Attività 2023
Richieste 2024

ALICE-HMPID (High Momentum Particle Identification) detector

G. De Cataldo and G. Volpe
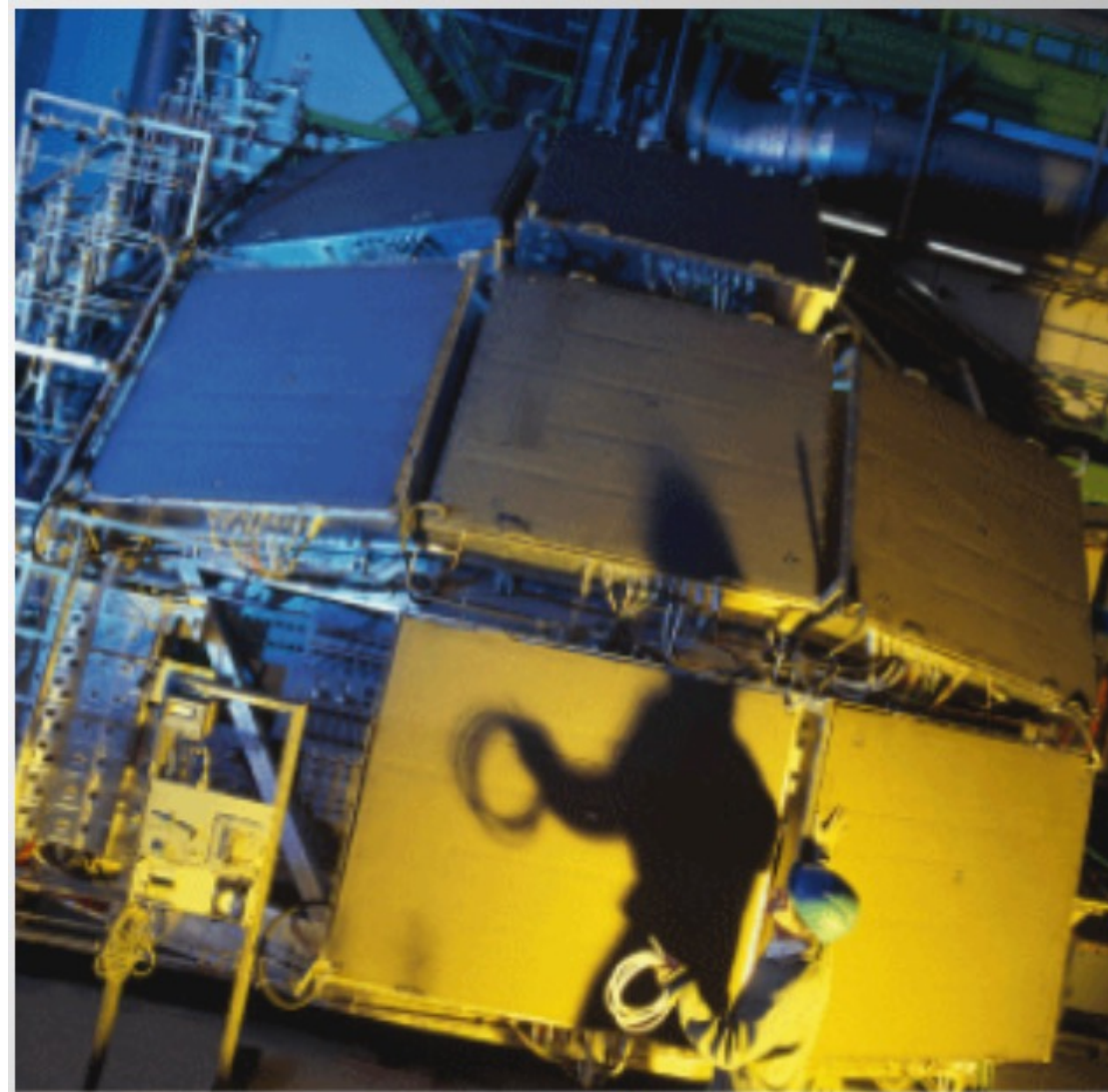
ALICE-HMPID

Contributing institutes:
- 80% University & INFN Bari (G. Volpe PL and G. De Cataldo deputy PL)
- 20% CERN team

Participating institutes with in-kind contributions:
- Centro de Aplicaciones Tecnológicas y Desarrollo Nuclear (CEADEN), Lavana, Cuba
- Wigner Inst. Budapest, Hungary.
- Dep. of Physics and CIT dept. of the University of Malta, Msida, Malta;

7 RICH (Ring Imaging CHerenkov) modules
- ~1.3 x1.3 m2 for a total CsI active area of ~11 m^2
- (@ 3σ) π/k **identification** in 1-3 GeV/c and protons in 1.5-5 Gev/c momentum intervals;
- |η|<0.5

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I would like to thanks Giacinto to have served the project as team leader in the last 12 years!!
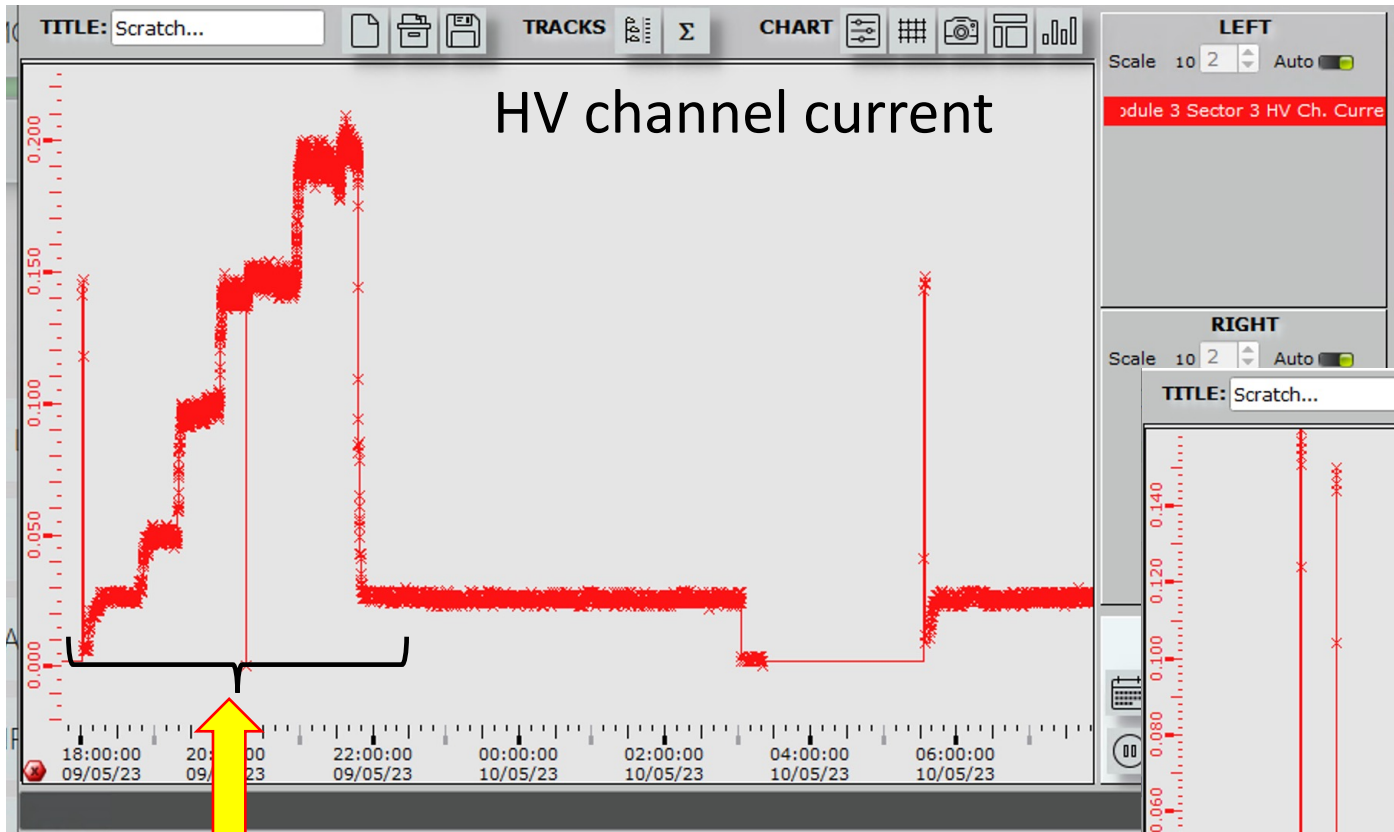
3

