

# Ferrous Materials:

## Pion Donut Tie-rods

Eric King

Updated:

July 19th, 2023

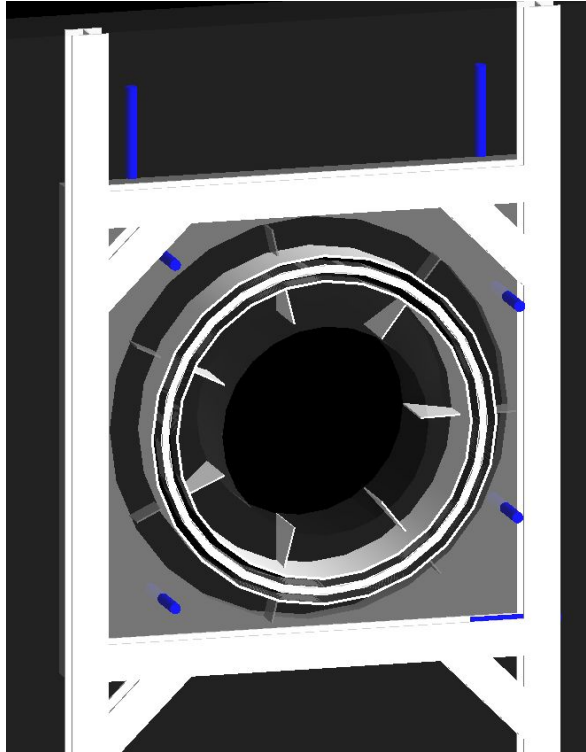
# Pion Donut Tie-rods

Total volume of steel = to amounts cited by Ryan in email.

Modeled as tubes of steel from end to end making no assumptions about the material.

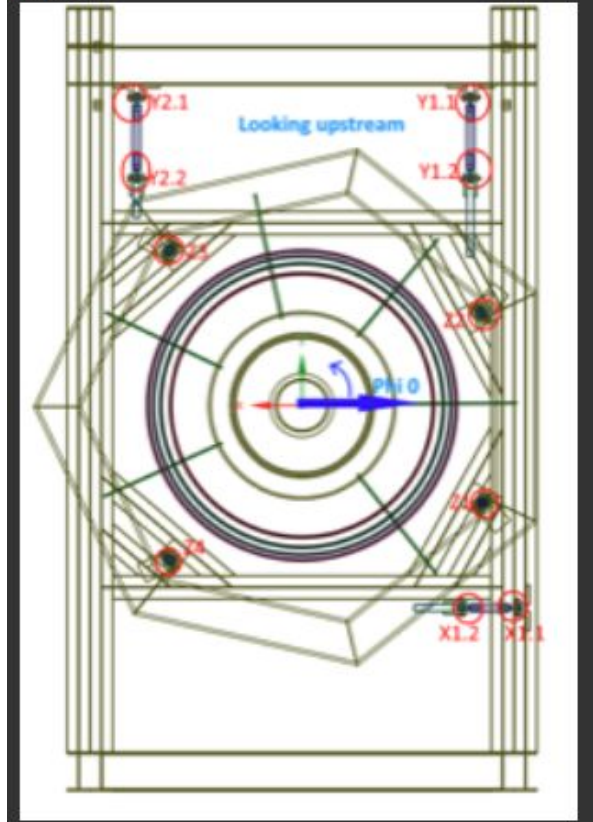
Model Looks reasonable.

