Continuous Radiocarbon Records by Laser Ablation – Status Report

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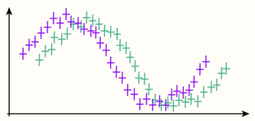
Abstract

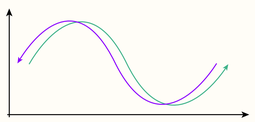
The laser ablation (LA) setup at ETH Zurich[1] is coupled to a MICADAS accelerator mass spectrometer (AMS) and enables rapid ^{14}C analyses of carbonate archives. It has been successfully employed for a broad range of samples such as stalagmites[2], otoliths[3], and shells of Arctica islandica. A 193 nm ArF excimer laser is used to liberate CO and CO_2 from the sample surface by ablation. The gas is then flushed with helium into the gas ion source of the AMS for online measurement.

A



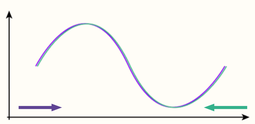
As a transient signal is captured in 10 s integration bins, each data point has high scatter from counting statistics. To reduce some of the high frequency noise, a Savitzky-Golay filter is applied.

B



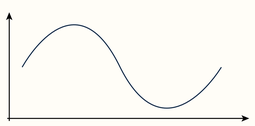
To correct for washout effects from the cell and capillary, two scans in opposite directions are measured and shifted against each other. The shift that minimises the difference between the two scans is chosen.

C



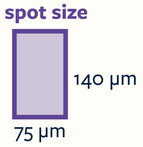
The final track is given by the mean of the filtered and shifted scans with uncertainties derived from error propagation.

D

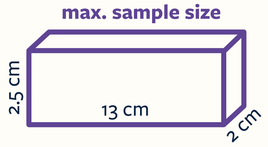


Setup Parameters

spot size



max. sample size



blank level

0.09 $F^{14}C$
(~ 38 ky)

Acknowledgments

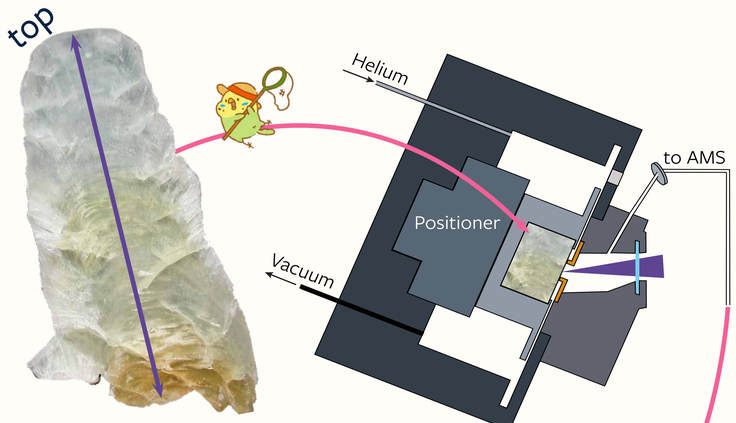
Thanks goes to Jens Fohlmeister and Christoph Spötl for their stalagmite expertise as well as the opportunity to work on this fascinating sample.

References

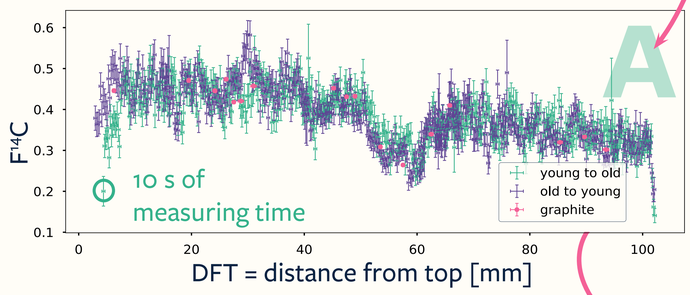
[1] LA-Setup
[2] Stalagmites
[3] Otoliths

