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► To cite this version:

Guillaume Laurent, Christian Bonhomme. Non-uniform sampling & denoising applied to nuclear magnetic resonance. Spring School on Sparse Representations and Compressed Sensing, Apr 2016, Ilmenau, Germany. hal-01516795

HAL Id: hal-01516795

<https://hal.sorbonne-universite.fr/hal-01516795>

Submitted on 2 May 2017

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Non-Uniform Sampling & Denoising applied to Nuclear Magnetic Resonance



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Nuclear Magnetic Resonance



Physico-chemical
spectroscopic analysis

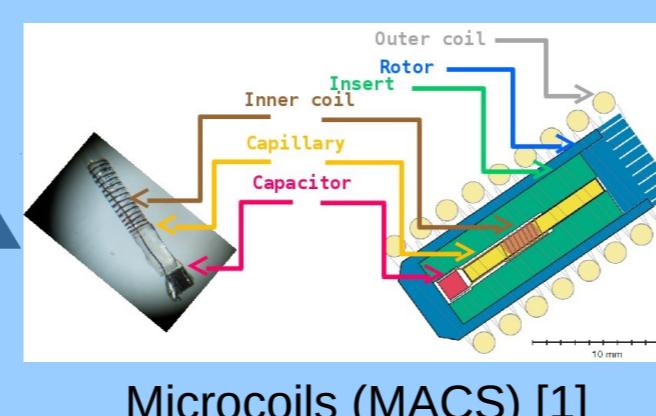


Precise but poor sensitivity
↓
100 mg of sample needed
Broad noisy peaks
for distributed environments

