



European landscape on traceability in the field of Electricity-Magnetism

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• Motivations

- What are the present traceability links between NMIs and how are they changing with time, *i.e.* since 2004 ?
 - ⇒ How is EURAMET TC-EM progressing ?
- A contribution for the analysis on the strong points / weak points of EURAMET organization

• Data

- CMC tables
- Traceability project forms

European landscape on traceability in EM

- 27/32 NMIs have declared CMCs (they were 19 before 2004)
- 72 traceability links between NMIs for services covered by CMCs
 - 22% over the 12 categories and the 27 NMIs
 - 14 European NMIs are identified as traceability sources for the other NMIs (Only 7 before 2004)
 - 4 laboratories outside EURAMET provide traceability for EURAMET NMIs (6 before 2004)
- 7 traceability projects among which 3 are for services not covered by CMCs

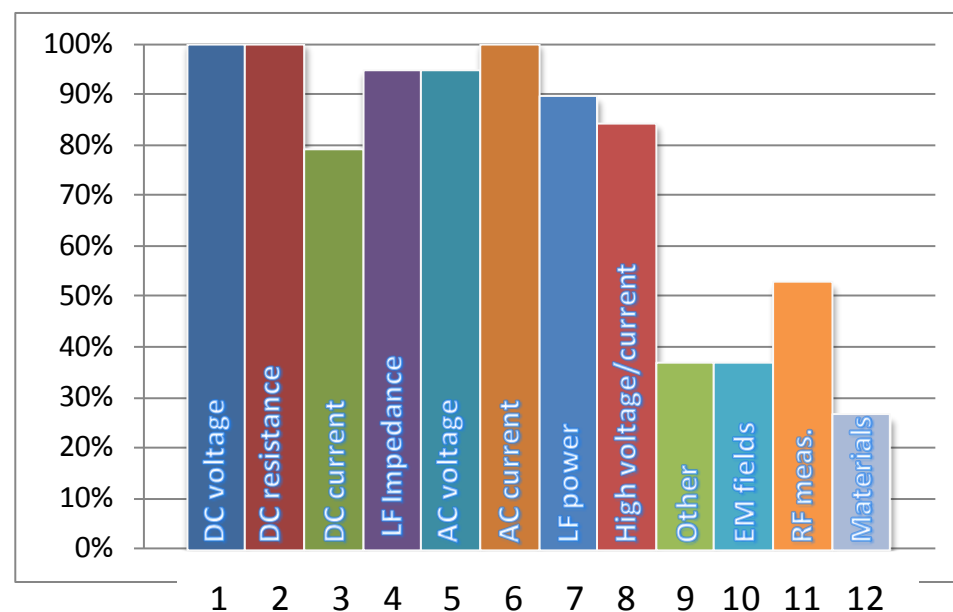
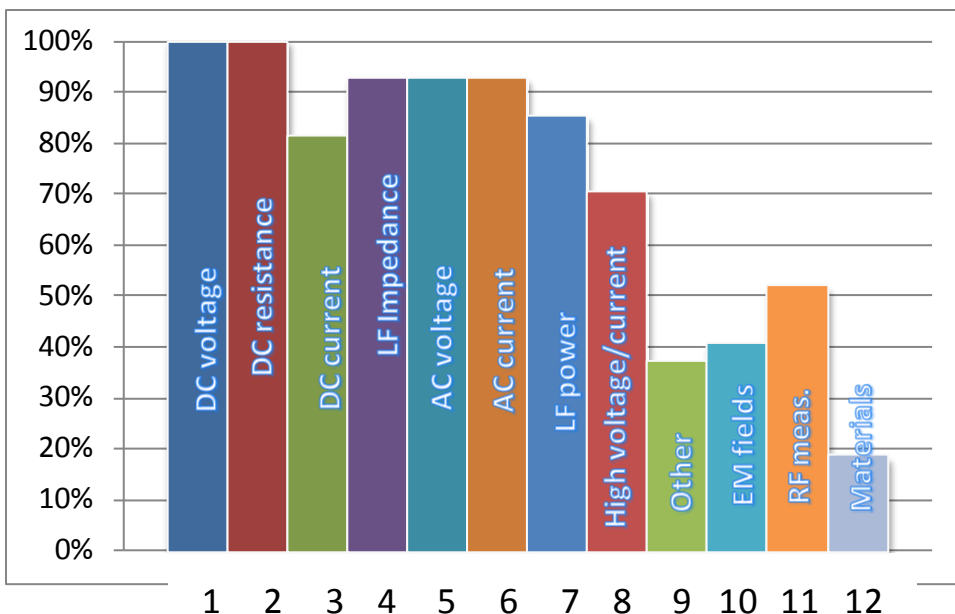
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- Percentage of NMIs declaring CMCs per category

2012
(25 NMIs)

Rather similar !

