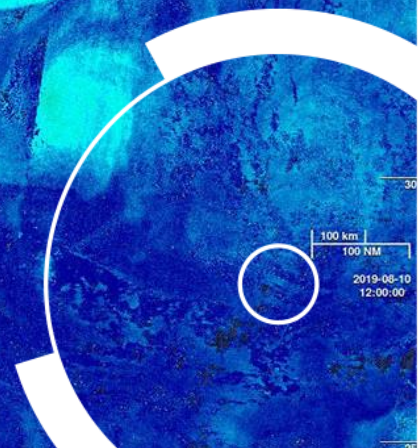


# Concluding remarks and way forward.

Juan Ignacio Gossn (EUMETSAT – Darmstadt, Germany)  
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Second FRM4SOC Workshop on Calibration and Characterisation of Ocean Colour Field Radiometers  
20 – 22 May 2025, Tartu Observatory, University of Tartu, Estonia

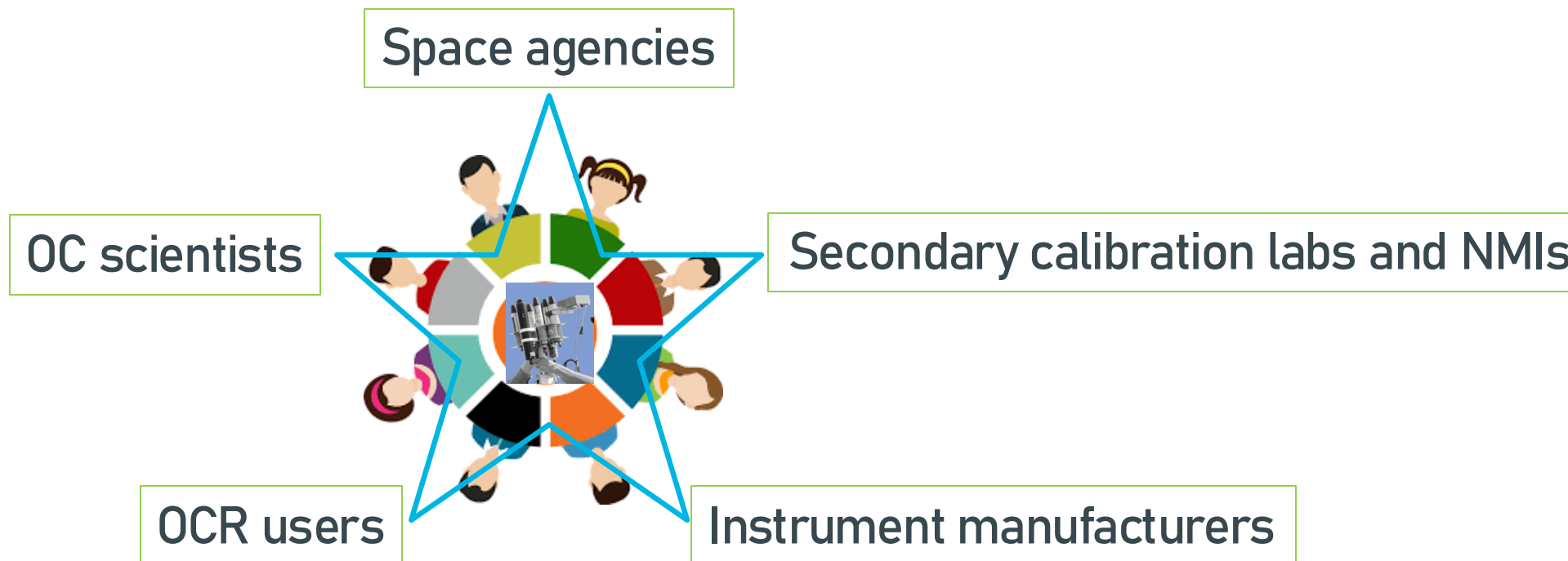




# It's a major challenge ahead of us, but it's worth it, let's celebrate!

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## Ocean Colour Field Radiometry stakeholders



We are the OCR stakeholders, with different backgrounds, languages, expertise, resources and following diverse mandates and pressures. Our lives are stressful, some of us are jet lagged, we come from far away.

