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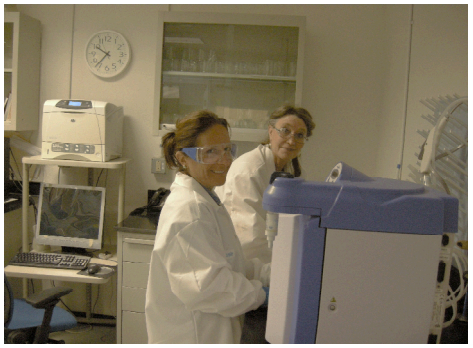

Radionuclide Sleuthing By Means Of Gamma Spectroscopy Analysis

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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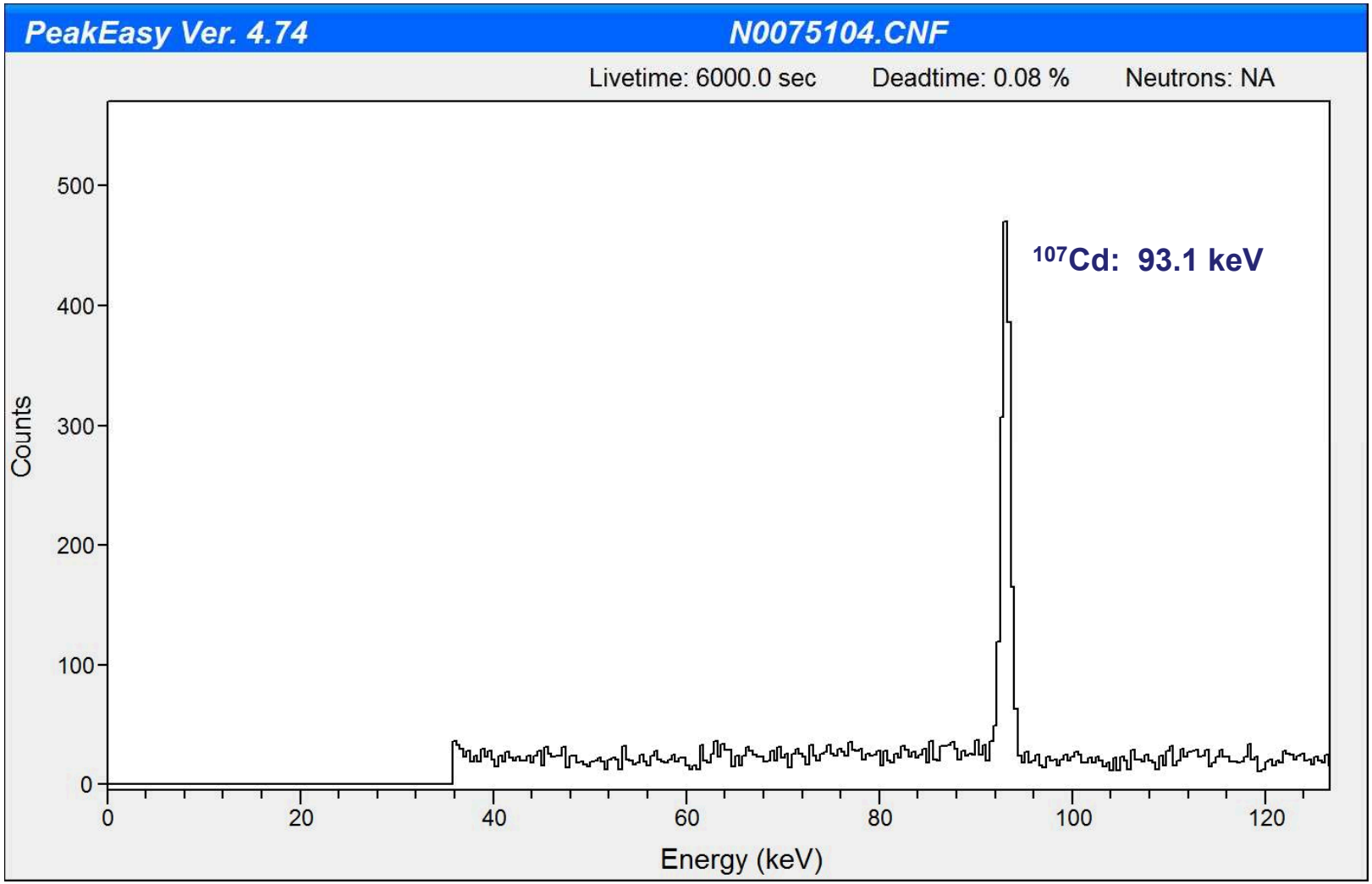
Summary

