Report of the CCM Working Group on Hardness

Febo Menelao

20th CCM meeting, 26-27 June 2025

WG Meetings

Past meetings

- **28. September 2023 at *ASTM headquarter, West Conshohocken (Philadelphia), USA***
- **20. September 2024 at *Tsukuba International Congress Center, Tsukuba, Japan***

Next meeting

- **19. September 2025 at UNM, Paris, France**

Meetings are held in the period of the ISO TC 164 (Mechanical testing of metals) meetings

Main actions and achievements

- Report of the last comparisons and Pilot studies
- Planning the next Key comparisons
- Changes in the RMOs
  - Main changes: EURAMET TC-M a subcommittee Hardness was created
- Revision and update of CMCs
  - *Possible entries*
  - [42 to 80] HR30N(T)
  - [5 to 1000] HV
  - [30 to 3000] (HV 20 to HV 125)
  - [30 to 1000] (HV 0.01 to HV 0.2)
  - [3 to 650] (HBW 5/62.5 to HBW 5/750)
  - [10 to 93] (HR 15TW to HR 45TW)
  - [20 to 94] (HR 15N to HR 45N)
  - [40 to 100] HR
  - HB1/1 to HB2.5/187.5
  - [150 to 450] HBS(W)

Main actions and achievements

All Branches	All Services	All Sub-Services	Individual Service
Hardness	Refrenece blocks	Rockwell	see details below
		Brinell	
		Vickers	
		Knoop	
		Shore	
		IRHD	
	Indenters	Rockwell Diamond - Geometry	
		Vickers - Geometry	
		Rockwell Diamond - Indirect Verification	
		Rockwell Ball - Indirect Verification	
	Testing Machines	Rockwell - Indirect Verification	
		Brinell - Indirect Verification	
		Vickers - Indirect Verification	
		Knoop - Indirect Verification	

All Branches	All Services	All Sub-Services	Individual Service
Hardness	Rockwell	Reference blocks	see details below
		Diamond Indenter Geometry	
		Diamond Indenter - Indirect Verification	
		Ball Indenter - Indirect Verification	
		Testing machines - indirect verification	
	Brinell	Reference blocks	
		Testing machines - indirect verification	
	Vickers	Reference blocks	
		Indenter Geometry	
		Testing machines - indirect verification	
	Knoop	Reference blocks	
		Indenter Geometry	
		Testing machines - indirect verification	
	Shore	Reference blocks	
	IRHD	Reference blocks	

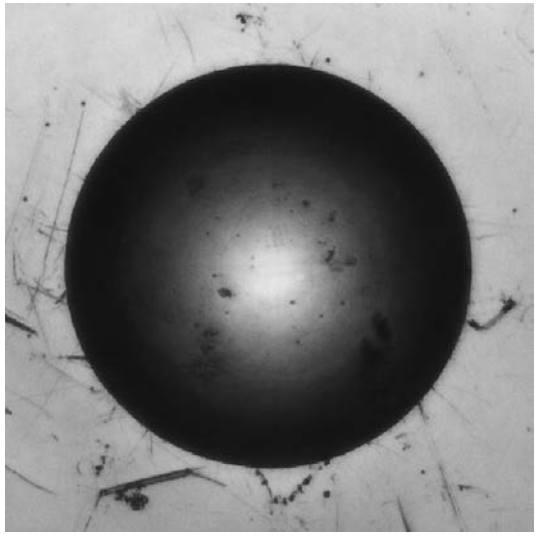
- **Then we needs aprox 180 different entries**

