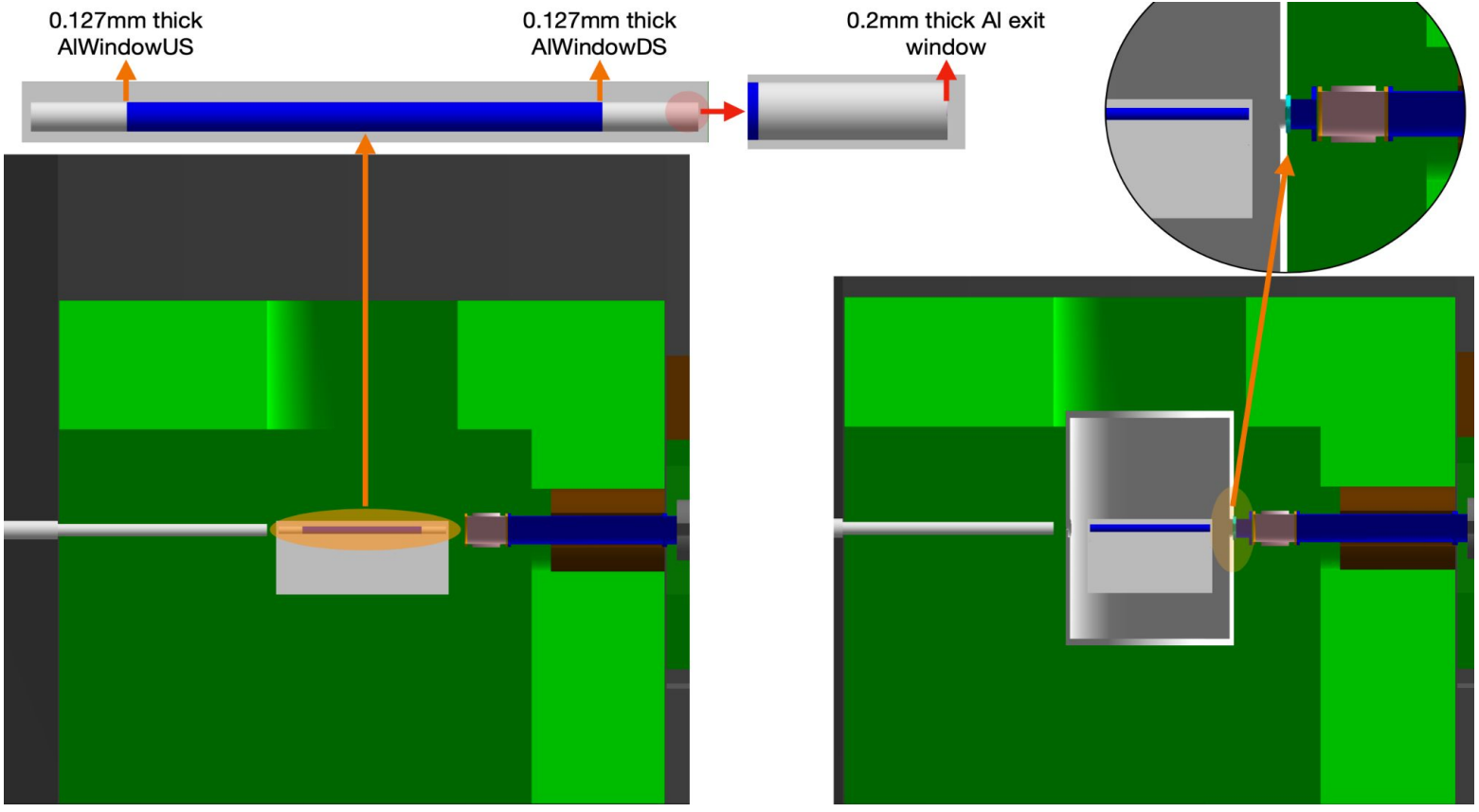
The deconvolution results with different thickness of the target Al exit window

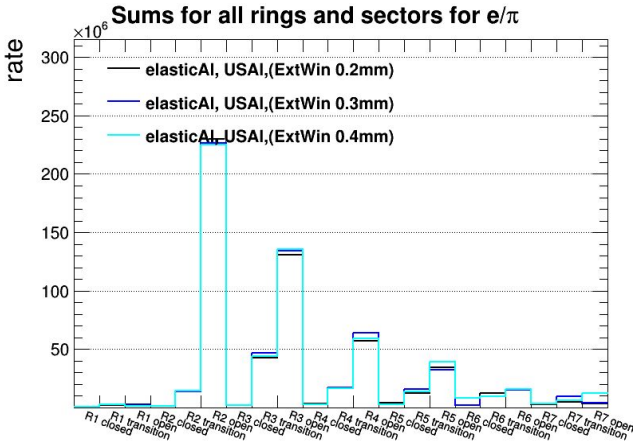
Ciprian Gal, Zuhal Seyma Demiroglu

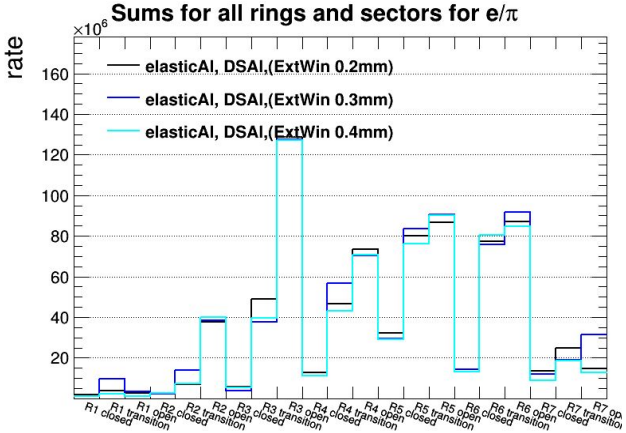
Simulation geometry, configuration 42

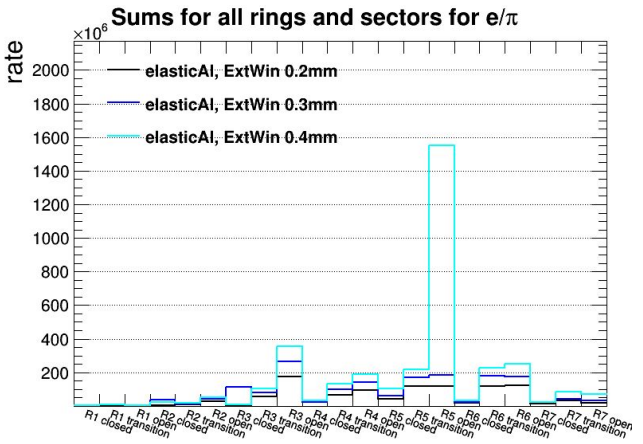
- Added the exit window in targetLadder.gdml.
- Changed the material from Be to Al.
- Ran the simulation with different Al-exit window thickness; 0.2mm, 0.3mm, 0.4mm



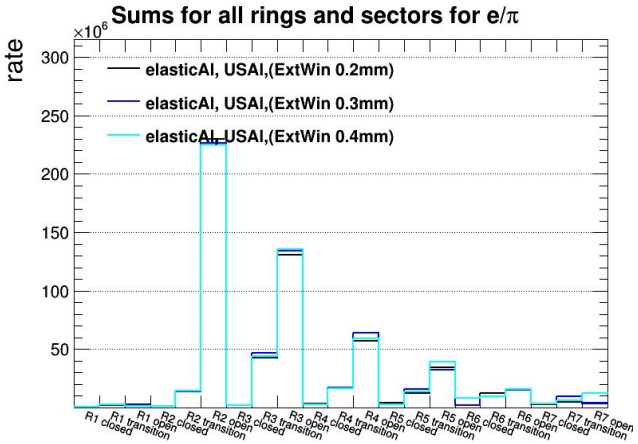
Comparison of the total rates of e/pion in the detector plane #132

