SUNDHEDSSTYRELSEN

”Transmission” Validation of assumed material composition (and the fine art of seasoning)

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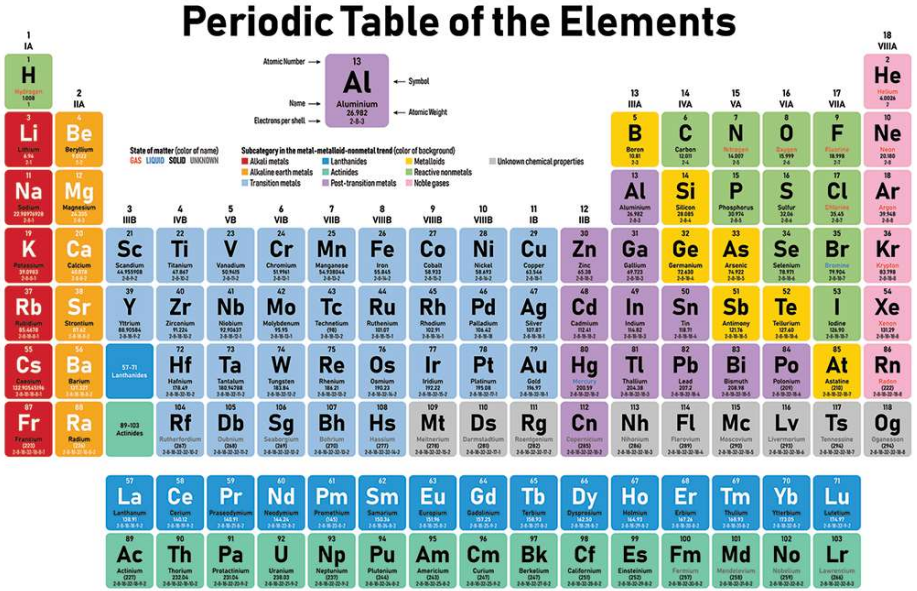
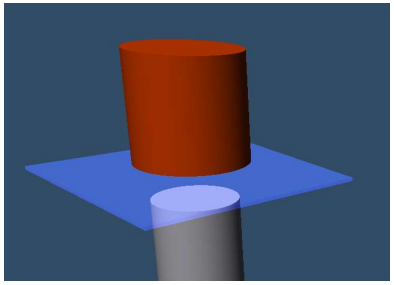
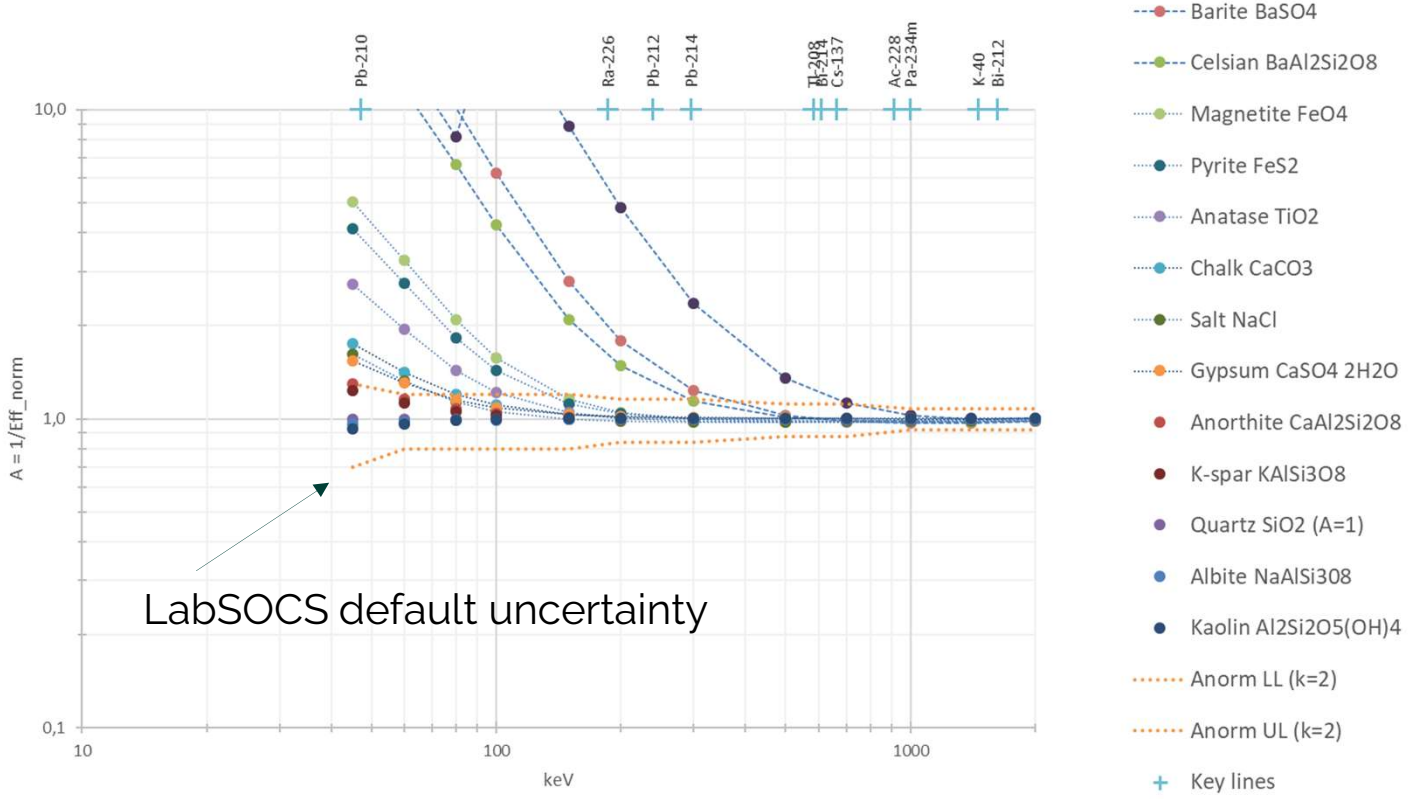
Unknown sample composition

