

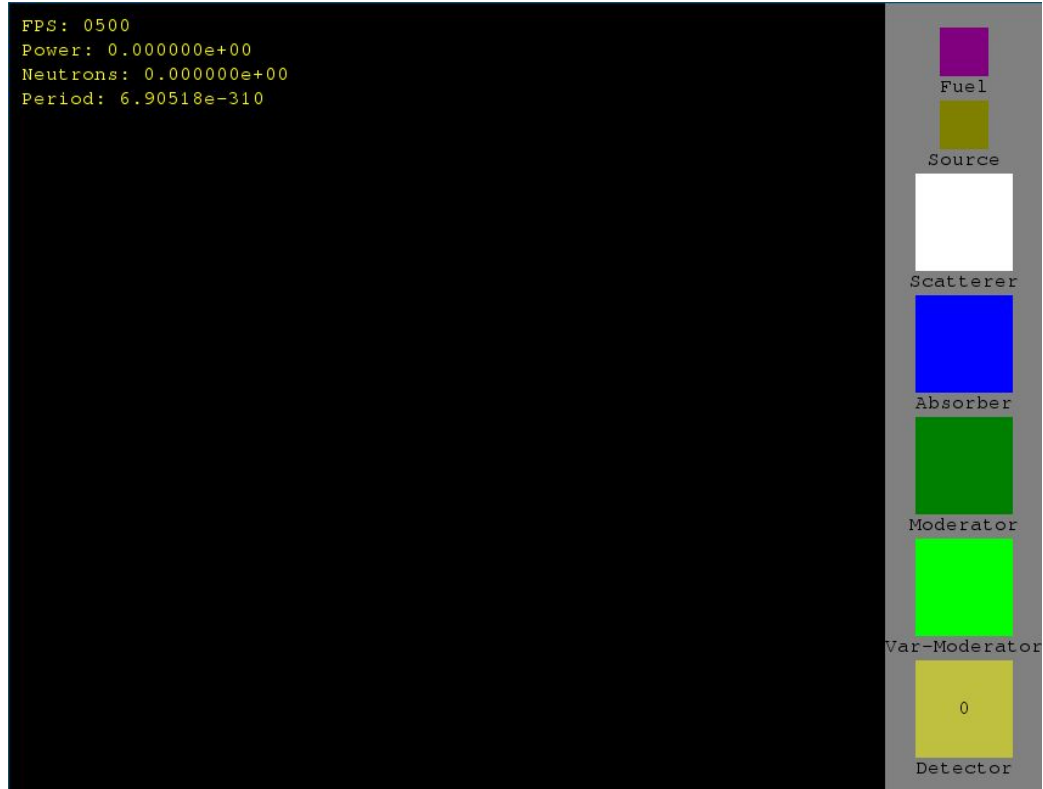
A Simple Neutron-Physics Game

Robert Carlsen and Matthew Gidden

Open Source!

- You can download the source code at <https://github.com/rwcarlsen/reactor>
- Mac and Linux supported