- Targets (approximately equivalent to one or two inch diameter air filter)
- In the beginning . . .
  - Perform short count (600 s)
  - Perform long count (6000 s)
  - Activity varied
  - Counted on p or n-type instrument
  - Reviewed by various individuals
- What changed?
  - Increased long count time (60,000 s)
  - Target with enough activity counted on n-type identified low energy x-rays that could be linked to ^{107}Cd
  - At the same time, identified secondary gamma associated with ^{107}Cd

Key Radionuclides

- ^{180}Ta ($t_{1/2}$ = 8.152 h)
  - 93.326 keV (4.5%)
  - 103.557 keV (0.81%)
  - 54.611 x-ray (20.4%)
  - 55.790 x-ray (35.5%)
- ^{65}Zn ($t_{1/2}$ = 244.26 d)
  - 1115.546 keV (50.60%)
- ^{107}Cd ($t_{1/2}$ = 6.50 h)
  - 93.124 keV (4.8%)
  - 828.93 keV (0.17%)
  - 21.990 keV Ag K_{a2} x-ray (31.5%)
  - 22.163 keV Ag K_{a1} x-ray (59%)
  - 24.912 keV Ag K_{b3} x-ray (5.08%)
  - 24.943 keV Ag K_{b1} x-ray (9.8%)

Spectrum of a coupon counted on a p-type detector for 6000 seconds.



Peak Search Report For The 6000 s Count On The P-type Detector

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Peak Search Report / Sample ID: N0075104 Page 2

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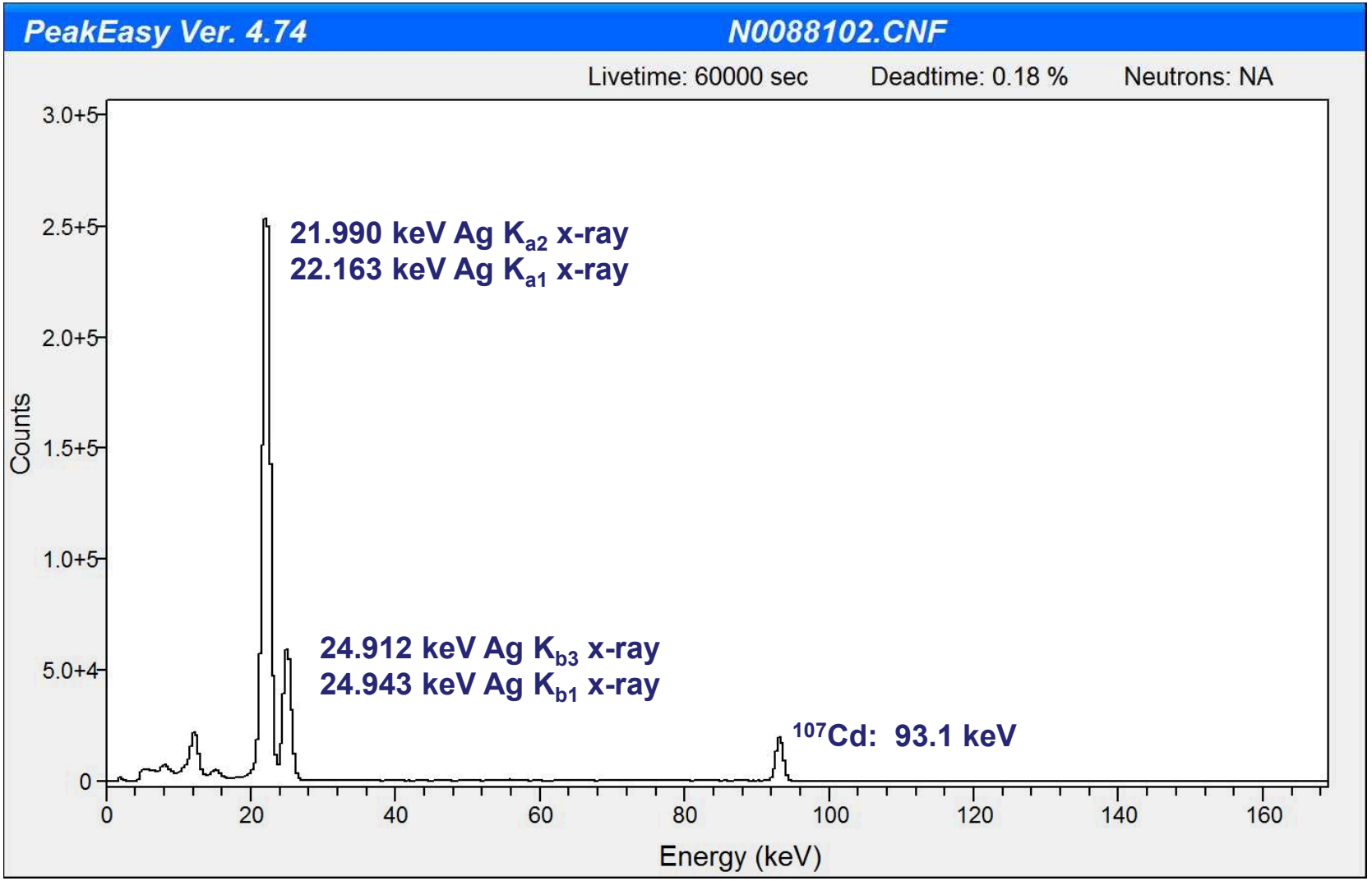
* Peak Search Report *
****

