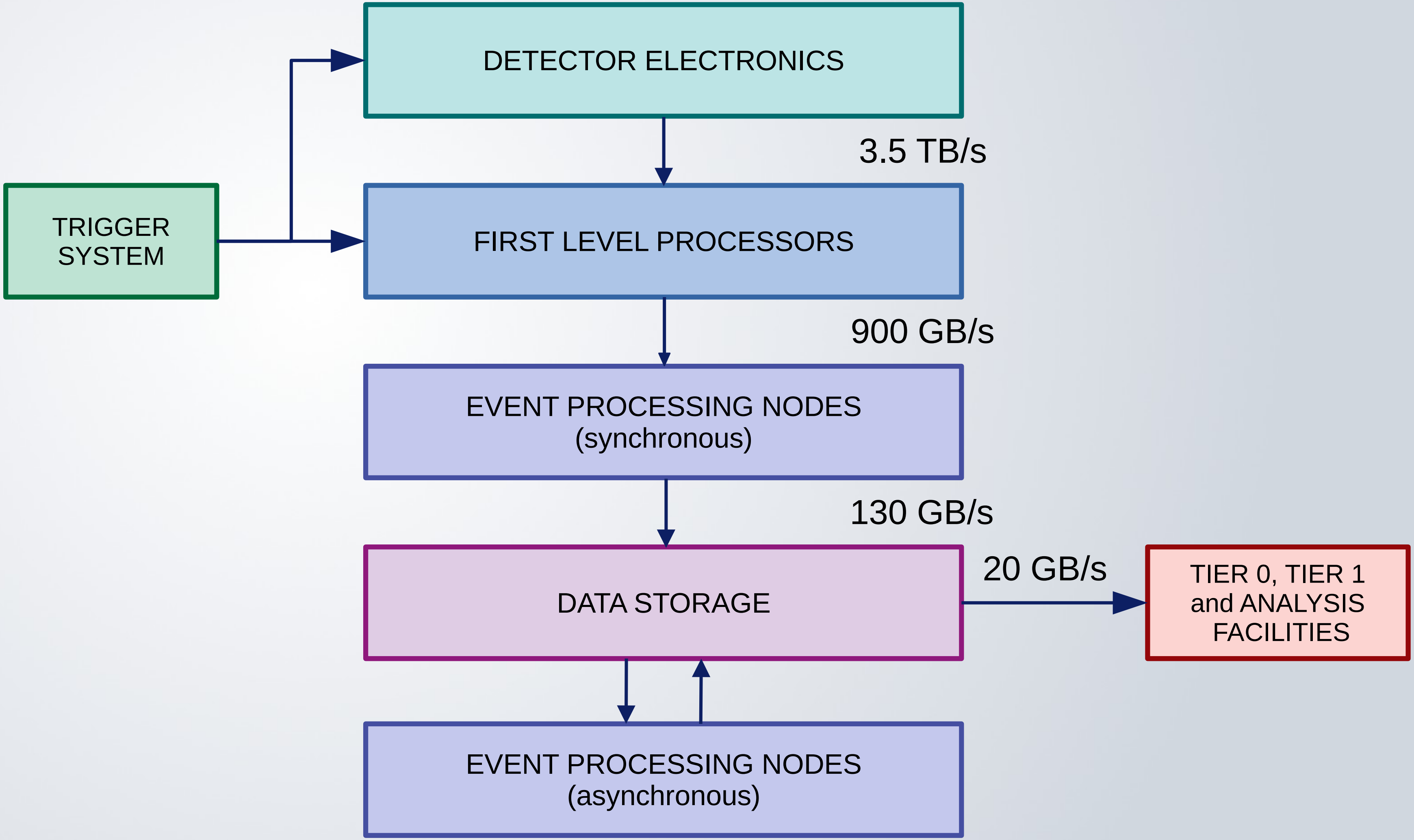
# The ALICE Data Quality Control

09.05.2023 Piotr Konopka and Barthélémy von Haller, ALICE, CERN

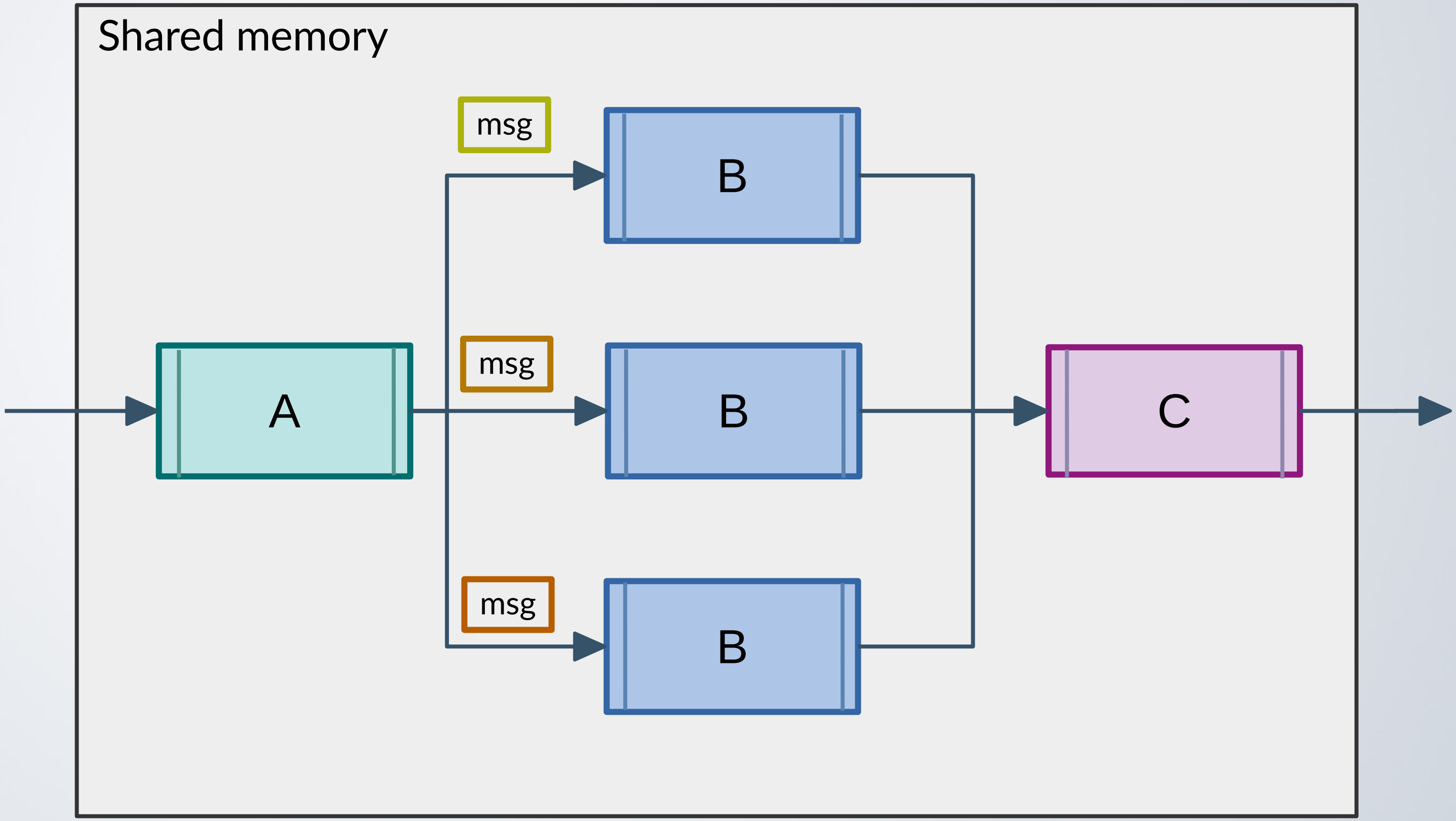
# Related presentations and posters

- V. Barroso & the FLP team, The new ALICE Data Acquisition system (O2/FLP) for LHC Run 3
- G. Eulisse, D. Rohr, The O2 software framework and GPU usage in ALICE online and offline reconstruction in Run 3
- T. Mrnjavac et al., The ALICE Experiment Control System in LHC Run 3
- C. Grigoras, Calibration and Conditions Database of the ALICE experiment in Run 3
- S. Chapeland, Commissioning of the ALICE readout software for LHC Run 3
- G. Raduta et al., Bookkeeping, a new logbook system for ALICE
- G. Raduta, M. Boulais, Security Models for ALICE Online Web–Based Applications
- M. Ivanov, M. Ivanov, RootInteractive tool for multidimensional statistical analysis, machine learning and analytical model validation
- M. Storetvedt et al., The ALICE Grid Workflow for LHC Run 3
- …and more ALICE presentations and posters

# O² – the Online-Offline Computing System



# O² message passing system in a nutshell

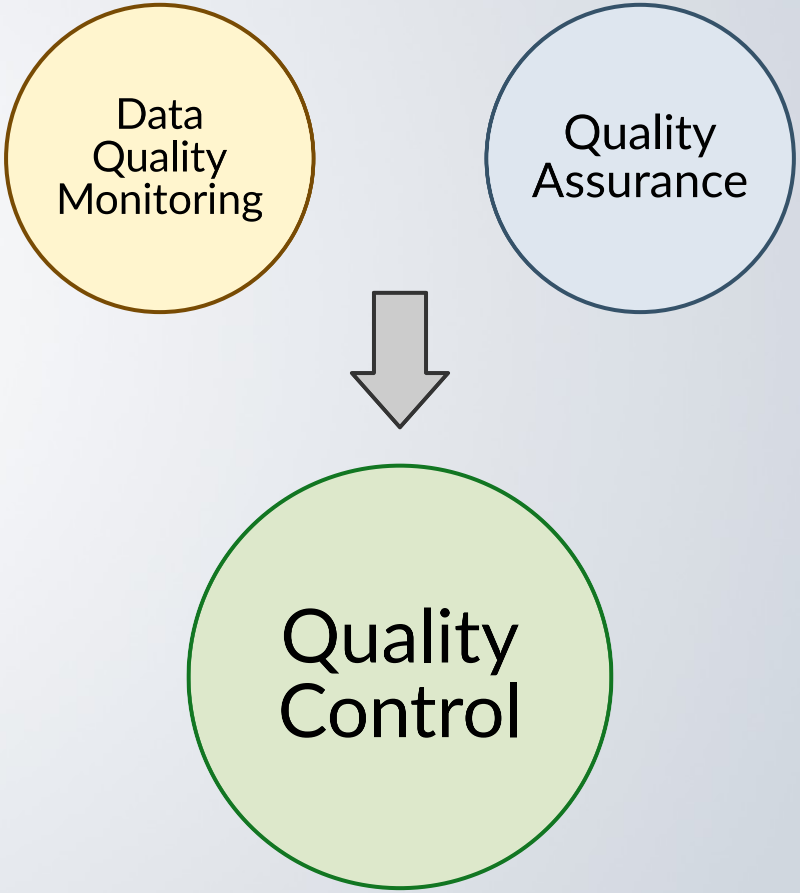



| Data Processing Layer | |
|---|---|
| FairMQ | |
| ZeroMQ | Sh. mem. |

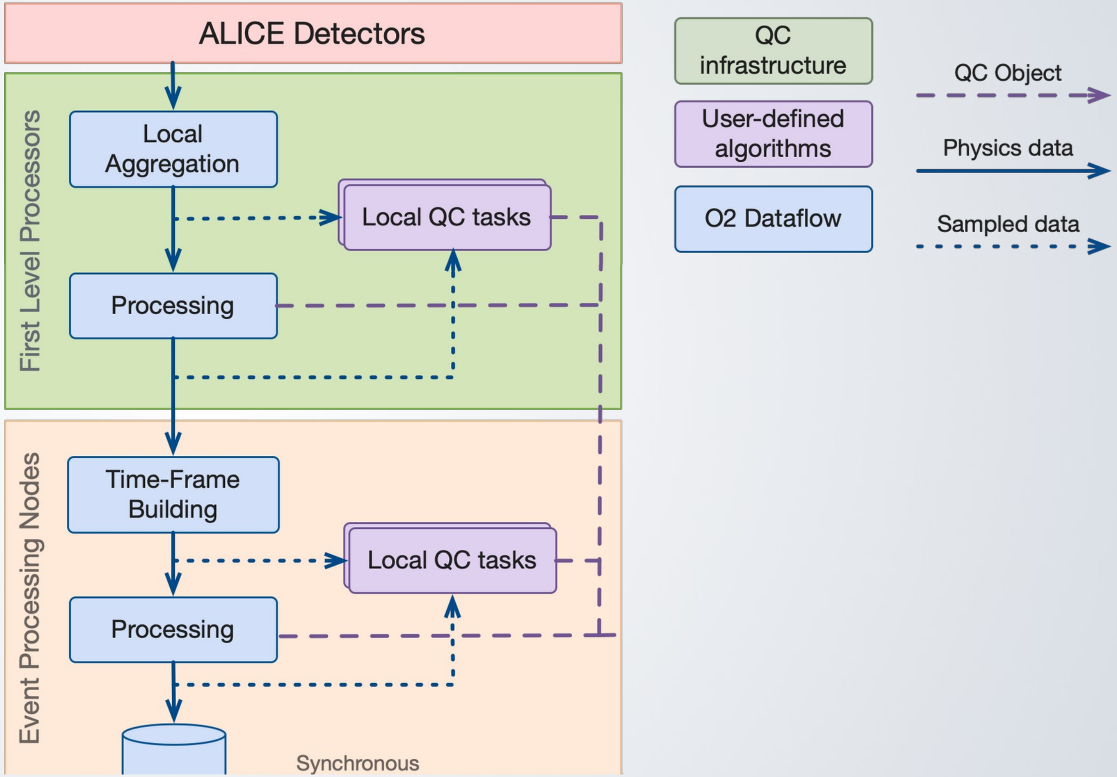
# Data Quality Control evolution in ALICE