?



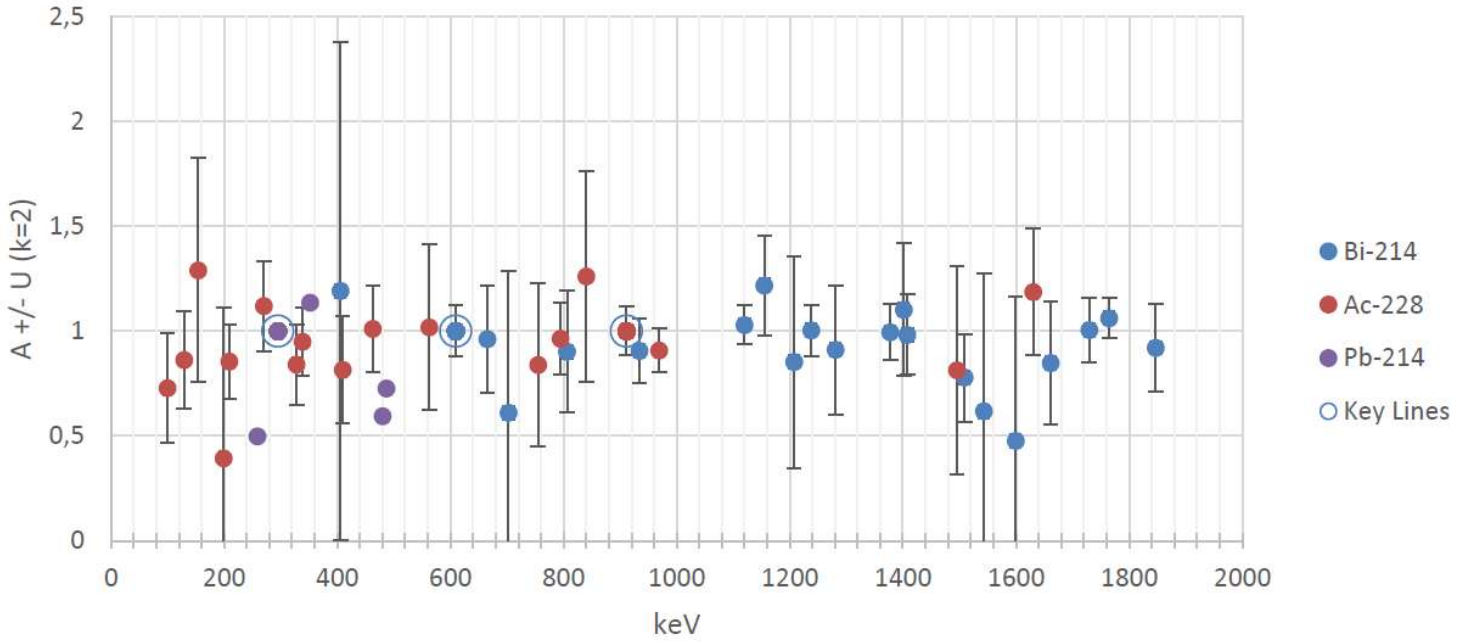
Heavy elements (e.g. Ba) are critical for lower energies – at same density





