A method of experimental measurement of Point Spread Function (PSF) due to scintillator for high energy protons

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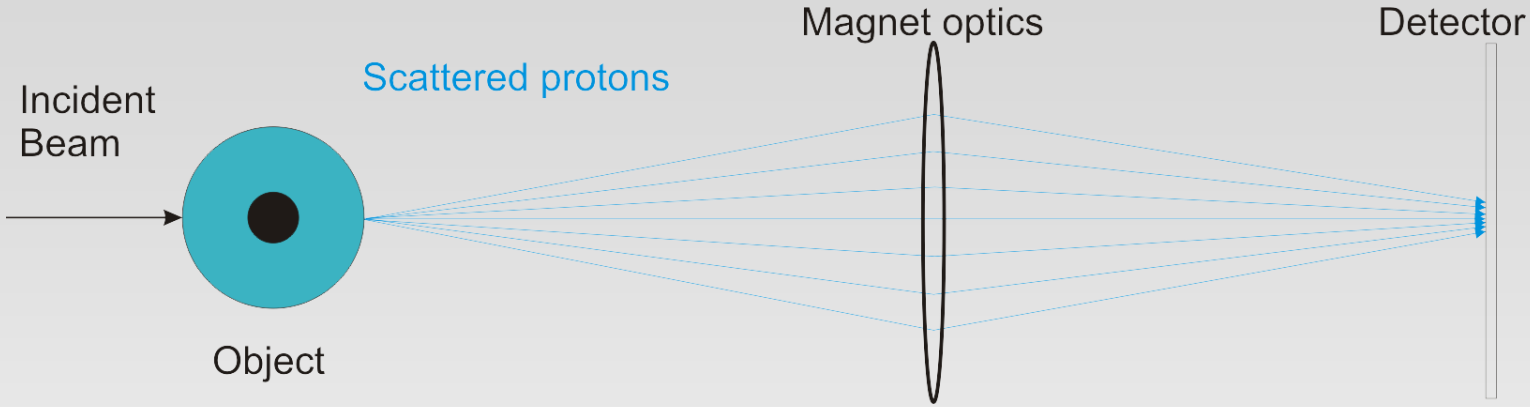
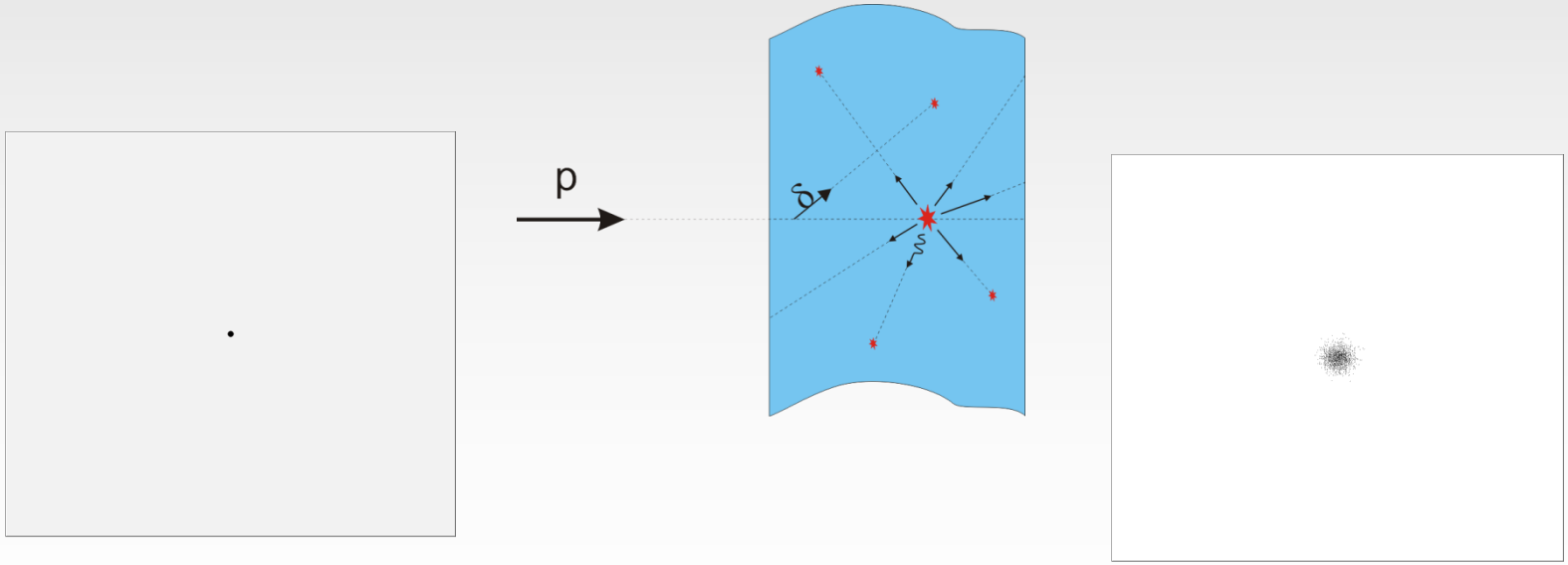
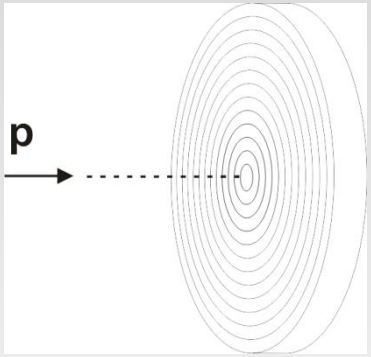
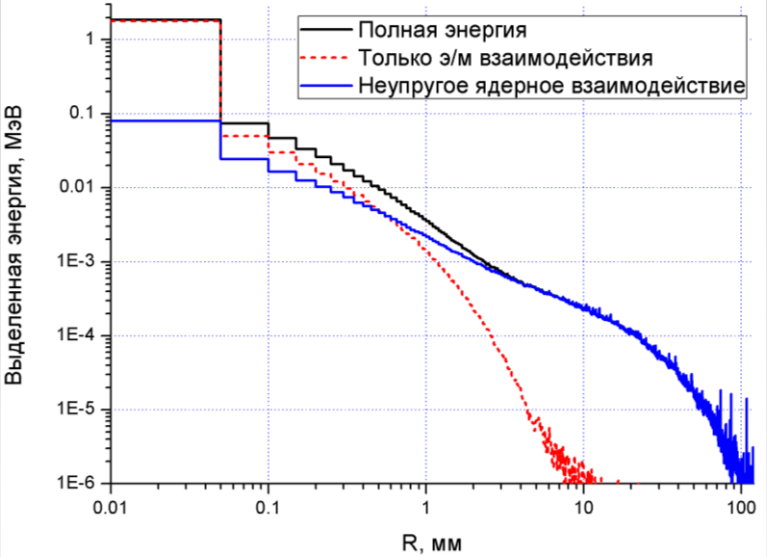
Point Spread Function