Assigned ferrous detector number 9221



Very Respectfully,

Ryan



# 9199 – LVPS [GEM DAQ]

Material	X <sub>r</sub>	Spin Polarization (P <sub>f</sub> )	Frac e- on Target	Frac of events Per Moller
Mild Steel	2000	1E-02	1E-11	1E-07
Stainless Steel (Worst)	1	1E-05	1E-08	1E-04
Stainless Steel (Ideal)	0.01	1E-07	1E-06	1E-02
Aluminum	0.0001	1E-09	1E-04	1E+00
Inconel 625	0.001	1E-08	1E-05	1E-01
Brass/Bronze (Worst)	0.001	1E-08	1E-05	1E-01

Sens Volume:	Pion Donut Tierods
Sim Date:	2/8/2023
Detector #:	9221

Background rates per e.o.t. are  
 $\sim 10^{-10} \ll 10^{-8}$

## Pion Donut Tierods -- Unweighted By BField

Total Prim's: 12,500,000,000

Total Sec's: 5,000,000 (per sens det)

Primary Counts		
Primaries	0	0&1
9221		4119

Primary Fractional		
Primaries	0	0&1
9221		3.30E-07

(9928 MainDet) Secondary Counts - 0&1		
Secondaries	Electrons	Gammas
9221	2348	5237

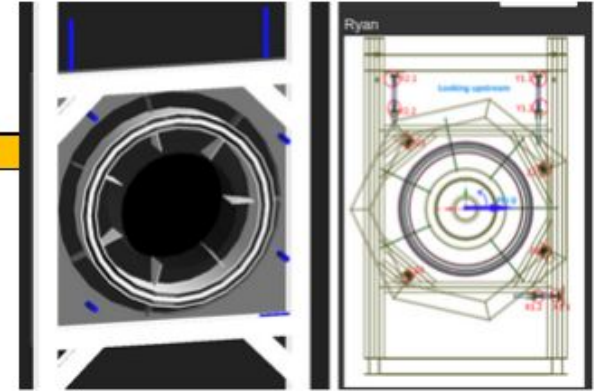
(9928 MainDet) Secondary Fractional - 0&1		
Secondaries	Electrons	Gammas
9221	4.70E-04	1.05E-03

(9928 MainDet) Total Fractional - 0&1		
Secondaries	Electrons	Gammas
9221	1.55E-10	3.45E-10

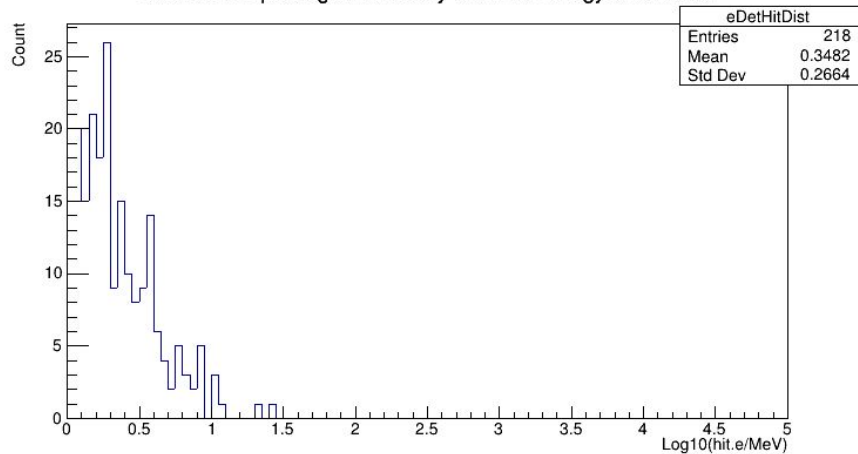
(9911 PMT Region) Secondary Counts - 0&1		
Secondaries	Electrons	Gammas
9221		

(9911 PMT Region) Secondary Fractional - 0&1		
Secondaries	Electrons	Gammas
9221	0.00E+00	0.00E+00

