



# Gamma MRI

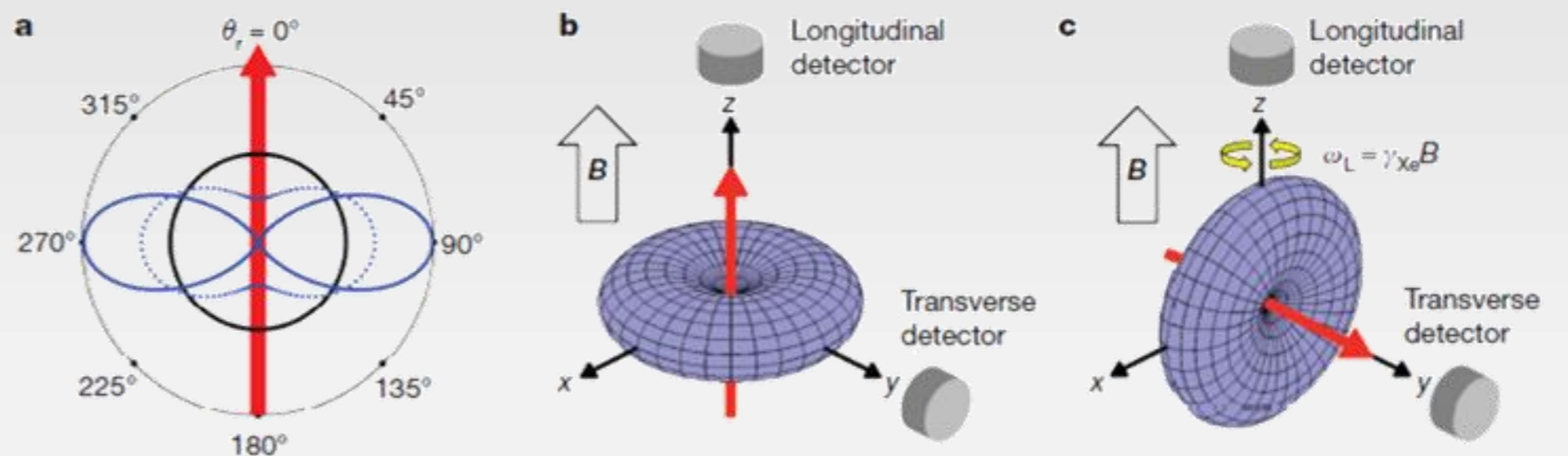
## GAMMA-MRI prototype designed around 50mT Low-Field MRI

### Physical principle

Goal: Benefit from high sensitivity of gamma detection combined with MRI spatial resolution.

Anisotropy of gamma emission is proportional to the polarization level and aligned with magnetization vector.

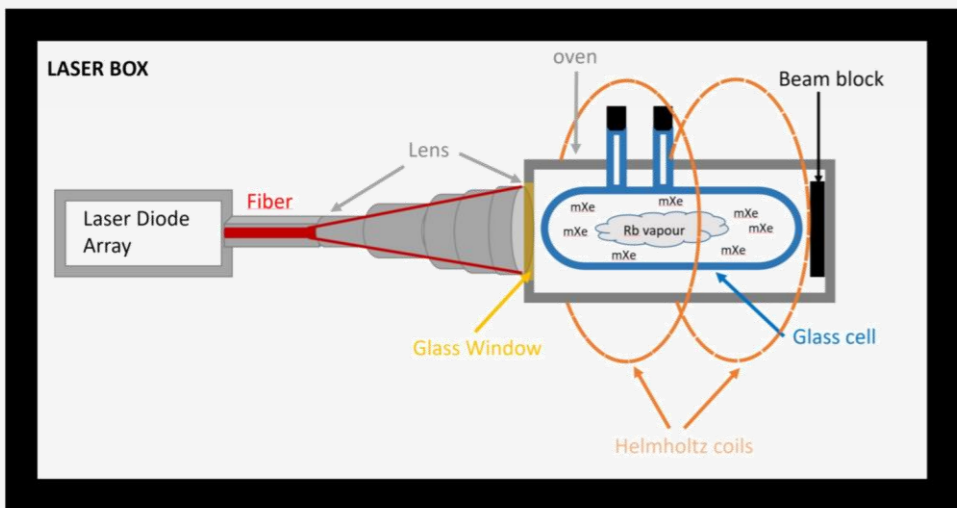
Hyperpolarized mXe magnetization is flipped and spatially dephased with RF and Gradient pulses. Acquisition is done by measuring the evolution of gamma anisotropy.



