# ALICE DCS preparation for Run 3

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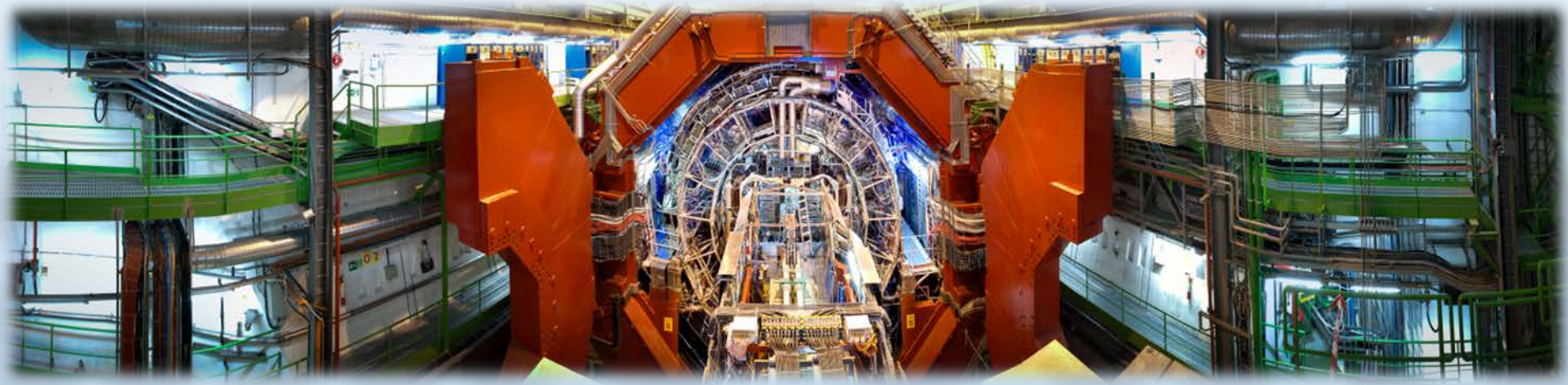
# The ALICE experiment is a heavy ion collision detector at the CERN LHC

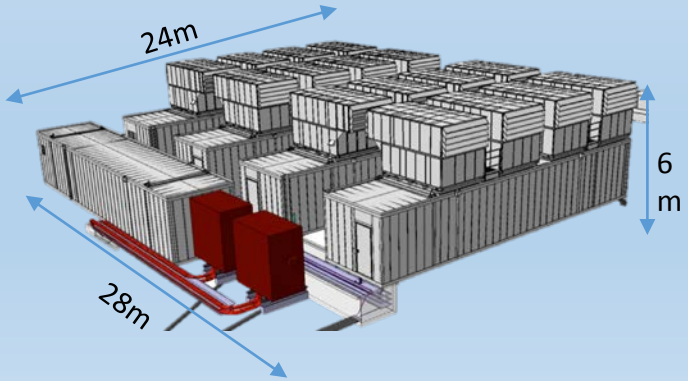


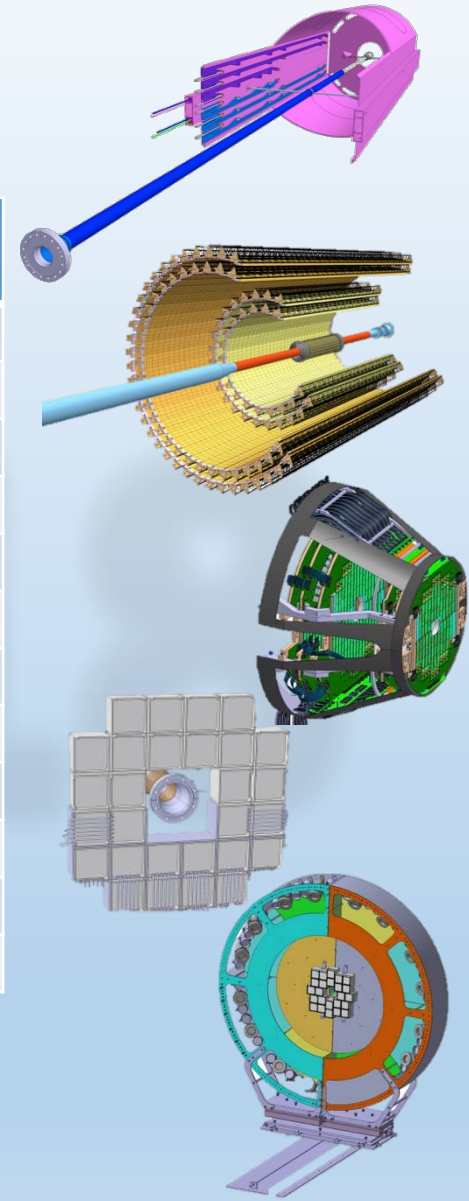
- It is collaboration of 41 countries and more than 1800 scientists working on 19 detectors
- A large number of complex subsystems require supervision and control system (DCS)
- DCS assures safe and efficient operation of the detector
- 4 PB of raw physics data collected in 2017
- Search for rare events requires the increase of collision rate by factor 100
- ALICE detector needs to be modernized to cope with the new requirements

