

Emissivity Spectra of some Phyllosilicates in the [3-50] μm Spectral Range from the Berlin Emissivity Database (BED)

A. Maturilli, J. Helbert, M. D'Amore

Institute for Planetary Research, DLR, Berlin, Germany



(alessandro.maturilli@dlr.de)

The Spectral Library

The BED library contains plagioclase and potassium feldspars, low Ca and high Ca pyroxenes, olivines, elemental sulphur, common martian analogues (JSC Mars-1, Salten Skov, palagonites, montmorillonite, hematite, goethite, smectites), other phyllosilicates, anorthosites, garnets, feldspathoids, and a lunar highland soil sample

All the spectra measured in the [3-50] μm spectral range, with 2 cm^{-1} spectral resolution

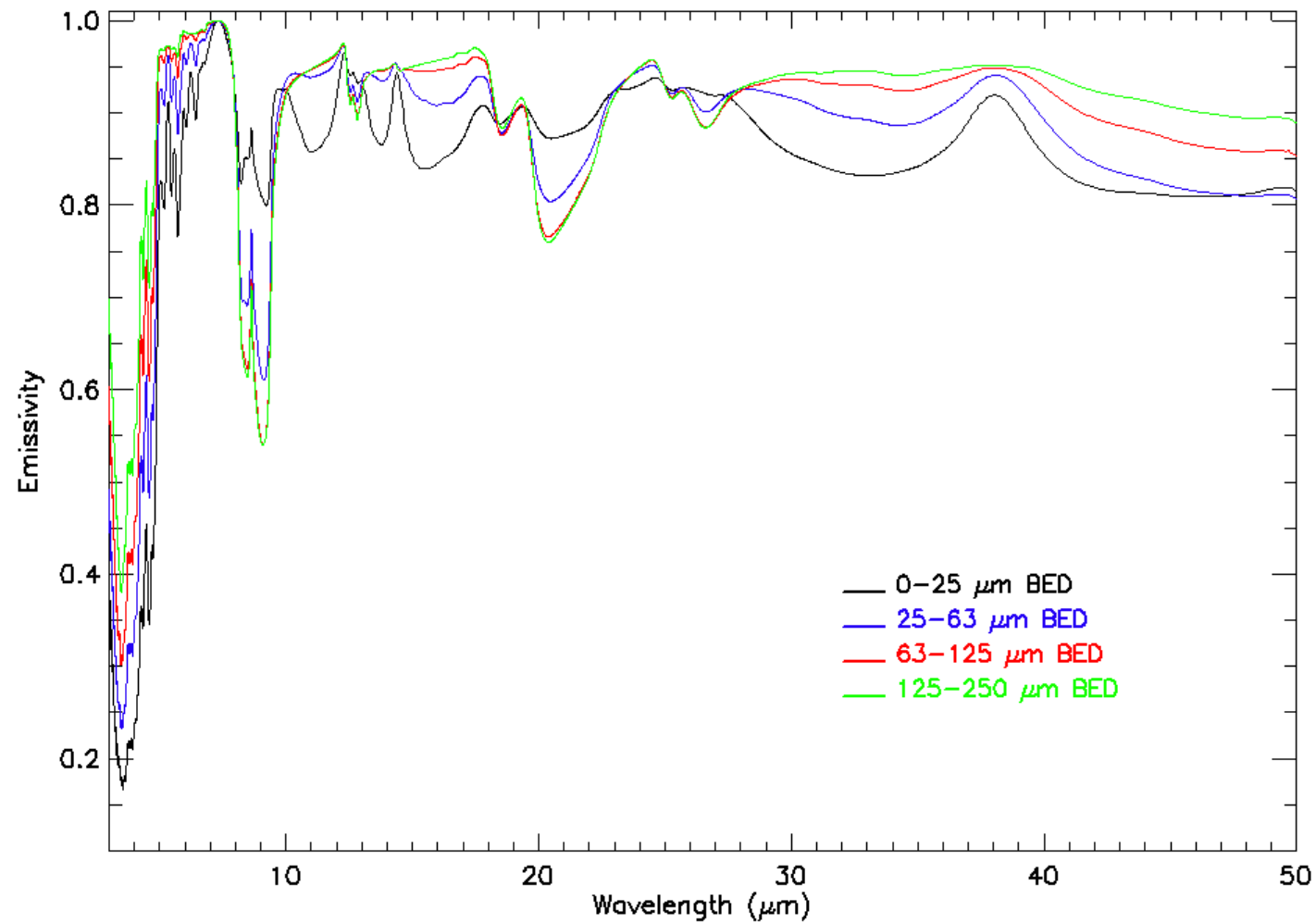
4 standard particle size ranges: <25, 25-63, 63-125, 125-250 μm + occasionally larger or slabs

