

# MIDAS data analysis status: efficiency

Igor Zhitnikov

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# Method to obtain *relative* efficiency parameters

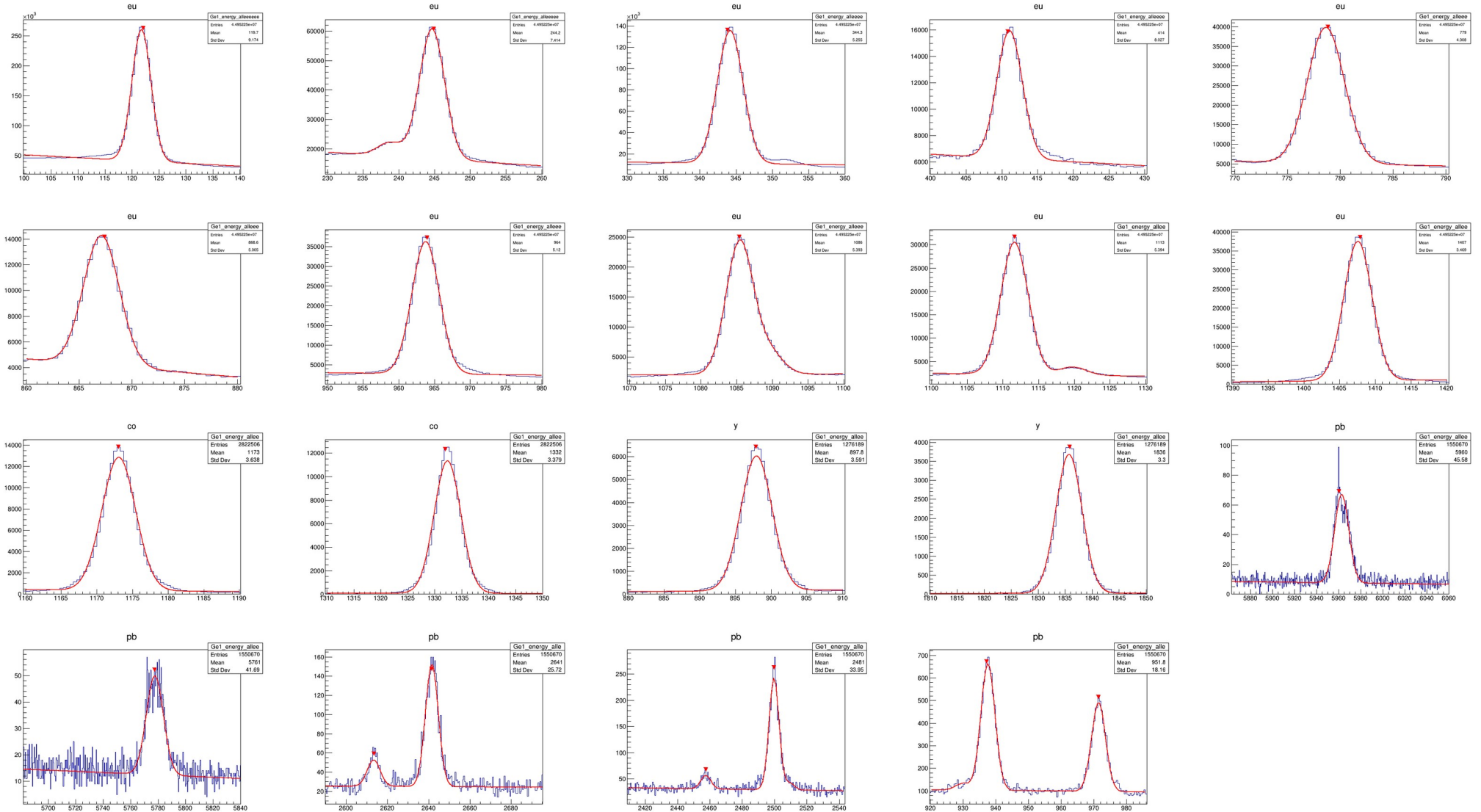
- Take measurements with radioactive source with at least 2 gamma-lines (Eu, Co, Y, Pb)
- Avoid sources activity information (we don't need this)
- Fit gamma-lines and compare intensities from tabulated data
- Fit simultaneously different sources data (by algorithm from [https://root.cern/doc/master/combinedFit\\_8C.html](https://root.cern/doc/master/combinedFit_8C.html) )
- For efficiency curve we take function:

$$Eff = e^{p_0 + p_1 \log(x) + p_2 \log^2(x) + p_3 \log^3(x) + p_4 \log^4(x) + p_5 \log^5(x)}$$

