

# The Ultraviolet Calibration Centre at PMOD/WRC

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# Overview

- Quality Assurance of Spectral UV Measurements in Europe (QASUME)
- Performance of the QASUME reference spectroradiometer
  - QASUME irradiance reference
  - Brewer #163 long-term comparison
- Results of QASUME audits
  - QA of selected sites (repeated site visits)
- Comparison with CUCF
- Highlights of the PMOD/WRC-COST726 intercomparison campaign 2006

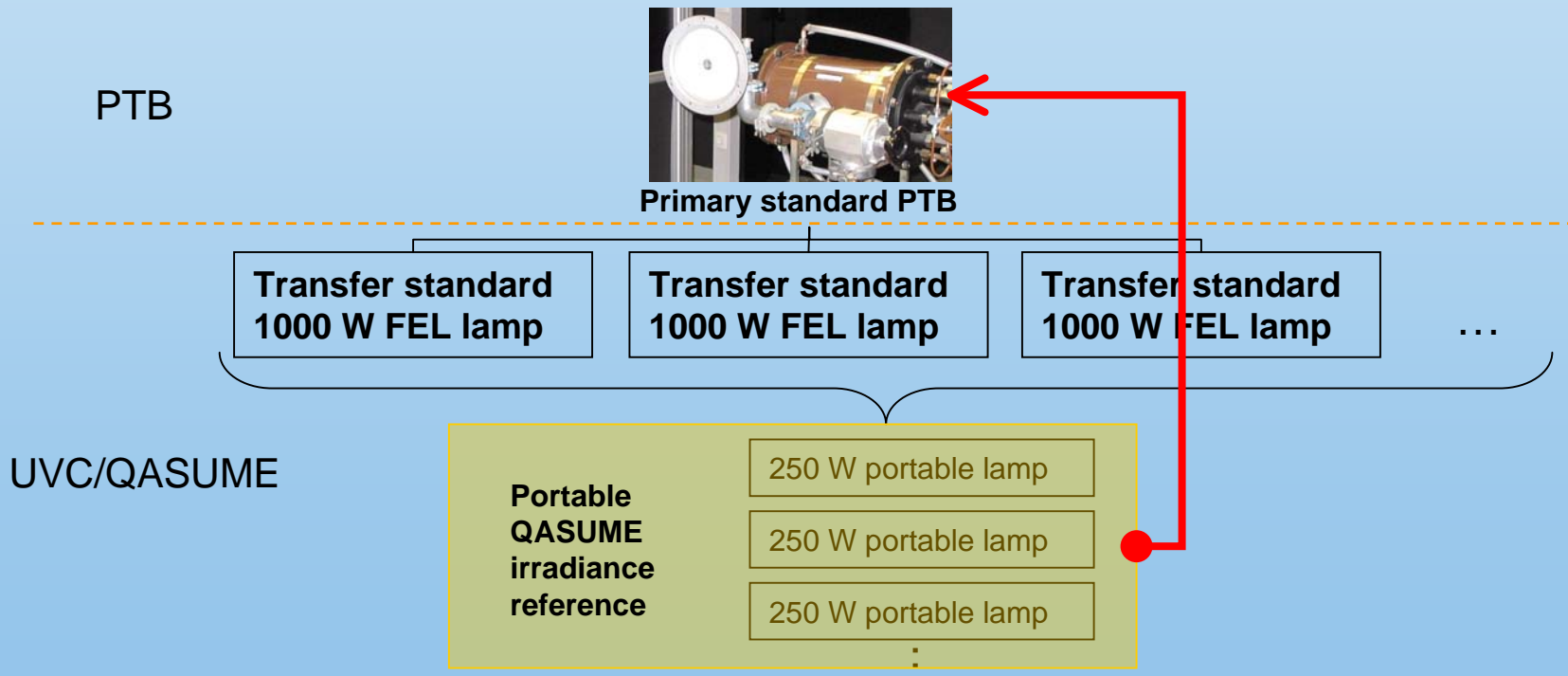
# The portable QASUME reference spectroradiometer

- Bentham DM-150 double monochromator
- portable calibration system consisting of calibrator and 250 W lamps.
- Irradiance is traceable to PTB through a set of transfer standards calibrated directly against the PTB-blackbody.



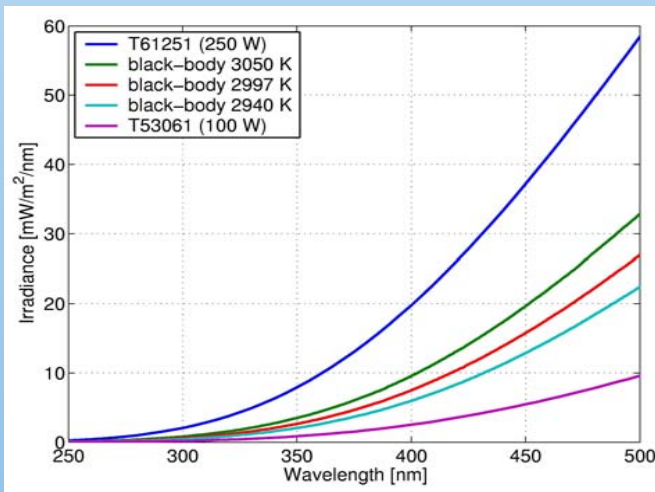
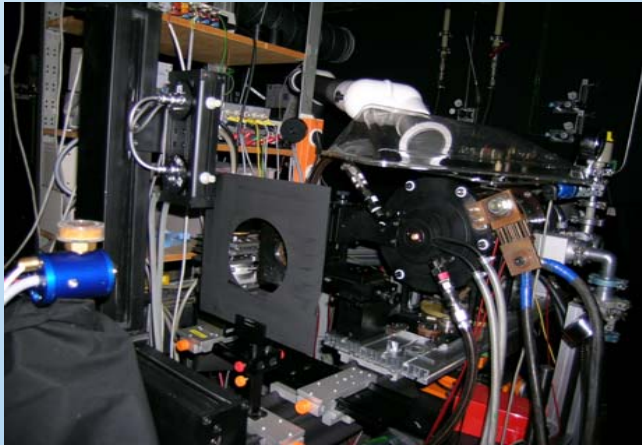
# QASUME irradiance reference

