Vernier Scan Instructions

RIKEN/RBRC

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Vernier Scan Procedure

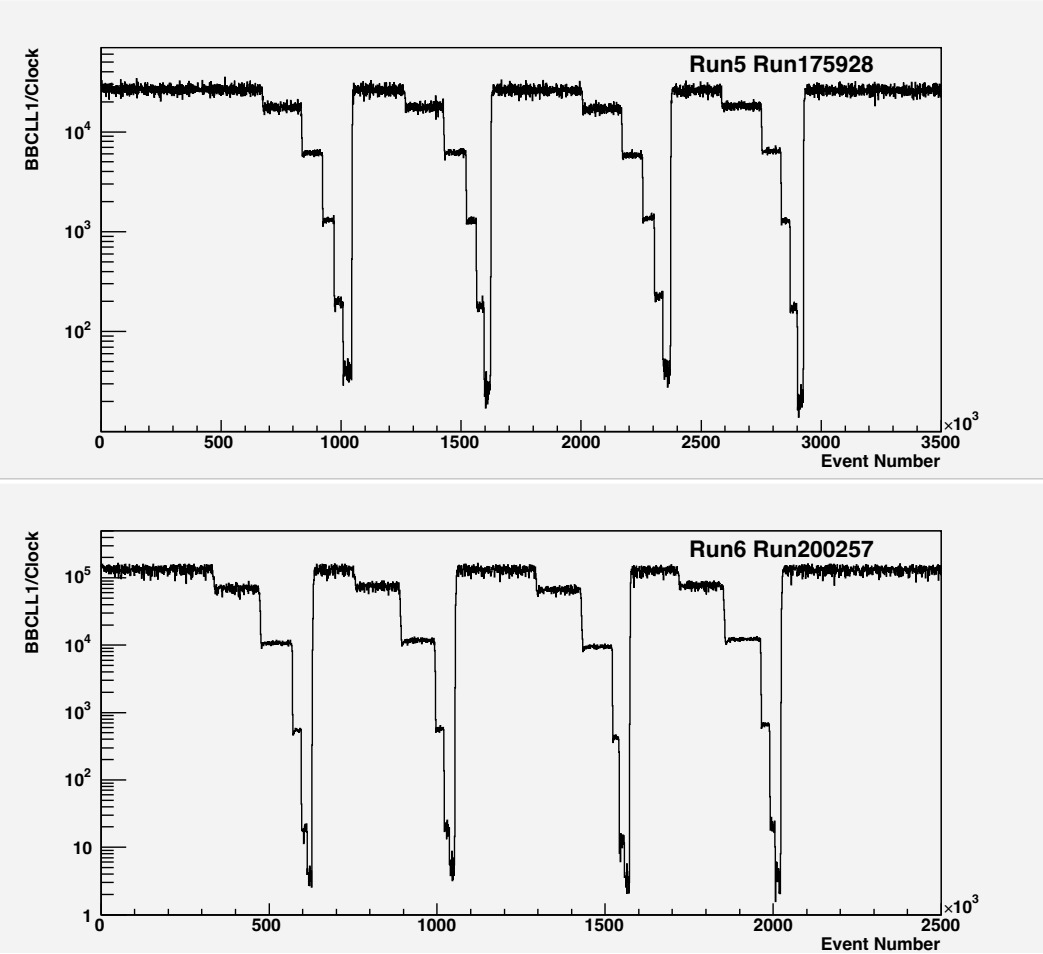
1. Activate only GL1p, MBD, and ZDC in the DAQ.
2. Keep the power in ”safe position” for other detectors.
3. Set trigger prescales as Table. 1.
4. Start rcdaq.
5. Call MCR to start steering the magnets on either side of the sPHENIX IP to step one of the beams (blue or yellow) across the other (Angelika should know the procedure).
6. Typically the beam is moved every thirty seconds by a few hundred microns. The decrease and subsequent increase in the rates in the MBD can be monitored by the scaler display.
7. Once scan is completed (~ 10 minutes), MCR supposed to give a call to 1008.
8. Stop rcdaq. Make an entry to the cold-QCD channel (Time, Run#) in the mattermost.

Table. 1. Triggers for Vernier scan

Trigger	Scaledown
CLOCK	10000
MBD N&S>=1	10
MBD N>= 1	500
MBD S>= 1	500
ZDC Coincidence	0
ZDC N	100
ZDC S	100

What we see during the Vernier Scan

BBC rate vs Time



MBD rates drastically changes as beam position shifts in steps.