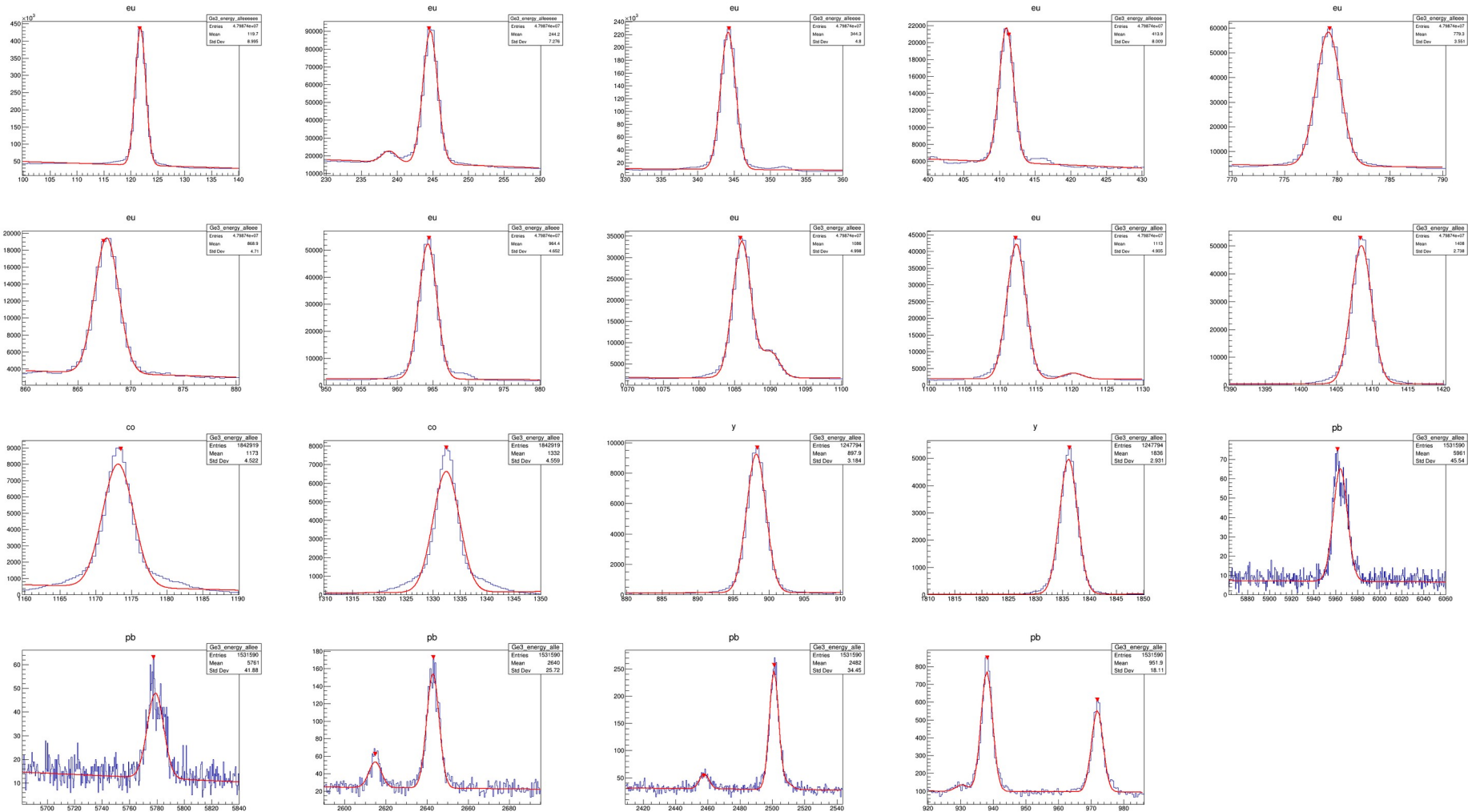
Find normalising coefficients to Eu points:  $K_{norm\ OTHER} = \exp(p_{0\ EU} - p_{0\ OTHER})$

- Plot all point with “Eu scale”
- Results from the most important steps are stored at \*.json files (make it possible to read by script or by text editor) with libjsoncpp library for c++ (allows c++ like comments!)

