

A New Dedicated Plunger device for the GALILEO γ -ray array

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Outline

Lifetime Measurements using Plunger devices

The GALILEO spectrometer

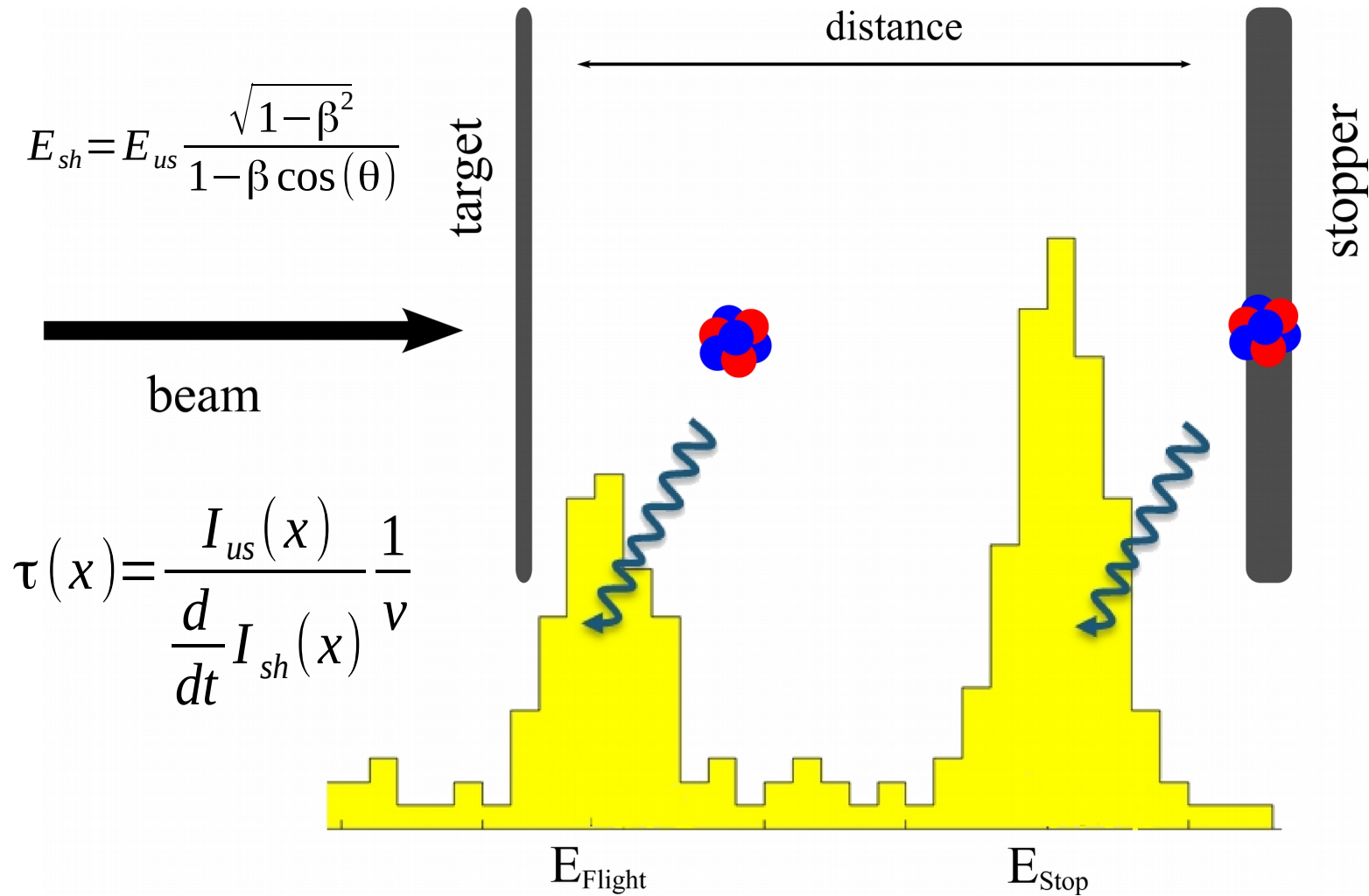
Design and functionality of the GALILEO Plunger

Commissioning Run reproducing lifetimes in ^{180}Pt

Discussion of the results

Summary

Lifetime measurements using Plunger devices



The GALILEO spectrometer



The GALILEO spectrometer

Phase I: 3 rings with 5 single GASP detectors each @ 119°, 129° and 152°
1 ring with 10 single GASP detectors @ 90°
neutron wall in forward angles
possible use of EUCLIDES for light charged particles

