

Safety through proper measurements

# safety --

How strong are the steel cables or concrete reinforcing bars used in this bridge ?



# safety --

- How much pesticide residues are in these vegetables ?



safety --

Can the tank withstand  
build up of LPG vapor  
pressure ?



safety --

Is the overhead clearance adequate ?

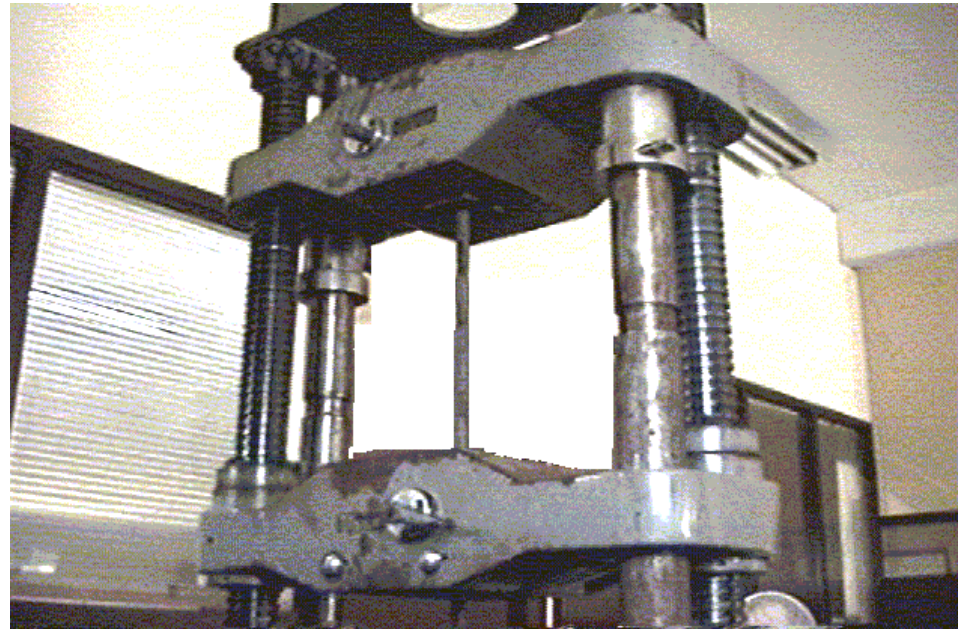


# Measurements in different fields

- Force – strength of steel bar per unit area
- Chemical concentration - in food
- Pressure – stress capacity of LPG tank
- Length – distance from road surface to structure above

