

# GPR measurements on Aletch Glaciers



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# Outline

1. Introduction

2. Method

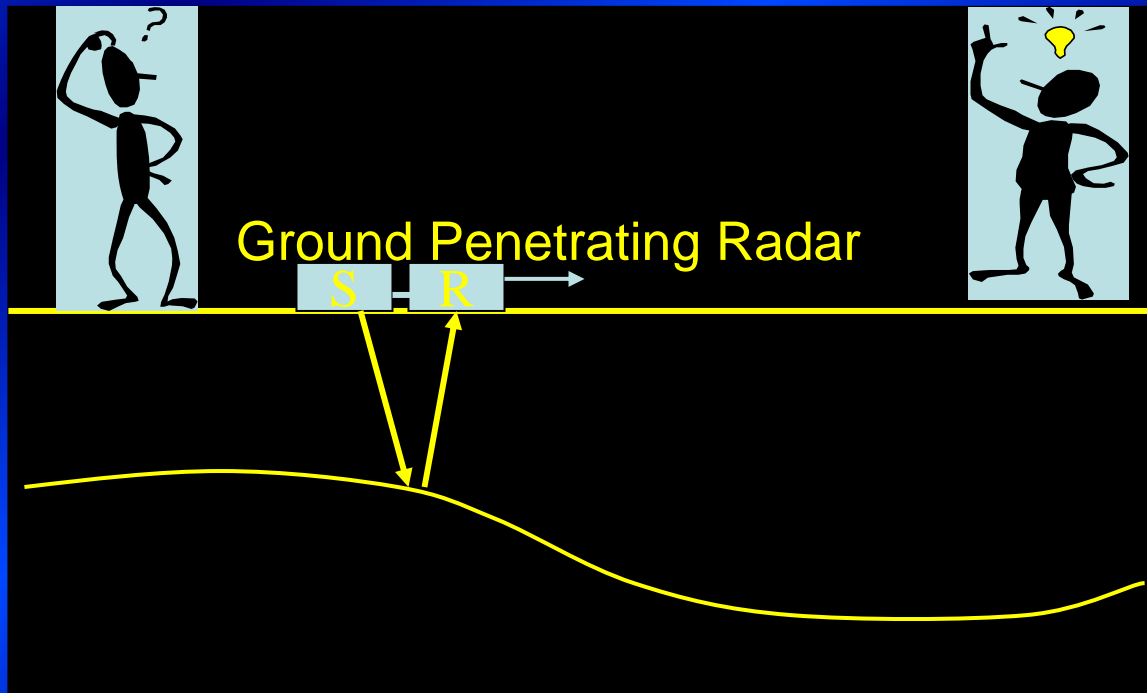
Study site

Mechanism of GPR

3. Future prospective

# Introduction

GPR : Ground Penetrating Radar technique  
tool to obtain an image of the subsurface



Measurement → Imaging — Image



# Study site

## Three ways of positioning

1. GPS
2. Poles (distance 20 m)
3. Wheel ruler (distance 5 or 10 cm)





# Mechanism of GPR

Antenna centre frequency as a function of exploration depth

Depth (m)	Center Frequency (MHz)	Vertical resolution (m)
0.5	1000	0.04
1.0	500	0.08
2.0	250	0.17
3.0	200	0.21
7.0	100	0.42
10.0	50	0.84
30.0	25	1.68
50.0	10	3.36

