



Charles University  
Prague



# PXD, SVD, VXD and Tracks DQM In On-line ExpressReco status in basf2

Peter Kodyš, Björn, Giulia, Thomas, Tadeas, Jakub,...  
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29<sup>th</sup> B2GM, Tracking meeting, February 3, 2018, KEK

Source is 300 BBbar events of standard Phase2 simulation.

All plots are independent of geometry, work for Phase 2 and Phase3 also.

There is discussion with Tadeas and Jakub to add 1-4 plots for alignments.

Under progress.

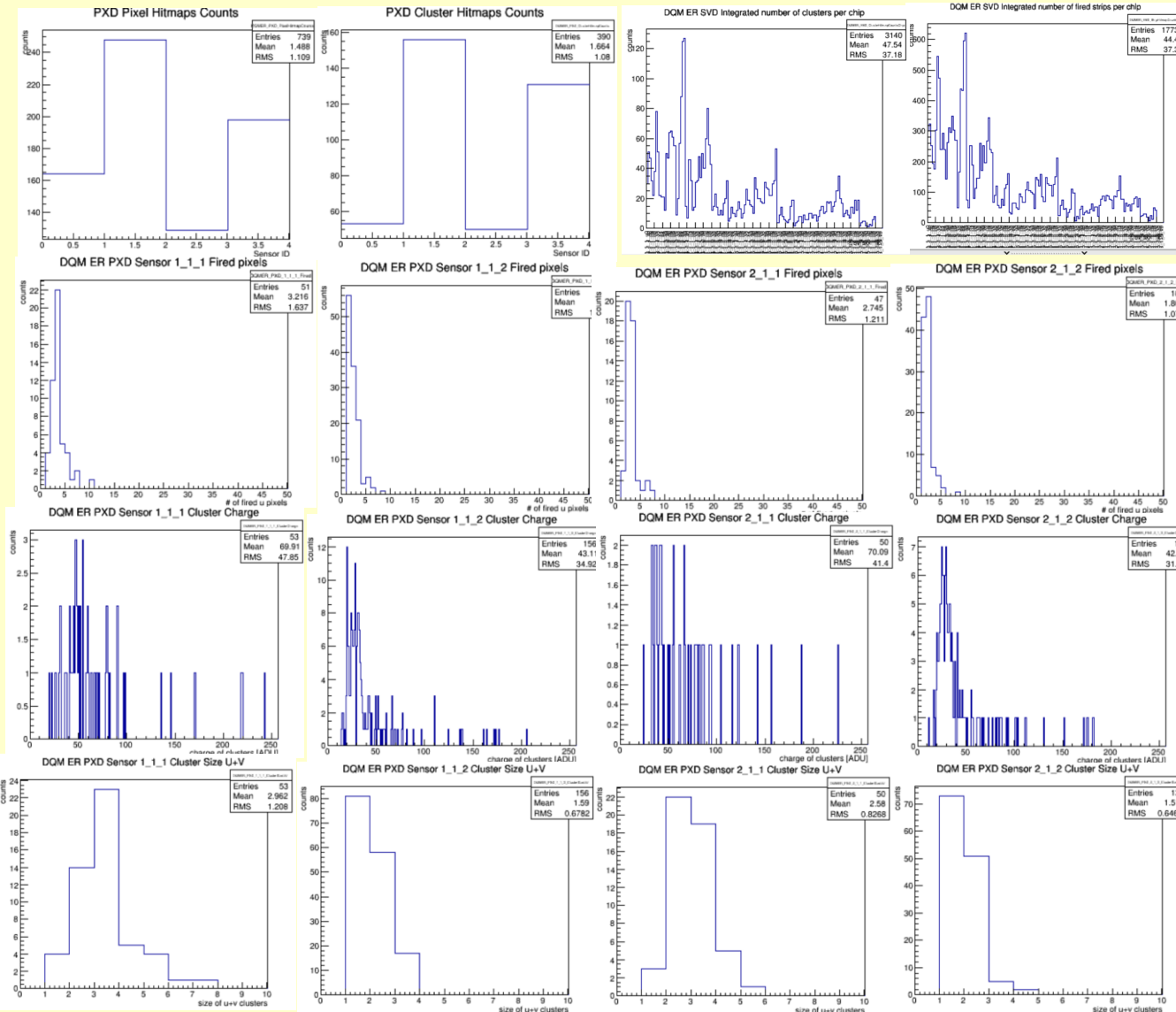
More information about technical realization: Björn Spruck talk on B2GM:

- DQM session: “**Title not specify yet**”, Wed. 7 Feb 2018, 11:00 - 12:50, 3-325, 3-go-kan
- PXD session: “**Status of SC, RC, DQM**”, Tue. 6 Feb 2018, 6:30 - 16:00, 3-go-kan - Meeting Room

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### PXD Obligatory



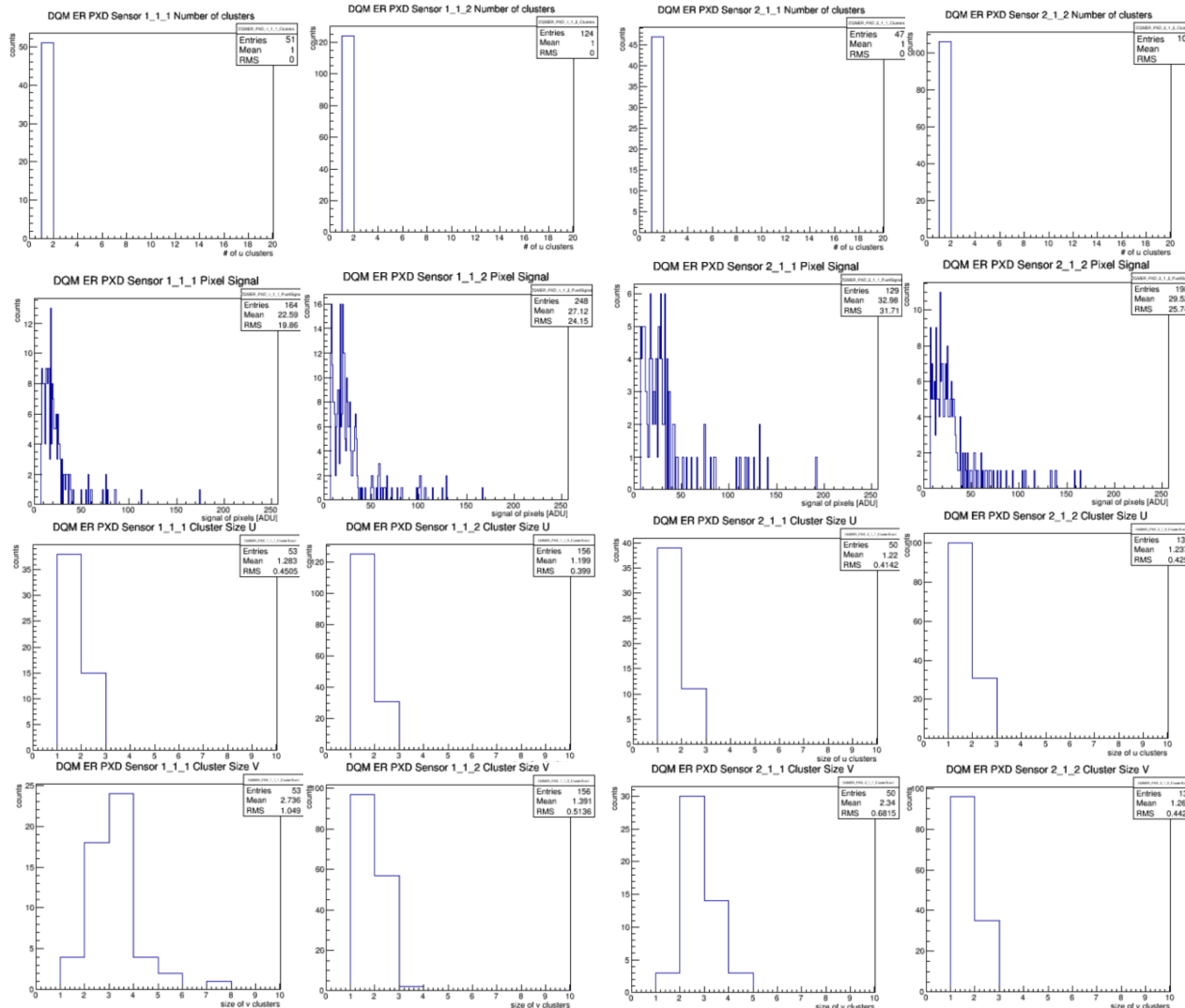
Belle II: 36 more plots, higher granularity

- Pixel and cluster occupancy @ sensor
- Pixel and cluster occupancy @ chip
- Fired pixels per frame @ sensor
- Cluster charge @ sensor
- Cluster size @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### PXD Optional



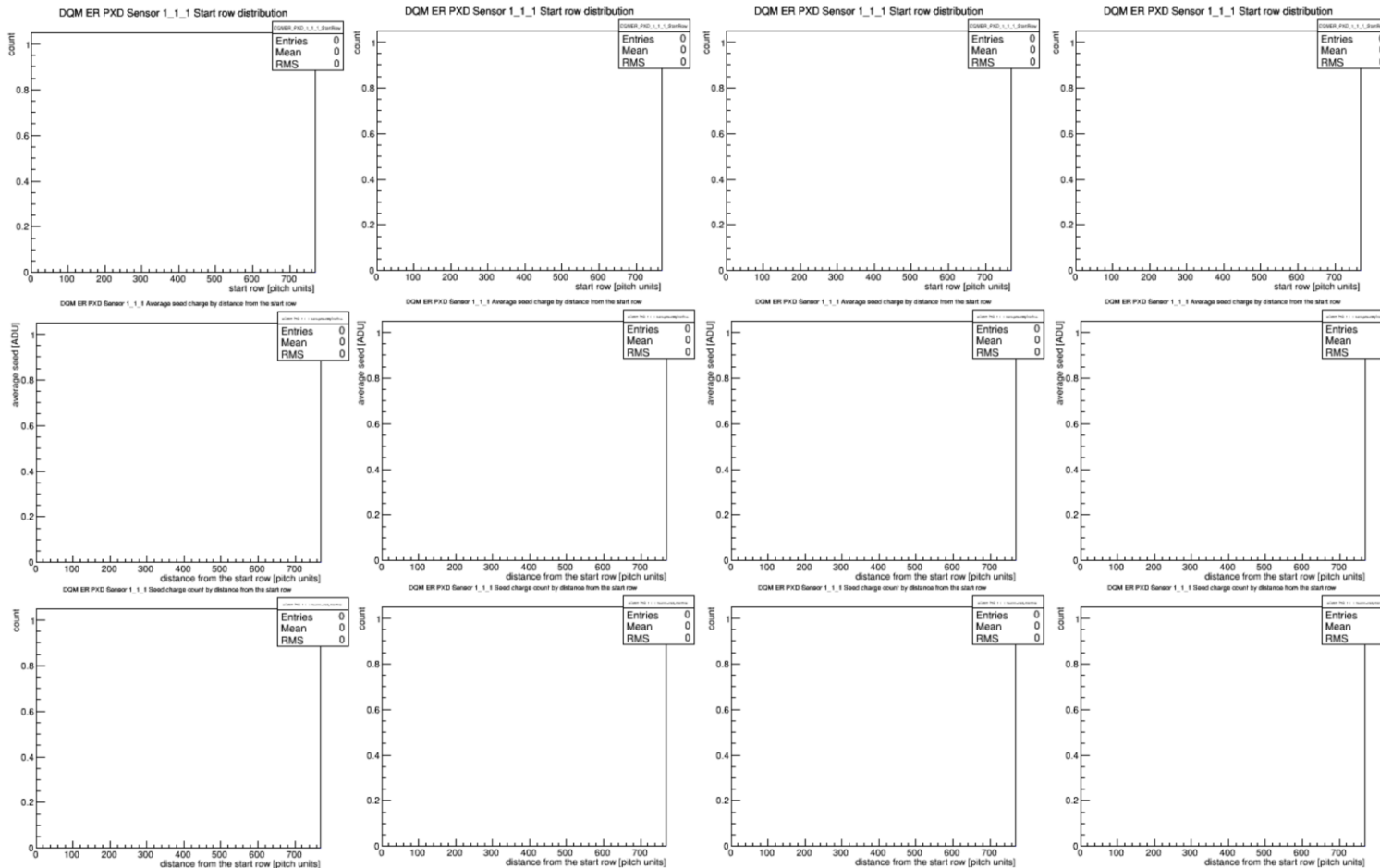
Belle II: 36 more plots per line

- Clusters per event @ sensor
- Pixel signal @ sensor
- Cluster size U @ sensor
- Cluster size V @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### PXD Expert



