



**ALICE**

A JOURNEY OF DISCOVERY

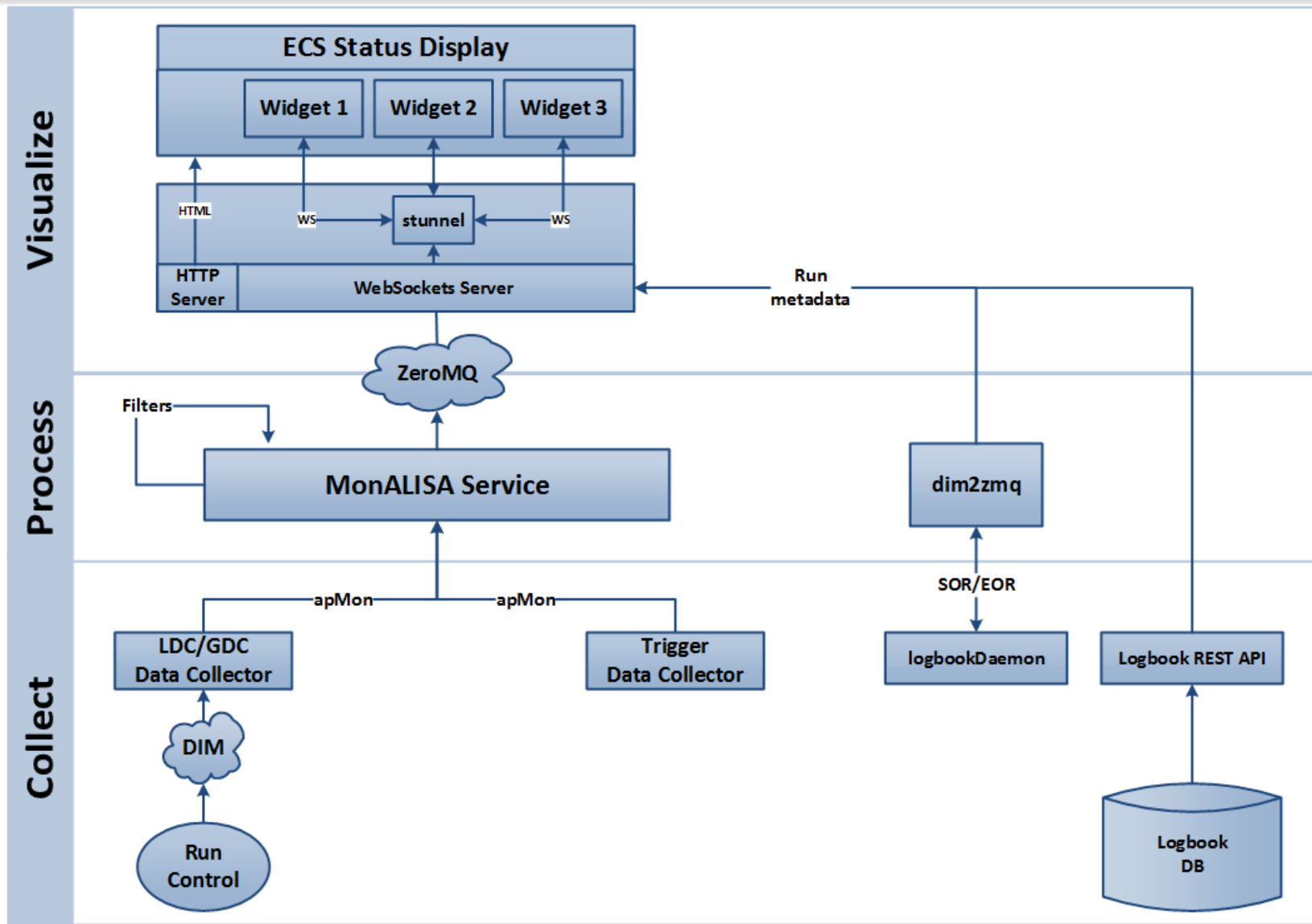


# Dataflow monitoring in **ALICE**

ALICE, ATLAS, CMS & LHCb Second Joint  
Workshop on DAQ@LHC

- Motivation & Requirements
- Architecture and components
  - Data Model
  - Data Collectors
  - Data Filters
  - Web Sockets Server
  - Status Display
- Future Work
- Conclusion

- Discussions during 1<sup>st</sup> DAQ@LHC Workshop
- Provide shift crews and DAQ oncalls with a centralized view of data flow status
- Reflect operational experience after 3 years of Run 1 operations
- MAD – Monitoring ALICE Dataflow
  - Negligible impact on existing DAQ machinery
  - Aggregate metrics into higher level values
  - Display should be:
    - Web based, accessible from outside
    - Dynamic, no page refresh
    - Clear content for shift crew



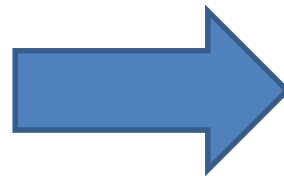
- A value in MonALISA is represented by the tuple (cluster, node, parameter, timestamp, value)
  - Abuse free-text fields cluster and node:

## MonALISA

Cluster

Node

Parameter



## MAD

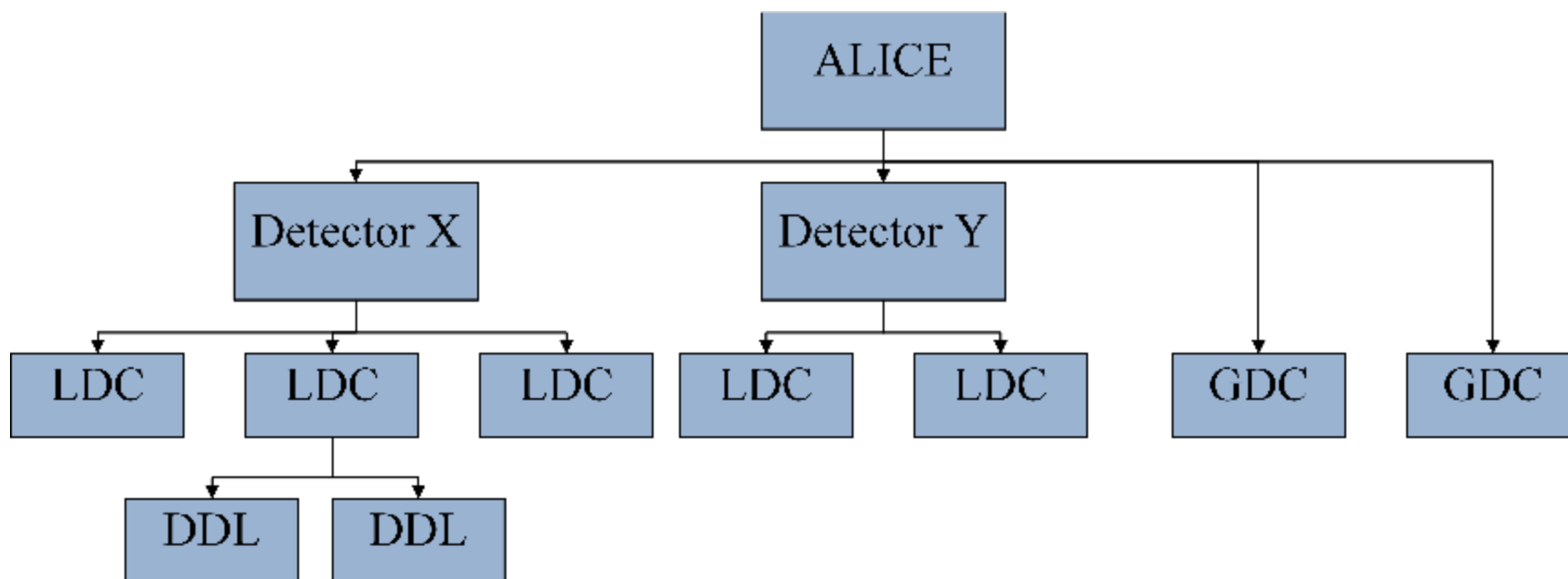
Run

Entity <sup>(1)</sup>

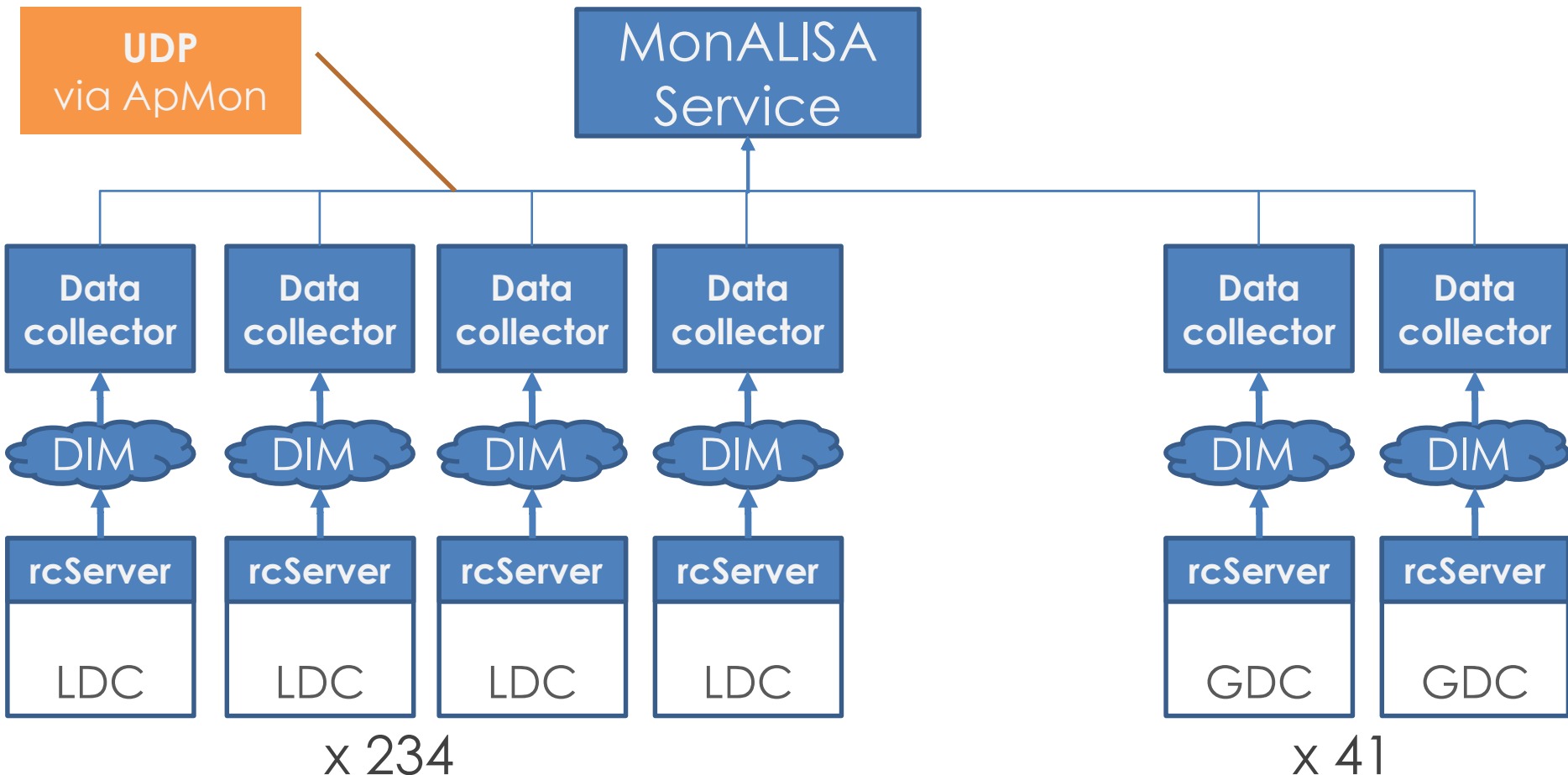
Parameter

(1) DDL(X), LDC(Y), GDC(Z), DET(ABC), ...

