

# NPS-DVCS-Jan2024

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## Abstract

A plan for completing the NPS 2023-2024 by 07:00 on 20 May 2024

## 1 Angle Constraints

There are tight constraints on the HMS and SHMS angles that must be respected. These are particularly challenging for the low- $x_{Bj}$  settings. In those cases I have slightly tweaked the NPS calorimeter angle(s) to respect the minimum HMS-SHMS separation requirements.

1. HMS minimum angle 12.373 deg. This is due to an interference with the special NPS beam pipe. This is independent of all other constraints
2. NPS-HMS Separation
  - (a) Current minimum separation between NPS and HMS is 26 deg. This corresponds to an SHMS to HMS separation  $\geq 42.3^\circ$ . We may need a new verification / spotting for less than 27 deg.
  - (b) I currently plan for the wings to come off the Sweep Magnet 6-March-2024. Then the minimum separation angle is expected to drop to 24.14 deg (SHMS-HMS  $\geq 40.44^\circ$ ). This will need to be re-certified by S. Lassiter.
3. NPS Minimum angle constraints
  - (a) Current NPS angle requirement is  $\gtrsim 12.00$  deg, but spotters are needed below  $12.20^\circ$ . This is due to the Pb blocks mounted on the back of the Sweep Magnet. This shield can come off anytime, I currently plan removal for 23-Feb-2024.
  - (b) After removal of Pb on Sweep Magnet, the minimum planned angle is 7.4 deg.

## 2 Remaining 5-Pass Run Plan

Table 1 is a proposed chronological run plan for the remaining 5-pass running.

At 4 m, the calorimeter horizontal acceptance (relative to the geometric midline) is  $-13$  columns and  $+15$  column. This is  $-260$  mm and  $+300$ mm. At 3 m, we expected  $\pm 100$  mrad

At 4 m, I am tuning the split kinematics to achieve this  $\pm 100$  mrad horizontal acceptance. In angular acceptance at 4 m, this means the two calorimeter angle settings that split the statistics are offset from the nominal  $q$ -vector direction by  $-35$  mrad =  $-2.005^\circ$  and  $+25$  mrad =  $+1.432^\circ$ . These are spatial offsets of  $-140$  mm and  $+100$  mm.

At the moment, it appears that the wings on the Sweep Magnet only have to come off for KinC\_x25\_4. They can go back on for all Spring 3-Pass and 4-Pass kinematics.

Table 1: **Chronological Run Plan for Final 5-Pass NPS Running** 22-Jan to 11-Mar 2024 (07:00). Starting times are assumed  $\sim 08 : 00$ . Measured 5-Pass energy is  $10,544 \pm 4$  MeV.

Kinematic	Start 2024	$x_{Bj}$	$Q^2$ GeV <sup>2</sup>	$k_{\text{HMS}}$ GeV	$\theta_{\text{HMS}}$ deg	$\theta_{\text{NPS}}$ deg	$\theta_{\text{SHMS}}$ deg	$\theta_{\text{NPS}} + \theta_{\text{HMS}}$ deg	$D_{\text{Calo}}$ m
KinC_x50_2	22-Jan	0.48	3.40						
KinC_x50_3	26-Jan	0.48	4.80						
KinC_x36_5'	29-Jan	0.36	4.00	4.637	16.435	14.000	30.300	30.434	4.00
KinC_x60_3a KinC_x60_3b	1-Feb	0.58	5.10	5.878	16.483	16.713 20.151	33.013 36.451	33.196 36.633	4.00
KinC_x60_4a KinC_x60_4b	7-Feb	0.58	6.00	5.038	19.348	14.075 17.512	30.375 33.812	33.422 36.860	4.00
	23-Feb	Remove Pb-Shield on Sweep Magnet, continue KinC_x60_4							
KinC_x36_6	25-Feb	0.36	5.00	2.416	26.849	7.400	23.700	34.250	4.00
		Positron runs also for 10% beam charge							
Elastic	5-Mar	5-Pass, Calorimeter at 9.5 m							
	6-Mar	Wings off Sweep Magnet.							
KinC_x25_4	6-Mar	0.250	3.00	4.149	15.05	9.36	25.66	24.41	4.00
		Positron runs also for 10% beam charge							
	11-Mar	Change to 3-Pass							

### 3 Spring 2024 3-Pass and 4-Pass Runs

#### 3.1 3-Pass Schedule

We will have 25 days of 3-Pass beam (including pass-change) March 11 to April 5. We will have an additional 15 days of 3-Pass beam May 5–20.