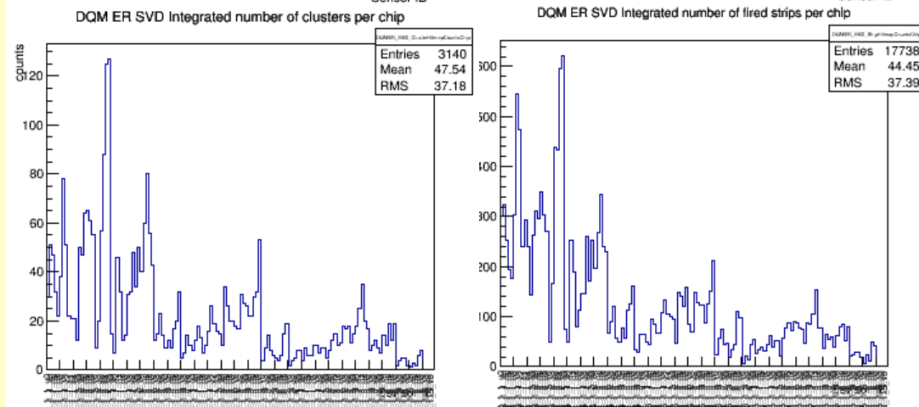
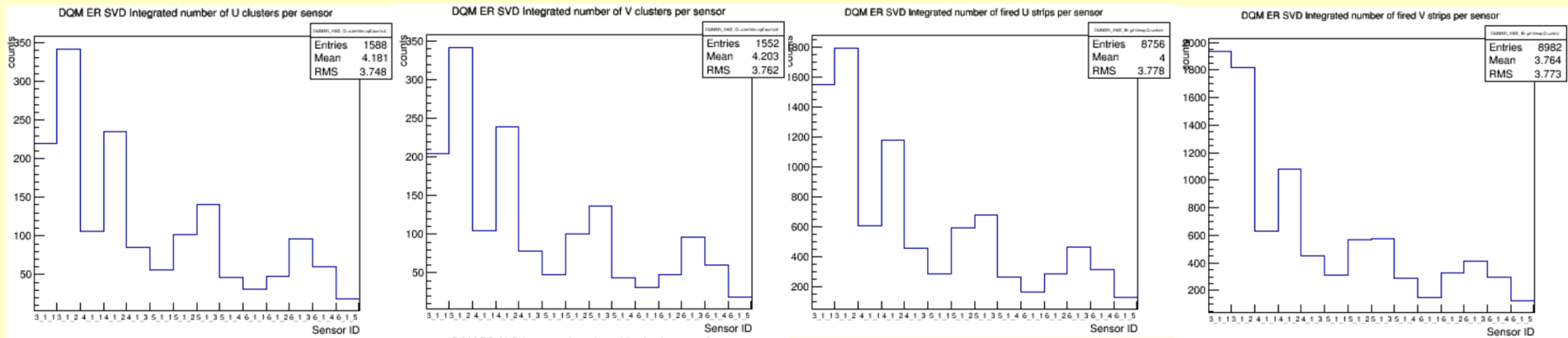
Belle II: 36 more plots per line

- Start Row distribution @ sensor
- Average seed per Start Raw @ sensor
- Seed counts per Start Raw @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

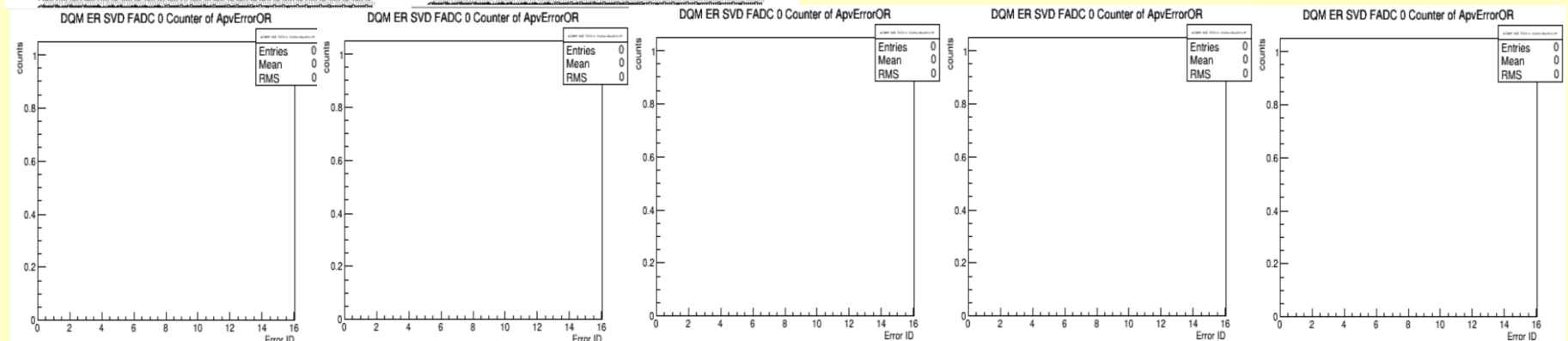
## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Obligatory



Belle II: No more plots, higher granularity

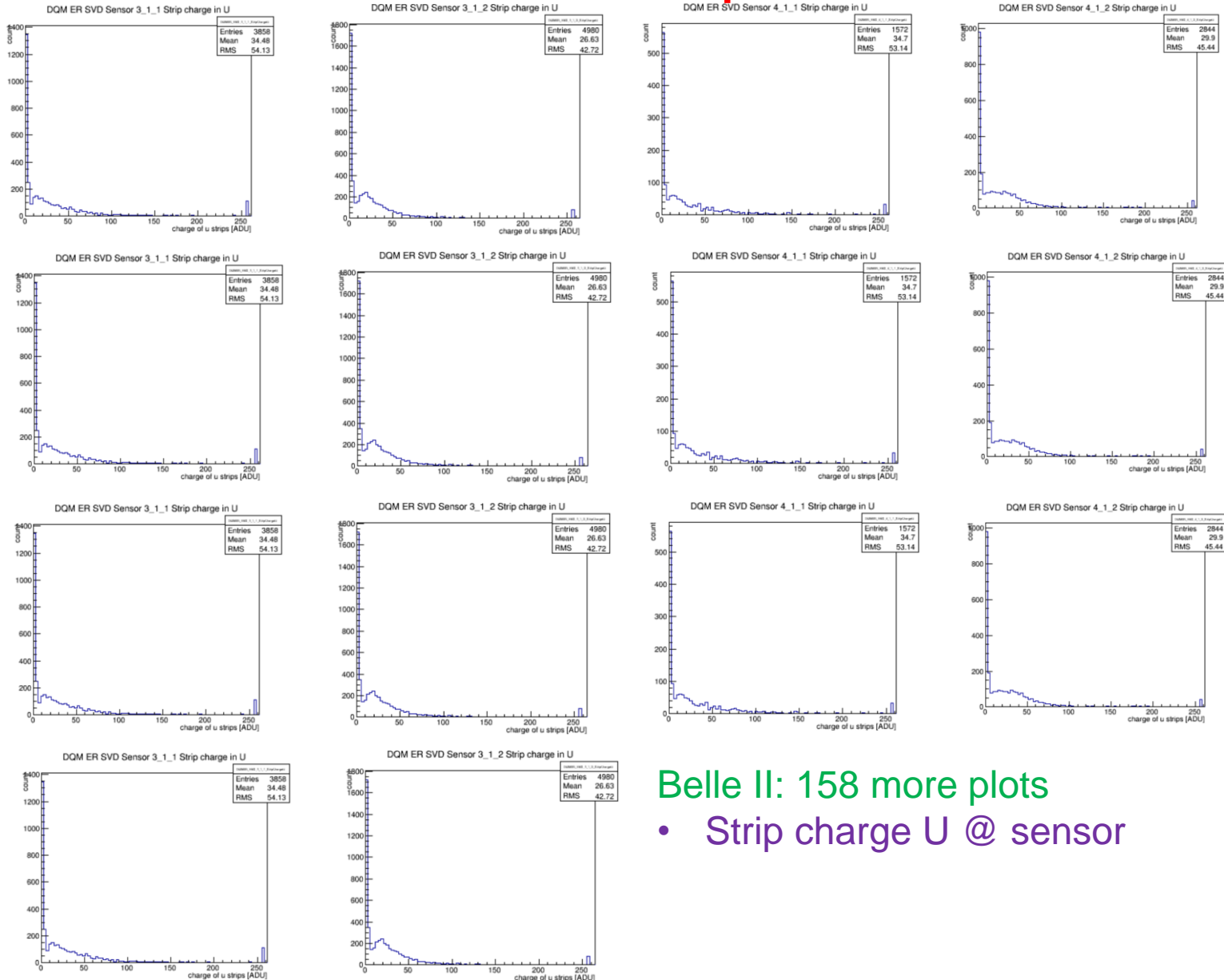
- Strip and cluster occupancy @ sensor
- Strip and cluster occupancy @ chip
- APV Error OR @ FADC ??? more plots



# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Optional



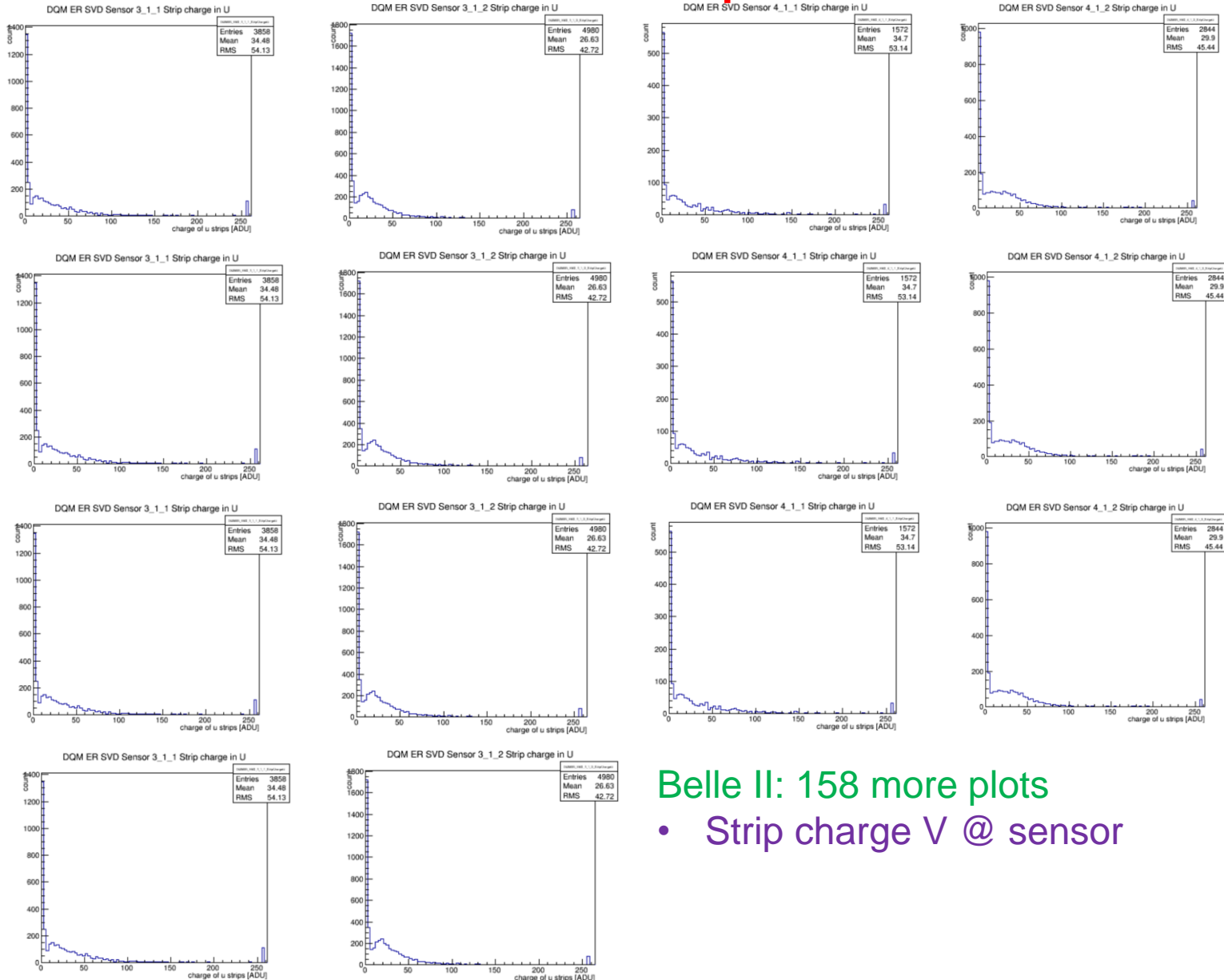
Belle II: 158 more plots

- Strip charge U @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Optional



Belle II: 158 more plots

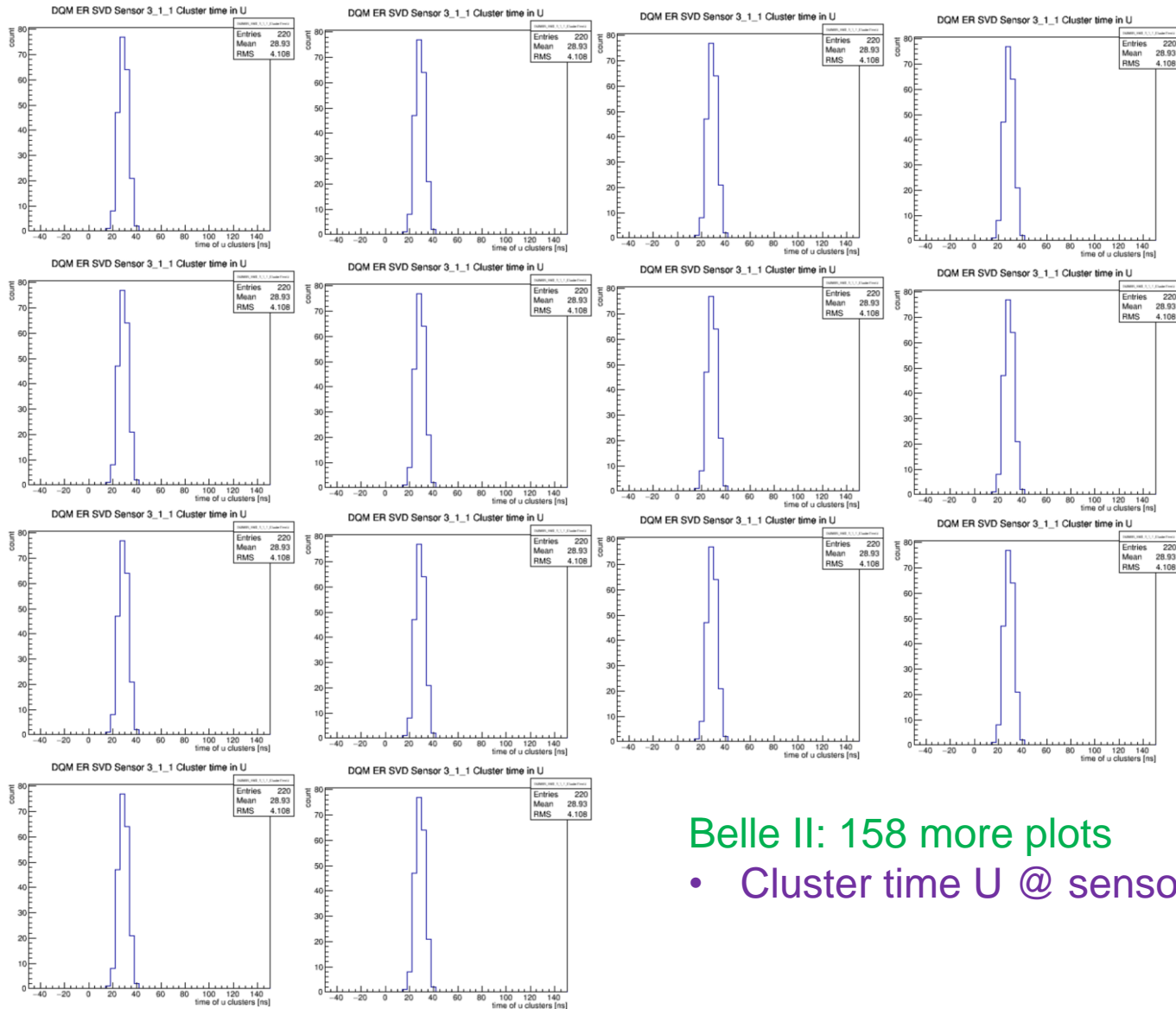
- Strip charge V @ sensor



# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Optional



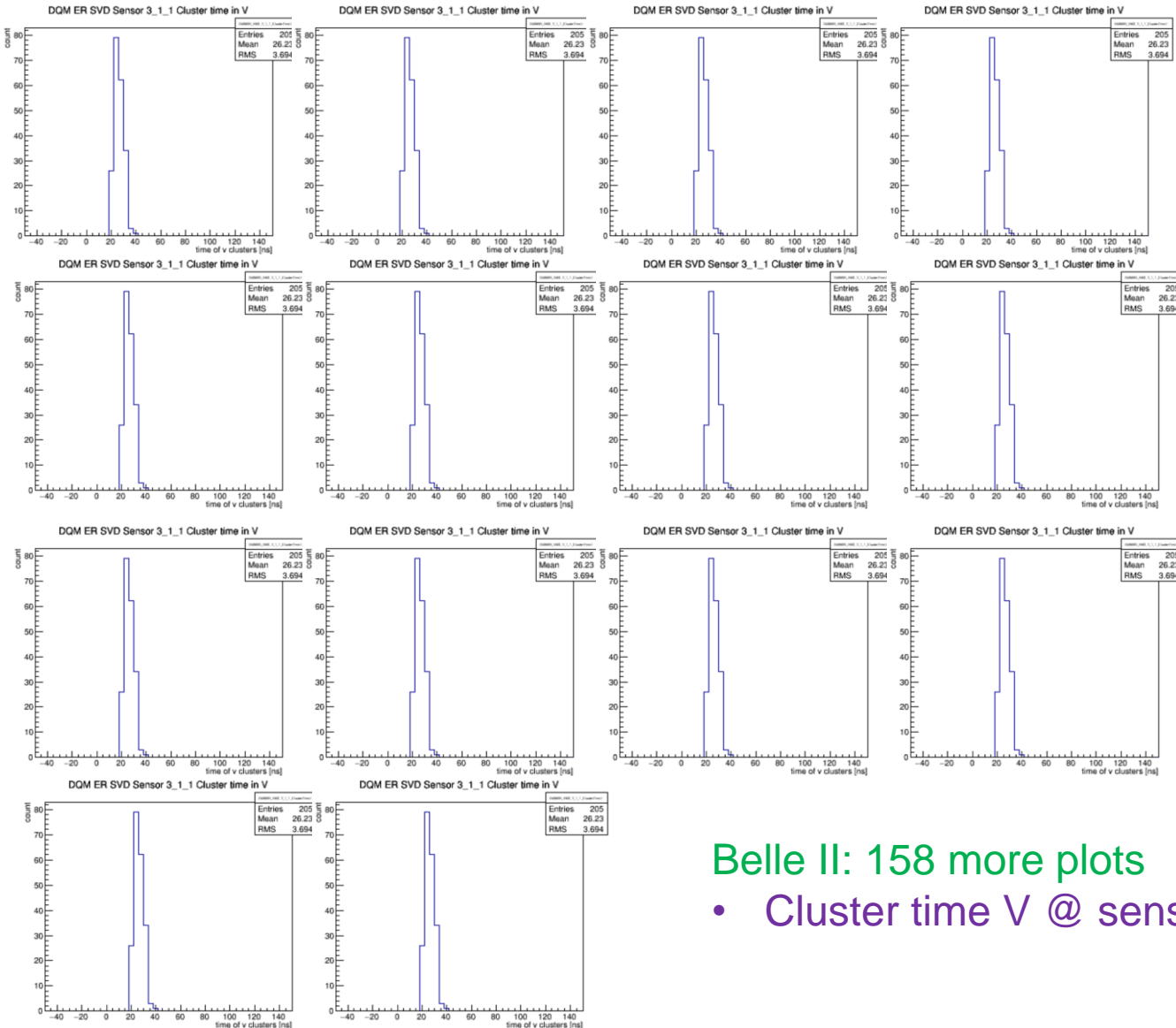
Belle II: 158 more plots

- Cluster time U @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Optional



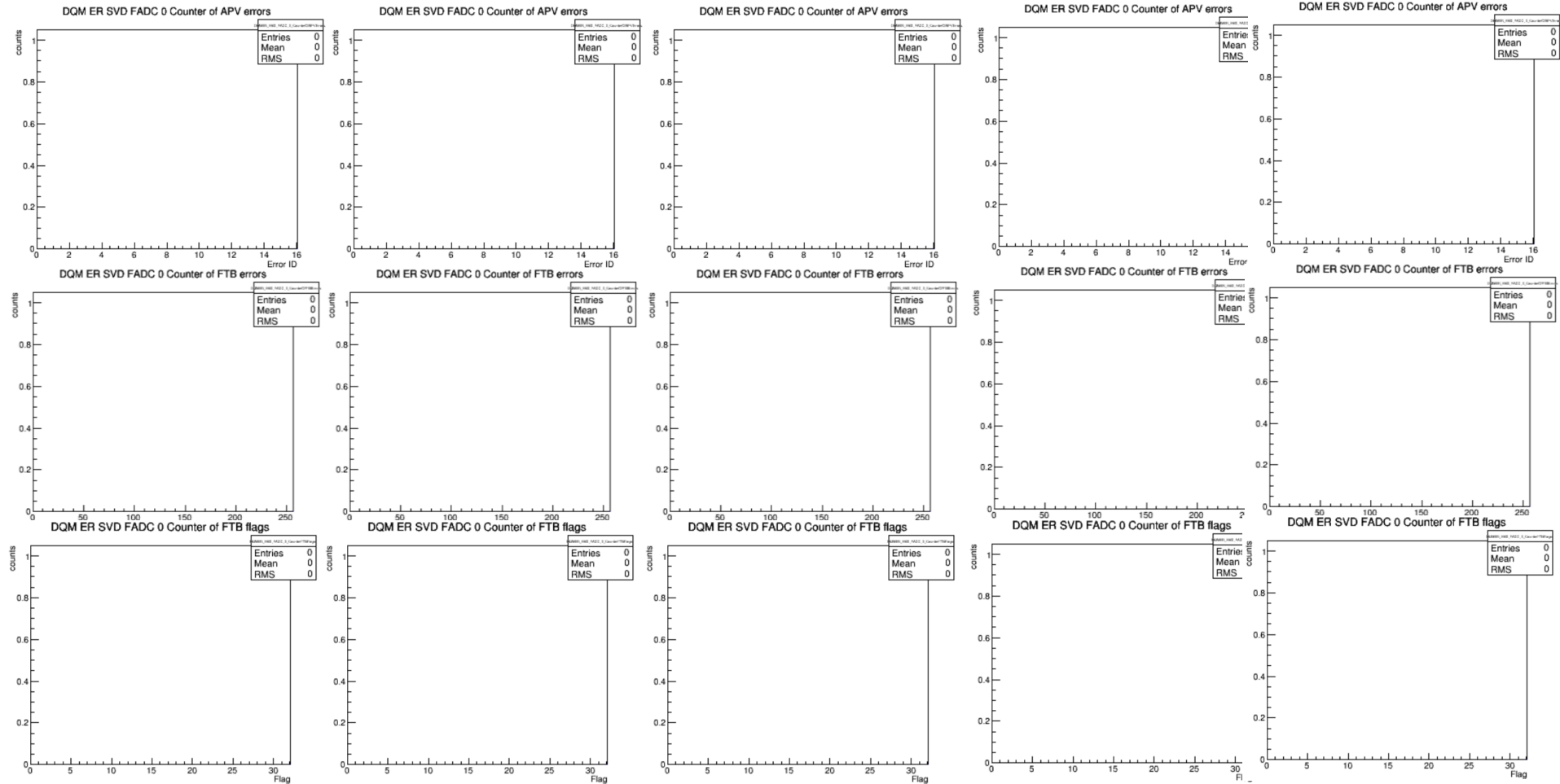
Belle II: 158 more plots