- Implicit entities (node) hierarchy, follows ALICE control structure:



- Data collectors are C++ DIM clients that push data via ApMon library to MonALISA Service every 5s



- Java classes running on MonALISA Service, subscribe to relevant values and perform aggregation into higher-level metrics

## MonALISA Service

DDL

- Subscribes to link status
- Computes list of links with backpressure

LDC

- Subscribes to HLT Pending Decisions, readout data rate, link status
- Computes MAX(HLT Pending Decisions), global readout rate, backpressure status per detector

GDC

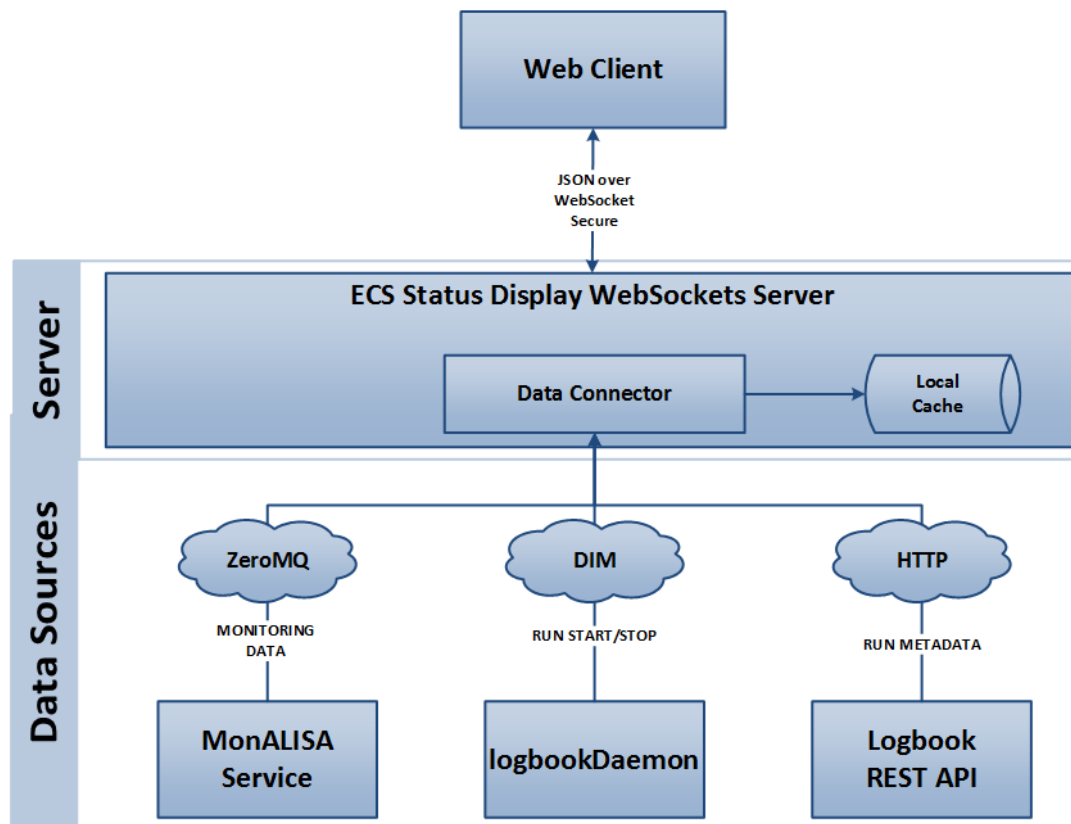
- Subscribes to recording data rate, event rate, incomplete events
- Computes global recording rate, event rate (global/per trigger cluster), total incomplete events