Shielded

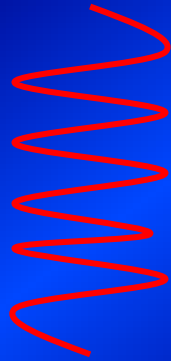
Unshielded

# Mechanism of GPR

## Frequency and exploration depth

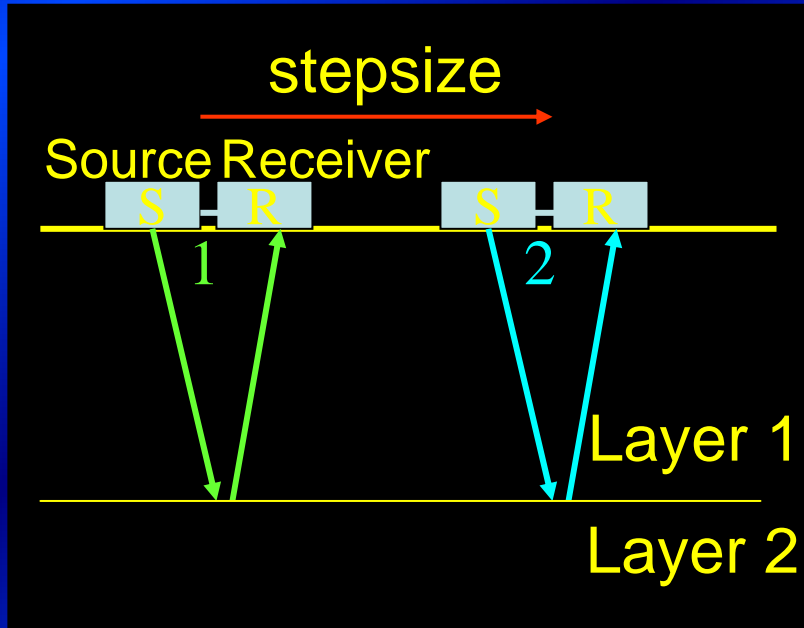
High frequency  
shallow depth

Low frequency  
deep depth

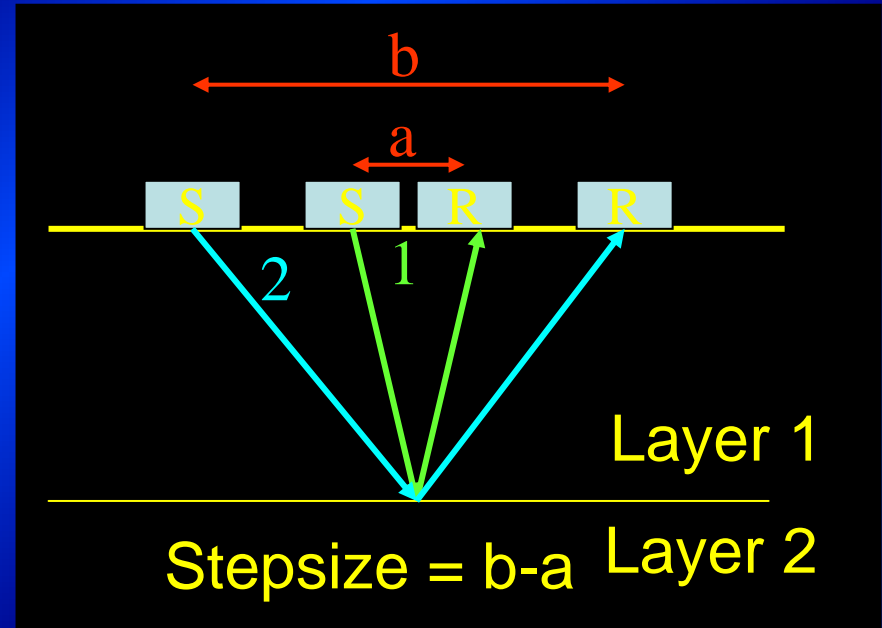




# Mechanism of GPR Set-up



Common offset configuration



Common midpoint configuration

