



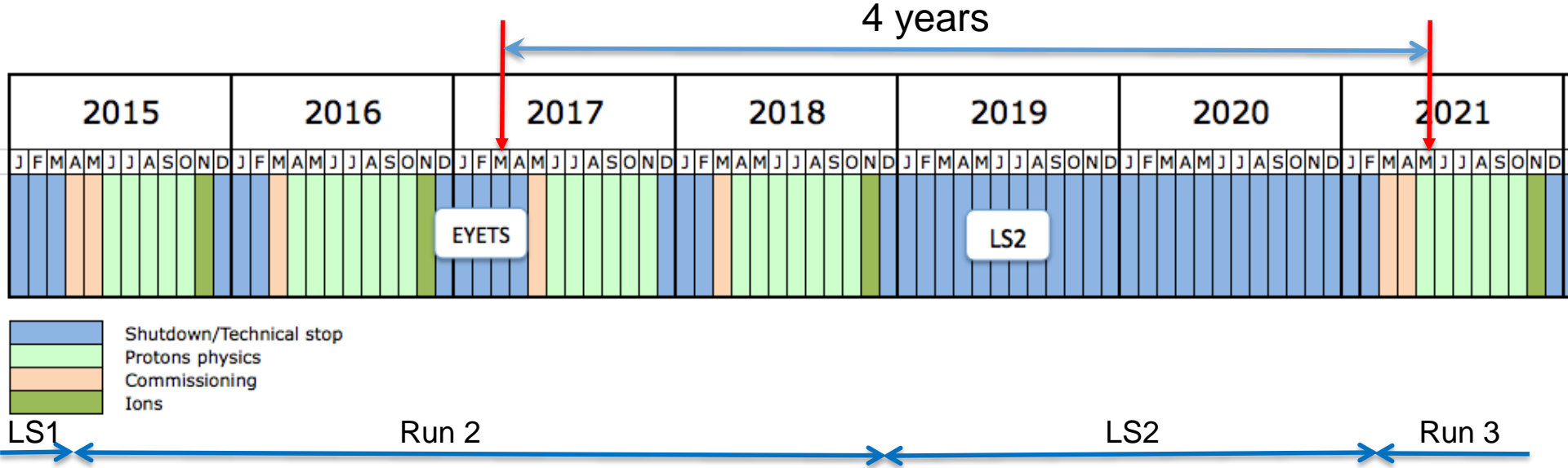
# ALICE Upgrade for Run 3 and Run 4

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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 O<sup>2</sup> 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: O<sup>2</sup>
- 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