Detector status

- Since 21st of April CH4 in the chambers and HV to the nominal value

- Since 5th of May filled radiator (Faulty power supply in CR5 replaced)

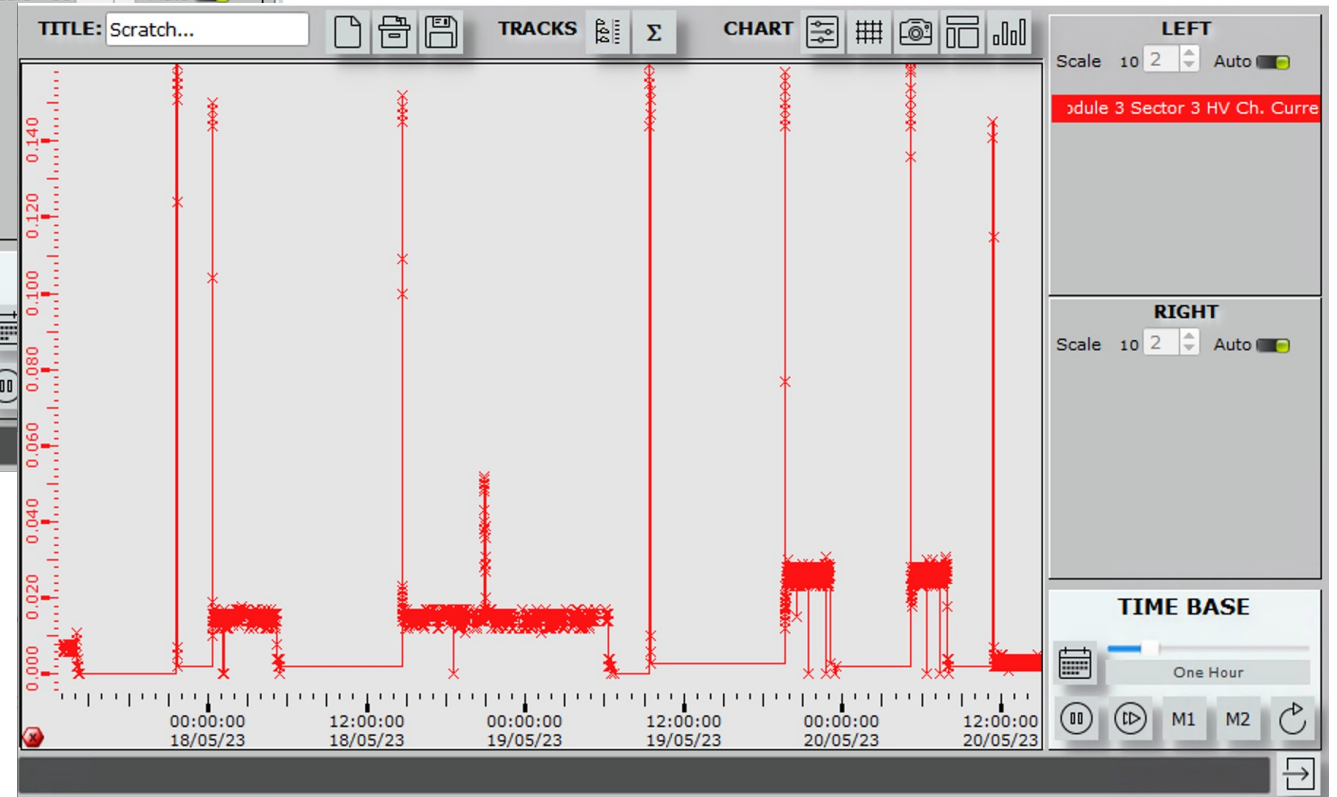- Since 8th of May time out set at 2ms → stably data taking in global physics run (RO rate ≅ 15 kHz)
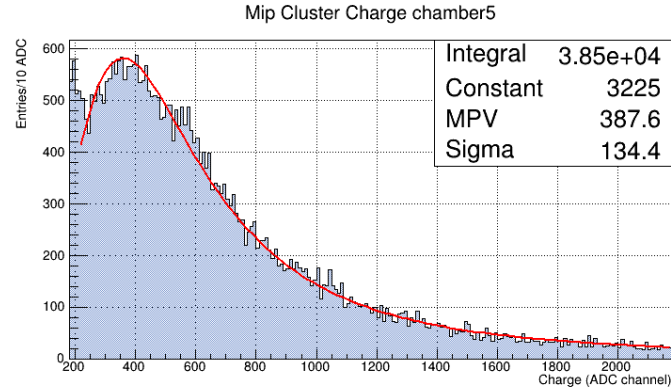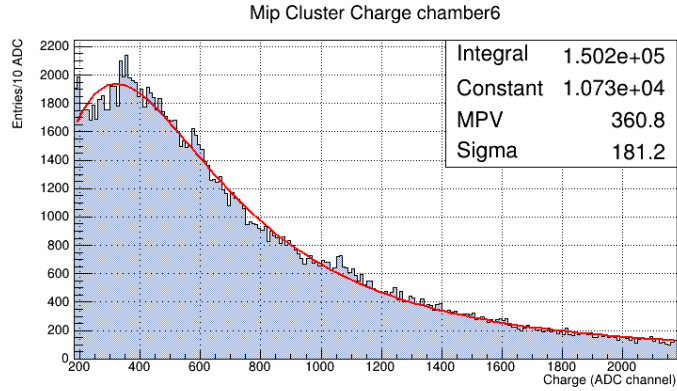
Detector status

