

PR-10-009, E12-10-009

A' Experiment ("APEX")

List of PAC Conditions & How We Plan to Address Them

Collaboration Meeting, Feb 17 2010

also see our replies to most of these concerns at

<http://ntoro.stanford.edu/APEX/>

(to be moved to JLAB url soon)

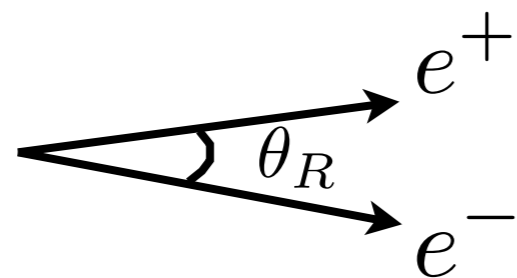
PAC Conditions (from P. Rossi & E. Rondio)

- 1) Run with the zig-zag mesh design of the tungsten target and prove that it allows the requested vertex resolution.
- 2) Prove that it is possible to reach the uncertainty of 0.1 mrad in determining the central scattering angle between the two spectrometers.
- 3) Prove that the vertical drift chambers (VDCs) can operate at a rate higher than 20 kHz/wire (that, according to the TAC report, is the maximum Hall A has operated till now).
- 4) Prove that it is possible to use the gas Cherenkov counters in the trigger to help clean pions. In fact the TAC report claims that this is not possible with total rates/PMT at the level of a few hundred Hz to MHz. Also prove that the off-line rejection of 10,000:1 can be achieved.
- 5) Prove that a 20 ns (S0-S0) and 40 ns (S0-S0-C) can be achieved.
- 6) If it is possible (not obvious for a test run) it will be advisable to set the septum magnets at higher fields to prove that also at energies higher than 2 GeV it is possible to reach the uniformity of the field requested from the experiment.
- 7) Detailed description of different contributions to background and their importance (how assumptions and/or approximations can influence the predictions) and comparison with measurement.

- 1) Run with the zig-zag mesh design of the tungsten target and prove that it allows the requested vertex resolution
 - Ken Moffeit (SLAC) will discuss target design
 - Dave Meekins (JLab) will advise us what we need to address for target installation and survey

2) Prove that it is possible to reach the uncertainty of 0.1 mrad in determining the central scattering angle between the two spectrometers.

We do not need stated accuracy of 0.1 mrad; even 0.5 mrad is enough; (we believe 0.2 mrad is achievable)



The diagram shows two arrows originating from a common point on the left. The upper arrow is labeled e^+ and the lower arrow is labeled e^- . The angle between the two arrows is labeled θ_R .

$$m_{e^+e^-} = \sqrt{p_{e^+} p_{e^-}} \sin \theta_R$$

- To determine invariant mass, need to know angle **between e^+e^- pair (θ_R)**
- **Uncertainty in θ_R of e.g. 0.5 mrad corresponds to a small systematic shift in the invariant mass corresponding to ~ 0.5 of mass resolution**
- This uncertainty does not affect the visibility of a bump!

Mass resolution is determined by multiple scattering in target (~ 1 mrad) and by angular resolution in HRS's (~ 1 mrad vertical and ~ 0.5 mrad horizontal); higher-order effects from uncertainty in θ_R will further reduce resulting event by event mass resolution from 1.41 mrad to not worse than 1.5 mrad (vertical) and from 1.12 mrad to not worse than 1.22 mrad (i.e. by less than $\sim 10\%$)

3) Prove that the vertical drift chambers (VDCs) can operate at a rate higher than 20 kHz/wire (that, according to the TAC report, is the maximum Hall A has operated till now).

- Experiment operates at a high rate & high rate capability of VDC is essential
- VDC operation **requires installation of new electronics**
 - need approval to start preparation as soon as possible
 - with these new electronics, VDC operation rate sufficient
- **a test run will demonstrate VDC operation quantitatively**
(see Bogdan's talk)
- **Ole Hansen** will address how analysis of VDC data will be done

4) Prove that it is possible to use the gas Cherenkov counters in the trigger to help clean pions. In fact the TAC report claims that this is not possible with total rates/PMT at the level of a few hundred Hz to MHz. Also prove that the off-line rejection of 10,000:1 can be achieved.

- Our actual rate is ~ 10 kHz/PMT
- We assume a pion rejection of ~ 100 in trigger from gas Cherenkov counter (in +ve polarity arm)
- test run would quantitatively test gas Cherenkov counters (see Bogdan's talk)
- Offline rejection of 10000:1 is not required
 - some settings require no additional pion rejection
 - for 4 GeV setting, additional offline rejection by factor of ~ 20 reduces π^+e^- to less than 10% of e^+e^- rate

5) Prove that a 20 ns (S0-S0) and 40 ns (S0-S0-C) can be achieved (S0 = scintillator, C = gas Cherenkov counter)

- We think this can be achieved
- a test run would quantitatively prove this (see Bogdan's talk)

6) If it is possible (not obvious for a test run) it will be advisable to set the septum magnets at higher fields to prove that also at energies higher than 2 GeV it is possible to reach the uniformity of the field requested from the experiment

- [John LeRose](#) will talk about this today

7) Detailed description of different contributions to background and their importance (how assumptions and/or approximations can influence the predictions) and comparison with measurement

- We have done detailed calculations
- Will need test run to test the numbers
- Natalia Toro will discuss signal and background rates today

Summary

In blue: talks today

Green check mark: addressed by a test run

In orange: actual requirements less stringent than PAC concern

- ✓ 1) Run with the zig-zag mesh design of the tungsten target and prove that it allows the requested vertex resolution.
- ✓ 2) Prove that it is possible to reach the uncertainty of 0.1 mrad in determining the central scattering angle between the two spectrometers.
- ✓ 3) Prove that the vertical drift chambers (VDCs) can operate at a rate higher than 20 kHz/wire (that, according to the TAC report, is the maximum Hall A has operated till now).
- ✓ 4) Prove that it is possible to use the gas Cherenkov counters in the trigger to help clean pions. In fact the TAC report claims that this is not possible with total rates/PMT at the level of a few hundred Hz to MHz. Also prove that the off-line rejection of 10,000:1 can be achieved.
- ✓ 5) Prove that a 20 ns (S0-S0) and 40 ns (S0-S0-C) can be achieved.
- ✓ 6) If it is possible (not obvious for a test run) it will be advisable to set the septum magnets at higher fields to prove that also at energies higher than 2 GeV it is possible to reach the uniformity of the field requested from the experiment.
- ✓ 7) Detailed description of different contributions to background and their importance (how assumptions and/or approximations can influence the predictions) and comparison with measurement.