

Identifying different particle interactions with an imaging detector

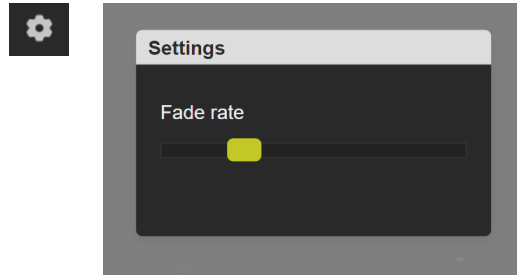
Instructions for Activity C.42: Task (c)

Note that there are five parts to this task. For parts 4 and 5 it is useful if you have a copy of the CERN@school paper by Whyntie et al. (2015) to hand.

1. Open the detector (Particle Camera A) and run it in the first detector in the default live imaging mode. Do not change any of the settings for now. You should be able to see the interaction of radiation with the detector, forming the types of shapes in the pixels of the detector that you read about in the early parts of Activity C.42.

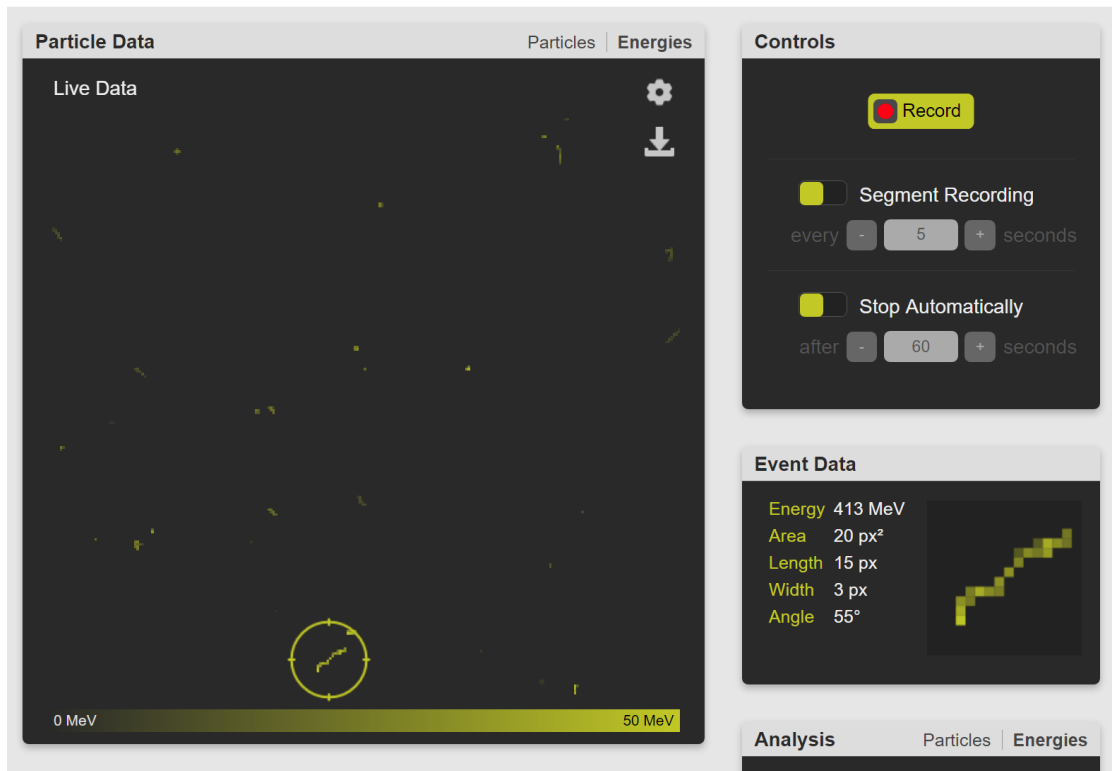


Watch the live imaging for a few minutes to get a rough feel for the different types of shapes you see and the rate at which they are hitting the detector (do not worry about the numbers for now). As particles interact in the detector you will see them appear on the screen and then gradually fade away. The fading is not a real phenomenon, but is included in the viewing software so that the images are easier to interpret in the live imaging mode. You can adjust the time it takes for the signal to fade by clicking on the “cog” in the upper right corner of the live image window and moving the slider in the pop-up panel to the left to slow it down or to the right to speed it up. To close the slider, click the mouse pointer outside of the pop-up panel.