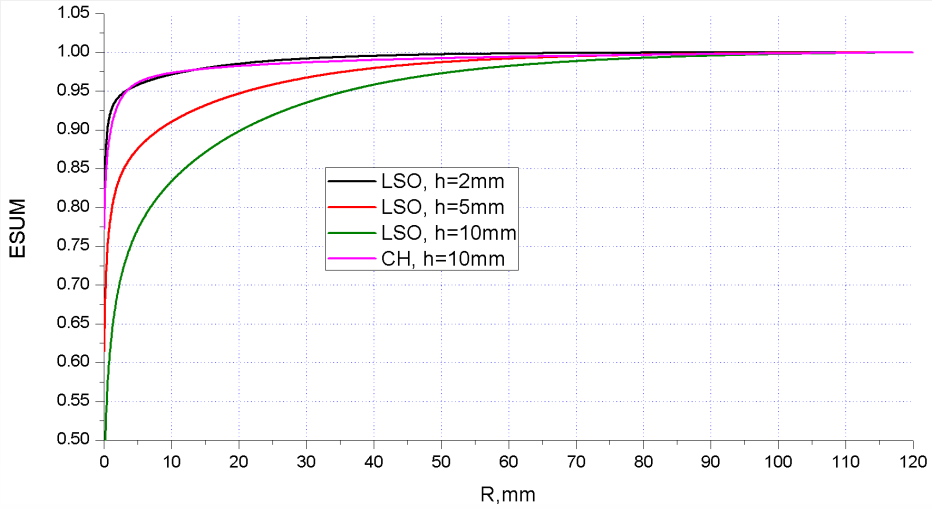




Monte-Carlo Modeling of Energy Deposition

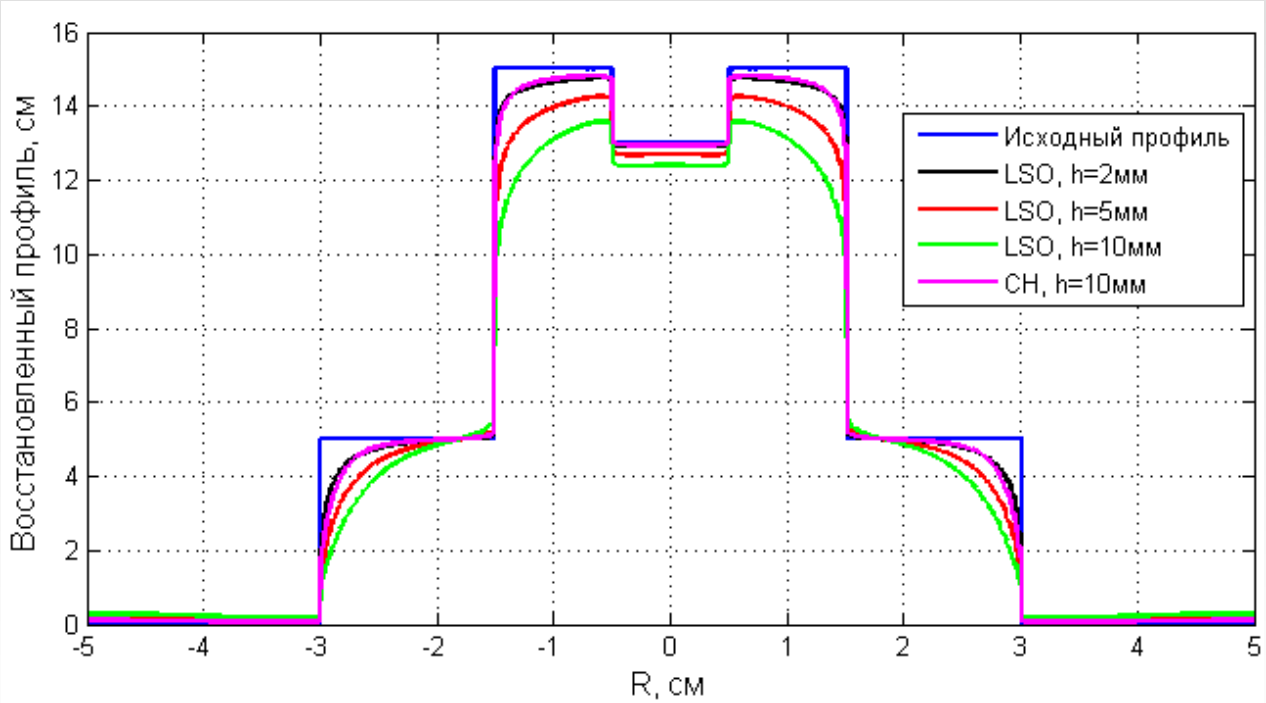




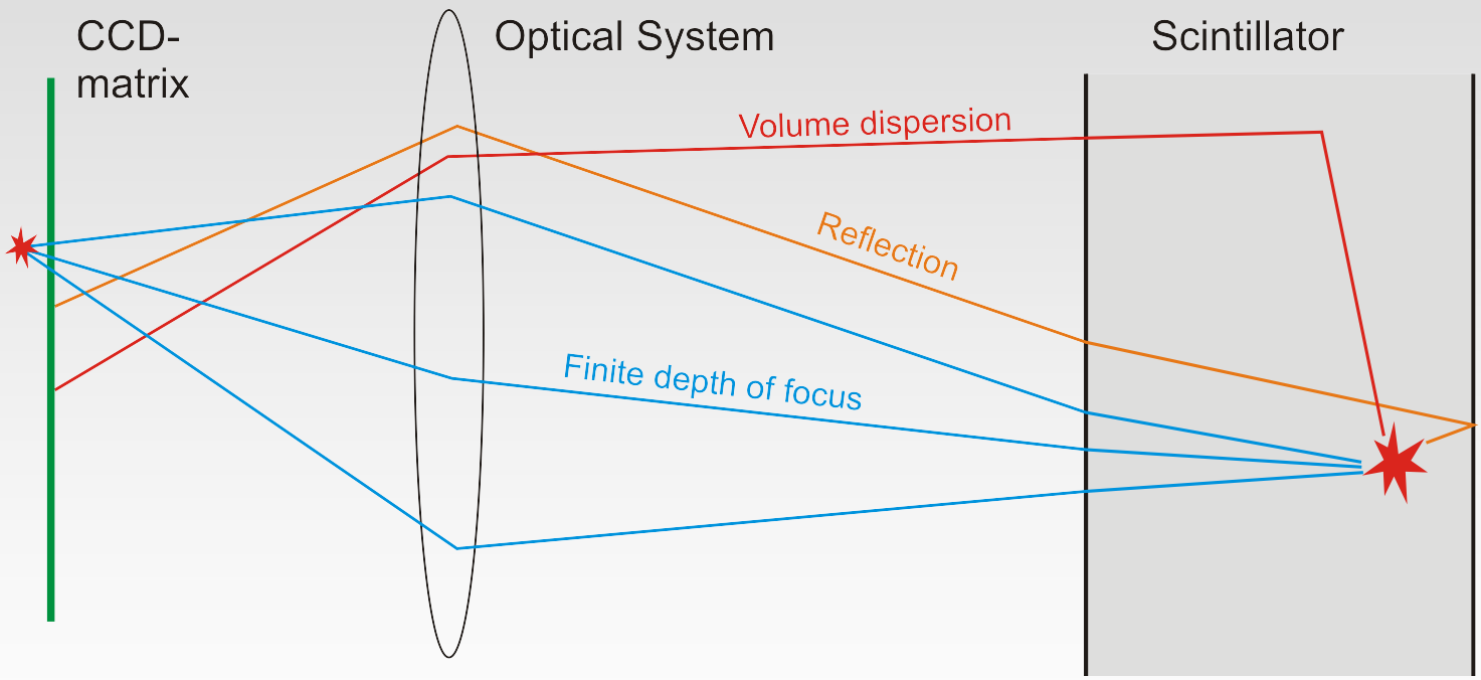


$$ESUM(R) = \int_0^R E(r)dr \Big/ \int_0^\infty E(r)dr$$

Influence of simulated deposition of energy on the profile of restored object



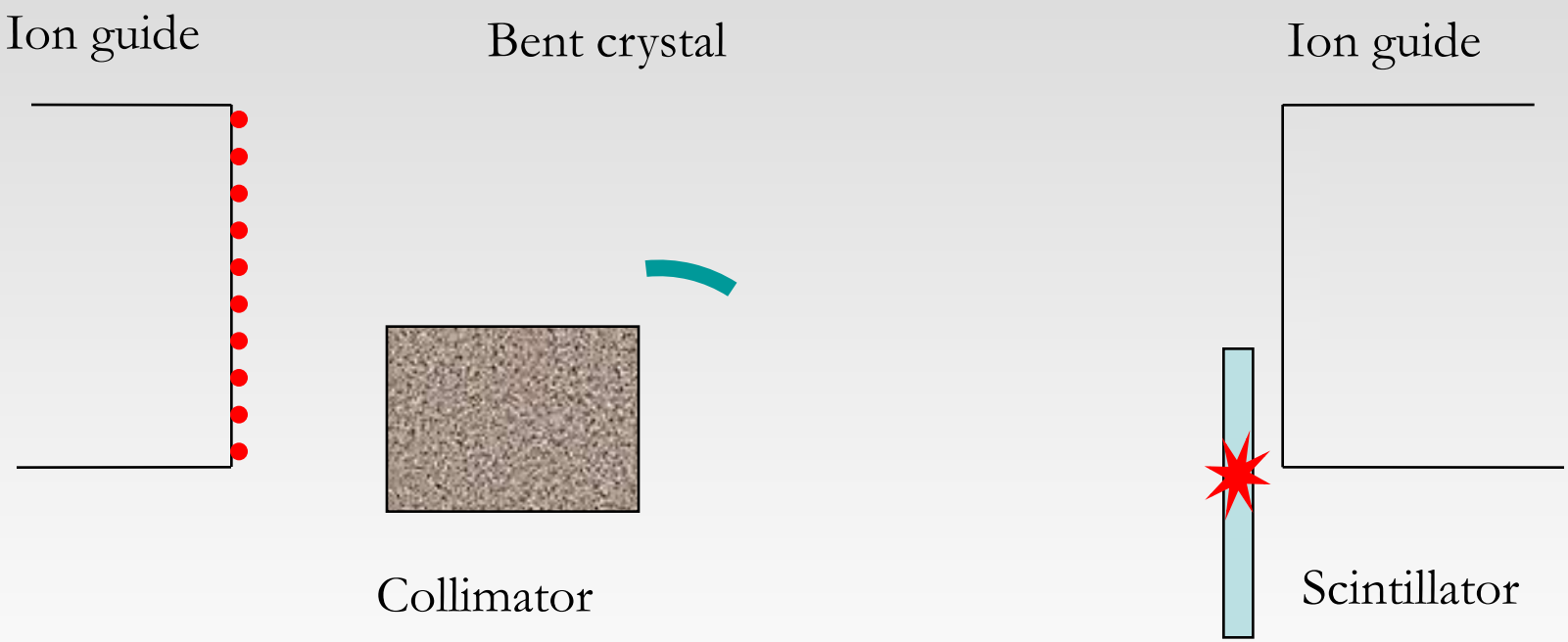
Mechanism of optical image blur