# ALICE what's next

- 2019-2021 Long shutdown (LS2)
- Upgrade and installation of detectors
- Open new datacenter infrastructure, witch will host more than 1600 servers

| Activity | Date |
|---|---|
| Open L3 doors | 14 Dec 2018 |
| TRD SM6 extraction | 19 Dec 2018 |
| PHOS rework (incl. de-installation & re-installation) | 7 Mar to 12 Dec 2019 |
| TRD rework | 8 Apr to 30 Oct 2019 |
| TPC in SXL2 | 4 Mar 2019 |
| TPC in cleanroom | 2 Apr 2019 |
| Move TPC to UX25 | 3 Feb 2020 |
| MFT installation | 15 Apr 2020 |
| ITS installation | 27 May 2020 |
| ITS & MFT commissioning time | 8w |
| ALICE global commissioning time | 18w |
| End of LS2 | 22 Feb 2021 |



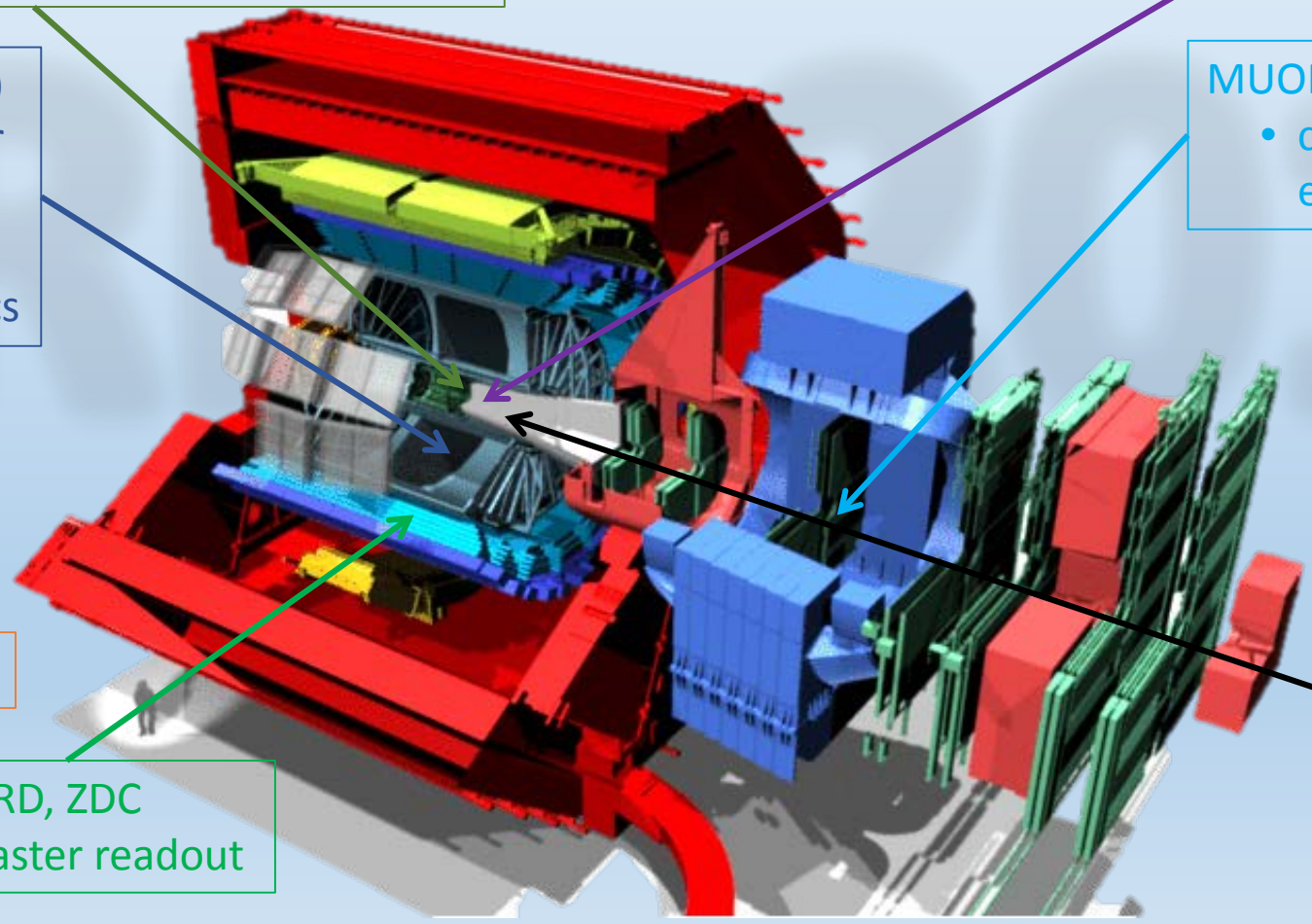
# LS2 ALICE upgrades

New Inner Tracking System (ITS)
- improved pointing precision
- less material -> thinnest tracker at the LHC

Muon Forward Tracker (MFT)
- new Si tracker
- Improved MUON pointing precision

Time Projection Chamber (TPC)
- new GEM technology for readout chambers
- continuous readout
- faster readout electronics

MUON ARM
- continuous readout electronics



New Central Trigger Processor (CTP)

