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**Scoring ? OK
But how?**

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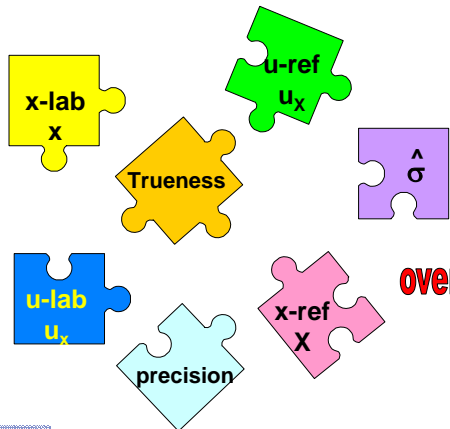
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A clear picture?



over-estimated?

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(Laboratory) Proficiency Testing - PT
'Determination of laboratory **testing performance**
by means of inter-laboratory test comparisons'

How did I perform?

● Lab ● Ref



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ISO 13528 (2005)

Statistical methods for use in proficiency testing
in laboratory comparisons

Determination of ...

- ① assigned value (§ 5)
- ② its standard deviation (§ 5)
- ③ standard deviation for PT (§ 6)
- ④ Calculation of performance statistics (§ 7)



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Assigned value & its stdev

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1. Formulation (5.2) GUM $\rightarrow u_x$
2. Certified reference values (5.3) X & u_x on certificate
3. Reference values (5.4) calibration against CRM
4. Consensus values from expert laboratories (5.5)
robust average & stdev $u_x = 1.25 \sqrt{\sum u_i^2}$
5. Consensus value from participants (5.6)
robust average & stdev $u_x = 1.25 (s^*/\sqrt{p})$

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Performance statistics (1/3)

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1. Laboratory bias (7.1)

Lab ● ● Ref

$$D = x - X$$
 with
 x = laboratory result
 X = assigned value
2. Percentage difference (7.2)

$$D_{\%} = 100 (x - X) / X$$

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Stdev for PTs

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1. Prescribed value (6.2) (legislation, other requirement)
2. By perception (6.3) (level of performance to be achieved)
3. General model (6.4) (Horwitz equation: $\sigma = 0.02 c^{0.8495}$)
4. From results of precision experiments (6.5)
(cf. repeatability-r, reproducibility-R, between-lab stdev- σ_x)
5. Consensus value from PT (6.6)
robust stdev $\sigma^{\wedge} = 1.25 (s^*/\sqrt{p})$

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Performance statistics (2/4)

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3. z-scores (7.3)

$$z = (x - X) / \sigma^{\wedge}$$
 with σ^{\wedge}
 (6.2) – prescribed value
 (6.3) – by perception
 (6.4) – from general model (Horwitz, ...)
 (6.5) – from results of a precision experiment
 (6.6) – from data obtained in a round of a PT
4. z'-scores (7.6)

$$z' = (x - X) / \sqrt{(\sigma^{\wedge})^2 + u_x^2}$$

$$\Re \sigma^{\wedge} \gg u_x \Rightarrow z' \rightarrow z$$

Evaluation:

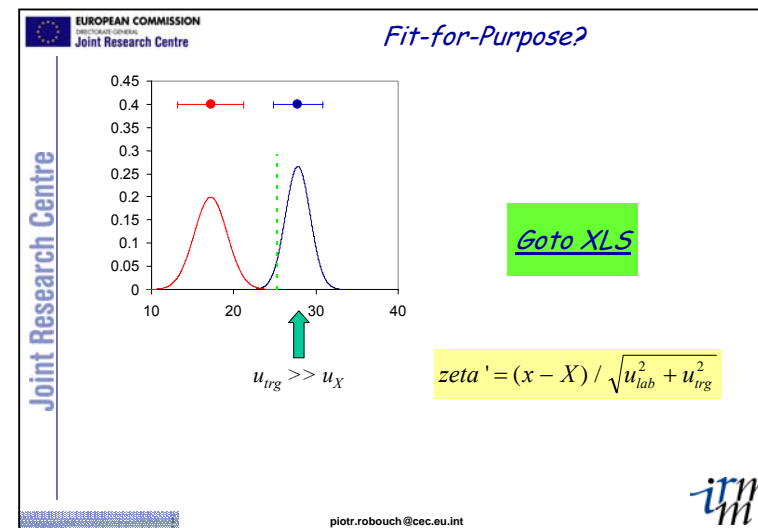
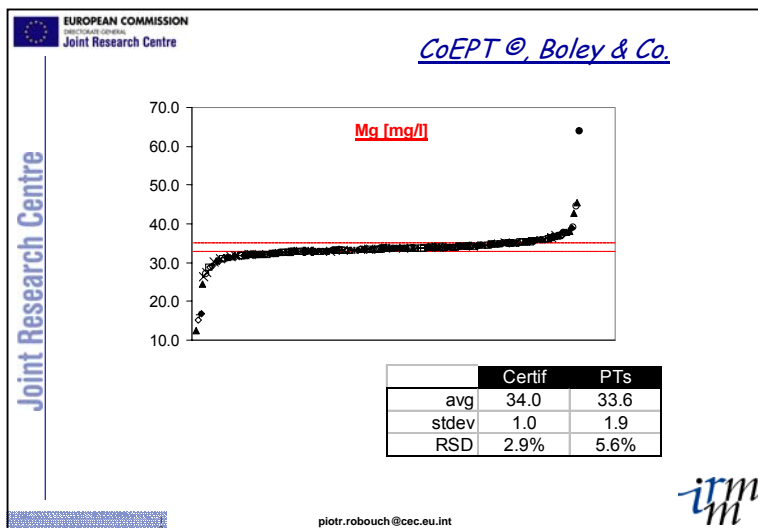
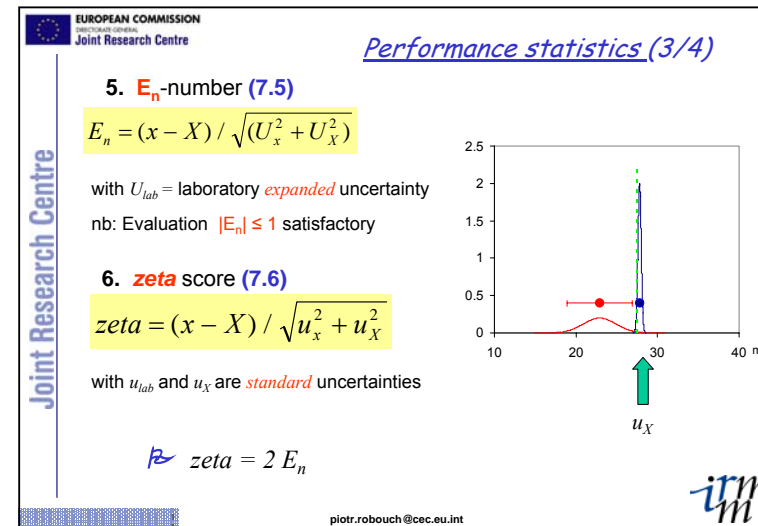
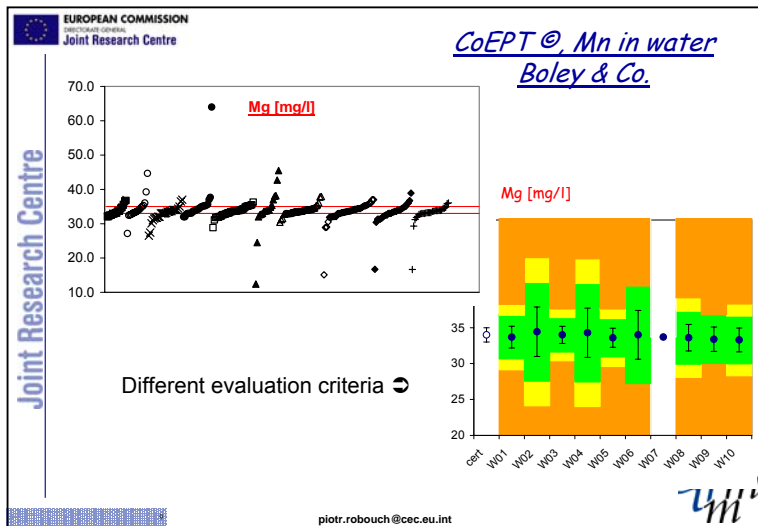
0 < |z| ≤ 2 : satisfactory

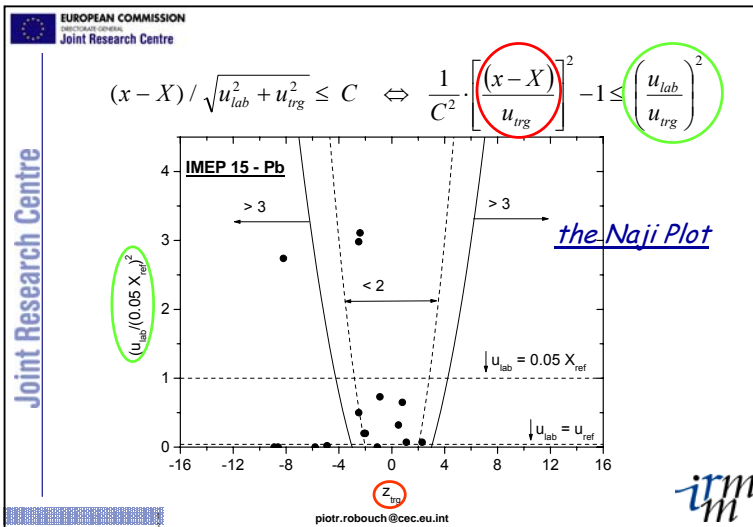
2 < |z| ≤ 3 : questionable (?)

|z| > 3 : unsatisfactory

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Prescribed evaluation criteria (?) according to EU Water Directive

- Is this Directive clear?
- How to interpret/implement the following info:
 - **Trueness = 10% of X (= D_%)**
 - **Precision = 10% of X (acceptable precision = 20% ??)**
- Should we combine these %?
($\sigma^{\wedge} = 5\%, 7\%, 10\%, 14\%, \text{other}???$)
- Can we pool/combine bias & uncertainty?
(should correct for bias and propagate unc)

Thank U 4 your attention

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