LACE: Line Activity Consistency Evaluation

Should be horizontal, QC: No significant correlation (p > 0,05)

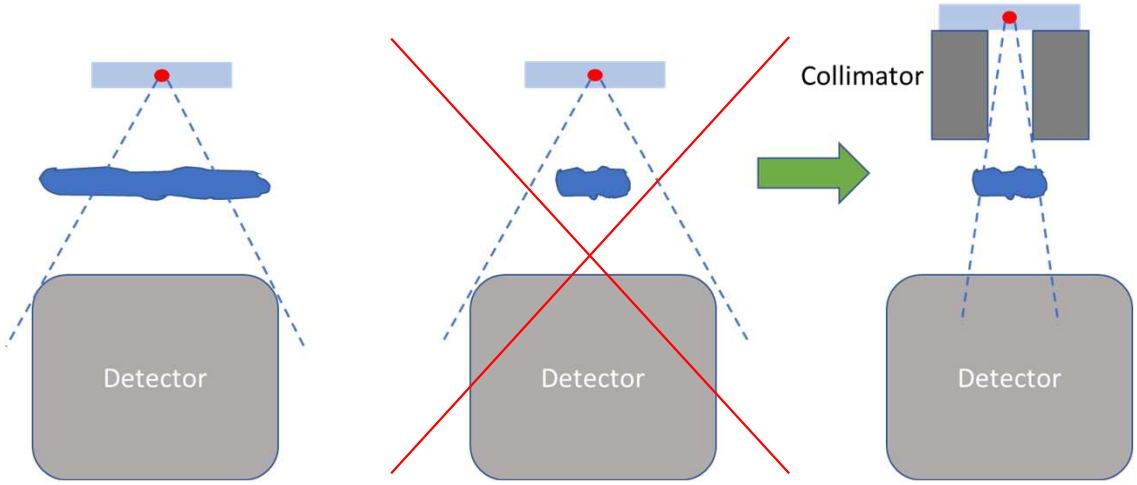


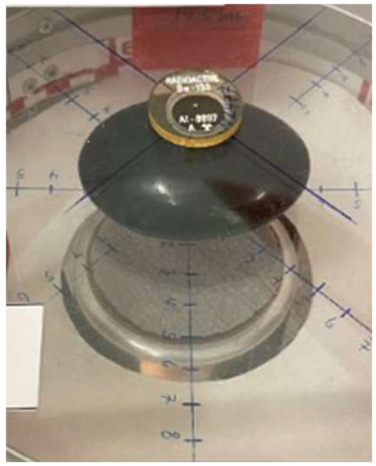
r: Pearson corr. coeff. t_corr = r * √(n-2) / √(1-r^2) p = T.DIST.2T(t_corr;(n-2))

