Formation of sub-nanosecond UWB impulse using sharp edge generator and resistive antenna

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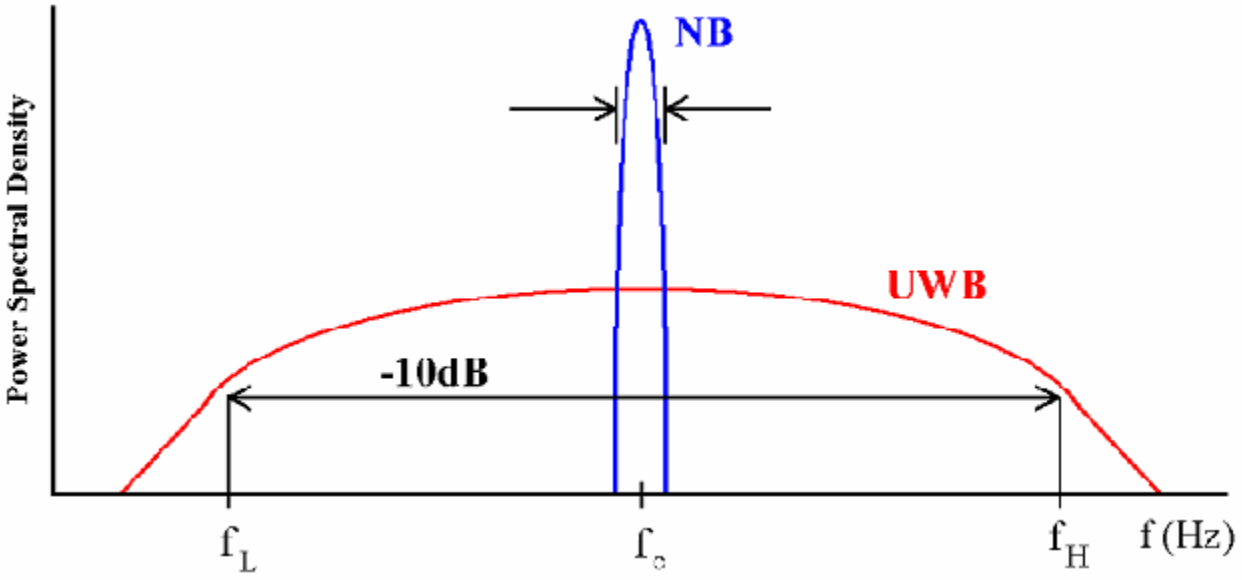
Outline

- Introduction
- Motivation and goals
- UWB pulse generation
- UWB antennas
- Experimental setup and results
- Conclusions

What is UWB?

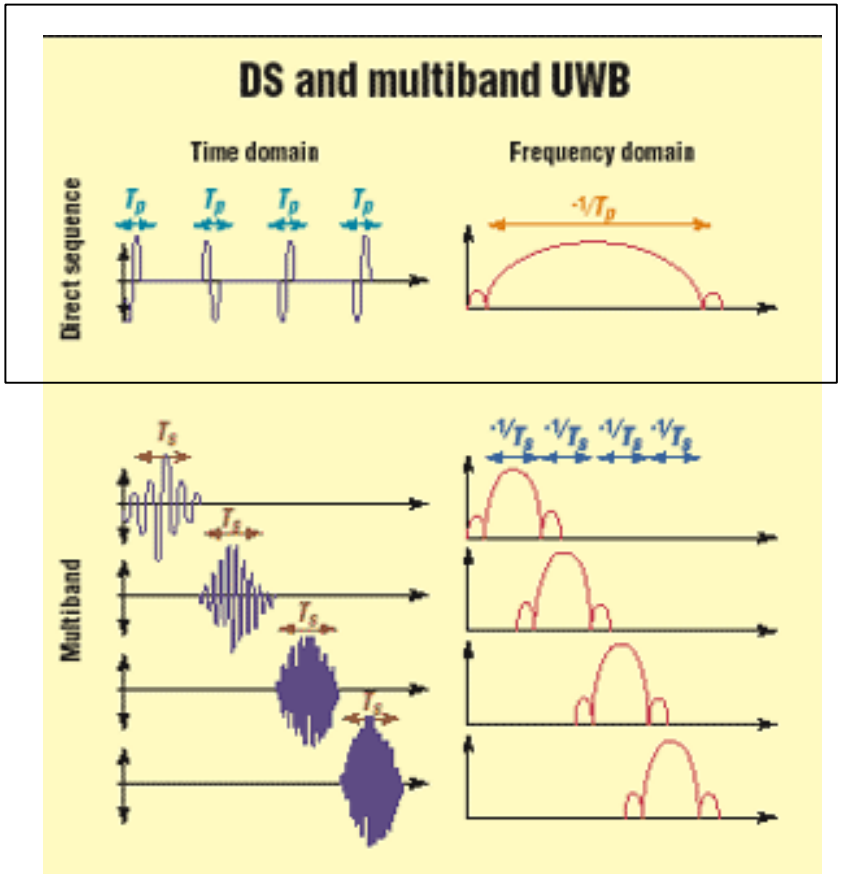
Fractional bandwidth (measured at the -10dB (fh -fl)/fc , > 20% or total BW > 500 MHz.



FCC/ITU-R Definition UWB

UWB types:

- Direct sequence (DS) UWB: using the whole available spectrum
  - transmitting very short pulses (impulse radio)
- Multiband: dividing the available spectrum into several bands, each having a minimum of 500 MHz of bandwidth.



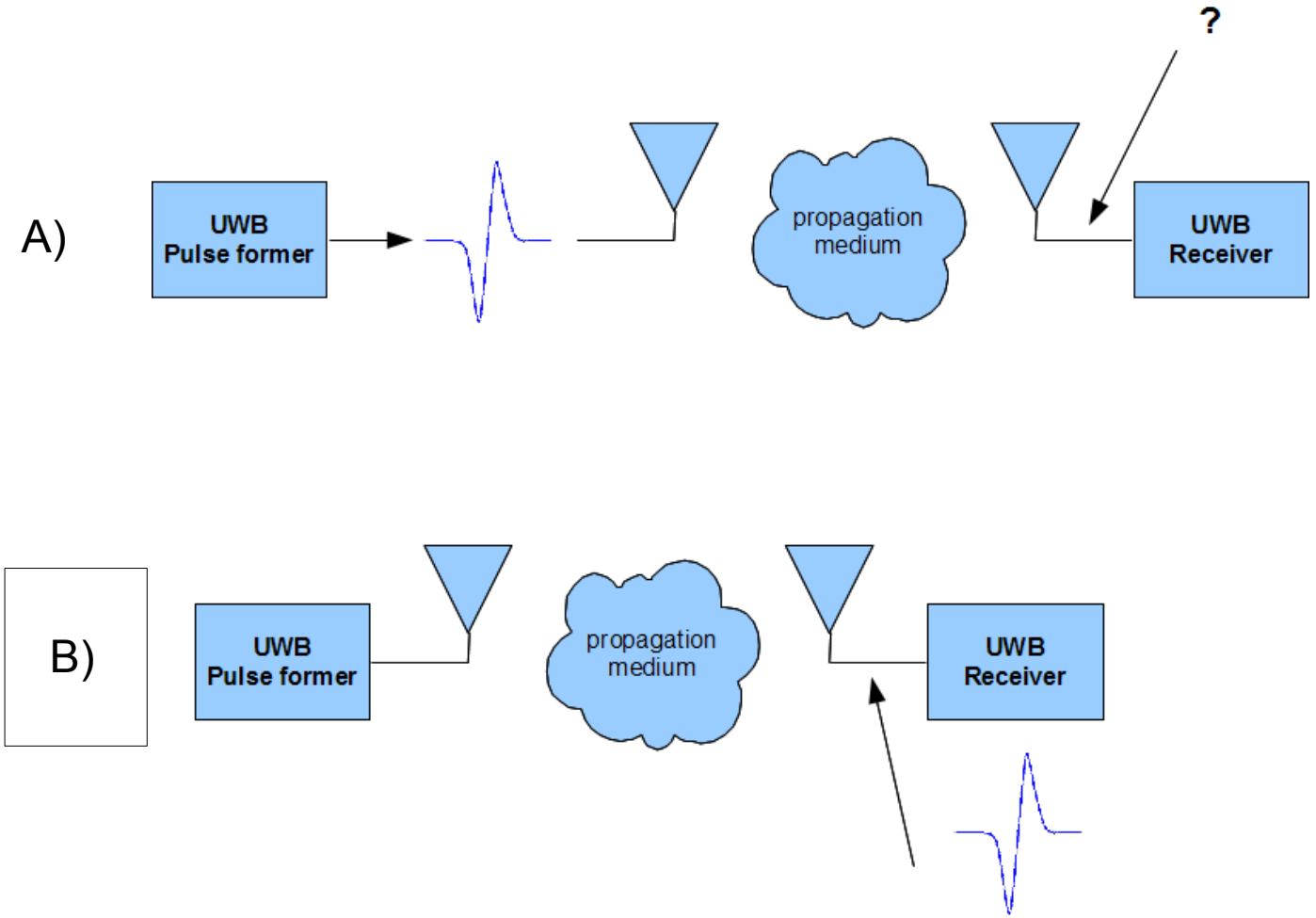
Pulse based UWB. Why?

