Calibrations with C5D10 Magnet

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1.0 General

We would like to request that the C5D10 magnet, currently scheduled for removal, be retained for E896 calibration purposes. It is our understanding that the cables and power supply for this magnet are scheduled to be moved to the E896 Analyzer (48D48). Since we envision using the C5D10 magnet in conjunction with this 48D48 magnet, we are further requesting that some arrangement be worked out whereby the C5D10 magnet and another magnet, perhaps in the EVA (C3) line (since the two lines can not run simultaneously), share resources.

At five (4) meters upstream of the scheduled location of E896 Sweeper[1], the C5D10 magnet is perfectly positioned for sweeping a charge 1 beam across the E896 detector set (e.g. SDDA, DDC, TOF and MUFFINS). This is not true in the case of the C5D09 magnet, positioned 12 meters further upstream[2]. Since the principal physics of the E896 experiment is realized in detecting the charge=1 daughters of neutral decays, the majority of the E896 detectors must be calibrated with a charge 1 beam, in situ. The charge 1 beam can be manufactured by colliding the Au beam into a production target in the C target area. The elements in the C5 line can then be tuned to transport a charge 1 beam.[3] However, this is only half the battle, this beam must then be directed to the various detectors. While this "sweep" could be accomplished using the E896 sweeper, changing the field in that magnet would affect the response of the many of the detectors (e.g. SDDA, DDC and TOF) which would negate the usefulness of the calibration. What is needed is C5D10. by varying C5D10, the charge 1 beam can be swept across the various detectors with the E896 sweeper in either switched off mode or at it's normal operating field.

We realize that calibrating with the C5D10 magnet will cause some added work in constructing a suitable beam stop. However, surely this time is made up for by the time saved from not having to pull the magnet. Second, we realize that positioning of a beam stop for charge=-1 particles may hamper some access to the upstream parts of the EVA experiment. however, since the C5D10 magnet will only be used for calibrations, it could be tagged out until that time. Actual calibration running would be on the order of 1 or 2 days, as such the beam stop could be temporary and cause minimum impact on EVA.

1. 518cm from C5D10 center to E896 Sweeper center. the mechanical separation is 396cm; sufficient space for the E896 upstream beam monitoring detectors.
2. due to longer lever arm, the beam will be occluded by the beam pipe.
3. for a range of momenta, P, and dP/P=1-2% (private communication from Hugh Brown)

Below are some comments from members of the different E896 detector groups concerning the need for the C5D10 dipole in performing necessary calibrations for their respective detectors.

2.0 DDC Calibrations

Several DDC calibrations techniques involving some form of beam are currently envisioned. Of particular interest is a technique which will involve producing negative secondaries (pi- & K-) produce with Au beam on C target. The C5 line would then be tuned to transport charge=-1 particles with specific momentums into the E896 experimental area. One calibration will be done with both magnets off producing straight tracks. Using the C5D10 magnet the beam can be swept across the face of the DDC. Although the space time curve will be different than during HI data taking (because the magnetic field will be absent), the information from this type of running will be needed to obtain the ultimate wire position map. Further, this data will provide information needed to deconvolve the detector resolution function. Another calibration will involve having both magnets turned on (to operating field levels). This will produce curved tracks in the DDC which will provide the information to determine the absolute momentum calibration of the chamber. This data set when coupled with the above “no-field” data set will be necessary to determine the effect of the magnetic field on chamber. Since the magnetic field will not be constant over the active area of the chamber, it will be necessary to use the C5D10 magnet to test various regions of the DDC. This information in turn also will determine the number of space time curves that need to be generated.

For completeness, there are other calibrations planned which will require the Au beam. Perhaps most important is a technique which will utilize protons produced in CEX with neutrons from Au interactions on the 896 target. This data set will contain charge=+1 tracks with various momenta produced in presence of HI background.

Finally, the mass reconstruction, and resolution thereof, will be calibrated by reconstructing the Ko and Λ Vee’s found in the Au and charge=1 datasets.

jack

3.0 TOF Calibrations

“please count me in as voting to keep it”. If this dipole were to stay and suitable cables and power supplies could be found, it would allow us to sweep a charge=1 beam across the time of flight walls. this “would be extremely powerful” and is probably the best way to calibrate the TOF wall timing and HV settings (etc.).

bill

4.0 MUFFINS Calibrations

A charge-1 beam has the potential to be a great facility for the Muffins calibration and is certainly very welcome. Actually it might solve the most outstanding unresolved problem with Muffins in E896. Specifically, we need to pierce a small-charge, mono-energetic beam, through the centers of the discs. We select central hits geometrically by placing two very small paddles one in front of the first disc and one behind the last one, and including the coincidence of both in the trigger. We also need to know exactly VELOCITY and PARTICLE ID as the particles hit the first disc. Both are needed to deduce with help from GEANT the TDC offsets and the PMT gains. For the offsets, for example, after having set a conventional TDC value for the PMTs of the first disc, since we have selected hits at the center, light travel times to PMTs must be identical. So any differences between the conventional TDC and actual TDCs are called “offsets”. From the 2nd disc on however the conventional TDC values have to be increased by a quantity that takes into account the particle travel time between discs. An accurate estimate of this needs both initial energy or velocity and particle id. Something similar holds for the PMT gains.

Last year we could not only select charge-1 but had also a mono-energetic beam in terms of momentum. By selecting a sufficiently small momentum (1.5 GeV/c in the B2 case) and placing a START paddle a few meters upstream of the Muffins discs (7.5 in that case) we were able to separate two very well distinct peaks due to protons an pions. In this case we could do our calibration using only the protons or only the pions or both, but knowing which is which.

Salvo

5.0 SDDA Calibrations

I know that for positioning the detector, we will need some running with the sweeping magnet turned off. Then we can get straight lines which point back to some upstream target and figure out our position to the resolution (20 micron) that we need it....I also know, based on some studies performed by the Ohio State gentlemen, that there is a need to know how the magnetic field will affect the detectors themselves. This will require some running with the sweeper on.

Jeff