Planetary Emissivity Laboratory (PEL) at DLR Berlin

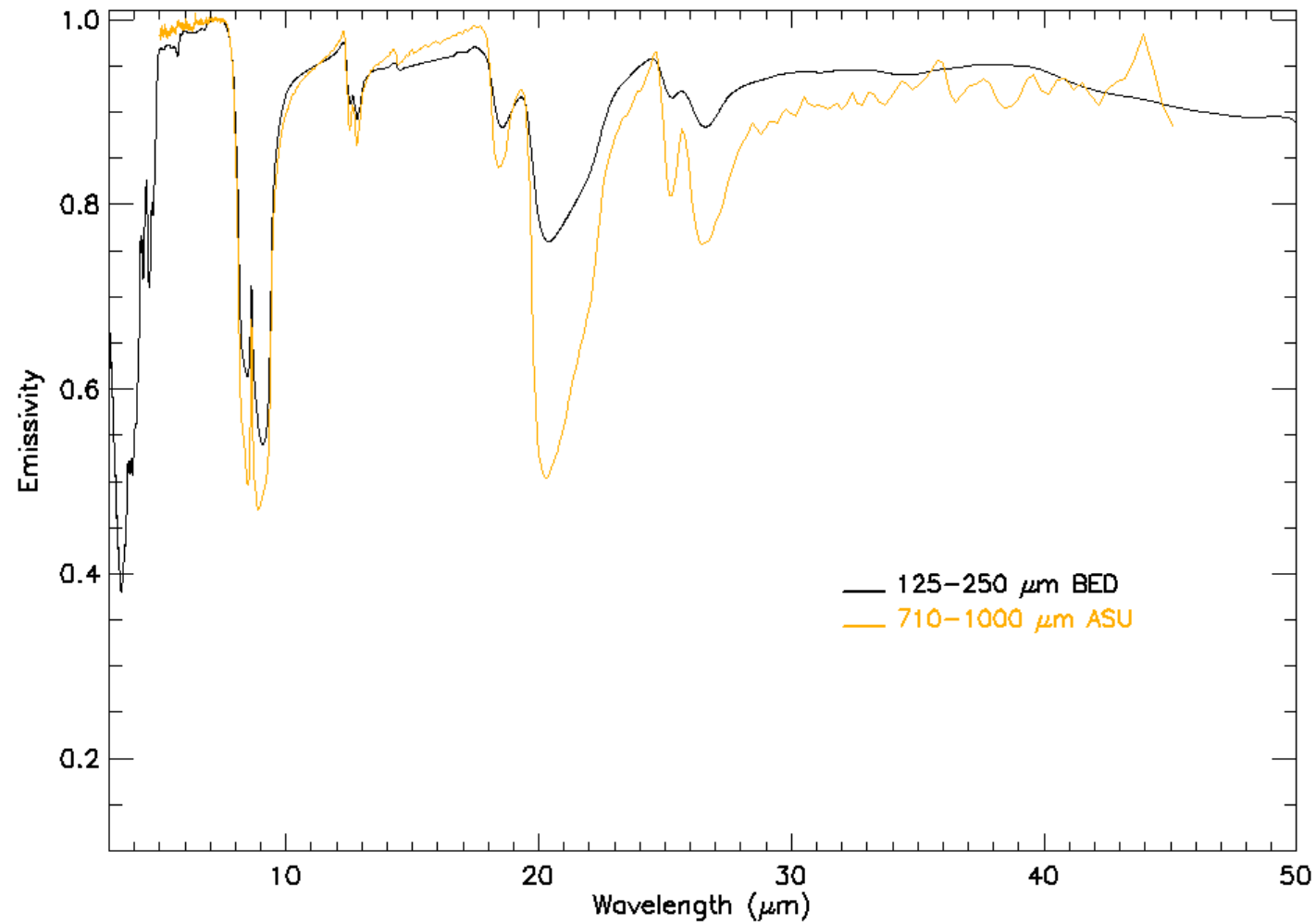


- Instrument Bruker Vertex 80v (under vacuum) coupled with emissivity chamber, blackbody, cooling system, purging system
- HgCdTe (MCT) nitrogen cooled detector + KBr beamsplitter and entrance window in the spectral range $[10000-600] \text{ cm}^{-1}$ or $[1-16] \mu\text{m}$
- DTGS room temperature detector + Mylar multilayer beamsplitter and CsI entrance window in the spectral range $[600-200] \text{ cm}^{-1}$ or $[16-50] \mu\text{m}$
- Sample measured @ 150° C after keeping several hours in oven

