

CMS ZDC data monitoring for RUN 3

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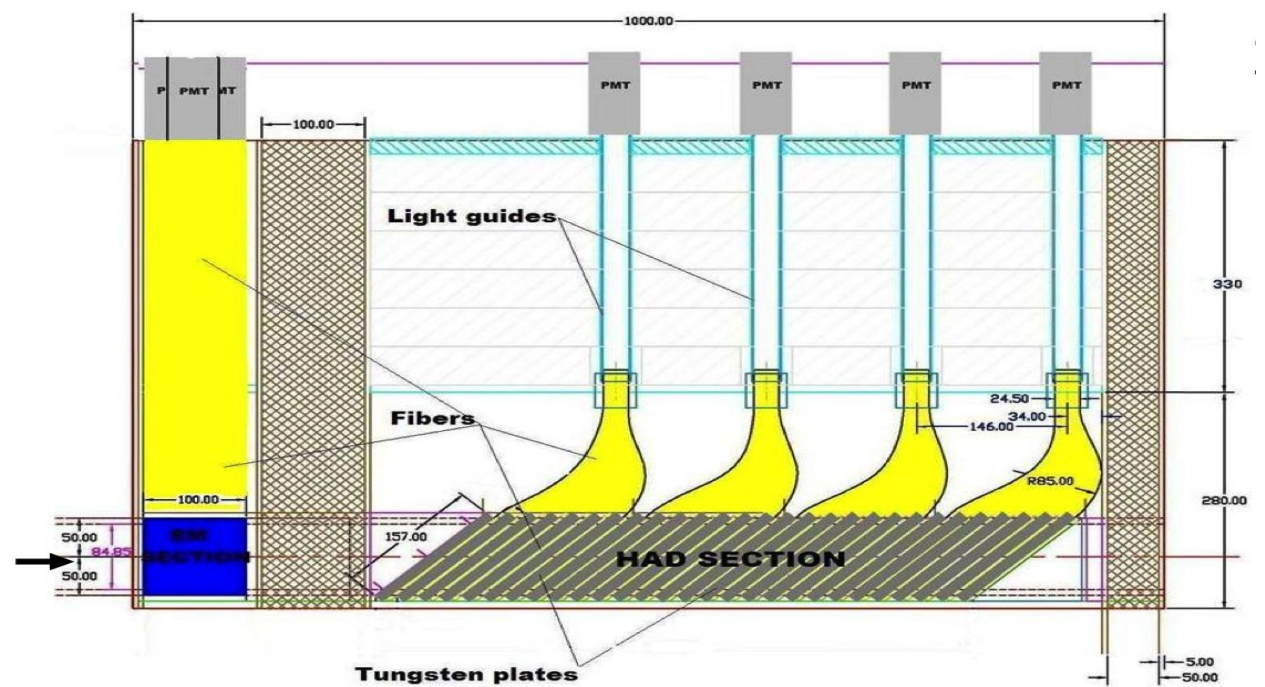
2022.10.24

Table of content

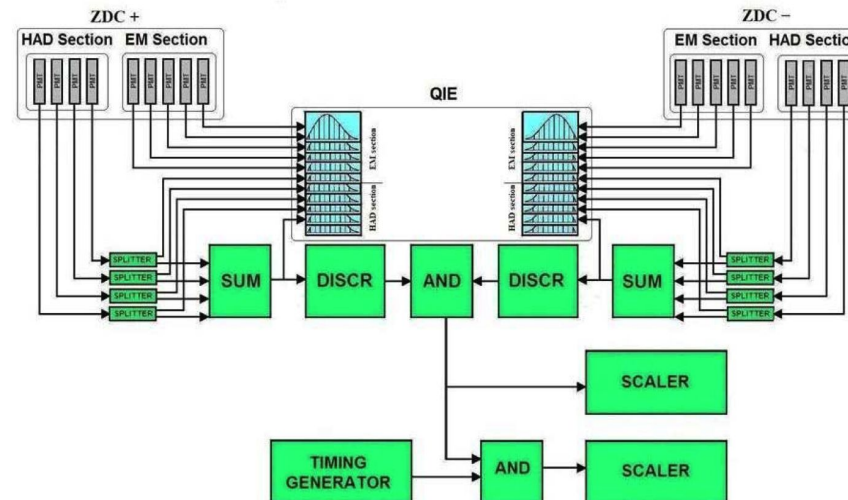
- **ZDC**
- **Online Monitoring System (OMS)**
- **ZDC Data display on OMS**

CMS ZDC

- Measure very forward and backward neutrons and photons in HI collision
- Built from layers of tungsten and quartz fibers
- ZDC + and ZDC- are installed symmetrically at 140 m away from interaction point
- Data is digitized via the QIE electronics



ZDC electronic circuit



- **MB-trigger**
- **UPC-trigger**
- **Tuning beams**
- **Real-time luminosity**

Online Monitoring System (OMS)

- **Web based application to display data from various sources**
- **Display real-time and historical information**
- **Aggregate and integrate different sources of information into a central place**
- **Allow users to view, compare and correlate information**