- Advantages
  - Mixed localisaton and data transfer possibility
  - Simple transmitter side design
  - Noise-like spectrum
- Applications
  - Wireless comunication systems
  - Road information systems (Car <-> Road signs)
  - Non-contact medical examination
  - Localisation, positioning

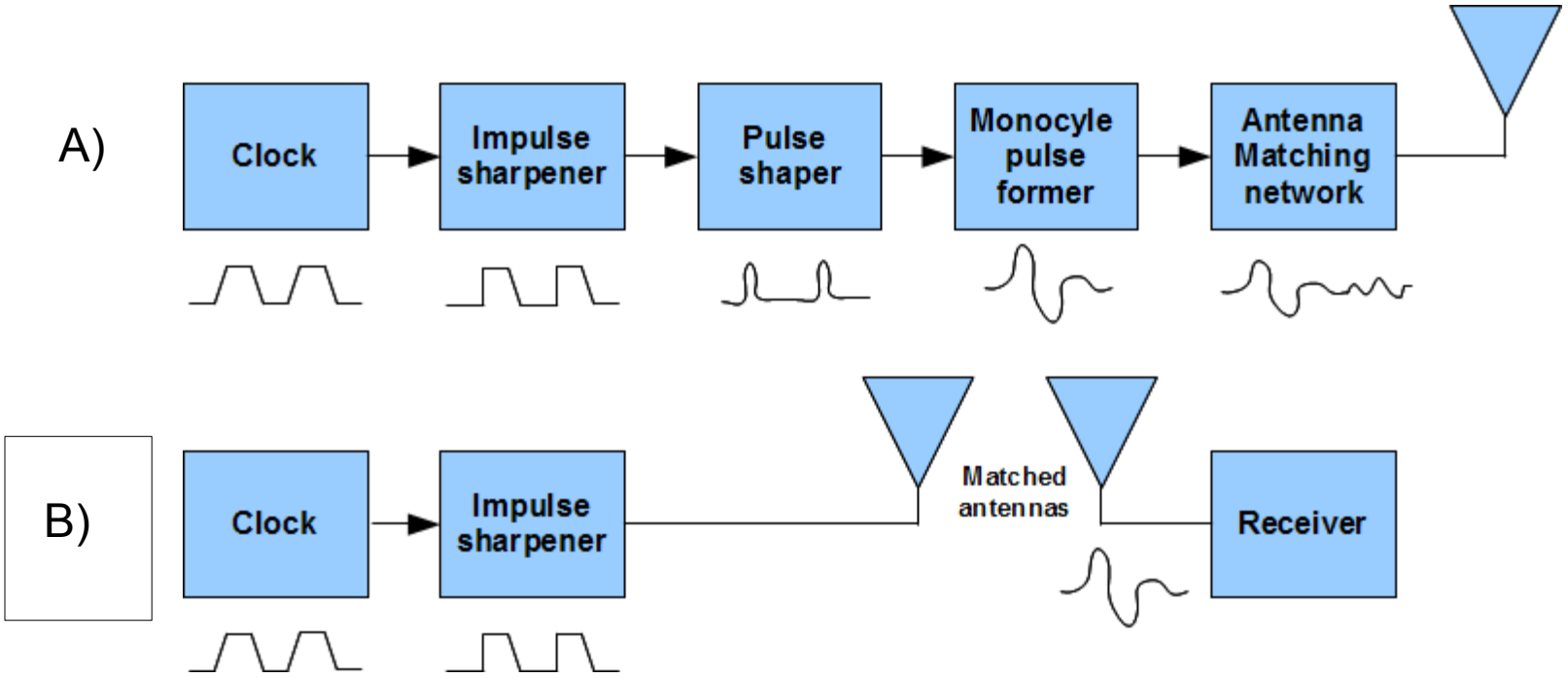
Motivation and goals

- To gain experience/knowledge in design of wideband/microwave systems
- **UWB impulse generation**, antenna, localization and data transfer **experiments**
- Practical goals:
  - Universal UWB antenna test system
  - Ground penetrating radar (GPR)
  - Through wall imaging device (TWI)

Different aproaches



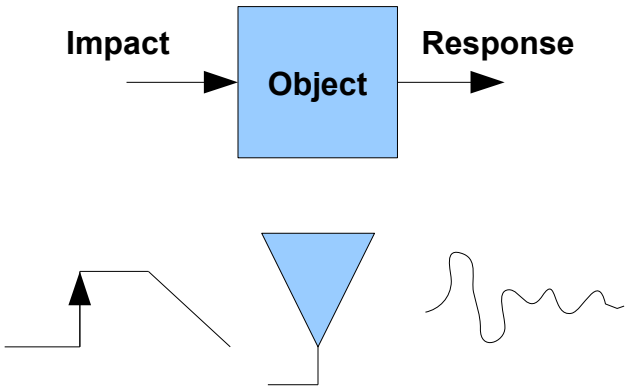
Different aproaches



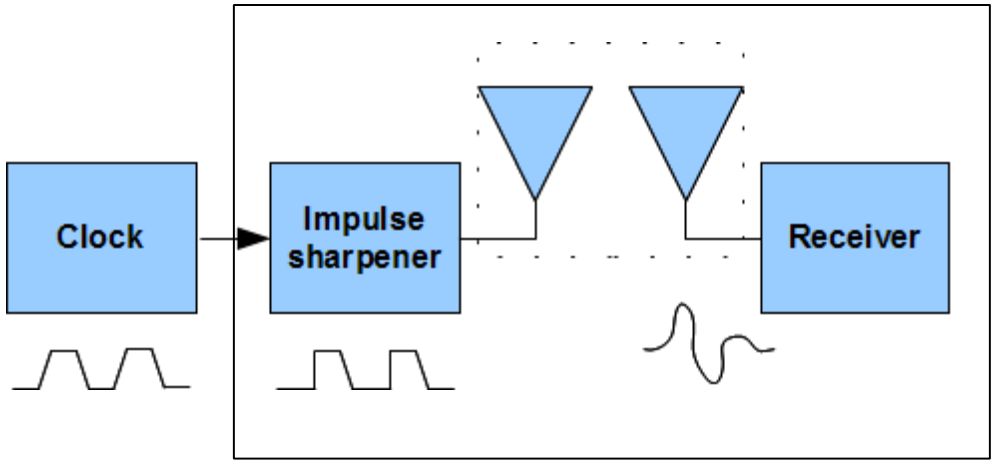
UWB pulse generation

Antenna is a part of UWB pulse generator!