Later: 5 additional single GASP detectors and 10 EUROBALL triple cluster detectors

other neutron detectors e.g. NEDA

Recoil detectors e.g. SPIDER or RFD

Fast timing detectors e.g. LaBr₃

Binary reactions fragment detectors e.g. MW-PPAC

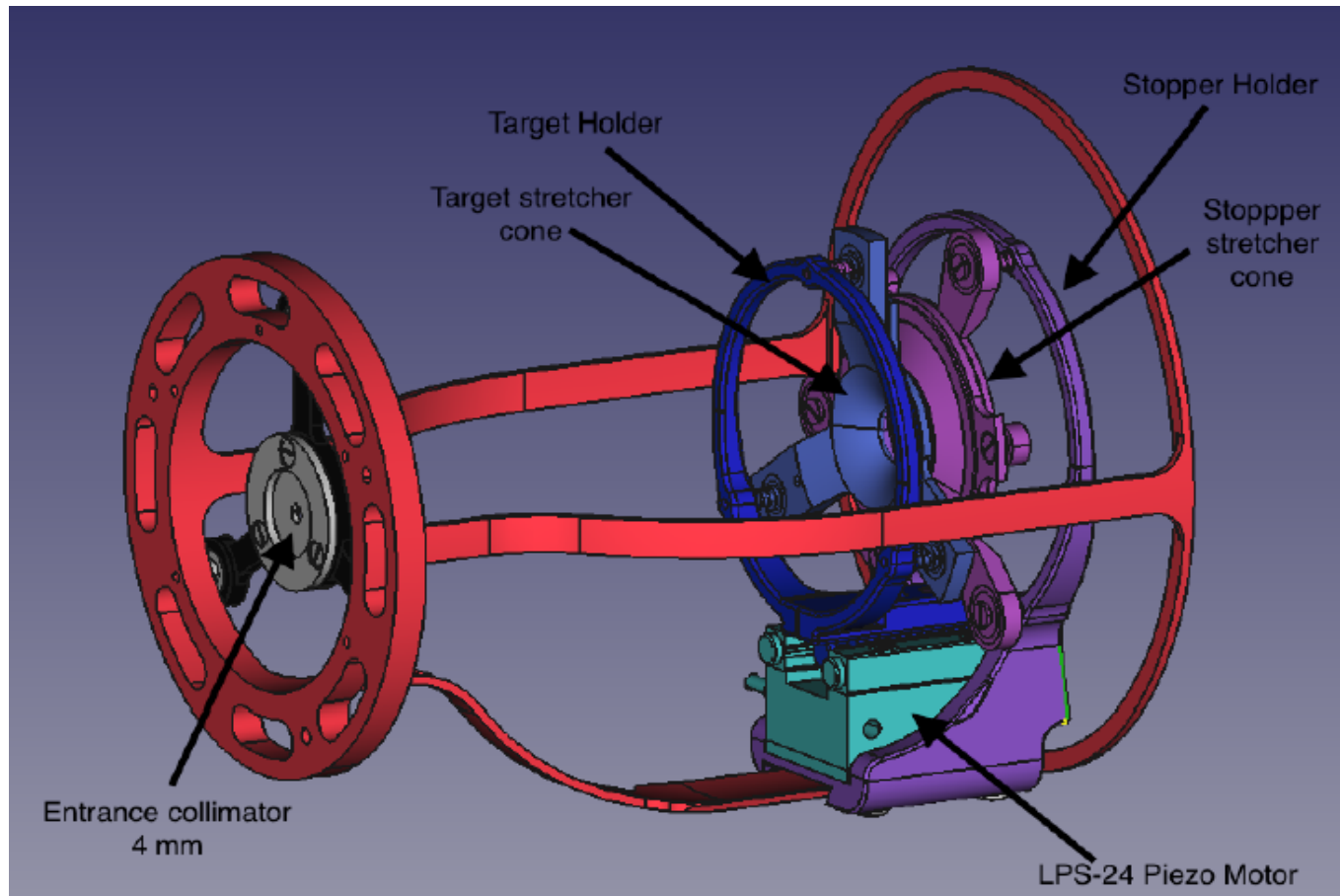
High-energy γ -ray detectors e.g. PARIS prototype

