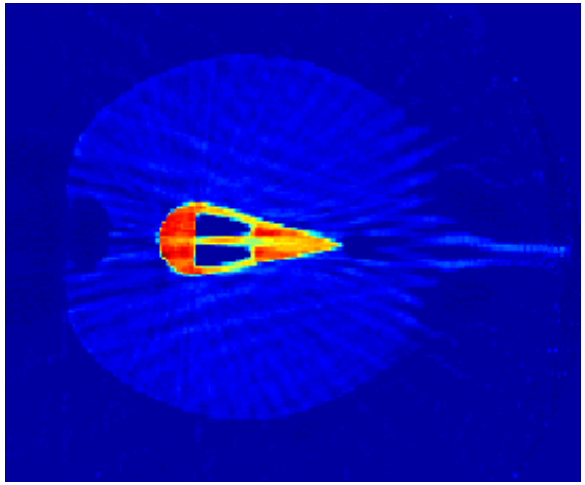
TV-Regularized Proton Radiograph Inversion:

Object : BCO4 – Aluminum and Lead static test object
Data : 30 independent view proton radiographs

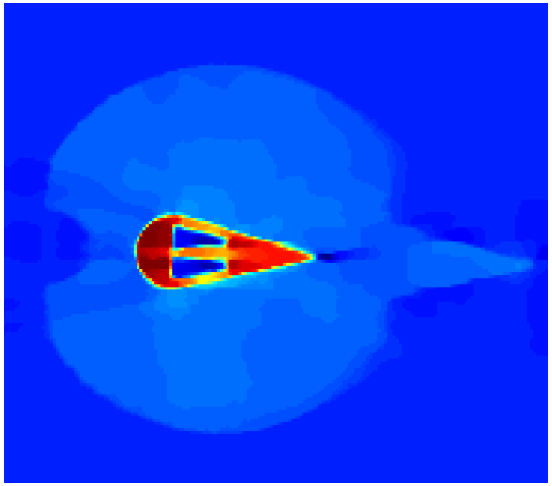
$$\text{cost} = F(u) = \int |d - Pu|^2 \, dz + \alpha \int |\nabla u| \, dx dy$$

data fidelity total *image* variation

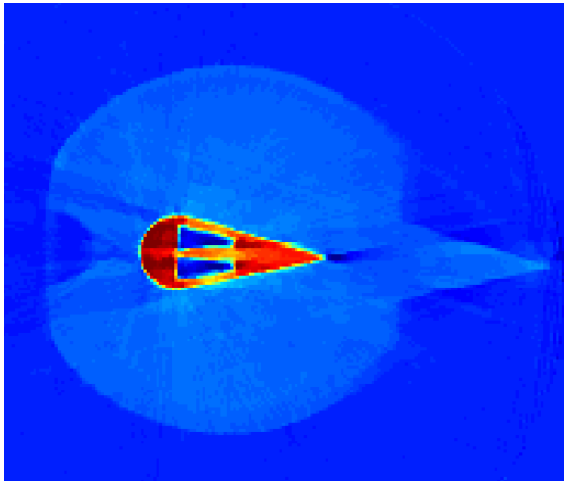
Nonnegative pSVD



Noise-Constrained TV



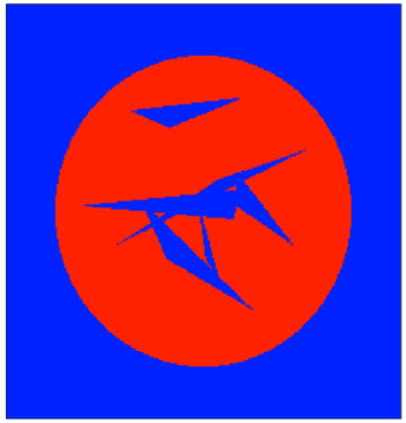
TV pSVD



TV-Regularized Simulated Radiograph Inversion

Object : binary-density ‘standard’ test object
Data : 9 independent view synthetic noisy radiographs

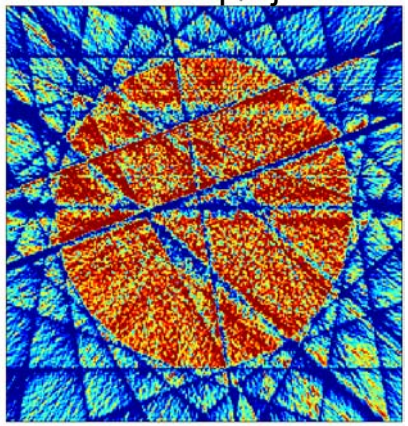
object



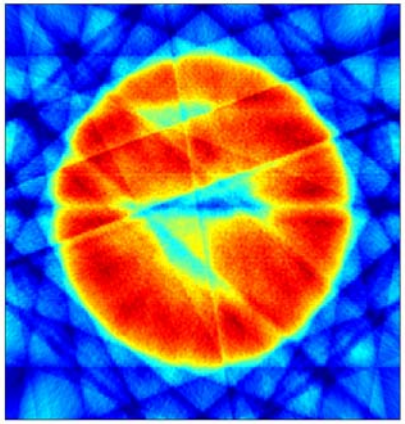
$$\text{cost} = F(u) = \int |d - Pu|^2 \, dz + \alpha \int |\nabla u| \, dx dy$$

