Ground Penetrating Radar (GPR) Detection of service pipes and the risk of collapsing sinkholes at the Lake of Constance in Switzerland

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Edi Meier

Edi Meier + Partner AG

Winterthur, Switzerland

www.georadar.ch

edi.meier@emp-winterthur.ch

Inma Gutiérrez

Edi Meier + Partner AG

Winterthur, Switzerland

inma.gutierrez@emp-winterthur.ch

Marco Baumann

Kanton Thurgau

Frauenfeld, Switzerland

marco.baumann@tg.ch

Max Bosshard

Wälli AG Ingenieure

Arbon, Switzerland

m.bosshard@waelli.ch

Rainer Heeb

Stadt Arbon

Arbon, Switzerland

rainer.heeb@arbon.ch

Arbon: summer days - winter days

Hidden large holes

Ice shield on the shore in February (left) and collapsed ground after melting of the ice in March 2018 (right)

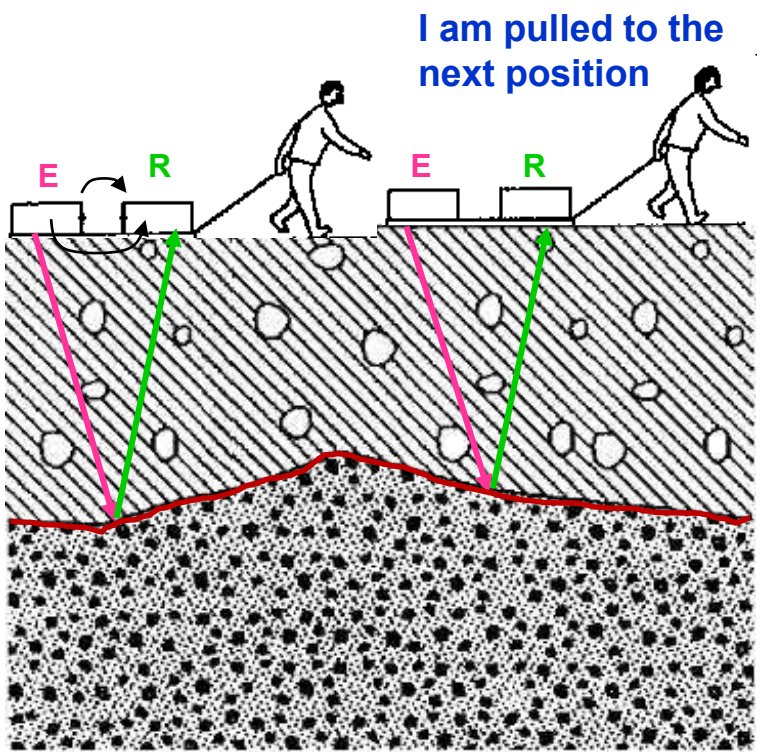
GPR investigation

- I am a GPR system with 250- / 700-MHz double antennas
- I can see up to 6 meters deep
- I don’t destroy
- My images show a high resolution
- I can measure very fast

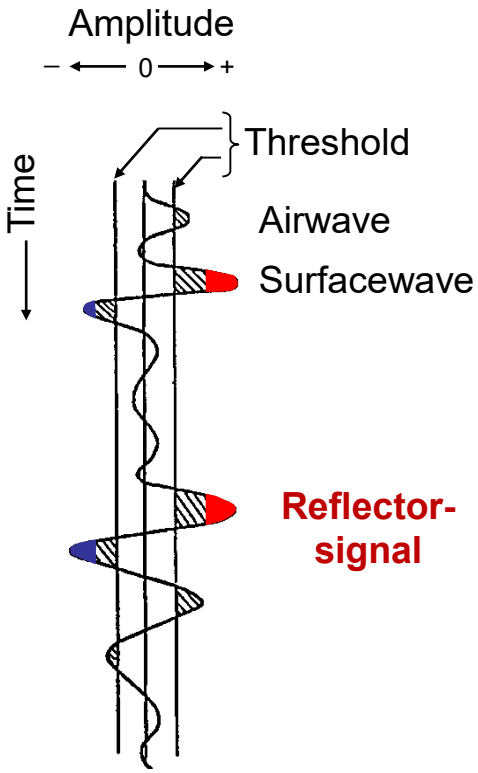
How I measure:

I emit a short electromagnetic pulse
I have an emitter- (E) and receiver (R)

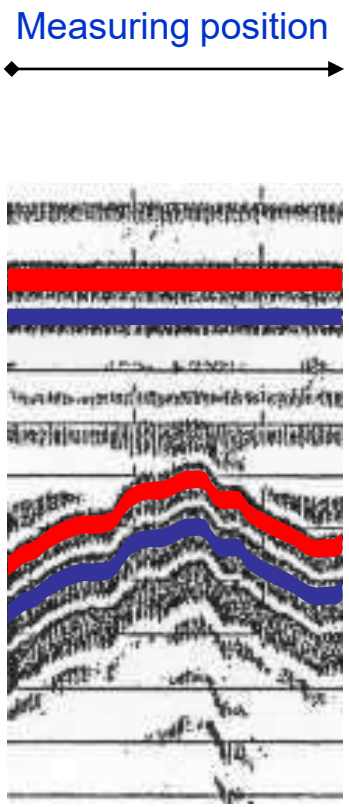
I see a change in electrical resistivity



That is my receiver signal



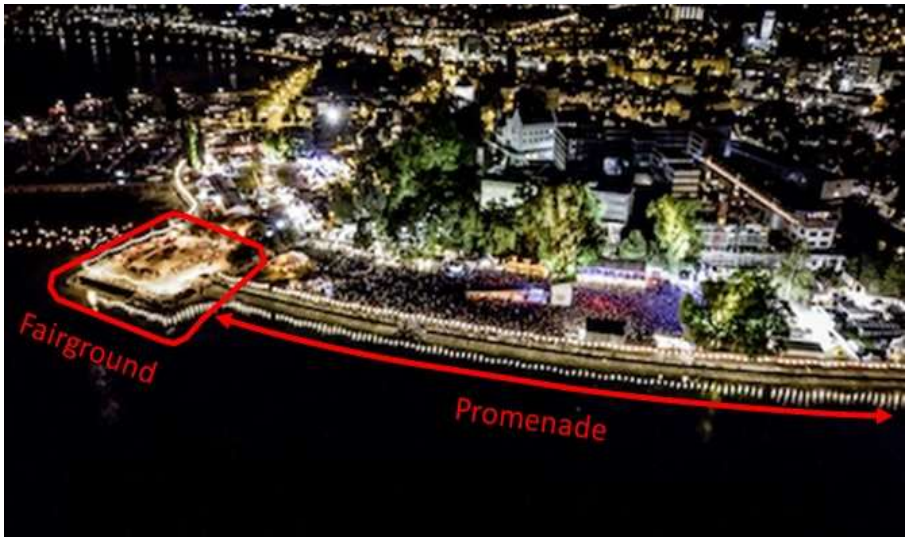
I add the receiver signals to form a profile



Do you like colors?