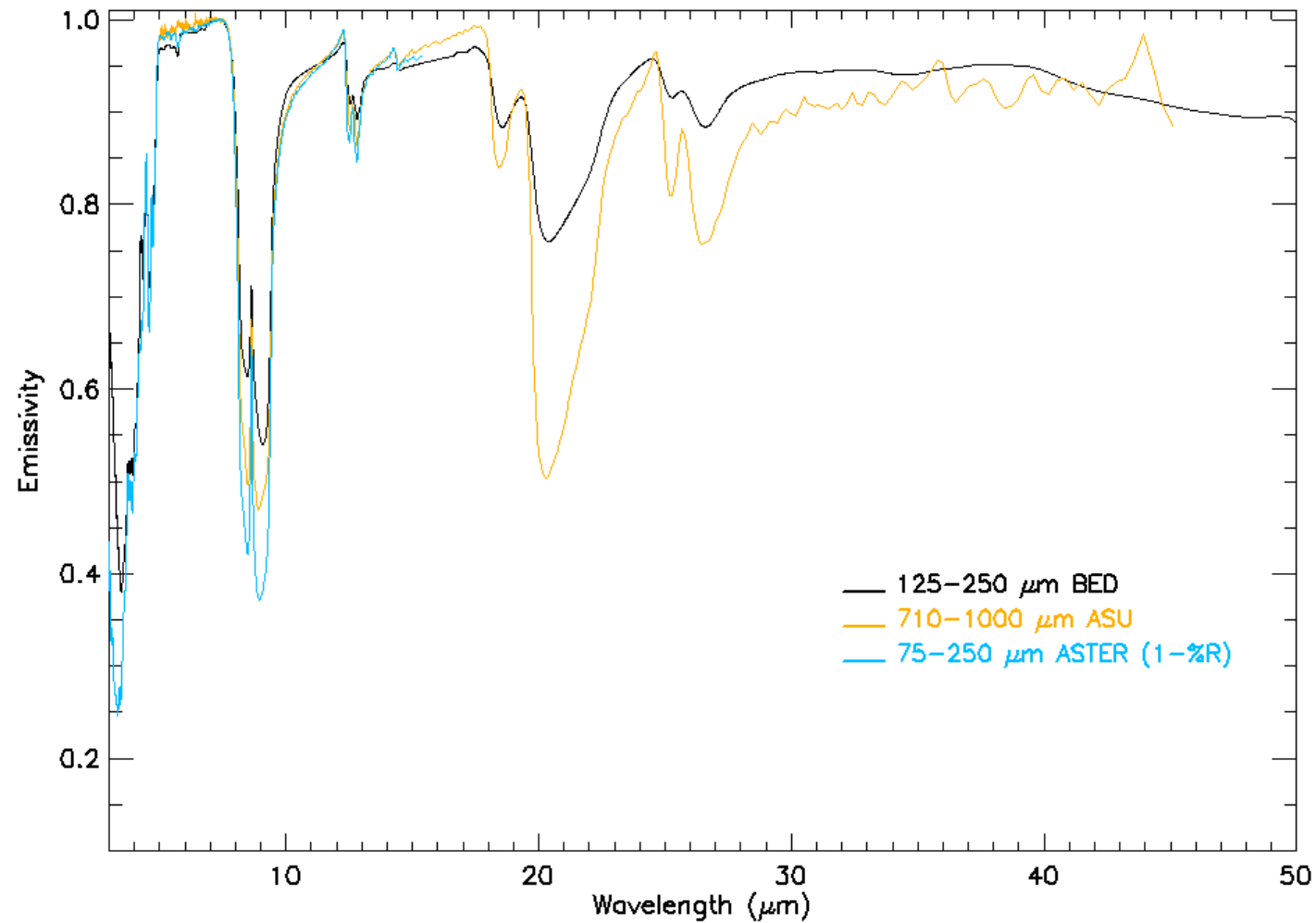
BED quartz in the whole spectral range



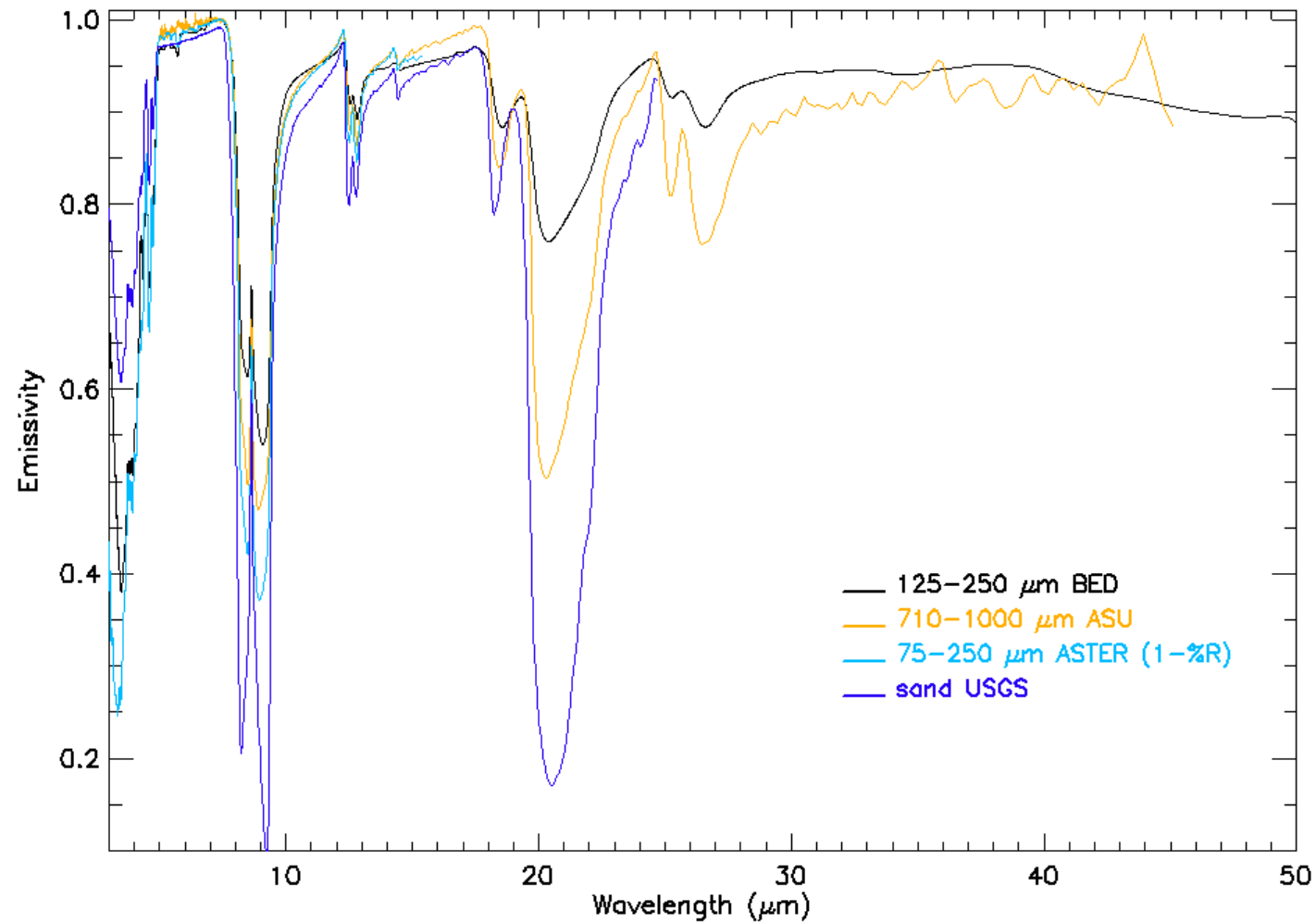
BED quartz and other spectral libraries 1



