



The cryogenic fluorescence source for calibration of the Milano neutrino mass experiment



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U09

The stability of a long lasting experiment like neutrino mass measurements is especially important to avoid deformations of the measured β spectrum. Since the measured spectrum does not have any peak-like feature, one or more additional reference peaks are required to monitor the stability and to calibrate the non-linear energy scale. For the Milano neutrino mass experiment we have developed a fluorescence source which has been successfully used for about one year of measurement. The source is designed for cryogenic use and can be removed by means of a computer controlled motor placed at room temperature. Special care has been used to

minimize the contribution of the ⁵⁵Fe primary source *Inner-Bremsstrahlung* to the radioactive background of the experiment.



2. The source mounted in the cryostat



3. Low friction pulleys tested extensively at LN2 temperature for lowest possible friction



Roman Pb shield fluorescence target: Al, NaCl, CaF₂, Ti

steel rod guides

control string: 6 epoxied cotton strands

⁵⁵Fe 5 mCi source







4. Remotely controlled DC motor

the data acquisition controls the source movement driving a room temperature DC motor

DC motor coupling belt ferrofluid sealed rotating feedthrough

5. Calibration of the Milano neutrino mass experiment

- during data acquisition the source opens for 25 min every 2 h
- \triangleright total calibration spectrum from source-open periods: \approx 42 days \Rightarrow 7978 h \times detector

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6. Detector energy response function

- X-ray peaks have tails on low energy side (see poster U12) • 1~6 keV X-rays in AgReO₄ have an attenuation length $\lambda \leq 3 \mu m$ \triangleright absorption at shallow depth (absorber dimensions \approx 300 m) > ¹⁸⁷Re β s are emitted uniformly throughout the absorber
 - is the response function the same for 187 Re β s and X-rays?

Ti K, line: E = 4.511 keV



7. A possible way to determine the β response function • escape peaks from photons with $E_{v} \ge E(\text{Re K-edge}) = 71.7 \text{ keV}$ (see poster U11)

- $\triangleright \lambda$ (70 keV) $\approx 400 \mu m$ in AgReO₄
- 44Ti source: $E_y = 78 \text{ keV}$