HV channel current
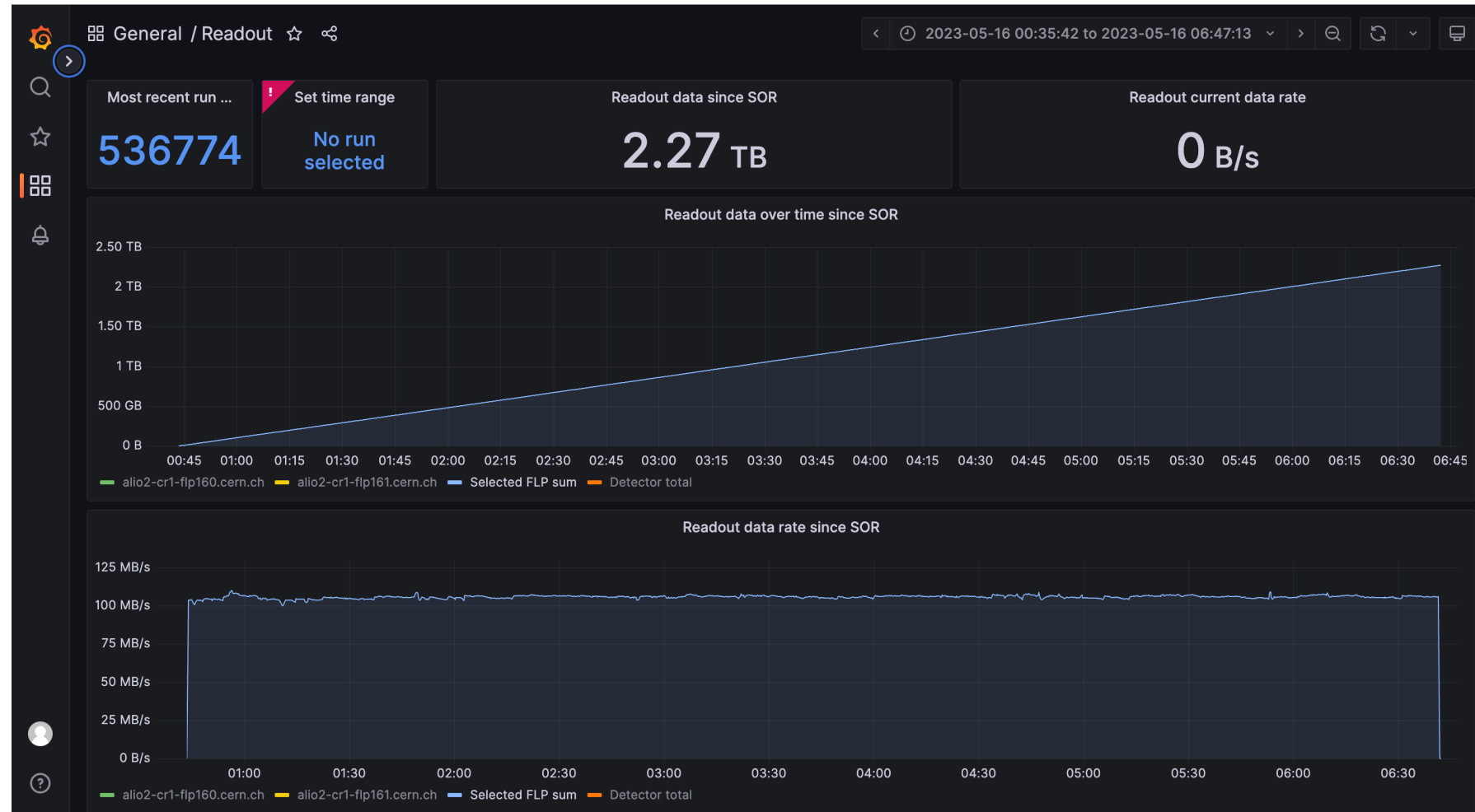
Rate scan

- Chambers quite stable

- Low HV channel trips frequency exprienced so far

Run 536548 (18th of May)
→ global physics run with other detectors
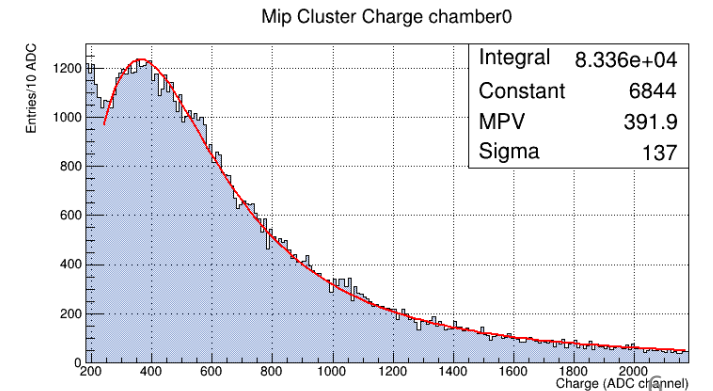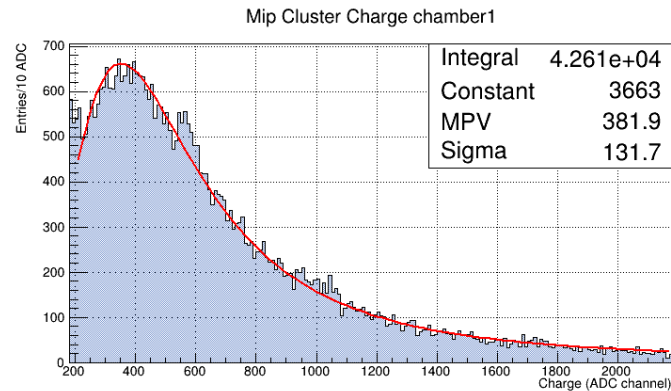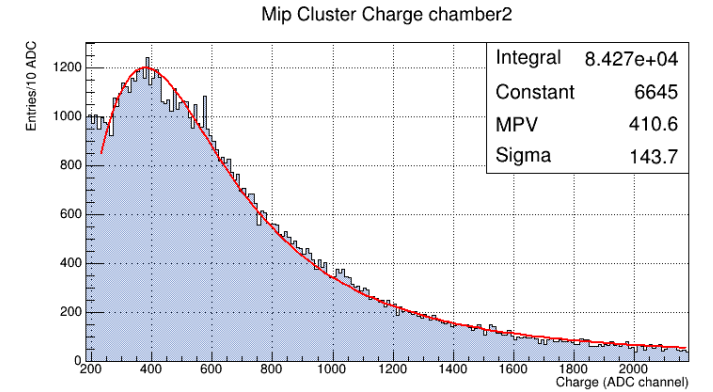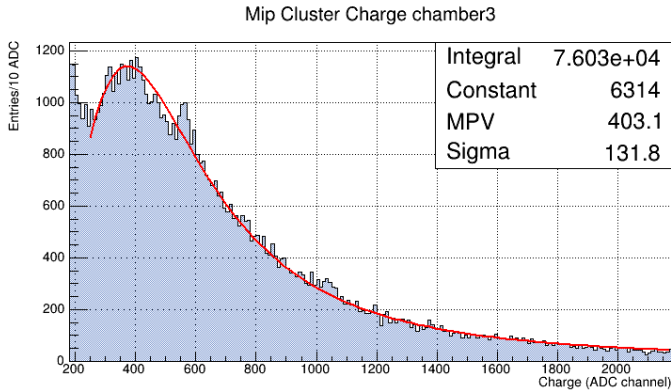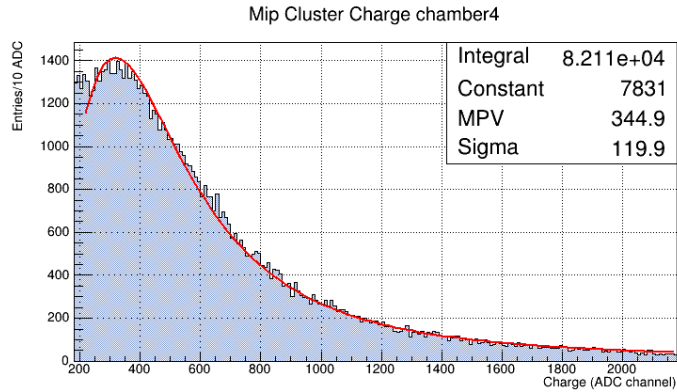
Operations

Calibration

- Pedestal calculation and uploading in FW are implemented in PEDESTAL RUN
  - PEDESTAL RUN is fully automatized. For the time being run by experts → ready to be run by shift crew

Firmware updates

- New firmware version allows:
  - setting the L0 delay
  - skipping RDH with orbit number equal to zero

Foreseen firmware improvement

- In presence of back pressure, the processing of the X-ON/XOFF in HMP RO firmware (the line used by FPL to flag the backpressure) needs to be improved.
- From time to time this causes a link to stuck in busy.
- We are discussing on the new features of the firmware to prevent this.