data fidelity total *image* variation

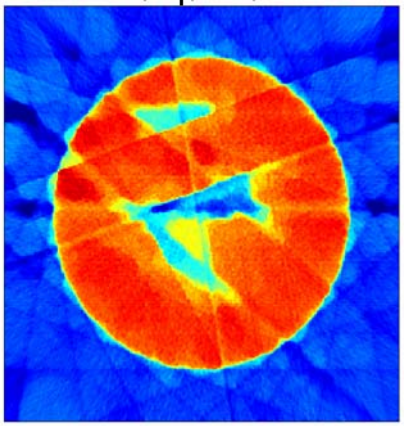
filtered back projection



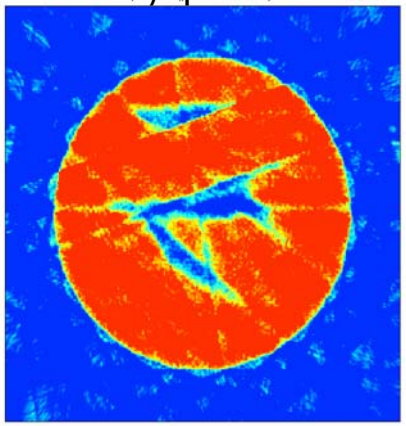
truncated SVD



TV-pSVD

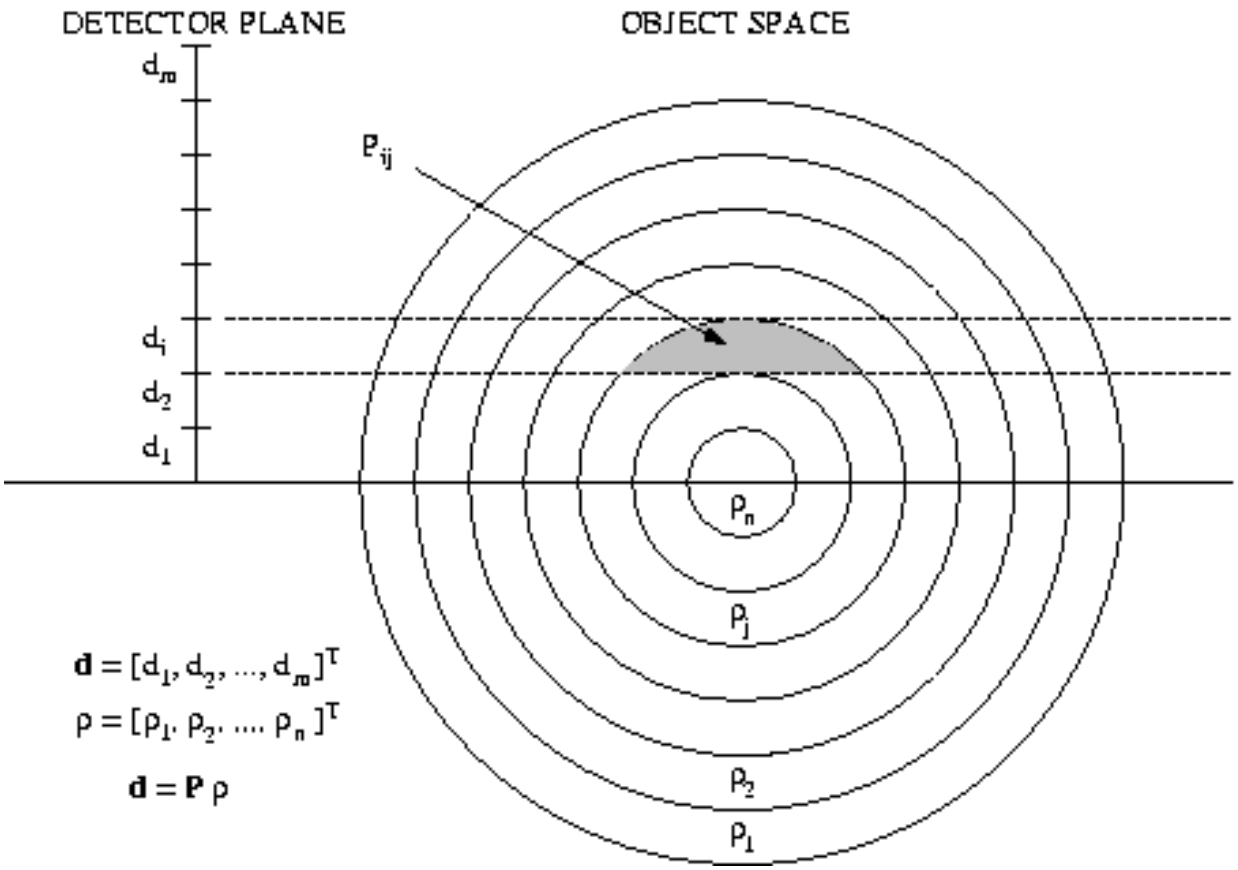


ρ-pSVD

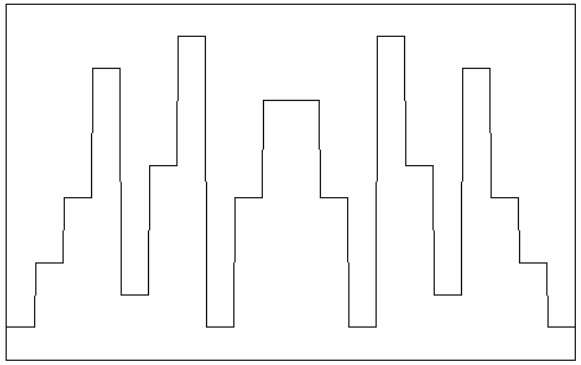


TV-Regularized Abel Tomography

