

Update on cosmic QA/QC analysis

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Offline monitoring

From Sept CGEM-IT WS JATA FLOW Offline Monitoring and Data Quality Check by A. Bortone @ CGEM WS 2020 June, 23 **GEMROCs** PC DAQ GUFI Reference plot Every subrun GUF TER production (10 min) Online Monitor Published on Grafana Data stream Every 1\2 --> GRAAL info on days Every RUN Grafana Clusters information Ferrara's server CGEMBOSS TER GRAAL Data cut To data analysis (incoming) Check on decode performances Check on cluster stats Check on subrun ending CARMEN Run validation SANDIEGO TER analysis

Procedure to monitor the **cosmic ray data** taking in every step

- TER and GRAAL are already in the monitoring system
- CgemBoss was incoming, now the package has been implemented
- It will be inserted in the monitoring system as soon as it is validated



Validation with run 17



	STANDALONE		CgemBoss	
L1 bottom	n fitted 1	123607	n fitted 2	153160
L1 top	n fitted 1	124799	n fitted 2	151818
L2 bottom	n fitted 1	65932	n fitted 2	150586
L2 top	n fitted 1	69937	n fitted 2	153433

STANDALONE

Selection (on trackers):

- Three trackers fired
- Total cluster charge



- No cut on cluster size
- L1 2D-clusters shall not share the same v cluster

n fitted $1 \rightarrow$ the track is fitted (no limit on chi2)

CgemBoss

Selection (on trackers):

- Three trackers fired
- No cut on charge
- No cut on cluster size
- Loop all + max Q

n fitted 2 \rightarrow the track is fitted, with chi2 < 2000

The **Loop all + max Q** method loops on all combinations of highest charged clusters to find the usable ones

Cluster energy cut?

• Cuts used in my old standalone were:

 $\begin{array}{c|c} L1, x \text{ view, } Q_{\text{cLUSTER}} > 20 \text{ fC} \\ L2, x \text{ view, } Q_{\text{cLUSTER}} > 15 \text{ fC} \end{array} \begin{array}{c} L1, v \text{ view, } Q_{\text{cLUSTER}} > 10 \text{ fC} \\ L2, v \text{ view, } Q_{\text{cLUSTER}} > 10 \text{ fC} \end{array}$

L1 TOP

L2 BOT

L2 TOP



Validation with run 17



	STANDALONE		CgemBoss	
L1 bottom	n fitted 1	123607	n fitted 2	83247
L1 top	n fitted 1	124799	n fitted 2	83266
L2 bottom	n fitted 1	65932	n fitted 2	76955
L2 top	n fitted 1	69937	n fitted 2	82770

CgemBoss

- Throw away the clusters with cluster energy < CUT
- Use same cuts as standalone

L1, x view, Q _{CLUSTER} > 20 fC
L2, x view, Q _{CLUSTER} > 15 fC

L1, v view, $Q_{CLUSTER} > 10 \text{ fC}$ L2, v view, $Q_{CLUSTER} > 10 \text{ fC}$

Note! The cut must be applied before tracking, ...not, as done here, after it!!

New QA in CgemBoss

Two packages:

- **TestTrack**: all the hit/ + cluster 1D + cluster 2D + fitted track are saved to a TTree (root file)
- CgemCosmicRavOA reads the TTree and fills all the histograms

/[BESIII]/CgemBossCvs/Reconstruction/CgemLineFit/src/CgemCosmicRayQA.cxx

HIT – for each plane, each sheet, each view hit charge (fC), hit time (ns), hit charge (fC) vs stripID, hit time (ns) vs stripID, hit charge (fC) vs time (ns), hit charge (fC) vs length (mm)

> CLUSTER 1D – for each plane, each sheet, each view number of cluster1d, cluster1d size, cluster1d charge (fC) vs phi (deg)

> > HISTOS

CLUSTER 2D – for each plane, each sheet

number of cluster2d cluster2d charge (fC) vs phi (deg) cluster2d charge (fC) vs z (mm)

SIGNAL

total charge of the signal (fC) charge x of the signal (fC) charge v of the signal (fC) cl.size x of the signal cl.size v of the signal

TRACK and RESIDUALS

number of fitted tracks fitted track chi2 fitted track point of closest approach x (mm) test plane: residual in R * phi (mm) test plane: residual in z (mm) residual in R * phi (mm) on each plane/sheet residual in z (mm) on each plane/sheet

BACKGROUND

total charge of the background (fC) charge x of the background (fC) charge v of the background (fC) cl.size x of the background cl.size v of the background

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They have been compared to the standalone and are comparable









Test each layer

- Alignment on
- LoopAll + MaxCharge algorithm
- Test all the layers, one by one



Residuals

test plane: residual in z (mm)

3500

3000

2500

2000

1500

1000

500

-3

-2

 $^{-1}$ 0 1

2

3

4

z [mm]

LAYER 1, BOTTOM



LAYER 1, TOP





z (mm)				
Entries	47713	standalone	R*phi	Z
Mean	0.1609		•	
Std Dev	0.9308	mean	0.01388	0.004913
Constant	3106			
Mean	0.1795	sigma	0.3617	0.6144
Sigma	0.5196			

Chi2 < 20•

Residual R ϕ : •

- alignment not perfect since it does not separate top and bottom \rightarrow work in progress
- Sigma a little worse \rightarrow cluster selection is different

Residual z: •

- alignment not perfect
- sigma is better

Residuals

test plane: residual in z (mm)

2500

2000

1500

1000

500

Entries

Mean

Mean

Sigma

Std Dev

Constant

45605

1.186

2236

-0.1412

0.6712

-0.07261

LAYER 2, BOTTOM



LAYER 2, TOP





-2

-3

-1 0

1

2

3

4

z [mm]

standalone	R*phi	z
mean	-0.04101	0.0141
sigma	0.4534	0.8019

• Chi2 < 20

• Residual Rø:

- Sigma a little worse → cluster selection is different
- Residual z:
- alignment not perfect
- sigma is better

Efficiency

Efficiency = <u># events w/ both residuals within 5 sigmas</u> # eligible events

- LoopAll + MaxQ
- with/without charge cuts
- chi2 < 20

- LoopAll
- Test LAYER1 BOTTOM
- chi2 scanned in the values
- [1,2,3,5,10,20,50,100]

There is not a real and relevant difference



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Conclusions

The QA procedure in CgemBoss is ready - uploaded to CgemLineFit-00-00-17

- Alignment in CgemBoss is not finished, but usable ongoing the possibility to move L2 top *w.r.t.* L2 bottom
- Cluster selection (and fit):
 - LoopAll + MaxQ
 - LoopAll
- Fit with 3 out of 4 planes or 4 planes
- **To do**:
 - insert cut on energy @ cluster selection step
 - insert cut on cluster size @ cluster selection step
 - Investigate chi2 cut also with LoopAll + MaxQ
 - Update the QA histo list with other important information (e.g. μTPC related histo)

We can apply this in the QA procedure for data taking

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