



Presented at the FIG Working Week 2023,
28 May - 1 June 2023 in Orlando, Florida, USA

FIG WORKING WEEK 2023

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Protecting
Our World,
Conquering
New Frontiers

GRIMONIT (GroundRiskMonitor)

Fully automatic and remotecontrollable
deformation early warning system for
difficult measurement conditions

Inma Gutiérrez

Edi Meier



Organized By



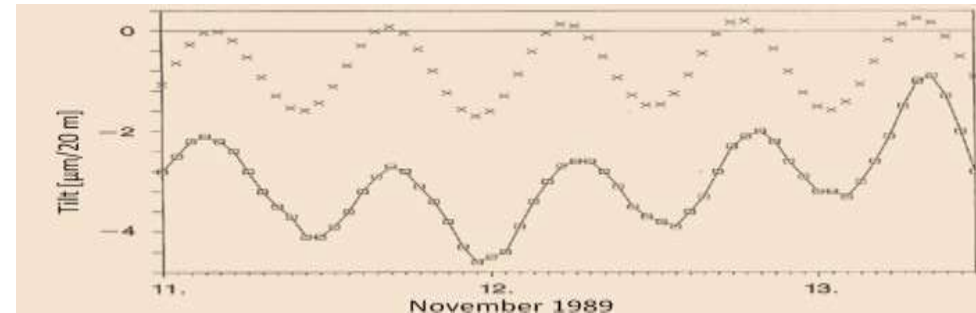
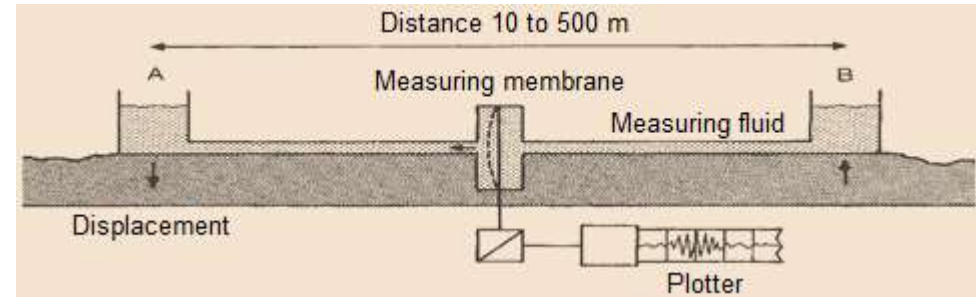
Diamond Sponsors



The GRIMONIT history

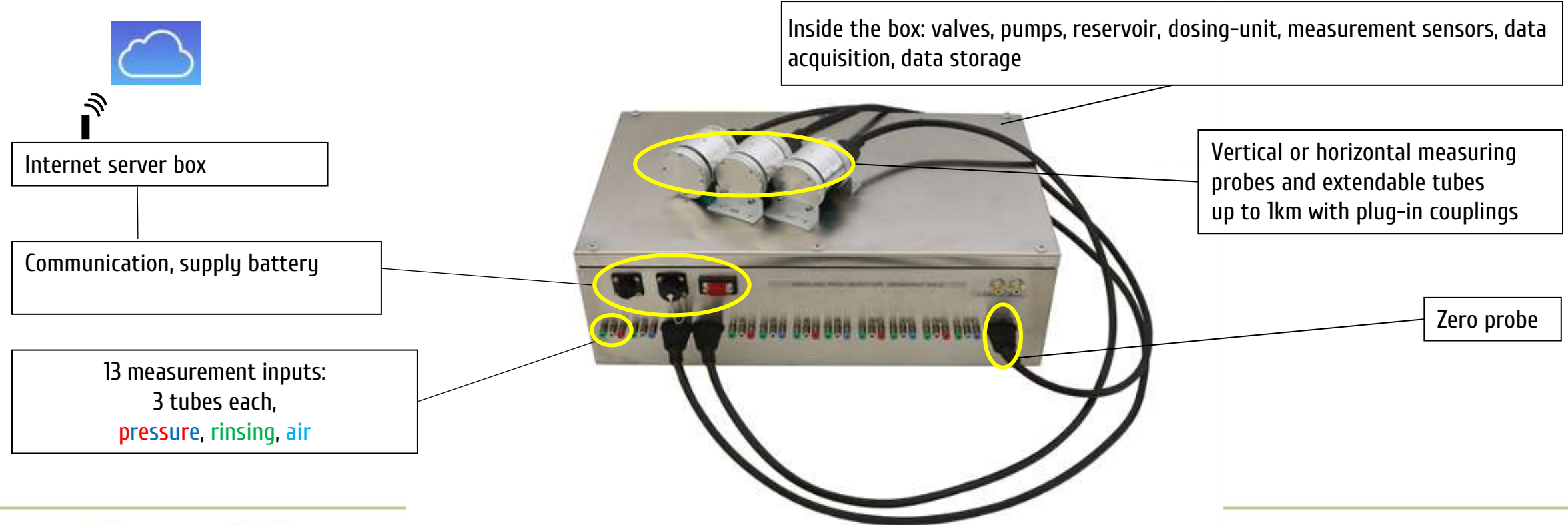
The measuring principle is very old...

