



Strål
säkerhets
myndigheten

Swedish Radiation Safety Authority

Results of the PIANOLIB proficiency test

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PIANOLIB workshop



PIANOLIB intercomparison

- Proficiency test: Check measurement performance by comparing reports against true fully traceable values
- Participants: 21 registered and received the phantom
17 reported
- The Irina phantom was circulated to mount the size P5 of the phantom, that is, a 77,8 kg and 170,5 cm
- One participant mounted the size P4 because of a particular geometry of his counter, which not permitted to have the phantom in its P5 size
- Two sets of radioactive rods were sent together with the phantom to simulate homogeneously distributed activity. Set of Cs137 rods and the set of K40 rods



Phantom Irina

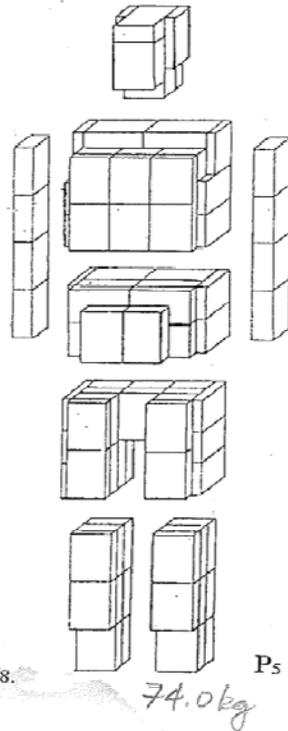
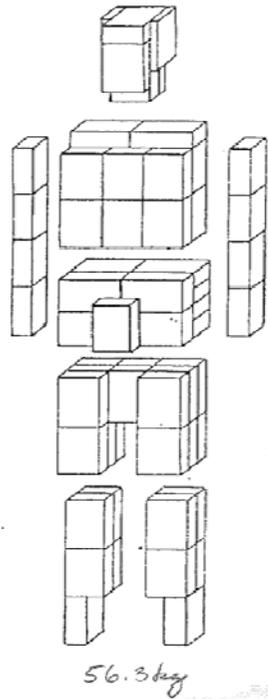
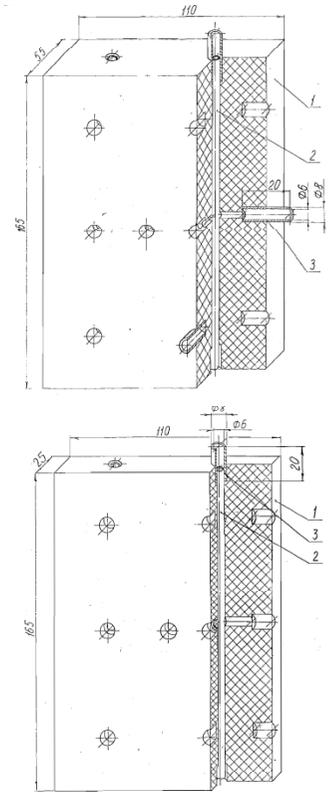
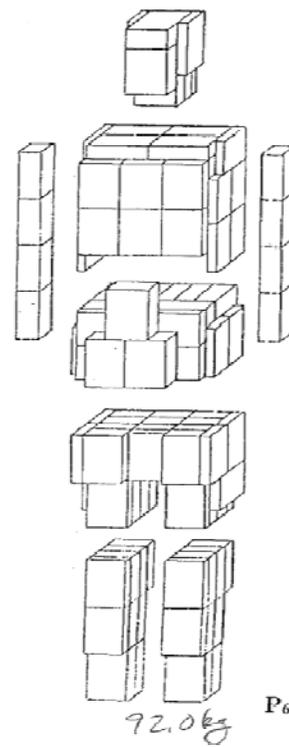


Fig. 8.



72 + 36 blocks



Instructions

- Simple stability test by reporting repeatability (gross and net counts) with at least 5 measurements of the blank phantom
- Participants were asked to mount the radioactive rods and report the measured activity together with its combined standard uncertainty, by using their routine method.
- Report the MDA at 95% level of confidence
- Participants were given 5 days to conduct the experiment and a week was allocated for transportation to the next laboratory.