< 2004
(19 NMIs)

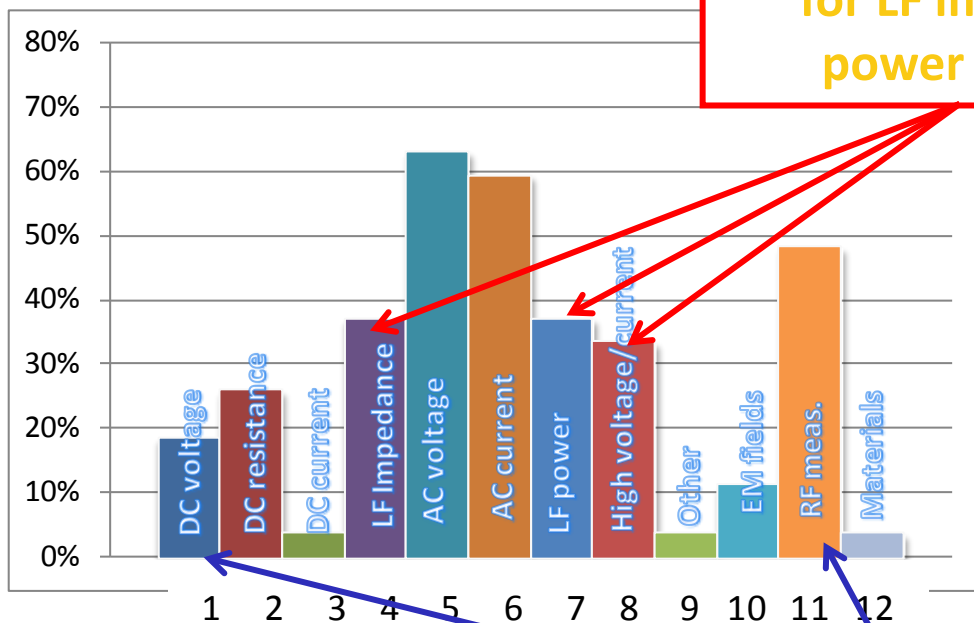


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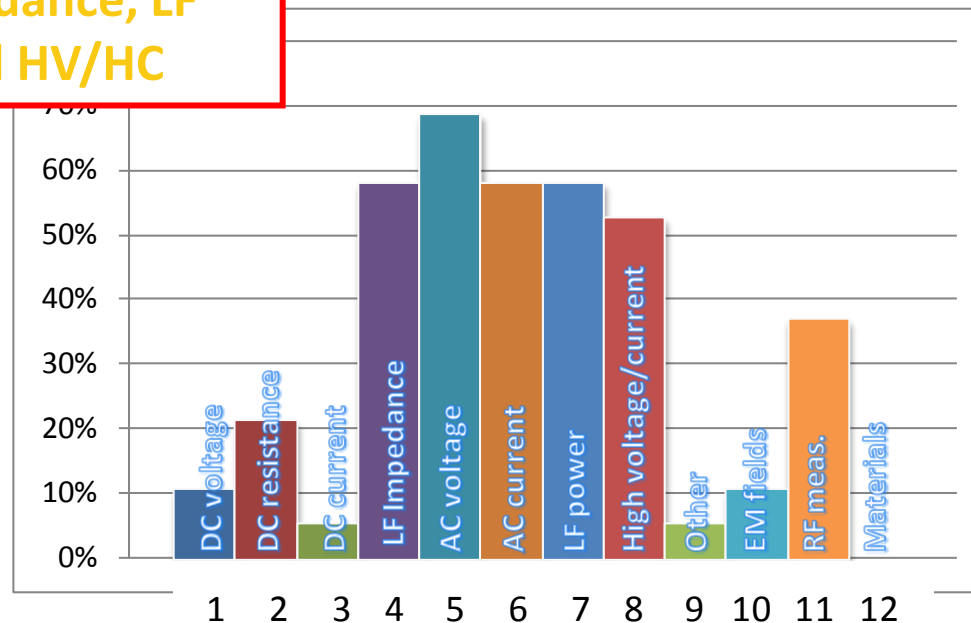
- Percentage of NMIs whose the traceability is partly provided by another EURAMET NMI