ALICE-HMPID in O^2

Simulation and reconstruction in O^2

- Detector geometry and hits creation implemented
- Creation of digits from hits implemented
- Creation of digits from raw data implemented
- Creation of raw data from digits implemented
- Cluster creation from digits
- Track matching and Cherenkov angle reconstruction implemented
- Fill AO2D with HMPID infomation implemented
- **Next: development of software tools for analysis of anti-deuteron absorbtion cross section and light nuclei momentum spectra**
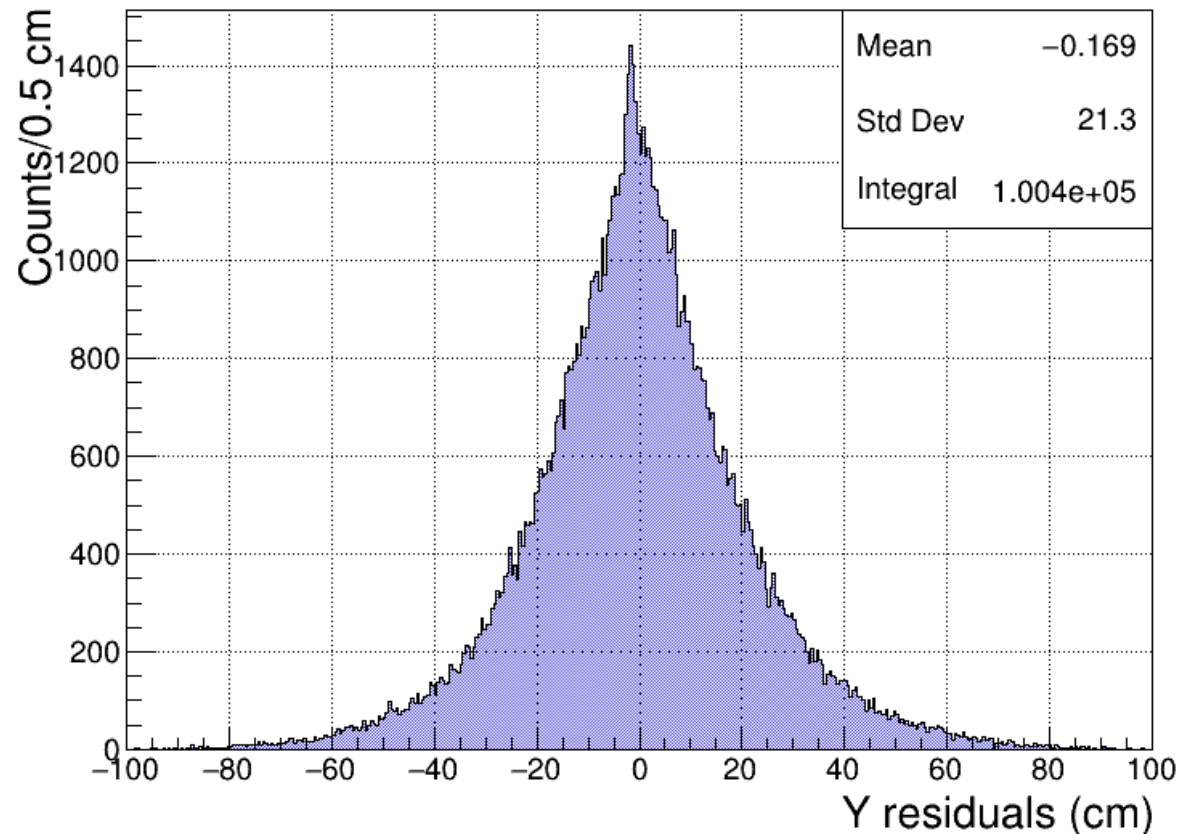
Calibration

- The calibration procedure for HMPID in RUN3 will be similar to that used in RUN1 and RUN2
  - Average and sigma of the pedestal need to be calculated in dedicated RUN (PEDESTAL RUN), loaded into the RO electronics and stored in the CCDB → code implemented
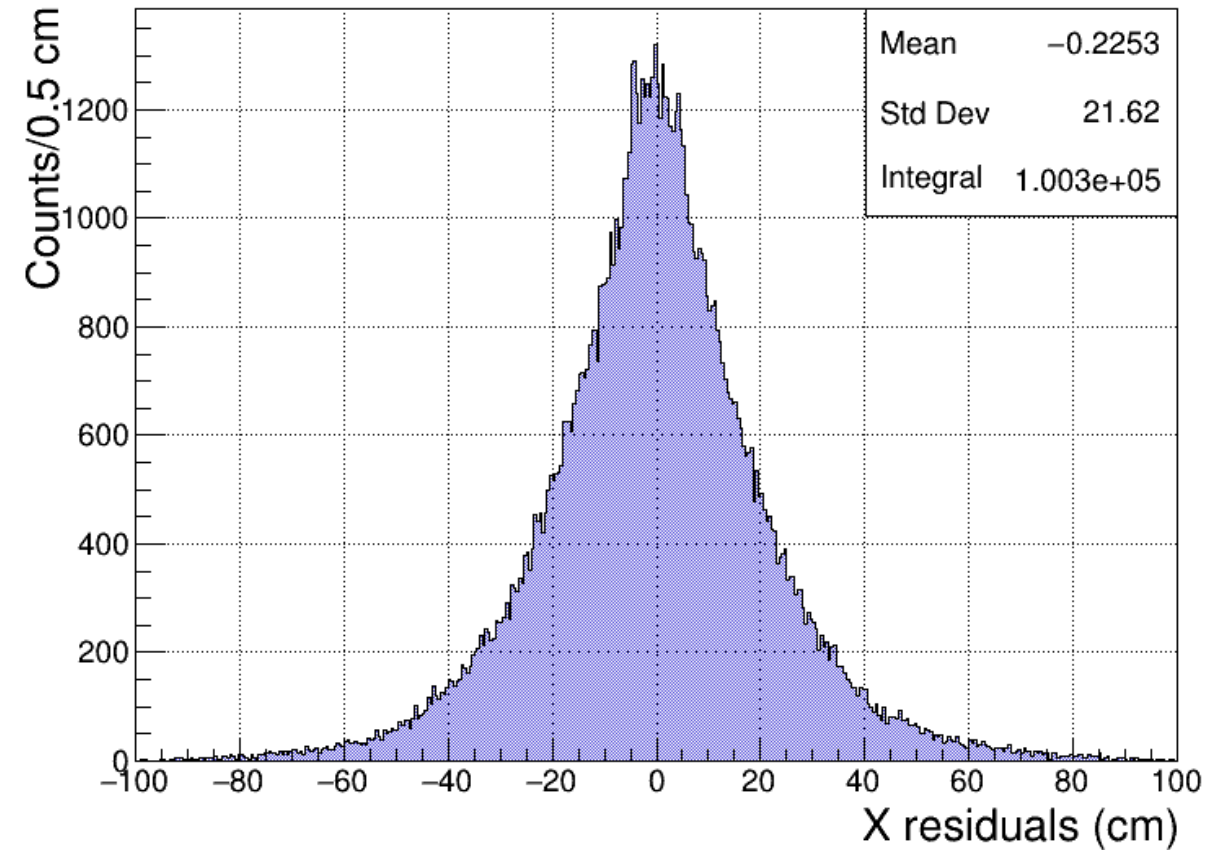   - Pedestal calculation and uploading in FW are implemented in PEDESTAL RUN

