

# Installation and Run Plans

The APEX Collaboration

June 9, 2010

## 1 Outline

**Organization of Safety** The Run Coordinator (RC) is the point of contact for safety concerns. As such the RC is responsible for ensuring that all shift workers are familiar with general safety precautions in Hall A and with particular hazards relevant to their tasks. The RC should organize a coordination meeting before each shift for the purpose of reviewing how to do each task properly and safely. The experts leading each task are required to instruct shift workers of all safety precautions specific to their work, keeping in mind that many shift workers have little or no experience in Hall A. All shift workers must read and understand the contents of the APEX safety documents (COO, ESAD, RSAD, and septum OSP), located in the Hall A counting room, and sign the attached signature sheet.

**Tasks** The purpose of the Test run is to provide empirical proof of the HRS capability for the APEX experiment. Mainly we need to test the high speed operation of the trigger detectors, the VDCs, and the PID detectors. We also need to test quality and reproducibility of the HRS optics for the long target and the operation of the long target constructed by SLAC. Finally, we need to measure the rate of  $e^+e^-$  coincidence events to confirm the calculation of the QED processes. This final measurement even if 12-hours long will result in 10 times more accurate limit than presently known for the A-boson mass range near 200 MeV.

**Operating Conditions** When using the PREX target without cooling, **currents of 5  $\mu\text{A}$  or less can be used on the Carbon target. The Pb targets cannot be used at all when the target is warm.** When the target is being cryogenically cooled, a trained target operator (TO) must monitor the target at all times, even when the beam is off.

**Detector** The APEX experiment requires the operation of both HRSs. After PREX, re-installation of the HRS detector packages needs to be done. The front-end of the VDC readout will be replaced with low noise A/D cards constructed for the BigBite wire chambers. The trigger front-end electronics will be optimized for high detector rates.

**DAQ** The trigger will use a 20-ns-wide coincidence between the S2m counters of two arms and a 40-ns coincidence with the Gas Cherenkov of HRS-R (which detects positrons). The S0 counters will be used to align the arrival time of the signals from relevant PMTs to the 2-3-ns level. The ADC gate signal originated by the Trigger supervisor will be delayed properly, reshaped, and distributed to the ADCs via the front panels. The delay lines for Gas Cherenkov will be shortened to 300 ns. The VDC readout will use two FASTBUS crates in each HRS.

**Target** The first stage of the Test run is based on the PREX target. Only this part of the run is approved for now. The beam intensity is limited by 5  $\mu\text{A}$  for the carbon target. Only carbon targets should be used until cryogenic cooling of the Pb target is organized. The second stage of the run will use the SLAC target.

**HRS & septum magnets polarity** During the first stage of the test run, the HRS-Left will be used with both polarities to study optics and the particle rates. The polarity of the septum magnets will be changed according to the HRS-Left polarity; **however, the direction of the magnetic fields in the two septa magnets will be anti-parallel as it was for PREX.** The polarity of the septum magnets will be flipped by reconnecting the current leads at the power supply.

## 2 Detector commissioning

The software for the detector testing and HV tuning has been prepared by S.Abrahamyan, who is leading the analysis team of the Test run.

The software for the VDC analysis was prepared by O.Hansen. This software will be use to prepare the VDC analysis prior to the optics study and to analyze VDC high-rate capability. The software for the optics study was prepared by V.Sulkovsky, who will lead the optics study.

**Commissioning with cosmic rays** Every detector will be tested using cosmic rays. This will allow initial adjustment of the amplitudes to the level of 10-20%. The timing alignment will also be done using cosmic rays. The trigger for the single arm operation will be the S2m and the S0 counters (S0 will be prescaled by a factor of 20).

**Commissioning with the beam** Detector calibration will use an HRS momentum of 1.13 GeV/c if the beam is 2-pass, or 0.565 MeV/c if the beam is 1-pass. The calibration of the VDC drift time-to-coordinate will be done by using the beam data. The final calibration of all PMTs of the detector will also use the beam data.

## 3 Optics study

The magnet settings will be based on J. LeRose's calculations. The PREX optics target with the carbon foils will be used. **The beam intensity on carbon foils should be less than 5  $\mu\text{A}$ .** The raster should be OFF for optics calibration. The HRS momentum settings should be tuned according to Vince's optics plan. The optics measurement needs to done at least twice to study reproduceability of the results.

## 4 Shift Schedule

### 4.1 Shift Timing

The three shifts each day are Owl (starting at 00:00), Day (starting at 08:00), and Night (starting at 16:00). Shift workers should arrive at the counting house 30 minutes before their shift is scheduled.

