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# P34 - Quantitative Hydrogen Microscopy

*Friday, 11 July 2014 13:00 (1 hour)*

Proton-proton scattering at the Munich microprobe SNAKE gives the unique possibility for sensitive 3D hydrogen microscopy [1]. Quantification of the hydrogen content without the need of any reference sample, a sensitivity of few or even less than one atomic part per million, a lateral resolution of about 1 µm and a depth resolution of a few micrometers are the main characteristics. We use proton energies between 10 MeV and 25 MeV for analyzing any kind of unsupported samples with thickness between 10 µm and 250 µm depending on the atomic density of the investigated material [2].
Two major aspects of the quantification of the method are presented in this paper: (1) Improving the sensitivity without loss of lateral resolution requires maximum beam brightness that we have optimized by a new Multicusp proton source [3] and improved temperature stabilized water-cooled microslits. (2) Precise quantification requires (a) scattering cross sections [4], but also (b) efficiency analysis of the coincident signal. The latter will be discussed as a main topic: Strict filters has to be applied on the selection of the scattering plane as well as a strict 90° angular sum for the coincident proton pair in order to avoid accidental coincidences. However, multiple (small angle) scattering effects on the path of the protons through the sample disturb this angular conditions of the detected protons. This decreases the detection efficiency depending on the atomic number Z and thickness (in at/cm2) of the scattering event. In order to understand this decrease and correct for a precise quantification, we use the CORTEO [5] Monte Carlo code. This code allows simulating coincident events with variable detector geometry by efficient numerical routines. We present simulation of multilayered sandwich targets compared to analytical calculations and experimental data. The results are applied to quantification of current studies of geological samples as well as heavy metals.

References

[1] P. Reichart, et al., Science 306 (2004) 1537.
[2] P. Reichart, et al., Nucl. Instr. and Meth. B197 (2002), pp. 134-149
[3] M. Moser, et al., Nucl. Instr. and Meth. B273 (2012) 226.
[4] M. Moser, et al., Nucl. Instr. and Meth. B 269 (2011), pp. 2217-2228
[5] F. Schiettekatte, Nucl. Instr. and Meth. B266 (2008), pp. 1880–1885

**Primary author:** Mr MOSER, Marcus (Universitaet der Bundeswehr Muenchen, Muenchen, Germany)

**Co-authors:** Dr BERGMAIER, Andreas (Universitaet der Bundeswehr Muenchen, Muenchen, Germany); Dr SCHITTEKATTE, Francois (Regroupement Québécois sur les Matériaux de Pointe, Département de Physique, Université de Montréal, Montréal, Canada); Prof. DOLLINGER, Günther (Universitaet der Bundeswehr Muenchen, Muenchen, Germany); Ms PEEPER, Katrin (Universitaet der Bundeswehr Muenchen, Muenchen, Germany); Dr REICHART, Patrick (Universitaet der Bundeswehr Muenchen, Muenchen, Germany); Mr CARLI, Walter (Beschleunigerlabor Garching, Germany)

**Presenter:** Mr MOSER, Marcus (Universitaet der Bundeswehr Muenchen, Muenchen, Germany)

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