



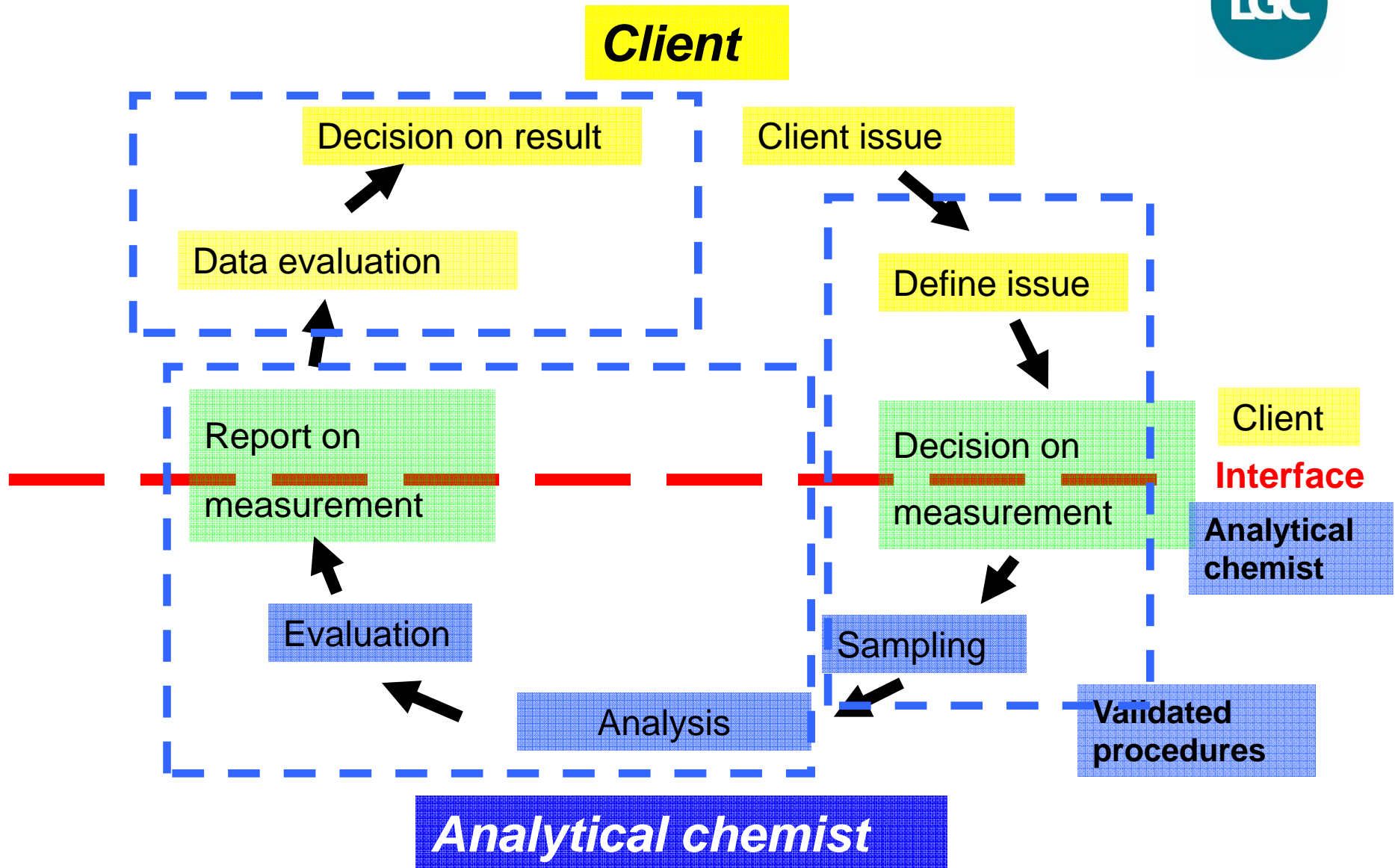
# Proficiency Testing (PT)

– a tool to improve laboratory performance

**Science**  
for a safer world



# The measurement cycle



# Overview



- PT within the quality assurance system
- Purpose, types and benefits of PT
- PT participation strategy
- Selecting fit for purpose PT schemes
- Unsatisfactory performance in PT
- Eurachem driving PT for 25 years



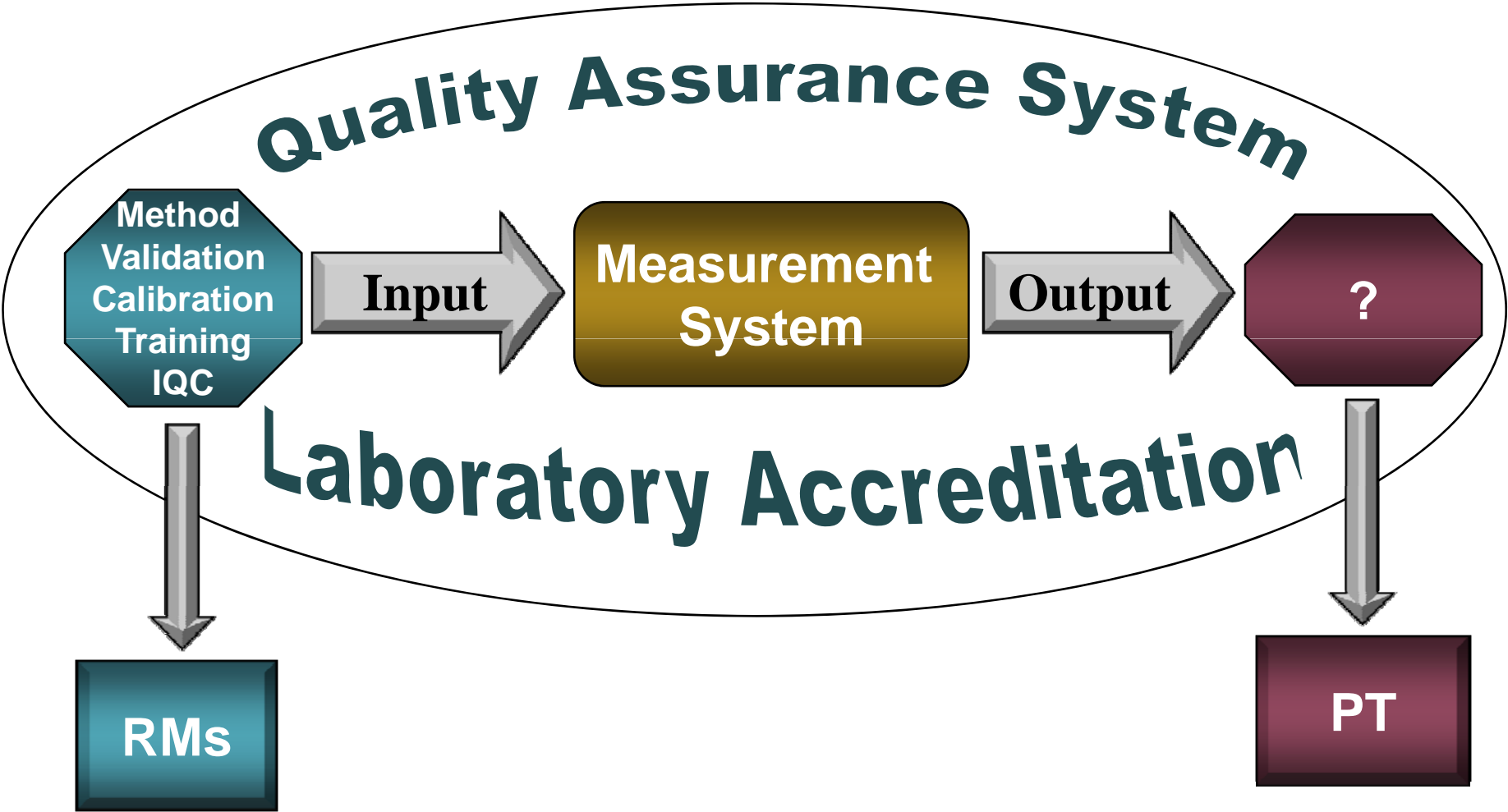
# Proficiency Testing

– role within the quality assurance system





# Quality Assurance System



# Proficiency Testing

– purpose, types and benefits





# What is PT?

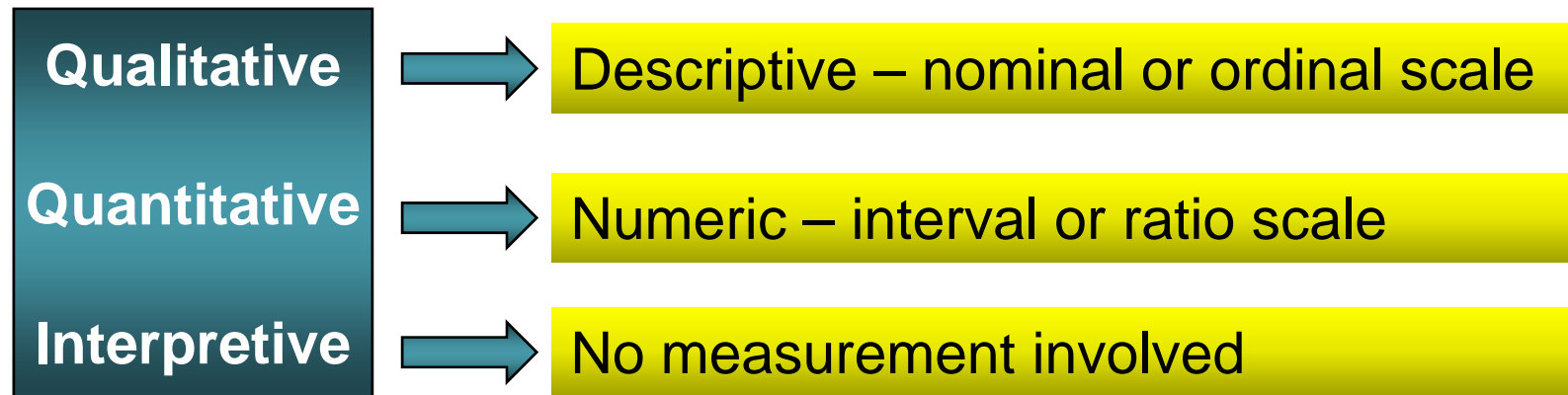
The primary aim of proficiency testing is:

*“To provide the infrastructure for a laboratory to monitor and improve the quality of its routine analytical measurements”*

- PT provides an objective evidence of the competence of the participant which can be used to
  - Improve the performance of the participant
  - Give confidence in the participant’s ability to perform a specific measurement
- PT provides information on other aspects of the management system
  - Reception/treatment of the sample, treatment of the data, result reporting etc

# Types of PT

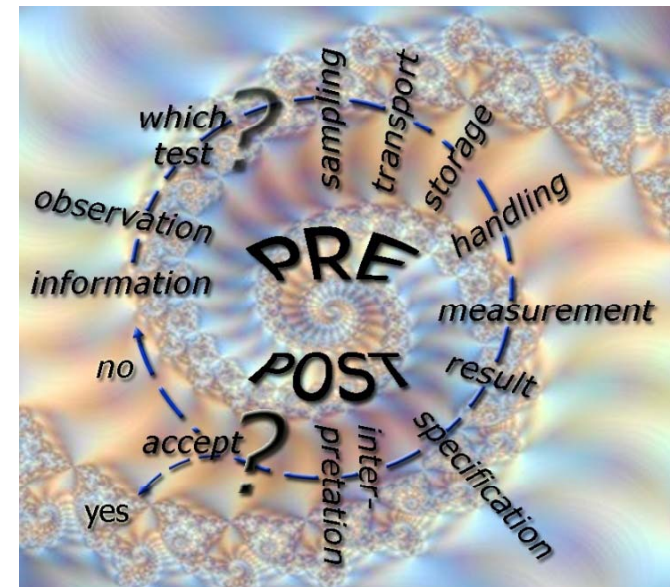
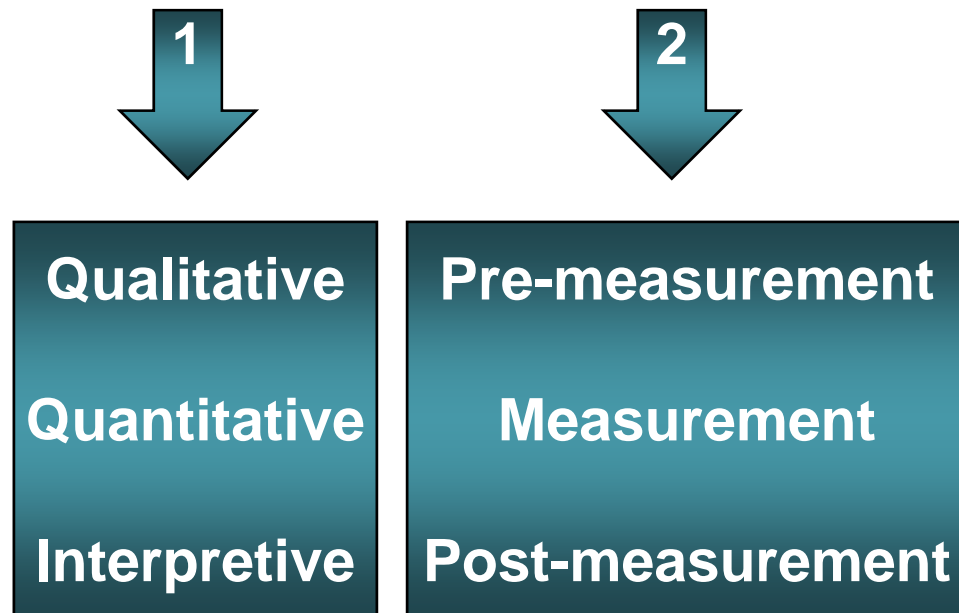
- Various types of PT available – based on one or more elements of four different categories:





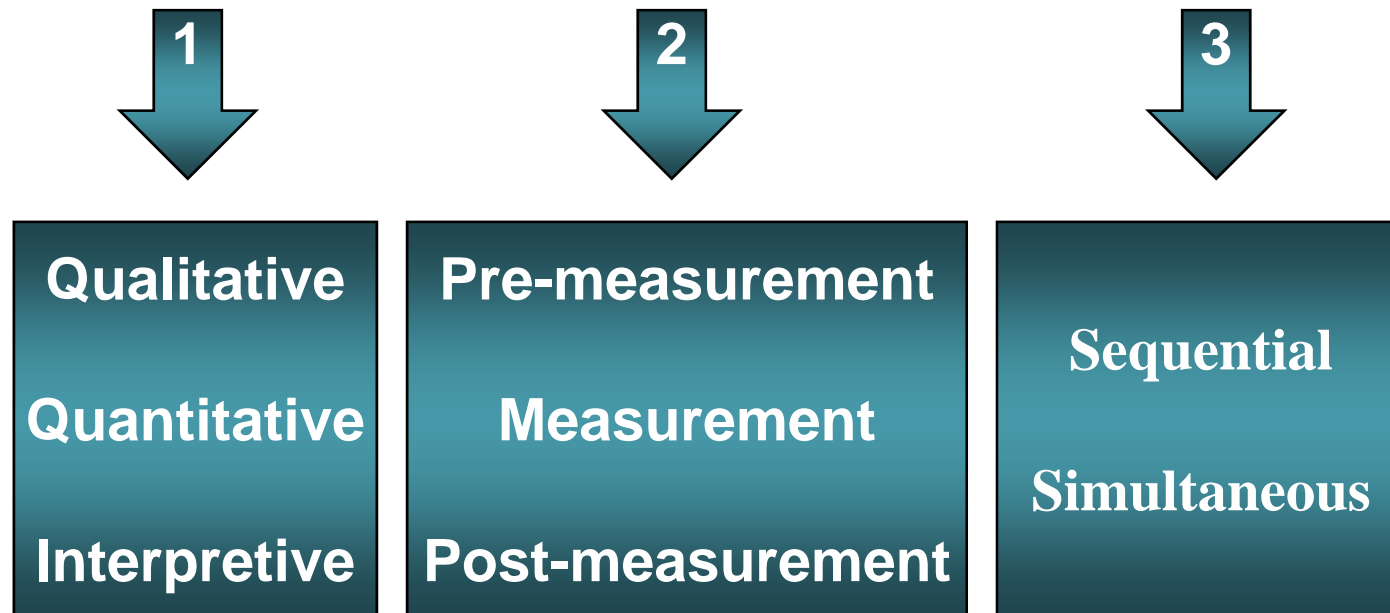
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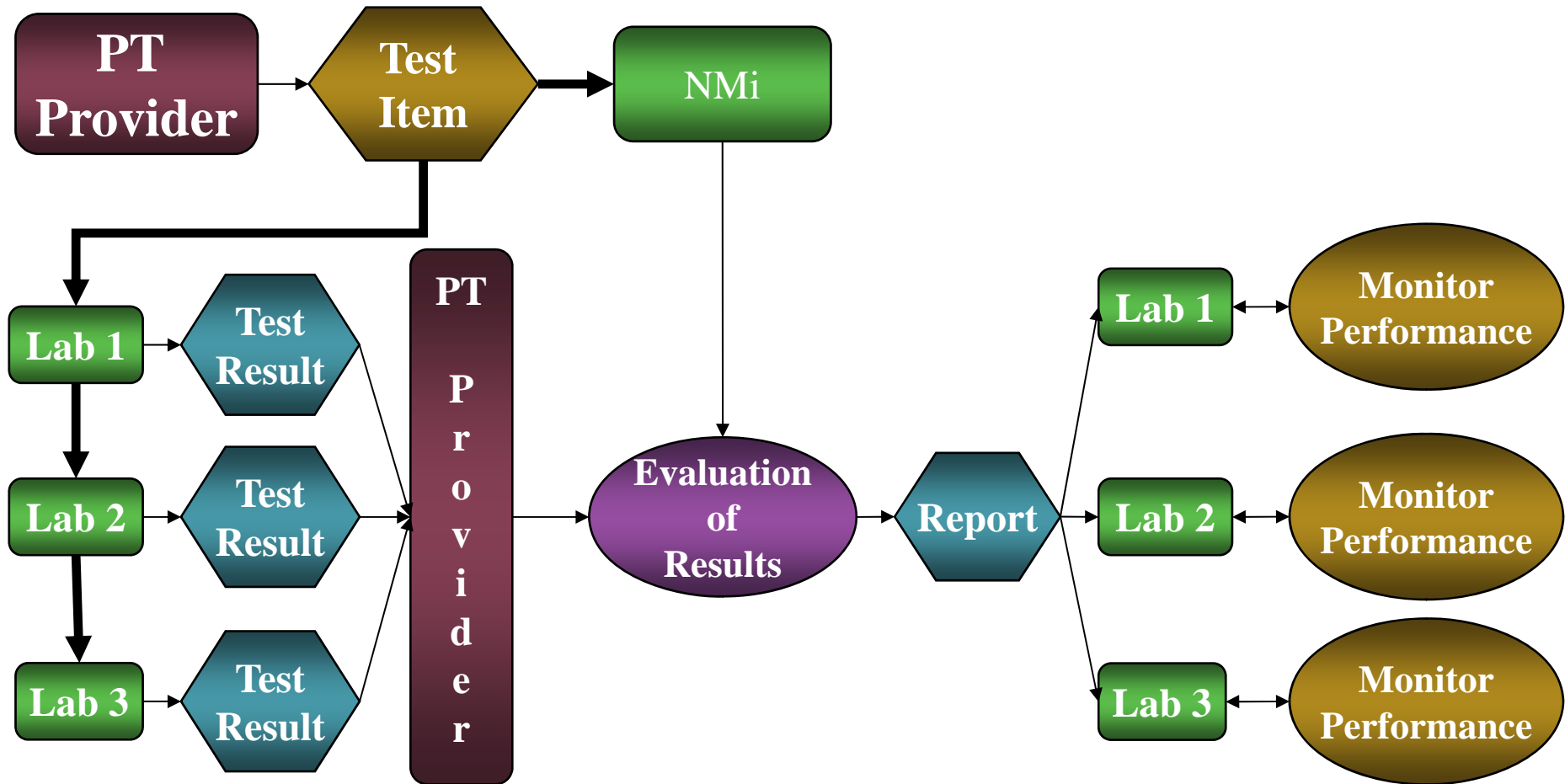