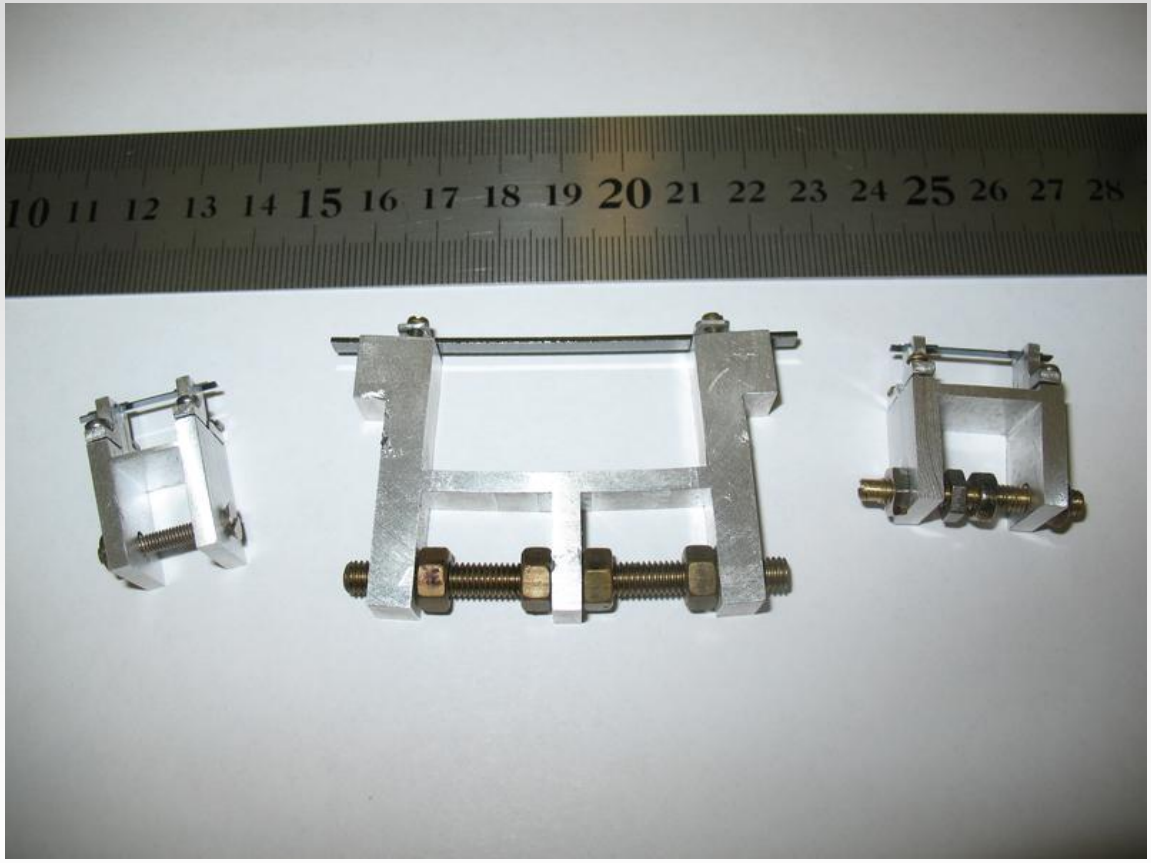
PSF applications

- Knowledge of PSF can help to simulate pRad images more accurately; this is important at the stage of experiment planning;
- Having PSF for several different scintillators one can choose optimal among them to obtain images of high quality;
- Having PSF one can solve inverse problem (deconvolution), i.e. restore density of protons impinging into scintillator by blurred detected image and PSF;
- Large "range of action" of PSF must be accounted for when planning experiments, especially when designing metrological test-objects for transmission curve measuring;
- Image blur can lead to a considerable error in reconstructed density, that could be of crucial importance for some applications, e.g. tomography, discrimination of materials in binary mixture etc.;