Design and functionality of the GALILEO plunger

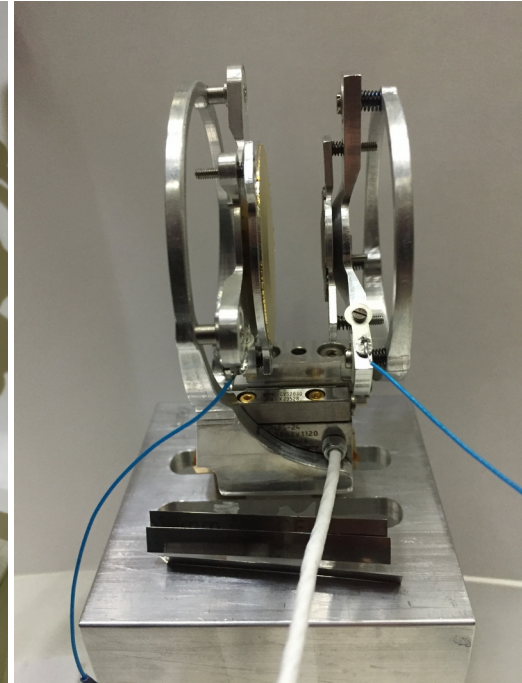
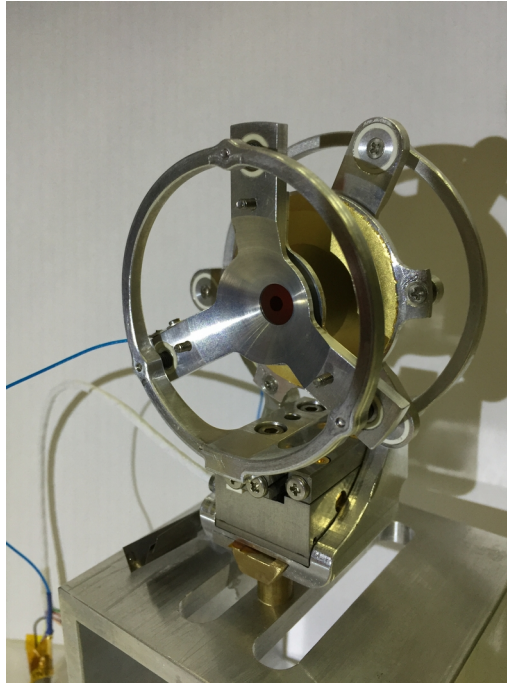
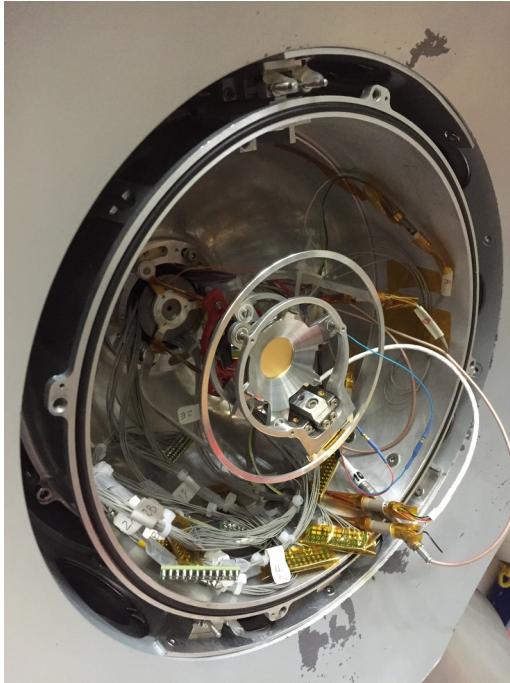
Some constraints for the design

- Possibility to vary distances between target and stopper foil from few micrometer to tens of millimeters with sub-micrometer precision
- γ -transparency of the device to minimize absorption of γ -rays emitted from de-exciting nucleus
- Positioning and alignment of the plunger in the existing target chamber
- Mechanism to stretch both target and stopper foils
- Active feedback system to compensate for changes in the target-stopper foil distance induced by the beam
- Coupling to existing complementary detectors like EUCLIDES

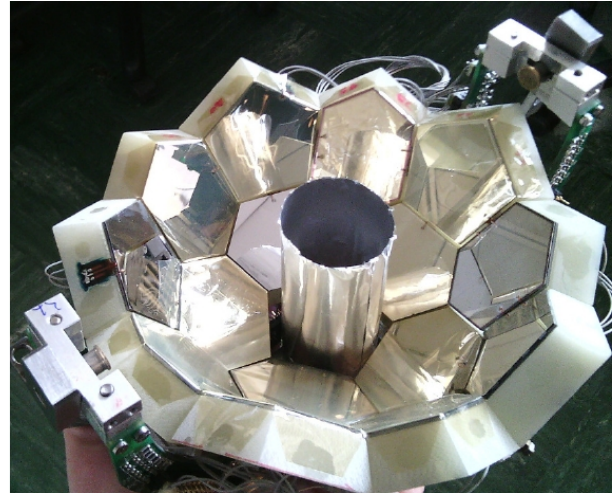
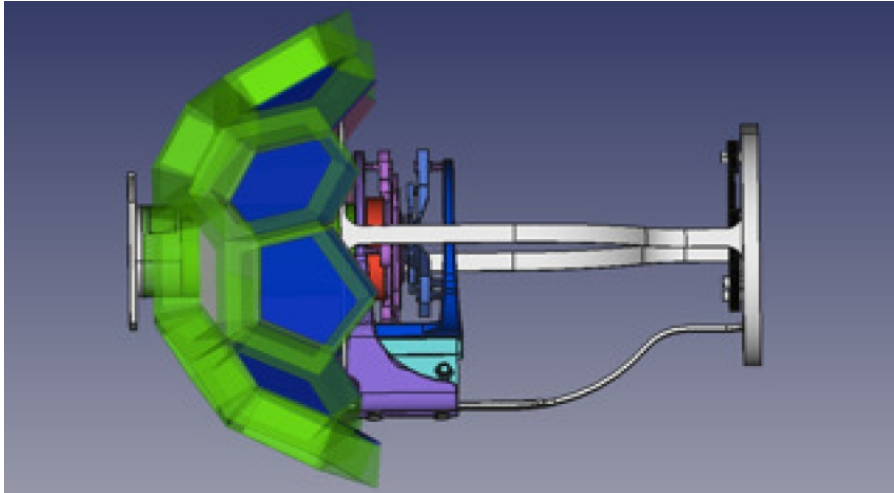
Design and functionality of the GALILEO plunger