2012
(25 NMIs)

More « autonomy »
for LF impedance, LF
power and HV/HC



< 2004
(19 NMIs)



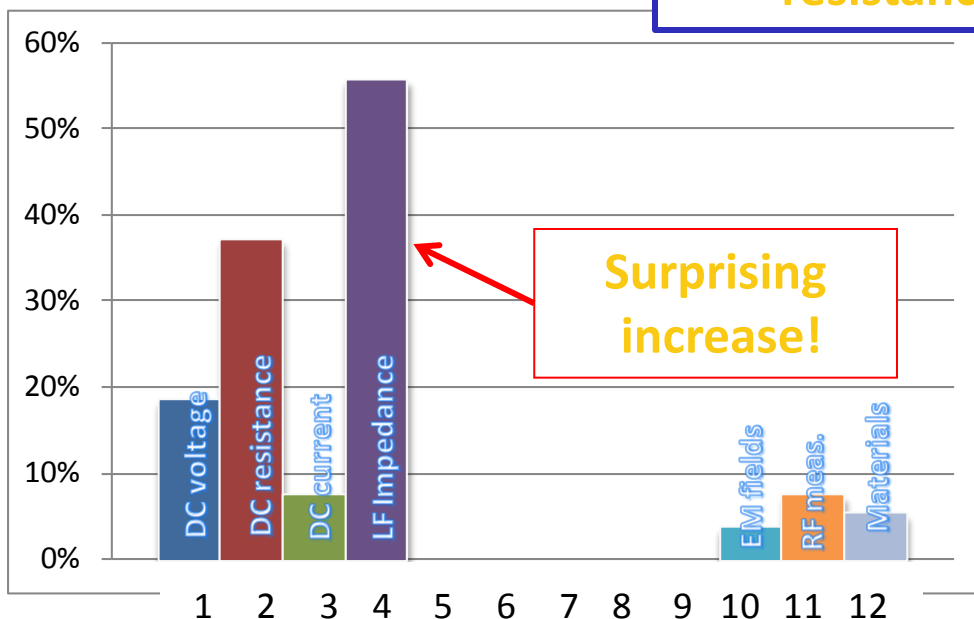
Good trends for RF measurements
and DC voltage

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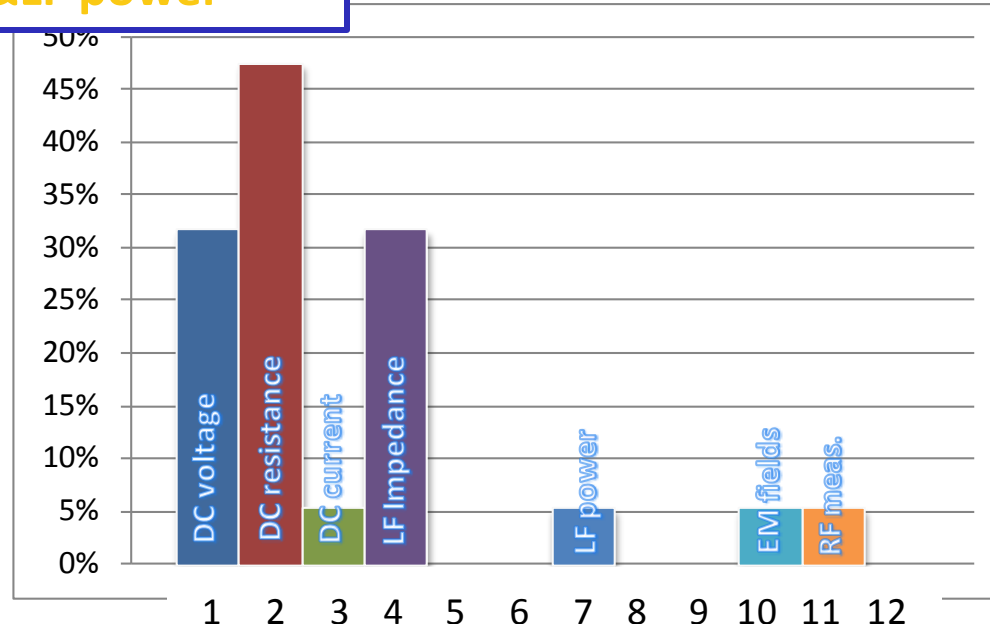
- Percentage of NMIs whose the traceability is partly provided by another institute outside EURAMET (BIPM + other RMOs)

