Prex Meeting

SAM Geometry Optimization

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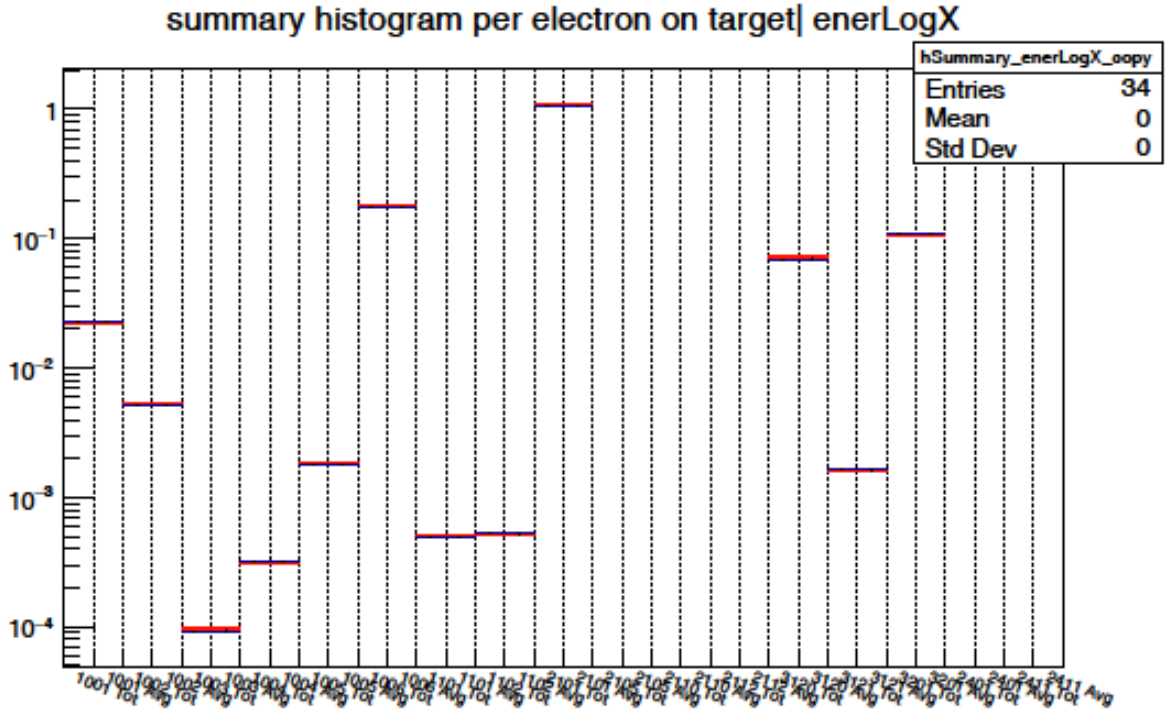
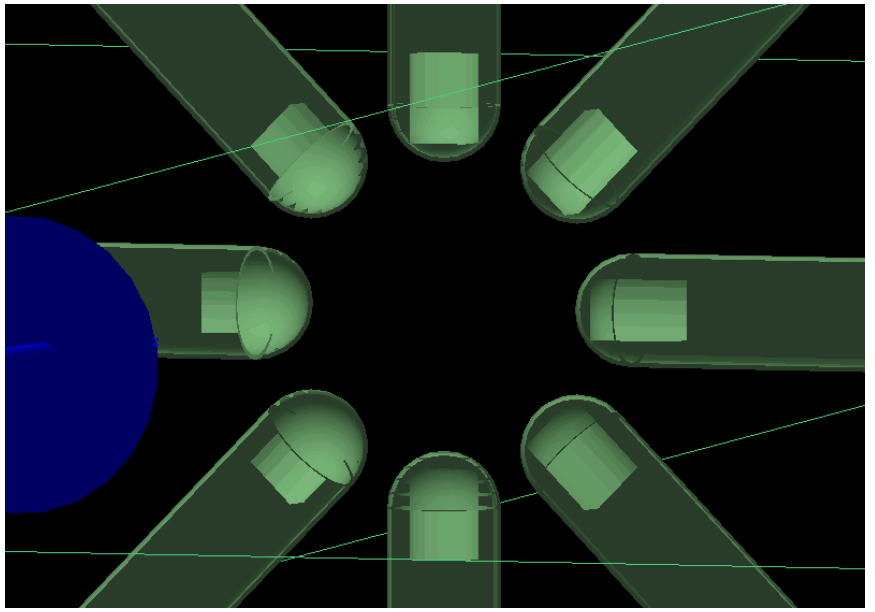
Summary of prior steps:

- Confirmed my simulation matches benchmark simulations from Ciprian (left -> red ~= blue rates)
- Developed a spherical end-cap variant of SAM can in Geant geometry (right -> visualization)
- Iterated a few times with changing (prior presentations)
    - radial offset of can
    - thickness of can aluminum (from 1.651 mm initially to .254 mm = 10 mills)
    - thickness of quartz Cherenkov radiator
    - spherical vs cylindrical end cap(and thin aluminum for first 6cm of can)
    - variants of the above
    - more variants with higher statistics
- Today's Results: Higher statistics for 5mm to 13mm Quartz thicknesses in 35 and 40 mm offset configurations for the spherical end cap design (less precise data exists for 30, 35, 40, and 45 mm offset cyl & sph endcaps)





Baseline simulations

Metrics of Radiation:

Total NEIL in LHRS (detector 1001)

E > 25 MeV Neutron Flux in the Roof (detector 1006)

Energy (MeV) Deposited in O-Ring (detector 3201)