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Mechanical compatibility proven in the commissioning run with 15 E - Δ E telescopes from the EUCLIDES array in forward angles

Commissioning Run reproducing lifetimes in ^{180}Pt

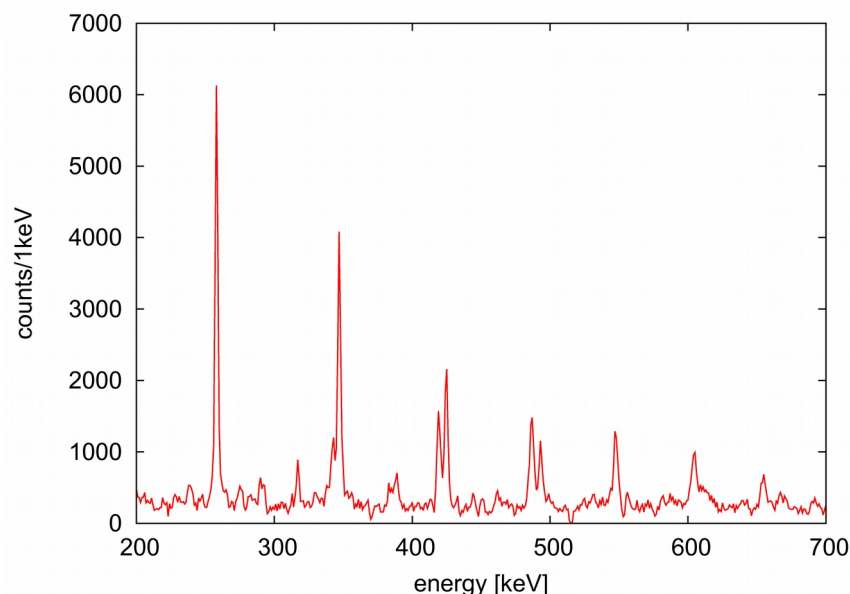
Reaction $^{154}\text{Sm}(^{32}\text{S},6n)^{180}\text{Pt}$ @ 183 MeV (v/c for ^{180}Pt = 1,53(5) %)

Target 1 mg/cm 2 ^{154}Sm on 2 mg/cm 2 Ta, Stopper 10 mg/cm 2 Au

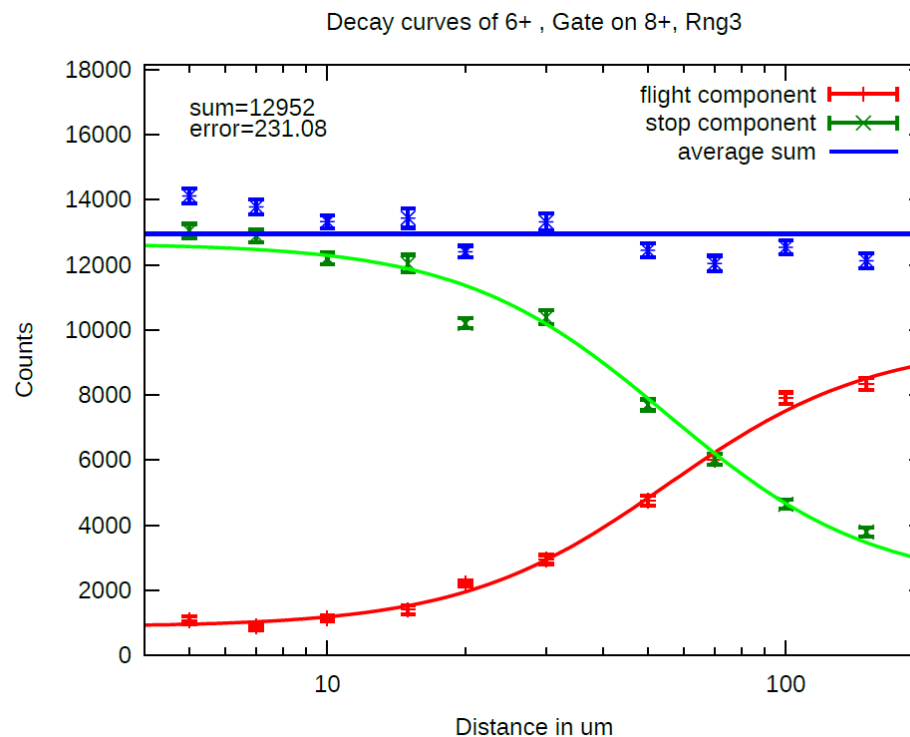
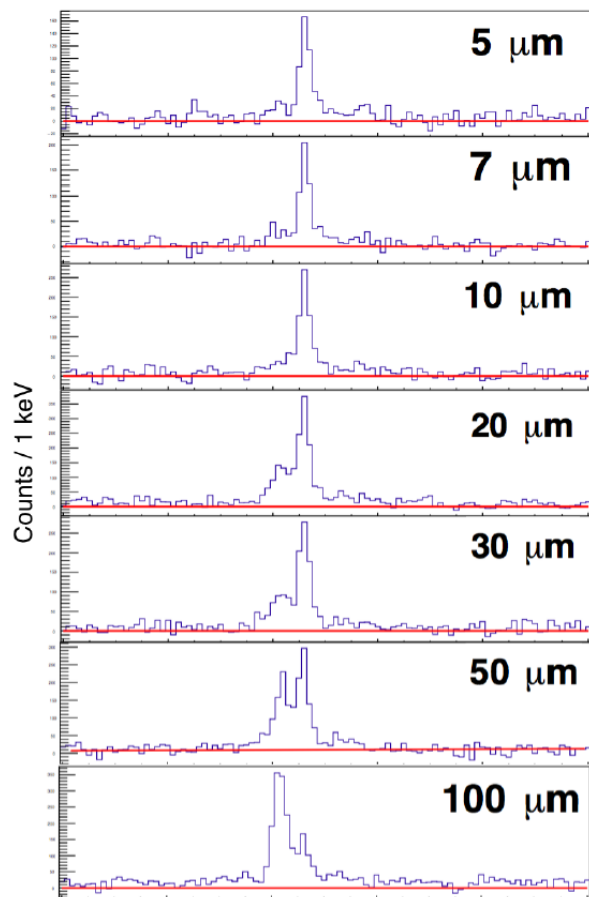
25 HPGe Compton-Suppressed detectors of GALILEO (in 4 rings)