- Cluster time V @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



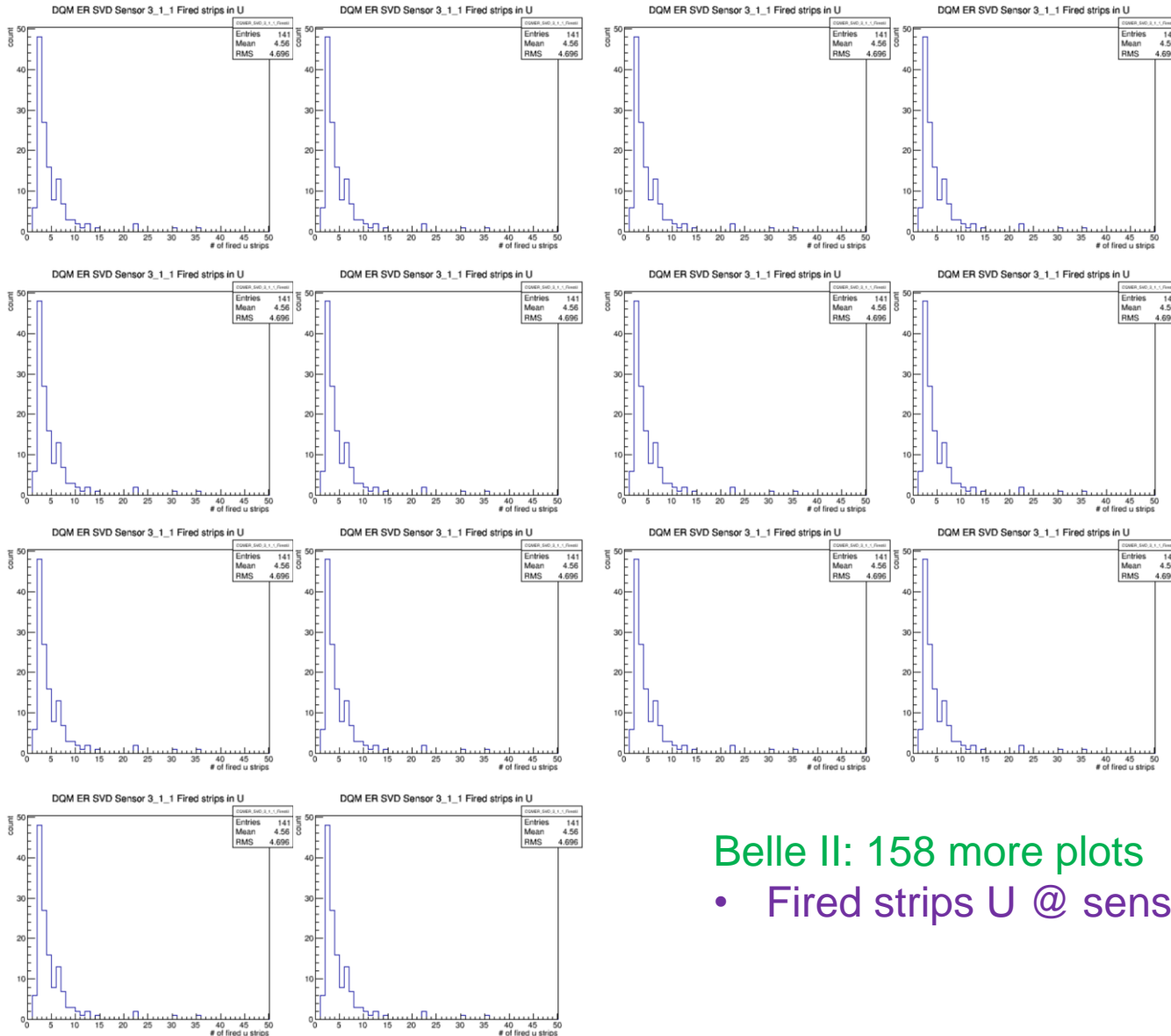
Belle II: ??? more plots

- APV errors @ FADC
- FTB errors @ FADC
- FTB flags @ FADC

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



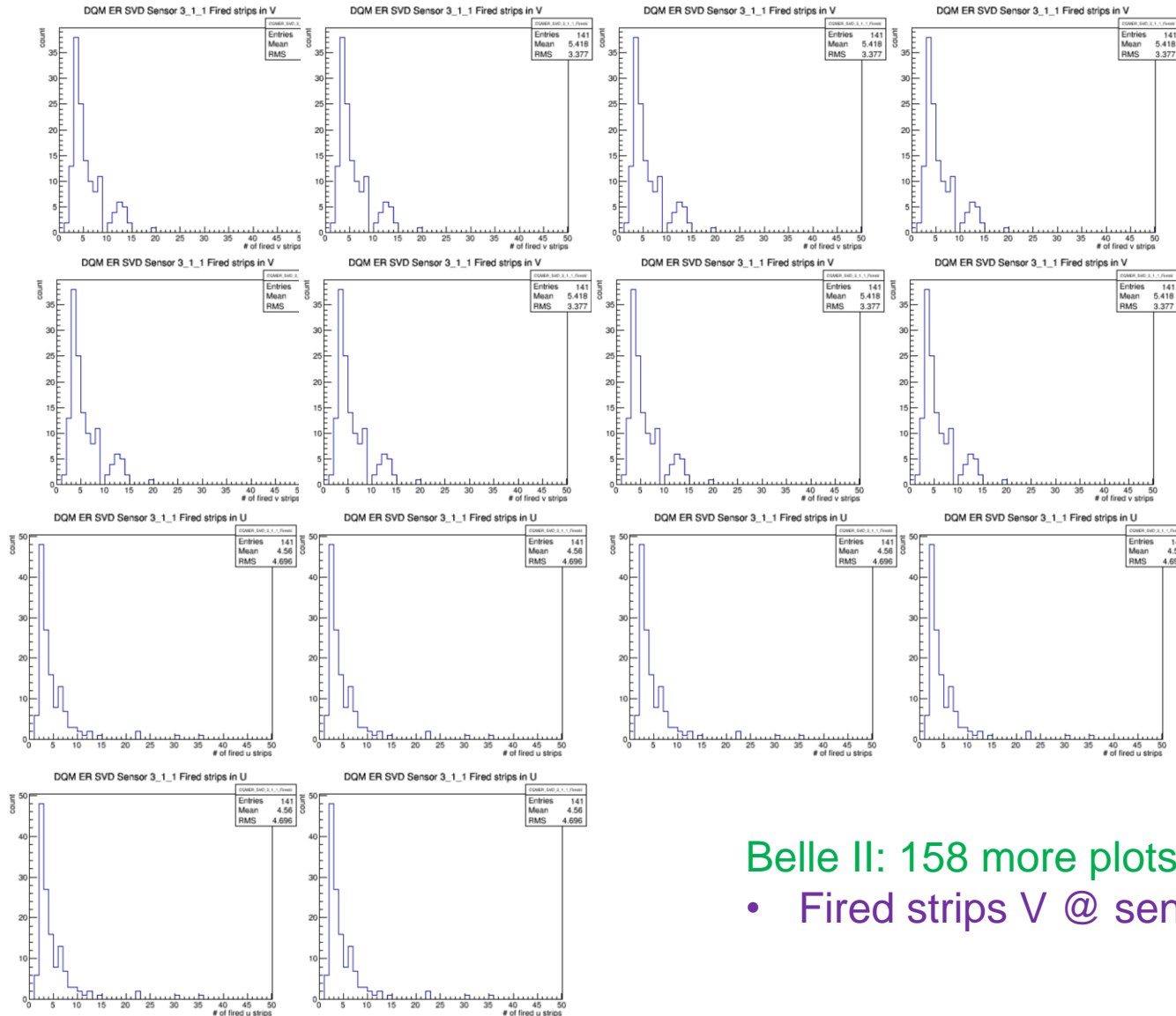
Belle II: 158 more plots

- Fired strips U @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



Belle II: 158 more plots

- Fired strips V @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



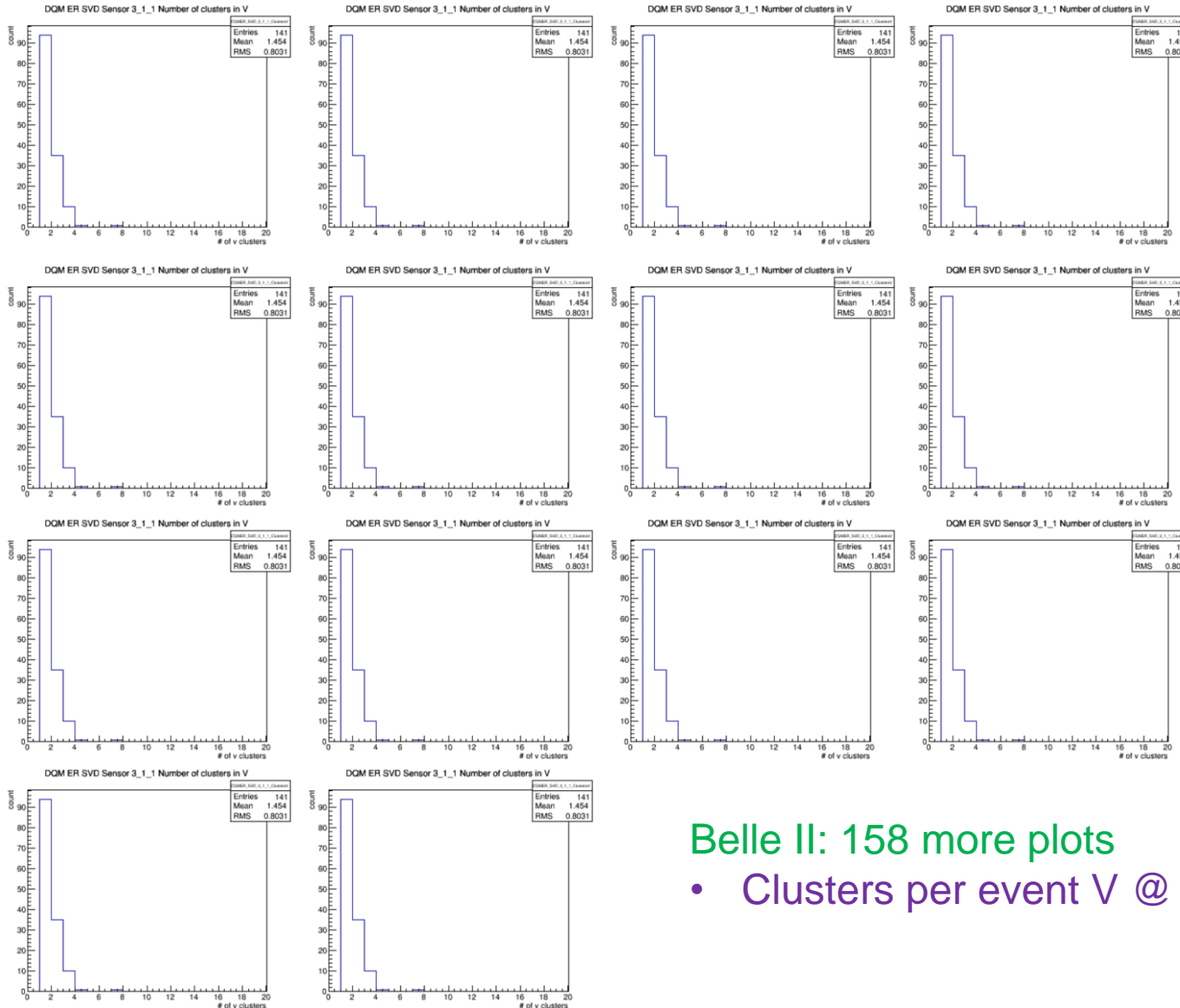
Belle II: 158 more plots

- Clusters per event U @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



