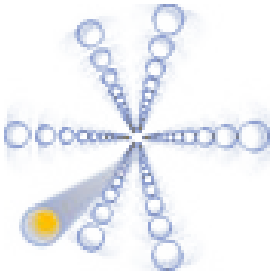

Contribution ID: **174** Type: **Invited talk**

Polycapillary Optics for Advanced X-ray Instrumentations

Tuesday, 7 October 2014 09:00 (30 minutes)

X-ray optics are powerful and effective tools to focus x-rays into small spots ranging from several 100 μm to world records of a few nm. The demand to reach such dimensions is the interest to have an extreme spatial resolution and getting information about elemental distribution, chemical state, morphology of a sample. The classical x-ray optical components are Fresnel lenses, compound refractive lenses, Kirkpatrick Baez optics, single and polycapillaries. An overview of the theoretical fundamentals and the physics involved for these optical elements is given. In detail the operating principle of single and polycapillaries and the influence of total reflection occurring on the inside walls of the single fibres are discussed. This effect results in changes of the primary spectrum after the passage through the optics and also an energy dependence in the size of the focal spot is observed. The technical instrumentation of a scanning device and its optimization is discussed and moreover the results in the 2-D presentation. A combination of 2 polycapillaries one to focus the primary beam and the second in confocal geometry in front of the detector leads to a depth resolution with the possibility to create by a presentation of the scans layer by layer from the well defined depth to achieve a 3-D image of the sample. In addition corrections for absorption effects can be done which is a necessary prerequisite for quantification procedures. In various setups using these x-ray optical elements classical absorption tomography and mathematical reconstructions can be performed leading to images with high resolution. Achievable results for a setup using special detectors with 300nm polymer windows to detect light elements as well as a portable compact spectrometer for the analysis of art objects will be discussed in detail. Applications and results from various fields and many research groups are presented to show the interesting new world unveiled by the combination of x-ray optics with classical laboratory sources and the brilliant high intensive synchrotron radiation.

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