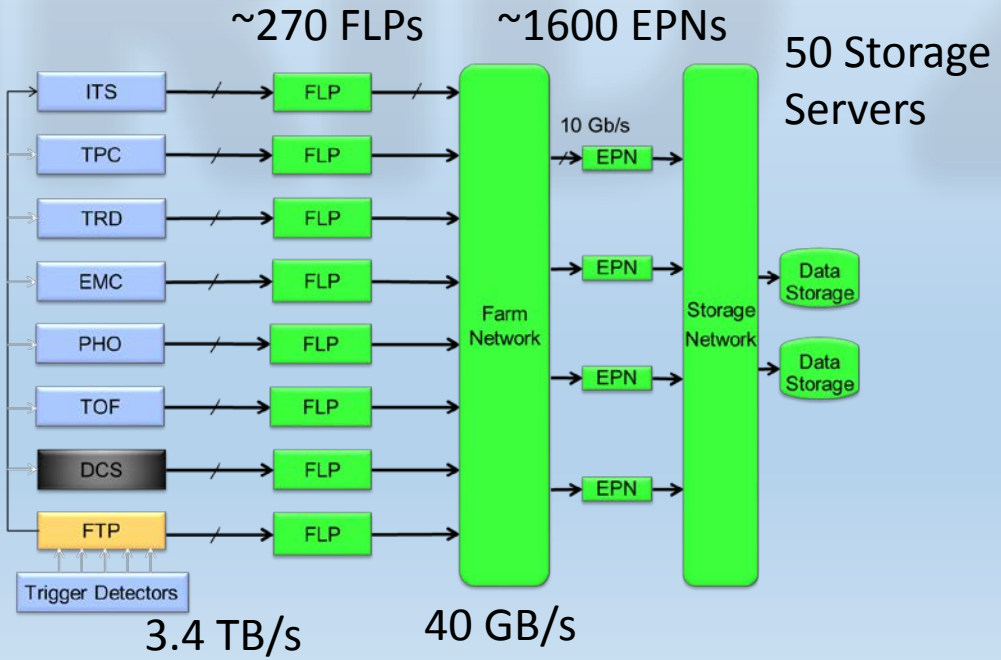
Online-Offline Computing $O^2$

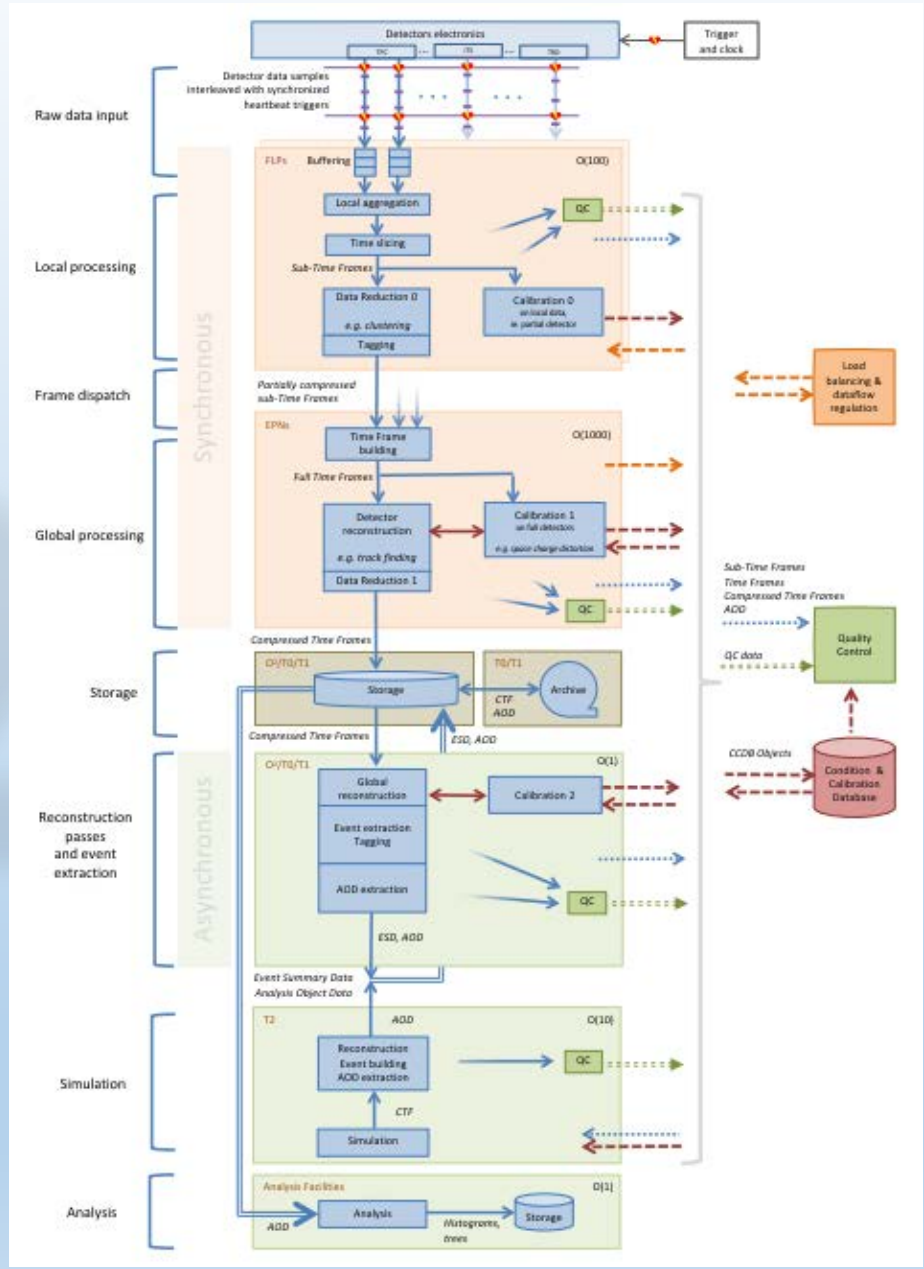
TOF, TRD, ZDC
- Faster readout

New Trigger Detectors (FIT)