birds by てんキュ

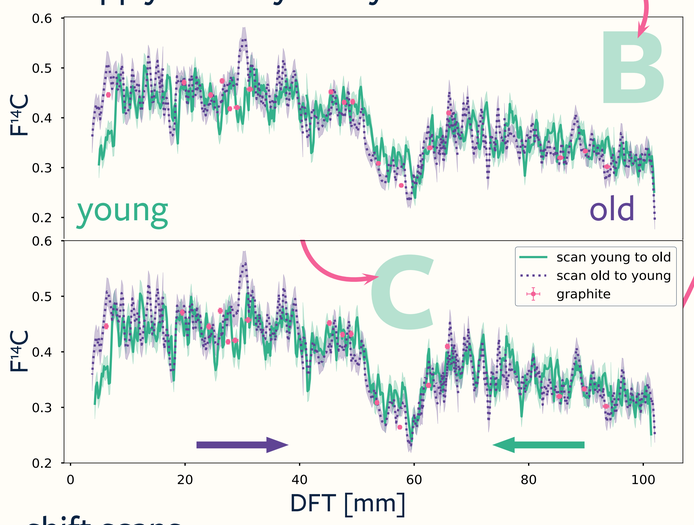
How to Achieve Robust Rapid Radiocarbon Records by Laser Ablation?



stalagmite SPA-127

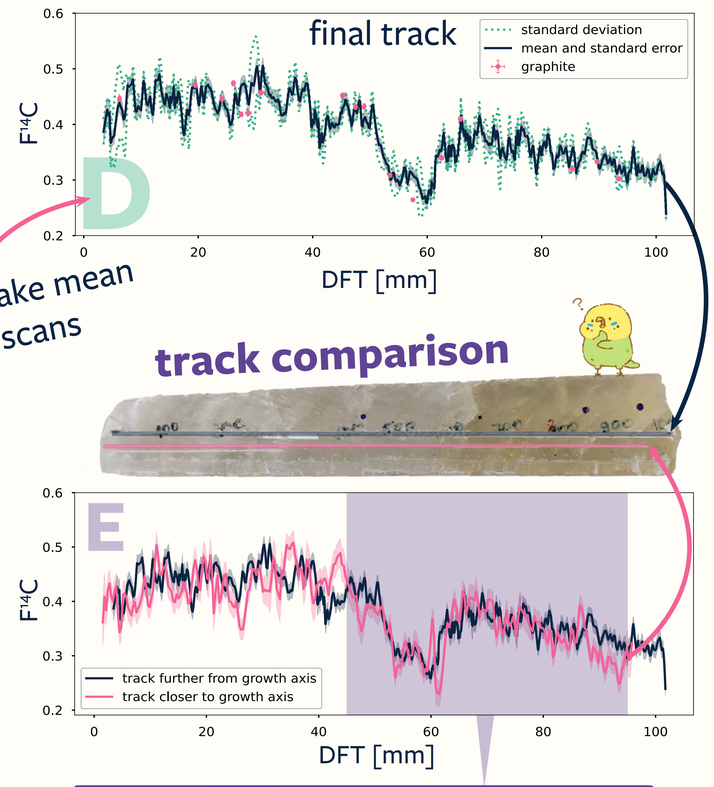


apply Savitzky-Golay filter to scans



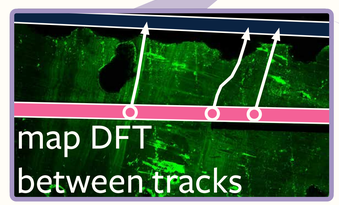
shift scans
to correct for washout

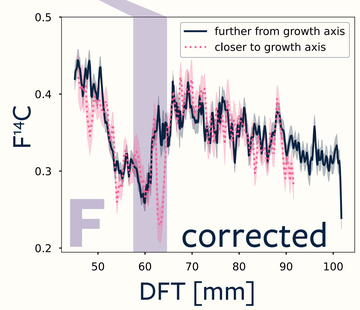
take mean of scans



track comparison

confocal microscopy images





Confocal microscopy can help explain offsets between different tracks.

With some effort, robust results are achievable!