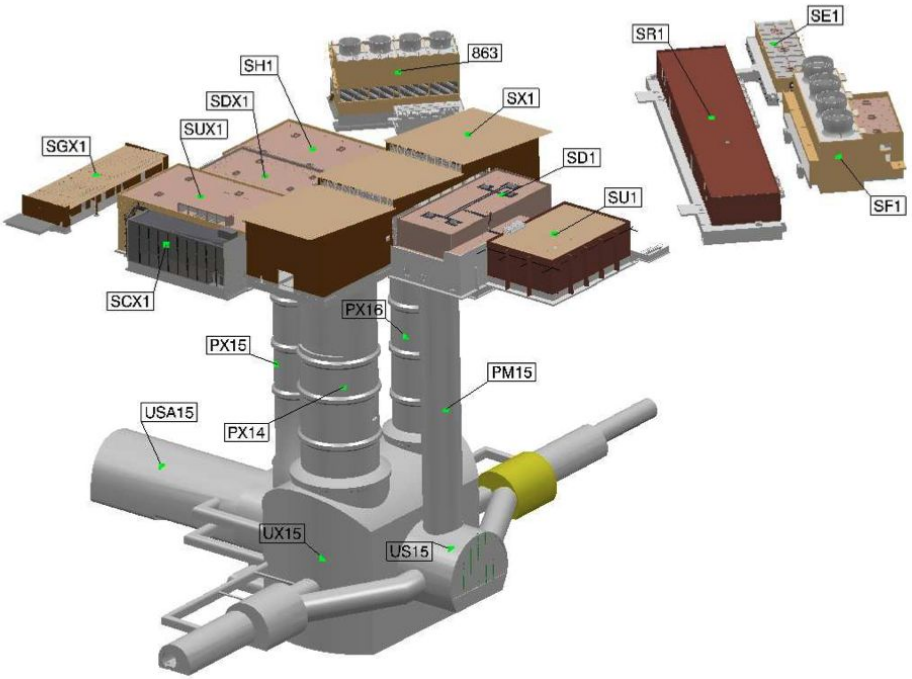
The ATLAS Technical Coordination WAterLeakDetection project

