TOWARDS A NEW QUALITY OF HIGH-PRECISION HALF-LIFE MEASUREMENTS: ^{60}FE, ^{53}MN, ^{146}SM, ^{32}SI

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Short-lived cosmogenic radionuclides (SCR) with half-lives shorter 100 My are produced in explosive states of star evolution or via spallogenic processes induced by high energetic particles and can undergo further nuclear reactions, thus influencing the cosmic abundances of stable isotopes. Moreover, SCR can be used as sensitive chronometers for meteoritic or geophysical ageing.

The knowledge of the half-life is an indispensable precondition to use SCRs. For that determination, the most important prerequisite is a sizable amount. It is striking that half-life determinations of e.g. ^{32}Si, ^{53}Mn, ^{60}Fe, ^{146}Sm were performed with puny samples (about 10^{11} to 10^{13} atoms), resulting in widely scattered data with high uncertainty. Raw materials with sufficient amount are e.g. components of high-intensity proton accelerators irradiated over many years. Our home institute (PSI) operates a 590 MeV Ring cyclotron providing a proton current exceeding 2 mA, thus, owning excellent sources for rare and exotic radionuclides.

An initiative was initiated at PSI several years ago to exploit this resource with extraordinary success [1]. For instance, all ongoing or completed experiments with ^{60}Fe within this century use sample material produced at PSI [2-7].

We started a series of experiments aiming on the determination of half-lives of the above given SCR, with an envisaged uncertainty of less than 5%. We are able to prepare samples with more than 10^{16} atoms. In the present contribution, we report on the available isotope sources, describe the radiochemical extraction and purification of the desired radionuclides, explain the envisaged measurements and show first results.