A joint **CT reconstruction model** that computes **intensity drift** and **detector response**.

CT with Uncertain Source Model

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The Problem

- Source model errors arise from uncertain detector response and source intensity drift.
- The errors in data can lead to severe reconstruction artifacts (see FBP reconstruction).

Our Model

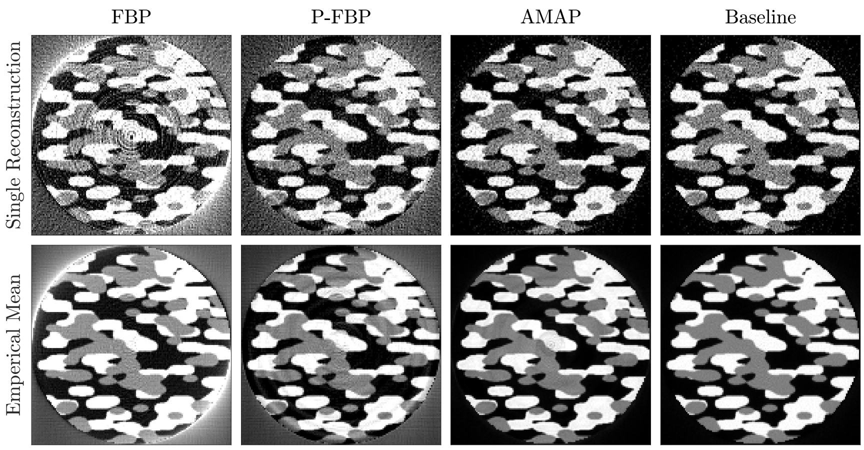
- Approximated MAP formulation,

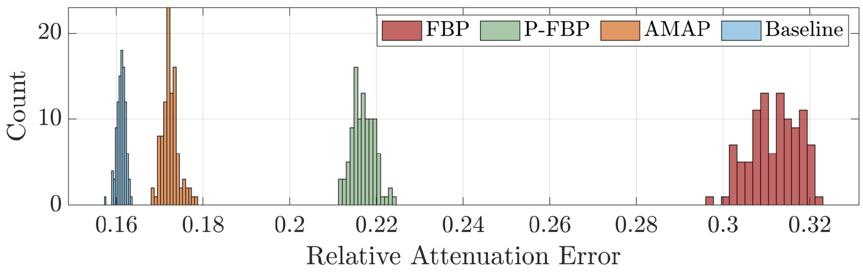
$$\min_{u\geq 0} \frac{\lambda}{2}\|\mathcal{M}x - b\|^2 + \varphi(x;\delta,\alpha,\beta)$$

where λ, δ, α and β are hyperparameters associated with b, u, v and w, respectively.

Results

- Simulation study with 100 noise realizations comparing FBP, preprocessed FBP with heuristisk intensity drift correction (P-FBP), our proposed model (AMAP) and the baseline reconstruction without model errors.





Background

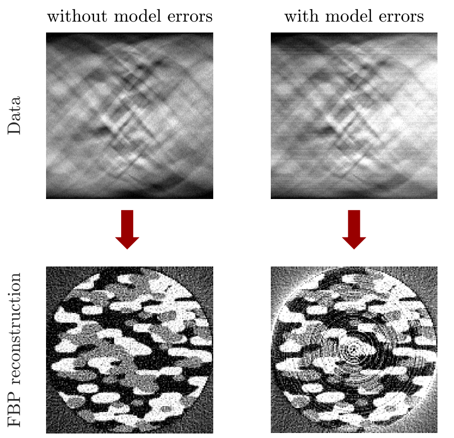
- Computed Tomography (CT) is a non-invasive scanning technique with applications in various areas of sciences such as medical imaging and materials science.
- Lambert-Beer's law links measured source intensity (y), object of interest (u), detector response (v) and intensity drift (w), i.e.

$$y = \mathrm{diag}(\hat{y}_0)\exp(-\mathcal{A}u + w\otimes v)\,,$$

where the matrix $\mathcal{A}$ contains information about the traveled path of the beams and $\hat{y}_0$ is the estimated intrinsic intensity.

- Rearranging the terms yields,

$$\underbrace{-\log\left(\frac{y}{\hat{y}_0}\right)}_{b} = \underbrace{\left[\mathcal{A},\ (\mathbf{1}\otimes I),\ (I\otimes\mathbf{1})\right]}_{\mathcal{M}} \underbrace{\begin{bmatrix} u \\ v \\ w \end{bmatrix}}_{x}$$



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