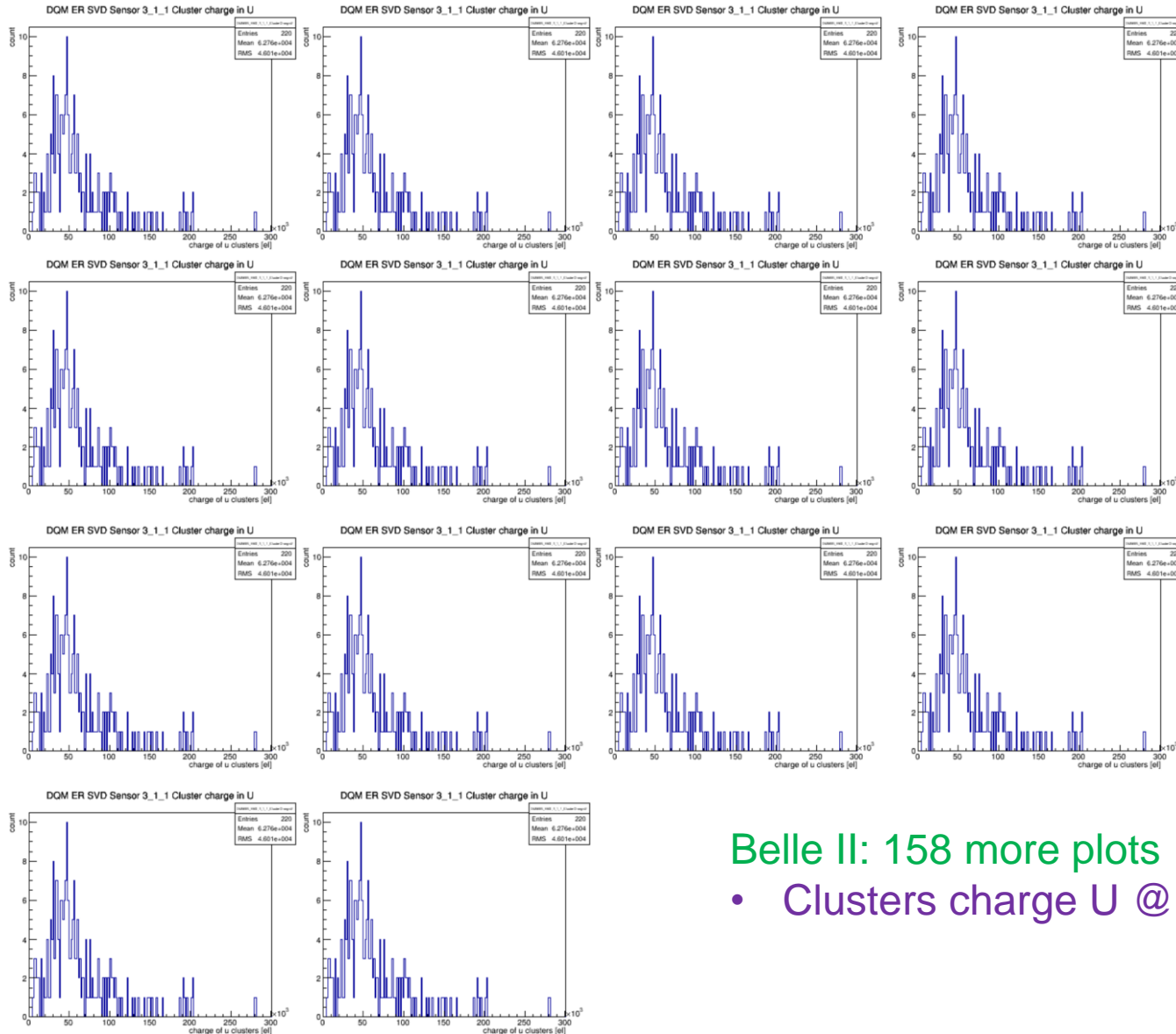
Belle II: 158 more plots

- Clusters per event V @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



Belle II: 158 more plots

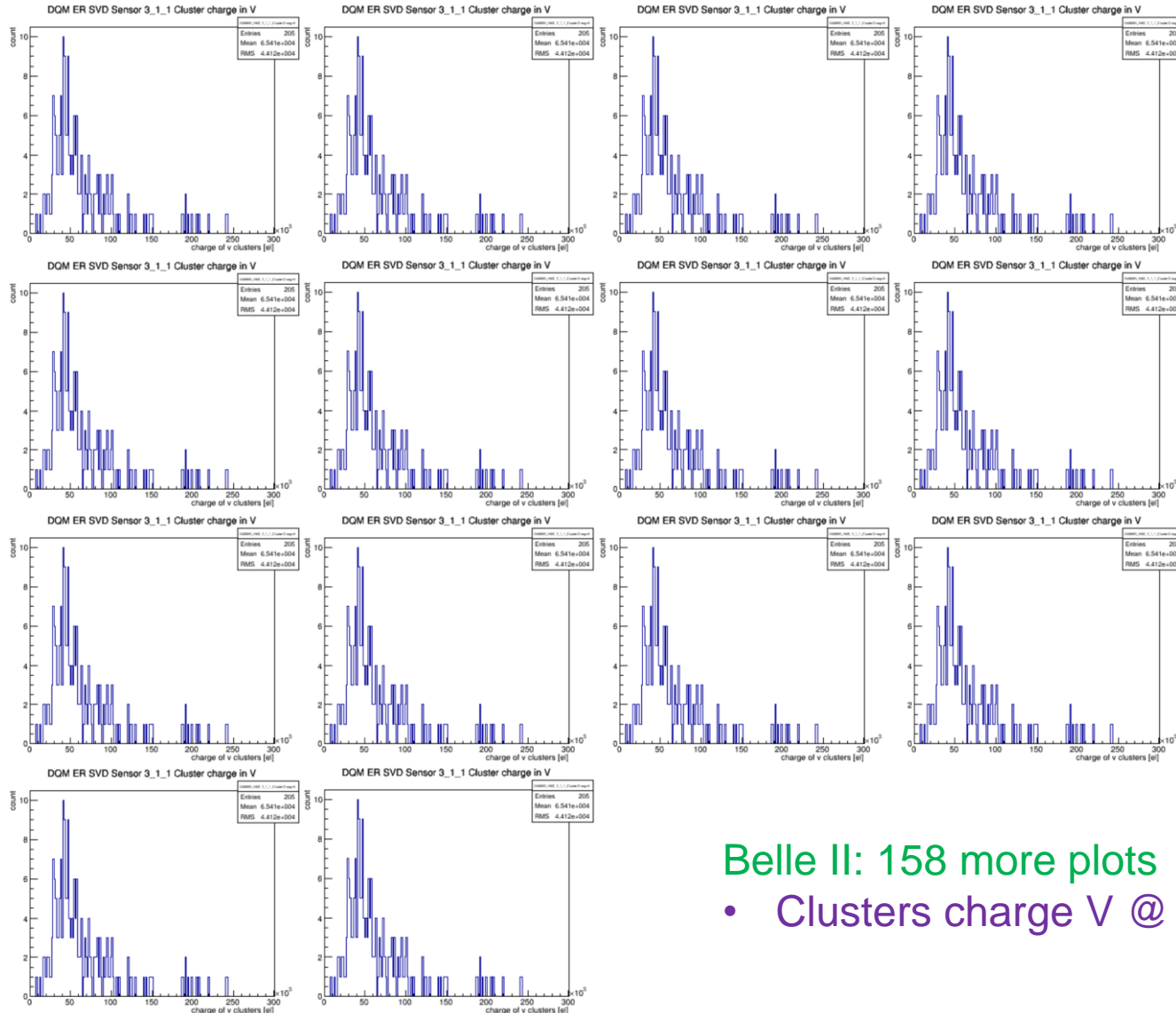
- Clusters charge U @ sensor



# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



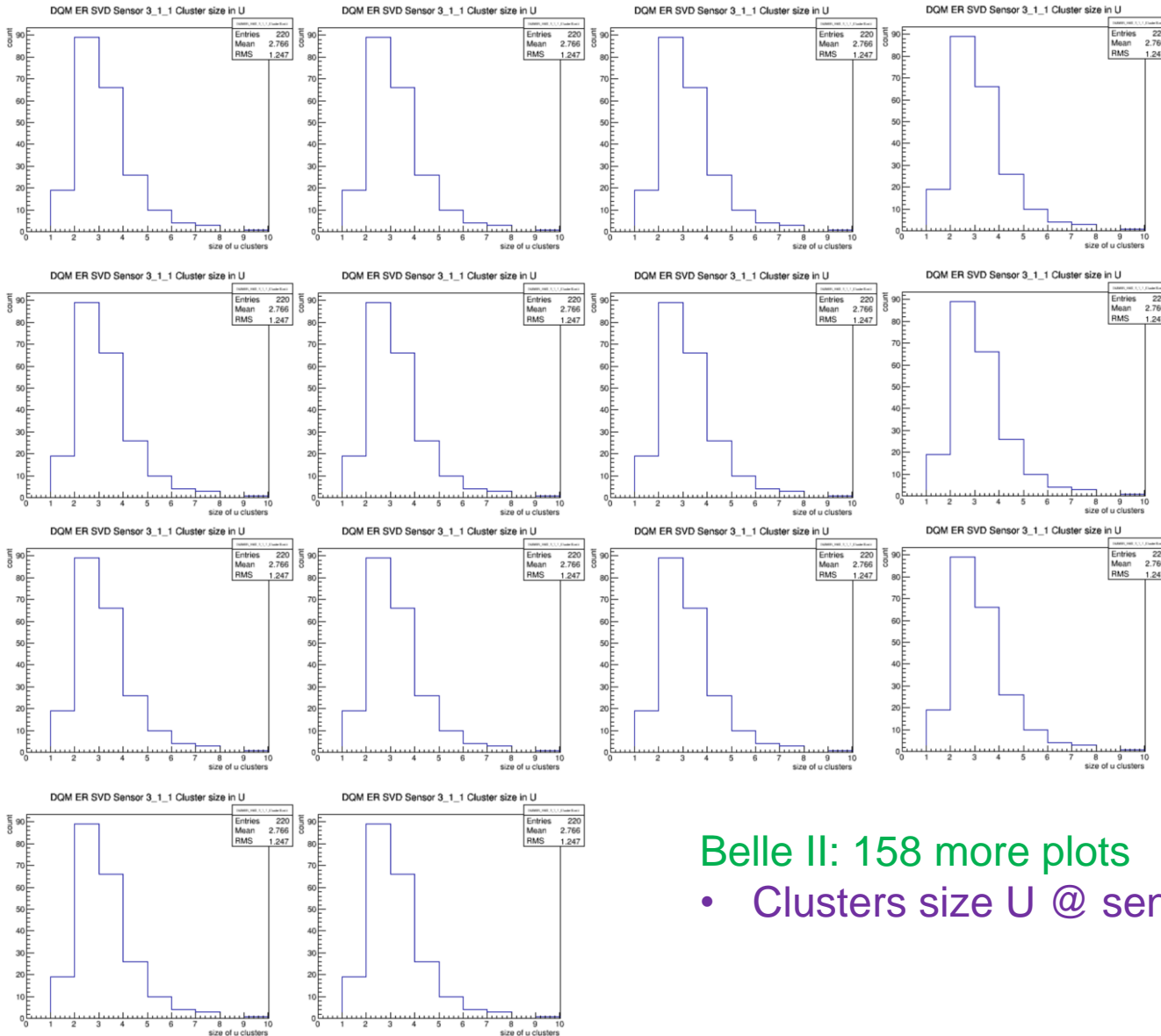
Belle II: 158 more plots

- Clusters charge V @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



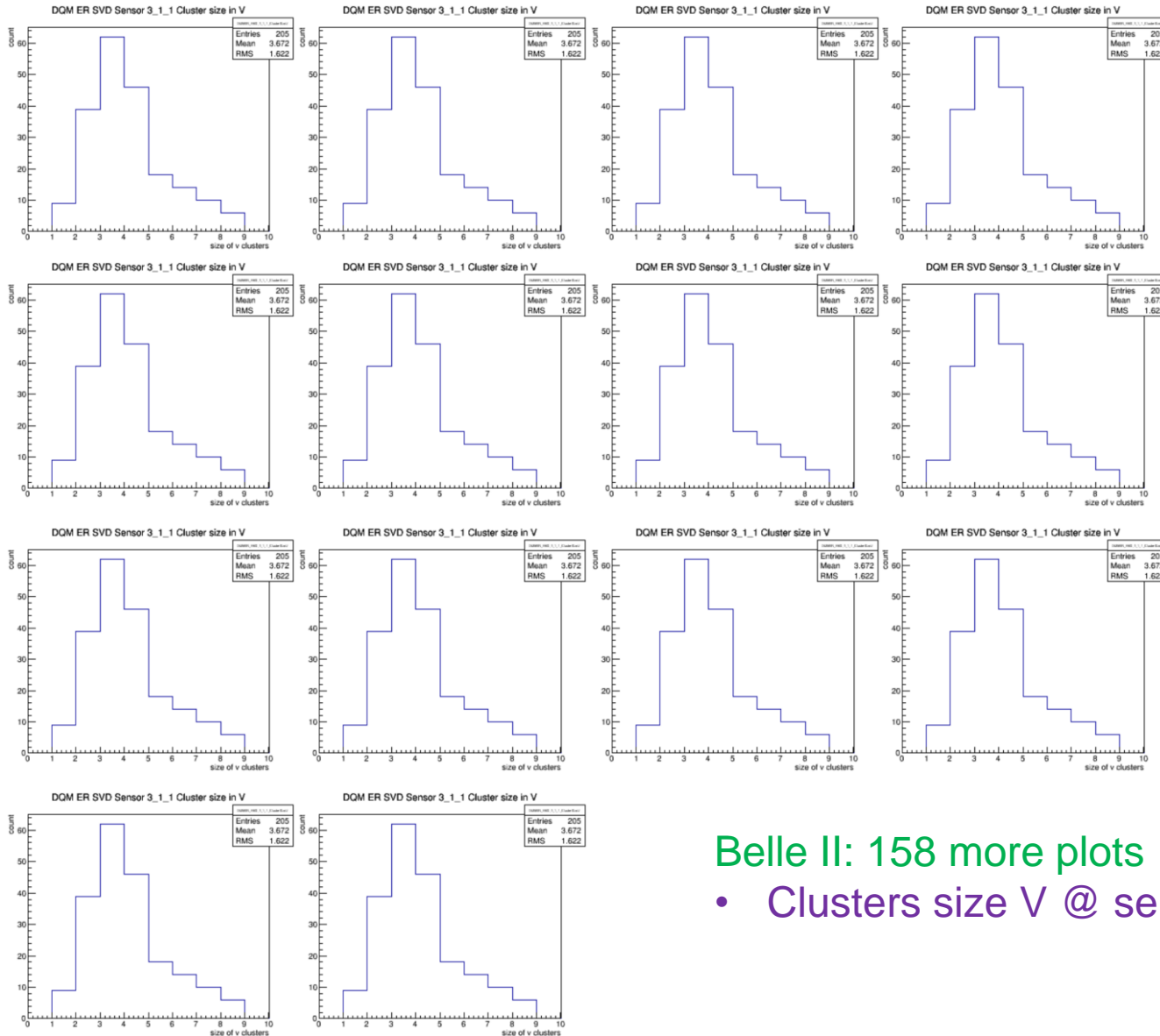
Belle II: 158 more plots

- Clusters size U @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### SVD Expert