1st day morning : 500, 250 MHz

2nd day morning : 1000 MHz

2nd day afternoon : 50 MHz

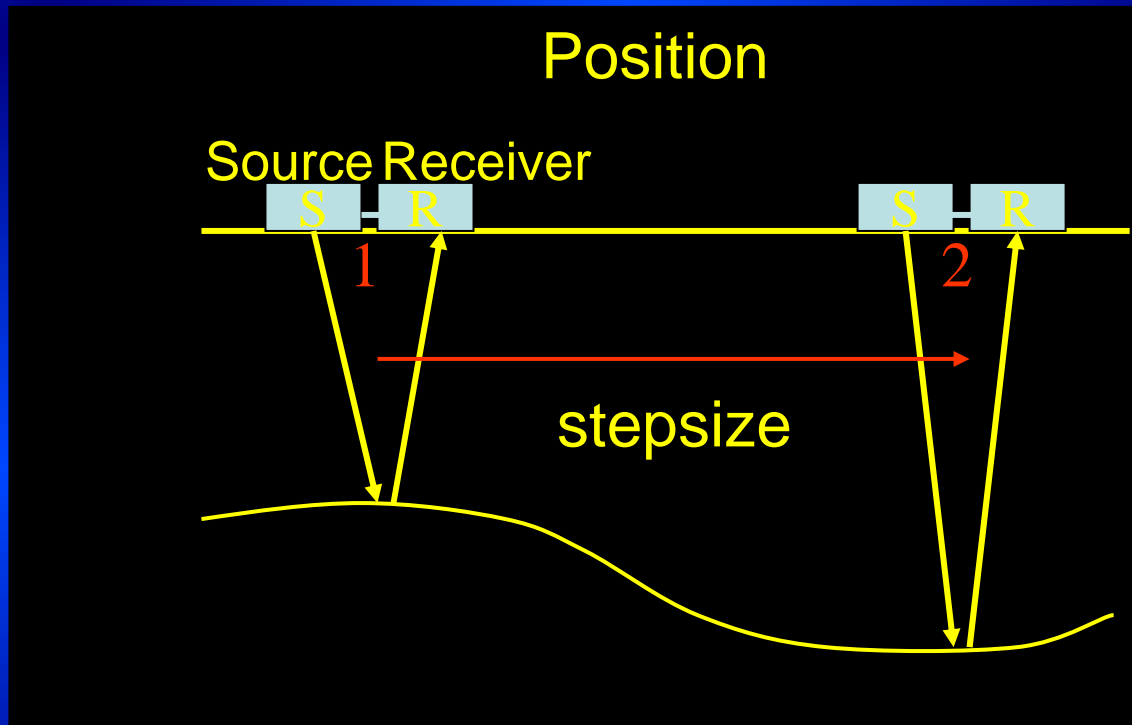
1st day afternoon : 500 MHz

# Mechanism of GPR

## Common offset measurement

Source and receiver antennas are

1. at a fixed distance
2. moved together a fixed distance (stepsize) for each measurement