# Measuring instruments --

UTM



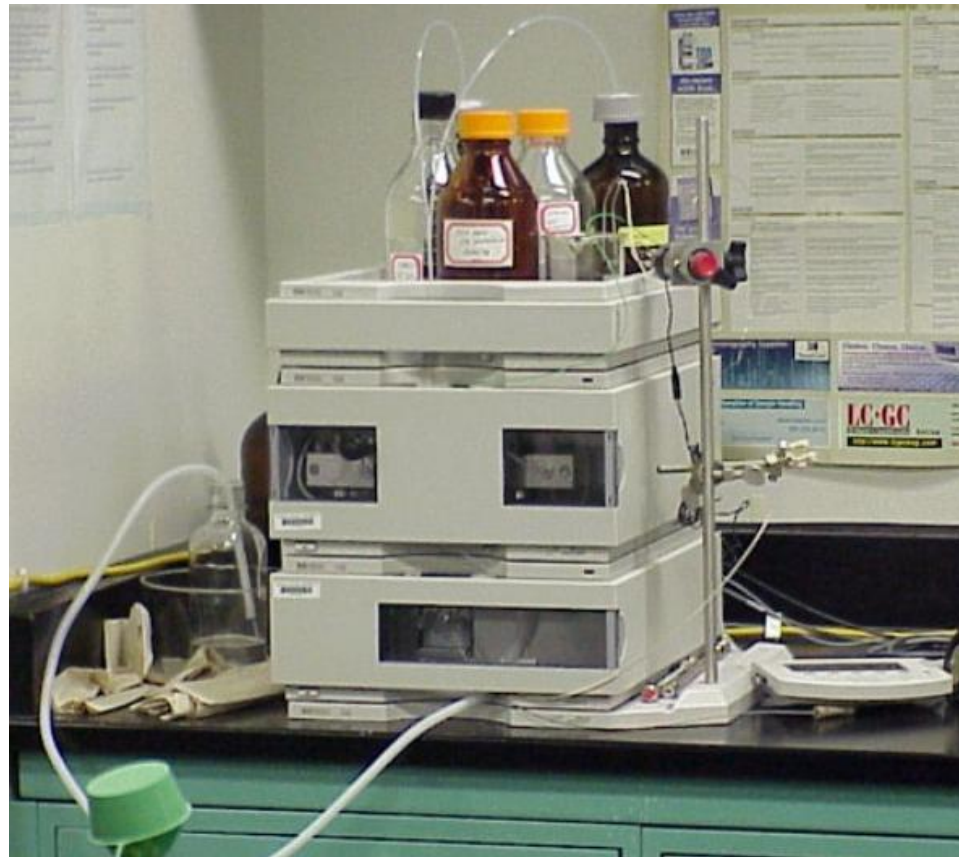
Force - load cell





# Measuring instruments --

Food contaminants – HPLC





# Measuring instruments --

Hydrostatic test system

Pressure – pressure gage



# Measuring instruments --

Length – steel measuring tape or rod



# Confidence in the indication of measuring instruments

- Regular check ups, maintenance
- Periodic comparison with standards

# Importance of accurate measurements

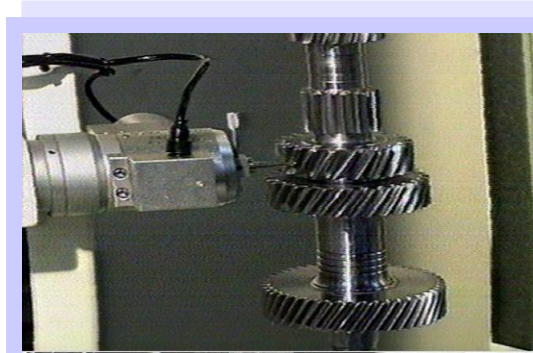


**Consumer Protection**

**Fair Trade**



**Health**



**Product Quality**

**R&D**



**Safety**





# Environmental Protection



# Required characteristics of the measurement --

- Comparable results when repeated
- Comparable results using another instrument
- Comparable results by different laboratory in the country
  - - even outside the country



# An agreement has to be reached:

- 1 metre in one laboratory the same as the metre as understood or used by another laboratory
- 1 metre the same length for different countries.
- Must choose a standard defining the metre
- Must be as constant as possible [in contrast the length of foot of some king .. edema., death

# METROLOGY

- The science of measurements
- Includes all aspects both theoretical and practical with reference to measurements, whatever their level of accuracy, whatever fields of science or technology they occur

# International bodies



Metre convention

*Convention du Metre*, the treaty signed in Paris on 20 May 1875 by 17 Member States during the final session of the Diplomatic Conference of the Metre, and amended in 1921

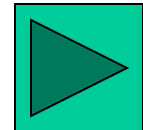
**BIPM**



The *Bureau International des Poids et Mesures*, (International Bureau of Weights and Measures), with headquarters near Paris, set up by the Metre Convention with the task of ensuring worldwide unification of physical measurements, operates under the exclusive supervision of the CIPM which itself comes under the authority of CGPM