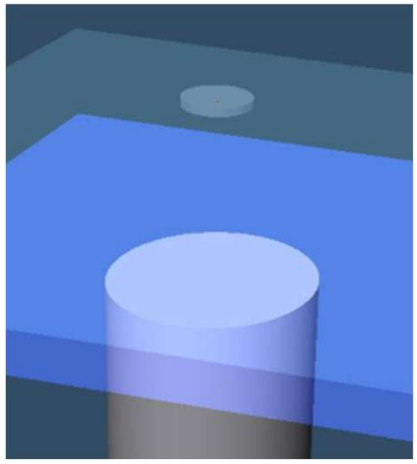
”Transmission”: Source on sample

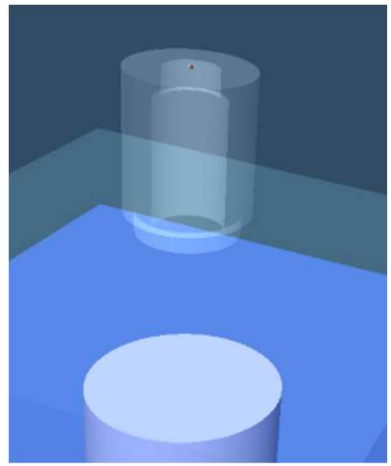
Source

Sample



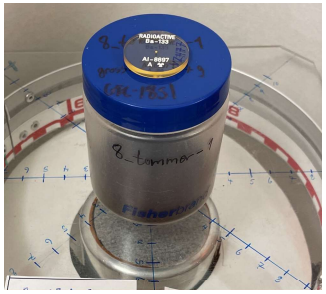


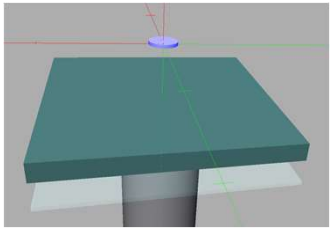




”Transmission”: Ba-133 LACE and validation

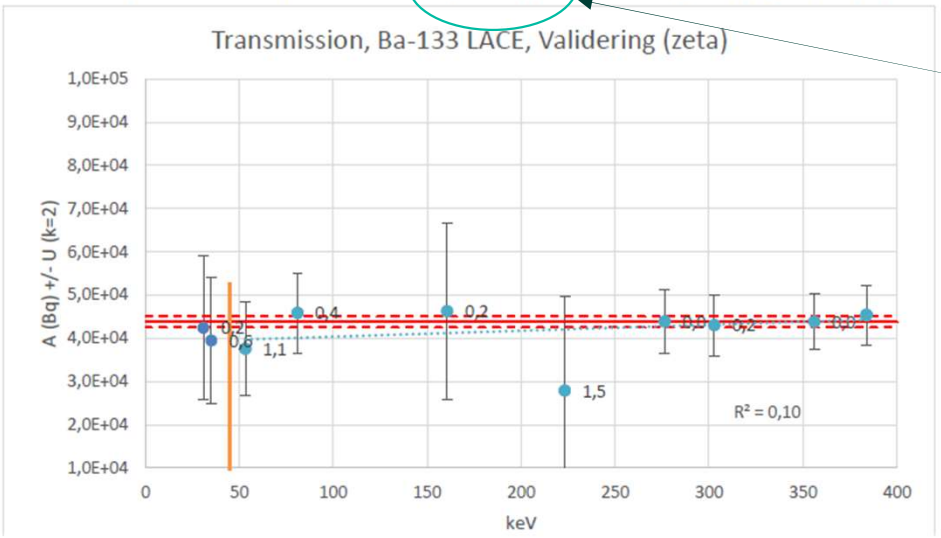
For energies above lowest reported (45 keV)





