

**Non-obvious controls:**General:

- Be sure to try all the different tabs at the top of the simulation.
- You can **Pause** the sim and then use **Step** to incrementally analyze.
- If you are doing a lecture demonstration, set your screen resolution to 1024x768 so the simulation will fill the screen and be seen easily.

Alpha Radiation Tab:

- After the **Polonium** nucleus decays to **Lead**, press **Reset** to start over with a new Polonium nucleus.
- Use **Rewind to decay** to watch the decay again.

Fission: One Nucleus Tab:

- **Fire** the gun to shoot a **neutron** at the **Uranium** nucleus and make it decay.
- After the **Uranium** nucleus decays, press **Reset** to start over with a new one.

Chain Reaction Tab:

- Add a **containment vessel**, fill it with **U-235** and **U-238**, and **fire** the gun to create a chain reaction.
- Grab the edge of the **containment vessel** and drag it in or out to change the size.

Nuclear Reactor Tab:

- **Fire neutrons** to create a chain reaction. Moving the **control rod adjuster** out of the reactor will allow the reaction to spread more quickly.

**Important modeling notes / simplifications:**

- In the **Alpha Radiation** tab, the graph shows the average **total energy** of any single alpha particle in the nucleus. When the nucleus decays, the alpha particle that leaves carries away energy, so that the total energy of the remaining alpha particles drops.

**Insights into student use / thinking:**

- In interviews, we found that even students with no science background were able to figure out the basics of nuclear physics by playing with this simulation. However, students were not able to make sense of the graphs without instruction.
- In the **Chain Reaction** tab, students quickly learn that **U-235** contributes to the chain reaction and **U-238** does not. They then wonder why we bother to include **U-238** in the simulation. Further instruction is needed to explain that Uranium in the real world is mostly **U-238**.
- Students can usually figure out what is happening in the **Nuclear Reactor** tab, but they may not realize that this represents a nuclear power plant unless you point it out.

**Suggestions for sim use :**

- For tips on using PhET sims with your students see: [Guidelines for Inquiry Contributions](#) and [Using PhET Sims](#)
- The simulations have been used successfully with homework, lectures, in-class activities, or lab activities. Use them for introduction to concepts, learning new concepts, reinforcement of concepts, as visual aids for interactive demonstrations, or with in-class clicker questions. To read more, see [Teaching Physics using PhET Simulations](#)
- For activities and lesson plans written by the PhET team and other teachers, see: [Teacher Ideas & Activities](#)