We could be easily discouraged. Still, we abandon our “comfortable” silos, especially because it seems not too much can be done in isolation... We are here to achieve a common goal:

***Achieve FRM quality measurements and promote them across the OC community***





# Sometimes it could feel like the Babel Tower...

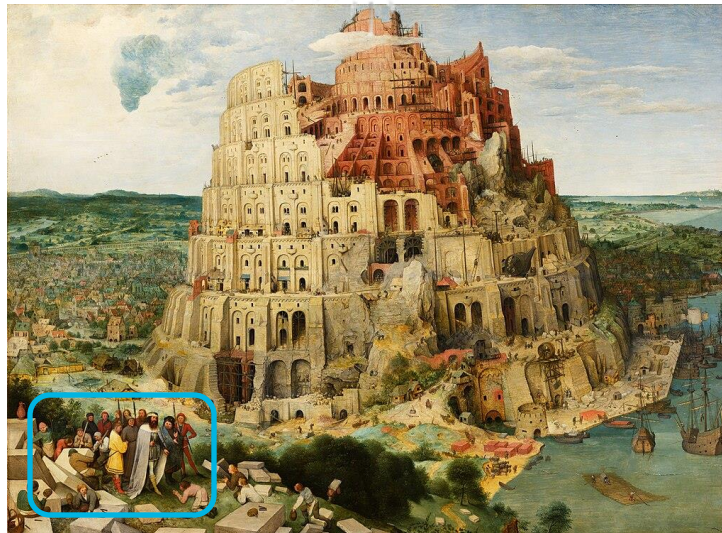
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FRM standard (well, maybe a bit exaggerated...  
as Ilmar said, it may not be so hard 😊)



US



(especially because our Tartu colleagues have progressed so much in the recent years, are very enthusiastic and willing to share their knowledge, big thanks to them!)

- *Should we have prescriptive guidelines for laboratories, as cooking recipes? “*
- *Should we instead keep the guidelines open so that each laboratory can invent their own strategies as far as following basic metrologic principles?”*
- *How should we interpolate the FEL lamp uncertainties across the wavelengths?”*
- *Should we plan for regular characterization for X effect or just occasional?”*



## Uncertainty workshop:

- Distinction was emphasized between Background signal vs. Dark.
- Background signal: check negligible straylight, "make your lab great", Take away perturbations
  - Irradiance: Only blocking the direct component (a rod), just like metrology labs do. Width of rod? ensure that diffuser is shaded.
  - Radiance: Block the aperture.
- Uncertainty of the lamp flux: interpolation strategies may differ.
  - Giuseppe proposes: Wang et al. 98 (Metrologia), splitting the spectrum in two ranges (shared by Aga).
- FEL lamps:
  - the 1 year time cap may be dropped as far as you have effective ways of monitoring the drift.
  - Purchasing several lamps is essential.
  - Calibration should always be done in horizontal setups to avoid filament bending – significant effect!

## Manufacturers presentations

- SeaBird is pushing to conform to all the (excessively demanding) requirements in D-27. However, those established in the IOCCG JiRA are the most pressing. Others can be diversified.
- SeaBird: Continued inclusion of tilt sensor highly encouraged and continuation of HyperPRO hyper profilers.
- TriOS: may face issues with vertical set-up for calibration.
- TriOS: Issues with immersion factor determination could occur if using a very thin layer of water.
- TriOS: Acknowledged internal thermistor for G2 and cosine collector material replacement (already ongoing for current G1's).
- DALEC: Acknowledged extremely fast acquisition rate, and very promising calibration procedures, assessing thermal effects and others.
- DALEC: Still no way to avoid superstructure perturbations hitting the Es measurements.
- Water Insight: Acknowledged practical deployment method for WISP Orca and WISPstation.



