

21 October 2009

To: Volker Burkert
From: Larry Weinstein, for the TPE Collaboration
Subject: Experimental Readiness, E07-005

The TPE (Two Photon Exchange) experiment is a very important part of the 6 GeV program. To quote from the PAC34 report:

A key experiment "At Risk" is E07-005, which explores these multi-photon exchange contributions. ... the PAC would be dismayed if this important check was not completed in a timely fashion.

Following extensive data analysis and simulation, the TPE Collaboration has determined that it can perform the TPE experiment and achieve statistical uncertainties that are equal to or smaller than the expected 1% systematic uncertainty in almost all bins for $Q^2 \leq 2$ GeV² within the running time allotted by the PAC. See Figure 1 and TPE ENOTE page 373 (<http://clasweb.jlab.org/cgi-bin/ENOTE/enote.pl?nb=tpe&action=view&page=373>).

By adding additional shielding elements, we can run with 100 nA 5.5 GeV primary electrons incident on a 2% radiator followed by a 5% convertor. The target length will be 30 cm. This will result in a 3% Region 1 and a 1.8% Region 3 DC occupancy. The data rate will be 10 kHz. These rates are determined by using simulation to extrapolate from the measured test run occupancies. The determination of the maximum luminosity is shown in TPE ENOTE page 371.

The additional shielding and beam line elements required are as follows:

- 1) 0.25 inch lead shielding on the exposed top and sides of the tagger vacuum box that are outside the shielding bunker.
- 2) Redesigned, more hermetic, shielding between the chicane magnets.
- 3) A 2.5 meter long, 6 cm ID, 16 cm OD high-density concrete tube (or equivalent steel pipe) placed after the rad phi wall on the space frame.
- 4) A 2-m radius, 20 cm thick high-density concrete disk (or equivalent in other materials) placed before the insertion cart on the space frame.
- 5) A device to move our beam monitors (a small calorimeter with a scintillating fiber monitor before it) into and out of the beam line near the downstream collimator.
- 6) A 4-cm ID insert for the downstream collimator.
- 7) A 30-cm long, 6-cm diameter liquid hydrogen target.
- 8) The minitorus with the interior shielding removed to widen the bore.
- 9) A new Moller-catcher shield.

I have discussed these with Dave Kashy. While some of the details need to be worked out, all the items should be possible.

We request help from the engineering staff in designing and constructing the various shielding elements. While there are many new elements, most are relatively

straightforward. It is crucial that we be ready to install in July 2010, in case there is an opportunity to run the experiment at that time.

Note that TPE should not cause any more drift chamber aging than any other high energy electron-beam run. Like those experiments, we will operate the Region I drift chambers at their maximum occupancy of 3%. Unlike those experiments, our drift chamber occupancies will be more uniform and cause less aging of the forward wires.

We will be happy to furnish any additional information.

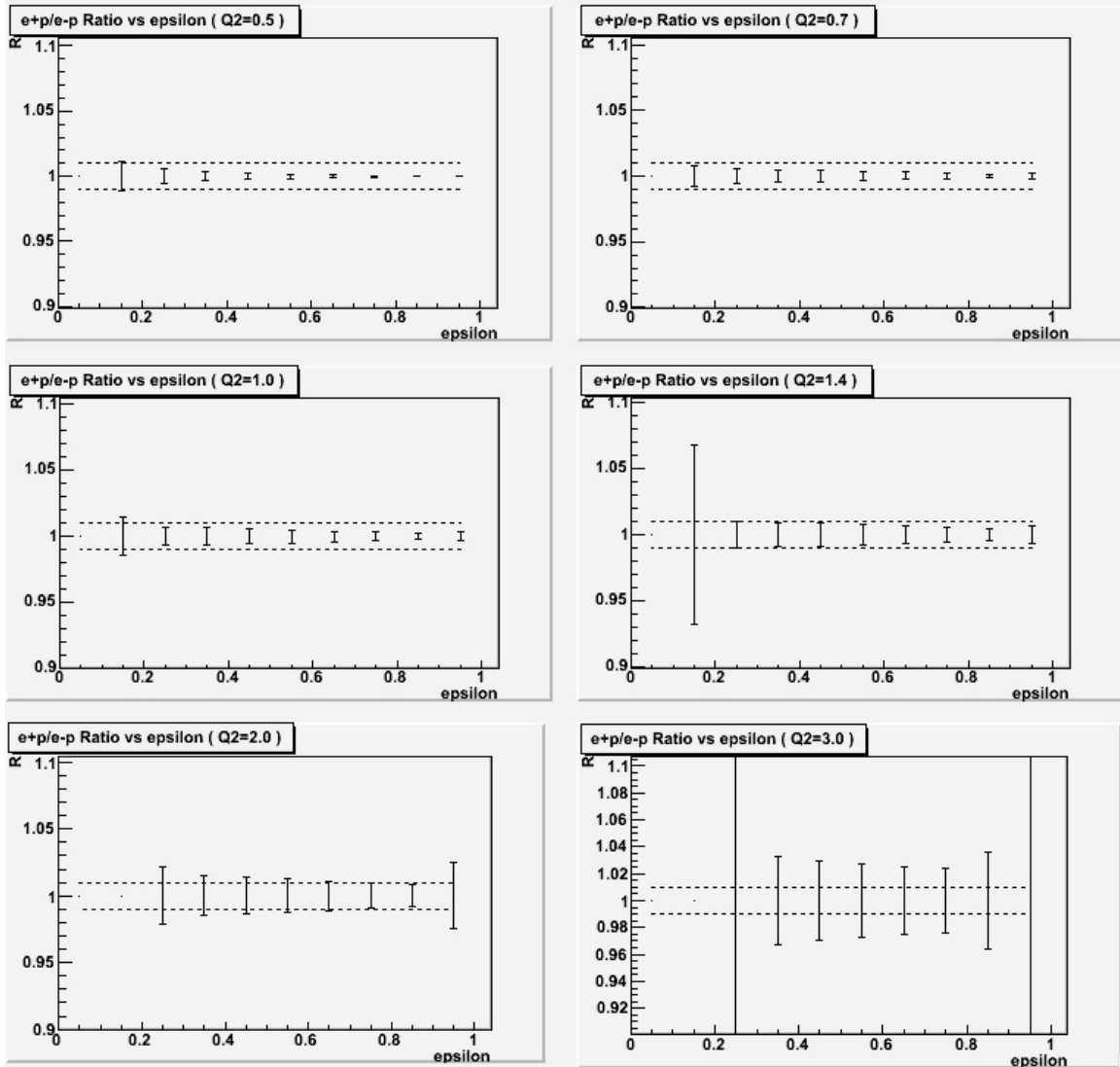


Figure 1: The expected uncertainties for 15 days running with a 100 nA 5.5 GeV beam incident on a 2% radiator, 5% convertor and a 30-cm target. The horizontal dashed lines indicate the expected $\pm 1\%$ systematic uncertainties. The results for the full PAC time of 35 days will have correspondingly smaller statistical uncertainties.