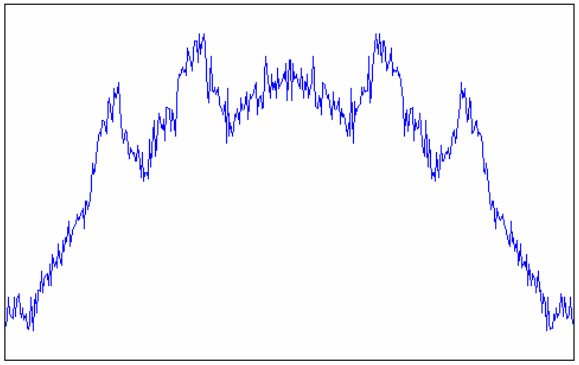
$$\text{cost} = F(u) = \int |d - Pu|^2 \, dr + 2\pi\alpha \int |\nabla u| r dr$$



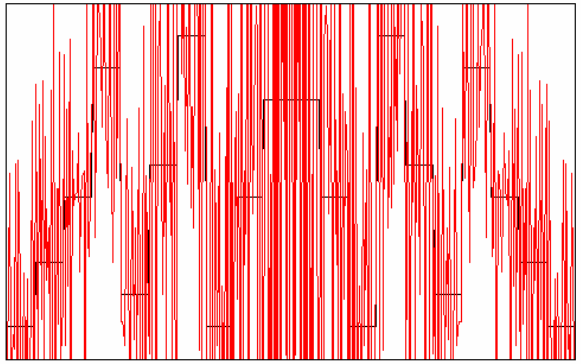
Object Radial Density Profile



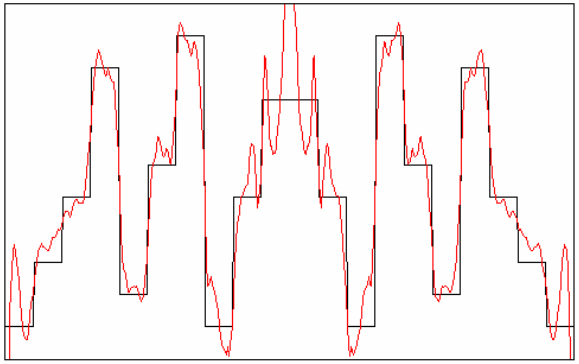
Noisy Areal Density Profile (Mass Projection)



