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Fast Neutron-induced Gamma-ray Spectrometry (FaNGaS)

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Prompt Gamma Neutron Activation Analysis (PGNAA) based on cold or thermal neutron capture is a powerful technique for non-destructive elemental analysis of small and thin samples. However, due to limited penetration and attenuation effects, PGNAA is not suited for a precise investigation of large objects. The feasibility to analyse large samples by measuring prompt gamma rays from fast-neutron-induced reactions was already demonstrated several decades ago [1]. The FaNGaS (Fast Neutron-induced Gamma-ray Spectrometry) instrument, installed at Heinz Maier-Leibnitz Zentrum (MLZ) in 2014, advances this technique in nuclear analytical chemistry and makes it available for a broad community of industry and research [2-8]. Using the intense fission neutron beam delivered by the research reactor FRM II (Forschungs-Neutronenquelle Heinz Maier-Leibnitz) to investigate fast-neutron induced prompt gamma-ray emission, it offers new possibilities for the chemical analysis of large or small samples as a complementary method to conventional thermal- or cold-neutron based PGNAA. The predominant reaction channel of fast neutrons at FaNGaS is the (n,n'γ) inelastic scattering reaction, currently with only one existing database: the "Atlas of Gamma-rays from the Inelastic Scattering of Reactor Fast Neutrons", published in 1978 by Demidov et al. [9]. This data compilation is valuable and a relational database has been recently developed based on this Atlas [10]. However, it was yet never validated and previous measurements with FaNGaS show the need for a critical and meticulous validation [3-6,8]. Apart from building up a comprehensive catalogue of (n,n'γ) reactions another main objective is a continuous optimization of the instrument to achieve a further peak-to-background reduction.
In this talk the experimental set-up and technical specifications of FaNGaS will be given. Relative intensities and partial gamma-ray production cross sections of fast-neutron-induced prompt gamma rays derived from the measurement of various elements will be presented along with literature comparisons.

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