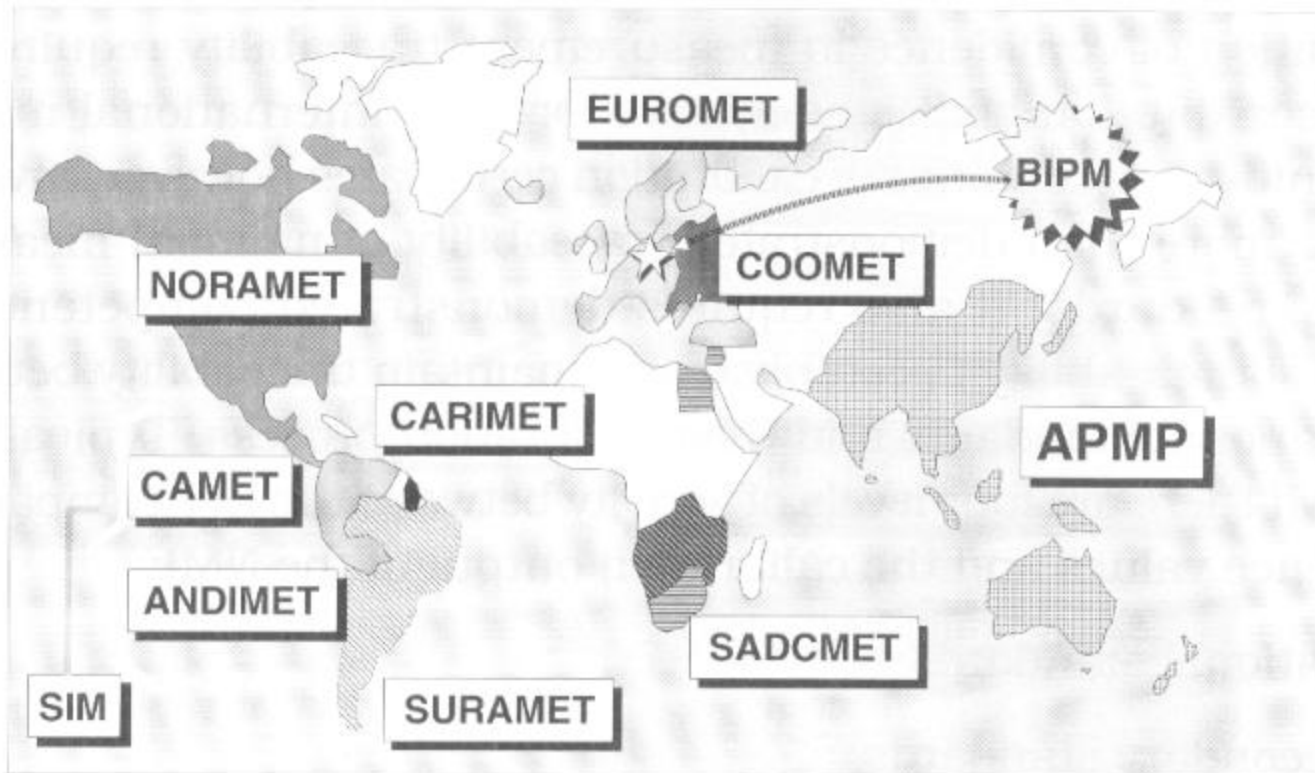
SI Units, The International System of Units: the practical system of units of measurement established, defined, and updated by the CGPM