CMS OMS structure

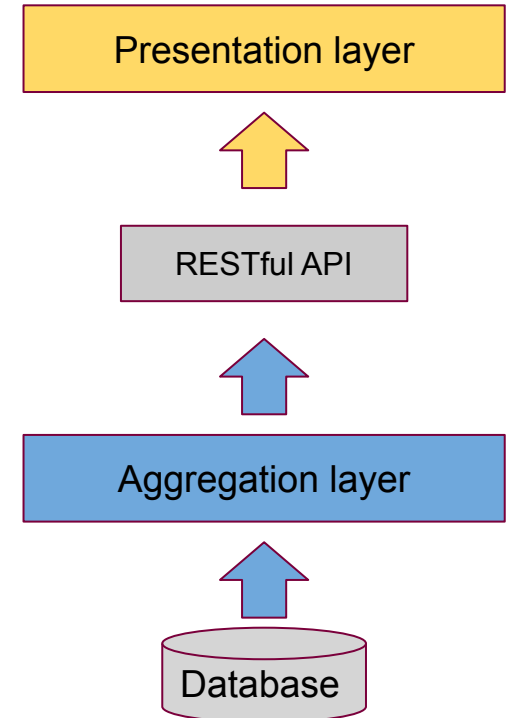
OMS is divided into two separate layers which communicate via **RESTful API**.

Aggregation layer

Fetch data from database and present it via RESTful JSON:API
(LHC Fills, CMS Runs, Lumisections, Trigger rates, ...)

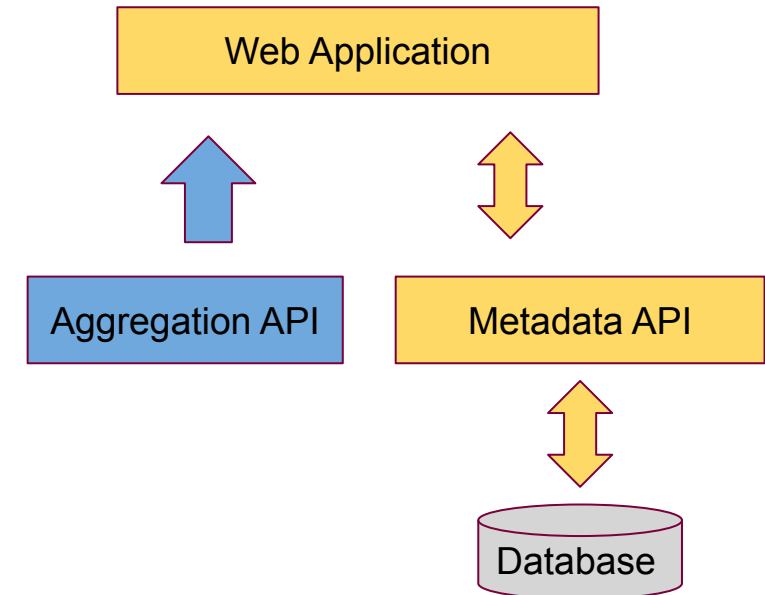
Presentation layer

Fetch data from multiple sources and display it via web interface
(Datatables, interactive charts, images, ...)



Presentation layer

- **Metadata API** provides portal configuration:
 - Workspaces, Folders, Pages
 - Page layout (controller & portlets & relations)
 - Portlet type, size, position
 - User privileges
- **Web application** is graphical user interface:
 - User friendly
 - Interactive
 - Responsive
 - Customizable



Content organisation

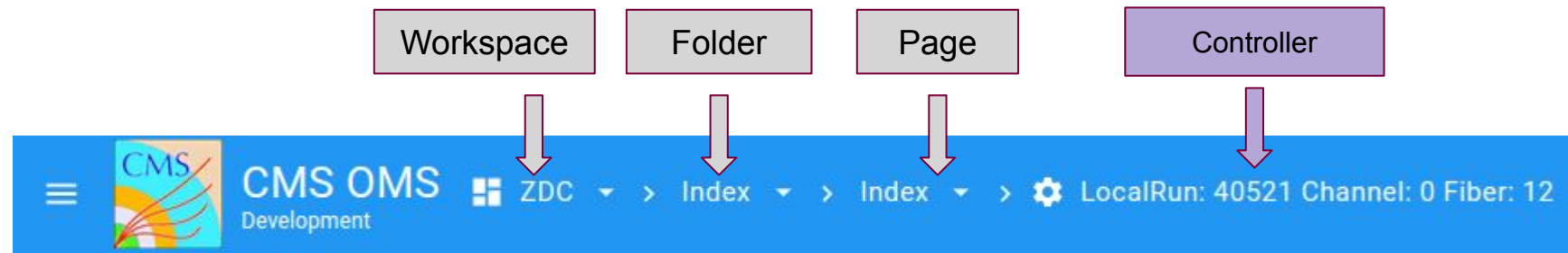
Workspace – top-level container - defines organizational unit, sub-detector, etc.

Folder – lower-level collection - contains Pages organized by context.

Page – lowest-level collection - contains of one or more Portlets.

Controller - (optional) component - allows user to filter result set.

Portlet - content presentation component.



Components: Controller

- Controller is a reusable filtering component.
- User selected filter is applied to all Portlets within the Page.