# Fit lines: Eu, Co, Y, Pb-nat (Ge1)



# Remark to fit : something weird with Co measurements (Ge3 example)



# Json files:

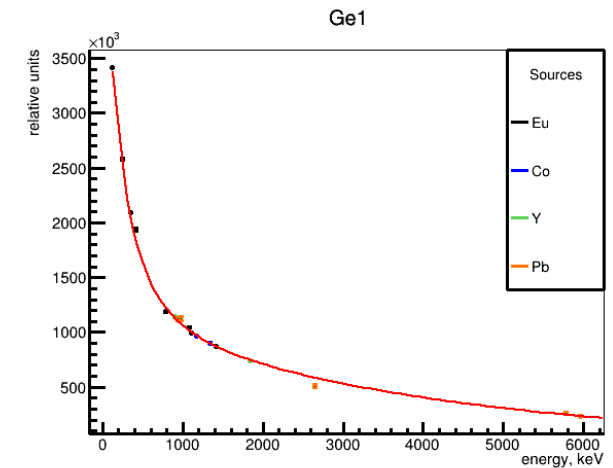
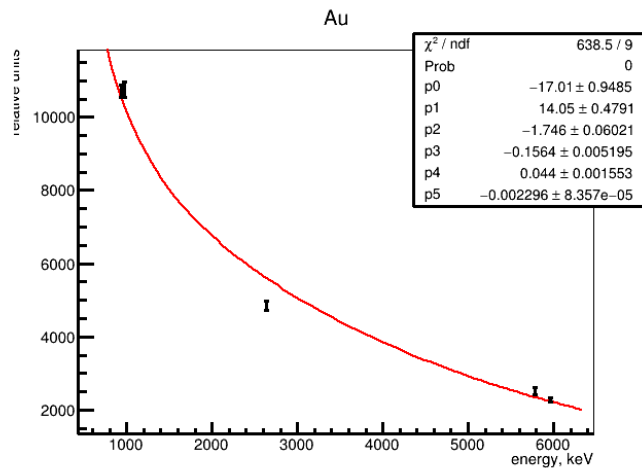
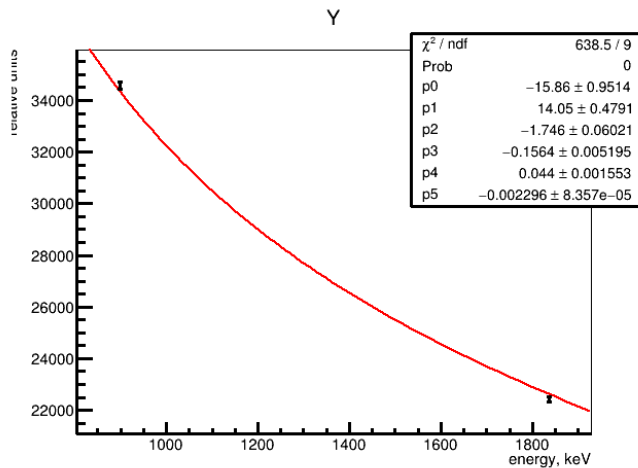
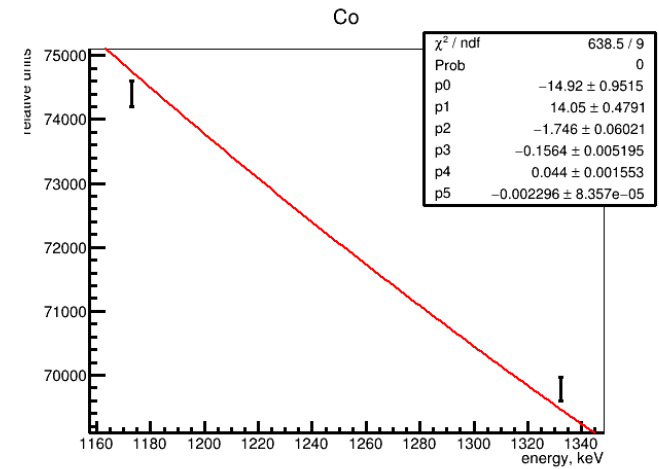
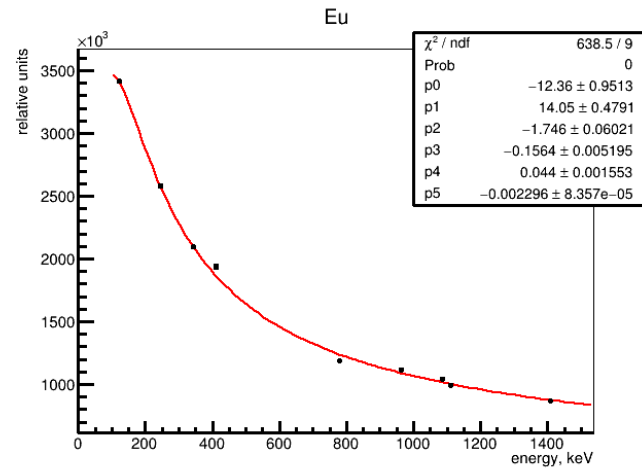
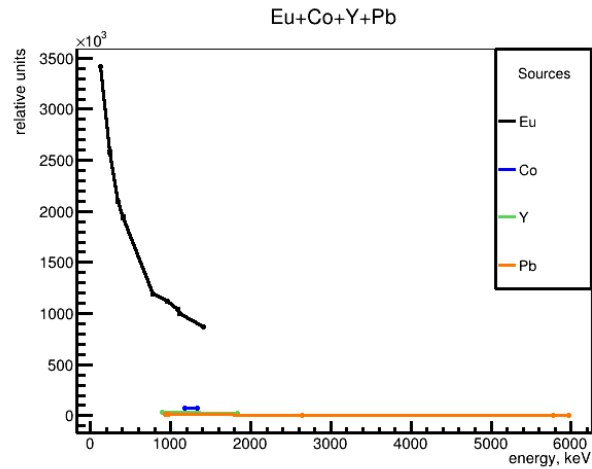
```
{
  "sources": [ "co", "eu", "y", "pb" ],
  "eu":
  [
    { "energy": 0.0, "energy_error": 0.0, "intensity": 0.0, "intensity_error": 0.0 },
    { "energy": 121.7817, "energy_error": 0.0003, "intensity": 28.53, "intensity_error": 0.16 },
    { "energy": 244.6974, "energy_error": 0.0008, "intensity": 7.55, "intensity_error": 0.04 },
    { "energy": 344.2785, "energy_error": 0.0012, "intensity": 26.59, "intensity_error": 0.20 },
    { "energy": 411.1165, "energy_error": 0.0012, "intensity": 2.237, "intensity_error": 0.13 },
    { "energy": 778.9045, "energy_error": 0.0024, "intensity": 12.93, "intensity_error": 0.08 },
    // { "energy": 867.380, "energy_error": 0.0030, "intensity": 4.23, "intensity_error": 0.03 },
    { "energy": 964.057, "energy_error": 0.005, "intensity": 14.51, "intensity_error": 0.07 },
    { "energy": 1085.837, "energy_error": 0.010, "intensity": 10.11, "intensity_error": 0.05 },
    { "energy": 1112.076, "energy_error": 0.003, "intensity": 13.67, "intensity_error": 0.08 },
    { "energy": 1408.013, "energy_error": 0.003, "intensity": 20.87, "intensity_error": 0.09 }
  ],
  "co":
  [
    { "energy": 1173.228, "energy_error": 0.003, "intensity": 99.85, "intensity_error": 0.03 },
