Current status of Reaction Plane Code development & QA of Q-vectors

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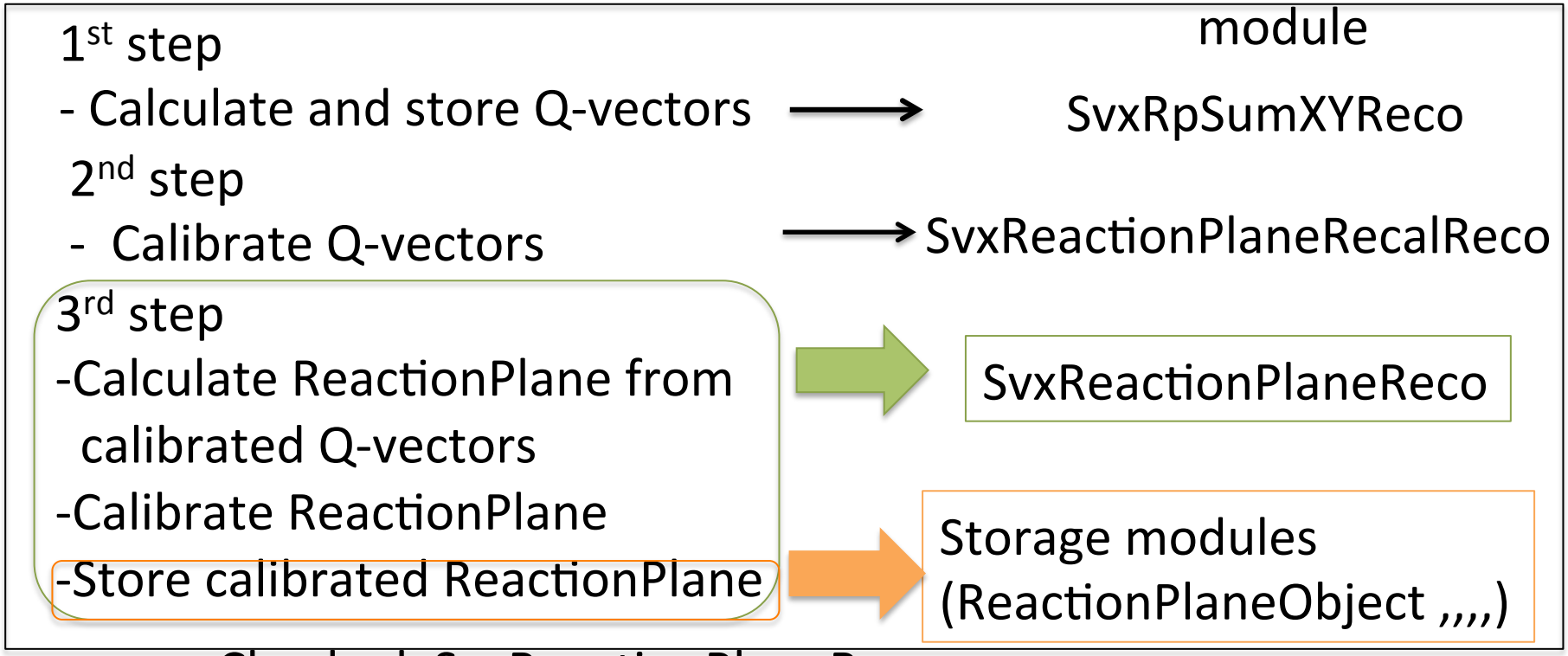
RP calculation and storage step