Prex II "Benchmark" = Goal: (Removing SAMs entirely, including U shaped dump shield)

NEIL 1001 per event = $1.05(4)\times10^{-5}$ == 1

Flux 1006 per event = $1.27(5)\times10^{-5}$ == 1

Energy 3201 per event = $1.1264(17)\times10^{-2}$ == 1

Starting Point: (Including SAMs as implemented currently, including U shaped dump shield)

NEIL 1001 ratio to goal = 6.09(23)

Flux 1006 ratio to goal = 1.59(8)

Energy 3201 ratio to goal = 9.587(16)

Reasonable target – get these ratios down to 1.2 or so

May require rebuilding the SAMs

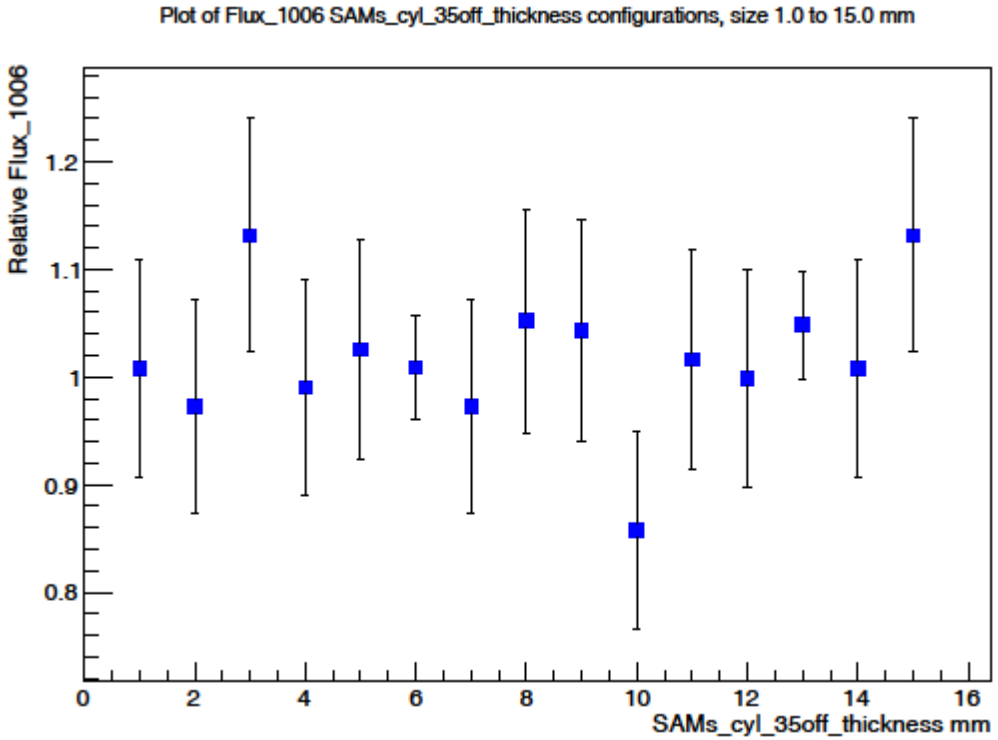
Pulling out past ~45mm radially hurts SAM signal

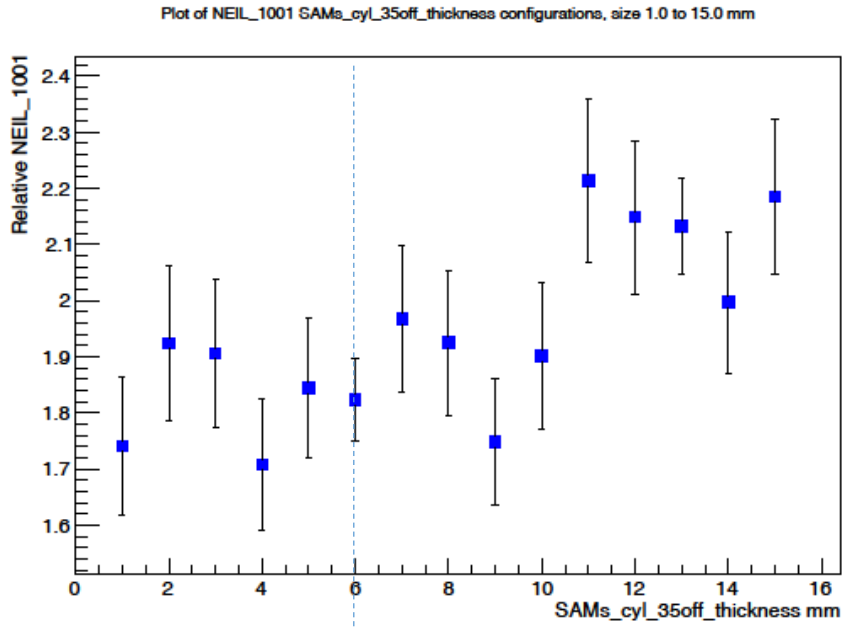
The quartz can be thinned by a significant amount