A sequential schedule of 3-Pass running is listed in Table 2. The kinematics are sorted in order of decreasing calorimeter angle to maximally preserve the calorimeter.

Table 2: Chronological Run Plan for 3-Pass NPS Running. Starting times are assumed  $\sim 08 : 00$ . Expected 3-Pass energy is 6397 MeV. All calorimeter distances are 4.00 m. Days are **Calendar** days, assuming 50% efficiency. Calendar Days include equal statistics on LH<sub>2</sub> and LD<sub>2</sub>, with deuterium running at half the beam current as hydrogen.

Kinematic	Start 2024	$x_{Bj}$	$Q^2$ GeV <sup>2</sup>	$k_{HMS}$ GeV	$\theta_{HMS}$ deg	$\theta_{NPS}$ deg	$\theta_{SHMS}$ deg	$\theta_{NPS}$ + $\theta_{HMS}$ deg	Days
Elastic	11-Mar 11-Mar	Wings Back on Sweep 3-Pass Elastic. Calorimeter at 8.0 m?							
KinC_x50_0	12-Mar	0.48	3.40	2.638	25.939	15.998	32.298	41.937	9.0
KinC_x60_1	21-Mar	0.58	5.10	1.719	39.81	12.24	28.54	52.05	16
	5-Apr	Schedule break for 4-pass							
KinC_x60_1	5-May	0.58	5.10	1.719	39.81	12.24	28.54	52.05	8
KinC_x36_1	13-May	0.36	3.00	1.956	28.341	11.235	27.535	39.576	3
KinC_x25_1	16-May	0.24	2.10	1.734	25.129	8.675	24.975	33.804	3
		Positron running required							

### 3.2 4-Pass Schedule

We will have 21 days of 4-Pass beam (including pass-change) April 5–29. April 29 to May 5 we can potentially have either 3- or 4-pass beam, but neither will be polarized more than  $\sim 50\%$ .

Table 3: **Chronological Run Plan for Final 4-Pass NPS Running.** Starting times are assumed  $\sim 08 : 00$ . Measured 4-Pass energy is  $8,477 \pm 4$  MeV. All calorimeter distances are 4.00 m. Days are **Calendar** days, assuming 50% efficiency. Calendar Days include equal statistics on LH<sub>2</sub> and LD<sub>2</sub>, with deuterium running at half the beam current as hydrogen.

Kinematic	Start 2024	$x_{Bj}$	$Q^2$ GeV <sup>2</sup>	$k_{\text{HMS}}$ GeV	$\theta_{\text{HMS}}$ deg	$\theta_{\text{NPS}}$ deg	$\theta_{\text{SHMS}}$ deg	$\theta_{\text{NPS}} + \theta_{\text{HMS}}$ deg	Days
KinC_x36_2a KinC_x36_2b	6-Apr	0.36	3.00	4.042	17.010	12.360 15.795	28.660 32.095	29.370 32.805	2
KinC_x36_4	8-Apr	0.36	4.00	2.562	24.775	9.890	26.190	34.665	6
KinC_x60_2a KinC_x60_2b	14-Apr	0.58	5.10	3.805	22.925	14.575 18.015	30.875 34.315	37.500 40.940	6
KinC_x25_2 KinC_x25_3	20-Apr 24-Apr	0.24 0.25	2.10 2.98	3.820 2.131	14.625 23.695	11.395 7.395	27.695 23.695	26.020 30.820	4 4
Positron running for KinC_x25_2 & _3 could be Apr 29-30									
	29-Apr	Elastic Calibration (no polarization)							6