Beam position vs time

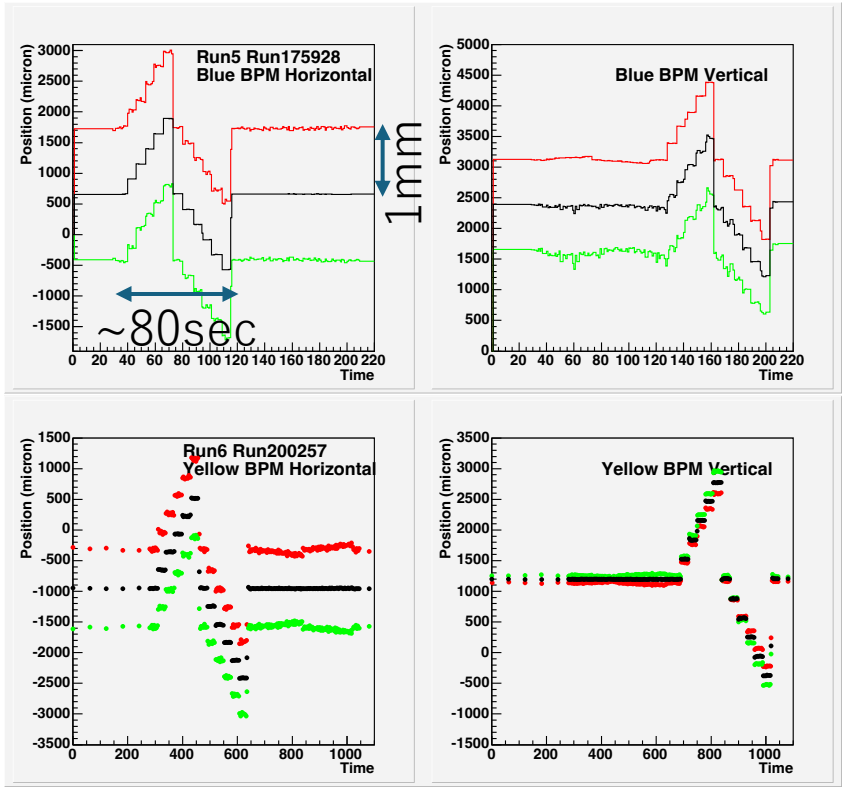


Figure 2: Positions measured by BPM vs time on the south side (7 o'clock) of the IR (Red) the north side (8 o'clock) of the IR (Green) and the mean of the two (Black) for typical two runs in Run5 and Run6. In run5-run175928, the north side measurement shows a unstable behavior and give an unreliable result. The south side measurement is good.

What is GL1p Scalers?

GL1p trigger mapping

- Last updated : 2024/6/6

(Martin - I added the current GL1 trigger numbers as I see them)

Channel	Trigger	GL1 Trigger number
0	MBD NS	10
1	MBD VTX	14
2	MBD +/-10cm VTX	12
3	MBD S	8
4	MBD N	9
5	ZDC NS	3
6	ZDC S	1
7	ZDC N	2
8	CLOCK	0

- GL1p scalers are trigger scalers for each bunch crossing. GL1p scaler records 9 triggers on the left table for each 120 bunches.