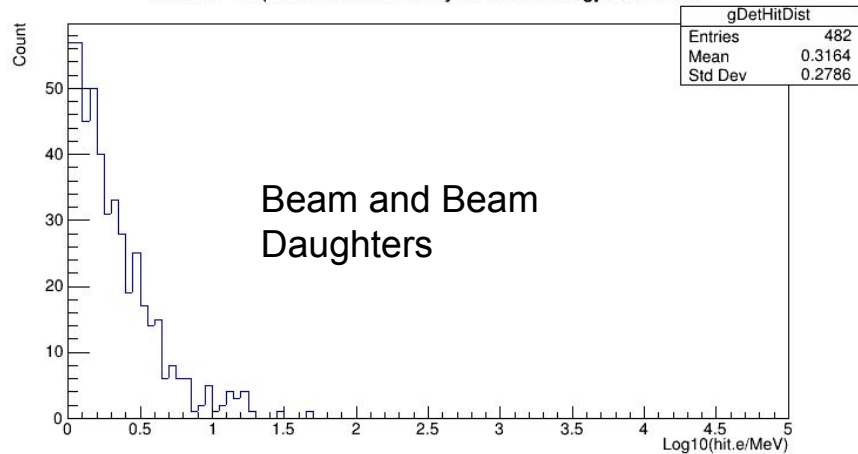
(9911 PMT Region) Total Fractional - 0&1		
Secondaries	Electrons	Gammas
9221	0.00E+00	0.00E+00



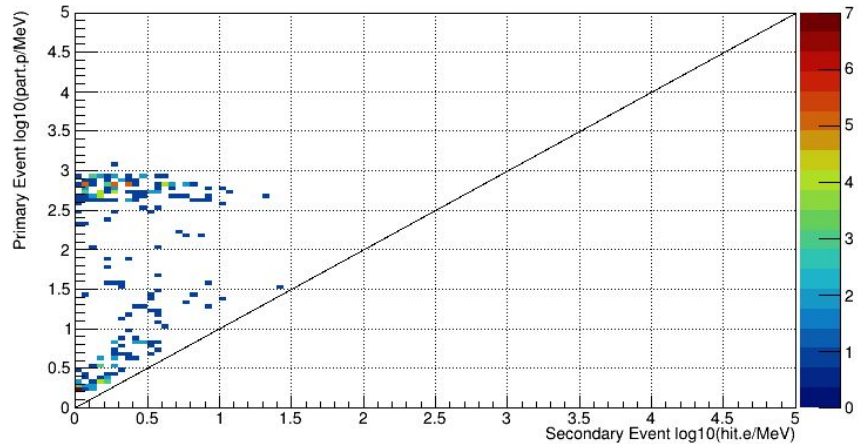
Detector '28' | Charge Secondary Sim Hits Energy Distribution



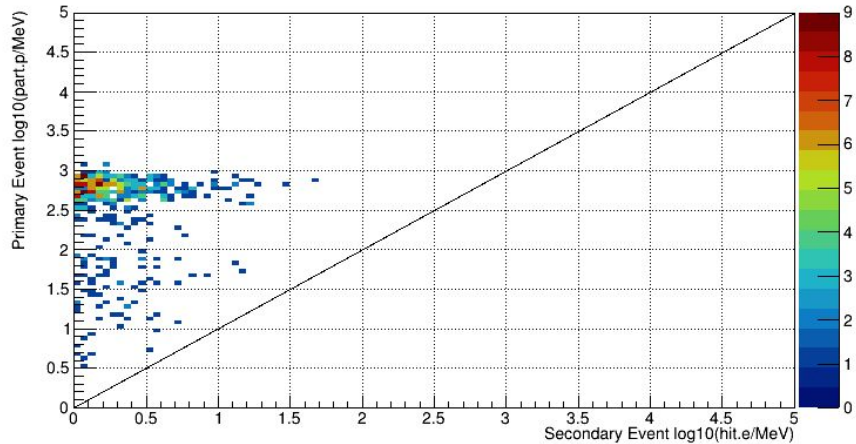
Detector '28' | Gammas Secondary Sim Hits Energy Distribution