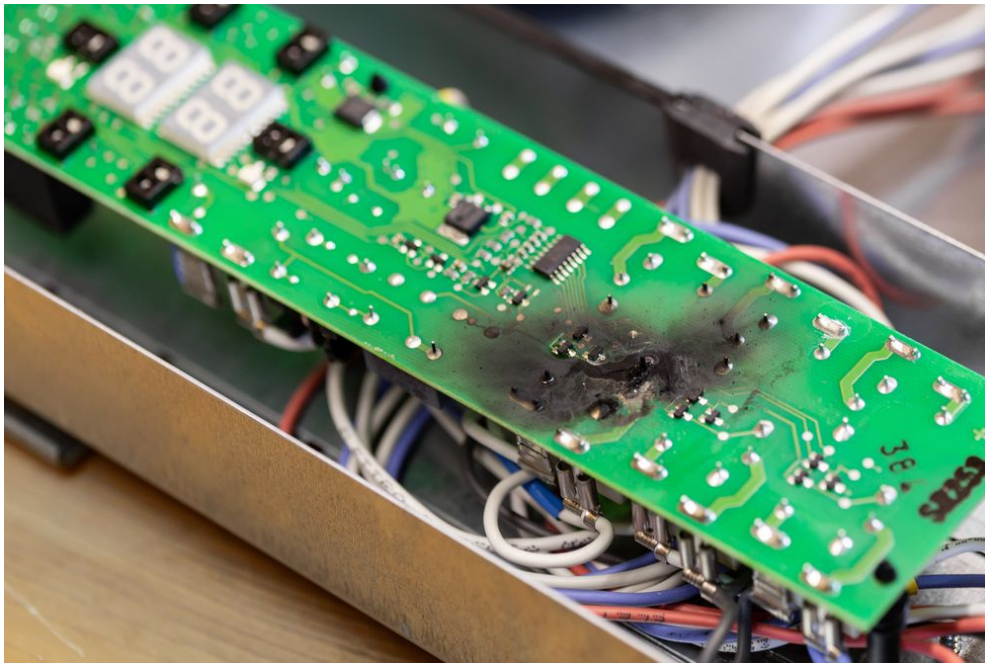
Uku Luhari
10 August 2023

Atlas is more than the detector

- Support systems
- DSS (Detector Safety System)
  - Water leaks



Layout of ATLAS



Water damaged computer

Current solution - sensing wires

- Reliable and widely used
- Can cover large areas

- Binary signal: leak / no leak
- Can only detect big leaks.

- 191 water leaks
  from 2017 to 2022

- Recently, more and more small leaks have been detected…

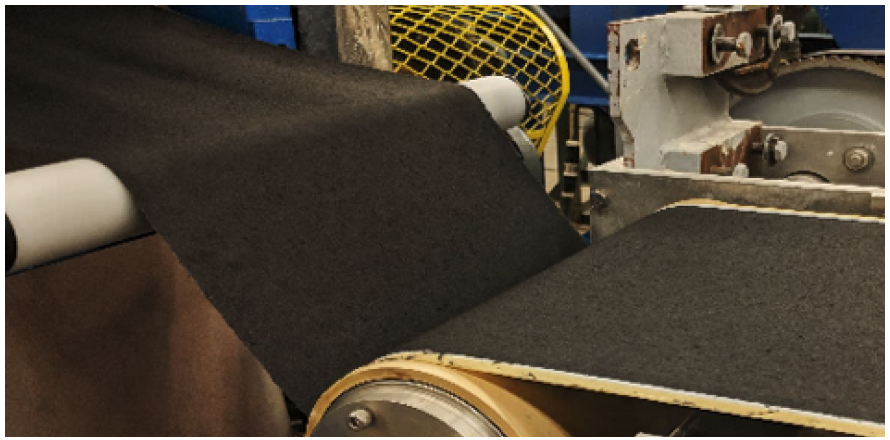
Sensing wire near leak

“Smart paper”

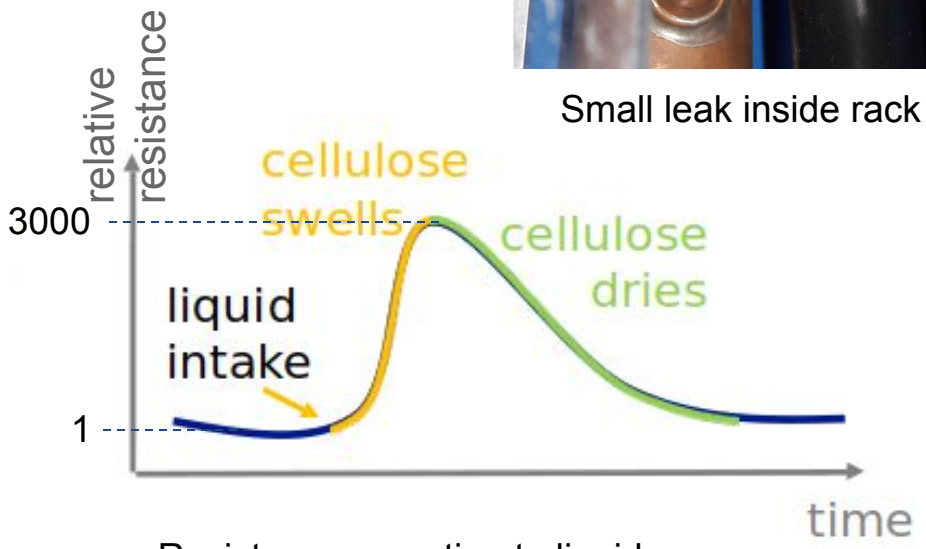
- Developed in University of Washington
- Great sensitivity to water
- Can cover complex geometries inside racks or around pipes

