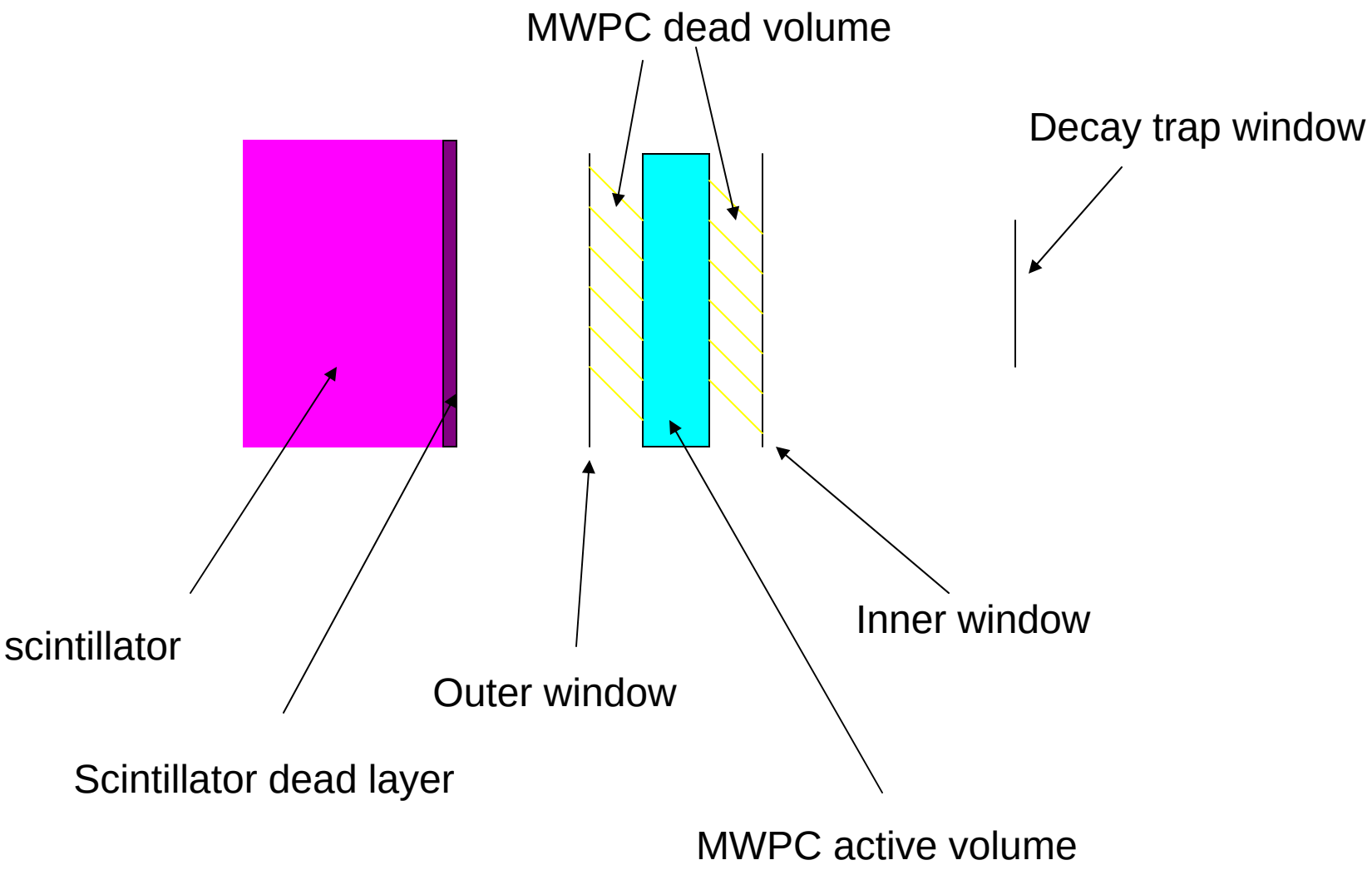
Detector Geometry



GEANT4 Simulations

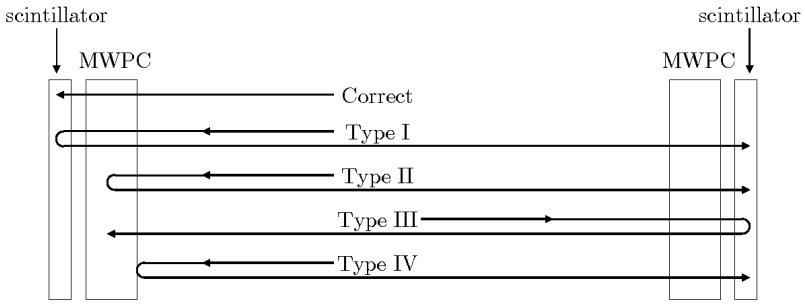
To characterize the energy response function, generate monoenergetic electrons isotropically. Then example the energy loss and backscattering issues