Run 1&2:

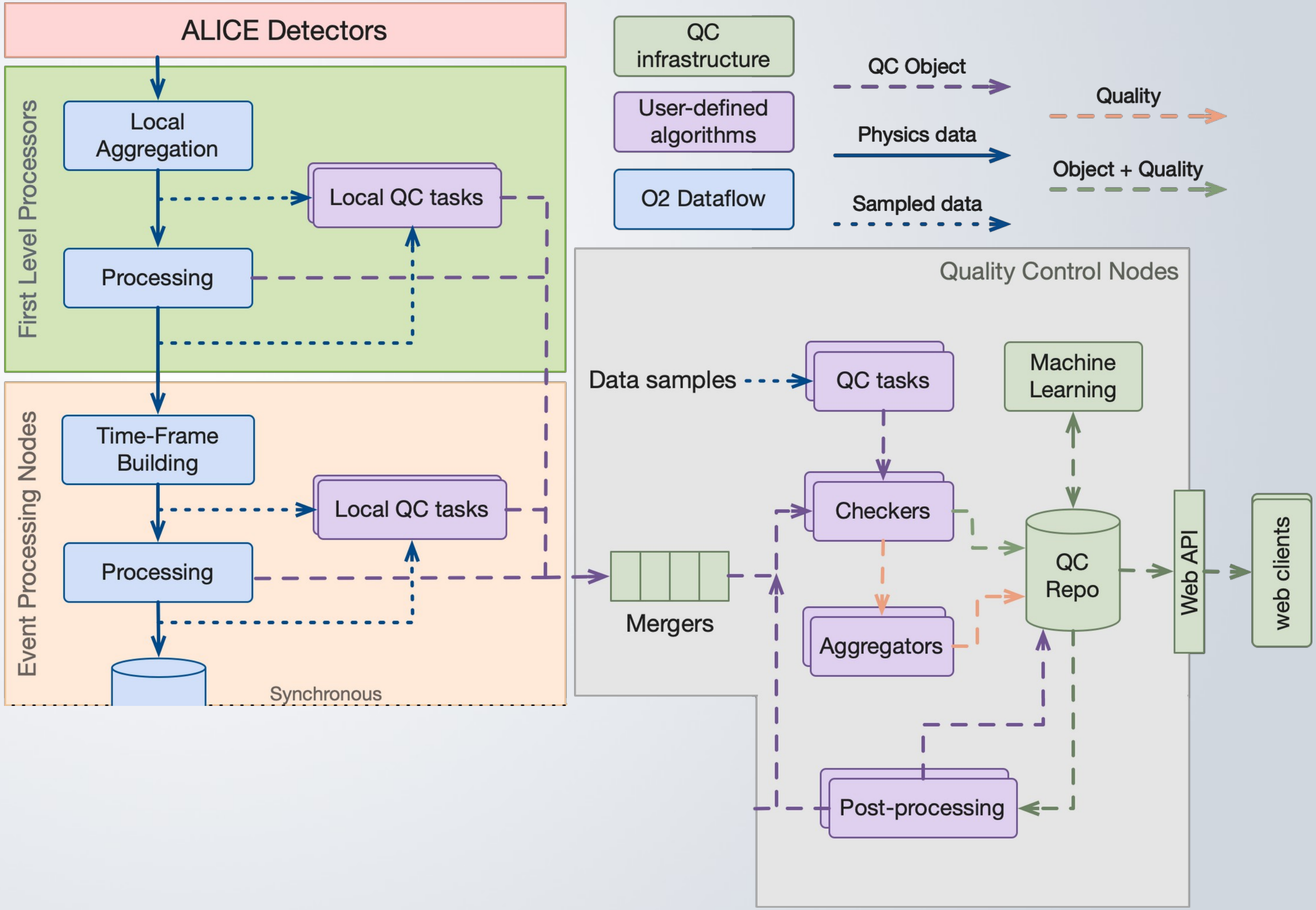
Run 3&4:



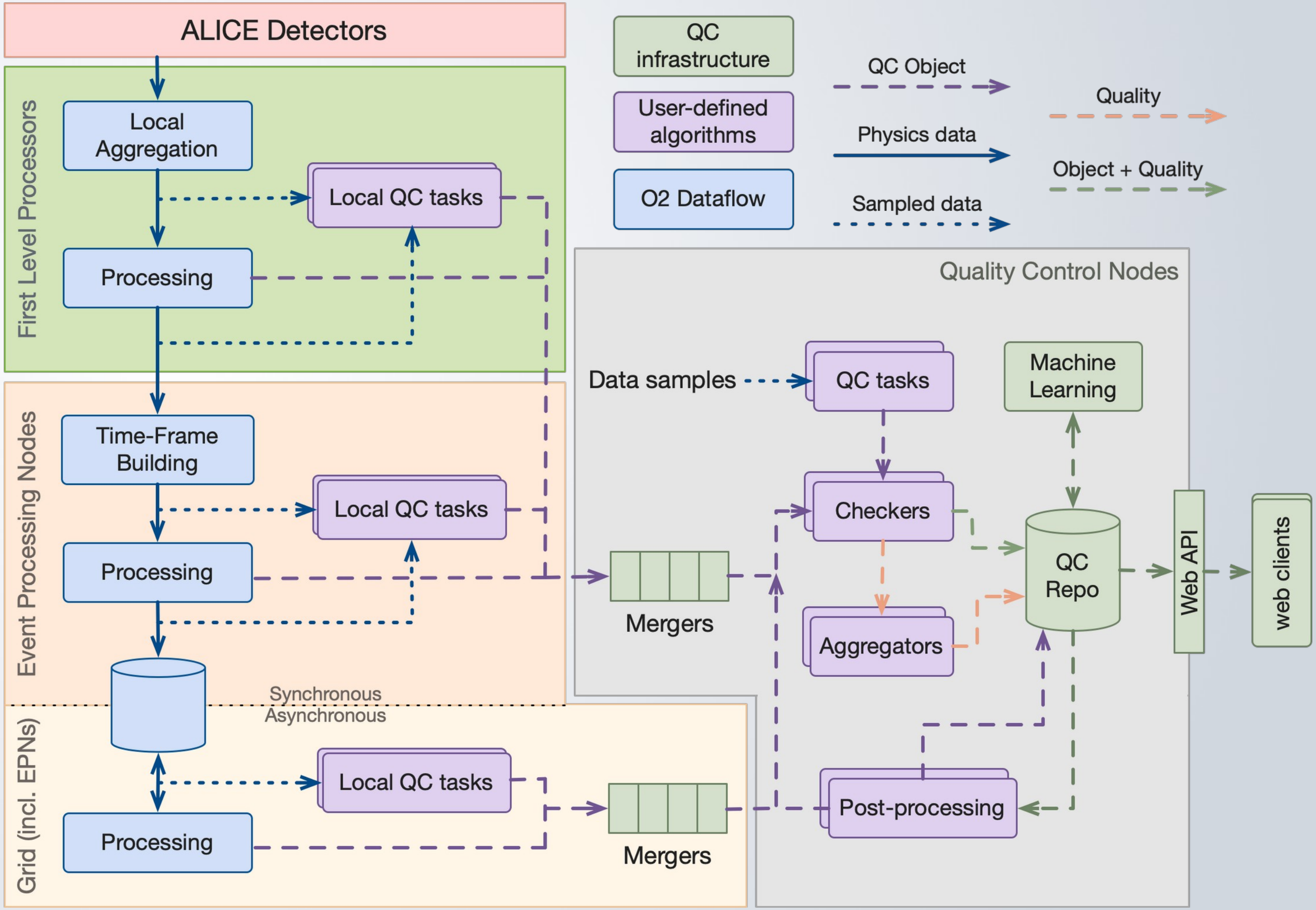
# Quality Control framework



# Quality Control framework



# Quality Control framework



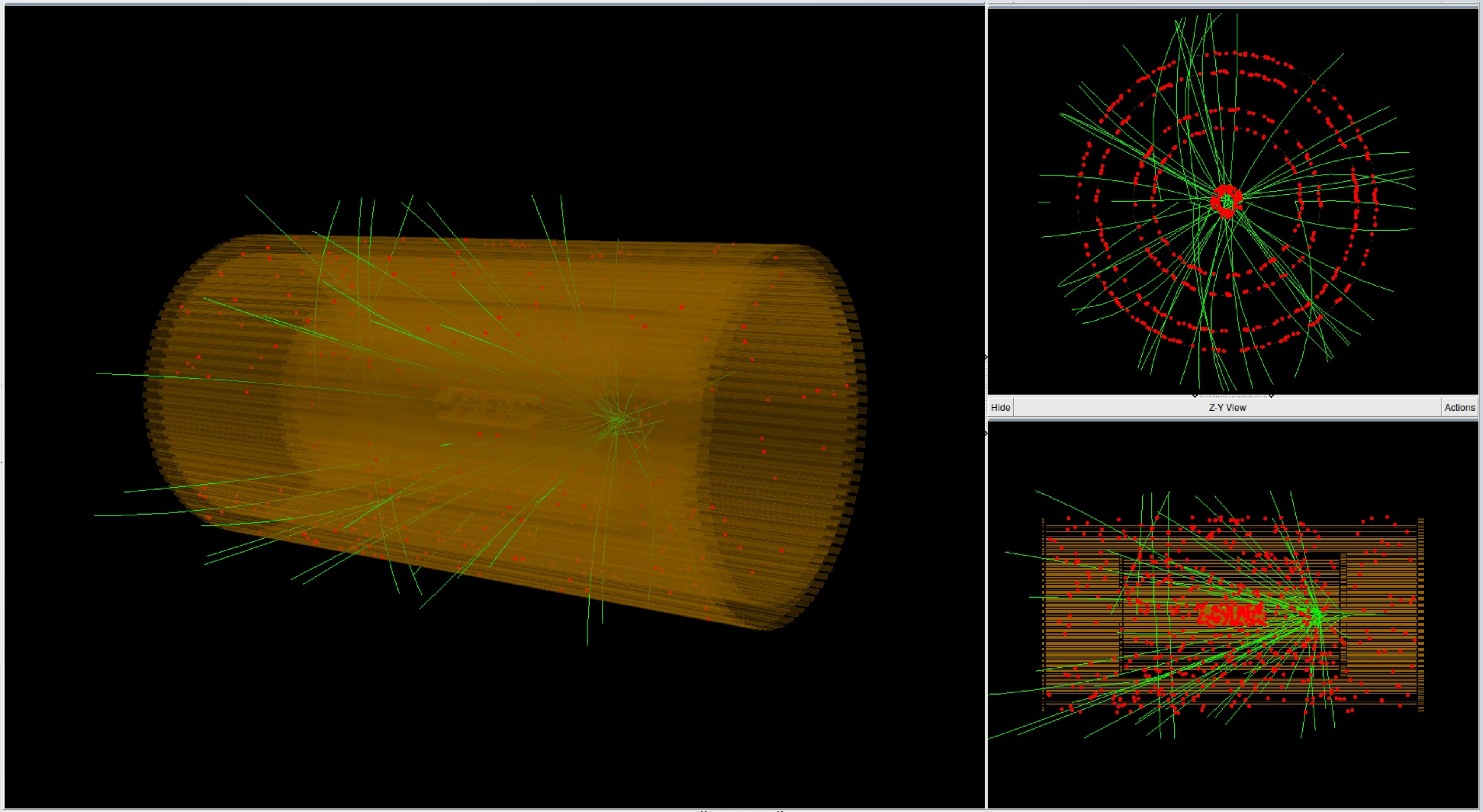
# First experience – usage and performance