10 target to stopper distances from 5 μm to 150 μm measured (8 h each)

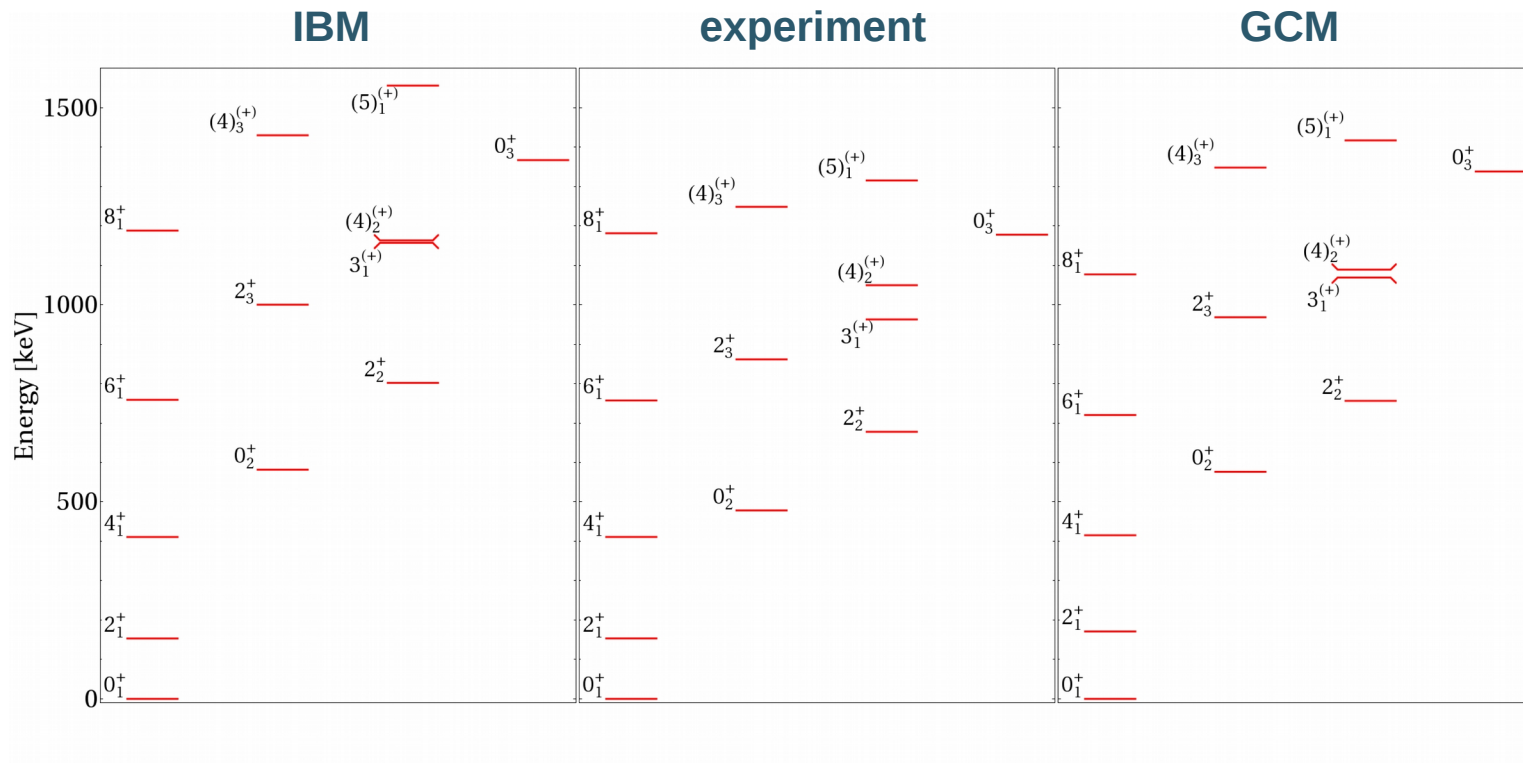
Spectrum of the ring @ 152° with a gate on $2^+ \rightarrow 0^+$ in the same ring