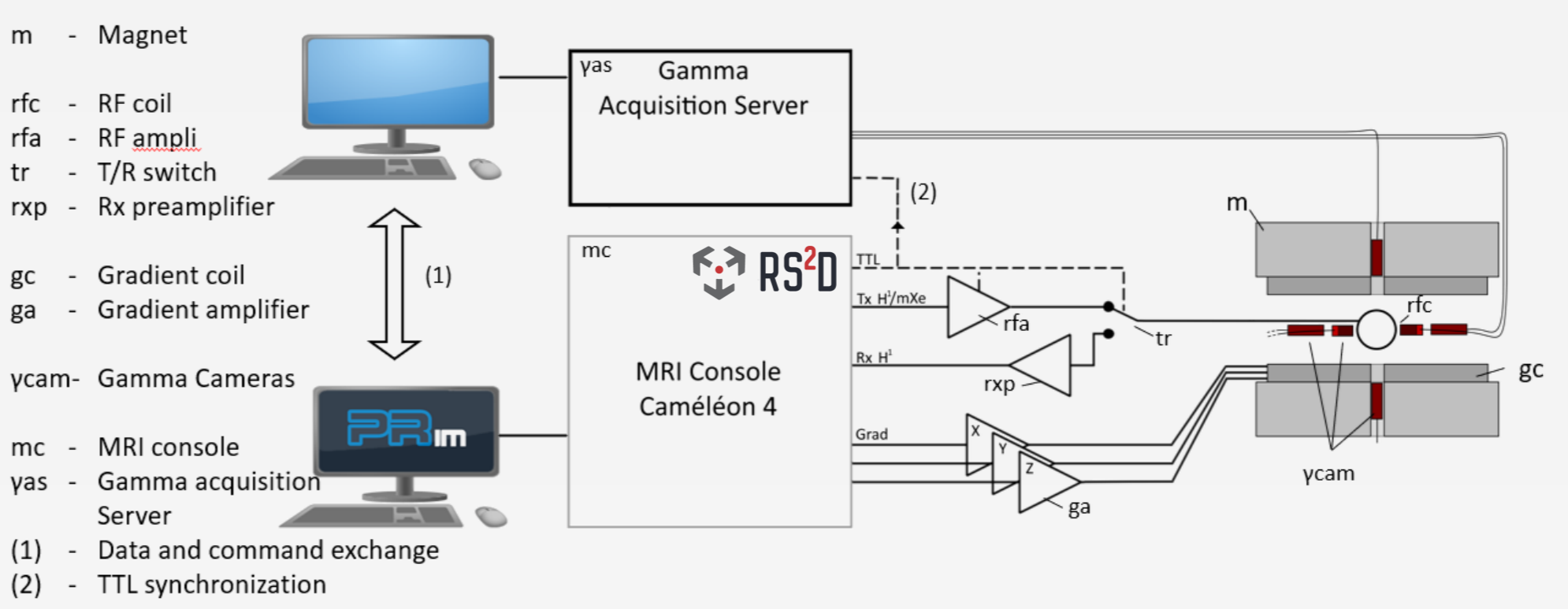
Zheng, GW Miller, WA Tobias and GD Cates. Nature 537, 652 (2016)

### Methods

1. Production of radioactive  $^{129m}\text{Xe}$  and  $^{131m}\text{Xe}$  via neutron activation at ILL (France), MARIA (Poland) (CERN).
2. Hyperpolarisation of  $^{129m}, ^{131m}\text{Xe}$  via Spin Exchange Optical Pumping (HESSO).