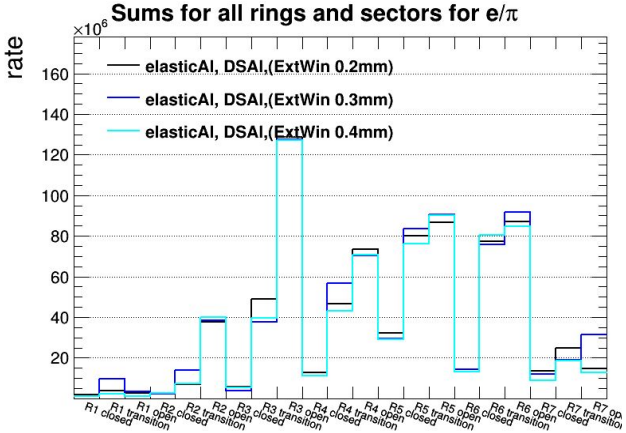


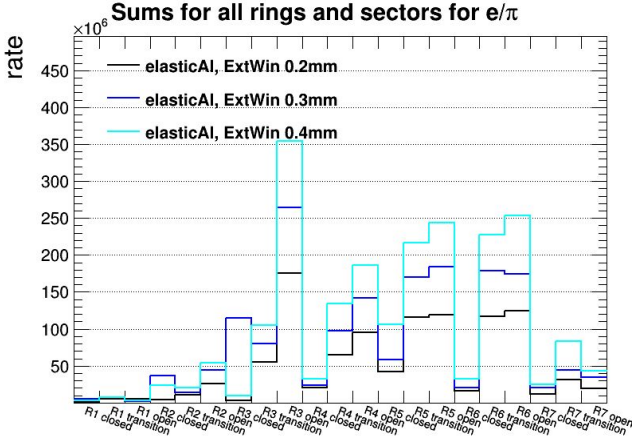




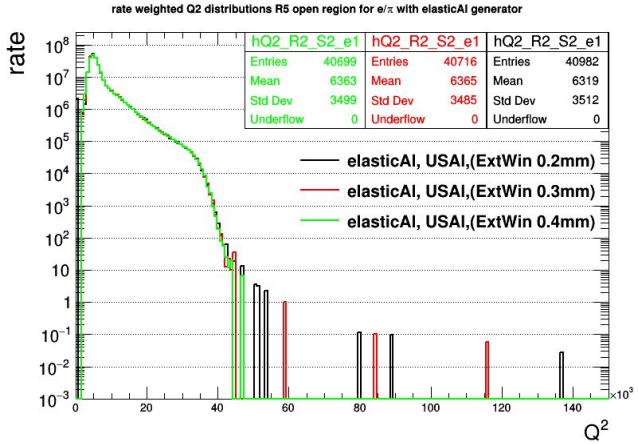
Comparison of the total rates of e/pion in the detector plane #132 v2

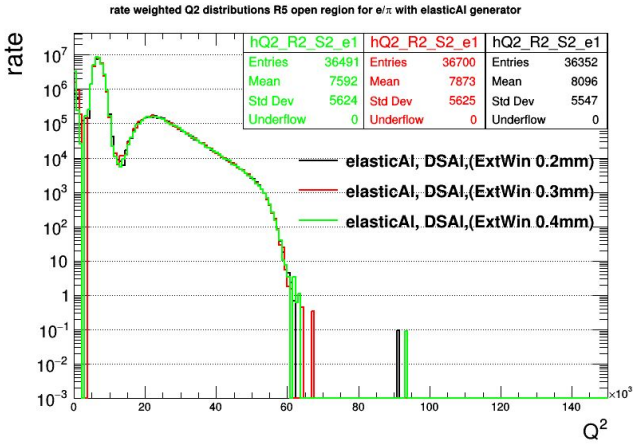


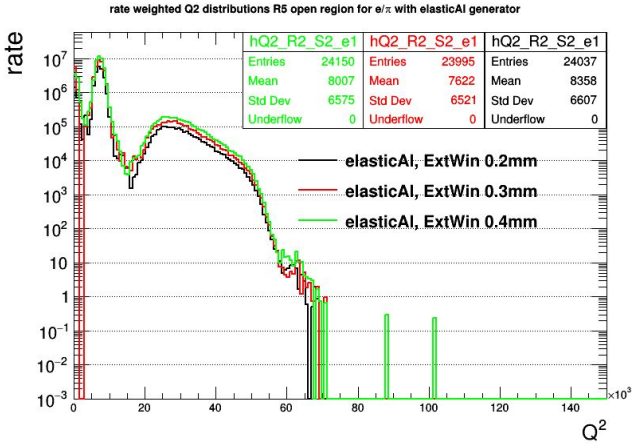




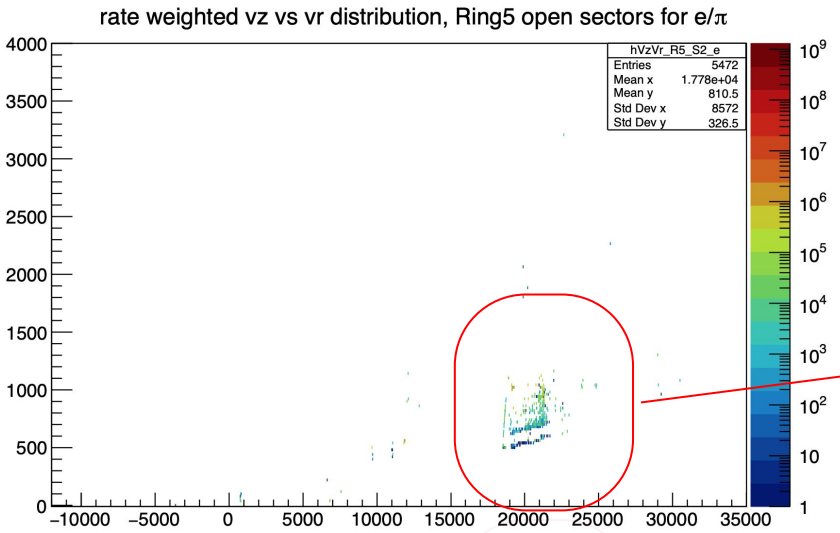
Rate weighted Q2 distributions

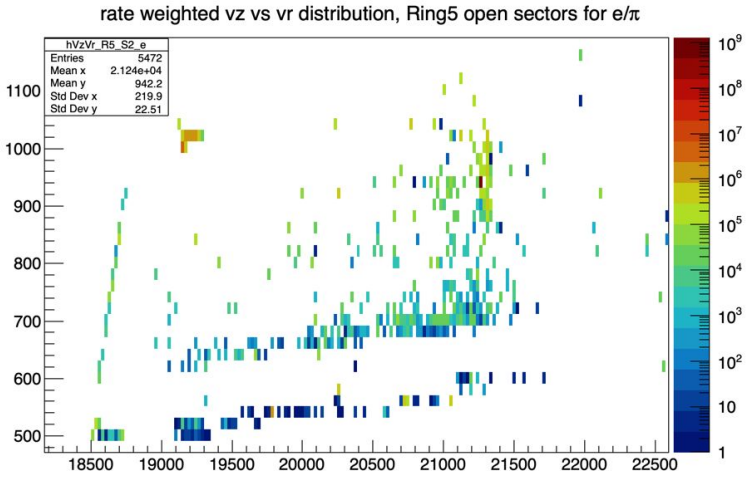


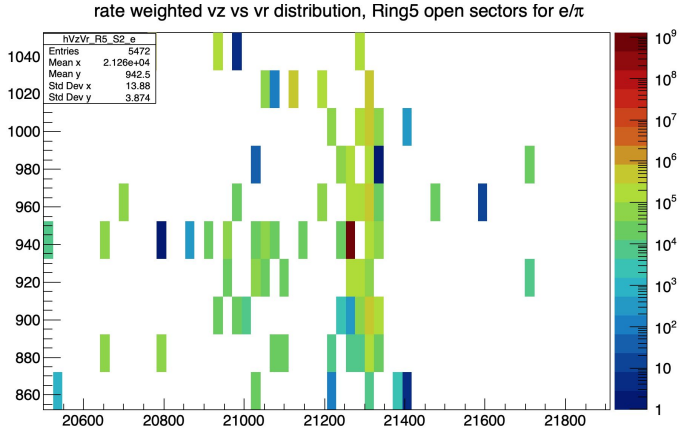




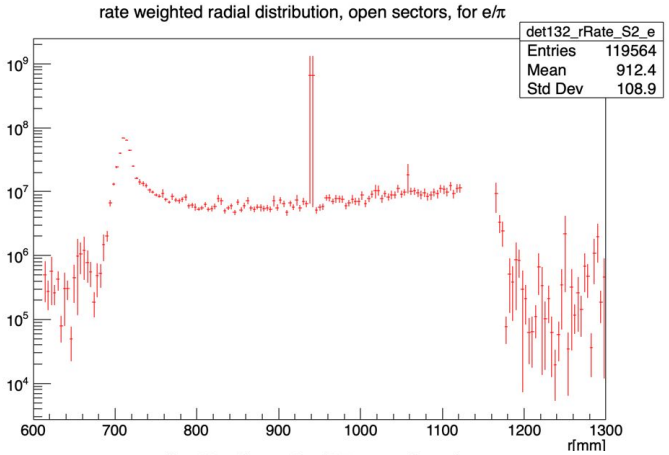
Rate weighted source distributions, Ring5, Open Sectors