# Statistics of the QC framework usage

(since the beginning of Run 3)

| | Sync. data | Async. data | Simulation |
|---|---|---|---|
| **Tasks** | 121 | 35 | 23 |
| **Checks** | 69 | 8 | 2 |
| **Object paths** | 17817 | 8263 | 7812 |
| **Object versions** | 10 millions | 2 millions | 2.75 millions |

# Collision point shift seen by ITS



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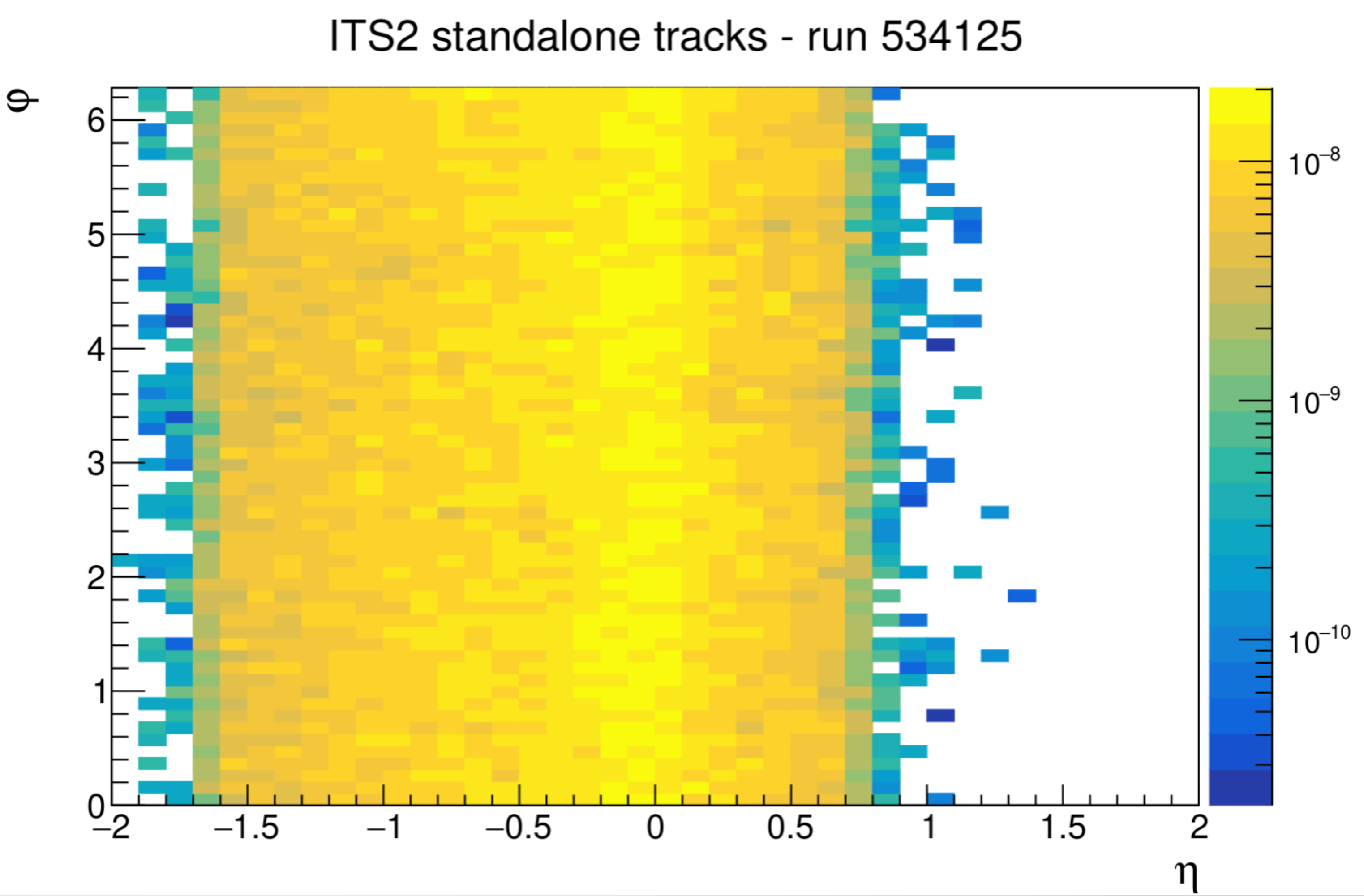
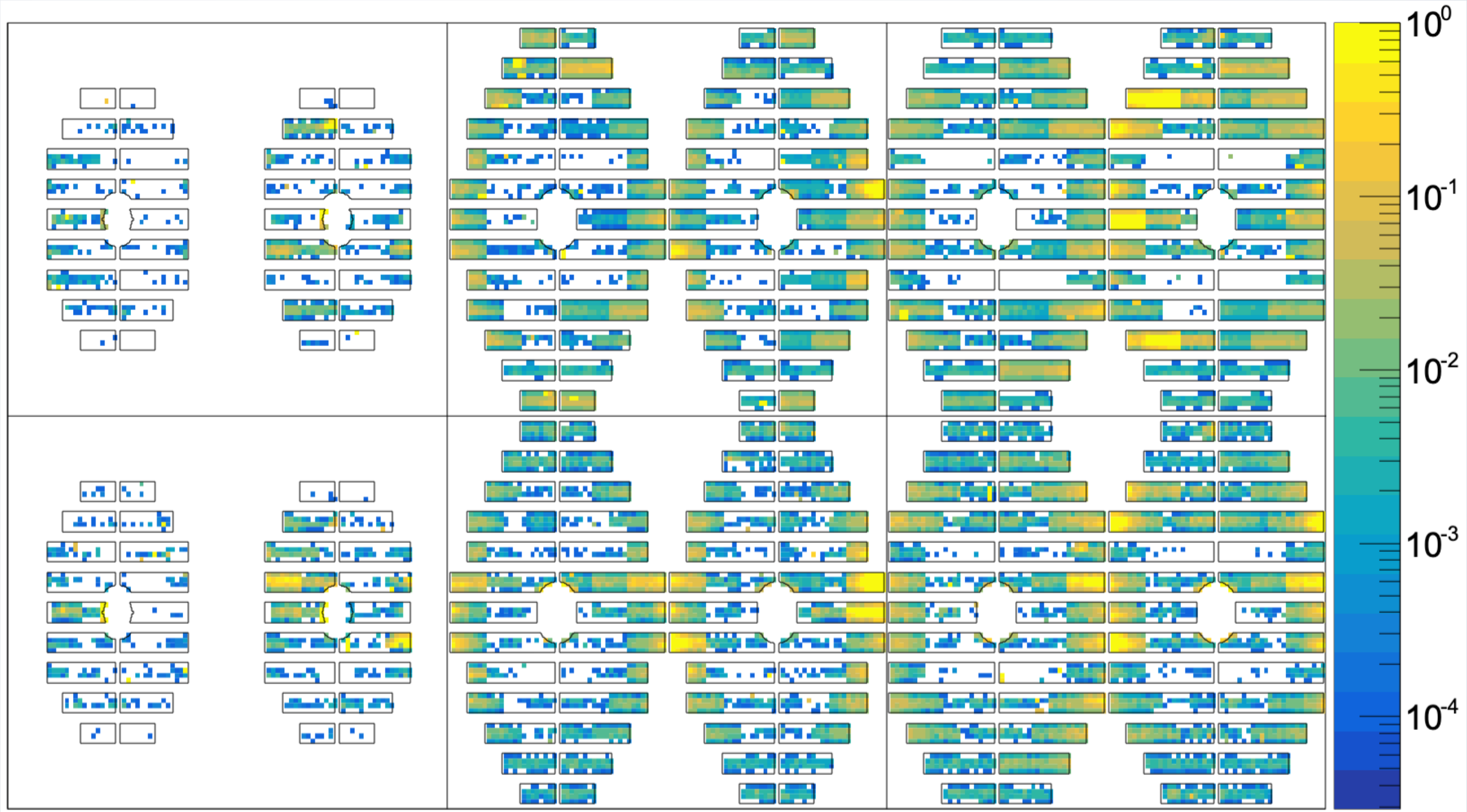


