QA of Q-vectors
&
current status RP code

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For the DST production,

- QA of Q-vectors

  - I am checking Q-vectors stored in DST.

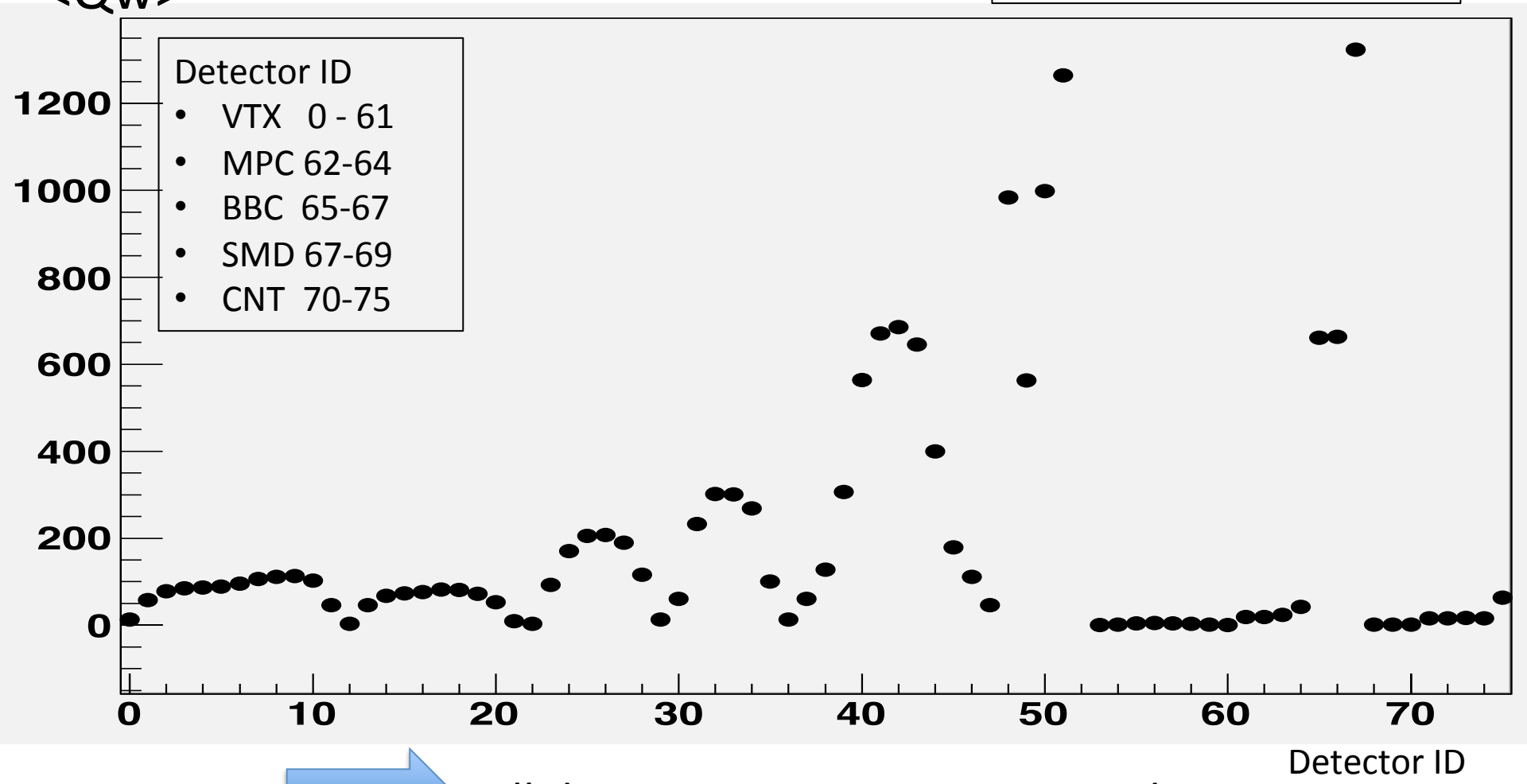
- Reaction Plane code

  - I made reaction plane code.