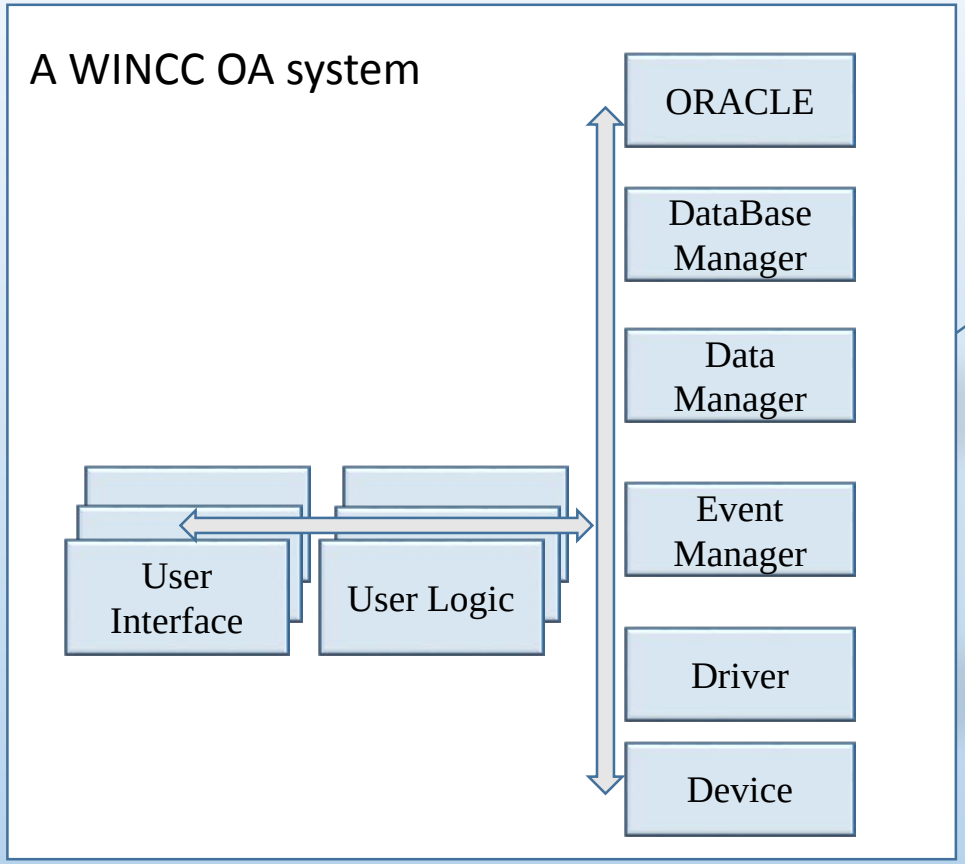
# $O^2$ new computing system

- New architecture
  - read-out the data of all interactions
  - compress data and online reconstruction
  - common online-offline computing system
  - 50kHz Pb-Pb event rate

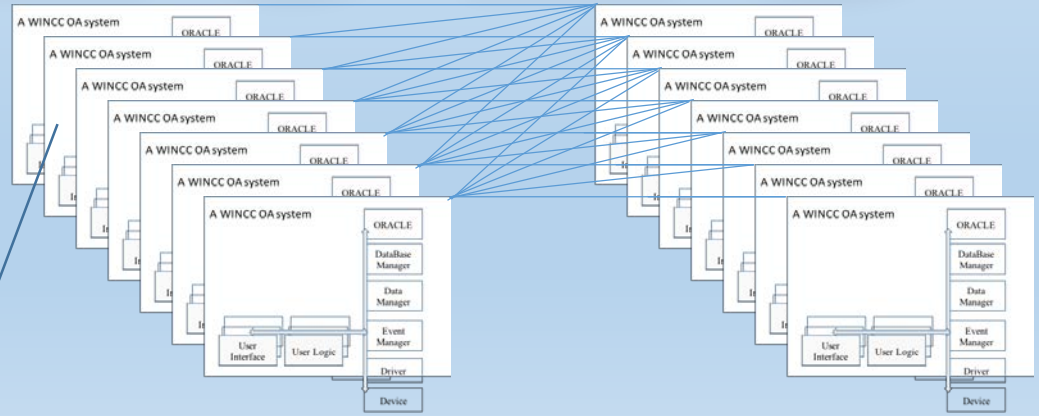


# Standard DCS Data Flow




- WinCC OA is a commercial SCADA, used for controls in all major CERN experiments and several technical infrastructure controls (electricity, gas, cooling, cryo).
- A WINCC OA system is a collection of specialized modules – managers
- Managers communicate over network using custom protocol on top of TCP/IP



- ALICE DCS is based on 100 individual WINCC OA systems configured as one large distributed system
- DCS is in charge of 1 000 000 parameters scattered across > 1200 devices

