

2 Multiple TPC Au+Au Event Displays and Animations

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## 4 Event Display Creation Summary

5 The first 7 images presented here are of several event displays (and one animation in the 7th  
6 image) of different Au+Au collisions observed within the first 100 TPC time frames recorded after  
7 full TPC high voltage turn on with the sPHENIX magnet on as well. GEM voltage was set to 4.45  
8 kV with a central membrane voltage of 45 kV. Data comes from a single TPC data run (Run 10931,  
9 segment 0000) taken after complete HV activation of the TPC (the north top sector has GEM HV  
10 held off due to possible GEM deformation issue) in the IR with beam and magnet on from June  
11 23rd, 2023. The 8th image presented here (an animated display shown here as a screenshot of the  
12 full display) is instead a display of an event from a diffuse laser test with GEM voltage at 4.35 kV,  
13 Central Membrane voltage set to 45 kV, the laser 98% all on, and trigger set to modebit @ 2 (run  
14 11011, segment 0000). This run was taken on July 6, 2023.

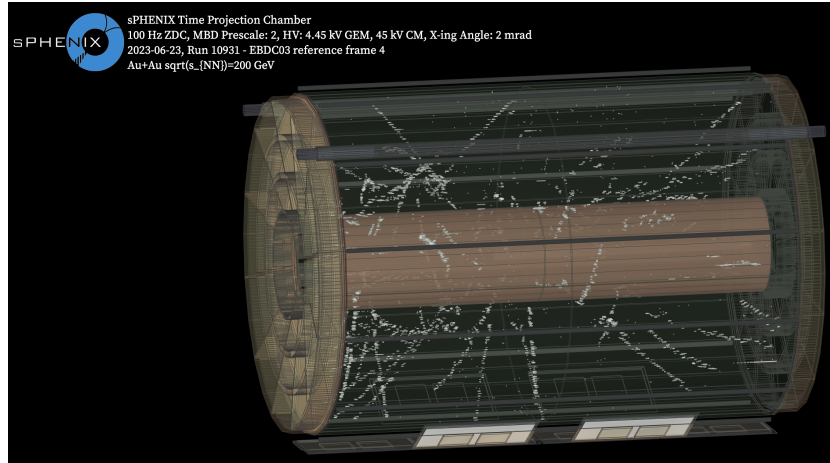
15 The figures display approximate (X,Y,Z) positions of hits accumulated over a single TPC time  
16 frame (2 consecutive frame values in the data constitute a single time frame) observed after  
17 complete turn-on of the TPC with beam and magnet (or the conditions of the aforementioned laser  
18 test without beam). All reference frame values listed in this note also include the following integer  
19 value in order to encompass a complete TPC time frame for the event. A hit in this instance is  
20 considered any waveform sample with an ADC value at least 4 standard deviations and at least  
21 10 ADC counts above the pedestal mean of the channel. Pedestal mean values and standard  
22 deviations were determined using the first 15 samples from all waveforms from a given channel  
23 from the complete dataset of the first 100 TPC time frames recorded. To reconstruct the precise  
24 (X,Y) position of each hit using the channel information associated with it, the [TPCMap module](#)  
25 was used to map channel and sector information to a global position in the TPC. To reconstruct  
26 an approximate Z position for a hit, the 10th sample (0th sample for laser run 11011) in each  
27 waveform was assumed to occur at +/- 105 cm, depending on which endcap received the signal,  
28 and the 255th sample (260th sample for laser run 11011) was assumed to occur at the central  
29 membrane (0 cm), with all other hits being evenly spaced between those two limits. No clustering,  
30 distortion corrections, or tracking software was used in the production of the images.

31 There was an additional cut on channels with greater than 50 hits that passed the cut conditions  
32 mentioned above applied to these images to remove streaky channels in the TPC in order to  
33 improve the track visualization quality of the images.

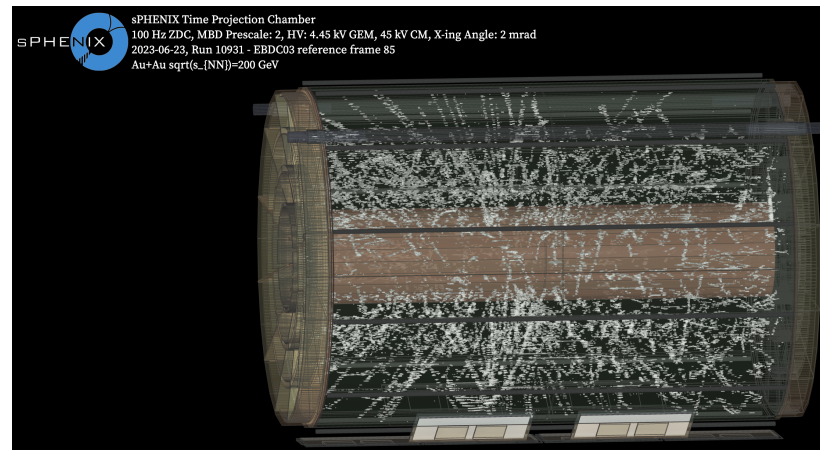
34 The (X,Y,Z) position of each sample and its ADC height above pedestal mean is written out to both  
35 a JSON file which can be passed to the [sPHENIX Event Display website](#) to view in 3 dimensions,  
36 and a root file which can be analyzed at a later time.