Principle



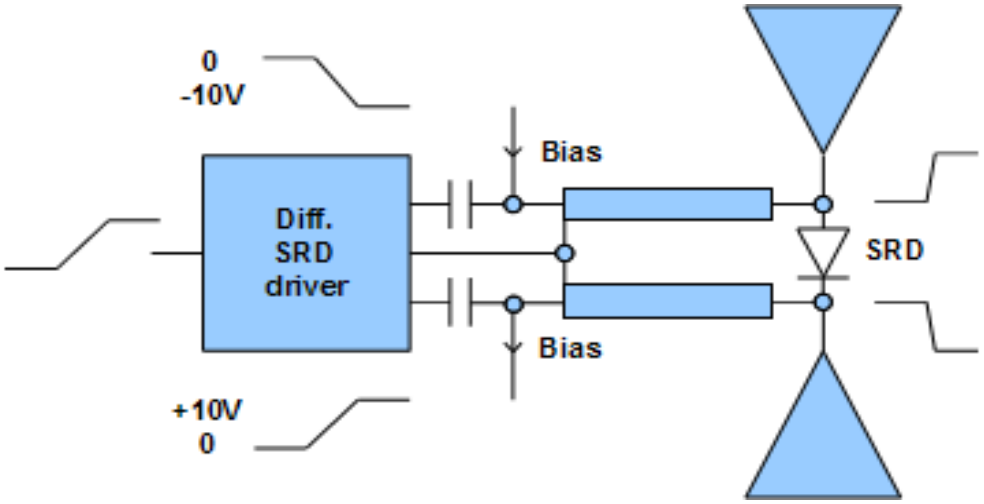
Test system



UWB impulse is formed as an antenna step response

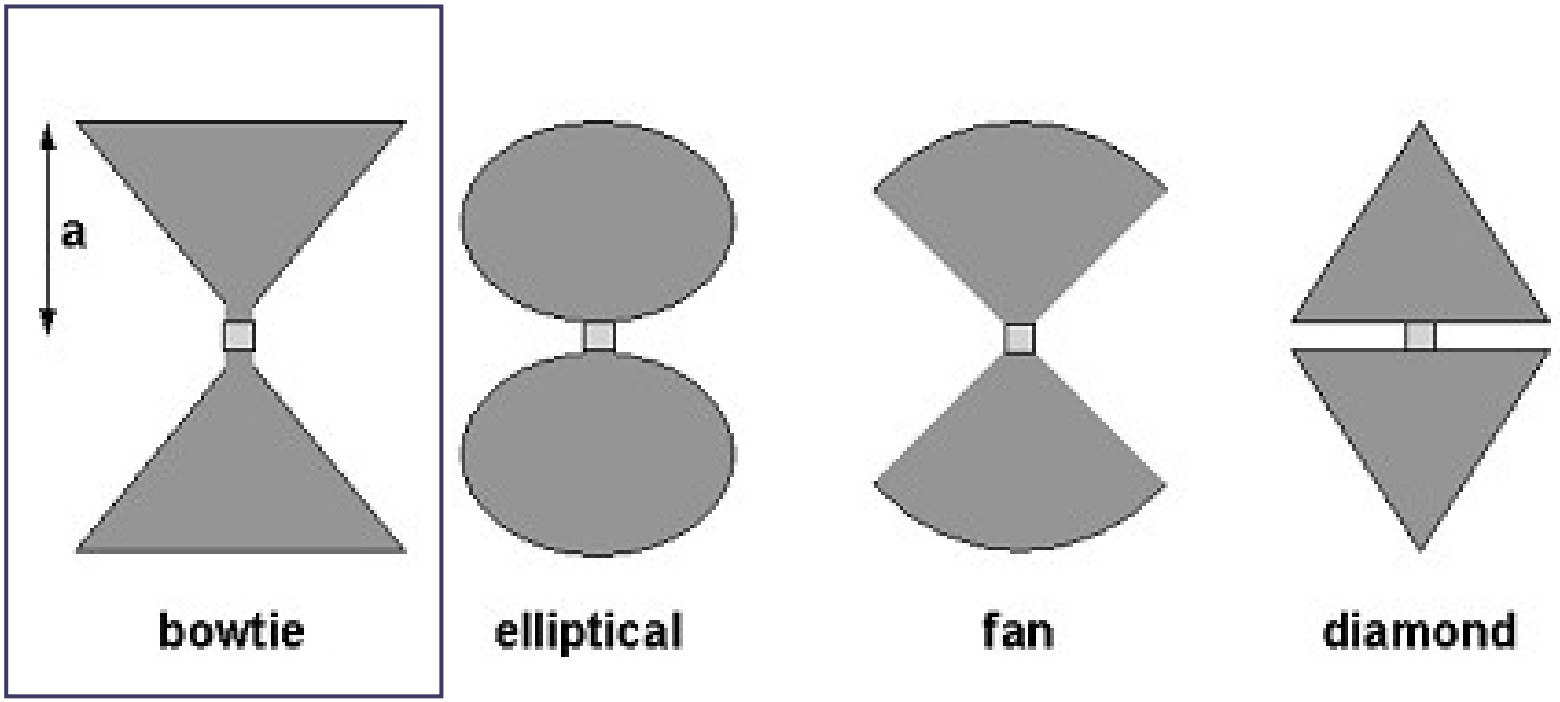
UWB pulse generation

A fast rise time differential pulse generator in combination with a Bow-Tie type antenna on a lossy dielectric



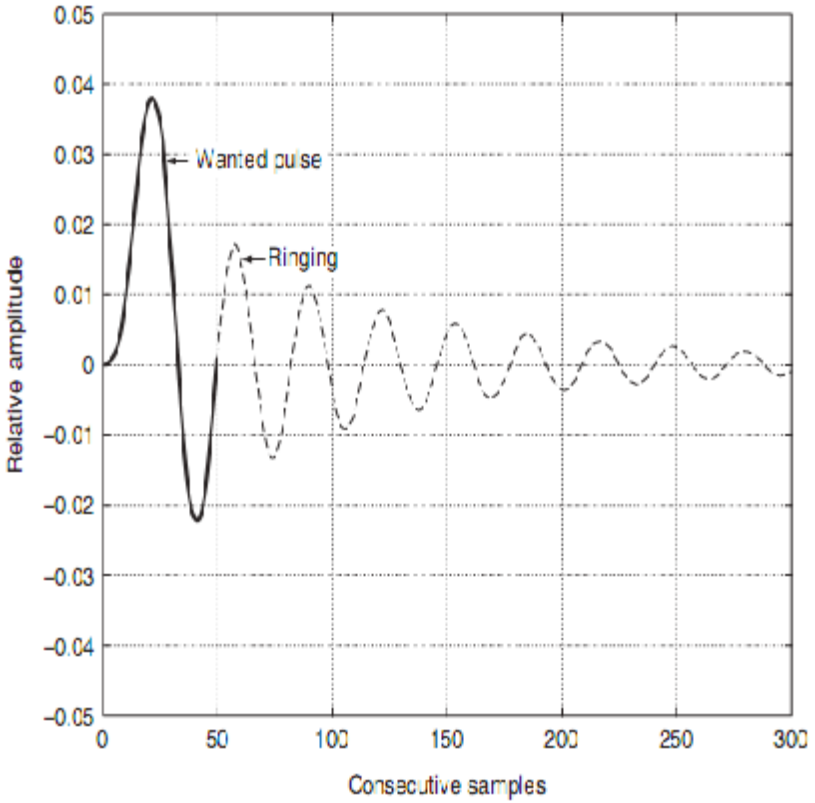
A Step Recovery Diode (SRD) is used as a differential pulse sharpener

Typically used antennas



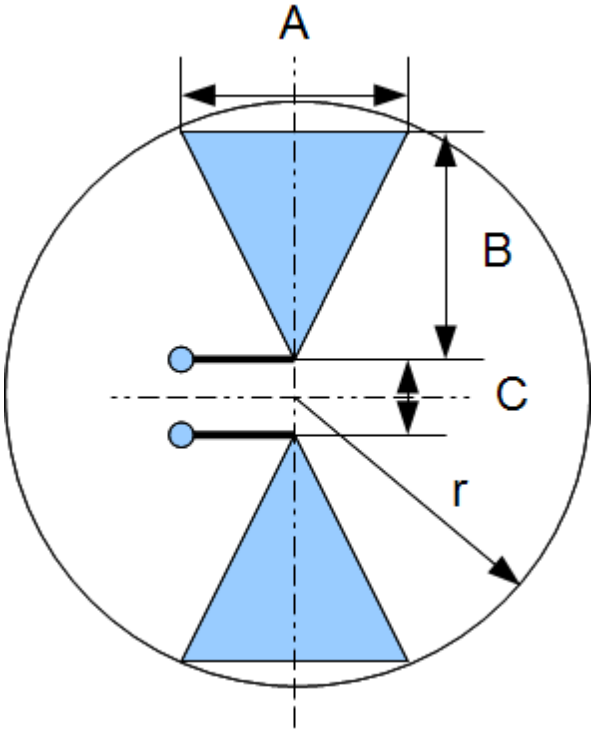
UWB antenna requirements

- Small size (for embeded devices)
- Effective energy transfer
- Linear phase delay
- Wide frequency range impedance matching
- Short step response (radar applications)
- Non-resonant (multi resonant)
- 0 < Q factor < 1