Some results from MC simulation

X Residuals

Mean $\quad$ −0.2253

Std Dev $\quad$ 21.62

Integral $\quad$ 1.003e+05

Y Residuals

Mean $\quad$ −0.169

Std Dev $\quad$ 21.3

Integral $\quad$ 1.004e+05

Some results from MC simulation

Photon cluster charge

Cherenkov angle
p = 4.5 GeV/c

10
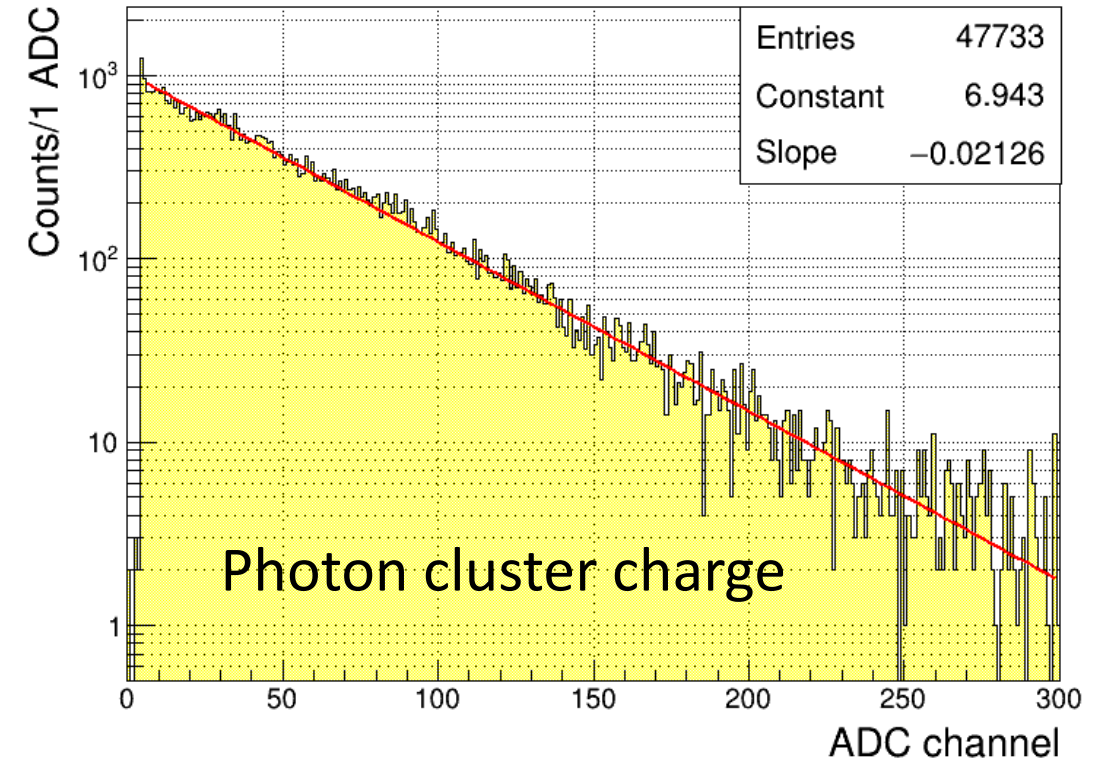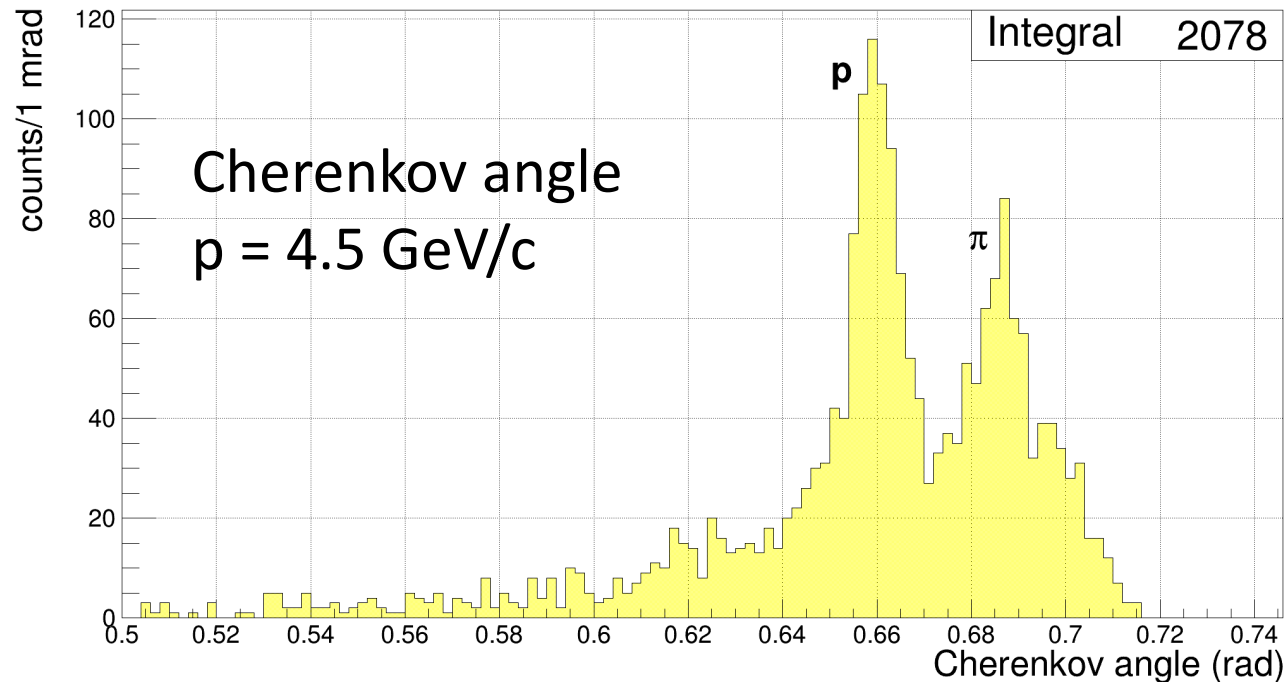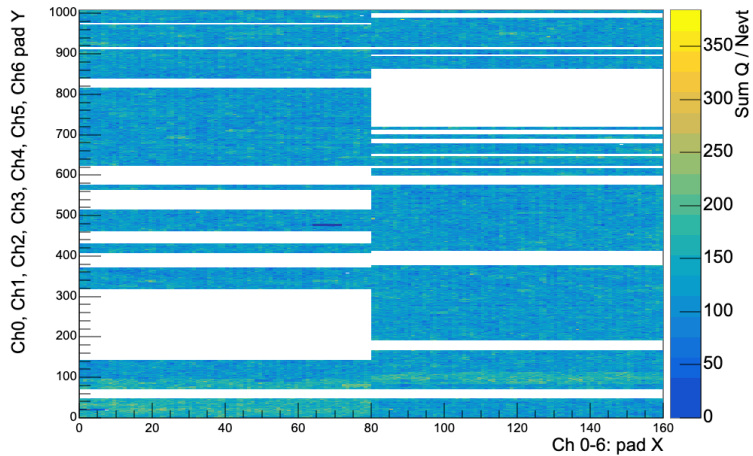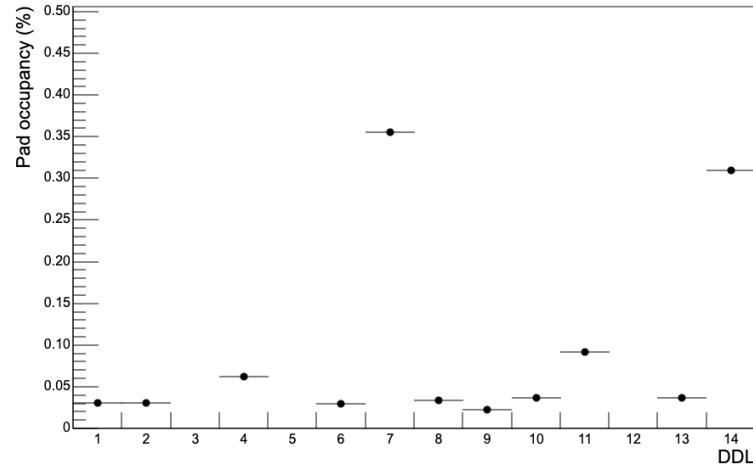
Quality control

- **HmpidTask.cxx** → raw data QC task:[**implemented and committed**]
  - Plots: Busy time, event size, pedestal (mean and sigma), charged pad maps
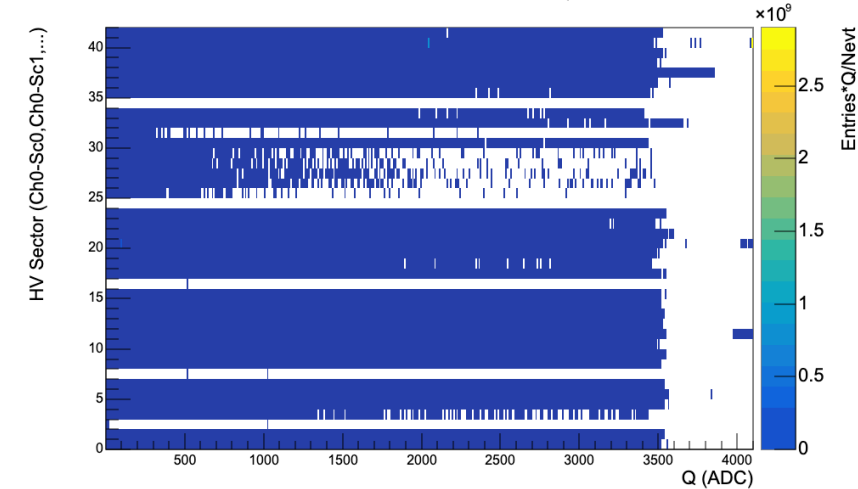 - New three plots added!

- **HmpidDigitTask.cxx** → digits QC task: [**implemented and committed**]
  - Plots: charged pad maps, occupancy

- **HmpidClusterTask.cxx** → clusters QC task: [**implemented and committed**]
  - Plots: charged pad maps, occupancy

- Next:
  - Implement quality checker
  - matching infos (Cherenkov angle, ecc…) QC

11

Budget request (M&OB) for 2024

The HMPID will be brought at the surface and dismounted during 2026;

As from 2023 till 2025, the maintenance and interventions will be reduced at the minimum;

The total on 2026 is an estimate for the detector removal and dismounting ;

The expected increase of A08 areas is just an estimate for the infrastructures in the dismounting area.