Context

Increasing sensitivity

Sensitivity gain
= time gain
or sample size gain

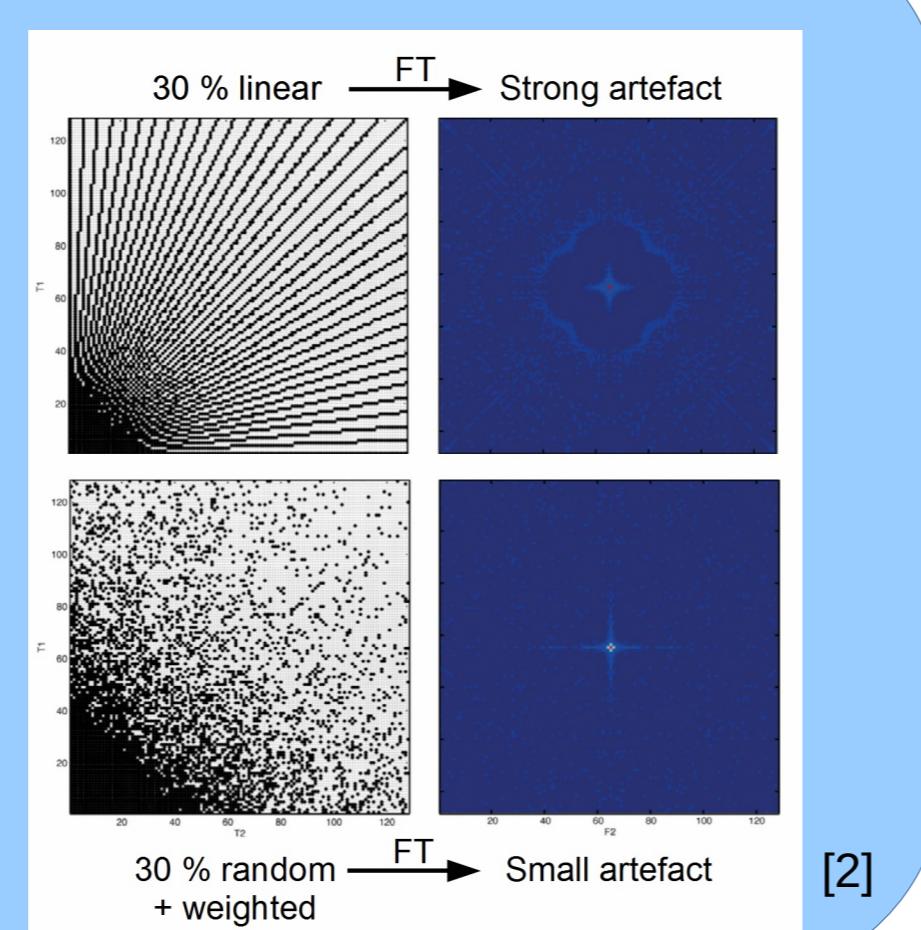
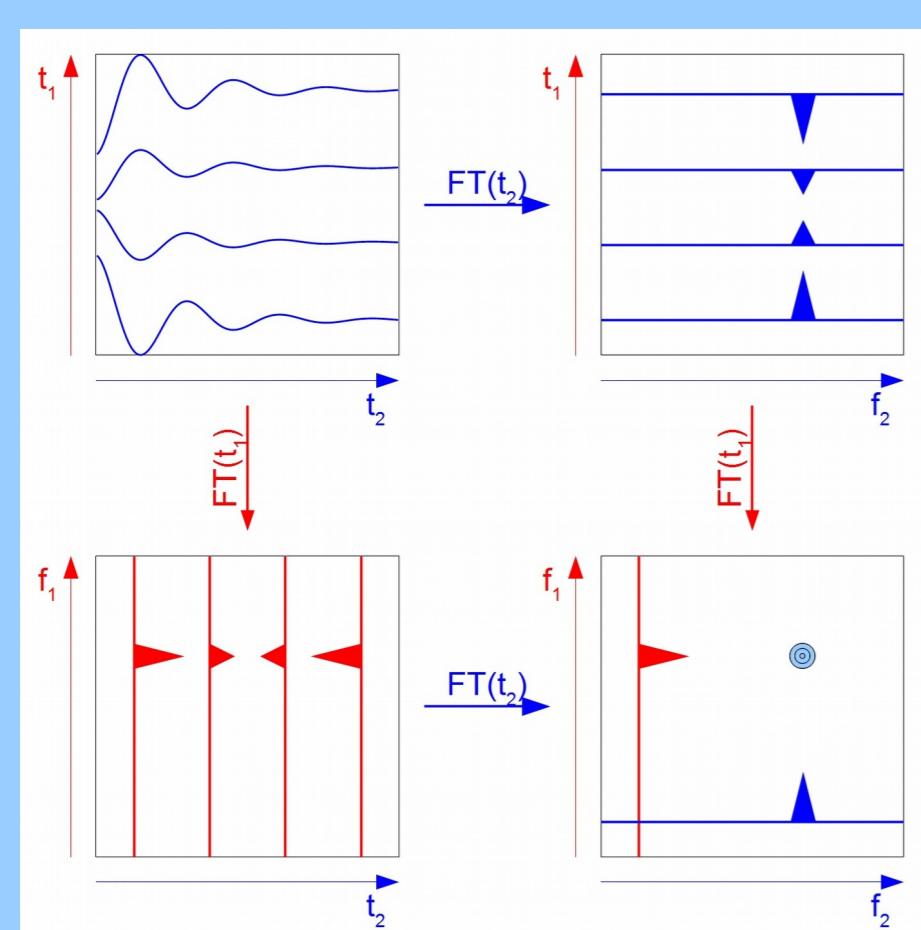


Microcoils (MACS) [1]