37 It is useful to note that the innermost 10 cm of the TPC (R = 20-30 cm) is a distortion shaping  
38 region and has no signal by design, which is why no hits are seen there.

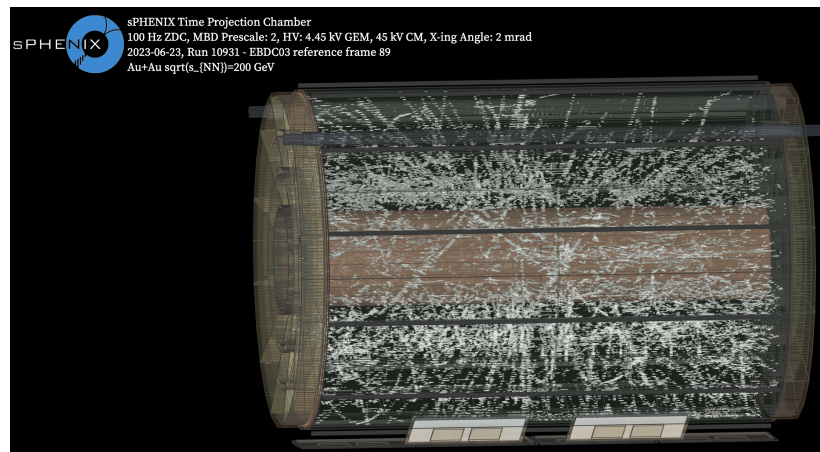
39 All event display images and animations will be stored on the sPHENIX invenio page located  
40 [here](#).



**Figure 1:** TPC single event display using EBDC03 frame 4 as the reference frame.



**Figure 2:** TPC single event display using EBDC03 frame 85 as the reference frame.



**Figure 3:** TPC single event display using EBDC03 frame 89 as the reference frame.

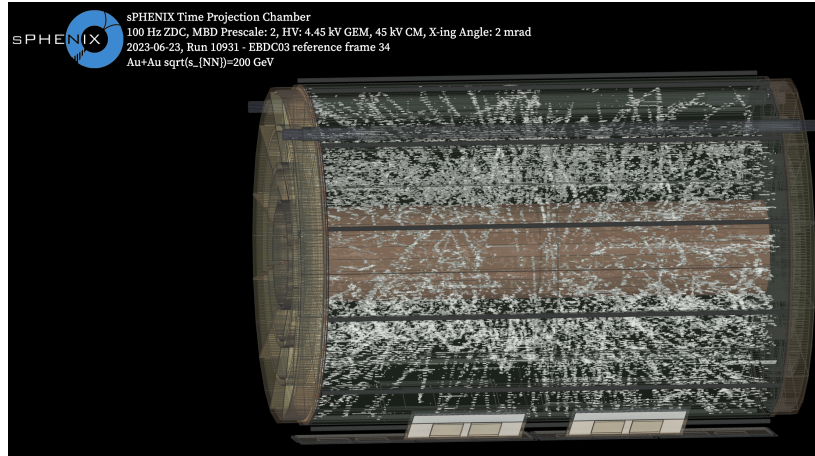


Figure 4: TPC single event display using EBDC03 frame 34 as the reference frame.

