

***Traceability in Legal Metrology:  
the Calibration and Measurement Capabilities  
(CMCs)  
of NMI's and Designated Institutes  
and many other things ...***

**Dr. Peter Ulbig**

**Department Q.3: Legal Metrology and Technology Transfer  
Physikalisch-Technische Bundesanstalt, Germany**



## Topics:

- Transformation of the German accreditation system
- Traceability given by the legal metrology sector
- The CIPM MRA
- Transformation of the German legal metrol. system
- Accreditation/self-declaration of NMIs

## Topics:

- **Transformation of the German accreditation system**
- Traceability given by the legal metrology sector
- The CIPM MRA
- Transformation of the German legal metrol. system
- Accreditation/self-declaration of NMIs

# 1. Transformation of the German accr. system

1977



= private labs  
take over  
calibration tasks  
for industry

1992



= DKD starts  
as accreditation  
body

2007



= DKD has to  
be independent  
of PTB (due to  
EA request)

2010



= accr. body  
of DKD went  
to DAkkS

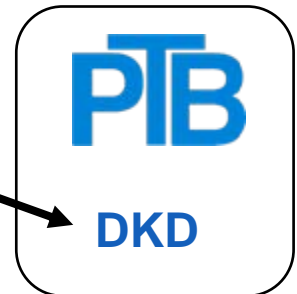
2011

**DKD**

= DKD starts  
work on techn.  
guides

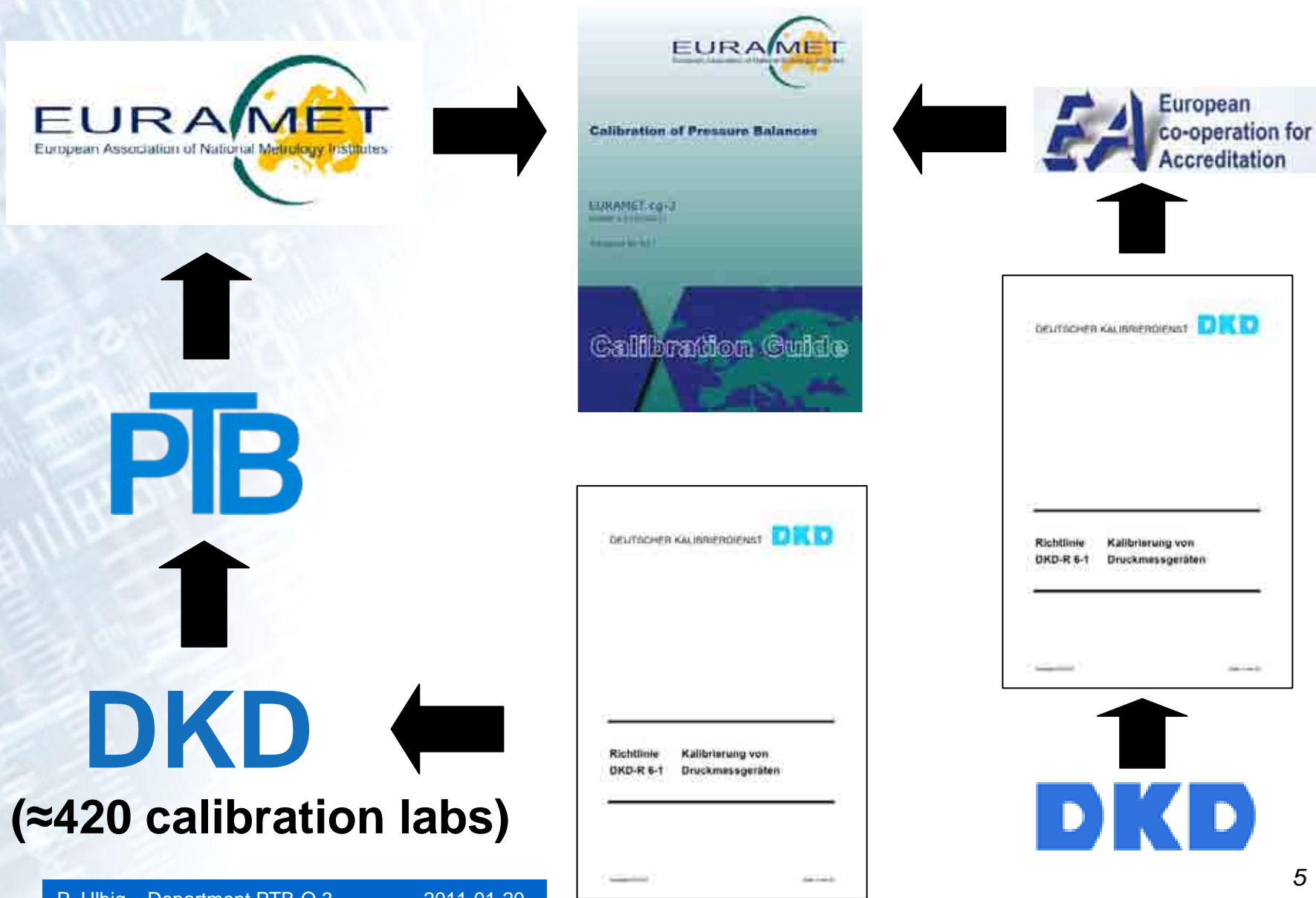
**DKD**

= DKD has  
established  
12 techn. fora



techn. forum<sub>4</sub>

# 1. Transformation of the German accr. system

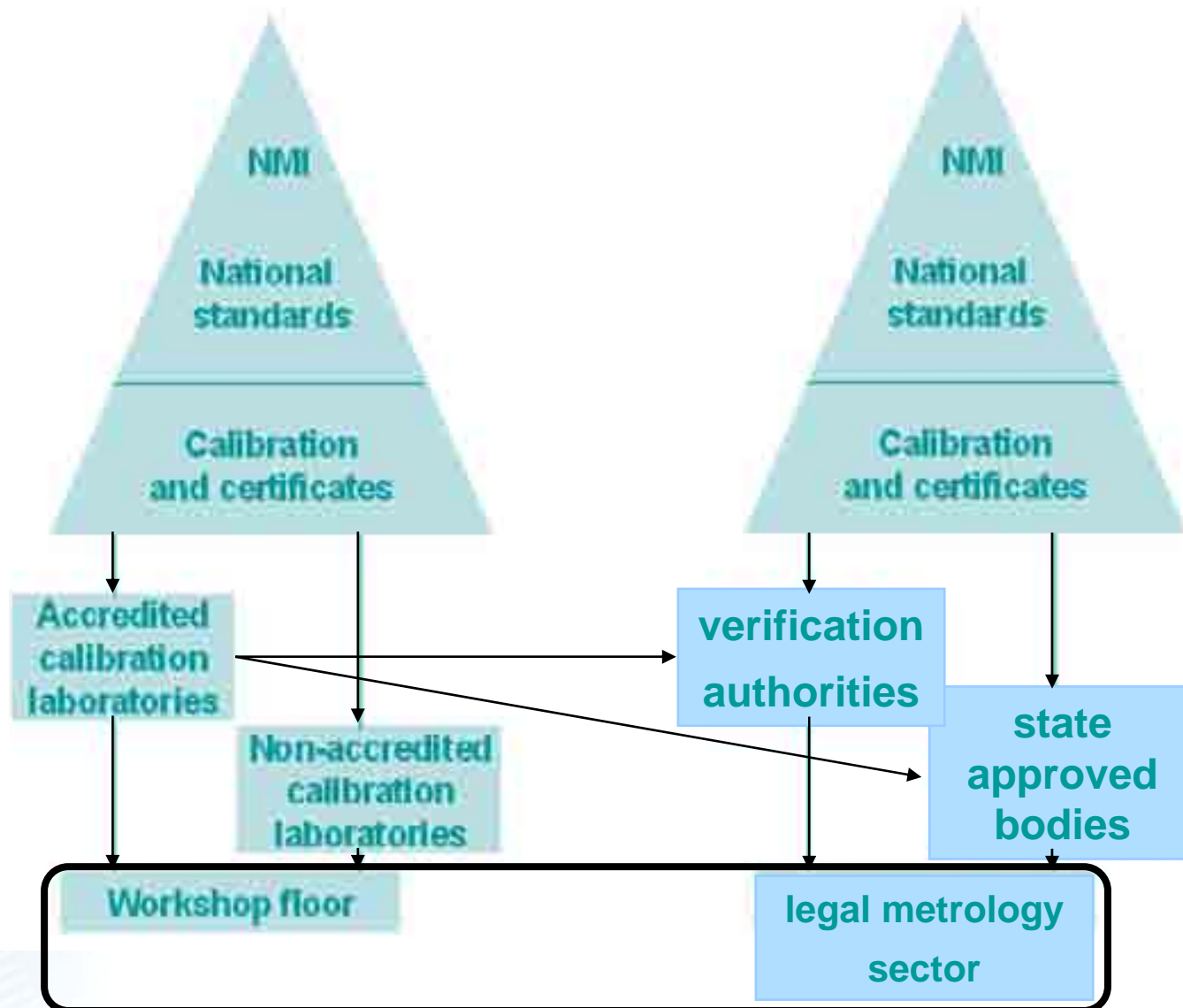


## Topics:

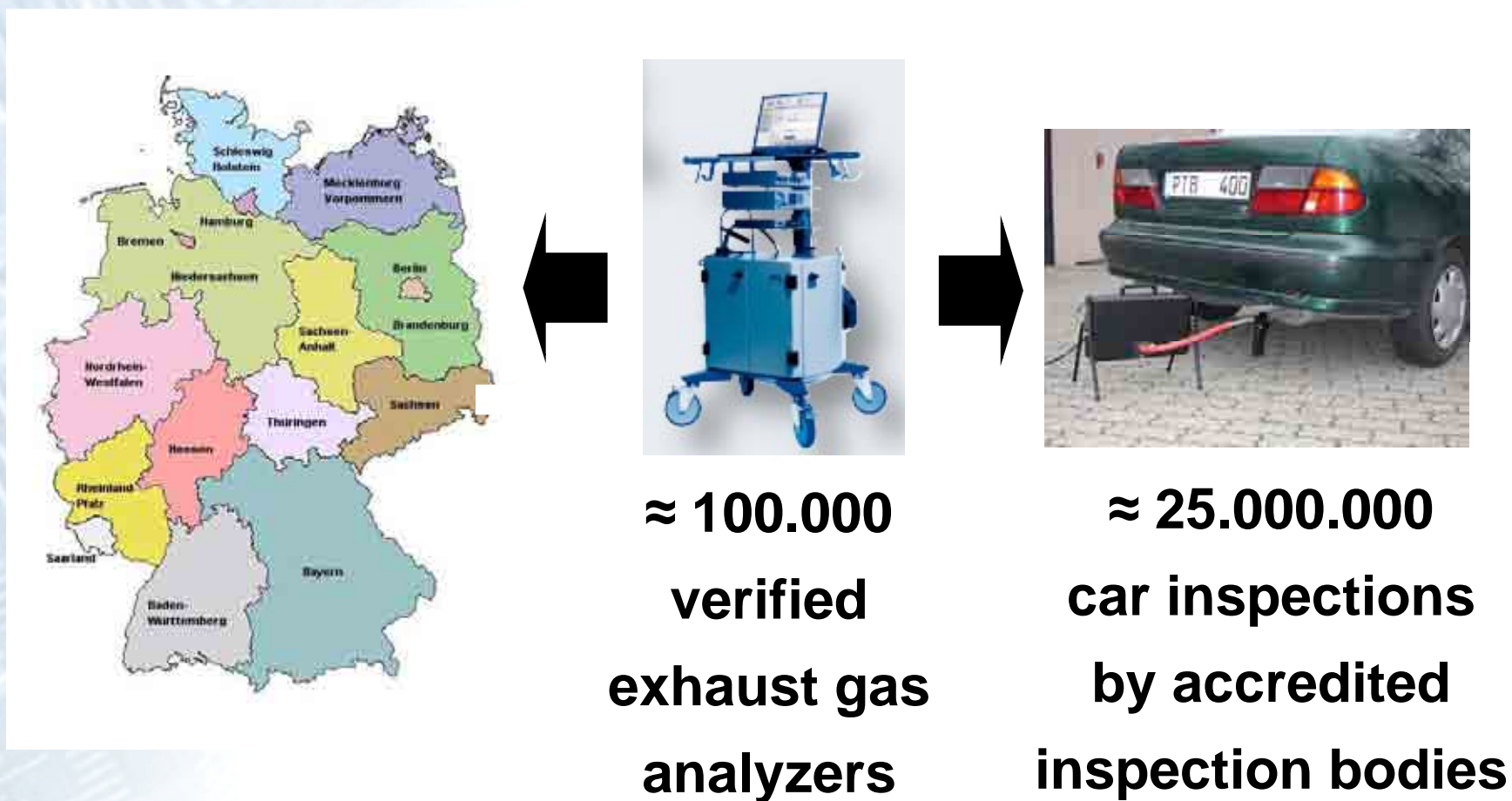
- Transformation of the German accreditation system
- **Traceability given by the legal metrology sector**
- The CIPM MRA
- Transformation of the German legal metrol. system
- Accreditation/self-declaration of NMIs