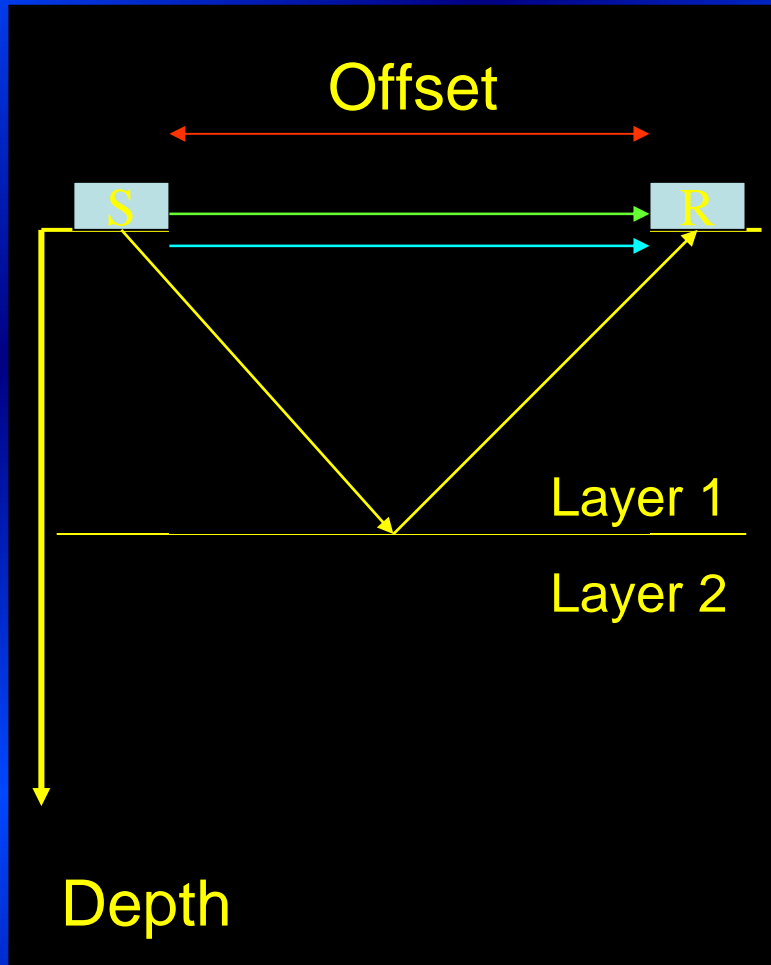


3. Determine lateral changes in subsoil
4. Detect objects

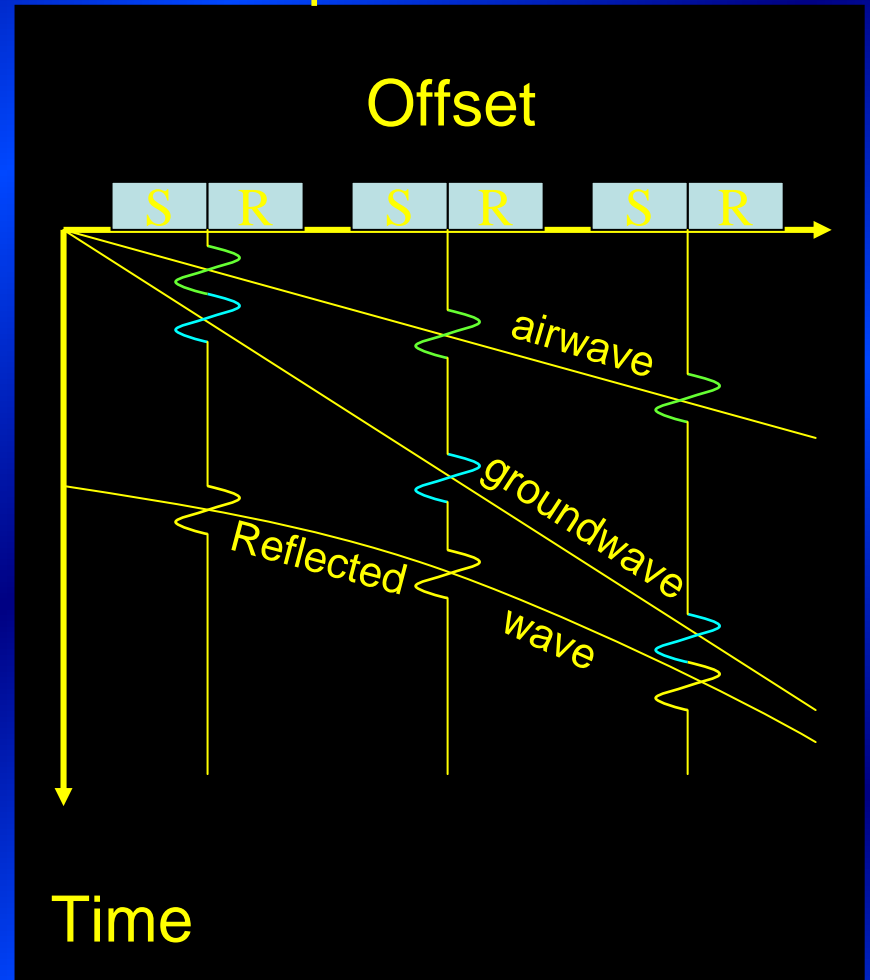
# Mechanism of GPR

## Common midpoint measurement

Geometrical situation



Response in time



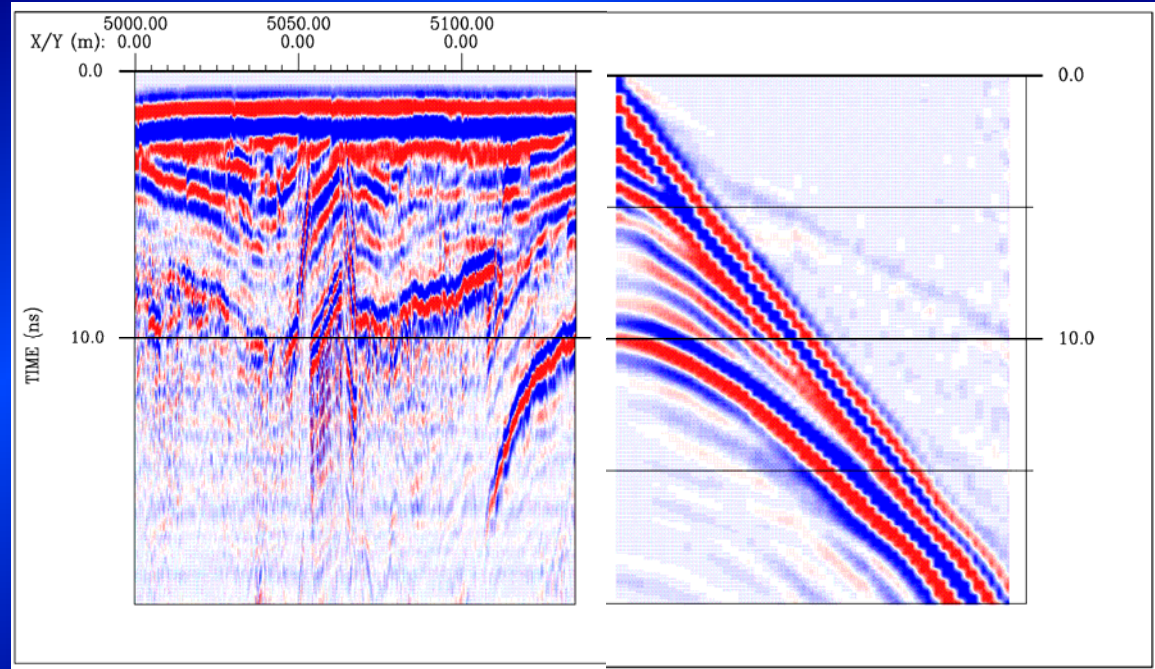
# Mechanism of GPR

Estimation of asphalt thickness of Rijksweg 16



Common offset

Common midpoint



- Centre frequency : 900 MHz
- Detailed discrimination between events
- Velocity information : 0.12 m/ns
- Time - depth conversion (10 ns : 60 cm)

