sPHENIX Report

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MBD Performance Plots, Run2pp

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1 Introduction

This note is an explanation of the z-vertex and MIP fit plots using the MBD for a preliminary request. The calibrations and procedures are the same as documented in notes [1] and [2].

2 Event selection

Run numbers which are used for this analysis are:

Run	Date	Plots
43123	5/19/24	z-vertex
43572	5/23/24	MIP fit

Events were checked for rudimentary data acquisition errors (existence of both packets, checksums, consistency of event numbers and fem clock across both packets and with xmit event and clock). Otherwise, no event selection was made. The events are from MBD-LL1 triggered events with no vertex cut.

3 Analysis

The vertex distribution shown in fig. 1 is taken from run 43123, from MBDNS¿=1 triggered events. The MBD measures the z-vertex using

$$z = (t_S - t_N) * C/2 \tag{1}$$

where t_S and t_N are the times of arrival (TOA) of the particles in the south and north MBD, respectively. C is the speed of light. The TOA in each arm is determined from taking the mean of a gaussian fit using the arrival times of each PMT with a charge above a threshold of 1/4 the MIP peak. The fit is taken around the earliest time cluster, in order to reduce effects from late secondaries.

The hit times are calculated using the timing discriminator channels in the MBD. These have been calibrated using an internal timing pulse that is scanned with a precise set of delays. Slewing corrections are applied after this timing correction. Time zero offset corrections have been applied.

The MIP peak fits in figs 2 and 3 were taken from run 43572. They show the distribution for the amplitude of the waveforms from PMT ch 34 in the MBD. The prominent so-called MIP peak comes predominantly from events where there was a single charged hadron going completely through the MBD SiO2 Cerenkov radiator. The underlying background comes from albedo, overlaps from multiple mips in a PMT, or from particles which only partially go through the radiator, or have a different response than a typical hadron (such as electrons), as well as other contributions. This background was determined using ROOT TSpectrum, and the remaining MIP peak signal was fit with a gaussian.

4 Figures

The three figures requested for approval are shown below. One is a z-vertex distribution, and the other two are representative of MIP fits.

References

[1] A. Holt A. al-Sayegh L. Mwibanda M. Chiu, S. Nelson. MBD Commissioning, Z-Vertex Plots During Initial Crossing Angle Scan. *sPHENIX Invenio*, 2023. 1

[2] A. Holt A. al-Sayegh L. Mwibanda M. Chiu, S. Nelson. MBD Commissioning, MIP Fit. *sPHENIX Invenio*, 7 2023. 1

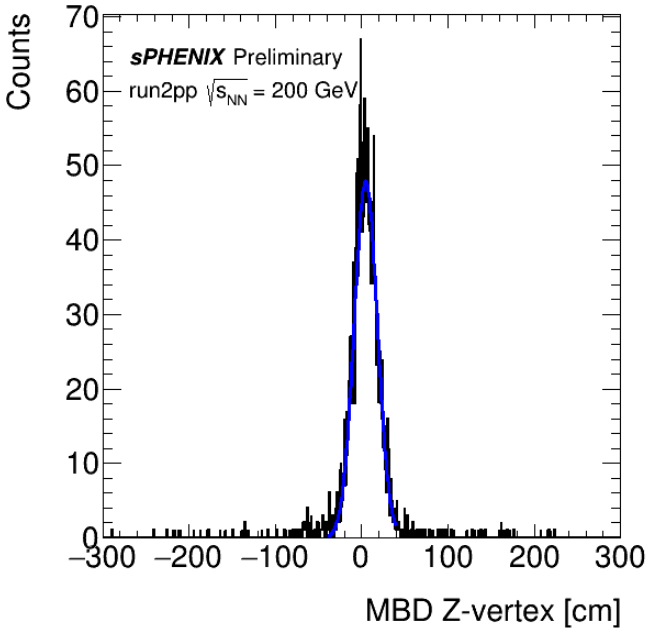

Figure 1: Z_{vtx}, Run 43123, 1 mrad crossing angle

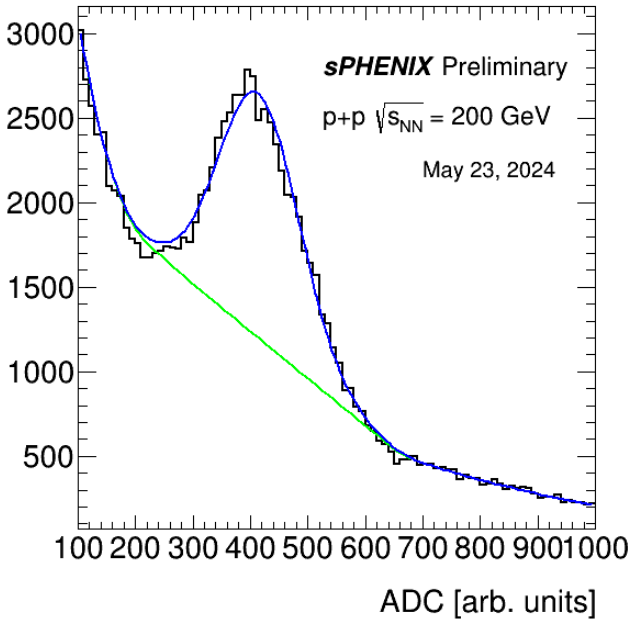

Figure 2: Run 20708, ch 35

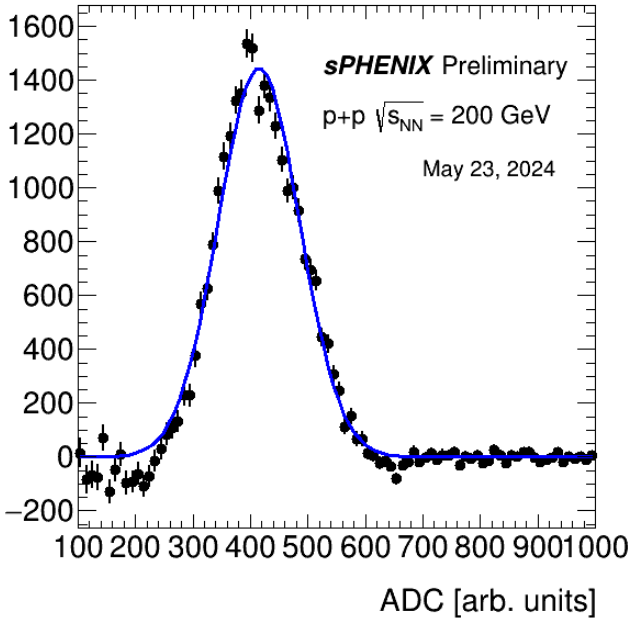

Figure 3: Run 20708, ch 35, background subtracted, Landau fit