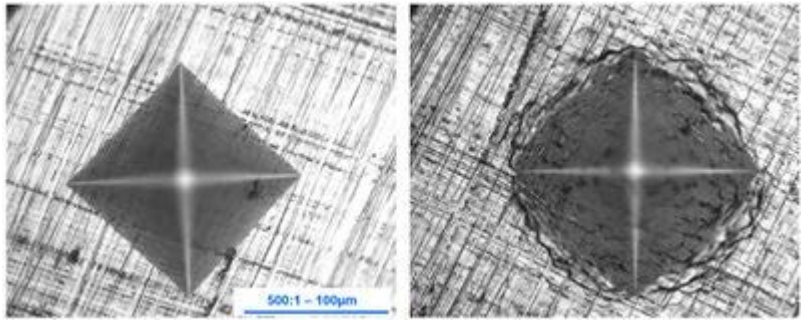
Main actions and achievements

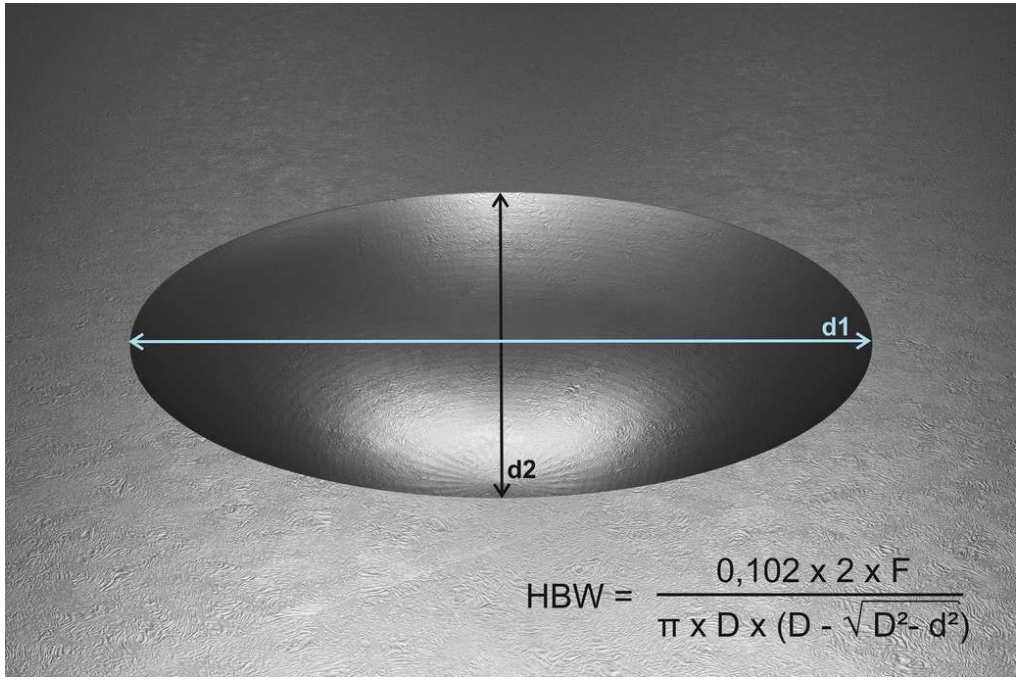
- Guidelines on the Estimation of Uncertainty in Hardness Measurements | TC-M | Version 2.0, 03/2011
  - Start to update, new calculation in uncertainties and expand to more scales
- Establishing instrumented indentation hardness testing in accordance with ISO 14577-1:2015 at NIMT Thailand
- Verifying instrumented indentation hardness testing machines according to ISO 14577-2:2015 at NIMT Thailand
- “Development of Transfer Standards for Traceability of Hardness Diamond Indenter Calibration Systems”, GULFMET.M.RD-01, supported and financed by GSO/GULFMET, on going, Cordinator is TÜBİTAK UME.
- This Project aims at production and metrological characterization of transfer standards to be used to constitute the traceability of every component of Rockwell and Vickers hardness diamond indenter calibration systems present at NMIs of the GULF countries