Fill Summary
Fill Summary controller

Fill Range
Fill Range: From
Fill Range: To

Date Range
Date Range: From
Date Range: To

Era

Controller Options

Stable beams only
 Protons only
 Ions only
 Protons-Ions only

APPLY OK CLOSE RESET

Run Summary
Run Summary controller

Fill
Fill

Run Range
Run Range: From
Run Range: To

Date Range

Components Online Status

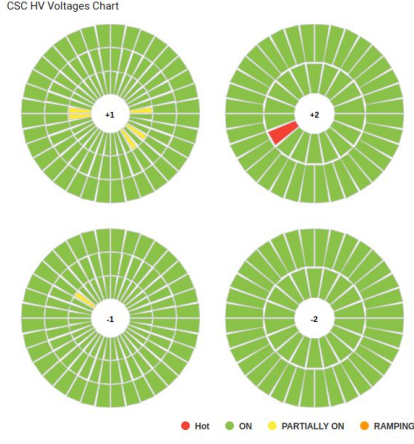
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<input type="checkbox"/> DAQ	<input type="checkbox"/> TRACKER	<input type="checkbox"/> HF	
<input type="checkbox"/> SCAL			

Sequence
GLOBAL-RUN

APPLY OK CLOSE RESET

Components: Portlet

- Portlet is a reusable content presentation component.
- Displays single well-defined aspect of information: chart, datatable, text, etc.

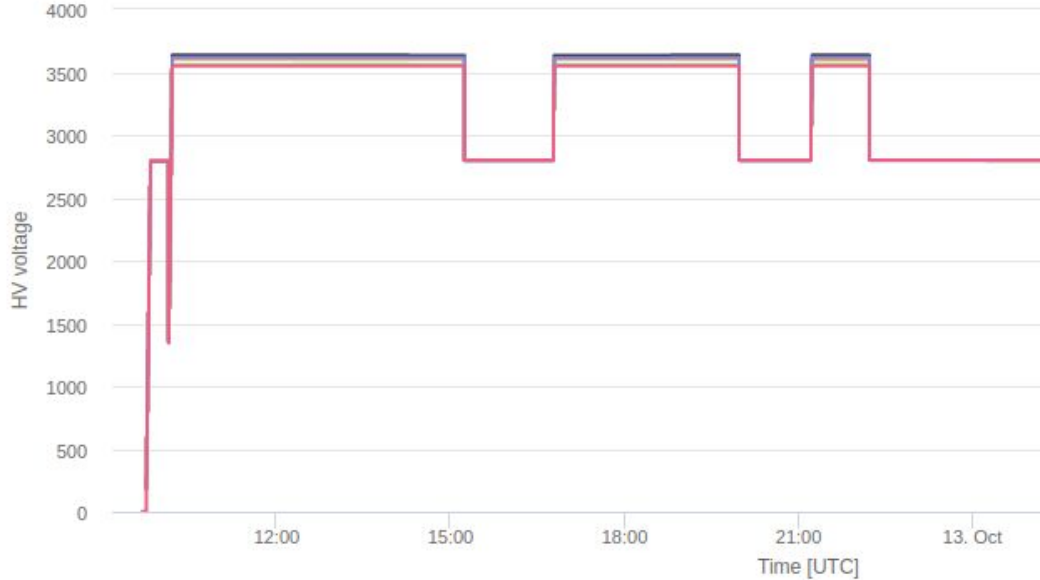


Lumisessions Run# 360287

LS #	Start Time UTC	End Time UTC	Del. Lumi pb^{-1}	Rec. Lumi pb^{-1}	Init Lumi $10^{31}cm^{-2}s^{-1}$	End Lumi $10^{31}cm^{-2}s^{-1}$	Physics	CMS active	beam proton	stable beam	RP Time	RP SECT 4S	RP SECT 5S	Eb+	Eb-	Ee+	Ee-	GEM+	GEM-	Hbhea	Hbheb	Hbhec	Hf	Ho	RPC	DT0	DT+	DT-	CSC+	CSC-
1	2022-10-12 21:35:24	2022-10-12 21:35:48	0	0	0	0																								
2	2022-10-12 21:35:48	2022-10-12 21:36:11	0	0	0	0																								
3	2022-10-12 21:36:11	2022-10-12 21:36:34	0	0	0	0																								
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7	2022-10-12 21:37:44	2022-10-12 21:38:08	0	0	0	0																								
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10	2022-10-12 21:38:54	2022-10-12 21:39:18	0	0	0	0																								
11	2022-10-12 21:39:18	2022-10-12 21:39:41	0	0	0	0																								
12	2022-10-12 21:39:41	2022-10-12 21:40:04	0	0	0	0																								
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19	2022-10-12 21:42:24	2022-10-12 21:42:47	0	0	0	0																								
20	2022-10-12 21:42:47	2022-10-12 21:43:11	0	0	0	0																								

Rows per page: 50 Total # of rows: 74 Page 1 of 2

C02 (channels 01-06)



◆ m31_c02_p01
 ▲ m31_c02_p02
 ◆ m31_c02_p03
 ◆ m31_c02_p04
 ◆ m3:

Portal: Edit Mode

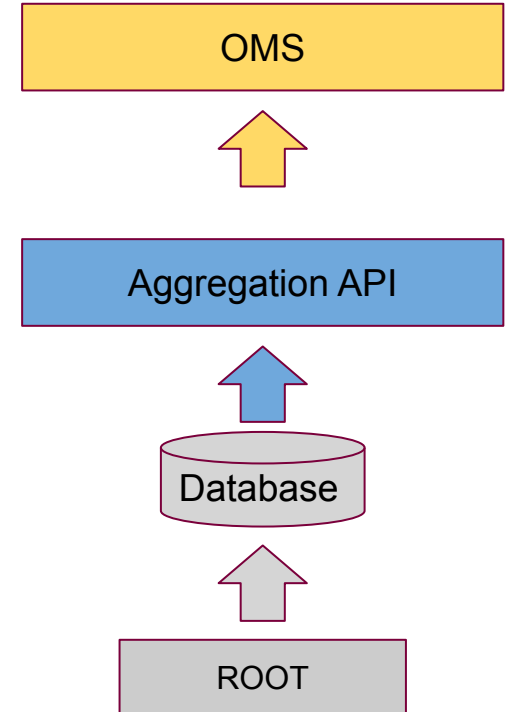
- **Privileged users can realtime:**
 - Add/Remove/Resize/Rearrange existing Portlets within a Page.
 - Create/Update/Delete/Reorder Folders and Pages

No need to redeploy!

