

TECNOLOGIA DTS per individuazione immissioni improprie in fognatura

Progetto pilota Cernusco sul Naviglio, Via Masaccio



SERVIZIO IDRICO INTEGRATO





Introduction to DTS

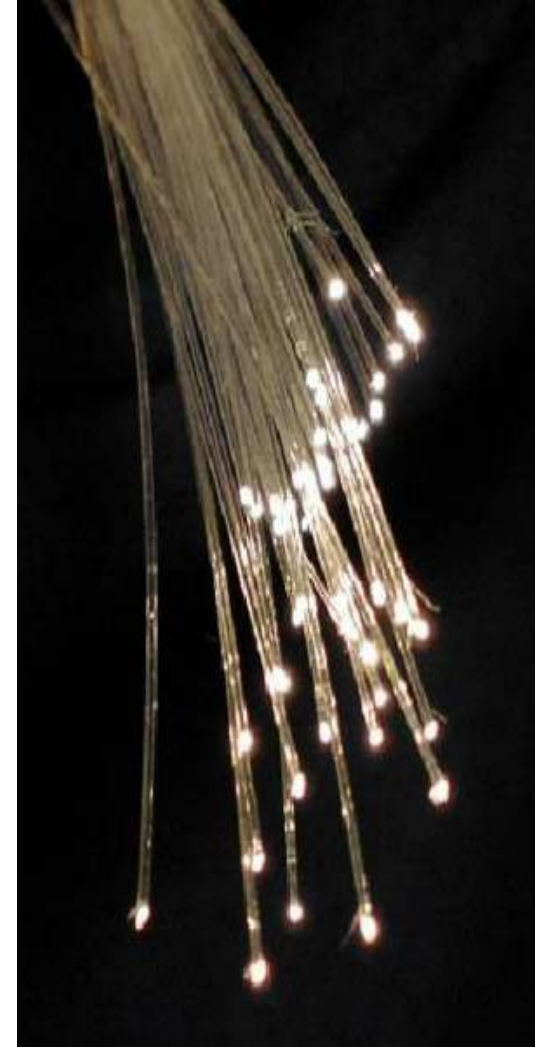
DTS = Distributed Temperature Sensing

Measuring **temperature** along a fibre-optic cable in a sewer pipe

Method to **localize** inflows into sewer pipes (“exactly where are the inflows to my system?”)

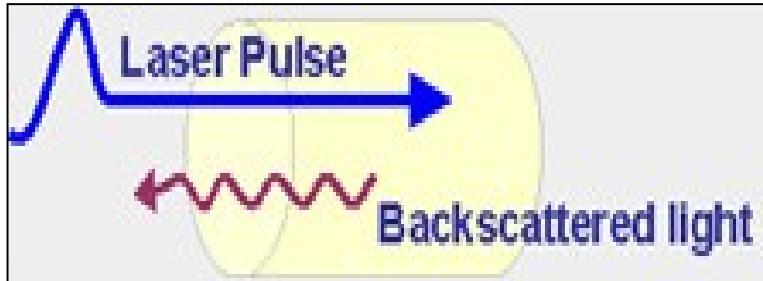
DTS technology exists since **1980's**
only since **2009**

but application in sewers

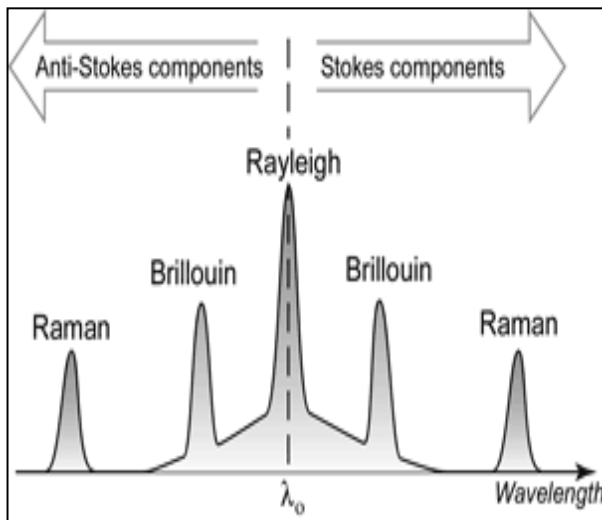


DTS monitoring principle

1.



2.



3.

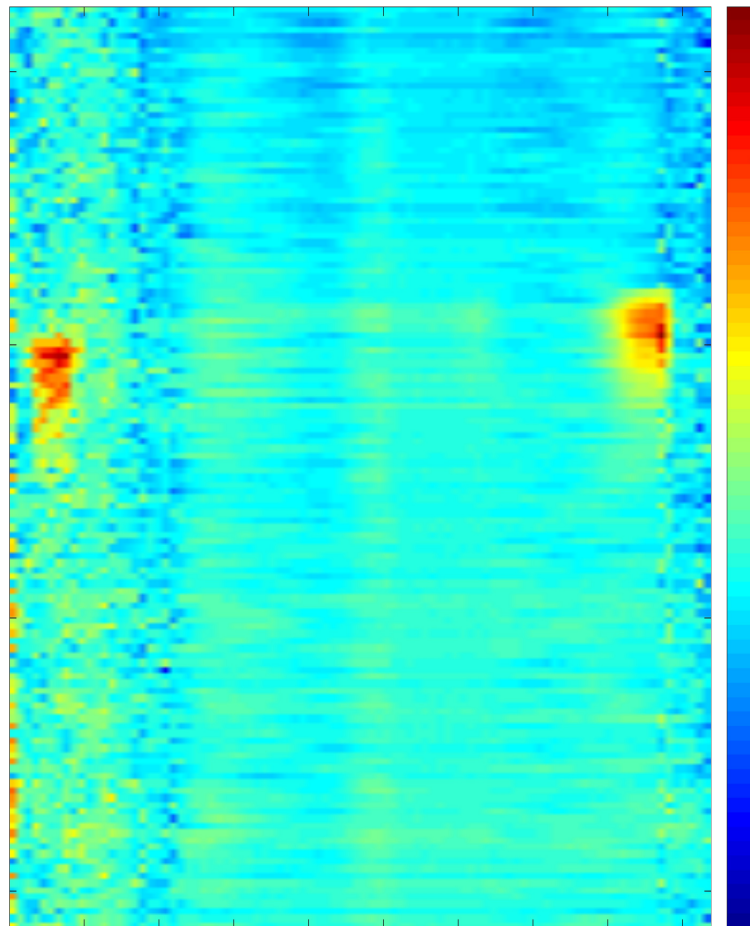
Average reflections over Δx (e.g. 1 meter) and Δt (e.g. 30 seconds)



office Cologno Monzese

30 minutes

computer



temperature:

blue $\approx 20^{\circ}\text{C}$

red $\approx 23^{\circ}\text{C}$

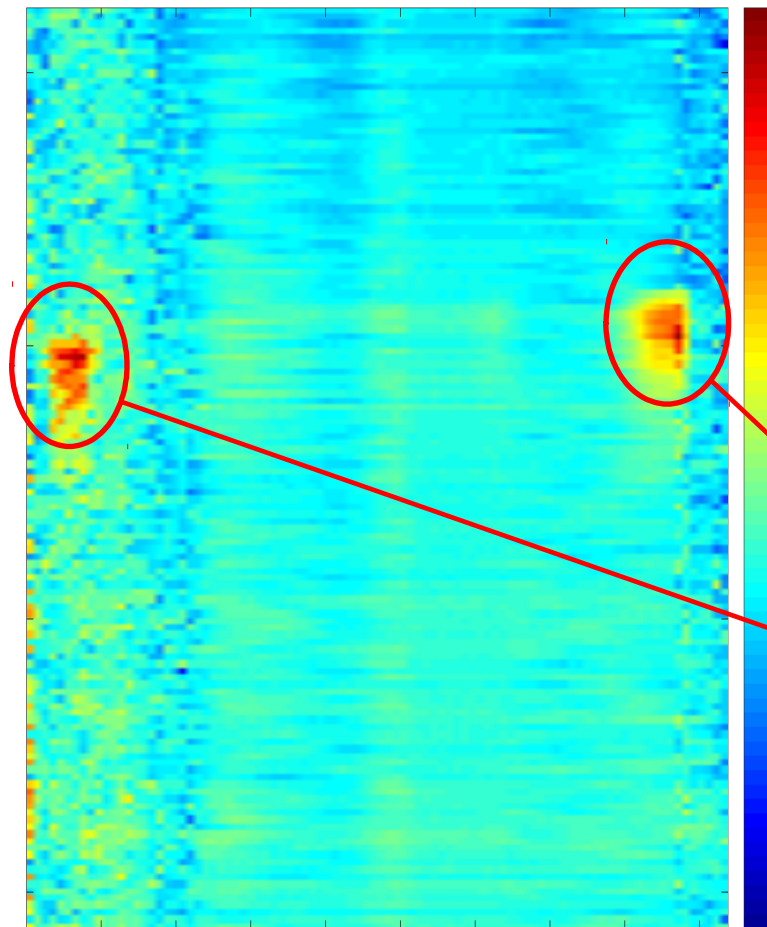
50 m of cable



30 minutes

computer

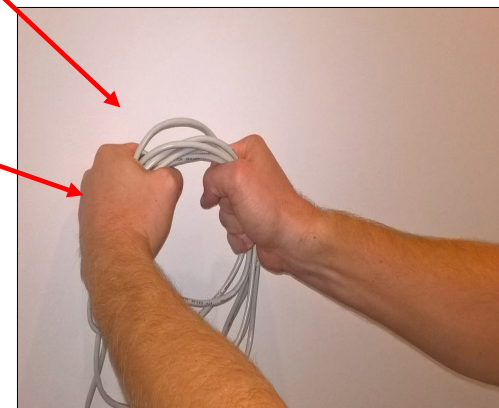
50 m of cable



temperature:

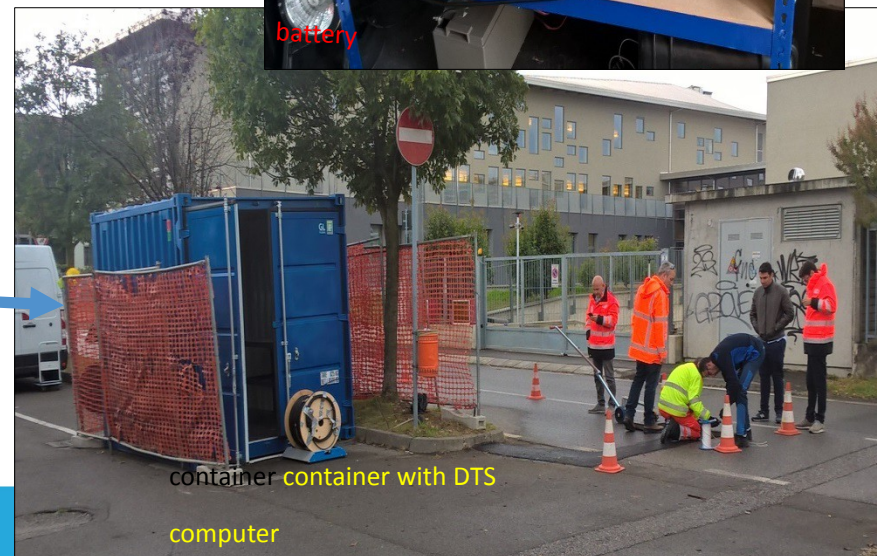
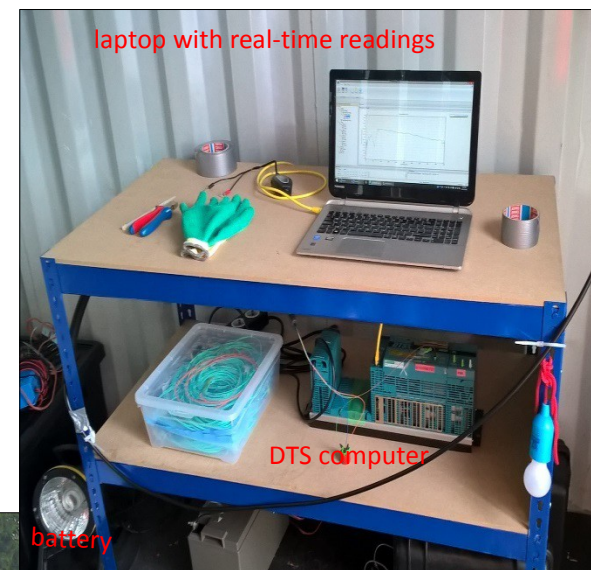
blue $\approx 20^{\circ}\text{C}$

