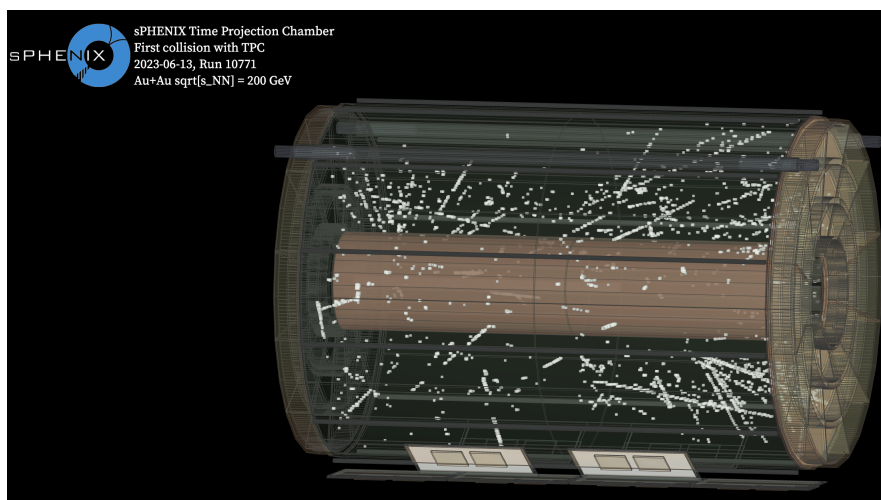


TPC First Au+Au Collision Display

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Event display of a Au+Au collision observed within the first 10 events after full TPC high voltage turn on to a reasonable setting (4525 V were on the GEMs with a full drift field at 45 kV during this run). Data comes from a single TPC data run (Run 10771, segment 0000) taken after complete HV activation of the TPC in the IR with beam from June 13th, 2023. There was no magnetic field at this point in the run, so tracks are expected to be straight as can be seen in the image.

The figure displays approximate (X,Y,Z) positions of hits accumulated over a single TPC time frame observed after complete turn-on of the TPC with beam. A hit in this instance is considered any waveform sample with an ADC value at least 100 counts larger than the first ADC value observed in the waveform, which we use an effective pedestal approximation. To reconstruct the precise (X,Y) position of each hit using the channel information associated with it, the channel mapping csv files for TPC sector segments R1, R2, and R3 were used to obtain local phi and PadR values within a given sector. A global phase shift in factors of $2\pi/12$ depending on sector number is then applied to get the correct (r,ϕ) position of a given hit. To reconstruct an approximate Z position for a hit, the 10th sample in each waveform was assumed to occur at ± 105 cm, depending on which endcap received the signal, and the 255th sample was assumed to occur at the central membrane (0 cm), with all other hits being evenly spaced between those two limits. No clustering, distortion corrections, or tracking software was used in the production of the image.

The (X,Y,Z) position of each sample is written out to both a JSON file which can be passed to the sPHENIX Event Display website to view in 3 dimensions, and a root file which can be analyzed at a later time.

The vertex distribution of these events was found to be quite wide, presumably due to the special low luminosity tune at RHIC that offsets the two beams in the transverse dimension. This particular event seems to have a vertex 80cm to the left of the center of the detector. The non-vertex pointing tracks are likely collision-induced secondary particles (e.g. photonic conversion on inner field cage or calorimetric albedo).

It is also important to note that data for sectors 22 and 23 in the south end of the TPC were not used to make this figure as they were not accessible. Additionally, the innermost 10 cm of the TPC ($R = 20\text{-}30$ cm) is a distortion shaping region and has no signal by design, which is why no hits are seen there.

This figure was previously shown in the following presentations:

- Physics Coordination Meeting June 16, 2023 - Charles Hughes

1 Data Used

More information on the data taken during this run can also be found at this [wiki page](#).

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