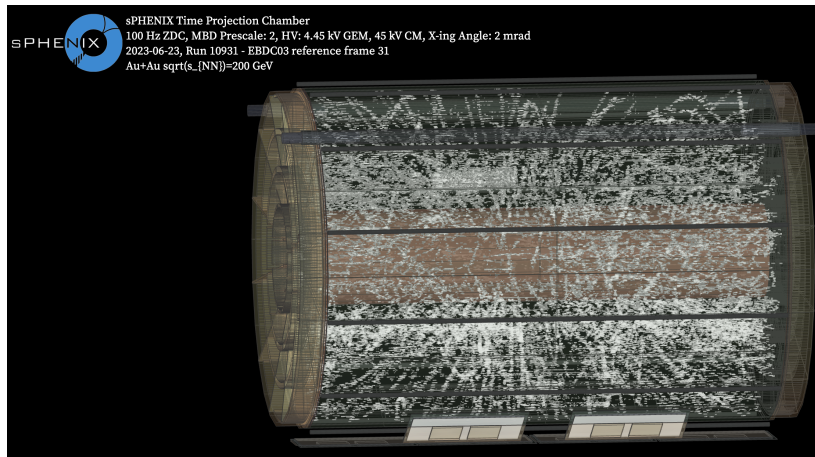


Figure 5: TPC single event display using EBDC03 frame 31 as the reference frame.

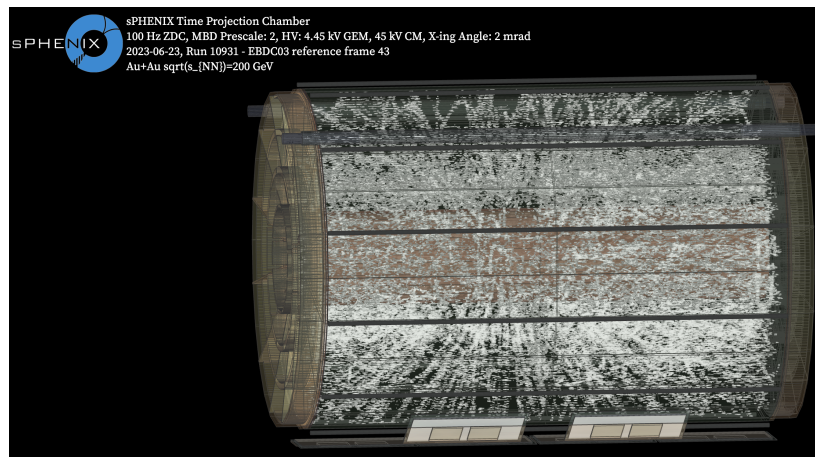
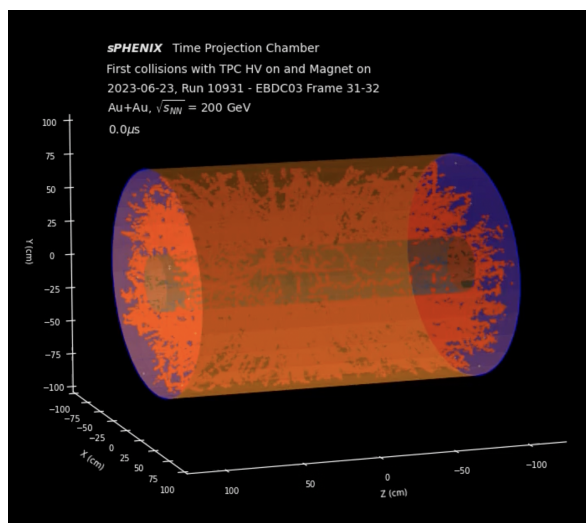


Figure 6: TPC single event display using EBDC03 frame 43 as the reference frame.



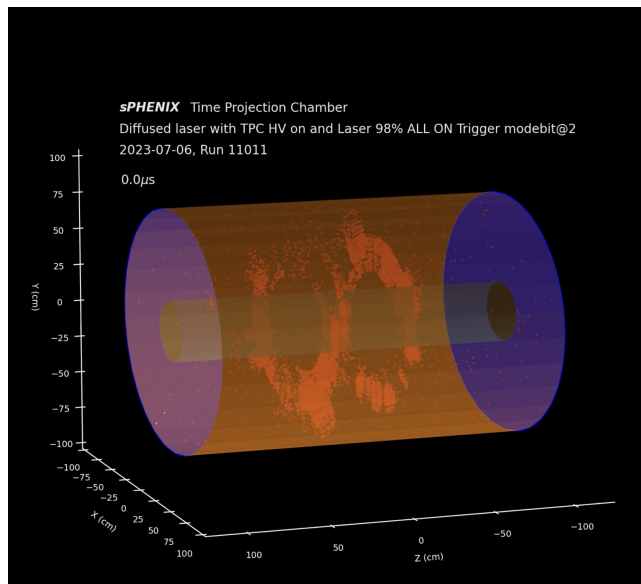
## 41 Animation of the event

42 The animation of the drifting of clusters in the TPC from the json files were gen-  
43 erated using the [TPC-ClusterAnimation](#) module. The user defined values in the  
44 [TPC\\_Cluster\\_Drift\\_Animator\\_beam.py](#) are set to  $\text{TPC\_drift\_speed} = 8\text{cm}/\mu\text{s}$ , dimensions of the TPC  
45 are set to  $\text{length}=105\text{cm}$ , inner radius= $20\text{cm}$  and outer radius= $80\text{cm}$ . The output is a matplotlib  
46 animation that can be viewed in different angles along with a mp4 video file of the animation for  
47 future use. The sPHENIX animation of first Au+Au collisions at  $\sqrt{s_{NN}} = 200\text{ GeV}$  with TPC HV  
48 on and magnet on from Run 10931 (EBDC03 reference frame 31) can be found [here](#) and that of the  
diffuse laser event can be found [here](#).



