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Polarisation of longer-lived isotopes and Zero to Ultra low Field Radiation Detected NMR

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Radiation detected (RD) NMR is a sensitive and versatile experimental technique. It relies on the detection of asymmetric nuclear decay. For that, a high degree of nuclear polarisation beyond thermal equilibrium is required and multiple techniques are commonly used to achieve it. One specific case is the optical pumping method that works very well for alkali metals which is used at the VITO beam-line at ISOLDE and successfully used to polarise short-lived nuclei like ^{26}Na or ^{47}K with half-life of seconds. However, other approaches are not all easily applicable to short-lived unstable nuclei due to the time required to build up the polarisation, which can in the order of minutes up to several hours using e.g. Signal amplification by reversible exchange (SABRE) or Dynamic nuclear polarisation (DNP). These approaches would be suitable for isotopes like ^{11}C, ^{13}N, ^{18}F which are being used as PET tracers, since they have longer half-lives (10-110 min) and are readily available from hospital cyclotrons. In this contribution we will present the work towards application of the SABRE polarisation technique on the PET isotope 13N combined with zero to ultra low field (ZULF) NMR. The latter is a novel type of conventional NMR which does not require high magnetic fields and is performed in a magnetic shield at field $\leq$1 μT. The method provides a very compact setup and allows for e.g. study of metallic samples. We will present the current status of the RD ZULF NMR project (funded by CERN Medical Applications Fund) and outlook for near future.

Author: Dr PESEK, Michael (CERN)

Co-author: SPARKS, Amy (CERN)

Presenter: Dr PESEK, Michael (CERN)

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