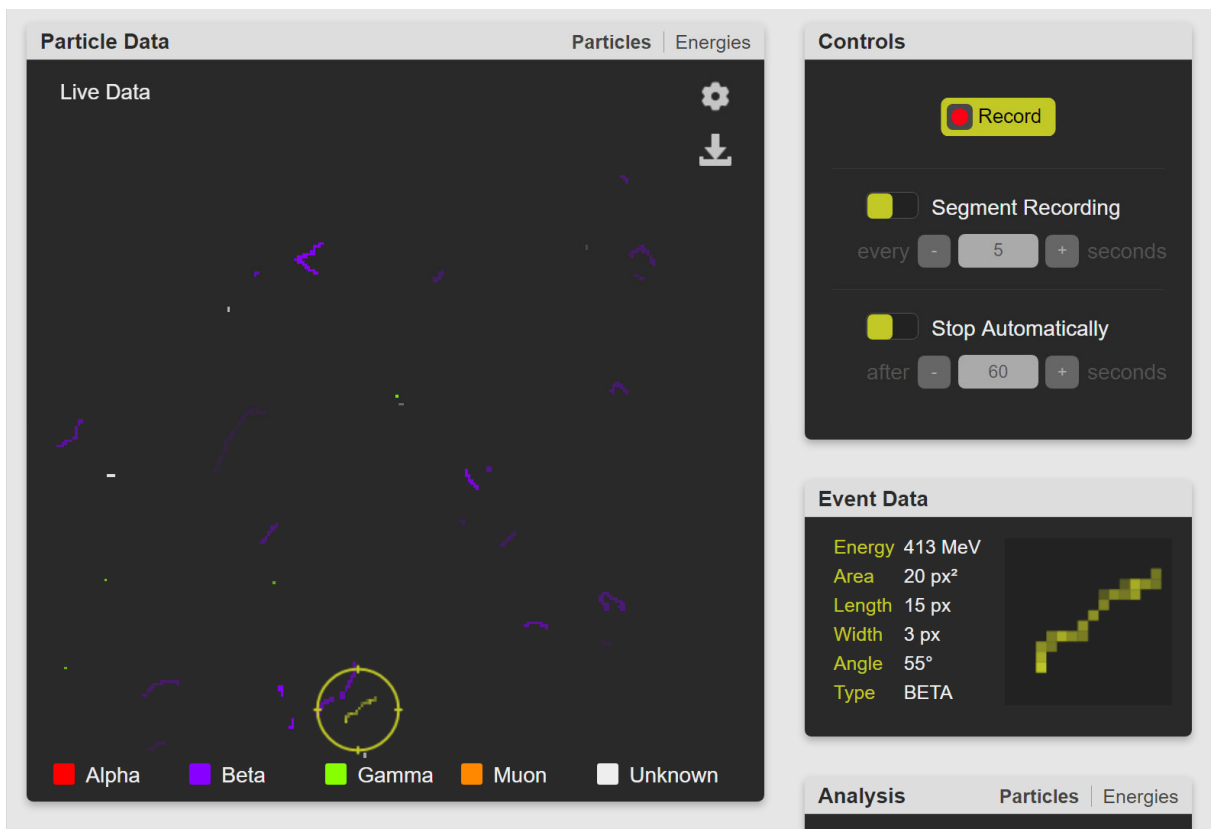
2. Now switch to the other particle camera and repeat the process in step 1 for this other detector, still in the live imaging mode.
3. You should have seen a significant difference in the number of events being detected per unit time between Particle Camera A and Particle Camera B. The two detectors are themselves identical. Before moving on, can you think of three reasons that might cause this difference? (An answer to this question is provided in the notes at the end of this document.)

4. Using the particle camera with the higher count rate (the one with the higher rate of particle interactions), determine by eye the “type” of several different events in the detector in terms of the likely candidate causing the event (e.g. alpha, beta, gamma, muon/MIP). You may find Figure 1 from the Whyntie et al. (2015) paper a useful guide. Click on an event to zoom in and show more information about the event in the “Event Data” window on the right of the screen.



5. We have made this process much easier for you in the camera software, using a similar algorithm to that presented in section 2.3 of the Whyntie et al. (2015) paper. You can read about the method there if you are interested, but the details are not important here.

Switch on the event-type detection with the “Show Particles” switch (at the bottom of the screen) and observe the particle interactions for several minutes. Click on a few events of each type as you go and look at the Event Data to make sure that you are happy with the shapes that each different particle interaction makes in the detector.



Notes

Part 3 – In response to the question about why the two particle cameras might measure different numbers of events per unit time, there are many reasons, but here are the three that we thought about:

- a) Different location: We know from Part A that the radiation environment varies with location, so if the detectors were in different locations then we might expect a different flux of particles.
- b) Shielding: If some radiation shielding was placed in front of one of the detectors then the flux of the radiation reaching the detector would decrease.
- c) Radioactive source: If a radioactive source was placed near the detector then the detector could detect the radiation from the source as well as that from the local environment.

In this case, there is actually a “uranium marble” (a very small amount of uranium encased inside a glass marble) in front of one of the detectors! We shall continue to use this higher flux to give more events to analyse in the rest of the activity.

Reference

Whyntie T., Bithray, H. Cook, J. Coupe, A. Eddy, D., Fickling, R.L. McKenna, J. Parker, B. Paul, A. Shearer, N. (2015) CERN@school: demonstrating physics with the Timepix detector, Contemporary Physics, 56:4, 451-467, DOI: 10.1080/00107514.2015.1045193