Smart paper sample wrapped around rack manifold

Small leak inside rack



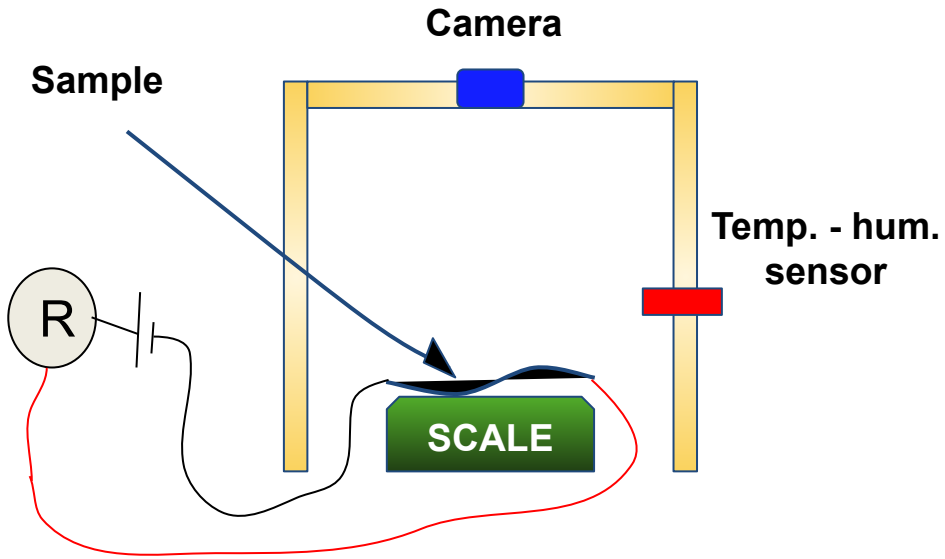
Production at the Uni. of Washington



Resistances reaction to liquid

Water leak detection model

- Samples of various sizes and shapes were measured using different amounts of water.
  - Raspberry pi with a camera V2
  - Scale
  - Custom PCB for resistance measurement
    - featuring Raspberry pi
  - Temperature - humidity sensor