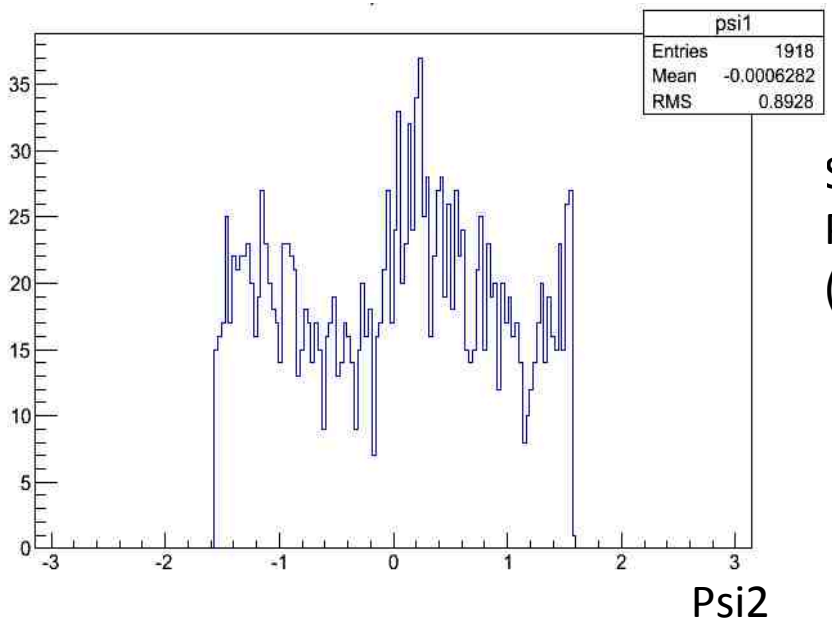
- Checked SvxReactionPlaneReco
  - Compared calibrated RP by SvxReactionPlaneReco to calibrated RP by my calculation. Plotted RP.
- Checked storage modules.
  - stored the numbers that I know in DST.
  - stored RP in DST.

Result of calibration part in SvxReacionPlaneReco

I plotted ReactionPlane(harmonis=2) measure by VTX total layer

Centrality 0-20%

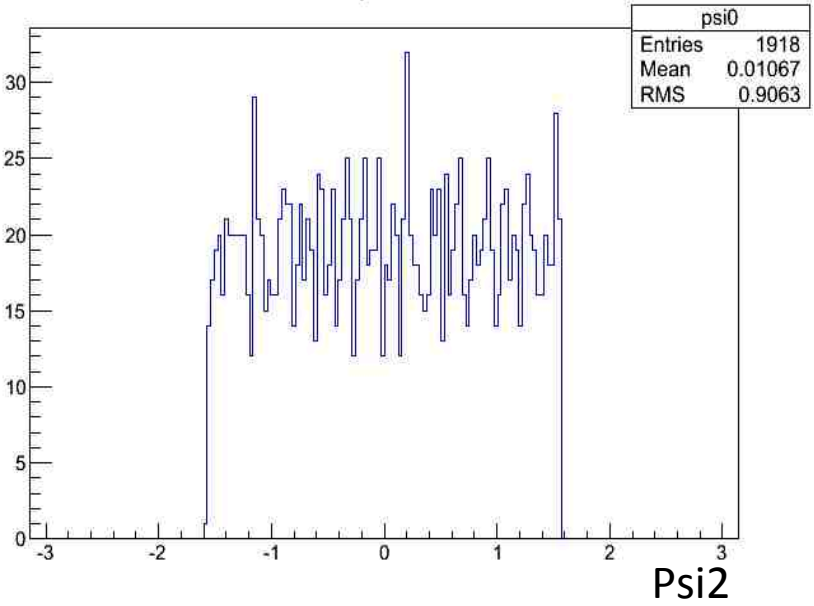
ReactionPlane(harmonics=2)



SvxReaction PlaneReco (Calibrate RP)

Centrality 0-20%

Calibrated ReactionPlane(harmonics=2)



ReactionPlane is flattened .

So ReactionPlane is calibrated by SvxReactionPlaneReco.

Result of Storage modules

I plotted ReactionPlane(harmonis=2) measure by VTX total layer

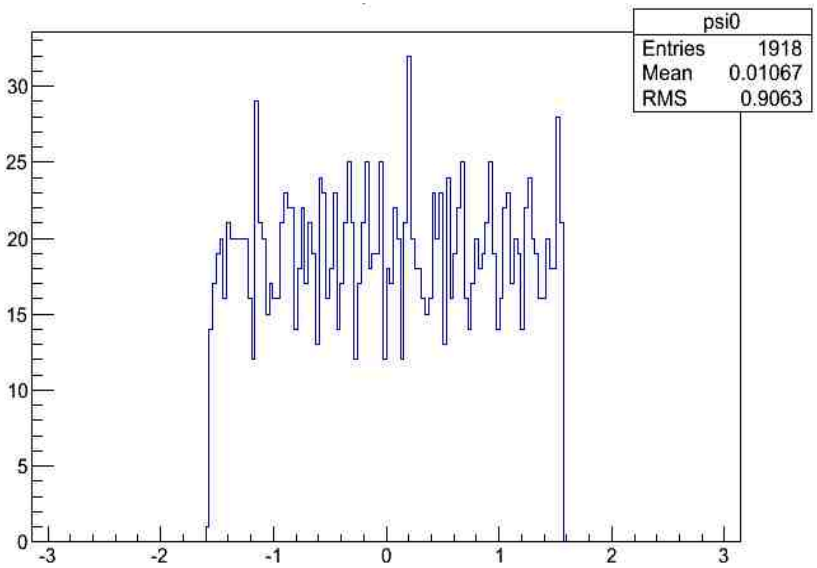
-Left side plot is RP before stored in DST.