red $\approx 23^{\circ}\text{C}$





Cernusco sul Naviglio, Via Masaccio





Overview DTS results

500m @ 0,5 m =

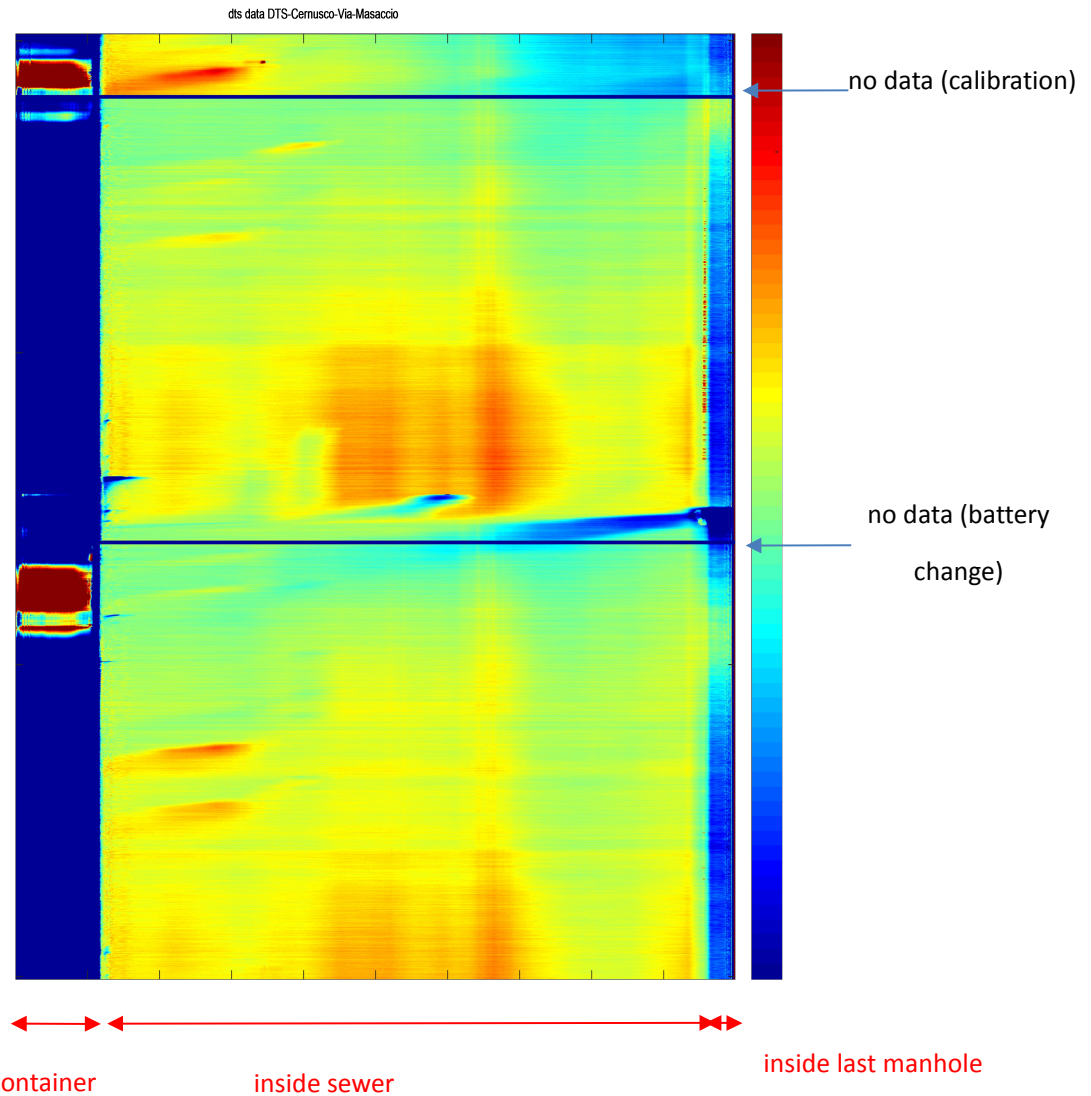
1.000 locations

42 hours @ 1 minute =

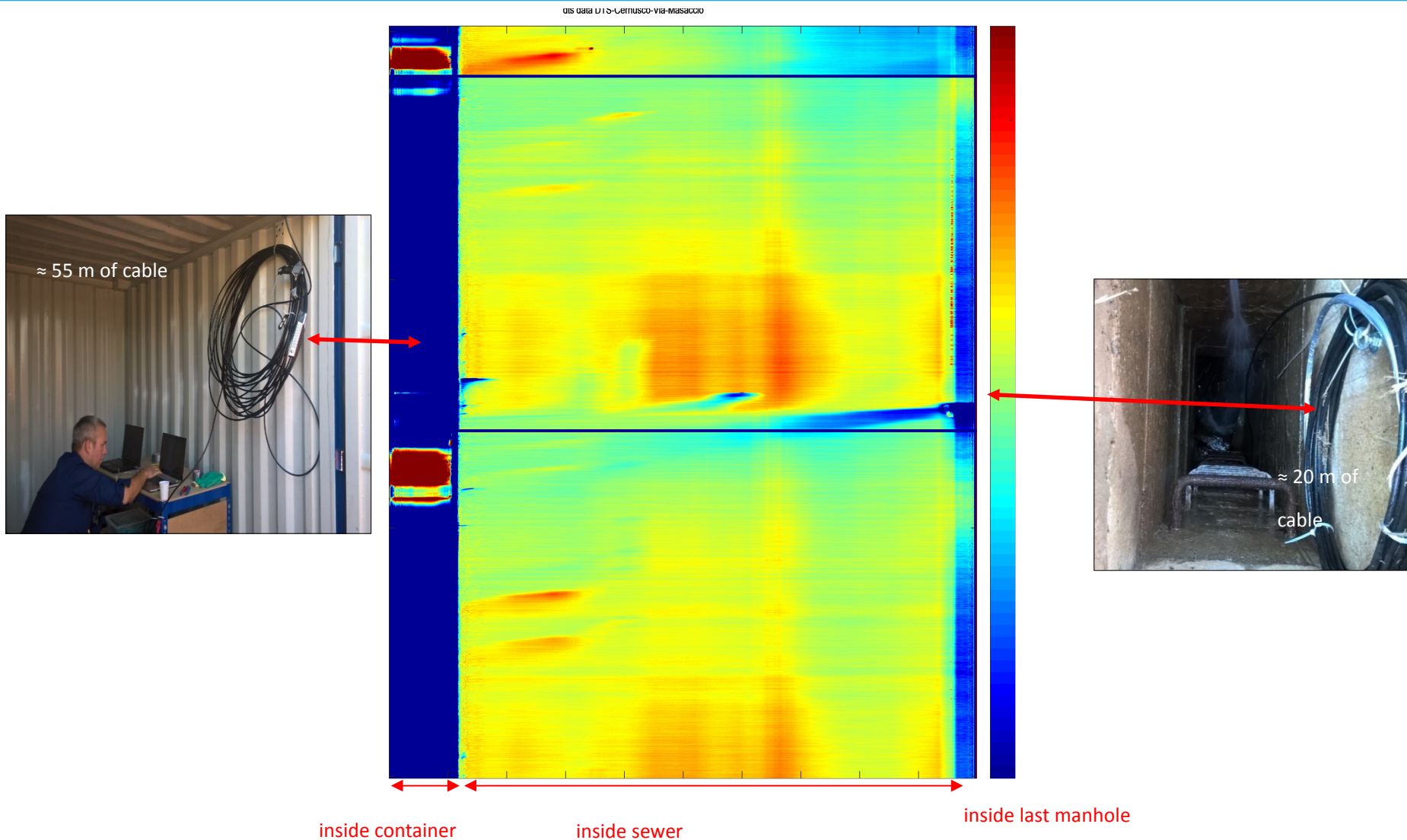
2.520 time-steps

in total

2.520.000 values/pixels



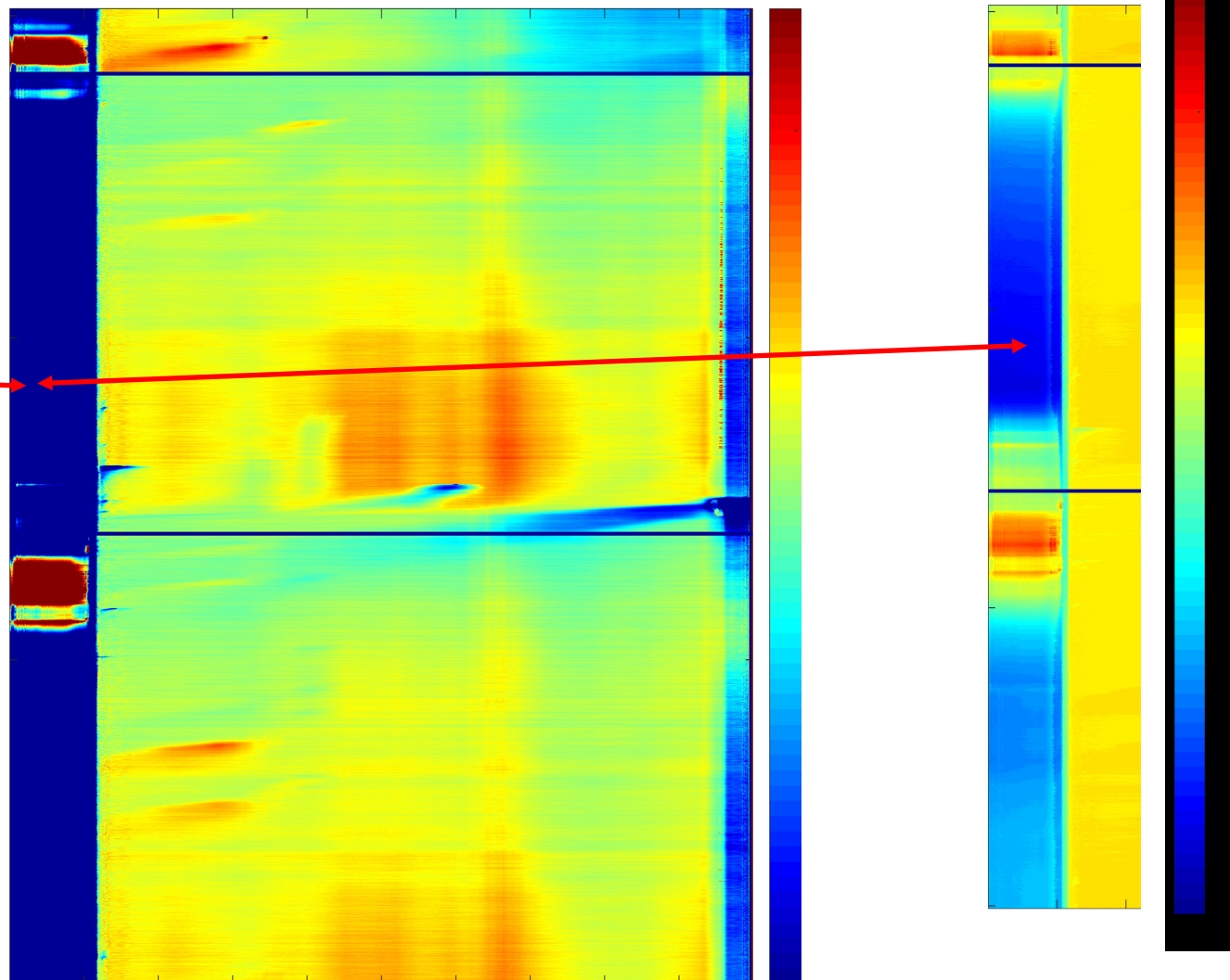
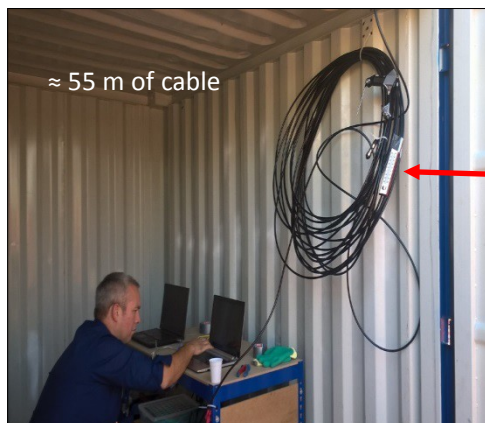
Overview DTS results





