Prex Meeting

SAM Geometry Optimization Post Collaboration Meeting

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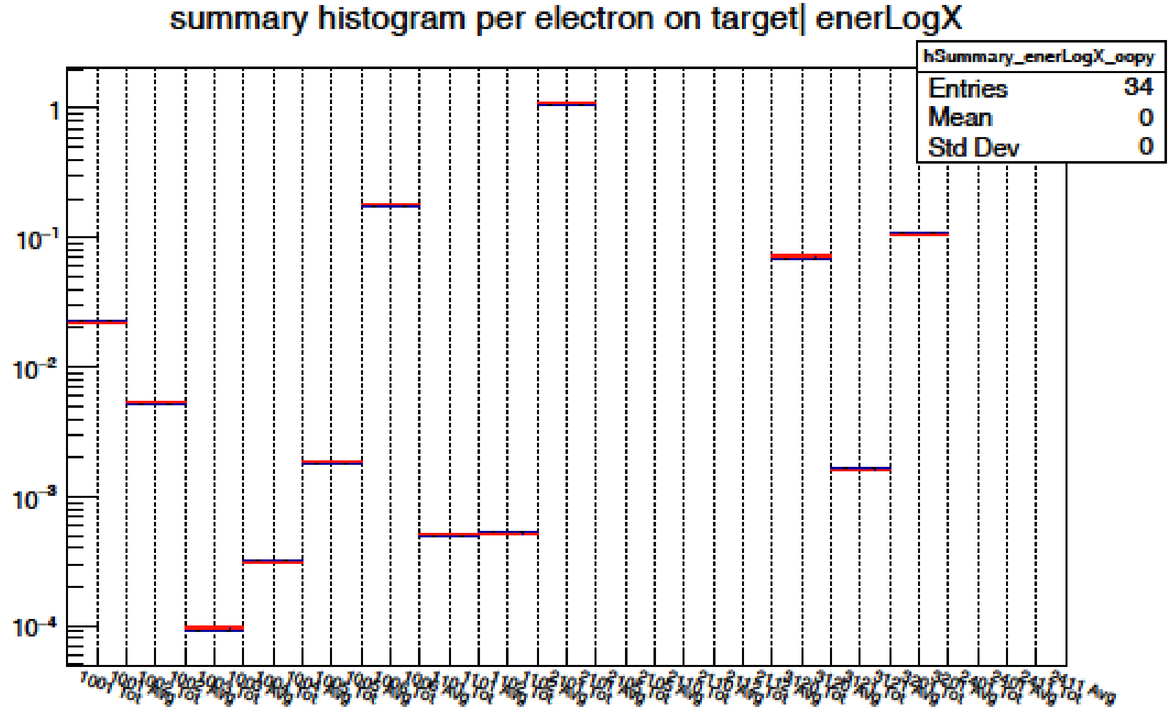
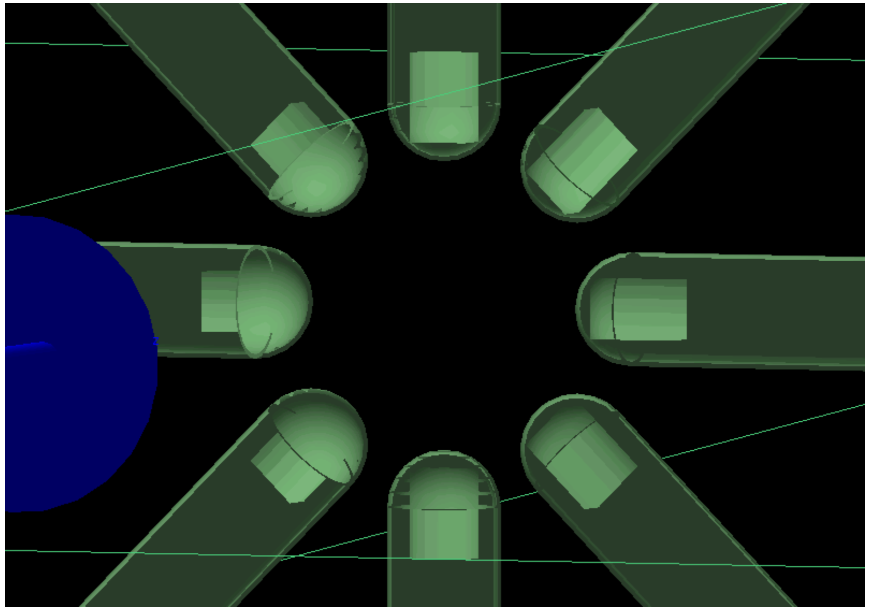
Summary of prior steps:

- 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 = $1.012(13)\times10^{-5}$ == 1
Flux 1006 per event = $1.279(17)\times10^{-5}$ == 1
Energy 3201 per event = $1.11300(6)\times10^{-2}$ == 1

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

NEIL 1001 ratio to goal = 6.33(11)
Flux 1006 ratio to goal = 1.58(3)
Energy 3201 ratio to goal = 9.556(8)

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

Solid angle considerations

Solid Angle Ratio		q len	q bevel ler	q width	targ offse	targ pos z	SAM pos z	r offset ini	offset r		Solid Angle =	Ratio
	new SAMs	2	0.6	2	0	-105.3	567.765	5.5	3.5		0.159967359	
	US	2	0.6	2	-5	-105.3	567.765	5.5	3.5		0.159967111	0.9999984
	no r offse	2	0.6	2	0	-105.3	567.765	5.5	0		0.378412201	2.3655588
	shorter	1.25	0.6	2	0	-105.3	567.765	5.5	3.5		0.107226528	0.6703025
	thicker	2	1.3	2	0	-105.3	567.765	5.5	3.5		0.159967359	1.0000000
	bevel	2.6	0.6	2	0	-105.3	567.765	5.5	3.5		0.197286279	1.2332908
		1.25	1.3	2	-5	-105.3	567.765	5.5	0			
		1.25	1.3	2	-5	-105.3	567.765	5.5	0			

Looking at differences in Quartz size, position, and target position

Determine that solid angle has no effect on target upstream shift

Shortening quartz looses some solid angle, but at low rate region
Approximations in integral break down for no r offset case, but its is probably close to a factor of 2 less solid angle at 3.5cm radial offset

Comparing new and old Energies and Target Positions

		Ratios wrt 1.000, without new SAMs, original target, original E						
			Original Energy		**New Energy**	**SAM Effect Ratios**	**Energy Ratios**	
		Original Target	US target	0 radial offset	US Target		US Target	
Prex	Without new SAM	1	1.013	1	1.079	**>> new baseline**	0.9388	> lower energy improves PrexII
	With new SAMs	1.291	1.184	1.836	1.316	**1.219647822**	0.8997	> SAMs are decreasing with decreasing E
Crex	Without new SAMs		0.0094357		0.00722366	**>> Crex baseline**	1.3062	> higher energy makes Crex worse
	With new SAMs		0.008169		0.0091524	**1.267003154**	0.8926	> SAMs are not increasing as much with increasing E

	No SAMs ratio	**SAMs ratio**	
Pulling Target US	**1.013**	**0.91711851**	>> This means that including SAMs when the target is upstream is less significant
(Original Energy)		Solid Angle ratio	even though the NIEL in LHRS goes up in this configuration
(case only)		0.9999984	>> doesn't explain it

Original E = 1.00 and 2.00 GeV for Prex and Crex
New E = 0.95 and 2.22 GeV

Original Position = -105.3 cm upstream
New Position = -110.3 cm upstream

Data at
/work/parity/disk1/moller12gev/cameronc/masterPrexSim/output/data_FINAL_2018-07-31_post-collab-meeting