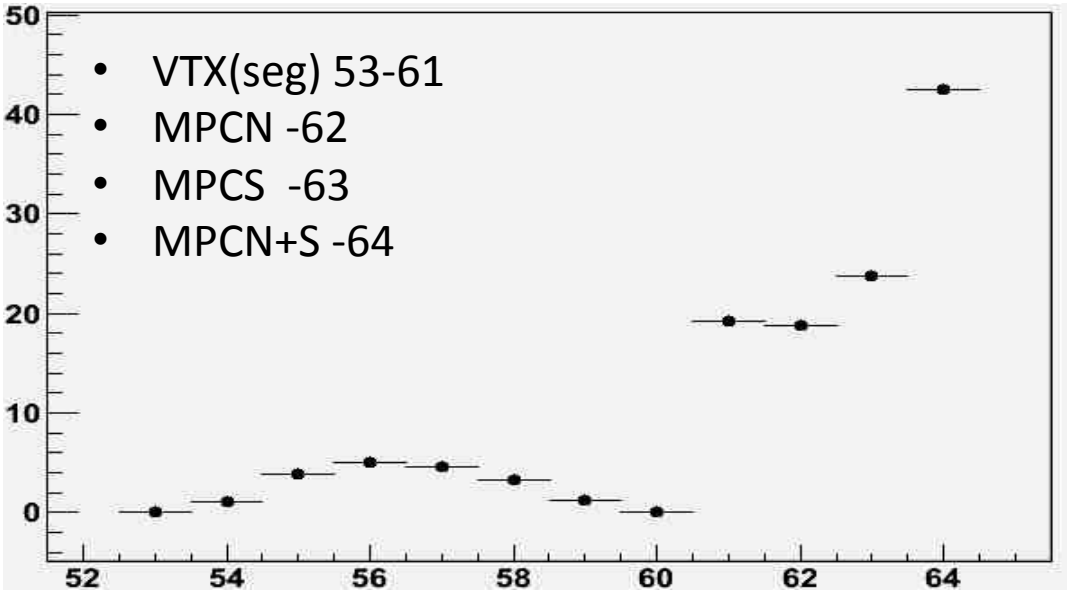
  - Now, I am testing these codes.