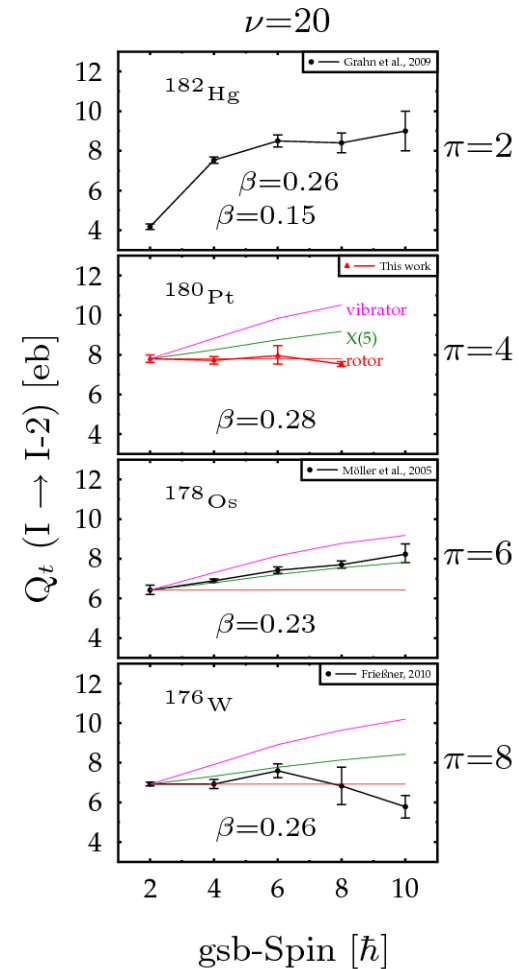
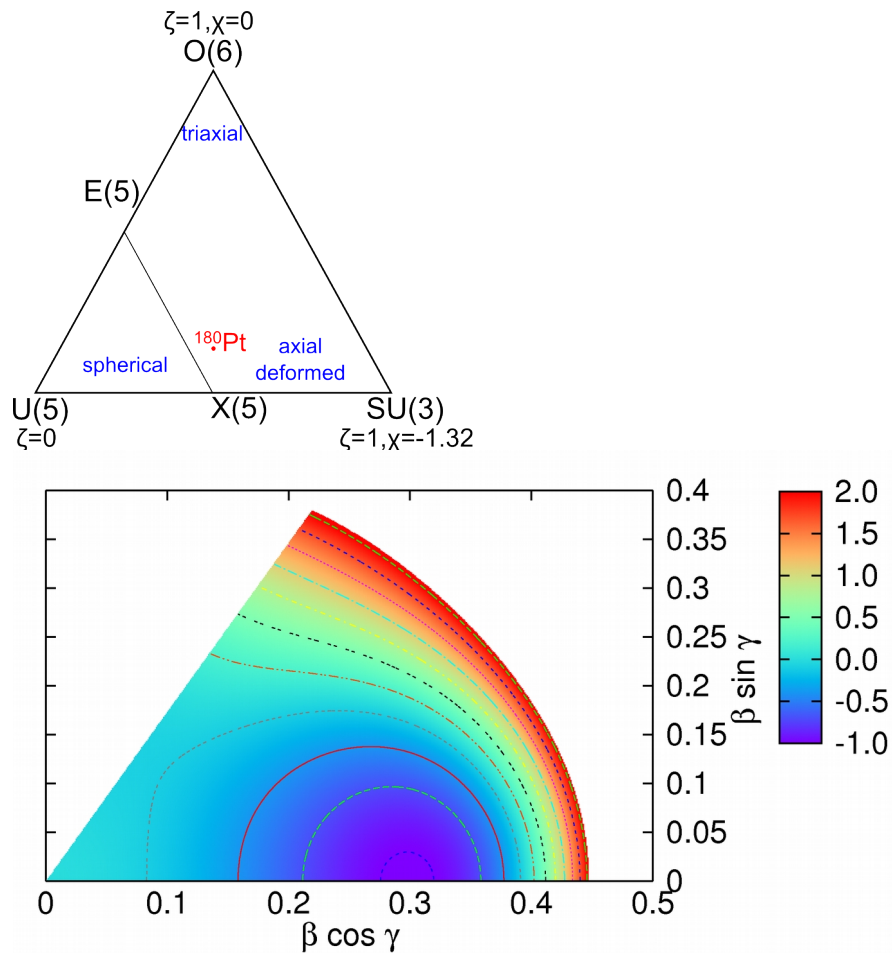
Commissioning Run reproducing lifetimes in ^{180}Pt