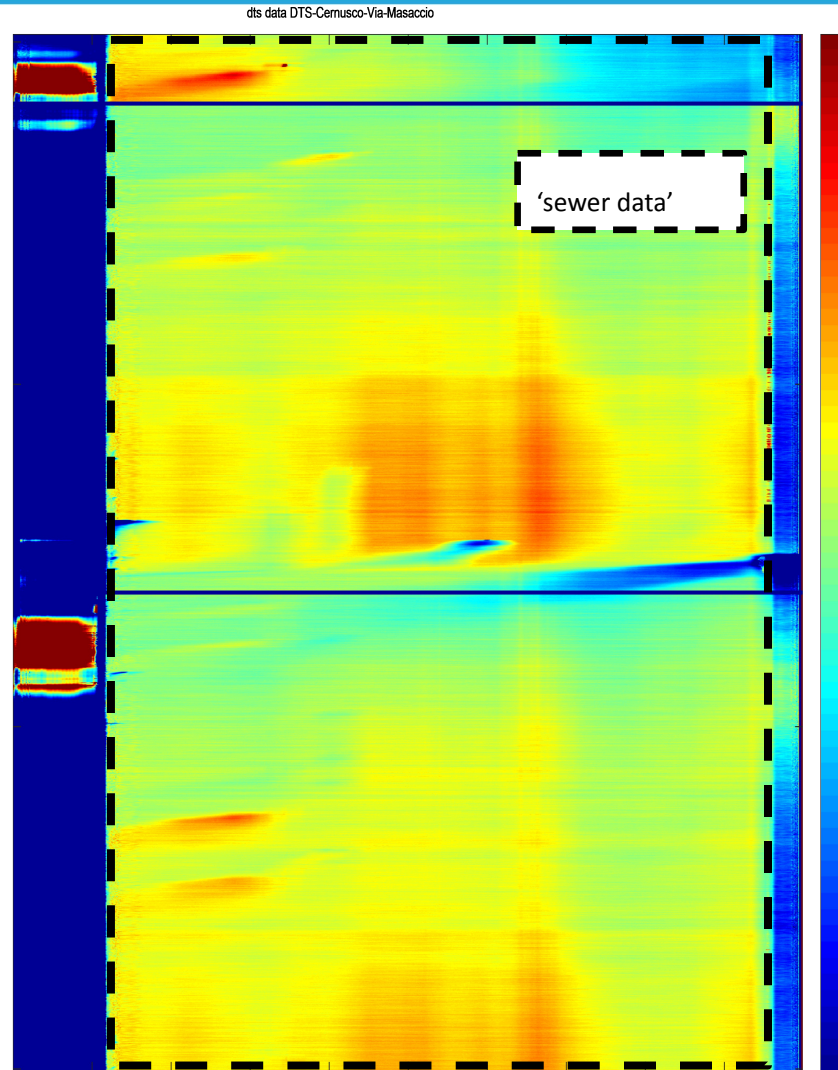
Overview DTS results

dts data DTS-Cernusco-Via-Masaccio



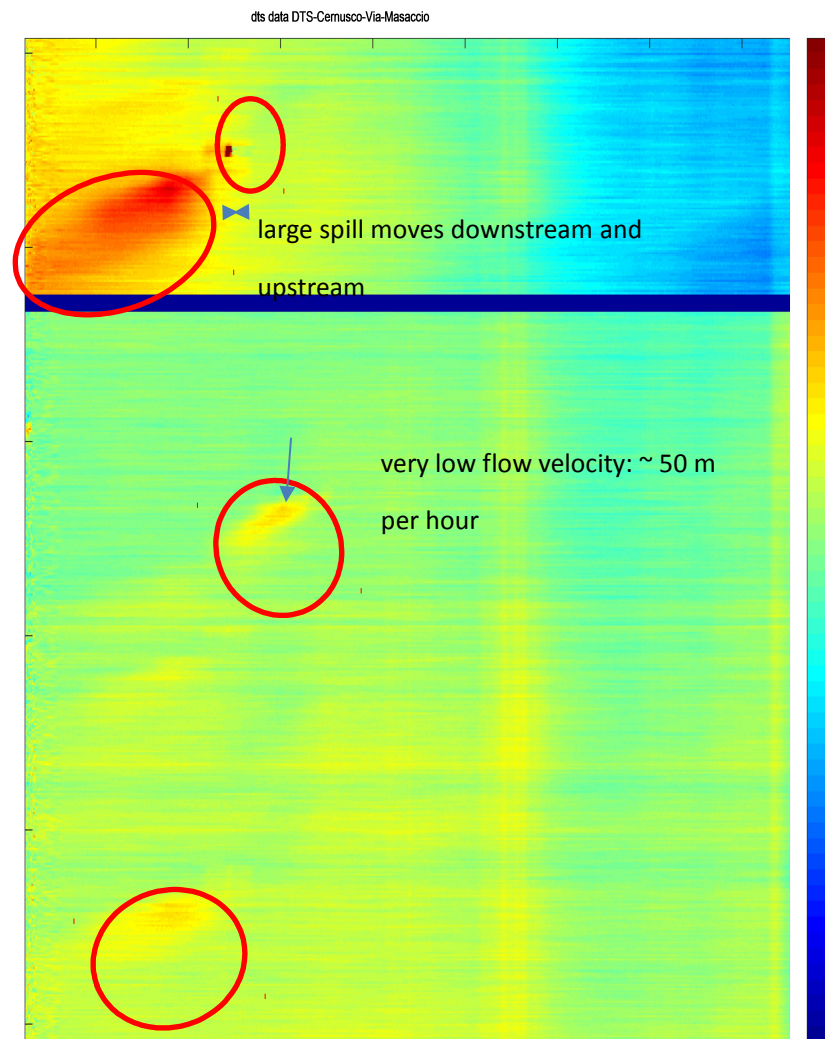


Overview DTS results

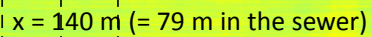




DTS results: normal spills

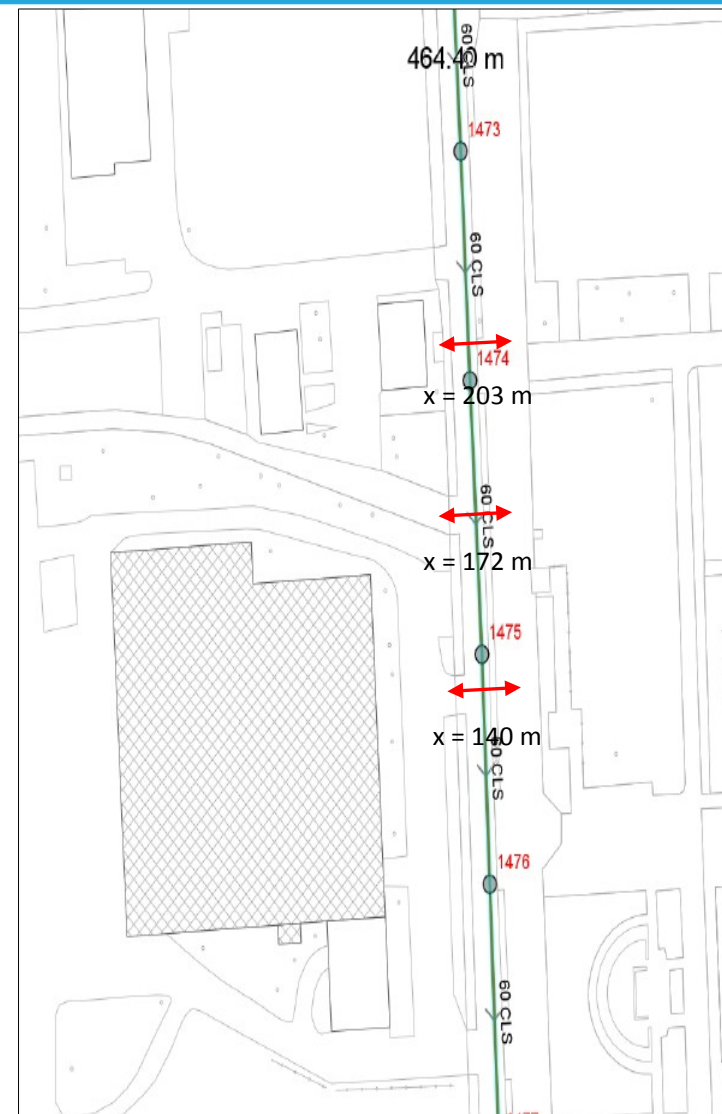
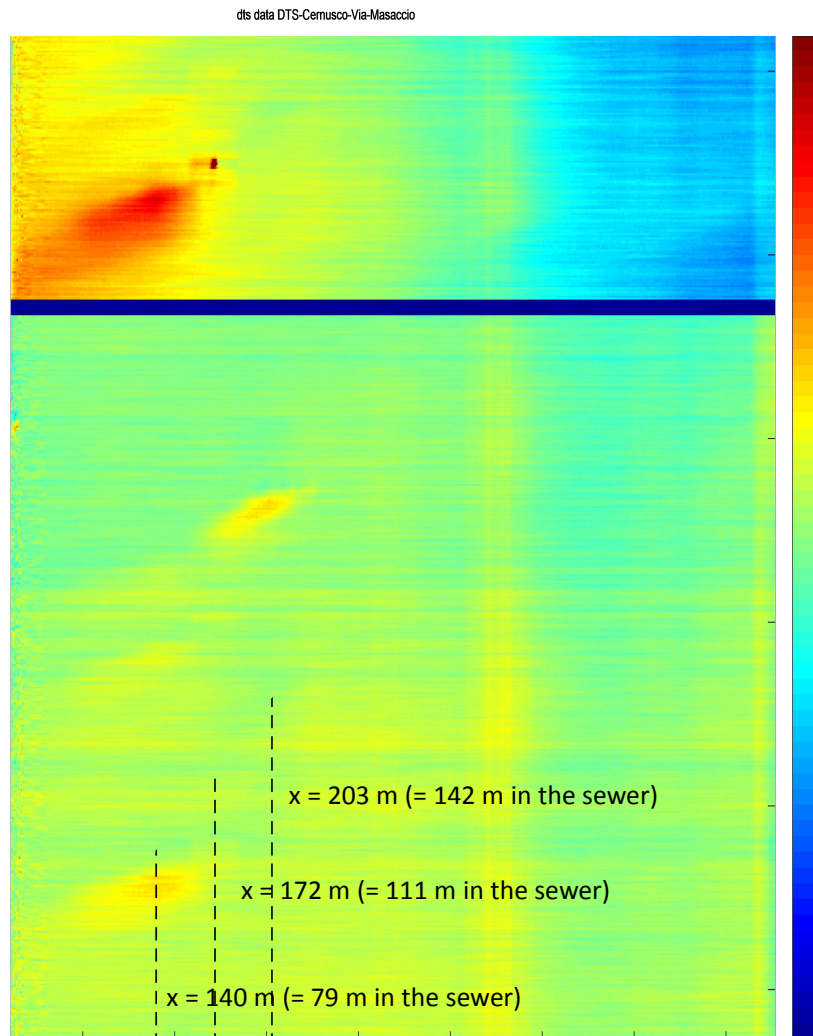