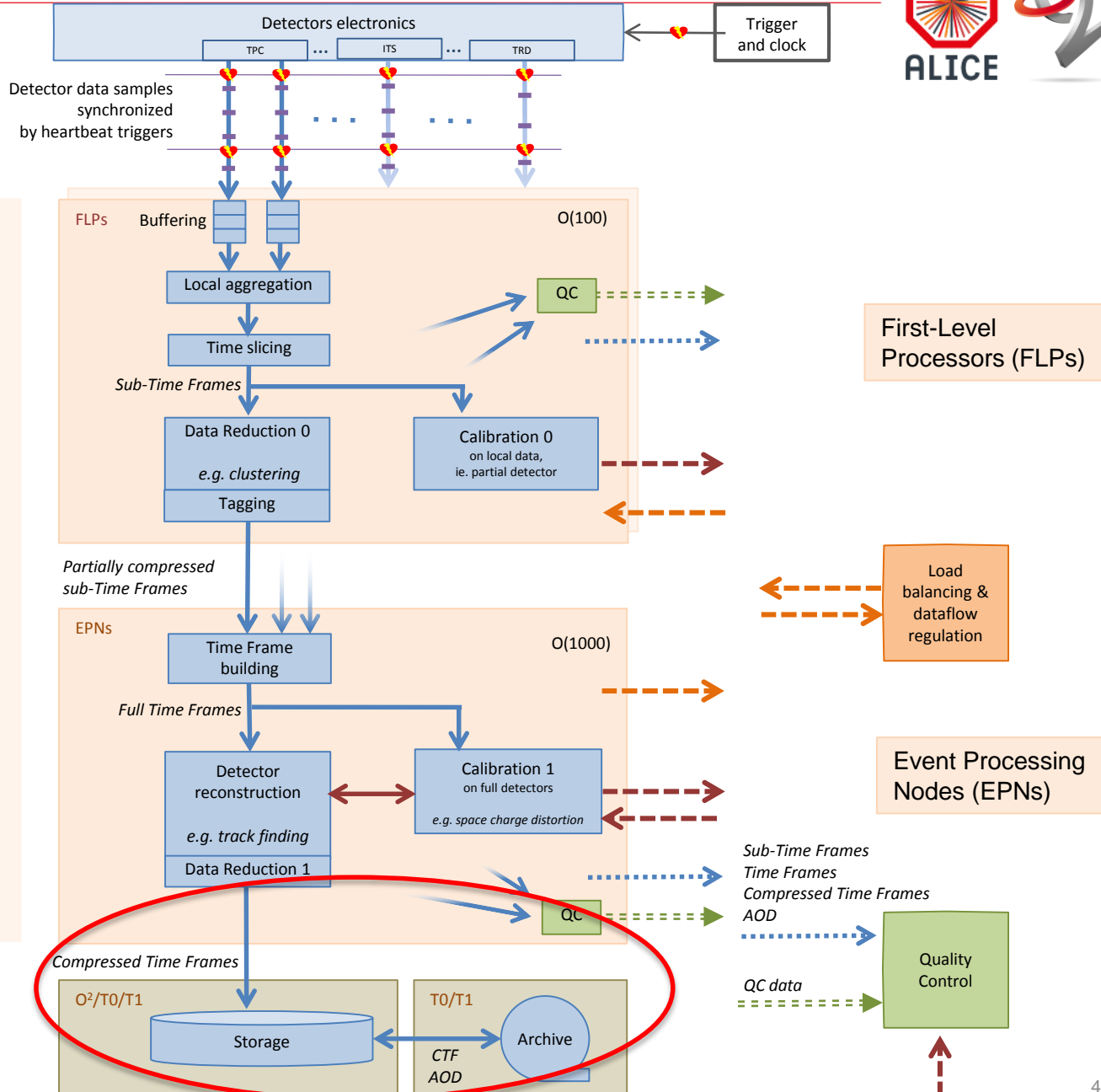
Local processing

Frame dispatch

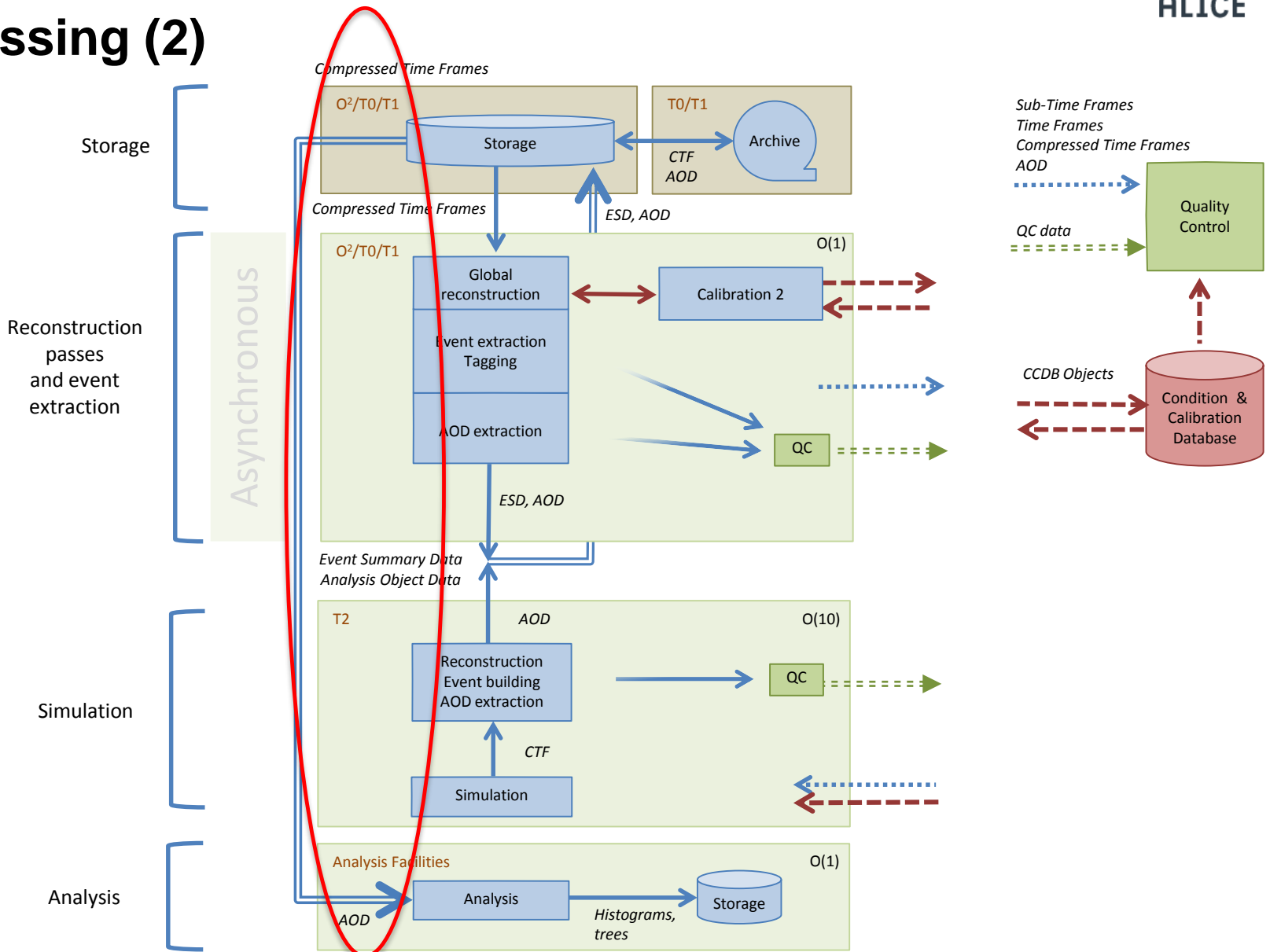
Global processing

Storage

Synchronous



# 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)

