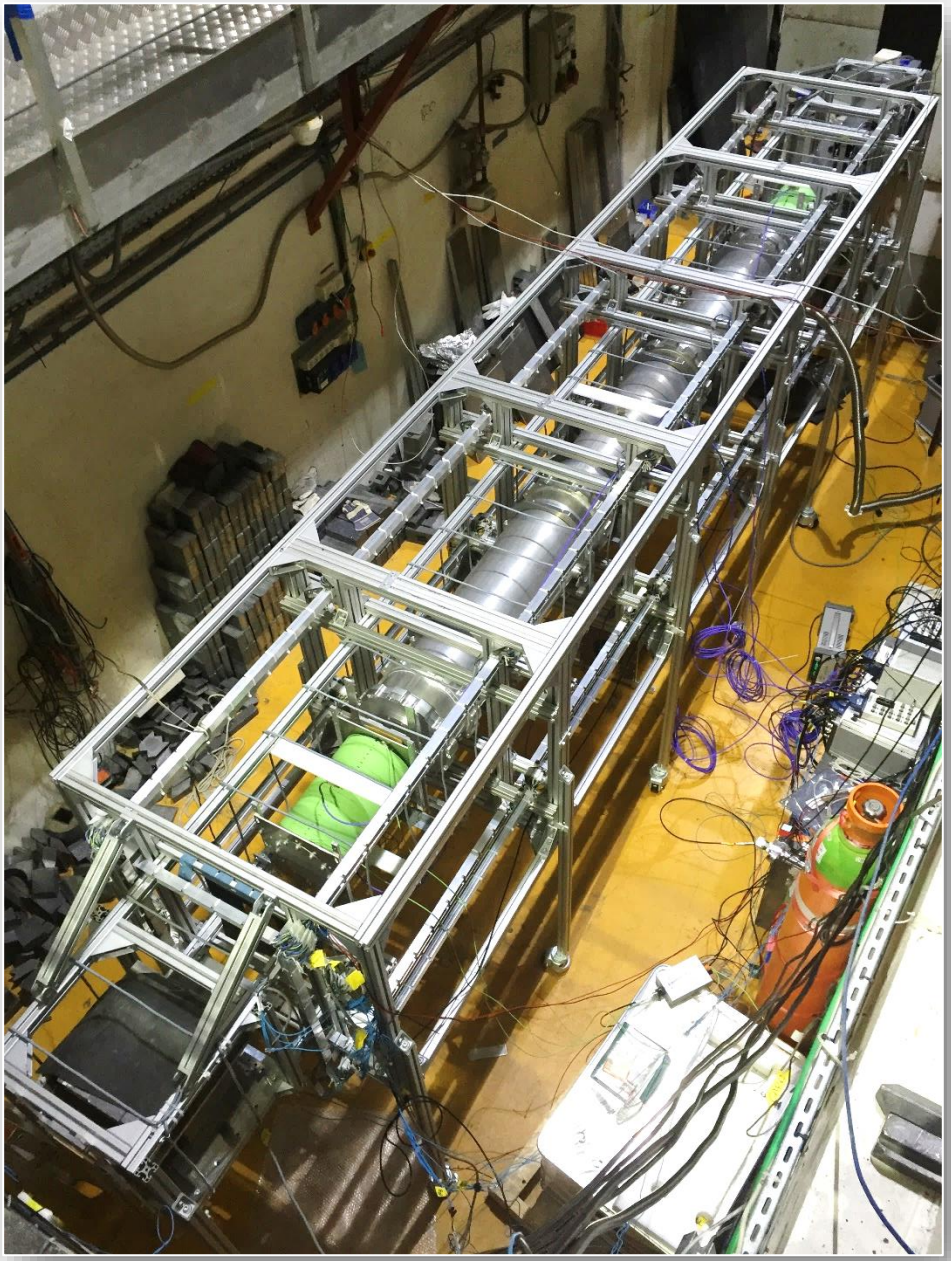
Feedback from the Beam EDM Analysis

Florian Piegsa

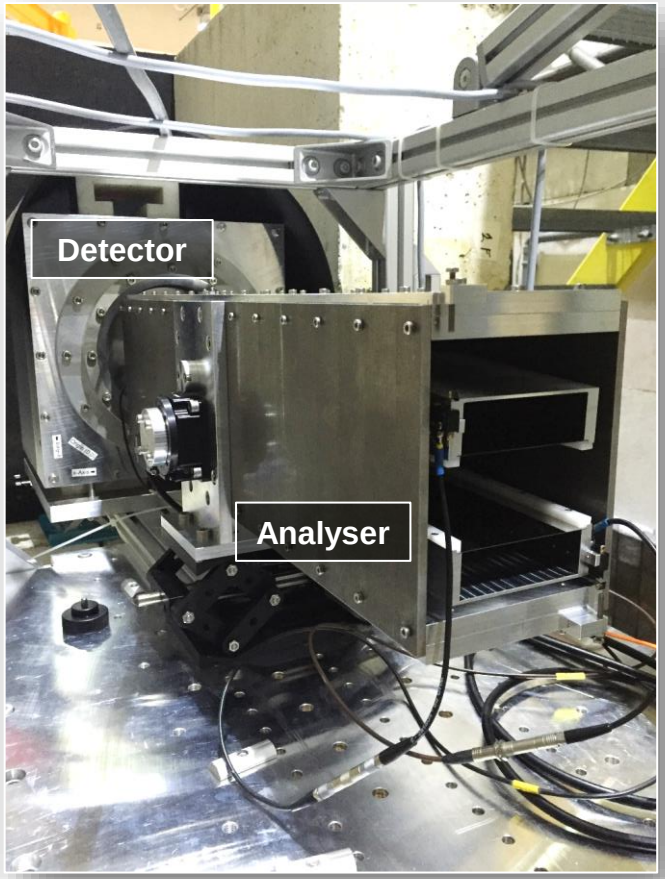
Albert Einstein Center for Fundamental Physics
University of Bern, Switzerland