Performance criteria

- **Trueness score.** Acceptable status for trueness was given if $A1 \leq A2$, where

$$A1 = |Value_{target} - Value_{reported}|, \quad A2 = 2,58 \cdot \sqrt{u_{target}^2 + u_{reported}^2}$$

- **Precision score.** Estimator for the precision of the measurement should be under a predefined Limit of Acceptable Precision ($P \leq LAP$; $LAP = 15\%$)

$$P = \sqrt{\left(\frac{u_{target}}{Value_{target}}\right)^2 + \left(\frac{u_{reported}}{Value_{reported}}\right)^2} \cdot 100 \%$$

- A report can be given the marks:
"ACCEPTABLE" (A) if they fulfill both the scores for precision and trueness
"NOT ACCEPTABLE" (NA) they do not fulfill the scores for precision and trueness



Performance criteria

- In the case that only one of the scores is met, a further bias check is applied, that is, Rel. bias should be under a predefined Maximum Acceptable Bias (Rel. bias \leq MAB; MAB = 15 %)
- A report is given "ACCEPTABLE WITH WARNING" (AW) if it fulfill only one of the scores and pass the check on the Rel. bias

$$Rel. bias = \frac{Value_{reported} - Value_{target}}{Value_{target}} \cdot 100 \%$$

AW reflect either a report with small measurement uncertainty but still within MAB or a report with the result close to the target but with large associated uncertainty



Additional parameters of performance

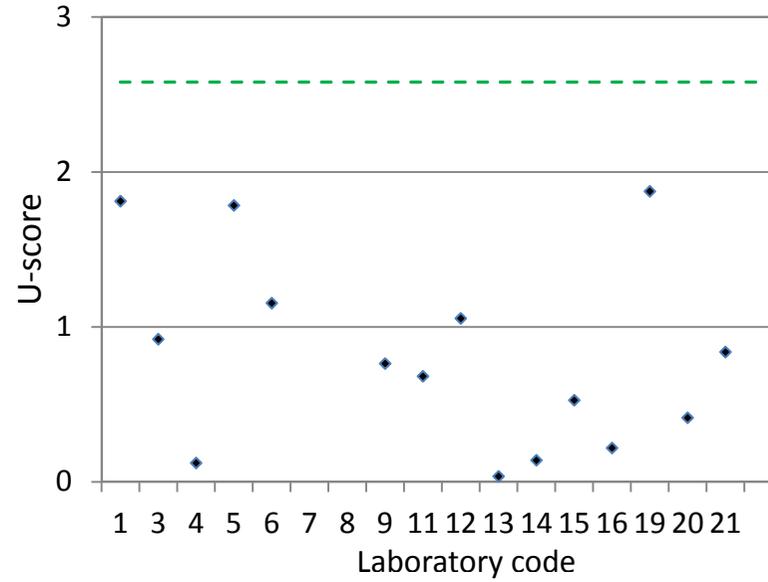
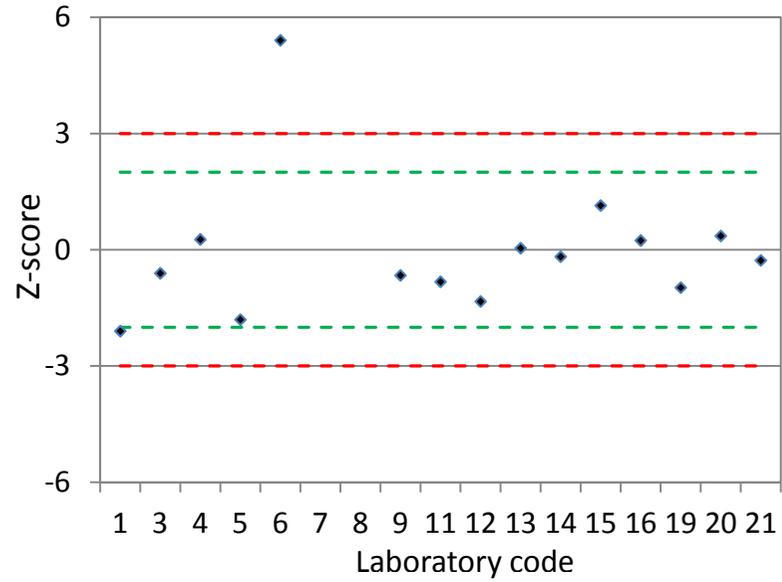
➤ Observed to Poisson precision based in repeatability measurement

➤ Z and U scores.