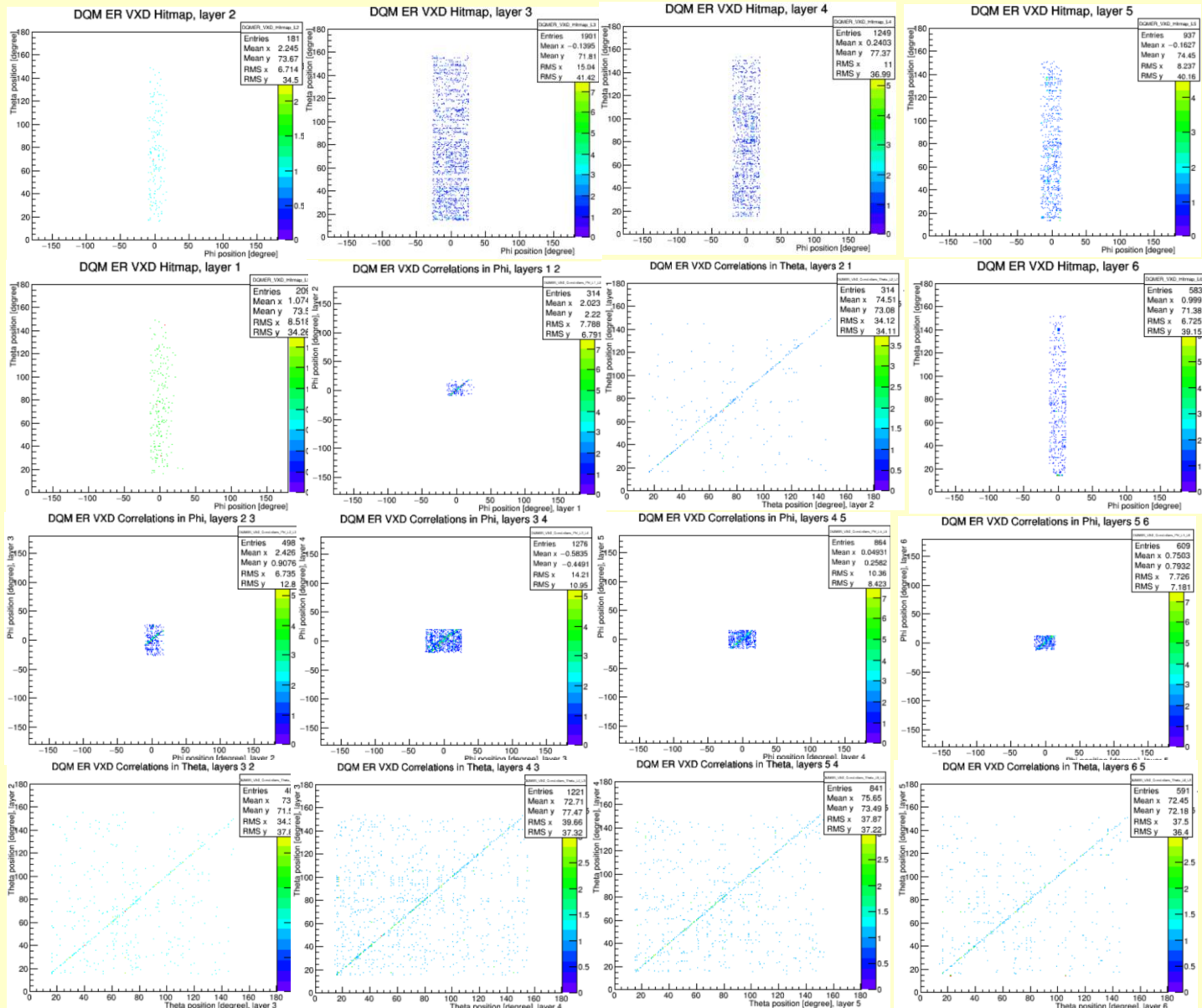
Belle II: 158 more plots

- Clusters size V @ sensor

# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

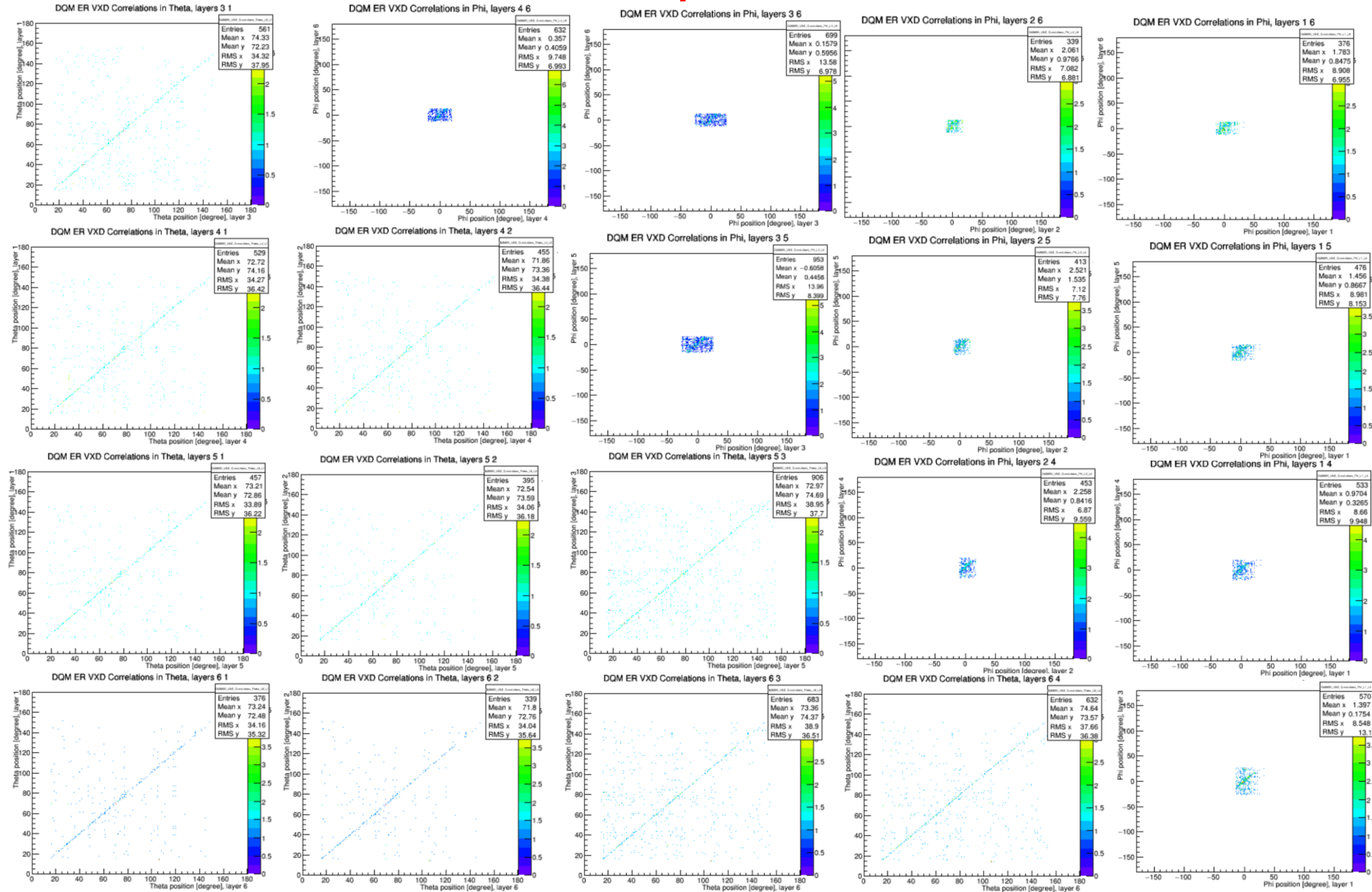
### VXD Obligatory



# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

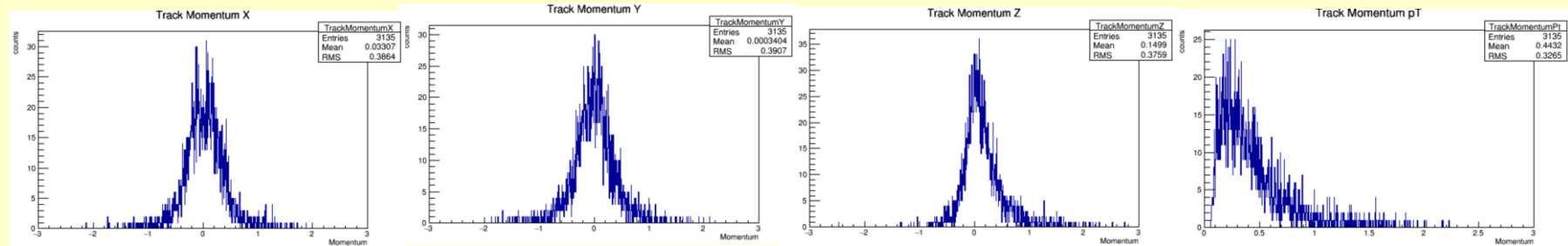
### VXD Optional



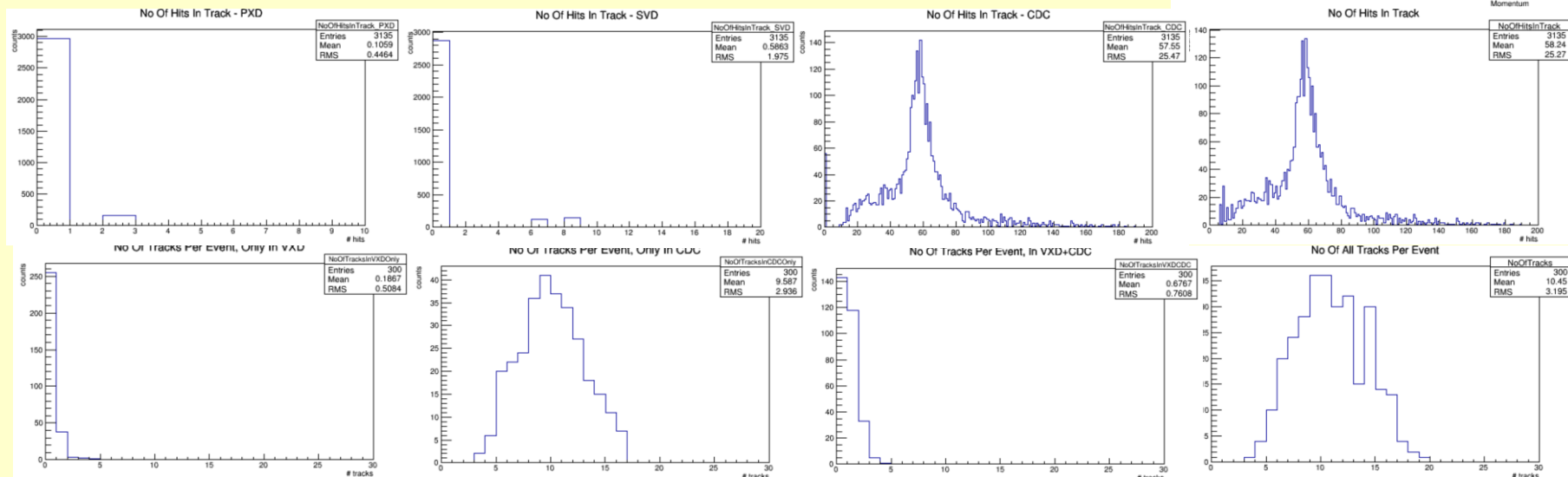
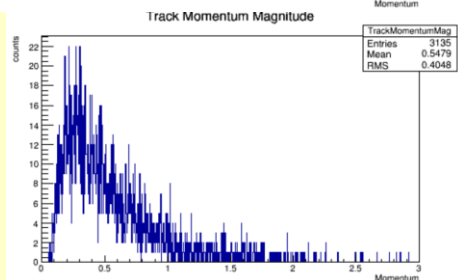
# PXD, SVD, VXD and Tracks DQM – proposal of screens for shifters

## Arrangement and list of plots, sorted to 3 levels: Obligatory, Optional, Expert

### Tracking (and alignment?) Obligatory



3x alignment plots?



**Thank you for your attention.**

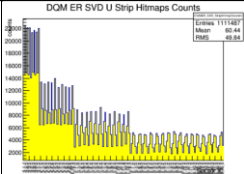
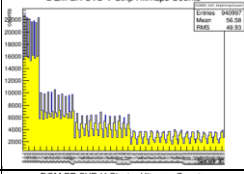
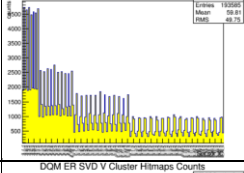
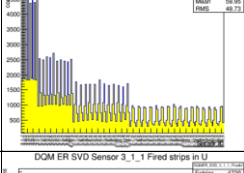
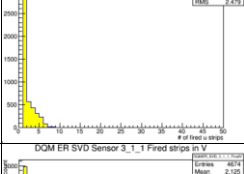
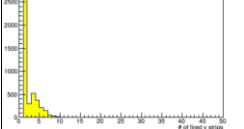
Backups

# List of SVD variable for Express Reco DQM

**DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags**

2 - error, 1 - warning, 0 - OK, -1 too low statistics in reference (<100 samples), -2 missing or masked reference histogram

Value criteria: agree with reference in 6 sigma (warning), 10 sigma (error)

Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
SVD	1	DQMER_SVD_StripHitmapCountsUFlag	DQMER_SVD_StripHitmapCountsU	Counts	172		similar to reference	Default	bin content	Drop of expected sum of occupancy in every sensor	Basic information	Done
SVD	2	DQMER_SVD_StripHitmapCountsVFlag	DQMER_SVD_StripHitmapCountsV	Counts	172		similar to reference	Default	bin content	Drop of expected sum of occupancy in every sensor	Basic information	Done
SVD	3	DQMER_SVD_ClusterHitmapCountsUFlag	DQMER_SVD_ClusterHitmapCountsU	Counts	172		similar to reference	Default	bin content	Drop of sum of reconstructed clusters in every sensor	Basic information	Done
SVD	4	DQMER_SVD_ClusterHitmapCountsVFlag	DQMER_SVD_ClusterHitmapCountsV	Counts	172		similar to reference	Default	bin content	Drop of sum of reconstructed clusters in every sensor	Basic information	Done
SVD	5	DQMER_SVD_FiredUFlag	DQMER_SVD_3_1_1_FiredU	Counts in every bin	172		first N bins fired, then drop down	Default	cumulative for every sensor histogram	Number of strips per event in every sensor	Basic information	Done
SVD	6	DQMER_SVD_FiredVFlag	DQMER_SVD_3_1_1_FiredV	Counts in every bin	172		first N bins fired, then drop down	Default	cumulative for every sensor histogram	Number of strips per event in every sensor	Basic information	Done

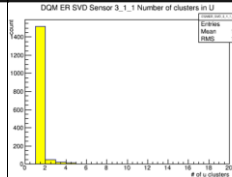
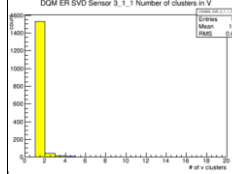
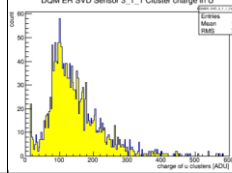
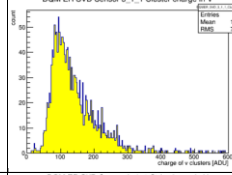
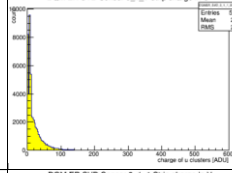
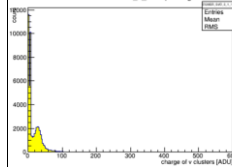


# List of SVD variable for Express Reco DQM

**DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags**

2 - error, 1 - warning, 0 - OK, -1 too low statistics in reference (<100 samples), -2 missing or masked reference histogram

Value criteria: agree with reference in 6 sigma (warning), 10 sigma (error)