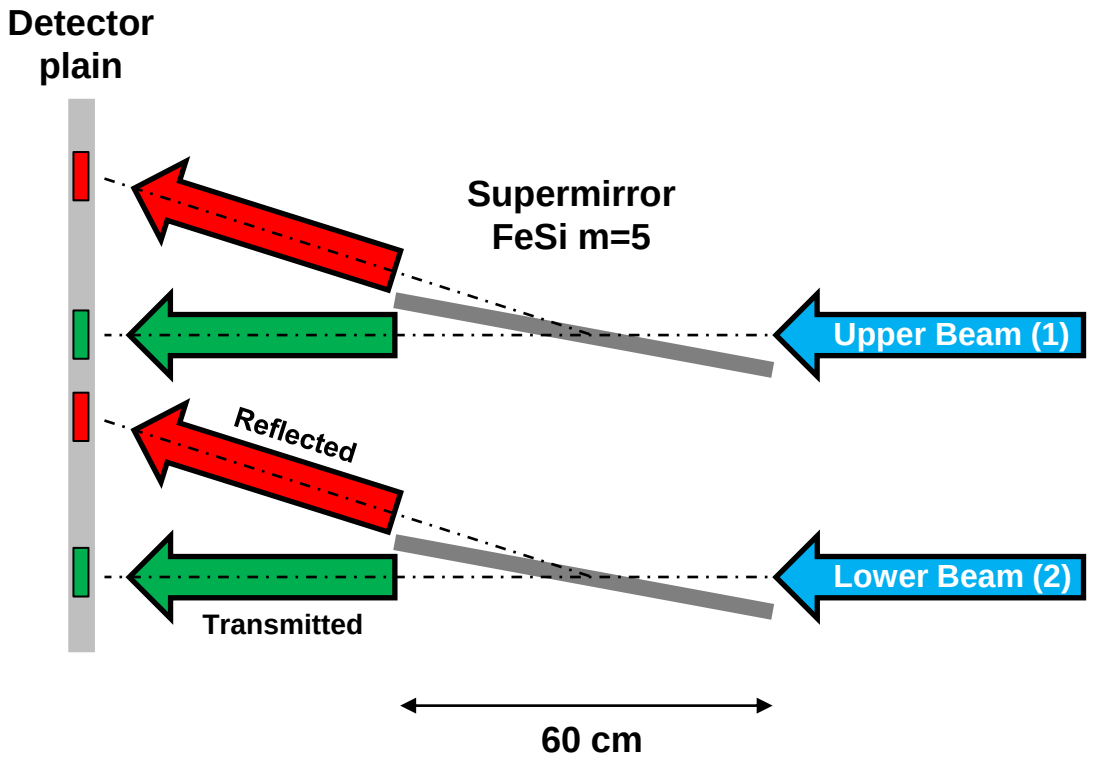
UNIVERSITÄT
BERN

AEC
ALBERT EINSTEIN CENTER
FOR FUNDAMENTAL PHYSICS

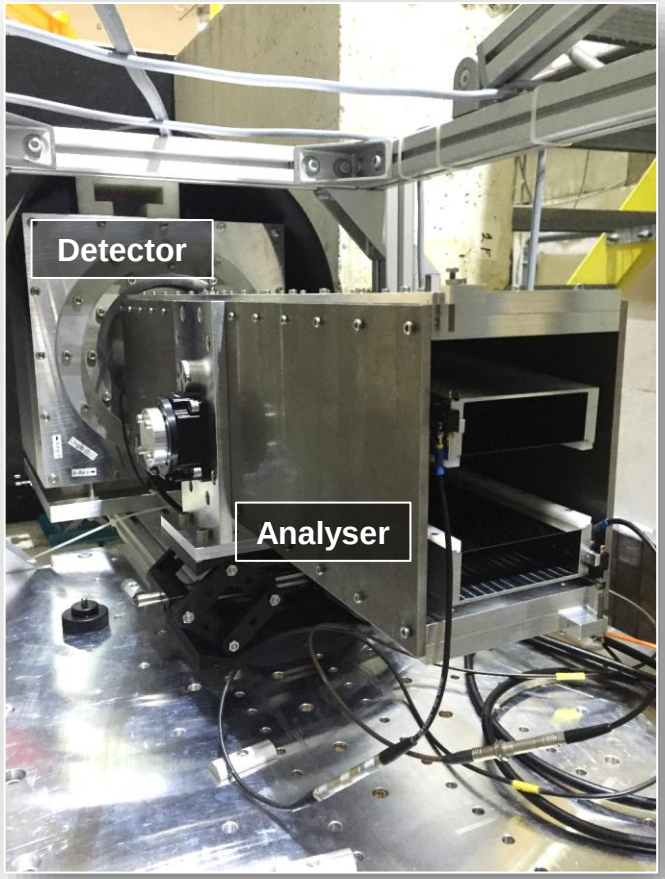


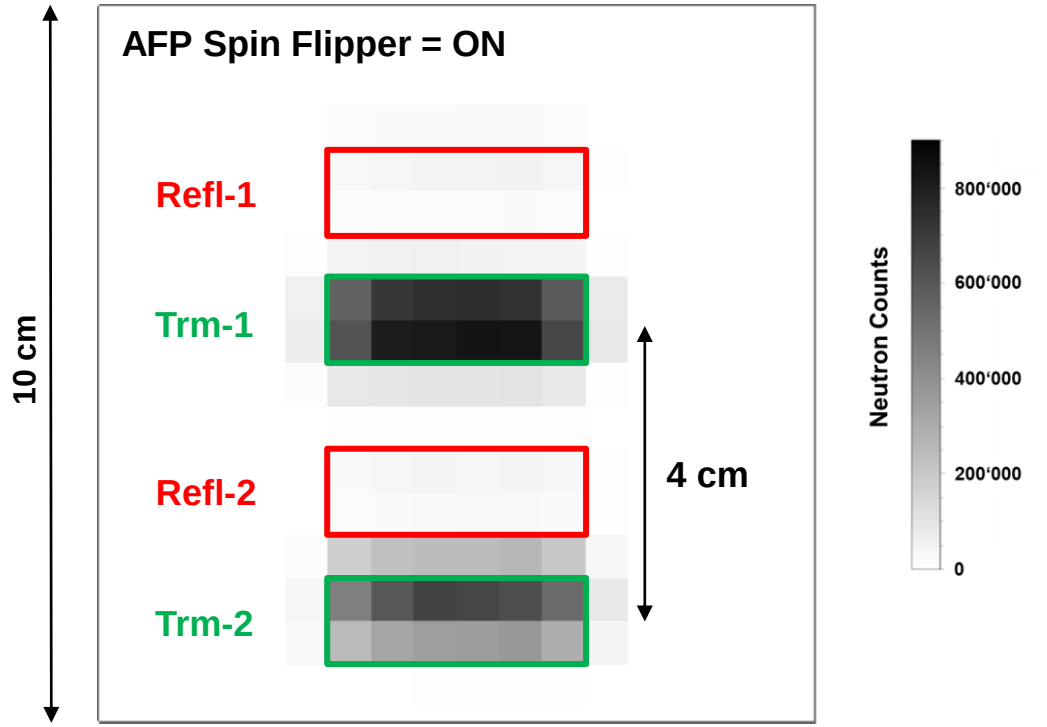
Beam EDM – Spin Analyser & Detector





Beam EDM – Spin Analyser & Detector





Two beams/Four beam spots each with 3×1 cm²
16×16 Pixels, Pixel-Size = 6×6 mm²
Exposure time: 10 sec (at λ = 0.48 nm)
FeSi supermirror *m* = 5 (*SwissNeutronics*)

Is the total count rate of spin up plus down constant?

