

MAKING TRACKS I: CLOUD CHAMBER

STUDENT GUIDE

Right now, you are being bombarded by cosmic ray muons and neutrinos that, fortunately, do not interact with matter much, so they pass right through you and do no harm. Do you see them? C'mon, squint. Now? Of course not.

Physicists “see” atomic and subatomic particles with detectors, devices designed to interact with particles and produce evidence of their existence and behavior. A good place to start to learn about detectors is the CERN [Seeing the Invisible](http://cern.ch/go/Xr9q) site at <http://cern.ch/go/Xr9q>.

It turns out that one of the earliest and simplest particle detectors is the *cloud chamber*. A cloud chamber contains a supersaturated vapor. When an energetic charged particle passes through, some of that vapor turns to liquid and the passing particle leaves a track, similar to the trail left by an airplane at high altitude.



What is the research question?

Is it possible to distinguish one particle type from another by how they behave in the cloud chamber?

What tools do you need for your analysis?

In class, you might build a cloud chamber or inspect one that is already built. Or you can watch a video to see how a cloud chamber is constructed and how it works.

The video we recommend is on the CERN [How to make your own cloud chamber](http://cern.ch/go/9dqj) page at <http://cern.ch/go/9dqj>.

Observe a cloud chamber in operation in small groups. Again, if you do not have access to a cloud chamber, you can watch a video. We recommend:

- [Diffusion cloud chamber](http://cern.ch/go/wb7B) at <http://cern.ch/go/wb7B>.
- [CERN cloud chamber](http://cern.ch/go/6gbF) at <http://cern.ch/go/6gbF>.
- [BNL/SB QuarkNet 2007](http://cern.ch/go/Zc69) at <http://cern.ch/go/Zc69>.

What will you do?

You will work in teams of three to five students. Each team will have 10–15 minutes to work with a cloud chamber or a video of a cloud chamber in operation. Each team looks for four different types of particle tracks. Are they long? Short? Thick? Thin? In a straight line, a curve, or something else? You determine the types from categories you create based on your observations. Use the Team Report Form to record your observations. Don't worry if you end up with more or less than four types; it depends on the categories and, since *you* are making the categories, your answers are correct.

What are your claims? What is your evidence?

How many particle track types did you observe?

Which type occurred most often?

Which types were rare?

Be sure and describe the evidence you used to justify your claims.