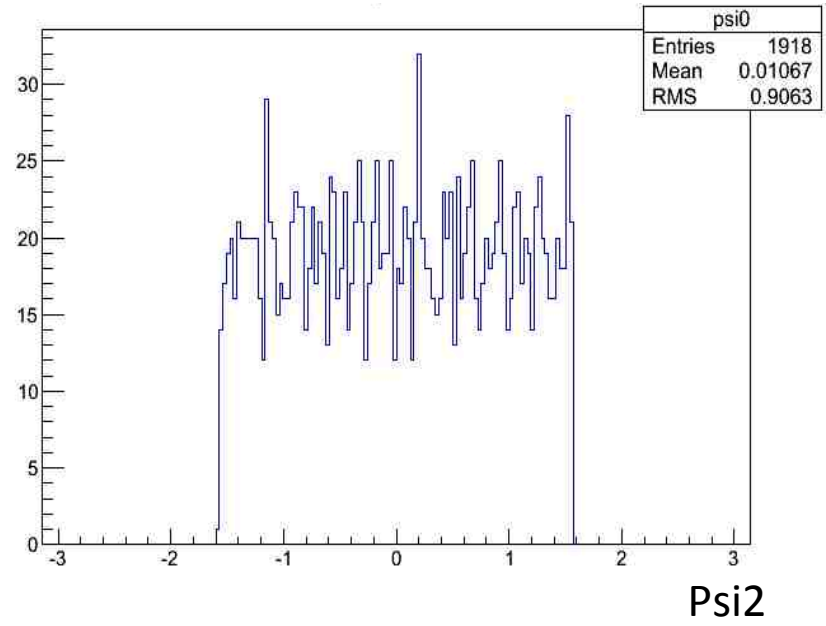
-Right side plot is RP in DST

Centrality 0-20%
Calibrated ReactionPlane(harmonics=2)

store → DST →

Centrality 0-20%
ReactionPlane(harmonics=2) from DST





Left side RP plot and Right side RP are same distribution.
So storage modules can work