## 2. Traceability by the legal metrology sector



### Example: Accreditation of car inspection bodies





## 2. Traceability by the legal metrology sector



**Policy paper P10 (2002):**  
„Policy on Traceability of Measurement results“

**„Legal metrology frameworks are also accepted as  
a source of traceability“**



verification mark  
and certificate



**in terms of  
traceability**



calibration mark  
and certificate

## Re-evaluation of the DKD\* (2006):

**„In the opinion of the EA team  
it is not possible to accept  
verification authorities  
as a source for traceability.“**

(for accreditation processes of calibration laboratories)

- ➔ no acceptance of verification certificates after 31.12.2010
- ➔ many complaints by industry in first quarter of 2011

\*re-evaluation as accreditation body<sub>10</sub>



## 2011: new draft of ILAC policy paper P10

For equipment and reference standards that must be calibrated, the ILAC policy is that they shall be calibrated by:

1. A NMI whose service is suitable for the intended need and is covered by the CIPM MRA. Services covered by the CIPM MRA can be viewed in Appendix C of the BIPM KCDB, which includes the range and uncertainty for each listed service. Some NMIs also indicate that their service is covered by the CIPM MRA by including the BIPM logo on their calibration certificates, however the fixing of the logo is not mandatory and the BIPM KCDB remains the authoritative source of verification.
2. An accredited calibration laboratory whose services are covered by the ILAC Arrangement. This is the case if the calibration certificate contains the ILAC laboratory combined mark or the mark of the ILAC full member accreditation body. Traceability is dependent on the accreditation mark being included in the calibration certificate.
3. Another calibration laboratory neither covered by the CIPM nor the ILAC Arrangement. In these cases the accreditation body shall ensure that the accredited laboratory, who has used such service, shall provide evidence that the calibration laboratory meets the relevant criteria of ISO/IEC 17025:2005 and that the calibration certificate includes statements concerning measurement uncertainty and traceability. The evidence shall be documented and the documentation shall be assessed by the accreditation body\*. This applies also to internal calibrations.