dts data DTS-Cernusco-Via-Masaccio





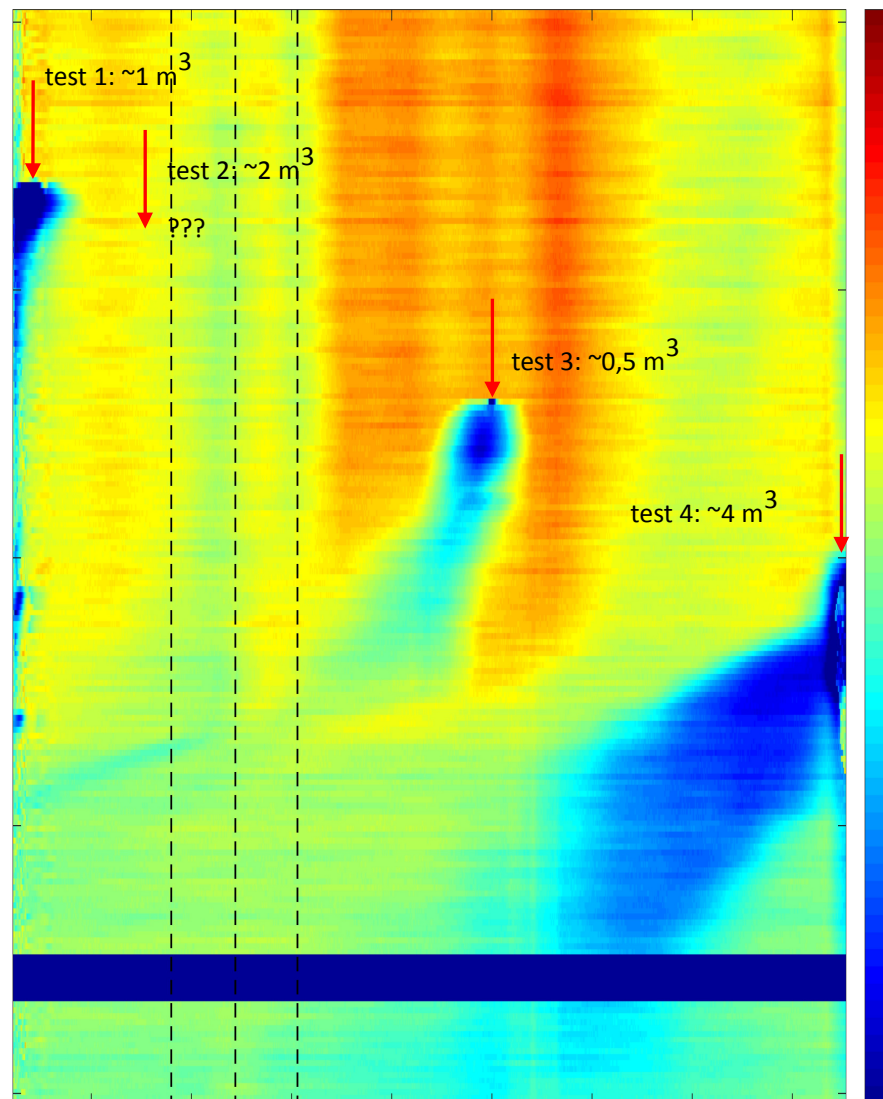
DTS results: normal spills



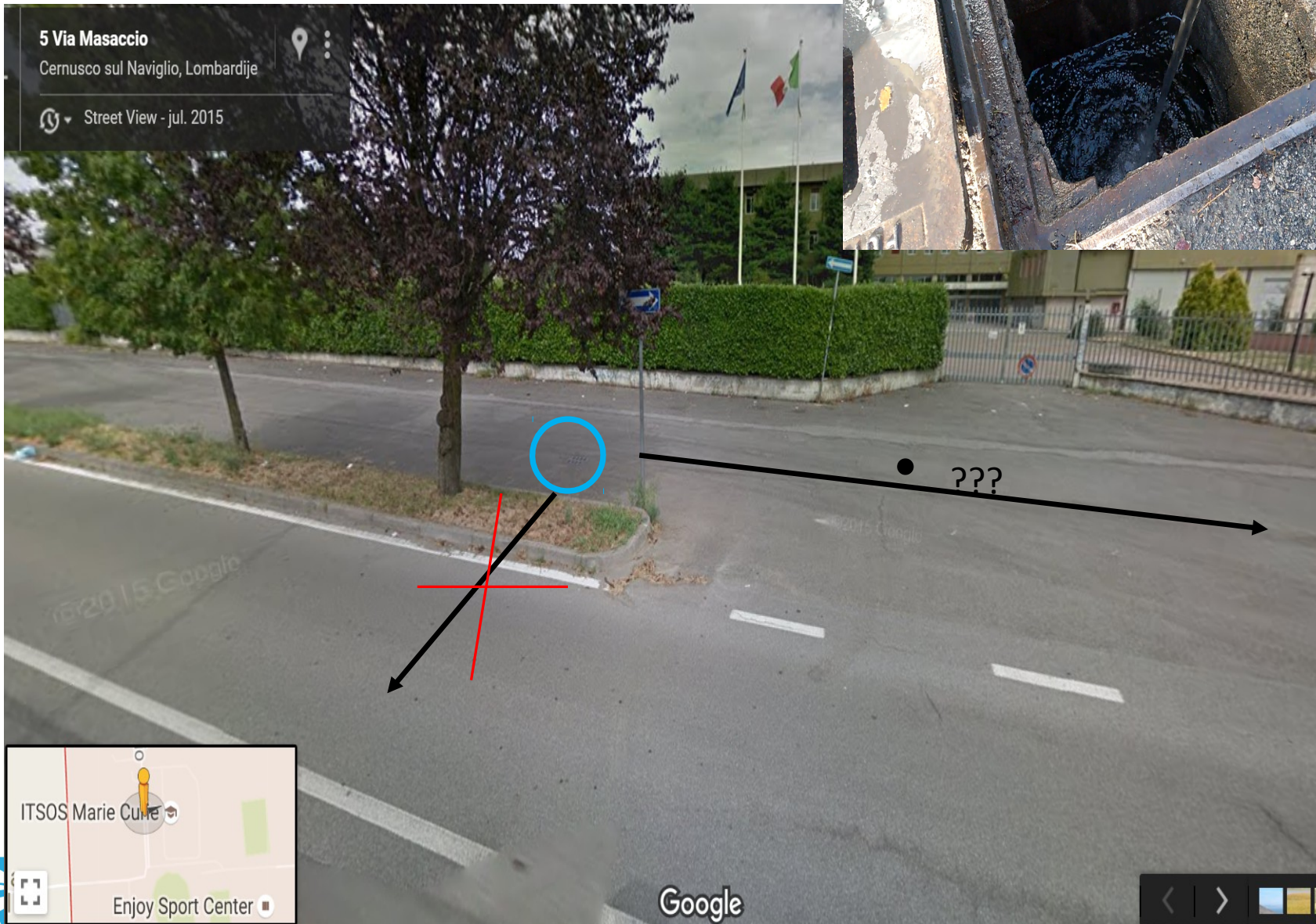


DTS results: artificial spills

dts data DTS-Cernusco-Via-Masaccio



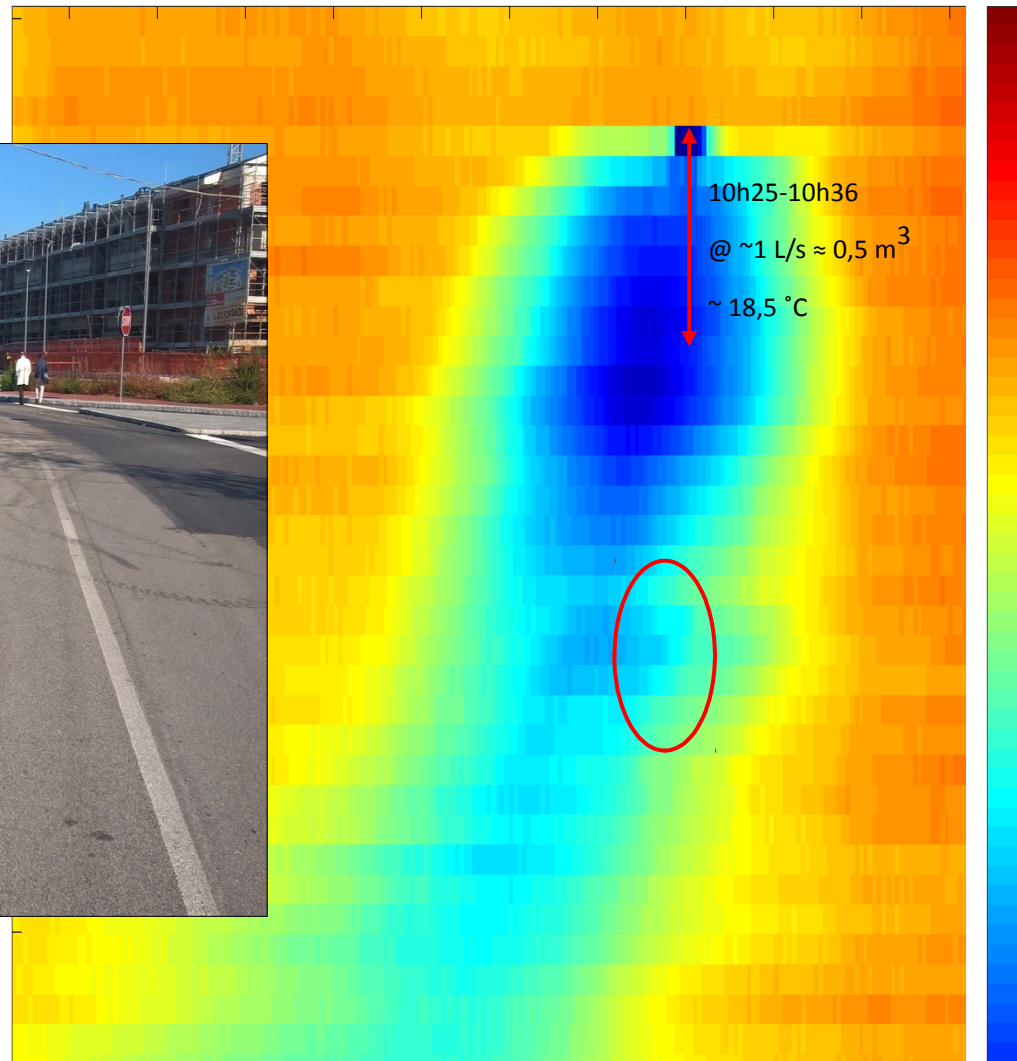