Request to Angelika

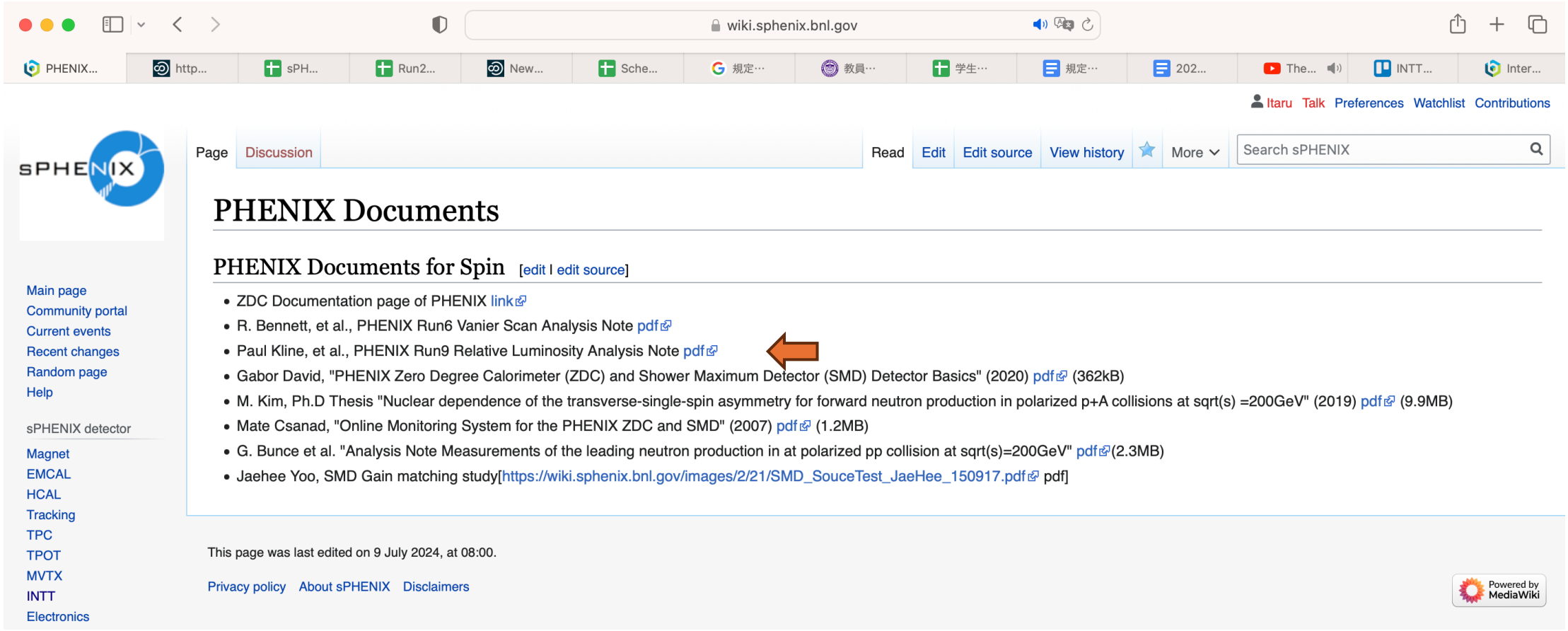
- We don’t have strong preference to customize vernier scan, since this is the first measurement for sPHENIX.
- 40 to 45 seconds/STEP for 11 ~ 12 STEPS for each horizontal and vertical steps.
- Scan range can be as you recommend based on your experience.

Backups

Data to be provided from MCR

- Beam Position Monitor (BPM) information (how do we synchronized with sPHENIX data needs to be sorted out) for the beam position during the scan.
- Wall Current Monitor (WCM) and the Direct Current Current Trans- former (DCCT) for the beam current information.