# Types of PT

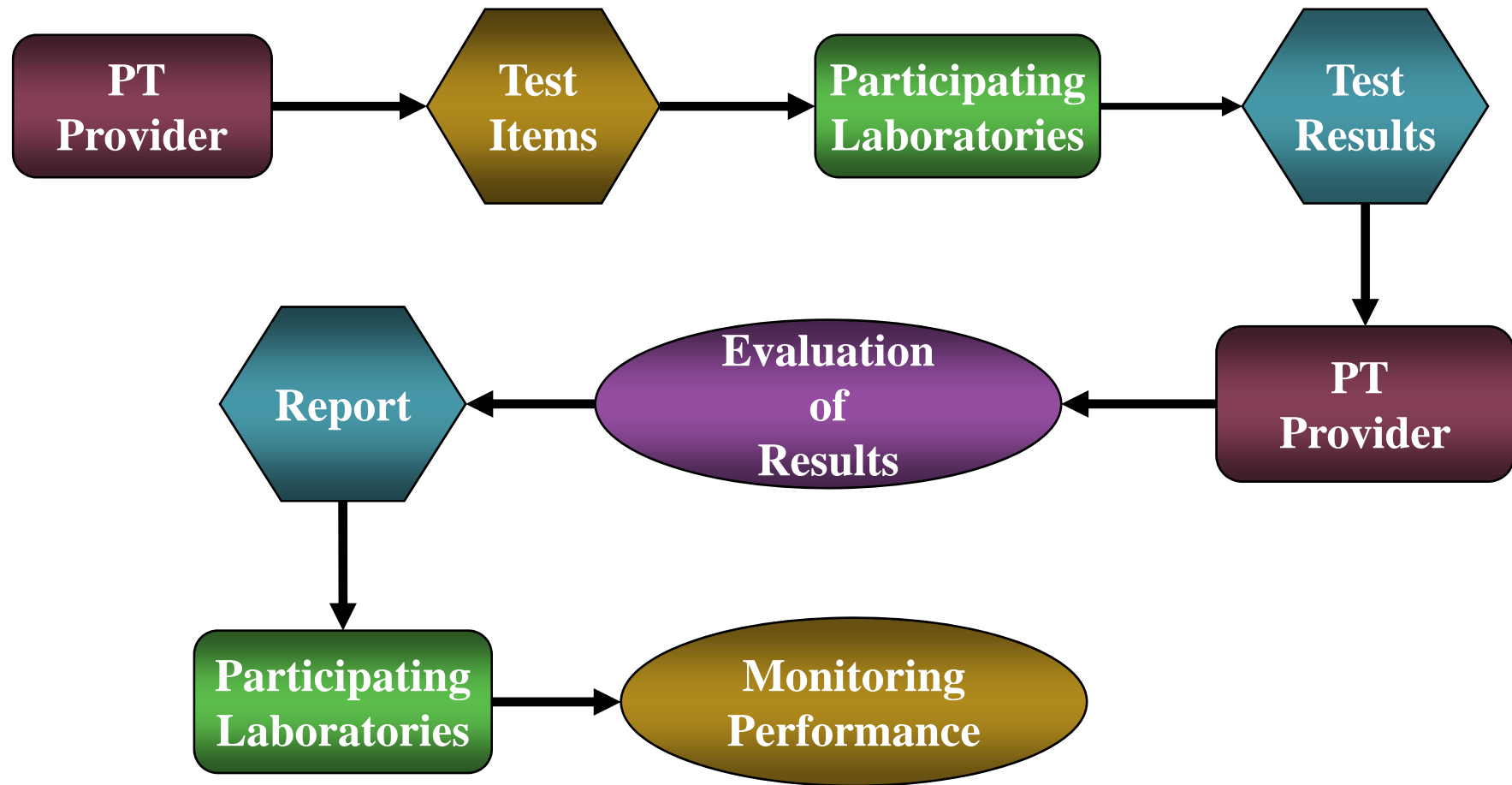
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# Sequential participation scheme structure