Test 2





Test 3

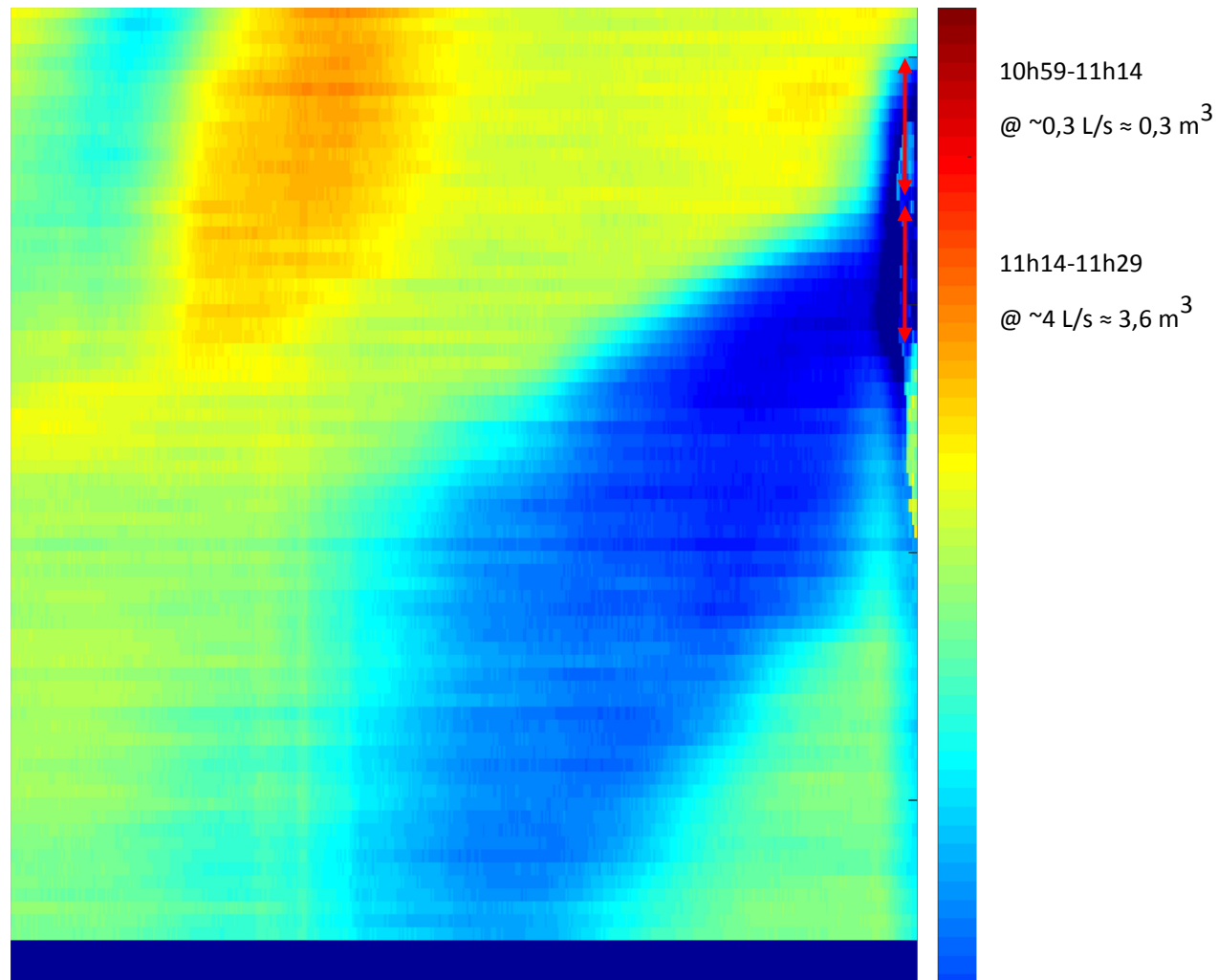
dts data DTS-Cernusco-Via-Masaccio





Test 4

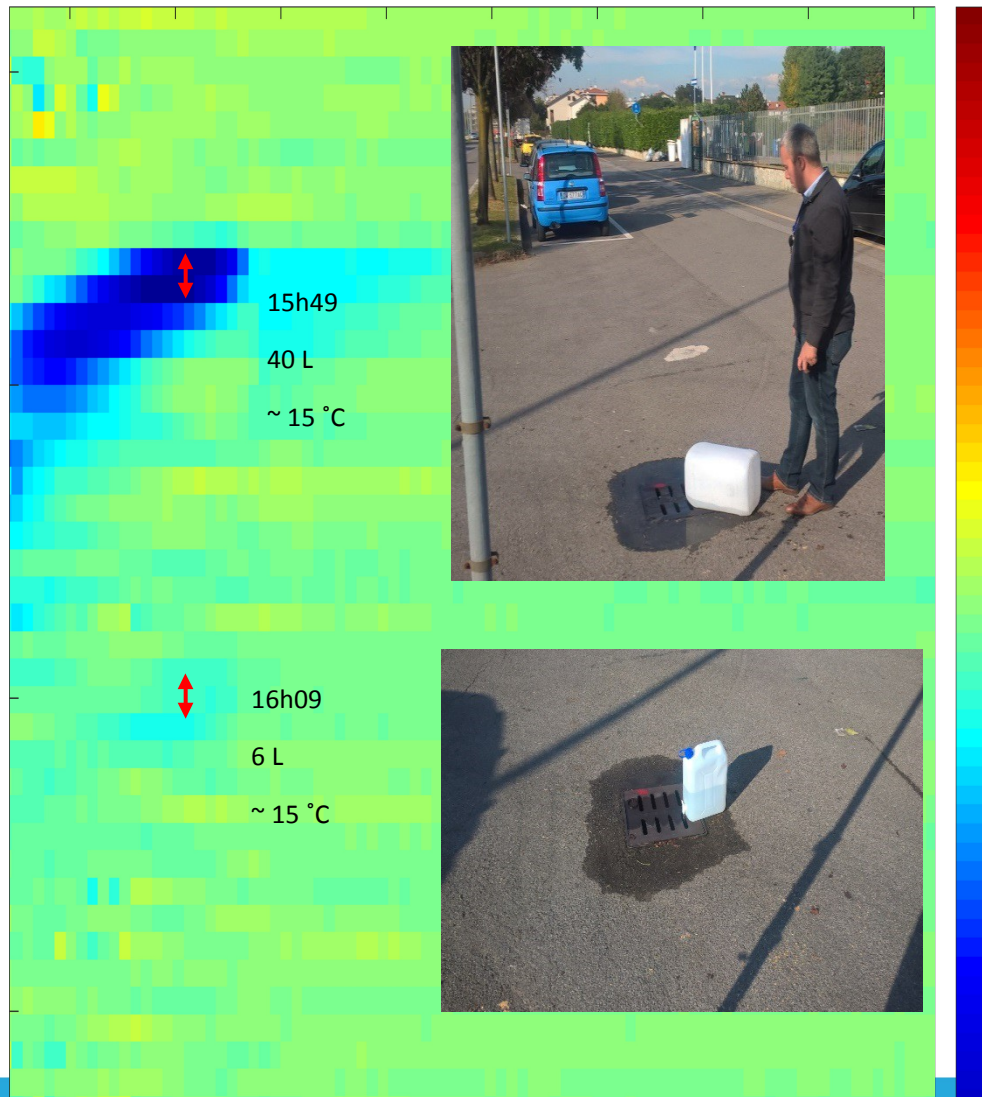
dts data DTS-Cernusco-Via-Masaccio





Test 5 & 6

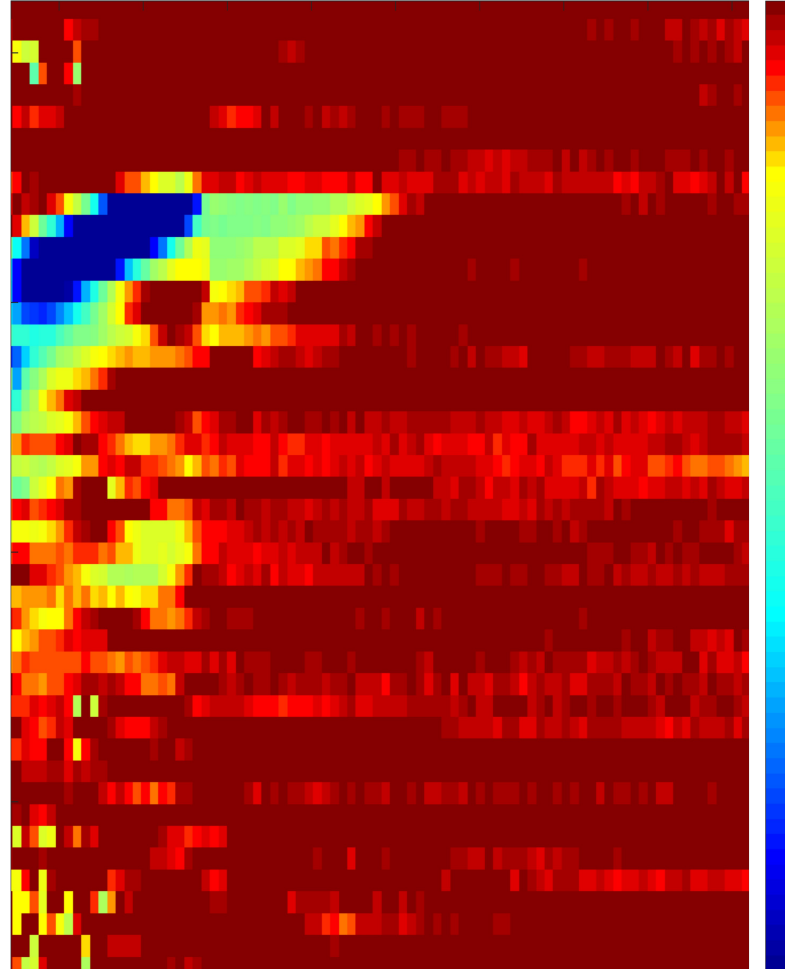