Energy Loss vs Energy, “Correct”

E (keV)	Trap win	Inner win	Outer win	MWPC active	MWPC dead	Scint dead	Scint active
100	2.4	15.8	25.6	4.4	5.7	4.3	40.3
200	2.9	14.0	18.7	4.7	4.5	2.1	150.6
300	2.8	12.5	14.8	4.3	3.7	1.5	257.7
400	2.8	11.4	12.9	3.9	3.3	1.3	361.9
500	2.7	10.9	11.9	3.6	3.0	1.2	463.8
600	2.6	10.6	11.2	3.4	2.8	1.1	565.11
700	2.7	10.3	10.8	3.2	2.7	1.1	665.7
800	2.6	9.8	10.3	3.2	2.6	1.0	766.0
Sn	2.7	11.8	13.3	4.0	3.4	1.3	328.9

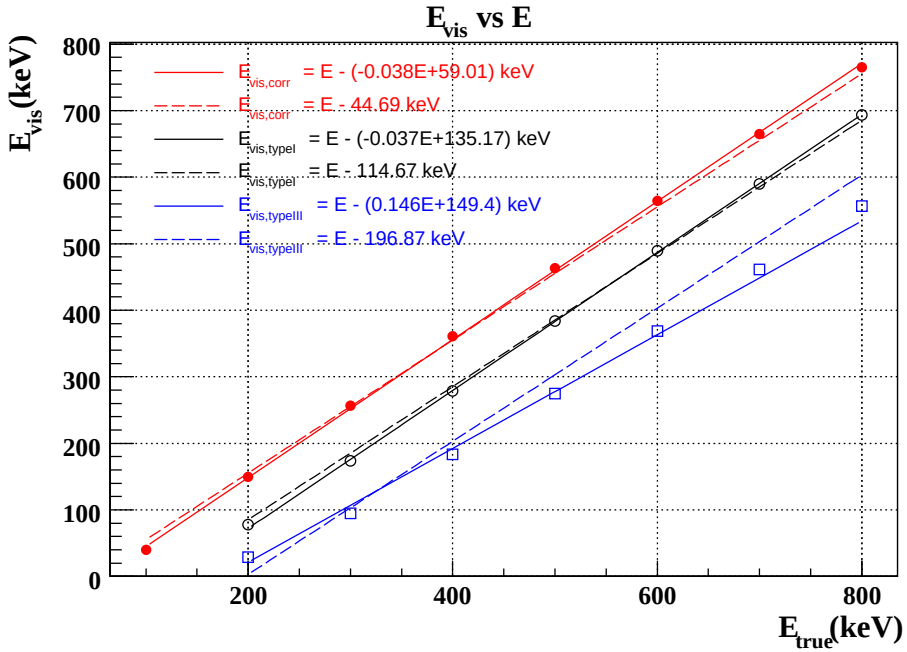
Total Visible Energy Vs Energy

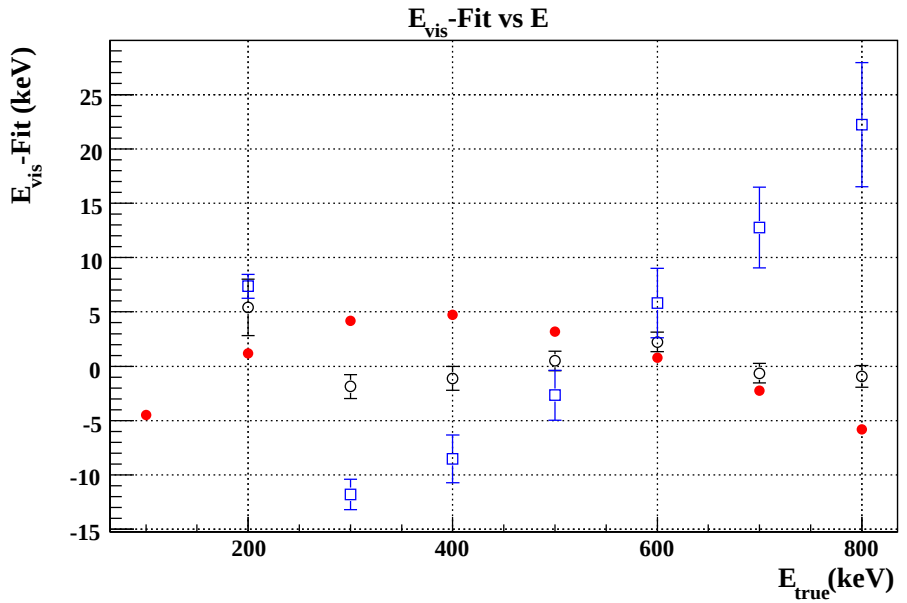