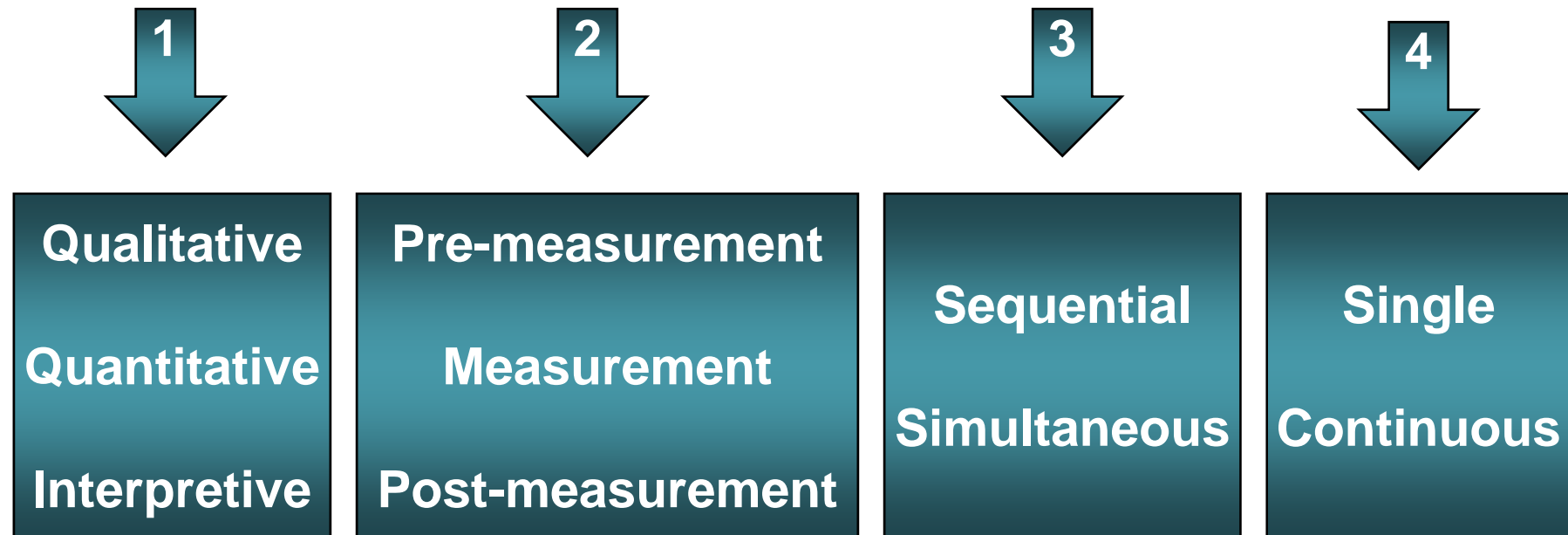
# Simultaneous scheme structure





# Types of PT

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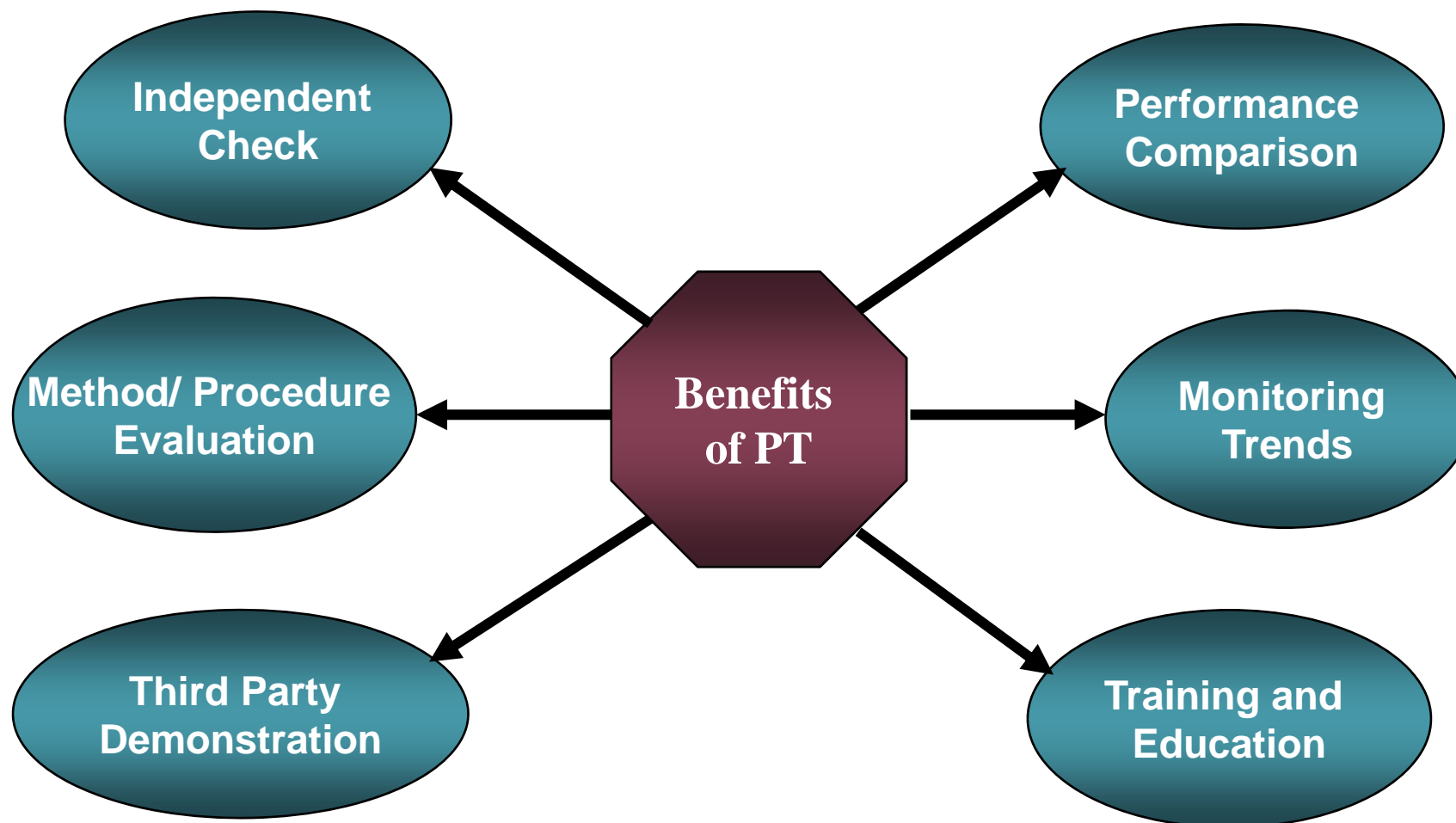




## Use of PT by laboratories

- Basic use of PT for a laboratory is:
  - to assess its performance for the conduct of specific measurements or calibrations
- Results and information received from participation will provide laboratories with:
  - Confirmation that the laboratory's performance is satisfactory
  - An indication that there are potential problems and that corrections should be made
- However, the use of PT should be much wider
  - Many additional benefits from PT participation

# Benefits of PT to laboratories





# PT Participation Strategy







## Strategy of PT participation

- All laboratories need to develop an adequate PT participation strategy
- A laboratory should decide on an appropriate level and frequency of participation
  - Level: number of specific proficiency tests in which to participate
  - Frequency: How often the laboratory will participate in each of the specific test identified
- This will be specific to the laboratory's circumstances
- Guidance provided by the European co-operation for Accreditation (EA) EA-4/18: 2010
  - [www.european-accreditaion.org](http://www.european-accreditaion.org)



## Level of PT Participation

- Consider areas of technical competence based on:
  - Measurement technique e.g. ICP-MS, GC-MS
  - Property to be measured e.g. PAHs, Fat, hardness
  - Products to be tested e.g. soil, milk, human serum
- An area of technical competence may encompass several products, properties and/or measurement techniques
- The laboratory must be able to demonstrate equivalence within each area of technical competence

# Level and frequency of PT participation



- Important to consider a number of different aspects

- Other QA measures implemented:

- Use of CRMS
- Comparisons by independent techniques
- Participation in validation or characterisation studies
- Use of internal QC measures
- Other laboratory comparisons

- Level of risk:

- No measurements undertaken
- Turnover of technical staff
- Staff experience/knowledge
- Known stability/instability of measurement technique
- Significance and final use of data

- Different types of PTs can be used

- Difficulty of PT participation e.g. technical characteristics of the measurement, low number of laboratories etc
- Legislative requirements for frequency of type of participation



# Selecting fit for purpose PT schemes





## Fit for purpose PT schemes

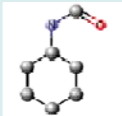
- Need to decide which scheme is fit for purpose
  - Often a scheme will not have a perfect fit, so need to find the best fitness for purpose
- A number of factors to consider
  - Test Items
  - Distribution
  - Participants
  - Results
  - Reports
  - PT Provider




# Selection factors




- **Test Item**
  - Matrix (real/simulated)
  - Parameters
  - Concentrations




- **Distribution**
  - Dates available
  - Frequency
  - Flexibility




- **Participants**
  - National/International
  - Language
  - Methods




- **Results**
  - Deadlines
  - Reporting mechanism
  - Statistical approach



- **Reports**
  - Speed
  - Information/Language
  - Format



- **PT Provider**
  - Experience
  - Scope
  - Competence





# Unsatisfactory performance in PT



# Causes of unsatisfactory performance



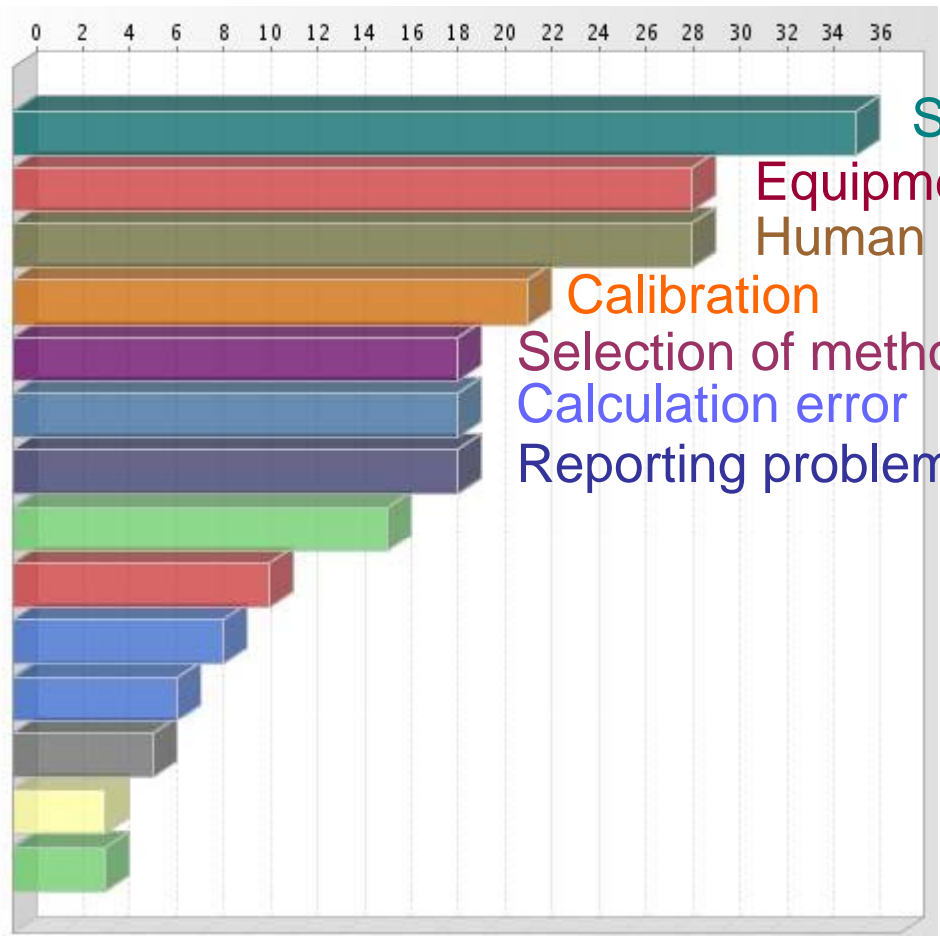
- Can be analytical and non-analytical
- Both are equally serious
  - the result reported is the important factor for a laboratory