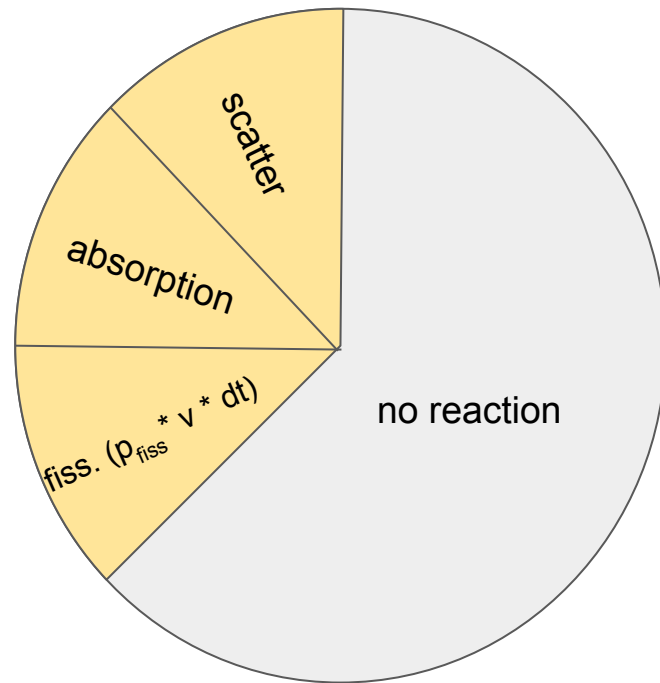
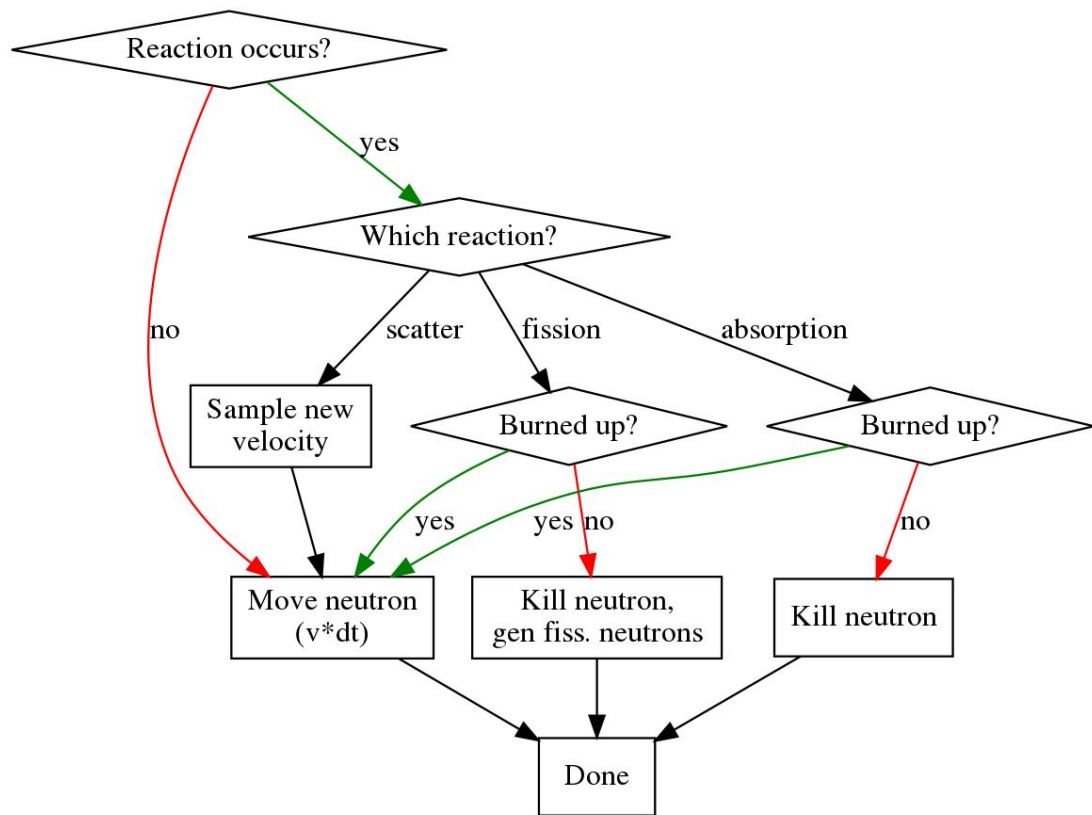
Main Screen