The Asia-Pacific Metrology Programme

## ***REGIONAL METROLOGY ORGANISATIONS***

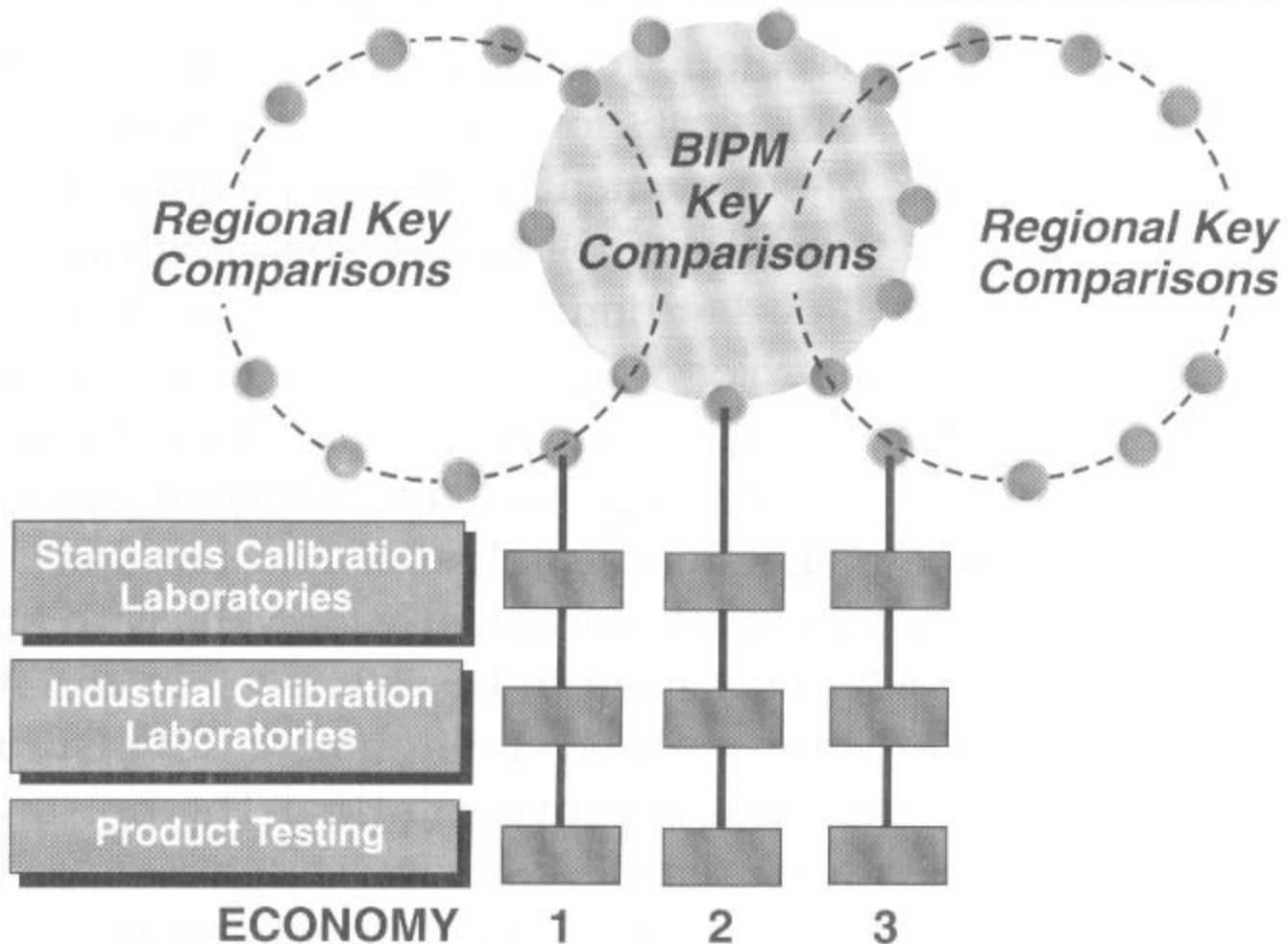




