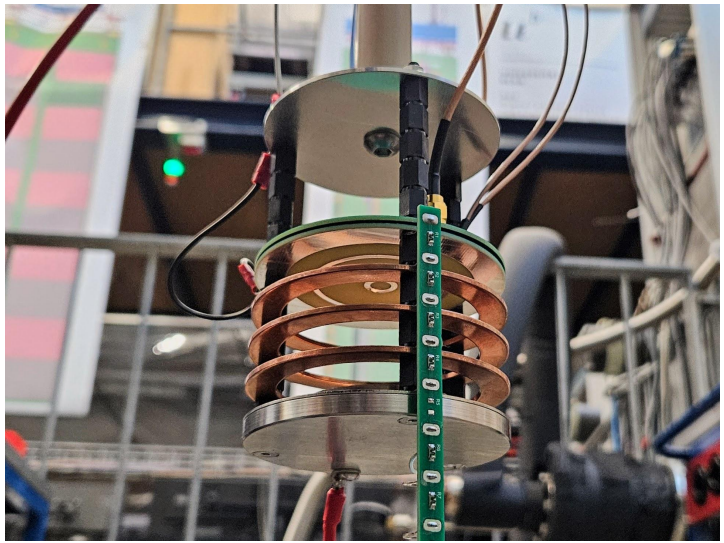
# Purity Monitor Simulation update

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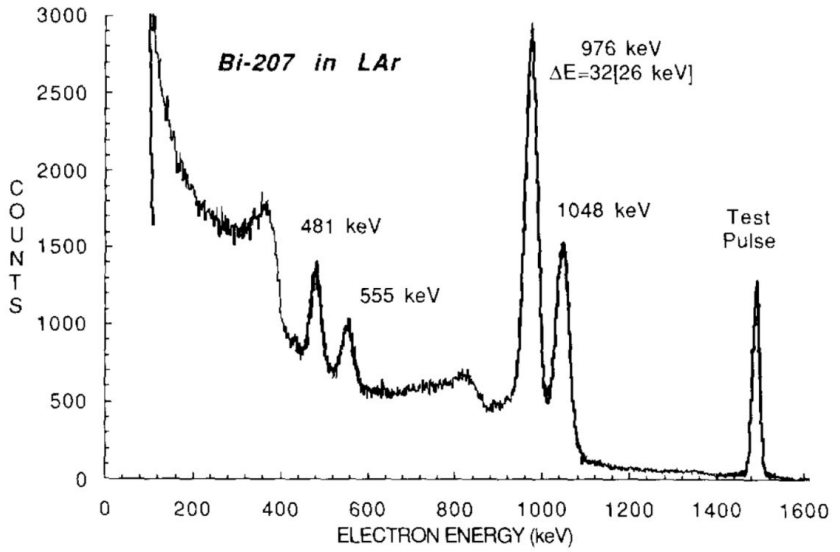
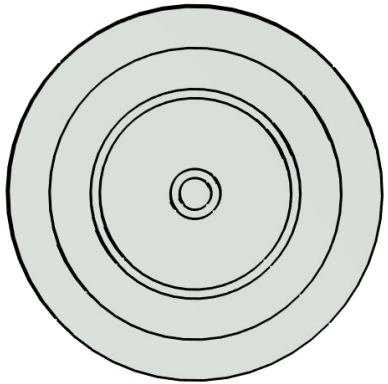
| Energy [keV] | Transition | Relative intensity | |
|---|---|---|---|
| 10.8 | Pb $L_{III}-M_V$ | 50 | |
| 13.0 | Pb $L_{II}-M_{IV}$ | 25 | |
| 72.8 | Pb $K-L_{II}$ | 1800 | |
| 75.0 | Pb $K-L_{III}$ | 3700 | |
| 84.9 | Pb $K-M_{II-III}$ | 1460 | |
| 87.3 | Pb $K-N_{II-III}$ | 155 | |
| 553.8 | Pb $L_1$ conv | 18 | |
| 554.4 | Pb $L_{II}$ conv | 20 | |
| 556.6 | Pb $L_{III}$ conv | 5 | |
| 566.0 | Pb M conv | 15 | |
| 569.6 | Pb γ | 9775 | Compton edge: 408 |
| 897.7 | Pb γ | 12 | |
| 975.6 | Pb K conv | 719 | |
| 1047.8 | Pb $L_1$conv | 132 | |
| 1048.4 | Pb $L_{II}$conv | 35 | |
| 1050.6 | Pb $L_{III}$conv | 11 | |
| 1060.0 | Pb M conv | 59 | |
| 1063.6 | Pb γ | 7408 | Compton edge: 858 |
| 1442.2 | Pb γ | 13 | |
| 1682.2 | Pb K conv | 2 | |
| 1770.2 | Pb γ | 701 | Compton edge: 1546 Escape peaks: 1259 748 |