# Future prospective

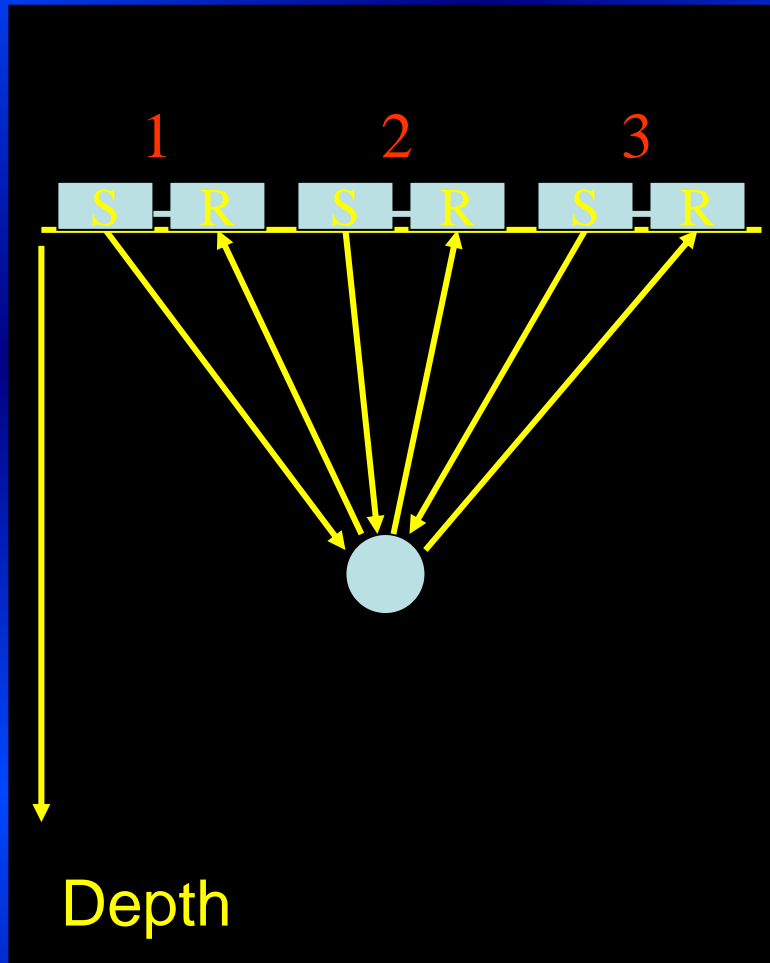
- Further continuous research of the glacier.
- Data analysis.
- Comparison.
  - other glaciers of the same height
  - other areas of Aletch glacier
  - previous data (VAW, other projects)
- Theoretical consideration.
  - modeling of fluid dynamics
  - effects of climatic factors
    - radiation, temperature, precipitation,
    - melt water, artificial elements, etc.