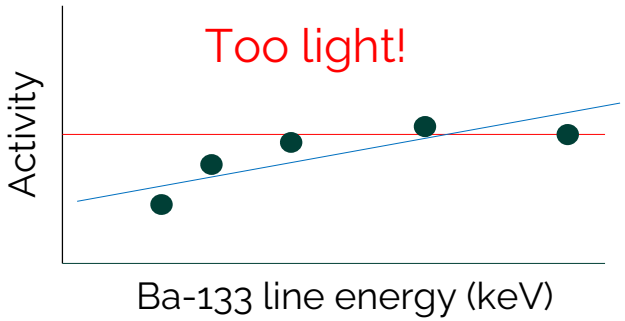
Påviste (keV)	A (Bq)	u(A)	CSC	Diff (%)	zeta	zeta < 2 ?
30,8	4,24E+04	8,4E+03	1,00	-3%	**0,2**	-
35,1	3,95E+04	7,3E+03	1,00	-10%	**0,6**	-
-	-	-	-	-	-	-
53,2	3,76E+04	5,4E+03	0,98	-14%	**1,1**	SAND
80,9	4,59E+04	4,6E+03	0,98	5%	**0,4**	SAND
160,6	4,63E+04	1,0E+04	miss	6%	**0,2**	SAND
223,2	2,79E+04	1,1E+04	miss	-36%	**1,5**	SAND
276,4	4,39E+04	3,7E+03	0,98	0%	**0,0**	SAND
302,9	4,30E+04	3,5E+03	0,98	-2%	**0,2**	SAND
356,0	4,38E+04	3,3E+03	0,99	0%	**0,0**	SAND
383,9	4,54E+04	3,5E+03	1,00	4%	**0,5**	SAND
-	-	-	-	-	-	-

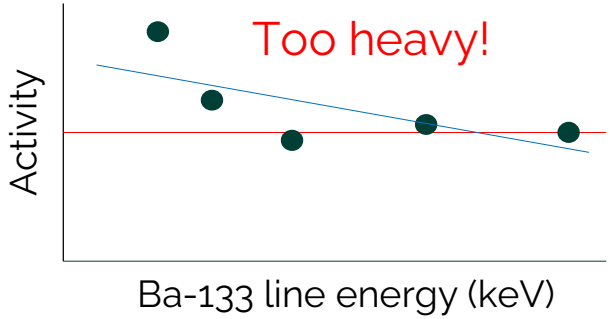
Pearson r^2: 0,10 p: **0,37** OK hvis p > 0,05 (DokID 3867)



QC
zeta < 2
p(Pearson) > 0,05

QC iteration - Composition fine-tuning





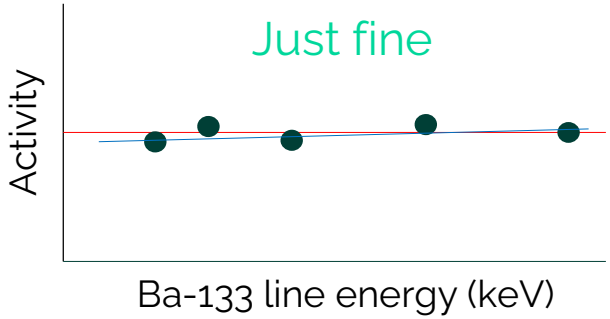
Add heavy element(s)

Remove heavy element(s)

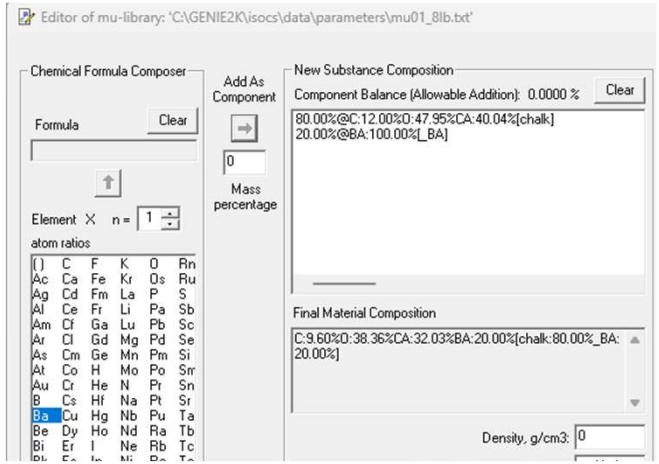
>> CONSTANT DENSITY <<

...