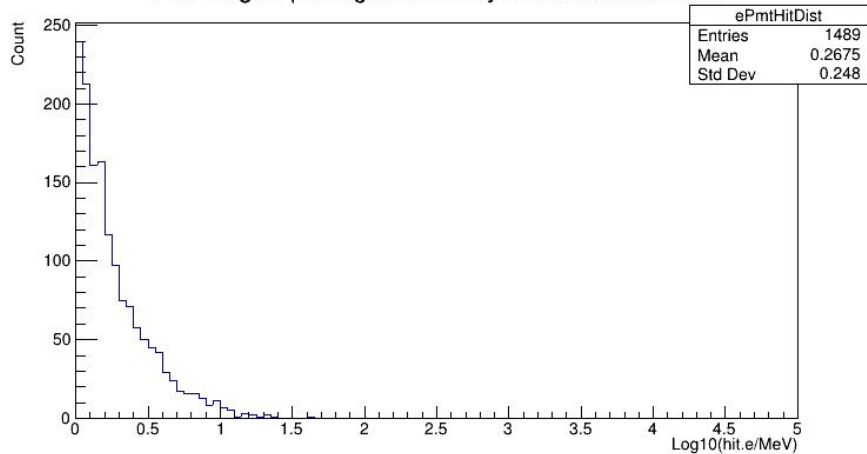
Detector '28' | Charge Primary Sim hit.p vs. Resultant Secondary hit.e



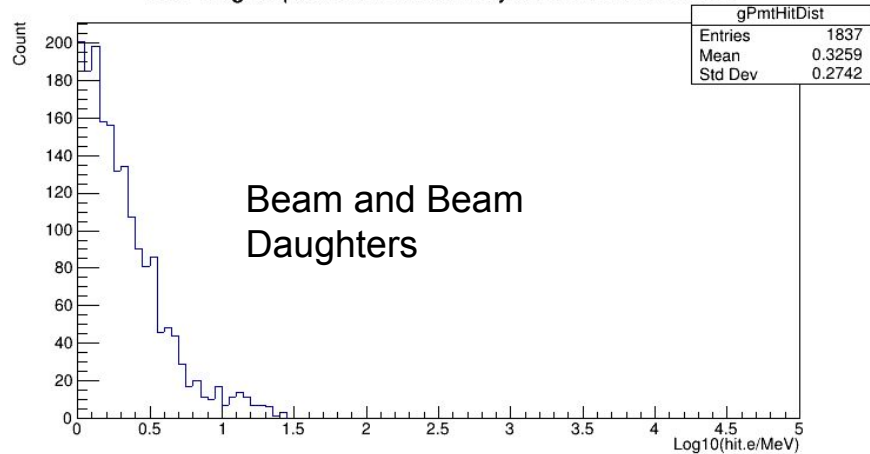
Detector '28' | Gammas Primary Sim hit.p vs. Resultant Secondary hit.e



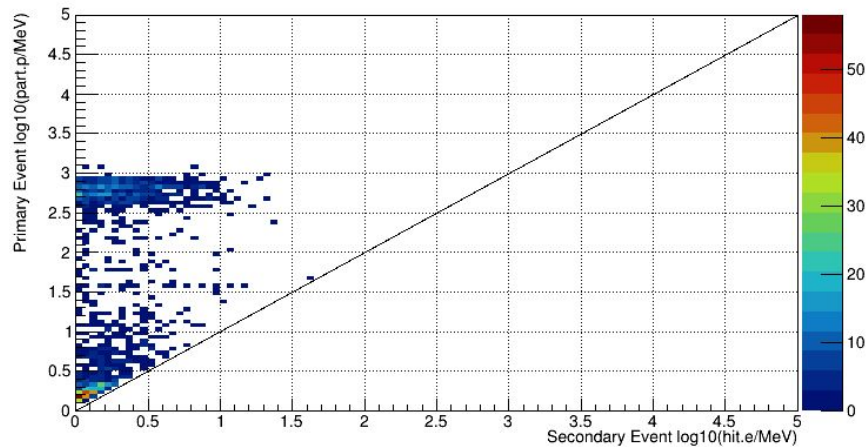
PMT Region | Charge Secondary Sim hit.e Distribution