- Based on 6 transfer standards directly calibrated against the primary irradiance normal of the Physikalisch-Technische Bundesanstalt (PTB), in Germany.
- Validation of the QASUME irradiance reference was obtained by a direct comparison between QASUME and the primary reference at PTB (see also next slide).
- Cooperation agreement between PMOD/WRC and PTB for periodic calibrations of QASUME against the primary irradiance standard of PTB.

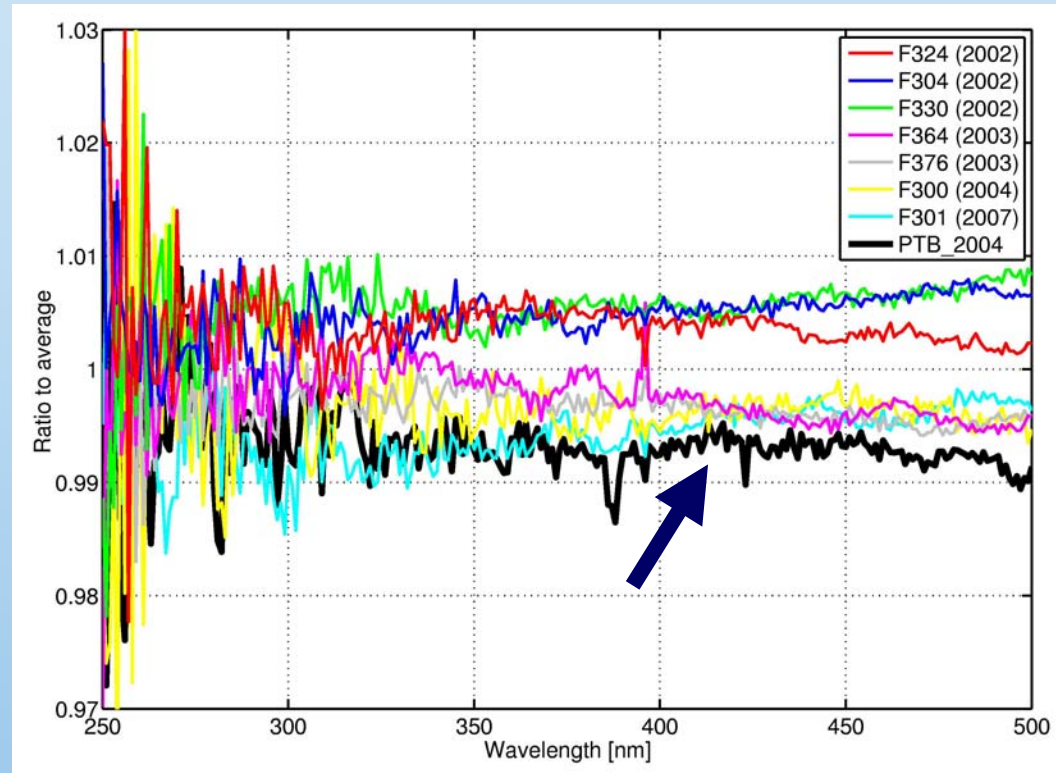


# Validation of the QASUME irradiance reference

blackbody BB3200pg at PTB



Measurement of BB3200pg at PTB on 15 June 2004



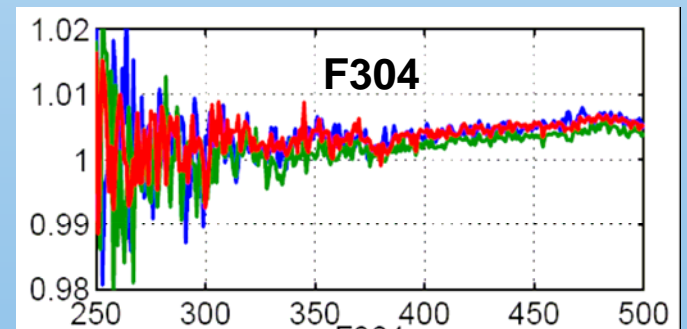
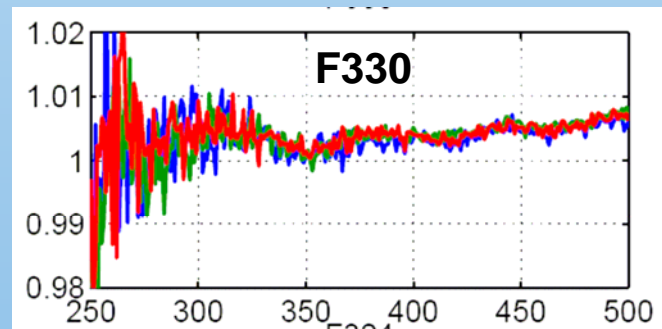
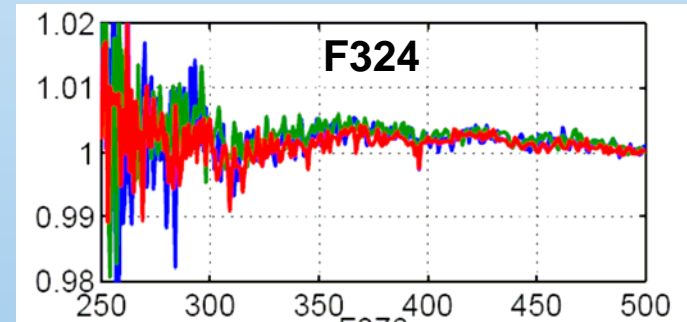
