# $^{14}C$ SCAR

## THE UNIQUE TOOL FOR RADIOCARBON DETECTION

ppq SENSE

# THE INSTRUMENT

14C SCAR C14 SCAR is an high-precision, laser-based, table-top 14CO2 analyzer, based on a new spectroscopic technique called saturated-absorption cavity ring-down (SCAR).
Radiocarbon (14C) is a radioactive chemical element, with a natural abundance of about 1 atom every 1 trillion carbon atoms. At present, accelerator mass spectrometry (AMS) is the reference technology for high-precision radiocarbon measurements.

Thanks to its new technology, 14C SCAR allows to take radiocarbon measurements in your laboratory in a simple and reliable way.

# APPLICATIONS

**Environmental monitoring and $CO_2$ emission quotes**

The $CO_2$ emission quotes have become products to measure, valorize and exchange on global financial markets. Therefore, the accurate high resolution $^{14}CO_2$ measurement is essential.

**Certification of biogenic fraction in materials**

The distinction between emissions of fossil and non-fossil origins is crucial for quality evaluation of products: knowing the biogenic fraction of textile, plastics, oil, fuels is important for assessing their environmental impact.

**Life/biomedical sciences**

14C is used as a marker of drugs / treatments, to monitor their metabolism and efficacy.

**Monitoring of nuclear sites**

Areas around nuclear power plants / waste repositories has a higher concentration of radiocarbon dioxide, whose radioactivity might raise health issues for resident people.

**Radiocarbon dating**

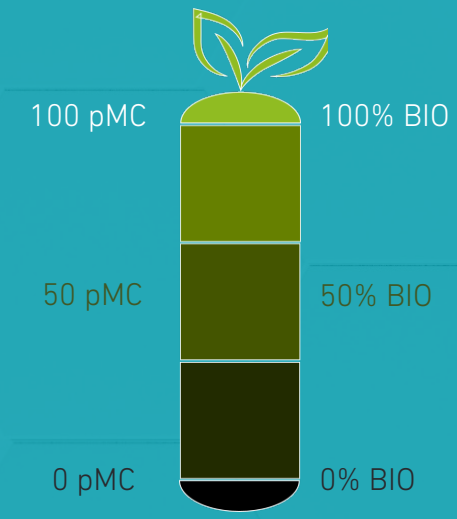
The most classic application of radiocarbon measurement for dating archaeological and cultural heritage: the radiocarbon content in a biological sample allows to trace the age of cessation of organic activity.

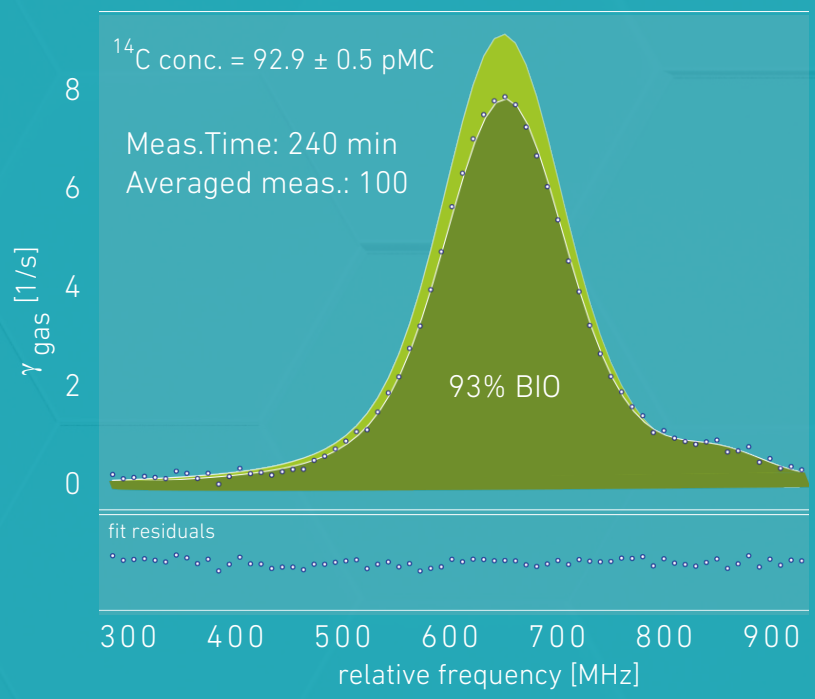
# BIOBASED CONTENT MEASUREMENTS

The objectives of the EU's 2030 Agenda focus on developing new technologies that can transform renewable natural resources into bio-based products and materials in a sustainable way.
The industry is starting to produce manufactured goods that contain mixtures of bio-based and petroleum-based materials. Measuring the 14CO2 mole fraction to retrieve the percentage of modern carbon (pMC) is a direct quantification of the biogenic fraction within a material.