## 4.2 Detector Installation

The high radiation area was fenced by the Hall A technical staff and locked by the Radiation Control Group people. Hall A is in restricted access and no radiation watch is needed.

Date	Shift	Task	Help	beam
Mon, June 21	Day	<b>PREX</b> Clear platform, remove detectors Start with left arm. <b>Jack</b> Lift Cerenkov, pull frame out, install shower <b>Albert</b> Modify Cerenkov	1-2	off
	Swing	<b>Albert</b> Install A/D cards (L-HRS VDC) <b>Bob</b> reinstall Fastbus for VDC in 2 crates	2-3 1	off
Tue, June 22	Owl	<b>Samuel</b> Cable (L-HRS VDC)	1-2	off
	Day	<b>Jack</b> Continue to install L-HRS detector package <b>Bogdan</b> Install A/D cards (R-HRS VDC)	2-3	off
	Swing	<b>Albert</b> L-HRS cabling (shower, S0) <b>Sergey</b> L-HRS VDC check	1-2 1-2	off
Wed, June 23	Owl	<b>Samuel</b> L-HRS cabling	1-2	off
	Day	<b>Jack</b> Continue to install L-HRS detector package <b>Bogdan</b> Install A/D cards (R-HRS VDC) <b>Sergey</b> L-HRS Cosmics	1-2 1-2	off
	Swing	<b>Albert</b> L-HRS cabling <b>Bob Michaels</b> L-HRS scaler, DAQ	2-3 1-2	off
Thur, June 24	Owl	<b>Samuel</b> L-HRS cabling	1-2	off

### 4.3 Detector Installation and Commissioning

Date	Shift	Task	Help	beam
Thur, June 24	Day	<b>Jack</b> install R-HRS detector set up for running w/ R-HRS open		off
	Swing	<b>Vince</b> Beam Commissioning <b>John LeRose</b> Beam Commissioning	1	ON
Fri, June 25	Owl	<b>Bogdan</b> Beam Commissioning	2	ON
	Day	<b>Jack</b> Continue to install R-HRS detector package		off
	Swing	<b>Vince</b> Optics <b>John LeRose</b> Optics	1	ON
Sat, June 26	Owl	<b>Bogdan</b> Beam Commissioning	2	ON
	Day	<b>Albert</b> R-HRS Cabling <b>Shiftworker</b> Monitor equipment from counting house <b>Hall A Tech</b> Flip L-HRS and septum polarity	1	off
	Swing	<b>Aidan</b> Beam Commissioning	2	ON
Sun, June 27	Owl	<b>Bogdan</b> Beam Commissioning	2	ON
	Day	<b>Albert</b> R-HRS Cabling <b>Shiftworker</b> Monitor equipment from counting house	1	off
	Swing	<b>John LeRose</b> Beam Commissioning <b>Vince</b> Optics	1	ON
Mon, June 28	Owl	<b>Philip</b> Beam Commissioning	2	ON
	Day	<b>Jack</b> Continue to install R-HRS detector package <b>Folts</b> Install magnetic shielding		off
	Swing	<b>Albert</b> R-HRS Cabling <b>Shiftworker</b> Monitor equipment from counting house	1	off
Tues, June 29	Owl	<b>Philip</b> Beam Commissioning		
	Day	<b>Folts</b> Install corrector <b>Jack</b> Set up for coincidence <b>Other Hall A tech</b> Flip 1/2 septum polarity <b>Albert</b> Finish cabling <b>Shiftworker</b> Monitor equipment from counting house	1	off
	Swing	<b>Vince</b> Optics	2	ON
Wed, June 30	Owl	<b>Philip</b> Coincidence Data	2	ON
	Day	<b>Folts</b> Remove collimator/Install permanent magnet		off
	Swing	<b>Shiftworker</b> Monitor equipment from counting house		off
Thur, July 1	Owl	<b>Shiftworker</b> Monitor equipment from counting house		off
	Day	<b>Folts</b> Install target		off
	Swing	<b>TO</b> vacuum pump		off
Fri, July 2	Owl	<b>TO</b> vacuum pump		off

#### 4.4 Production Running

Date	Shift	Task	Help	beam
Fri, July 2	Day	<b>Vince</b> Optics <b>John LeRose</b> Optics	1	ON
	Swing	<b>Bob Michaels</b> Commission Coincidence	2	ON
Sat, July 3	Owl	<b>Bogdan</b> Commission Detector	2	ON
	Day	Production	3	ON
	Swing	Production	3	ON
Sun, July 4	Owl	Production	3	ON
	Day	Production	3	ON
	Swing	Production	3	ON
Mon, July 5	Owl	Production	3	ON
	Day	Production	3	ON
	Swing	Production	3	ON
Tue, July 6	Owl	Production	3	ON