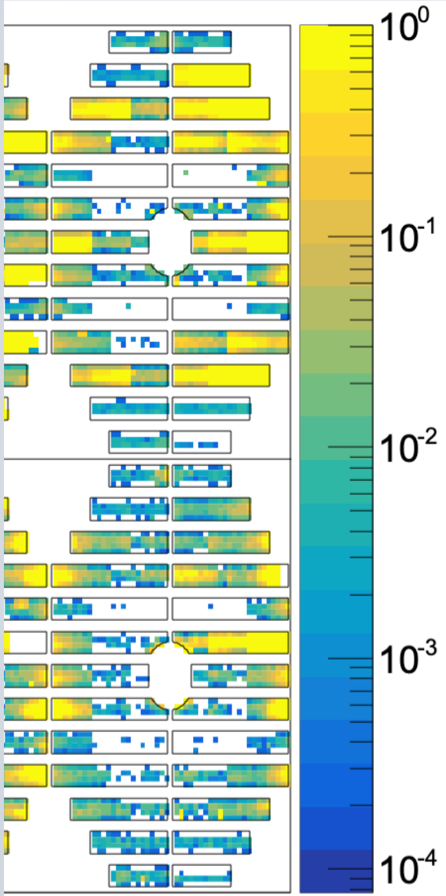

Ivan Ravasenga, Rik Spijkers

# Hit rates in Muon Trackers – discovering low-frequency noise




Andrea Ferrero

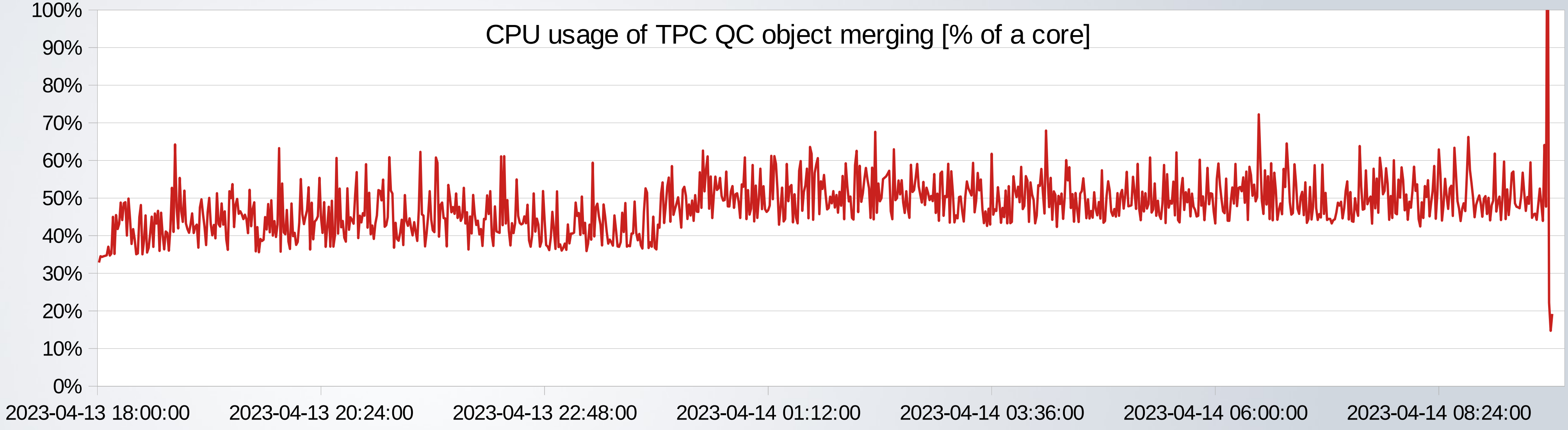
Normal rates

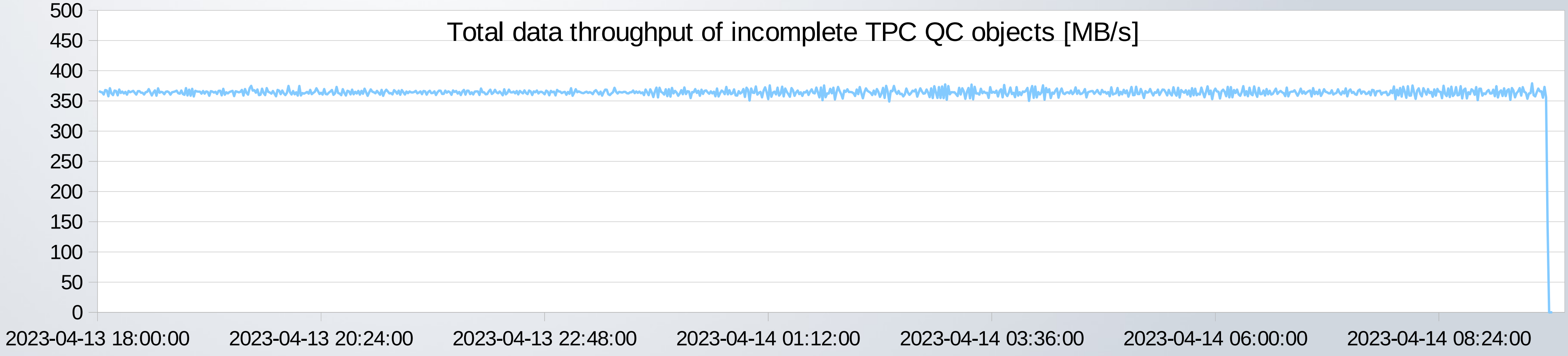



High noise

# Performance of merging QC objects

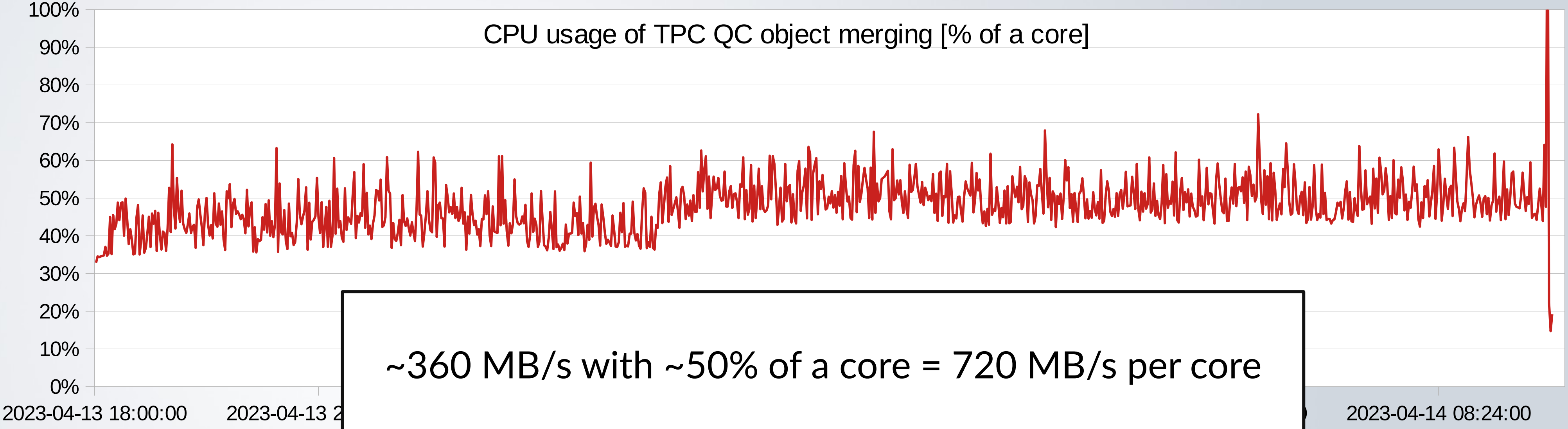
(more benchmarks in the previous CHEP: presentation & paper)



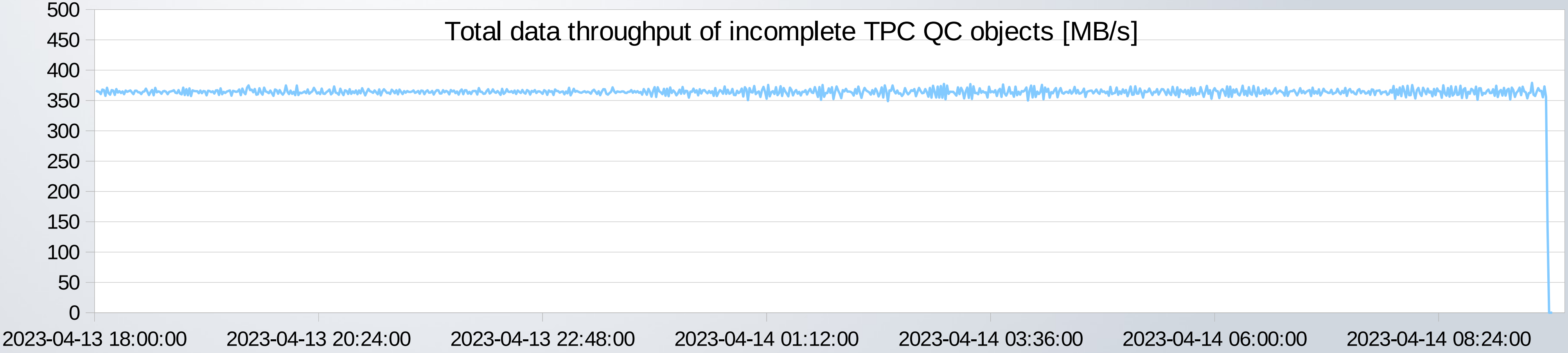



# Performance of merging QC objects

(more benchmarks in the previous CHEP: presentation & paper)

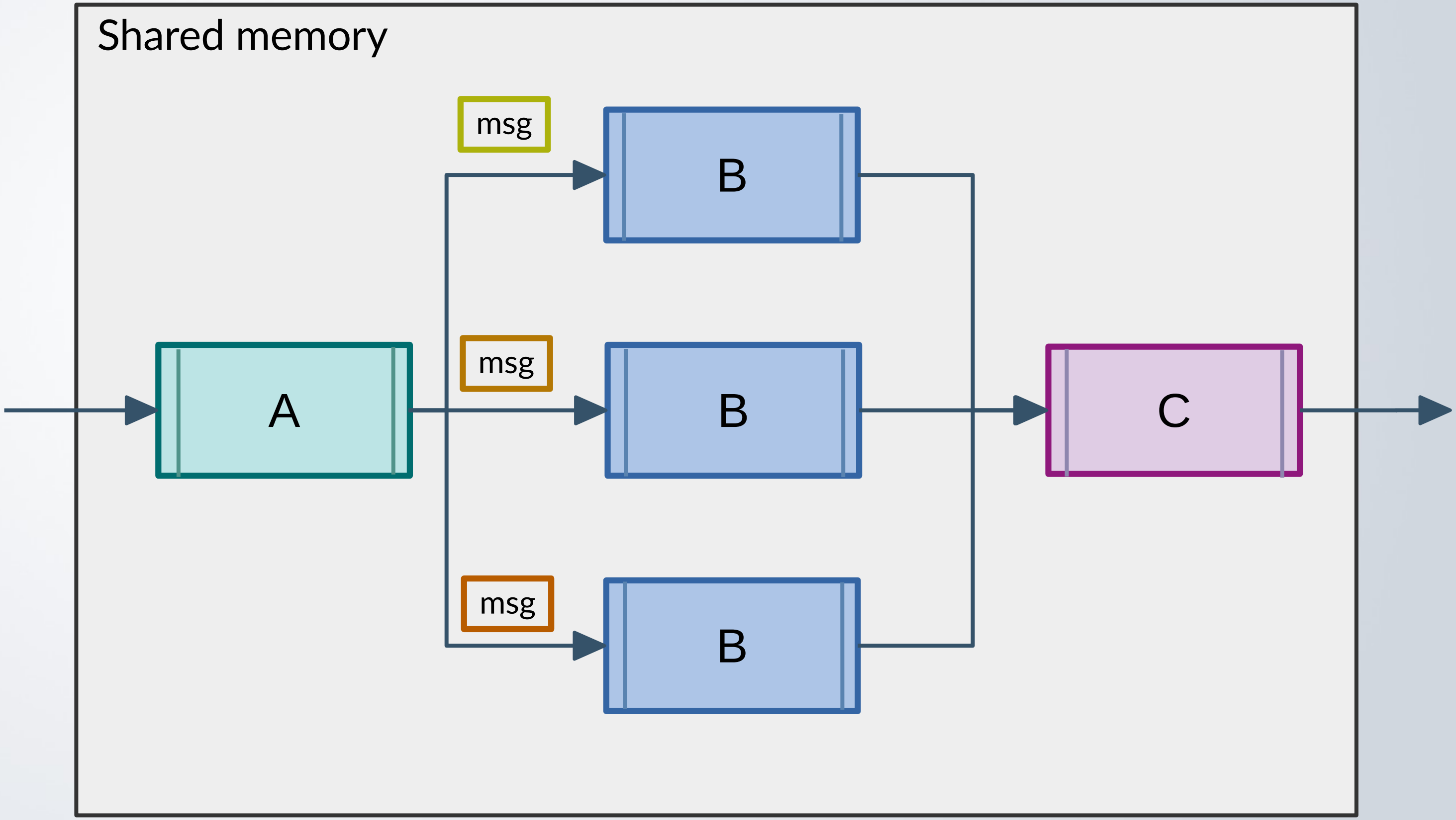



~360 MB/s with ~50% of a core = 720 MB/s per core



# First experience – challenges and solutions

# Simple message passing topology



# Typical message passing topology

Jan Matejko, Battle of Grunwald

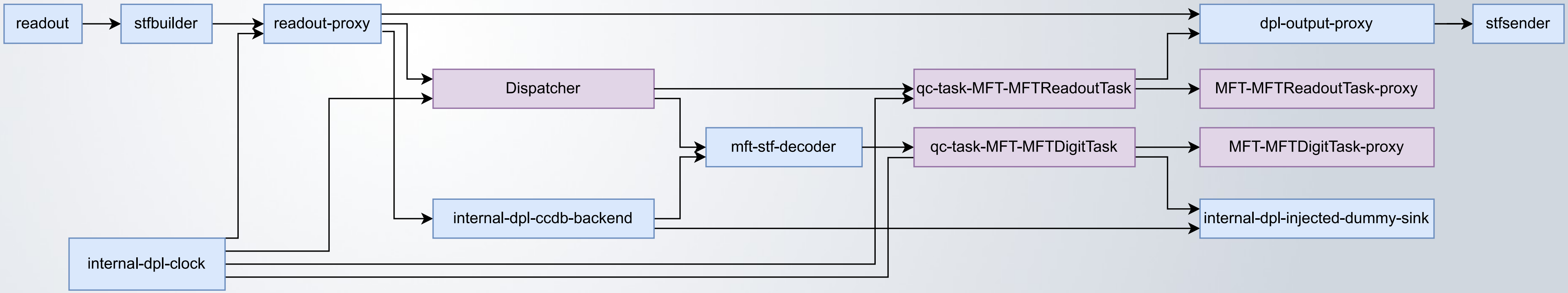
# Understanding data flow

Task list below does not explain how they are interconnected:

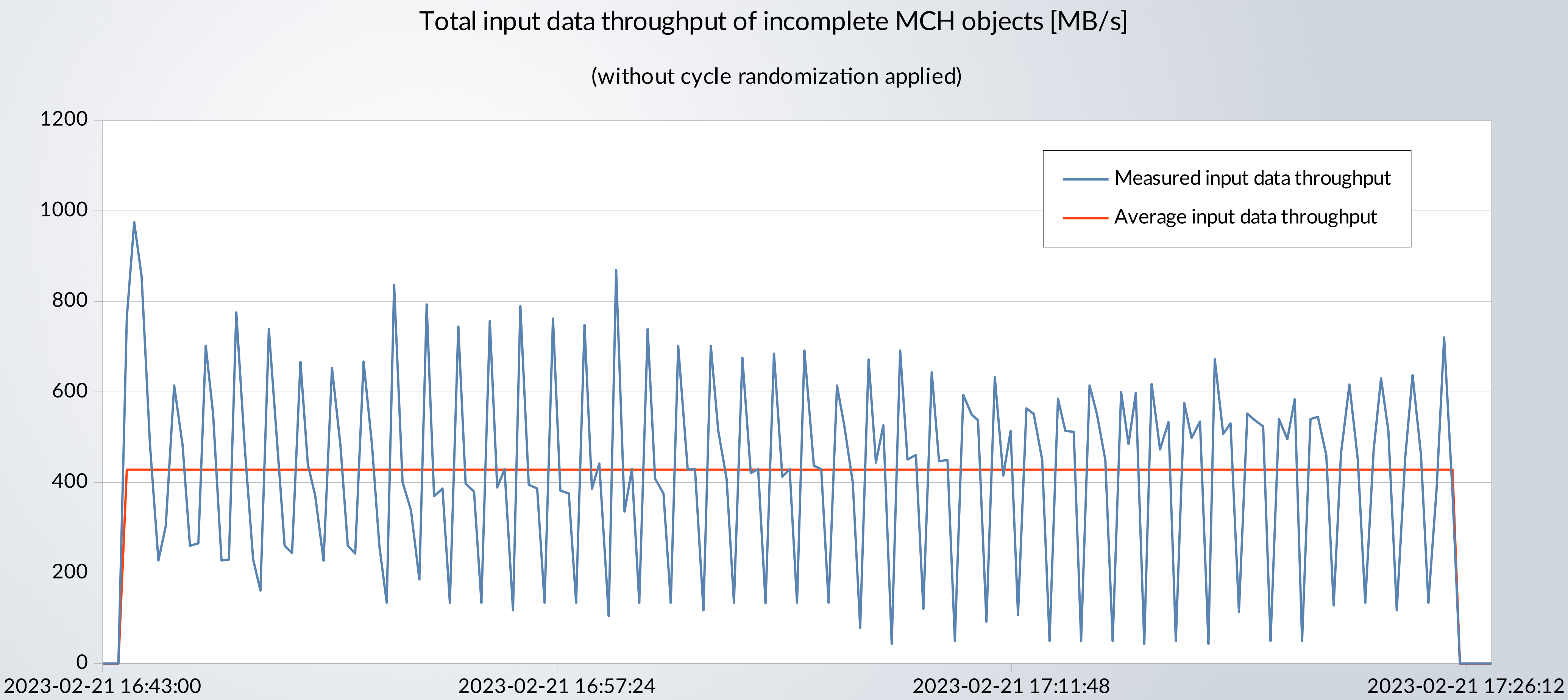
- readout
- stfbuilder
- stfsender
- internal-dpl-clock
- readout-proxy
- internal-dpl-ccdb-backend
- Dispatcher
- qc-task-MFT-MFTReadoutTask
- mft-stf-decoder
- qc-task-MFT-MFTDigitTask
- MFT-MFTReadoutTask-proxy
- internal-dpl-injected-dummy-sink
- MFT-MFTDigitTask-proxy
- dpl-output-proxy

# Understanding data flow

This graph does:

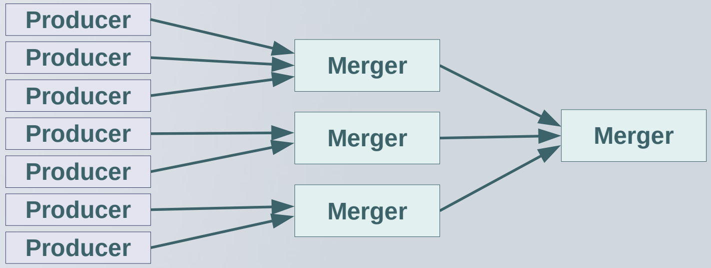


# Handling bursts of traffic



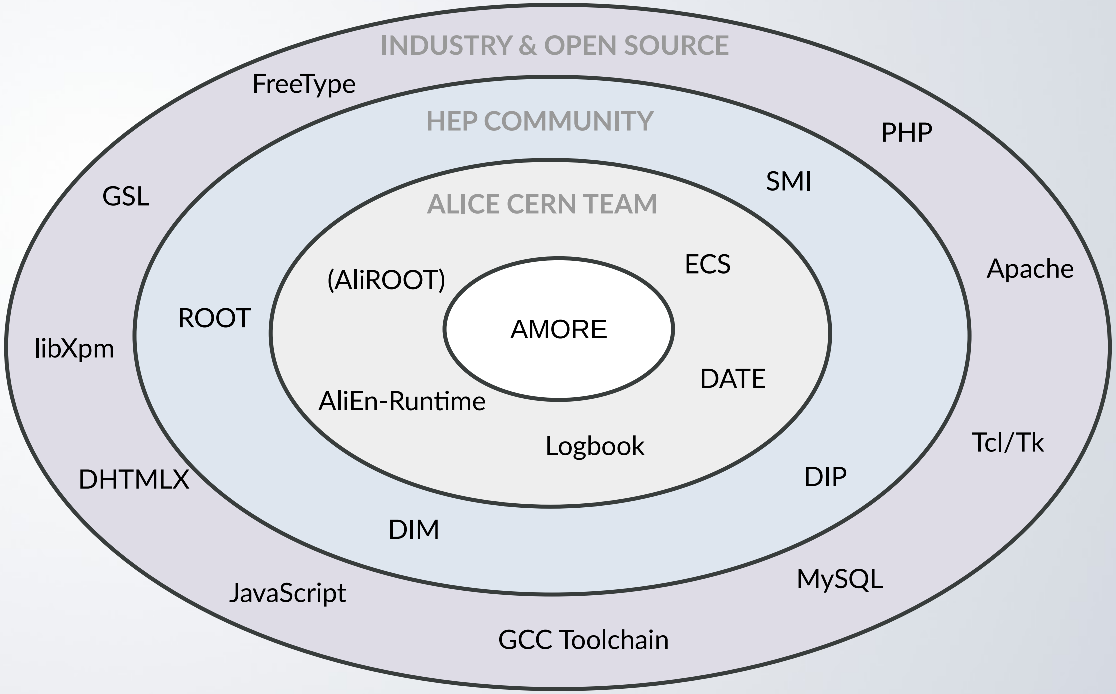
# Handling bursts of traffic

- Input queues are limited to one message per connection
  - Limiting queue size globally not possible in ZeroMQ
  - The high water mark option is not always respected in ZeroMQ
  - TCP buffers hold additional data anyway
- Using multiple layers of Mergers
  - Processing distributed among multiple cores
  - Increased memory usage and latency
- Parallel QC tasks publication cycles are randomly shifted in phase

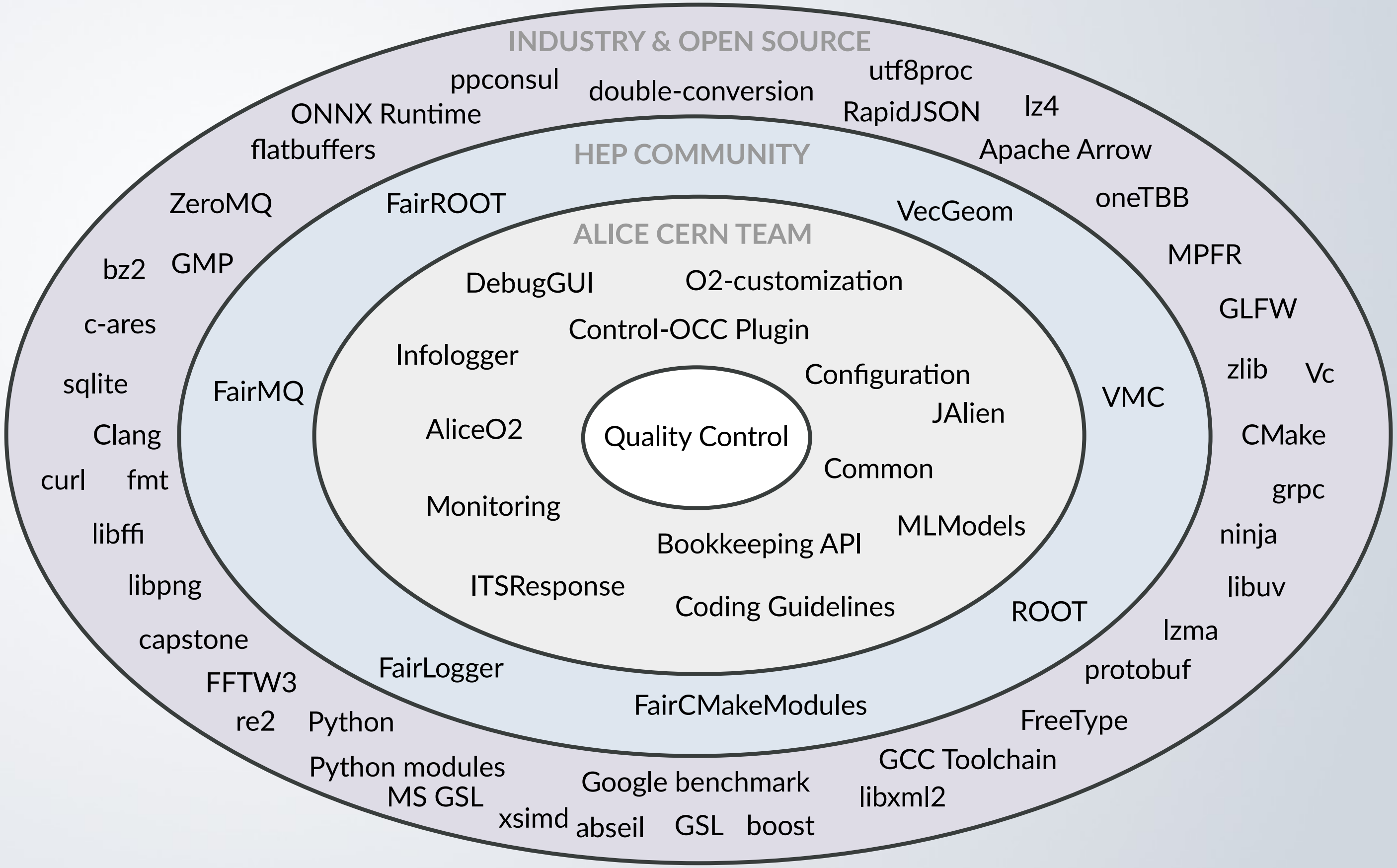


# Direct and indirect dependencies of AMORE

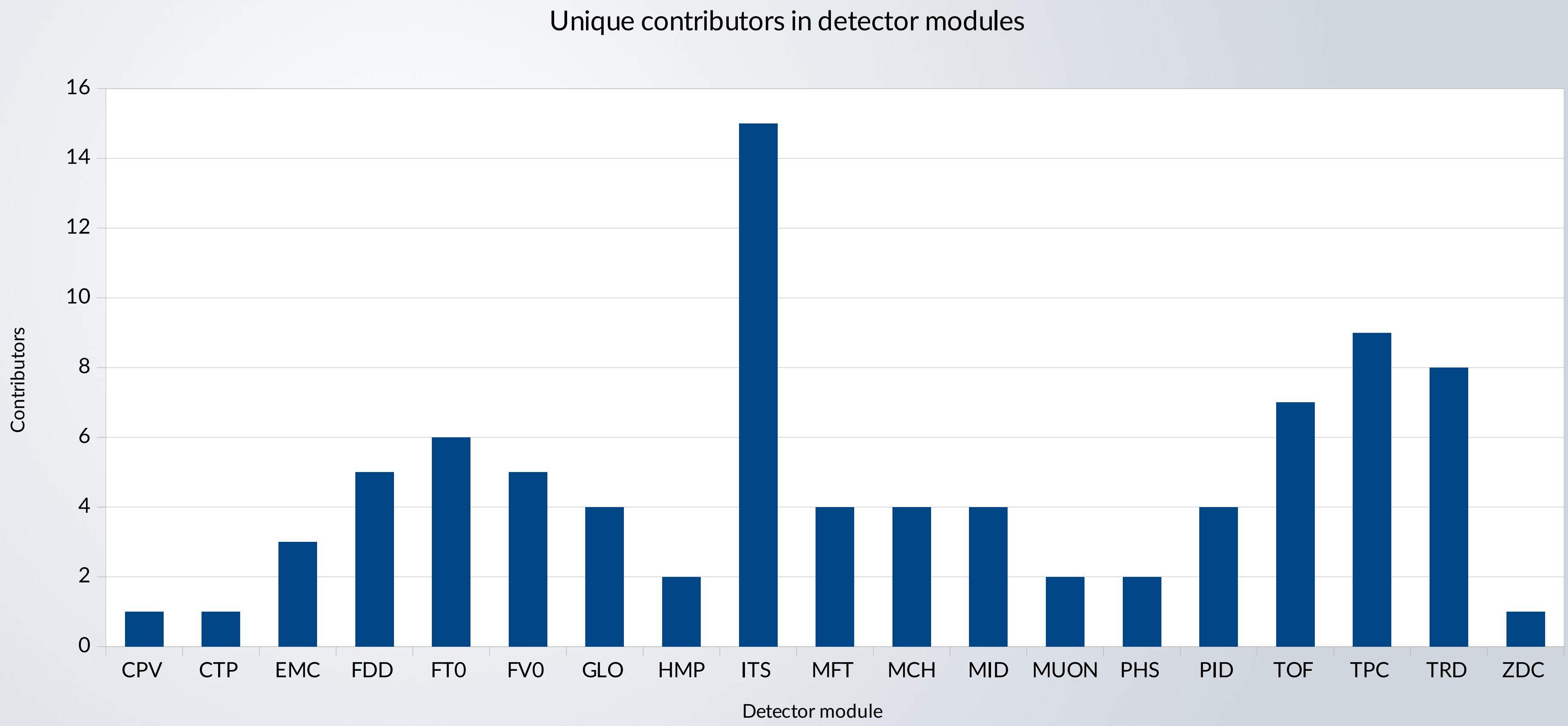
(DQM in Run 1 and 2)