- 1981 Diplomathesis ETH by Edi Meier
- 1989 Installation in powerdam Albigna, Graubünden



November 1989, Earthtides recorded

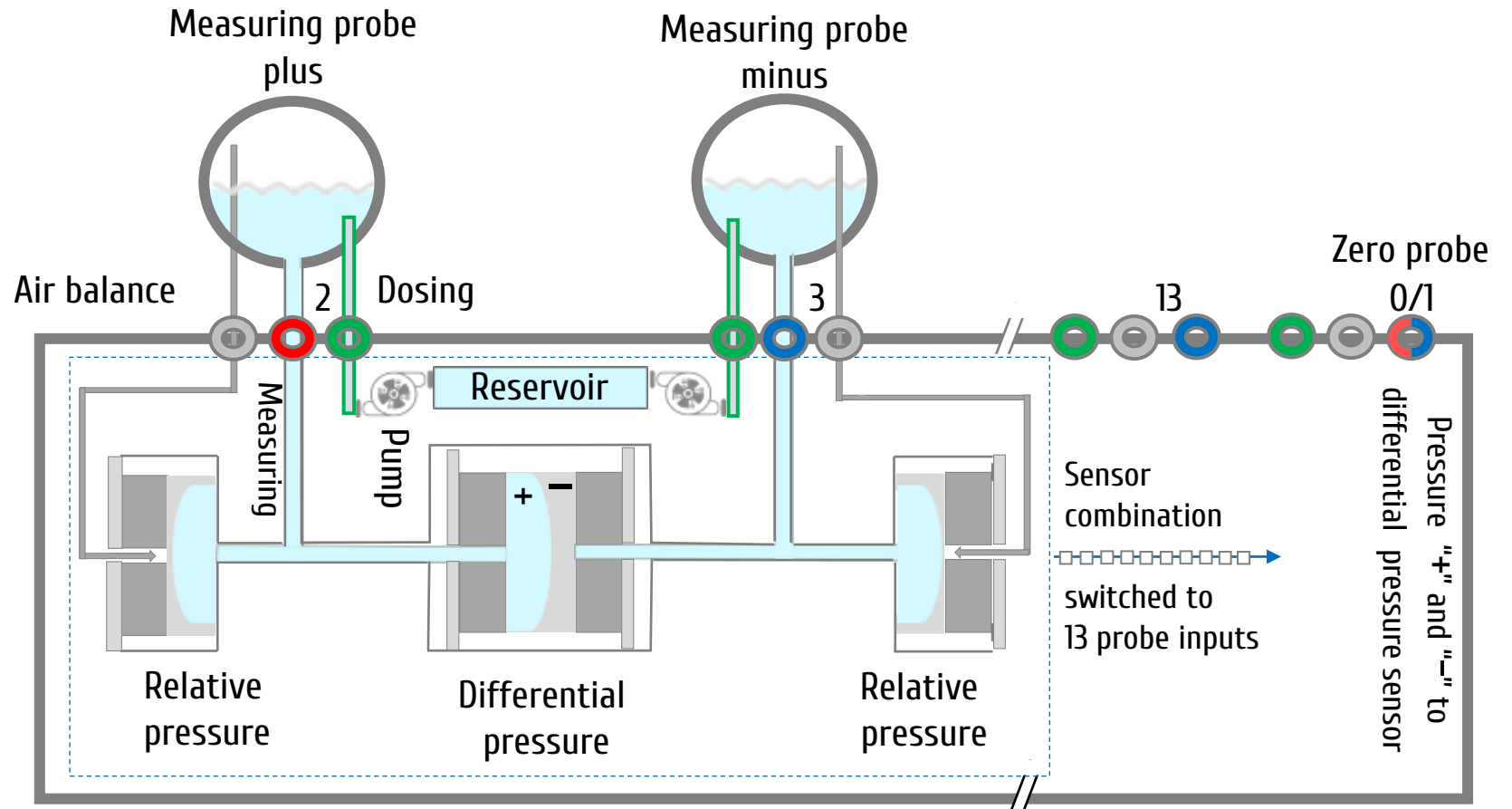
GRIMONIT - fully automated



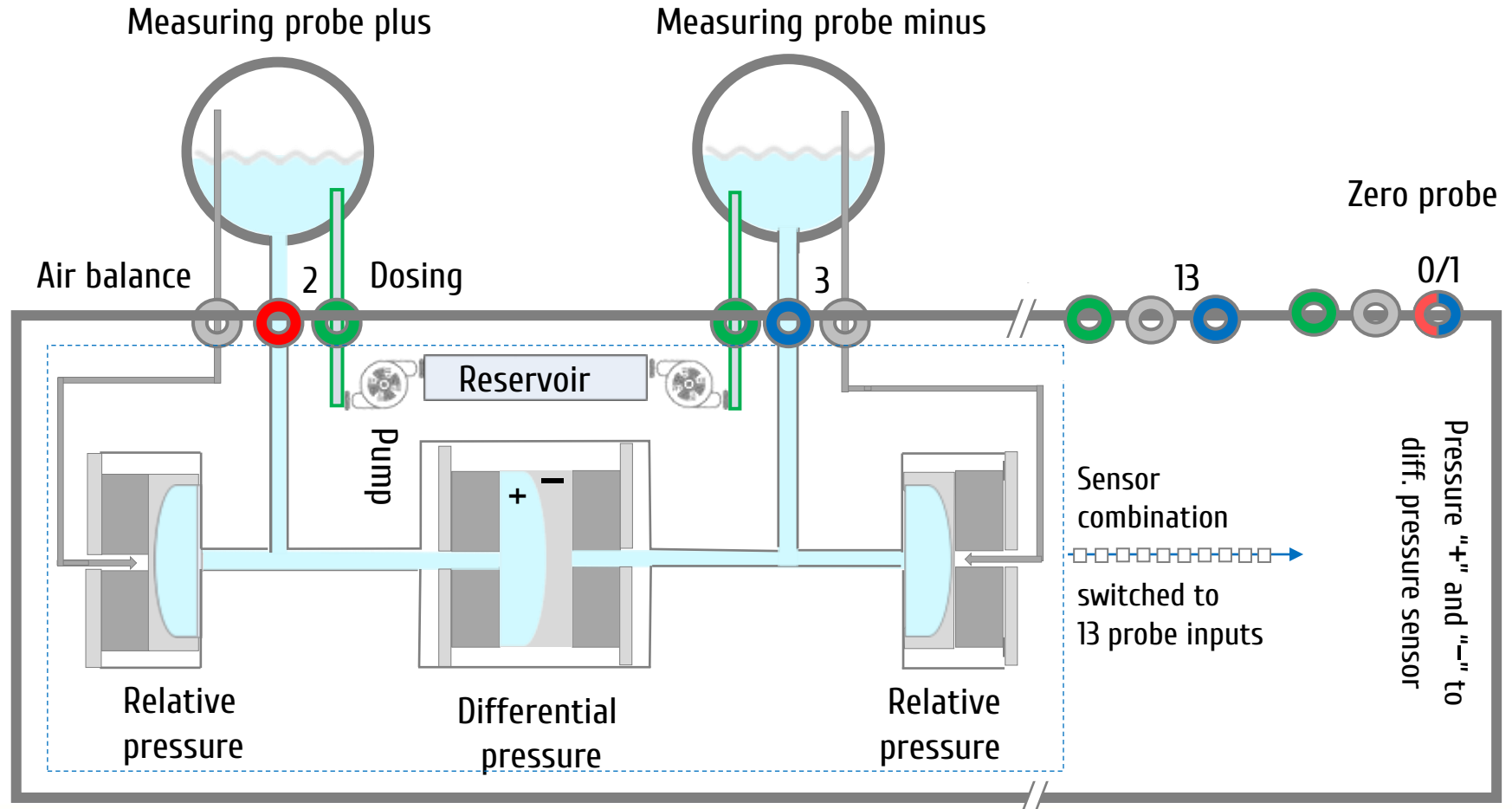
Measuring probe – what is inside ?