    { "energy": 1332.492, "energy_error": 0.004, "intensity": 99.9826, "intensity_error": 0.0006 }
  ],
  "y":
  [
    { "energy": 898.042, "energy_error": 0.003, "intensity": 93.7, "intensity_error": 0.3 },
    { "energy": 1836.063, "energy_error": 0.012, "intensity": 99.2, "intensity_error": 0.3 }
  ],
  "pb":
  [
    { "energy": 5974.0, "energy_error": 0.4, "intensity": 42.1, "intensity_error": 0.1 },
    { "energy": 5788.3, "energy_error": 0.5, "intensity": 23.3, "intensity_error": 0.1 },
    { "energy": 2643.8, "energy_error": 0.4, "intensity": 20.6, "intensity_error": 0.1 },
    // { "energy": 2501.5, "energy_error": 0.4, "intensity": 38.8, "intensity_error": 0.1 },
    { "energy": 971.7, "energy_error": 0.2, "intensity": 19.7, "intensity_error": 0.1 },
    { "energy": 937.8, "energy_error": 0.2, "intensity": 28.2, "intensity_error": 0.1 },
    { "energy": 0, "energy_error": 0, "intensity": 0, "intensity_error": 0 }
  ]
}
```

```
1 {
2   "Ge1" :
3   {
4     "co" :
5     [
6       {
7         "energy": 1173.0980230546975,
8         "energy_error": 0.0064309929133455615,
9         "intensity": 74291.444043317955,
10        "intensity_error": 198.25856990290302,
11        "sigma": 2.3687405554307199,
12        "sigma_error": 0.006318120084710434
13      },
14      {
15        "energy": 1332.3719712821612,
16        "energy_error": 0.0065342253267597922,
17        "intensity": 69767.513836357786,
18        "intensity_error": 182.73588258066414,
19        "sigma": 2.4691360439533119,