2012
(25 NMIs)

Good progress for DC voltage,
resistance & LF power



< 2004
(19 NMIs)



European landscape on traceability in EM from CMC tables

Before 2004

Traceability :

fully insured



partly from
EURAMET Lab



partly from non
EURAMET Lab



No CMC



Country (NMI)	1	2	3	4	5	6	7	8	9	10	11	12
Albania (DPM)												
Austria (BEV)		BIPM			SP, PTB	PTB	PTB	PTB				
Belgium (SMD)	BIPM	BIPM		NPL BIPM, NIST	NPL, PTB	NPL	NRC					
Bosnia-Herzegovina (IMBiH)												
Bulgaria (NCM)												
Croatia (HMI/FER-PEL)												
Czech Republic (CMI)	BIPM	LNE BIPM		BIPM, VNIIM	PTB	NPL	PTB			PTB VNIIM	PTB	
Denmark (DFM)	PTB (freq.)	BIPM		NPL	PTB	PTB, SP	PTB	SP			NPL	
Estonia (Metroserf)												
Finland (MIKES)				NPL, SP	PTB, SP	SP	PTB	SP				
France (LNE)							PTB				NPL	
FYR (Macedonia)												
Germany (PTB)											NIST	
Greece (EIM)												
Hungary (MKEH)	BIPM	METAS BIPM		PTB	NPL, PTB, SP	NPL	PTB	PTB			LNE	
Ireland (NSAI NML)	BIPM	BIPM		NPL	PTB, NPL				NPL			
Italy (INRIM)												
Latvia (LATMB)												
Lithuania (VMT/FTMC)												
Netherlands (VSL)				BIPM				PTB				
Norway (JV)		BIPM			PTB	PTB	PTB					
Poland (GUM)	Fluke Europe	BIPM, Fluke Europe	Fluke Europe	LNE, NPL, PTB QinetiQ, BIPM	NPL	NPL	PTB	PTB				
Portugal (IPQ)	BIPM	BIPM		PTB	PTB	PTB						
Romania (INM)												
Serbia (DMDM)												
Slovak Republic (SMU)												
Slovenia (MIRS/SIQ)	VSL	VSL	VSL	INRIM, NPL QinetiQ	SP	SP	VSL	VSL			IRIM NPL PTB VSL QinetiQ	
Spain (CEM)				PTB NIST				PTB				
Sweden (SP)				NPL	PTB			PTB		VSL	NPL, VSL	
Switzerland (METAS)				NPL	PTB	SP	NPL	PTB			LNE NPL PTB VS NIST	
Turkey (UME)												
United Kingdom (NPL)												

European landscape on traceability in EM from CMC tables

2012

Traceability :