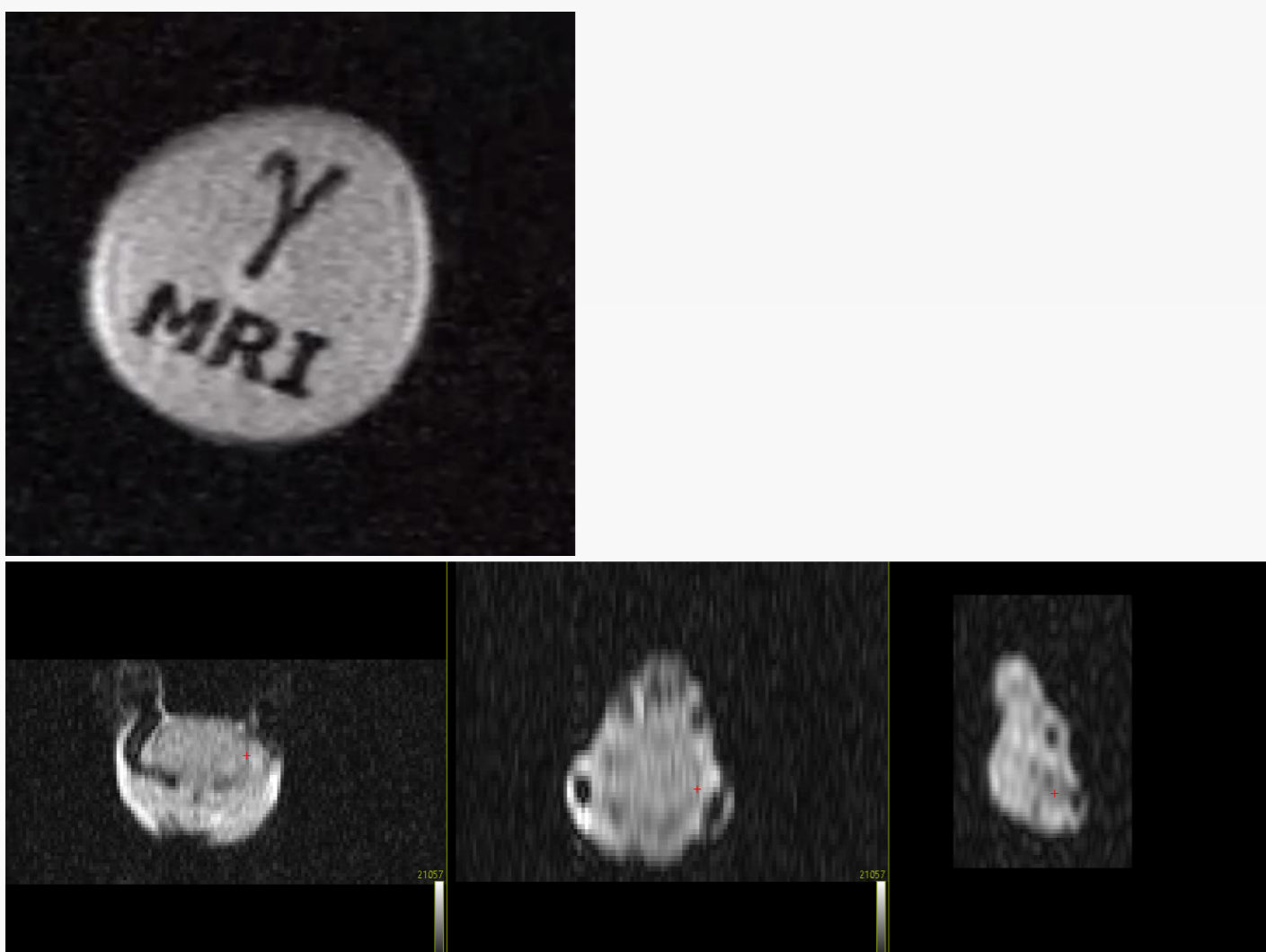
3. System prototype build around a 0.05 T H-shaped permanent magnet with MRI equipment and gamma camera (RS2D, KUL, UCM)