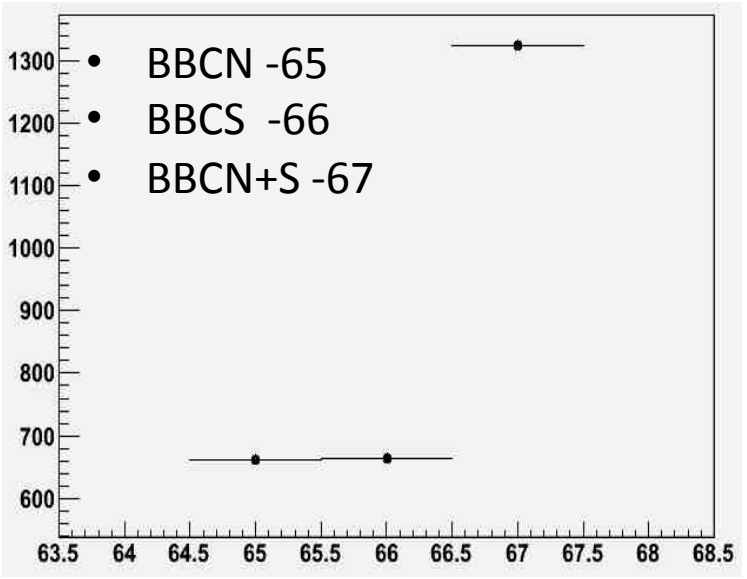
QA of Q-vectors
<Qw> vs detector

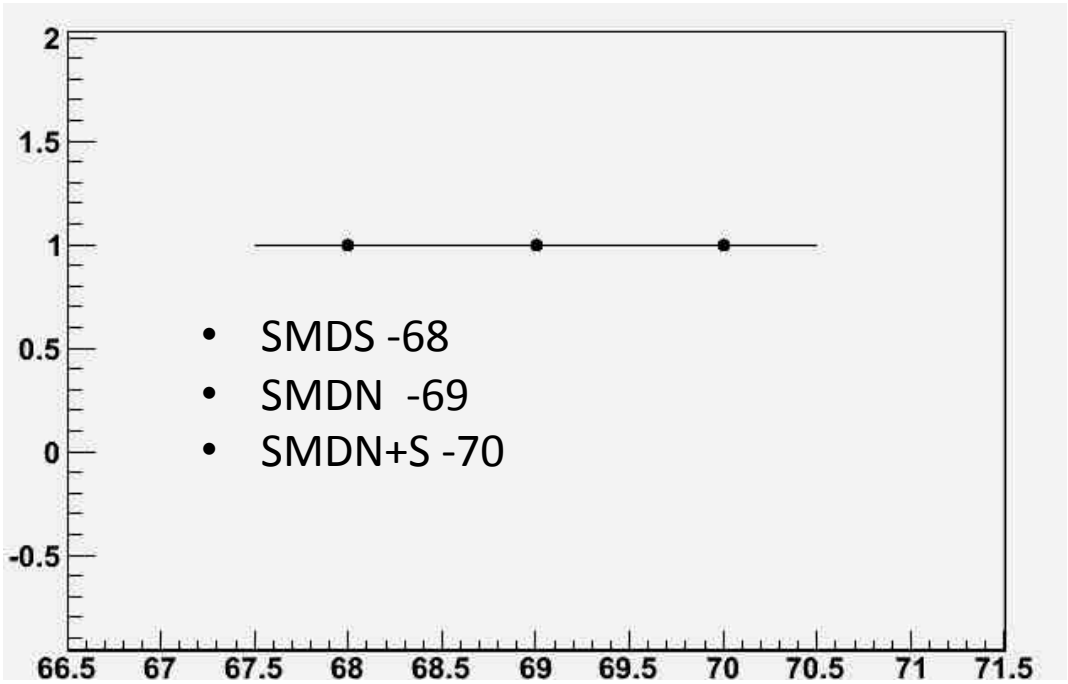
centrality 0-20%
Zvertex -10~10[cm]
run346663