dts data DTS-Cernusco-Via-Masaccio





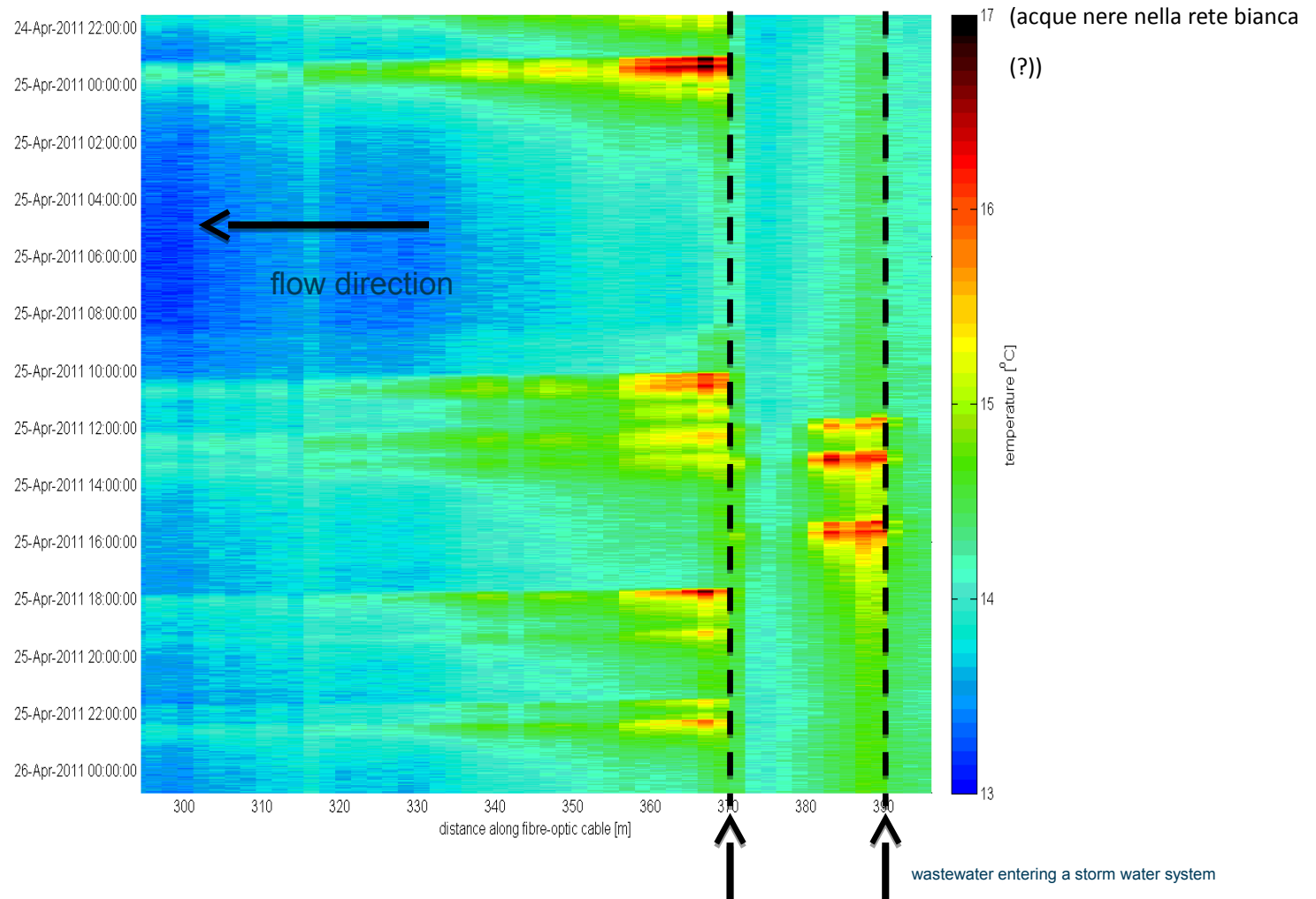
Test 5 & 6

dtb data DTS-Cernusco-Via-Masaccio



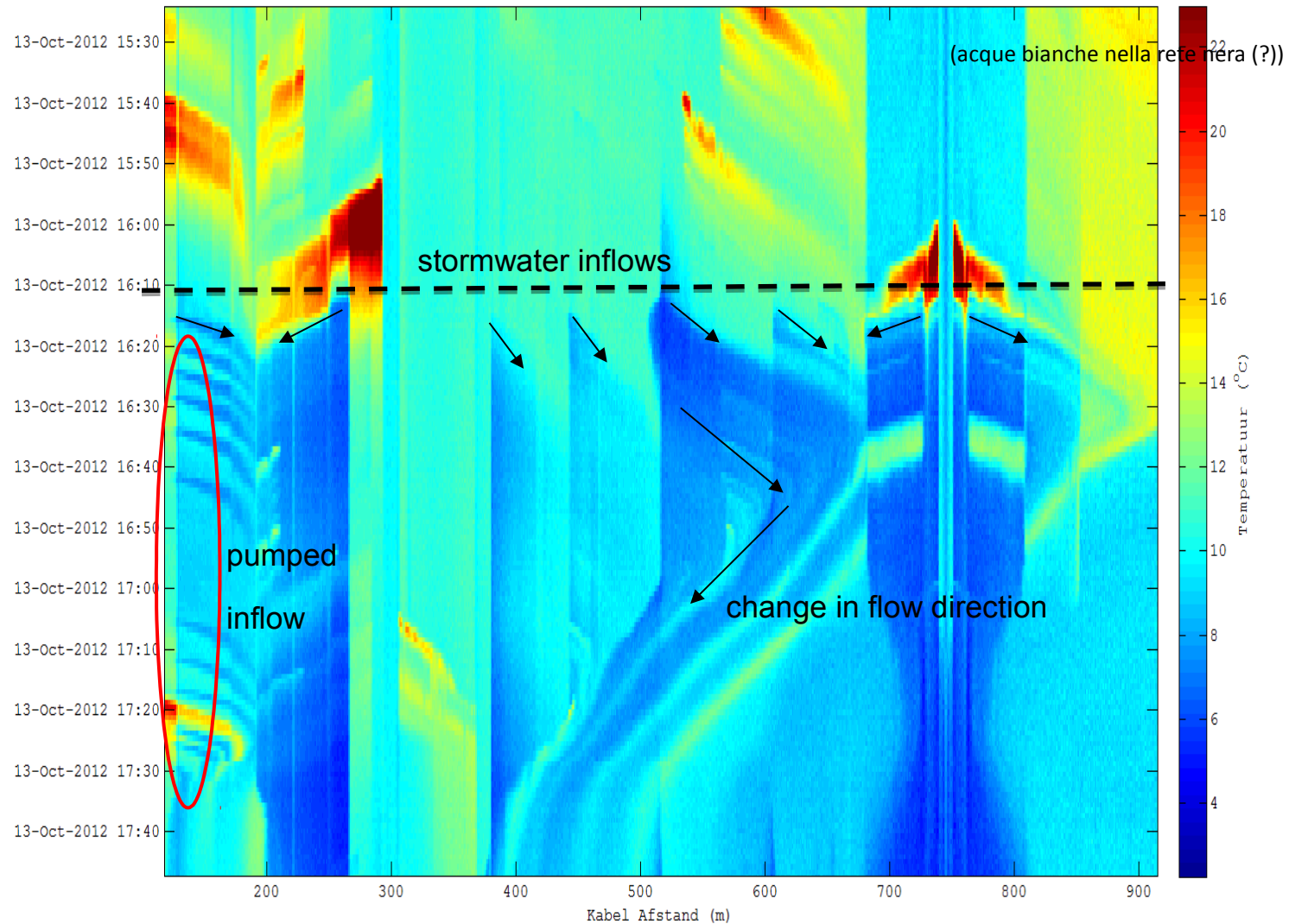


Wastewater in a storm water sewer

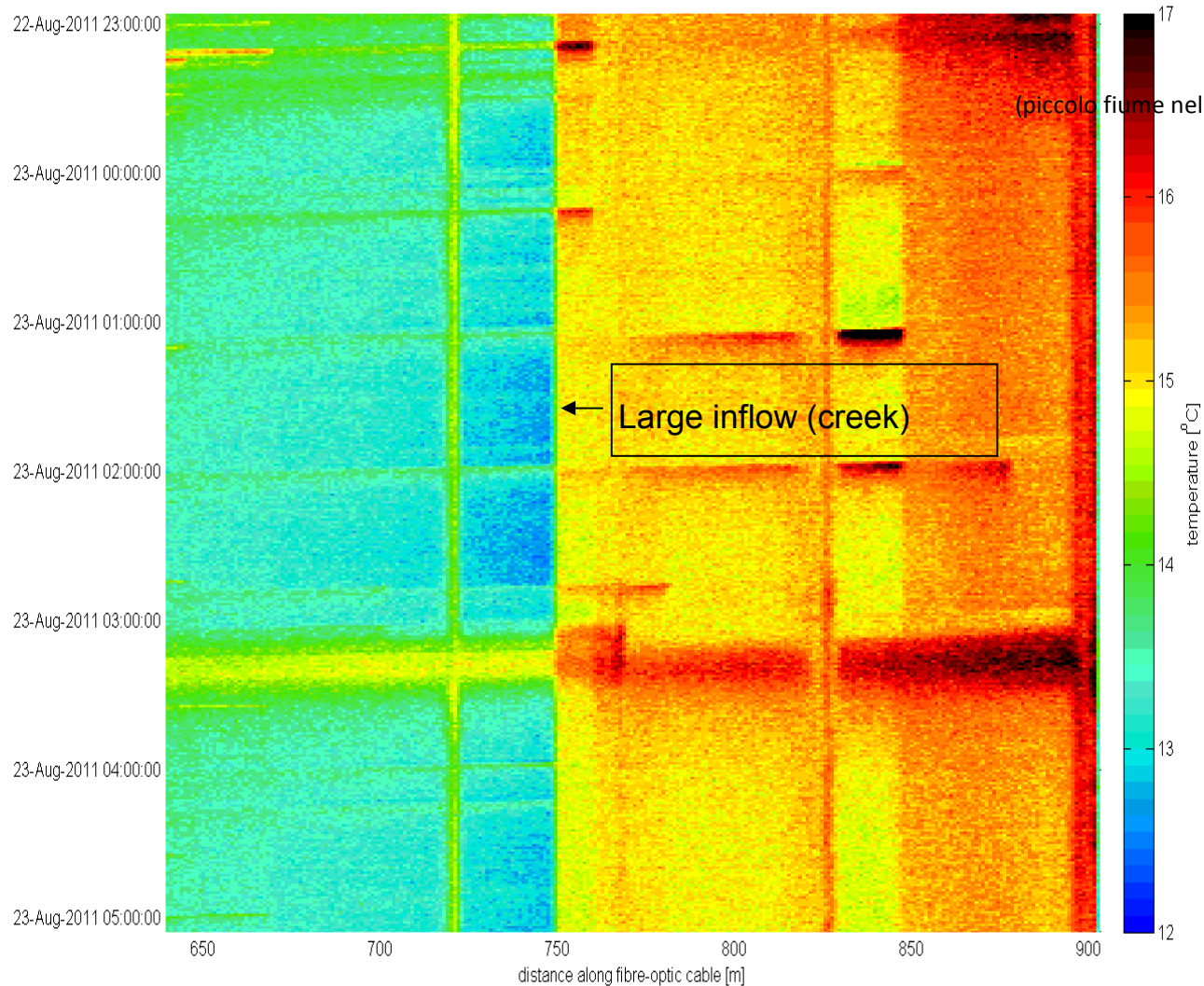




Storm water in a foul water sewer