fully insured



partly from
EURAMET Lab



partly from non
EURAMET Lab



No CMC



Country (NMI)	1	2	3	4	5	6	7	8	9	10	11	12
Albania (DPM)												
Austria (BEV)		BIPM			SP, PTB	PTB	PTB	PTB				
Belgium (SMD)	VSL BIPM, FLUKE	METAS, PTB BIPM		NPL, PTB BIPM, NIST	NPL, PTB		PTB					
Bosnia-Herzegovina (IMBiH)												
Bulgaria (NCM)	BIPM			PTB BIPM	BEV, VSL, SP	PTB	PTB	NPL				
Croatia (HMI/FER-PEL)		PTB										
Czech Republic (CMI)		BIPM		BIPM, VNIIM	PTB	NPL	PTB			PTB VNIIM	PTB	
Denmark (DFM)		BIPM		NPL		SP					METAS	
Estonia (Metroserf)												
Finland (MIKES)			BIPM	BIPM	PTB, SP	SP					NPL	
France (LNE)											NPL	
FYR (Macedonia)												
Germany (PTB)											NIST	
Greece (EIM)				BIPM	PTB, NPL		PTB				METAS	
Hungary (MKEH)	BEV	BIPM		GUM BIPM	PTB	NPL	PTB	PTB				
Ireland (NSAI NML)	METAS BIPM	METAS BIPM		NPL BIPM	CMI	JV						
Italy (INRIM)											NIST	
Latvia (LATMB)												
Lithuania (VMT/FTMC)		CMI										
Netherlands (VSL)				BIPM		NPL, PTB		PTB			METAS, NPL	
Norway (JV)					LNE, PTB	PTB	PTB					
Poland (GUM)				LNE, NPL, PTB BIPM	PTB	PTB		PTB			NPL, PTB NIST	
Portugal (IPQ)		BIPM		BIPM	PTB	PTB						
Romania (INM)	UME BIPM	METAS BIPM	UME	NPL, PTB BIPM	PTB, UME	UME	PTB					
Serbia (DMDM)	BIPM	BIPM	BIPM	CMI, SP	METAS	METAS, PTB, SP	PTB		CMI, SP			
Slovak Republic (SMU)		BIPM		BIPM	PTB						CMI	
Slovenia (MIRS/SIQ)	VSL	PTB		NRIM, LNE, NPL VNIIM	PTB, SP	BEV, SP	VSL	VSL			METAS, NPL	
Spain (CEM)				BIPM	PTB	PTB						
Sweden (SP)				NPL	NPL, PTB, VSL			PTB		VSL	METAS, NPL, PTR, VSL	
Switzerland (METAS)					PTB	BEV		PTB			NPL	
Turkey (UME)				BIPM				MIKES, MKEH, PTB		NPL, PTB	NPL, PTB, VSL	NPL, PTB NIST
United Kingdom (NPL)												

European landscape on traceability in EM

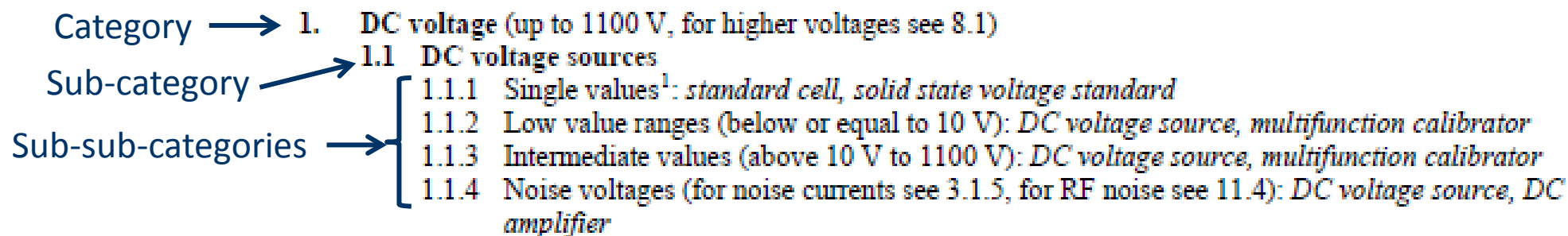
- In EM, large spectrum of quantities, parameters, instruments and artefact

⇒ classification of services in :

12 categories, **49** sub-categories and **194** sub-sub-categories,

METROLOGY AREA: ELECTRICITY AND MAGNETISM

BRANCH: DC VOLTAGE, CURRENT, AND RESISTANCE



⇒ *See the landscape at the more precise level of sub-categories!*

European landscape on traceability in EM from CMC tables

- 2012, more precise view at the level of 49 subcategories

Country	1			2			3			4			5			6			7	8							9			10			11									12						
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	12.1	12.2	12.3	12.4	12.5	12.6	12.7
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DC resistance
ratios