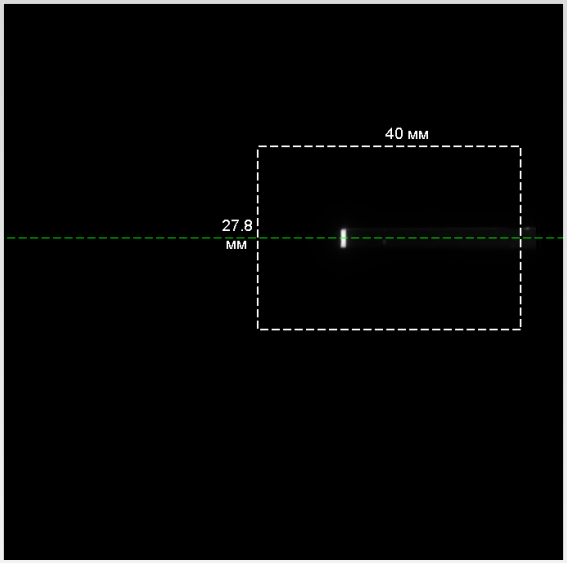
Scheme of experiment with bent crystal

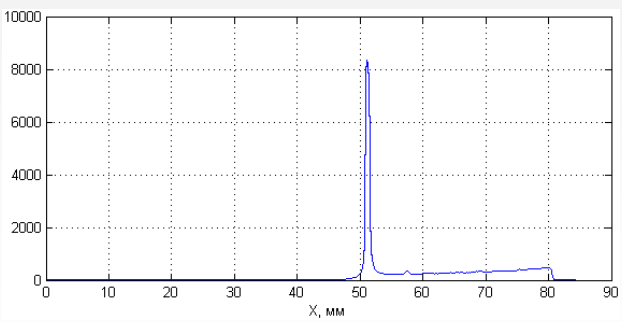


Crystals outlook

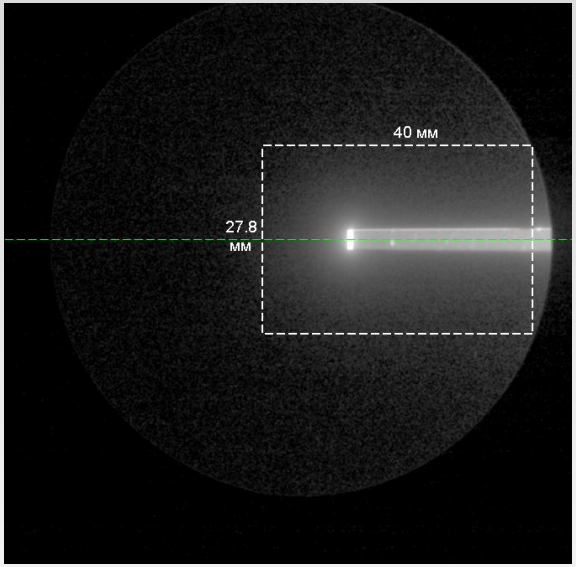


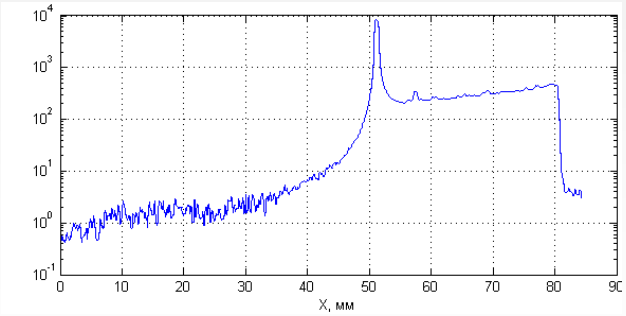
Registered experimental images





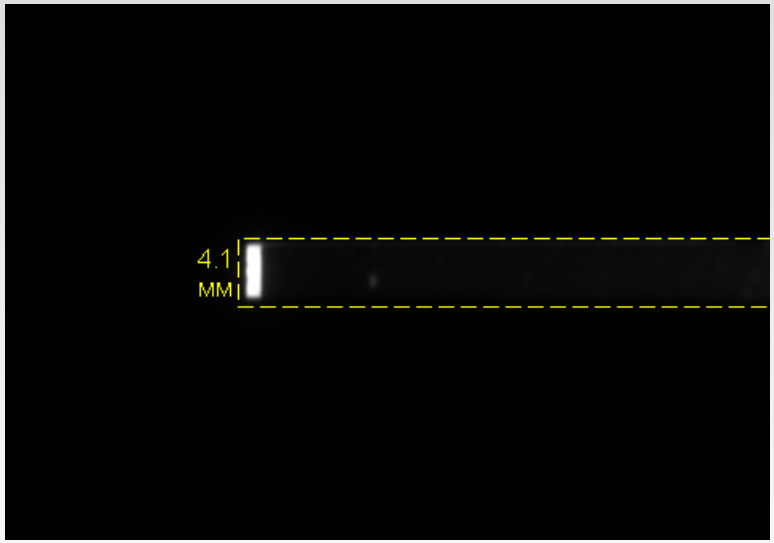