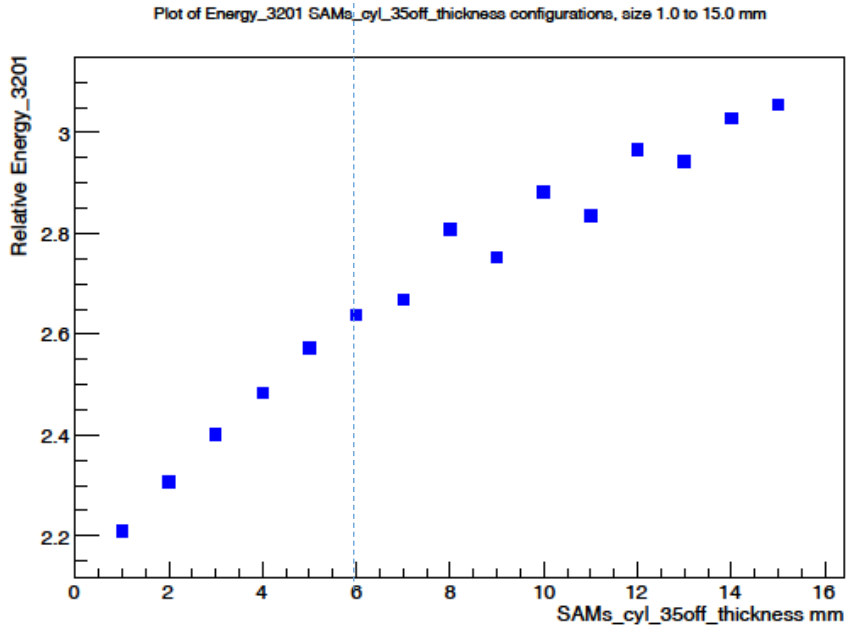
Higher statistics – Quartz thickness varied, 35 mm offset

Original baseline gdml cylindrical design
(1.5 mm Al thickness)

- NEIL in LHRS
- Roof Flux Neutrons with E>25 MeV
- Energy in O-ring
- blue line arbitrarily at 6mm thickness