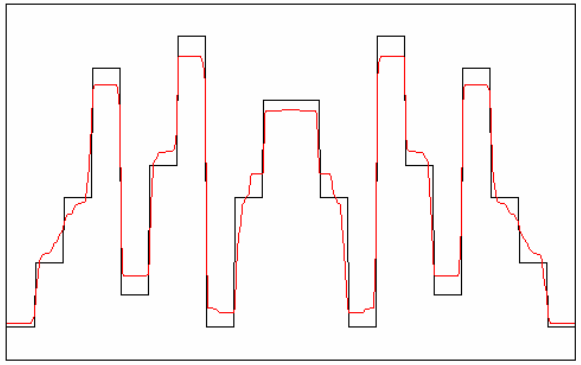
Non-Regularized Abel Inversion



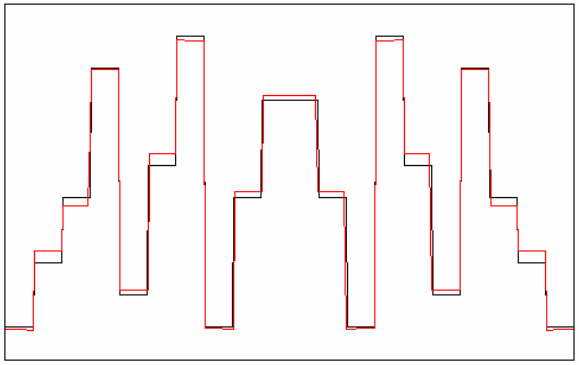
L2-Regularized Abel Inversion

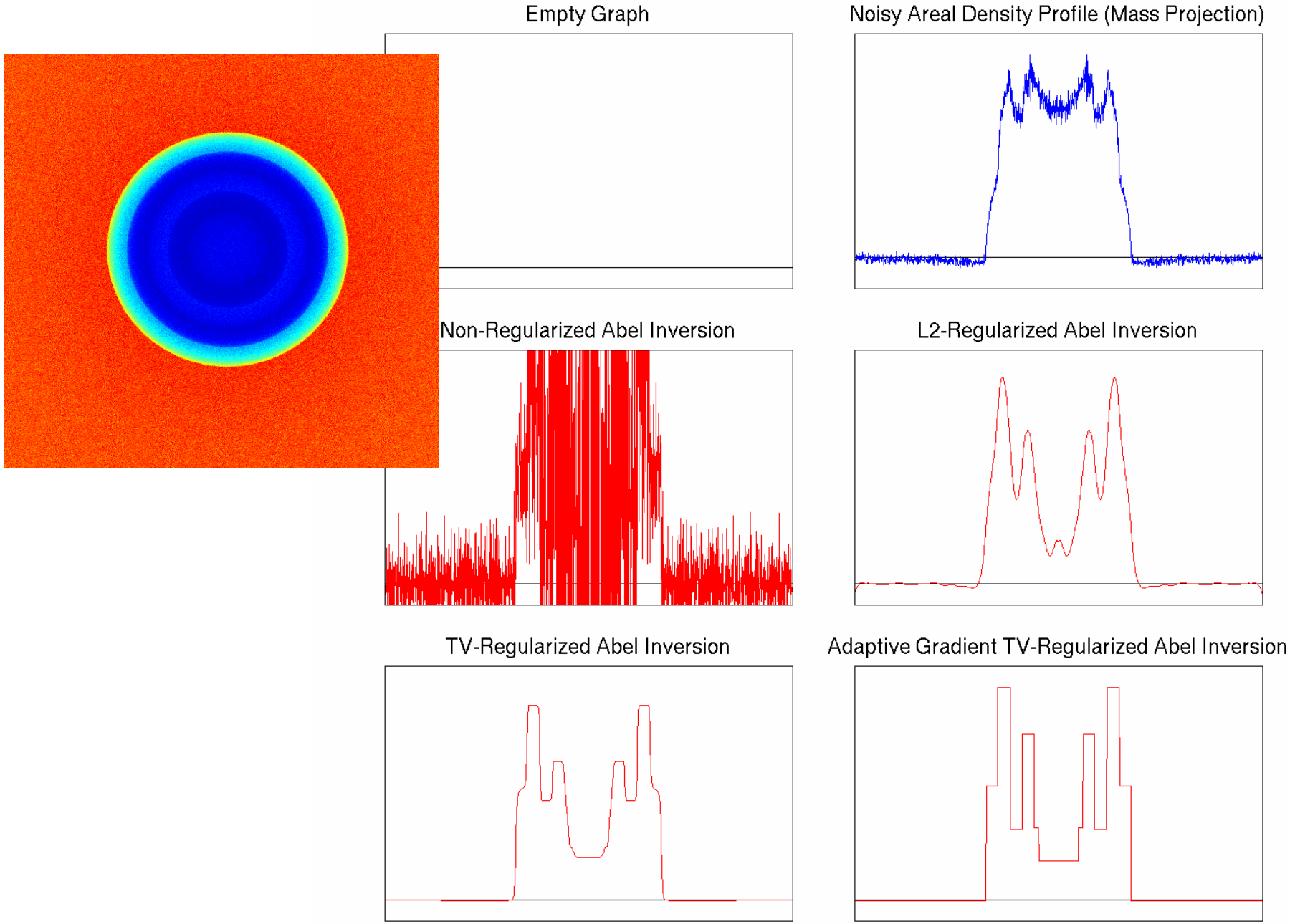


TV-Regularized Abel Inversion



Adaptive Gradient TV-Regularized Abel Inversion




Empty Graph
Noisy Areal Density Profile (Mass Projection)
Non-Regularized Abel Inversion
L2-Regularized Abel Inversion
TV-Regularized Abel Inversion
Adaptive Gradient TV-Regularized Abel Inversion