Features

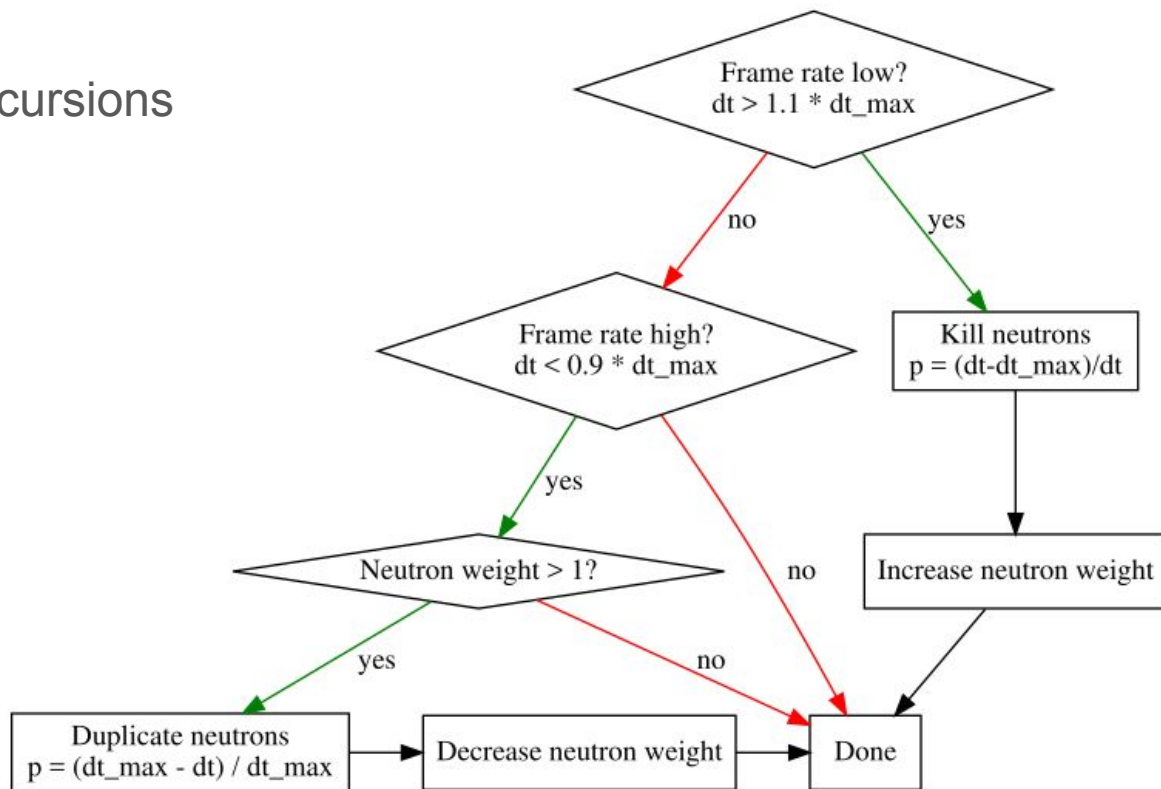
- Burnup
- Energy-dependence
 - neutron speed/color
 - absorption probability
 - fission probability
- Rouletting for wider power range
 - Low frame rate \Rightarrow roulette neutrons and increase weights
 - High frame rate \Rightarrow duplicate neutrons and decrease weights
- Void coefficient

Neutron Transport



Rouletting

- Enable longer excursions
- Preserve physics



Absorber Attenuation and Burnup

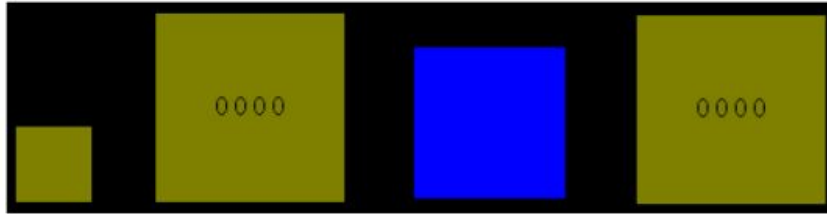


Fig. 1. An attenuation-with-absorption experimental setup.

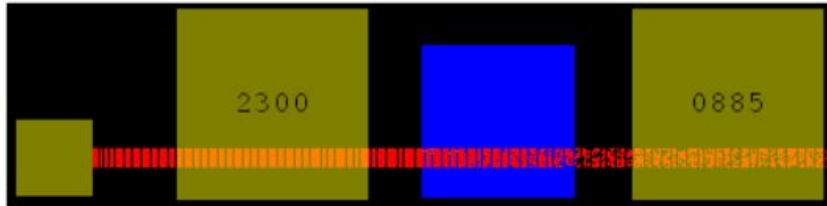


Fig. 2. Initially, attenuation is shown due to neutron absorption.