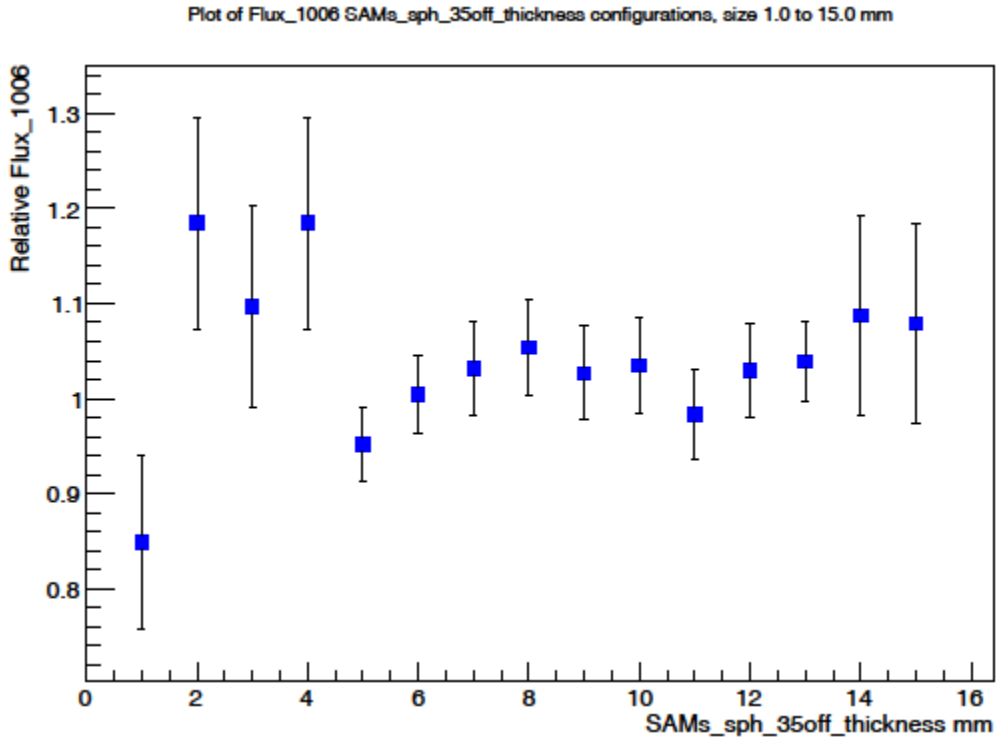


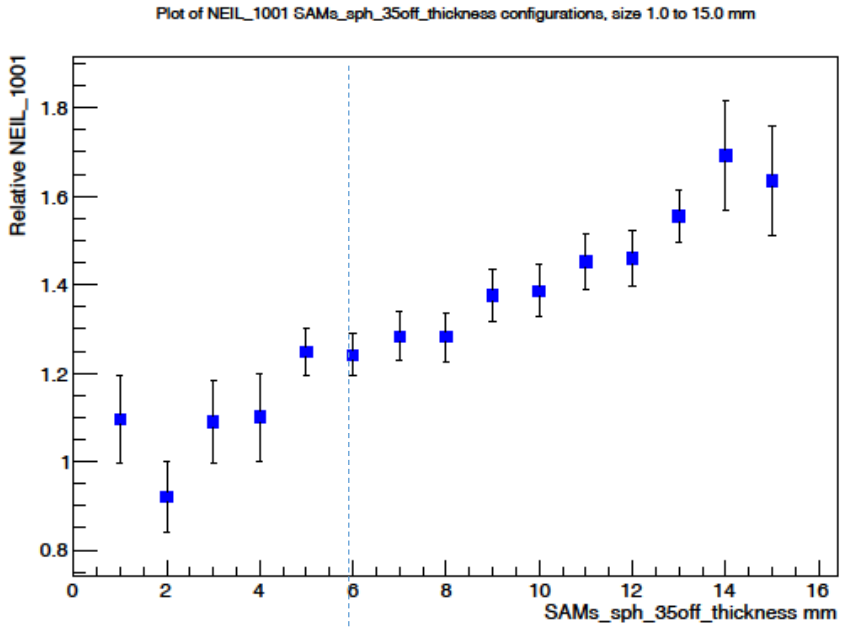


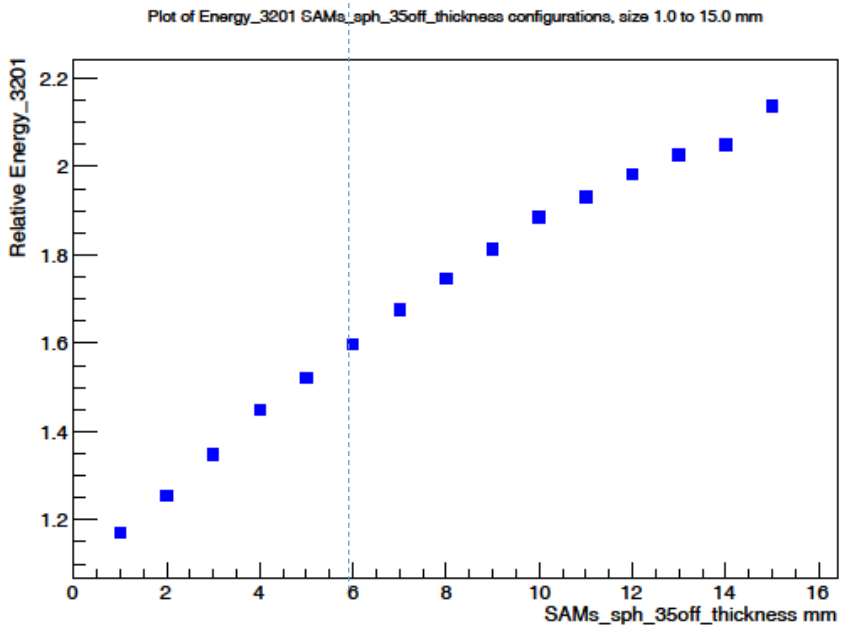
Higher statistics – Quartz thickness varied, 35 mm offset

New spherical design
(0.254 mm Al thickness - first 6cm of can, 1.651 mm rest)

- NEIL in LHRS
- Roof Flux Neutrons with E>25 MeV
- Energy in O-ring
- blue line arbitrarily at 6mm thickness



