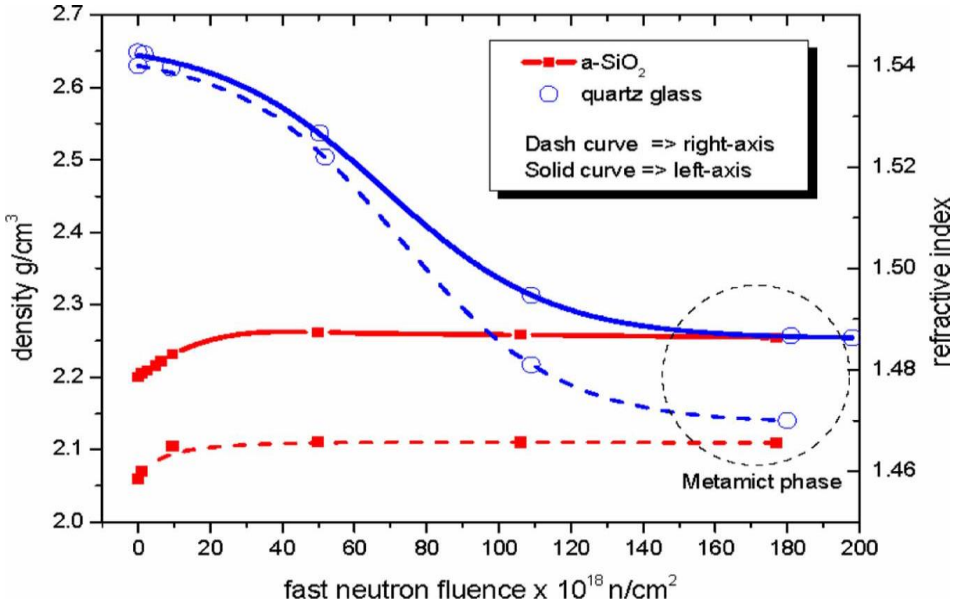
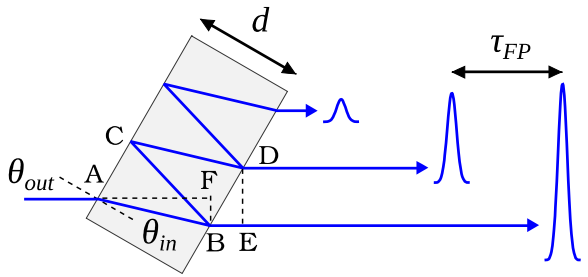
Summary of UNM work on crystal based dosimetry
Project 15-142

Neutron Measurements via Optical Material Damage

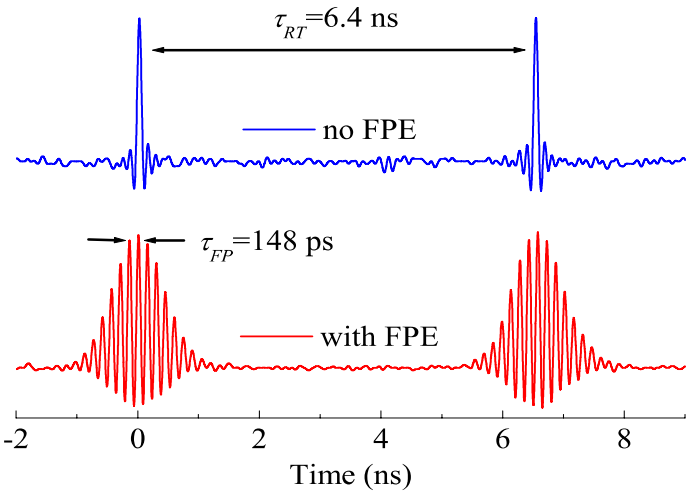


neutrons displace lattice atoms,
change index of refraction
Long known effect, data from 1958 study.