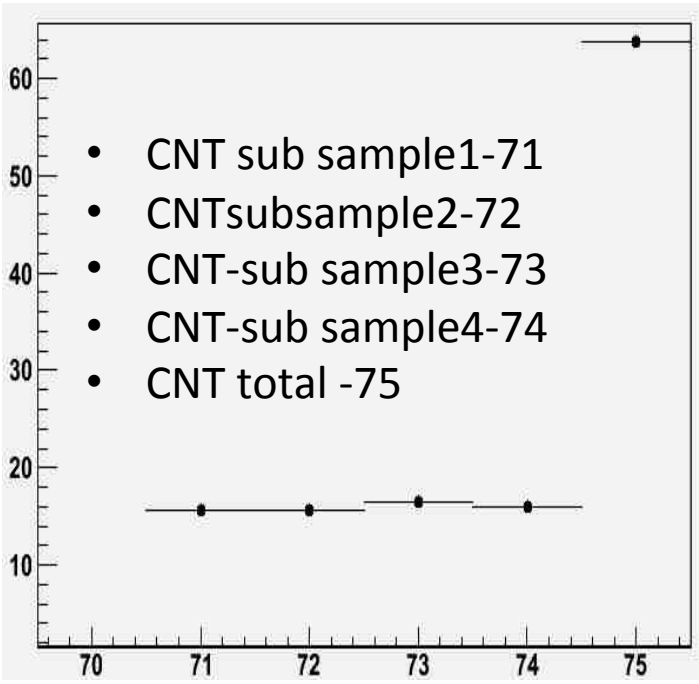


all detector Q-vectors are stored in DST


• VTX(seg) 53-61
• MPCN -62
• MPCS -63
• MPCN+S -64


• BBCN -65
• BBCS -66
• BBCN+S -67

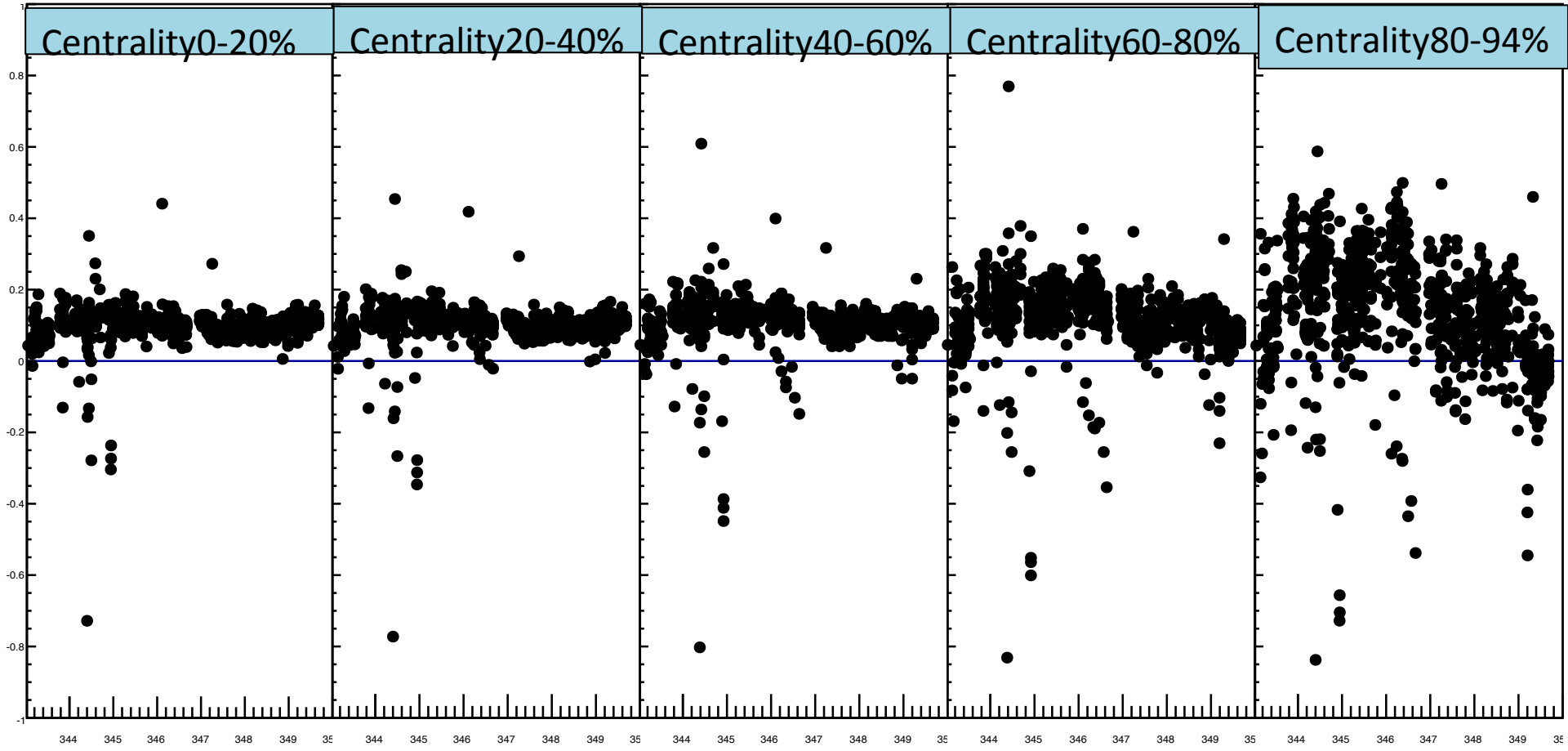

• SMDS -68
• SMDN -69
• SMDN+S -70


• CNT sub sample1-71
• CNTsubsample2-72
• CNT-sub sample3-73
• CNT-sub sample4-74
• CNT total -75