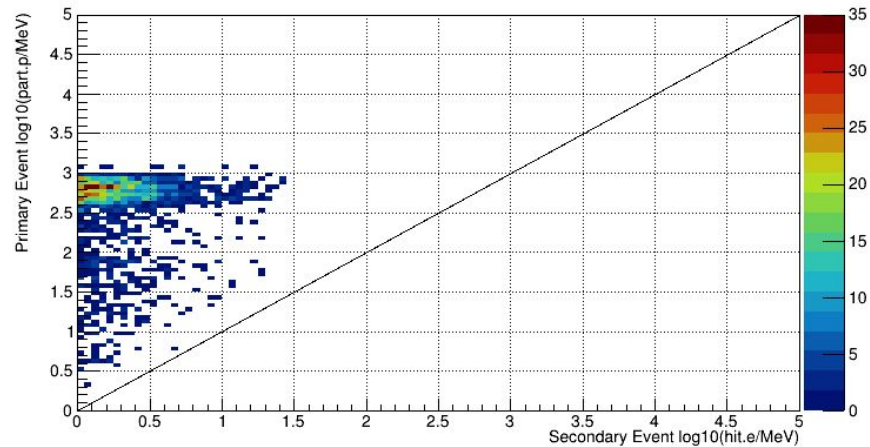
PMT Region | Gammas Secondary Sim hit.e Distribution



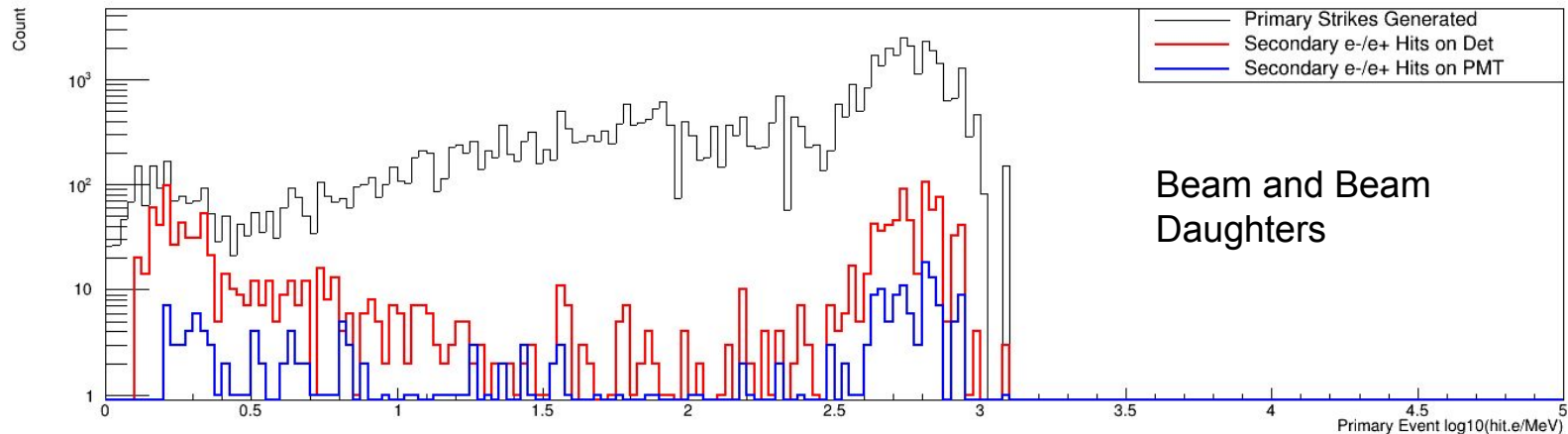
PMT Region | Charge Primary Sim hit.p vs. Resultant Secondary hit.e