20        "sigma_error": 0.0062858169150059179
21      }
22    ],
23    "eu" :
24    [
25      {
26        "energy": 0.0,
27        "energy_error": 0.0,
28        "intensity": 0.0,
29        "intensity_error": 0.0,
30        "sigma": 0.0,
31        "sigma_error": 0.0
32      },
33      {
34        "energy": 121.80169457113956,
35        "energy_error": 0.0016552474139939835,
36        "intensity": 974585.6039087266,
37        "intensity_error": 847.40398752073179,
38        "sigma": 1.7733145033912678,
39        "sigma_error": 0.001613851739065473
40      },
41      {
42        "energy": 244.6718327317561,
43        "energy_error": 0.004589590437052523,
44        "intensity": 194817.34158227313,
45        "intensity_error": 490.93078640825985,
46        "sigma": 1.7477060253965888,
47        "sigma_error": 0.0045893089486354552
48      },
49      {
50        "energy": 238.8188103168479,
51        "energy_error": 0.037423468236397639,
52        "intensity": 20479.387267453556,
53        "intensity_error": 309.27377491015806,
54        "sigma": 1.7477060253965888,
55        "sigma_error": 0.0045893089486354552
56      },
57      {
58        "energy": 344.20642826463057,
59        "energy_error": 0.0019591564913503004,
60        "intensity": 557034.26790126704,
61        "intensity_error": 585.89528615630581,
62        "sigma": 1.7815232403444008,
63        "sigma_error": 0.0018766387962033404
64      },
65      {
66        "energy": 411.0987949255184,
67        "energy_error": 0.010635614740936885
68      }
69    ]
70  }
71 }
```

