

Symmulation of Fe58 activation with proton beam

— Results —

Maciej Lewicki¹

Helmholtz Zentrum Dresden-Rossendorf

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hzdr



Penetration depth

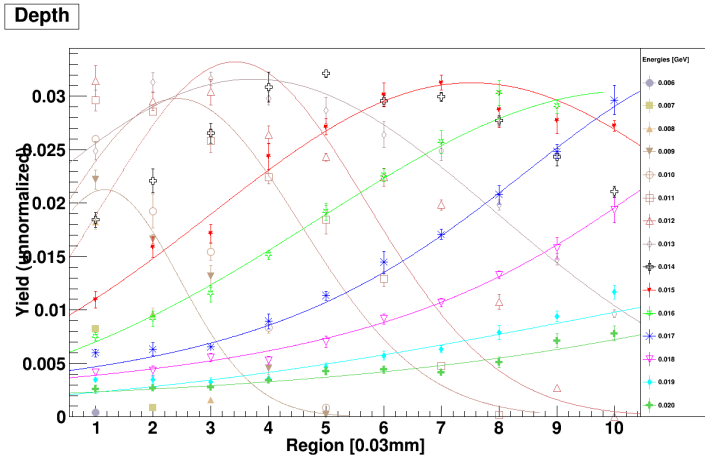


Figure: Yield of Co58 in various depths

Isotope yields

Iron target

Isotope yields

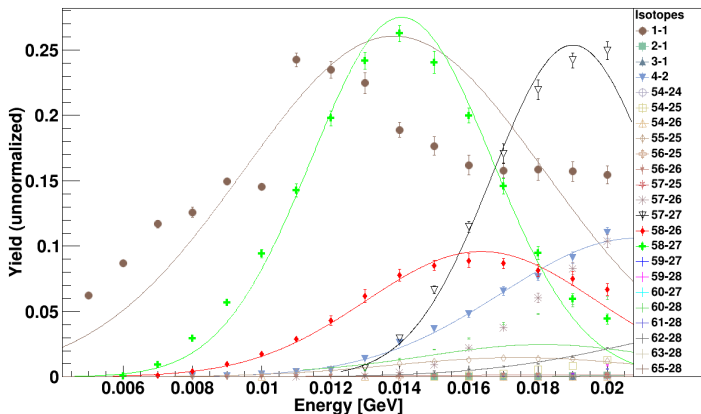


Figure: Isotope yield distribution for energies $\in [0.006 : 0.020]$ GeV

Isotope yields

Iron target

- $^{54}_{24}\text{Cr}$ - stable
- $^{54}_{25}\text{Mn}$ - stable
- $^{54}_{26}\text{Fe} - \beta^+, 7.5 \cdot 10^4 a$
- $^{55}_{25}\text{Mn} - \beta^-, \gamma: 1332, 1173$
- $^{56}_{25}\text{Mn}$ - stable
- $^{56}_{26}\text{Fe}$ - stable
- $^{57}_{25}\text{Mn}$ - stable
- $^{57}_{26}\text{Fe} - \beta^-, \text{no } \gamma$
- $^{57}_{27}\text{Co} - \beta^-, \text{no } \gamma$
- $^{58}_{26}\text{Fe}$ - stable
- $^{58}_{27}\text{Co} - \beta^+, 70.86d$
- $^{59}_{27}\text{Co}$ - stable
- $^{59}_{28}\text{Ni} - \beta^+, 7.5 \cdot 10^4 a$
- $^{60}_{27}\text{Co} - \beta^-, \gamma: 1332, 1173, 5.272a$
- $^{60}_{28}\text{Ni}$ - stable
- $^{61}_{28}\text{Ni}$ - stable
- $^{62}_{28}\text{Ni}$ - stable
- $^{63}_{28}\text{Ni} - \beta^-, \text{no } \gamma$
- $^{65}_{28}\text{Ni} - \beta^-, \gamma: 1482, 1115, 2.52h$

Isotope yields

Iron target

Z	57Cu 196.3 MS e-: 100.00%	58Cu 3.204 S e-: 100.00%	59Cu 81.5 S e-: 100.00%	60Cu 23.7 M e-: 100.00%	61Cu 3.333 H e-: 100.00%	62Cu 9.673 M e-: 100.00%	63Cu STABLE 69.15%	64Cu 12.701 H e-: 61.50% p-: 38.50%	65Cu STABLE 30.85%
	56Ni 6.075 D e-: 100.00%	57Ni 35.60 H e-: 100.00%	58Ni STABLE 68.077%	59Ni 7.6E+4 Y e-: 100.00%	60Ni STABLE 26.223%	61Ni STABLE 1.1399%	62Ni STABLE 3.6346%	63Ni 101.2 Y p-: 100.00%	64Ni STABLE 0.9255%
	55Co 17.53 H e-: 100.00%	56Co 77.236 D e-: 100.00%	57Co 271.74 D e-: 100.00%	58Co 70.86 D e-: 100.00%	59Co STABLE 100%	60Co 1925.28 D p-: 100.00%	61Co 1.650 H p-: 100.00%	62Co 1.50 M p-: 100.00%	63Co 27.4 S p-: 100.00%
	54Fe STABLE 5.845%	55Fe 2.744 Y e-: 100.00%	56Fe STABLE 91.754%	57Fe STABLE 2.119%	58Fe STABLE 0.262%	59Fe 44.495 D p-: 100.00%	60Fe 2.62E+6 Y p-: 100.00%	61Fe 5.98 M p-: 100.00%	62Fe 68 S p-: 100.00%
	53Mn 3.74E+6 Y e-: 100.00%	54Mn 312.12 D p-: < 2.9E-4%	55Mn STABLE 100%	56Mn 2.5769 H p-: 100.00%	57Mn 65.4 S p-: 100.00%	58Mn 3.0 S p-: 100.00%	59Mn 4.59 S p-: 100.00%	60Mn 0.28 S p-: 100.00%	61Mn p-: 100.00%
	28	29	30	31	32	33	34	35	