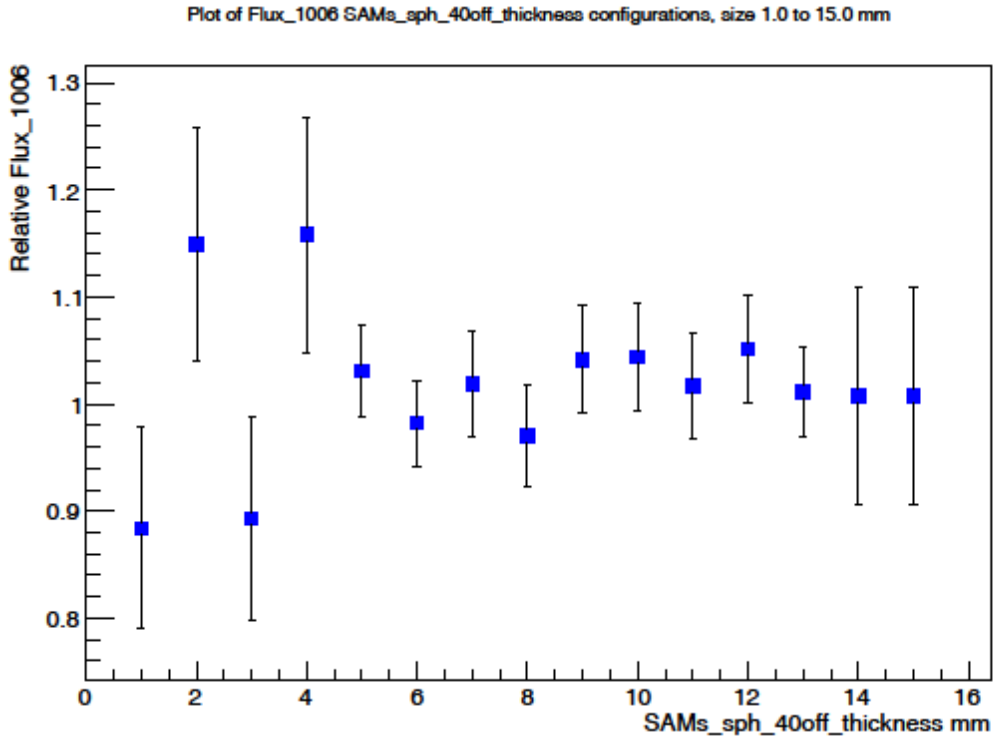


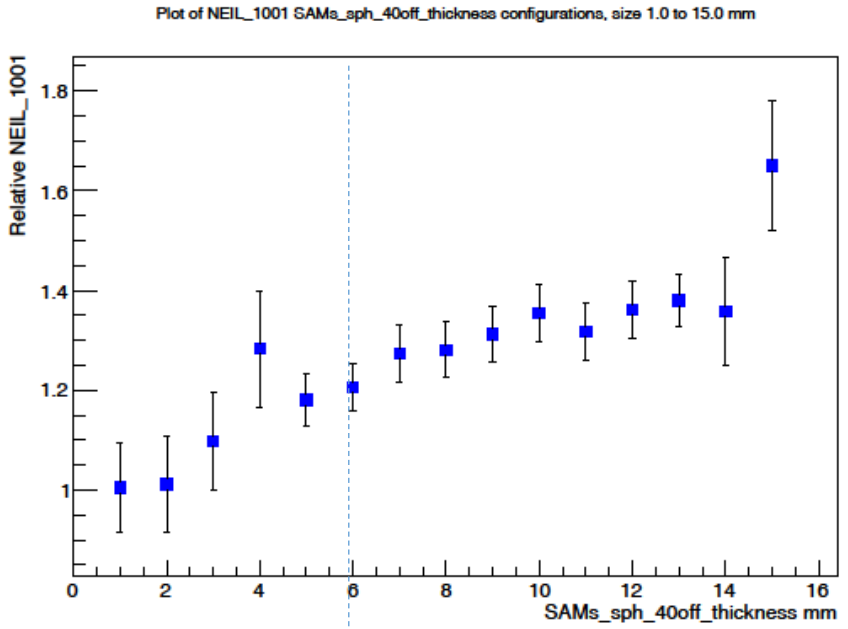


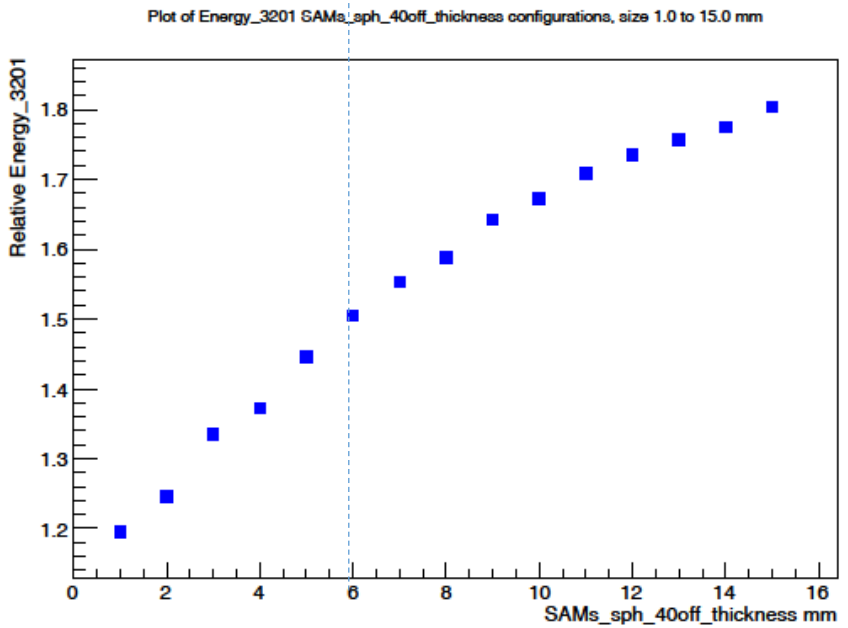
Higher statistics – Quartz thickness varied, 40 mm offset

New spherical design
(0.254 mm Al thickness - first 6cm of can, 1.651 mm rest)

- NEIL in LHRS
- Roof Flux Neutrons with E>25 MeV
- Energy in O-ring
- blue line arbitrarily at 6mm thickness