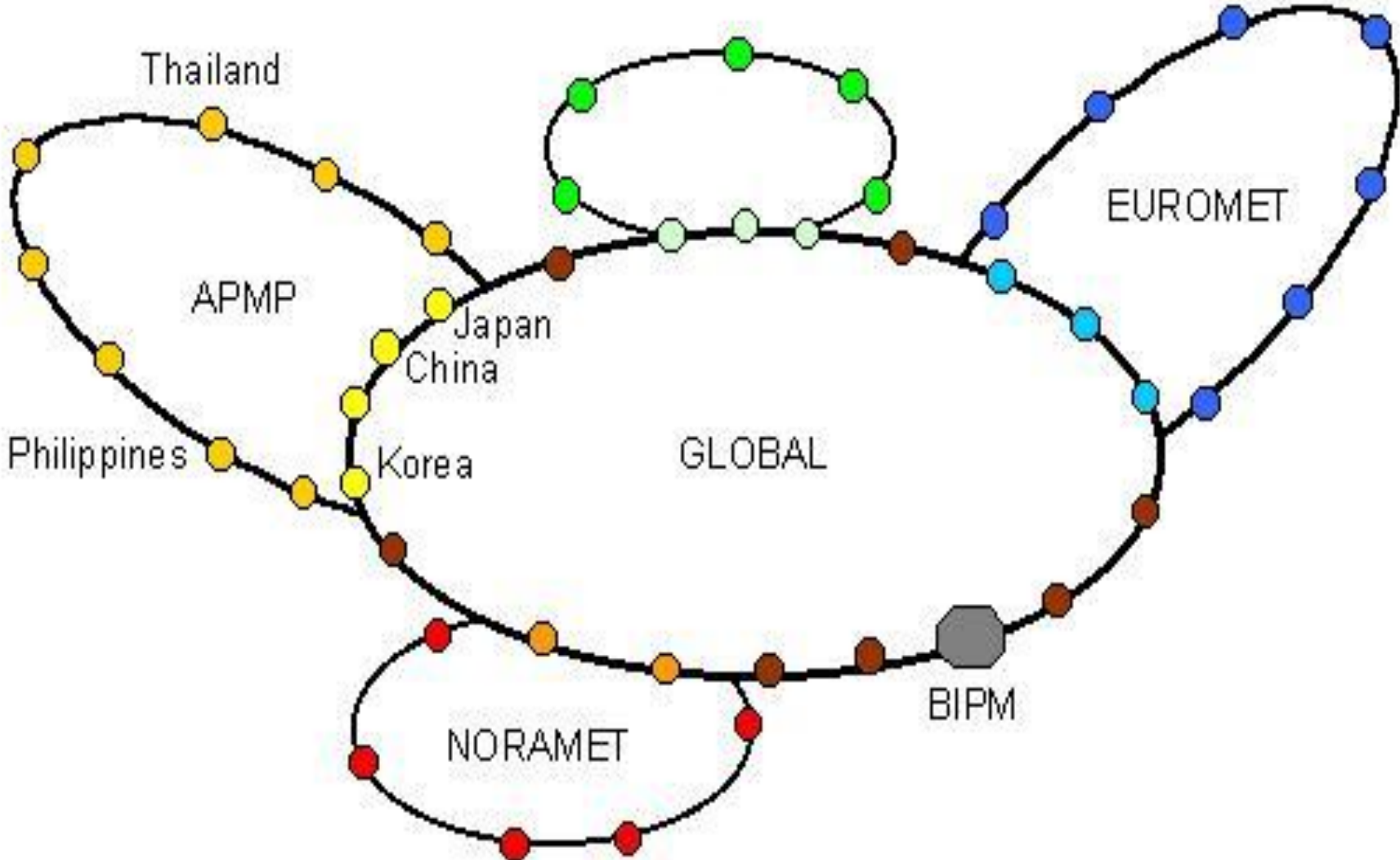


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# ***INTERNATIONAL TRACEABILITY***