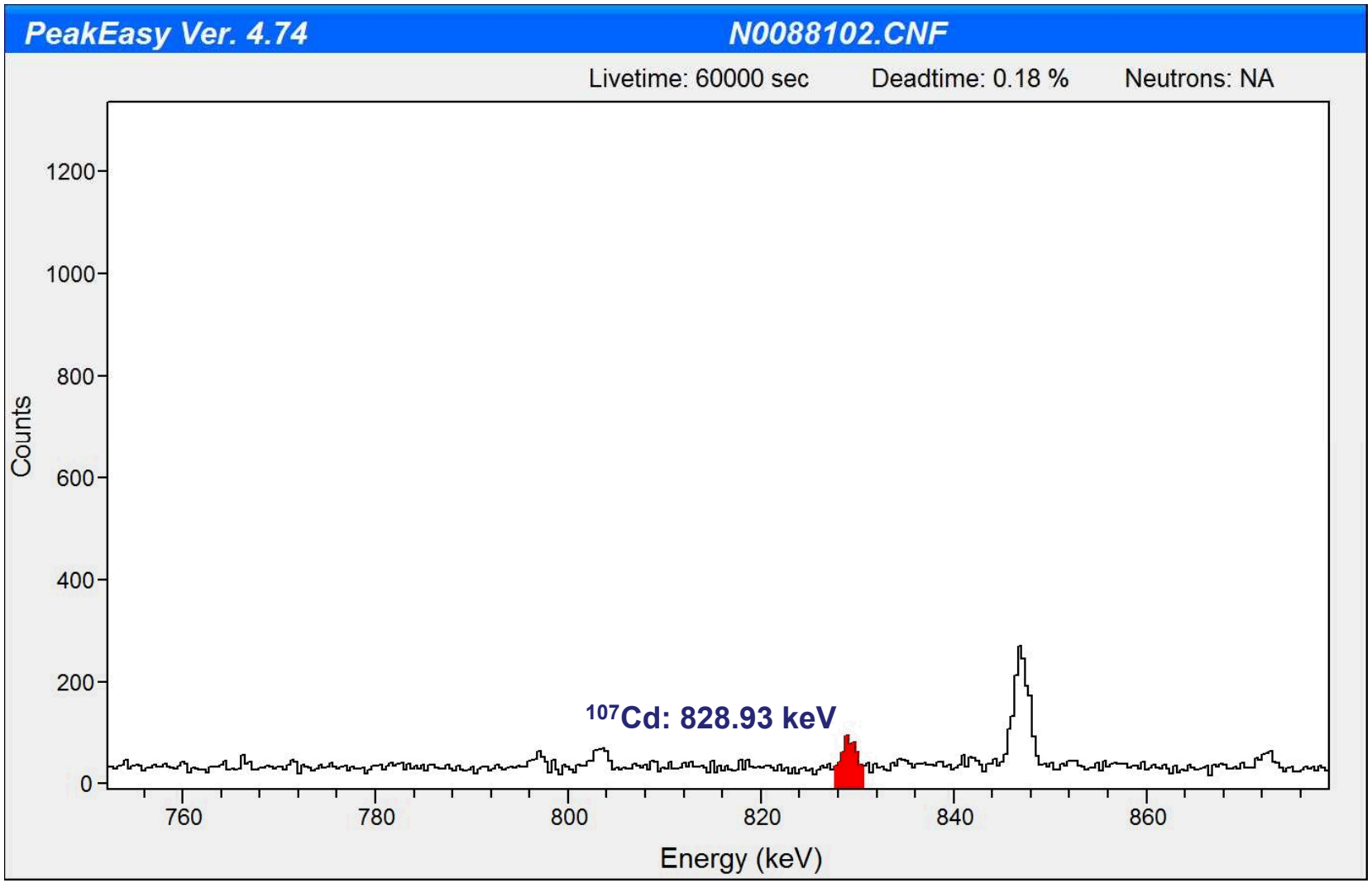
M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Peak No.	Energy (KeV)	Peak centroid	FWHM (KeV)	Continuum Counts	Net Peak Area	Net Area Error
1	93.12	255.1	1.1	304	1386	96
2	238.62	652.6	0.9	204	71	54
3	271.25	741.8	1.3	191	203	53
4	351.95	962.2	1.0	113	71	38
5	372.93	1019.5	1.2	69	30	27
6	511.12	1397.0	2.9	162	829	74
7	583.28	1594.2	0.4	49	18	23
8	609.39	1665.5	1.3	104	39	35
9	846.76	2314.0	1.8	36	93	26
10	1157.09	3161.8	0.7	17	31	17
11	1460.94	3991.8	1.2	6	35	14
12	2614.49	7143.2	1.3	6	22	12