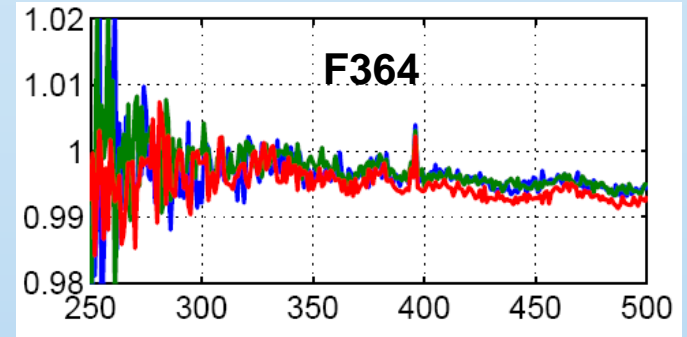
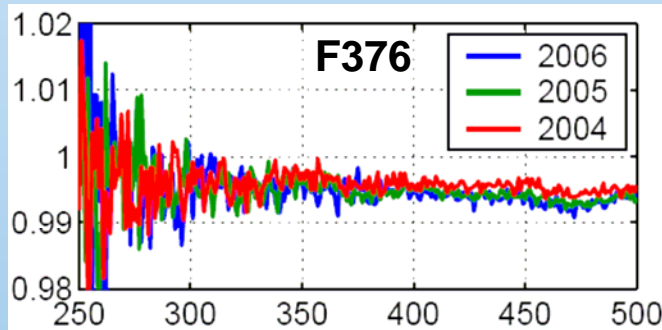
Expanded uncertainty of PTB transfer standards  $\pm 3\%$

New expanded uncertainty of the QASUME irradiance reference  
(based on these blackbody measurements)  $\pm 2\%$

Gröbner J., and P. Sperfeld, Direct traceability of the portable QASUME irradiance scale to the primary irradiance standard of the PTB, Metrologia, **42**, 134—139, 2005.

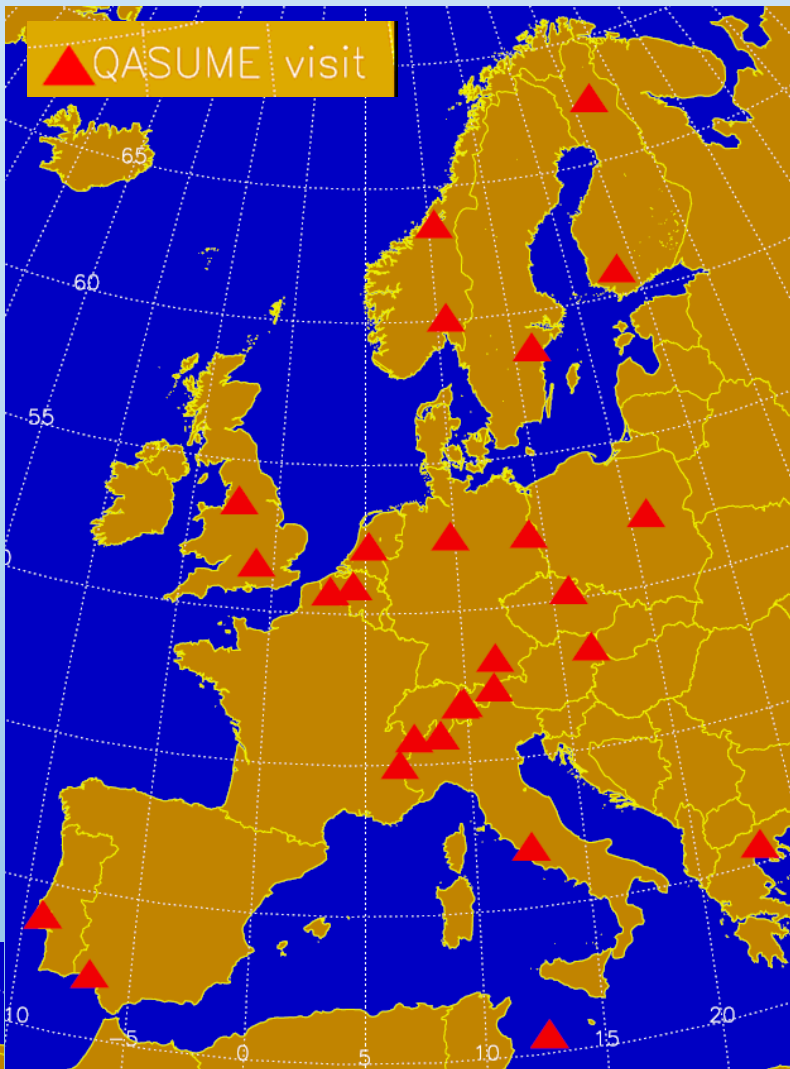
# Stability of the QASUME irradiance reference

The differences between the transfer standards from PTB are systematic and are due to the successive realisations of the PTB scale. The QASUME factor has been introduced to represent these relative differences between the transfer standards.