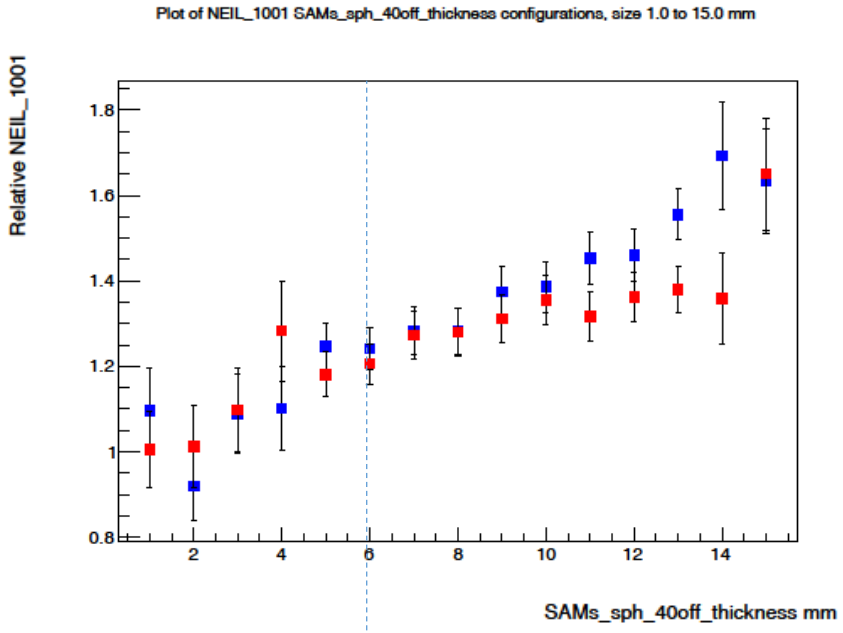


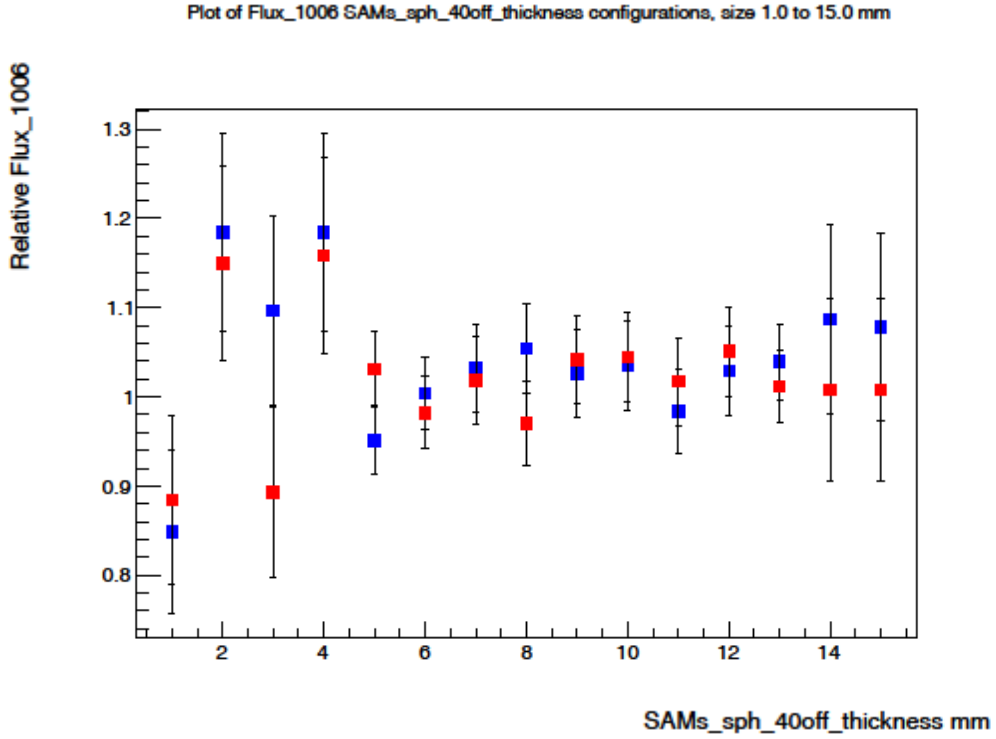


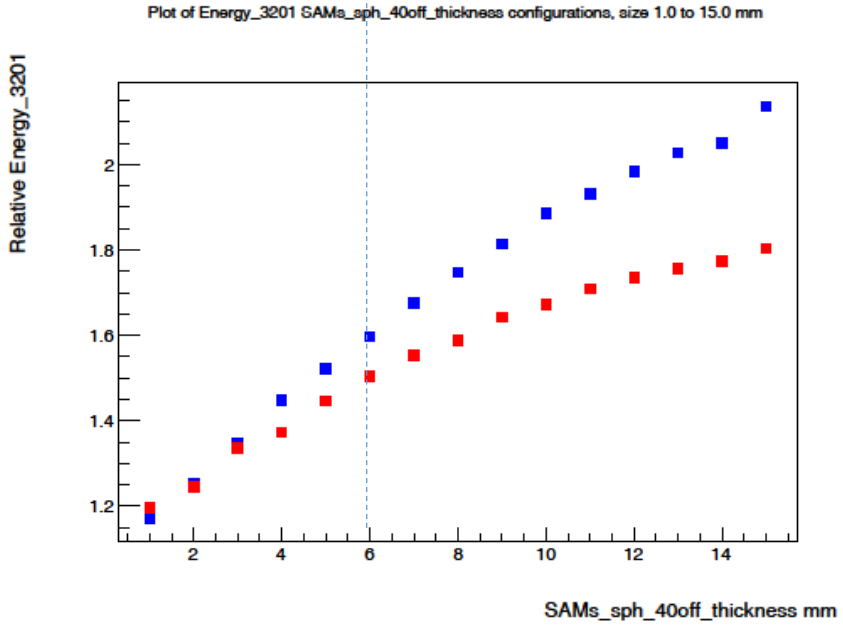
Higher statistics – 35 mm (blue) & 40 mm (red) offset

New spherical design
(0.254 mm Al thickness - first 6cm of can, 1.651 mm rest)

- NEIL in LHRS
- Roof Flux Neutrons with E>25 MeV
- Energy in O-ring
- blue line arbitrarily at 6mm thickness