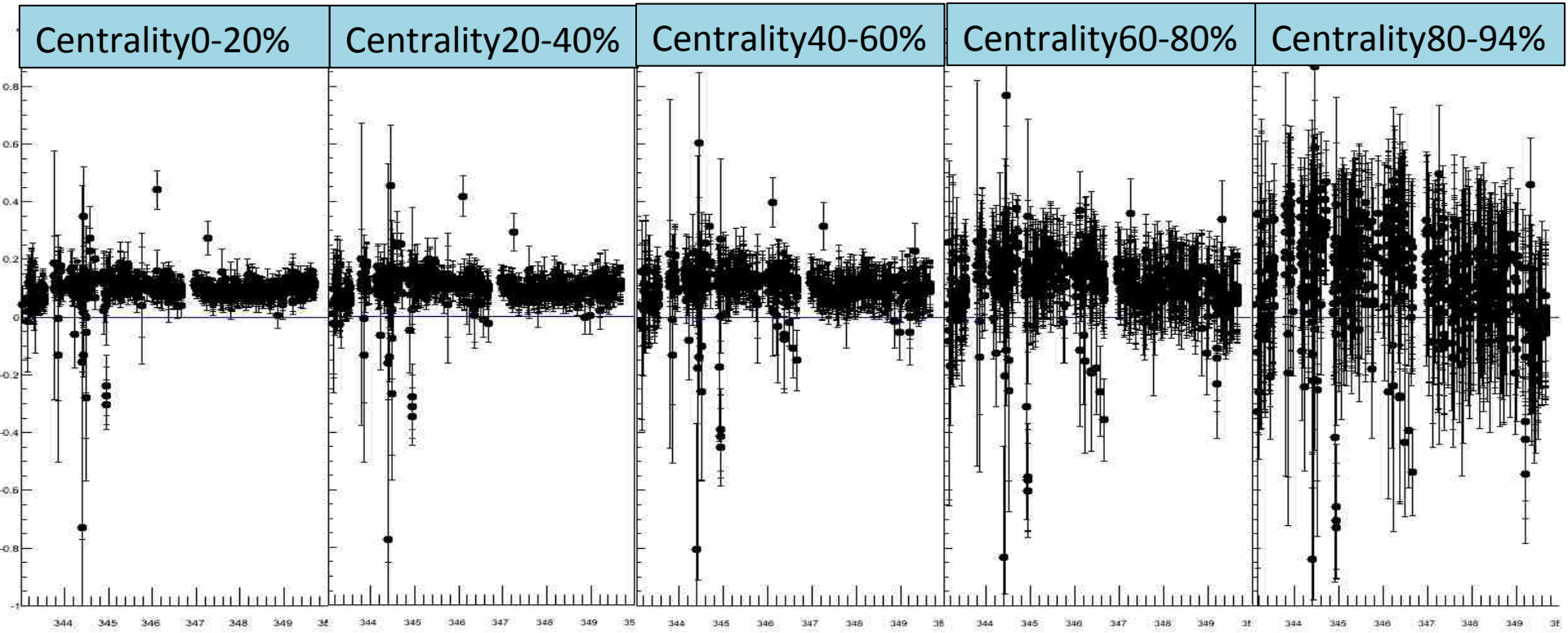
QA;<Qx> vs runnumber

$$< Qx >= \sum^{Nevents} Qx / Nevents \; (Qx = \frac{\sum_{i}^{Nhits} \cos(\phi_i)}{Nhits})$$

