Supplementary Materials: Perspectives on Neutron Scattering in Lanthanide-Based Single-Molecule Magnets and a Case Study of the $\text{Tb}_2(\mu\text{-N}_2)$ System

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**Figure S1.** A low-energy $S(Q,\omega)$ scan on the parent compound 1. The 0.75 meV excitation is clearly visible at lower momentum transfers $Q < 0.5 \text{ Å}^{-1}$, which confirms its magnetic origin.

**Figure S2.** An intermediate energy $S(Q,\omega)$ scan on the parent compound 1. The 5 meV excitation is clearly present at lower momentum transfers $Q < 1 \text{ Å}^{-1}$, which confirms its magnetic origin.
Figure S3. INS spectra of compounds 1 (a), 2 (b) and 3 (c) at low temperatures (blue symbols) and high temperatures (red symbols). The Bose-corrected high-temperature data are shown by black symbols, but obviously do not estimate the low-temperature lattice contributions in these compounds accurately.

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