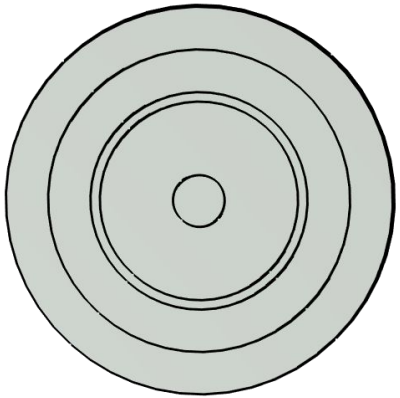

arxiv.org/abs/2411.10796

# Anode segment geometry

Version 1



Version 2



# Simulation Overview

- Drift field and weighting potentials from COMSOL simulation (static)
- Bi-207 source simulation using Geant4 radioactive-decay module
- Transport simulation in python

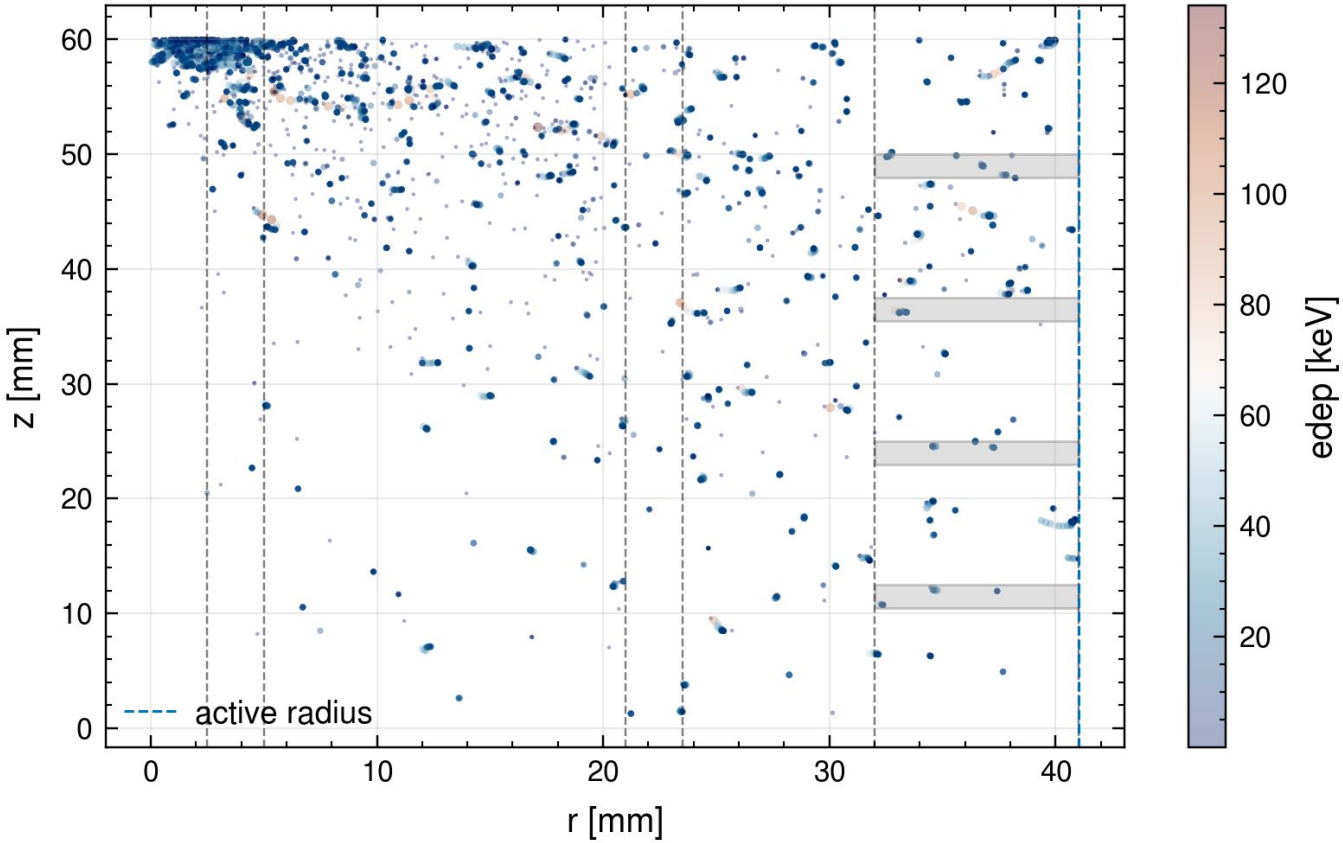
Ionization: $$N_e^0 = \frac{E_{\text{dep}}}{W_{\text{ion}}}$$