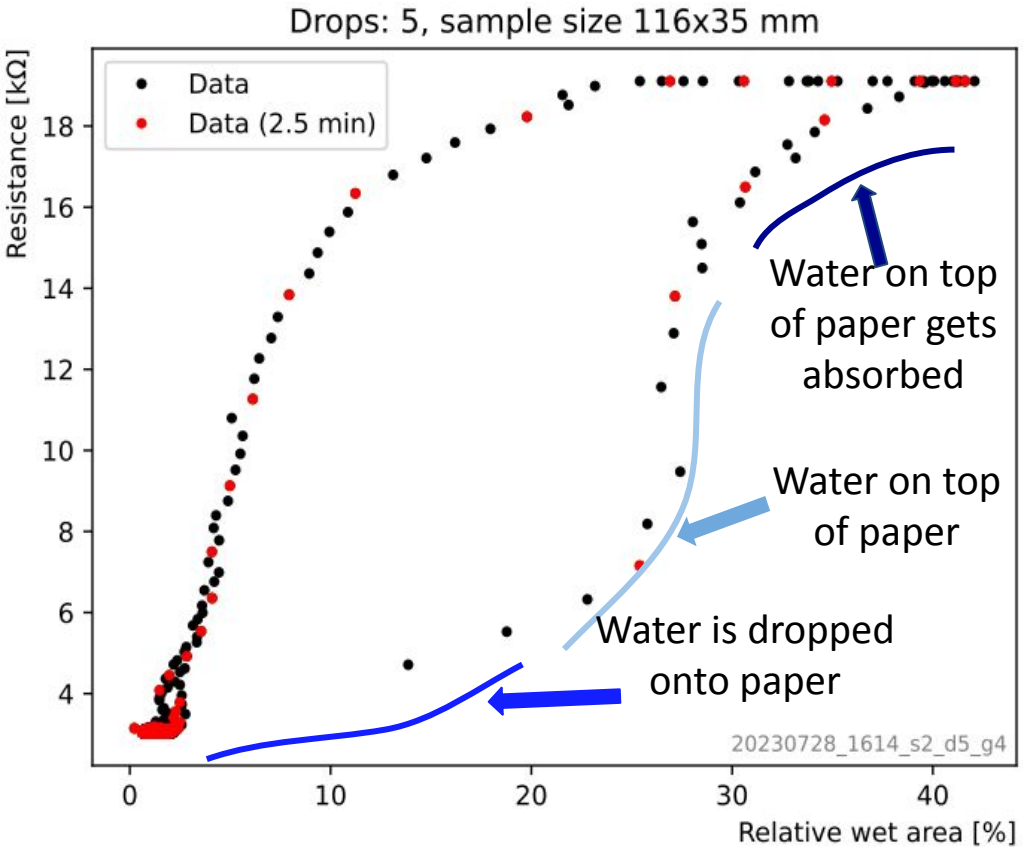


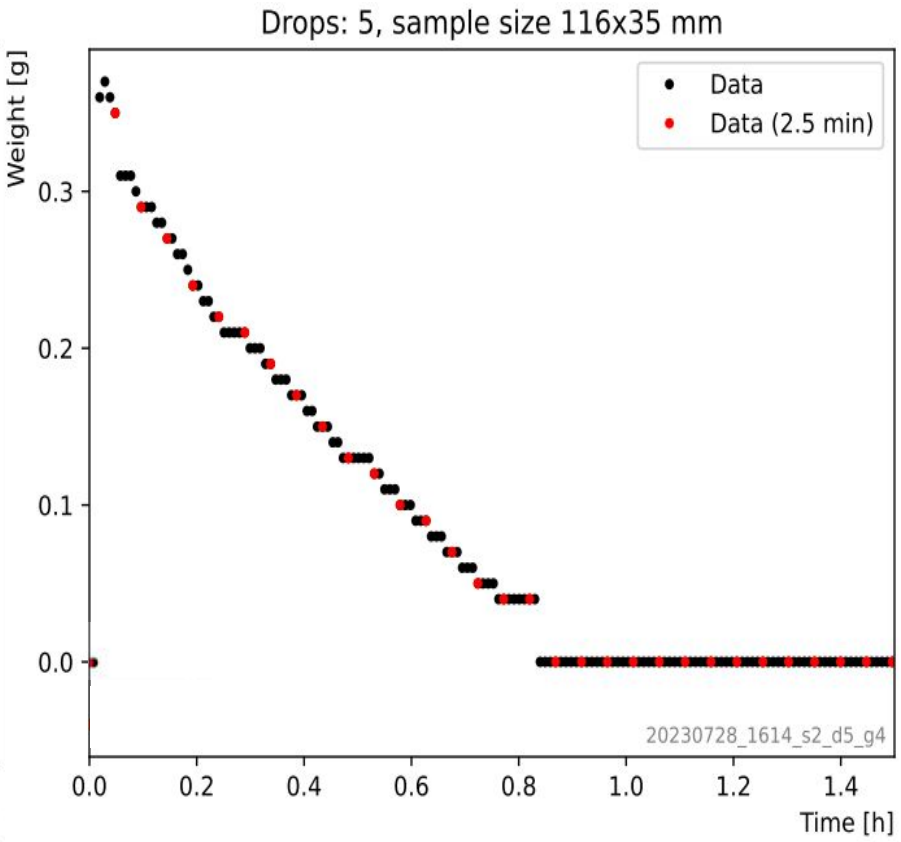
Test setup

Inside the box

Analysis 1/2