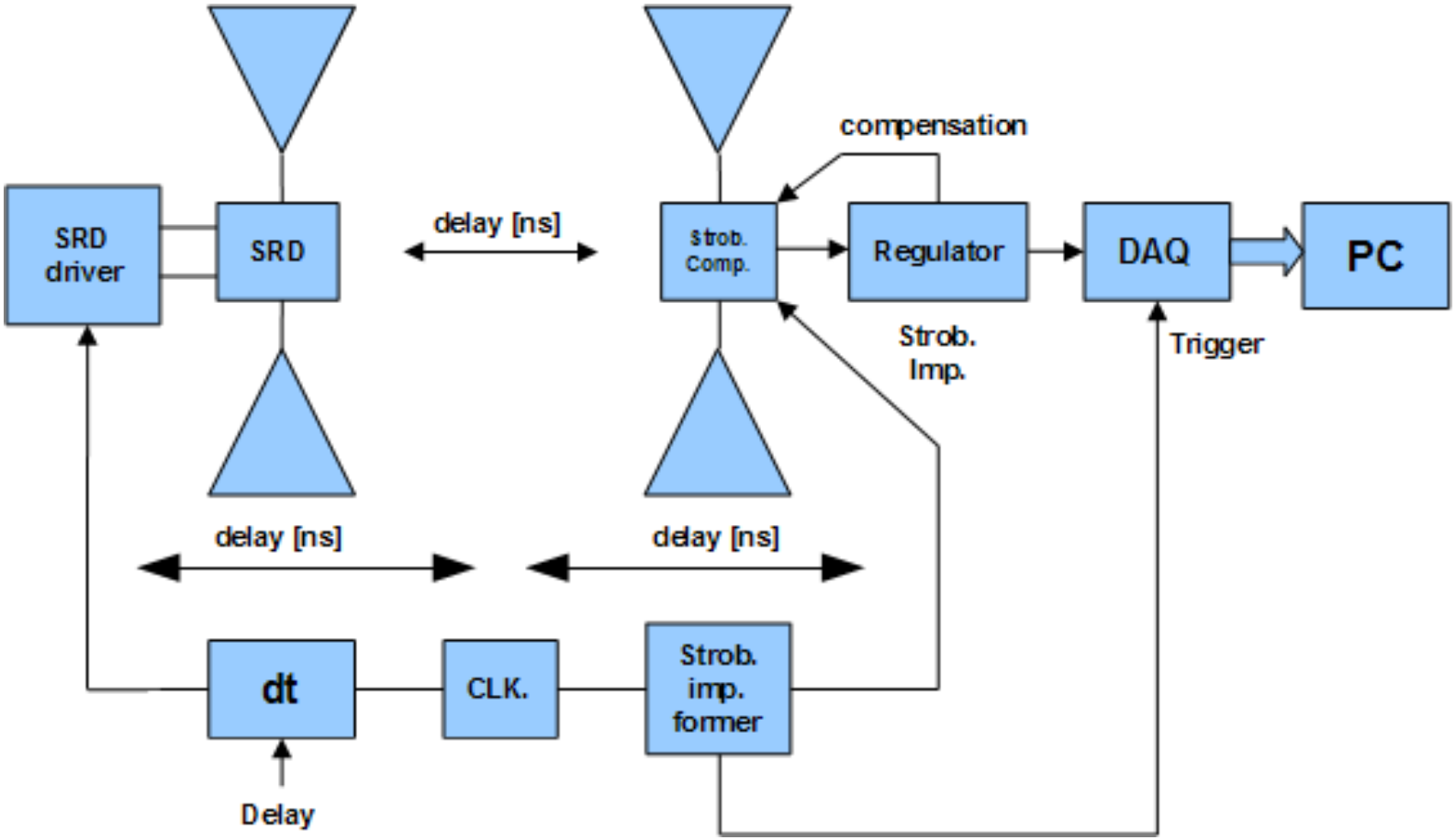


Antenna couple used for experiments

- A Bow-Tie type antena is used
- Antenna is made on a lossy dielectric material

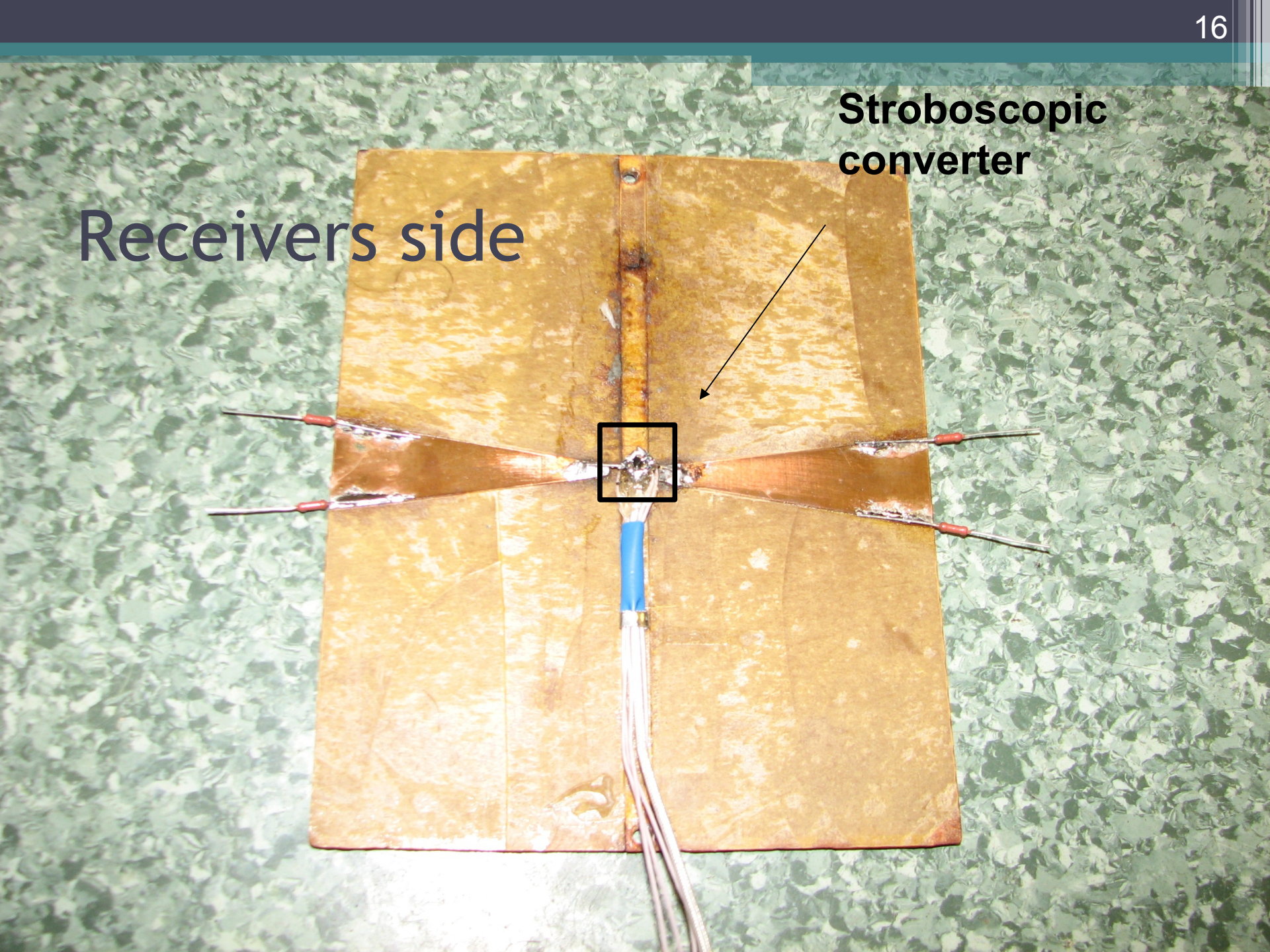


Experimental setup

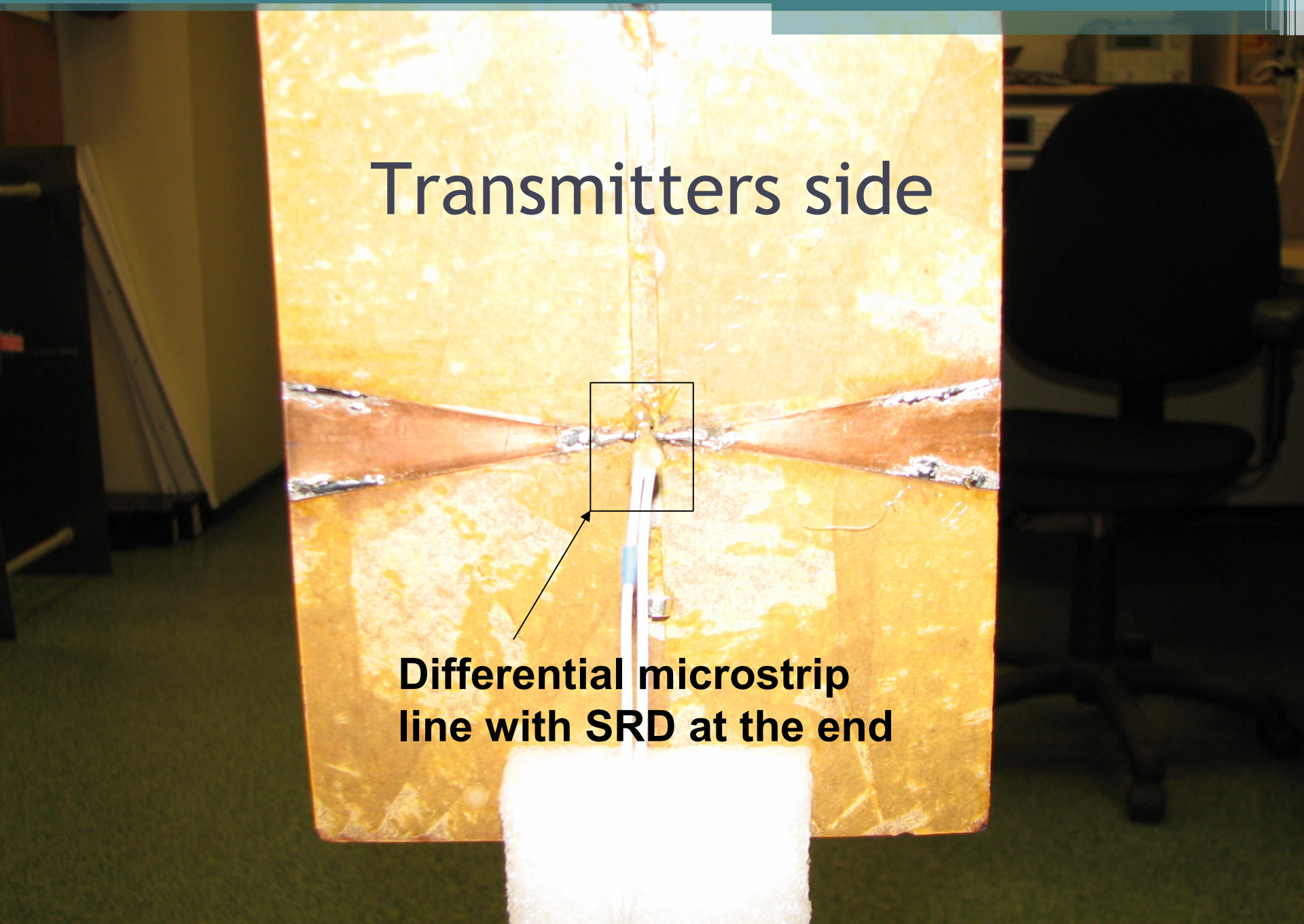


Real-world look