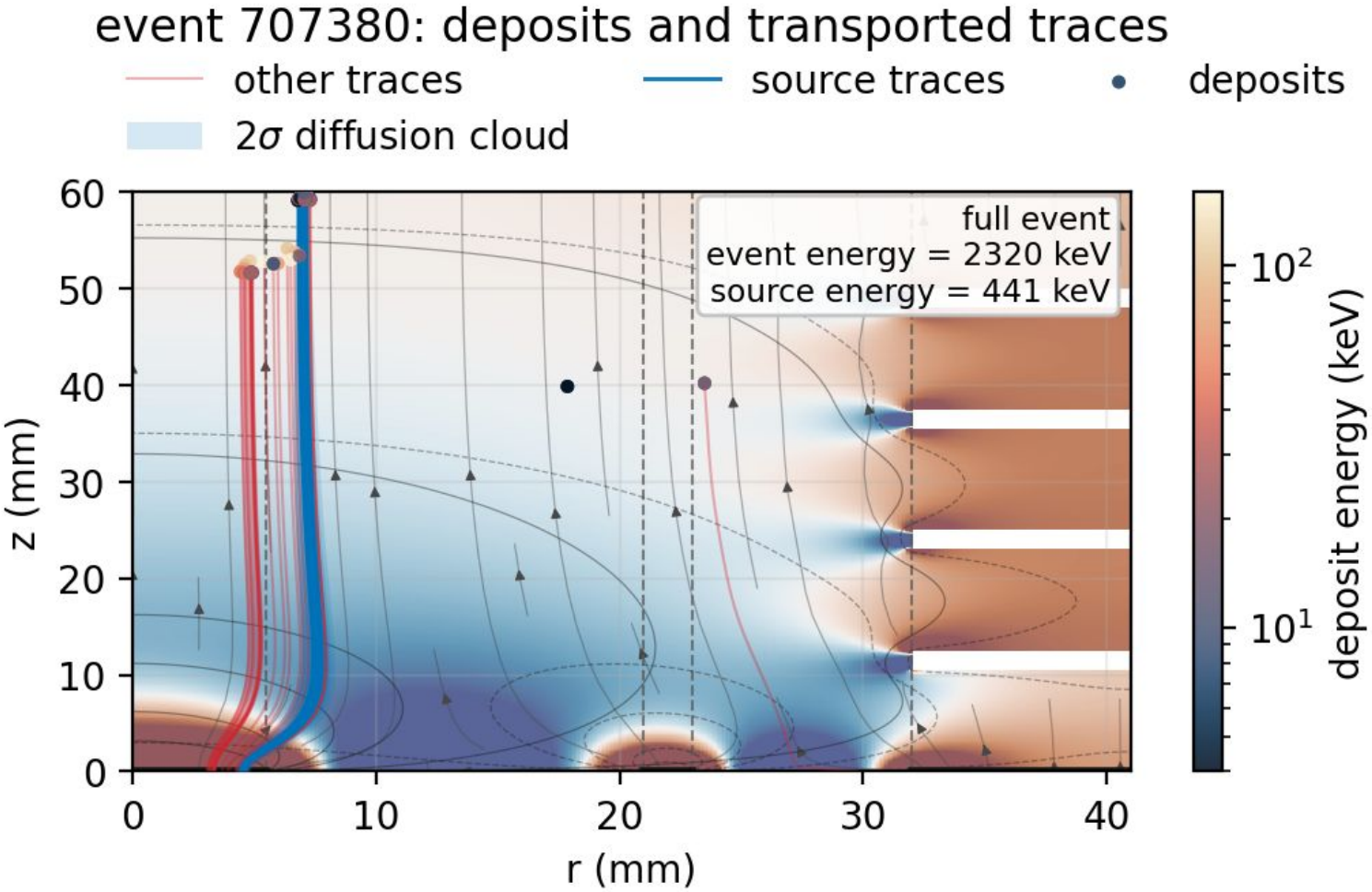
Recombination / attachment: $$N_e = R\, N_e^0 \, \exp\left(-\frac{t_{\text{drift}}}{\tau_e}\right)$$