Progressing the state of the art

Definition of the edge of an Indent

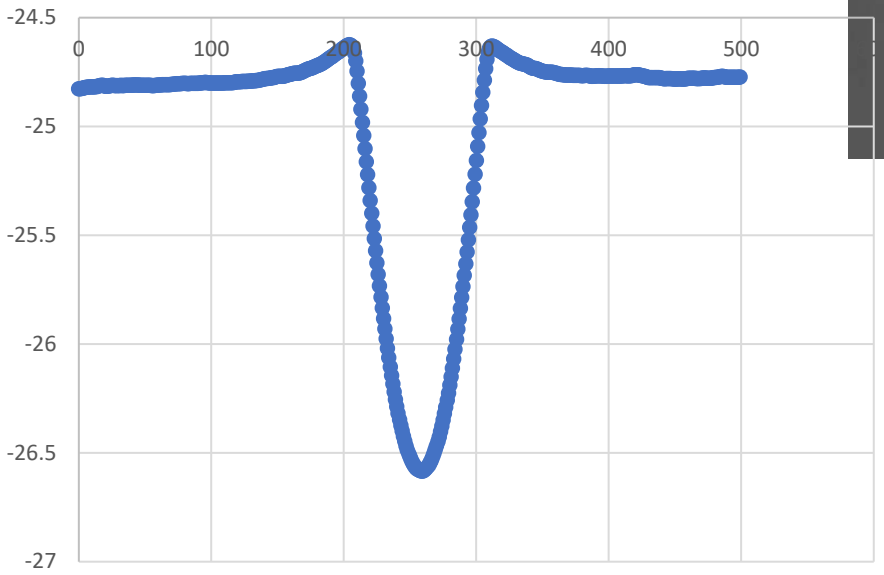


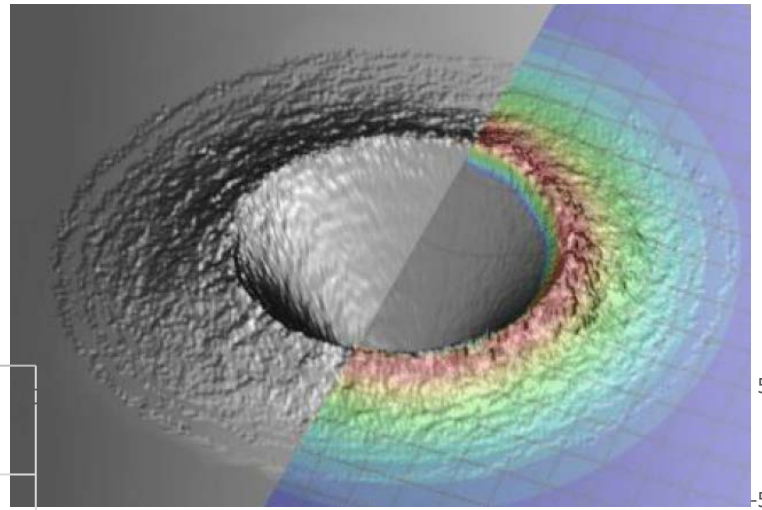


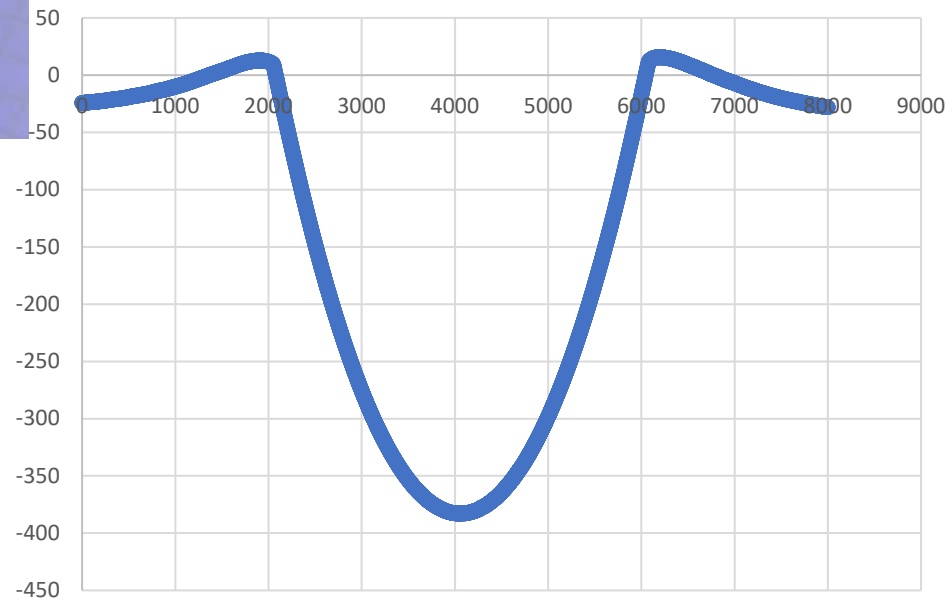


Progressing the state of the art

Definition of the edge of an Indent







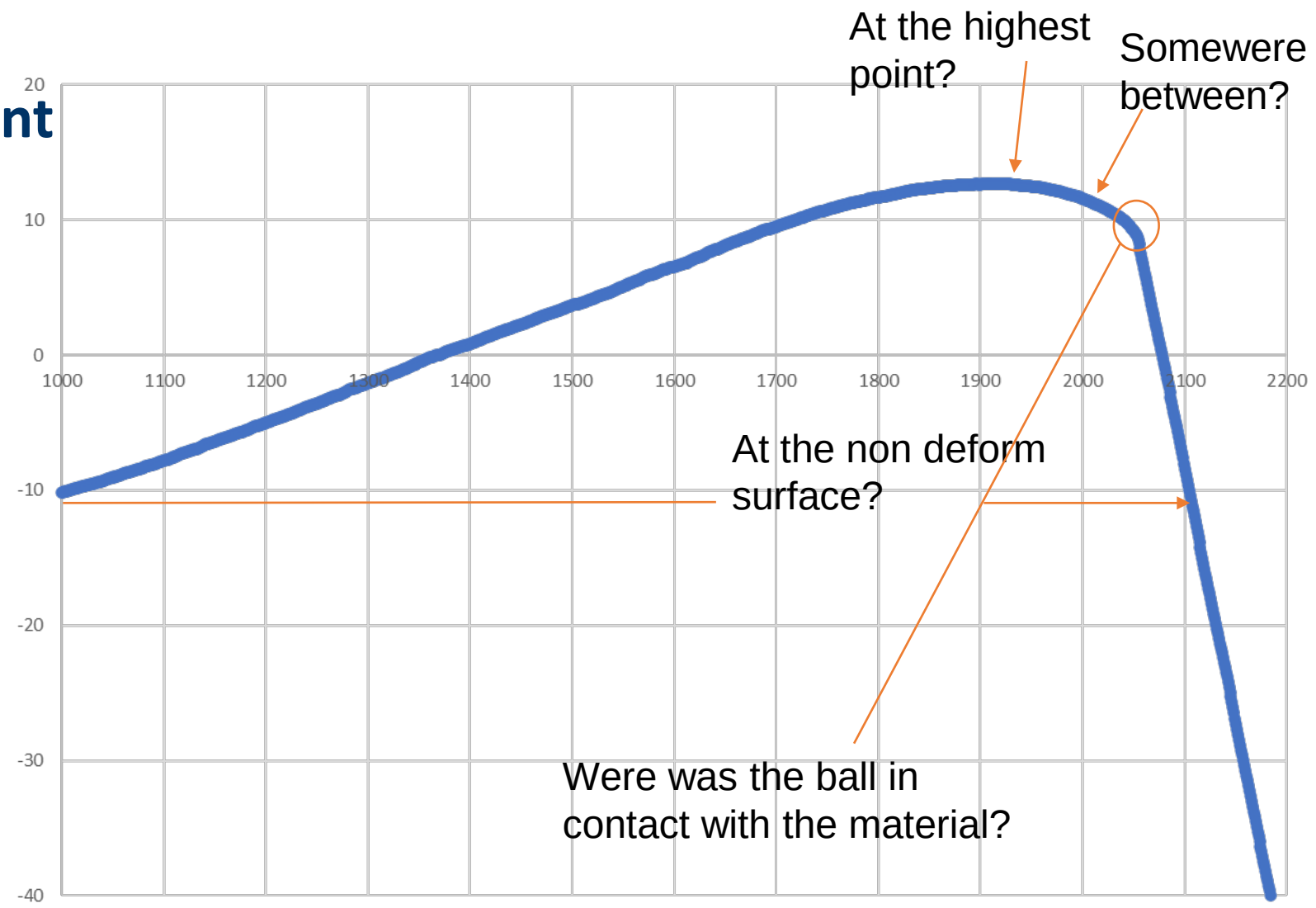
Progressing the state of the art

Were starts/ends an Indent

EURAMET Project

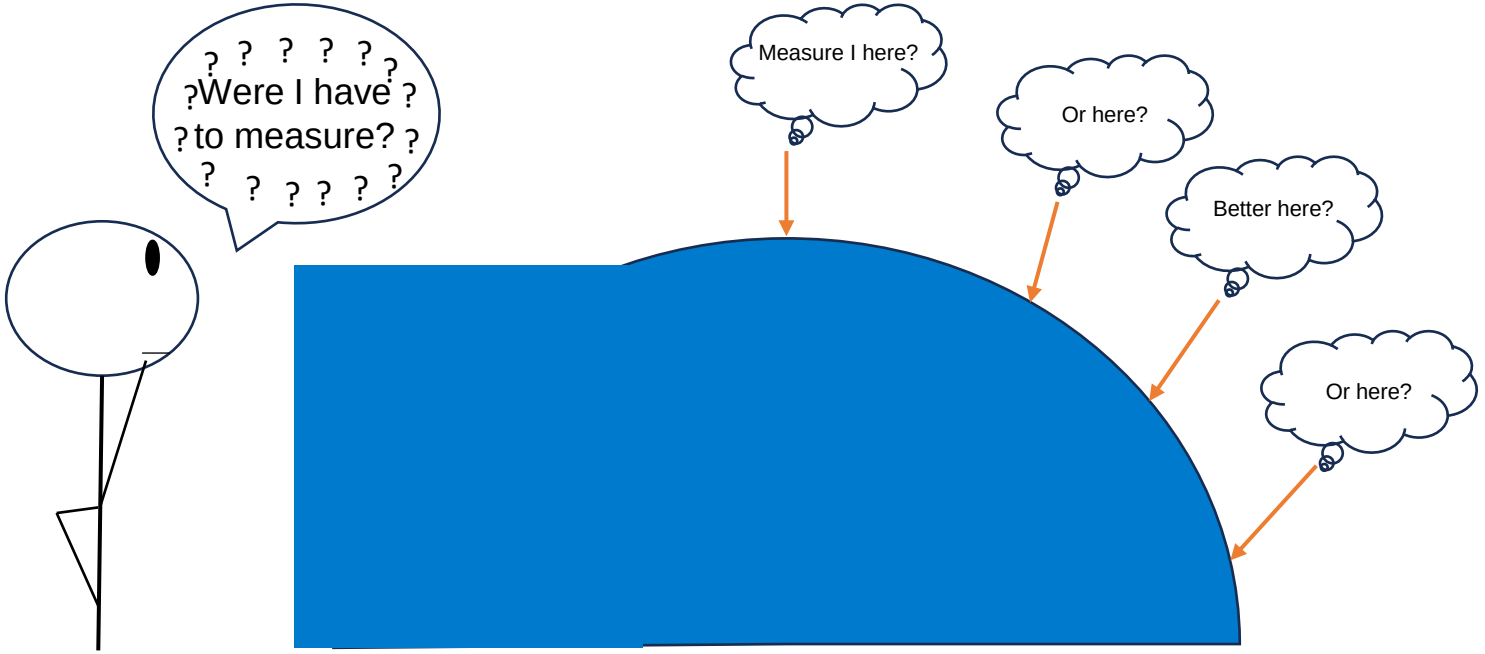
TracInd BVK-H

https://tracind-bvk-h.org



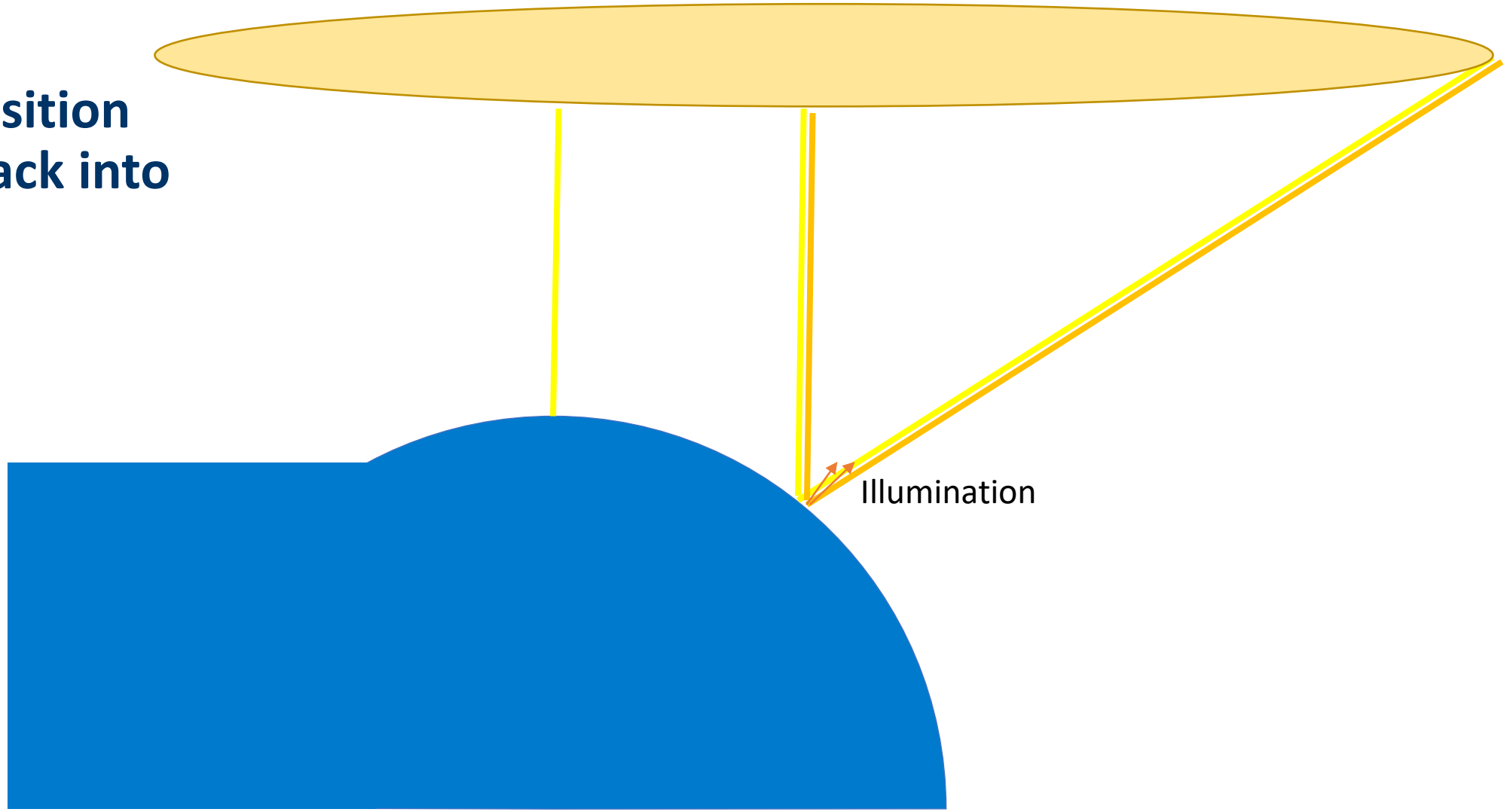
Progressing the state of the art

Were starts/ends an Indent