Linear scale



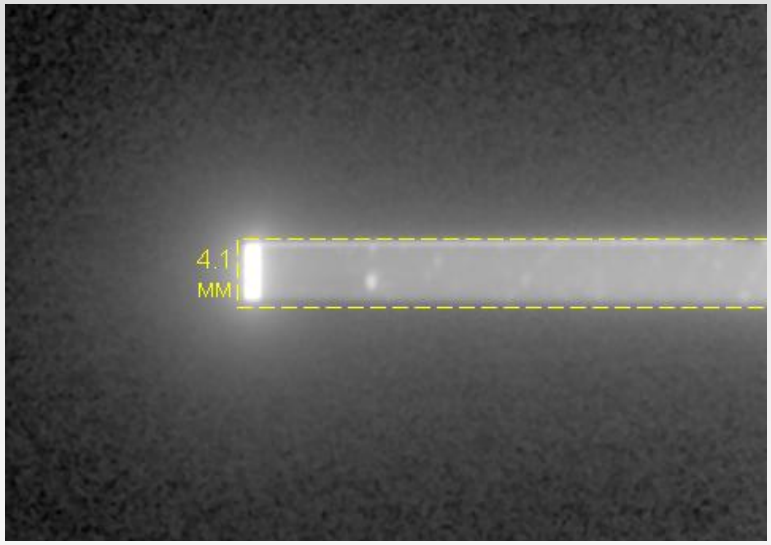


Logarithmic scale

Registered experimental images

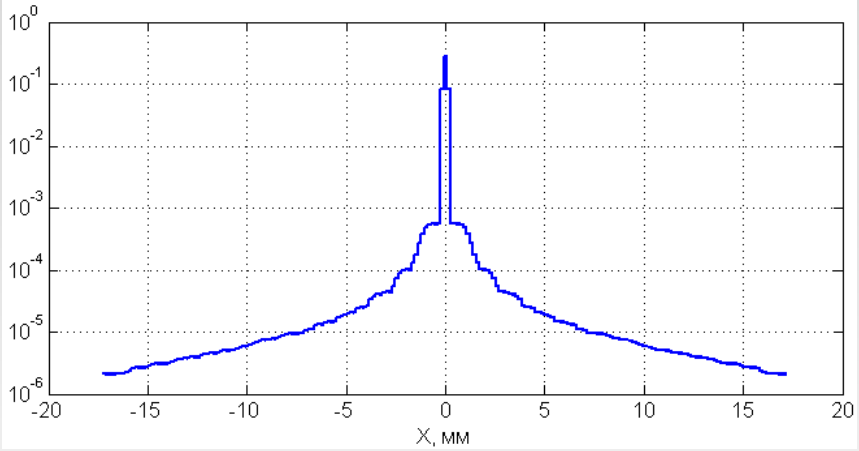


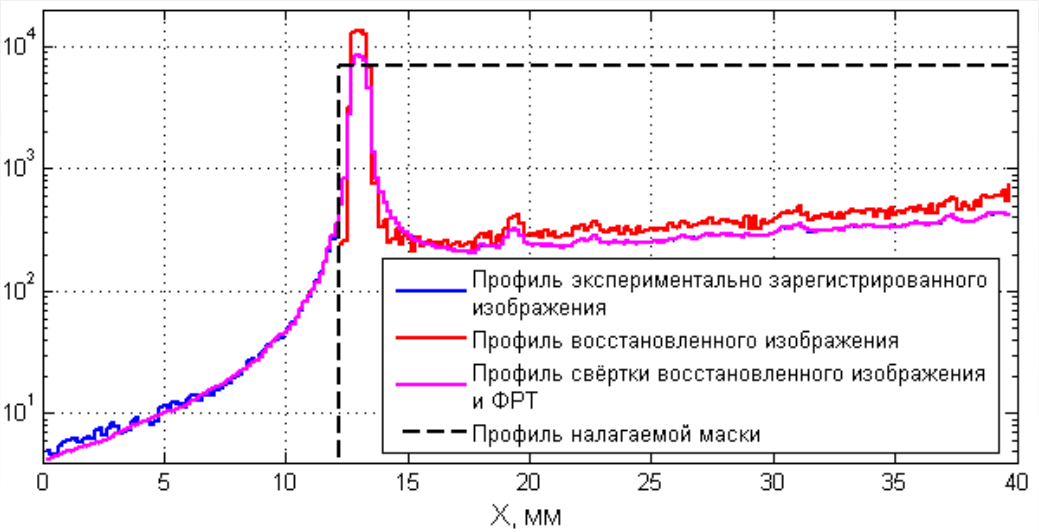
Linear scale



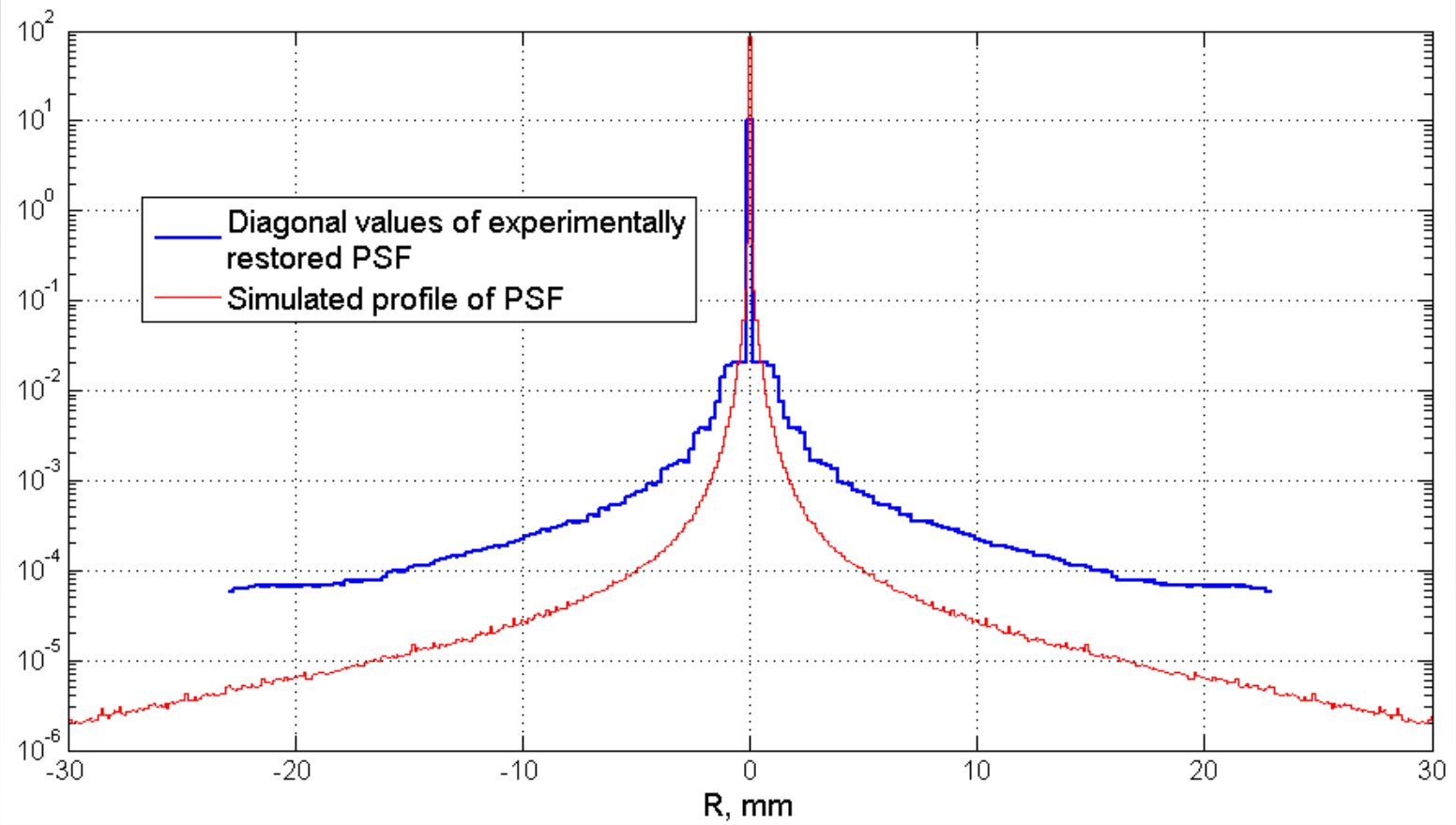
Logarithmic scale