## HyperCP:

- Tilt correction not performed, but tilt can be filtered and reported using the ship attitude variables.
- Still to be tested in extremely turbid waters.
- High SZA may become critical for the rho correction (polarization may play an important role, and still not assessed).
- In water: Out of scope.
- Photos of sky/water are considered only qualitatively (no generic operational assessment of superstructure perturbations can be derived from these photos)

## Cal/Char Secondary Labs and NMIs

- HCMR, Greece: seek guidance about how to implement baffling, unsure about the need to become ISO compliant.
- INTI, Argentina: differences of 14% observed wrt TriOS calibration (from 2017).
- DLR, Germany: promote to use multiple foreoptics attached to single radiometer to avoid absolute calibration.
- HEREON, Germany: Discrepancies wrt Tartu – likely caused by not applying plaque, non-linearity and thermal correction.
- JRC, EC: Able to perform all lister characterisations with the only exception of pressure effects. Willing to spread the know how in cooperation to Tartu Observatory.



- All laboratories across the world face lack of experienced staff, and funding issues. Initiatives such as FRM4SOC are essential to keep the community motivated to progress and face the local challenges in a cooperative, coordinated way.
- Achieving and promoting FRM standard for OCR is a hard task, but not impossible: Tartu is willing to spread the expertise, both because of excessive workload and because sharing know-how is intrinsic to the metrology needs.
- Comparison exercise (LCE): The exercise was beneficial to all participants and pilot, quasi-periodic exercises are intrinsic to ensure traceability, i.e. to conform to FRM standards.
- Cal/char efforts from manufacturers should always prioritise the assessment of absolute calibration uncertainties. As a second priority: angular, thermal and non-linearity.



- Tartu is willing to spread the expertise:
  - Must plan laboratory short visits between the labs, since written documentation will never describe the full picture.
  - It is recommended to repeat LCE exercise to ensure traceability of calibrations, diversify the know-how, in sum, achieve and promote FRM ...
  - Clearer and more prescriptive guidelines were requested in preparation for a potential new LCE.
- Request to manufacturers:
  - Concentrate efforts in absolute calibrations with uncertainties, rather than the somewhat excessive D-27 requests
  - Direct dialogue between space agencies and manufacturers to establish a business case to comply with JiRA?
- FRMOCnet is looking to expand to new instrument classes (DALEC, others?) but also families of method (in water?), however for the latter user niches with a critical number must be identified.
- HyperCP: A hybrid regime is needed to support users having only some of the instrument specific characteristics
- Let's keep FidRadDB growing: trying to conform to the established human/machine-readable format and submit to FidRadDB, to ensure compatibility and accessibility to HyperCP.