-- tab2.json All (2,0) <N> (JavaScript Undo-Tree yas AC) 13:41 Br 2022-03-15 11/52

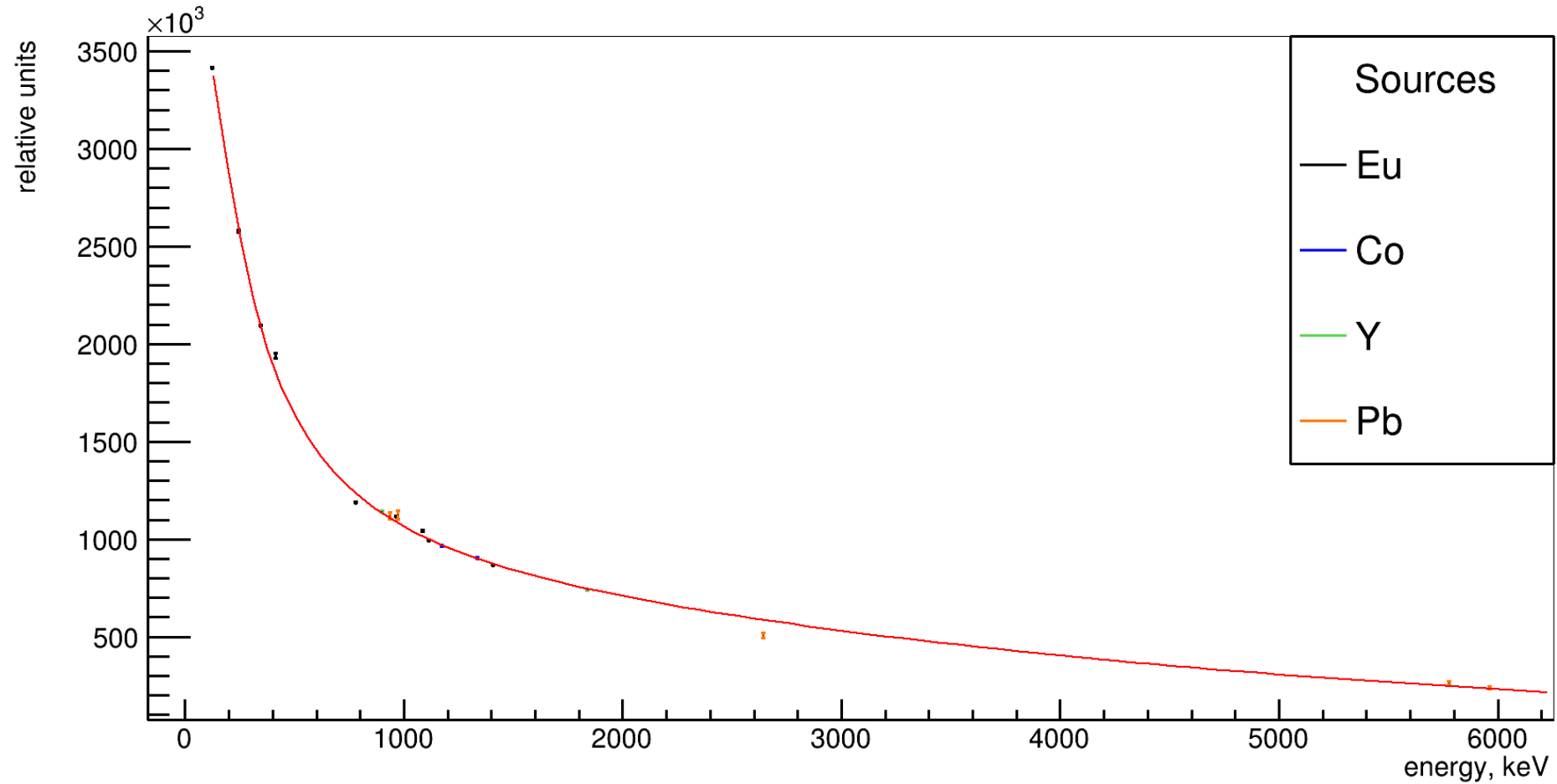
-- out.json Top (20,0) <N> (JavaScript Undo-Tree yas AC) 13:41 Br 2022-03-15 11/52

# Efficiency fit (Ge1 detector)



# Efficiency curve

Ge1



# Efficiency.json

```
"Ge1" :  
  [  
    {  
      "par_0" : -12.359887339030076,  
      "par_0_error" : 0.9512790937794311,  
      "par_1" : 14.04701526497281,  
      "par_1_error" : 0.479072964873065,  
      "par_2" : -1.7463638738428955,  
      "par_2_error" : 0.060205108708787321,  
      "par_3" : -0.1563725756700137,  
      "par_3_error" : 0.0051951900940586616,  
      "par_4" : 0.044003659754119573,  
      "par_4_error" : 0.0015532915593653978,  
      "par_5" : -0.0022961109600188514,  
      "par_5_error" : 8.3567683528394429e-05  
    }  
  ],  
  "Ge2" :  
  [  
    {  
      "par_0" : 15.339806886486702,  
      "par_0_error" : 0.51959994240261886,  
      "par_1" : 0.04955473387534557,  
      "par_1_error" : 0.0081134350870194355,  
      "par_2" : -0.018466160867868713,  
      "par_2_error" : 0.0085843032703344906,  
      "par_3" : -0.0047302520180899687,  
      "par_3_error" : 0.0018215922739001601,  
      "par_4" : -0.00046009346410851395,  
      "par_4_error" : 0.00011436601990272321,  
      "par_5" : 4.231879035445381e-05,  
      "par_5_error" : 3.6812685929186042e-05  
    }  
  ]  
}
```