ZDC on CMS OMS

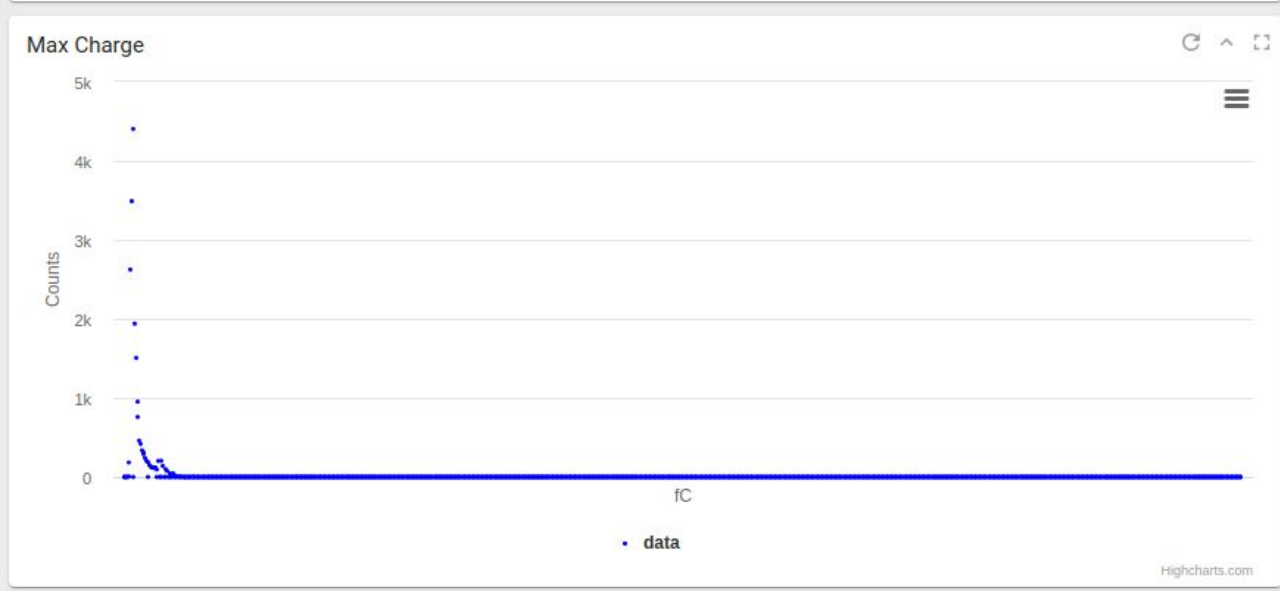