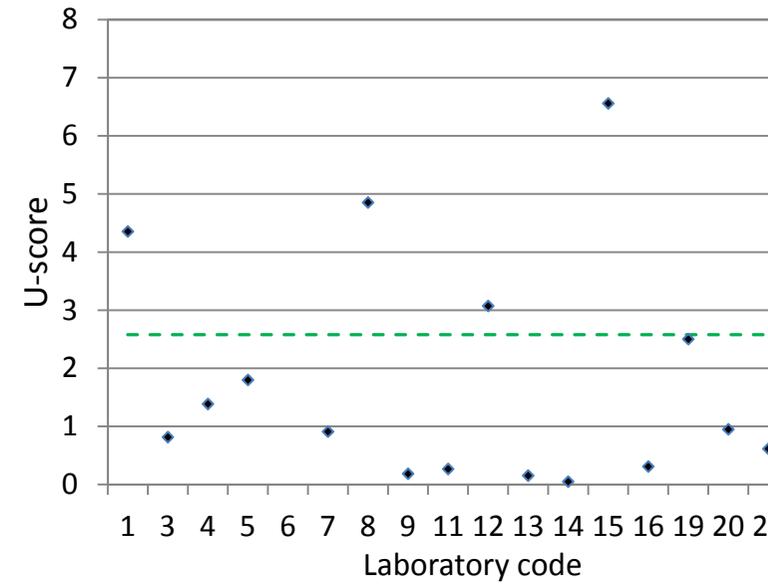
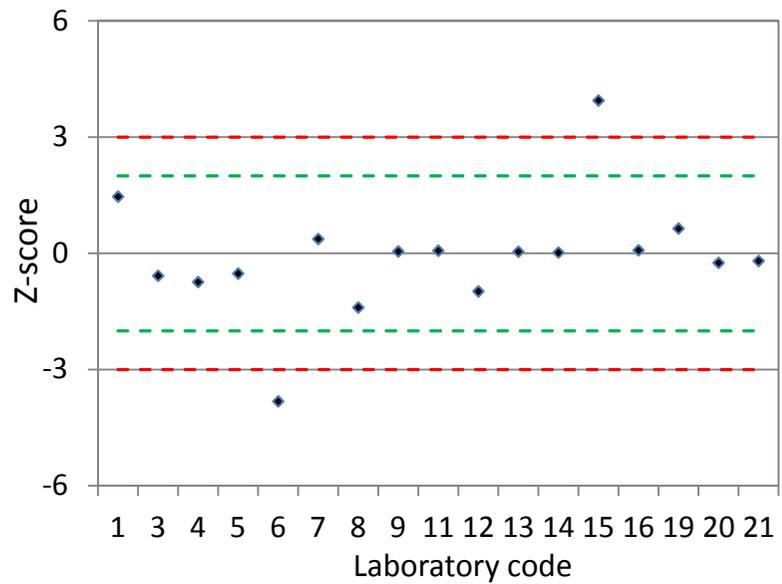
z-score (bias evaluation) represents the distance between the reported and the target value in units of the standard deviation. $|z| < 2$ is considered acceptable, $|2| < z < |3|$, questionable; and $|z| > 3$, unsatisfactory

U-score (significance test) whether the reported value is significantly different from the target at a given level of probability. The u-score is compared with critical values of the t-statistics tables. The choice of significance level was 99 %, which gives 2.58

That is, for reported values getting u-score above 2.58 you can say with 99% confidence that the reported values are significantly different from the target