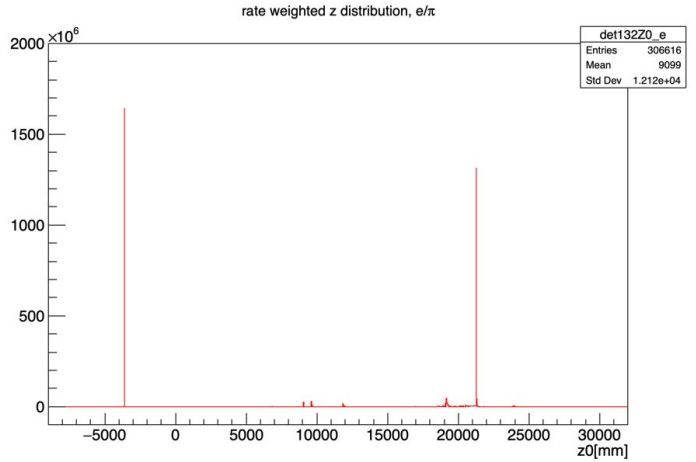


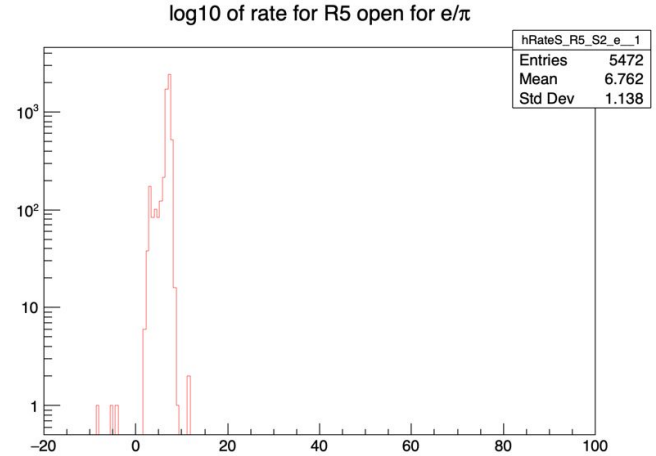


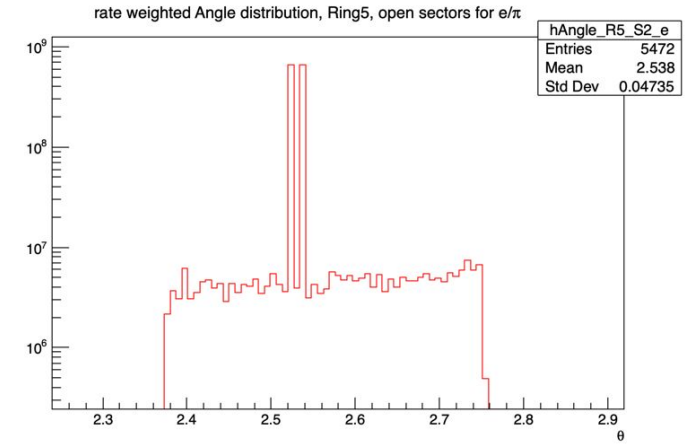


Xcheck plots

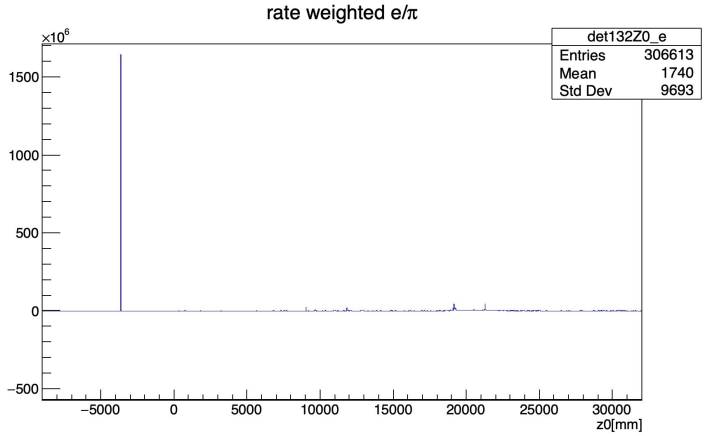


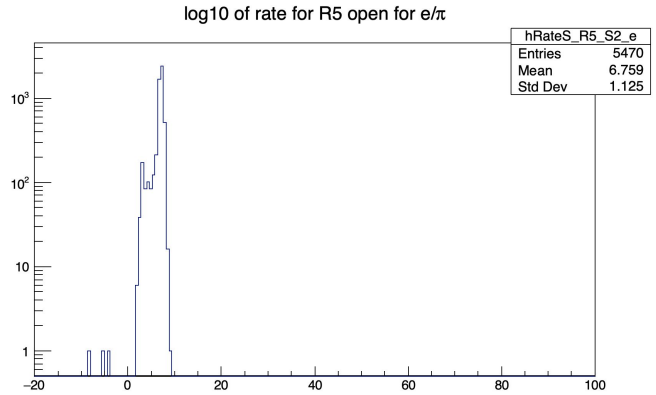


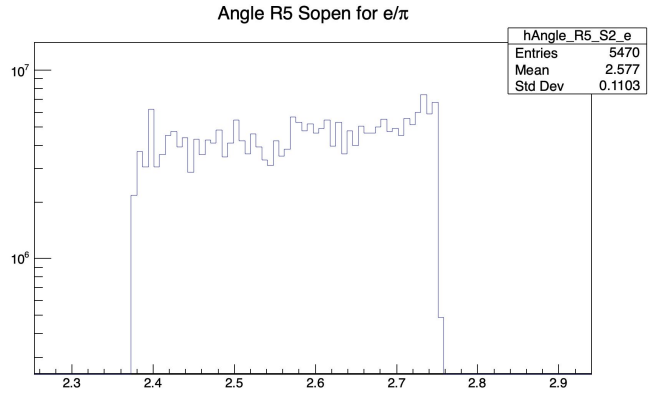




Xcheck plots, after removing the events with very high rate







Fit results, primary e with E>1 MeV, d132

ring #	sectorID	σ_A/A (%)	Am (ppb)	Moller (%)	e-p elastic (%)	e-p inelastic (%)	e-Al elastic (%)	e-Al quasielastic (%)	e-Al inelastic (%)	pions (%)
1	0	113.82%	-120.9	5.00%	4.30%	0.1%	0.00%	0.00%	-0.10%	90.70%
1	1	96.30%	-102.8	6.00%	9.00%	0.1%	0.00%	0.00%	0.00%	84.90%
1	2	128.66%	-111.3	9.30%	2.20%	0.4%	-2.30%	0.00%	0.00%	90.40%
2	0	3.02%	-528.5	0.00%	52.90%	47.5%	-0.50%	0.00%	-0.70%	0.80%
2	1	1.32%	-390.9	0.00%	59.10%	42.5%	-1.10%	0.00%	-0.70%	0.20%
2	2	2.39%	-96.7	0.00%	77.40%	29.3%	-6.00%	0.00%	-0.80%	0.10%
3	0	2.00%	-514.6	0.00%	35.60%	65.6%	-0.80%	0.00%	-1.30%	1.00%
3	1	1.16%	-244.4	0.00%	47.50%	57.1%	-3.30%	0.00%	-1.70%	0.40%
3	2	1.75%	-108.7	0.00%	58.30%	50.4%	-7.30%	0.00%	-1.50%	0.20%
4	0	3.68%	-249.7	0.90%	35.70%	51.3%	-2.30%	0.00%	-0.50%	14.80%
4	1	2.46%	-158.4	1.00%	43.80%	53.6%	-4.20%	0.00%	-0.80%	6.60%
4	2	3.52%	-55.9	27.30%	41.00%	34.8%	-4.90%	0.00%	-0.60%	2.40%
5	0	4.92%	-31.1	84.70%	5.00%	4.4%	-0.60%	0.00%	0.00%	6.50%
5	1	2.96%	-34.8	86.60%	6.00%	4.7%	-0.90%	0.00%	0.00%	3.70%
5	2	2.69%	-35.7	88.30%	7.10%	4.1%	-1.00%	0.00%	0.00%	1.50%
6	0	19.23%	-28.4	61.40%	12.70%	9.3%	-1.50%	0.00%	-0.10%	18.20%
6	1	9.14%	-25	67.70%	15.60%	6.7%	-2.60%	0.00%	-0.10%	12.60%
6	2	8.64%	-23.9	70.60%	19.60%	7.8%	-3.40%	0.00%	-0.10%	5.50%

USAl: 0.127mm, DSAl: 0.127mm, ExtWinAl: 0.2mm

https://docs.google.com/spreadsheets/d/1AXHkXTpXv5nyfQCpx8BQf8Nr0BDCzLRzRpB4TD4cBMQ/edit?usp=sharing

Fit results, primary e with E>1 MeV, d132

ring #	sectorID	σ_A/A (%)	Am (ppb)	Moller (%)	e-p elastic (%)	e-p inelastic (%)	e-Al elastic (%)	e-Al quasielastic (%)	e-Al inelastic (%)	pions (%)
1	0	113.79%	-120.9	5.00%	4.30%	0.1%	0.00%	0.00%	0.00%	90.70%
1	1	98.00%	-100.4	6.10%	9.10%	0.1%	-1.20%	0.00%	0.00%	85.90%
1	2	104.96%	-163.6	9.10%	2.10%	0.4%	0.00%	0.00%	0.00%	88.50%
2	0	3.02%	-528.1	0.00%	52.90%	47.6%	-0.50%	0.00%	-0.80%	0.80%