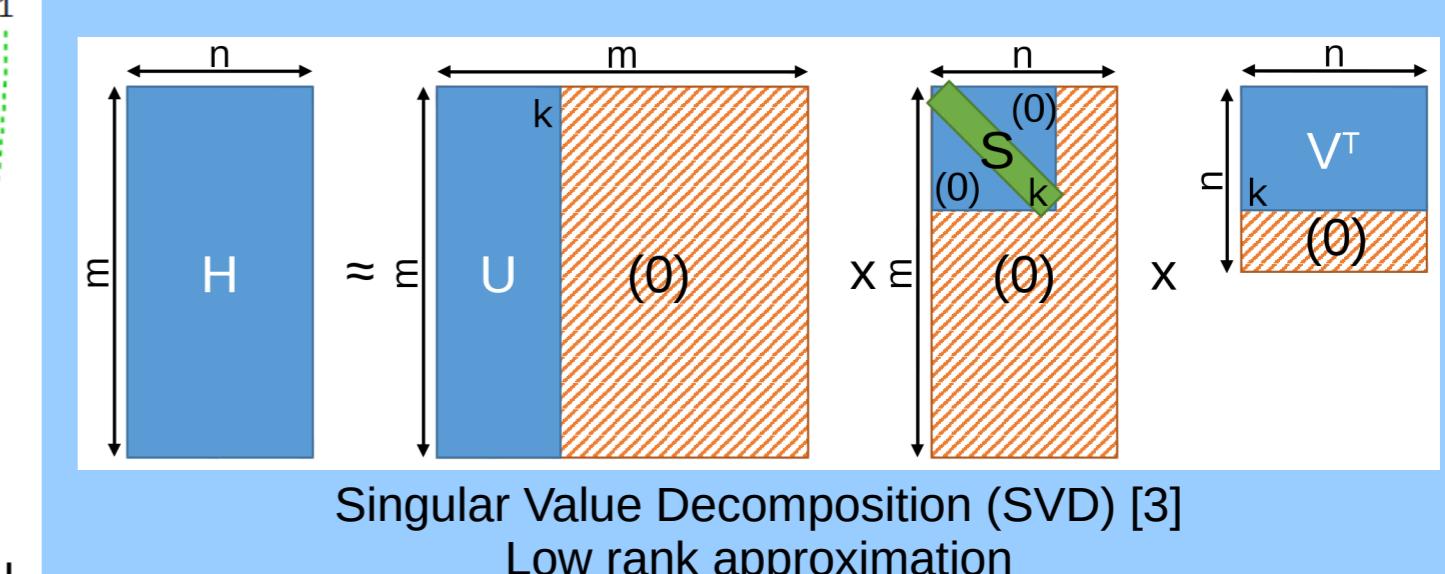
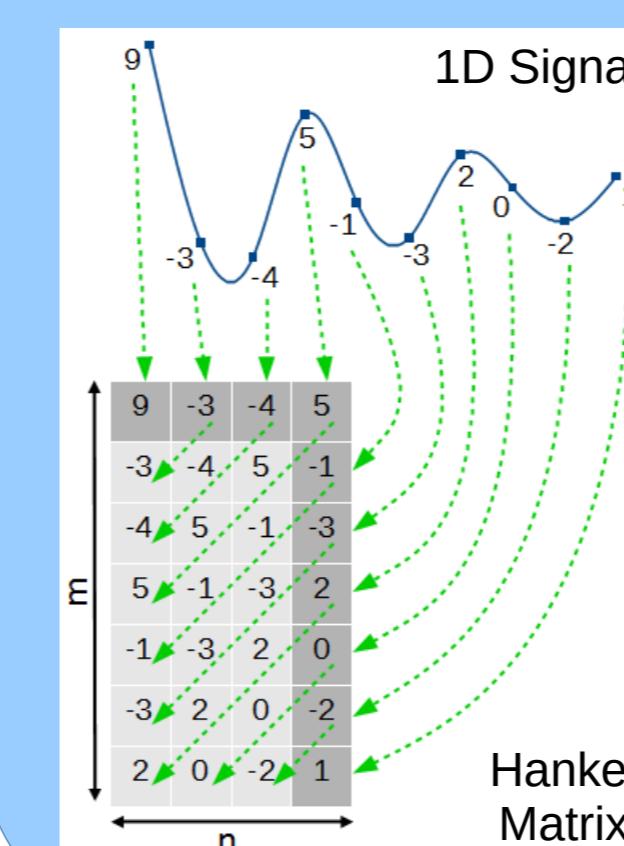
References

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- [4] P. P. Man, C. Bonhomme, and F. Babonneau, 'Denoising NMR time-domain signal by singular-value decomposition accelerated by graphics processing units', *Solid State Nucl. Mag.*, vol. 61–62, pp. 28–34, Jul. 2014.