Stability of the transfer standards better than 0.15%

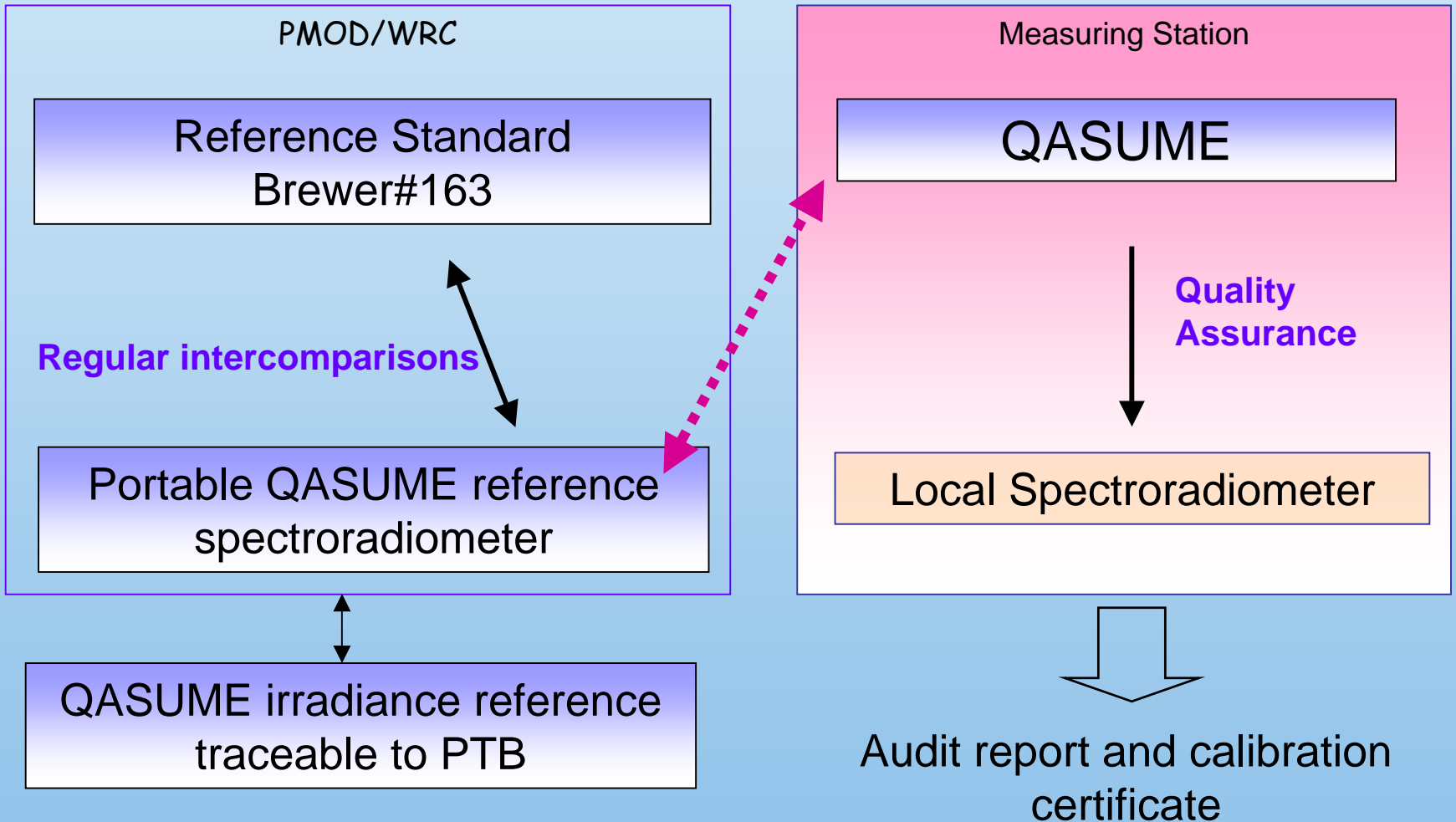
# Summary of 5 years QASUME Audits 2002-2007