\*proposal PTB: „...or by an NMI“

We understand both

**Calibration** and **Verification**

of measuring instruments

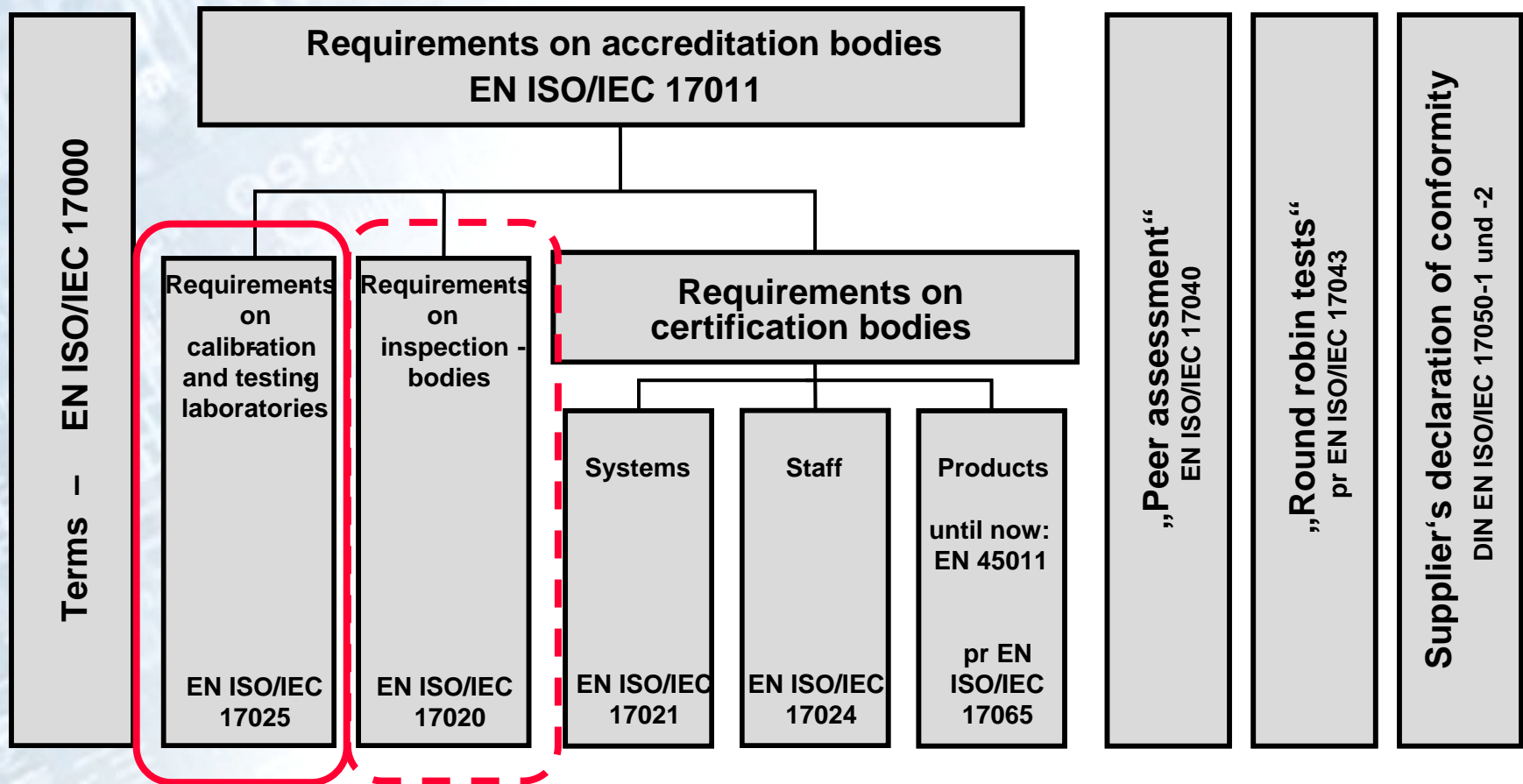
as two ways for the **dissimination of units.**

➔ Calibration labs have to demonstrate their competence

➔ So we follow the idea of ILAC to take the **relevant criteria of ISO/IEC 17025** in combination with an **assessment regarding traceability** carried out by PTB for verification authorities and corresponding state approved bodies.



# 1. Traceability by the legal metrology sector





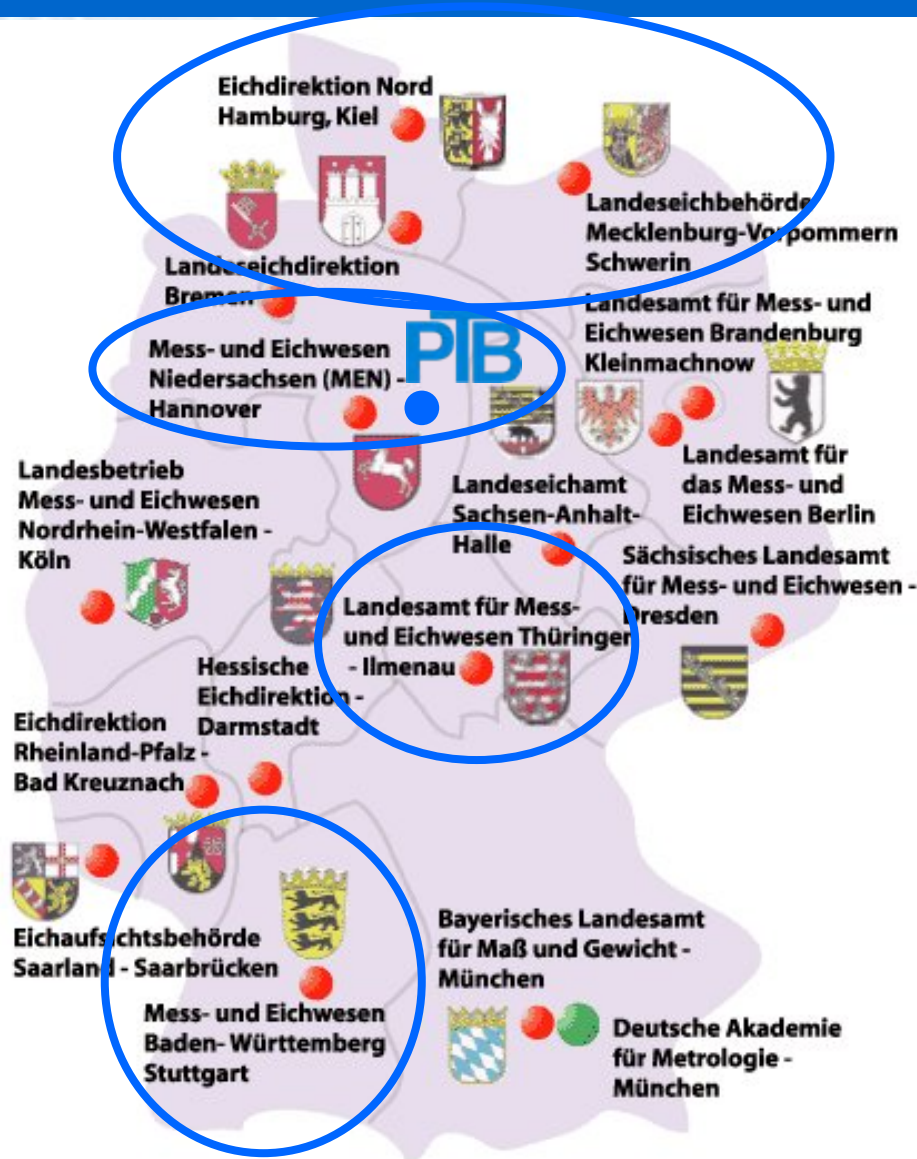
## Final solution:

### **Verification certificates are accepted, if**

- the corresponding institution is able to demonstrate the **corresponding competence in terms of the ISO/IEC 17025** for this special calibration. This competence has to be **documented and assessed (by PTB)**;
- the certificates shall give information about the **measurement uncertainty** and about the **measurement traceability**;
- the acceptance of these certificates has to be documented in the **evaluation report**.