Progressing the state of the art

At which position I got light back into my lens?



Liaison & stakeholders

- IMEKO TC5 – Hardness Measurement
- ISO/TC 164 Mechanical testing of metals
  - ISO/TC 164/SC 3 – Hardness
- Industry
  - Manufacturers of hardness reference blocks
  - Manufacturers of hardness testing machines
  - Calibration and testing laboratories in hardness
  - Steel Industry
  - Car Industry, Aircraft & Space Travel Industry

CIPM MRA: KCs & CMCs

- **Pilot study of Leeb hardness**
  - **Scale HLD and HLG**
- **Comparison on Rockwell Hardness 30 TW (APMP.M-H2.2024)**
- **Comparison on Rockwell Hardness 30 N (APMP.M-H1.2024)**
- **Re-initiate [CCM.H-K3] Rockwell C hardness (HRC): Key Comparison**
- NEW Key Comparison for the Geometrical Measurement of the Rockwell Diamond Indenter. Are use after [CCM.H-K3] Rockwell C hardness (HRC) KC
- Rockwell N: Key Comparisons
- Brinell (HBW scales to be determined): Key Comparison
- Leeb hardness: Key Comparison
- Geometrical Measurement of the Vickers and Knoop Diamond Indenters: Pilot Studies

Program of work for the next 2 years

- Develop additional hardness test definitions for the Brinell and Rockwell hardness
- Develop unified format for reporting hardness CMCs
- Initiate new Key Comparisons
- Setting a schedule for KCs and Pilot Studies is difficult and has been varied in recent years
- Finalize the definition of an edge of an indent
- Find some sensitivity coefficient for hardness measurement (illumination, focus point, holding period, temperature)

Proposals (KCs, chairmanship, membership…)

- Change in membership
  - NIST: Change from Mr Carlos Beauchamp to Dr Ami Ahure Powell

Thank you.

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