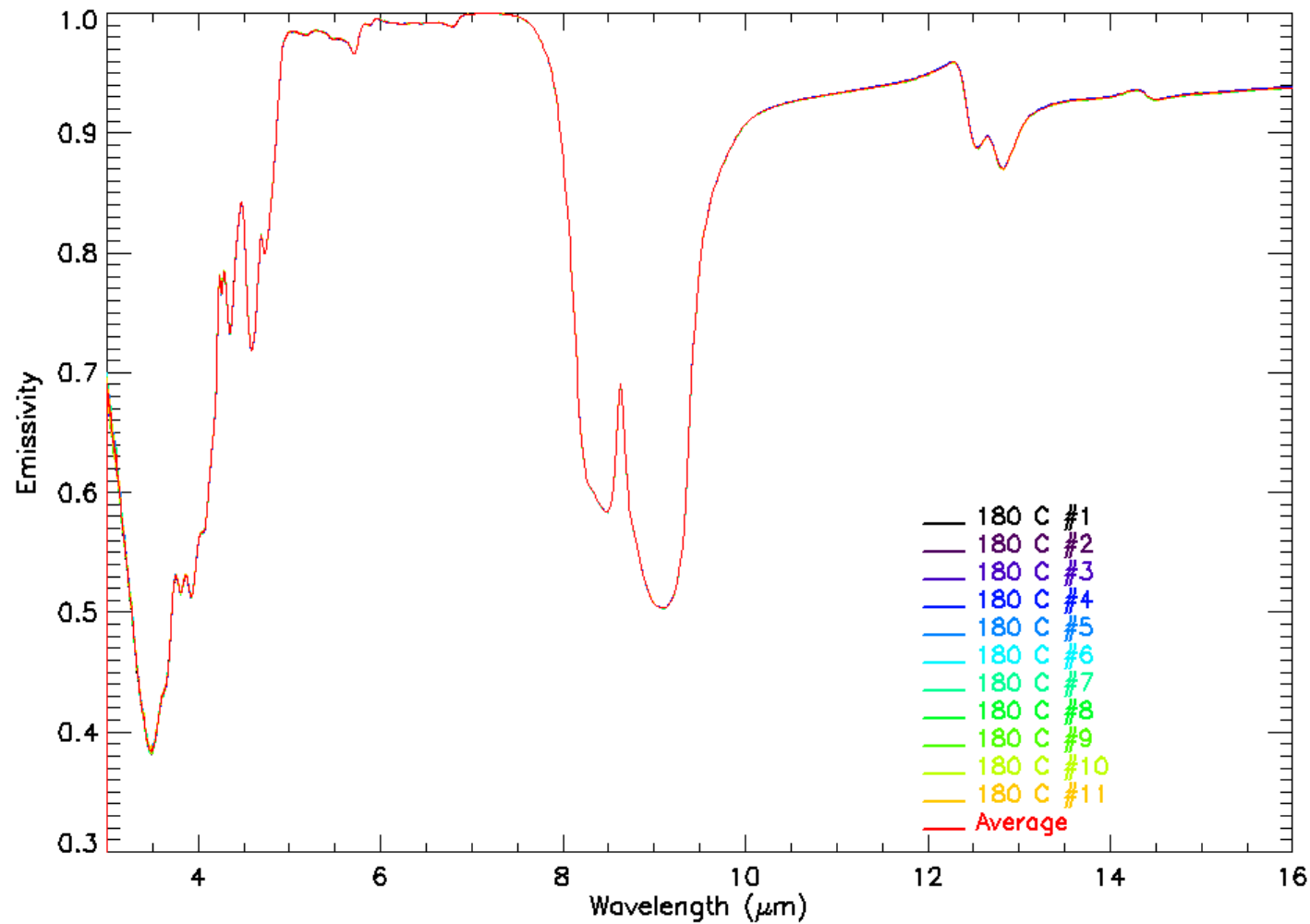
BED quartz and other spectral libraries 2



