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Retrospective view on progress and recent developments in AMS technology

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Modern AMS instruments are still following design concepts of the pioneering experimental setups as invented during the early times of AMS. However, measurement procedures have undergone a continuous evolution. Groundbreaking progress was made when molecular isobaric interferences could be eliminated by collisional interaction of swift ions with the stripper gas atoms. Radiocarbon detection, still the most important AMS discipline, has advanced most significantly by introducing vacuum insulated high voltage stages, He as stripper gas, fixed field magnetic spectrometers, optimized ion optics, and compact instrument designs. Today, such almost tabletop sized instruments are commercially available and capable to measure carbon isotopic ratios with sup permille precision and measurement quality is more and more no longer limited by the instrumental capabilities but rather by the reproducibility of the sample preparation procedures. This has boosted applications of radiocarbon analyses in many different research fields, making it to a widespread standard analytic technique rather than an exotic experimental endeavour. The analytical progress achieved over the past decades has opened a great potential as well for applications of *Be-10, Al-26, Ca-41, I-129*, and actinides measurements. Instruments using terminal voltages of less the 1 MV, He as stripper gas and utilizing the 3+ charge state obtain high ion transport efficiencies for actinide nuclides. They are not interfered by stable isobars and can be identified with optimized gas ion detectors at low ion energies. But also, in cases of nuclides with stable isobar interferences such as *Be-10*, dedicated low energy instruments can provide suitable measurement performance for a wide variety of applications. Here, elaborated ion identification techniques and optimized ion optical designs are crucial to achieve competitive efficiencies and background levels. However, there is still a need for AMS instruments based on large accelerator facilities. Isobar suppression of medium heavy nuclides such as *Cl-36, Mn-53 or Fe-60* rely on substantial ion energies above 40 MeV to exploit the energy loss differences of isobaric ions. This may change soon, when isobar suppression technique at very low ion energies such as RF cooler in combination with lasers beams become mature. This presentation will review major AMS development steps and highlight latest progress in AMS measurement technology.

Student Submission

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