Two oscillating count rates in the two (USSA) detectors shifted by 180°:

$$N_+(f) = a_+ + b_+ cos(p \cdot f + \varphi)$$

$$N_-(f) = a_- - b_- cos(p \cdot f + \varphi)$$

Period: $p = \frac{2\pi}{\Delta\nu} \approx 2\pi \cdot 182.5\ \text{s}$

2 + 180 + 2 sec

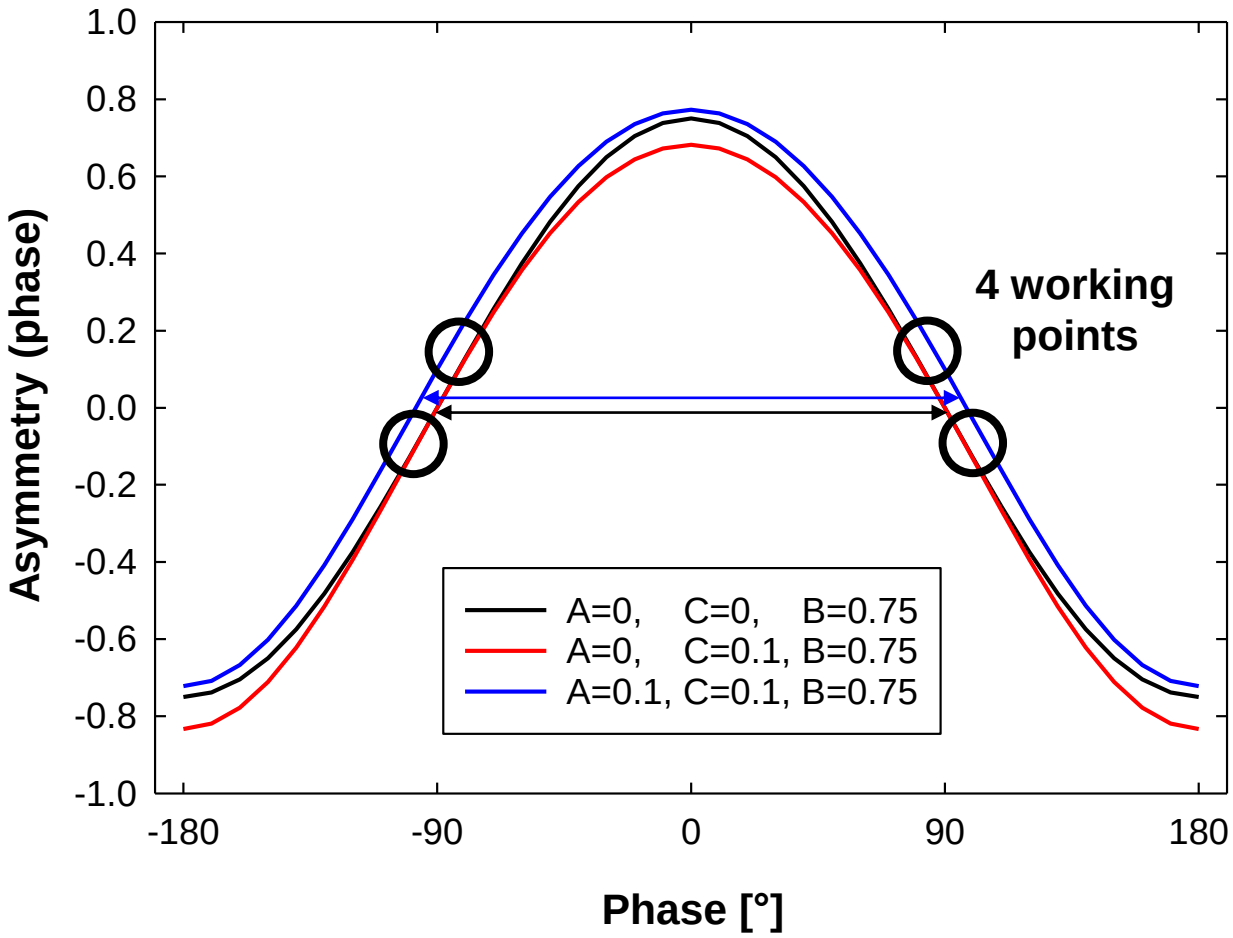
$$\frac{N_+ - N_-}{N_+ + N_-} = \frac{(a_+ - a_-) + (b_+ + b_-)\, cos(p \cdot f + \varphi)}{(a_+ + a_-) + (b_+ - b_-)\, cos(p \cdot f + \varphi)}$$