- Analytical Errors
  - Calibration
  - Instrument problems
  - Extraction/clean-up
  - Interferences
  - Method performance
  - Analyst

- Non-Analytical Errors
  - Calculation
  - Transcription
  - Units
  - Reporting format



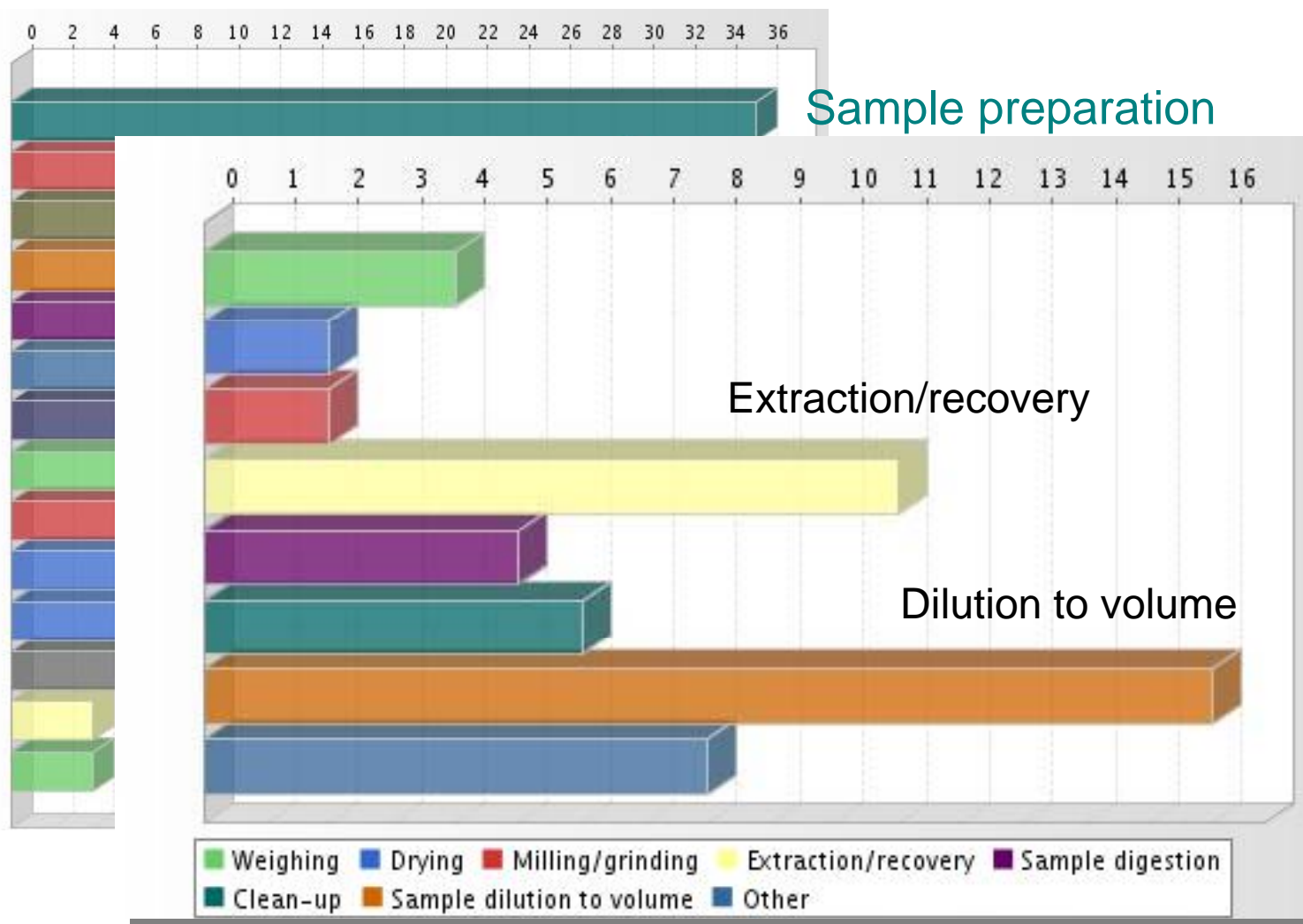
# Top causes of poor scores



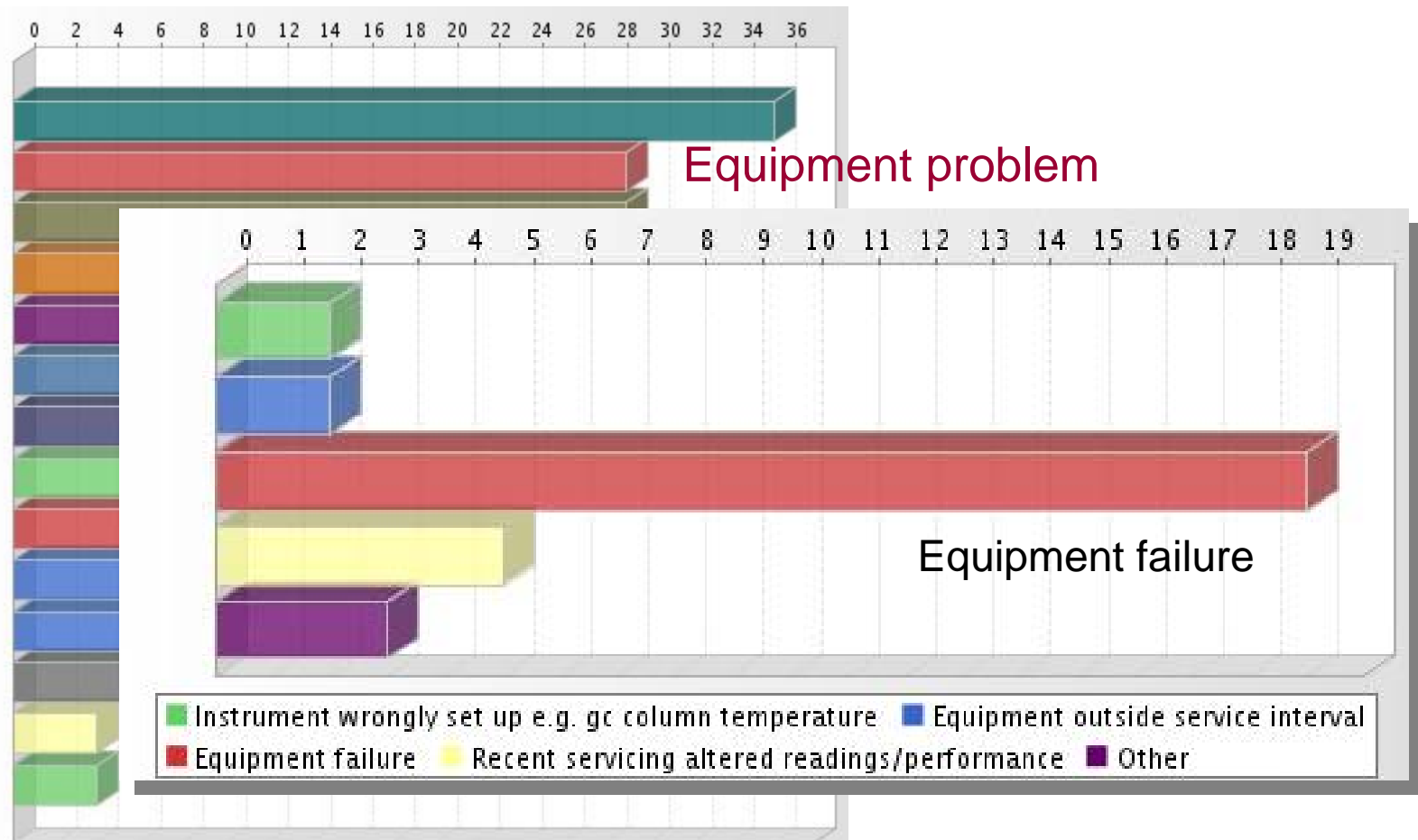
Sample preparation  
Equipment problem  
Human error  
Calibration  
Selection of method  
Calculation error  
Reporting problem