Our goal is calibration for this to be
a useable tool

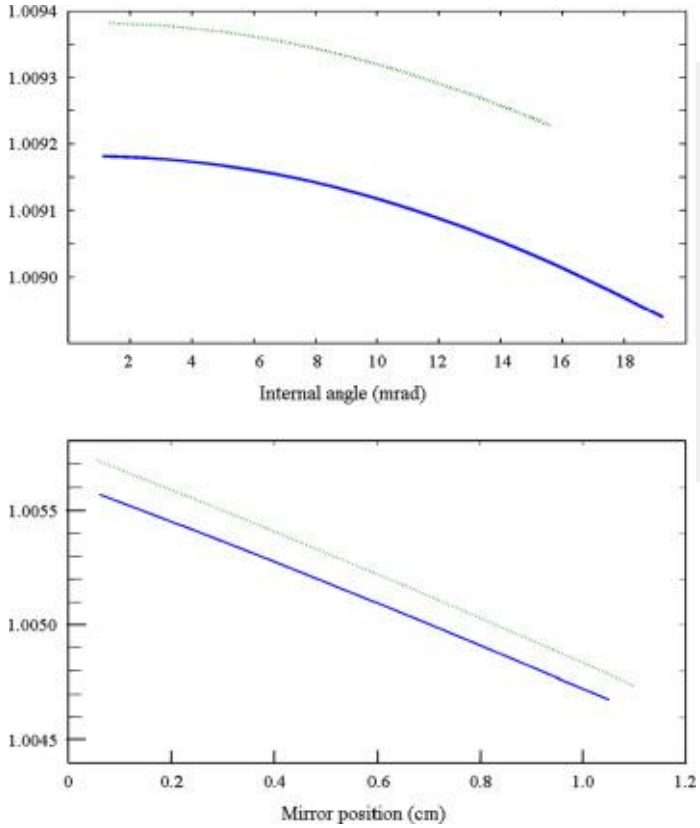


Internal reflection gives fast repetition rate
based on crystal index of refraction
- Crystal acts as a Fabry Perot etalon (FPE)

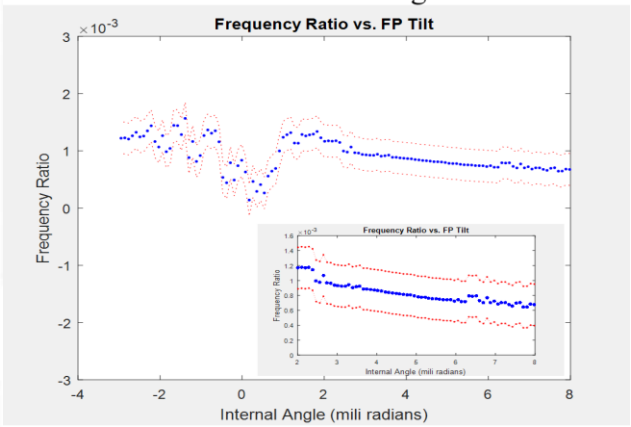


Difference seen by pulses without/with crystal
Precise measurement of refractive index change
from high freq/low freq ratio changes