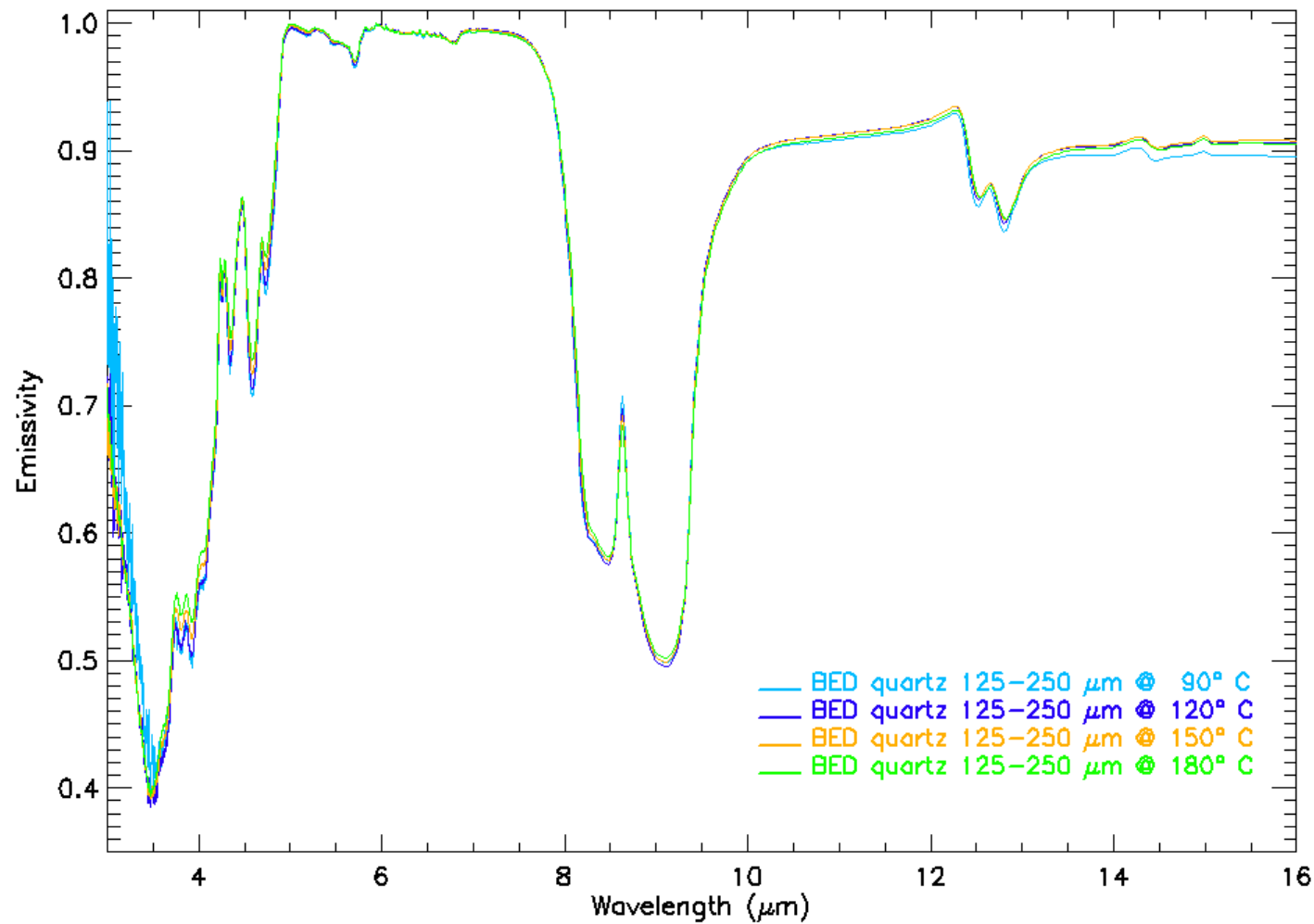
BED quartz and other spectral libraries 3



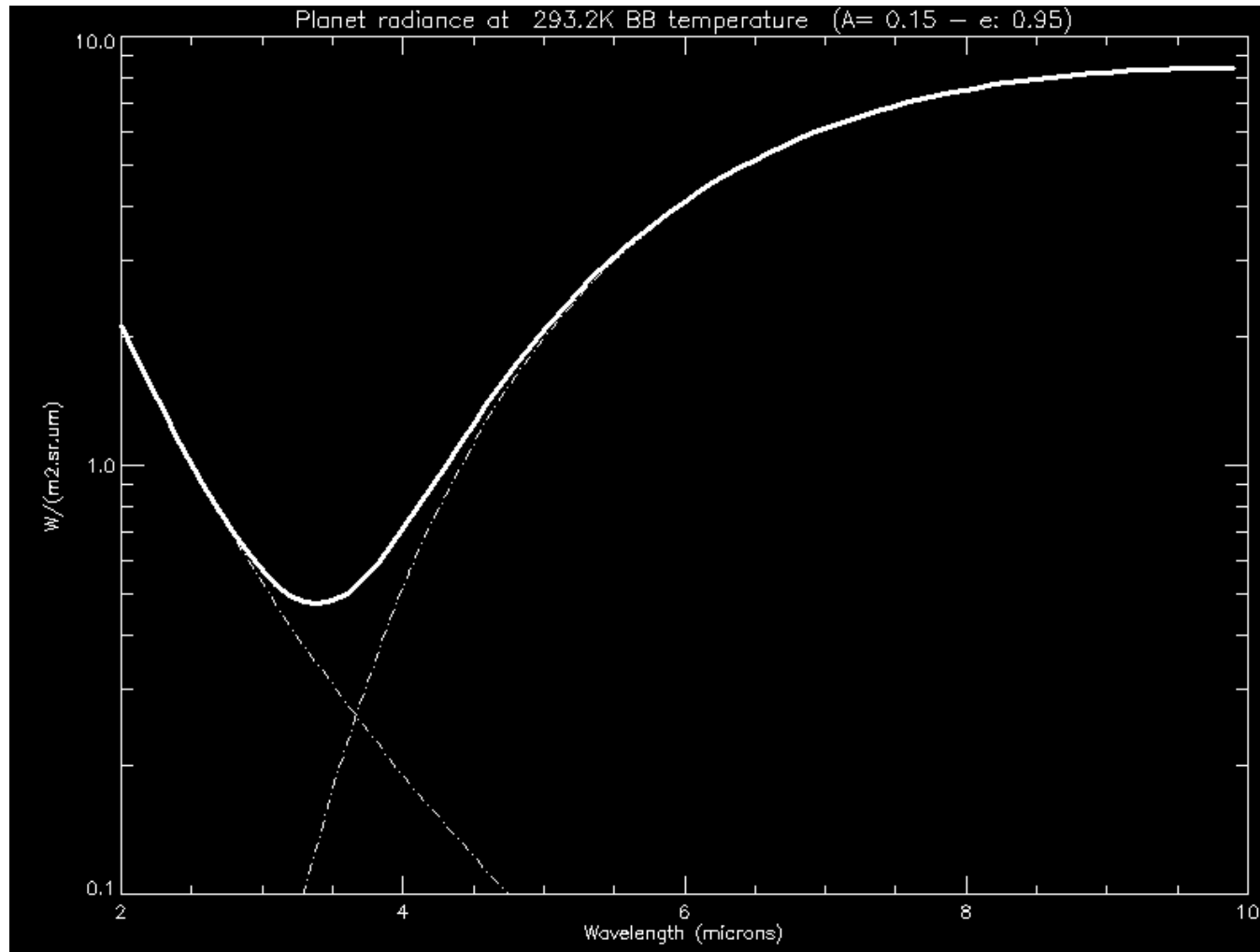
Repeated measurements of BED quartz 125-250 μm