ALICE

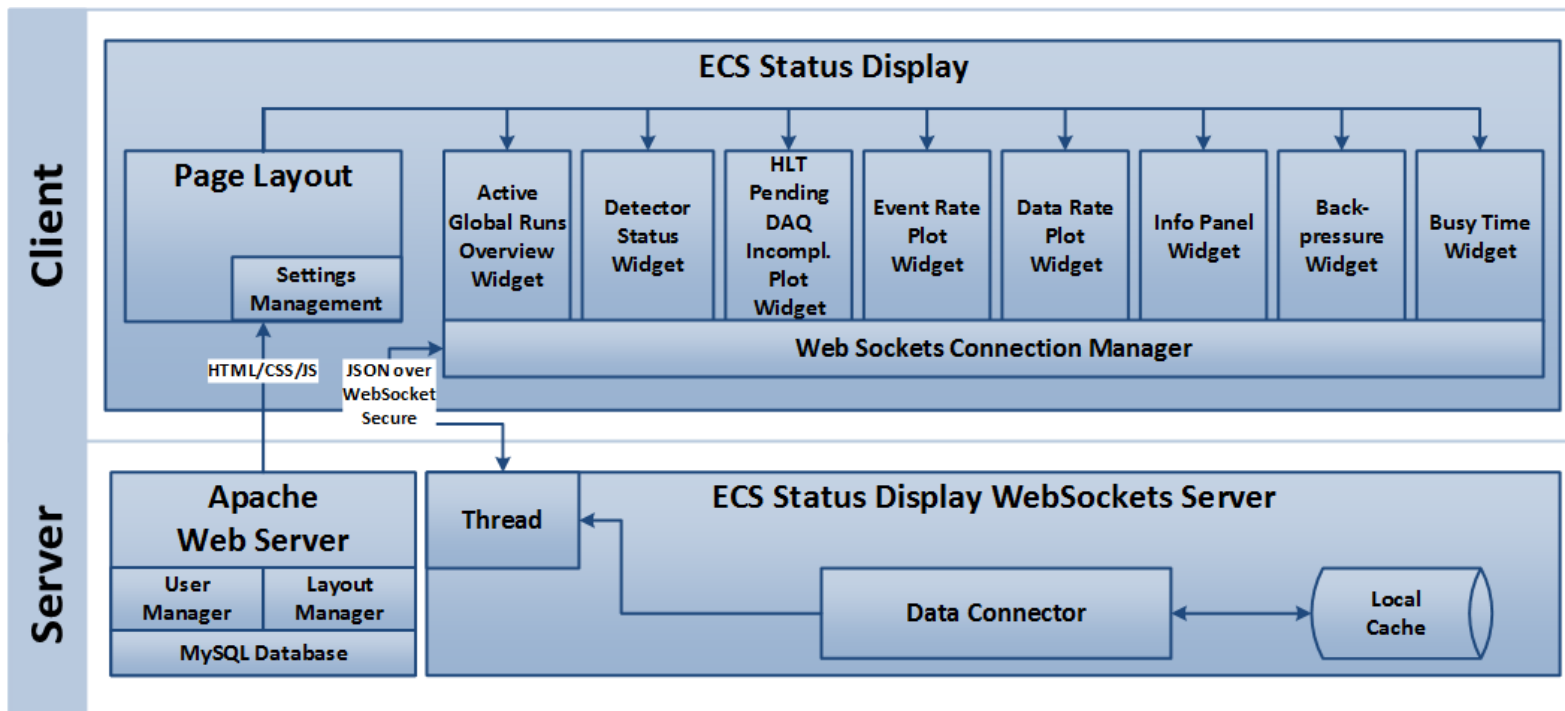
- Subscribes to all metrics to be displayed
- Sends them via ZeroMQ to Web Sockets Server



- Collects data from multiple sources, keeps local cache, pushes values to clients
- Home-made PHP implementation of RFC 6455



- Common layer handles connections, data
- Widgets subscribe to data channels
- Plots use *Flot* javascript library, have zoom window
- Replay runs, follow partition, auto switch, CERN SSO



# Status Display

Run	Beam	Partition	Run type	HLT	Rec	Duration	Events
250972	N	TEST_1	TECHNICAL	A	N	01:16:30	1.5M
CTP Config: CTP_rnd1khz (v4)							
251039	N	TEST_1	TECHNICAL	A	N	00:14:52	275k
CTP Config: CTP_rnd1khz (v4)							
▶ 251050	N	TEST_1	TECHNICAL	A	N	00:18:44	353k
CTP Config: CTP_rnd1khz (v4)							

Calib	Bsy	Bck	Name	RUN	TC 1	TC 2	TC 3	TC 4	TC 5	TC 6	TC 7	TC 8
-	-	-	-	353k	336k	-	-	-	-	-	-	-
○	○	○	ACO	✓	✓	-	-	-	-	-	-	-
○	○	○	AD0	✓	✓	-	-	-	-	-	-	-
10:01 PFD	○	○	CPV	✓	✓	-	-	-	-	-	-	-
-	-	-	EMC	-	-	-	-	-	-	-	-	-
-	-	-	FMD	-	-	-	-	-	-	-	-	-
○	○	○	HMP	✓	✓	-	-	-	-	-	-	-
-	-	-	MTR	-	-	-	-	-	-	-	-	-
-	-	-	MCH	251049	STANDALONL	no rec	00:35:51	#Fvts: 14	-	-	-	-
○	○	○	PHS	✓	✓	-	-	-	-	-	-	-
-	-	-	PMD	-	-	-	-	-	-	-	-	-
○	○	○	SDD	✓	✓	-	-	-	-	-	-	-
○	○	○	SPD	✓	✓	-	-	-	-	-	-	-
○	○	○	SSD	✓	✓	-	-	-	-	-	-	-
○	○	○	T00	✓	✓	-	-	-	-	-	-	-
○	○	○	T0F	✓	✓	-	-	-	-	-	-	-
○	○	○	TPC	✓	✓	-	-	-	-	-	-	-
○	○	○	TRD	✓	✓	-	-	-	-	-	-	-
○	○	○	TRI	✓	✓	-	-	-	-	-	-	-
-	-	-	TST	-	-	-	-	-	-	-	-	-
○	○	○	V00	✓	✓	-	-	-	-	-	-	-
○	○	○	ZDC	✓	✓	-	-	-	-	-	-	-
-	-	-	HLT	-	-	-	-	-	-	-	-	-



User manual | Feedback - alice-datesupport@cern.ch

- Global Overview
  - Active / Recent runs (up to 3)
  - Run #, Beam status, Partition, Run Type, HLT Mode, Recording, Duration, # of Events, Trigger Configuration
  - On run selection, other widgets are notified and can change display

	Run	Beam	Partition	Run type	HLT	Rec	Duration	Events
▶	235343	Y	PHYSICS_2 CTP Config: emcal_test (v7)	PHYSICS	A	Y	00:22:31	1.1M
■	235344	Y	PHYSICS_1 CTP Config: pp2015 (v105)	PHYSICS	B	N	00:15:23	537k
▶	235345	Y	PHYSICS_1 CTP Config: pp2015 (v105)	PHYSICS	B	Y	00:41:59	95k