A	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Comments
Budget	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Comments
A01 Mechanics																Comment from A01 till A11.3 : the HMPID will be brought
A02 Gas Systems	25	15	10	15	15	15	15	5	5	10	10	5	5	5	0	
A03 Cooling Systems	4	4	4	4	4	4	4	2	2	4	4	1	1	1	0	
A04 FEE spares	6	1	1	1	1	1	1	1	1	0	0	0			0	
A05.1 Standard Electronics LV/HV PS	8.5	4	4	4	4	4	10	4	4	0	0	0			0	
A05.2 Standard Electronics Crates	2	1	1	1	1	1	1	1	1	0	0	0			0	
A05.3 Standard Electronics R/O modules																
A06 Controls (DCS & DSS)	3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0			0	
A07 Sub-Detector spares																
A08 Areas	50	35	30	25	25	25	25	20	15	10	10	5	5	5	10	
A09 Communications	8	8	8	8	8	8	8	8	8	8	5	5	5	5	0	
A10 Store Items	8	8	8	8	8	8	8	8	8	8	5	5	5	5	5	
A11.1 Technical Manpower @ CERN: Industrial Support	10	5	10	5	5	5	5	5	5	5	1	2	2	2	5	Comment from raw 1 to 15: the HMPID will be brought at t
A11.3 Technical Manpower @ CERN from Collaborating Institutes	20	10	15	10	10	10	10	10	10	5	15	2	2	2	5	
Total	144.5	92.5	92.5	82.5	82.5	82.5	88.5	65.5	60.5	50	50	25	25	25	25	
A11.2 Technical Manpower @ CERN from Collaborating Institutes (in man-months)																

Backup

Reconstruction: track matching and Cherenkov angle calculation
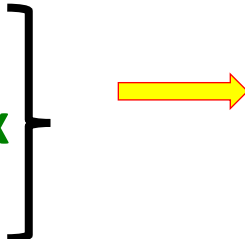
- **Detectors/GlobalTrakingWorkflow/helpers**
  - **InputHelper.cxx/.h** → added HMPID cluster reader

Modified
Fully implemented

- **DataFormats/Detectors/GlobalTracking**
  - **RecoContainer.cxx/.h**

⟶ Relevant HMPID information (clusters and matching info) added.

- **Detectors/GlobalTracking**
  - **MatchHMP.cxx/.h** → track matching

- **Detectors/GlobalTrackingWorflow**
  - **HMPMatcherSpec.cxx/.h**
  - **hmpid-matcher-workflow.cxx**

⟶ workflow for track matching and Cherenkov angle calculation

- **DataFormats/Reconstruction**
  - **TrackHMP.cxx/.h** → custom track propagation algorithms
  - **MatchInfoHMP.cxx/.h** → HMPID matching info

Reconstruction: track matching and Cherenkov angle calculation

- **Detectors/HMPID/reconstruction**
  - **Recon.cxx/.h** → Cherenkov angle calculation algorithm

- **Detectors/HMPID/workflow**
  - **HMPMatchedWriterSpec.cxx/.h** → matching info writer
  - **HMPMatchedReaderSpec.cxx/.h** → matching info reader

HMPID Reconstruction: clusterization

- **Detectors/HMPID/workflow**
  - **DigitsToClustersSpec.cxx/.h**
  - **Digits-to-clusters-workflow.cxx**

  → Get the workflow running (DPL); digits reading for cluster creations [**implemented**]

- **DataFormat/Detectors/HMPID**
  - **Cluster.cxx/.h** → cluster implementation: [**implemented**]

- **Detectors/HMPID/reconstruction**
  - **Clusterer.cxx/.h** → HMPID clusterization algorithm: [**implemented**]
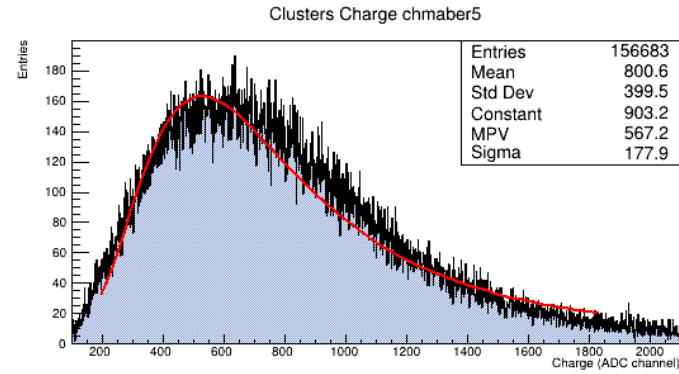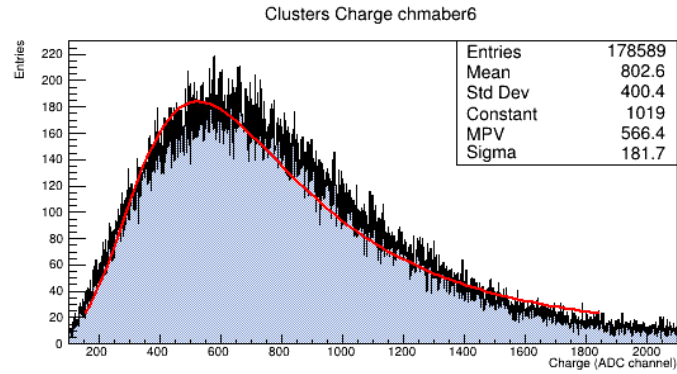
Digits map