DC current
ratios

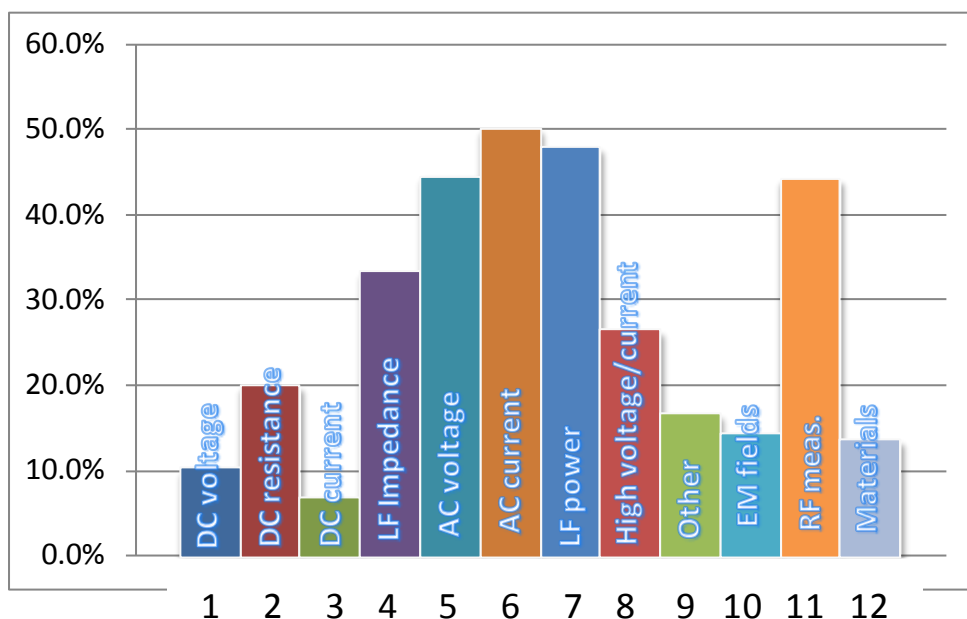
AC current ratios
up to 100 A

Lumped impedance
Dielectric properties

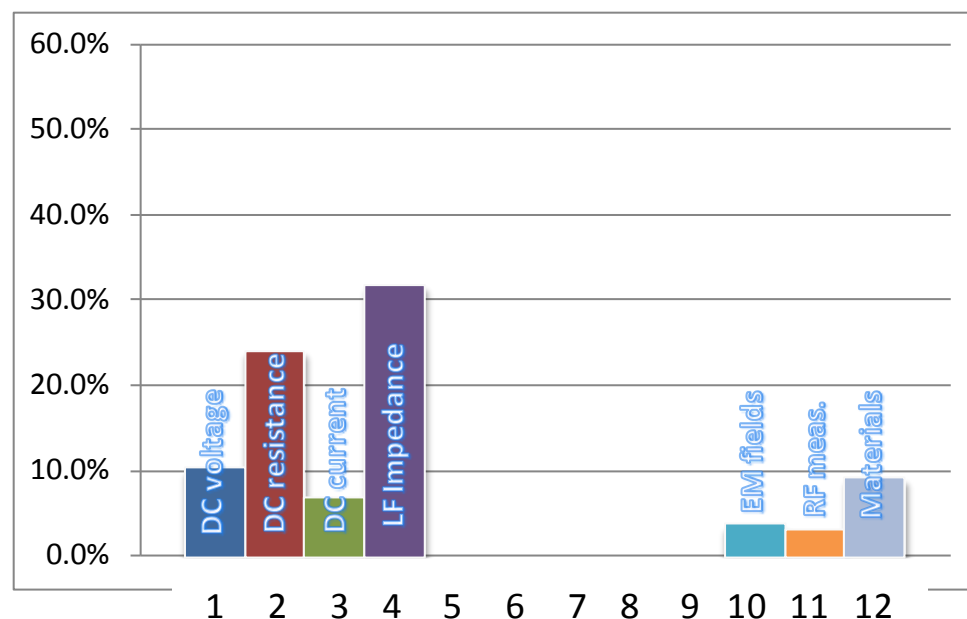
Magnetic data storage media

European landscape on traceability in EM from CMC tables in 2012

Occurrence of traceability
provided by another
EURAMET NMI

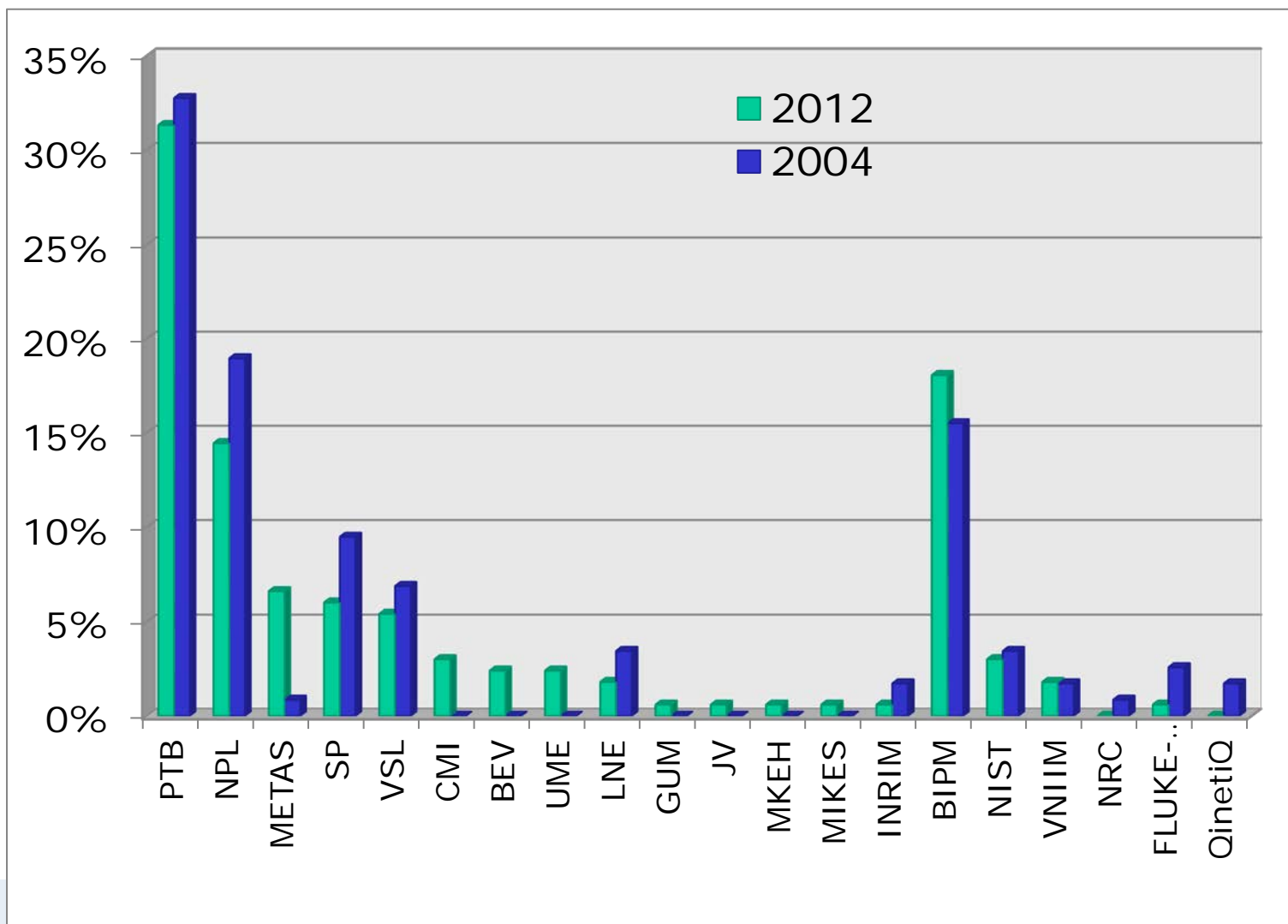


Occurrence of traceability
provided by another institute
outside EURAMET



European landscape on traceability in EM

NMIs as traceability sources for the other NMIs



• Conclusion

- Traceability links significantly exist between EURAMET NMIs.
The number is not ridiculous!
- Progress since 2004 is not so significant, and even slightly disappointing in respect with the aim of EURAMET at sharing traceability among NMIs.
 - ✓ The links **increase** for RF quantities and DC voltage
 - ✓ But significantly **decrease** for LF impedance, LF power and HV/HC
 - ✓ The number of NMIs as traceability sources within EURAMET **strongly increases**
- More « autonomy » of EURAMET
 - ✓ Traceability needs towards non EURAMET institutes **decrease**.