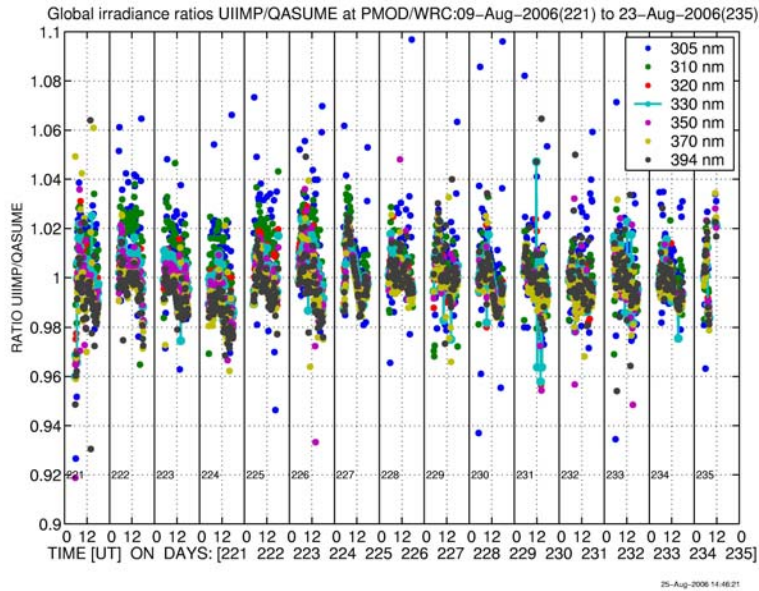
- 29 sites in Europe (most coinciding with EUVDB data submitting sites).
- 40 campaigns
- 37 spectroradiometers



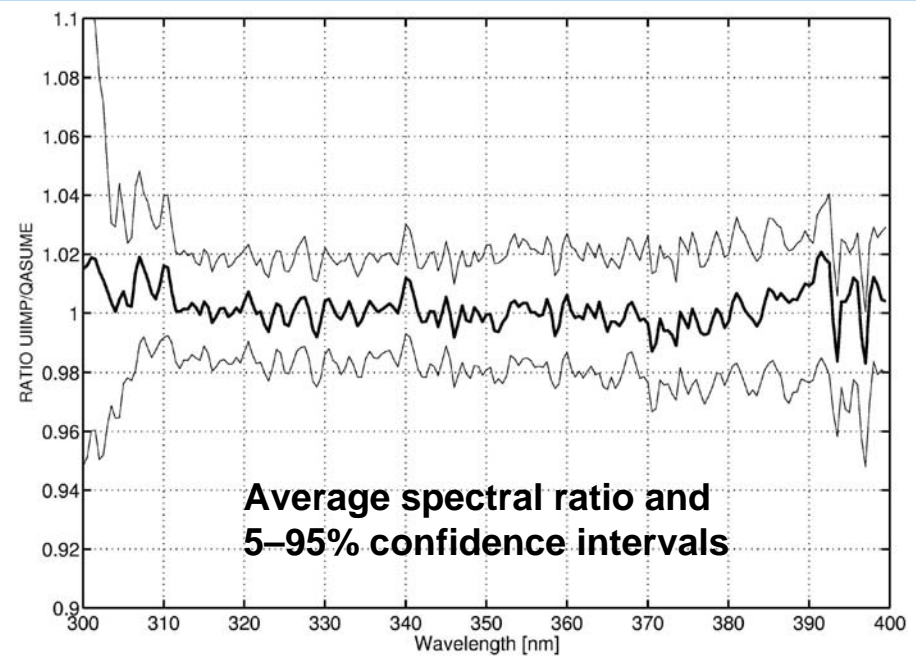
# QASUME Audit



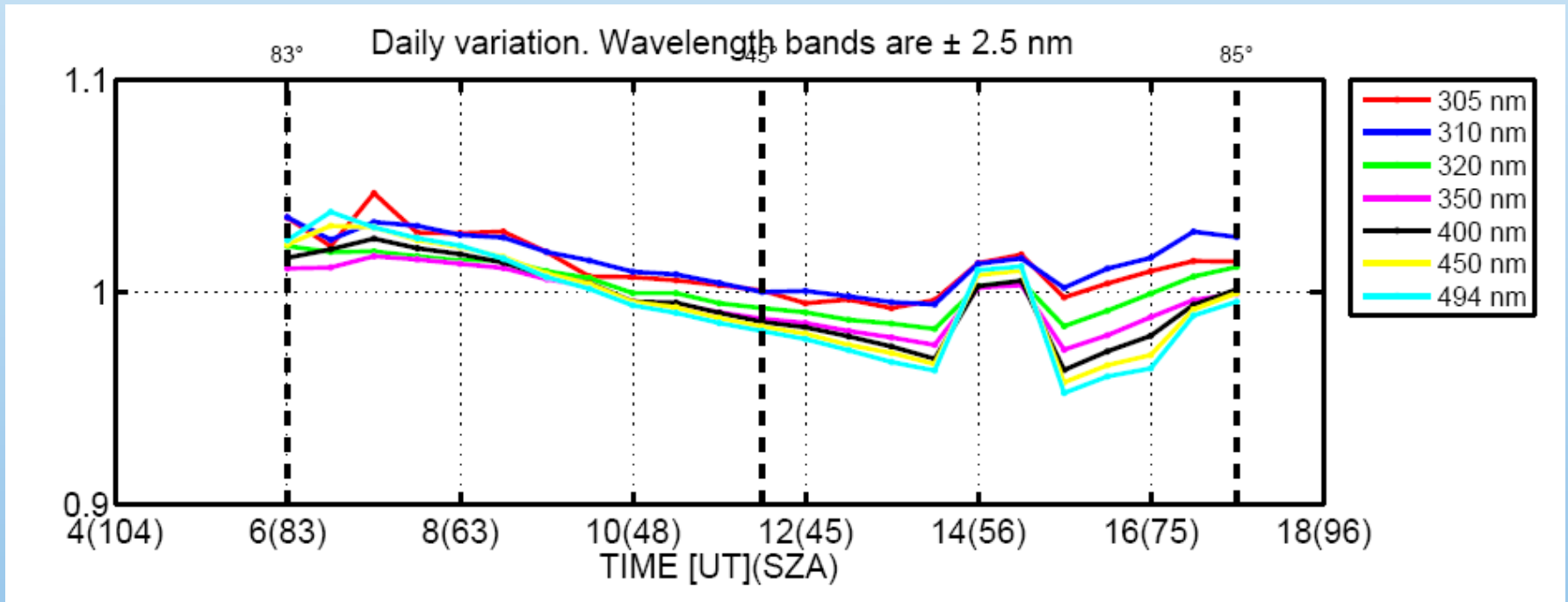
# Example result between UIIMP and QASUME during the PMOD/WRC-COST726 campaign August 2006