## The concept of Modern/Biogenic and Fossil

14C SCAR analyzes the $CO_2$ gas produced by burning the sample and retrieves the mole fraction of $^{14}C$ by measuring the spectral area of a given molecular transition of the $^{14}CO_2$ molecule. If the sample is taken from a modern living being, the measured $^{14}C$ mole fraction will be close to the so-called natural abundance or **Modern Carbon (MC)** mole fraction. This corresponds to 100 percent of Modern Carbon, i.e. **100 pMC**. A similar measurement taken on a sample containing only fossil carbon will not show any signal corresponding to the $^{14}CO_2$ transition, since no $^{14}C$ is present: this corresponds to **0 pMC**.




### Measurement on Textile

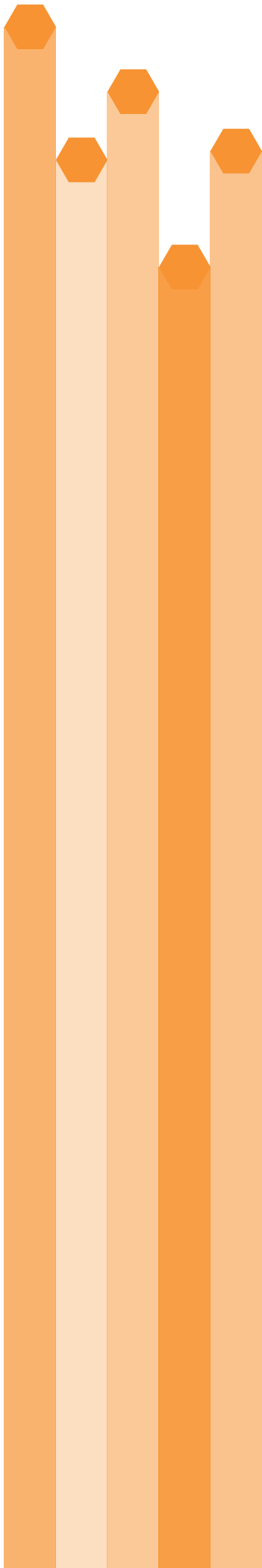
Measuring the biogenic content of a tissue reveals that about 7 percent of the material is derived from fossil sources.

## MEASUREMENT PERFORMANCE

| | MIN | TYP | MAX | UNITS | NOTES |
|---|---|---|---|---|---|
| Carbon sample mass required | 6 | 8 | | mg | |
| $N_2O$ contamination level | | 5 | 10 | ppb | |
| $^{14}C$ content precision | | | | | |
| @ 10 minutes avg time | 1.0 | 1.5 | | pMC | |
| @ 60 minutes avg time | 0.4 | 0.6 | | pMC | |
| @ 240 minutes avg time | 0.2 | 0.3 | | pMC | |
| Accuracy | 0.2 | 0.5 | | % | |
| $^{14}C$ content measurement range | 0 | | $10^4$ | pMC | with negligible memory effect |
| Limit of detection | 1 | 1.5 | | pMC | |

## SPECIFICATIONS

| | MIN | TYP | MAX | | NOTES |
|---|---|---|---|---|---|
| Power Supply | | 230 | | $V_{ac}$ | |
| Absorbed Power | | 2.5 | 3 | kW | |
| Weight | | 600 | | kg | |
| Size | 200 x 110 x 160 | | | cm | |
| Warranty | 1 | | | year | |
| Safety Tested to | EN 61326-1<br>EN 55011<br>EN 61000-4-2<br>EN 61000-4-8<br>EN 61000-4-3 | | | | European Council Directives:<br>2004/108/EC<br>2006/95/EC |



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