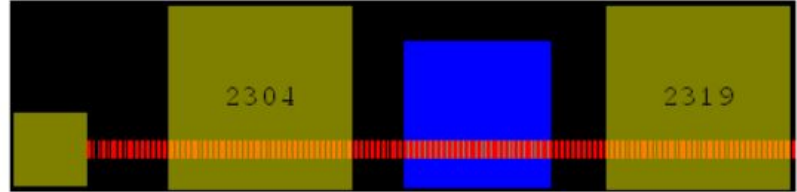


Fig. 3. Upon depletion of the absorber, no attenuation of neutrons is observed.

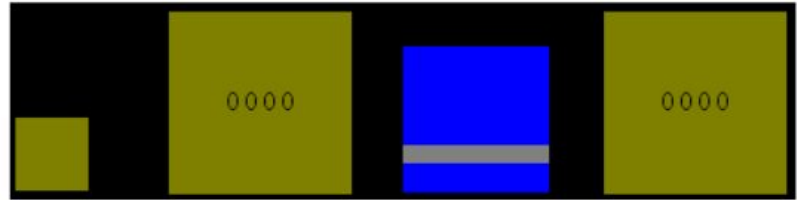
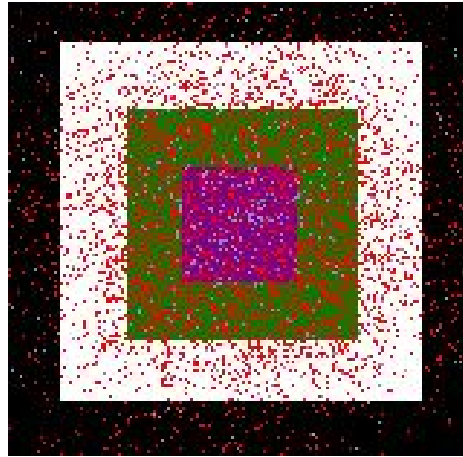
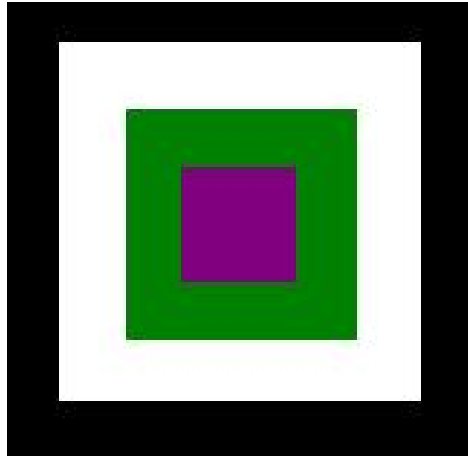
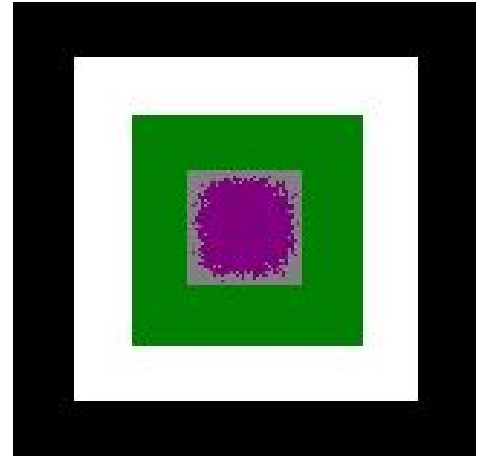


Fig. 4. After turning off the neutron beam, absorber depletion is observable.

