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Diagnostics for understanding reactor control through time- and space--resolved imaging of neutron and gamma flux in Reactor Environments.

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For AECL visit

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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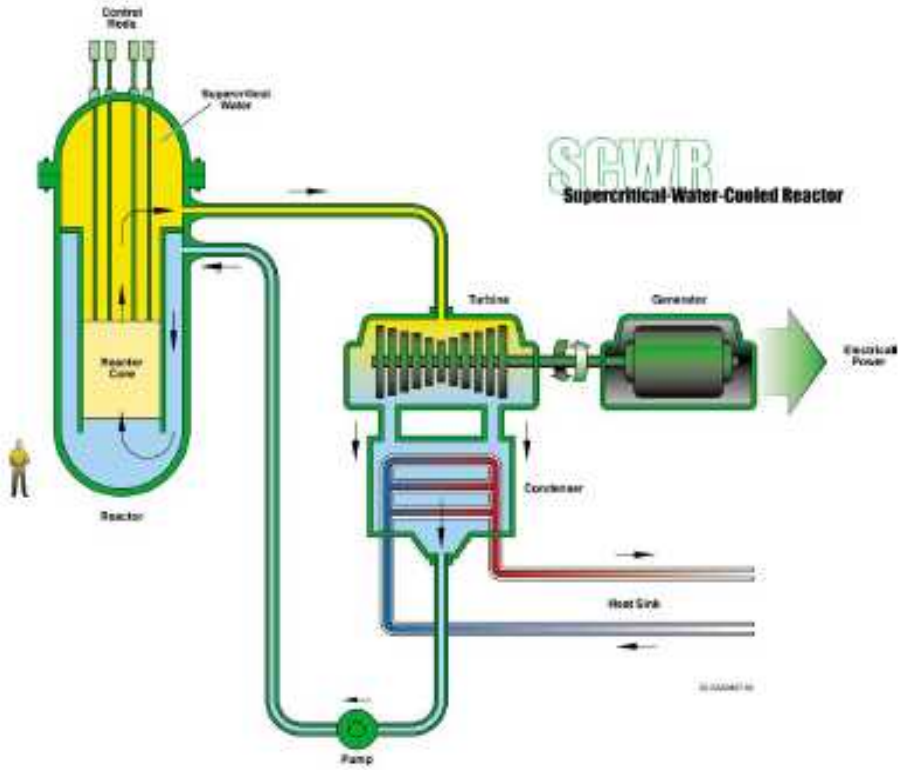
Basic Idea – rad hard electronics with sheet fabricated sensors

Representative Reactor



Imagine wrap around

Diagnostics covering the surface – sensitive To minor changes in flux

- Lifetime years

One aspect of understanding reactor control and transparency would be the ability to perform time-resolved and space-resolved flux measurements internal and external to the core. Recent advances in high pressure capillaries and radiation hardened electronics may make cost effective large area imaging cost effective and robust.

We'll describe some of the electronic advances and diagnostics.

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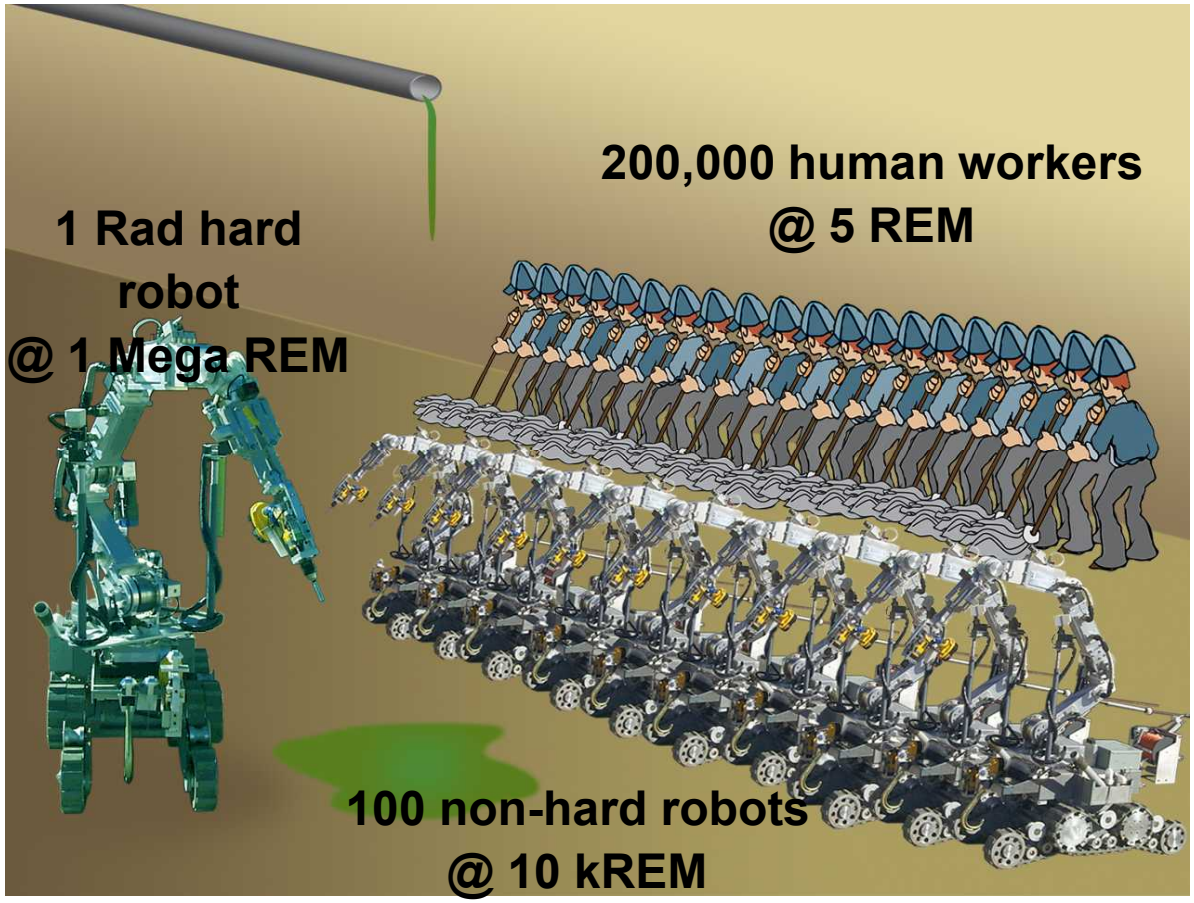
Radiation Hardened Chips Developed for Robotics and other applications

