Caylar NMR20 Gaussmeter

Marc Aragonès Fontboté

CAYLAR
INSTRUMENTATION SCIENTIFIQUE

JOHANNES GUTENBERG
UNIVERSITÄT MAINZ
JG|U

Description & Specifications

- Nuclear Magnetic Resonance method for an **absolute measurement of the magnetic field**
- Field Range from **0.1T to 2.1T**
- No temperature drift

Resolution	0.1 µT (1 mG)
Absolute precision	< 5 µT
Relative precision	< ± 0.5 µT
Internal clock stability	± 1 ppm (0°C – 70°C)
Internal clock aging 1st year	< 1 ppm
Clock Aging after 1 year	< ± 0,2 ppm / an
Sampling	2 Hz
Sampling	170 – 1000 ppm / cm
NMR Field time tracking rate (Auto mode on full range)	1 à 32 s < 1 s with Hall Option
NMR Field time tracking rate (Auto mode on 5% range)	< 3 s if field is approximately known
NMR signal access	Analog output with synchronisation signal
Channels	1 to 256 (possible extension)
Distance	300 meters
Control by external PC	TCP / IP, MODBUS, RS232

CAYLAR
INSTRUMENTATION SCIENTIFIQUE

Components

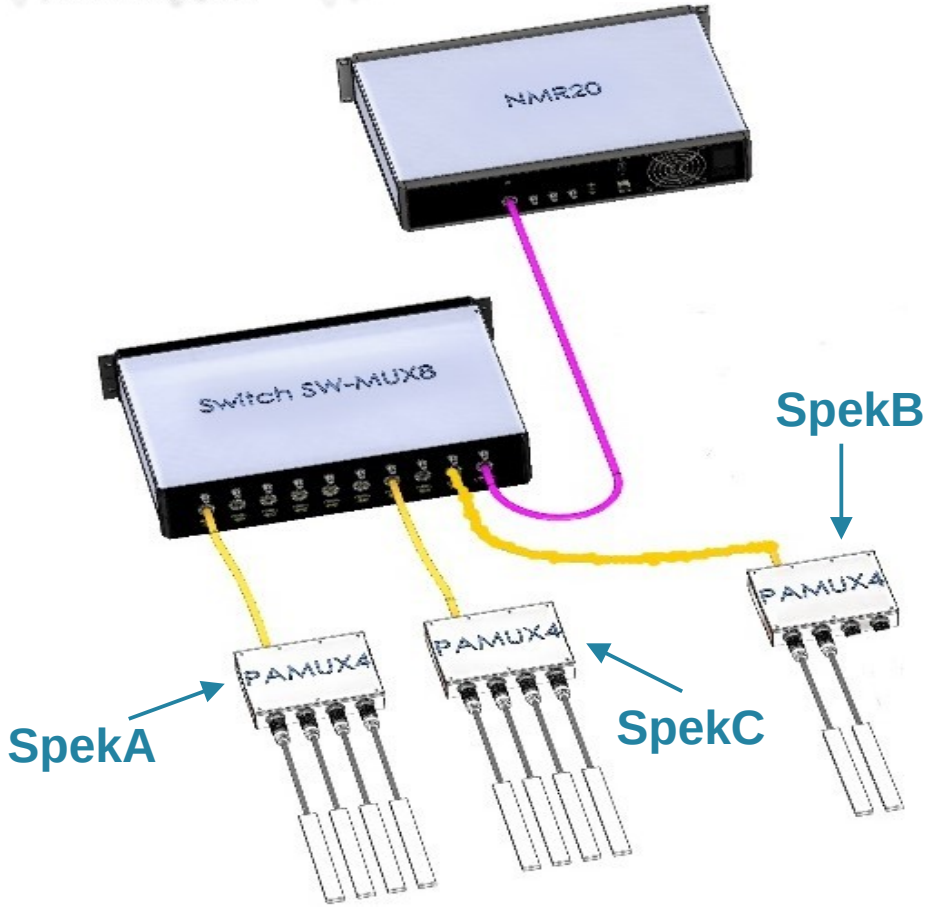
NMR20 Gaussmeter

Switch Multiplexer

Preamplifiers

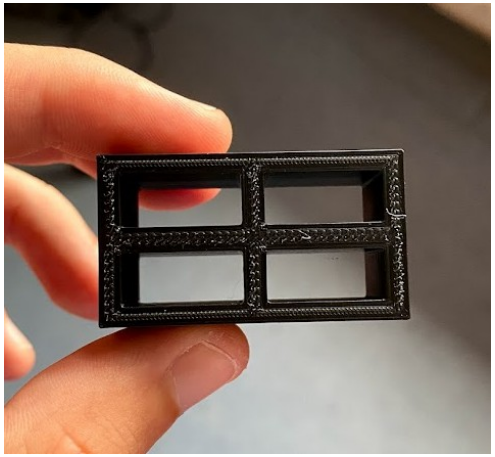
Probes

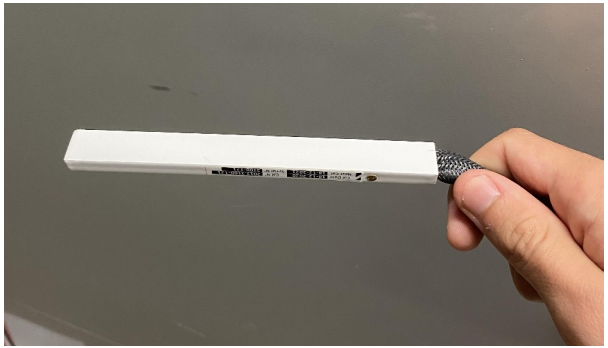
Our setup



- **1 Gaussmeter**
- **1 Switch Multiplexer**
- **3 Preamplifiers**
  - Spectrometer A
  - Spectrometer B
  - Spectrometer C
- **10 probes**
  - 5 High Field
  - 5 Low Field