QA of Q-vectors
<Qx> vs runnumber

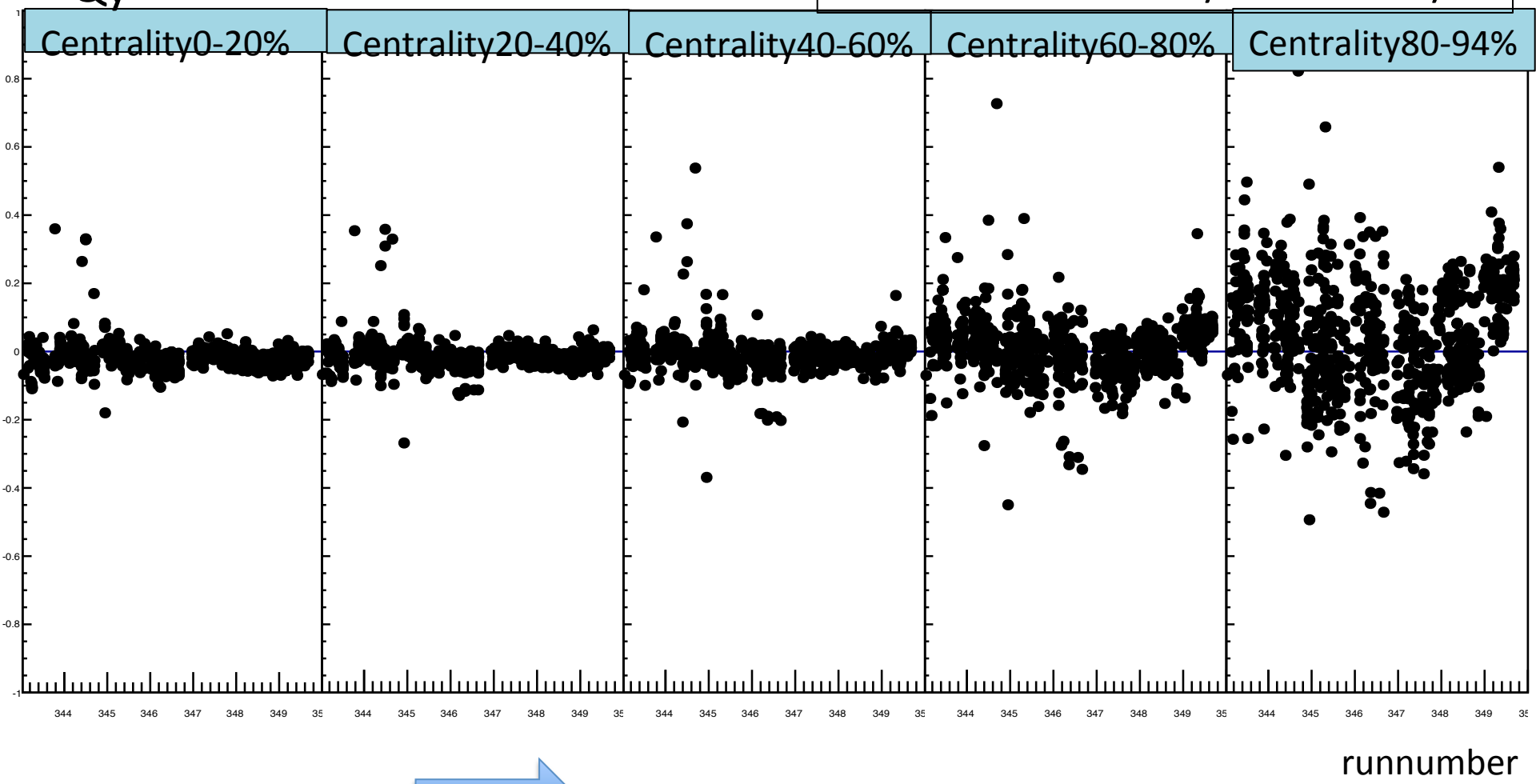
Zvertex -10~10[cm]
Q-vector measured by VTX total layer

<Qx>



QA of Q-vectors
<Qy> vs runnumber

Zvertex -10~10[cm]
Q-vector measured by VTX total layer



Almost Q-vectors are same value.

RP calculation step

module

1 Calculate Q-vectors → SvxRpSumXYReco (Takashi made)

2 Calibrate Q-vectors

-change Q-vector mean coordinate →Q(x,y)=Q(0.0)

-normalization of width →RMS=1

→ RreactionPlaneRecalReco v1(I made)

3 Calculate Reaction Plane

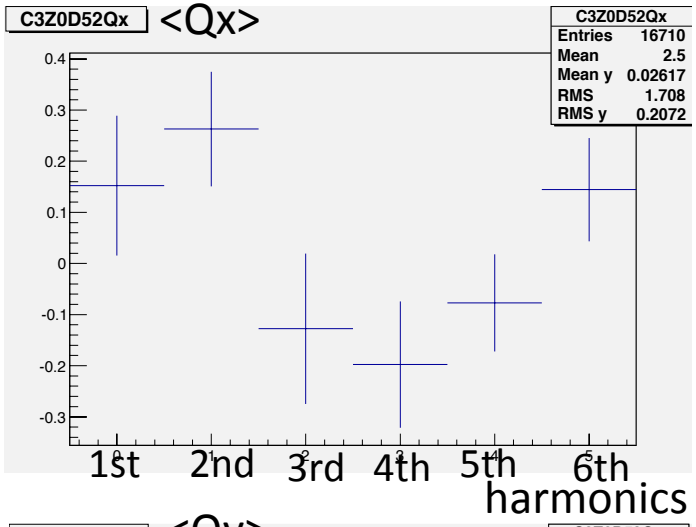
4 Calibrate Reaction Plane → RreactionPlaneRecalv1 (I made)