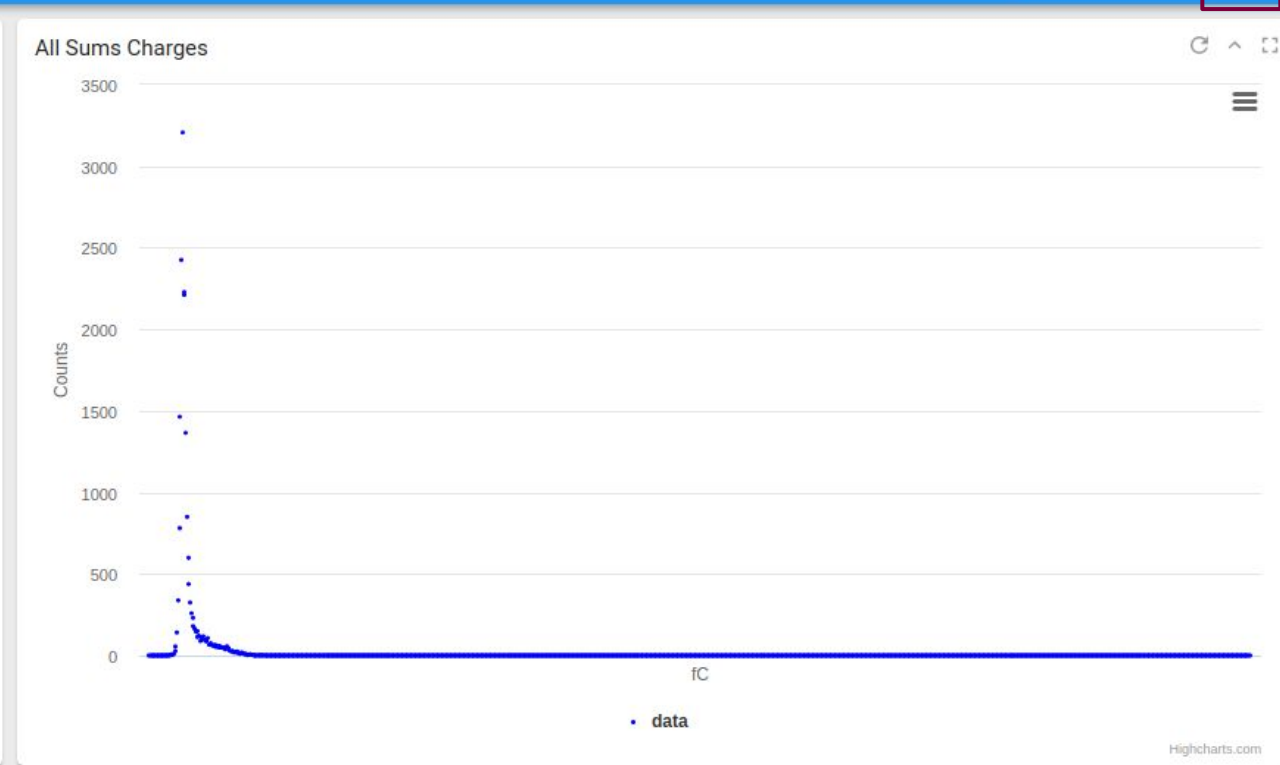
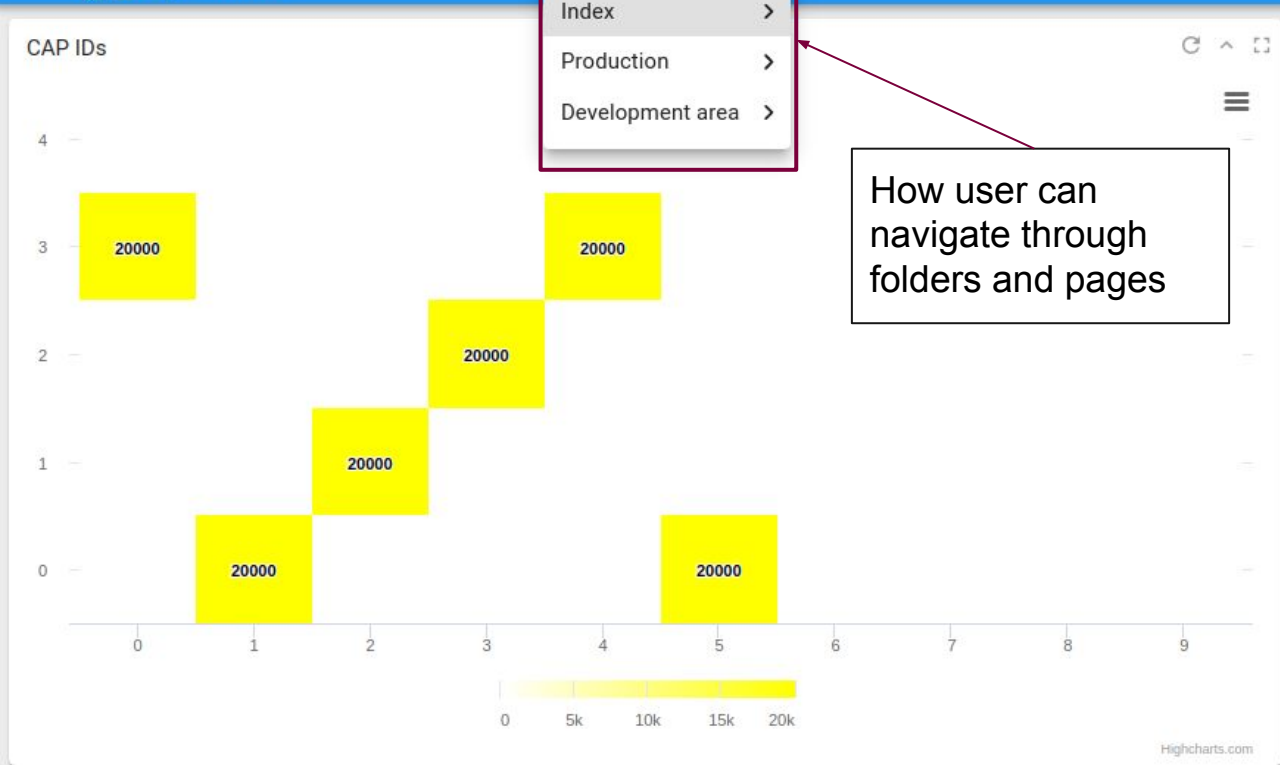
Data flow