**accepted by the advisory board of DAkkS  
on 31 August 2011; accepted by EA-team**

# 1. Traceability in the legal metrology sector



First assessment  
of the traceability  
of one verification  
authority  
on 24 August 2011

the others will  
(hopefully)  
follow soon

## Topics:

- Transformation of the German accreditation system
- Traceability given by the legal metrology sector
- **The CIPM MRA**
- Transformation of the German legal metrol. system
- Accreditation/self-declaration of NMIs

### 3. The CIPM MRA

#### Country 1



Equivalence of National  
Measurement Standards

#### Country 2



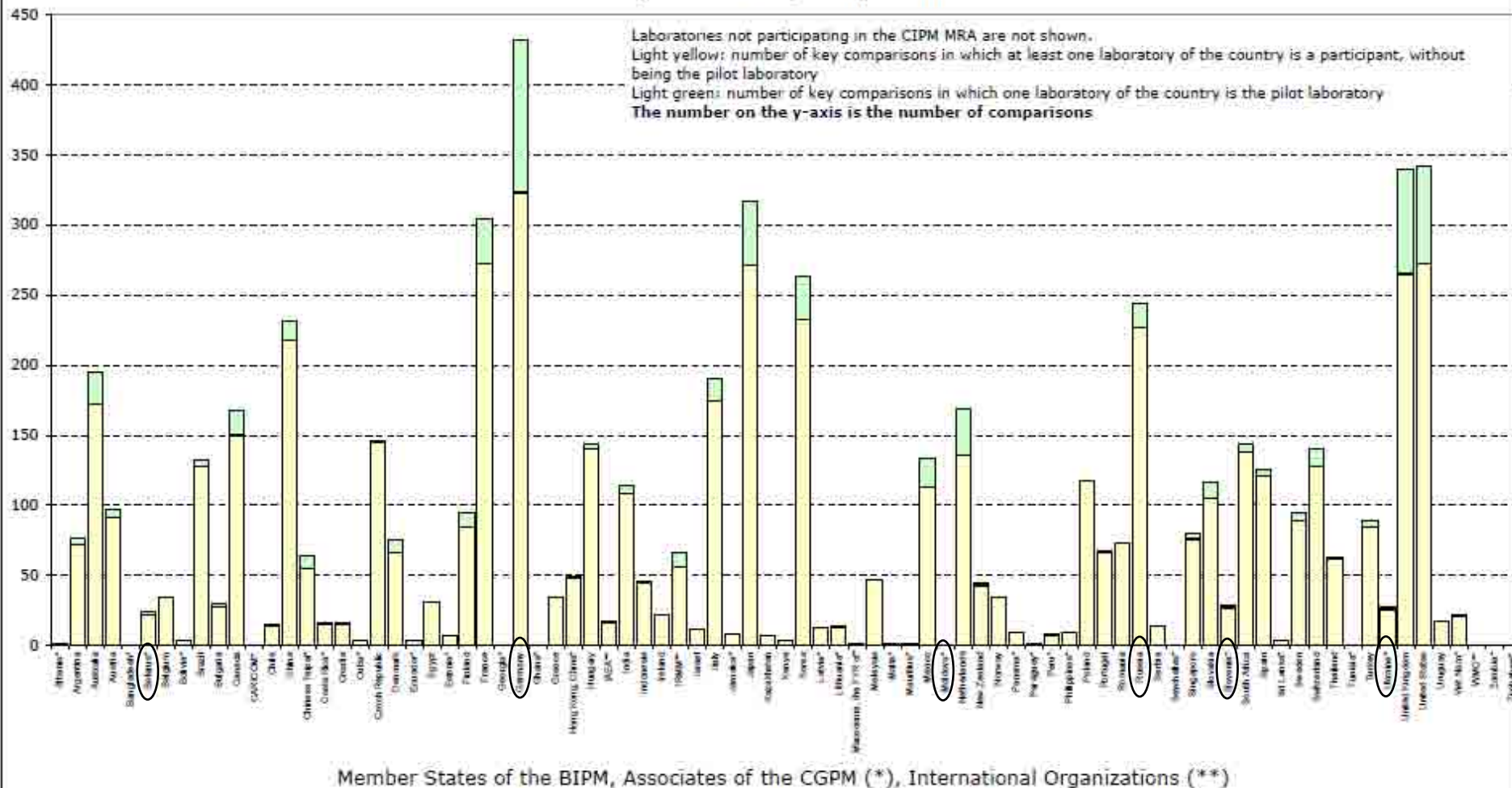
Equivalence of  
measurements



### 3. The CIPM MRA

The BIPM key comparison database, KCDB

Participation in key comparisons



Statistics based on the key comparisons recorded in the KCDB on 16 May 2011



#### **Current situation:**

- 1. many countries would like to have more CMCs**
- 2. intention to have CMCs for many more quantities (metrology in chemistry (e.g. grain moisture))**
- 3. the average time to finish one key comparison is about 4 years (sometimes more than 10 years)**
- 4. it's difficult to compare two CMCs of two countries via the Key Comparison Data Base because measurement ranges and descriptions are different**