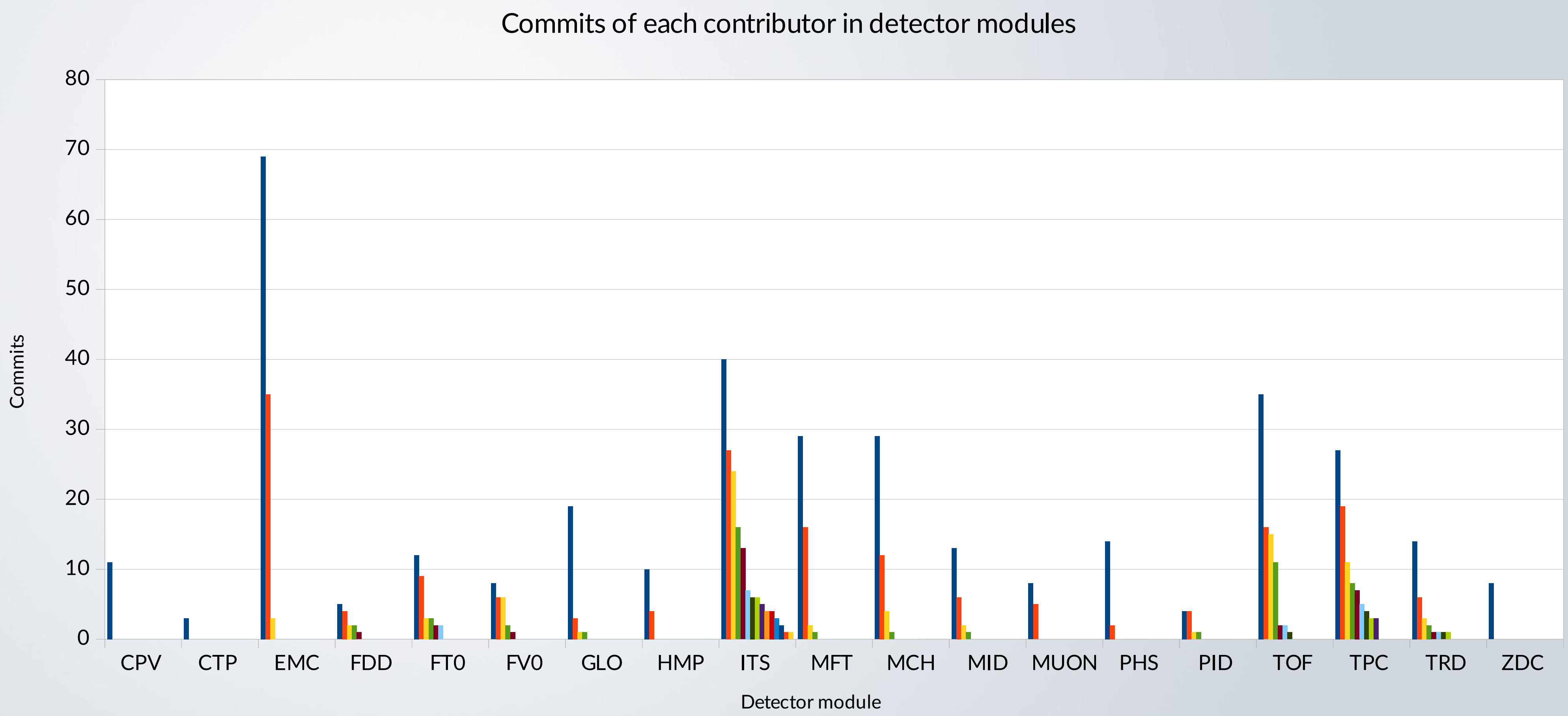
# Direct and indirect dependencies of Quality Control