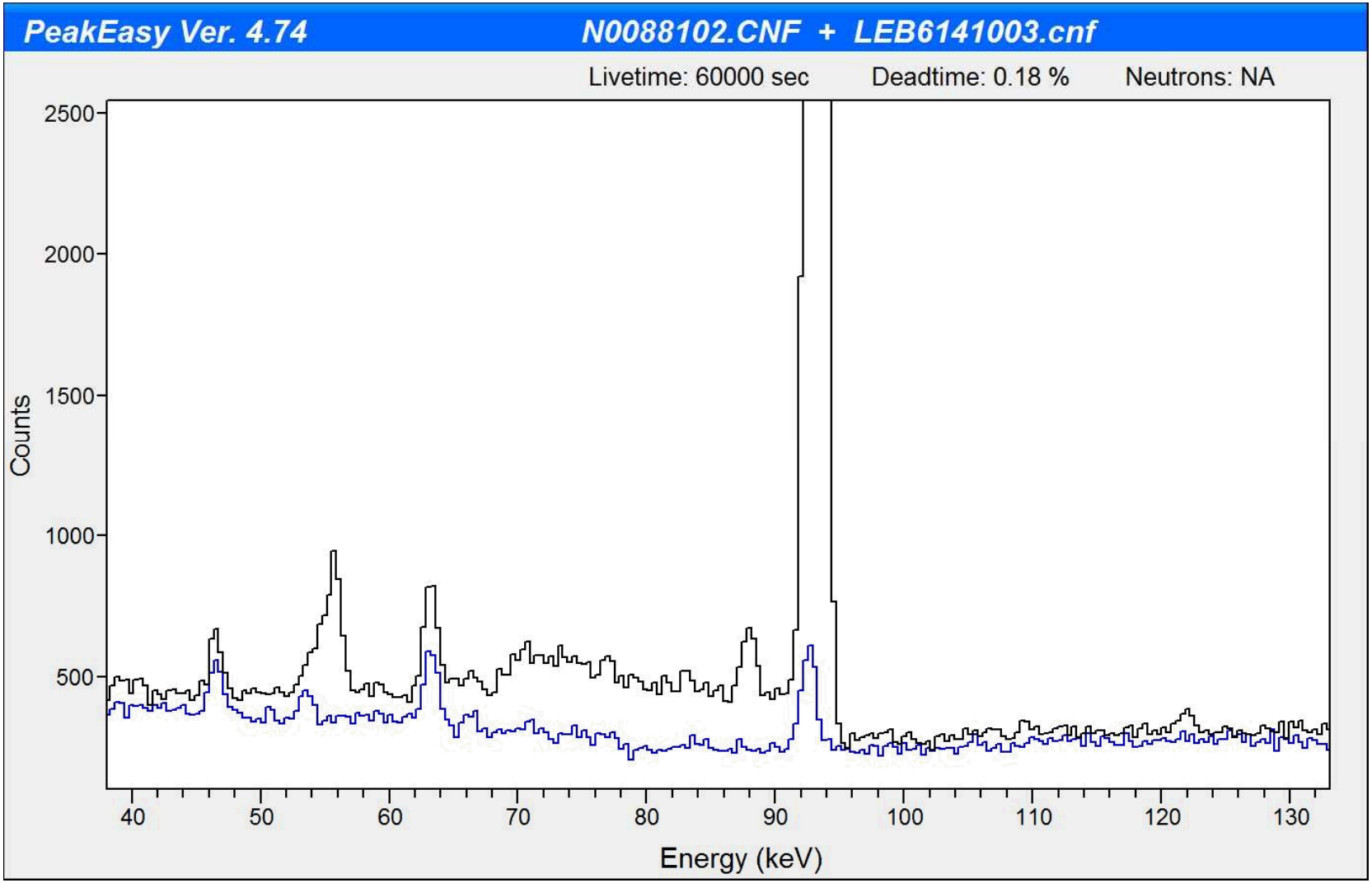
Spectrum of a coupon counted on a n-type detector for 60,000 seconds.