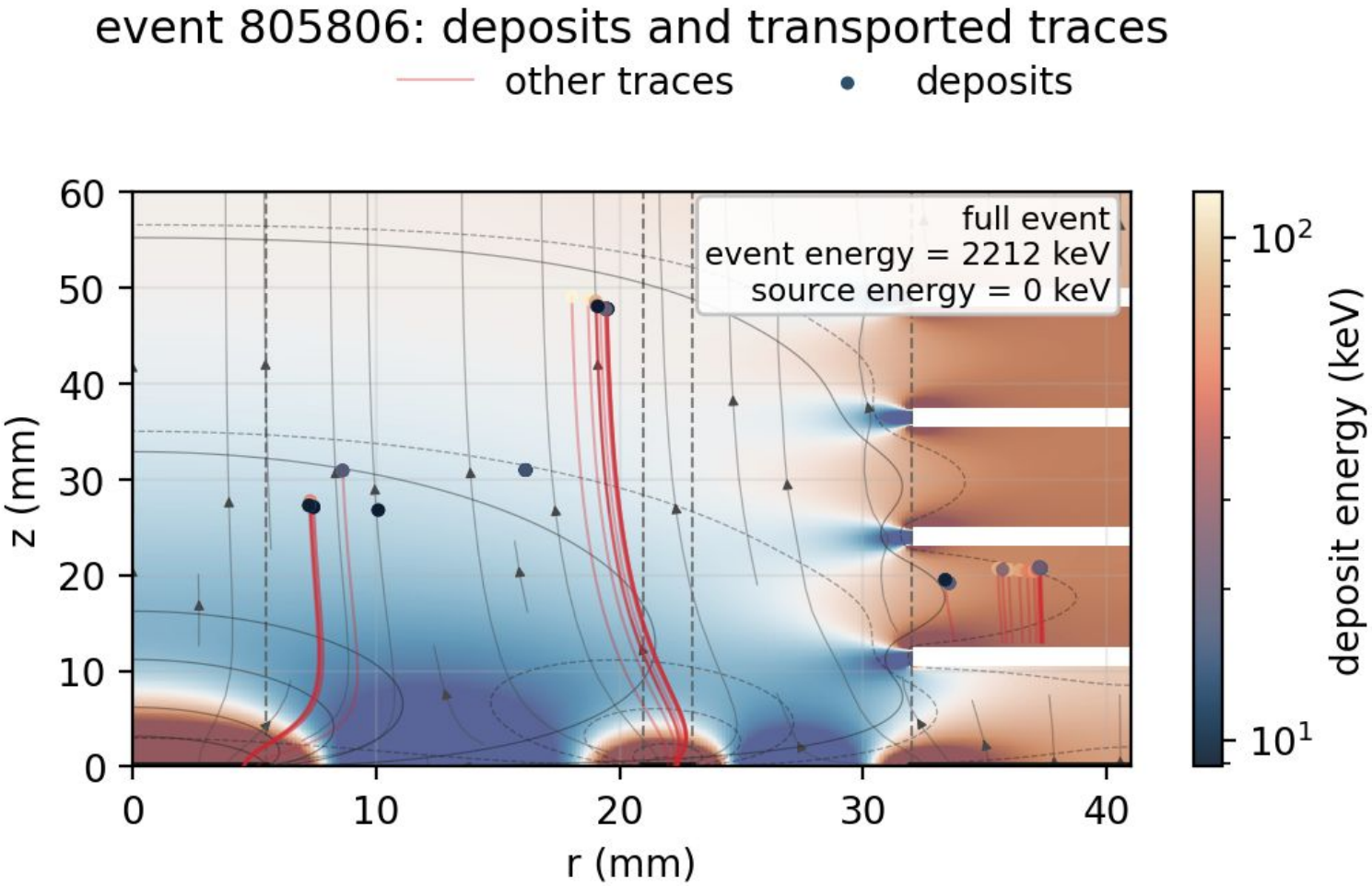
Diffusion: $$\sigma_T^2 = 2D_T t_{\text{drift}}, \qquad \sigma_L^2 = 2D_L t_{\text{drift}}$$