**⇒ the whole system will collapse without changes !**

#### Consequences:

**BIPM would like to discuss the topic on the next CIPM meeting in October 2011**



**EURAMET TC-IntMet has established a working group to make proposals**



**PTB tries to finish a paper for improvement of the CIPM MRA by end of September 2011**

## Topics:

- Transformation of the German accreditation system
- Traceability given by the legal metrology sector
- The CIPM MRA
- **Transformation of the German legal metrol. system**
- Accreditation/self-declaration of NMIs

## 4. Transform. of the German leg. metrol. system



**Proposal 5 September 2011 about the future  
of the German legal metrology system**

## 4. German legal metrology system (old)

**nationally  
regulated  
measuring  
instruments**



type  
approval +  
initial  
verification

**EC-Directive NAWI**  
(EC type examination)



modules  
B,D,F,G

**EC-Directive MID**  
(EC type examination)






modules  
A to H

**conformity assessment  
carried out by notified bodies**

-----  
periodical verification



## 4. German legal metrology system (old)

	<b>EC-Directive MID</b> 	<b>new German law</b> 
<b>placing on the market, putting into use</b>	<b>europ. Articles</b> <b>Annex I (essent.)</b> <b>Conf. Ass. modules</b> <b>europ. MI Annexes</b>	<b>nat. Articles</b> <b>Annex I (essent.)</b> <b>Conf. Ass. modules</b> <b>europ. MI Annexes</b> <b>nat. MI Annexes</b> <b>market surveillance</b>
<b>use of instruments</b>		<b>periodical verification</b> <b>repair of instruments</b> <b>user surveillance</b>

**+ prepackages**

## 4. German legal metrology system (new\*)

**nationally  
regulated  
measuring  
instruments**



modules  
A to H

**carried out  
by PTB or  
private bod.**

**EC-Directive NAWI**  
(EC type examination)



modules  
B,D,F,G

**conformity assessment  
carried out by notified bodies**

**EC-Directive MID**  
(EC type examination)



modules  
A to H

## 4. German legal metrology system (new\*)

**nationally  
regulated  
measuring  
instruments**



placing on the market/  
putting into use

modules

A to H

**carried out by:**

**PTB**

**private bod.**

**requirements on institutions:**

**peer review (notified bodies)**

**accreditation (17025 + x)**

## 4. German legal metrology system (new\*)

**nationally  
regulated  
measuring  
instruments**



**EC-Directive NAWI**  
(EC type examination)



**EC-Directive MID**  
(EC type examination)



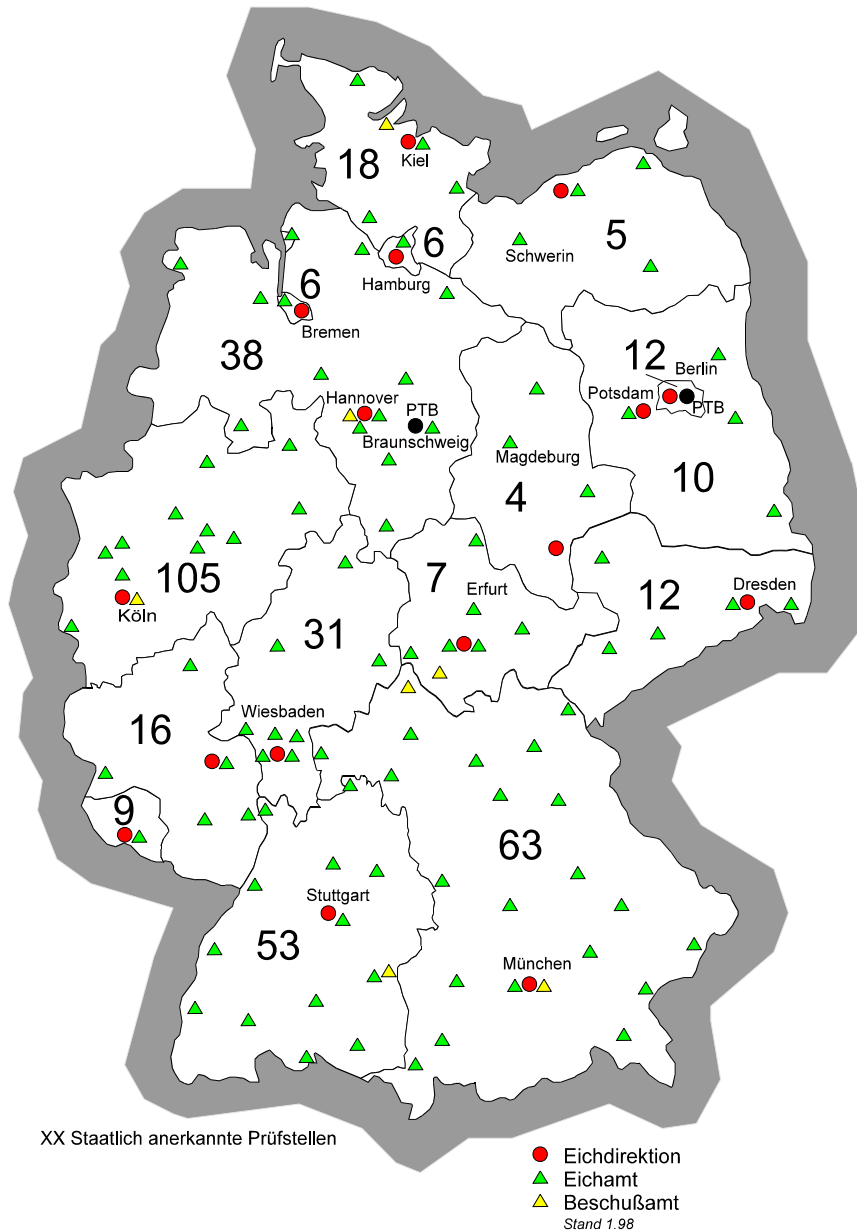
**periodical verification**

**carried out by:**  
**authorities**

**requirements on institutions:**

**state appr. bodies** → **peer review (authorities)**  
→ **accreditation (17025 + Nom.)**

## 4. German legal metrology system



**71 verification  
offices**  
(remain constant)

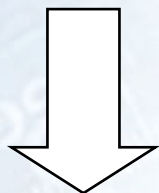
**332 state approved  
testing services**  
(probably reduced)  
(114 for electr. meters,  
100 for gas meters,  
79 for water meters,  
39 for heat meters)