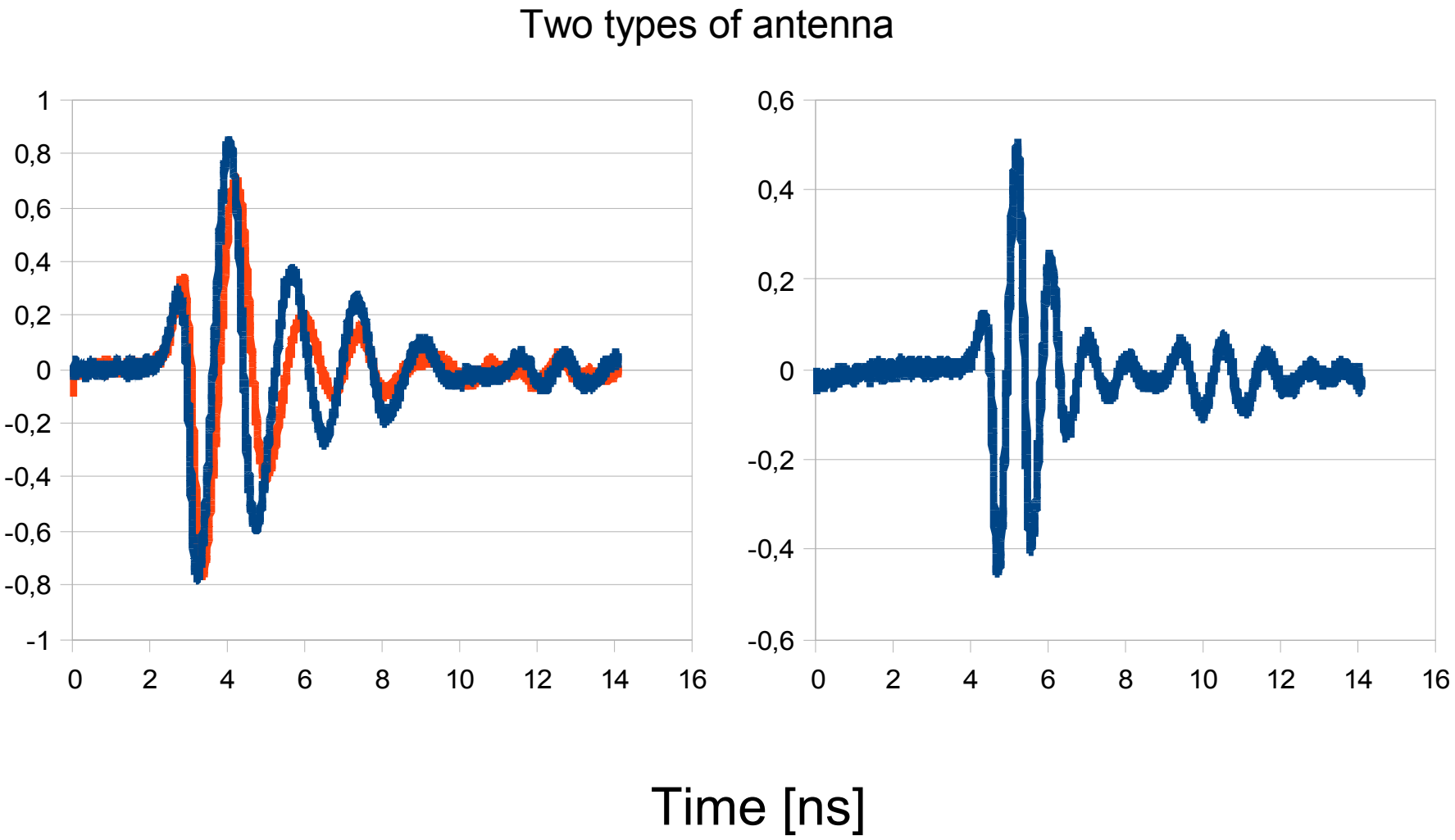
Receivers side



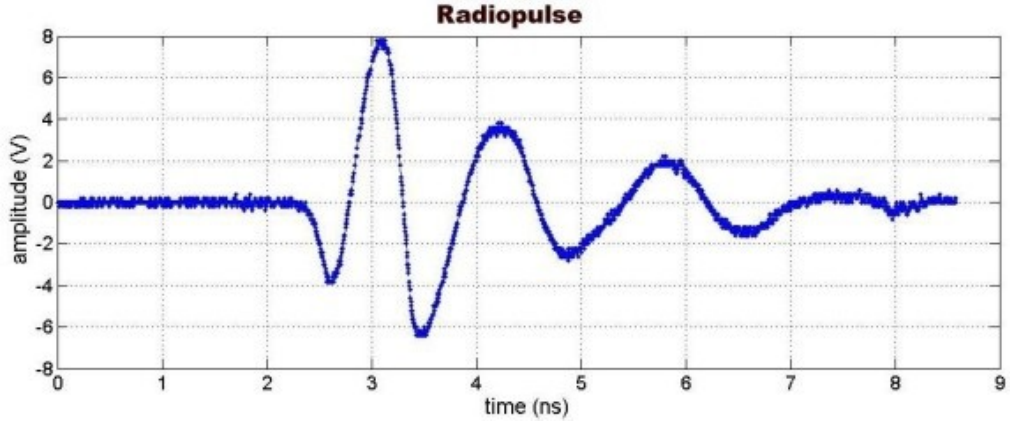
Transmitters side

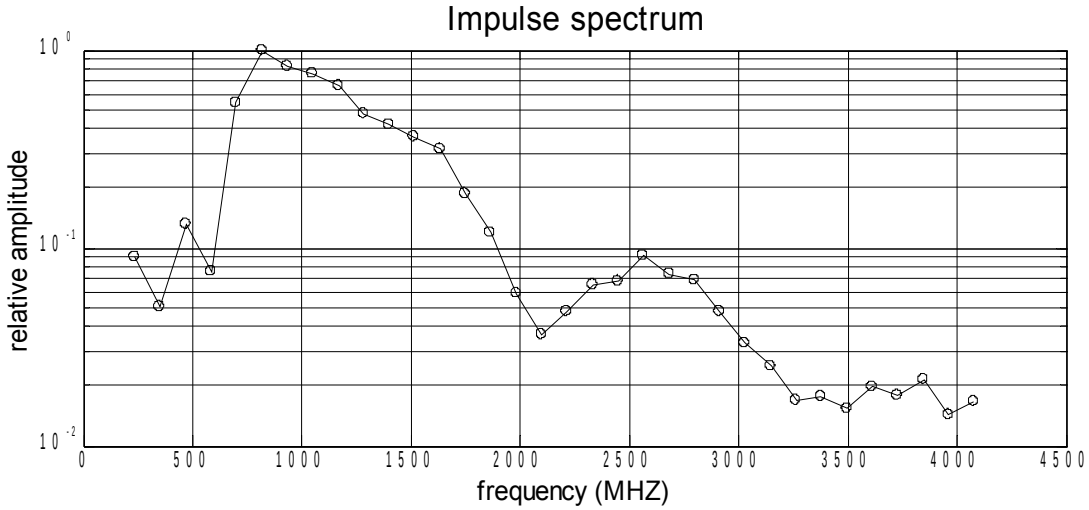


Measurements



Pulse spectrum





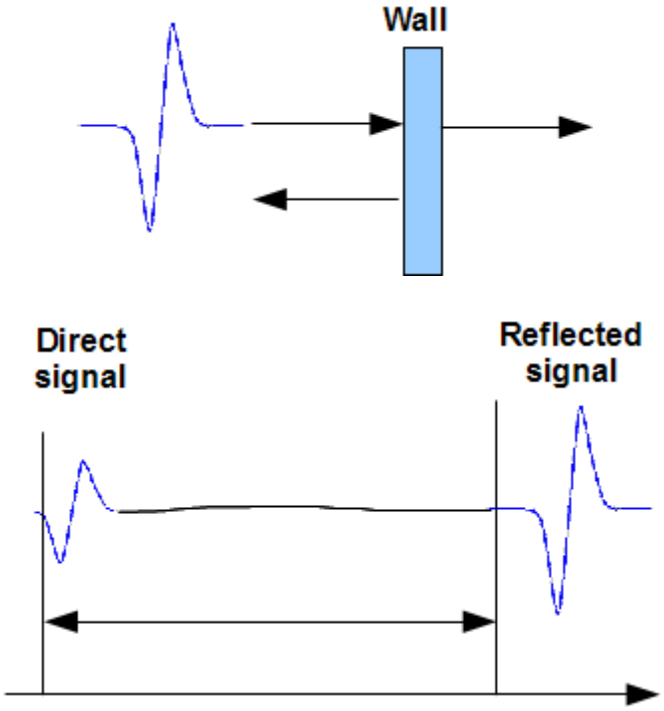
Conclusions

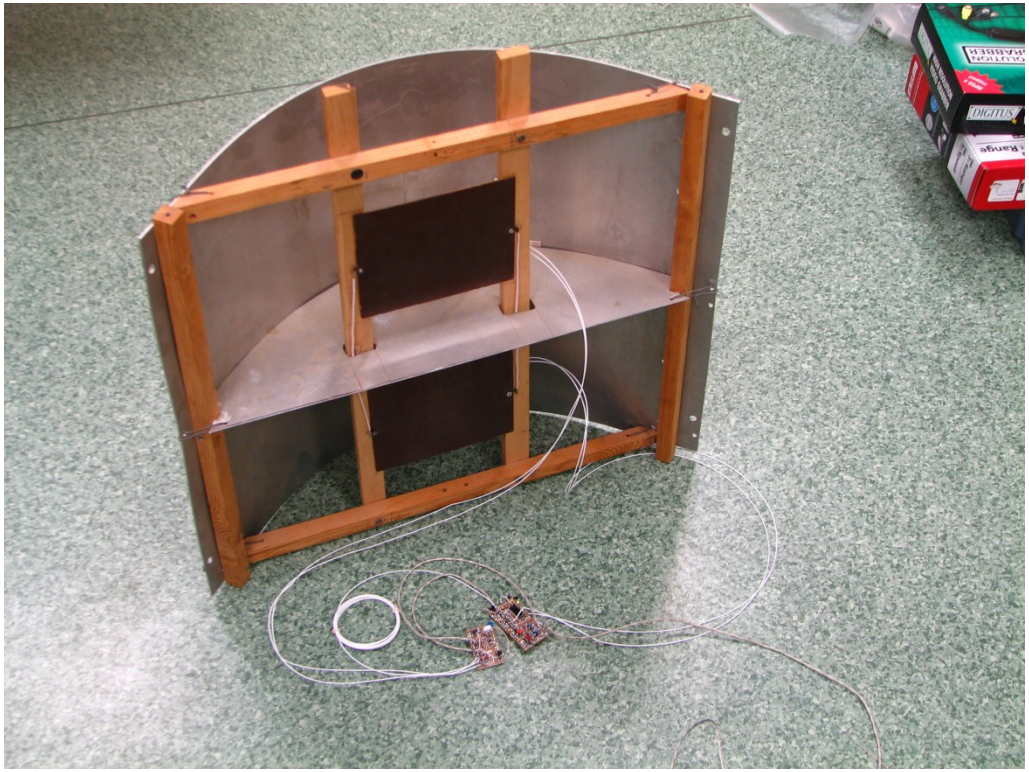
