MS17-2-7 Nano materials analysis by combination of PDF and (U)SAXS
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Abstract
X-ray powder diffraction is one of the most important techniques for material analysis with applications in areas ranging from pharmaceuticals to mining and from semiconductors to building materials. Each material presents its own challenges, and this creates a constant demand for improved data quality and shorter measurement times. Despite its long history, instrumentation for laboratory X-ray diffraction is in continuous development and recent years have marked significant progress in practically every component involved in the X-ray diffraction experiments.
The highly versatile Empyrean instrument enables a variety of X-ray scattering techniques for the structural and dimensional characterization of matter on multiple length scales. The Empyrean makes accessible on laboratory high-performance ultra-small-angle X-ray scattering (USAXS), small- and wide-angle X-ray scattering (SAXS/WAXS) as well as total scattering (atomic pair distribution function analysis; PDF) experiments. It covers Bragg spacings from sub-Angstroms to 1.7 microns, thus allowing the analysis of dimensions and complex structures in (nano-)materials on multiple length scales. The accessible scattering vector q-range spans over almost five decades (qmin = 0.0036 nm-1 to qmax = 215 nm-1), without any gaps.
SAXS and USAXS allow to investigate the size distribution, internal structure, and shape of nanoparticles and macromolecules and to determine characteristic repeat distances in nanostructured materials. On the other hand, with the total scattering (PDF) technique, the local atomic structures in (partially) disordered materials can be studied. The combination of all scattering techniques thus enables the investigation of complex structures on the atomic and nano- and meso- (length) scales, which is essential for a better understanding of and control over the macroscopic properties of a given material.