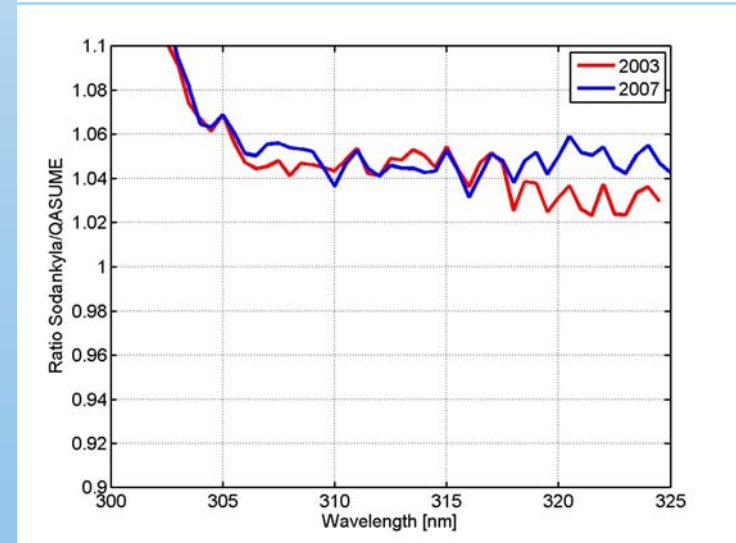
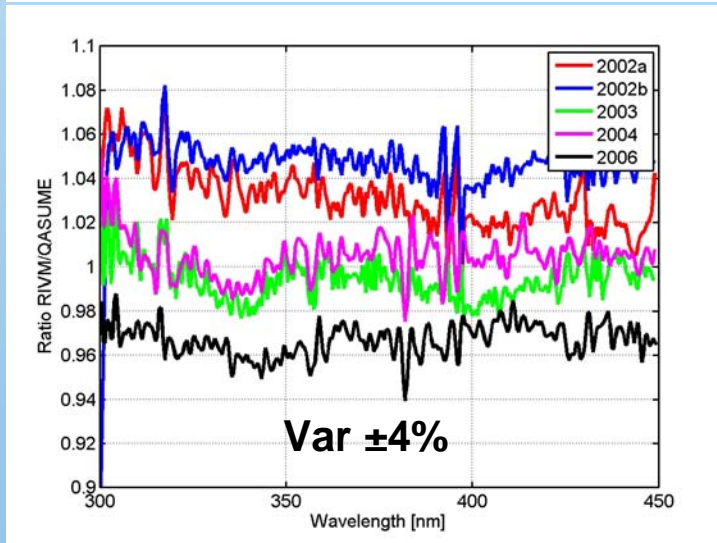
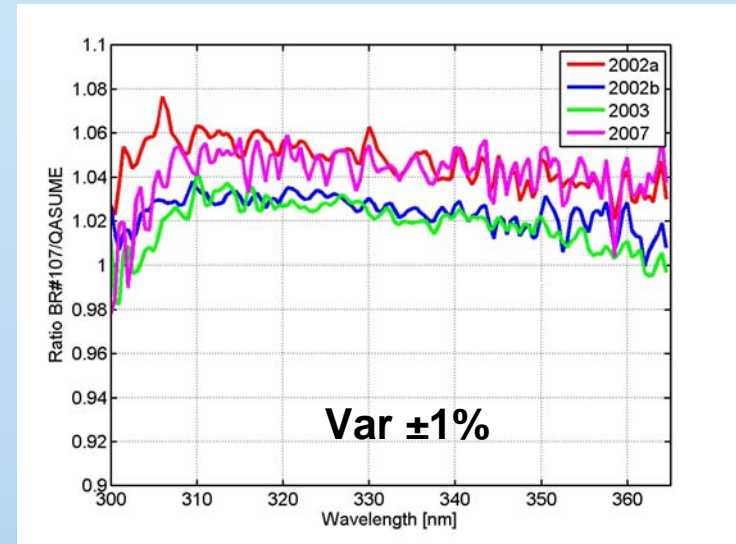
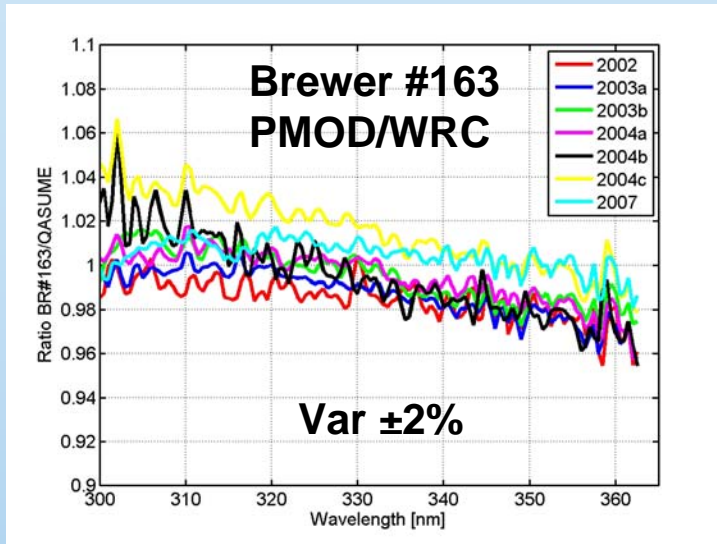
- 730 spectra on 15 days with SZA between 32° and 75°.
- Very variable atmospheric conditions