Spectrum of a coupon counted on a n-type detector for 60,000 seconds.



Spectrum of a coupon counted on a n-type detector for 60,000 seconds.



Peak Search Report For The 60,000 s Count On The N-type Detector

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Peak Search Report / Sample ID: N0088102 Page 2

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* Peak Search Report *
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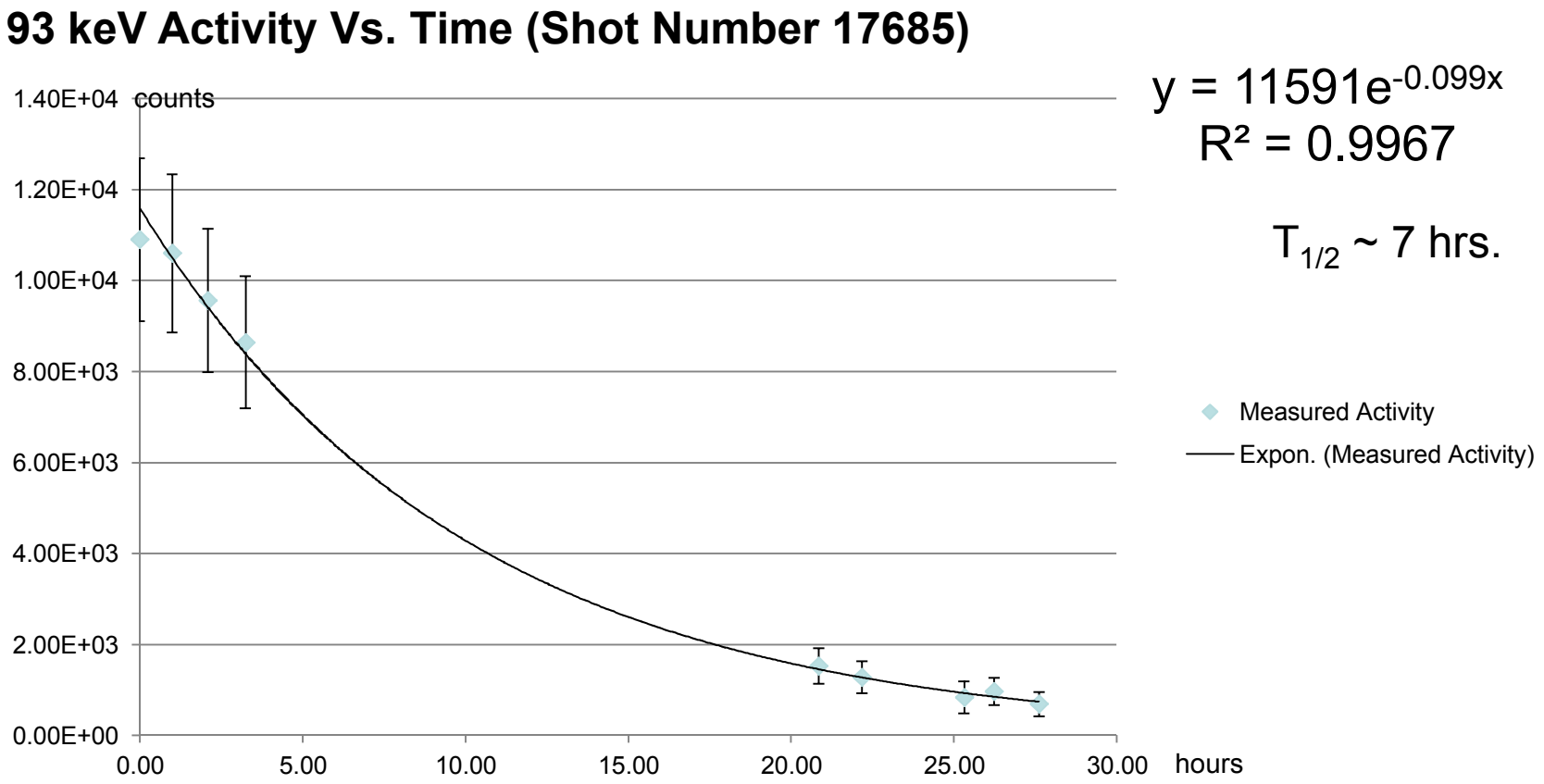
M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