# Scheme of equivalence of national measurement standards through key comparisons



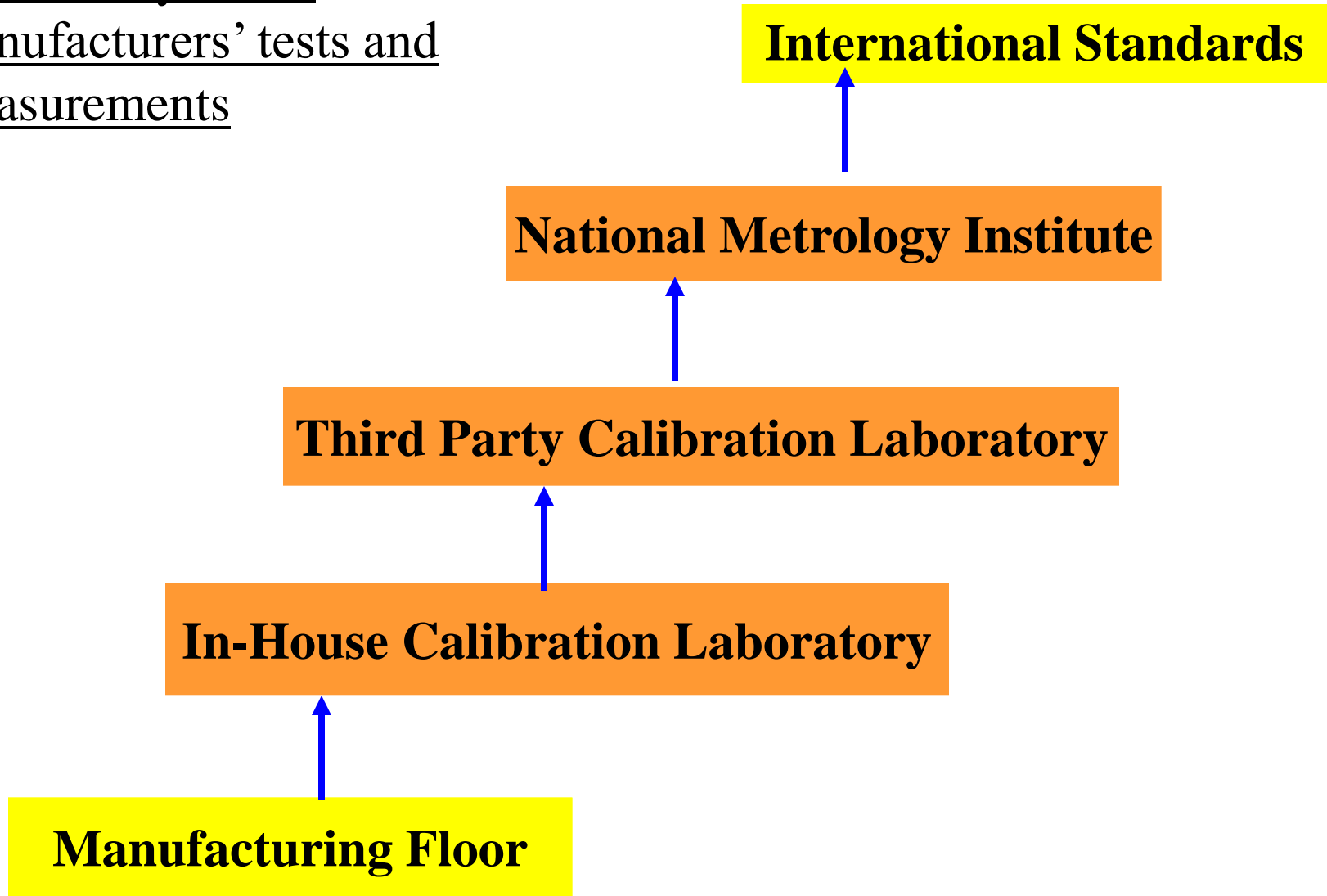
# Calibration chain

- How can we be sure that length standard of laboratory A is accurate?
- This is done through an unbroken chain of comparisons
- We will see this chain in the succeeding slides.

# Calibration

Calibration is essentially the comparison, under specified conditions, with a higher standard, which is traceable to a national or international standard, or an acceptable alternative.

Traceability of the  
manufacturers' tests and  
measurements



# National Measurement System Hierarchical Structure

**NMI**

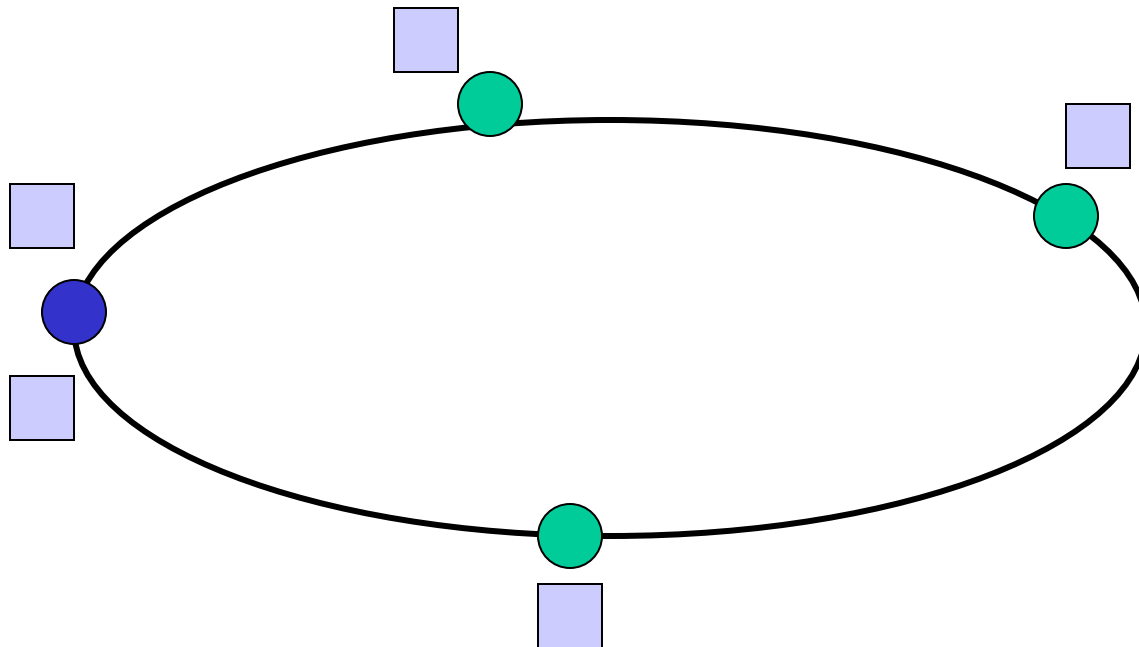
**Commercial and other Third-Party Calibration  
Laboratories**