# Example showing diurnal variation due to azimuth dependence of the entrance optic



# Results from repeated site audits 2002 to 2007



# PMOD/WRC-COST 726 broadband campaign 2006

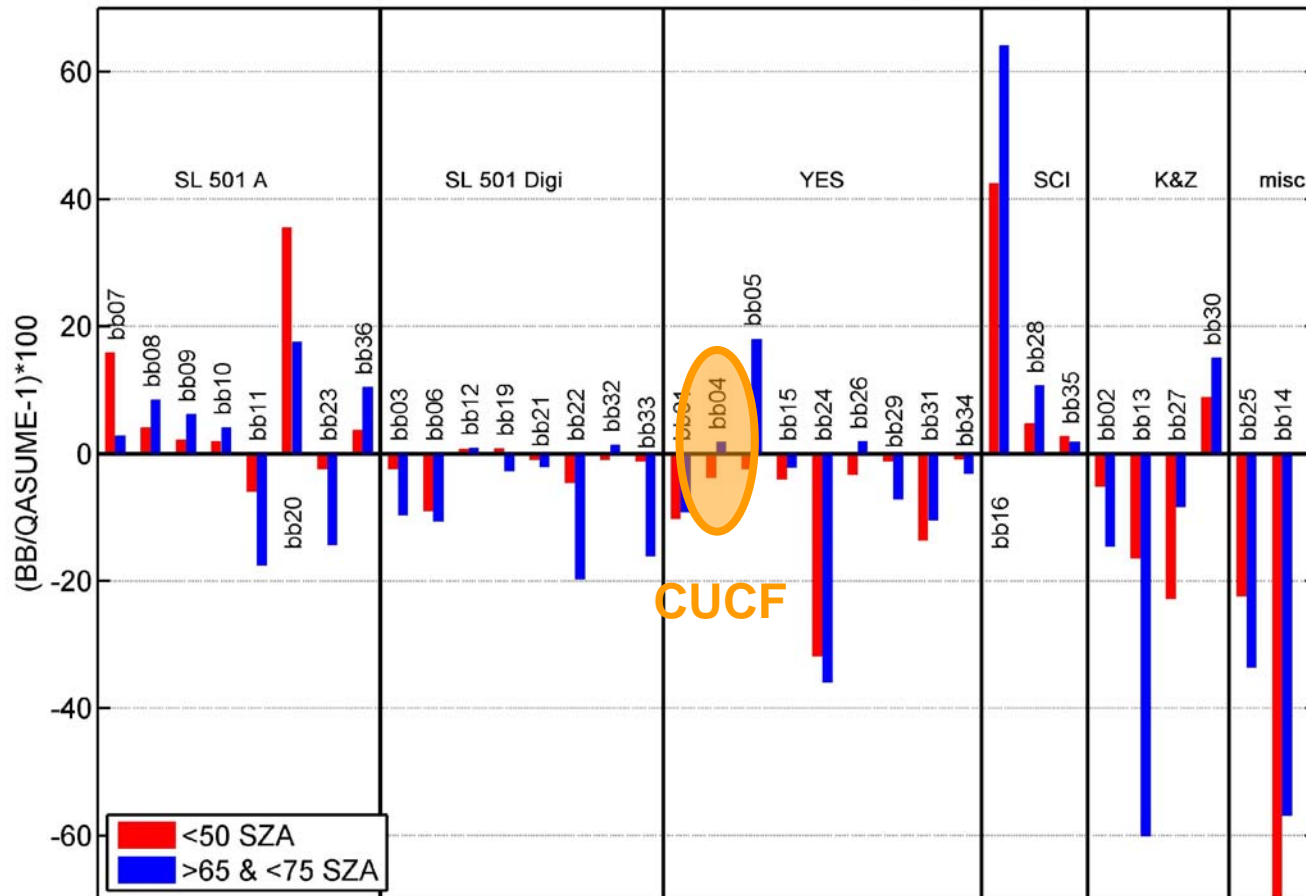
37 instruments participated

## Summary:

- 9 UVB-1 YES
- 4 Kipp & Zonen
- 3 Scintec
- 19 Solar Light
  - 11 analog
  - 8 digital
- 1 SRMS (Solar light)
- 1 Eldonet
- 2 Spectroradiometers
  - QASUME (PMOD/WRC)
  - DM300 (Univ. Innsbruck)