Super Critical Thermal Reactor

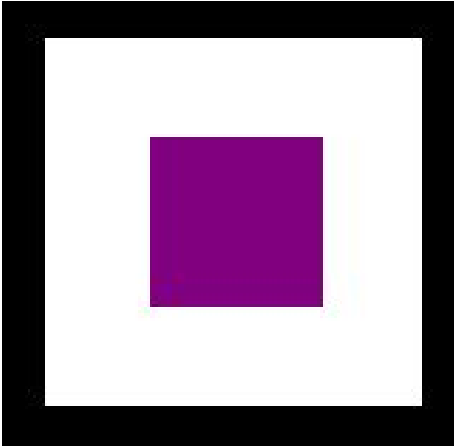


very non-uniform burnup

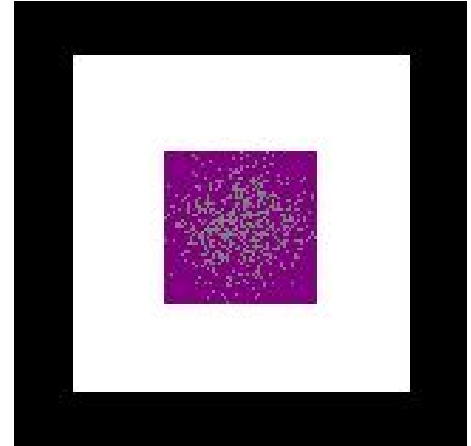
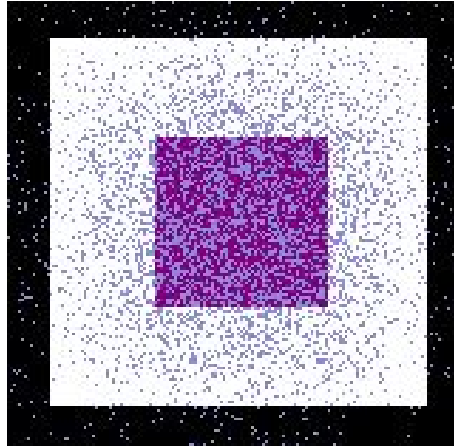


Super Critical Fast Reactor

requires bigger fuel

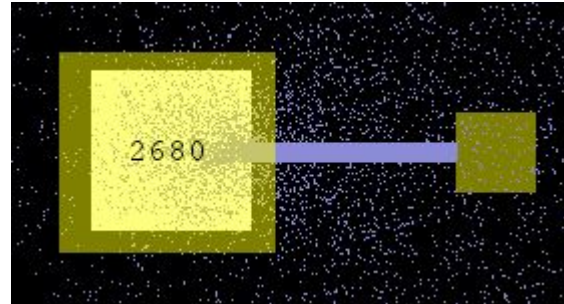


more uniform burnup



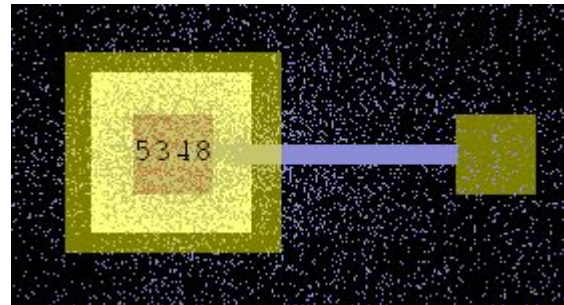
Subcritical Multiplication

plain scattering medium

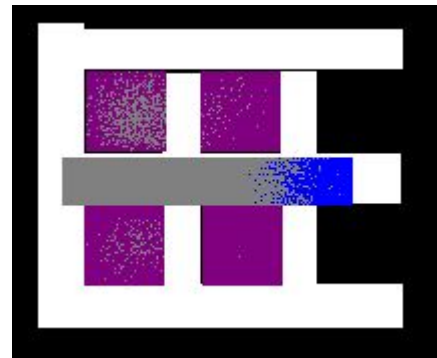
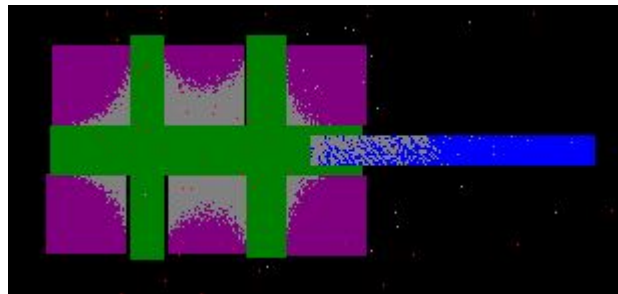