- Custom script parses ZDC ROOT files and stores data at Oracle DB (at P5)
- We use Aggregation API to create REST endpoints which fetch data from database
- OMS use Aggregation API endpoints in order to retrieve data and display in OMS



- Index >
- Production >
- Development area >

How user can navigate through folders and pages





ZDCGenericController

ZDC Generic Controller Test

LocalRun

< 40521 >

Channel

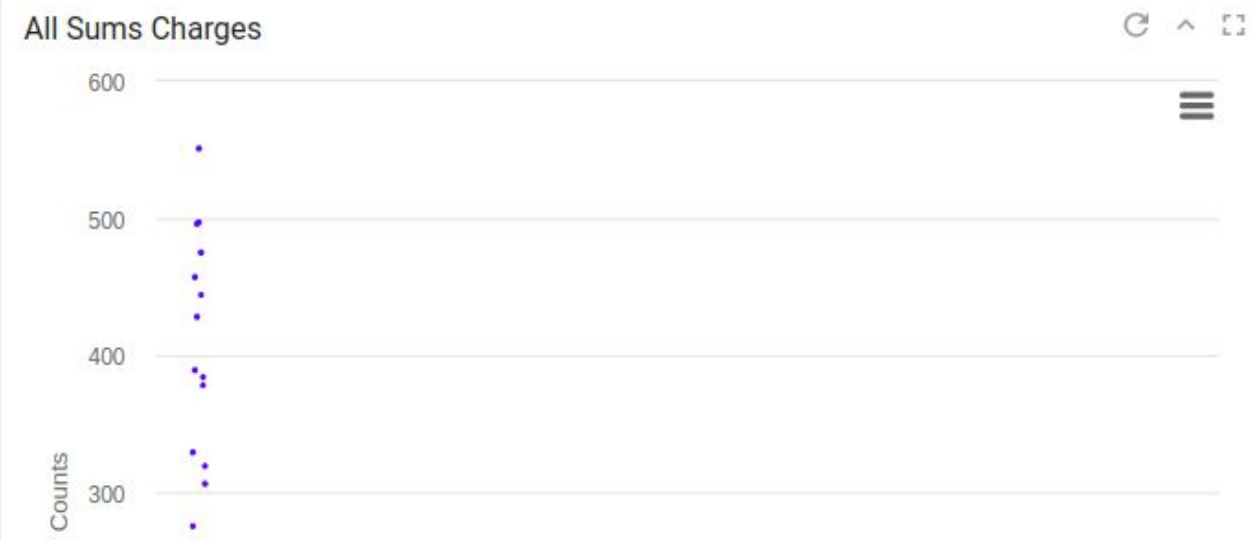
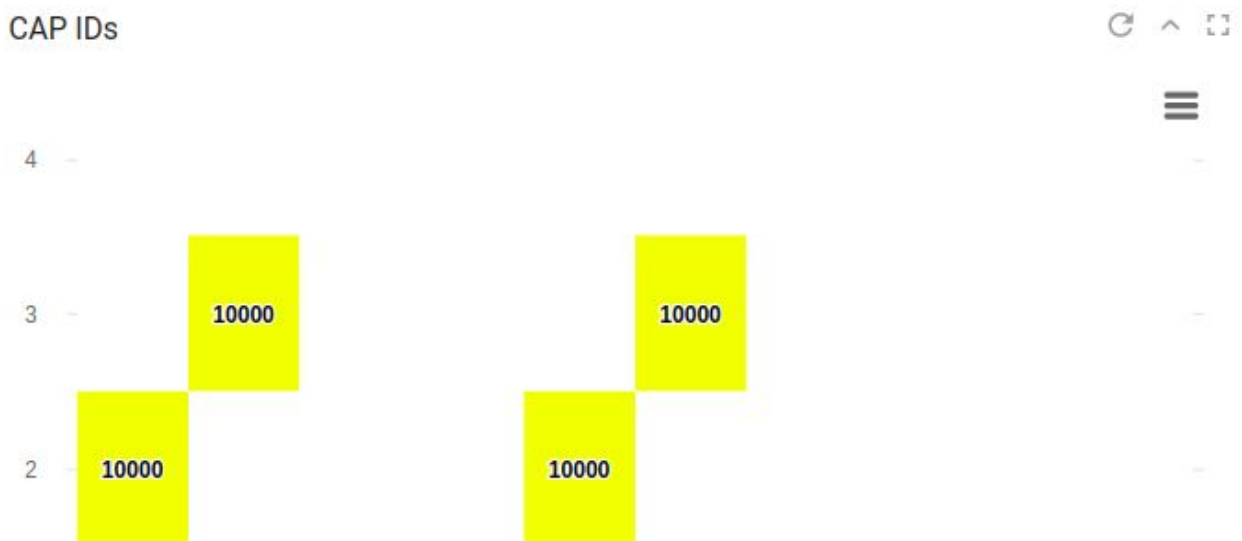
< 0 >