111 respondents  
230 causes

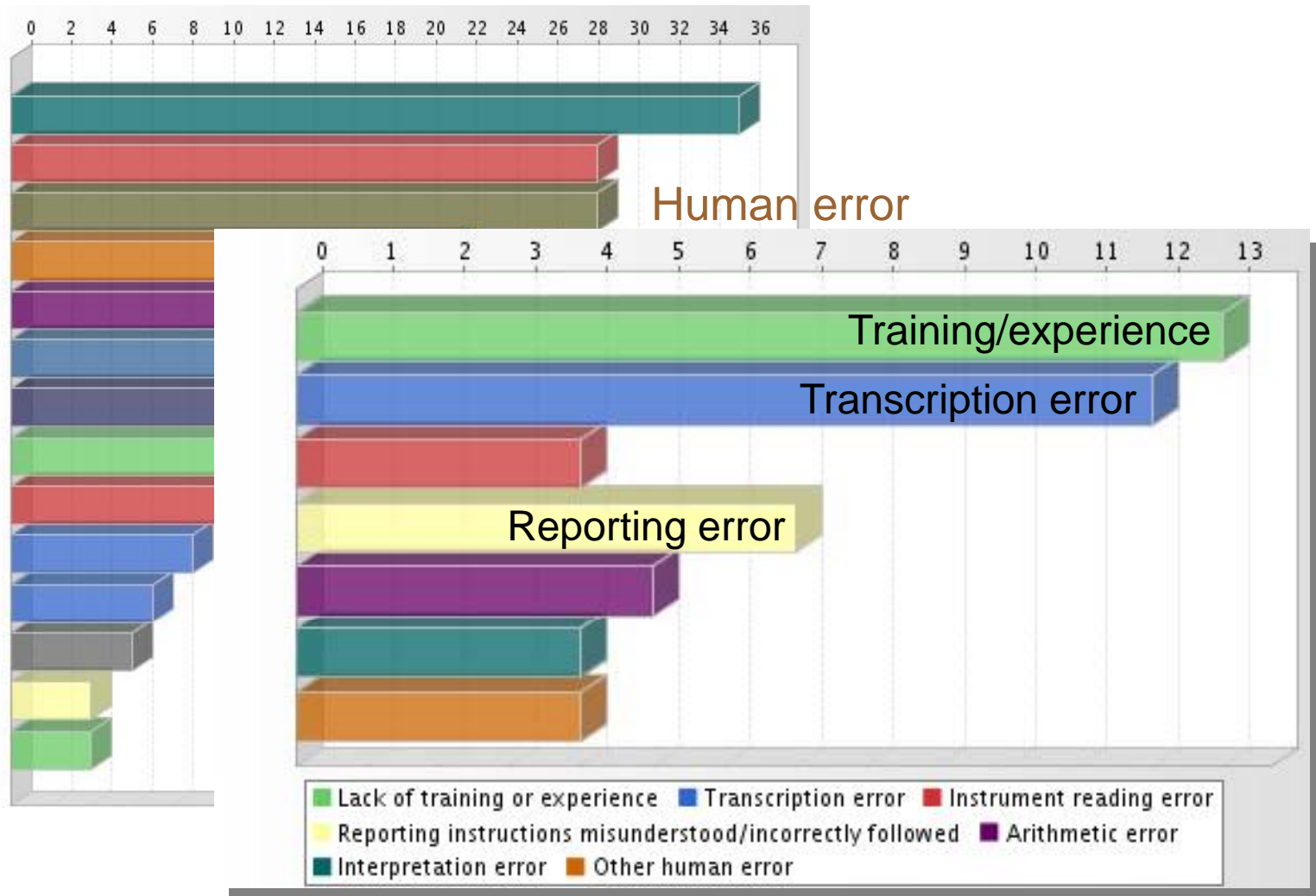
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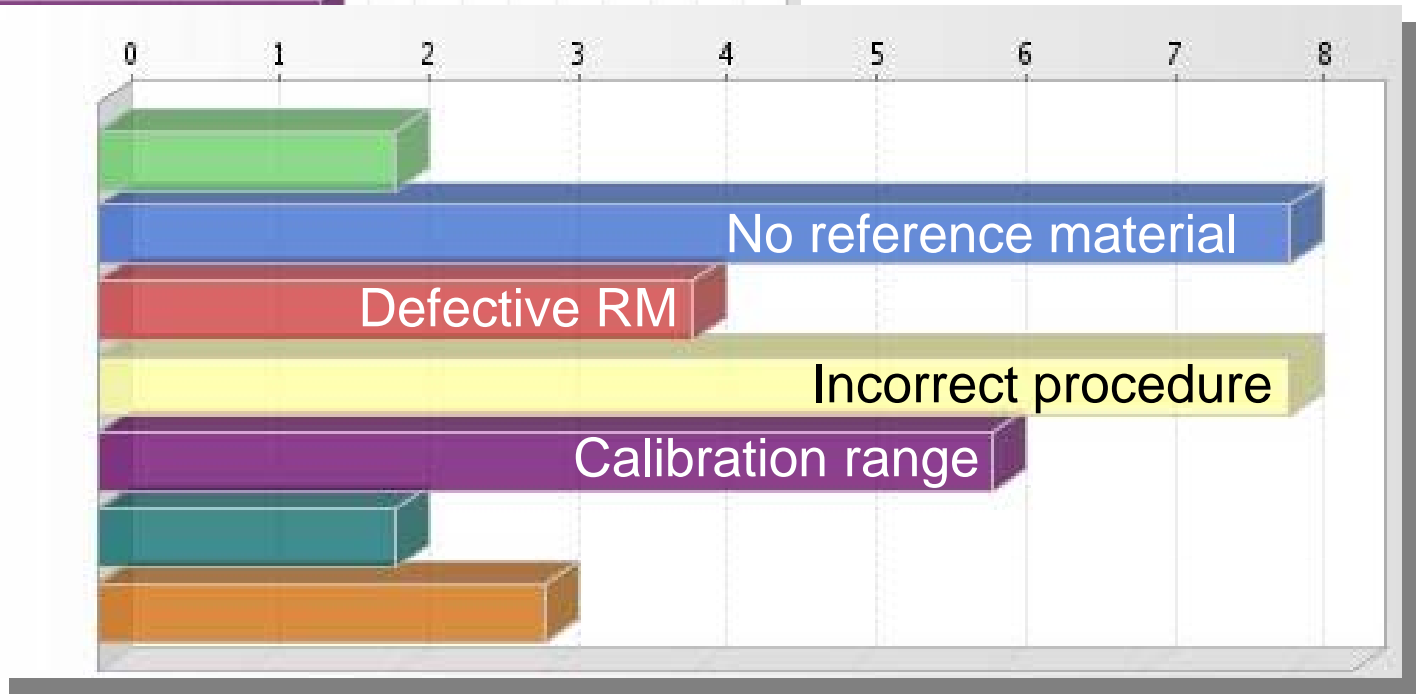
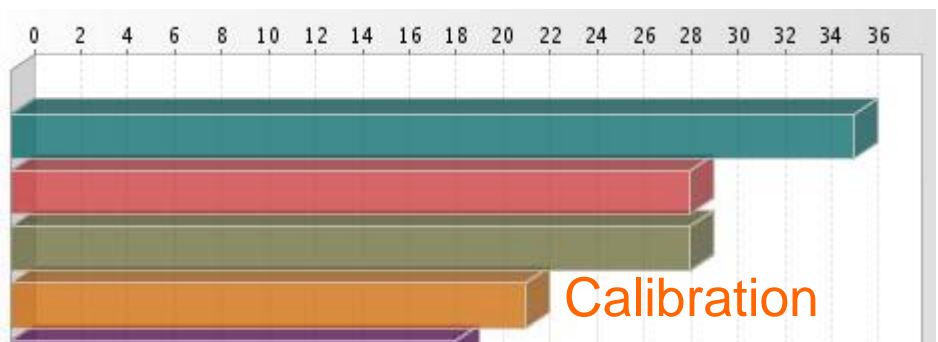
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