



27<sup>th</sup> March 2026

Re: **Letter of support for KVASIR**

To the ESS Instrument Proposal Committee,

I am writing to lend my strong support to the KVASIR instrument proposal for the second round of instruments at the European Spallation Source.

KVASIR combines excellent energy resolution with good **Q**-resolution, making it ideally suited for studying the excitations of quantum magnets and other quantum materials. Furthermore, its high count-rate (thanks to its efficient secondary spectrometer design), means that it should allow measurements on very small single crystals; this is especially important given the difficulty of growing crystals of many of these materials. One example of a material from my own research that would benefit from KVASIR is the one-dimensional frustrated magnet  $\text{KTi}(\text{SO}_4)_2(\text{H}_2\text{O})$  (KTi). KTi has been proposed to be the potential host of a spontaneously dimerized state predicted by Haldane (Nobel Prize 2016) in 1982 but never before confirmed experimentally. This state is associated with the opening of a small gap in the spin excitation spectrum at low temperatures that should be observable by inelastic neutron scattering. On the other hand, KTi is metastable, and therefore difficult to synthesize in quantities sufficient for these experiments; doing so required over a year of synthesis effort, and the experiment could only be carried by combining hundreds of unaligned crystals, entailing a significant loss of information. With KVASIR, measurements on the small single crystals of KTi would be possible, and the full details of the excitation spectrum could be resolved for the first time.

Beyond its applications in quantum matter, KVASIR also shows great potential for the study of crystalline energy materials like battery solid electrolytes, where good energy and **Q**-resolution are required to observe diffusion and other stochastic motions and to distinguish them from *e.g.* lattice vibrations. Its high count-rate is also needed to detect the weak signals from mobile ions like  $\text{Na}^+$  and  $\text{Li}^+$ . KVASIR thus makes an excellent complement to the MIRACLES, BIFROST, and CSPEC instruments, filling gaps in resolution and count-rate between them and thus bringing the ESS spectroscopy suite closer to completion.

To conclude, I wish to restate my strong support for KVASIR, and to add that I believe it will revolutionize the study of a broad range of materials in condensed matter physics and beyond.

Sincerely,

A handwritten signature in black ink, appearing to read 'gln', written over a white background.

**Dr. Gøran J. Nilsen**

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