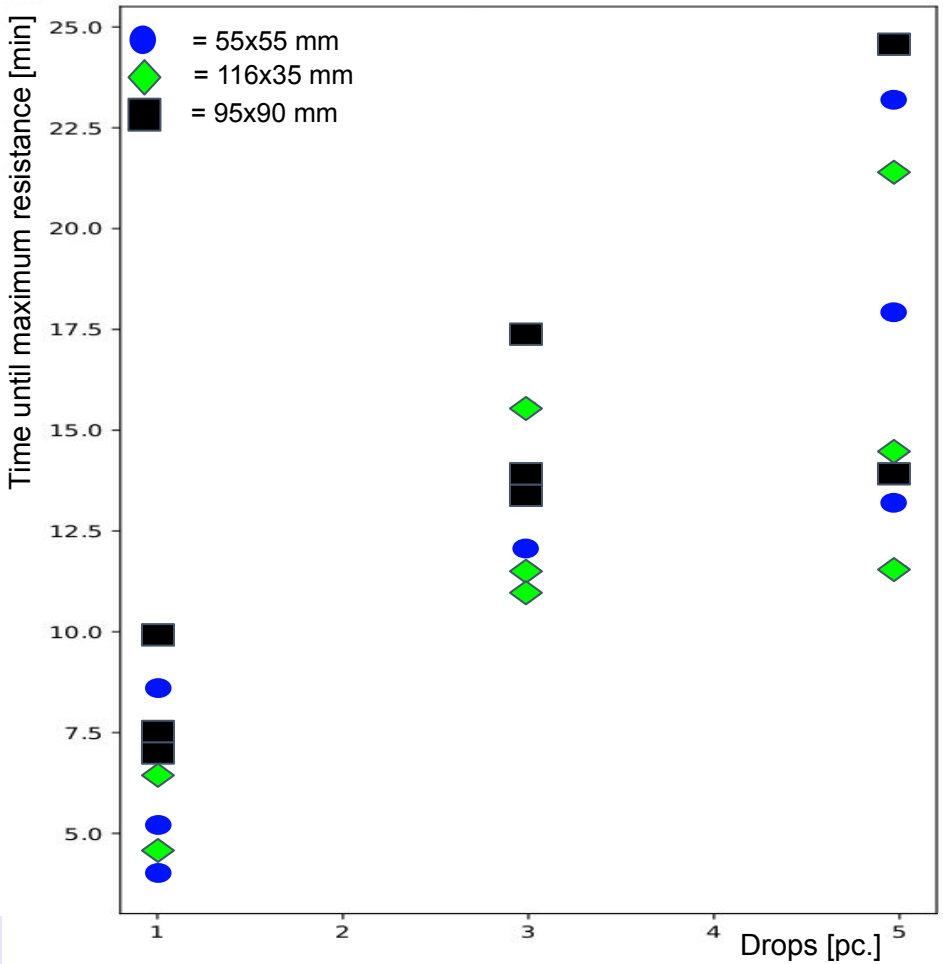
- Complicated absorption process
  - Big difference between absorbing and drying
  - Has to be further understood

