



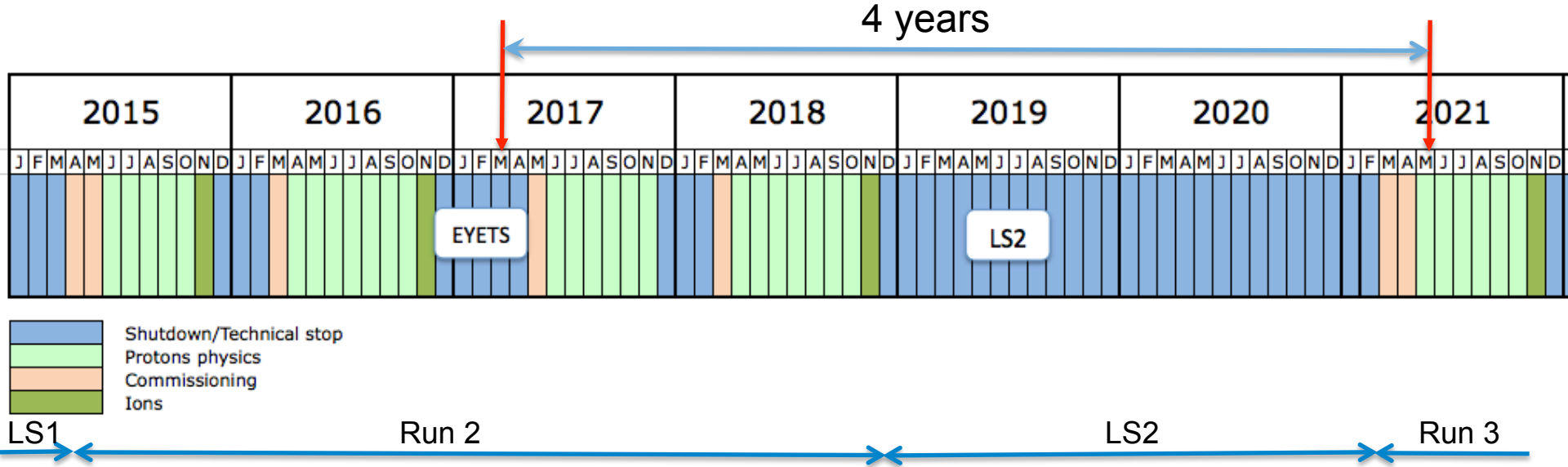
ALICE Upgrade for Run 3 and Run 4

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CERN Schedule



- LS2 2019-2020
 - Upgrades of ALICE and LHCb
- LS3 2024-2026
 - Upgrades of ATLAS and CMS (HL-LHC)
- **ALICE upgrade ready in Spring 2021** – 4 years from now, fits well with the CERN openlab next project phase



ALICE O² in a nutshell

Requirements

1. LHC min bias Pb-Pb at 50 kHz
~100 x more data than during Run 1
2. Physics topics addressed by ALICE upgrade
 - Rare processes
 - Very small signal over background ratio
 - Needs large statistics of reconstructed events
 - Triggering techniques very inefficient if not impossible
3. 50 kHz > TPC inherent rate (drift time ~100 μs)
Support for continuous read-out (TPC)
 - Detector read-out triggered or continuous

New computing system

- Read-out the data of all interactions
- ➔ Compress these data intelligently by online reconstruction
- ➔ One common online-offline computing system: O²
- Paradigm shift compared to approach for Run 1 and 2

Unmodified raw data of all interactions shipped from detector to online farm in triggerless continuous mode

HI run 3.3 TByte/s ↓

Baseline correction and zero suppression
Data volume reduction by zero cluster finder.
No event discarded.
Average compression factor 6.6

500 GByte/s ↓

Data volume reduction by online tracking. Only reconstructed data to data storage.
Average compression factor 5.5

90 GByte/s ↓

Data Storage: 1 year of compressed data

- Bandwidth: Write 90 GB/s Read 90 GB/s
- Capacity: 60 PB

20 GByte/s ↔

Tier 0, Tiers 1 and Analysis Facilities

↕

Asynchronous (few hours) event reconstruction with final calibration

Data flow & processing (1)