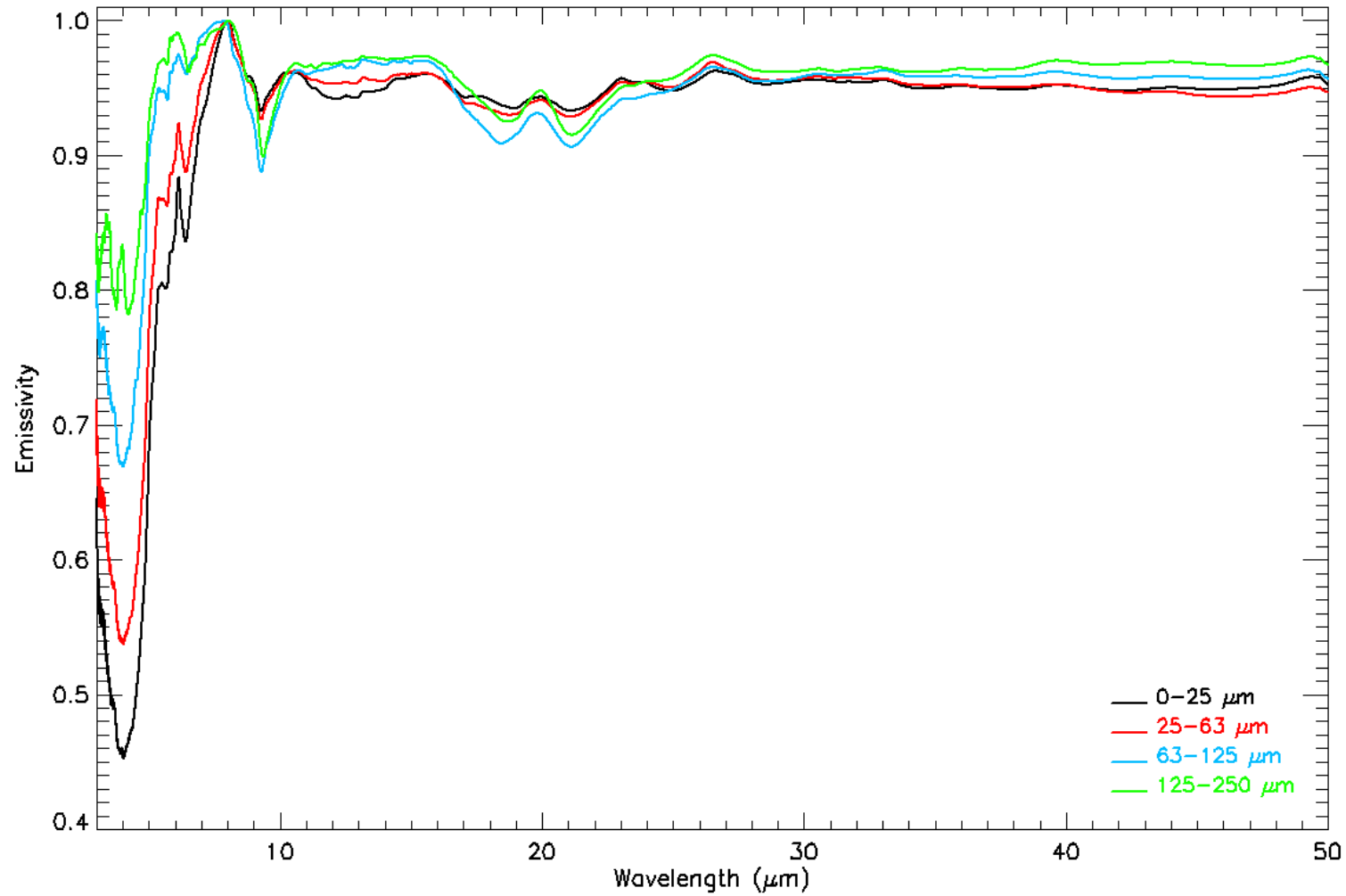
Is emissivity really Temperature independent ??!