**In-house calibration laboratories of instrument users**

**Measuring instruments users: hospitals, R&D, schools,  
manufacturers, traders, service providers**



# Proficiency Evaluation through Interlaboratory Comparisons



Laboratories

Measurement

Artifact

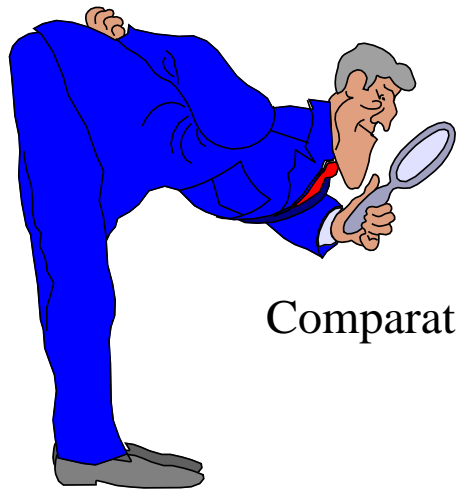
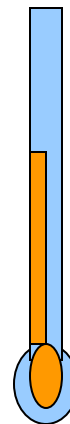
External Calibration



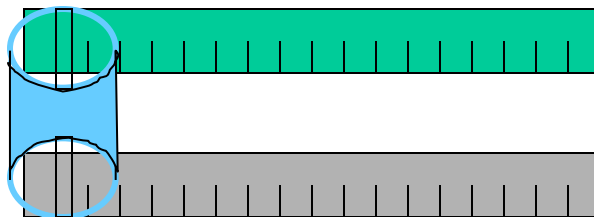
National Standard



In-house Calibration



Working Standard



Comparator

LABORATORY B

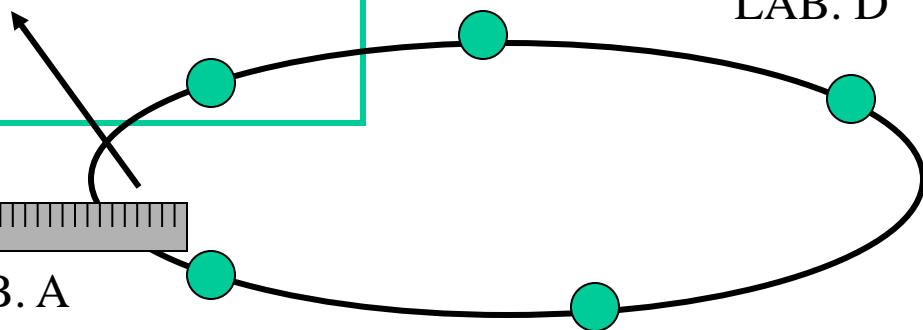
LAB. C

LAB. D

Artifact



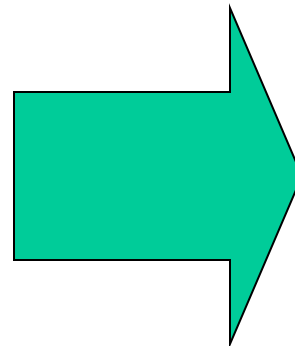
LAB. A



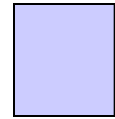
# Proficiency Evaluation through interlaboratory comparisons

One of the effective ways of evaluating the over-all competence of the laboratory

- \* Staff
- \* Working Standard
- \* Comparator
- \* Reference Standard
- \* In-house calibrations
- \* Environmental conditions



Laboratory's  
Performance



Appropriate  
Artifact

Thank you.