	Peak No.	Energy (KeV)	Peak centroid	FWHM (KeV)	Continuum Counts	Net Peak Area	Net Area Error
M	1	12.19	36.2	1.3	40691	73072	648
m	2	15.11	44.2	1.3	26118	12401	339
M	3	22.16	63.4	1.2	18988	922561	1941
m	4	25.06	71.4	1.2	9628	218827	956
	5	46.53	130.0	1.0	4920	589	242
	6	55.77	155.2	1.6	5871	2409	290
	7	63.21	175.5	1.2	6063	1171	286
M	8	87.96	243.0	1.2	4542	760	121
m	9	93.17	257.2	1.2	3897	69514	541
	10	121.95	335.8	1.2	3732	214	214
	11	139.93	384.8	1.4	3993	285	208
	12	185.34	508.8	2.3	4192	1211	235
	13	198.46	544.6	1.5	3212	282	183
	14	271.17	743.0	1.3	2473	366	170
	15	300.34	822.6	1.2	1393	165	112
	16	325.28	890.7	1.0	1532	138	123
	17	352.01	963.6	1.6	1722	379	146
	18	511.18	1398.0	2.9	1467	8123	227
M	19	569.71	1557.7	1.4	611	81	45
m	20	574.46	1570.7	1.4	721	216	55
	21	583.41	1595.1	0.9	552	102	70
	22	609.35	1665.9	1.4	985	361	108
	23	670.11	1831.7	0.5	501	78	67
	24	744.45	2034.6	1.0	385	53	59
M	25	796.86	2177.6	1.5	401	113	38
m	26	803.33	2195.3	1.5	420	174	44
	27	829.20	2265.9	1.4	571	271	88
	28	847.03	2314.5	1.8	1035	1212	145
	29	872.47	2383.9	1.4	332	148	58
	30	911.40	2490.2	0.4	392	63	66
	31	962.18	2628.8	0.5	328	108	60
	32	983.81	2687.8	1.6	406	282	75
	33	1039.30	2839.2	1.7	477	204	82
M	34	1107.27	3024.7	1.8	300	302	46
m	35	1115.91	3048.3	1.8	360	211	43
	36	1156.99	3160.4	0.7	244	48	51
	37	1238.66	3383.3	1.8	295	262	66
	38	1312.53	3584.9	2.5	255	220	63
	39	1369.03	3739.0	2.2	244	858	80
	40	1434.71	3918.3	1.6	209	41	48
	41	1461.27	3990.8	1.8	200	233	54
	42	1592.97	4350.2	1.3	87	24	27

Evaluation of the Decay Rate Associated With The 93.1 keV Gamma



Mystery solved.