Discussion of the results



Discussion of the results



summary

A compact plunger device was build for the GALILEO spectrometer

It is mechanically compatible to ancillary detectors like EUCLIDES

This plunger device works only with a linear motor (no piezo)

The commissioning run was successful

The lifetimes in ^{180}Pt are confirmed (for the $8^+ \rightarrow 6^+$ even higher precision)

Thank you for your attention!

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DFG Deutsche
Forschungsgemeinschaft

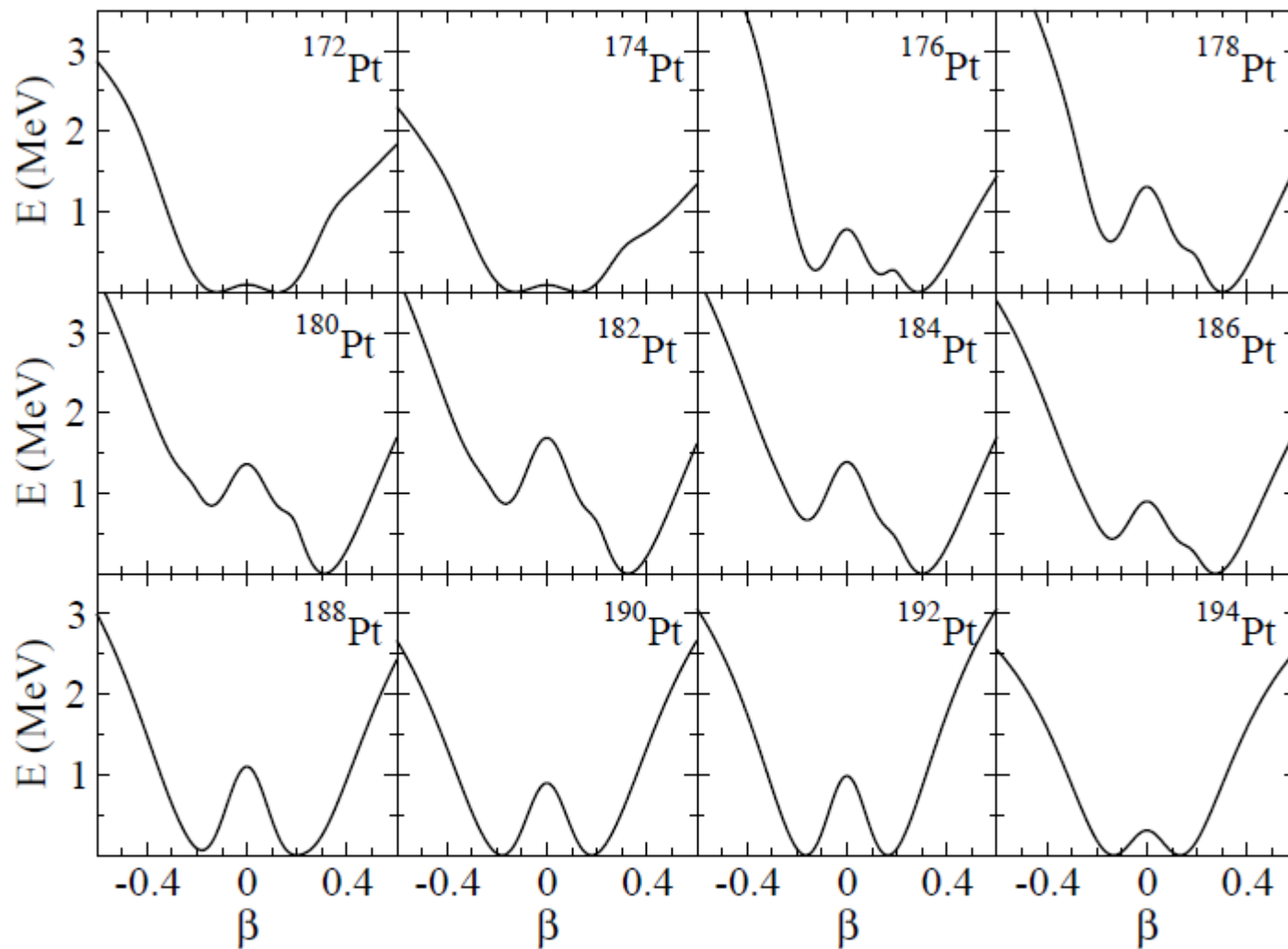


FIG. 1: IBM-CM total energy curves for $^{172-194}\text{Pt}$ as a function of the β deformation parameter (IBM-CM parameters as given in [36]).