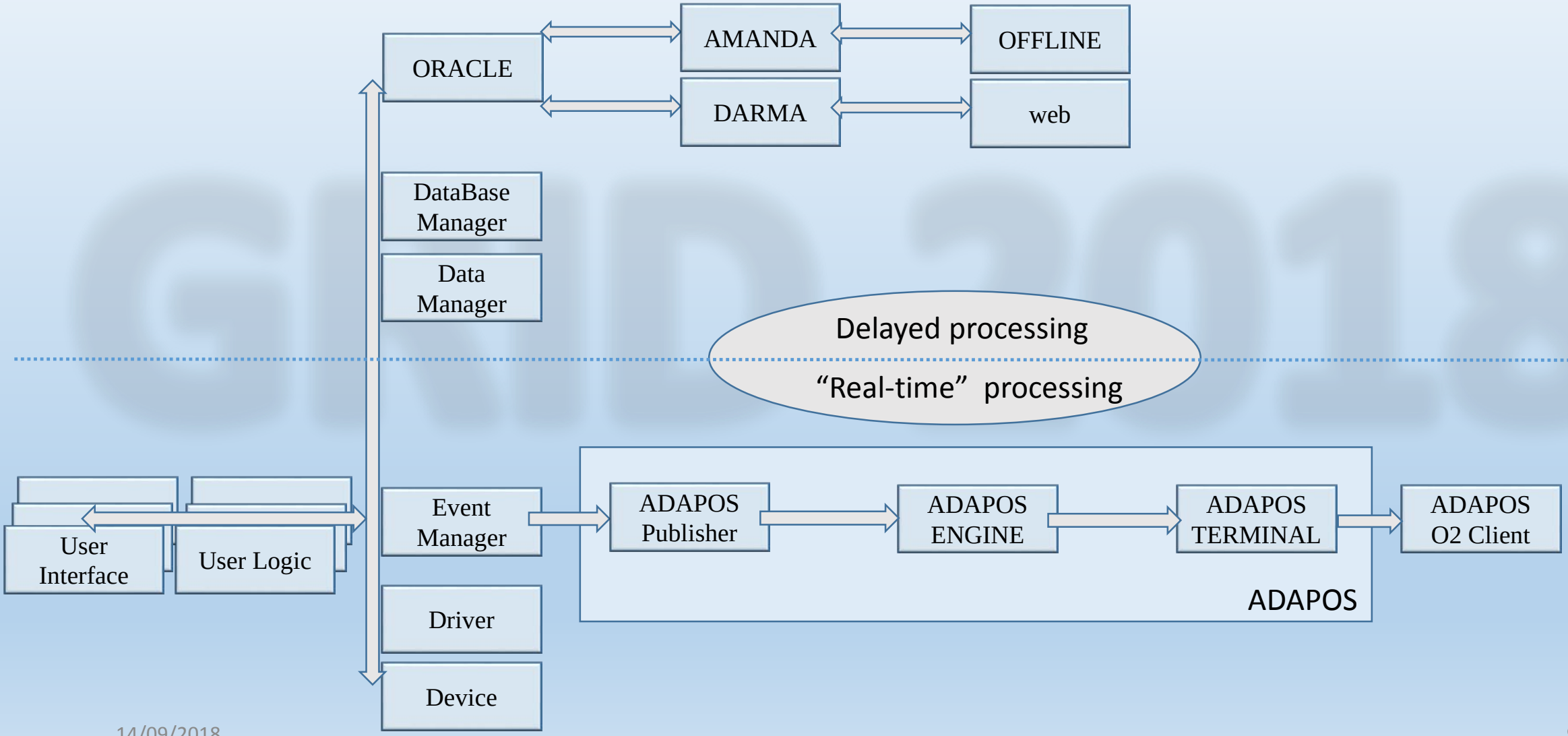
# What are the challenges?

- The DCS is in charge of ~1 000 000 parameters, scattered across:
  - >100 controls computers
  - ~1000 network attached devices
  - Hundreds of additional  devices connected via many different busses
- The DCS receives the data on change, most of the devices do not use triggered readout
  - It is impossible to predict the time of arrival for a certain value
  - The update rate is typically slow, ranging from seconds to days
- The task is to:
  - Find and collect data
  - Assemble information for $O^2$
  - Inject the DCS data into the $O^2$ data frames