Raw data input

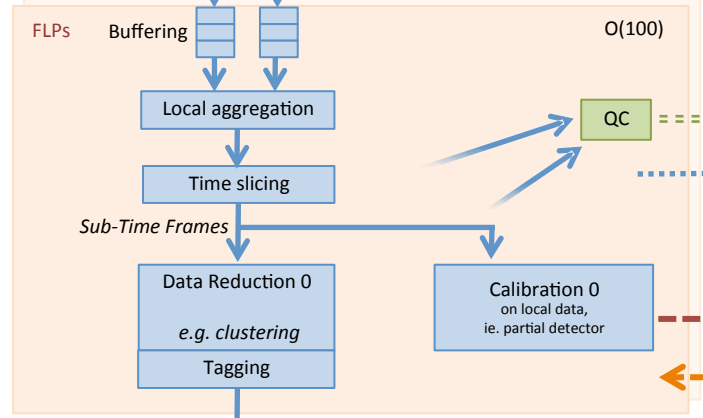
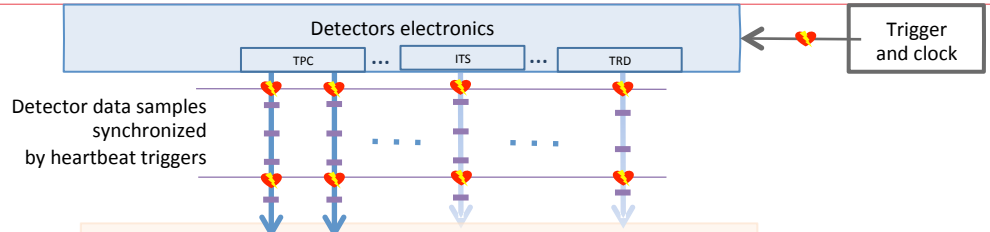
Local processing

Frame dispatch

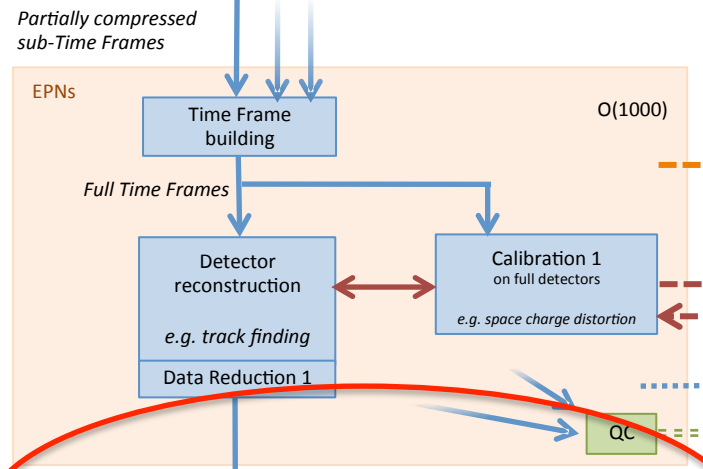
Global processing

Storage

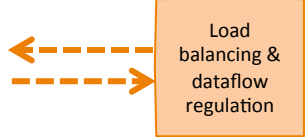
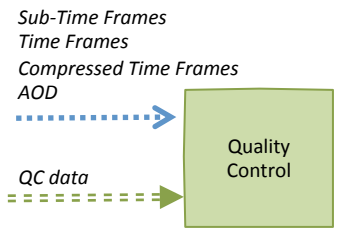
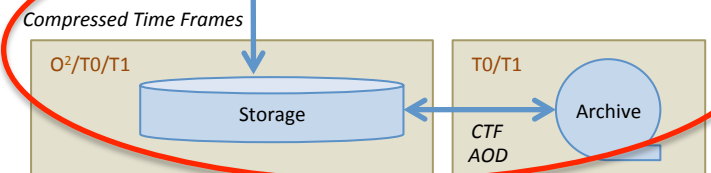
Synchronous