Experiments and Simulations

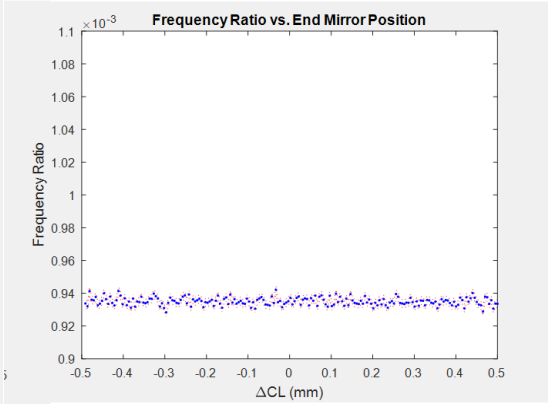


03/09/2016 FP-Angle

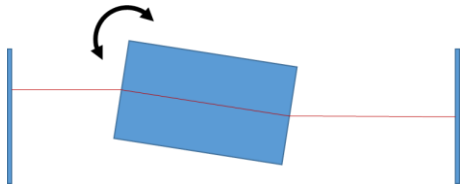


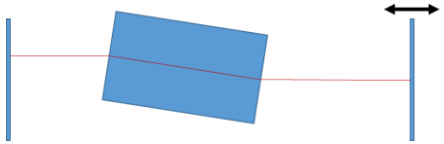
σ_{Ratio} (2-8mrad) = 2.781E-4

03/11/2016 FP-CL



σ_{Ratio} = 2.397E-6



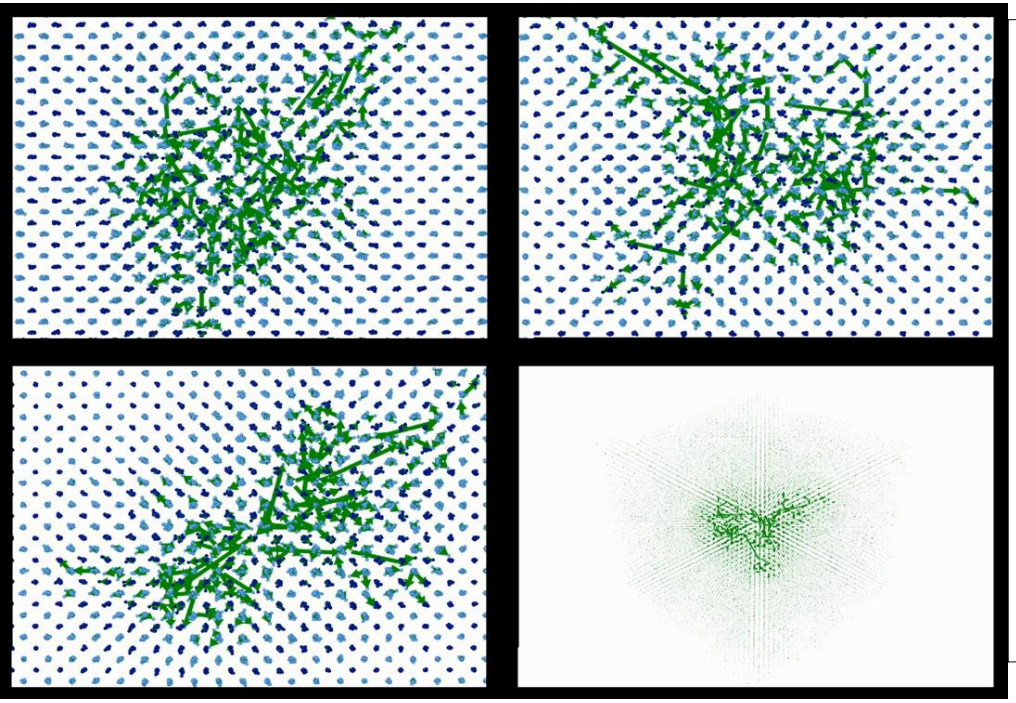


High freq/low freq ratio
divided by an order factor
for 2 different crystals
over range of angles and cavity lengths
Ratio between 1 and 2 stable to 10-6

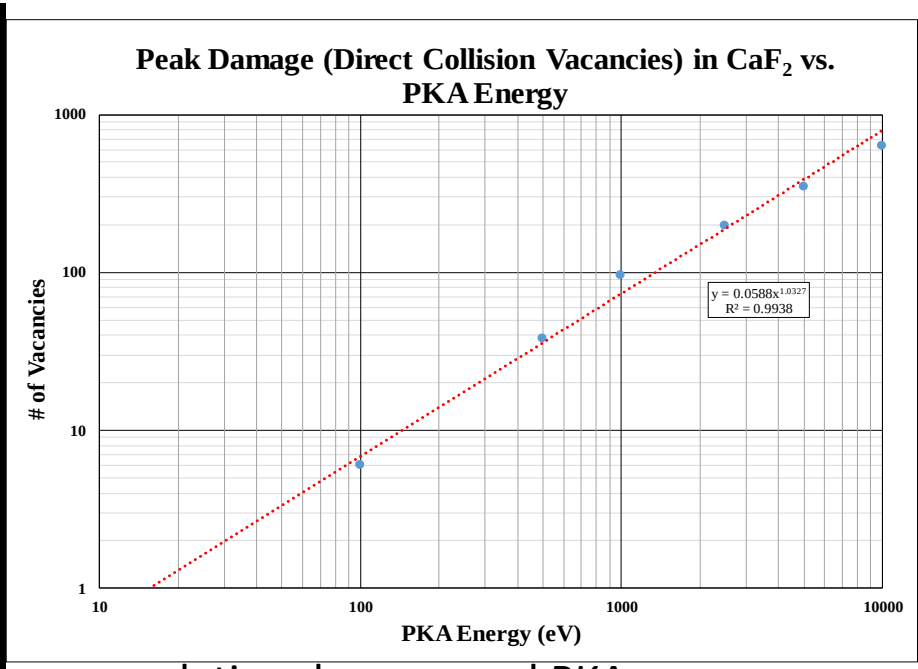
confirming measurement repeatability
with crystal angle, cavity change
outcome: very stable

