Sweden and the UK are developing the NQR approach to detect and identify high explosives in nuclear disarmament verification.

Development of an NQR demonstrator for high explosives verification in arms control

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INTRO

- The bilateral collaboration between Sweden (FOI) and the UK (AWE and Dstl) aims to provide the community with a practical contribution to options for future nuclear disarmament verification.
- A nuclear warhead contains both fissile material and high explosives (HE). During dismantlement, these components are separated.
- Warhead dismantlement verification may involve detection and possibly identification of HE, both before and after dismantlement.
- Detecting and identifying HE using Nuclear Quadrupole Resonance (NQR) is this collaboration's focus.

EXPERIMENTAL WORK

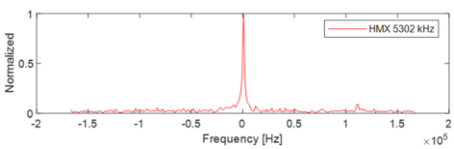
- NQR uses radio waves to selectively excite nuclei in HE. The response is very material specific and can be used to differentiate between substances.
- Establish the experimental apparatus to analyse HE samples.
- Search and investigate the response (resonance frequencies) of relevant substances.

CONCEPTUAL DEVELOPMENT

- Define and study potential use cases for NQR in nuclear warhead dismantlement verification.
- Select promising use cases to inform design of demonstrator.

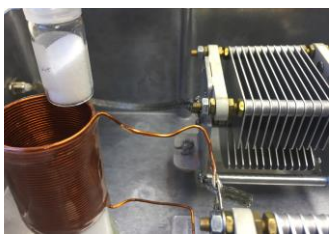
OUTLOOK

- Design and construct an NQR demonstrator by the end of year 2022.
- Use the design to demonstrate an arms control use case including HE detection.

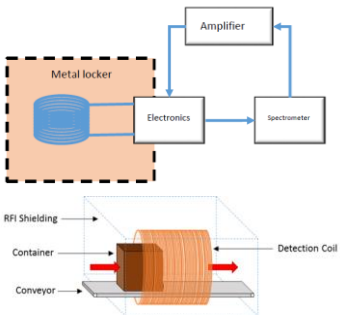


An NQR resonance in response to a radio frequency pulse, identifying the sample as the HMX high explosive.

Experimental facility at FOI.



Close-up of prototype NQR coil with HE sample.



Schematics of NQR measurement set-up.