# QA tools overview

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### (Data Preparation Group)

# Lesson from CMS, ATLAS and LHCb

- Databases for QA information
    - CMS (trending information)
    - ATLAS (validation decisions)
    - LHCb (trigger decisions)
- ROOT histograms and trees for storing QA information
- Custom tools for data analytics (regression tests, statistical tests, classifiers…)
- Custom tools for QA visualization

# ALICE QA information sources

- Software release validation
  - Performance benchmarks on data and MC simulations
  - Validation with reference data and MC
- Online DQM and HLT
- Offline QA: detector, trigger, calibration, tracking, PID and analysis
- OCDB and AODB
- Logbook, MonAlisa, RCT, …

# ALICE QA tools - status

- Different solutions for DQM, HLT and offline QA
- Several solutions for the offline QA
  - Detector QA
  - Tacking QA
- QA tools developments
  - ROOT tree based DB (TPC QA generalization)
  - Elasticsearch (nosql database) + Kibana (visualisation)
  - Overwatch (EMCAL QA)
  - RCT

Goal: Develop common set of tools for online and offline QA

# ROOT tree based DB development (TPC QA generalization)

Marian Ivanov, Hans Beck, Jens Wiechula, Julius Gronefeld, Peter Malzacher

- Input information stored in the ROOT files
  - Relations (e.g. TPC QA vs. TRD QA) made with friend trees
  - Inner joins (SQL) to combine columns from one or more tables in a rational database implemented
- Access to the external information provided (RCT, Logbook,…)
  - https://alice.its.cern.ch/jira/browse/ATO-46
  - Standardized cross queries possible (e.g. TPC QA vs. RCT)
- Functionality to transform ROOT tree to other formats (html table, cvs, json, xml) + exporting metadata
  - https://alice.its.cern.ch/jira/browse/ATO-373
  - Can be used to export to e.g. Elasticsearch
- Time series query support for tree using AliTreePlayer
  - https://alice.its.cern.ch/jira/browse/ATO-382
- Data selection (acceptance cuts) based on the custom parameterizations (AliNDLocalRegression)
  - https://alice.its.cern.ch/jira/browse/PWGPP-163
- TPC QA visualization
  - https://aliqatpc.web.cern.ch/aliqatpc/data/2015/LHC15o/pass2_lowIR

# Elasticsearch and Kibana

- Elasticsearch
  - https://www.elastic.co/products/elasticsearch
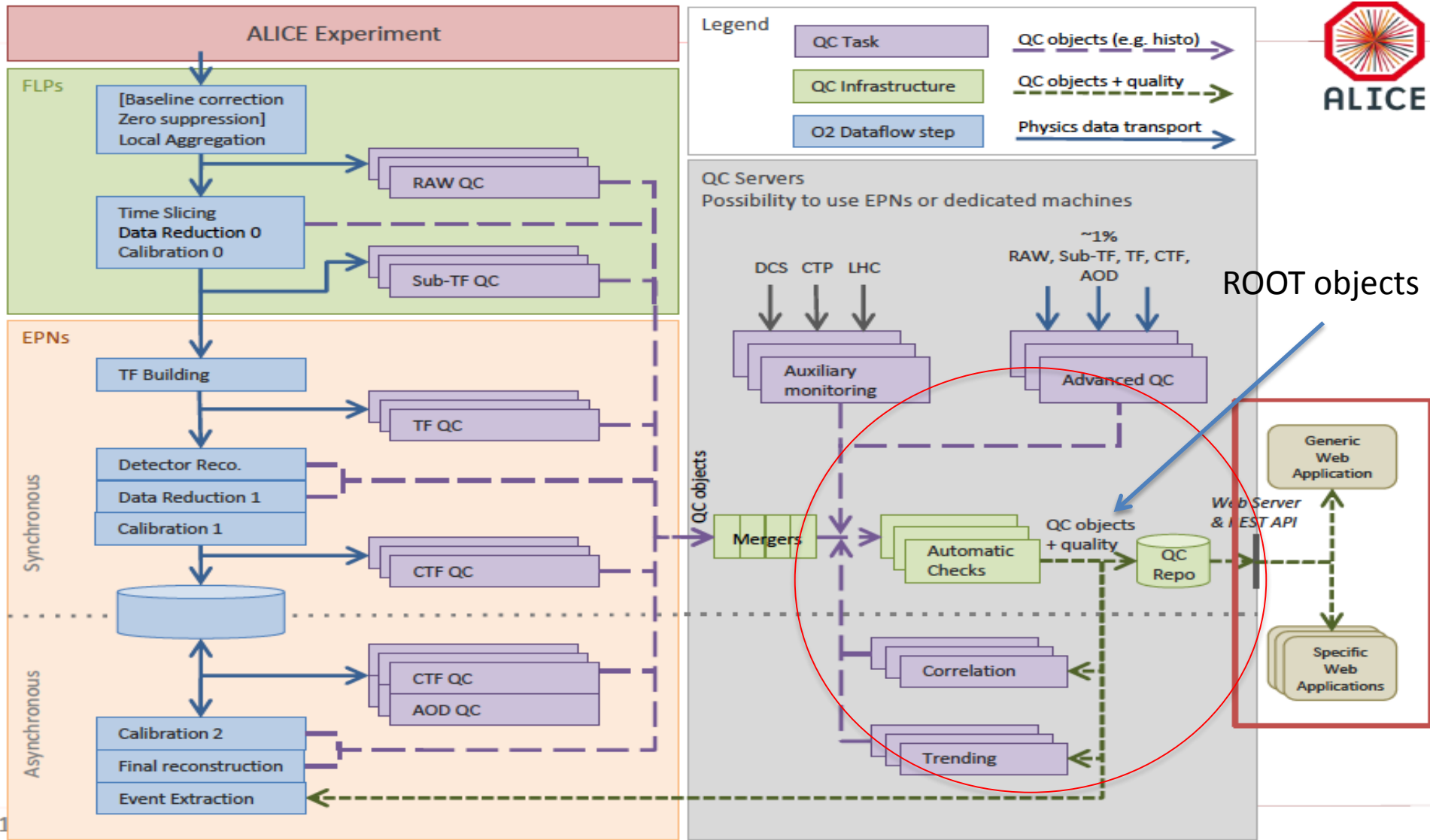  - Full-text search engine with HTTP web interface and schema-free json documents
  - It can serve as distributed NoSQL database
  - Several techniques to manage relational data (e.g. parent/child)
  - Used for Grid monitoring at CERN
    - https://www.elastic.co/elasticon/conf/2016/sf/grid-monitoring-at-cern-with-the-elastic-stack
- Kibana
  - Data visualization plugin for Elasticsearch
  - https://www.elastic.co/products/kibana
  - Limitation in visualization of relationships (e.g. parent/child)
- Kibi
  - Plugins for Elasticsearch and Kibana (relationships visualization implemented but only in enterprise edition)
  - https://siren.solutions/