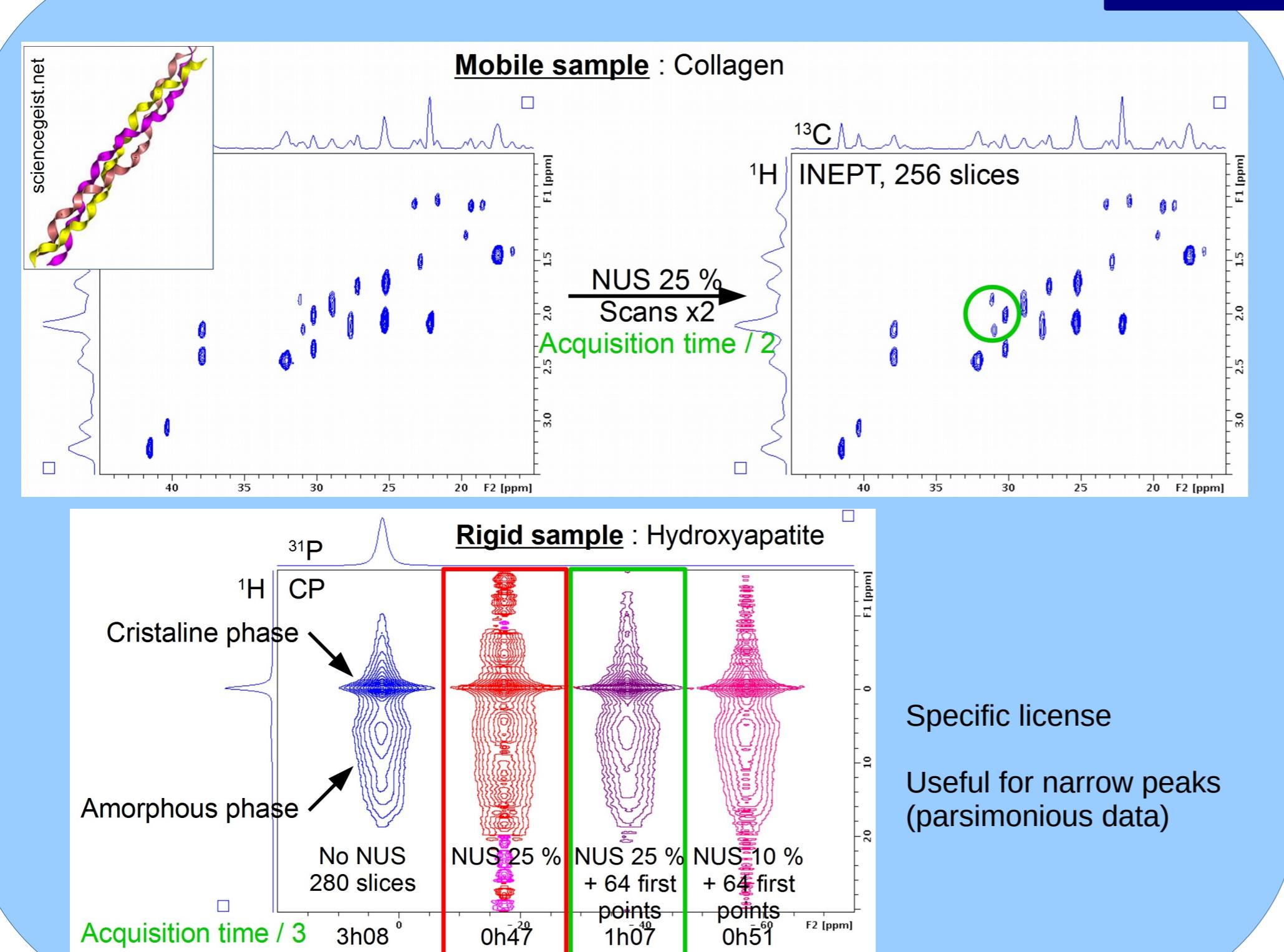
Non-Uniform Sampling (NUS)