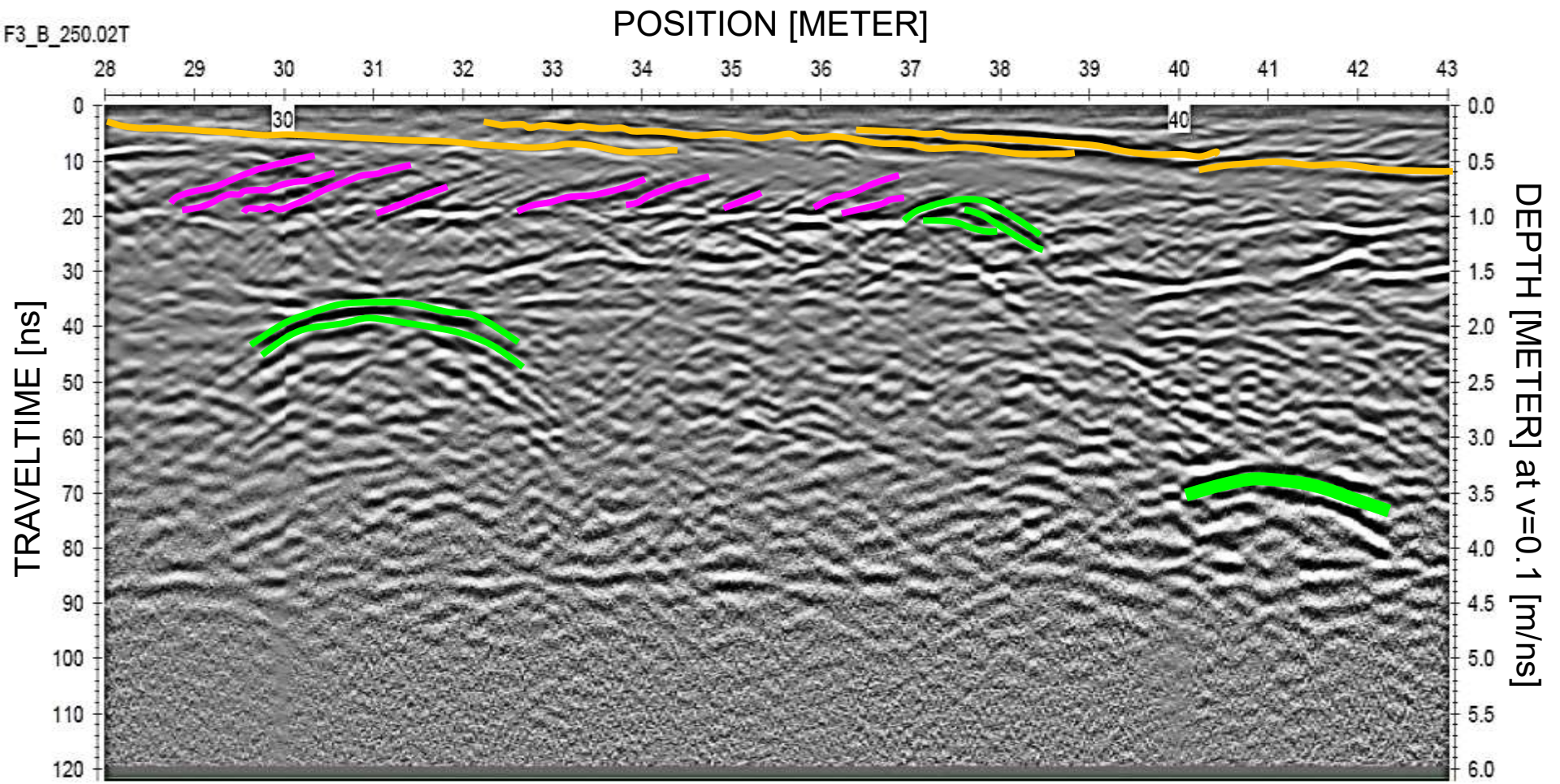
Process of the measures

- Fairground plaza: 55 parallel profiles
- Pedestrian walkway: 5 parallel profiles
- With the associated ramp

