# Johann spectrometer: operation with point-like and extended sources

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Johann spectrometers are widely used for registration of soft x-ray spectra emitted from various x-ray sources. Such device equipped by unique dispersive elements (concave crystals) are usually designed and fabricated in a single copy. High light power and spectral resolution combined with relatively wide spectral range made this device indispensable in daily experiments. A special place is given to the use of Johann spectrometers in diagnostics of hot plasma. The analysis of relative intensities and shape of x-ray lines in close proximity of each other allows one to determine plasma density, temperature, ion and electron energy, electromagnetic field strength. Actually x-ray spectroscopy is best contactless diagnostics implemented on many types of installations including thermonuclear ones. One of the main advantage of x-ray spectroscopy compared to optical spectroscopy is the use of close lying lines which means no need of calibration. Reliable theories for the intensities of x-ray lines are also well developed, which in particular assumes that considered lines are emitted by the same plasma region. However the peculiarity of Johann device is: the source area from which radiation is selected depends on crystal to x-ray source distance, source size, crystal sizes etc, i.e. from the actual geometry of experiment. Such an area may be different even for closely lying lines, used in plasma diagnostics, significantly increasing the errors in estimation of plasma parameters. This paper is devoted to the analysis of peculiarities of operation of Johann devices in various experimental geometries including registration spectra from extended sources (tokamaks, stellarators), point-like sources (vacuum spark, laser produced plasma) and also point-like sources consisted from few point-like areas (plasma focus). Results of presented analysis allows one to optimize errors in the experiments on determination of plasma parameters.