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Feasibility study on local three-dimensional soft x-ray tomographic imaging for KSTAR plasmas JUNGHEE KIM, SEUNG HUN LEE, W. CHOE, Department of Physics, Korea Advanced Institute of Science and Technology, 373-1 Guseong-dong, Yuseong-gu, Daejeon 305-701, Korea — To obtain a 3-D internal soft x-ray emissivity structure of tokamak plasmas at a specific shot time, a direct inversion from 2-D detector arrays is required. The direct local 3-D soft x-ray imaging will be a powerful diagnostic tool for monitoring core plasmas. In order to pursue it, we introduce in this paper our sophisticated design of the system matrix and the newly modified fast MEM (maximum entropy method) without prior knowledge. Because the spatial accessibility of 2-D cameras in KSTAR is very limited, the posterior probability density function of the fast MEM inversion is modified and the geometrical characteristics around the local sought-for plasma are considered to calculate 3-D system matrix. A partly toroidal sought-for emission region is divided into several thousands of trapezoidal voxels instead of using cubical voxels. All tests for this study were performed on KSTAR-like 3-D emission phantoms and the reconstruction region is about a quarter of the whole plasma volume when the tangential cameras are installed at the same horizontal port of KSTAR. We expect that the tangential camera system for the local 3-D tomography can be consisted of one or two miniaturized CCD, MPGD (micro-pattern gas detector), 2-D photodiode arrays, and so on.

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