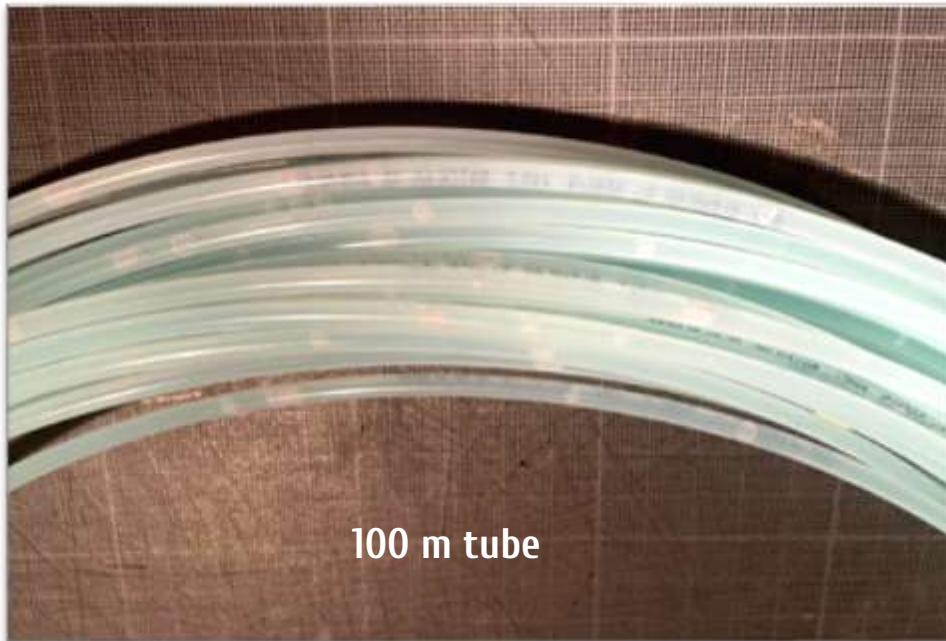
Measuring principle



Measuring principle Step by step



Error sources



Error source

Solution

air bubbles



rinsing

Remote-controlled

loss of liquid



refill

temperature changes



*additional
temperature
measurements*

Application: Zingel quarry at Lauerzersee (Schwyz)

Siliceous limestone mine



Landfill with refuse slag

Tunnel in the landfill body

- Conveyor belt -> material transport
- 8 Inclinometer tubes -> settlements monitoring below the landfill sealing

Subsidence of the landfill base

Risk of cracking

Leakage of the base barrier



Deformation measurements 2021



Pipe 33.2: Results from 2010 and 2021



Advantages and possible applications

Advantages

- No free sight necessary, measures below snow and below bushes in forested areas.
- Continuous measurement possible, online monitoring.
- Periodic measurements, the tubes and probes remain on site. GRIMONIT is connected only if measurement is desired or planned

Possible applications

- Landslides
- Soil resilience to compaction due to trafficking with heavy machines
- Underground mining
- Deformation in bridges, dams...

Thanks to all

- The GRIMONIT project was financed by the FOEN, Bern with CHF 148'000. Students from the Swiss Federal Institute of Technology, the University of Applied Sciences Rapperswil and 5 industrial partners worked on this project. Thanks to them, there is now a field-suitable, automated early warning system available.
- The present layout of GRIMONIT can be used in a variety of ways, yet we continue to develop it. We are happy to meet application partners and to tackle new challenges.

Questions now?

Questions later? www.emp-winterthur.ch

