ADAPTIVE APPROACH TO SPATIAL INTERPOLATION AND VISUALISATION OF SCATTERED MONITORING DATA AT CERN

ICALEPCS
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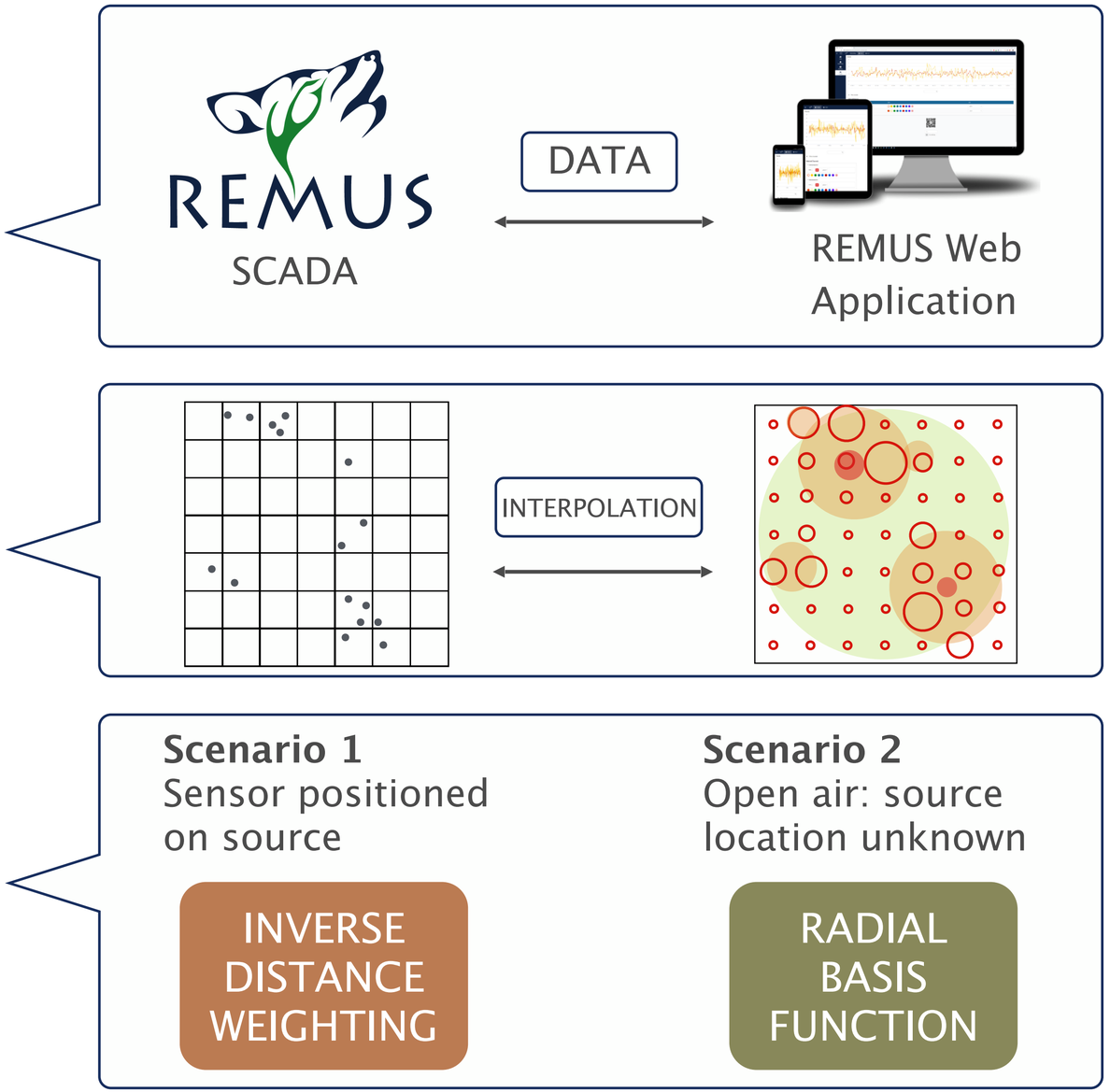
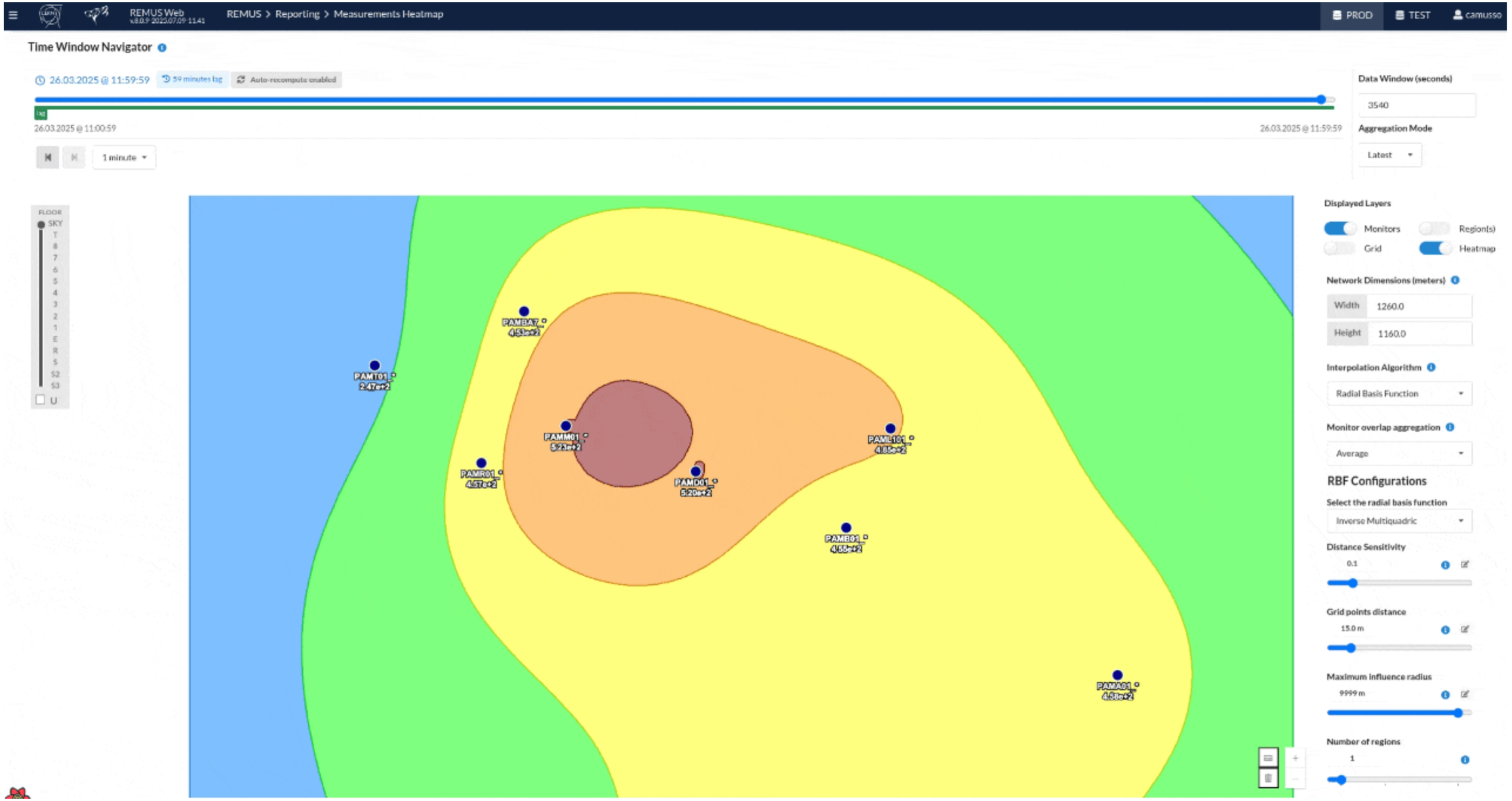
CONTEXT AND GOAL