**Figure 7:** Snapshot of the animation for the TPC drift of a single event display using EBDC03 frame 31 as the reference frame from run 10931.

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**Figure 8:** Snapshot of the animation for TPC drift for a single event from the diffuse laser test in run 11011.

## 50 Data Used

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

52 Figures 1-6:

53 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc00\_beam-00010931-0000.prdf  
 54 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc01\_beam-00010931-0000.prdf  
 55 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc02\_beam-00010931-0000.prdf  
 56 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc03\_beam-00010931-0000.prdf  
 57 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc04\_beam-00010931-0000.prdf  
 58 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc05\_beam-00010931-0000.prdf  
 59 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc06\_beam-00010931-0000.prdf  
 60 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc07\_beam-00010931-0000.prdf  
 61 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc08\_beam-00010931-0000.prdf  
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 65 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc12\_beam-00010931-0000.prdf  
 66 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc13\_beam-00010931-0000.prdf  
 67 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc14\_beam-00010931-0000.prdf  
 68 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc15\_beam-00010931-0000.prdf  
 69 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc16\_beam-00010931-0000.prdf  
 70 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc17\_beam-00010931-0000.prdf  
 71 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc18\_beam-00010931-0000.prdf  
 72 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc19\_beam-00010931-0000.prdf

73 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc20\_beam-00010931-0000.pdf  
74 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc21\_beam-00010931-0000.pdf  
75 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc22\_beam-00010931-0000.pdf  
76 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc23\_beam-00010931-0000.pdf

77 Figure 7:

78 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc00\_beam-00011011-0000.pdf  
79 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc01\_beam-00011011-0000.pdf  
80 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc02\_beam-00011011-0000.pdf  
81 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc03\_beam-00011011-0000.pdf  
82 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc04\_beam-00011011-0000.pdf  
83 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc05\_beam-00011011-0000.pdf  
84 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc06\_beam-00011011-0000.pdf  
85 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc07\_beam-00011011-0000.pdf  
86 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc08\_beam-00011011-0000.pdf  
87 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc09\_beam-00011011-0000.pdf  
88 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc10\_beam-00011011-0000.pdf  
89 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc11\_beam-00011011-0000.pdf  
90 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc12\_beam-00011011-0000.pdf  
91 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc13\_beam-00011011-0000.pdf  
92 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc14\_beam-00011011-0000.pdf  
93 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc15\_beam-00011011-0000.pdf  
94 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc16\_beam-00011011-0000.pdf  
95 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc17\_beam-00011011-0000.pdf  
96 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc18\_beam-00011011-0000.pdf  
97 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc19\_beam-00011011-0000.pdf  
98 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc20\_beam-00011011-0000.pdf  
99 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc21\_beam-00011011-0000.pdf  
100 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc22\_beam-00011011-0000.pdf  
101 /sphenix/lustre01/sphnxpro/commissioning/tpc/beam/TPC\_ebdc23\_beam-00011011-0000.pdf

102 All sector frame values used for each image:

EBDC	Figure 6	Figure 4	Figure 2	Figure 3	Figure 1	Figure 5
00	38	28	80	84	4	26
01	48	38	87	91	4	36
02	37	35	83	89	6	33
03	43	34	85	89	4	31
04	37	27	75	79	4	25
05	52	40	93	97	4	38
06	64	51	76	76	6	47
07	50	38	91	97	6	34
08	44	36	83	87	4	33
09	41	33	81	85	4	31
10	39	30	75	79	4	28
11	40	32	74	74	4	30
12	47	37	92	96	4	34
13	40	32	74	80	4	30
14	47	36	91	97	4	N/A
15	43	33	84	90	5	31
16	41	31	77	83	5	29
17	46	36	80	86	5	34
18	39	31	85	90	4	29
19	48	38	85	90	4	36
20	42	34	82	86	6	32
21	42	34	82	86	4	32
22	50	38	93	97	4	34
23	44	34	86	90	4	32

103