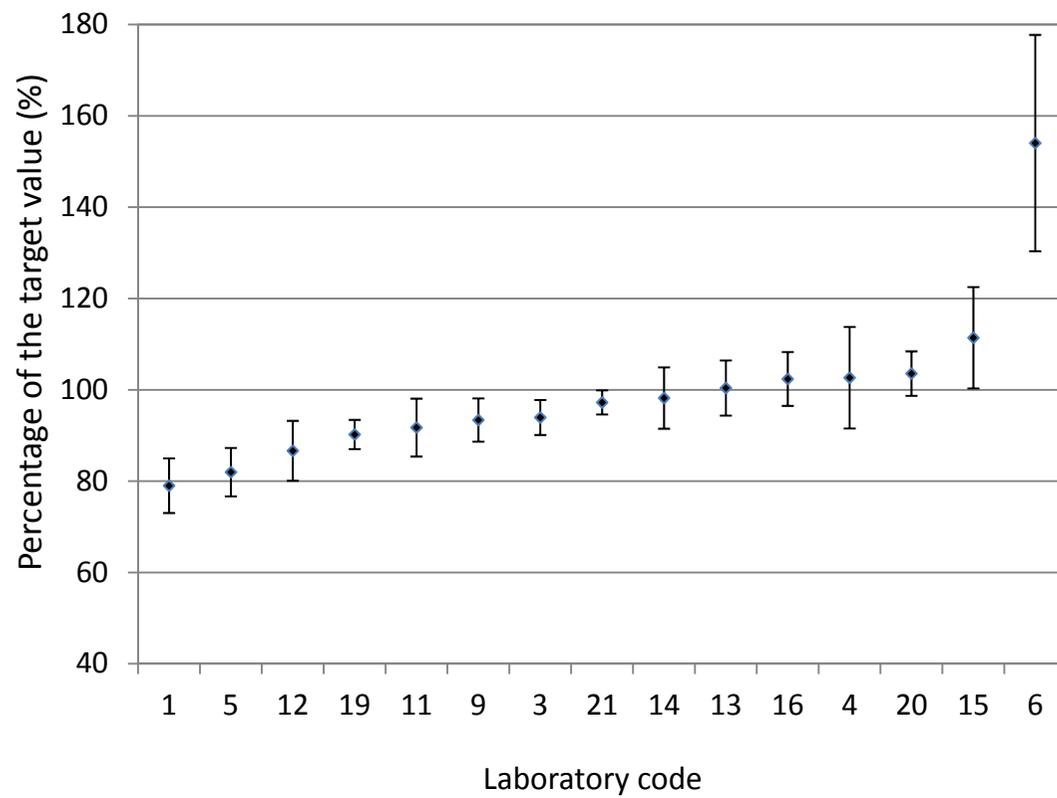
K-40



Cs-137

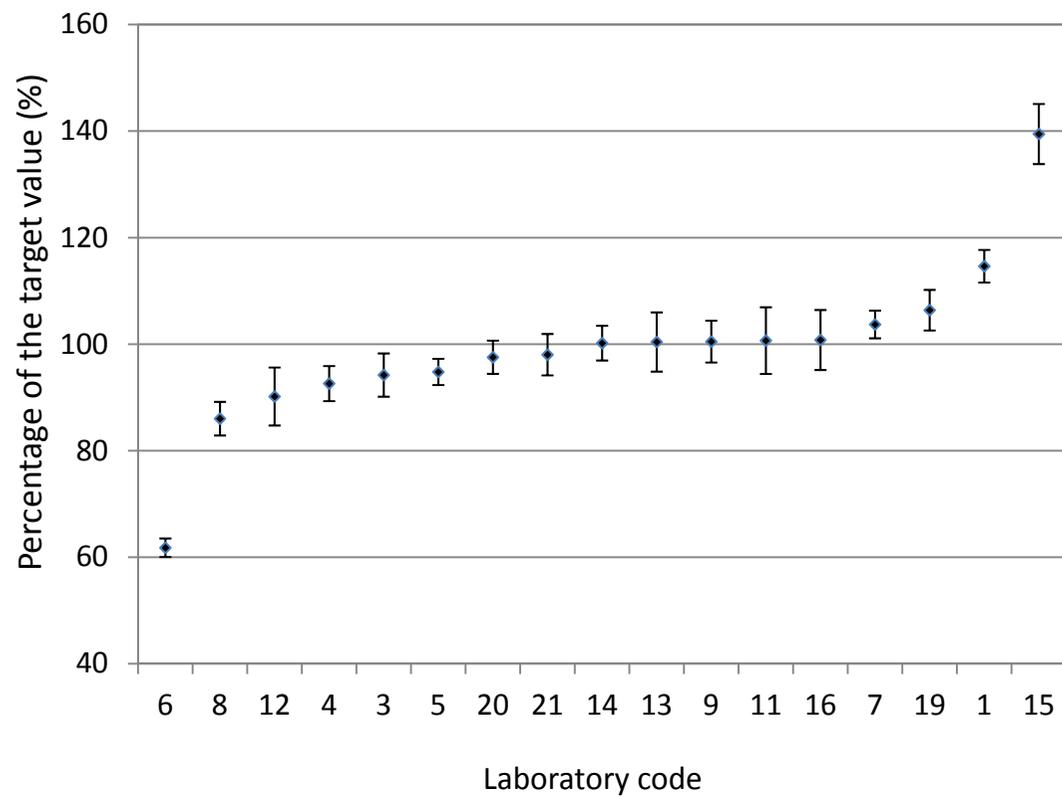


K-40





Cs-137





Evaluation of performance

Laboratory code	K-40	Cs-137
1	NA	NA
3	A	A
4	AW	A
5	NA	A
6	NA	NA
7		A
8		AW
9	A	A
11	A	A
12	AW	A
13	A	A
14	A	A
15	AW	NA
16	A	A
19	A	A
20	A	A
21	A	A



Conclusions

- Most of the participant laboratories obtained acceptable results
- The problems experienced by laboratories that submitted not acceptable results could in general be attributed to calibration problems.
- Compared to the 2004's intercomparison, the 2010/2011 campaign was less demanding but the results are better.
- It may be appropriate to broaden the scope of any further intercomparison exercise to include other radionuclides.