# Overview of the IBA activities at thE Laboratory of Ion Beam Physics at ETH Zurich

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The Laboratory of Ion Beam Physics operates several accelerators with a broad field of applications. The 6 MV Tandem accelerator has been in operation for almost 60 years, originally installed for nuclear physics experiments, it was one of the first facilities used in the highly successful field of Accelerator Mass Spectrometry (AMS). Based on the extensive experience at that instrument, the method was further improved to gain performance and reduce size, complexity and cost of the AMS instruments, which led to development of the Tandy (the first compact AMS system) and MICADAS, a dedicated instrument for the ever-increasing number of radiocarbon measurements. The Multi-isotope machine (MILEA) and the (very) low energy instrument (LEA) are the latest developments following the concepts of the Tandy and MICADAS systems. The 6 MV Tandem accelerator is still in use for the measurement of radionuclides (e.g. 36Cl, 32Si) that require high ion energy for isobar separation.

In parallel there have been several activities in the field of ion beam analysis (IBA) using the 6 MV Tandem accelerator. Classical techniques such as Rutherford Backscattering Spectroscopy (RBS) and Particle Induced X-Ray Emission (PIXE) had been applied over many decades. But also new developments like a new ToF spectrometer for Elastic Recoil Detection Analysis (ERDA) or Heavy Ion Backscattering were driving the field of IBA. Recently a dedicated setup for MeV-SIMS was developed to study fundamental processes upon the impact of energetic heavy ions (including clusters up to C60). The synergies between the different applications of ion beam physics led to important developments in both fields. An example is the development of improved gas ionization detectors based on experiences in IBA and AMS, which led to an optimized detector setup that is now extensively used in both fields.

Since 2018 we have a 1.7 MV Tandetron accelerator in operation dedicated for our IBA activities. The Tandetron facility had been situated for 10 years at Haute Ecole Arc in La Chaux-de-Fonds, Switzerland, and we moved it to LIP in 2017, after HE-Arc decided to discontinue the activities in that direction. Two ion sources, a Cs sputter and Duoplasmatron ion source, provide the needed beams for the experiments. There are two main beam lines and dedicated experimental stations for RBS/PIXE and ERDA, respectively. These analysis techniques provide the backbone for IBA measurements of the majority of IBA questions. A new developed sample changer allows to change and analyze a large number of samples in an efficient way. Other stations for techniques like Nuclear Reaction Analysis (NRA) or Scanning Transmission Ion Microscopy (STIM), or an Oxford Microbeam complement our measurement portfolio.

Our wide-spread, diverse and complementary measurement capabilities allow us to tackle questions related to material composition and properties from various fields. Our service is used by scientists and industry alike. Development of new materials and coatings rely on the knowledge of the material properties that can be well analyzed by our techniques. Furthermore, based on well-understood ion beam physics, IBA techniques provide accurate results and can help to calibrate other, more accessible techniques that are used e.g. to answer cultural heritage questions.

An overview of our IBA activities at the Laboratory of Ion Beam Physics at ETH Zurich will be presented together with a few examples of lessons learned from collaborations with industry and scientists.