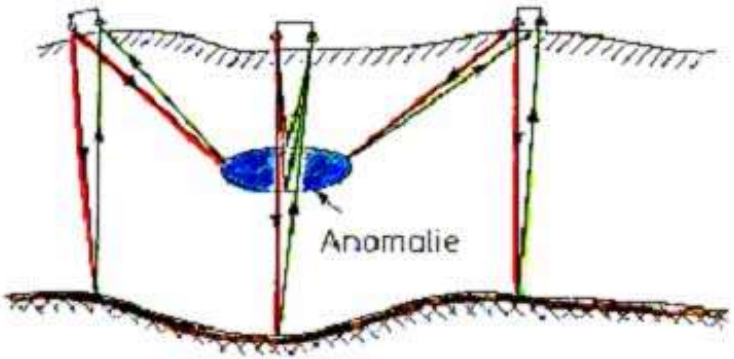


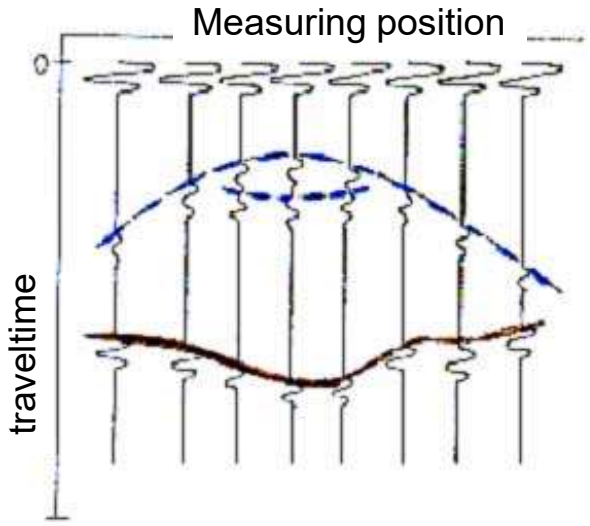
Radargram on the pedestrian walkway

250 MHz Antenna



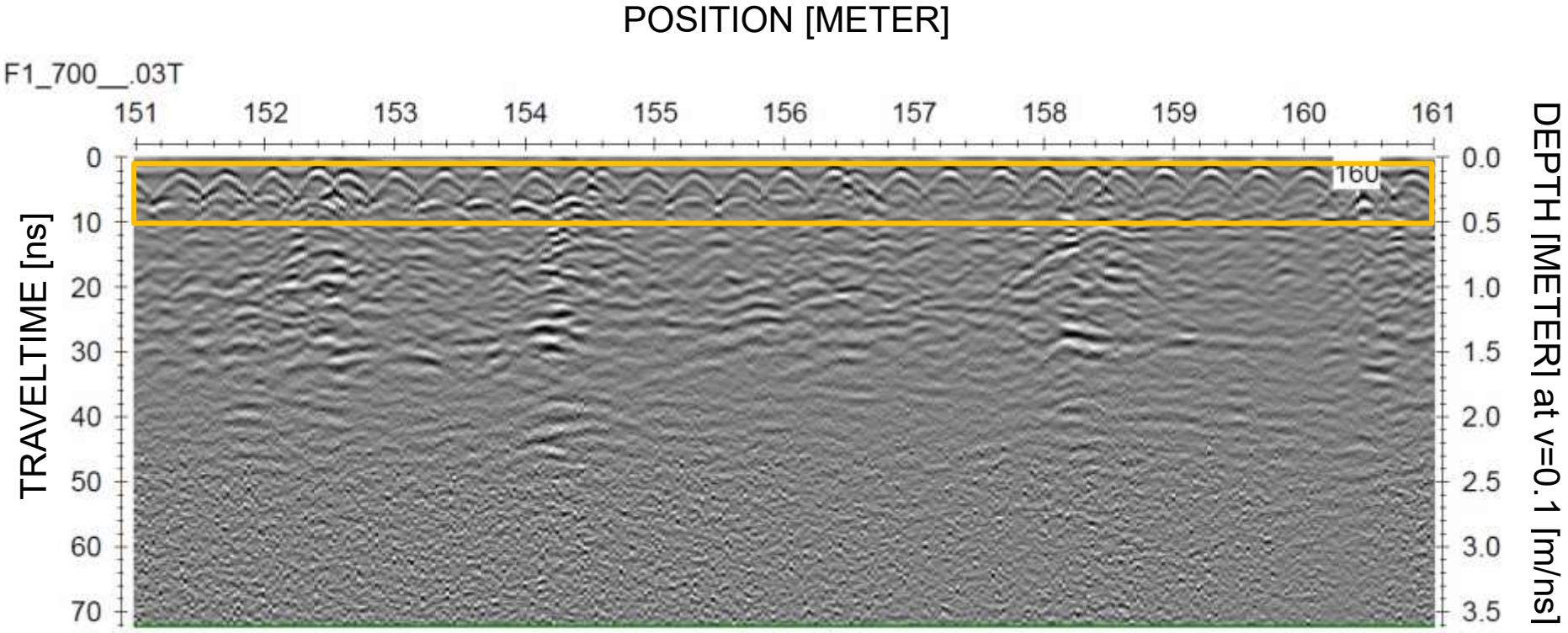
Why do we see hyperbolas ?





