A2 Photonic Sensors

iTEL: a lightweight device to measure liquid water content in the snowpack

Laureate of OSEO 2006 National Innovation Contest

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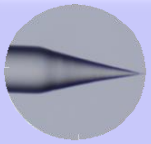
Rev-2015-1

A2 Photonic Sensors is an expert manufacturer of innovative measurement systems for fluid mechanics and earth sciences

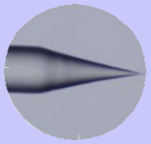
- Founded in 2007
- Spin-off from 2 academic research labs:
  - CNRS-LEGI - Fluid Mechanics
  - IMEP-LAHC - Micro-technology
- Located in France on the MINATEC campus

Our vision is to provide easy-to-use and affordable measurement instruments complementary to the existing offer for the R&D market.

Offer dedicated to scientific and industrial R&D applications

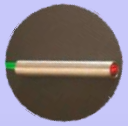


- B-POP: optical probes for bubbly flow characterization



- S-POP: optical probes for spray & atomization

Fluid mechanics



- iLDA: µ-LDV for near-wall & micro-fluidic measurements

- IceCube for specific surface area of snow

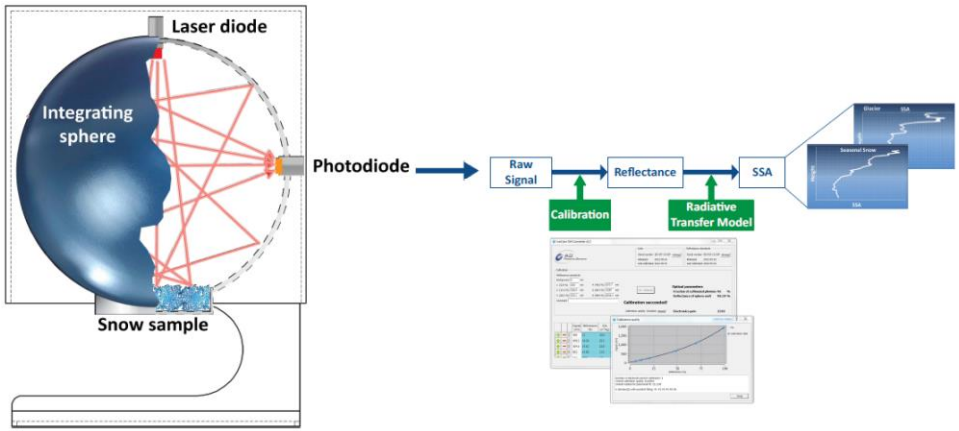
Q3 2015

- *iTEL for liquid water content of snow*

Earth sciences

IceCube:
Specific Surface Area (SSA) of snow measurement

- Instantaneous measurements in the field (polar cond.) or in lab
- Accurate and reliable output
- Easy to set up and use



A2PS collaborated with LGGE to develop a commercial version of DUFISSS, a novel instrument for measuring snow SSA in the field.

iTEL: re-engineering a lightweight and reliable LWC sensor

- CNRM-GAME/CEN developed in the 80's a robust and portable LWC sensor that proved to be very adapted to field measurements but this sensor was only little commercialized and is now discontinued

- Goals of the collaboration:
  - Develop a new version of the sensor with today's technology
  - Improve the ease-of-use and user-friendliness of the instrument
  - Distribute the tool widely and ensure technical support & after-sales service

iTEL: working principle

- The measurement relies on the experimental relationship between the LWC, the density and the dielectric constant of the snow:

$$\varepsilon = 1 + 2.2 * \rho + 21.3 * w \qquad (1)$$

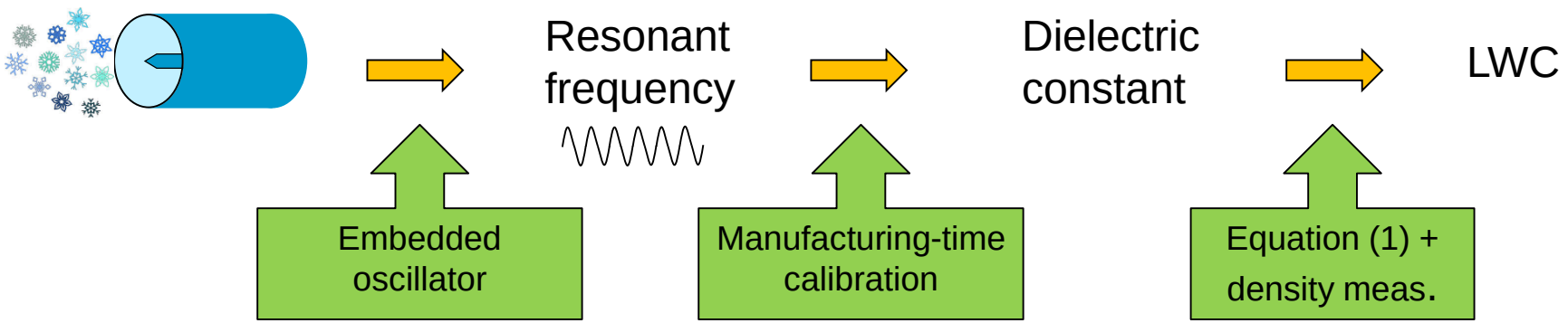
where ε: dielectric constant, ρ: density, w: volumetric LWC

- Ice and water have very different dielectric properties: $\varepsilon_{water} = 88$, $\varepsilon_{ice} = 3$

=> the presence of liquid water in the snow, even in small quantities, does significantly affect the dielectric properties of the medium.

iTEL: setup

- The device is a sampling cylinder with a central electrode, which is directly inserted in the snow pack
- The sampler is linked to a handheld computing unit that processes the data



- Note: in the case of dry snow, it would be possible to use the instrument to measure its density.

iTEL: key characteristics

- Reliable, easy-to-use
- Instantaneous and accurate results (well-defined measurement volume)
- Small and lightweight portable device
- Robust device (stainless steel sampler, IP65 computing unit)
- Automatic recalibration by checking the permittivity of air

iTEL: project status and planning

- A first prototype is ready, we are currently working on the calibration process, in order to make it safer and quicker

- We expect to run validation tests soon and to start commercializing the product this fall

Comments welcome!

- We are looking for all kinds of feedback, questions, comments, suggestions…

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Thank you!