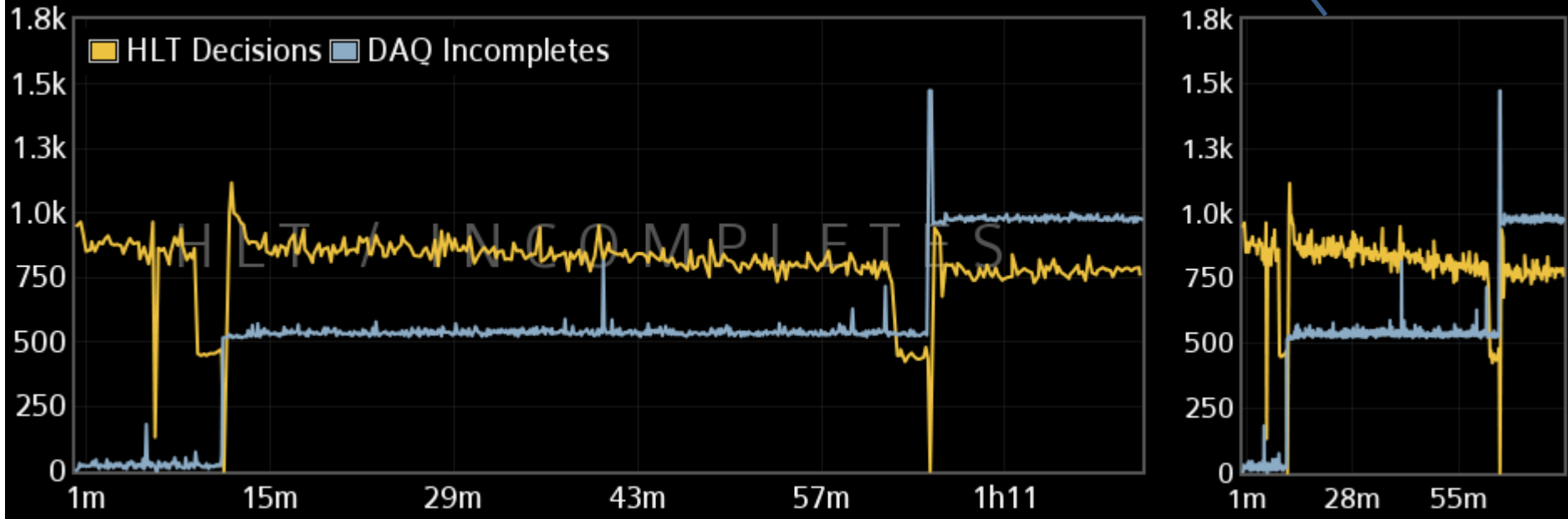
- Detector Status
  - Participating detectors
  - Calibration runs of last 8 hours
  - Standalone runs
  - Backpressure
  - Busy
  - % of active links
  - Events per TC
  - Disabled trigger inputs

Calib	Bsy	Bck	Name	RUN	TC 1	TC 2	TC 3	TC 4	TC 5	TC 6	TC 7	TC 8
-	-	-		367k	277k	85k	-	-	-	-	-	-
	○	○	ACO	✓	-	✓	-	-	-	-	-	-
09:38 PED	○	○	AD0	✓	✓	-	-	-	-	-	-	-
	○	○	CPV	✓	-	✓	-	-	-	-	-	-
	-	-	EMC	-	-	-	-	-	-	-	-	-
	-	-	FMD	-	-	-	-	-	-	-	-	-
	○	○	HMP	✓	-	✓	-	-	-	-	-	-
	○	○	MTR	✓	-	✓	-	-	-	-	-	-
13:52 PED	○	○	MCH	✓	-	✓	-	-	-	-	-	-
	-	-	PHS	-	-	-	-	-	-	-	-	-
	-	-	PMD	-	-	-	-	-	-	-	-	-
10:03 INJ	○	○	SDD	✓	-	✓	-	-	-	-	-	-
	●	○	SPD	✓	✓	-	-	-	-	-	-	-
13:50 PED	○	○	SSD	✓	-	✓	-	-	-	-	-	-
	○	○	T00	✓	✓	-	-	-	-	-	-	-
	○	○	T0F	✓	✓	-	-	-	-	-	-	-
	-	-	TPC	-	-	-	-	-	-	-	-	-
	○	○	TRD	✓	-	✓	-	-	-	-	-	-
	○	○	TRI	✓	✓	✓	-	-	-	-	-	-
	-	-	TST	-	-	-	-	-	-	-	-	-
	○	○	V00	✓	✓	-	-	-	-	-	-	-
	○	○	ZDC	✓	-	✓	-	-	-	-	-	-
	-	-	HLT	-	-	-	-	-	-	-	-	-