Experiments and Simulations

LAMMPS molecular dynamics simulations



multiplane image of displacements



relating damage and PKA energy

Neutron Damage for Measurements

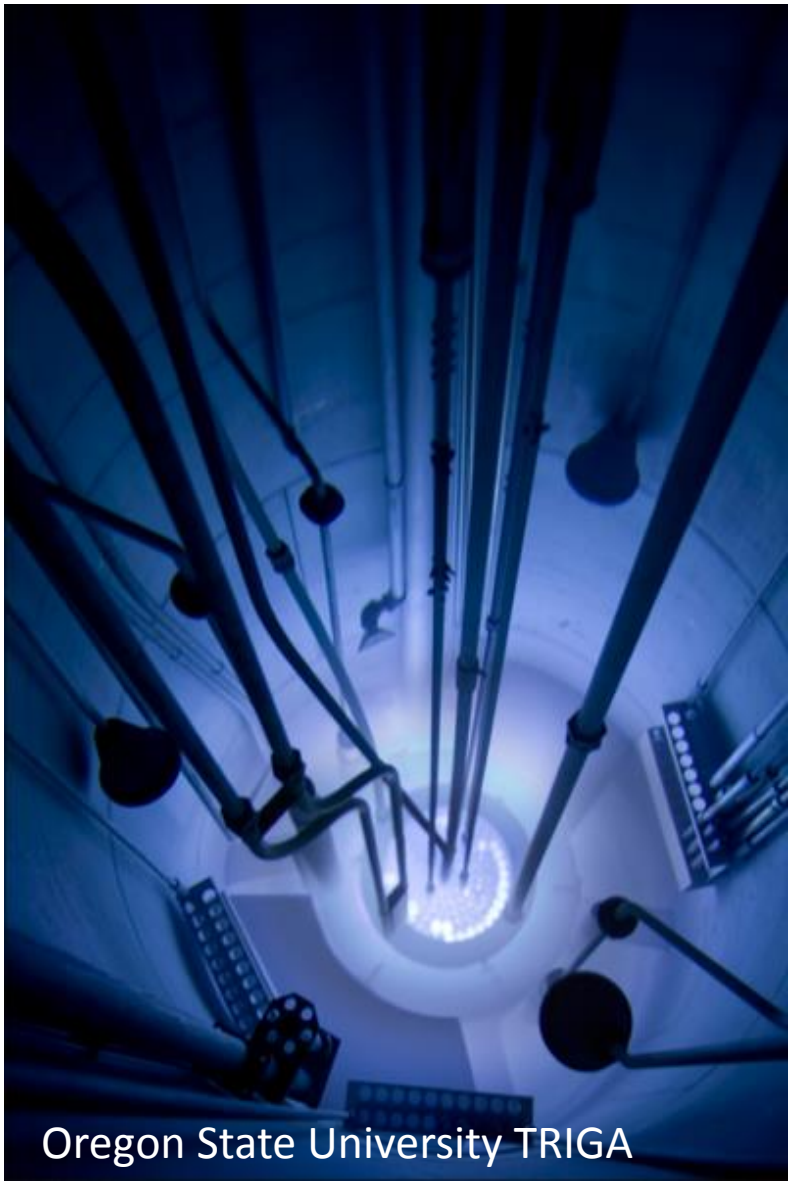
This program needs crystals irradiated a different conditions that cover a large enough range of dose.

This year efforts were focused on acquiring such specimens:

- Irradiation at intense DD,DT source at Sandia
  - Source just returned 1/12/17,
  - analysis ongoing

- Plan for 1E17 – 1E18 n/cm2s at>1keV n at Oregon State TRIGA reactor.
  - Design and planning on going
  - Irradiation to be performed this fiscal year

- Submission of a pre-proposal to NSUF
  - 1E17 – 1E19 n/cm^{2}s at MITR
  - Invited for full proposal
  - Irradiation to be performed next fiscal year


Oregon State University TRIGA