Assumption: $(b_+ - b_-) \approx 0 \ll \sqrt{N_\pm}$

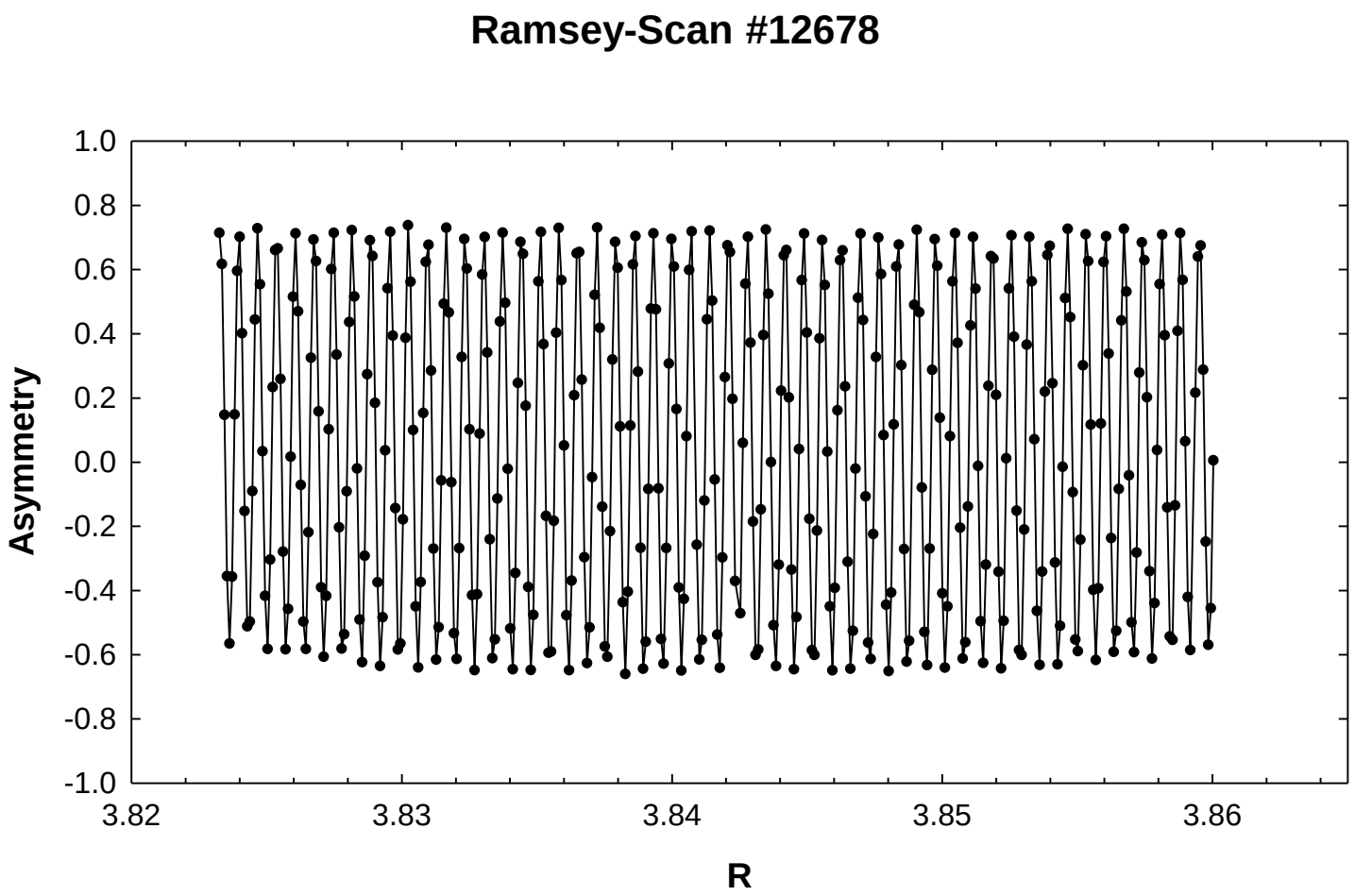
With this assumption one ends up with the usual cos-fit function for the Ramsey signal/pattern …