- Experimental setup is developed for further research
- Obtained first results confirms the correctness of the approach
- Some experience in high frequency design is gained

That`s all

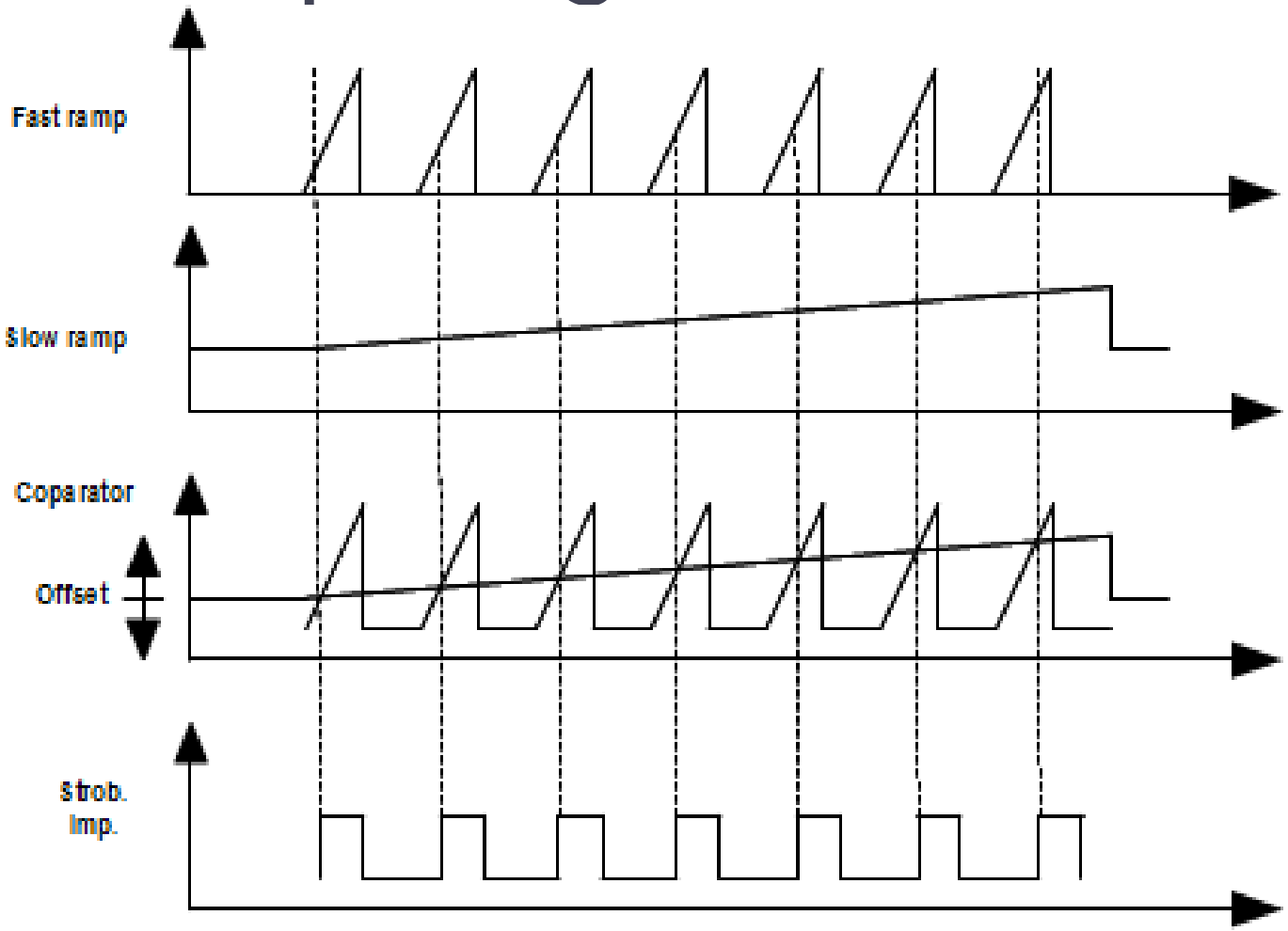
Any questions?
Comments?
Sugestions?