- CERN’s HSE Unit operates **REMUS** (SCADA covering CERN's environmental monitoring and radiation protection)

- The **goal** is to implement **continuous field maps** to monitor radiation distribution across large regions.

- This project develops a **system to estimate radiation fields from individual measurement points**
  —> offering two interpolation algorithms according to the monitoring scenario




REMUS Web
REMUS > Reporting > Measurements Heatmap
PROD
TEST
camusso
Time Window Navigator
26.03.2025 @ 11:59:59
59 minutes lag
Auto-recompute enabled
Data Window (seconds)
3540
26.03.2025 @ 11:00:59
26.03.2025 @ 11:59:59
Aggregation Mode
Latest
1 minute
FLOOR
SKY
Displayed Layers
Monitors
Region(s)
Grid
Heatmap
Network Dimensions (meters)
Width
1260.0
Height
1160.0
Interpolation Algorithm
Radial Basis Function
Monitor overlap aggregation
Average
RBF Configurations
Select the radial basis function
Inverse Multiquadric
Distance Sensitivity
0.1
Grid points distance
15.0 m
Maximum influence radius
9999 m
Number of regions
1
PAMT01_1
2.47e+2
PAMBA7_1
4.53e+2
PAMM01_1
5.23e+2
PAMR01_1
4.57e+2
PAMD01_1
5.20e+2
PAML101_1
4.85e+2
PAMB01_1
4.55e+2
PAMA01_1
4.58e+2

ACHIEVEMENTS

- Implemented continuous map visualisations from sensor data, with extensive configurations
- Integrated two interpolation methodologies from established academic research to address main monitoring scenarios
- Designed a solution to stabilise RBF computations when unstable weights are generated from matrix inversion
- The system can generalise and be applied to different types of sensors and measurements

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LESSONS LEARNED

- Low sensor coverage is an inherent challenge for environmental monitoring interpolation
- Real-world data reveals gaps between theory and practice

"In theory, there is no difference between theory and practice, but in practice there is"