Tests: experimental setup magnet



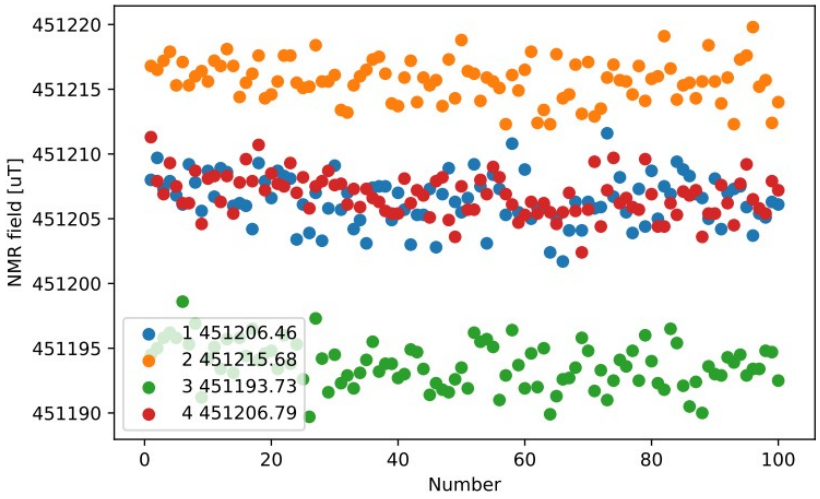


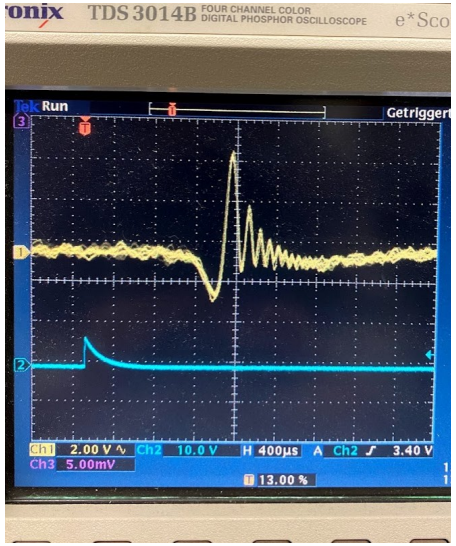
Experiments

- We conducted experiments from 1h to 15h measuring the magnetic field

Results

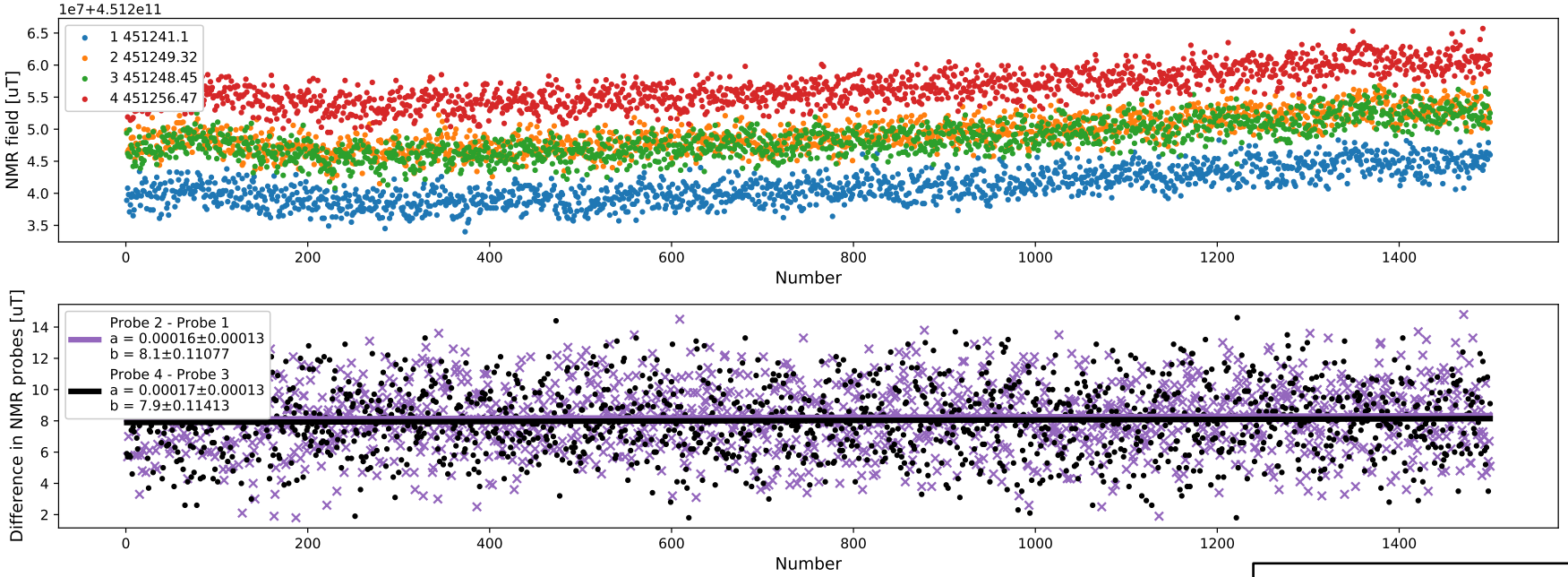
Each point taken every 36s



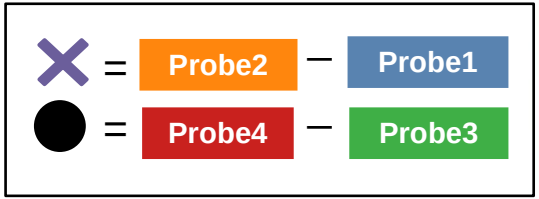


Results

Each point taken every 36s



- Linear fit of H-L field probe values in 15h experiments $[y = ax + b]$:
  - Mean value for the slope: $\boldsymbol{a = 0.021 \pm 0.015}\left[\frac{\mu T}{h}\right]$
  - Therefore, probes are stable over time.



Data analysis

- Corrected Standard Deviations for each probe in PA1:

Probe	*Corrected STD [uT]*
1	σ ≤ 1.63
2	σ ≤ 1.55
3	σ ≤ 1.58
4	σ ≤ 1.58
Mean	**σ ≤ 1.59**

- Relative error:

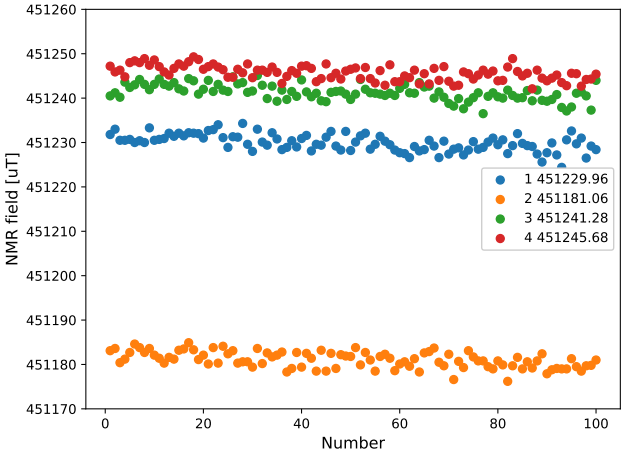
$$\frac{Corrected\ STD}{Field\ Value} = \frac{\sigma = 1.59[uT]}{\mu = 451216.9[uT]} = \mathbf{3.52 \cdot 10^{-6}}$$