$$Errorbar =< RMS_{Qx} >$$

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

<Qx>



runnumber

RMS becomes wider as multiplicity becomes lower

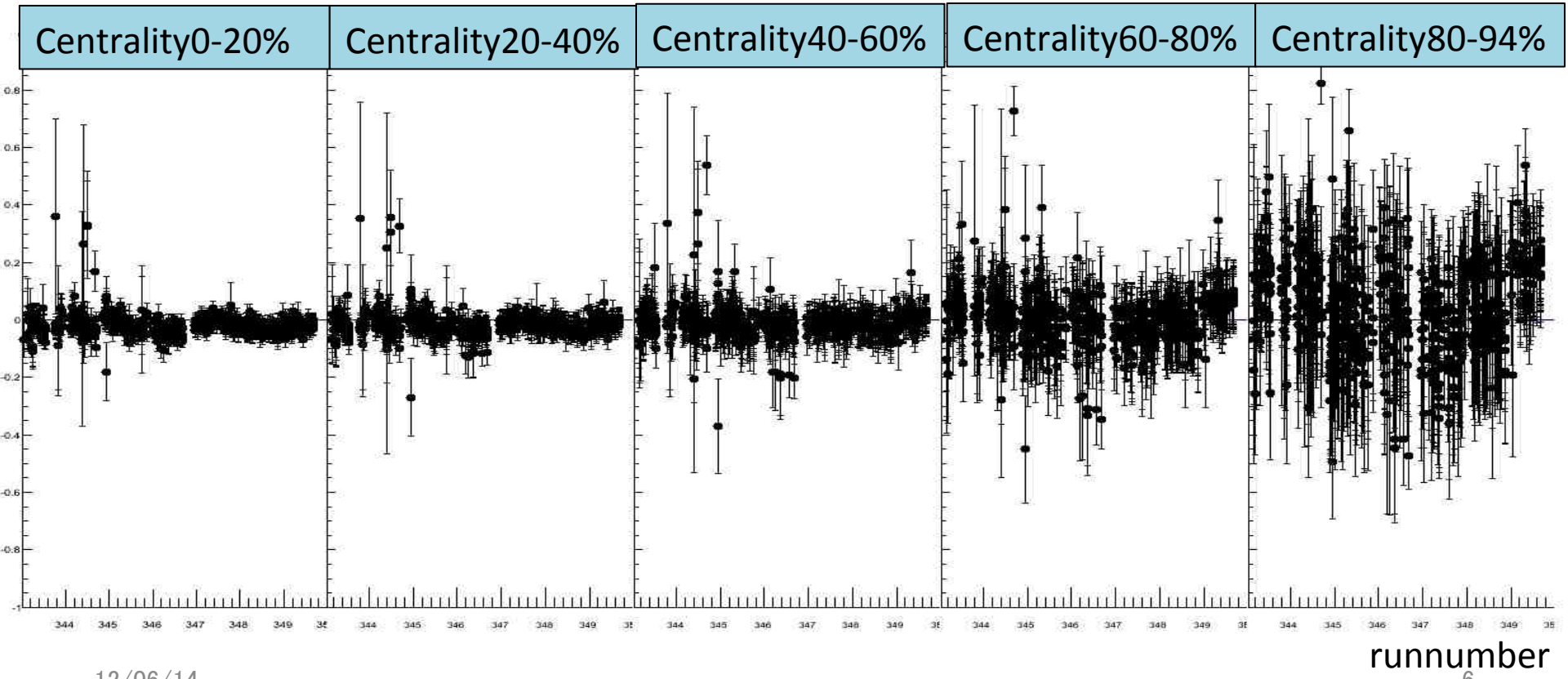
QA;<Qy> vs runnumber

$$< Qy >= \sum^{Nevents} Qy / Nevents(Qy = \frac{\sum_{i}^{Nhits} \sin(\phi_i)}{Nhits})$$

$$Errorbar =< RMS_{Qy} >$$

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

<Qy>



Summary

- RP code
  -Checked calibration of ReactionPlane module.
  → all calibration module are good.
  -Checked storage module.
  →ReactionPlane can be stored.
- QA
  -Almost Qvectors are good.

Back up

Storage of Reaction Plane

- I made 8 modules to calibrate and store Reaction Plane
- 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

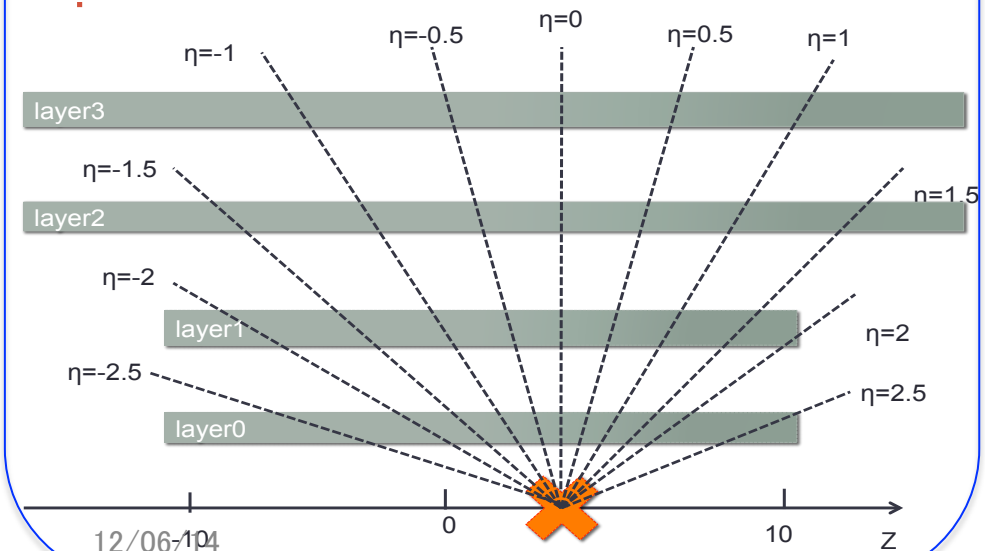
Detector

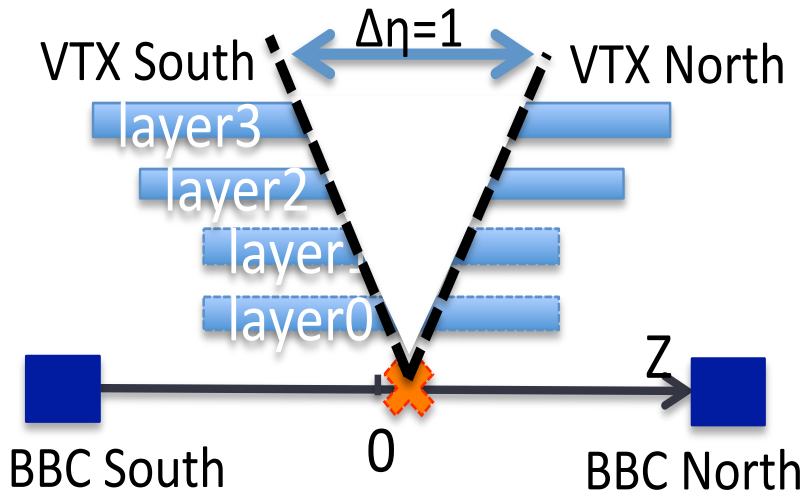
MPC: 3planes, BBC: 3planes,

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

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