Fiber

< 12 >

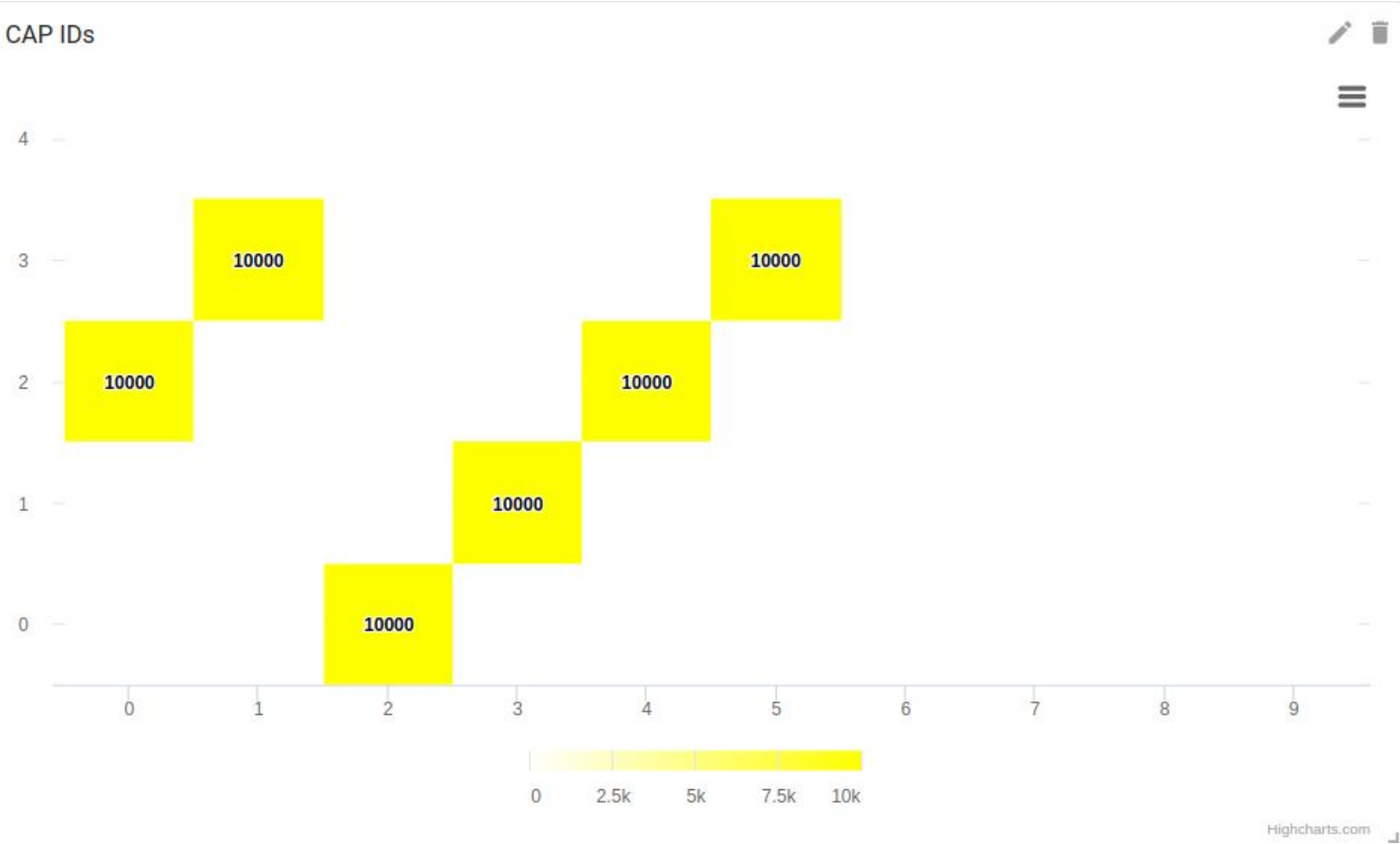
Controller shows selected parameters.