- Translation to momentum:

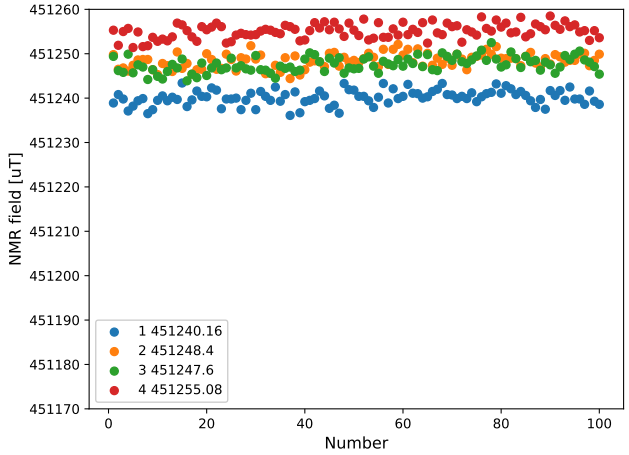
$$Momentum\ precision: \frac{\Delta p}{\bar{p}} \sim \mathbf{3.52 \cdot 10^{-6}}$$

Conclusions

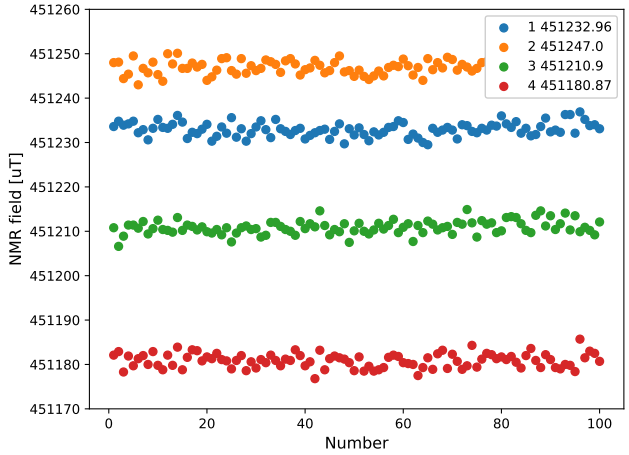
Our test magnet is too inhomogeneous for our purposes…
We can't go further for the moment.



Holder in: $x \approx -1\,cm$



Holder in: $x \approx 0\,cm$

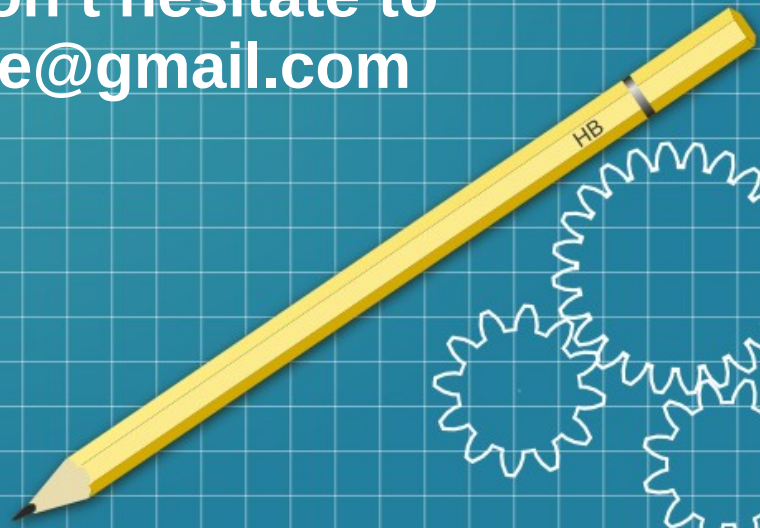


Holder in: $x \approx 1\,cm$

Next step: testing our NMR Gaussmeter in SpekC's magnet

Thank you for your attention

For any further questions please don’t hesitate to contact me: marcaragonesfontbote@gmail.com



CAYLAR
INSTRUMENTATION SCIENTIFIQUE

JOHANNES GUTENBERG UNIVERSITÄT MAINZ
JG|U