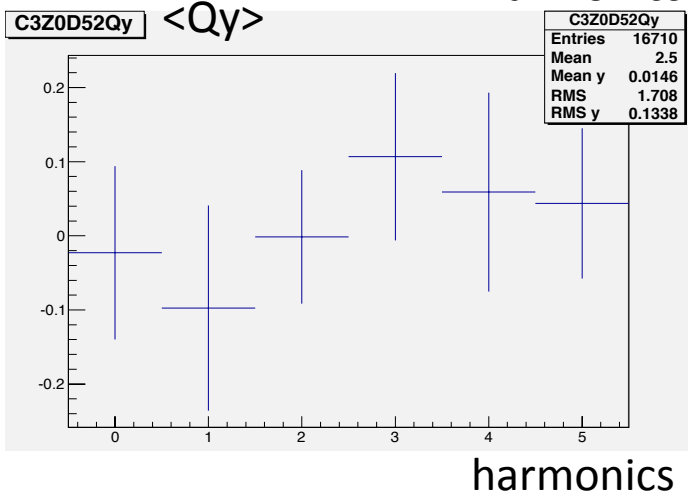
5 Store Reaction Plane

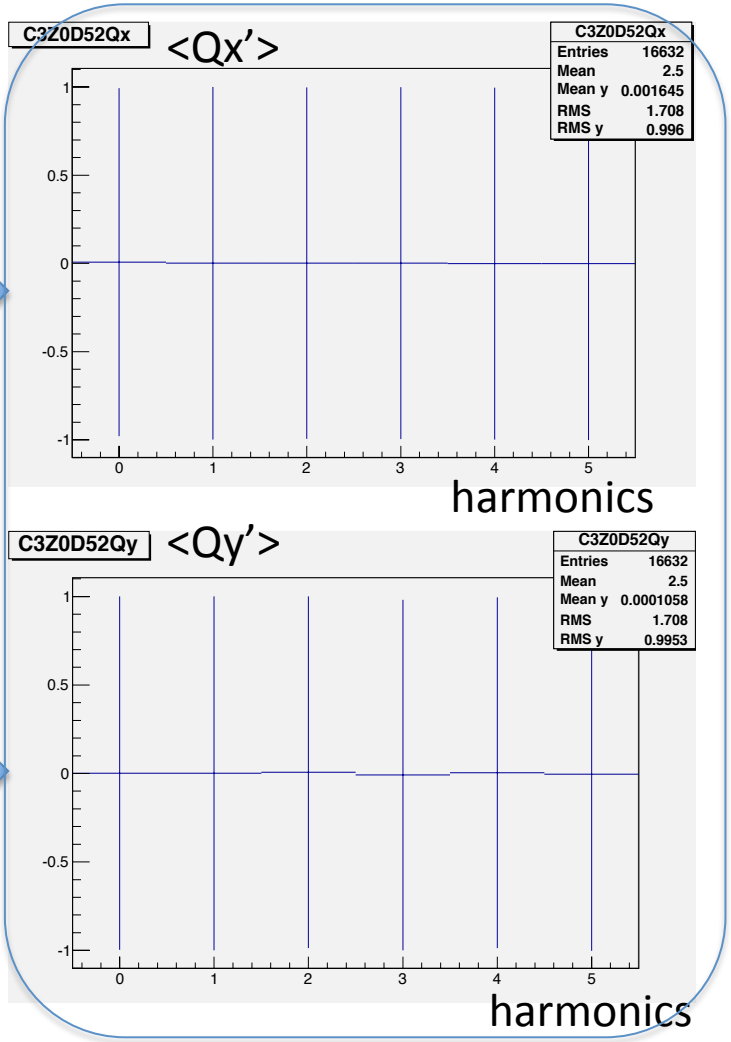
→ I made all calibration step module.
I checked Calibration Q-vector module (2^{nd} step)

Calibration of Q-vectors

calibrated Q-vector







Q-vectors are calibrated. (<Q>(x,y)=(0,0),RMS=1)
But entries are difference !

outlook

- QA

  Q-vecotors are stored in DST file.