Sandia has been developing radiation Hardened electronics

- Continued function after intense irradiation
- Function during irradiation



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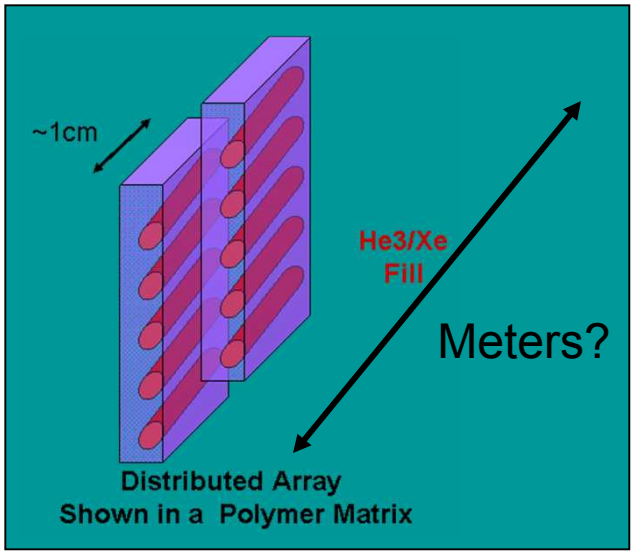
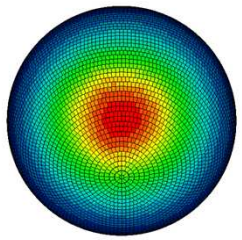
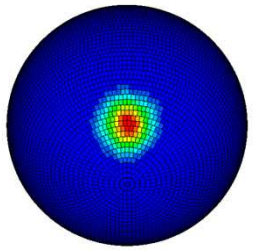
Global Mapping of Radiation Fields