# Overwatch

- [https://aliceoverwatch.physics.yale.edu/monitoring](https://aliceoverwatch.physics.yale.edu/monitoring)
- Online processing and interface for online detector monitoring and basic QA using data from the HLT (originally implemented for EMCAL)
- Overwatch is python and ROOT based
- Utilizes ZMQ for data transport
- Histogram visualization based on JSROOT
- Architecture similar to data processing at Run3 (parallel processing -> merging -> QA -> visualization)

# Quality Control in Run3

# Run Control Table
# (QA feedback status)

http://alimonitor.cern.ch/QA/

QA status of RAW data production **LHC15o pass4 lowIR pidfix cookdedx**

Select production type [RAW ▾] and the tag [LHC15o pass4 lowIR pidfix cookdedx ▾] [ » ]

| | QA | | | | | | | | | | | | Detector QA status | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | - all - ▾ | | | ▾ | ▾ | ▾ | ▾ | ▾ | ▾ | ▾ | ▾ | ▾ | ▾ | ▾ | |
| Run# | Merged QA | No. events | Date | AD0 | EMC | FMD | HMP | MCH | MTR | PHS | PMD | SDD | SPD | SSD | T |
| 244918 | Y | 701,599 | 29 Oct 2016 09:10 | | | | | | | | | Done | Done | Done | |
| 244975 | Y | 312,684 | 29 Oct 2016 09:46 | | | | | | | | | Done | Done | Done | |
| 244980 | Y | 1,271,057 | 29 Oct 2016 07:39 | | | | | | | | | Done | Done | Done | |
| 244982 | Y | 1,358,950 | 29 Oct 2016 23:38 | | | | | | | | | Done | Done | Done | |
| 244983 | Y | 522,803 | 29 Oct 2016 12:13 | | | | | | | | | Done | Done | Done | |
| 245061 | Y | 144,975 | 29 Oct 2016 02:59 | | | | | | | | | | | | |
| 245064 | Y | 1,477,441 | 29 Oct 2016 15:09 | | | | | | | | | Done | Done | Done | |
| 245066 | Y | 347,270 | 29 Oct 2016 12:22 | | | | | | | | | Done | Done | Done | |
| 245068 | Y | 185,662 | 29 Oct 2016 09:08 | | | | | | | | | Done | Done | Done | |
| 246390 | Y | 389,398 | 29 Oct 2016 14:49 | | | | | | | | | Done | Done | Done | |
| 246391 | Y | 1,324,390 | 30 Oct 2016 13:40 | | | | | | | | | Done | Done | Done | |
| 246392 | Y | 1,497,964 | 29 Oct 2016 20:29 | | | | | | | | | Done | Done | Done | |
| 12 runs | | 9,534,193 | | 0/12 | 0/12 | 0/12 | 0/12 | 0/11 | 0/11 | 0/12 | 0/12 | 11/12 | 11/12 | 11/12 | 0/ |

# ALICE QA/QC tools requirements

- Data/MC QA monitoring (trending)
  - Possibility to trigger alarms
- Database for QA information
  - Relationships (joins) possible
- Extended data analytics possible
  - regression tests, statistical tests, classifiers…
- User interface and data visualization
  - Interactive QA data analysis

# ALCE QA/QC tools selection

- They should fulfill experiment and data processing requirements in Run2/Run3
- ROOT objects for storing QA information
  - primary source of information
- Study existing solutions (before implementing the customize solutions)
  - e.g. JSROOT library to visualize ROOT objects (histograms, trees) using browsers
  - e.g. Jupyter, SWAN notebooks for data analysis and visualization (https://swan.web.cern.ch/)
  - e.g. Elasticsearch as QA database
- Selection should based on extensive tests
  - Online QA
  - Offline (user/expert) QA

# DPG QA tools group

- Weekly meetings: Wednesdays 2:30 PM
  - Please join and participate in developments and tests
- Mailing list: alice-dpg-qa-tools
  - Please subscribe and stay updated