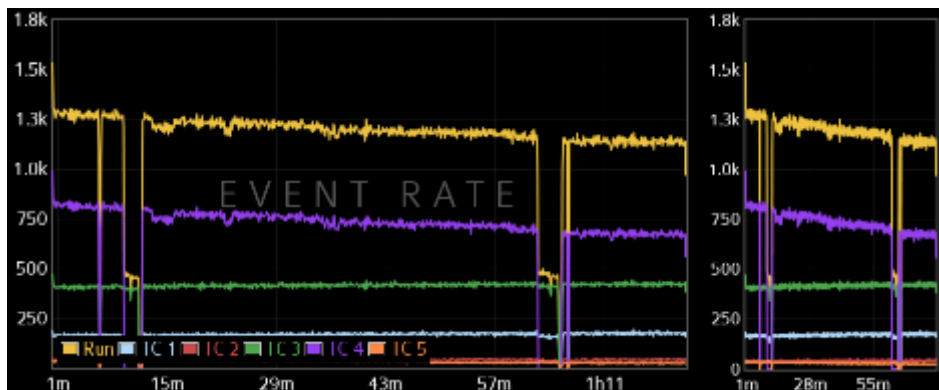
# Status Display

- HLT Pending Decisions
- DAQ Incomplete Events

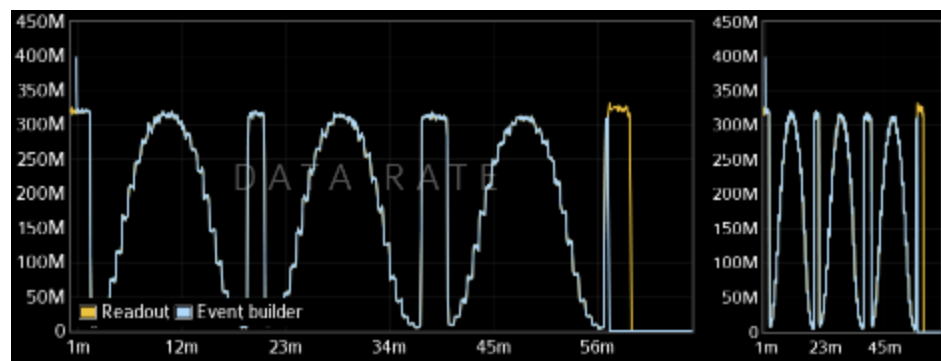
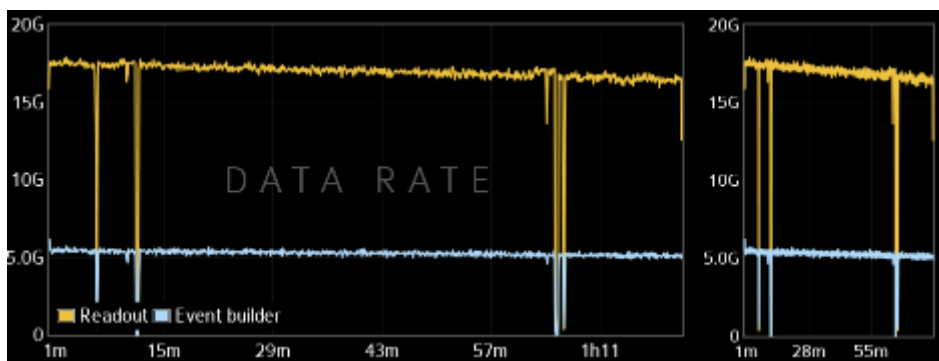
In LIVE mode,  
latest 10 min



- Event Rate (total and per Trigger Cluster)

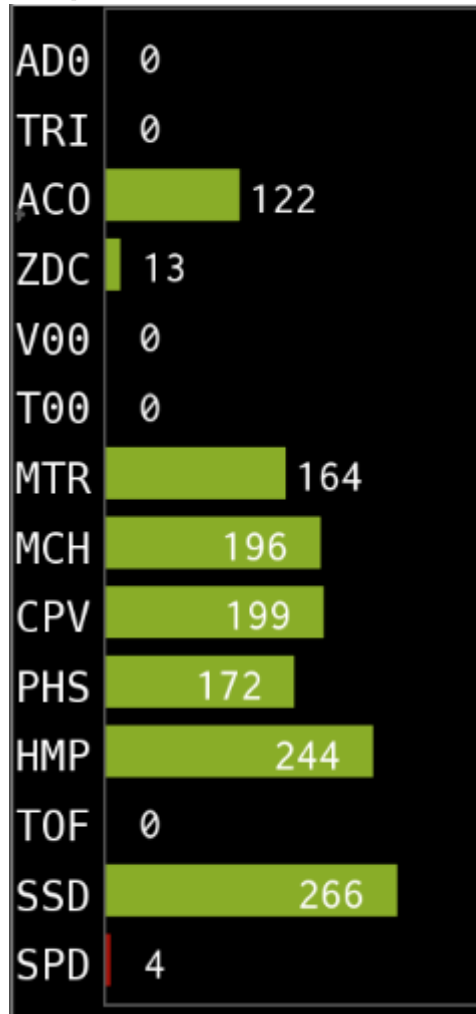


- Data rate (Readout and Event Builder)