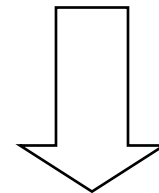
## 4. German legal metrology system

71 verification offices

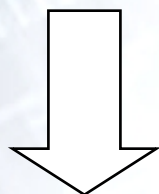
332 **(150)** state approved bodies



1450 employees

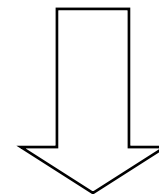


2300 **(2000)** employees



1.5 million verifications  
(about 4 million instruments)

≈ 8 %



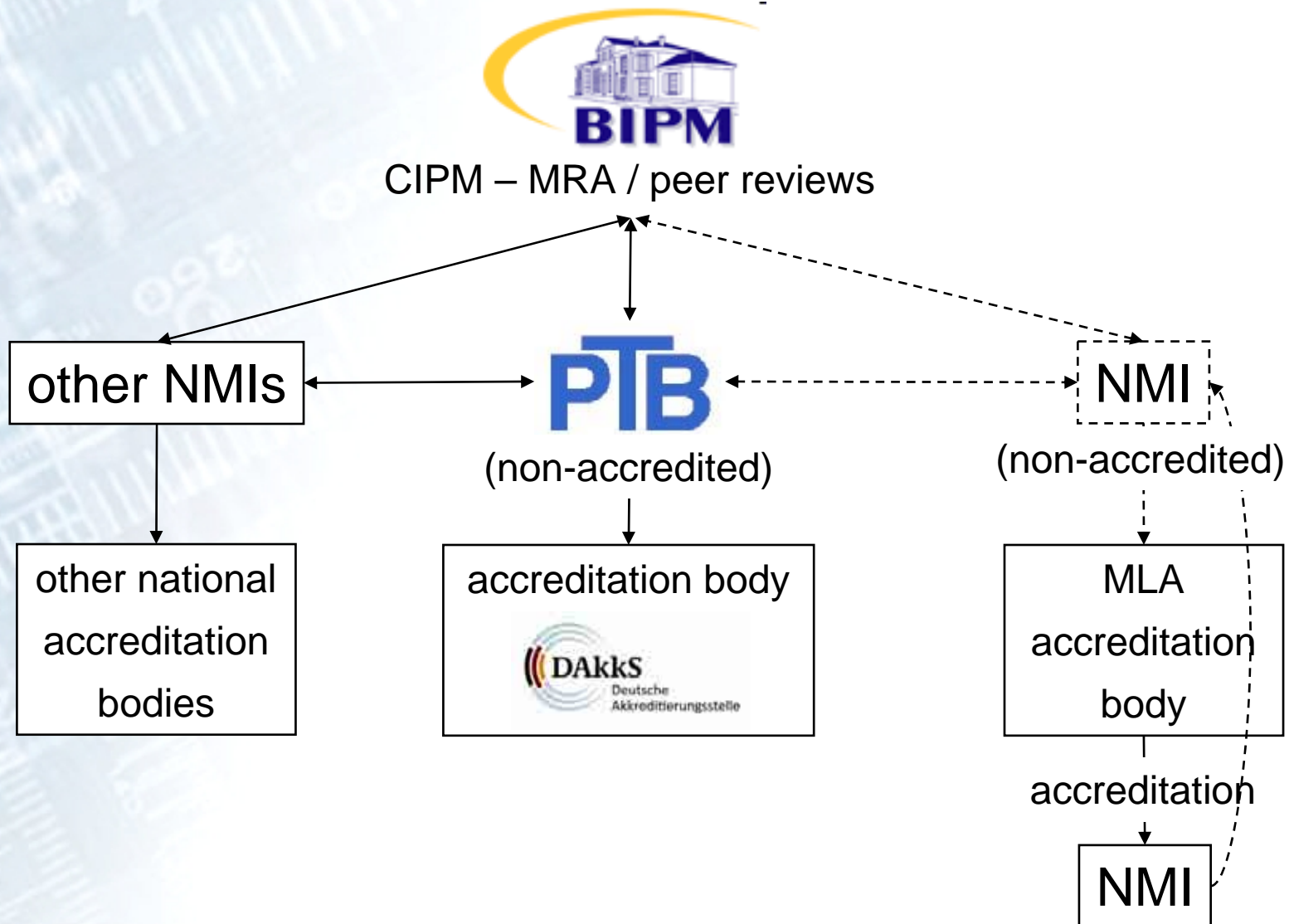
15.3 million verifications  
(104 million instruments)