See poster Nr. 13

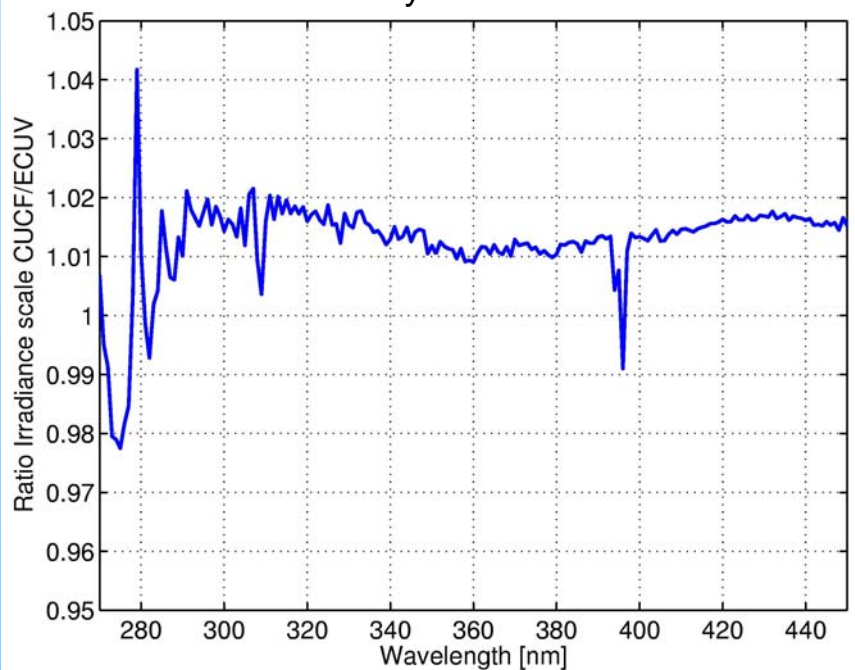
# Comparison between original radiometer calibration to QASUME spectroradiometer



# Comparison with the Central UV Calibration Facility (CUCF), NOAA, U.S.

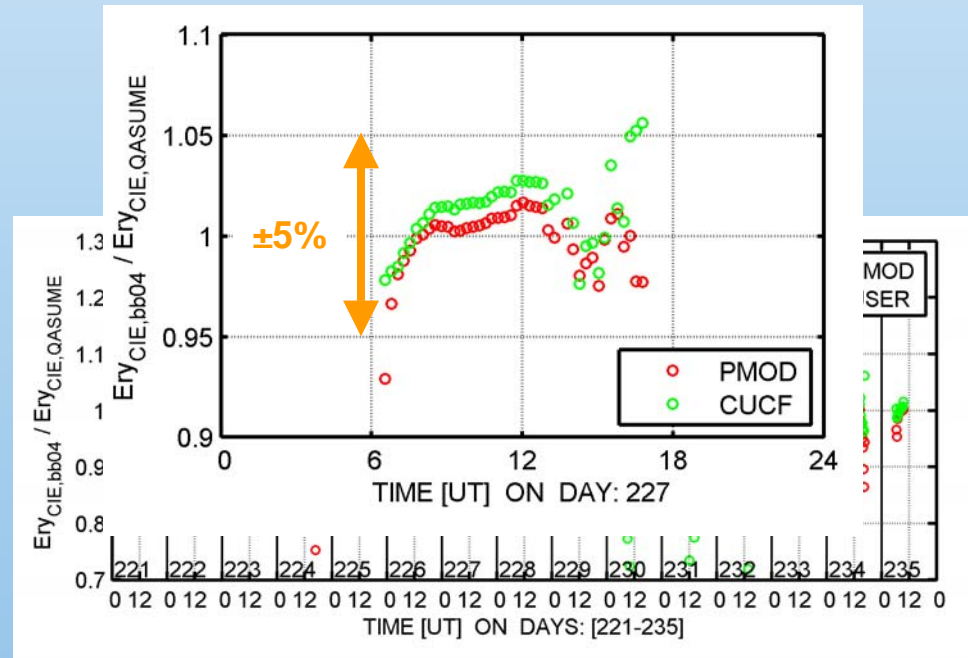
## Laboratory

Spectral irradiance reference comparison between CUCF and QASUME at JRC, Ispra, May 2004



## Solar

Comparison Erythemal broadband radiometer calibration during PMOD/WRC-COST726 campaign June 2006



# Conclusion and outlook

- Former ECUV is now hosted and operated by PMOD/WRC.
  - 2 spectroradiometers (Bentham DM150 and double Brewer #163)
  - Broadband radiometer calibration facility (spectral and angular response facility)
- QASUME irradiance reference is traceable to PTB via
  - 1) 7 Secondary transfer standards (1000W FEL lamps)
  - 2) direct comparison to the primary irradiance standard of PTB.
- Long-term stability of the QASUME irradiance reference is better than 1%.
- QASUME site audits are being requested by UV monitoring sites also after the end of the QASUME project.
- QASUME site visit provides objective assessment of instrument performance in a European context.
- Outlook: Become a GAW regional UV calibration centre for Europe (WMO RA IV)

# Acknowledgments

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Special thanks to all former QASUME project partners:

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