

Improving solid-state NMR sensitivity using instrumentation, fast acquisition and post-processing

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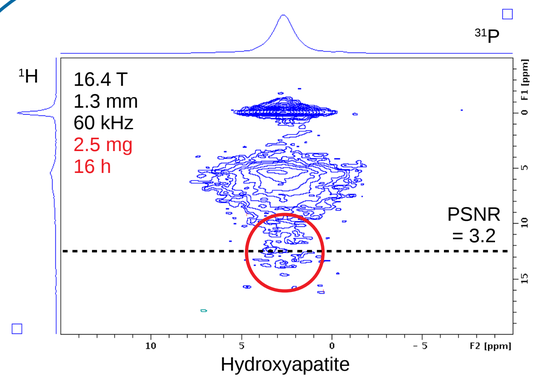
Improving solid-state NMR sensitivity using instrumentation, fast acquisition and post-processing



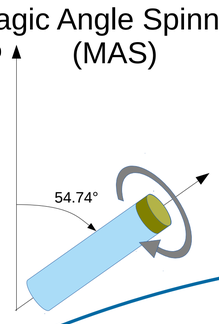
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1 – Introduction



Magic Angle Spinning (MAS)



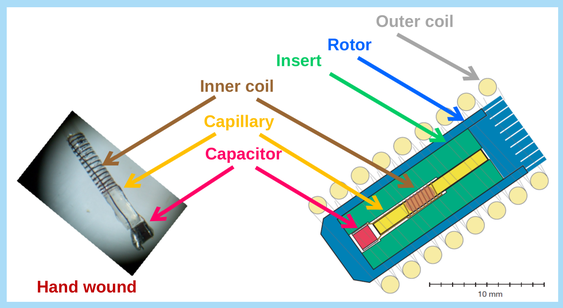
$$PSNR_{max} = \frac{H_{signal}}{h_{noise_peak_peak}/2}$$

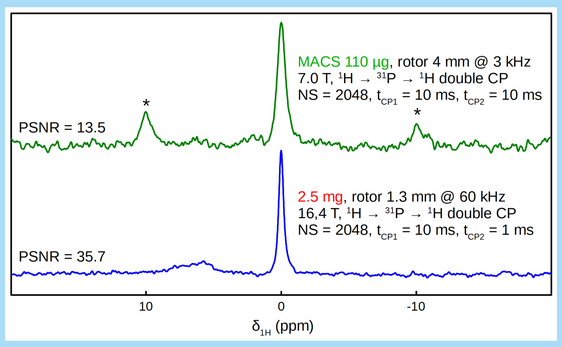
Solid-state NMR:
- Broad peaks
- Partial narrowing with MAS
- Low sensitivity

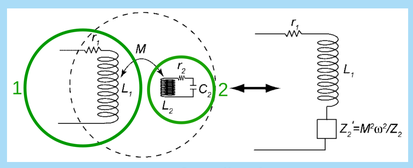
2 – Instrumentation

Magic Angle Coil Spinning (MACS) [1-3]

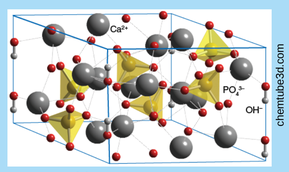
Micro-quantities (100 µg)
PSNR / sqrt(t) / g → x 8







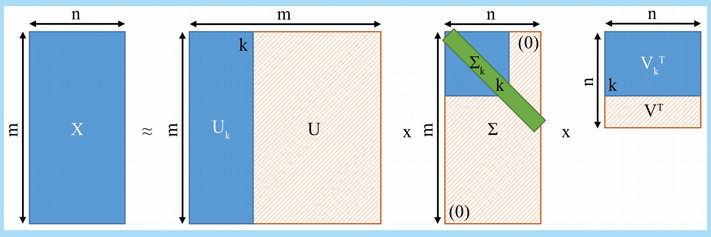
Coupling between main coil and micro-coil