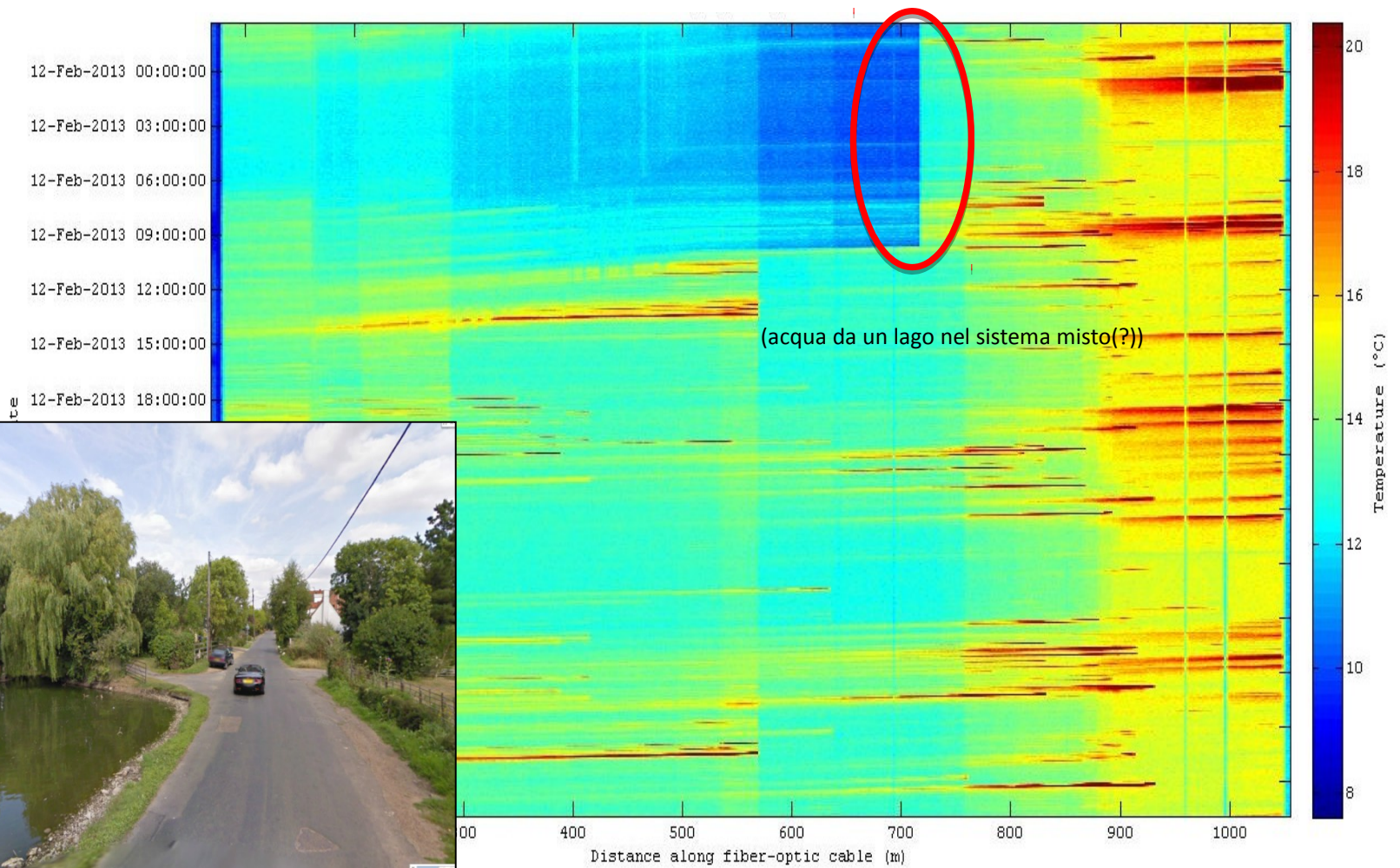


Small 'river' into combined sewer





Lake into combined sewer





DTS within a Framework for Infiltration and Inflow

- DTS = tool, not objective!

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