- Testing reaction plane calibration code

confirm Re-centering module calibrate Q-vectors (Q-vector mean value is 0 and RMS is 1).

But there is entries problem.

Back up

Reaction Plane for the DST file

- I made 8 modules to store Reaction Plane in DST.
- I am planning to store following Event Class, Harmonics, and Detectors.

Event Class

- centrality 5% step
- z vertex 2[cm] step

Harmonics - 1^{st} - 6^{th} order

Detector

next slide

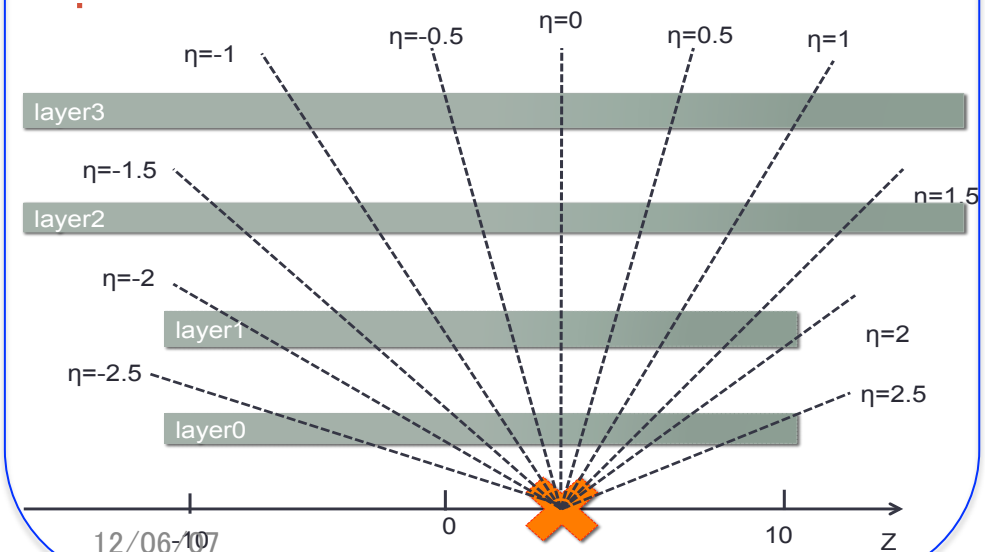
Detector

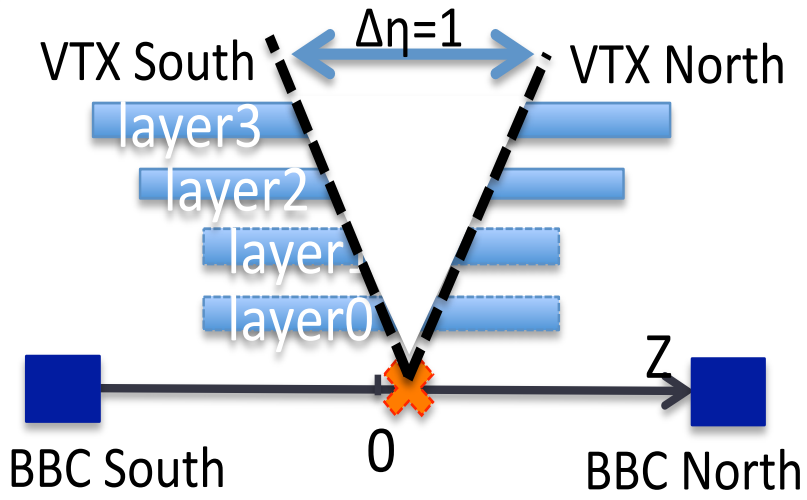
MPC: 3planes, BBC: 3planes,

SMD: 3planes, CNT:5 planes,

SVX: 12planes + 6 planes,

Separate VTX with 0.5 η step.
There are 12 planes.