Restored PSF profile

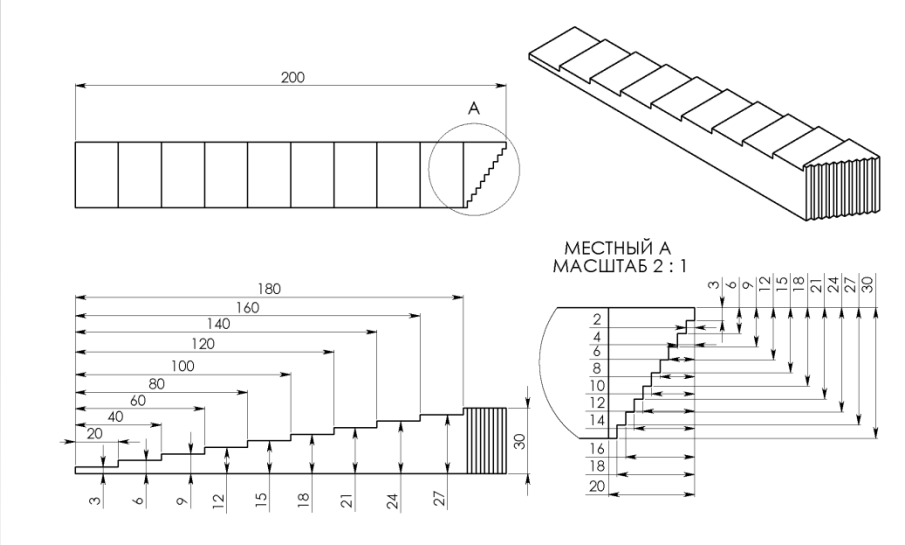




Comparison of experimentally restored and simulated PSF



Application of PSF for treatment of experimental data



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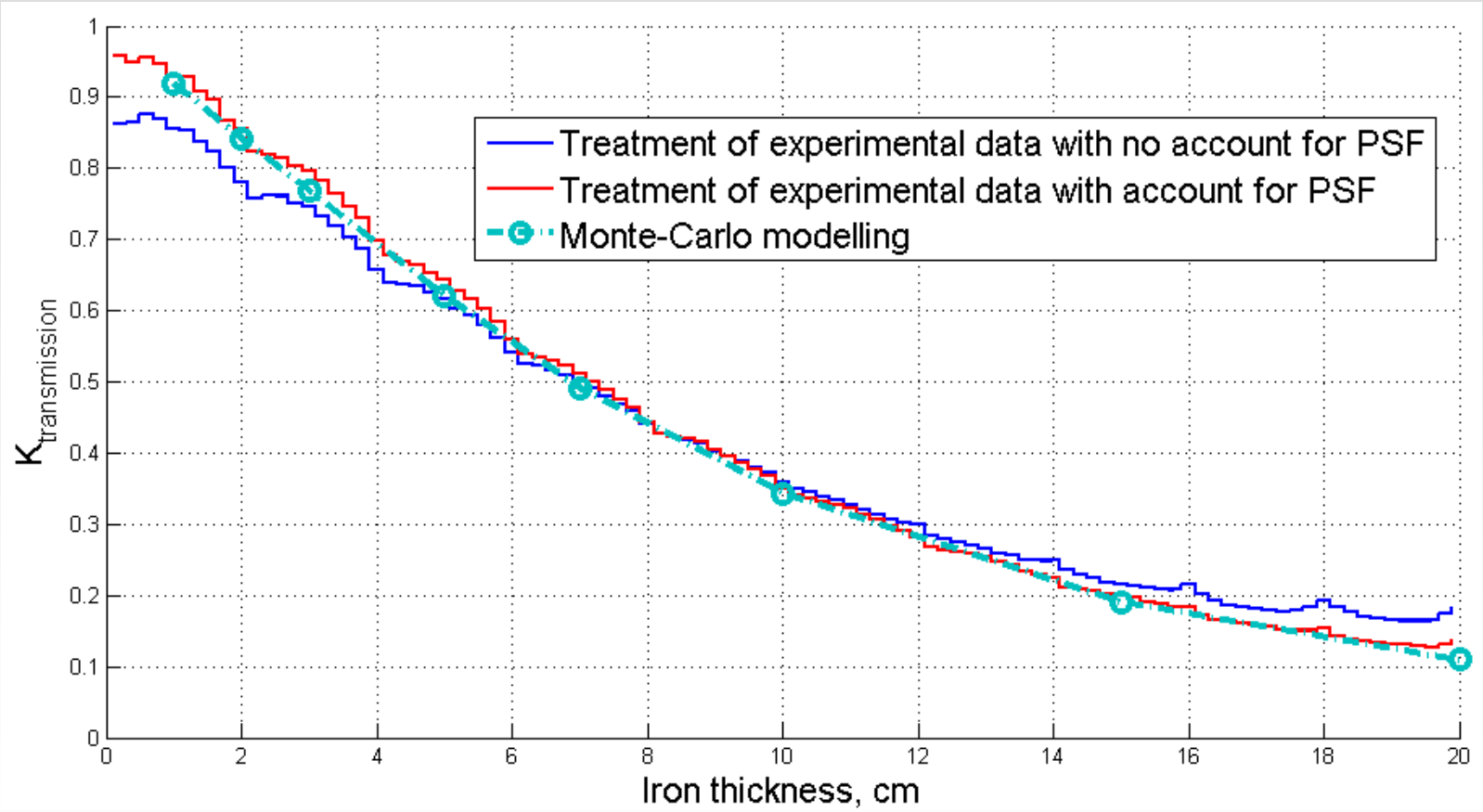

