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Detailed process characterization of carbonated LGADs through Secondary Ion Mass Spectroscopy

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Using high resolution Secondary Ion Mass Spectroscopy (SIMS), the gain layer doping profiles of carbonated FBK UFSD 2 and CNM RUN 10478 LGADs are evaluated. A combination of ^{55}Cs^{-} and ^{16}O^{+} primary ion driven campaigns yield a high sensitivity in the order of 1.35×10^{14} $atoms/cm^3$ for Boron concentrations along with a precise depth estimation within ˜ 5 nm. For Carbon profile studies, a 62-hour Caesium pre-sputtering protocol is established which, combined with beam parameter optimization, result in an unprecedented sensitivity of 2×10^{15} $atoms/cm^3$. Through advanced analysis techniques, conclusions are extracted concerning the implantation dose, energy and activation for Boron and Carbon implants. The latter are validated though Monte-Carlo TCAD process simulations, while Boron de-activation on carbon co-implantation is discussed. Finally, using as input the measured dopant profiles, electrical simulations are presented and compared with previously reported laboratory data.

Primary authors: Dr GKOUGKOUSIS, Vagelis (CERN); COCO, Victor (Syracuse University)

Presenter: Dr GKOUGKOUSIS, Vagelis (CERN)

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