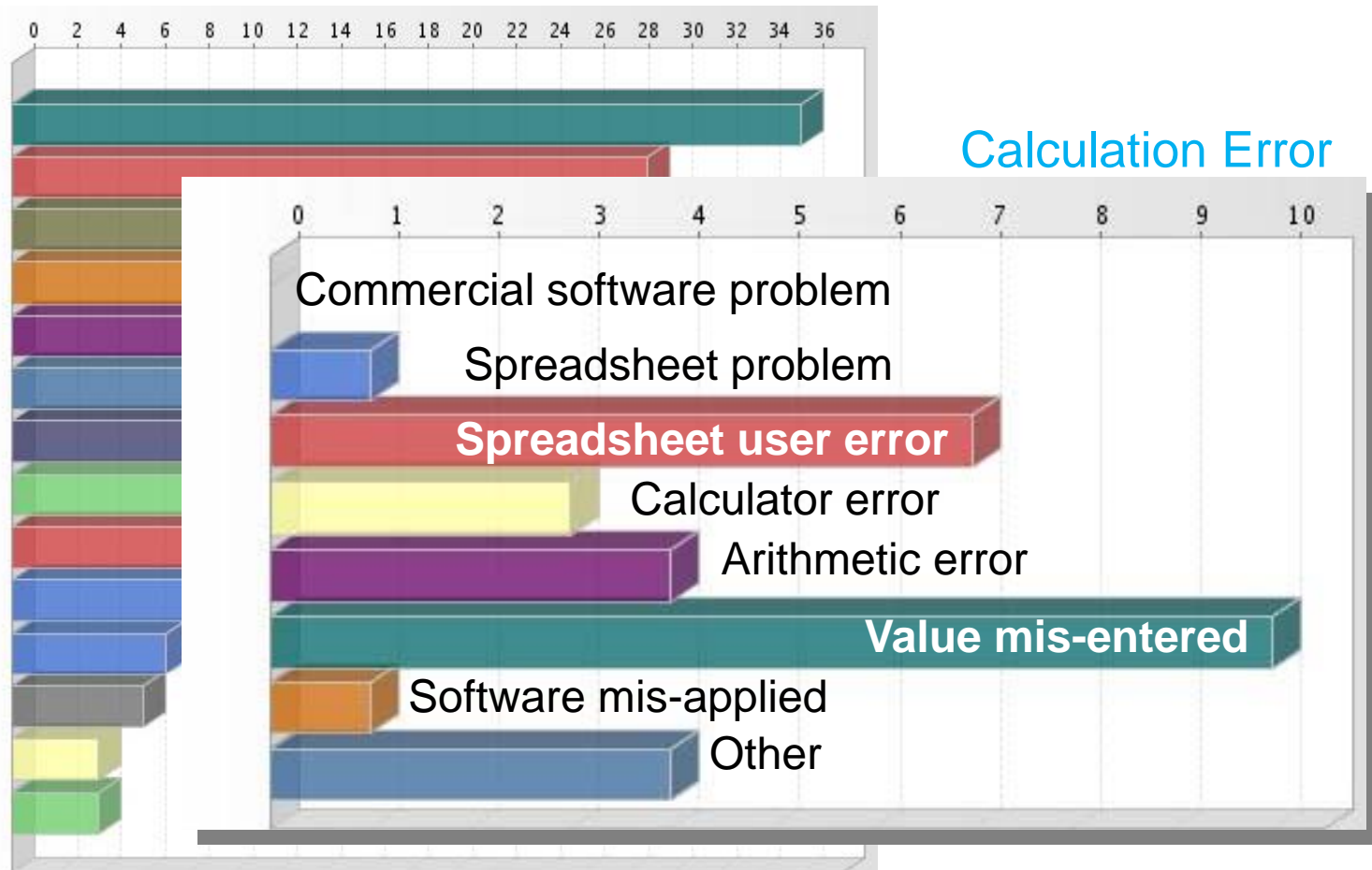
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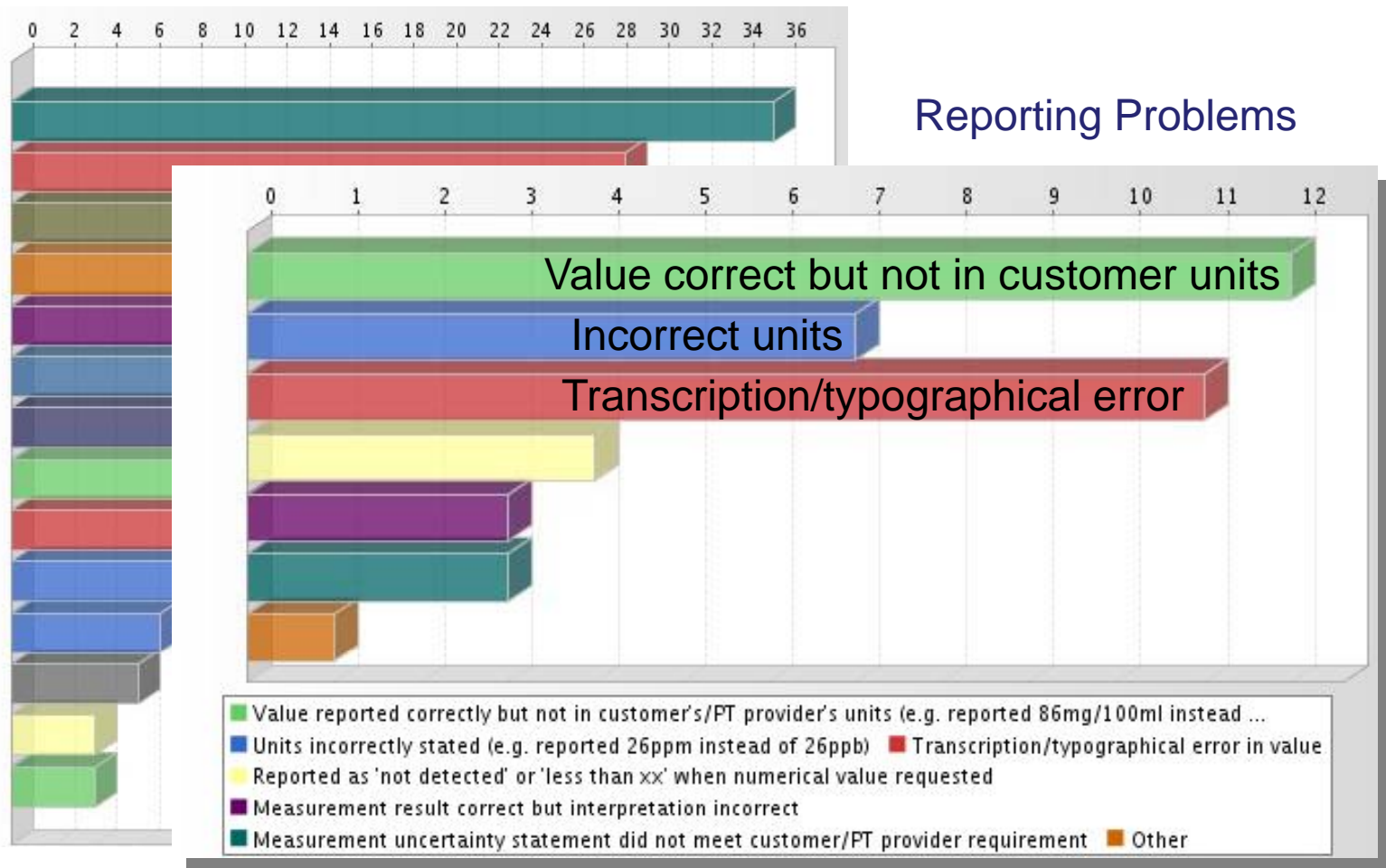
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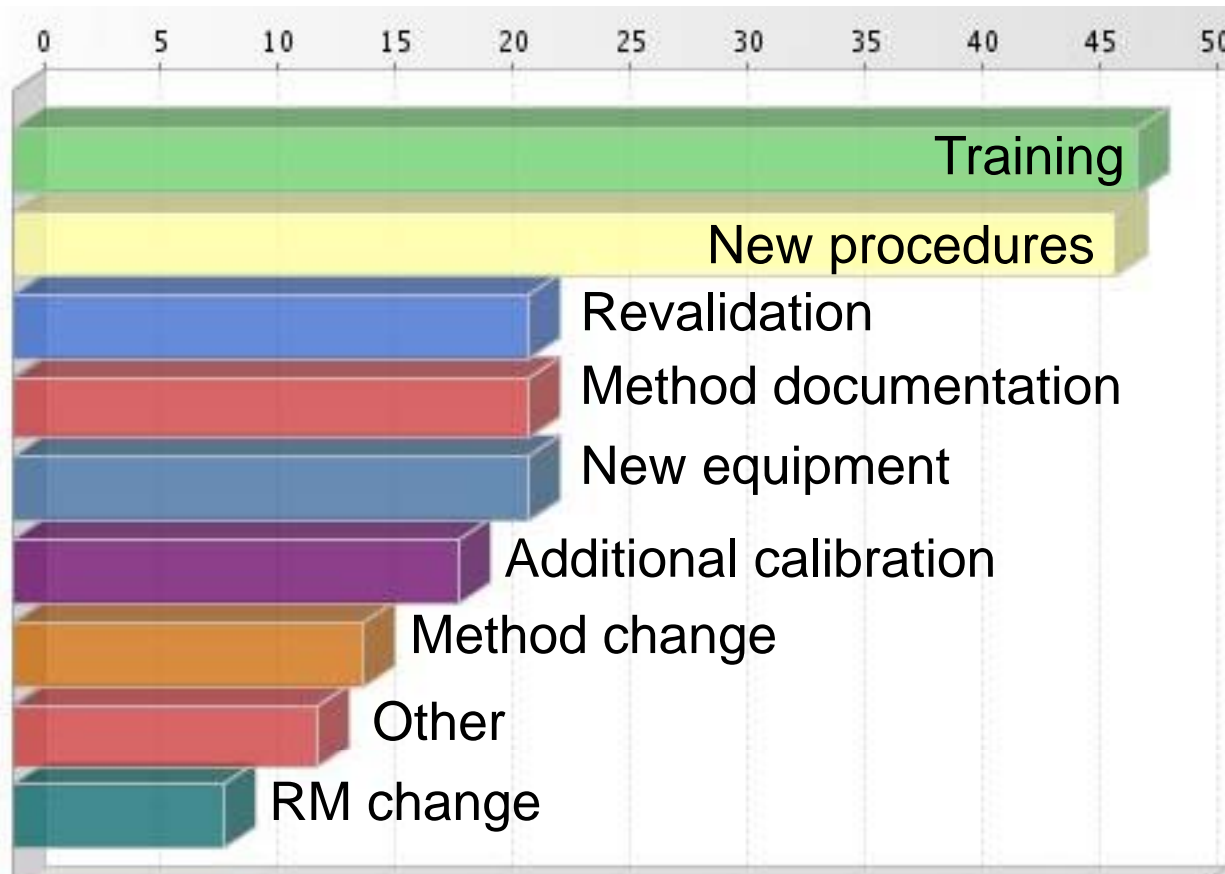
# Top causes of poor scores