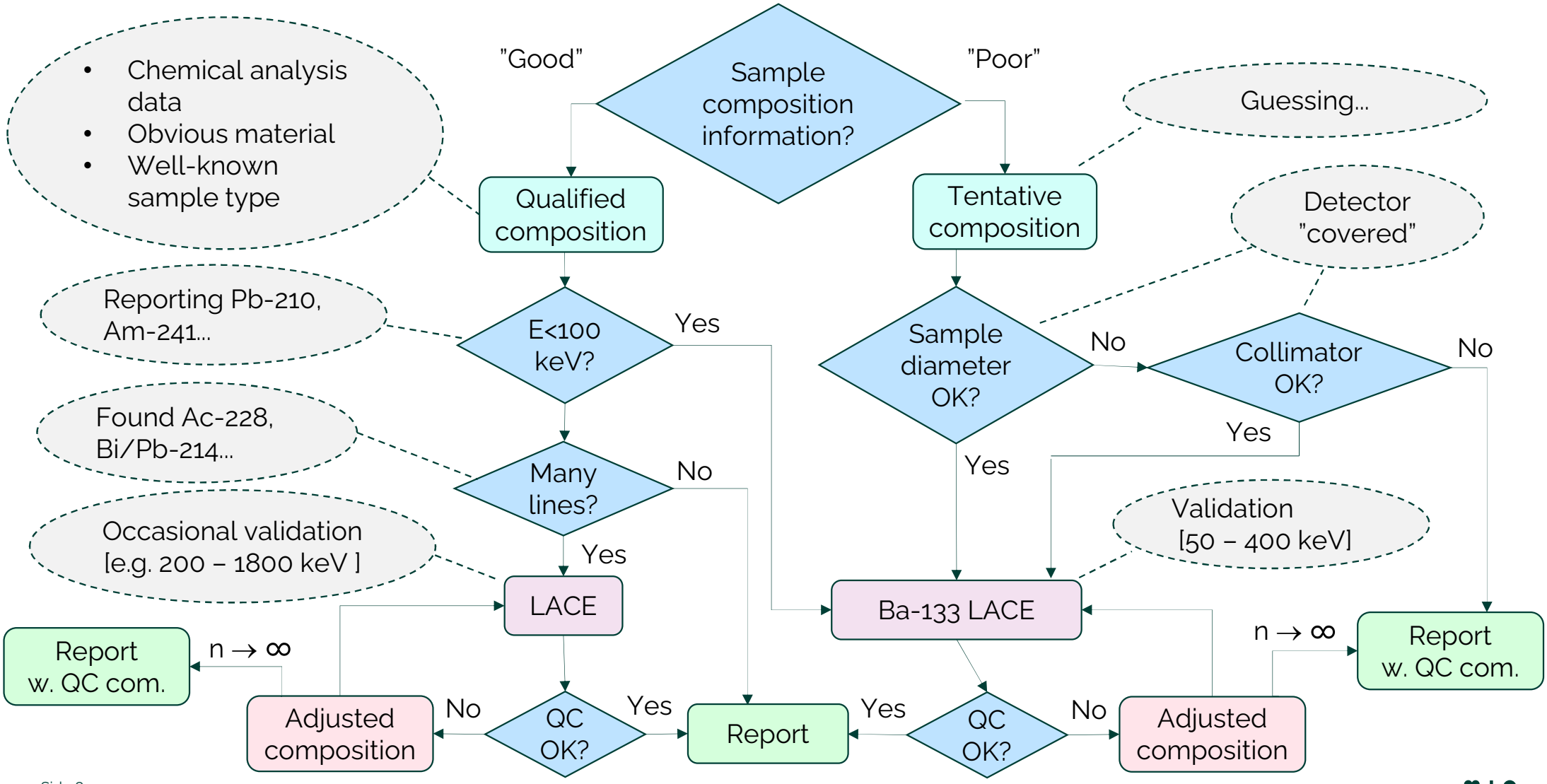
Typically n< 5



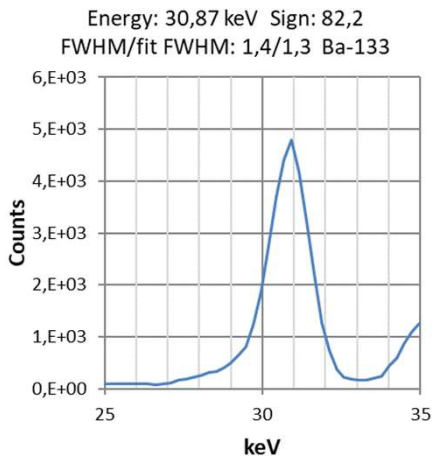
QC:
p(Pearson) > 0,05
zeta < 2

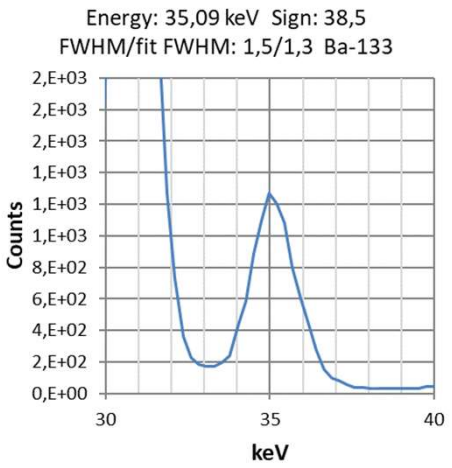


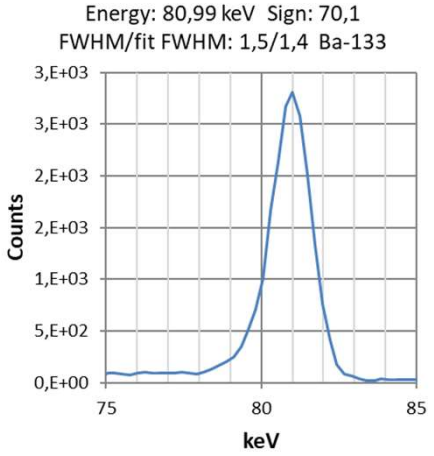
Workflow


Sample composition information?
"Good"
"Poor"
Chemical analysis data
Obvious material
Well-known sample type
Qualified composition
Tentative composition
Guessing...
Detector "covered"
Reporting Pb-210, Am-241...
E<100 keV?
Yes
Sample diameter OK?
No
Collimator OK?
No
Yes
Found Ac-228, Bi/Pb-214...
Many lines?
No
Yes
Yes
Validation [50 – 400 keV]
Occasional validation [e.g. 200 – 1800 keV]
LACE
Ba-133 LACE
Report w. QC com.
n → ∞
n → ∞
Report w. QC com.
Adjusted composition
No
QC OK?
Yes
Report
Yes
QC OK?
No
Adjusted composition

Merging of unresolved Ba-133 lines







30.62 keV (33.8%)
30.97 keV (62.4%)

↓

30.8 keV (96.2%)

35.05 keV (18.24%)
35.90 keV (4.45%)

↓

35.2 keV (22.7%)

79.61 keV (2.63%)
81.00 keV (33.31%)

↓

80.9 keV (35.9%)

Peaks are somewhat broader than expected (FWHM vs fit)