E (keV)	Correct	Type I	Type III
100	40.3	0	0
200	149.7	77.6	28.8
300	256.4	174.0	95.1
400	360.7	278.4	183.8
500	462.9	383.7	275.1
600	564.3	489.1	369.0
700	665.0	589.9	461.4
800	765.2	693.3	556.3
Sn	327.8	243.4	151.7



- Use Brad's backscattering event sorting for easy connection with the data analysis.
- For type I events, do E+W scintillator energy

Parameterization of Visible Energy





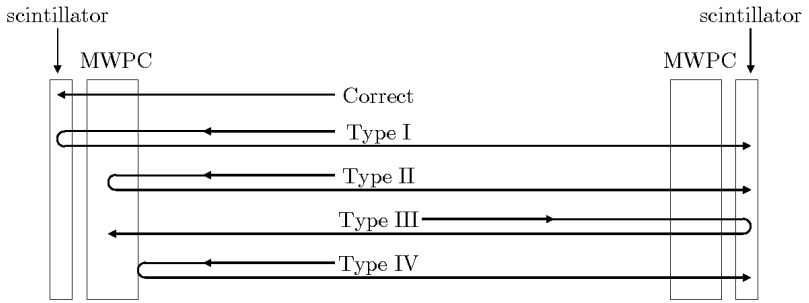
Simple offset not sufficent for the energy loss. So use

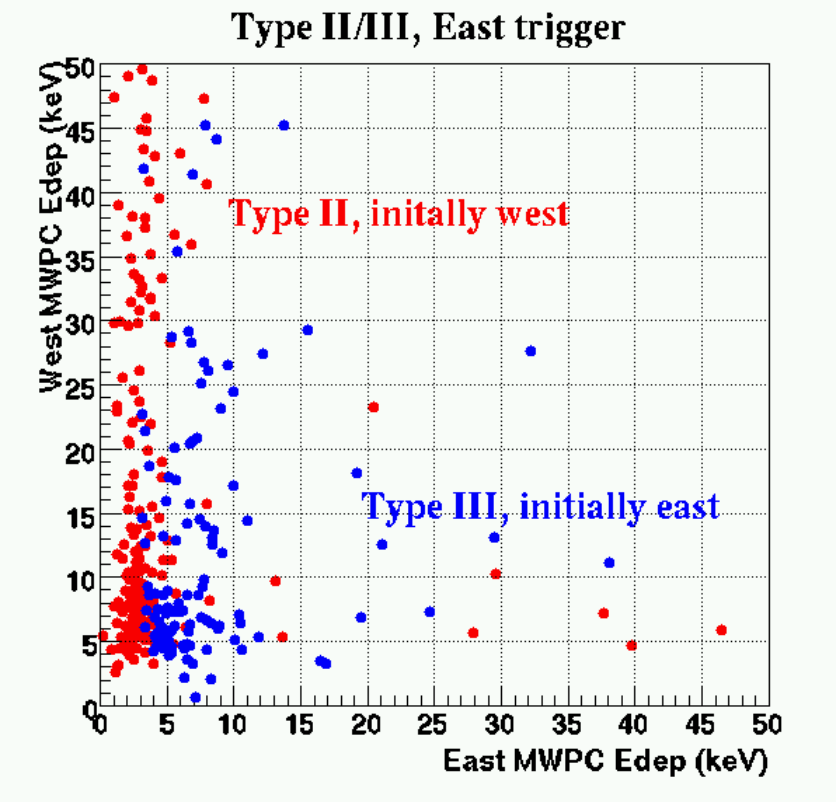
$$E_{vis} = E - \Delta E = E - (aE + b)$$