APPLY OK CLOSE RESET



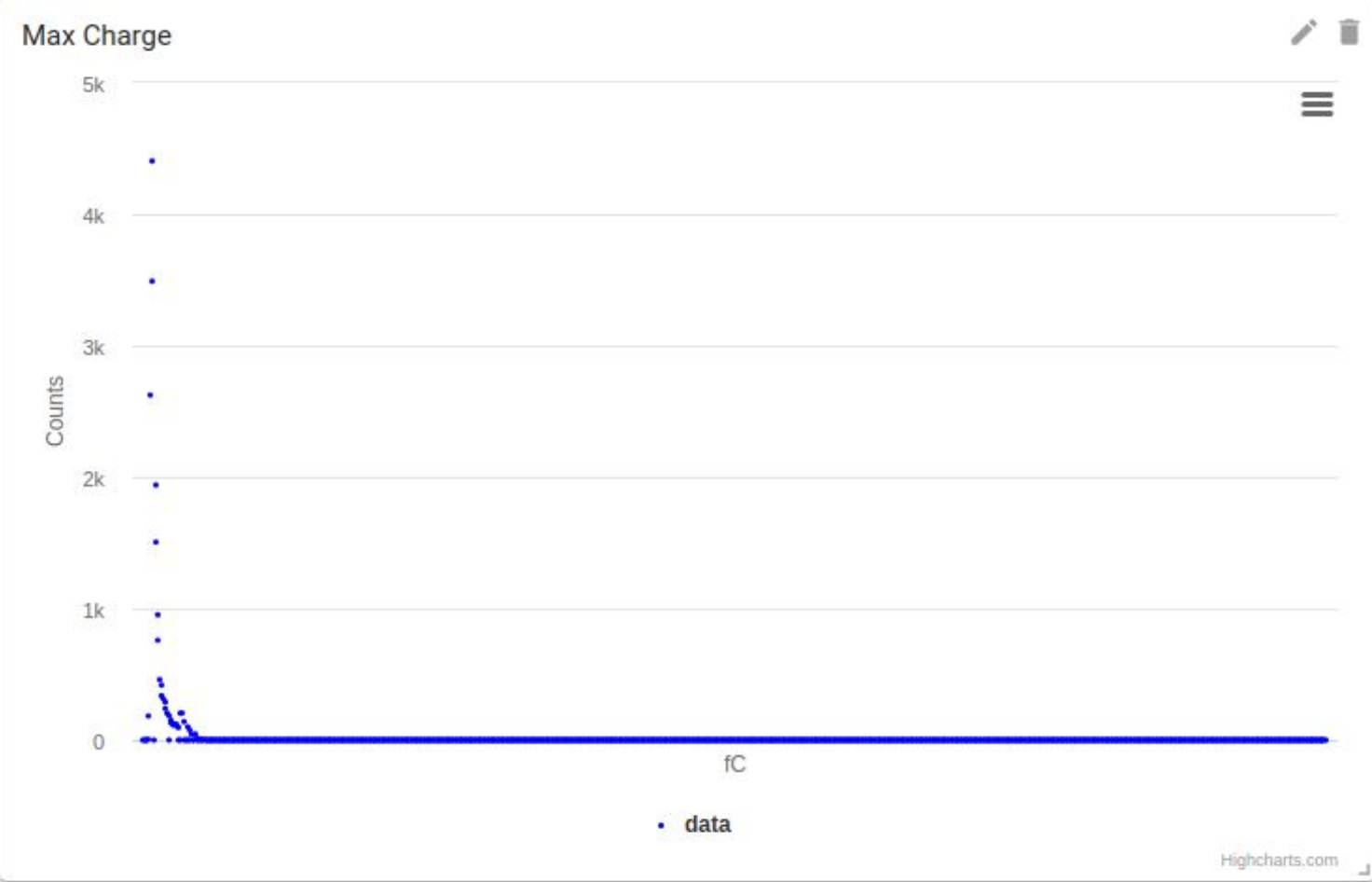
Use case: CAP Ids

- Reading the correct fiber every time data are received
- Indicating correct timing



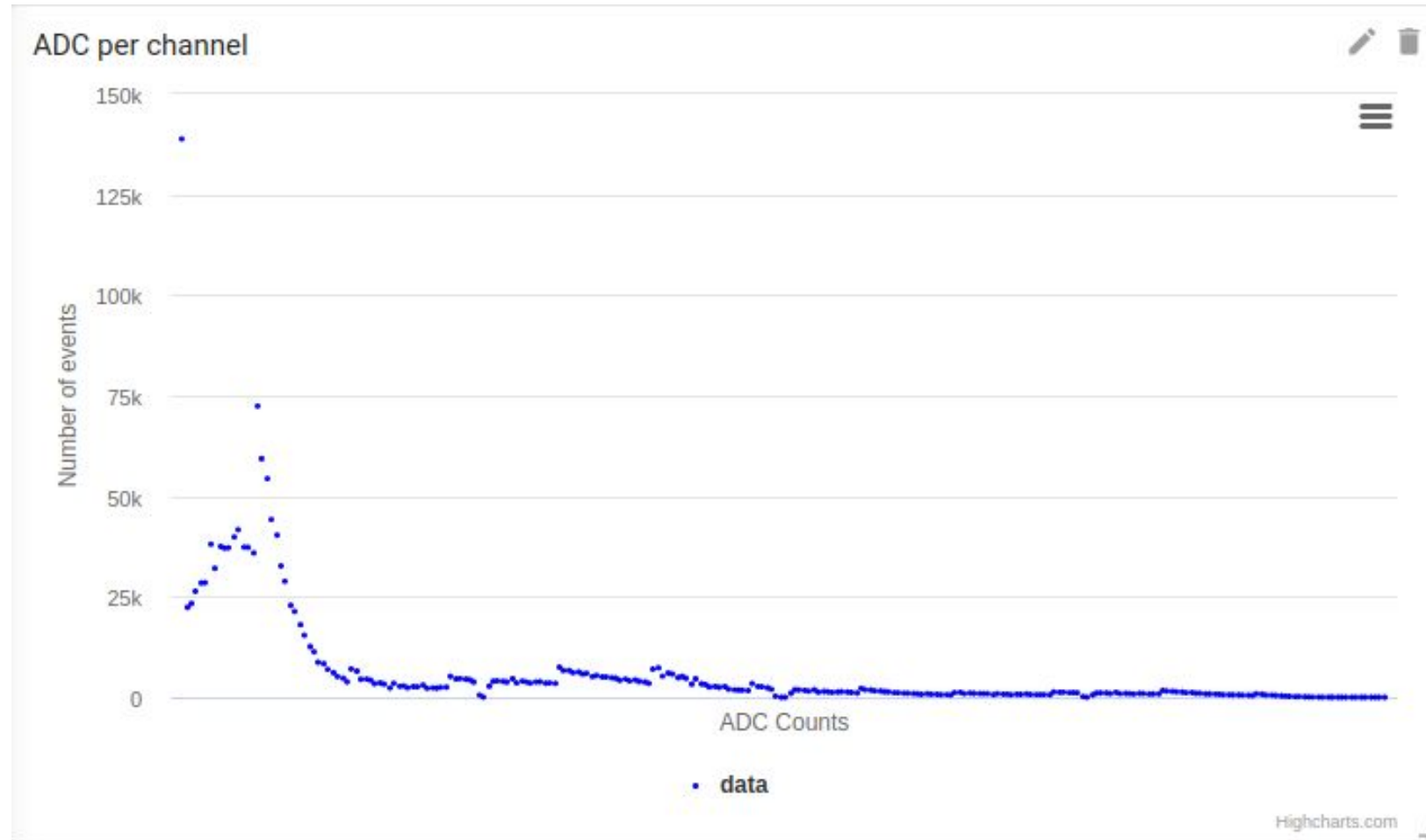
Use case: Max Charge

- The charge from the time slice of an event containing the maximum value



Use case: ADC per channel

- Number of ADC counts per channel



Conclusions

- **We created a proof of concept how ZDC can display data using CMS OMS**
- **Data displayed can be from different sources:**
 - 4 charts from development (local runs)
 - 1 chart from production (CMS runs)
- **Interface is user friendly and intuitive**

