses that subsequently follow.
  - This means that more than one algorithm could have to be run on any single event, if that event satisfies more than one tag criterion.
  - The first stage in the analysis is therefore performed in production (**Production Analysis**) soon after data taking at CERN (real data) and in MC production centres (MC).
  - **AOD** (20 TB/a real data) are **systematically distributed** to all Tier-1 centres. **ESD** (100 TB/a real data) are **kept in production centres**.

Production — Production Analysis



User Analysis — Interactive Analysis



LHCb Tier-n Tasks

- **Tier-1.**
  - MC production (→ RAWmc, → ESDmc) + production analysis (→ AOD) + reprocessing (→ ESDmc).
  - User analysis (selection task) in collaboration with Tier-3s.
  - ➢ Storage of RAWmc and ESDmc **produced in the centre itself**.
  - ➢ Storage of **all** the AOD (real AOD produced at CERN, MC AOD produced in all Tier-1 centres).
- **Tier-3s.**
  - User analysis (processing task, → DPD) in collaboration with Tier-1.
  - Interactive analysis of DPD.
  - ➢ Storage of AOD selections.
  - ➢ Storage of DPDs.
- **Tier-2s.**
  - Can collect several Tier-1 and Tier-3 functionalities.

LHCb Total Capacity Needs

Processing Step	Output Data	Frequency	Response/ Pass Time [d]	Total CPU Power [SI95]	Total Data Storage [TB]	Total Data IO [MB/s]
L2/3 Farm	Raw	1/a	120	40000	125	25
Reconstruction	ESD	1/a	120	50000	100	20
Reprocessing	ESD	2/a	46	0	100	70
Production Analysis	AOD	12/a	7	8000	80	200
Simulation/ Reconstruction	Raw + ESD	3×10^6 evt/d	300	550000	365	14
User Analysis	DPD	2/d	0.2	160000	20	–

LHCb Tier-1 Capacity Needs

Processing Step	Output Data	CPU Power [SI95]	Disk Storage [TB]	Active Tape Storage [TB]	Archive Tape Storage [TB]
Real Data	AOD+TAG	—	40	80	0
Simulation/ Reconstruction	Raw+ESD	110000	23	70	40
Production MC Analysis	AOD+TAG	8000	18	35	0
Calibration	—	—	10	0	10
Disk Cache for Staging Data	—	—	15	0	0
User Analysis	DPD	23000	5	0	5
Total	—	141000	111	185	55

The Proposed INFN Unique Tier-1 RC

- The proposed unique INFN Tier-1 Regional Centre for the 4 LHC experiments **doesn't change LHCb-Italy computing planning**: since the beginning LHCb-Italy planned indeed to build up a **"concentrated"** Tier-1, and already in 2001, it will put computing resources in only one site (the Tier-1 prototype at CNAF).
- INFN unique Tier-1:
  - must place at LHCb's disposal the **computing resources needed** (in terms of CPU power, disk/tape storage, connectivity, etc.).
  - with the **requirements** demanded by LHCb (operating system, experiment software, etc.).
- In our opinion, **personnel** at Tier-1 should include:
  - Qualified **system administrators**;
  - **Computer scientist** motivated by the interest about computing methods;
  - **Physicists** directly involved in analysis, motivated by the scientific results.

LHCb-Italy Required Personnel

	Tier-1 [FTE]	Tier-3 [FTE]
Support for R&D and general software tools	4	—
Support for experiment-specific LHCb software	2	0.5
System administration	2	0.5

2007 LHCb Tier-n Organization in Italy

Centre	#	Location	Resources
Tier-1	1	CNAF	**140 kSI95**, **110 TB disk**, 185 TB active tape, 55 TB archive tape
Tier-2	0	—	—
Tier-3	9	Bologna, Cagliari, Ferrara, Firenze, Frascati, Genova, Milano, Roma1, Roma2	Average (10 physicists): **5 kSI95**, **10 TB disk**. They can vary, depending upon group size and analysis activity.