2	1	1.33%	-390.6	0.00%	59.10%	42.5%	-1.10%	0.00%	-0.80%	0.20%
2	2	2.40%	-96.2	0.00%	77.70%	29.4%	-6.30%	0.00%	-0.90%	0.10%
3	0	2.08%	-477.2	0.00%	35.80%	65.9%	-1.00%	0.00%	-1.70%	1.00%
3	1	1.18%	-241.2	0.00%	48.00%	57.7%	-4.00%	0.00%	-2.20%	0.40%
3	2	1.78%	-106.2	0.00%	59.50%	51.4%	-9.10%	0.00%	-2.00%	0.20%
4	0	3.71%	-247.3	0.90%	36.00%	51.8%	-3.00%	0.00%	-0.60%	14.90%
4	1	2.50%	-156	1.00%	44.40%	54.4%	-5.30%	0.00%	-1.00%	6.70%
4	2	3.57%	-55.2	27.60%	41.50%	35.2%	-6.10%	0.00%	-0.70%	2.40%
5	0	4.93%	-31.1	84.80%	5.00%	4.4%	-0.70%	0.00%	0.00%	6.50%
5	1	2.97%	-34.7	86.80%	6.00%	4.7%	-1.10%	0.00%	-0.10%	3.70%
5	2	2.70%	-35.6	88.60%	7.10%	4.1%	-1.30%	0.00%	-0.10%	1.50%
6	0	19.29%	-28.3	61.50%	12.70%	9.4%	-1.70%	0.00%	-0.10%	18.20%
6	1	9.19%	-24.8	68.10%	15.70%	6.7%	-3.10%	0.00%	-0.10%	12.70%
6	2	8.70%	-23.7	71.00%	19.70%	7.9%	-4.00%	0.00%	-0.10%	5.60%

USAl: 0.127mm, DSAl: 0.127mm, ExtWinAl: 0.3mm

Fit results, primary e with E>1 MeV, d132

ring #	sectorID	σ_A/A (%)	Am (ppb)	Moller (%)	e-p elastic (%)	e-p inelastic (%)	e-Al elastic (%)	e-Al quasielastic (%)	e-Al inelastic (%)	pions (%)
1	0	113.76%	-120.9	5.00%	4.30%	0.1%	0.00%	0.00%	0.00%	90.70%
1	1	97.24%	-101.7	6.10%	9.10%	0.1%	-0.90%	0.00%	0.00%	85.70%
1	2	106.37%	-161.2	9.20%	2.20%	0.4%	-1.30%	0.00%	0.00%	89.50%
2	0	3.02%	-527.8	0.00%	53.00%	47.6%	-0.50%	0.00%	-0.80%	0.80%
2	1	1.33%	-390.1	0.00%	59.20%	42.6%	-1.10%	0.00%	-0.80%	0.20%
2	2	2.41%	-95.9	0.00%	78.00%	29.5%	-6.60%	0.00%	-0.90%	0.10%
3	0	2.02%	-509.4	0.00%	35.90%	66.1%	-1.10%	0.00%	-2.00%	1.00%
3	1	1.19%	-237.9	0.00%	48.60%	58.5%	-4.70%	0.00%	-2.70%	0.40%
3	2	1.83%	-103.6	0.00%	60.90%	52.6%	-11.10%	0.00%	-2.50%	0.20%
4	0	3.75%	-244.8	0.90%	36.30%	52.1%	-3.70%	0.00%	-0.70%	15.10%
4	1	2.53%	-153.6	1.00%	44.90%	55.0%	-6.50%	0.00%	-1.20%	6.80%
4	2	3.61%	-54.5	28.00%	42.00%	35.6%	-7.20%	0.00%	-0.80%	2.40%
5	0	4.94%	-31	85.00%	5.00%	4.4%	-0.90%	0.00%	0.00%	6.50%
5	1	2.97%	-34.6	87.00%	6.00%	4.7%	-1.30%	0.00%	-0.10%	3.70%
5	2	2.70%	-35.5	88.80%	7.10%	4.1%	-1.50%	0.00%	-0.10%	1.50%
6	0	19.42%	-28.1	61.90%	12.80%	9.4%	-2.30%	0.00%	-0.10%	18.30%
6	1	9.27%	-24.6	68.60%	15.80%	6.9%	-3.90%	0.00%	-0.10%	12.80%
6	2	8.80%	-23.4	71.70%	19.90%	7.9%	-5.00%	0.00%	-0.10%	5.60%