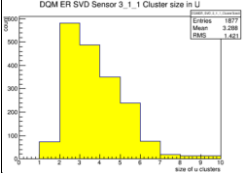
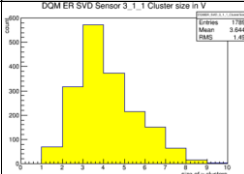
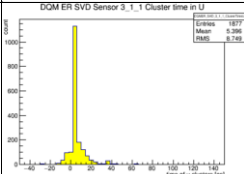
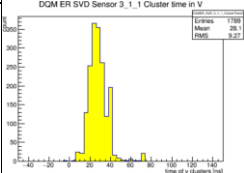
Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
SVD	7	DQMER_SVD_ClustersUFlag	DQMER_SVD_3_1_1_ClustersU	Counts in every bin	172		first N bins filed, than drop down	Default	cumulative for every sensor histogram	Number of reconstructed clusters per event in every sensor	Basic information	Done
SVD	8	DQMER_SVD_ClustersVFlag	DQMER_SVD_3_1_1_ClustersV	Counts in every bin	172		first N bins filed, than drop down	Default	cumulative for every sensor histogram	Number of reconstructed clusters per event in every sensor	Basic information	Done
SVD	9	DQMER_SVD_ClusterChargeUFlag	DQMER_SVD_3_1_1_ClusterChargeU	Landau fit, MPV position	172		similar to reference	Default	MPV in range	Indication of lost of charge, gain problem	Basic information	Done
SVD	10	DQMER_SVD_ClusterChargeVFlag	DQMER_SVD_3_1_1_ClusterChargeV	Landau fit, MPV position	172		similar to reference	Default	MPV in range	Indication of lost of charge, gain problem	Basic information	Done
SVD	11	DQMER_SVD_StripSignalUFlag	DQMER_SVD_3_1_1_StripSignalU	Landau fit, MPV position	172		similar to reference	Default	MPV in range	Indication of lost of charge, gain problem	Basic information	Done
SVD	12	DQMER_SVD_StripSignalVFlag	DQMER_SVD_3_1_1_StripSignalV	Landau fit, MPV position	172		similar to reference	Default	MPV in range	Indication of lost of charge, gain problem	Basic information	Done

# List of SVD variable for Express Reco DQM

**DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags**

2 - error, 1 - warning, 0 - OK, -1 too low statistics in reference (<100 samples), -2 missing or masked reference histogram

Value criteria: agree with reference in 6 sigma (warning), 10 sigma (error)

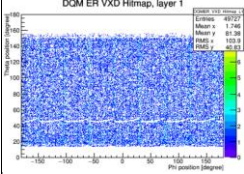
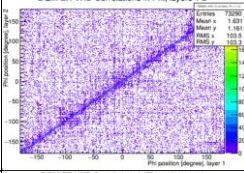
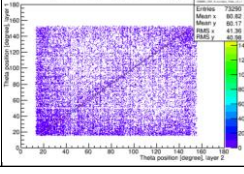
Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
SVD	13	DQMER_SVD_ClusterSizeUFlag	DQMER_SVD_3_1_1_ClusterSizeU	Counts in every bin or <b>first 7 bins?</b>	172		similar to reference	Default	cumulative for every sensor histogram	Indicate problem in readout, charge sharing	Basic information	Done
SVD	14	DQMER_SVD_ClusterSizeVFlag	DQMER_SVD_3_1_1_ClusterSizeV	Counts in every bin or <b>first 7 bins?</b>	172		similar to reference	Default	cumulative for every sensor histogram	Indicate problem in readout, charge sharing	Basic information	Done
SVD	15	DQMER_SVD_ClusterTimeUFlag	DQMER_SVD_3_1_1_ClusterTimeU	Counts in every bin	172		similar to reference	Default	cumulative for every sensor histogram	Indicate problem hardware or its setting	Basic information	Done
SVD	16	DQMER_SVD_ClusterTimeVFlag	DQMER_SVD_3_1_1_ClusterTimeV	Counts in every bin	172		similar to reference	Default	cumulative for every sensor histogram	Indicate problem hardware or its setting	Basic information	Done
SVD	17	DQMER_SVD_EfficiencyUVFlag	DQMER_SVD_3_1_1_EfficiencyUV		172	missing	similar to reference	Default	cumulative for every sensor histogram	Indicate general problem on SVD readout, tracking or track fitter	Basic information	ASAP

# List of VXD variable for Express Reco DQM

**DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags**

2 - error, 1 - warning, 0 - OK, -1 too low statistics in reference (<100 samples), -2 missing or masked reference histogram

Value criteria: agree with reference in 6 sigma (warning), 10 sigma (error)

Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
VXD	1	DQMER_VXD_Correlations2DFlag	DQMER_VXD_Hitmap_L1	Counts in every bin	36 combinations, 1 degree		similar to reference	Default	cumulative for every sensor histogram	Indicate problem on some sensors lost	Basic information	Done, need check
VXD	2	DQMER_VXD_CorrelationsPhiFlag	DQMER_VXD_Correlations_Phi_L1_L2	Counts in every bin	36 combinations, 1 degree		similar to reference	Default	cumulative for every sensor histogram	Indicate problem on correlation, timing or some sensors lost	Basic information	Done, need check
VXD	3	DQMER_VXD_CorrelationsThetaFlag	DQMER_VXD_Correlations_Theta_L1_L2	Counts in every bin	36 combinations, 1 degree		similar to reference	Default	cumulative for every sensor histogram	Indicate problem on correlation, timing or some sensors lost	Basic information	Done, need check

# List of Track variable for Express Reco DQM

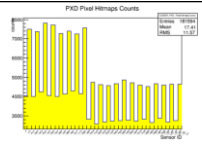

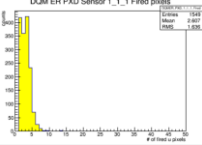
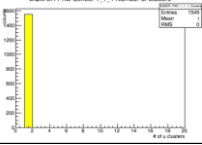
**DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags**

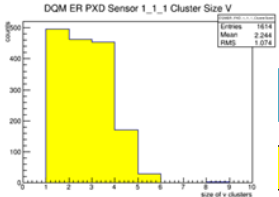
2 - error, 1 - warning, 0 - OK, -1 too low statistics in reference (<100 samples), -2 missing or masked reference histogram

Value criteria: agree with reference in 6 sigma (warning), 10 sigma (error)

Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
Tracking	1	DQMER_Trak_PXD FitPointsFlag		Counts in every bin	5 degree	missing	similar to reference	Default	for every angle step	Indicate general problem on PXD ROI or track finder/fitter	Basic information	ASAP
Tracking	2	DQMER_Trak_SVD FitPointsFlag		Counts in every bin	5 degree	missing	similar to reference	Default	for every angle step	Indicate general problem on SVD or track finder/fitter	Basic information	ASAP
Tracking	3	DQMER_Trak_VXD FitPointsFlag		Counts in every bin	5 degree	missing	similar to reference	Default	for every angle step	Indicate general problem on VXD or track finder/fitter	Basic information	ASAP
Tracking	4	DQMER_Trak_CDC FitPointsFlag		Counts in every bin	5 degree	missing	similar to reference	Default	for every angle step	Indicate general problem on CDC or track finder/fitter	Basic information	ASAP
Tracking	5	DQMER_Trak_PtFlag		Counts in every bin	5 degree	missing	similar to reference	Default	for every Pt step	Indicate general problem on track finder/fitter related to different Pt reco	Basic information	ASAP

# List of PXD variable for Express Reco DQM

DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags												
2 - error, 1 - warning, 0 - OK, -1 too low statistics in reference (<100 samples), -2 missing or masked reference histogram												
Value criteria: agree with reference in 6 sigma (warning), 10 sigma (error)												
Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
PXD	1	DQMER_PXD_PixelHitmapCountsFlag	DQMER_PXD_PixelHitmapCounts	Counts	40		similar to reference	Default	bin content	Drop of expected sum of occupancy in every sensor	Basic information	Done
PXD	2	DQMER_PXD_ClusterHitmapCountsFlag	DQMER_PXD_ClusterHitmapCounts	Counts	40		similar to reference	Default	bin content	Drop of sum of reconstructed clusters in every sensor	Basic information	Done
PXD	3	DQMER_PXD_FireFlag	DQMER_PXD_1_1_1_Fired	Counts in every bin or first 3-4 bins?	40		first N bins filled, then drop down	Default	cumulative for every sensor histogram	Number of pixels per event in every sensor	Basic information	Done
PXD	4	DQMER_PXD_ClustersFlag	DQMER_PXD_1_1_1_Clusters	Counts in every bin or first 3-4 bins?	40		first N bins filled, then drop down	Default	cumulative for every sensor histogram	Number of reconstructed clusters per event in every sensor	Basic information	Done
PXD	5	DQMER_PXD_StartRowFlag	DQMER_PXD_1_1_1_StartRow	Counts in every bin	40	Not available in simulations	flat distribution, not preferred StartRows	Default	cumulative for every sensor histogram	If drop - indication of problem in readout sequence of PXD	Advance information	Done, wait for data
PXD	6	DQMER_PXD_ChargeStartRowFlag	DQMER_PXD_1_1_1_AverageSeedByStartRow	Counts in every bin	40	Not available in simulations	flat distribution, not dependent from StartRow	Default	cumulative for every sensor histogram	average seed, if drop - indication of problem in readout sequence of PXD	Advance information	Done, wait for data
PXD	7	DQMER_PXD_StartRowCountFlag			40	Not available in simulations		Default			Support information	Done, not show



# List of PXD variable for Express Reco DQM

**DQM for Express Reco, 40 kEvents samples, compare with reference, create summaries, flags**

Subdetector	#	Name	Source Name Example	Monitored variable	Range Granulation	Example	Expectation	Value criteria	Flags	Why	Comment	Status
PXD	8	DQMER_PXD_ClusterChargeFlag	DQMER_PXD_1_1_1_ClusterCharge	Landau fit, MPV position	40		similar to reference	Default	MPV in range	Indication of lost of charge, gain problem	Basic information	Need fitting
PXD	9	DQMER_PXD_PixelSignalFlag	DQMER_PXD_1_1_1_PixelSignal	Landau fit, MPV position	40		similar to reference	Default	MPV in range	Indication of lost of charge, gain problem	Basic information	Need fitting
PXD	10	DQMER_PXD_ClusterSizeUFlag	DQMER_PXD_1_1_1_ClusterSizeU	Counts in every bin or <b>first 3-4 bins?</b>	40		similar to reference	Default	cumulative for every sensor histogram	Indicate problem in switcher sequency, charge sharing	Basic information	Done
PXD	11	DQMER_PXD_ClusterSizeVFlag	DQMER_PXD_1_1_1_ClusterSizeV	Counts in every bin or <b>first 3-4 bins?</b>	40		similar to reference	Default	cumulative for every sensor histogram	Indicate problem in DCD, charge sharing	Basic information	Done
PXD	12	DQMER_PXD_ClusterSizeUVFlag	DQMER_PXD_1_1_1_ClusterSizeUV	Counts in every bin or <b>first 3-4 bins?</b>	40		similar to reference	Default	cumulative for every sensor histogram	Maybe redundant with U/V separate monitors	Basic information	Done
PXD	13	DQMER_PXD_EfficiencyFlag	DQMER_PXD_1_1_1_Efficiency		40	missing	similar to reference	Default	cumulative for every sensor histogram	Indicate general problem on PXD readout, tracking, ROI or track fitter	Basic information	ASAP

# Introduction

Subdetector DQM is not for beam or trigger monitoring, DQM expect stable standard beam and comparable conditions.

Different ways for DQM:

1. PXD specific software and hardware pre-basf2 DQM, check DQ of data transfer
2. SVD specific software and hardware pre-basf2 DQM , check DQ of data transfer
3. basf2 DQM:
  1. Calibrations, constants, pedestals, CMN ← Do we need it on-line? How to move to basf2?
  2. Raw-data DQM for PXD, SVD (Björn, Peter Kv.)
  3. Pixel/Strip/Cluster level DQM, compare with reference, stability in time ← this talk
  4. Correlation VXD DQM , compare with reference, stability in time ← this talk
  5. ROI DQM (Giulia) ← this talk
  6. Tracking, misalignment,... VXD+CDC+... DQM ← Do we need it on-line?

DQM  
in  
basf2

no

GUI: Björn in basf2, Itoh-san in ExpressReco

## Few directions:

1. ExpressReco – restricted space of size and CPU, on-line for shifters!
2. Detail DQM – separate PXD/SVD, servers, analysis and enough space
3. Special DQM – storing to files only, merging for higher statistics, pixel/strip level

# Introduction

1. Set of **histogram plots** per No. of triggers is generate and stored to disk.
2. Comparing with **reference plots** create green/orange/red/gray **flag plots**.
3. Flag plots are monitored **units** base on request from subdetectors.
4. No single strip or pixel is monitored.
5. Flags are propagate to automatic shifter emergency system.
6. Flags are preview on summary and summary of summaries plots.
7. Split to on-line monitors (flags) and expert monitors for experts.

PXD DQM discussion (Björn):

<https://confluence.desy.de/pages/viewpage.action?spaceKey=BI&title=PXD+DQM+Histogram+Discussion>

1. What are sensitive observables in the histograms?
2. Fit? Mean? RMS?
3. How many events are needed to make histogram meaningful
4. What is the best place to fill the histogram (BonnDAQ, PXD-DQM, ERECO/ExpReco, Offline)
5. What problem can be detected

**Branch in basf2: `feature/DQM_VXD_Correlations`**



# Introduction

How it works:

1. Load reference histograms from database.
2. Create expert histogram file, derivate flag files and send it to storage.
3. Split histograms to smaller parts for quicker actualization (optional).
4. Remove and delete expert histograms (seems no need).
5. Show flag histograms on shifter GUI.
6. If needed send flag to emergency system.
7. Actualization: every 1-5 (15?) minutes.
8. Backups: every 15 (60?) minutes save all DQM files to storage for further analysis.