(snapshots taken at steady state)

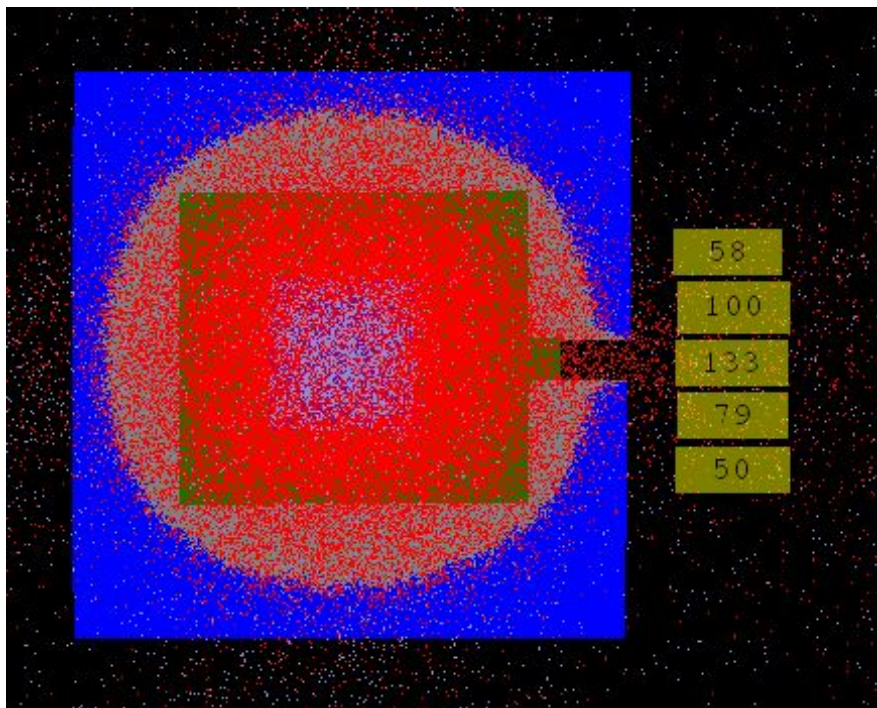
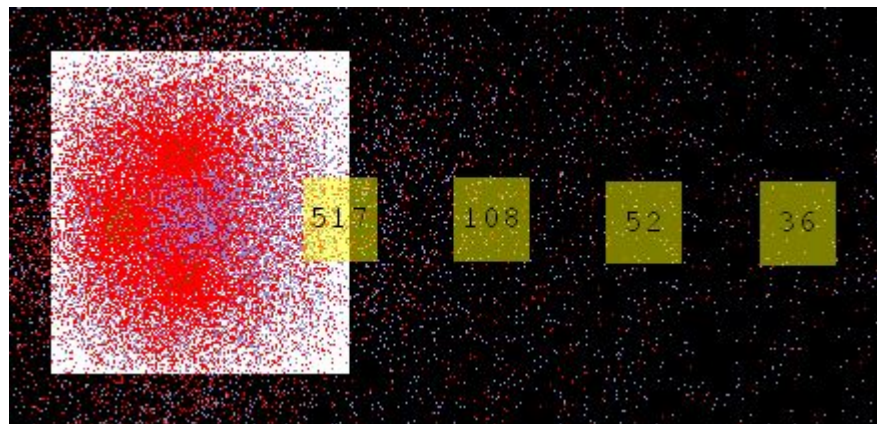
with fuel block added



Playing with Criticality



Detectors



Future Work

- Ability to save, load, script geometries
- Custom material properties
- Better detectors
 - report flux-dependent quantities
 - energy-dependent
- More realistic burnup - i.e. reactivity track burnup incrementally
- Continuum of neutron energy colors
- Challenge/objective oriented scenarios
- Windows support
- What would you like to see? Submit a patch at: <https://github.com/rwcarlsen/reactor>