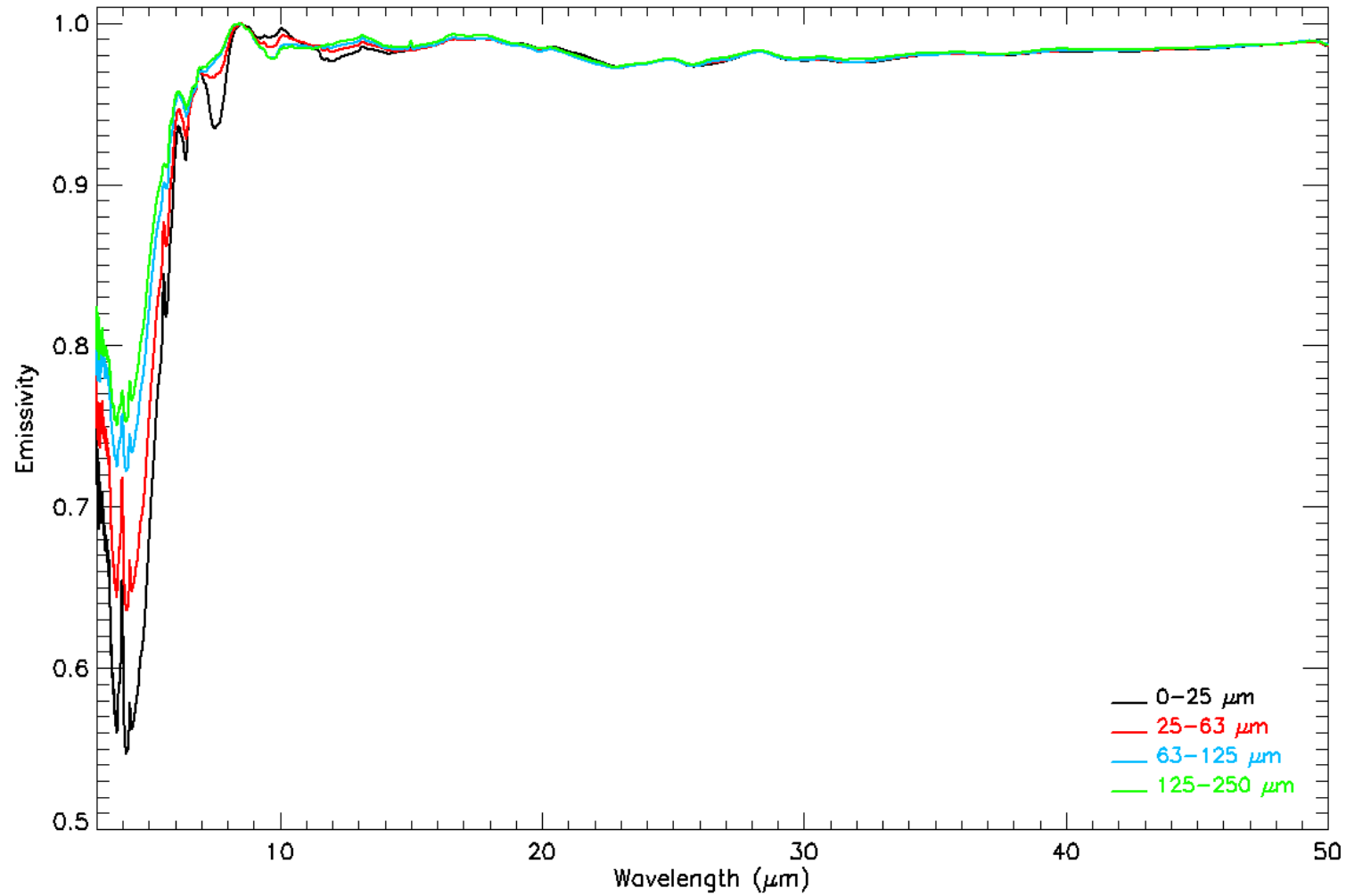
Remember the Planck function ...