# Basic calculations

Monitored unit: [switcher/DCD]/sensor/ladder/layer

Monitored variables:

1. Occupancy, dead/noised
2. Signal pixel/strip, seed/cluster
3. Cluster size u/v/uv, SVD: cluster time distribution
4. Angle correlations of VXD
5. PXD ROI: residual intercept - cluster position, occupancy, tracks: p-value, occupancy

Data handling rules: **Keep it as small as possible!**

**ExpressReco:** 40x PXD + 172x SVD + 6x VXD (VXD = layer granulation)

PXD: 6x 1D-histograms (Occ Pix+Clusters, Charge, CSize u+v+uv) + 4x40 = 166

SVD: 10x 1D-histograms (Occ Pix+Clusters:u+v, Charge u+v, CSize u+v, Time u+v) + 6x172 = 1042

VXD: 10x 2D-histogram (correlations in angular) = 10

PXD ROI, tracking: <10x 1D-histogram = <10

**We have ~10 Mbytes/subdetector  
PXD+SVD = ~20 Mbytes limit!**

Basic minimal set of histograms:	1.4 M/20 kSamples,	2.2 M/200 kSamples
Extended to [switcher/DCD] granularity:	3.8 M/20 kSamples,	4.8 M/200 kSamples
Add new PXD monitored value:	+30K (+600K for higher granularity)	
Add new SVD monitored value:	+110K	

# Basic calculations

## ExpressReco:

Seems we occupy  $\frac{1}{4}$  of limit so there is space to save also reference histograms for later crosschecks (doubled size).

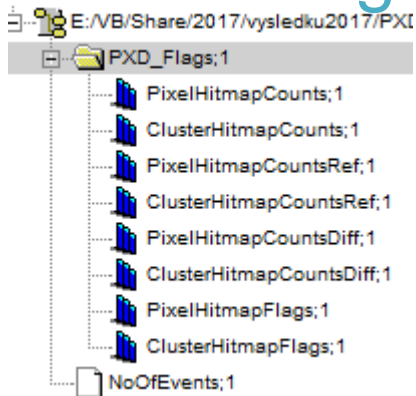
There is some small space for next flag-of-flags histograms, higher granulations, more values for monitoring, or better viewable 2D histograms.

Higher granulations: problem with fulfilling with reasonable statistics!

We have ~10 Mbytes/subdetector  
PXD+SVD = ~20 Mbytes limit!

Basic minimal set of histograms:	1.4 M/20 kSamples,	2.2 M/200 kSamples
Extended to [switcher/DCD] granularity:	3.8 M/20 kSamples,	4.8 M/200 kSamples
Add new PXD monitored value:	+30K (+600K for higher granularity)	
Add new SVD monitored value:	+110K	

# Flag monitors – example for PXD hitmaps



Every unit, 960 units per PXD

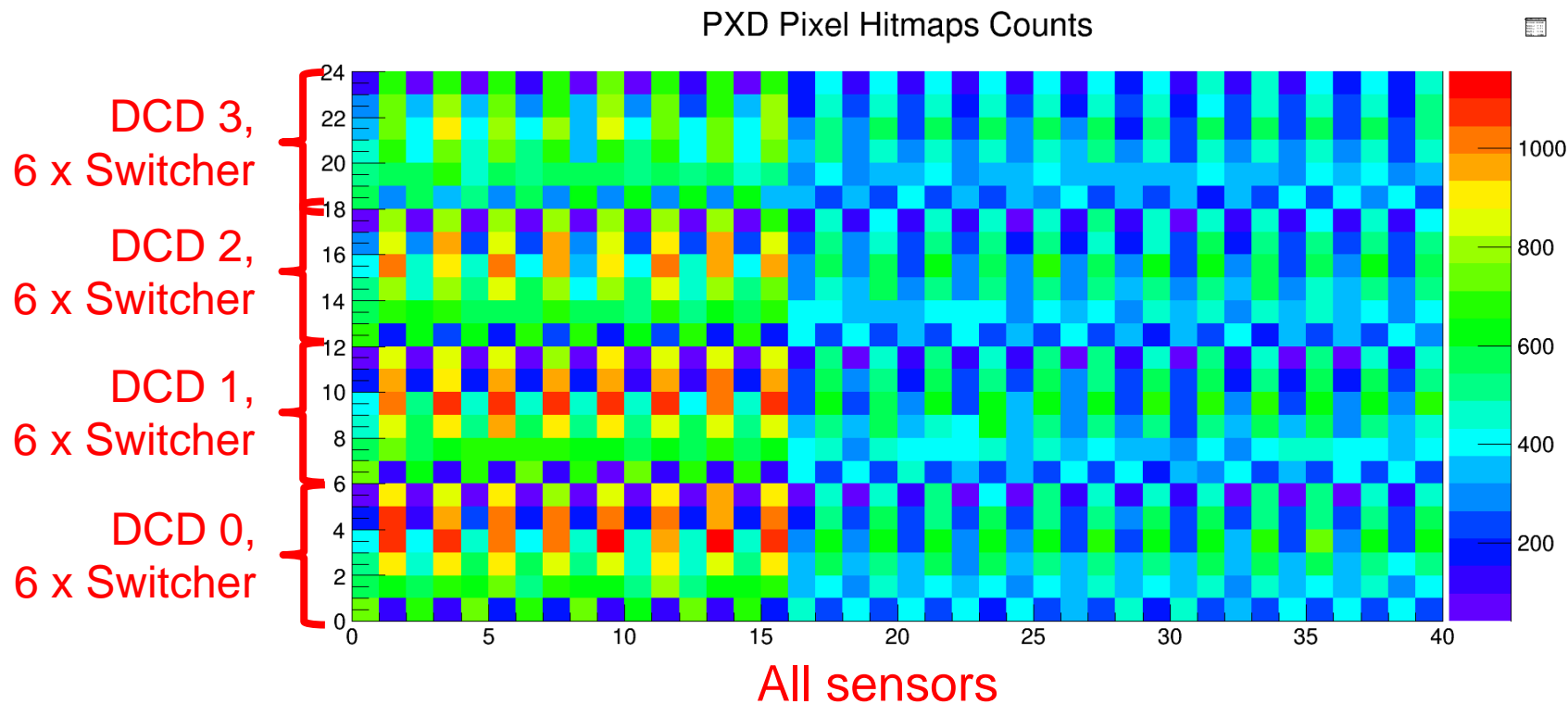
~200-500 samples per unit: 100 kEvents, 10 minutes?

~200-500 samples per sensor: 4 kEvents, 1 minute?

Real rate: 100/sec  $\approx$  6 kEv/min

Occupancy of units differ in 2 orders...

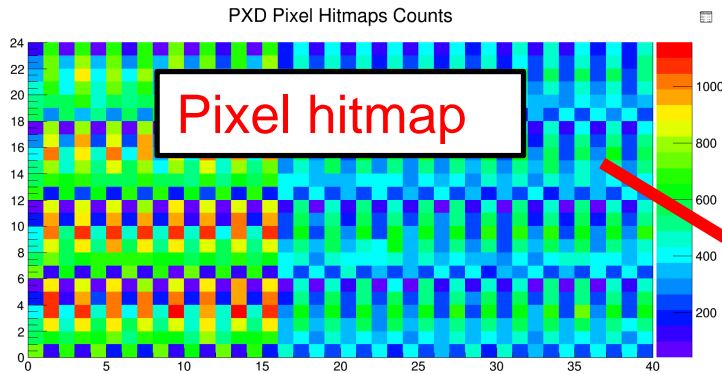
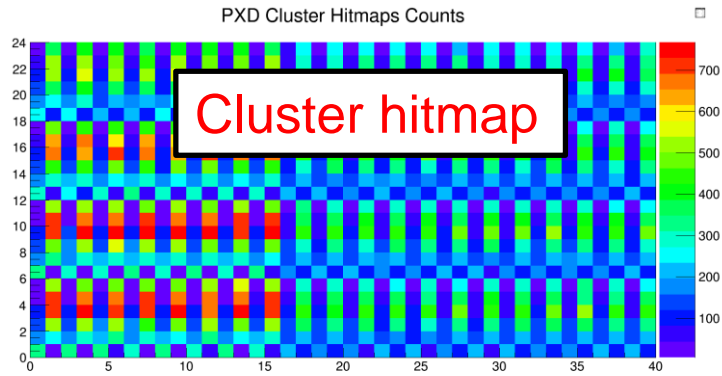
(1 event create ~ 2 cluster samples, 4-5 pixels)



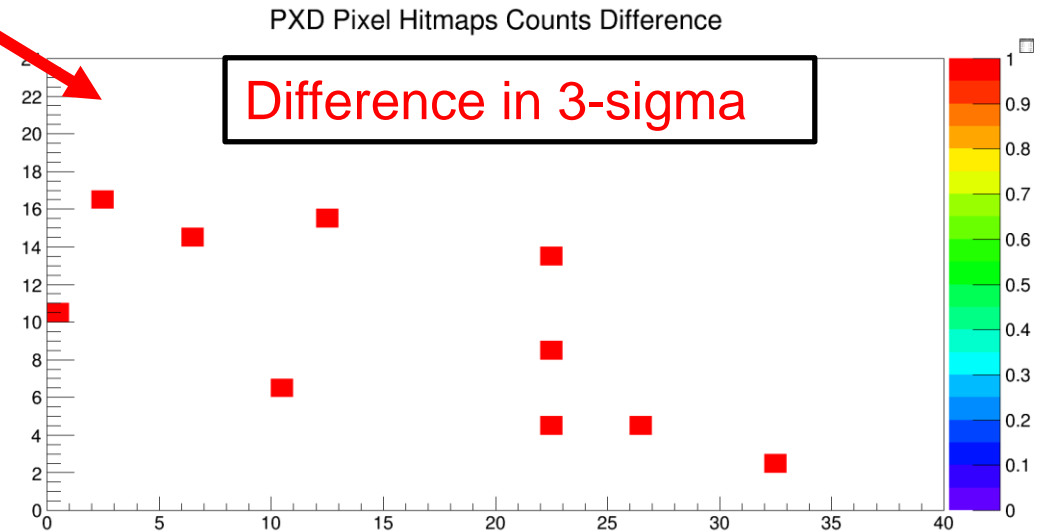
Without noise, particle gun

# Flag monitors

## Counts



From hitmap is derivate flag monitor showing unexpected differences.



# Status summary and plans.

Observable variables for PXD and SVD (VXD) on basf2.

**Missing, Done, For discussion, Related to SVD only**

shifter – mean shifter need check shape of histogram.

expert – mean is on call for shifter in case of non-green flag is coming, he check set of detail histograms for sensor, for pixel/strip expert evaluate list of noisy/dead channels for masking.

flag – mean there is automatic comparison of shape of histogram and check sum of hits, ch2 p-value, mean, MPV or RMS (depend of shape of plot) and propagate to cumulative flags for shifter.

per sensor/pixel/strip – need higher statistics, can create also set of histograms but just creation of flag should be enough.

# Status summary and plans.

Observable variables for PXD and SVD (VXD) on basf2.

**Missing, Done, For discussion, Related to SVD only**

Pixel level:

input: pixel/strip: position, signal, timebin(SVD)

monitor:

- ~~1. trigger rate: number of triggers per time unit, no output – not in VXD DQM~~
2. occupancy (number of hits per xxx triggers) – **PXD\_%\_Fired (per sensor)**
  - a. per layer – shifter, hitmap, propagate histograms 2x 1D, 1x 2D, flag
  - b. per sensor – expert, propagate flag – **PXD\_%\_PixelHitmap(U,V)**
  - c. per pixel/strip – expert, calibration, propagate flag **for masking! ??? Do we need it for shifter?**
3. signal (number of signals per xxx triggers)
  - a. per layer – shifter, histogram, propagate histograms 1x 1D, flag
  - b. per sensor – expert, propagate flag – **PXD\_%\_PixelCharge**
  - c. per pixel/strip – expert, calibration, propagate flag **For calibration! ??? Do we need it for shifter?**
4. timebin distribution (**only SVD**, timebins per xxx triggers)
  - a. per layer – shifter, histogram, propagate histograms 1x 2D, flag
  - b. per sensor – expert, propagate flag
  - c. per pixel/strip – expert, propagate flag

# Status summary and plans.

Observable variables for PXD and SVD (VXD) on basf2.

**Missing, Done, For discussion, Related to SVD only**

Cluster level:

input: cluster: position, seed, signal, cluster size in u, v, u+v(PXD), shape (PXD), time(SVD)

monitor:

1. occupancy (number of clusters per xxx triggers) – **PXD\_%\_Clusters (per sensor)**
  - a. per layer – shifter, hitmap, propagate histograms 2x 1D, 1x 2D, flag
  - b. per sensor – expert, propagate flag – **PXD\_%\_HitmapClt(U,V)**
  - c. ~~per pixel/strip – expert, calibration, propagate flag ??? Do we need it for shifter?~~
2. seed and signal (number of signals per xxx triggers)
  - a. per layer – shifter, histogram, propagate histograms 1x 1D, flag **??? Do we need it? For shifter?**
  - b. per sensor – expert, propagate flag – **PXD\_%\_ClusterCharge/\_Seed**
  - c. ~~per pixel/strip – expert, calibration, propagate flag ??? Do we need it for shifter?~~
3. time distribution (**only SVD**, time per xxx triggers)
  - a. per layer – shifter, histogram, propagate histograms 1x 1D, flag
  - b. per sensor – expert, propagate flag
  - c. per pixel/strip – expert, propagate flag
4. correlations between layers
  - a. neighbor layers – shifter, hitmap, propagate histograms 2x 1D, 1x 2D, flag – **done**
  - b. non- neighbor layers – expert, hitmap, propagate histograms 2x 1D, 1x 2D, flag – **done**

**Thank you for your attention.**