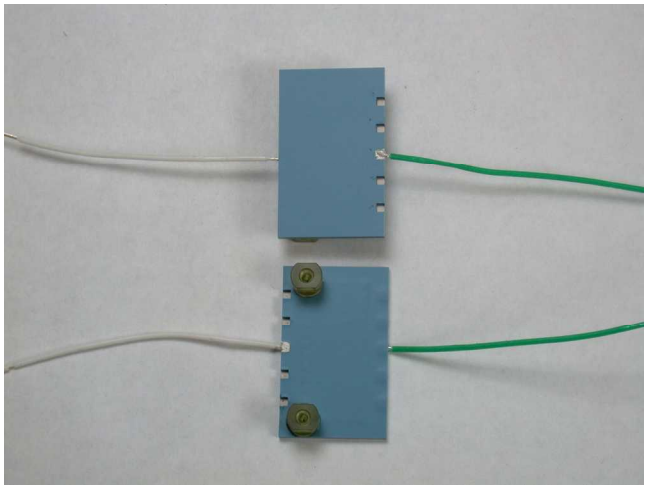


Average of 1 Event



Average of 20 Events

Example



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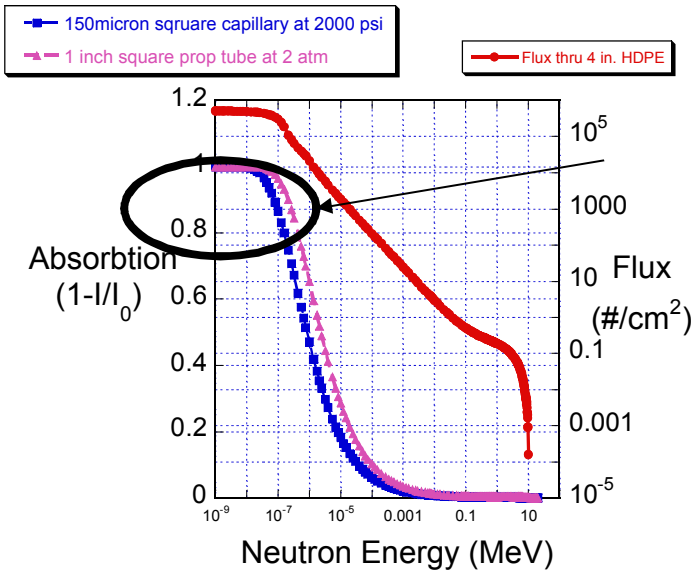
3He/4He/Xe as 3D pulsed sensors



Thermal neutrons are effectively captured

- Thermal Neutron
- Fast neutron
- Gamma

- Time
- Space
- Long Life/Rad hard

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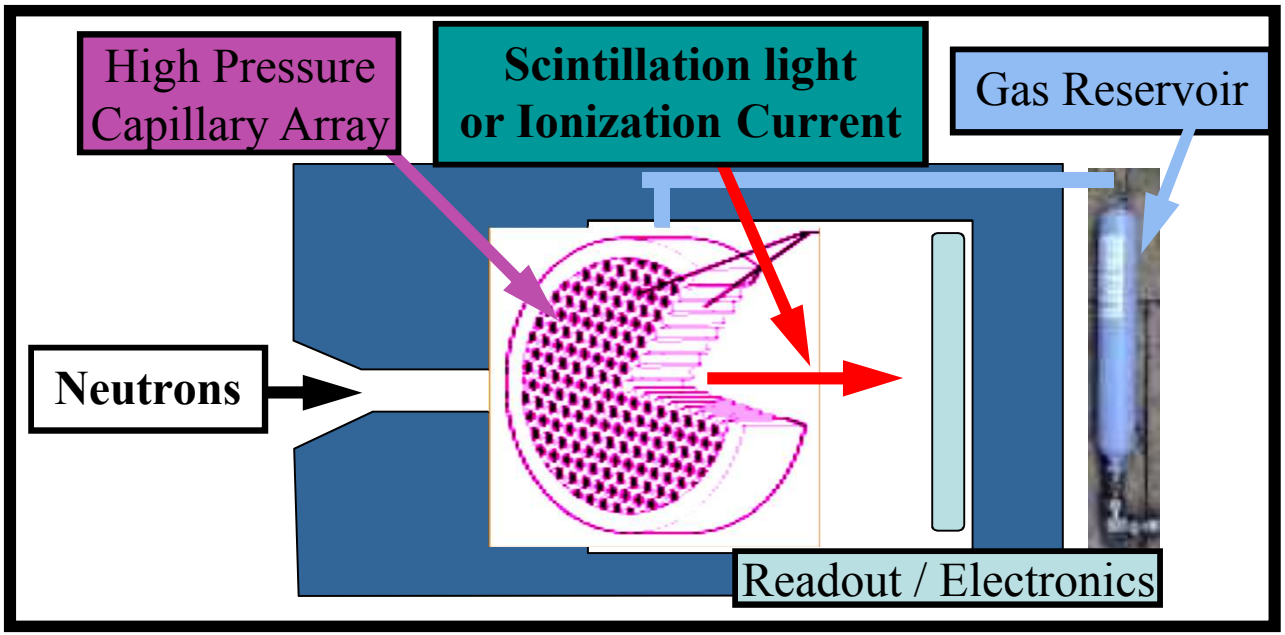
How does this detector system work?

- This detector system utilizes neutron reactions with high-pressure Helium gas to generate detectable scintillation photons or charged particles
- Sandia's MEM's and fluidics technologies allows for extremely high pressure fluid and gas fills of capillary arrays, ~2000 atm, yielding enhanced detection efficiency with enhanced gas density
- **A compact pixilated detector results which is naturally compatible with neutron imaging as well as neutron spectroscopy and burn/bang diagnostics**
- **This detector has a high neutron to gamma detection sensitivity due to the high neutron cross-sections, the low Z Helium gas fill and the long electron deposition range**



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Spatially-resolved, Dose-rate Sensing Cloth for Personal Protective Equipment and Dose sensitive Paint …….

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