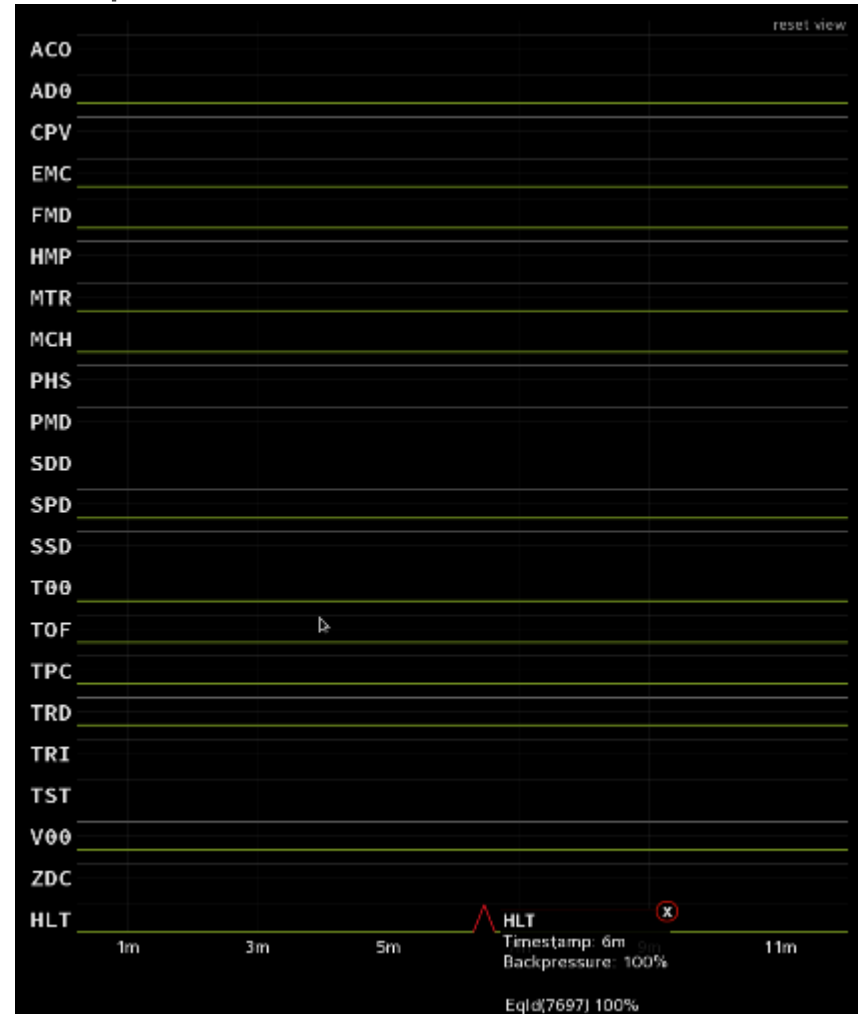




- Busy time

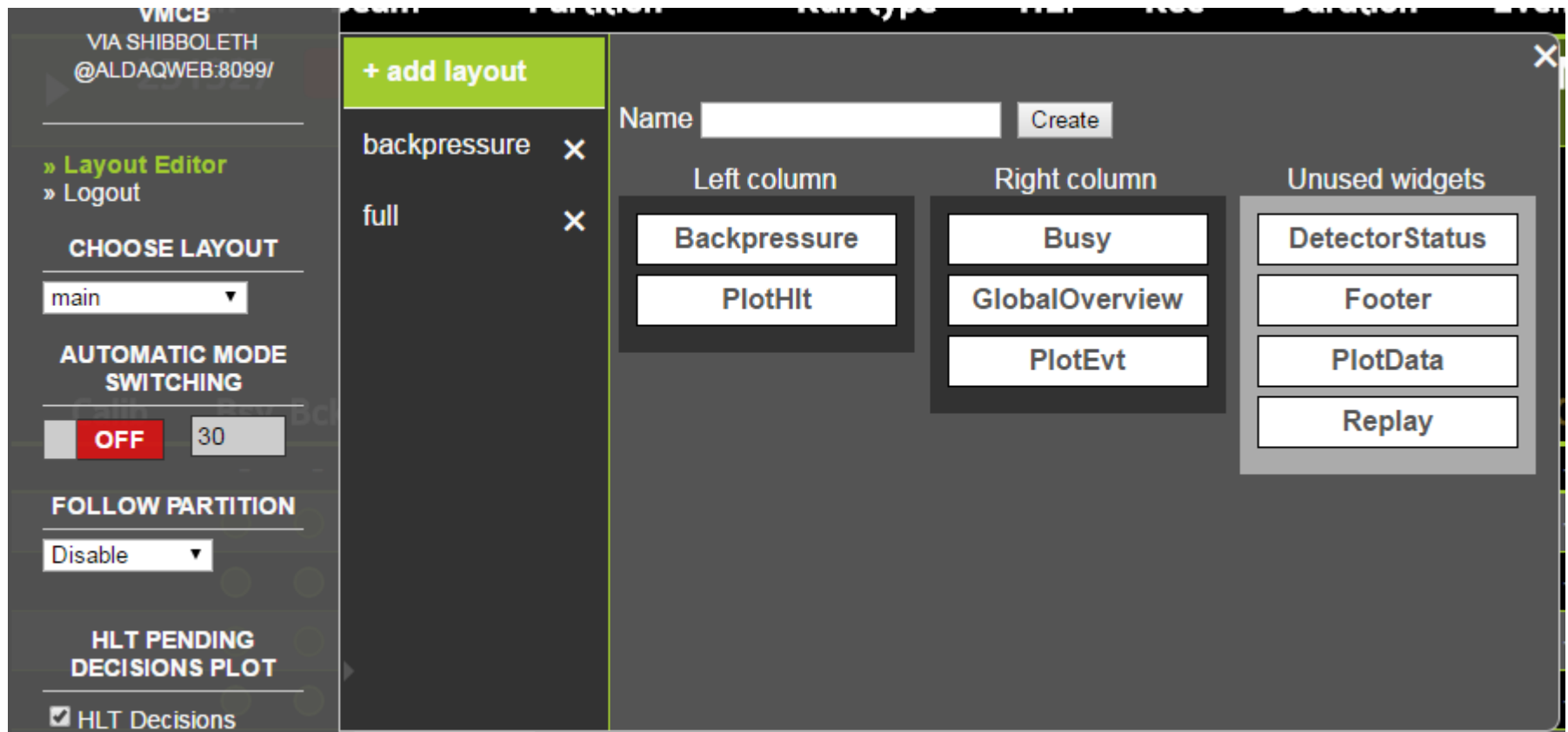


- Backpressure





- Widgets can be organized by users in personalized layouts



The screenshot displays the ALICE DAQ Status Display interface. On the left, a sidebar contains user information (VMCB, VIA SHIBBOLETH, @ALDAQWEB:8099/), navigation options (Layout Editor, Logout), and control settings (CHOOSE LAYOUT: main, AUTOMATIC MODE SWITCHING: OFF, FOLLOW PARTITION: Disable, HLT PENDING DECISIONS PLOT: HLT Decisions checked). The main area shows a layout editor with a list of active layouts (backpressure, full) and a 'Create' button. The layout is divided into three columns: Left column (Backpressure, PlotHit), Right column (Busy, GlobalOverview, PlotEvt), and Unused widgets (DetectorStatus, Footer, PlotData, Replay).