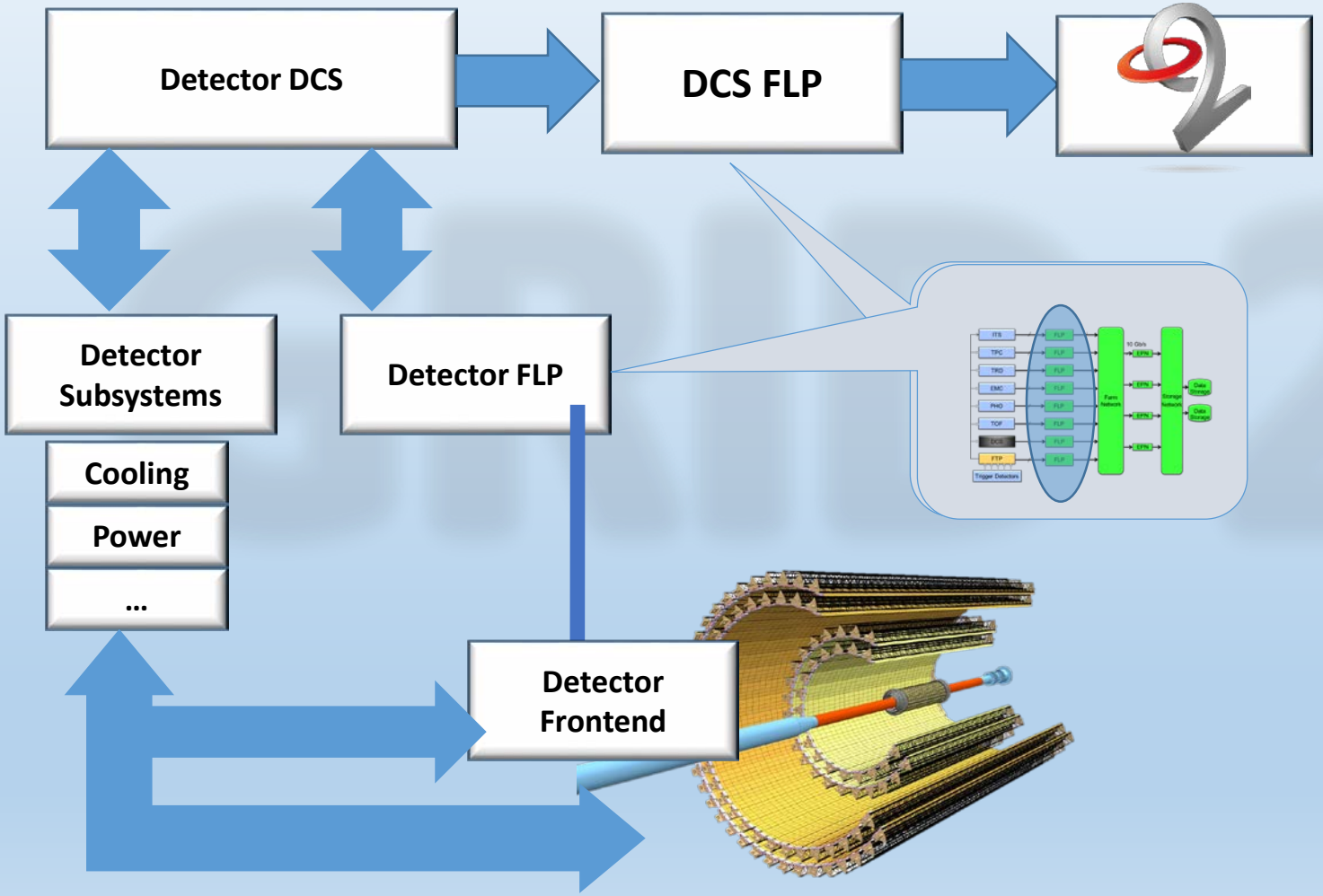
# The ADAPOS (Alice Datapoint Server) Architecture

- Each WINCC system will publish data to ADAPOS
- ADAPOS creates a process image – a data structure containing:
  - DP alias
  - DP Type
  - Timestamped value
  - Quality flags
- ADAPOS TERMINAL will create a process image copy on the DCS FLP and keep it up to date
- ADAPOS is scalable and redundant architecture
  - More engines and terminals can be added for load balancing and redundancy