Is this really valid for nEDM?

$$\frac{N_+ - N_-}{N_+ + N_-} = \frac{A + B \cdot cos(\varphi)}{1 + C \cdot cos(\varphi)}$$

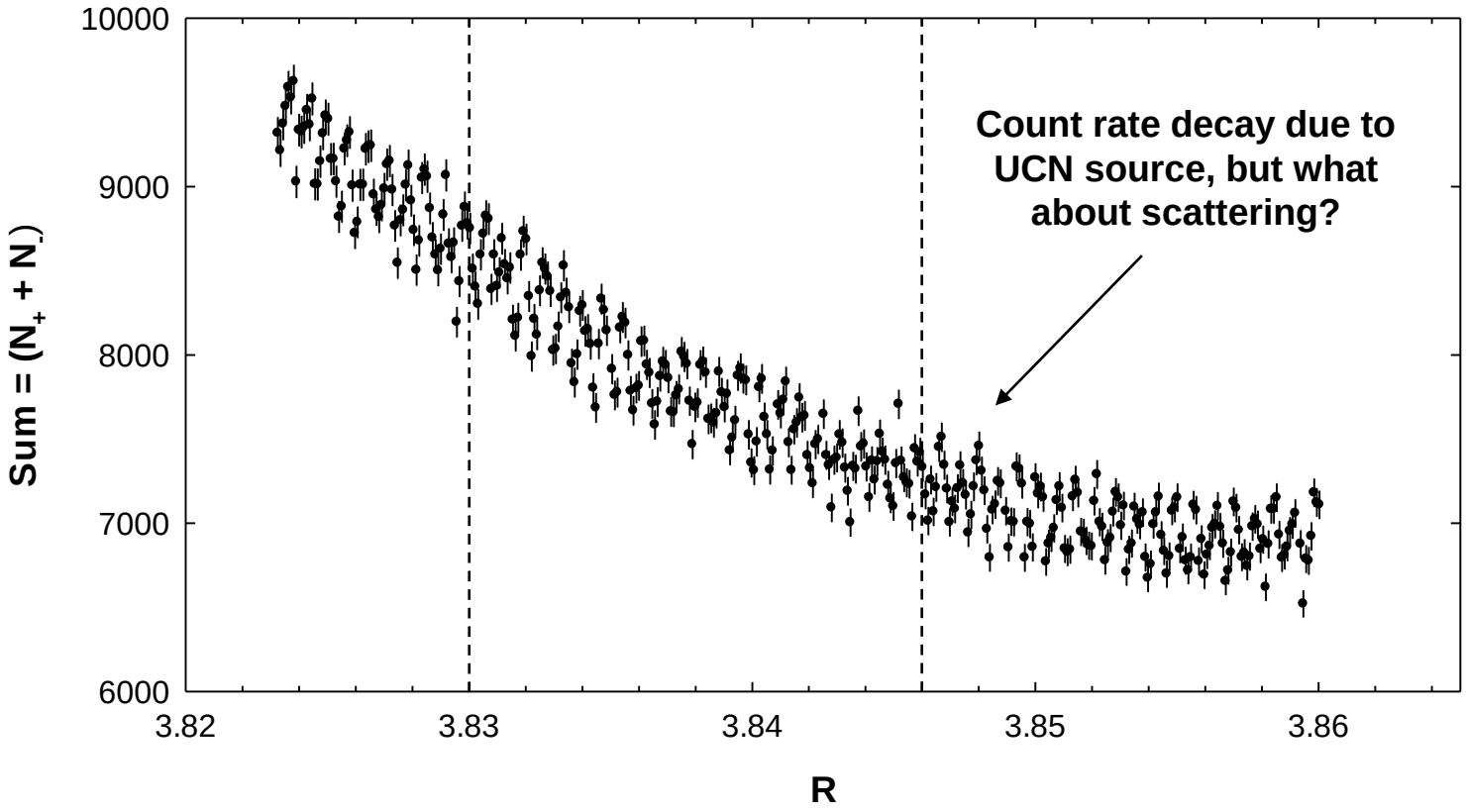


Asymmetry #12678 (Full Ramsey Scan)



