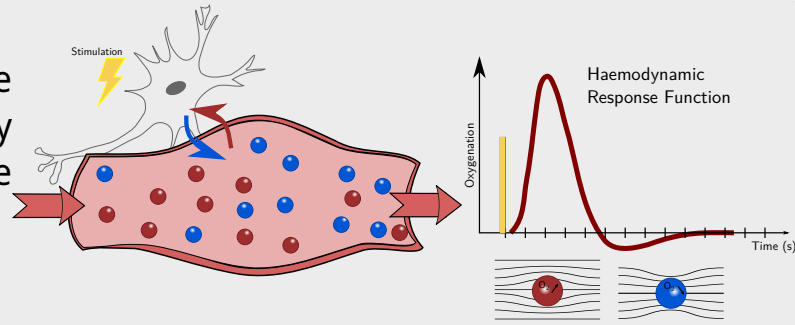


Signal of interest

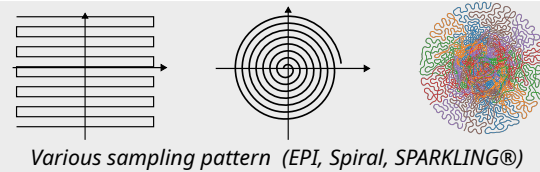
The *Neuro-Vascular* coupling and the *magnetic properties* of the blood give a proxy to measure brain activity using a sequence of MR Images.

Blood-Oxygen Level Dependent Signal



k-space to image

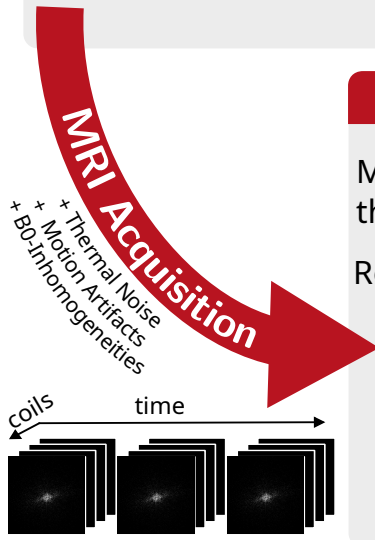
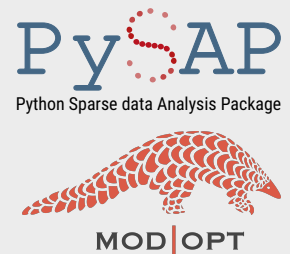
MRI Scanner samples the information in the 3D spatial Fourier domain (*k-space*)



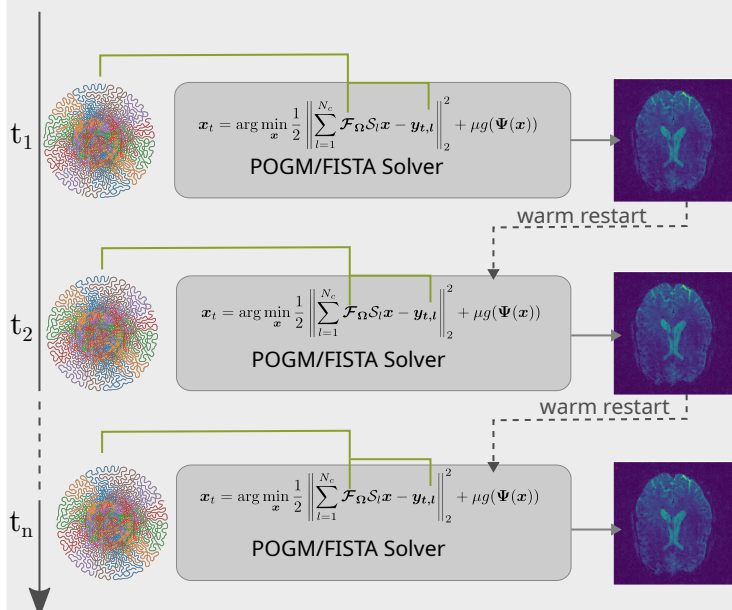
Reach high resolution volume at high speed using:

Compressed Sensing Regularisation
 Parallel Imaging
 Non Uniform Undersampling

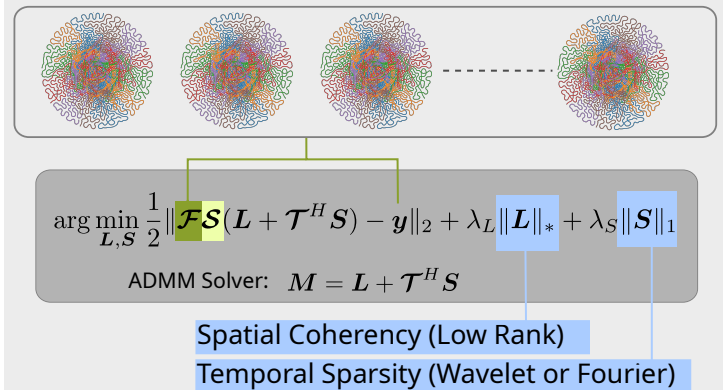
$$\mathbf{x}_t = \arg \min_{\mathbf{x}} \frac{1}{2} \left\| \sum_{l=1}^{N_c} \mathcal{F}_{\Omega} S_l \mathbf{x} - \mathbf{y}_{t,l} \right\|_2^2 + \mu g(\Psi(\mathbf{x}))$$



Sequential Reconstruction



Global Reconstruction



Discussion and Future Work

- Sequential Reconstructions are the de facto standard.
- Global Reconstruction is a new reconstruction framework allowing for tailored regularisation and innovative acquisition methods.
- Future Work
 - Move to local low rank approaches
 - Validation with in vivo acquisitions.

More Ressources

- <https://github.com/paquiteau/pysap-fmri>
- <https://github.com/paquiteau/mri-cufinufft>
- pierre-antoine.comby@ens-paris-saclay.fr

