Effect of Metallic Wall on Optical Diagnostics

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A metallic wall would present new challenges for optical diagnostics

- Diffuse background reflection/scattering of light from other parts of the tokamak
- Ghost images of other light sources reflected in the wall
- High reflectivity means low emissivity for Infrared wall temperature and heat flux measurements
- Increased background for Thomson scattering, particularly in the divertor

Diffuse background light confuses interpretation of optical emission

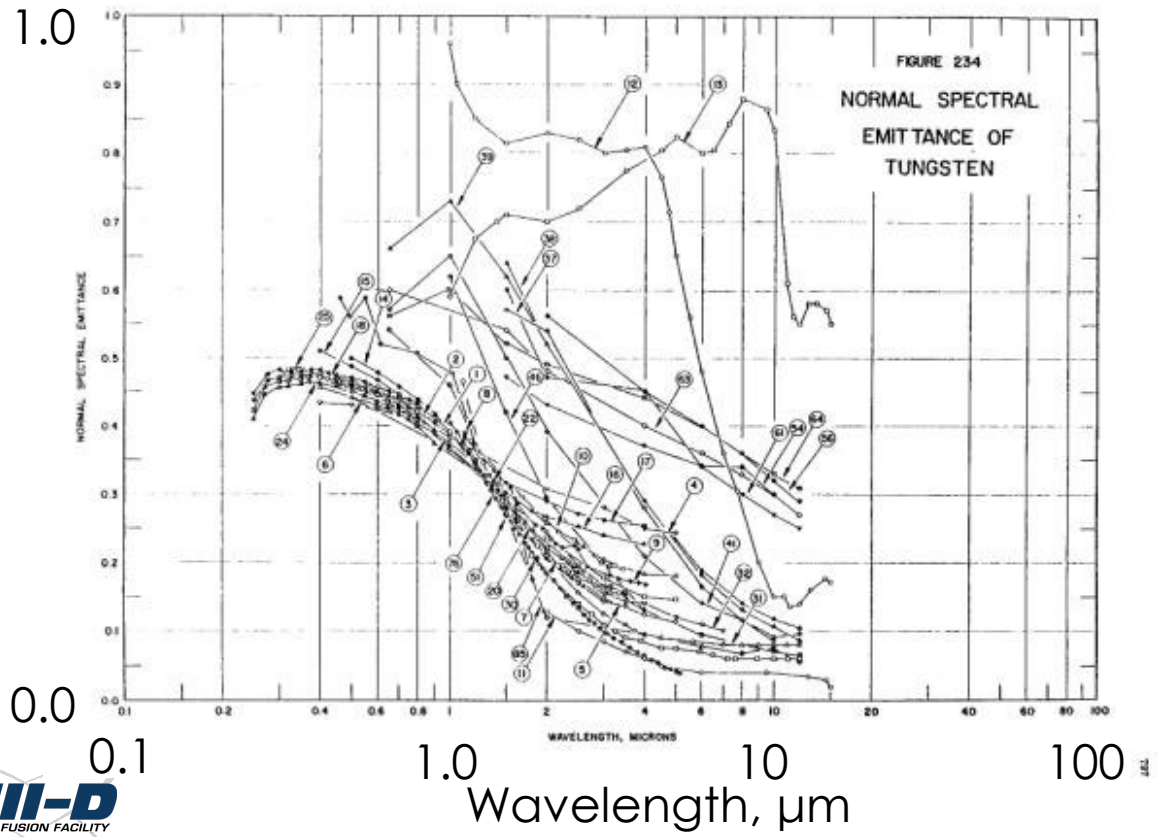
- A broad background signal that integrates contributions from potentially a large part of the tokamak adds noise and error to measurements of plasma emission. Extreme ultraviolet may still be safe due to poor reflection.
- Localization of emission would be more difficult- part (or all!) of the signal is from another location
- Increased use of viewing dumps will be required.

Ghost images are even more confusing

- **A reflective wall can produce a ghost image in a new location. This can sometimes be distinguished in camera based diagnostics so that the area of the ghosted light can be ignored.**

- **Ghost images are much harder to identify in signals from discrete detectors, viewing individual chords.**

Emissivity of a metallic wall can vary widely depending on surface condition -tungsten example



From Thermophysical Properties of Matter, Vol. 7: Thermal Radiative Properties, Y.S. Touloukian and D.P. DeWitt, IFI/Plenum, New York, 1970.

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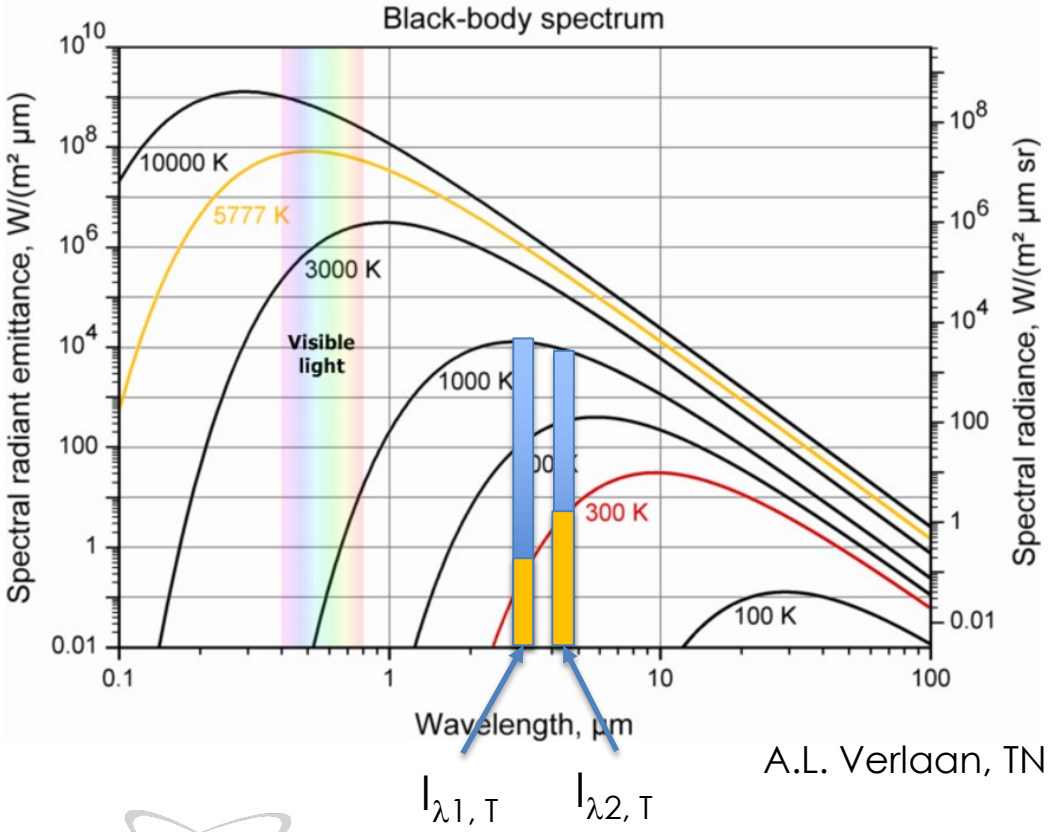
Two-color IR uses slope of emitted spectrum



A.L. Verlaan, TNO

- Measure calibrated intensity at two wavelengths
- Ratio of the two intensities corresponds to the temperature
- Independent of emissivity provided it is the same at both wavelengths
- Requires two IR cameras with the same view

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