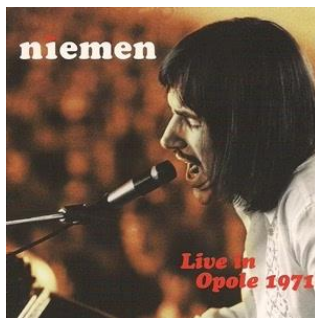




# Now, your voices to be heard! Spread the (FRM) word ☺

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Czesław Niemen, Poland



Jaak Joala, Estonia

Mari Pokinen, Estonia



Mercedes Sosa, Argentina



Victoria Santa Cruz, Peru



Djavan, Brazil



Freddie Mercury, UK



Taylor Swift, US



Charles Aznavour, France



Giorgos Mazonakis, Greece



Marlene Dietrich, Germany



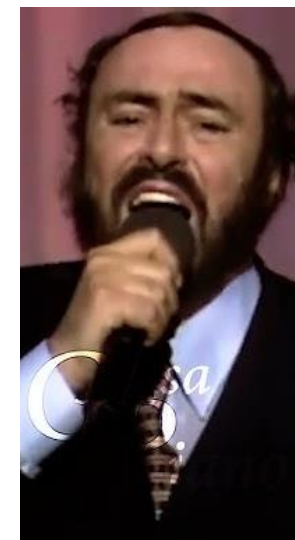
Concha Buika, Spain



Natalie Imbruglia, Australia



Luciano Pavarotti, Italy



Eason Chan, China



Anouk Teeuwe,  
The Netherlands



John Fogerty, US



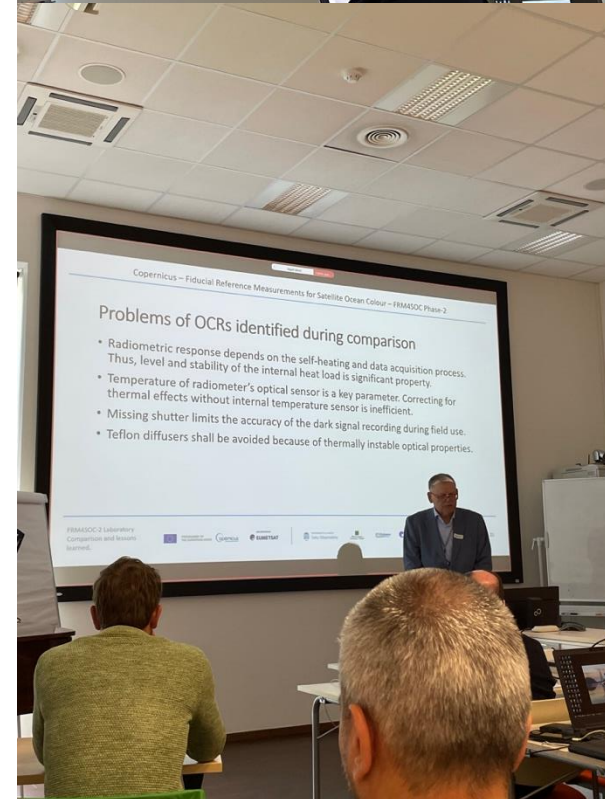
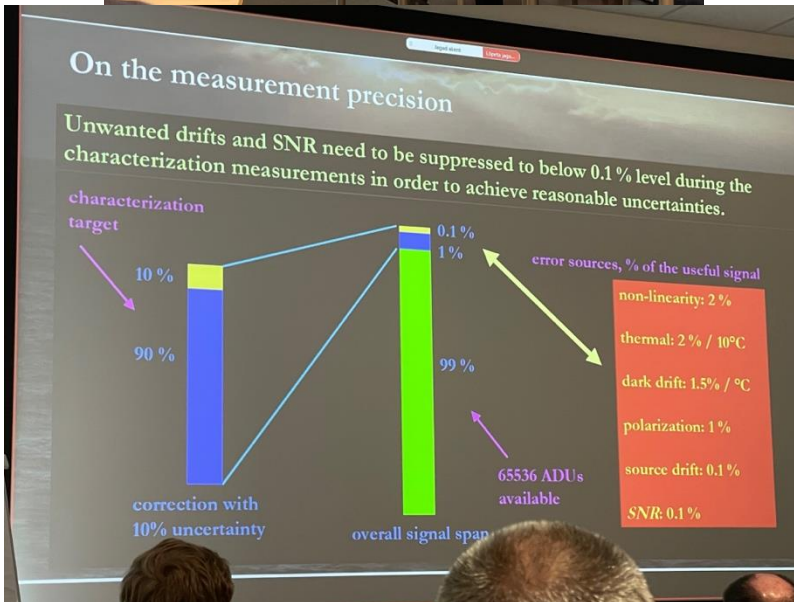
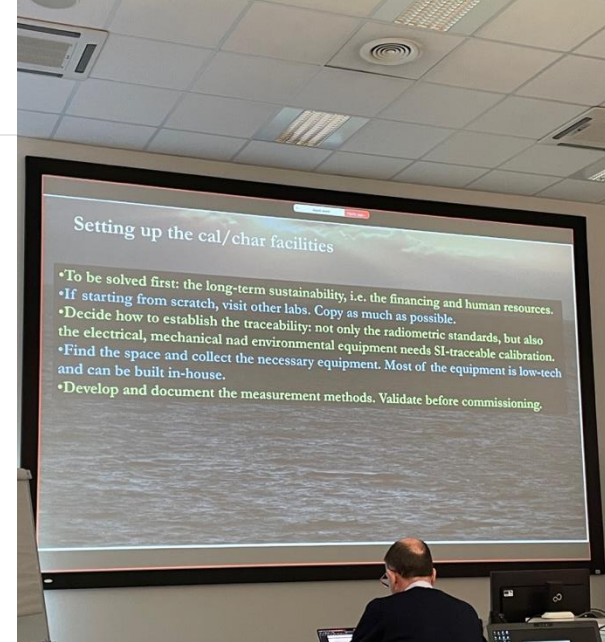
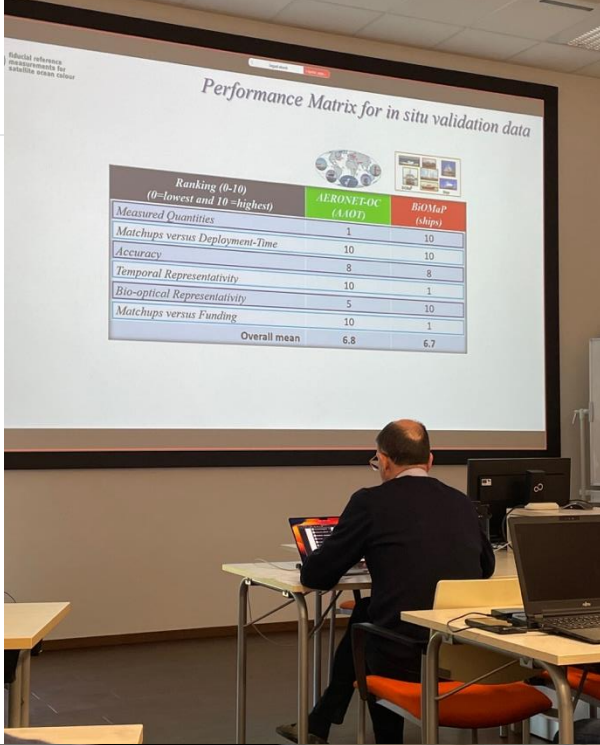
PROGRAMME OF  
THE EUROPEAN UNION