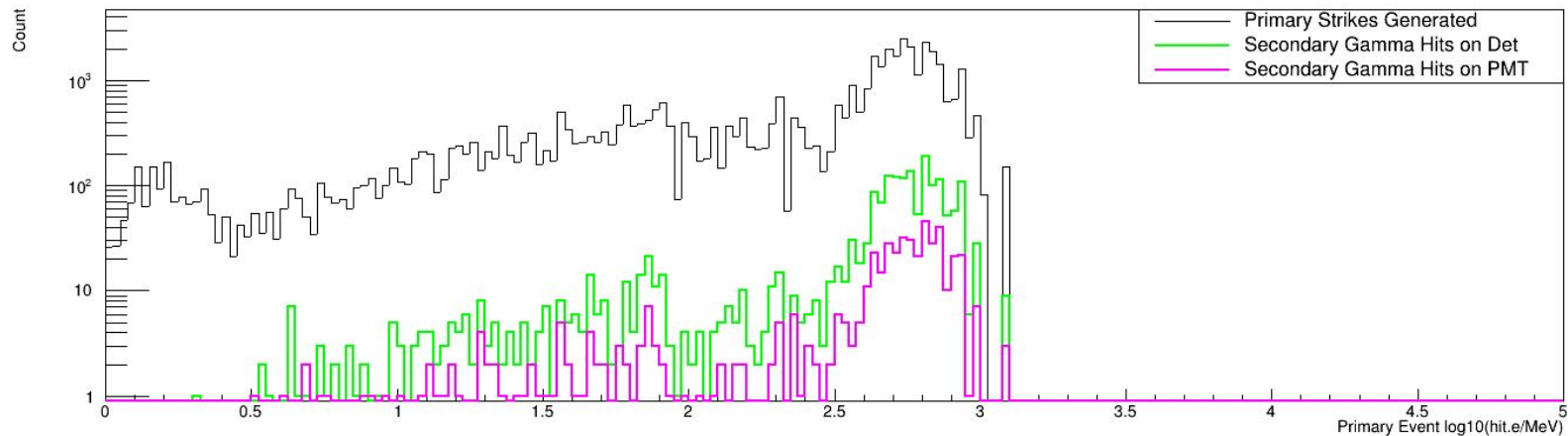
PMT Region | Gammas Primary Sim hit.p vs. Resultant Secondary hit.e



Detector 9221 | Charges hit.e From Primary hit.mtrid <= 1



Detector 9221 | Charges hit.e From Primary hit.mtrid <= 1



# Takeaway

Material	X <sub>r</sub>	Spin Polarization (P <sub>f</sub> )	Frac e- on Target	Frac of events Per Moller
Mild Steel	2000	1E-02	1E-11	1E-07
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Brass/Bronze (Worst)	0.001	1E-08	1E-05	1E-01

- No specific concerns about the pion donut tie-rods.
- Objects→tubes in simulation model the mass of the tie rods and tie rod ends per Ryan Biraben at specified locations
- **10<sup>-10</sup> (ferrous background rates) << 10<sup>-8</sup> rates for even the worst-quality (in terms of  $\chi_R$ ) stainless steel.**

Component specifics given to me.

Rod Ends (McMaster Carr 60656K62) are each 119 cm<sup>3</sup> of zinc-plated carbon steel. Bolts (McMaster Carr 91247A924) are each 76 cm<sup>3</sup> of zinc-plated grade 5 steel.

Specified locations for tie rods, just for the record.

Link	φ (°)	R (in)	R (mm)
X1.1	318.2	89.2	2267
X1.2	309.6	77.2	1961
Y1.1	62.3	107.2	2722
Y1.2	54.5	85.8	2180
Y2.1	116.9	106.4	2704
Y2.2	124.6	84.9	2157
Z1.1 & .2	331.6	63.4	1612
Z2.1 & .2	27.3	62.2	1580
Z3.1 & .2	130.6	63.0	1600
Z4.1 & .2	229.3	62.8	1596