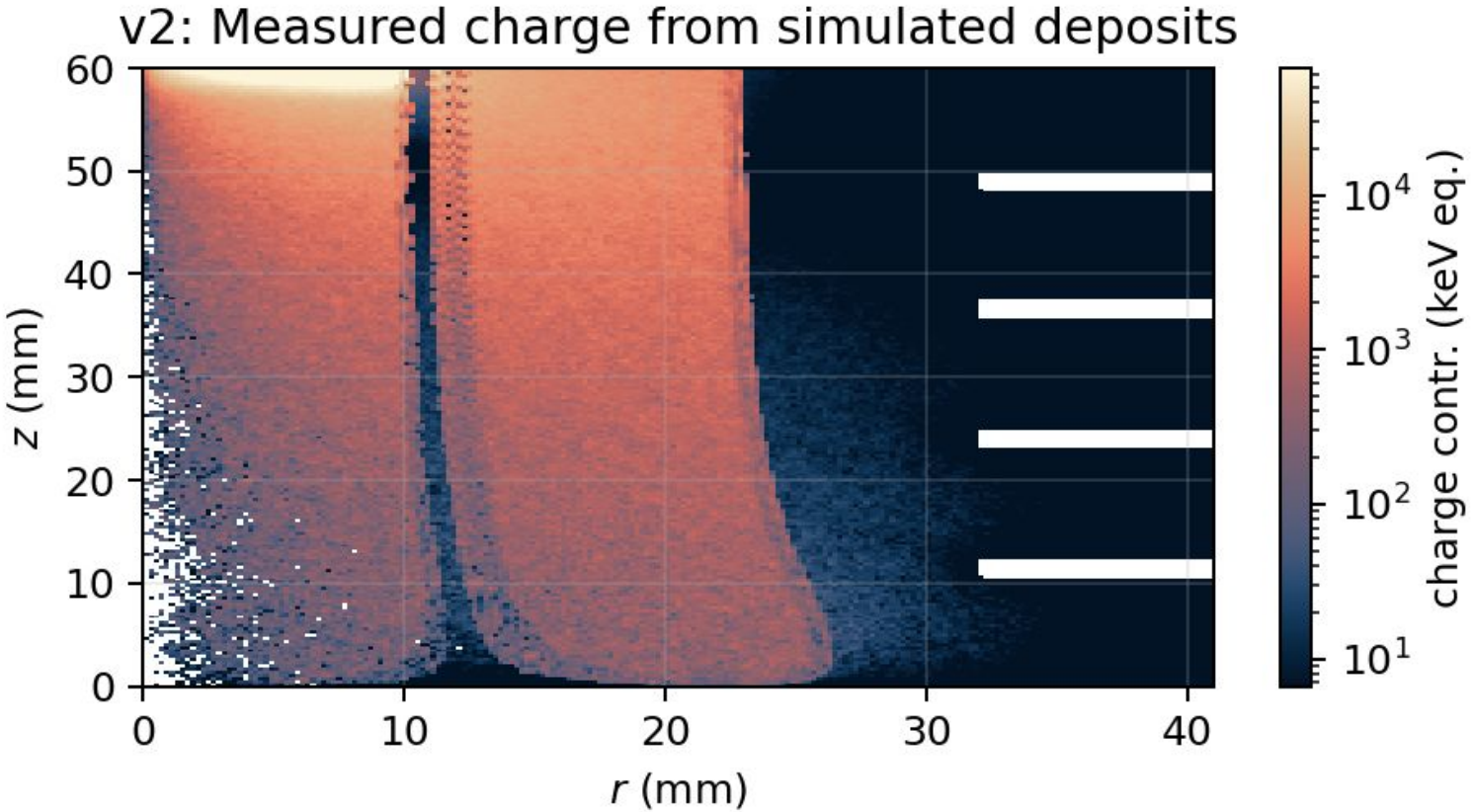
Shockley-Ramo induced charge: $$Q_k = -q_e N_e \Delta\phi_{w,k}$$