≈ 92 %

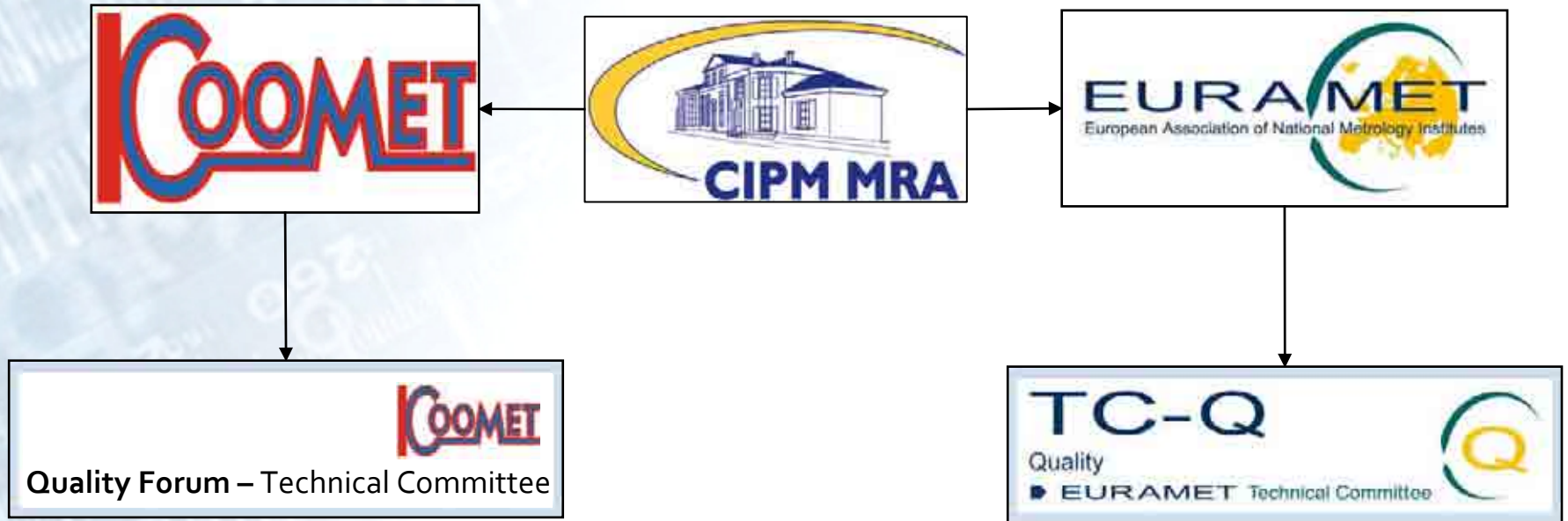
## Topics:

- Transformation of the German accreditation system
- Traceability given by the legal metrology sector
- The CIPM MRA
- Transformation of the German legal metrol. system
- **Accreditation/self-declaration of NMIs**

## 5. Accreditation/self-declaration of NMIs



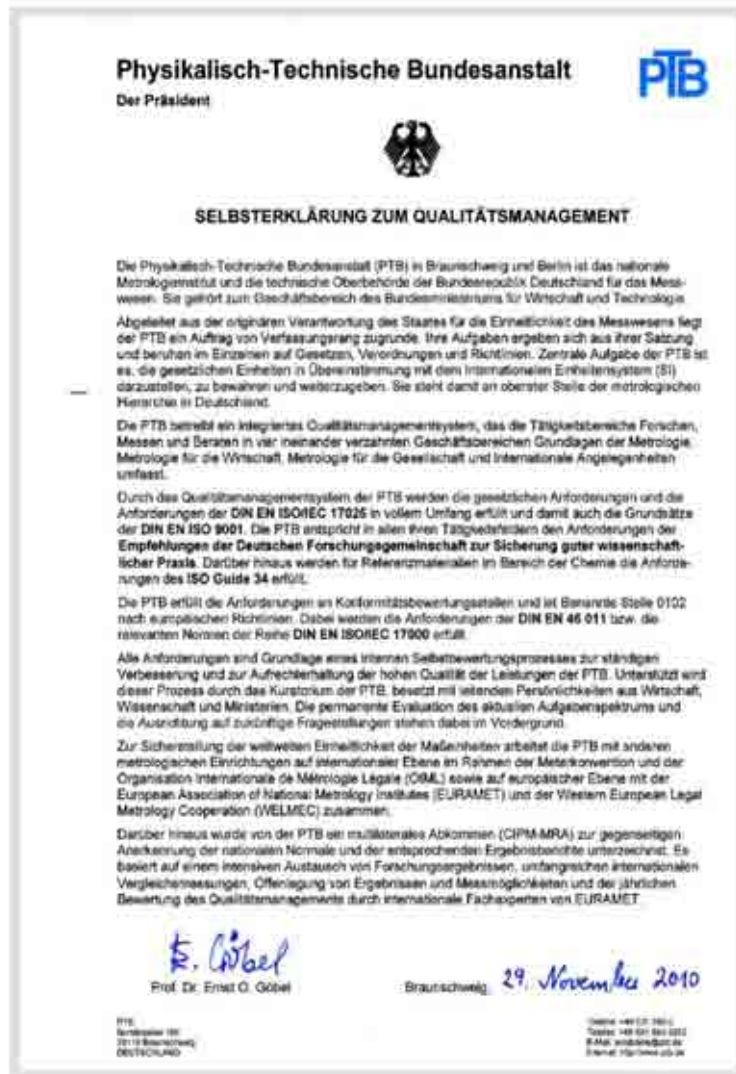
## 5. Accreditation/self-declaration of NMIs



**≈ 50 % self-declaration**  
**50 % accredited**

### Tasks of a TC-Quality:

- asking how an NMI's QS is implemented
  - doing QS review by peers
- } according to CIPM MRA



### Self declaration concerning quality management:

- signed by the President of PTB on 29 November 2010
- fulfillment of all requirements of ISO/IEC 17025
- fulfillment of the basic principles of ISO 9001
- fulfillment of ISO GUIDE 34 for reference materials
- note on CIPM MRA
- to be found on [www.ptb.de](http://www.ptb.de)