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Investigating two possible schemes of Laser Ablation – Cavity Ring Down Spectrometry for water isotope measurements on ice cores

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Thinning of the deep ice core layers must be considered when the water isotopic composition of the Oldest Ice Core is to be analyzed. From an experimental point of view, a novel instrument combining a micro-destructive cold femtosecond - Laser Ablation (LA) sampling system, that provides high spatial resolution together with minimal usage of ice sample, and a Cavity Ring Down Spectrometer is being built for high-quality water isotope measurements. Laser ablation results in crater formation and its morphology depends on the laser parameters used. Optical images that show crater morphology under different experimental conditions allow crater characterization towards an efficient cold LA sampling. An ablation chamber and a transfer line are both the connecting parts between the LA system and the CRDS instrument. They are to be designed and constructed in the optimal size and shape to collect the ablated mass and guarantee its smooth delivery to the CRDS analyzer with minimum disturbance.

Coupling a Laser Ablation system with a CRDS analyzer has already been achieved using a laser operating at the nanosecond regime and a cryo-cell as the ablation chamber. Comparison of the two Laser Ablation systems, by the means of ice sampling and collection of the ablated material, will be of great importance to understand the ablation mechanism and post-ablation processes on ice and further develop a system dedicated to water isotope measurements.