- Δη=1 VTXS,VTXN,VTXNS
- Δη=2 VTXS,VTXN,VTXNS

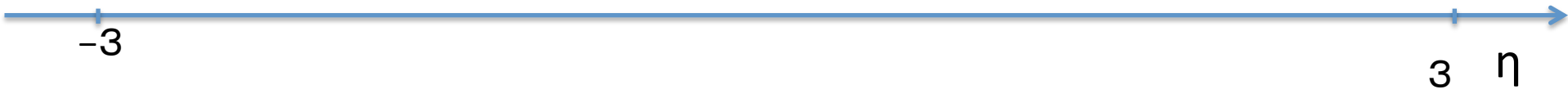
VTX

Cluster

	-3 ~ -2.5	-2.5~ -2	-2 ~ -1.5	-1.5 ~ -1	-1 ~ -0.5	-0.5 ~ 0	0~0.5	0.5 ~ 1	1 ~ 1.5	1.5 ~ 2	2 ~ 2.5	2.5 ~ 3	-3~3
Layer0	0	1	2	3	4	5	6	7	8	9	10	11	48
Layer1		12	13	14	15	16	17	18	19	20	21		49
Layer2			22	23	24	25	26	27	28	29			50
Layer2				30	31	32	33	34	35				51
Total	36	37	38	39	40	41	42	43	44	45	46	47	52

Segment

	-3 ~ -2.5	-2.5~ -2	-2 ~ -1.5	-1.5 ~ -1	-1 ~ -0.5	-0.5 ~ 0	0~0.5	0.5 ~ 1	1 ~ 1.5	1.5 ~ 2	2 ~ 2.5	2.5 ~ 3	-2~2
Total			53	54	55	56	57	58	59	60			61



Modules for storage of RP

/offline/package/reactionplane

Code name	explanation	modification
ReactionPlaneObject	Interface of ReactionPlaneObject	Add function for v4
ReactionPlaneObjectv4	Store RP	New one
ReactionPlaneSngl	Interface of RP	New one
ReactionPlaneSngl v1	Storage RP	New one
ReactionPlanCalibv1	Modification functions	New one

/offline/framework/recal

Code name	explanation	modification
ReactionPlanRecalRecov1	Calibration of Q-vector	New one
ReactionPlanRecov1	Calibration of RP	New one

/offline/analysis/rpcalib

Code name	explanation	modification
RpCalibratorv1.C	Upload calibration parameter	New one

RP calculation step (from Shinichi's slide)

1. Q-vector (summation over i hits/tracks)
   - $Q_{\{n\}x} = \Sigma_i \{ w_i \cos(n \phi_i) \} / \Sigma_i \{ w_i \}$
   - $Q_{\{n\}y} = \Sigma_i \{ w_i \sin(n \phi_i) \} / \Sigma_i \{ w_i \}$

VTX_DST production

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2. re-centering, normalization of width
   - $Q'_{\{n\}x} = (Q_{\{n\}x} - \langle Q_{\{n\}x} \rangle) / \sigma_{Q\{n\}x}$
   - $Q'_{\{n\}y} = (Q_{\{n\}y} - \langle Q_{\{n\}y} \rangle) / \sigma_{Q\{n\}y}$

Recalibrator Stage

Calibration Parameters:
$\langle Q_{\{n\}x} \rangle$, $\langle Q_{\{n\}y} \rangle$, $\sigma_{Q\{n\}y}$, $\sigma_{Q\{n\}x}$

3. n-th harmonics reaction plane
   - $\Phi_{\{n\}} = \text{atan2}(Q'_{\{n\}y}, Q'_{\{n\}x}) / n$

4. Fourier flattening (k=1~8 order corrections)
   - $n \Phi'_{\{n\}} = n \Phi_{\{n\}} + \Sigma_k (2/k) \{ - \langle \sin(k n \Phi_{\{n\}}) \rangle \cos(k n \Phi_{\{n\}}) + \langle \cos(k n \Phi_{\{n\}}) \rangle \sin(k n \Phi_{\{n\}}) \}$

Calibration Parameters:
$\langle \sin(k n \Phi_{\{n\}}) \rangle$, $\langle \cos(k n \Phi_{\{n\}}) \rangle$

5. After flattening

$\Phi''_{\{n\}} = \text{atan2}\{ \sin(n \Phi'_{\{n\}}) , \cos(n \Phi'_{\{n\}}) \} / n$

Calibration Parameters are needed
For each Z/centrality event class