USAl: 0.127mm, DSAl: 0.127mm, ExtWinAl: 0.4mm

Fit results, all e/pion with E>1 MeV, d132

ring #	sectorID	σ_A/A (%)	Am (ppb)	Moller (%)	e-p elastic (%)	e-p inelastic (%)	e-Al elastic (%)	e-Al quasielastic (%)	e-Al inelastic (%)	pions (%)
1	0	66.81%	-30.2	36.30%	25.10%	26.8%	-3.10%	0.00%	-0.60%	15.40%
1	1	45.47%	-24.5	36.80%	39.40%	18.7%	-5.30%	0.00%	-0.40%	10.80%
1	2	66.40%	-22.3	39.10%	46.50%	11.8%	-6.80%	0.00%	-0.90%	10.20%
2	0	4.56%	-214.3	2.50%	52.00%	45.8%	-0.70%	0.00%	-0.70%	1.20%
2	1	1.51%	-292	0.90%	58.60%	42.0%	-1.20%	0.00%	-0.70%	0.40%
2	2	2.42%	-93.8	0.40%	77.10%	29.1%	-6.00%	0.00%	-0.80%	0.10%
3	0	2.45%	-332.2	1.20%	35.60%	64.3%	-0.90%	0.00%	-1.30%	1.30%
3	1	1.22%	-219.3	0.40%	47.40%	56.8%	-3.30%	0.00%	-1.70%	0.50%
3	2	1.75%	-106.7	0.30%	58.20%	50.2%	-7.30%	0.00%	-1.50%	0.20%
4	0	4.89%	-126.8	4.90%	36.20%	47.7%	-2.60%	0.00%	-0.50%	14.20%
4	1	2.77%	-117.4	3.60%	43.40%	51.3%	-4.20%	0.00%	-0.80%	6.70%
4	2	3.52%	-54.2	27.60%	40.80%	34.6%	-4.90%	0.00%	-0.60%	2.50%
5	0	4.86%	-30.8	83.20%	5.90%	5.1%	-0.70%	0.00%	-0.10%	6.60%
5	1	2.94%	-34.3	85.40%	6.80%	5.0%	-0.90%	0.00%	-0.10%	3.80%
5	2	2.68%	-35.4	87.80%	7.40%	4.2%	-1.10%	0.00%	-0.10%	1.60%
6	0	17.30%	-27.4	57.80%	17.10%	10.9%	-2.00%	0.00%	-0.20%	16.40%
6	1	8.64%	-24.8	65.20%	17.30%	8.2%	-2.70%	0.00%	-0.10%	12.10%
6	2	8.39%	-23.8	69.20%	20.50%	8.2%	-3.40%	0.00%	-0.10%	5.70%

USAl: 0.127mm, DSAl: 0.127mm, ExtWinAl: 0.2mm

Fit results, all e/pion with E>1 MeV, d132

ring #	sectorID	σ_A/A (%)	Am (ppb)	Moller (%)	e-p elastic (%)	e-p inelastic (%)	e-Al elastic (%)	e-Al quasielastic (%)	e-Al inelastic (%)	pions (%)
1	0	69.25%	-29	37.50%	25.90%	27.7%	-6.30%	0.00%	-0.70%	15.90%
1	1	46.36%	-24	37.40%	40.10%	19.0%	-6.60%	0.00%	-0.80%	11.00%
1	2	66.27%	-22.3	39.10%	46.50%	11.8%	-6.90%	0.00%	-0.70%	10.20%
2	0	4.61%	-209.8	2.50%	52.10%	45.8%	-0.80%	0.00%	-0.80%	1.20%
2	1	1.51%	-291.5	0.90%	58.70%	42.0%	-1.20%	0.00%	-0.80%	0.40%
2	2	2.43%	-93.3	0.40%	77.40%	29.3%	-6.40%	0.00%	-0.90%	0.10%
3	0	2.52%	-316	1.20%	35.70%	64.5%	-1.10%	0.00%	-1.70%	1.30%
3	1	1.24%	-216.6	0.50%	47.90%	57.4%	-4.00%	0.00%	-2.10%	0.50%
3	2	1.79%	-104.3	0.30%	59.40%	51.2%	-9.10%	0.00%	-2.00%	0.20%
4	0	4.92%	-126	4.90%	36.40%	48.1%	-3.10%	0.00%	-0.60%	14.30%
4	1	2.80%	-115.7	3.60%	43.90%	51.9%	-5.40%	0.00%	-0.90%	6.80%
4	2	3.57%	-53.4	27.90%	41.30%	34.9%	-6.00%	0.00%	-0.70%	2.50%
5	0	4.87%	-30.8	83.30%	5.90%	5.1%	-0.80%	0.00%	-0.10%	6.60%
5	1	2.94%	-34.2	85.70%	6.80%	5.0%	-1.20%	0.00%	-0.10%	3.80%
5	2	2.69%	-35.3	88.10%	7.50%	4.2%	-1.30%	0.00%	-0.10%	1.60%
6	0	17.34%	-27.3	58.00%	17.20%	10.9%	-2.20%	0.00%	-0.20%	16.40%
6	1	8.70%	-24.6	65.60%	17.40%	8.2%	-3.30%	0.00%	-0.10%	12.20%
6	2	8.45%	-23.6	69.60%	20.60%	8.2%	-4.10%	0.00%	-0.20%	5.70%

USAl: 0.127mm, DSAl: 0.127mm, ExtWinAl: 0.3mm

Fit results, all e/pion with E>1 MeV, d132

ring #	sectorID	σ_A/A (%)	Am (ppb)	Moller (%)	e-p elastic (%)	e-p inelastic (%)	e-Al elastic (%)	e-Al quasielastic (%)	e-Al inelastic (%)	pions (%)
1	0	69.10%	-29.1	37.40%	25.90%	27.7%	-6.00%	0.00%	-0.90%	15.90%
1	1	46.51%	-24	37.60%	40.30%	19.2%	-7.30%	0.00%	-0.80%	11.10%
1	2	67.54%	-22	39.90%	47.50%	12.1%	-8.30%	0.00%	-1.60%	10.40%
2	0	4.60%	-211.1	2.50%	52.20%	45.9%	-0.90%	0.00%	-0.80%	1.20%
2	1	1.52%	-291.1	0.90%	58.80%	42.0%	-1.30%	0.00%	-0.80%	0.40%
2	2	2.44%	-93	0.40%	77.70%	29.4%	-6.70%	0.00%	-0.90%	0.10%
3	0	2.48%	-327.6	1.20%	35.90%	64.9%	-1.30%	0.00%	-2.00%	1.30%
3	1	1.25%	-213.6	0.50%	48.50%	58.1%	-4.80%	0.00%	-2.70%	0.50%
3	2	1.83%	-101.7	0.30%	60.70%	52.3%	-11.10%	0.00%	-2.50%	0.30%
4	0	4.97%	-124.7	5.00%	36.70%	48.4%	-3.80%	0.00%	-0.70%	14.50%
4	1	2.84%	-114	3.70%	44.50%	52.5%	-6.50%	0.00%	-1.10%	6.90%
4	2	3.61%	-52.8	28.20%	41.80%	35.3%	-7.20%	0.00%	-0.80%	2.50%
5	0	4.88%	-30.7	83.50%	5.90%	5.2%	-1.00%	0.00%	-0.10%	6.60%
5	1	2.95%	-34.1	85.90%	6.80%	5.0%	-1.40%	0.00%	-0.10%	3.80%
5	2	2.70%	-35.2	88.30%	7.50%	4.2%	-1.60%	0.00%	-0.10%	1.60%
6	0	17.48%	-27	58.40%	17.30%	11.0%	-2.90%	0.00%	-0.20%	16.50%
6	1	8.77%	-24.4	66.10%	17.60%	8.2%	-4.10%	0.00%	-0.20%	12.30%
6	2	8.54%	-23.3	70.30%	20.80%	8.4%	-5.10%	0.00%	-0.20%	5.80%

USAl: 0.127mm, DSAl: 0.127mm, ExtWinAl: 0.4mm

Fit results, all e/pion with E>1 MeV, d132

5	0	4.86%	-30.8	83.20%	5.90%	5.1%	-0.70%
5	1	2.94%	-34.3	85.40%	6.80%	5.0%	-0.90%
5	2	2.68%	-35.4	87.80%	7.40%	4.2%	-1.10%

Total Al contr.: 0.454mm

5	0	4.87%	-30.8	83.30%	5.90%	5.1%	-0.80%
5	1	2.94%	-34.2	85.70%	6.80%	5.0%	-1.20%
5	2	2.69%	-35.3	88.10%	7.50%	4.2%	-1.30%

Total Al contr.: 0.554mm

5	0	4.88%	-30.7	83.50%	5.90%	5.2%	-1.00%
5	1	2.95%	-34.1	85.90%	6.80%	5.0%	-1.40%
5	2	2.70%	-35.2	88.30%	7.50%	4.2%	-1.60%

Total Al contr.: 0.654mm

5	0	4.74	-31.86	87.3	5.46	3.77	-0.82
5	1	2.57	-35.00	88.0	5.95	3.50	-1.17
5	2	2.29	-34.34	88.6	7.42	3.56	-1.87