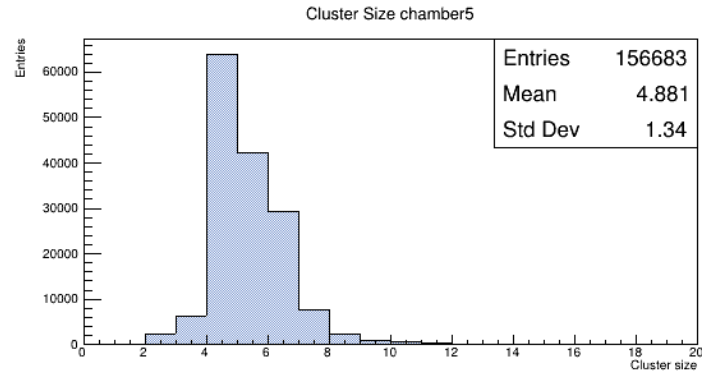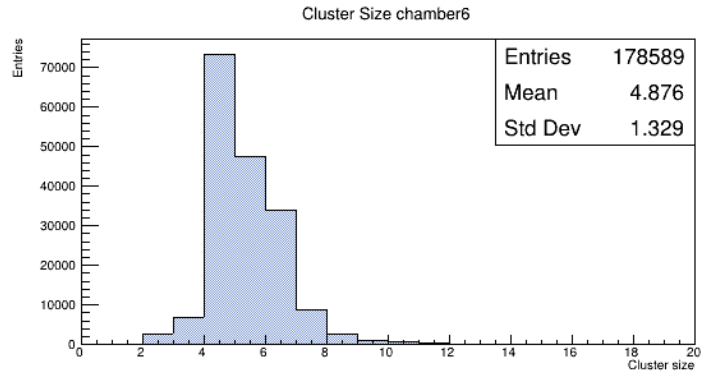
MC SIMULATION
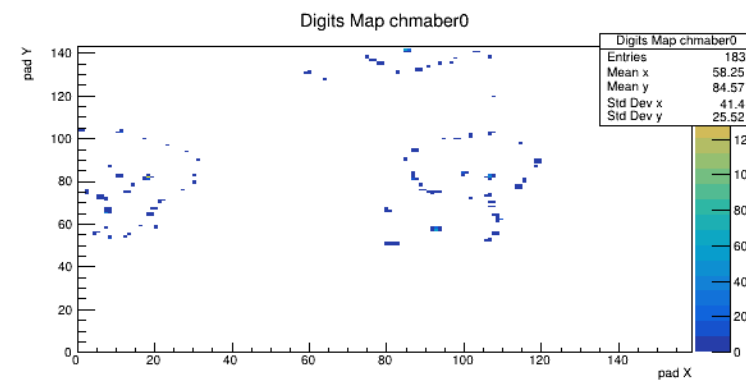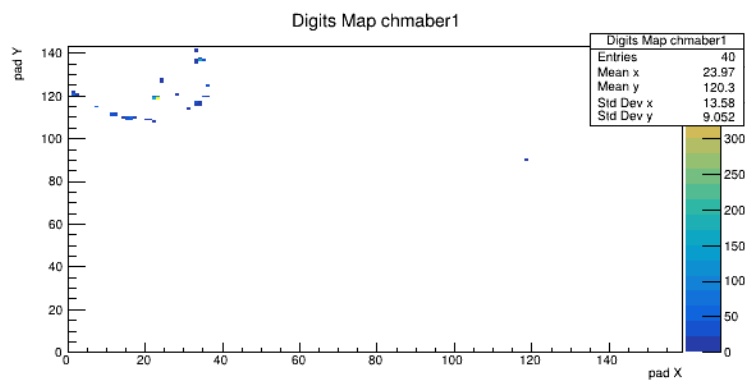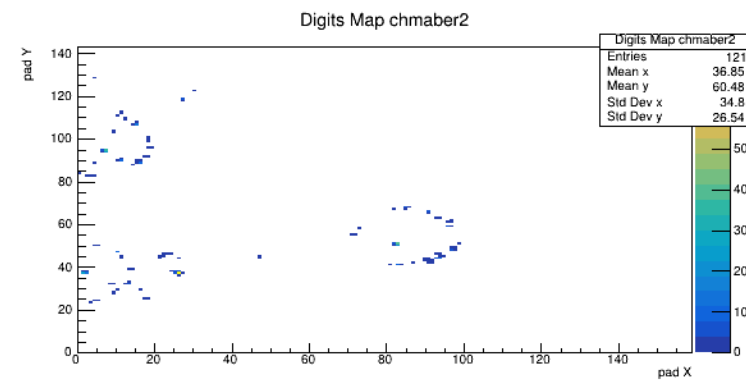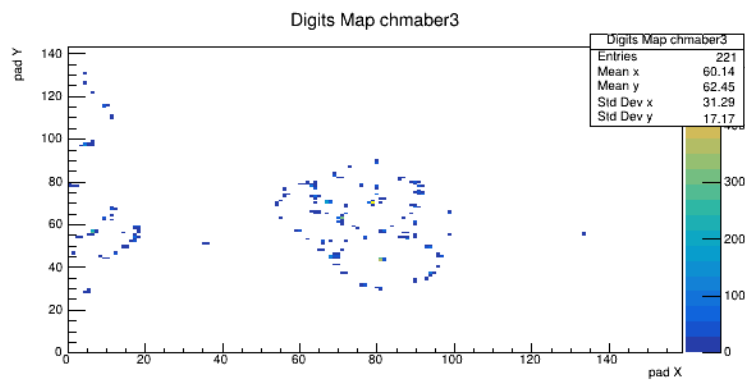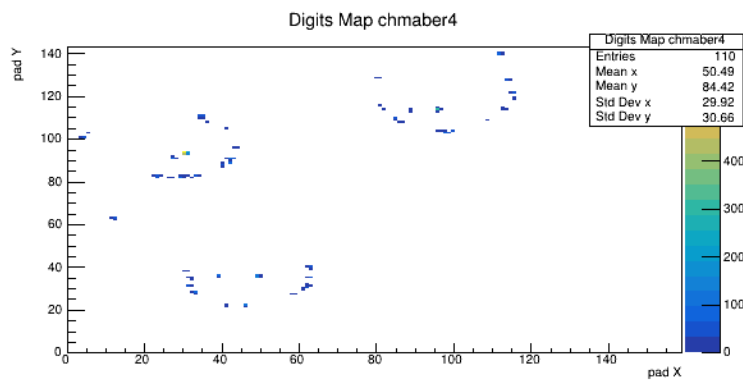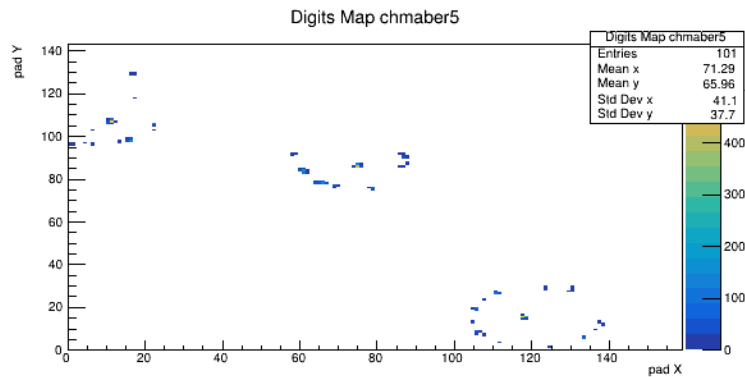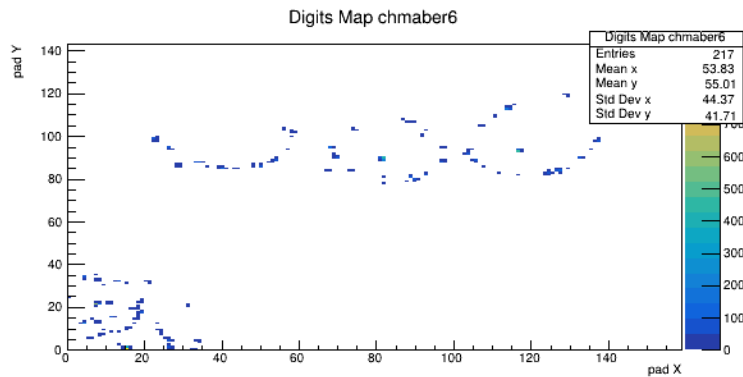
Clusters map
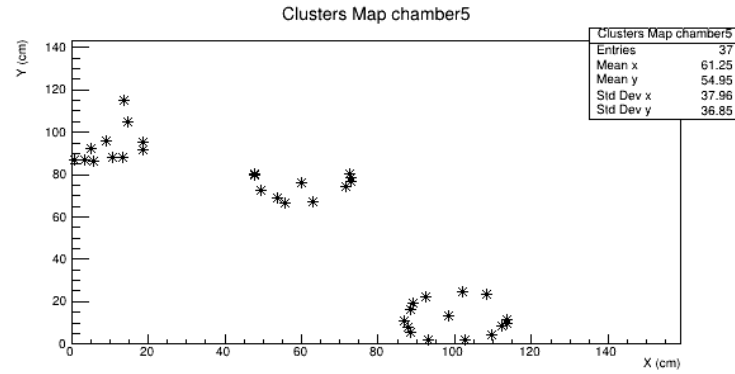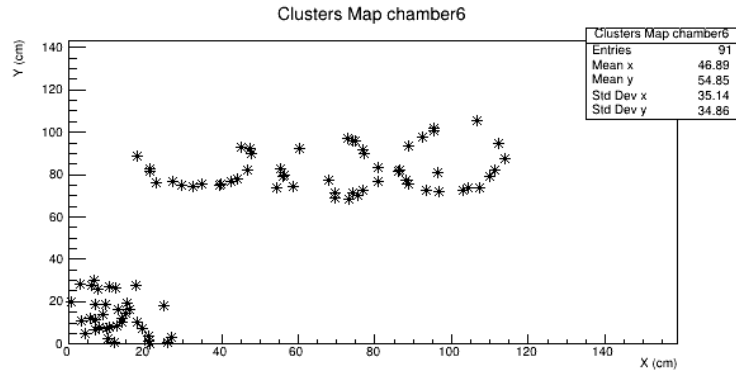
MC SIMULATION
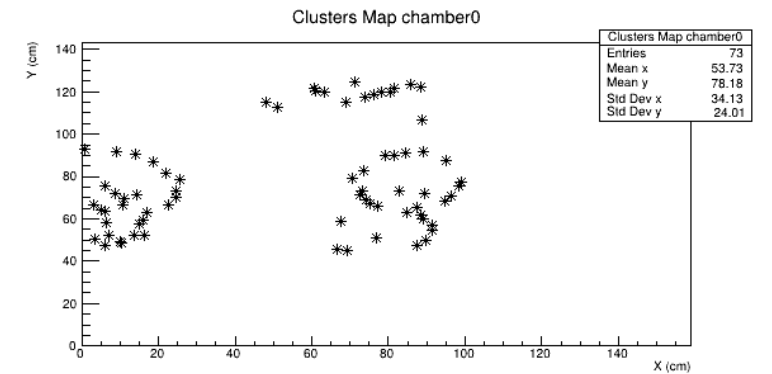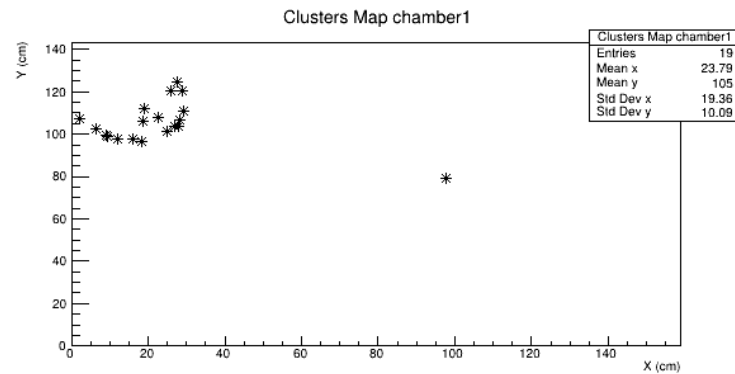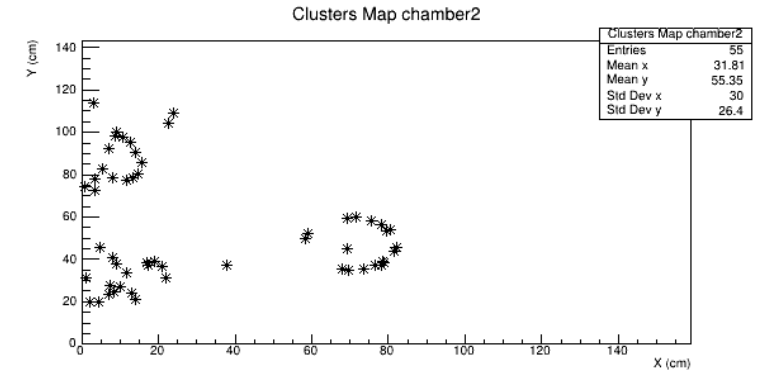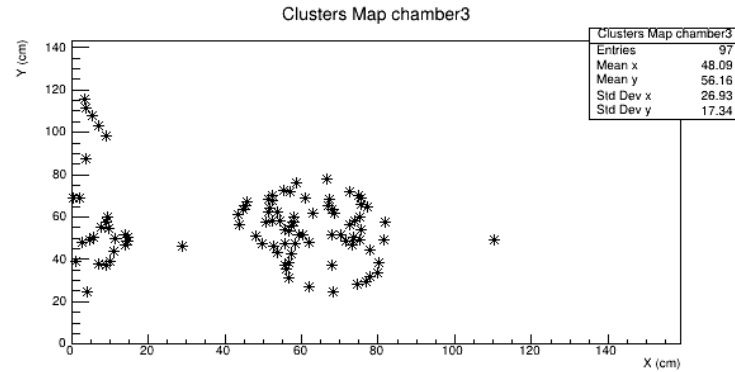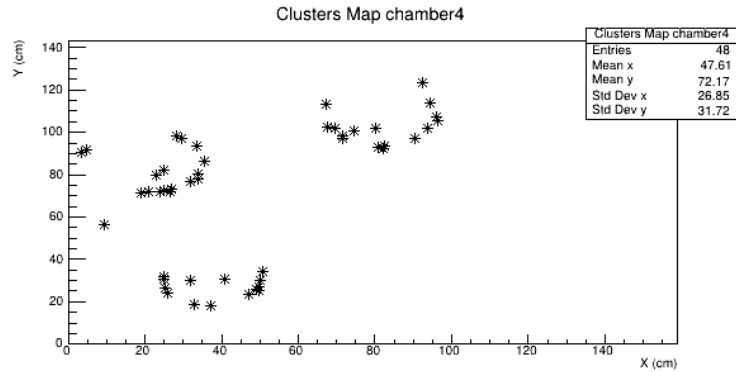
Cluster charge

