Tentative Run Plan for HAPPEx2 detector

D.Lhuillier

(February 12, 2002)

I- Goal:

Study the resolution and edge effects of the HAPPEx2+^4He detector. This test requires the use of high energy electrons and can't be performed with cosmic rays.
The simulations show that the segmentation of the HAPPEx2 detector induces rather large edge effects which affect the RMS of the detector response. At the end the error on the asymmetry measured in each segment is expected to be 10% larger compared with a simple split of the counting rates. This still provides useful informations from two bins in Q^2 and doesn't affect the total accuracy in the sum of the two segments. Nevertheless the test proposed here is an unique opportunity to check the real response of the detector and disentangle pure statistical width from resolution effects.

II- Experimental setup:

The Moller setup in hall A allows the installation of a bench test between the exit of the dipole and the entrance of the Moller detector shielding (see fig. 1). Downstream the magnetic elements the scattered Moller electrons split into two bands of high energy electrons: $E = E_{beam}/2 \pm 15\%$. Because of the vertical dispersion of the dipole, the vertical position of an electron at the bench test is directly related

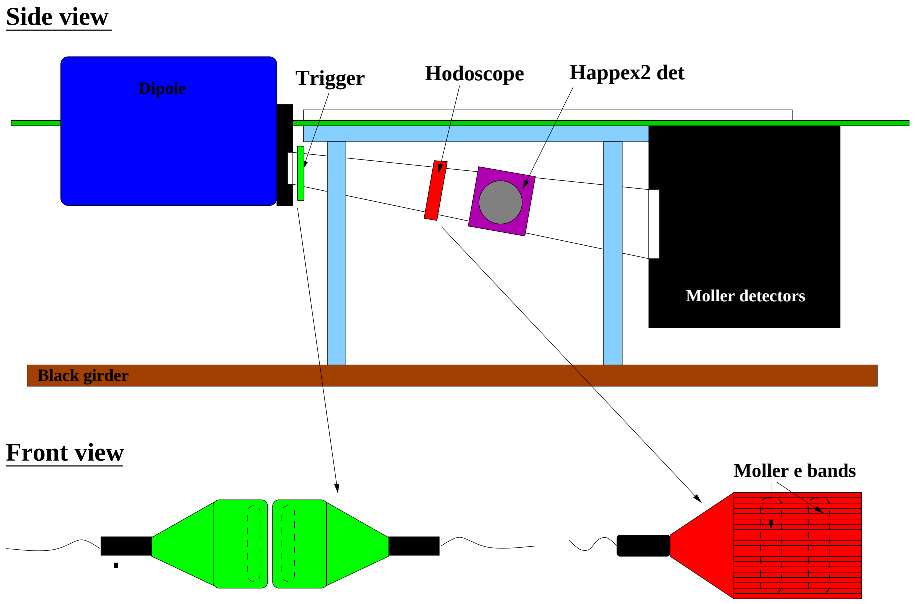

FIG. 1. Setup of the Moller bench test.

to its energy. Based on this principle a segmented hodoscope, illustrated on fig 1 can provide an energy tagging at the 2% level, which is small compared with the resolution we want to test. This tagger is already operational in hall A and has been used for previous calorimeter tests.
3D views of the implementation of the HAPPEx2 detector into the Moller setup are available at

$$http://www.jlab.org/~david/HAPPEX2/TEST\_MOLLER/$$

Minor changes in the mechanics are needed to adapt to the dimensions and orientation of the HAPPEx2 detector (to be discussed with Eugene and Jack Segal). Nevertheless the installation should remain easy. A rough estimate is 1 day of a hall A tech with help of a physicist.

III- Run Plan:

The HAPPEx2 detector will be mounted at JLab in April and can be ready for beam test anytime after early May. Once in place inside the Moller setup the HAPPEx2 detector won't affect the running experiment but will be invasive for any Moller measurement.

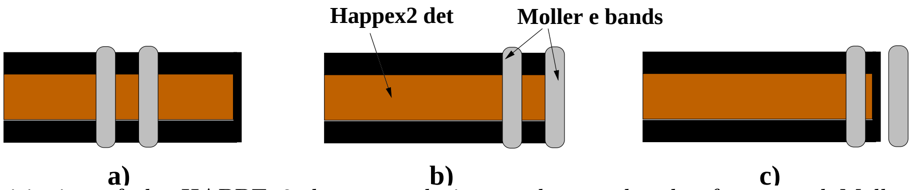

FIG. 2. Positioning of the HAPPEx2 detector relative to the two bands of scattered Moller electrons: a) Resolution study with two Moller e in coincidence; b) Study of edge effect in the end cap; c) Resolution study with one Moller e only in the detector.

I propose to take data in three different configurations illustrated on figure 2. The vertical extension of the electron bands is larger than the width of the active part of the detector and allows test of the edge effect. Longitudinal moves along the detector axis can be performed remotely thanks to a motorized rail system. The hodoscope is a crucial part part in this test allowing study of the detector response versus transverse position of the incoming electrons and providing the true number of events seen by the detector. In the a) and b) configurations of figure 2, the fact that 2 electrons hit the detector in coincidence is expected to simply improve the resolution by a factor $\sqrt{2}$.

Beam request is 1 shift: We need some time to check the trigger and the data quality then $\simeq$ 1h for each position of figure 2.

Beam energy $\geq$ 4 GeV: Mean energy of the Moller electrons is $E_{beam}/2$. There is a lower limit in beam energy because the active stack of the detector has been optimized for 3.2 GeV electrons.

Beam current $\simeq 1\mu A$: counting rate is not a limiting factor for the test of the resolution. Nominal operating beam current with the Moller target IN is fine.

Beam polarization is not relevant.

IV- Acquisition:

The acquisition for the hodoscope already exists. The test requires two more channels for the trigger (coinc between the 2 scintillators) and one ADC channel for the HAPPEx2 detector (a standard 2249A Lecroy is fine).

The use of one integrating HAPPEx ADC would offer consistency check of the event by event acquisition.