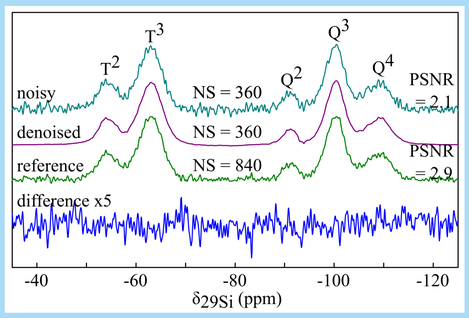


Hydroxyapatite
$Ca_{10}(PO4)_6(OH)_2$
Inorganic part of bone

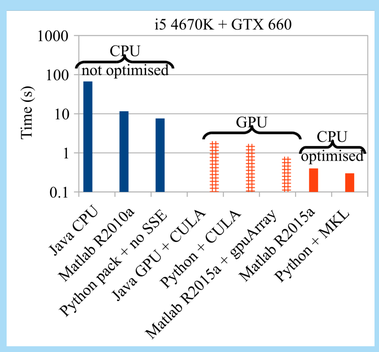
Singular Value Decomposition (SVD) [6-8]

Denoising
PSNR / sqrt(t) → x 2
computation time / 100



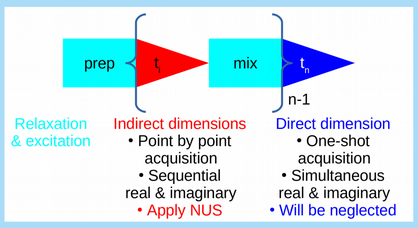


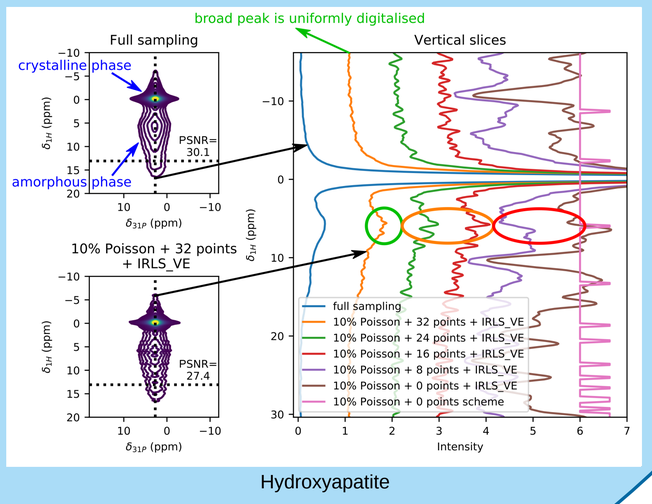
50 / 50, MTEOS (T) / TEOS (Q)
organic / inorganic hybrid material



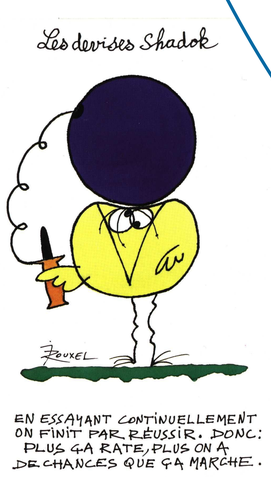
Non-Uniform Sampling (NUS) [4-5]

Increase resolution
PSNR / sqrt(t) → x 2





Hydroxyapatite





3 – Acquisition

4 – Processing

Sensitivity

5 – Conclusion

Complementary techniques:
- MACS: sensitivity increased by 8
- NUS: sensitivity increased by 2
- SVD: sensitivity increased by 2

Next step:
- Combining MACS + NUS + SVD: sensitivity increased by 32

6 – Acknowledgements

- Stanislas Von Euw and Virgile Barret-Vivin are thanked for providing the samples
- Laboratory head is acknowledged for its confidence
- Colleagues are recognized for their encouragements and fruitful discussions

7 – References

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