Total Al contr.: 0.254mm

Ref: https://moller.jlab.org/DocDB/0006/000627/001/MOLLER_backgrounds.pdf

Fit results, primary e with E>1 MeV, d132

5	0	4.92%	-31.1	84.70%	5.00%	4.4%	-0.60%
5	1	2.96%	-34.8	86.60%	6.00%	4.7%	-0.90%
5	2	2.69%	-35.7	88.30%	7.10%	4.1%	-1.00%

Total Al contr.: 0.454mm

5	0	4.93%	-31.1	84.80%	5.00%	4.4%	-0.70%
5	1	2.97%	-34.7	86.80%	6.00%	4.7%	-1.10%
5	2	2.70%	-35.6	88.60%	7.10%	4.1%	-1.30%

Total Al contr.: 0.554mm

5	0	4.94%	-31	85.00%	5.00%	4.4%	-0.90%
5	1	2.97%	-34.6	87.00%	6.00%	4.7%	-1.30%
5	2	2.70%	-35.5	88.80%	7.10%	4.1%	-1.50%

Total Al contr.: 0.654mm

5	0	4.74	-31.86	87.3	5.46	3.77	-0.82
5	1	2.57	-35.00	88.0	5.95	3.50	-1.17
5	2	2.29	-34.34	88.6	7.42	3.56	-1.87

Total Al contr.: 0.254mm

Ref: https://moller.jlab.org/DocDB/0006/000627/001/MOLLER_backgrounds.pdf

The fractional correction of eAl elastic to the Møller asymmetry in Ring 5 is 1.47%

5-process fit results, d132

- Run the physics generators moller, epelastic, epinelastic, pion for 10M events (target exit window is 0.2mm thick Al).
- Run the physics generators elasticAl, inelasticAl, quasielasticAl for 10M events (target exit window is 0.2mm/0.3mm/0.4mm thick Al).
- The deconvolution analysis is based on the 5 process fit.
  - Moller, ep-elastic, ep-inelastic ([1,1.4), [1.4,2.5), [2.5,6)).

5-process fit results, primary e with E>1 MeV, d132

with 0.2mm thick Al target exit window			
Name	Asymmetry	uncert[ppb]	relative uncer
moller	-34.79	0.72	2.07%
ep Elastic	-28.85	1.45	5.02%
ep Inelastic W1	-499.72	59.09	11.82%
ep Inelastic W2	-485.50	32.46	6.69%
ep Inelastic W3	-436.88	69.55	15.92%

with 0.3mm thick Al target exit window			
Name	Asymmetry	uncert[ppb]	relative uncer
moller	-34.79	0.72	2.07%
ep Elastic	-28.85	1.46	5.05%
ep Inelastic W1	-499.72	59.29	11.87%
ep Inelastic W2	-485.50	32.54	6.70%
ep Inelastic W3	-436.88	69.63	15.94%

with 0.4mm thick Al target exit window			
Name	Asymmetry	uncert[ppb]	relative uncer
moller	-34.79	0.72	2.07%
ep Elastic	-28.85	1.45	5.02%
ep Inelastic W1	-499.72	59.13	11.83%
ep Inelastic W2	-485.50	32.49	6.69%
ep Inelastic W3	-436.88	69.69	15.95%

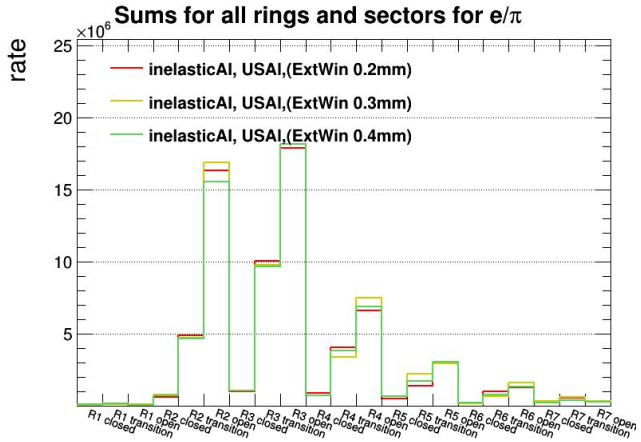
5-process fit results, all e/pion with E>1 MeV, d132

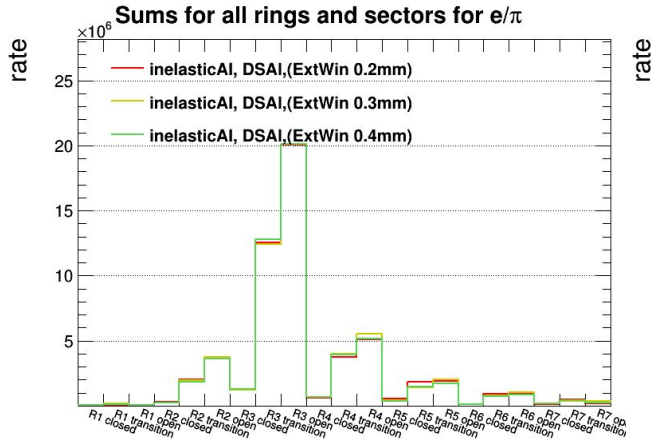
with 0.2mm thick Al target exit window			
Name	Asymmetry	uncert[ppb]	relative uncer
moller	-34.63	0.73	2.11%
ep Elastic	-27.09	1.50	5.55%
ep Inelastic W1	-480.75	67.14	13.97%
ep Inelastic W2	-504.48	39.59	7.85%
ep Inelastic W3	-434.88	88.43	20.33%

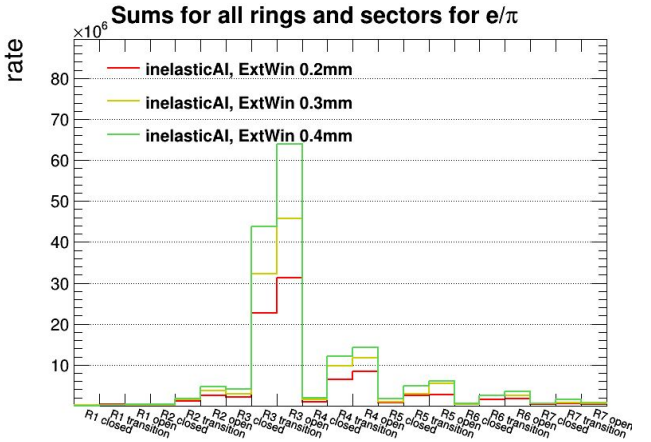
with 0.3mm thick Al target exit window			
Name	Asymmetry	uncert[ppb]	relative uncer
moller	-34.63	0.73	2.11%
ep Elastic	-27.09	1.51	5.57%
ep Inelastic W1	-480.75	67.37	14.01%
ep Inelastic W2	-504.48	39.66	7.86%
ep Inelastic W3	-434.88	88.51	20.35%

with 0.4mm thick Al target exit window			
Name	Asymmetry	uncert[ppb]	relative uncer
moller	-34.63	0.73	2.11%
ep Elastic	-27.09	1.50	5.55%
ep Inelastic W1	-480.75	67.24	13.99%
ep Inelastic W2	-504.48	39.65	7.86%
ep Inelastic W3	-434.88	88.57	20.37%

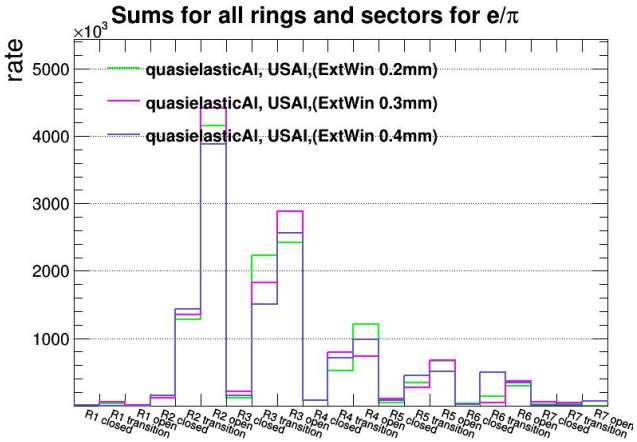
Comparison of the total rates of e/pion in the detector plane #132