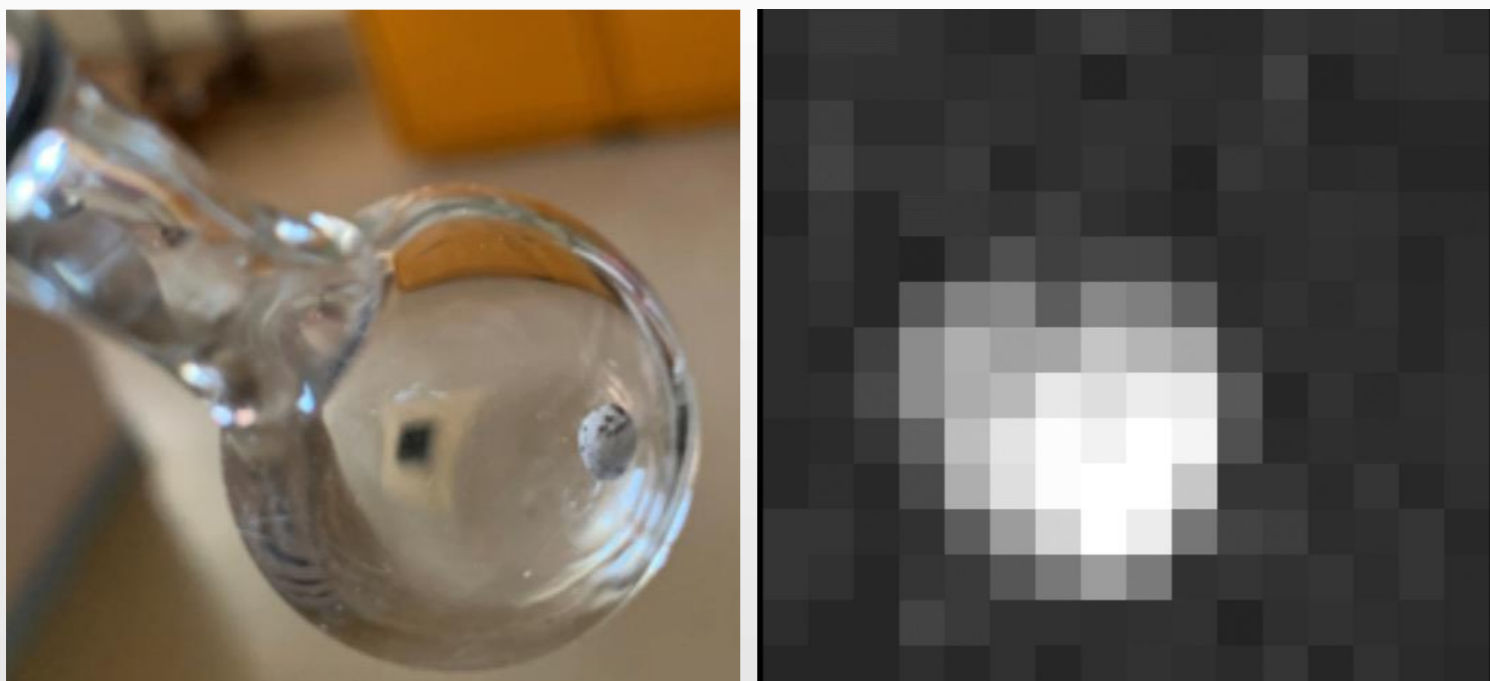
- (1) - Data and command exchange
- (2) - TTL synchronization



### First Results



1H MRI experiments for prototype validation



$^{129}\text{Xe}$  MRI images  
Measured  $T_1 = 40$  s,  $T_2 = 1.2$  s



$^{129m}\text{Xe}$  SEOP GAMMA MRI *in vitro* and *in vivo* experiments in 2024



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