Metal ion gradients across biomembranes play a fundamental role in cellular function. In plant tissue, this includes energy storage, nutrient distribution, signaling pathways and enzymatic reactions. However, ion gradients are not static and thus can change depending on leaf age, nutrient supply, light availability or external abiotic stress factors, e.g. soil salinity. Studying these spatial ion fluxes in correlation to factors such as leaf age and illumination provides insights into ion transport and its significance for plant function and allows for linked analyses of biochemical pathways and ion fluxes e.g. in photosynthesis under varying conditions in wild-type and mutant plants.

Accordingly, research efforts in analysis of essential metal ion in plants, in a similar fashion to proteomics and genomics referred to as ionomics has been intensified [1]. Only recently, the capacities of synchrotron radiation sources in plant research have been highlighted [2]. Here we present the investigation of K, Ca, Na and Mg ions in wild-type and mutant plant leaf tissue using total reflection X-ray fluorescence (TXRF) and micro-XRF imaging. The TXRF analysis enables us for analysis of minute amounts of plant leaf tissue. Low Z abundant metal ions i.e. Na and Mg were determined by atomic absorption spectroscopy. We also used laboratory based and synchrotron based micro-XRF imaging to probe elemental distribution. We observed significant changes in ion content between plant mutants and controls that were related to strong plant phenotypes.