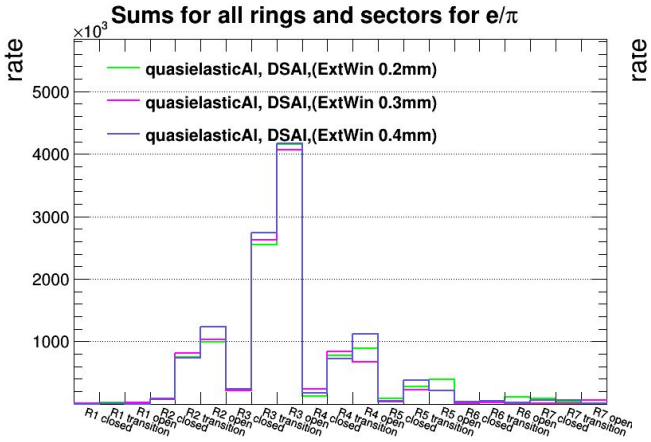


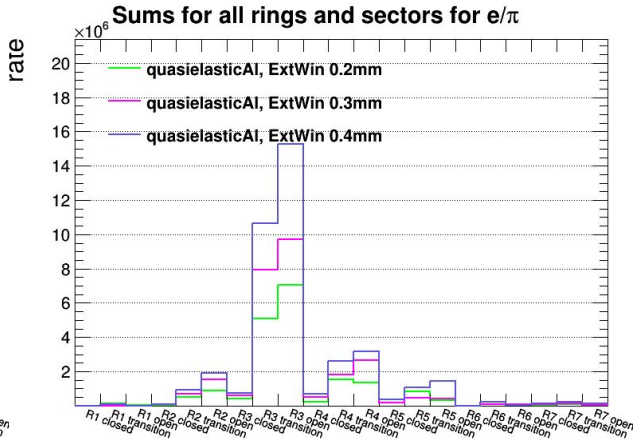




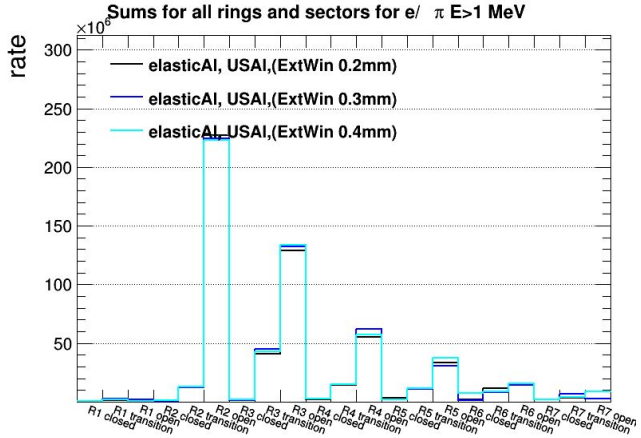
Comparison of the total rates of e/pion in the detector plane #132

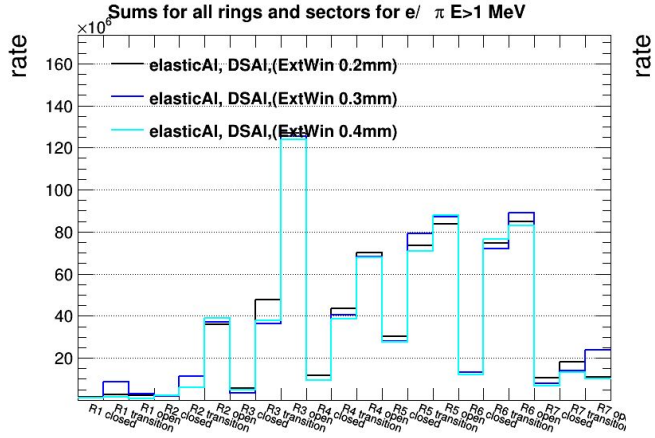


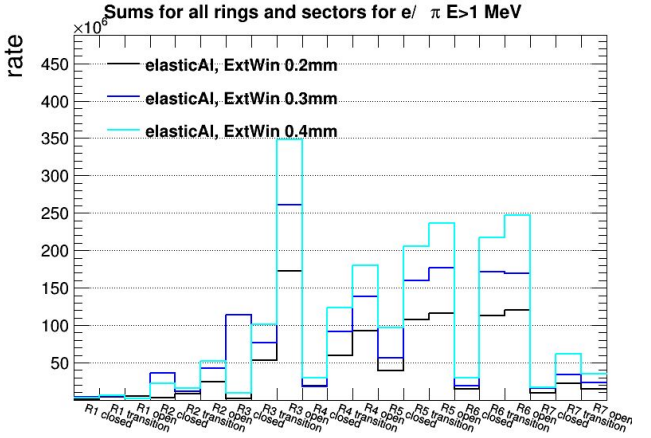




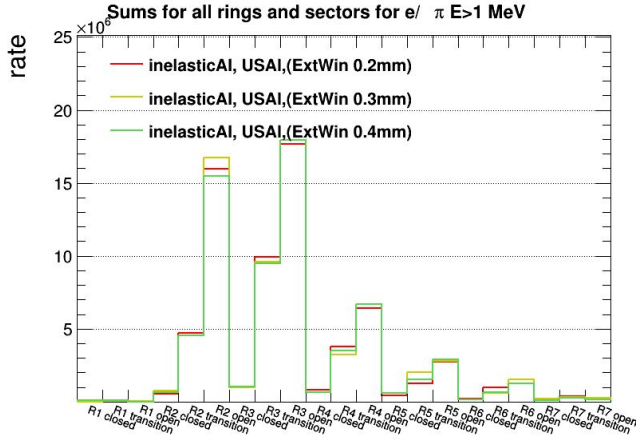
Comparison of the total rates of e/pion with E>1 MeV in the detector plane #132

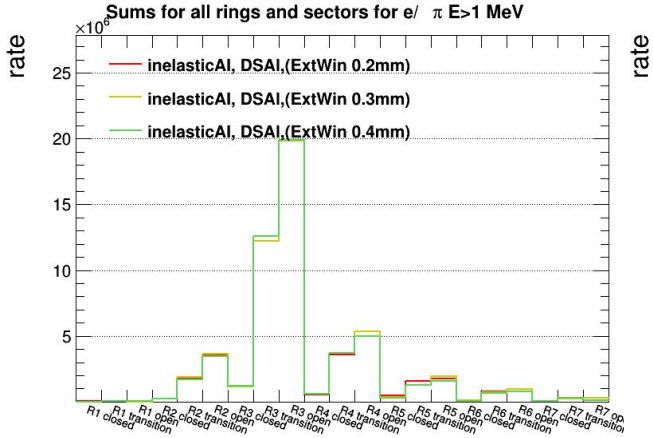


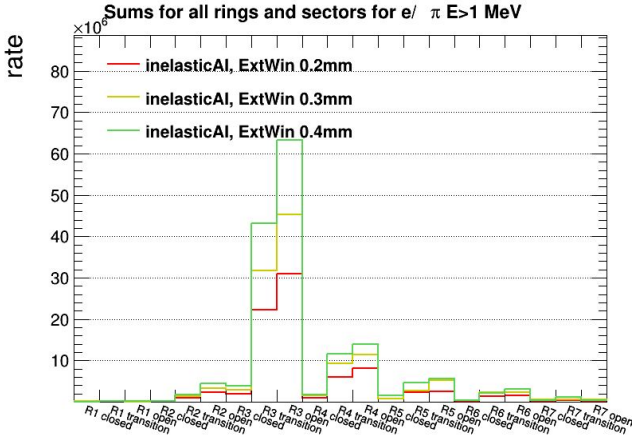




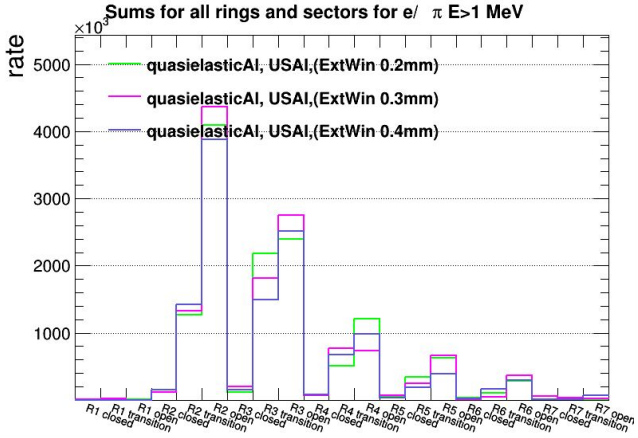
Comparison of the total rates of e/pion with E>1 MeV in the detector plane #132