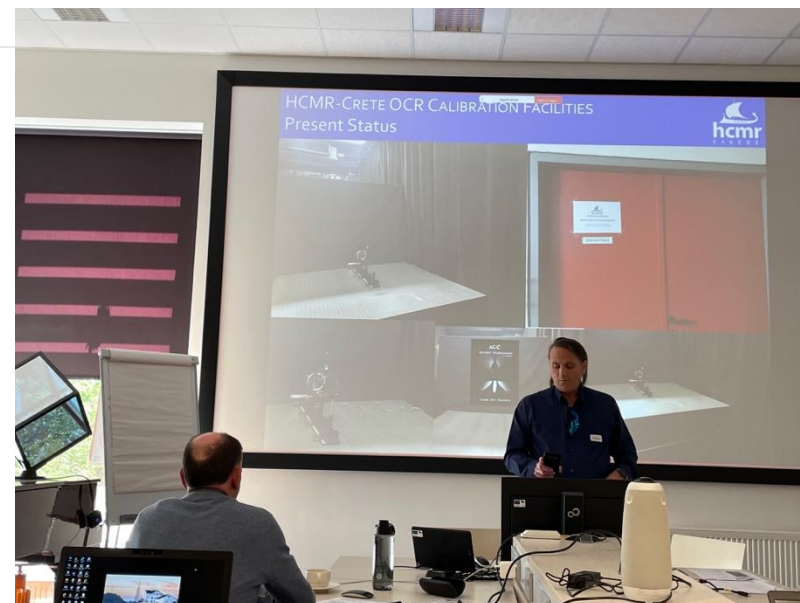


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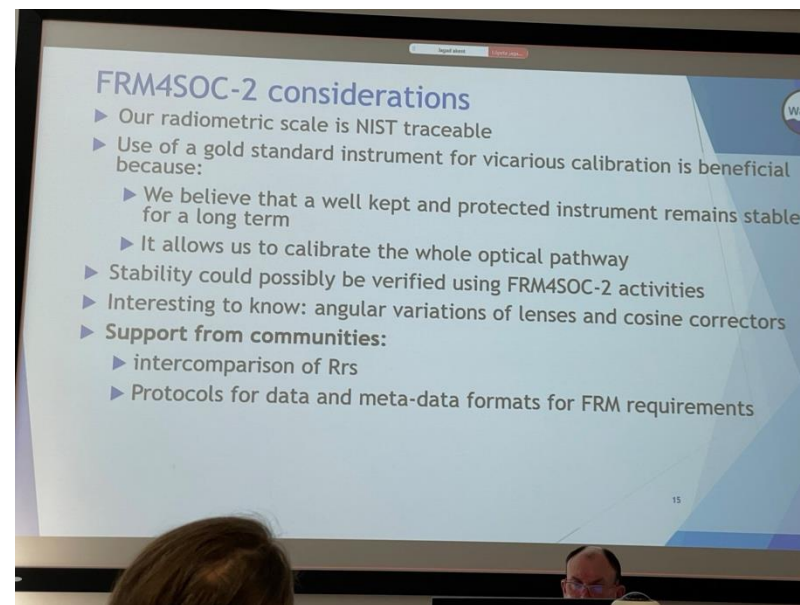








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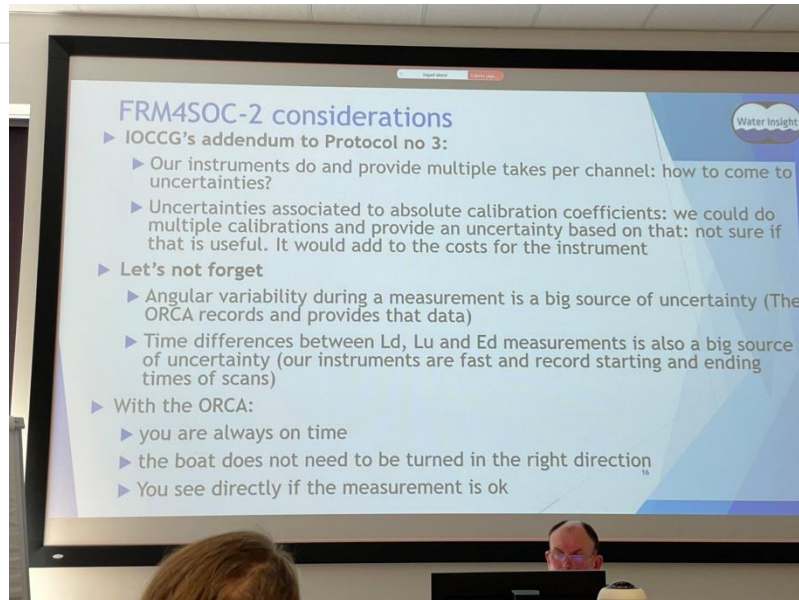


### FRM4SOC-2 considerations

- ▶ Our radiometric scale is NIST traceable
- ▶ Use of a gold standard instrument for vicarious calibration is beneficial because:
  - ▶ We believe that a well kept and protected instrument remains stable for a long term
  - ▶ It allows us to calibrate the whole optical pathway
- ▶ Stability could possibly be verified using FRM4SOC-2 activities
- ▶ Interesting to know: angular variations of lenses and cosine correctors
- ▶ **Support from communities:**
  - ▶ intercomparison of Rrs
  - ▶ Protocols for data and meta-data formats for FRM requirements

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