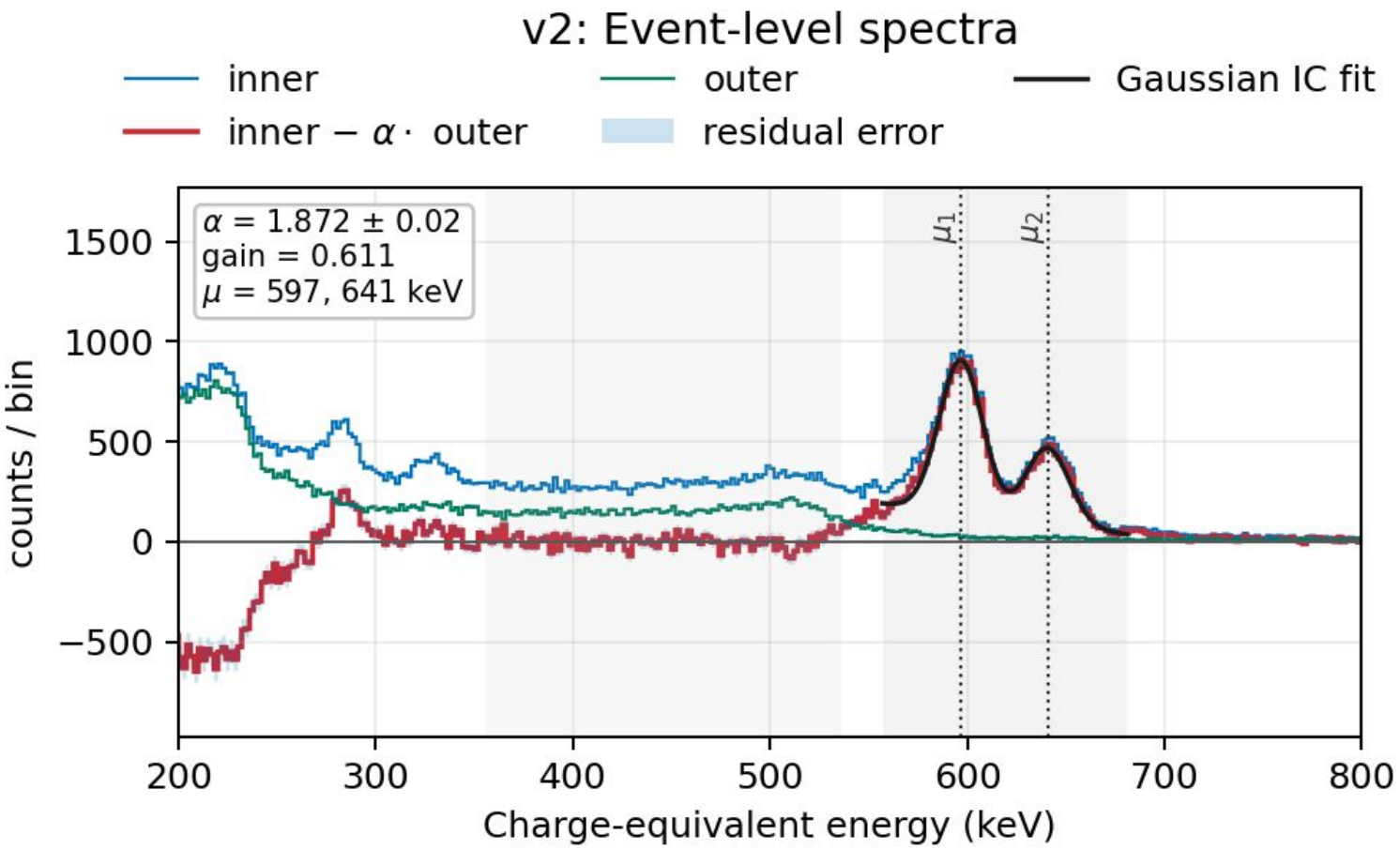
# r-z active-LAr deposits

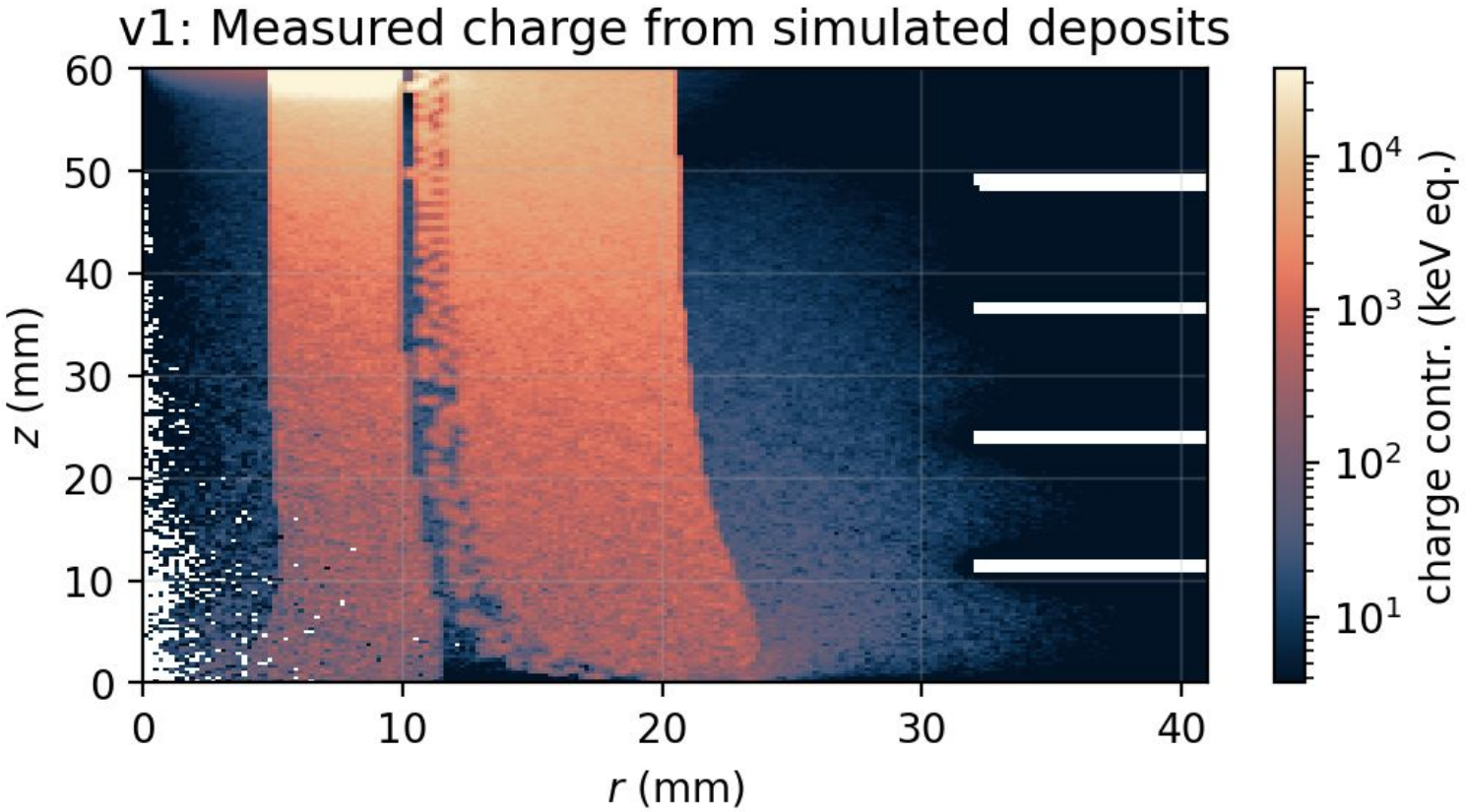


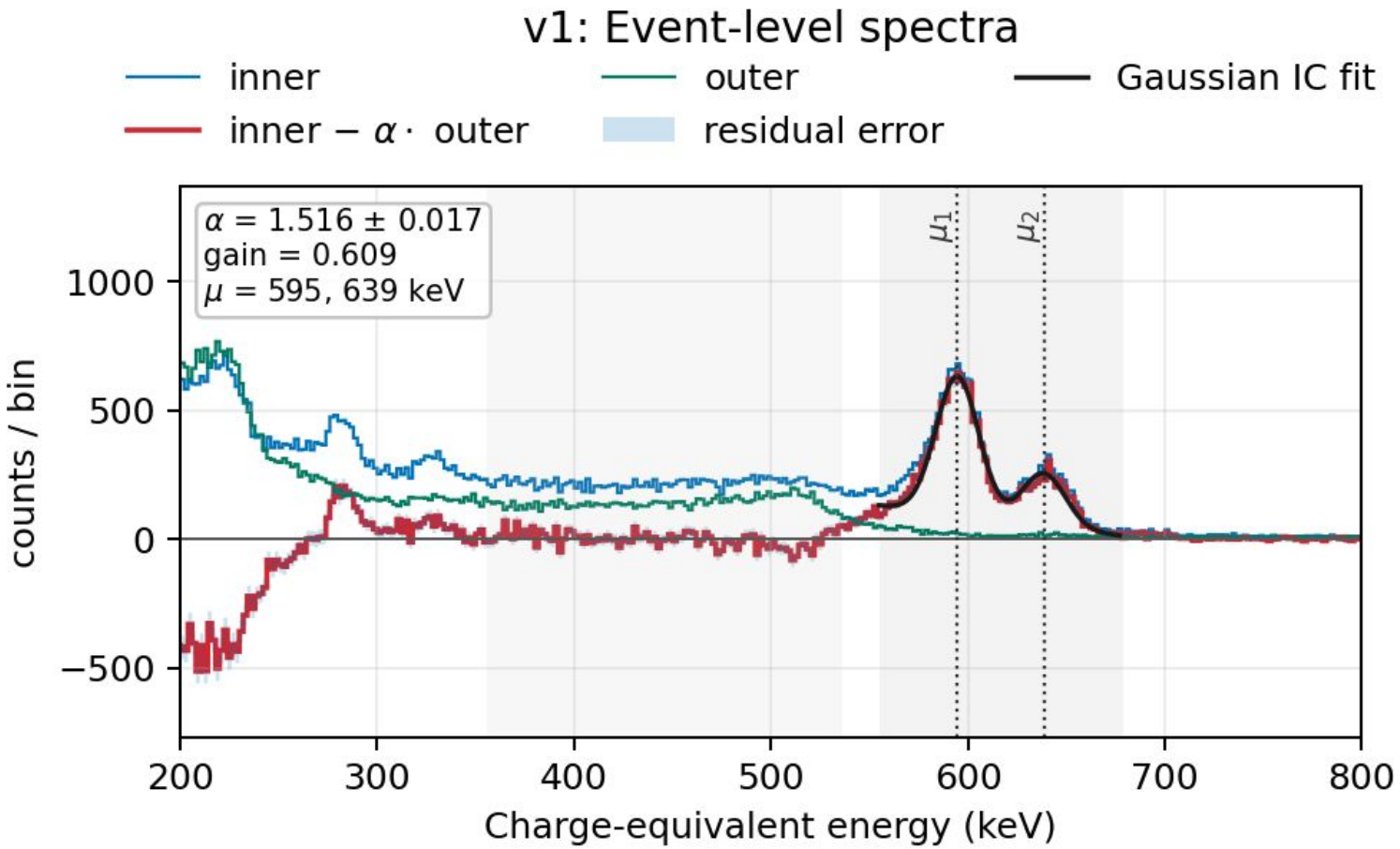

event 707380: deposits and transported traces
other traces
source traces
deposits
2σ diffusion cloud
full event
event energy = 2320 keV
source energy = 441 keV
z (mm)
r (mm)
deposit energy (keV)
0
10
20
30
40
50
60
$10^2$
$10^1$


event 805806: deposits and transported traces
other traces
deposits
full event
event energy = 2212 keV
source energy = 0 keV
z (mm)
r (mm)
deposit energy (keV)
0
10
20
30
40
50
60
$10^2$
$10^1$


v2: Measured charge from simulated deposits
z (mm)
r (mm)
0
10
20
30
40
50
60
charge contr. (keV eq.)
$10^4$
$10^3$
$10^2$
$10^1$


v2: Event-level spectra
inner
outer
Gaussian IC fit
inner − α · outer
residual error
α = 1.872 ± 0.02
gain = 0.611
μ = 597, 641 keV
μ1
μ2
counts / bin
1500
1000
500
0
−500
200
300
400
500
600
700
800
Charge-equivalent energy (keV)


v1: Measured charge from simulated deposits
z (mm)
r (mm)
0
10
20
30
40
50
60
charge contr. (keV eq.)
$10^4$
$10^3$
$10^2$
$10^1$


v1: Event-level spectra
inner
outer
Gaussian IC fit
inner − α · outer
residual error
α = 1.516 ± 0.017
gain = 0.609
μ = 595, 639 keV
μ1
μ2
1000
500
0
−500
counts / bin
200
300
400
500
600
700
800
Charge-equivalent energy (keV)