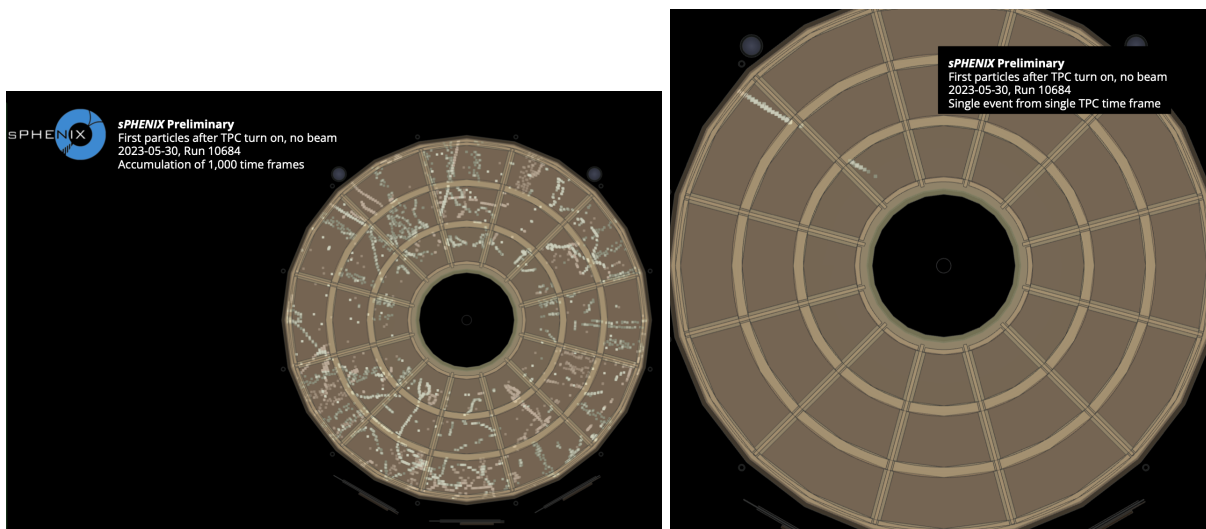


TPC Cosmic Event Display

Thomas Marshall for the sPHENIX TPC group

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Event displays for 1000 TPC time frames (left) and a single reconstructed track passing through multiple TPC sectors (right). Data for both images comes from a single TPC data run (Run 10684, segment 0000) taken after first complete HV activation of the TPC in the IR.

The left figure displays approximate (X,Y,Z) positions of hits accumulated over 1000 TPC time frames observed after complete turn-on of the TPC without 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 ϕ 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 (not seen in this 2D image of the (X,Y) distribution), the first sample in each waveform was assumed to occur at ± 105 cm, depending on which endcap received the signal, with each following sample occurring 0.4 cm closer to the central membrane. The 0.4 cm assumption comes from the known 50 ns/sample rate for each waveform and an approximate 8 cm/us drift speed.

The right figure displays approximate (X,Y,Z) positions of hits from a single track across one TPC time frame observed after complete turn-on of the TPC without beam. The same process as described above was used to reconstruct this single track, with the only difference being the number of frames viewed being reduced to a single TPC time frame. All waveform samples with an ADC value at least 100 counts larger than the first ADC value observed in the waveform for the first 12 sectors of the TPC that occurred within the relevant time frame are displayed in this 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. Relevant code to generate the JSON file and root file can be found here.

These figures and early uses of the code used to generate them were previously shown in several presentations:

- Physics Coordination Meeting June 2, 2023 - Thomas Marshall
- Tracking Software Meeting May 24, 2023 - Thomas Marshall
- sPHENIX General Meeting June 9, 2023 - Kin Yip
- sPHENIX General Meeting June 9, 2023 - Tom Hemmick

1 Data Used

/sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC_ebdc00_beam-00010684-0000.pdf
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