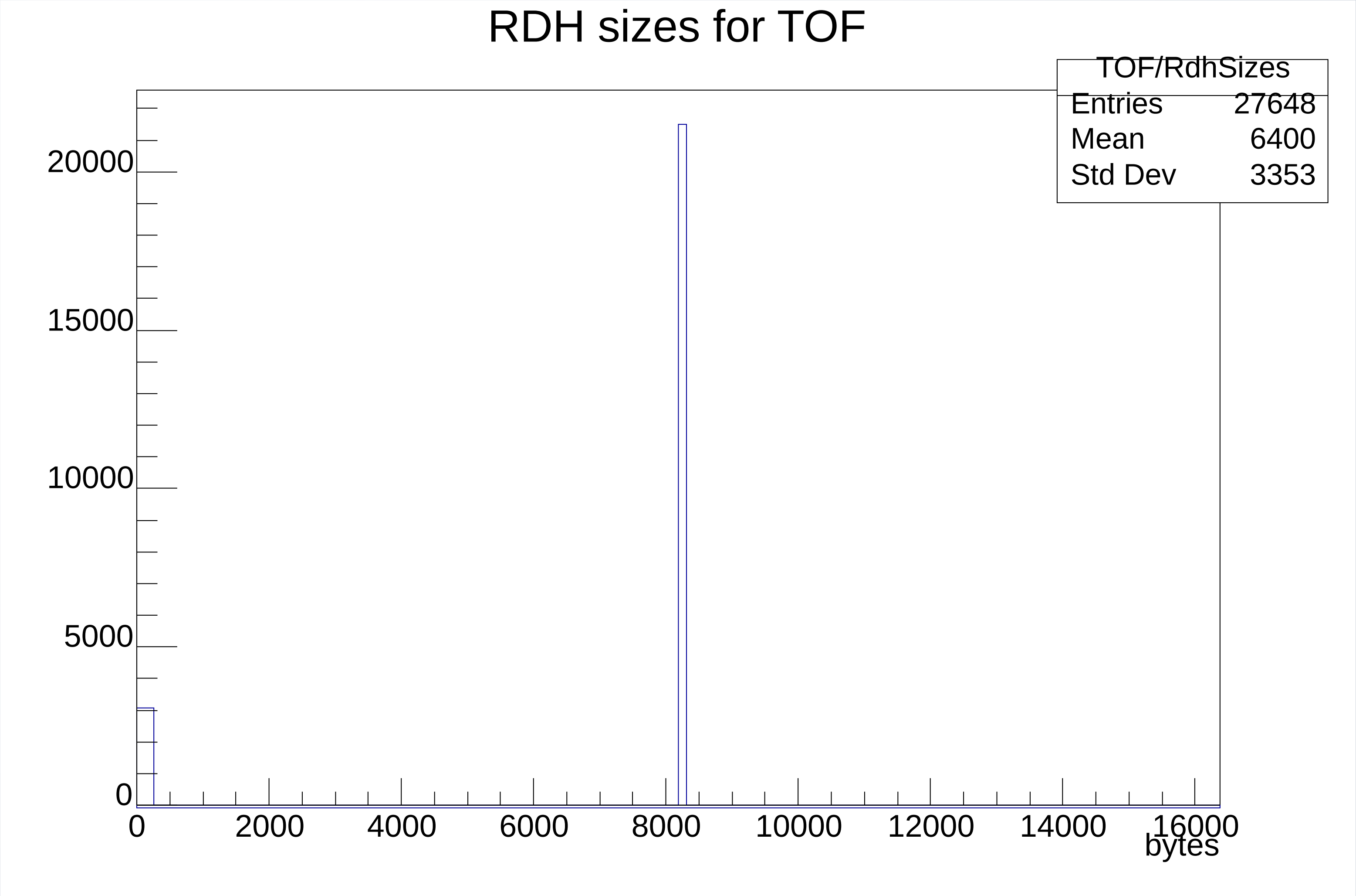
# Detector modules - contributors



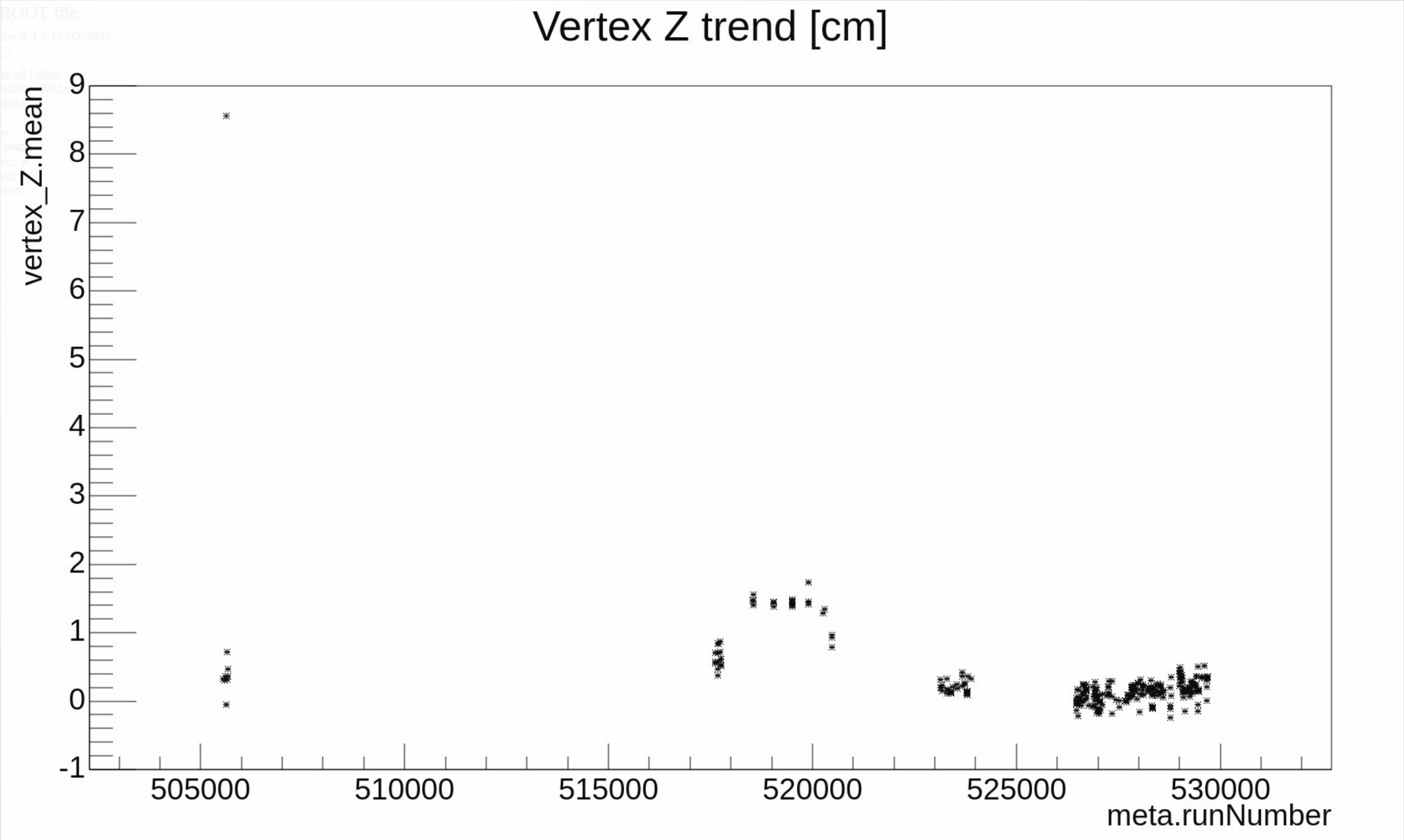
# Detector modules - contributions



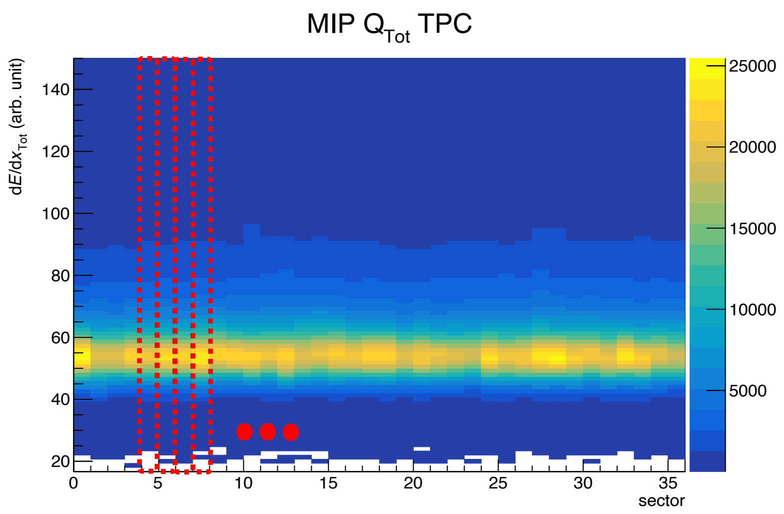
# Common tools – basic data inspection

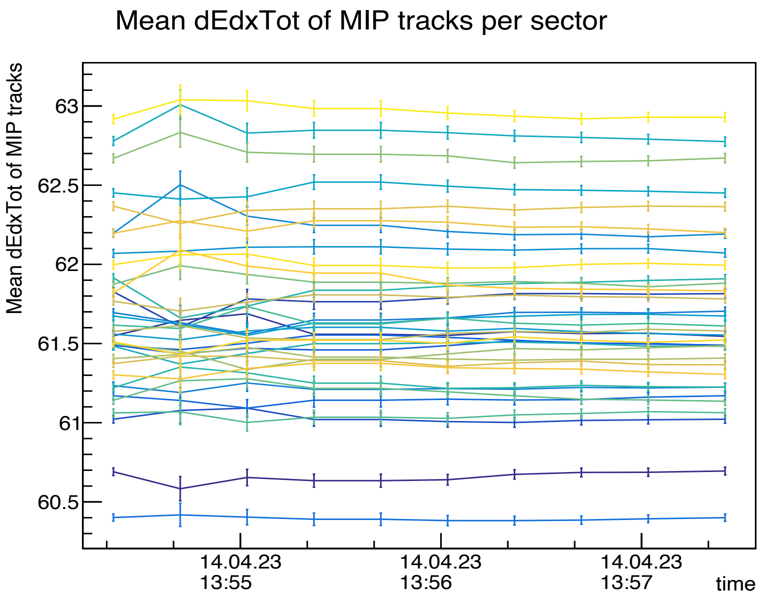


# Common tools – trending



# Common tools – slice trending




Marcel Lesch, Berkin Ulukutlu (TPC)

# Common tools – visualizing data quality

**ABC detector data quality**

**Acceptance : Bad**

**→ Flag: Limited Acceptance: Missing data for sector A1**

**Inform ABC oncall immediately!**

**Calibration : Good**

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**XYZ detector data quality**

**Acceptance : Good**

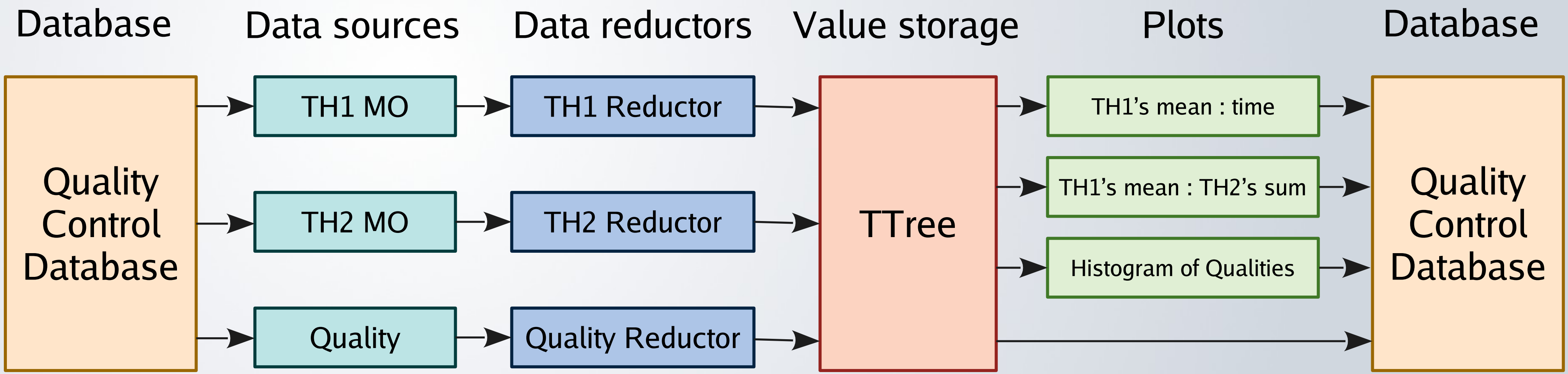
**Calibration : Good**

# Summary

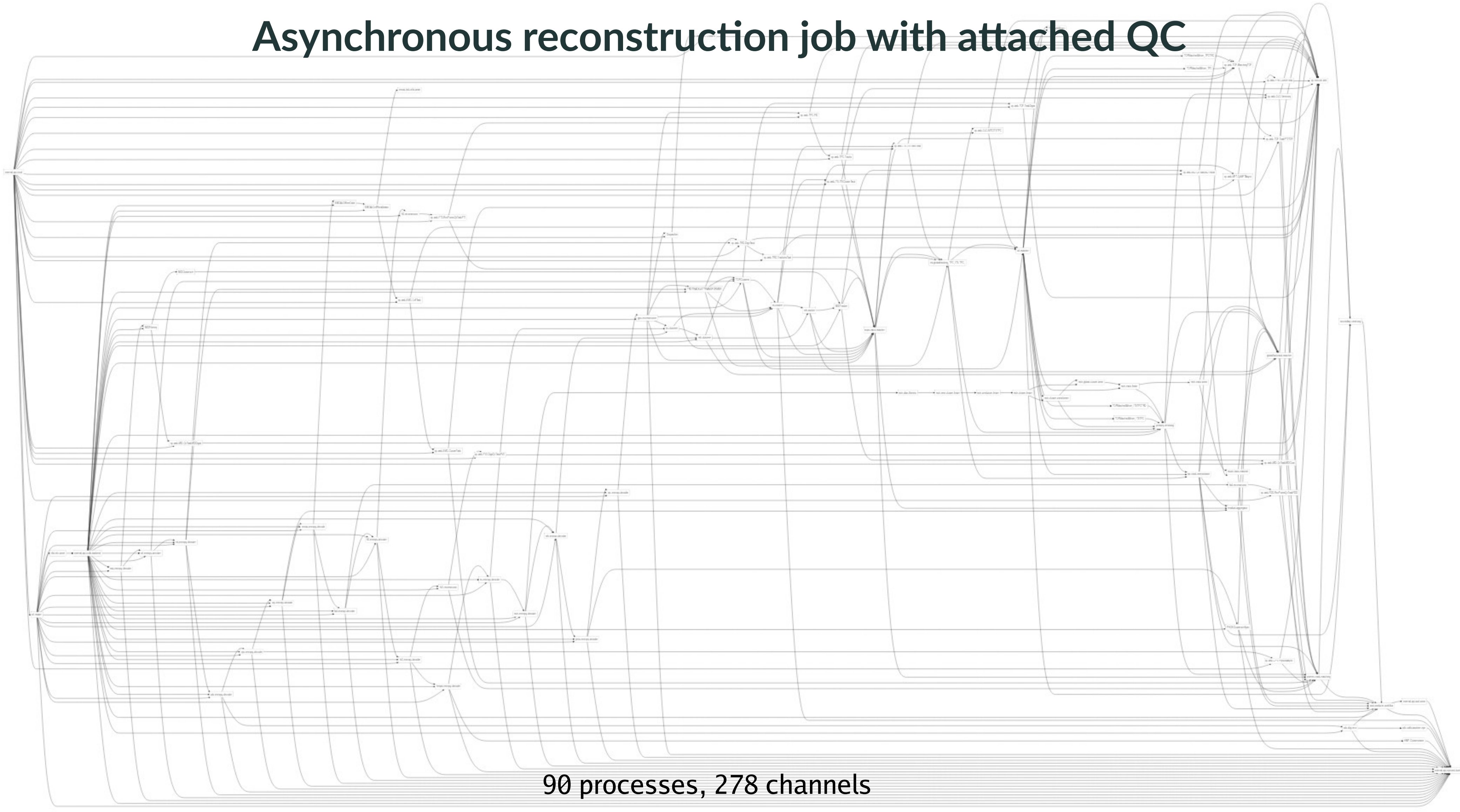
- QC software and infrastructure successfully used throughout the commissioning and the first year of data taking
- Online & offline worlds now share the same code base and teams
- Message passing allowed to sustain the large data throughput
- Performance matches the benchmarks and sustains the heavy needs of our users
- Differences between detector team manpower and expertise are balanced out with the common framework and a set of reusable tasks