Montmorillonite from the BED collection



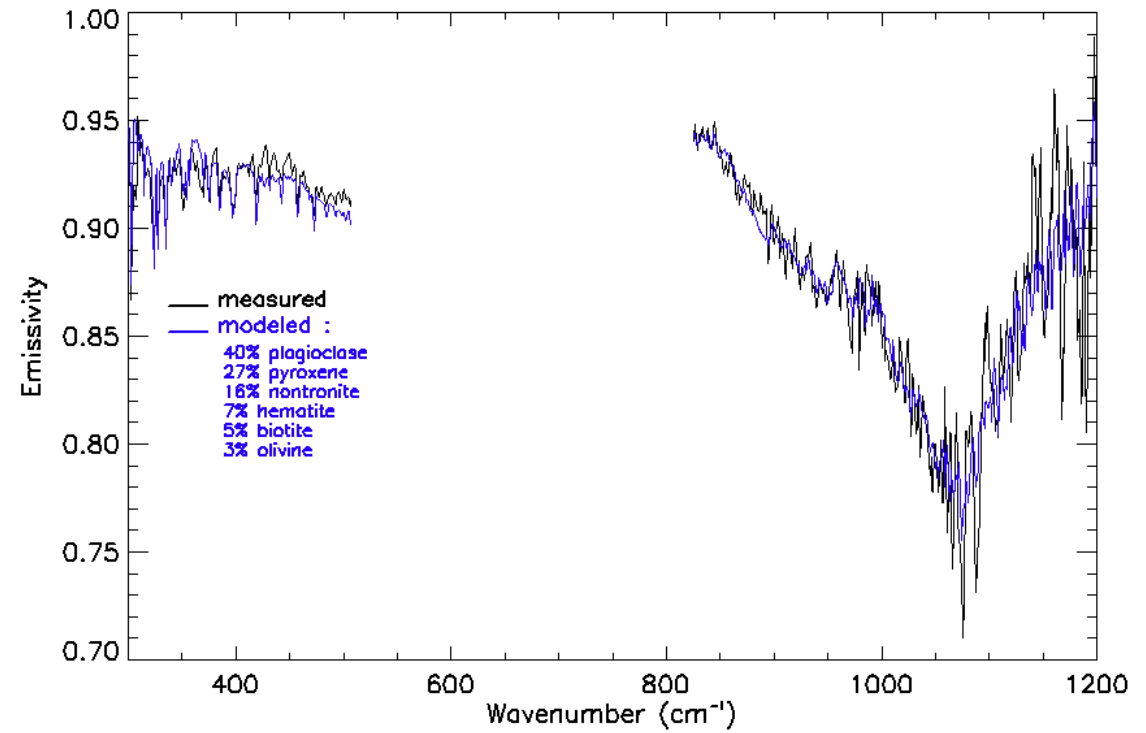
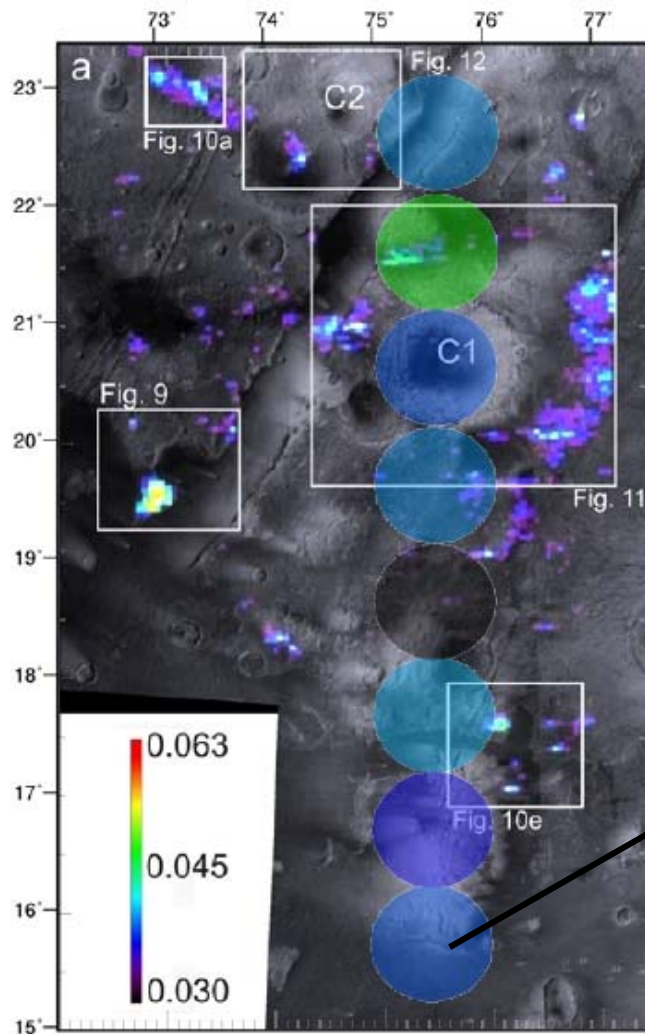
Palagonite from the BED collection



PCA & TT PFS data model

- PFS dataset analysis by means of Principal Component (Factor) Analysis and Target Transformation technique. [Bandfield et al., JGR 105, 2000]
- **Result: atmospheric aerosols spectral “shape” (transmission spectra) as seen by PFS.** [results in press, D’Amore et al.]
- Individual spectra modelled using both atmospheric and surface endmembers from PEL library.
- **Result: concentration coefficient for each endmember representing surface and atmosphere components.**
[Smith et al., JGR 105, 2000]
[Christensen et al., JGR 105, 2000]
- Improvements: high resolution allow to resolve individual gaseous lines, PEL is a true emissivity library that extend previous analyzed range (TES) by similar technique.

OMEGA phyllosilicates detection in Syrtis



Conclusions and Outlook

- **We can take spectra with very good S/N ratio from 3 to 50 μm**
 - Results in agreement with ASU and ASTER (1-R), but typically showing a higher spectral contrast
 - We cover in one emissivity measurement a wavelength range that is usually covered by combining ASU and ASTER (1-R) data
 - Emissivity of finer fractions at a sensitivity than can not be done at ASU
- **The Berlin Emissivity Database (BED) will be soon available online**
 - Four standard grain size fractions, spectral coverage from 3 to 50 μm
 - For infos on BED contact alessandro.maturilli@dlr.de
- **PFS data analysis confirm OMEGA phyllosilicate detection in Syrtis**
 - BED spectral library suitable for surface reconstruction
 - Multiple grain sizes can improve the result
 - BED library to be tested on TES database
 - ... And much more to come !!