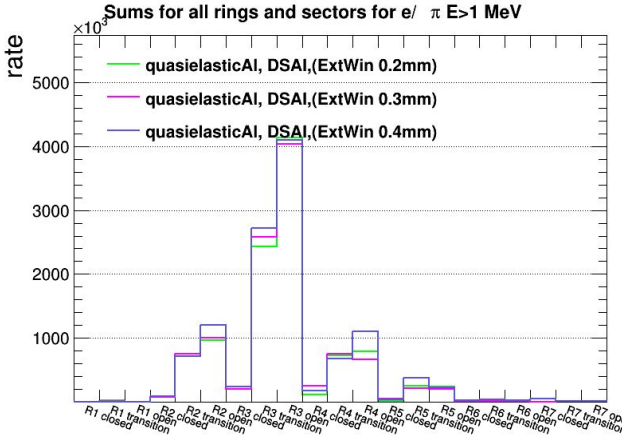


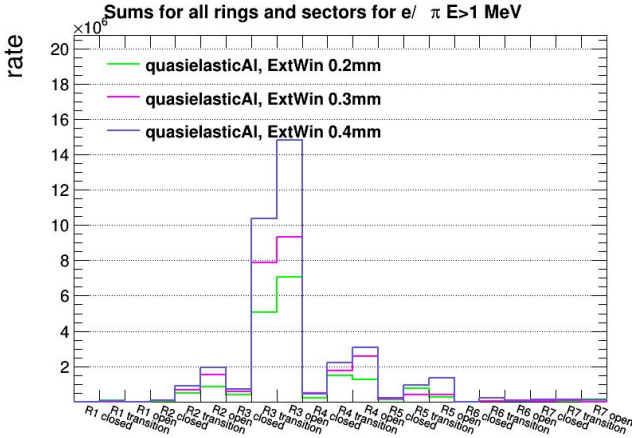




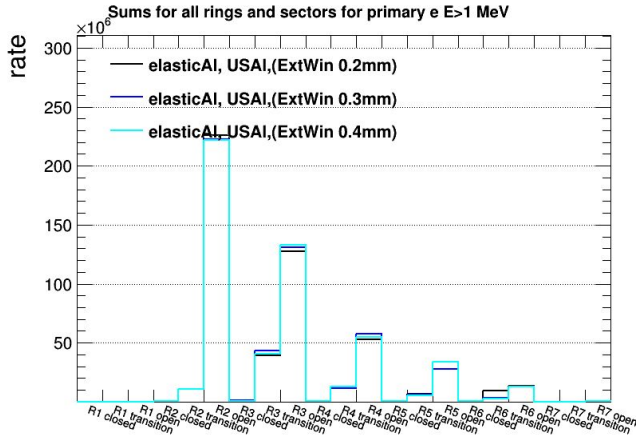
Comparison of the total rates of e/pion with E>1 MeV in the detector plane #132

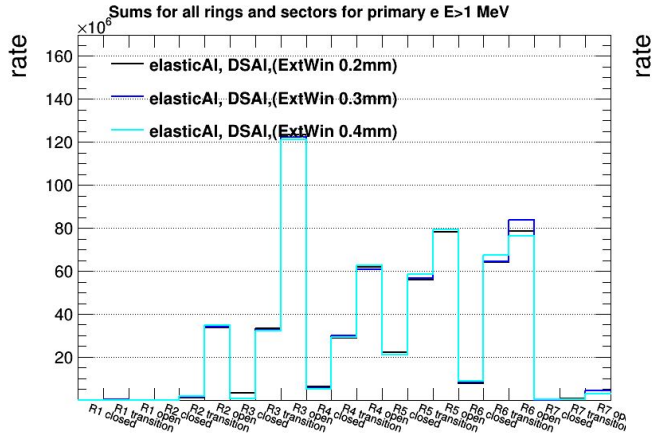


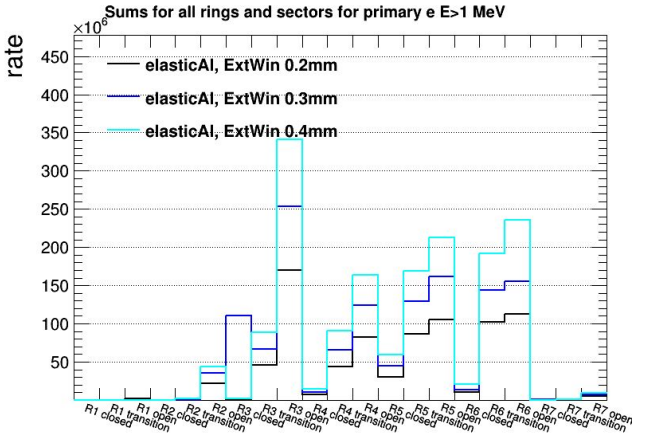




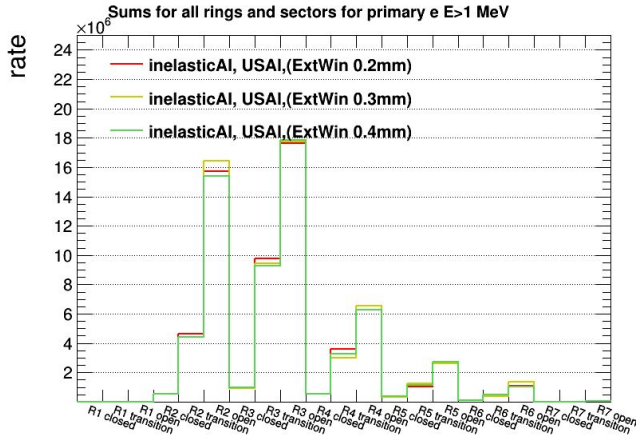
Comparison of the total rates of primary e with E>1 MeV in the detector plane #132

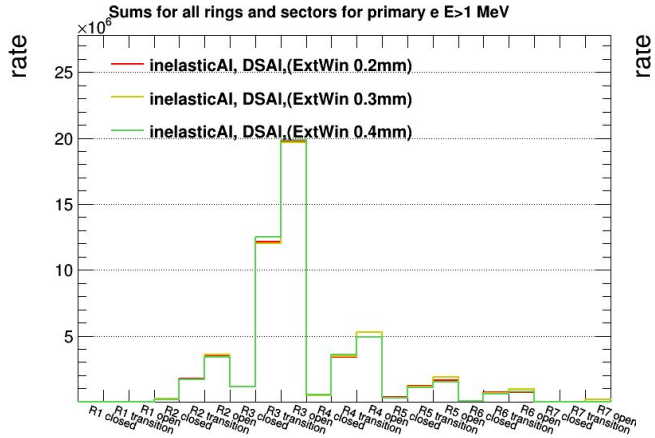


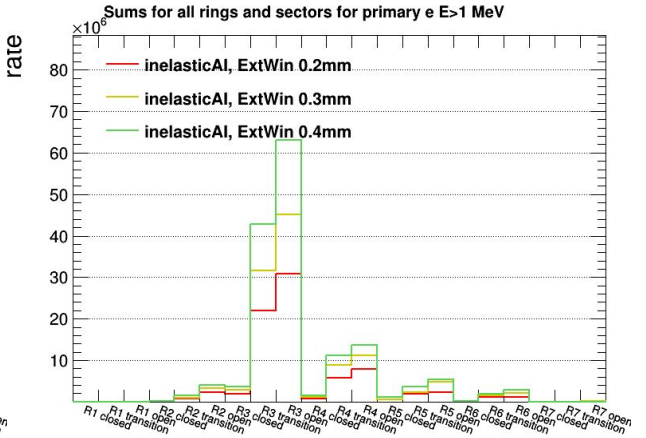




Comparison of the total rates of primary e with E>1 MeV in the detector plane #132







Comparison of the total rates of primary e with E>1 MeV in the detector plane #132