Residual to the linear fit

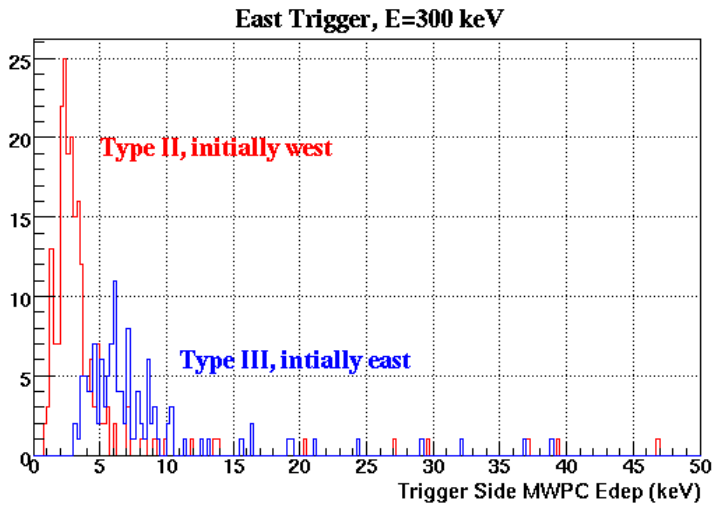
$$err = \frac{RMS}{\sqrt{N}}$$

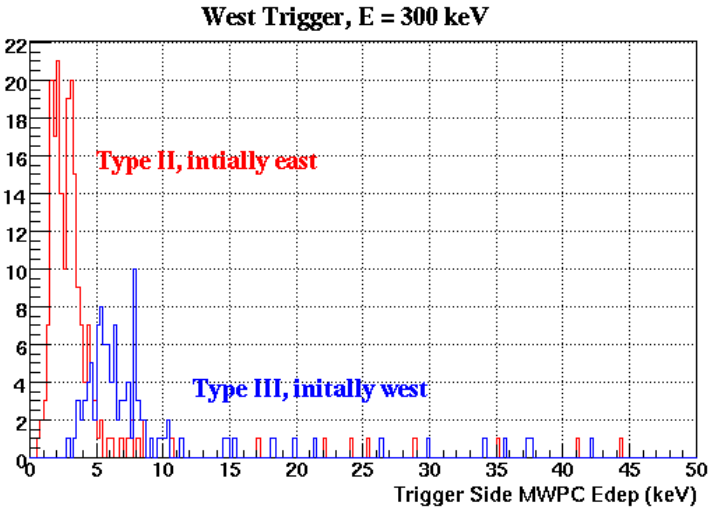
Efficiency of TypeII/III discrimination





- So can use the energy on the trigger side of the MWPC as the discrimation variable.
- Use anode signal from Sn to calibrate this cut. As seen on page 3, the dE/dX is about 4.0 keV, and is relatively insensitive to the electron energy





So applying 4 keV cut on the energy deposition in MWPC active volume

Efficiency for typeII/III

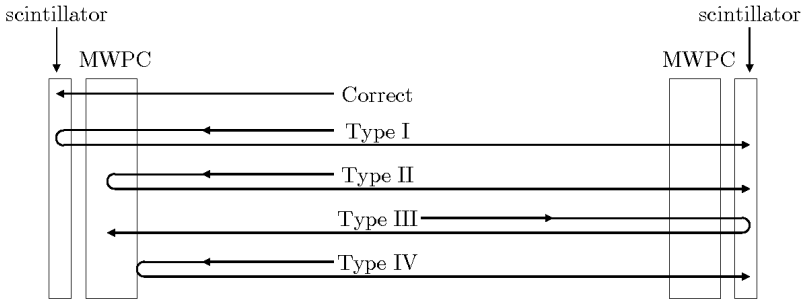
E (keV)	Type I	Type III
200	57.6%	91.4%
300	79.2%	90.5%
400	86.1%	86.9%
500	92.6%	86.2%
600	92.0%	85.7%
700	88.9%	77.9%
800	90.2%	78.7%
Sn	83.6%	88.4%
Neutron betas	76.8%	88.6%

Alternative event sorting

Use more detailed events sorting in the Monte Carlo (see next 4 pages for definitions of “types”)