Stable
 EC+β+
 β-
 α
 P
 N
 SF
 Unknown

Figure: 'Nuclear neighbourhood' of Iron(58)

Isotope yields

Iron target

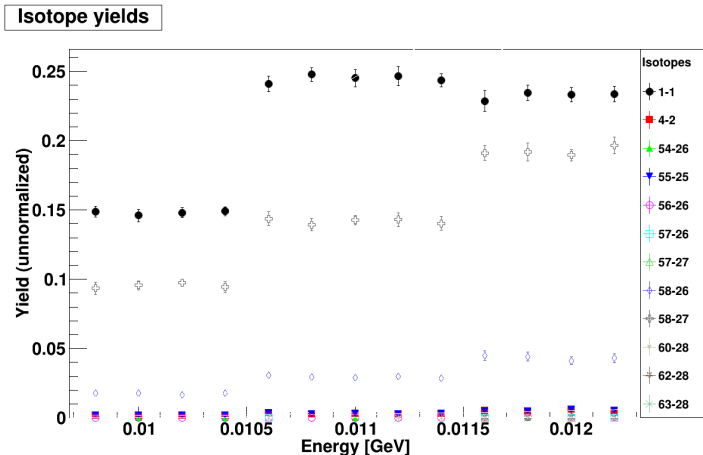
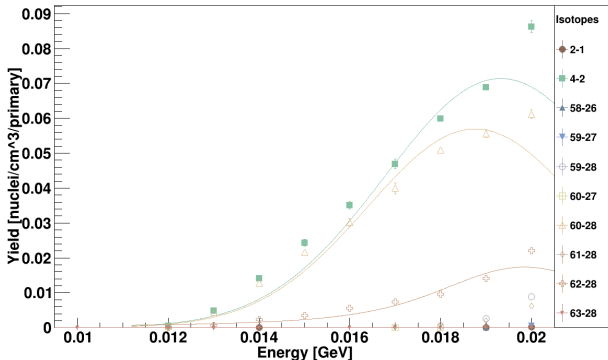


Figure: Multiple steps in yields for energies $\in [0.010 : 0.012]$ GeV

Isotope yields

Copper target

Isotope yields



- $^{58}_{26}\text{Fe}$ - stable
- $^{59}_{27}\text{Co}$ - stable
- $^{59}_{28}\text{Ni}$ - β^+ $7.5 \cdot 10^4 a$
- $^{60}_{27}\text{Co}$ - β^- , γ : 1332, 1173, 5.272a
- $^{60}_{28}\text{Ni}$ - stable
- $^{61}_{28}\text{Ni}$ - stable
- $^{62}_{28}\text{Ni}$ - stable
- $^{63}_{28}\text{Ni}$ - β^- , no γ

Energy deposition

Figure: Energy deposition for energies $\in [0.012 : 0.016] \text{ GeV}$

Energy deposition

Detailed look

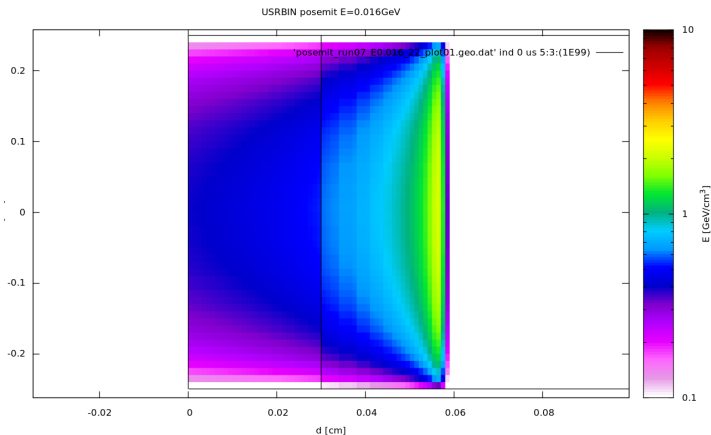


Figure: Energy distribution at its maximum

Energy deposition

in numbers

Parameters

- Average energy deposition density: $\rho = 1.0[\text{GeV}/\text{cm}^3]$
- Volumetric heat capacity of Iron: $C_{p,V} = 3.537[\frac{\text{J}}{\text{cm}^3\text{K}}]$
- Volumetric heat capacity of Copper: $C_{p,V} = 3.450[\frac{\text{J}}{\text{cm}^3\text{K}}]$

$d[\text{mm}]$	$V[\text{cm}^3]$	$E[\text{GeV}/\text{prmry}]$	$P[\text{J}/\text{s}]$
0.38	7.4613e-03	7.4613e-03	5.9690e+03
0.43	8.4430e-03	8.4430e-03	6.7544e+03
0.48	9.4248e-03	9.4248e-03	7.5398e+03
0.54	1.0603e-02	1.0603e-02	8.4823e+03
0.60	1.1781e-02	1.1781e-02	9.4248e+03

Figure: 2D projection of fluence for energies $\in [0.012 : 0.016]\text{GeV}$