# Appendix

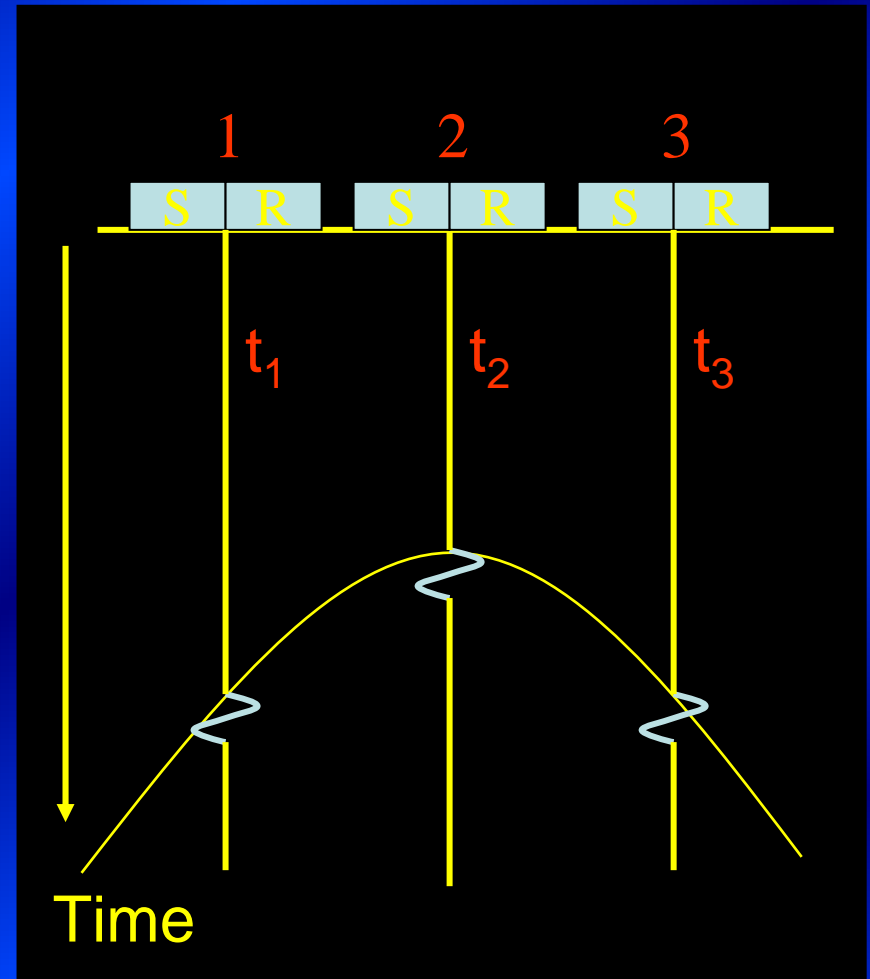


# Response of a buried object

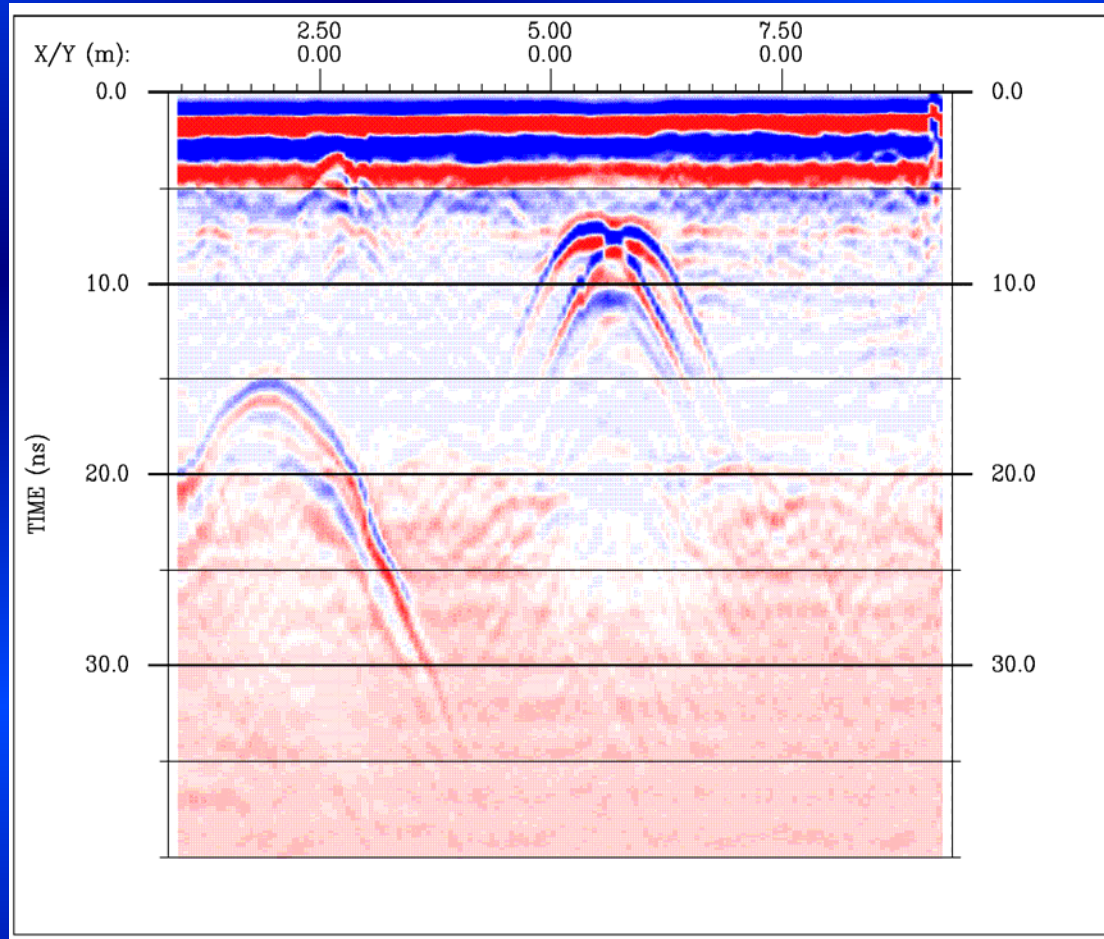
Geometrical situation



Response in time



# Detection of steel pipes in a controlled environment



Centre frequency: 450 MHz