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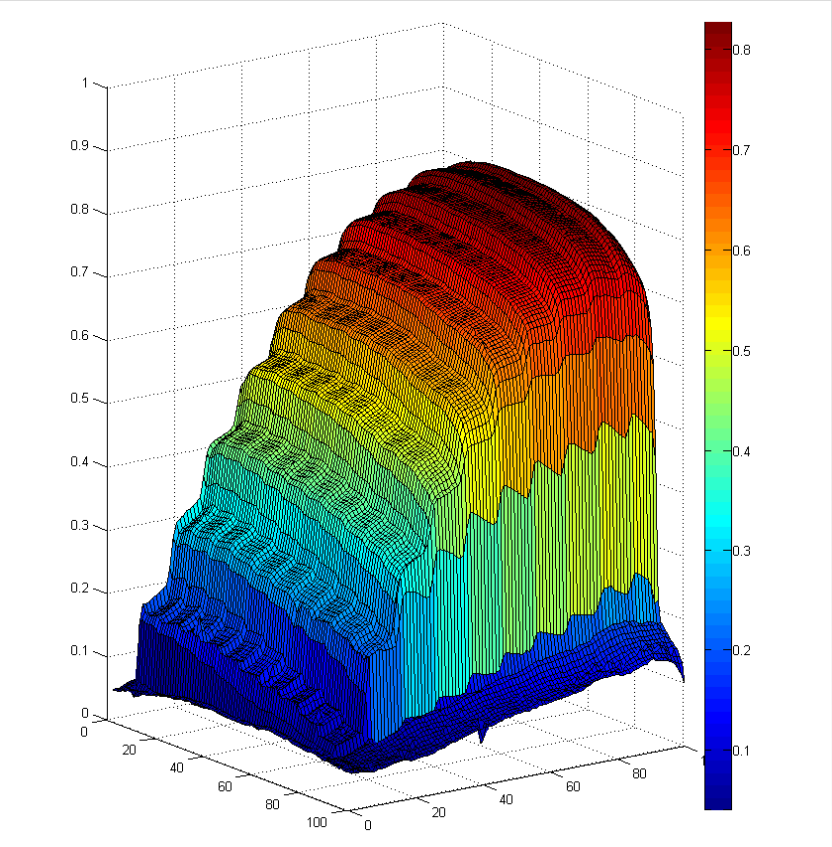
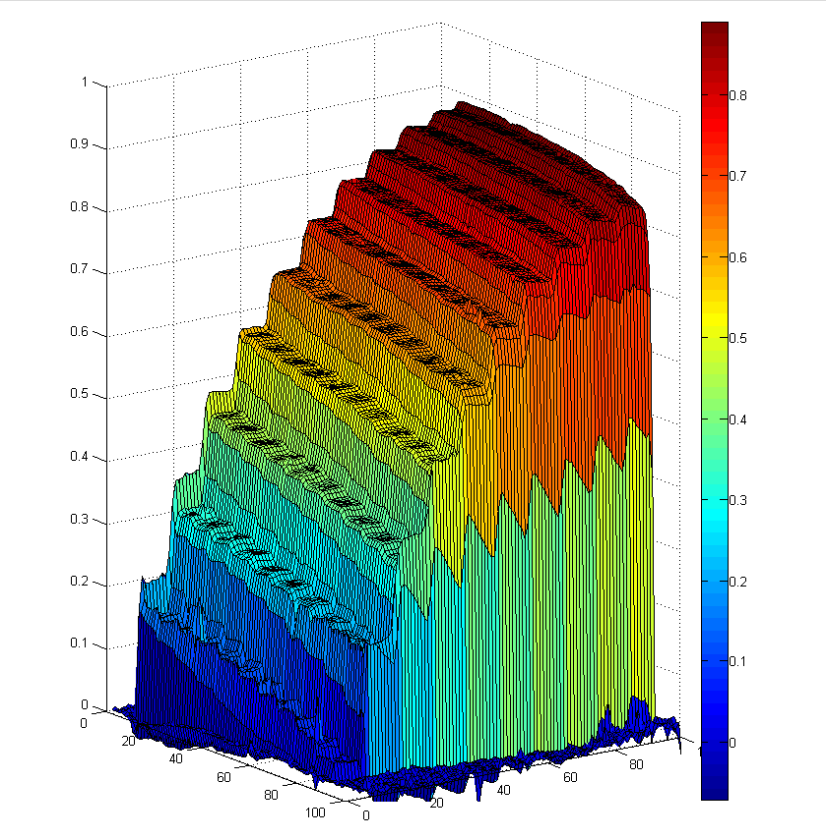


With no account for PSF



With account for PSF