# Backup slides

# Common tools – trending

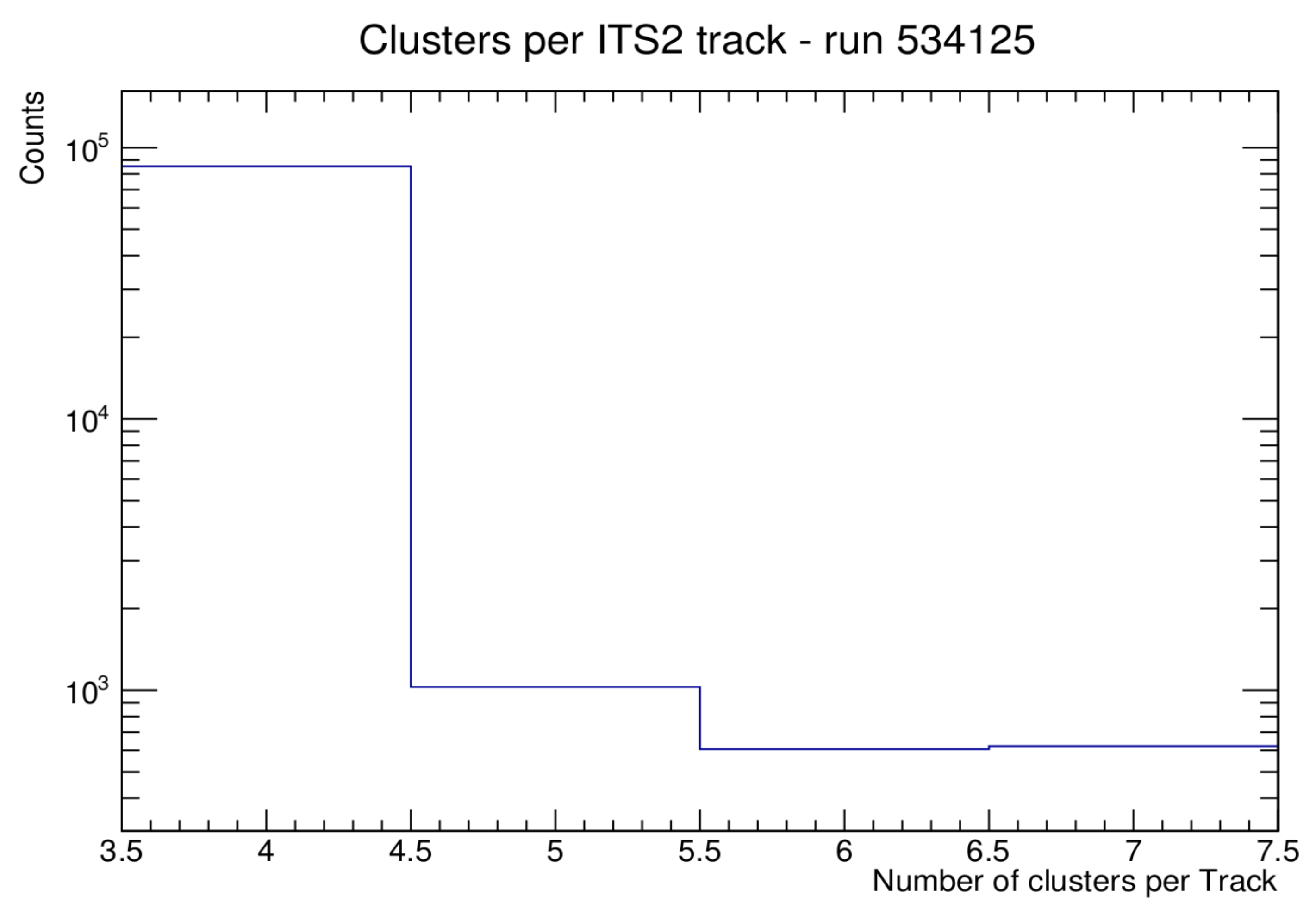


# Asynchronous reconstruction job with attached QC



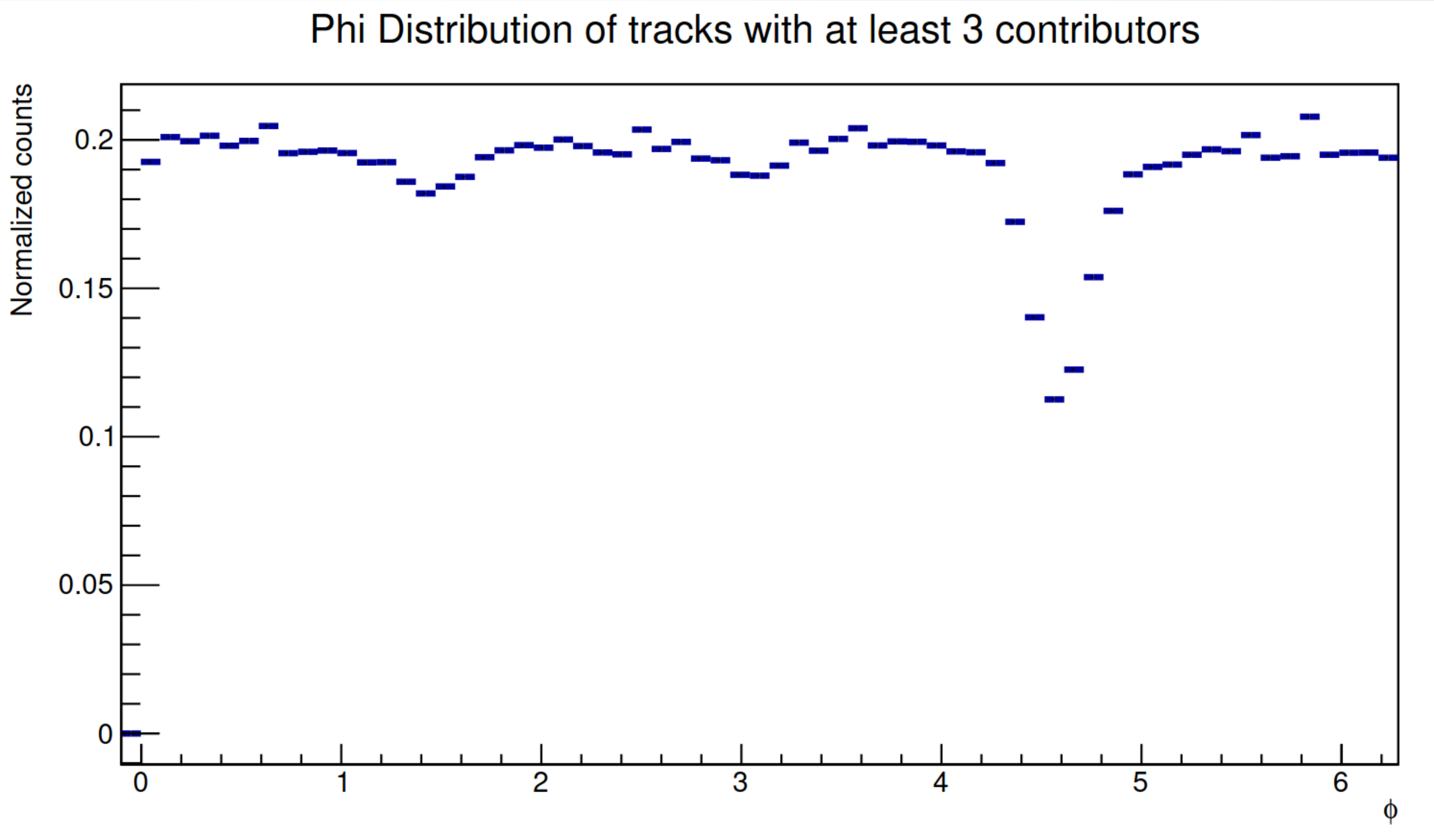
90 processes, 278 channels

# Collision point shift seen by ITS




Ivan Ravasenga, Rik Spijkers

# Hole in the ITS acceptance

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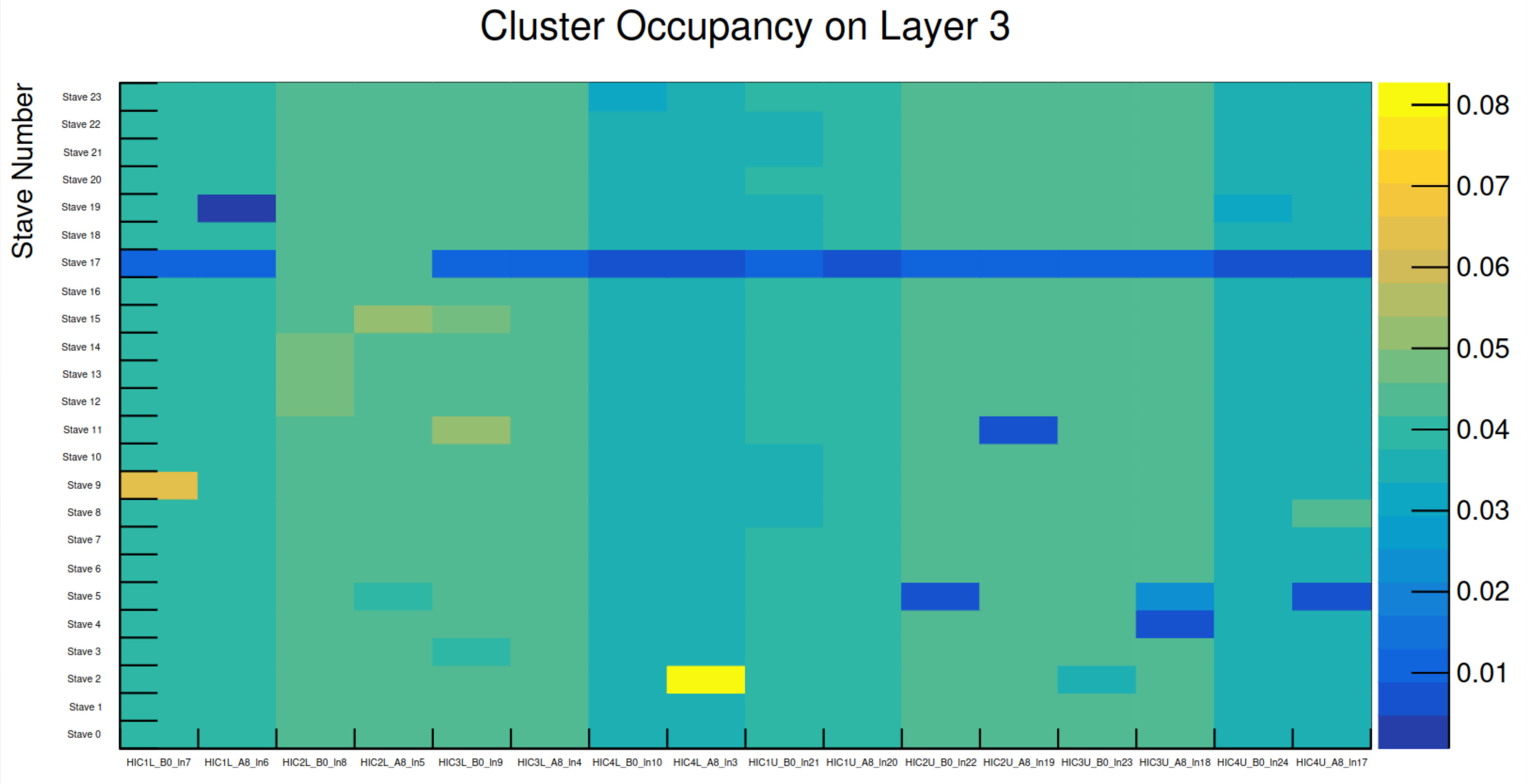


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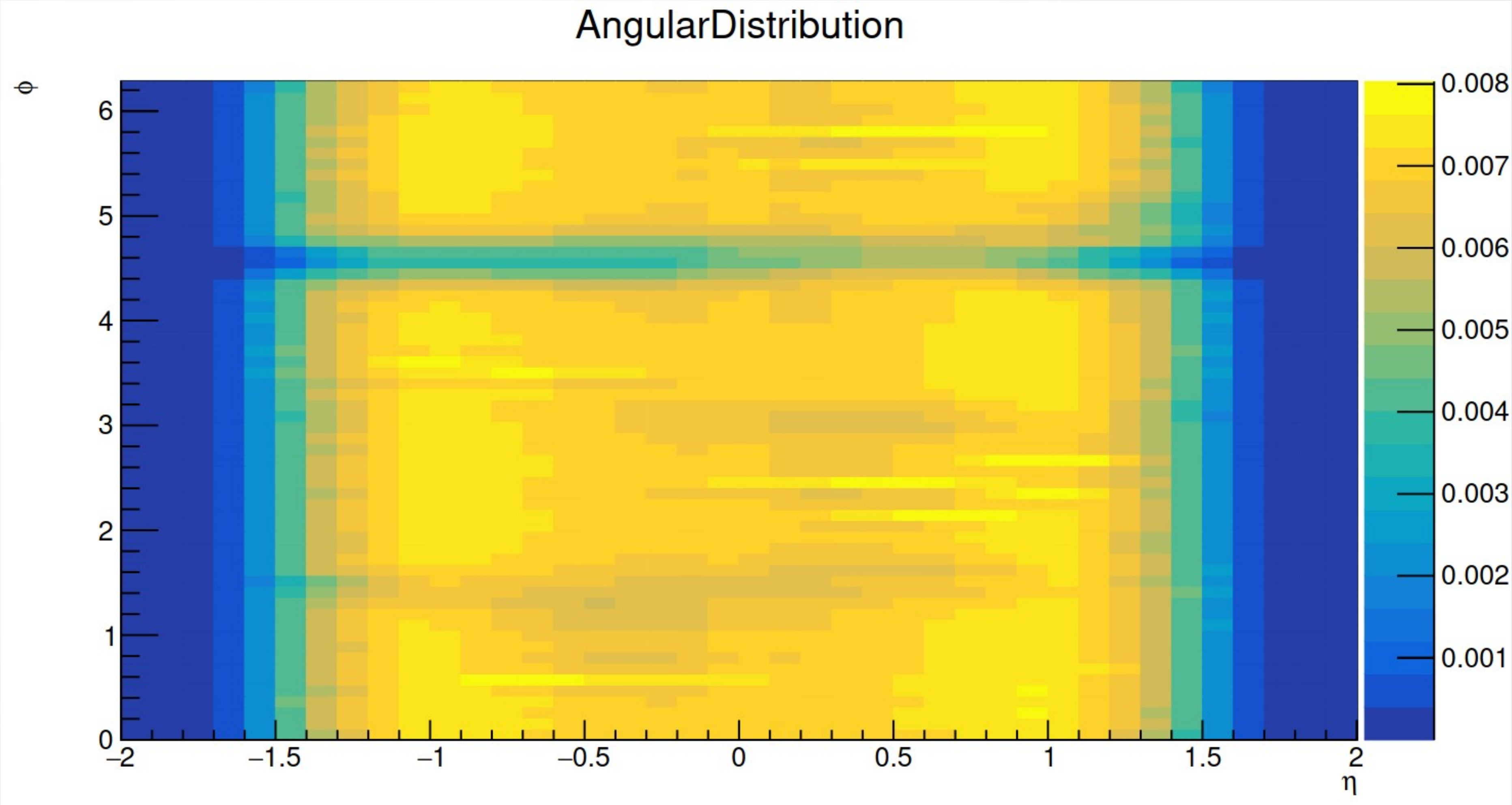


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