# Redesigned DCS Data Flow

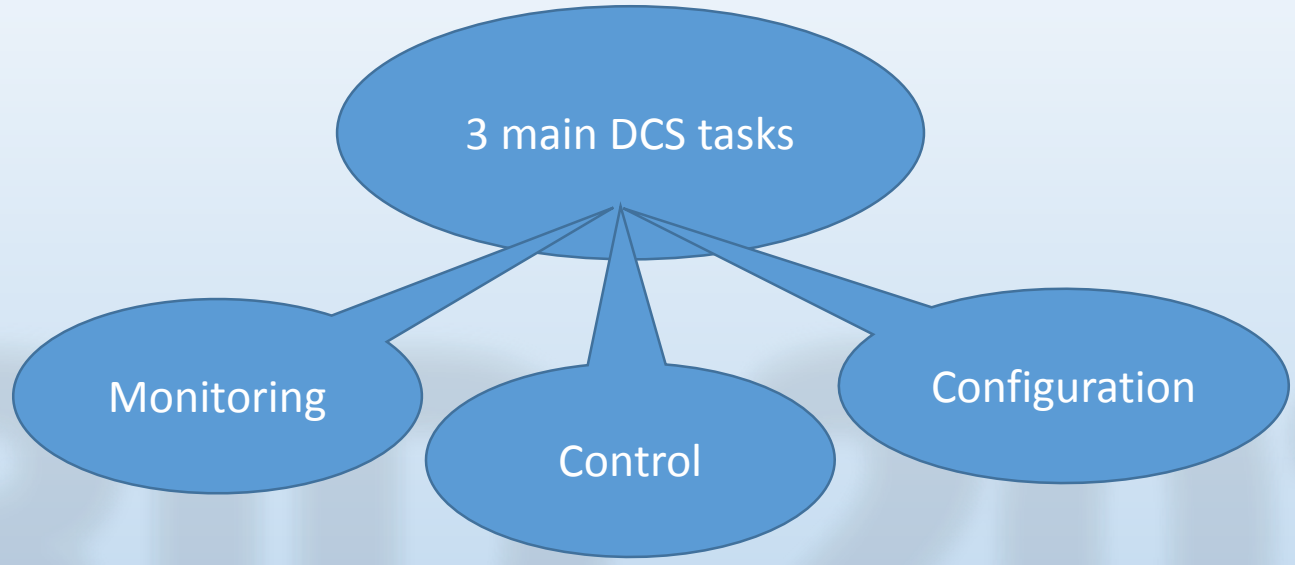


# DCS in the context of O2 CONTROL data flow from DCS



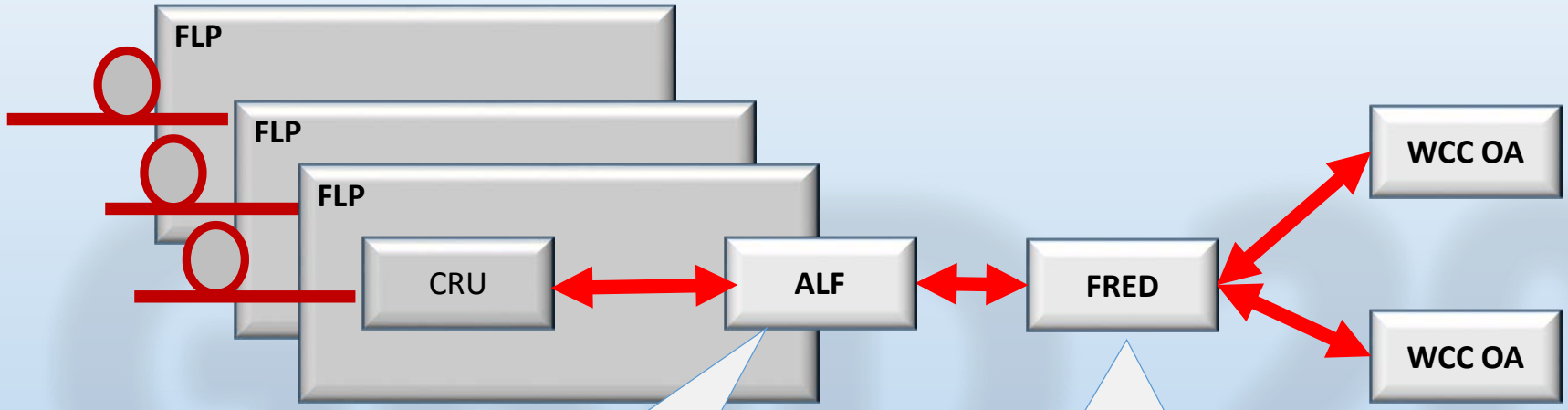

- Part of the DCS data will arrive from the detector frontends via the FLP
- Certain configuration will be sent to the detectors from the DCS via the FLP

# DCS Interface to CRU – common readout unit




- Basic design principles:
  - The FLP is detector independent
  - All customization done at the DCS level
  - Same technologies and tools for all CRU users
  - There will be a single configuration path for the CRU configuration

# The DCS place in the frontend chain

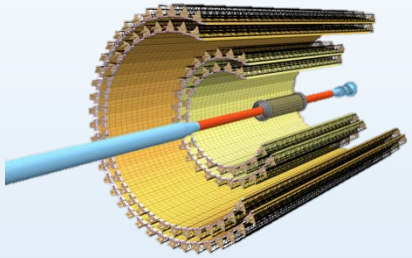



- We will run ALF on 270 servers and there will be 1 FRED per detector

- DETECTOR NEUTRAL LAYER ALF (Alice Low Level Frontend interface) provides communication interface to CRU firmware

- DETECTOR SPECIFIC LAYER FRED (Front End Device) runs on a dedicated server
- Receives commands from WinCC OA and forwards them to ALF
- Receives data from ALF and publish it to WinCC OA

# ITS detector facts



- DCS data will arrive to CRU where it will be stripped off from the data stream
- DCS can access the CRU in order to write data (configuration) to frontend
- Data to read:
  - 24120*1 temperature values from chips
- Data to set:
  - 10 parameters/chip (241200 values in total)

# Summary

- ALICE is preparing for long shutdown (LS2)
- Detector Control System assures safe work of detector
- DCS team developed ADAPOS architecture for communication with $O^2$ computing system
- To configure detector CRUs DCS will use ALFRED infrastructure
- Testing stand running in DCS laboratory
- ALICE DCS is now 14 years old and we do not need a major redesign of its core