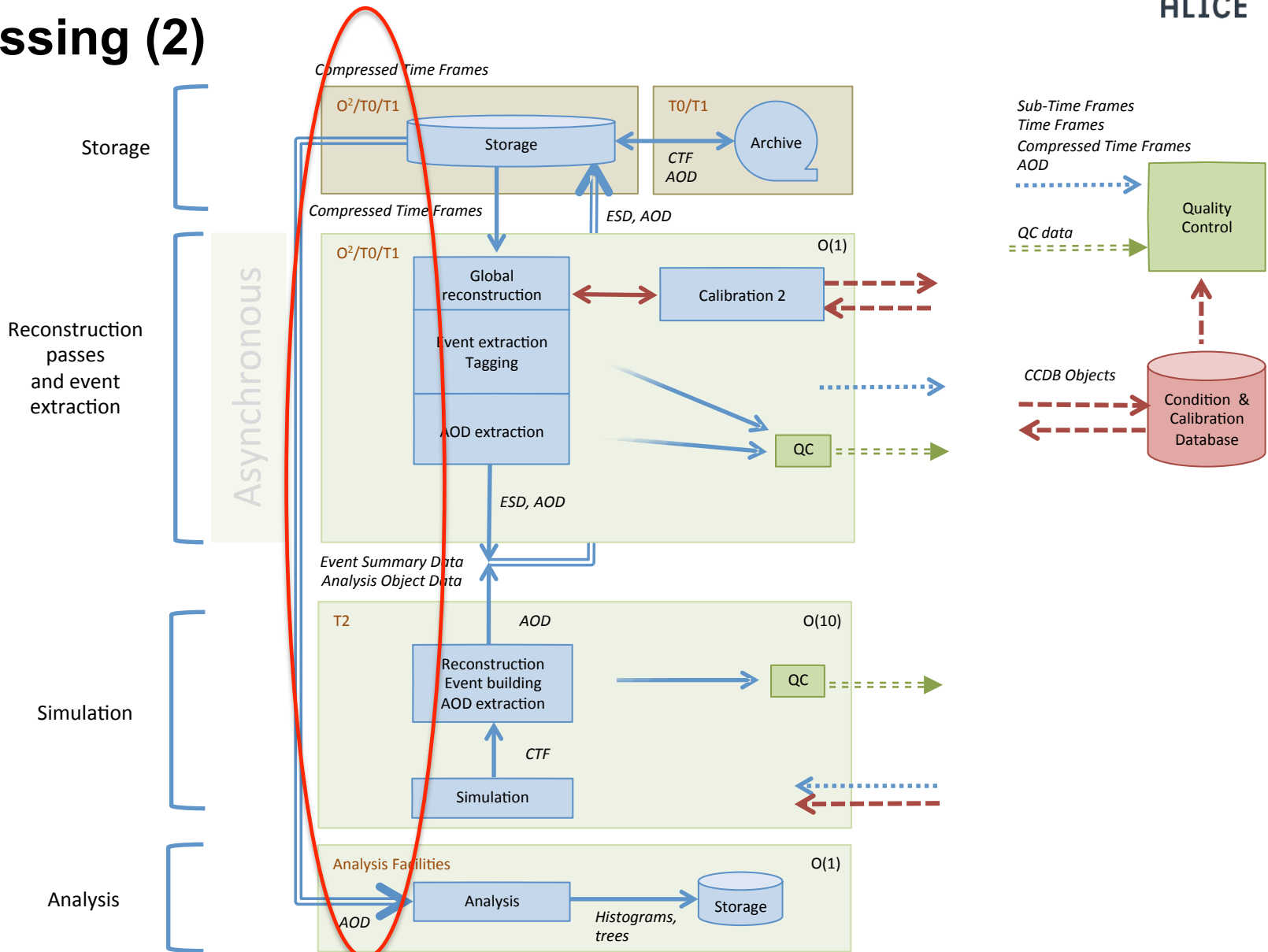
First-Level Processors (FLPs)



Event Processing Nodes (EPNs)



Data flow & processing (2)



Challenges

- Rates to storage – write 90GB/sec , read 20GB/sec out (+ delta)
- Capacity – 60PB in a single instance (first year)
- High availability – on the critical path for data taking
- Complex interactions with various systems – experiment/Grid/analysis
- Current experience (borrowed from EOS)