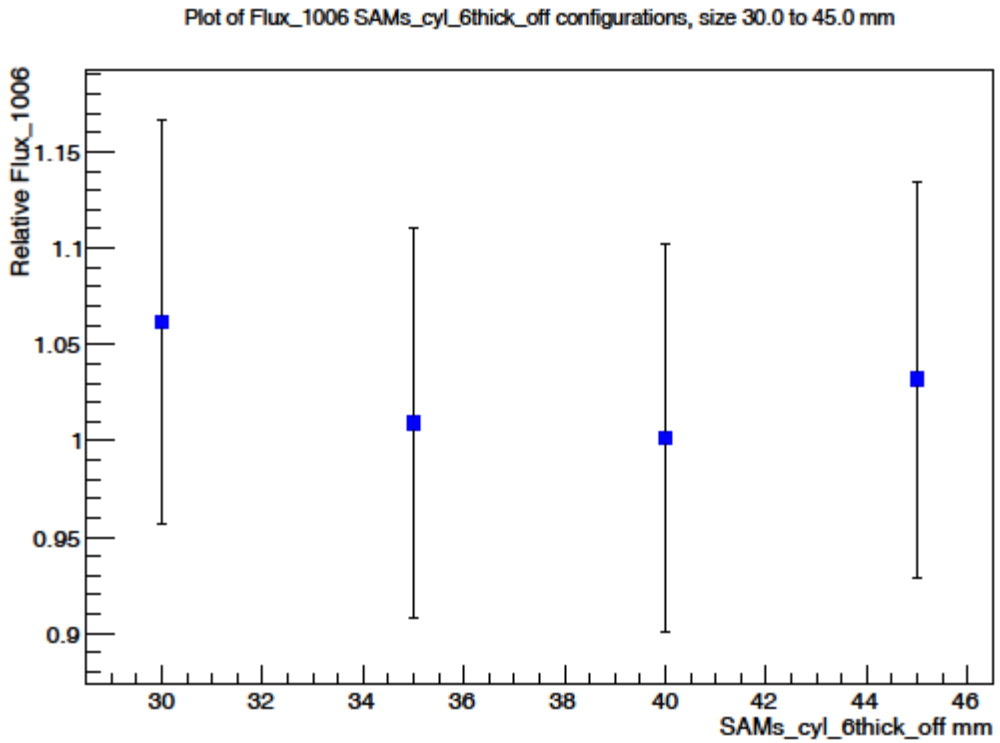


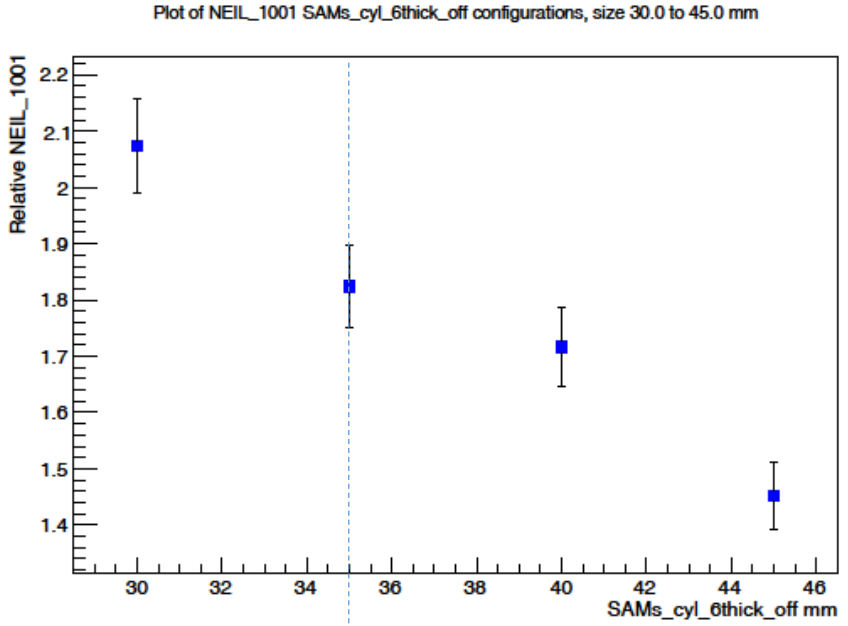


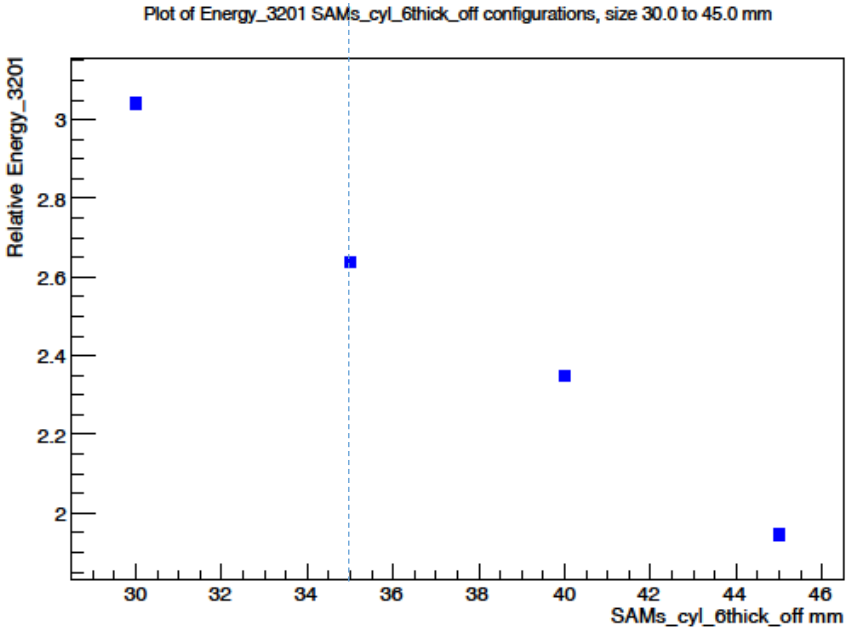
Higher statistics – Offset varied, 6mm Quartz thickness

Original baseline gdml cylindrical design
(1.5 mm Al thickness)

- NEIL in LHRS
- Roof Flux Neutrons with E>25 MeV
- Energy in O-ring
- blue line arbitrarily at 35mm offset