# Top causes of poor scores



# Corrective actions implemented







# Eurachem driving PT for 25 years





# PT Working Groups

- Eurachem PT Working Group
  - Aims to provide a forum for pursuing excellence in the development and implementation of proficiency testing
- EA/Eurolab/Eurachem (EEE) PT Working Group
  - Joint stakeholder WG Working on “Proficiency Testing in Accreditation”
  - Aims to develop common policy and technical advice covering proficiency testing to meet the European needs
- Wide range of activities over the past 25 years
  - Workshops
  - Surveys
  - Guides
  - Guidance documents
  - Information leaflets
  - Position papers



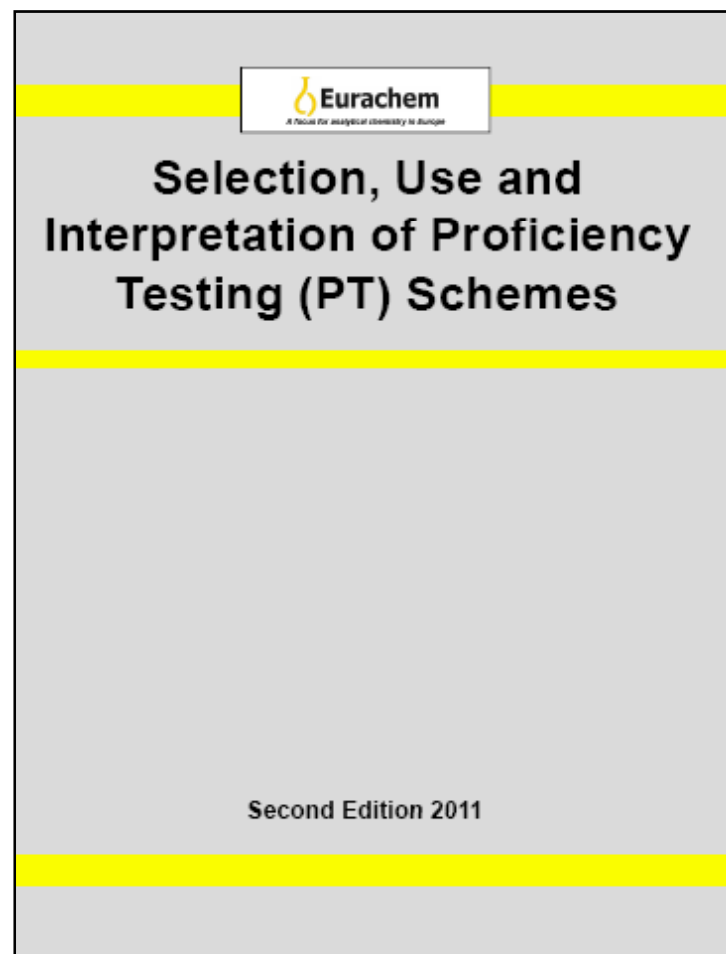
## PT Workshops

- Series of international workshops on PT in analytical chemistry, microbiology and laboratory medicine
- Since the 3<sup>rd</sup> Workshop run in collaboration with CITAC and EQALM
- 1993 – The Netherlands
- 1995 – The Netherlands
- 2000 – Borås Sweden
- 2003 – Bracknell, UK
- 2005 - Portorož, Slovenia
- 2008 – Rome, Italy
- 2011 – Istanbul, Turkey
- 2014 – Berlin, Germany

# Guides

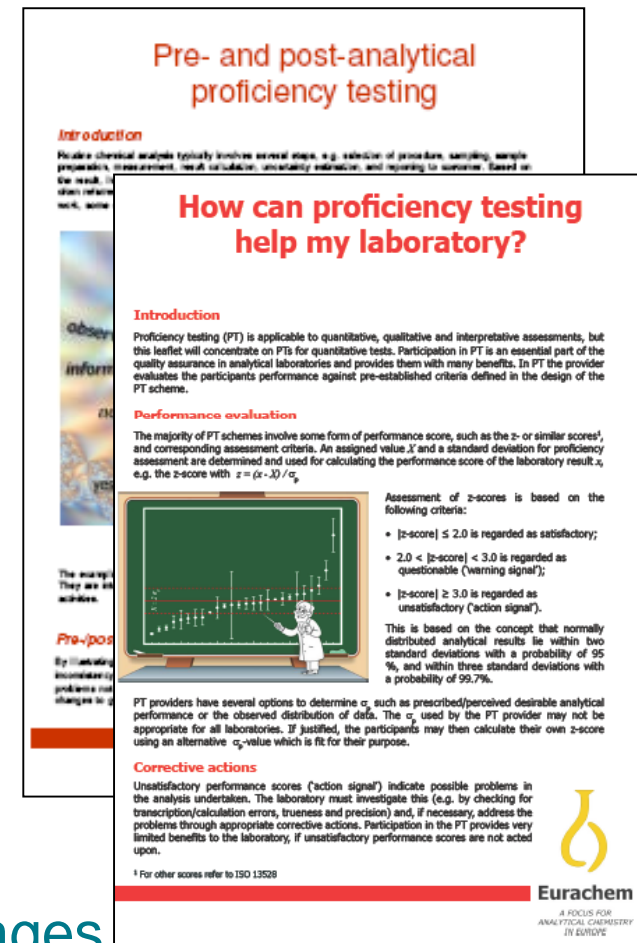


- Guide to the ‘Selection, use and interpretation of proficiency testing (PT) schemes’
  - 1<sup>st</sup> Edition 2000
  - 2<sup>nd</sup> Edition 2011
- Available to download from [www.eurachem.org](http://www.eurachem.org)



# Information Leaflets

- A series of educational leaflets on PT
  - Proficiency testing schemes and other interlaboratory comparisons
  - Pre- and post-analytical proficiency testing
  - How can proficiency testing help my laboratory?
  - Proficiency testing – how much and how often? (in prep)
  - Selecting the right proficiency testing scheme for my laboratory (in prep)
- Translated into various European languages
- Available to download from [www.eurachem.org](http://www.eurachem.org)



**Pre- and post-analytical proficiency testing**

**Introduction**

Most chemical analysis typically involves several steps, e.g. selection of procedure, sampling, sample preparation, measurement, result calculation, uncertainty estimation, and reporting to customer. Based on the result, the result is then used for various purposes, such as:

**How can proficiency testing help my laboratory?**

**Introduction**

Proficiency testing (PT) is applicable to quantitative, qualitative and interpretative assessments, but this leaflet will concentrate on PTs for quantitative tests. Participation in PT is an essential part of the quality assurance in analytical laboratories and provides them with many benefits. In PT the provider evaluates the participants performance against pre-established criteria defined in the design of the PT scheme.

**Performance evaluation**

The majority of PT schemes involve some form of performance score, such as the z- or similar scores<sup>1</sup>, and corresponding assessment criteria. An assigned value  $X$  and a standard deviation for proficiency assessment are determined and used for calculating the performance score of the laboratory result  $x$ , e.g. the z-score with  $z = (x - X) / \sigma_p$ .

Assessment of z-scores is based on the following criteria:

- $|z\text{-score}| \leq 2.0$  is regarded as satisfactory;
- $2.0 < |z\text{-score}| < 3.0$  is regarded as questionable (warning signal);
- $|z\text{-score}| \geq 3.0$  is regarded as unsatisfactory (action signal).

This is based on the concept that normally distributed analytical results lie within two standard deviations with a probability of 95 %, and within three standard deviations with a probability of 99.7%.

PT providers have several options to determine  $\sigma_p$  such as prescribed/perceived desirable analytical performance or the observed distribution of data. The  $\sigma_p$  used by the PT provider may not be appropriate for all laboratories. If justified, the participants may then calculate their own z-score using an alternative  $\sigma_p$ -value which is fit for their purpose.

**Corrective actions**

Unsatisfactory performance scores (action signal) indicate possible problems in the analysis undertaken. The laboratory must investigate this (e.g. by checking for transcription/calculation errors, trueness and precision) and, if necessary, address the problems through appropriate corrective actions. Participation in the PT provides very limited benefits to the laboratory, if unsatisfactory performance scores are not acted upon.

<sup>1</sup> For other scores refer to ISO 13528

**Eurachem**  
A FOCUS FOR ANALYTICAL CHEMISTRY IN EUROPE



Thank you for listening