Radar test system

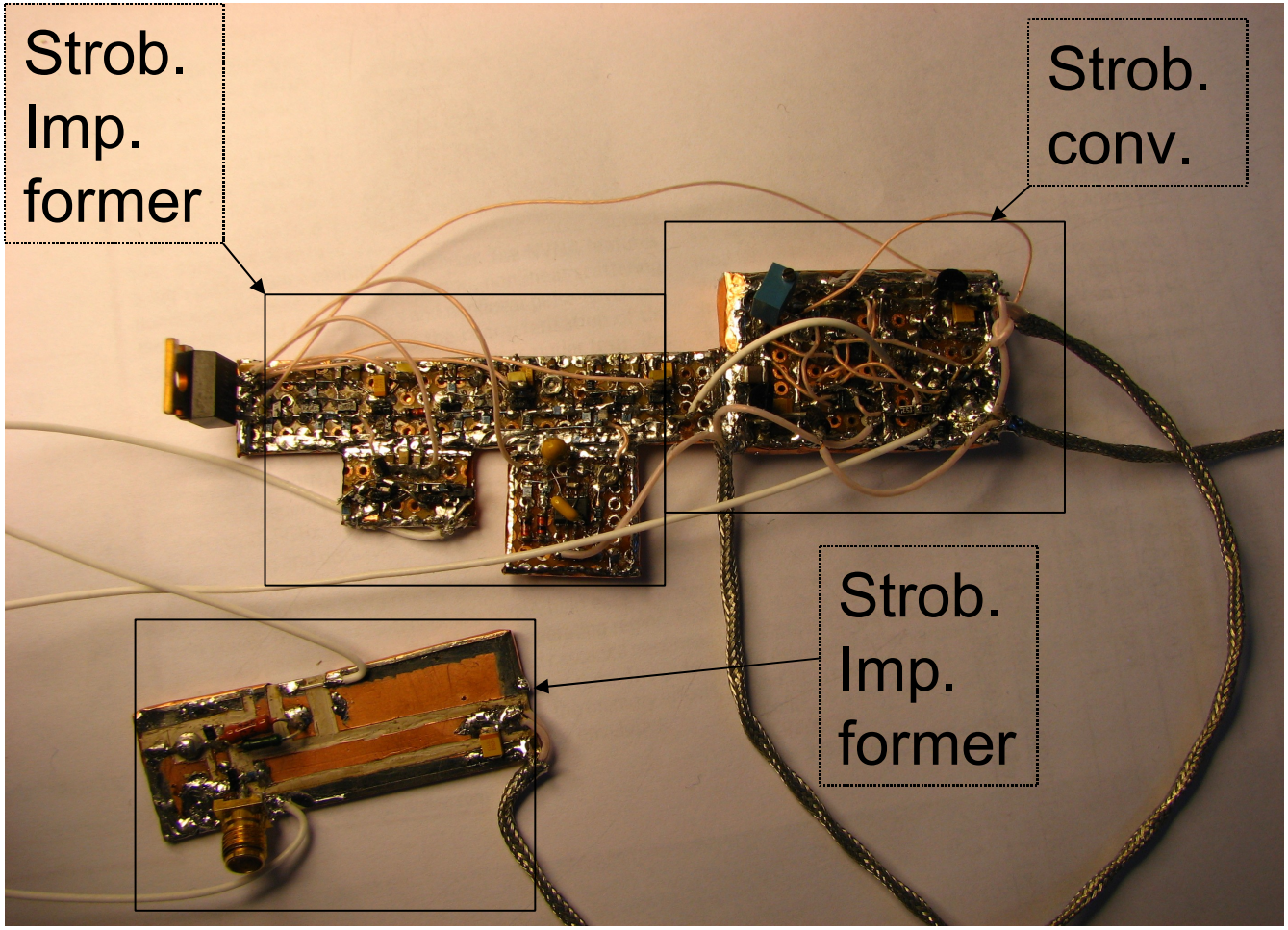


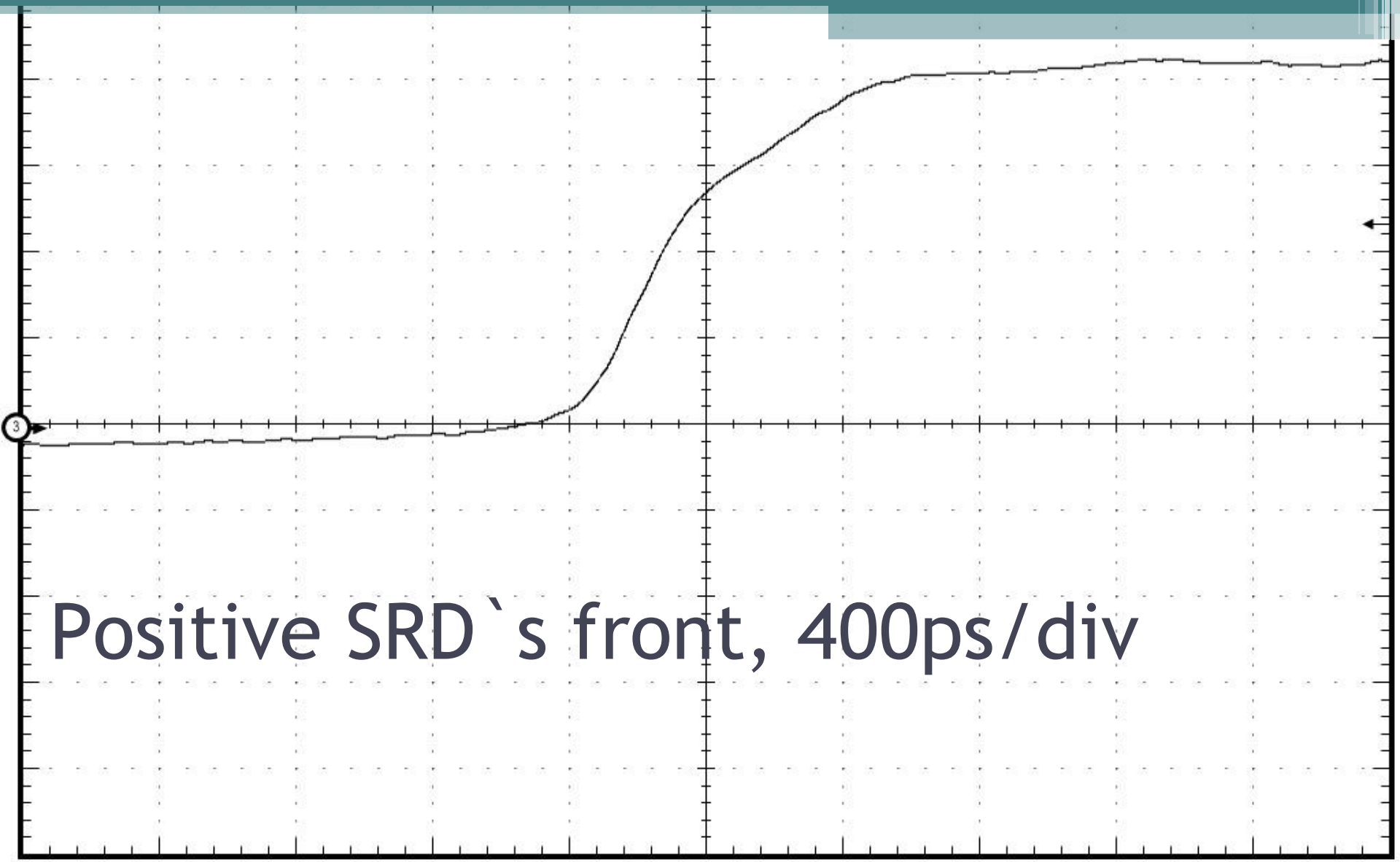


Strobe impulse generation

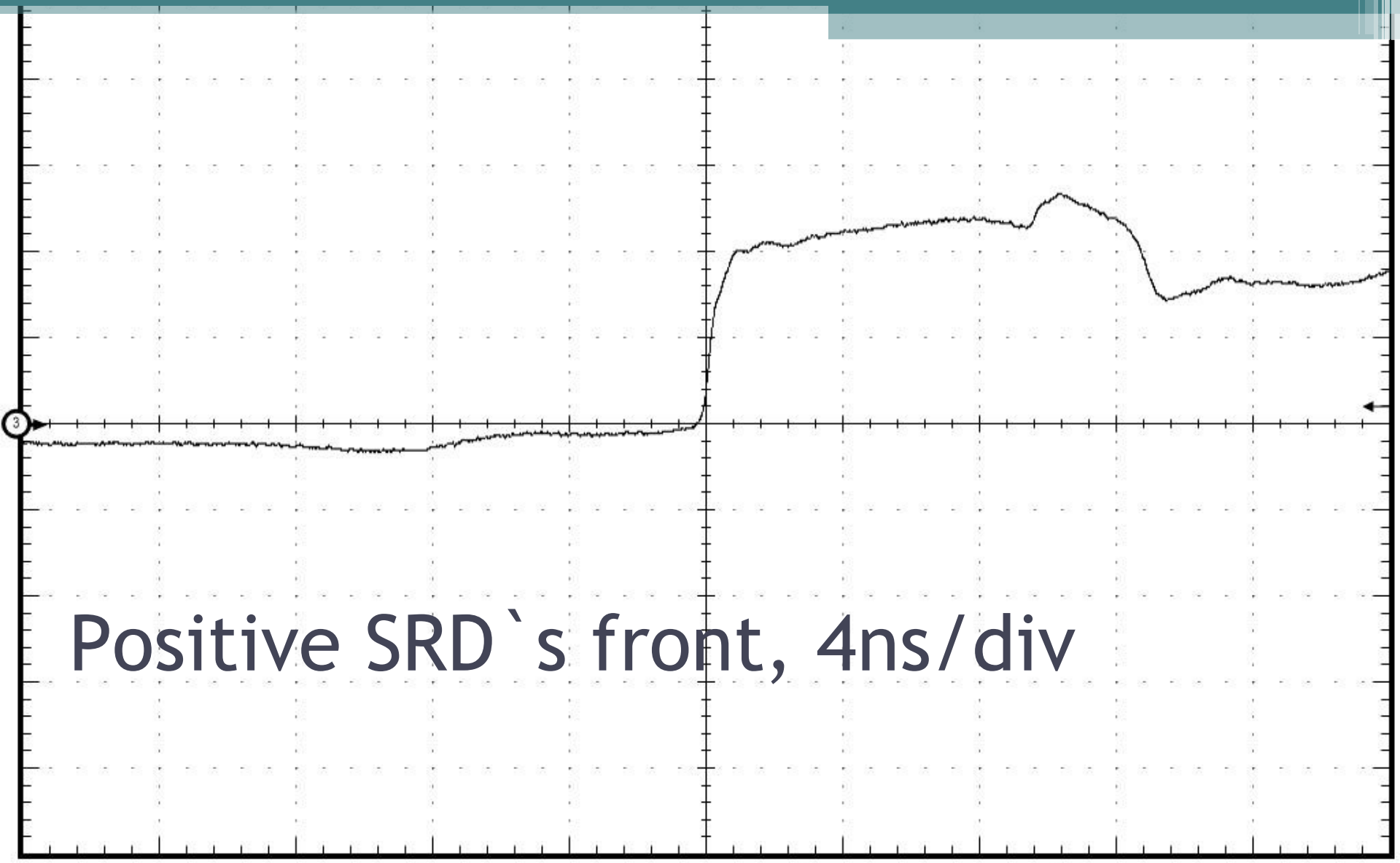