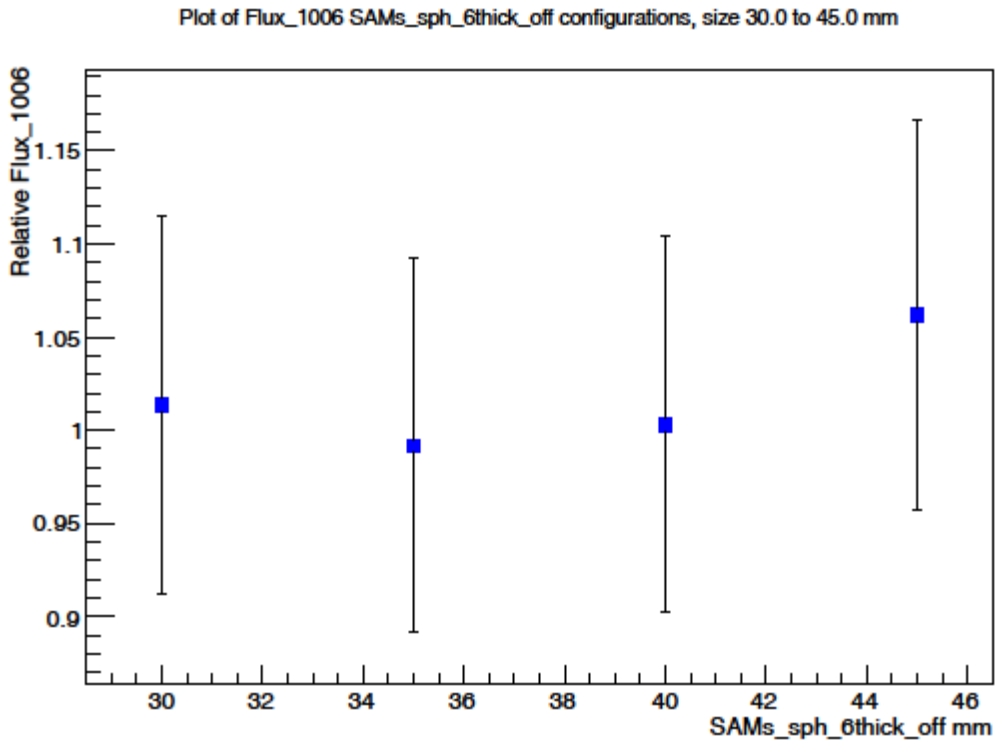


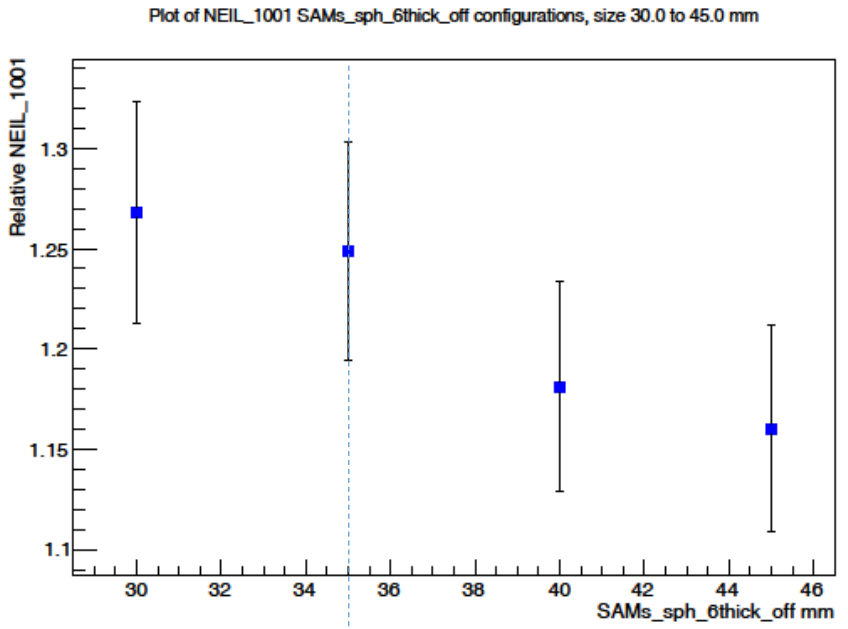


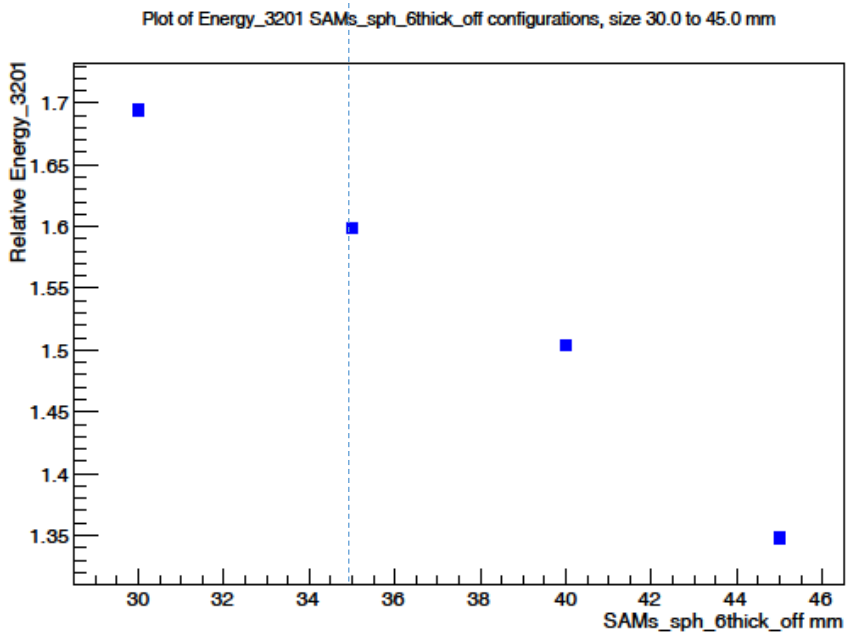
Higher statistics – Offset varied, 6mm Quartz thickness

New spherical design
(0.254 mm Al thickness - first 6cm of can, 1.651 mm rest)

- NEIL in LHRS
- Roof Flux Neutrons with E>25 MeV
- Energy in O-ring
- blue line arbitrarily at 35mm offset







Higher statistics – 35 mm offset, 6mm thick quartz

New spherical design, 35mm offset, 6mm thick quartz design results:

This can get us close to the no-SAM baseline radiation levels we want (equal to 1.00):

Roof Flux	= 1.00(4)
O-Ring Energy Deposited	= 1.598(3)
HRS NEIL	= 1.24(5)

- Cylindrical endcap and anything closer in radius will give even higher radiation levels
- Pulling out to 40mm reduces radiation levels by another 7% or so
- Using the original 13mm thick quartz increases radiation levels by 15% or so
- O-Ring energy deposition rises rapidly with any other less-ideal modifications