PVDIS RUN PLAN DURING THE 5-PASS BEAM TEST WITH FIXED HRS ANGLE SETTINGS

1 General Information – Apply to the Whole Test Period

1.1 The Carbon Target

A single carbon foil target will be installed on June 15 onto the current target motion system. It will be located at the "multi-foil" position. General precautions for operating the target motion system will be observed, such as requesting the MCC to mask the target motion system. A 4×4 mm^2 raster at the target is required when the carbon foil target is in beam at a current of higher than 5 μA. Raster can be turned off if the current is less than 5 μA.

1.2 HAPPEX and HRS Runs

- Take HAPPEX runs every 1.5 hours, preferablly with the same start and stop time as HRS runs, but do NOT need to take one HAPPEX run for every HRS run (one HAPPEX can correspond to 3 or 4 HRS runs, for example). Start new HAPPEX runs whenever there is a configuration change.
- Follow current instructions on how to start and stop HRS DAQs (time sequence, wait for 5 seconds... etc.)

1.3 Beam Current

Since the accelerator has the highest priority during this test period, we have no control for what current they will send us. But, if it is anticipated that the current will be changing from time to time, for example, 2 hours of 20 μA, 4 hours of 40 μA, etc., always start new HRS and HAPPEX runs when the current changes, unless if it has been less than 20 minutes since the last change. Make a note for what current has been used for each HAPPEX and HRS run.

2 Monday, 15 June, Day

Preparation for the test run:

A Set the HRS momentum and angles to the desired settings;

B Change DH threshold to -105mV;

C Change Cherenkov threshold from 50 to 400 (ADC channels), or equivalently from 30 to 240 (as read from the software, should be in mV);

D Adjust pion cable delays in group 1-4 to fix losses in pion narrow signals: add 8-10 ns to the cable between Total Shower Sum 8 output and Low-threshold Discriminators;

E Check group 5 electron trigger delay and remove 8-10 ns from two branches if possible: between Total Shower Sum 8 and DH, AND between Preshower Sum8 and DM (must remove the same amount from both);

F (Optional) Adjust delays for all electron and pion signals, make sure the 8 groups have coincidence with each other. Roughly, this means need to add 8-10ns delay to group 1-4 in all three branches: Total Shower Sum8 to DH, Preshower Sum8 to DM, and Total Shower Sum8 to DL (if not already added from D);

G Check tagger input rate and tagger+signal coincidence rate (4 groups) on the scope, check if there are observable losses (we are looking for a loss of 0.02%, or 0.02 Hz out of 100 Hz);

H Replace the 100Hz tagger by signals from a gate generator from the counting house, so it can be controlled or turned off (terminate the input) remotely; Check all 740 outputs to make sure there is no offset both with and without the tagger.

I Send T1 copy, instead of T1.or.tagger, to the PVDIS scalers.

J Check if it is possible to use two discriminators for the RHRS Cherenkov (2nd level).

3 Monday, 15 June, Swing

- We may start to get beam between 5 and 8 pm, but will not get high current (100 μA) until 8am on June 16.
- Move the target to Empty position during beam tuning;
- When the MCC is ready to send CW beam, move in the carbon target ("multi-carbon" position), ask for 5 μA with raster on. Start from a raster size of 5×4 MCC unit, take a short run and run spot++. Adjust raster size until spot++ shows a 4×4 cm^2 size at the target;
- Once the desired spot++ size is reached, write down the size in MCC units;
- Establish an approximate beam position and ask the MCC to keep the position feedback on if possible; Inform the MCC to send whatever beam current they want, take data with the carbon target at the kinematics shown in Table 1.
  - RHRS prescalers: take as much T1 as possible (likely PS1=1), take ??? T2, ??? T3, ??? T6, set all others to 65535;
  - LHRS prescalers: take as much T3 as possible (likely PS1=1), take ??? T4, set all others to 65535;
- Change the beam HWP half-way, i.e. after 6 hours of data taking.

Table 1: Kinematics #1.

Beam energy (GeV)	Left HRS angle	Left HRS momentum (GeV/c)	Time	Estimated Rate
6.0	12.5°	3.6	12 hours	5 kHz e^-
Beam energy (GeV)	Right HRS angle	Right HRS momentum (GeV/c)	Time	
6.0	17.0°	2.63	12 hours	1 kHz e^-

4 Tuesday, 16 June, Owl and Day

- Around 4am, or after 12 hours at the current settings (above), stop all runs, then change LHRS momentum to 2.63 GeV/c, see Table 2.
- Resume data taking on both HRS and HAPPEX once the LHRS momentum is settled;
- It is anticipated that a high current (100 μA) will be reached by 8am.
  - RHRS prescalers: take as much T1 as possible (likely PS1=1), take ??? T2, ??? T3, ??? T6, set all others to 65535;
  - LHRS prescalers: take as much T3 as possible (likely PS1=1), take ??? T4, set all others to 65535;

Table 2: Kinematics #2a.

Beam energy (GeV)	Left HRS angle	Left HRS momentum (GeV/c)	Time	Estimated Rate
6.0	12.5°	2.63	12 hours	3 kHz e^-
Beam energy (GeV)	Right HRS angle	Right HRS momentum (GeV/c)	Time	
6.0	17.0°	2.63	12 hours	1 kHz e^-

5 Tuesday, 16 June, Swing, and Wednesday, 17 June, Owl

- Change beam HWP half-way for the high current running (if we started running at 100 μA at 8am, change HWP at 4pm.
- Continue taking data at the kinematics shown in Table 2, for 3 hours;
- Disable the tagger from the counting house (if applicable), continue taking data for 4 hours;
- Coordinate with MCC for a controlled access near the end of the swing shift to change the PVDIS discriminator threshold: DH to -40mV, in the RHRS detector hut. Page or call Ramesh about 1 hour before the access.
- As soon as the beam stops for the access, change both HRS momentum to 1.0 GeV/c, see Table 3.
- Start taking HRS and HAPPEX runs as soon as the LHRS momentum settles. It will take much long for the RHRS momentum to settle, but we take data anyway on both HRS;
  - RHRS prescalers: take as much T1 as possible (likely PS1=1 or 2), take ??? T2, ??? T3, ??? T6, set all others to 65535;
  - LHRS prescalers: take as much T3 as possible (likely PS1=1 or 2), take ??? T4, set all others to 65535;
- Start new HRS and HAPPEX runs when the RHRS momentum becomes significantly more stable.

Table 3: Kinematic #3.

Beam energy (GeV)	Left HRS angle	Left HRS momentum (GeV/c)	Time	Estimated Rate
6.0	12.5°	1.0	until beam stops	6 kHz π^- (or less)
Beam energy (GeV)	Right HRS angle	Right HRS momentum (GeV/c)	Time	
6.0	17.0°	1.0	until beam stops	4 kHz π^- (or less)

Table 4: Shift Schedule

Date	Owl	Day	Swing
Monday, June 15	see E05-102	Xiaochao Zheng (or Diancheng Wang)	1^{st}: Xiaochao Zheng (until $\sim$10pm) 2^{nd}: Xiaoyan Deng
Tuesday, June 16	1st: Ramesh Subedi 2nd: Kai Pan	1st: Xiaochao Zheng 2nd: Abdurahim Rakhman	1st: Mark Dalton 2nd: Diancheng Wang
Wednesday, June 17	1st: Dustin McNulty 2nd: Kai Pan	N/A N/A	N/A N/A

6 Personnel

- Run Coordinator: Vince Sulkosky
- Physics Division Liaison: Doug Higinbotham

Figure 1: Rate estimation for LHRS (12.5°) and RHRS (17°).