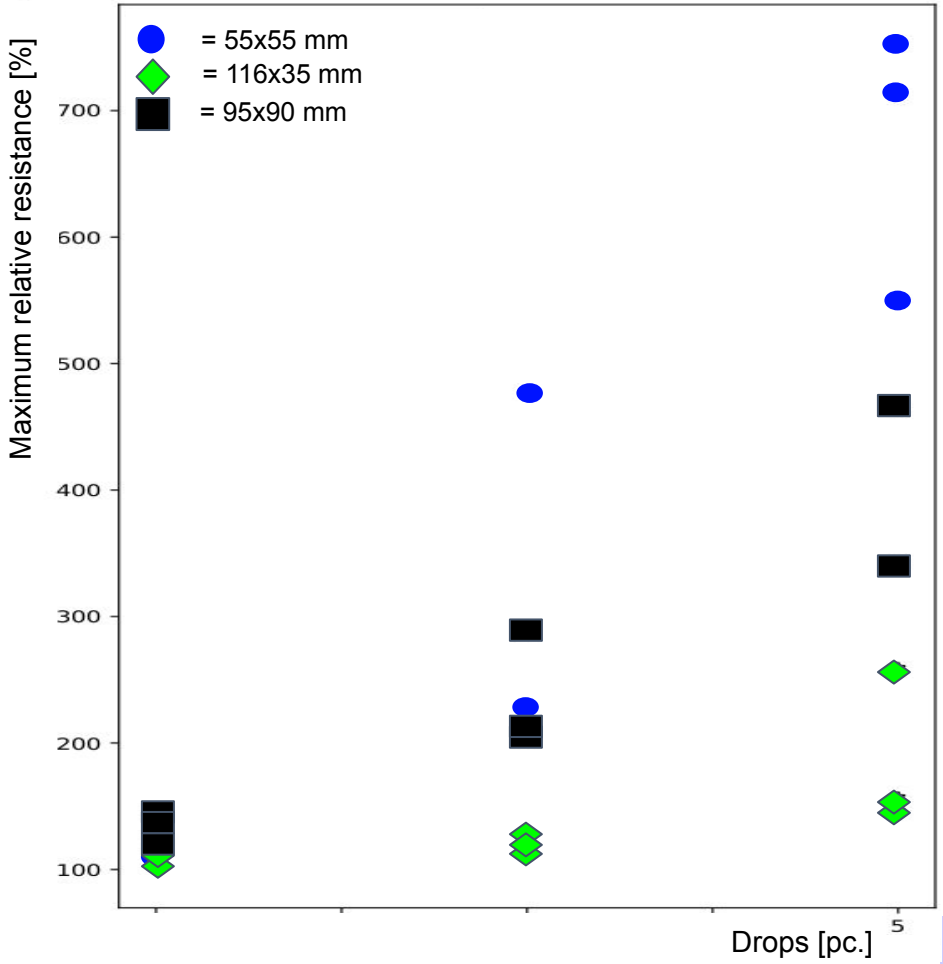




Analysis 2/2

- Linear relations
  - Time until max. resistance - drops
  - Max. relative resistance change - time

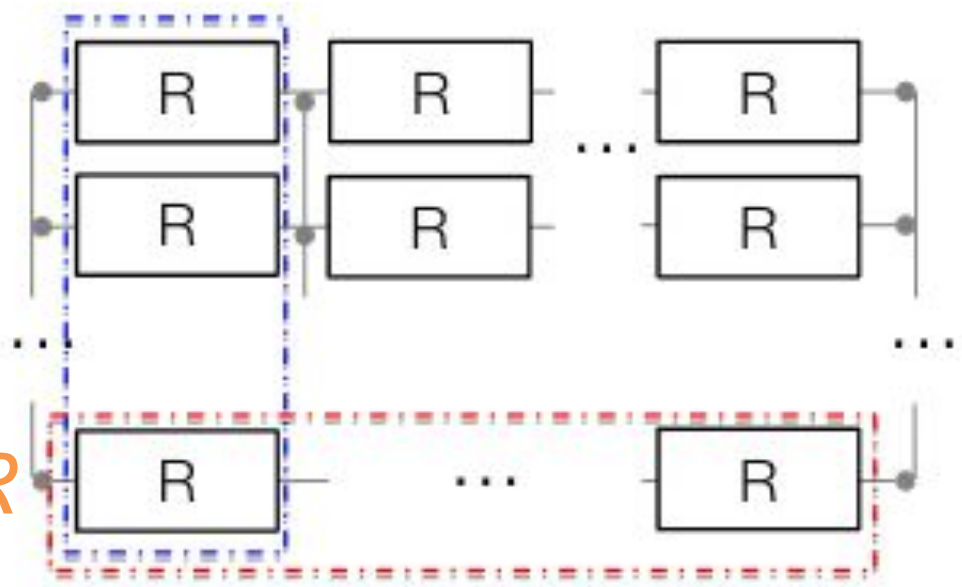




Conclusion and outlook

- Smart paper would be a reasonable addition to the sensing wires and could give valuable information on the size and severity of any possible leaks.
- Progress during project has been noticeable and the results are promising.
- Next step:
  - Modeling of the data using wet samples

$$1/R_{parallel} = \Sigma(1/R)$$



$$R_{series} = \Sigma R$$

Thank you for listening!