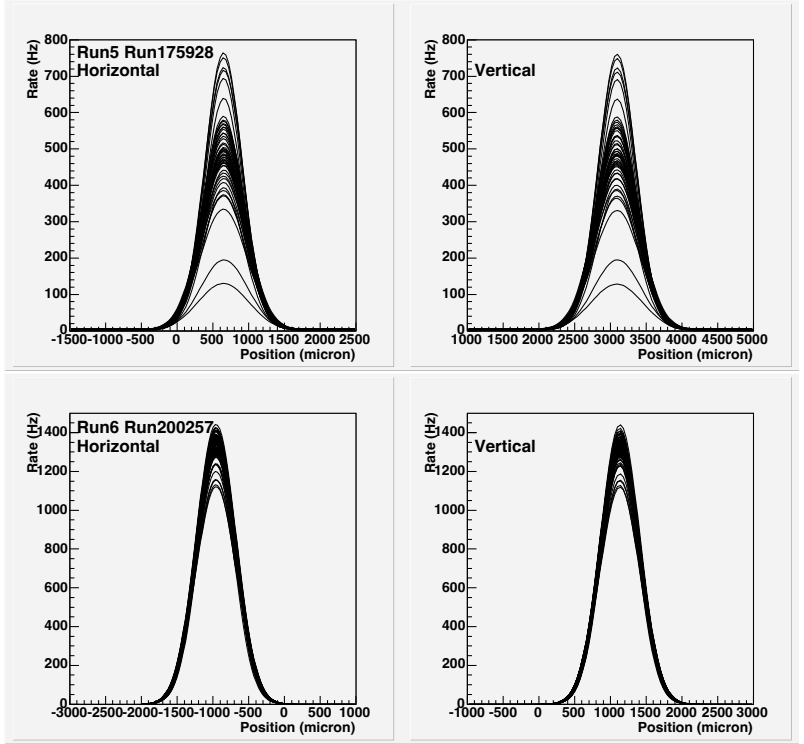
Reference



https://wiki.sphenix.bnl.gov/index.php?title=PHENIX_Documents

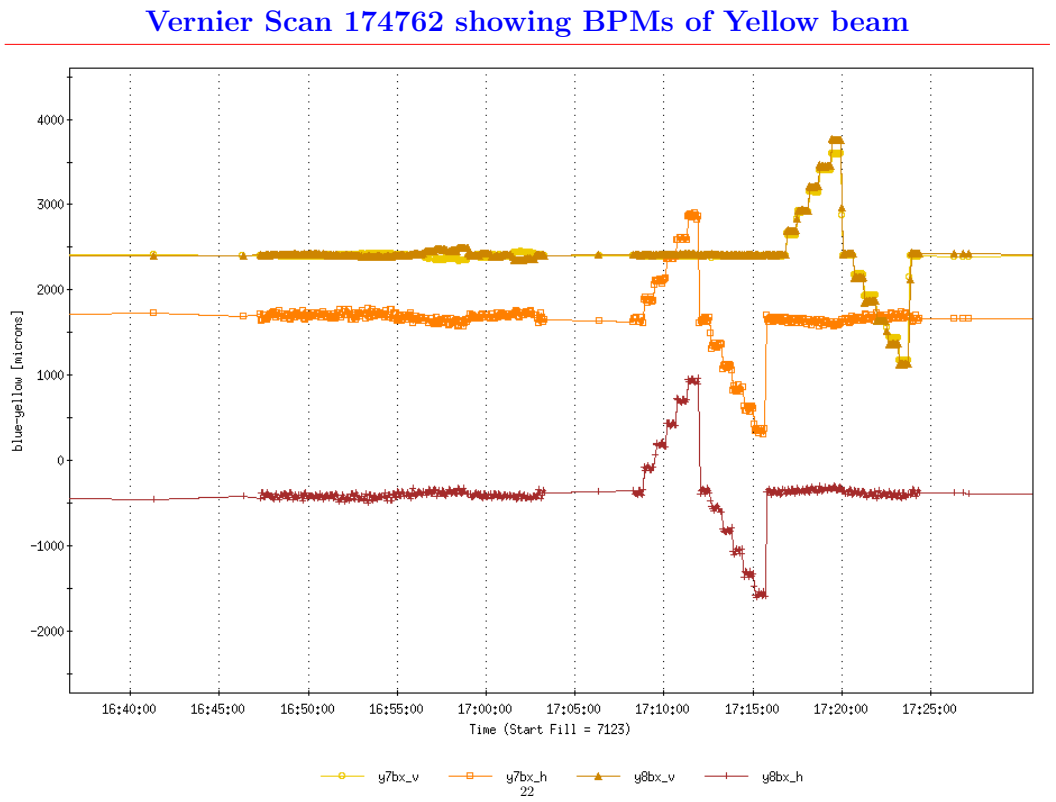
Analysis

$$(\mathcal{L}_{\text{machine}})_i = \frac{f_{\text{beam}}}{2\pi(\sigma_H)_i(\sigma_V)_i}(N_b \cdot N_y)_i,$$



- N_b,N_y : From WCM
- σ_H, σ_V : From Gaussian fitting for each bunch
- f_{beam} : RHIC Revolution frequency=78.2 kHz

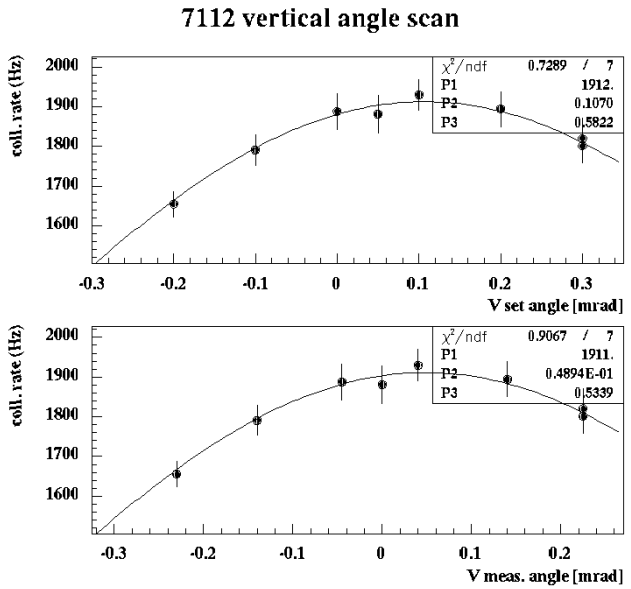
Run 5 Vernier Scan Example



- Scanned ±1.5mm range in 12 STEPS
- 40 seconds/STEP
- 8 minutes total

Angle dependence study by Angelika

Preliminary Results from Angle Scan (From Angelika)



- Is this opening angle?