J. E. Garca-Ramos, K. Heyde, L. M. Robledo, and R. Rodriguez-Guzman, Phys. Rev. C 89, 034313 (2014)

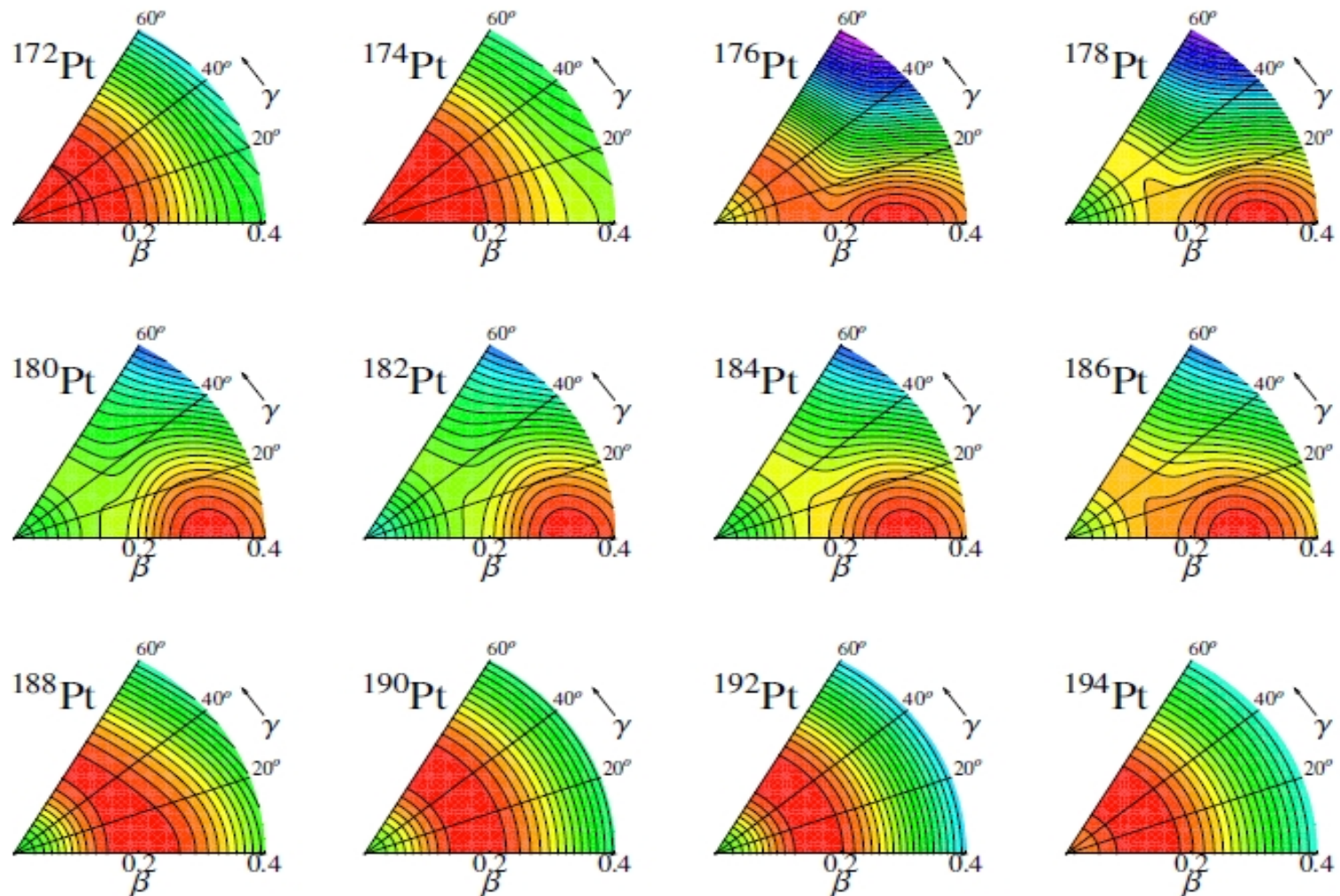


FIG. 4: (Color online) IBM-CM contour plots for $^{172-194}\text{Pt}$ as a function of β and γ (IBM-CM parameters as given in [36]). The separation between adjacent contour lines amounts to 100 keV. The deepest energy minimum is set to zero, corresponding to the red color, while green corresponds to ≈ 3 MeV.

J. E. Garca-Ramos, K. Heyde, L. M. Robledo, and R. Rodriguez-Guzman, Phys. Rev. C 89, 034313 (2014)