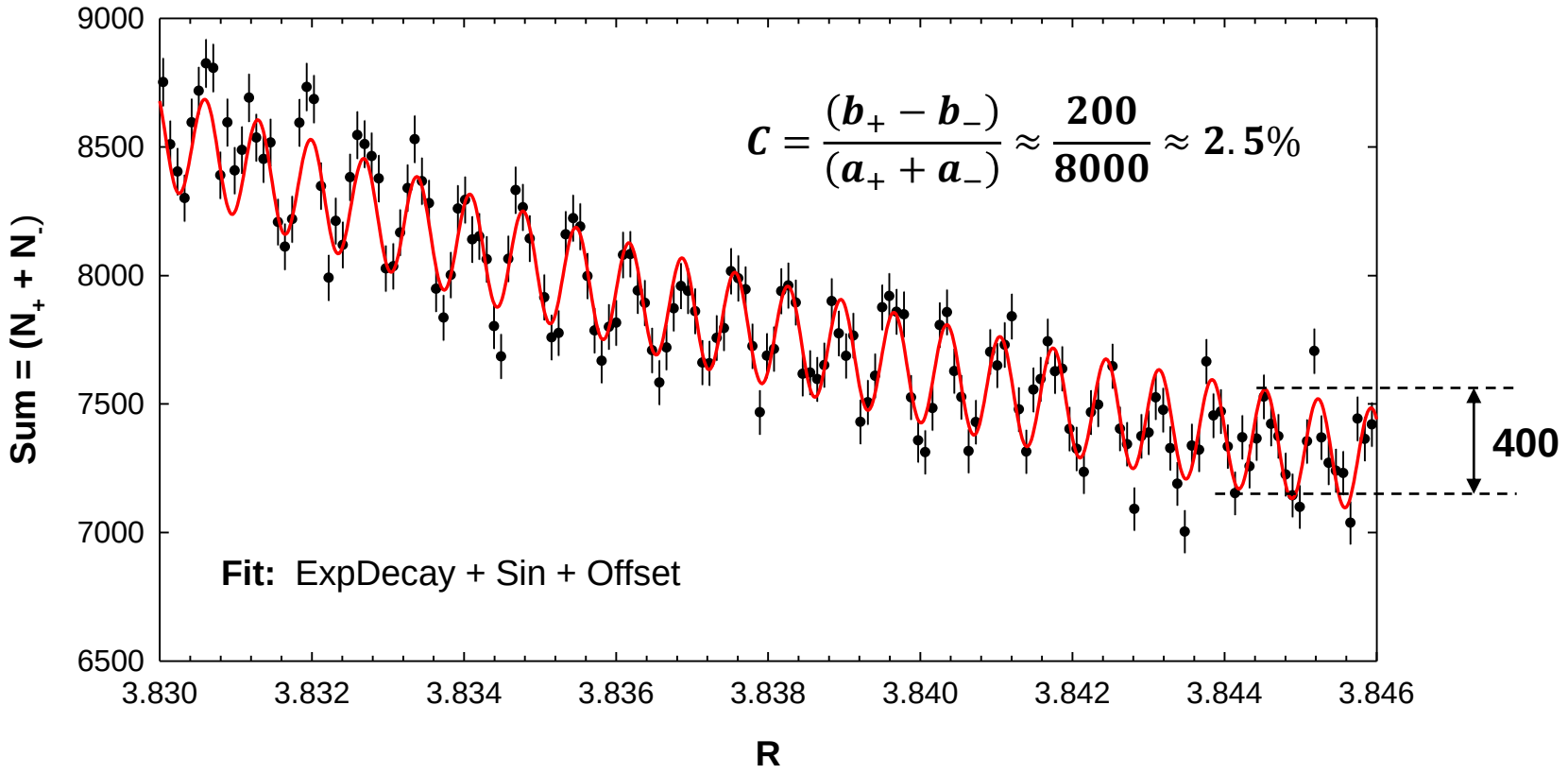
with: $R = \frac{f_n}{f_{Hg}}$

Ramsey-Scan #12678



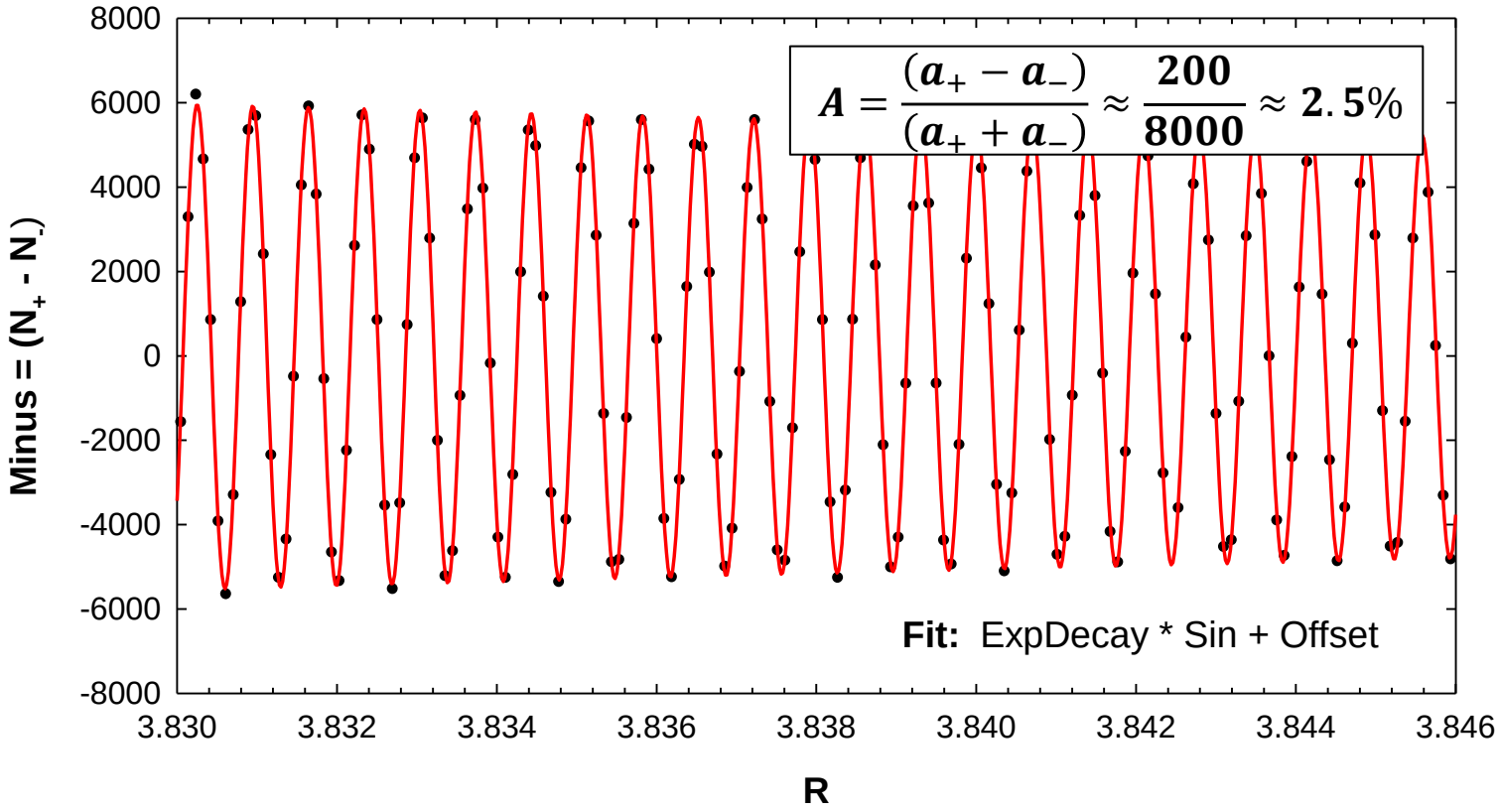
$$N_+ + N_- = (a_+ + a_-) + (b_+ - b_-)\, cos(p \cdot f + \varphi)$$

Ramsey-Scan #12678



$$N_+ + N_- = (a_+ + a_-) + (b_+ - b_-)\, cos(p \cdot f + \varphi)$$

Ramsey-Scan #12678



$$N_+ - N_- = (a_+ - a_-) + (b_+ + b_-)\, cos(p \cdot f + \varphi)$$

$$\frac{N_+ - N_-}{N_+ + N_-} = \frac{A + B \cdot cos(p \cdot f + \varphi)}{1 + C \cdot cos(p \cdot f + \varphi)}$$

- Maybe we need a modified fit function with an additioal fit parameter *C* (especially with higher statistics as in n2EDM).
- This effect also appears if one scans phase instead of frequency.
- Is there an influence/systematic effect on the result (already for nEDM) ?
- Maybe potential effect cancels out by flipping the spins (before filling the UCN and before detecting them). However, distortion remains.

Thank you for your attention.