

E217 STYX

E217.1 Aim of the Experiment

The Straw Tube Young student eXperiment (STYX) comprises elements of the forward tracking system of the decommissioned ZEUS detector at DESY. By designing a new trigger and readout system it was converted into a lab course experiment. The aim of the STYX experiment is to learn about basic nuclear electronics instrumentation, gas detectors, cosmic radiation, tracking of charged particles and state-of-the art readout systems as well as computer based data analysis.

E217.2 Literature

In preparation for the experiment, we recommend the following literature:

- STYX instructions. Pick up a copy from the tutor!
- Leo, W.R.: Techniques for Nuclear and Particle Physics Experiments
- Grupen, Claus: Astroparticle Physics

There is also an exhaustive overview about cosmic rays in the PDG (although the other references are probably easier to understand):

- PDG chapter 24: Cosmic rays <http://pdg.lbl.gov/2011/reviews/rpp2011-rev-cosmic-rays.pdf>

E217.3 Required Knowledge

- Essential for the conduction of the experiment is a solid knowledge of the working principle of gas detectors (chapters 6.1 - 6.5 and 6.7 of the Leo) and of secondary cosmic rays (chapter 7 of the Grupen).
- In general we also expect knowledge on the basics of general particle physics. If you need to refresh your knowledge, just any overview book is OK (e.g. Perkins, Griffiths, ...).
- You should understand the basic working principles of scintillation detectors and photomultipliers. The level of knowledge required for other lab course experiments is sufficient. In case of no prior knowledge, a good introduction can be found in chapters 7.1, 7.2 and 8 of the book by Leo.

- Finally you should be familiar with basic concepts of electronic signal processing. Units used in the setup are amplifiers, shapers, discriminators, TDCs, counters and coincidence units. Information can again be found in chapters 14 and 17 of the book by Leo.

E217.4 Assignments

STYX is a two day experiment to be carried out at two subsequent days. **Please contact the tutors early in advance to agree on dates and get an extended description of the experiment and the concrete assignments.**

The idea of the lab course experiment is to setup and commission a particle detector and analyse data taken with it. It is not about achieving a given expected final result. During carrying out the experiment you have freedom to put focus on things that are most interesting to you. Bottom line: Of course you can find older lab course reports but you will have more fun and learn more if you don't read them in advance.

E217.5 Procedure and analysis

E217.1.1 Day One

During the first day you will explore the detector. Several operational parameters will have to be tuned before you can actually take data. You will hence measure various properties of the setup and their dependence on externally supplied references.

After a suitable working point is found you will start an over night measurement.

E217.1.2 Day Two

During the second day you will analyse the data recorded over night. Before any physics can be deduced the data has to be calibrated. Afterwards you will have time to investigate properties of cosmic radiation and/or the detector setup on your own in a provided software framework.

Best wishes for a successful experiment!

Date: June 2013

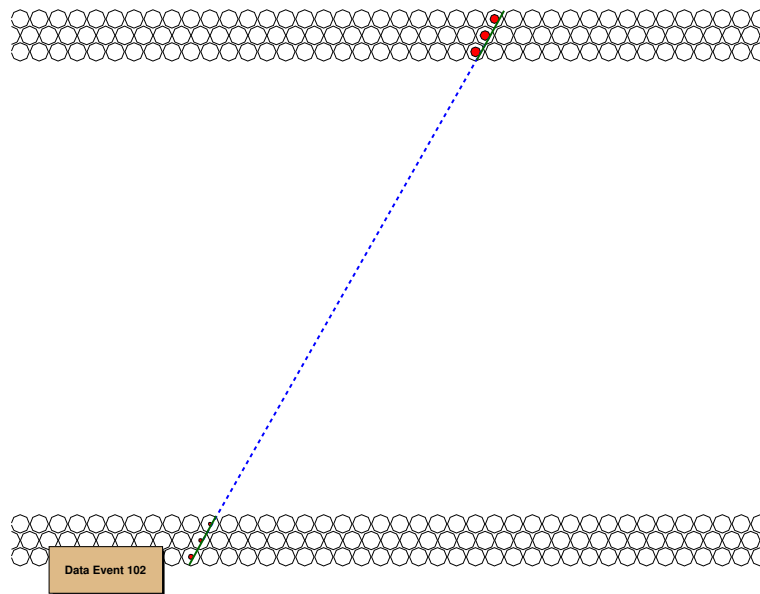


Figure E217.1: Example event of a reconstructed cosmic muon recorded by STYX

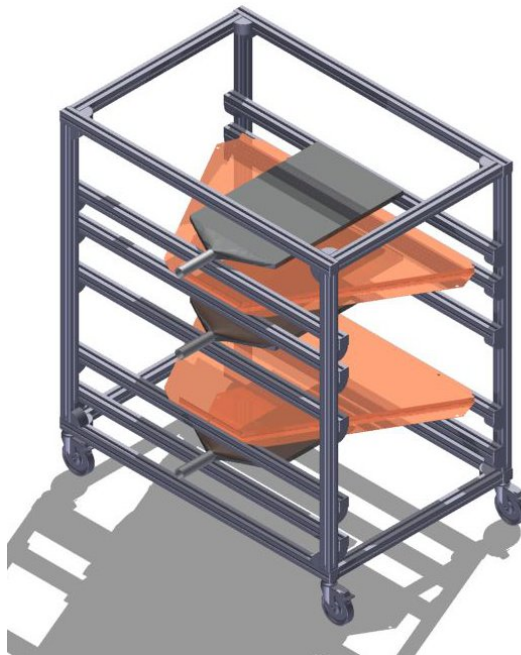


Figure E217.2: Sketch of the STYX experiment