MC SIMULATION
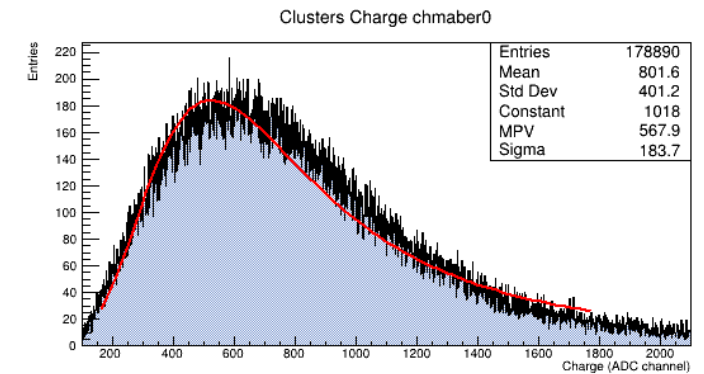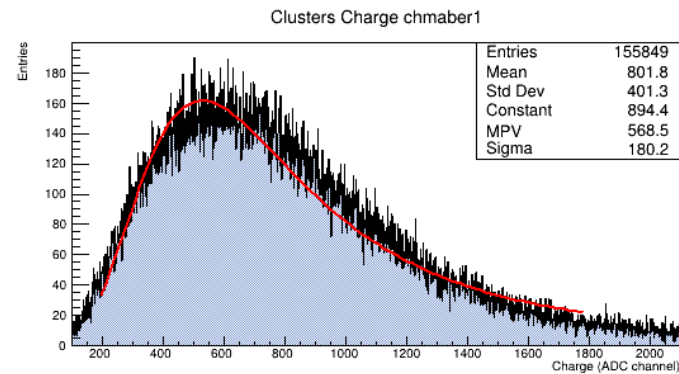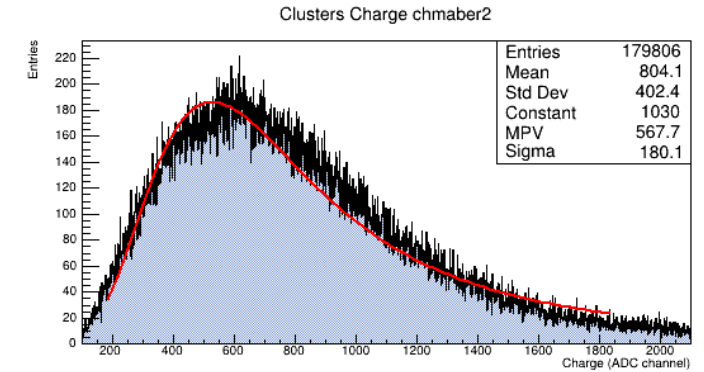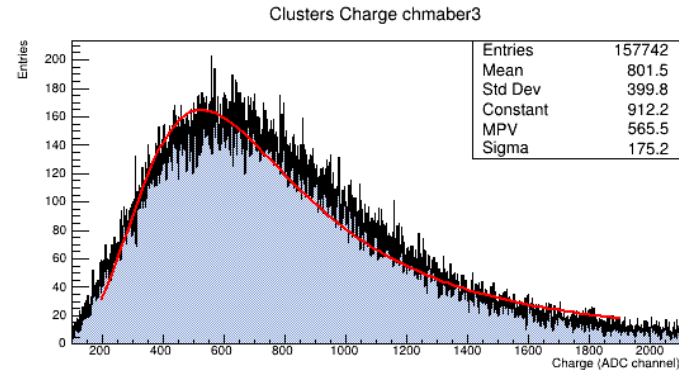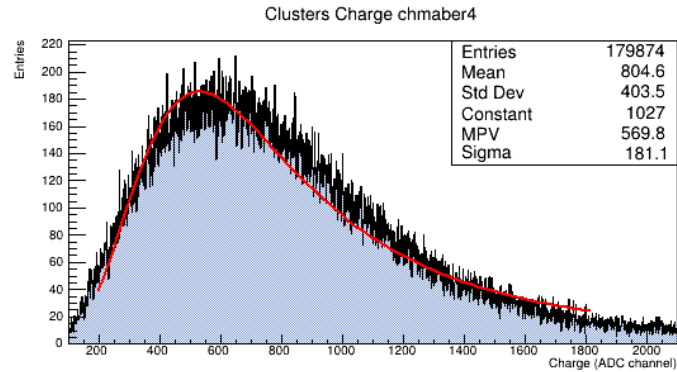
Cluster size

MC SIMULATION