For correctly identified events:

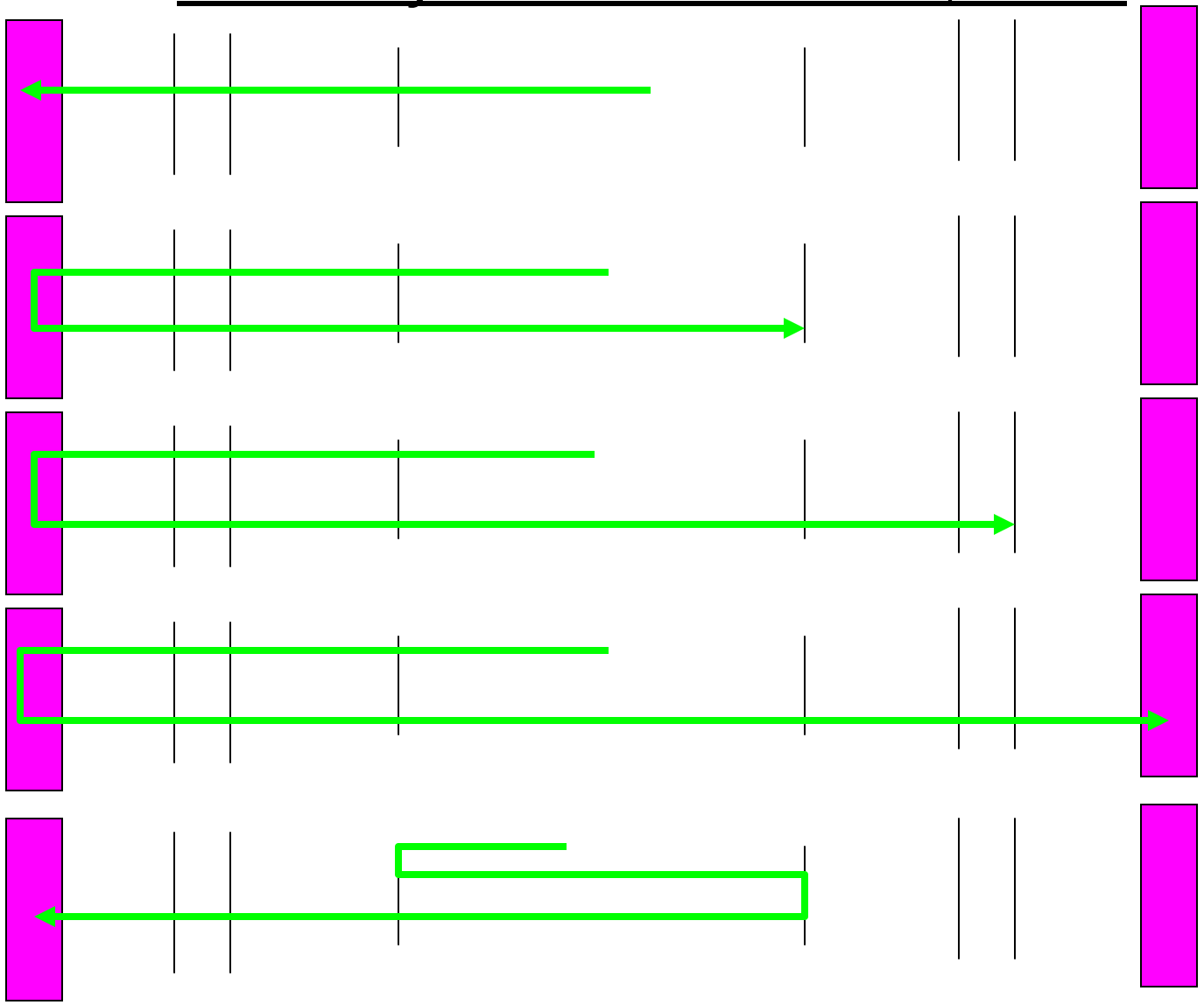
- Types A+B+E = Brad’s “Correct”
- Type D = Brad’s Type I
- Type C = Brad’s Type III



For misidentified events:

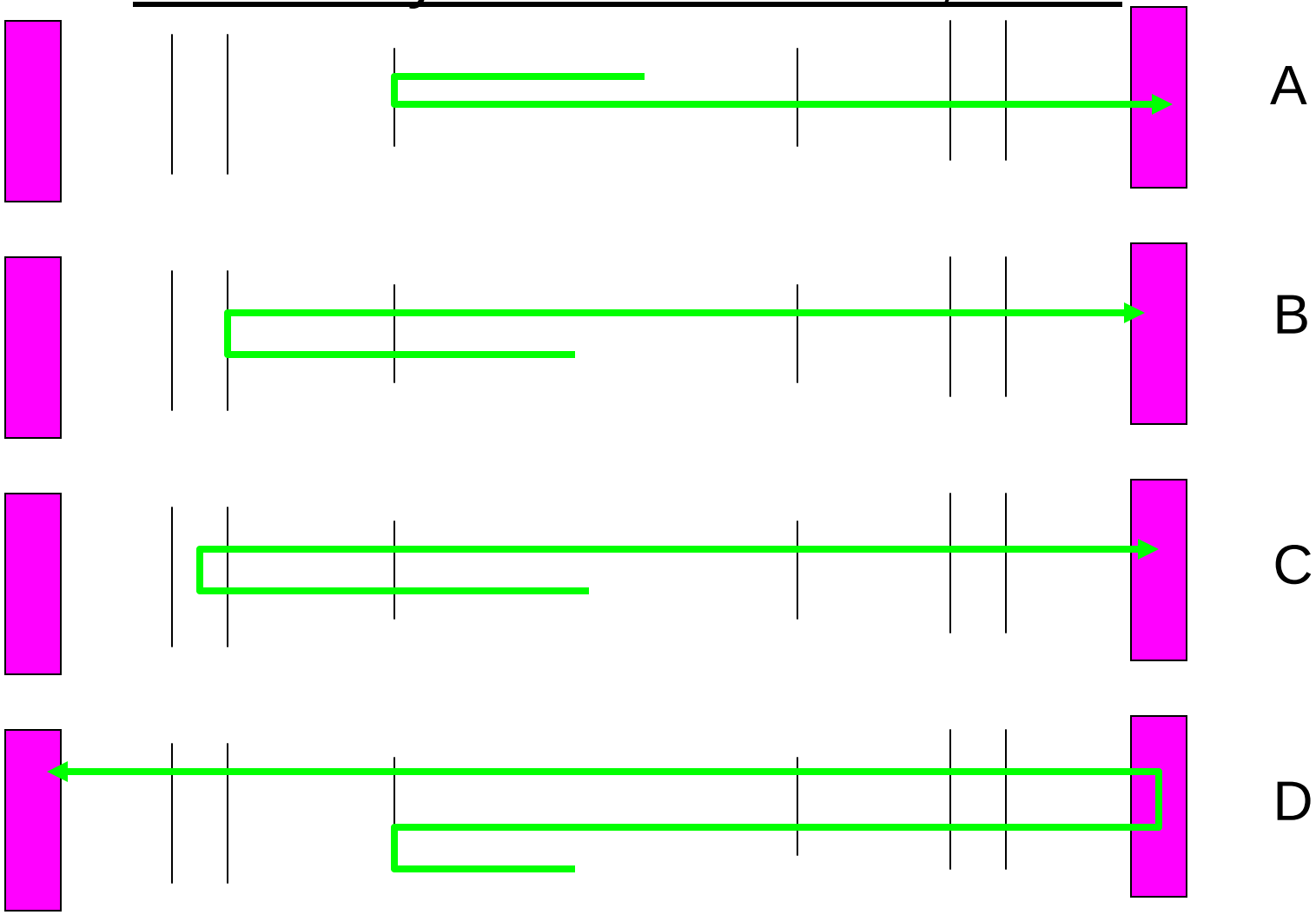
- Type A = “Type V” from decay trap window
- Type B = Brad’s Type IV
- Type C = Brad’s Type II
- Type D = undefined in Brad’s classification