ALICE  
A JOURNEY OF DISCOVERY

# MonALISA Client GUI



**Clusters**

- 251278
- 251279
- 251280
- 251282
- ALICE
- DET(ACO)
- DET(AD0)
- DET(CPV)
- DET(HMP)
- DET(MCH)
- DET(MTR)
- DET(OTHER)
- DET(PHS)
- DET(SPD)
- DET(SSD)
- DET(T00)
- DET(TOF)
- DET(TRI)
- DET(V00)
- DET(ZDC)
- EqId(0)
- EqId(1280)
- EqId(1281)
- EqId(1282)
- EqId(1283)
- EqId(1284)
- EqId(1285)
- EqId(1286)
- EqId(1287)
- EqId(1288)
- EqId(1289)
- EqId(1290)
- EqId(1291)
- EqId(1292)
- EqId(1293)
- EqId(1294)
- EqId(1295)

**Parameters**

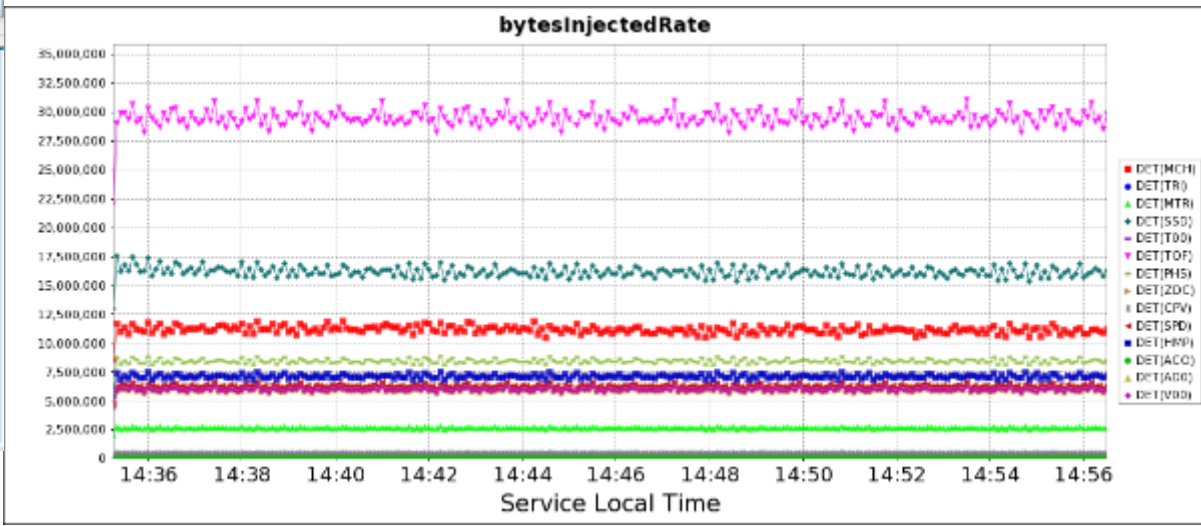
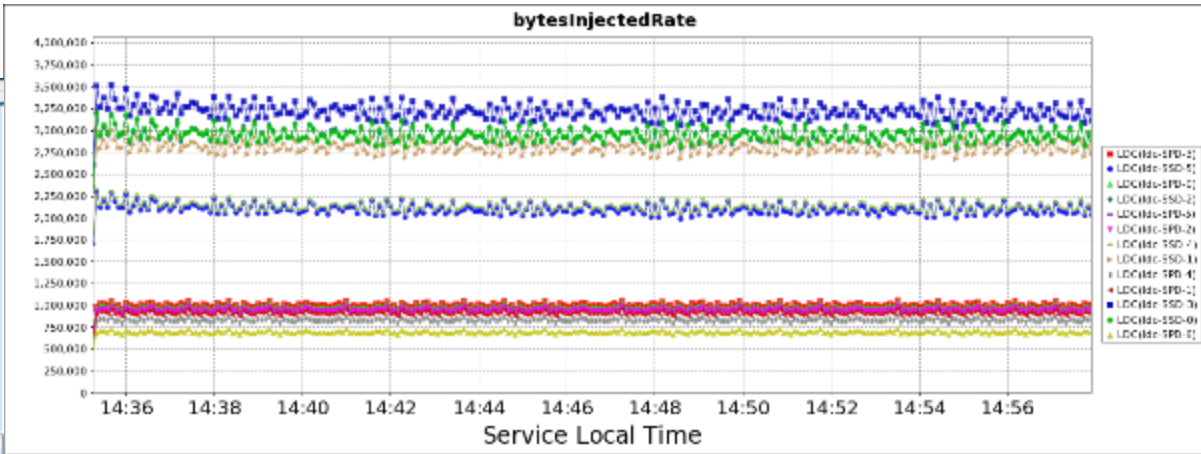
- bytesInjected
- bytesInjectedRate
- bytesRecorded
- bytesRecordedRate
- eventsRecorded
- eventsRecordedRate
- eventsRecordedRateTC1
- eventsRecordedRateTC2
- eventsRecordedTC1
- eventsRecordedTC2
- incompleteEvents
- pageAllocationFailures

**Modules**

- GdcRcServerFilter
- LdcRcServerFilter

History Plot    RealTime Plot

Nodes Sum...    Cluster Sum...



- Include more metrics/widgets
  - Incomplete per detector, busy over time, buffer occupancy, ...

- Dataflow Monitoring has been greatly improved in ALICE during LS1
- Extensively used by shift crew to detect abnormal situations
- Extensively used by experts to investigate abnormal situations
- Screenshots extensively used in presentations, reports, etc.
- Modular design allows for external teams to push data and develop widgets (e.g. busy time)