High resolution radargram on the quay wall

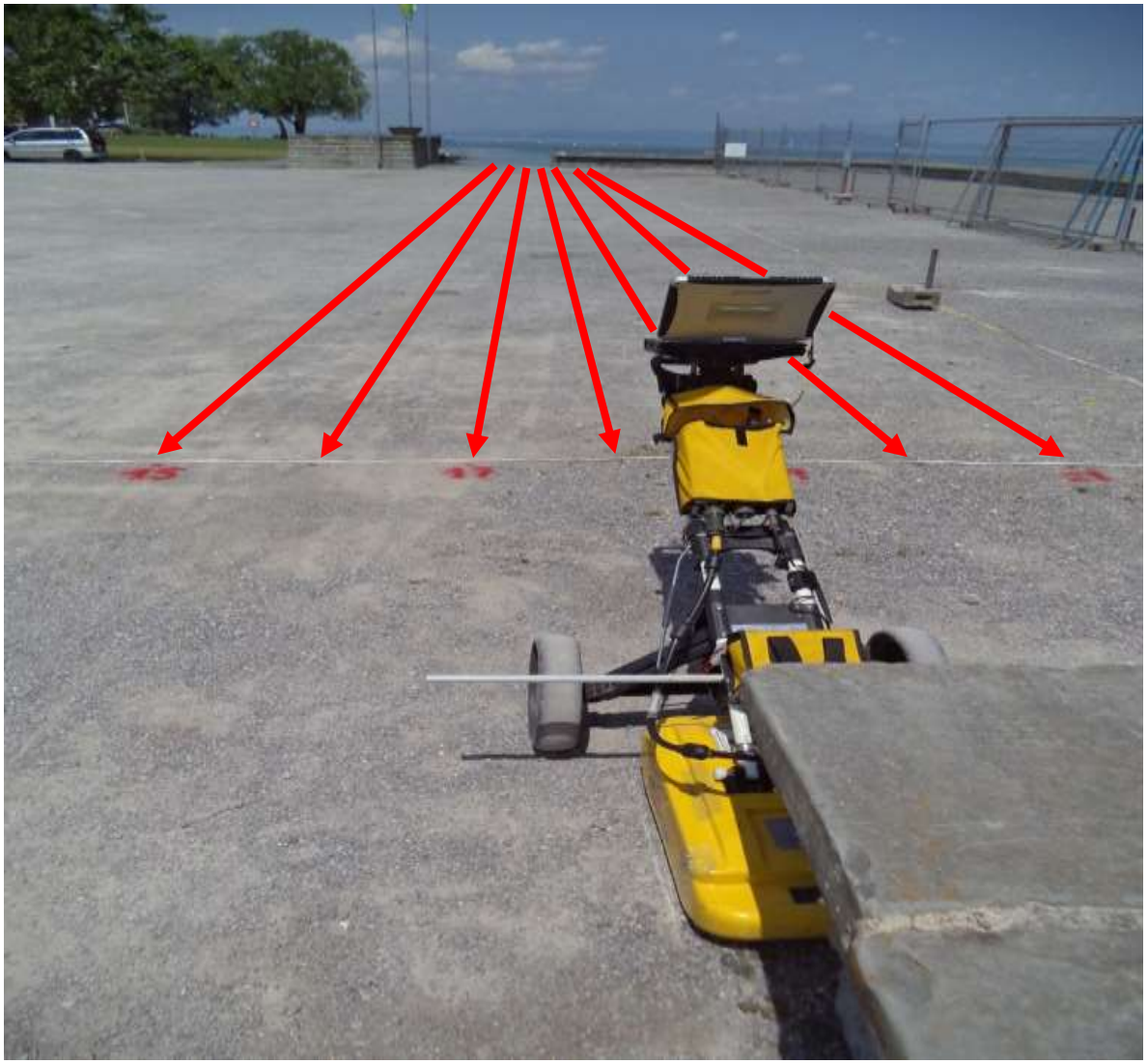
700 MHz Antenna



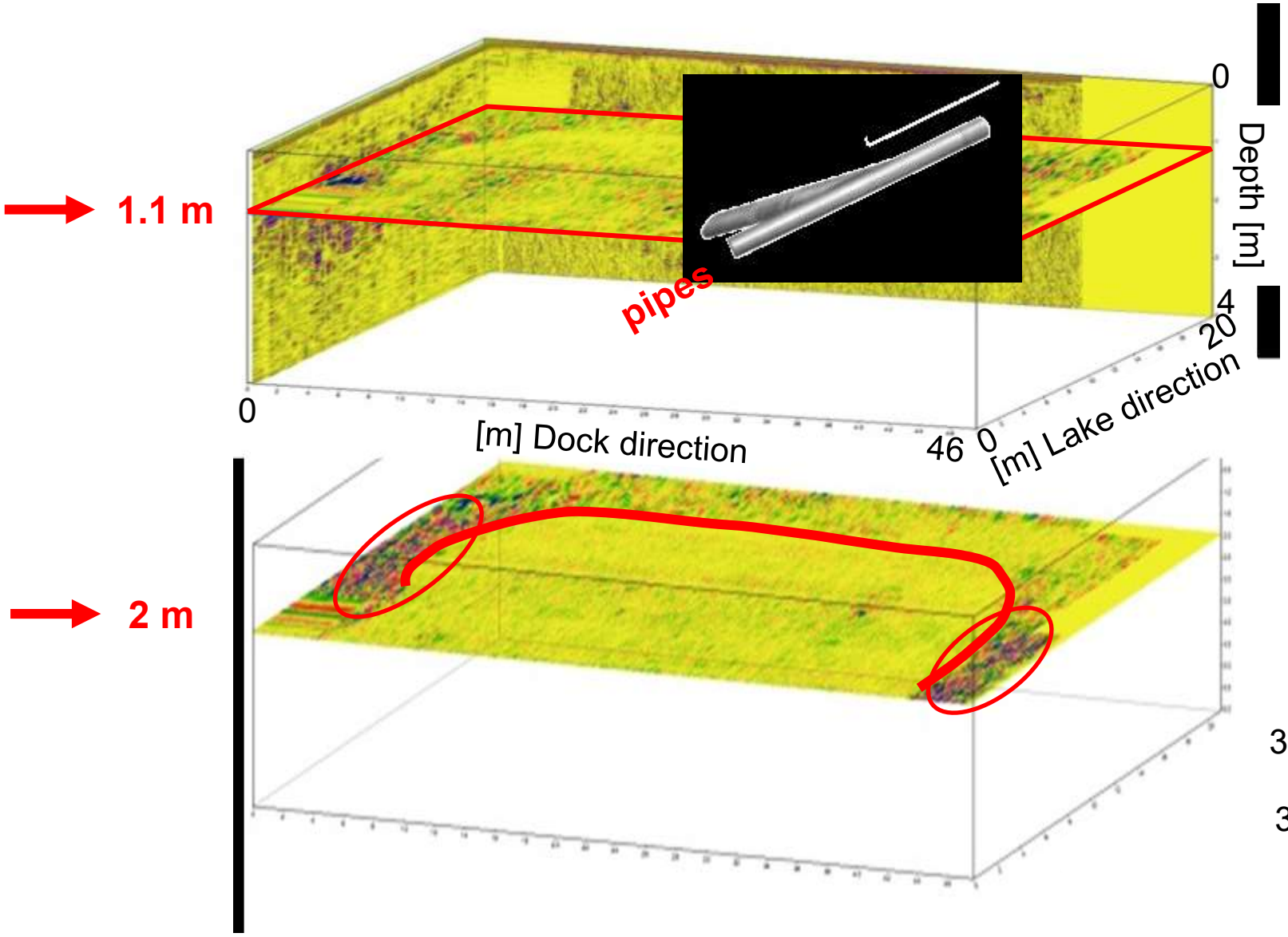
Reinforcing bar's are located at the top of each hyperbola

3-D Dataacquisition at the fairground plaza

55 parallel profiles



3-D Dataprocessing – Layer Interpolation



Summary and Outlook

- Often the maps are old and not up to date, GPR tells you precisely the position of water pipes and electric cables
- GPR can see electrical properties of the subsurface and NOT elastic properties
- GPR is a rapid method for a 3-dimensional documentation of the underground as well in walls

➢ In the future this method will become very important, because many flat places are full of pipes and old waste

Thank you for listening and good-bye!