Correctly Identified Events, West



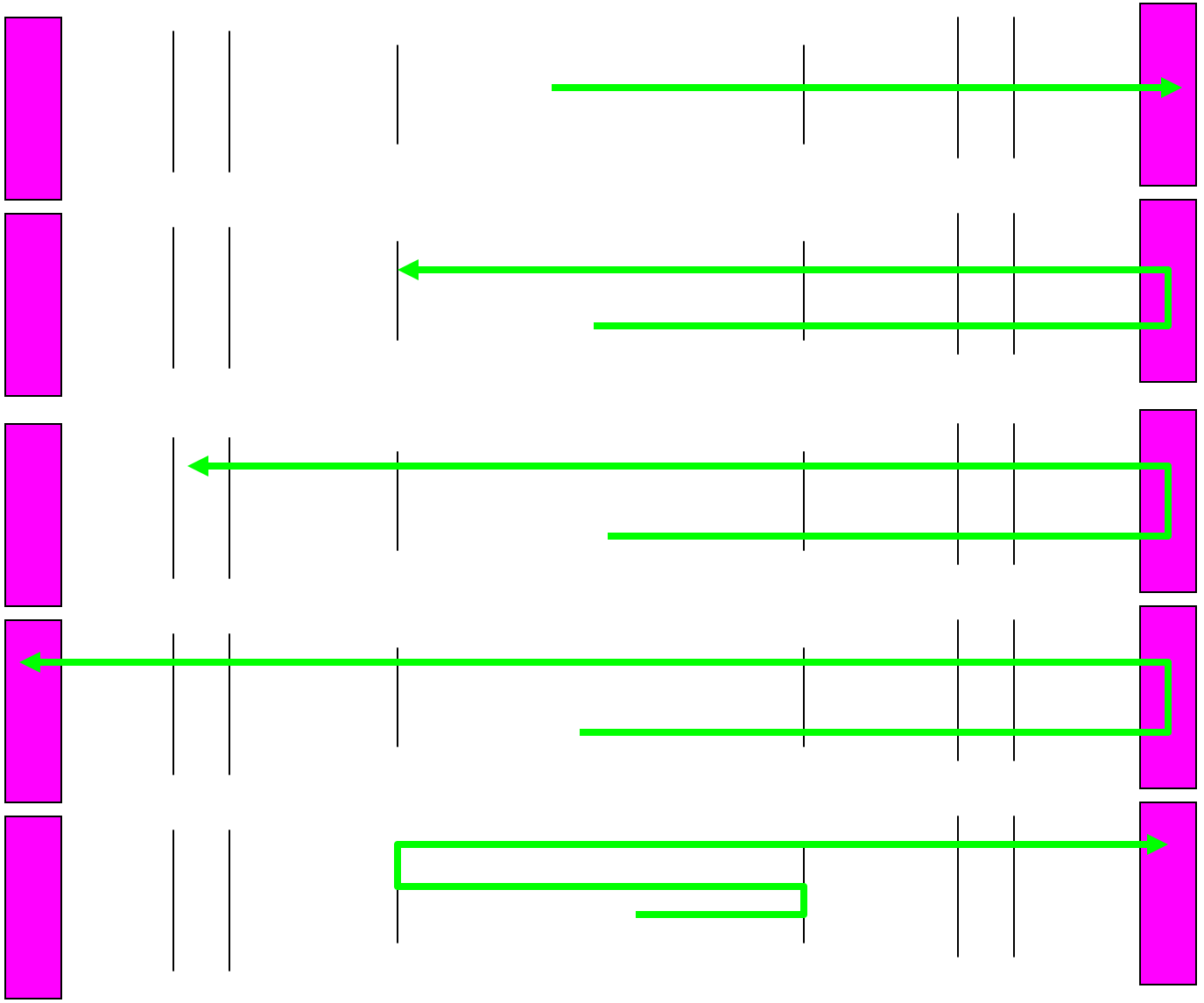
Others

Mistakenly Identified Events, West

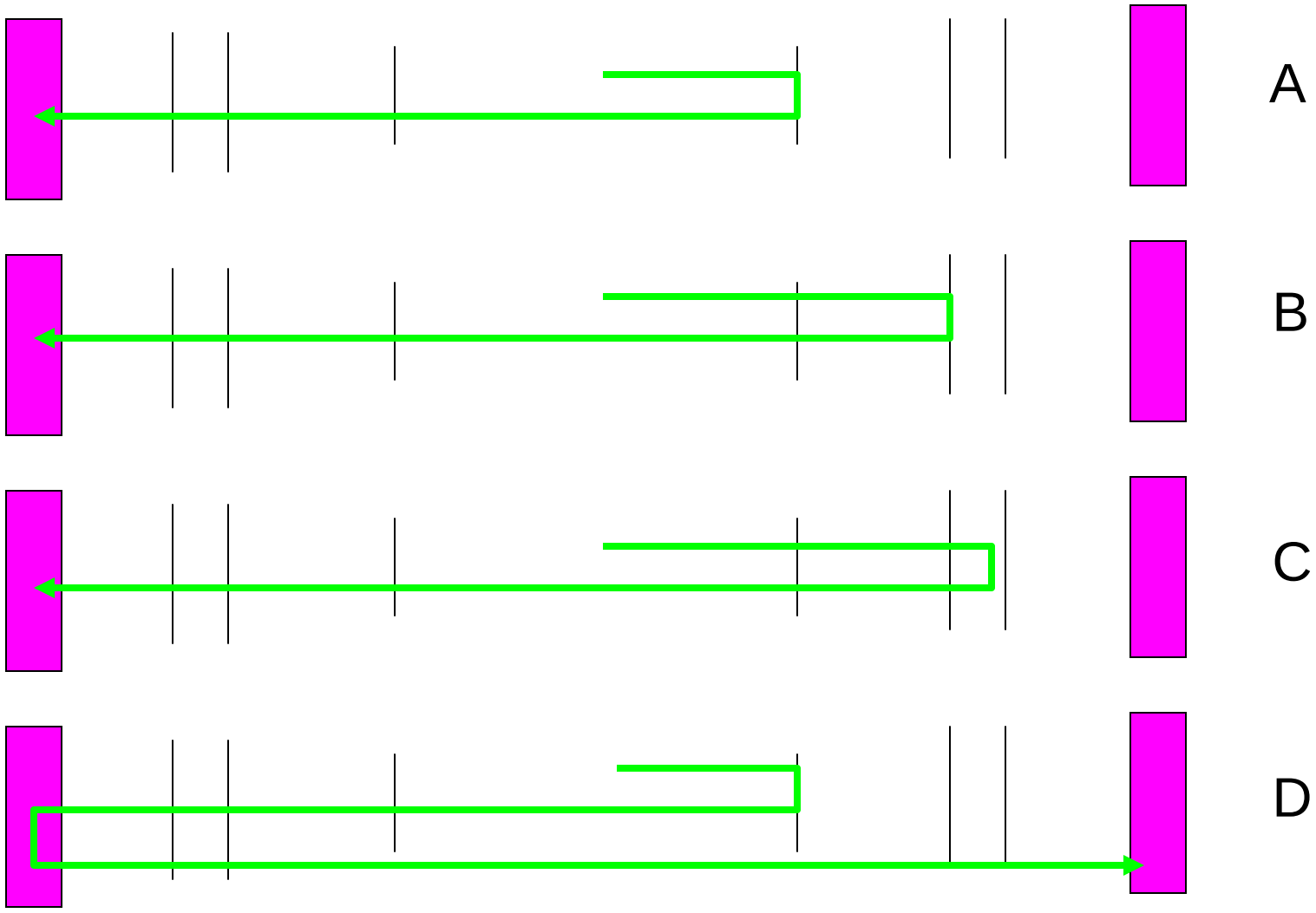


Others

Correctly Identified Events, East



Mistakenly Identified Events, East



Others

Backscattering Fraction

E (keV)	Correctly identified						Mistakenly identified				
	A	B	C	D	E	other	A	B	C	D	other
100	97.33	0.0	0.0	0.0	0.16	0.0	2.38	0.13	0.0	0.0	0.0
200	90.75	0.35	0.16	0.05	1.36	0.14	5.76	0.53	0.85	0.0	0.04
300	91.18	0.43	0.50	0.67	1.09	0.13	4.77	0.18	0.90	0.03	0.11
400	91.90	0.41	0.43	1.39	1.00	0.07	4.16	0.08	0.41	0.07	0.08
500	92.34	0.31	0.42	1.90	0.83	0.08	3.68	0.07	0.23	0.10	0.05
600	92.90	0.25	0.34	2.14	0.76	0.07	3.13	0.06	0.16	0.13	0.06
700	92.96	0.18	0.30	2.46	0.78	0.07	2.96	0.04	0.10	0.11	0.05
800	93.26	0.16	0.23	2.58	0.64	0.05	2.83	0.03	0.09	0.08	0.05
Sn	91.77	0.38	0.46	1.20	1.02	0.09	4.27	0.12	0.54	0.06	0.08
Neutron beta	91.65	0.36	0.38	1.05	1.11	0.10	4.43	0.22	0.56	0.06	0.06

Note, denominator = total # of events that generate triggers (>=2 PE)