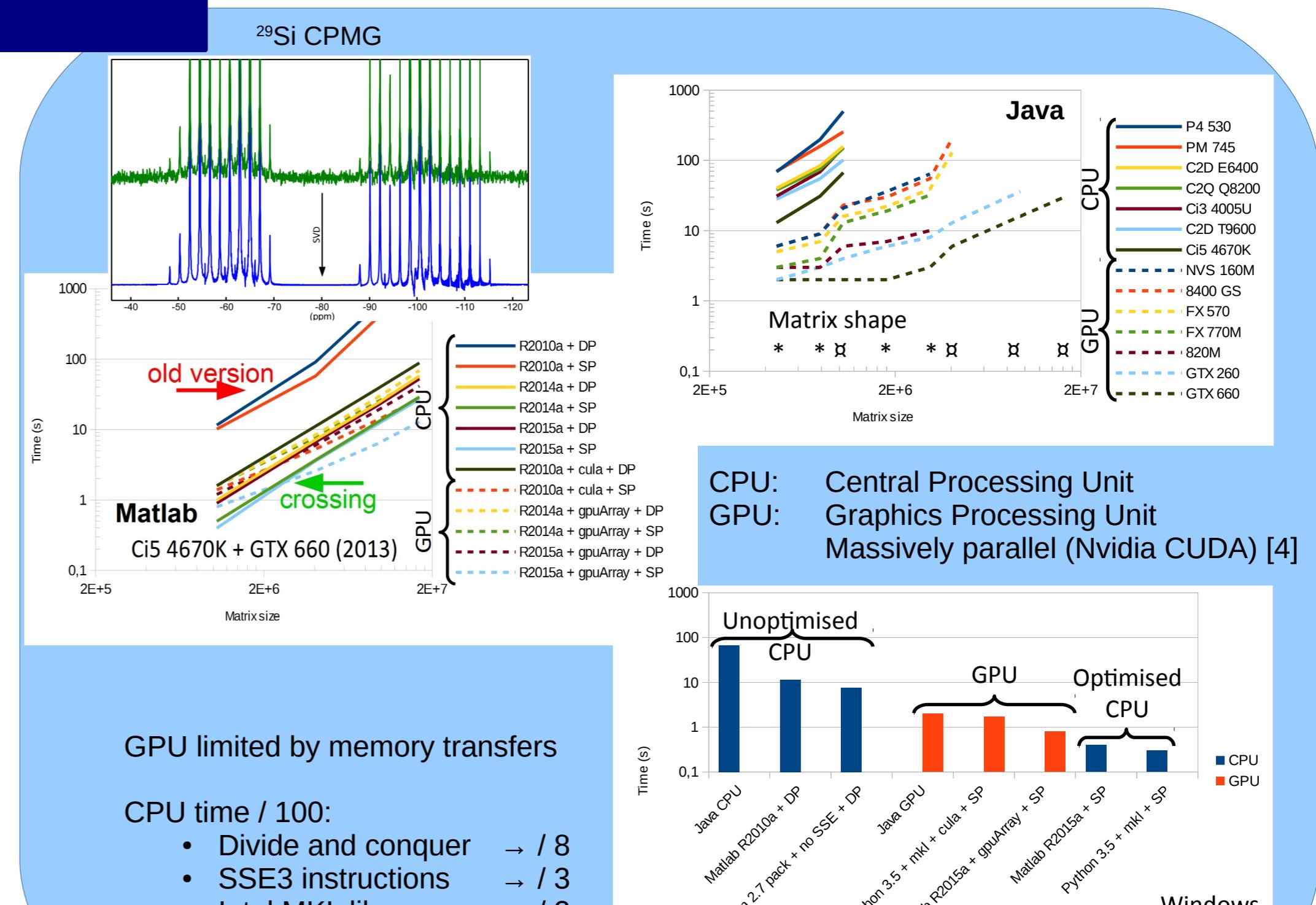
Tools



Spectra denoising



Results



Highlights

- NUS and SVD are useful to increase sensitivity
- Efficient algorithms are critical
- Graphic card is a low cost option (Nvidia GTX 750 = 120 €)

Future work

- Automatic SVD thresholding
- Sparse matrix SVD
- Combining NUS and SVD

Acknowledgements

- V. BARRET-VIVIN, F. PORTIER and M. ROBIN for samples
- P. P. MAN for Java application
- W. WOELFFEL for python application