First version of strob. converter



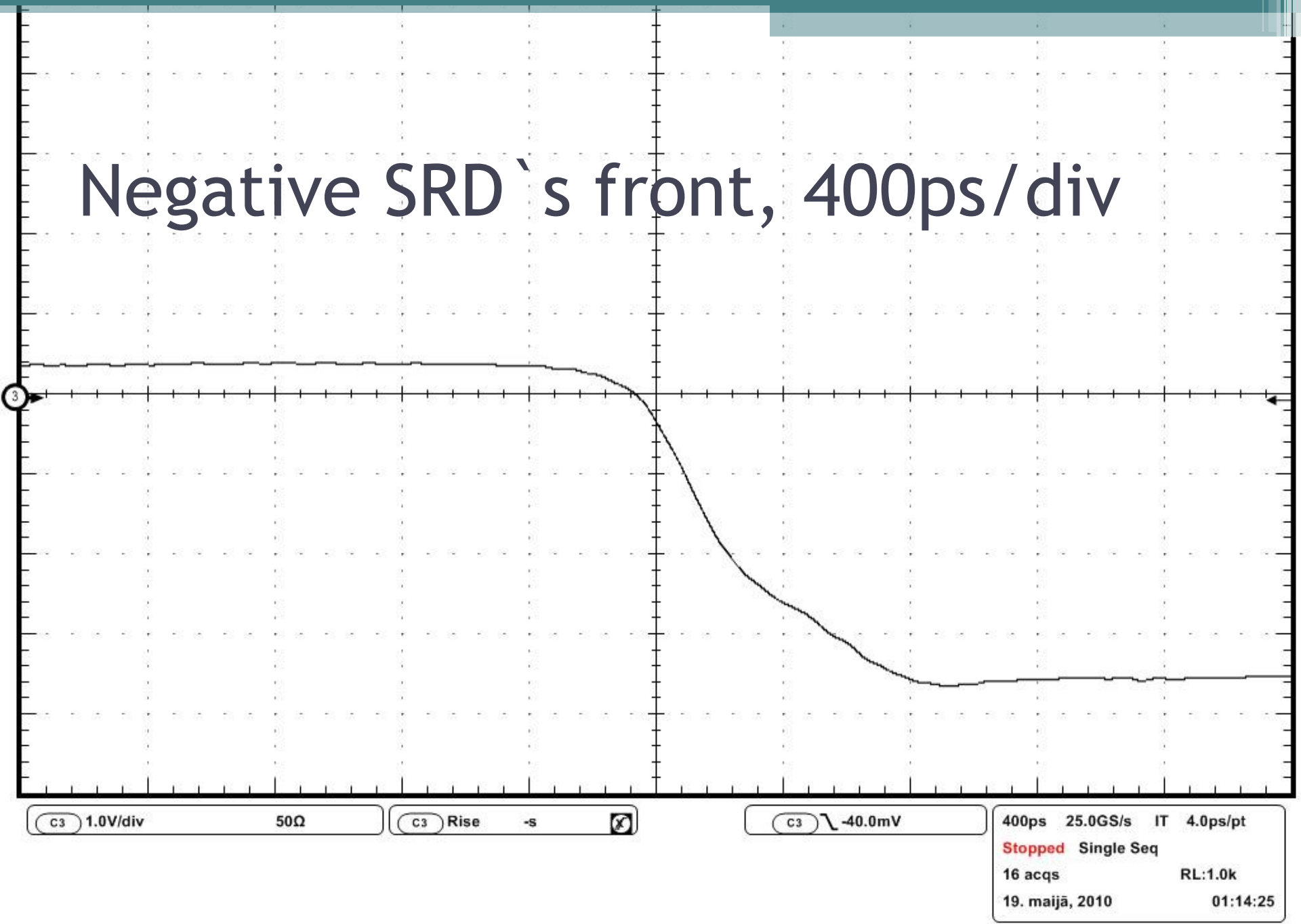


Positive SRD`s front, 400ps/div

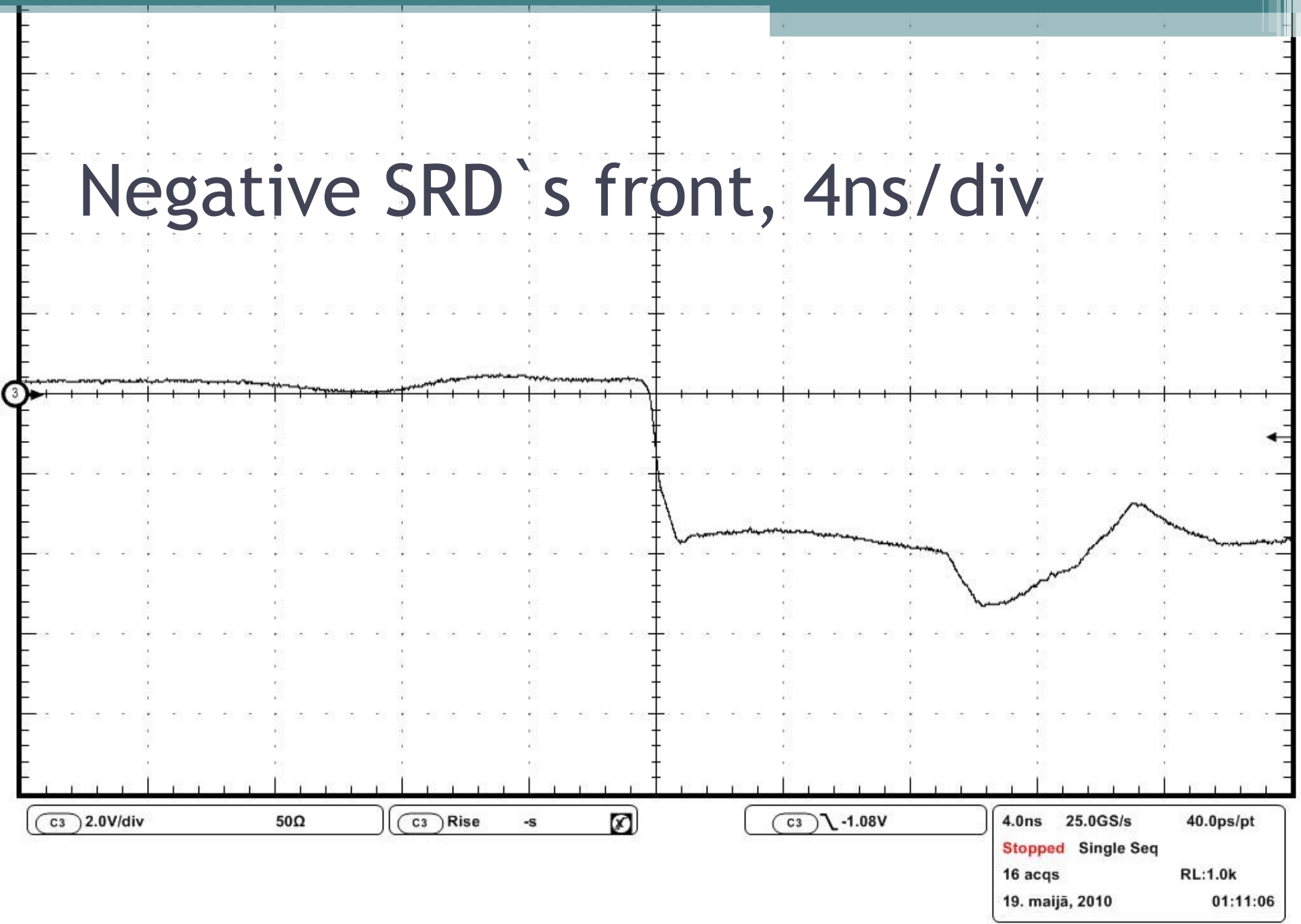


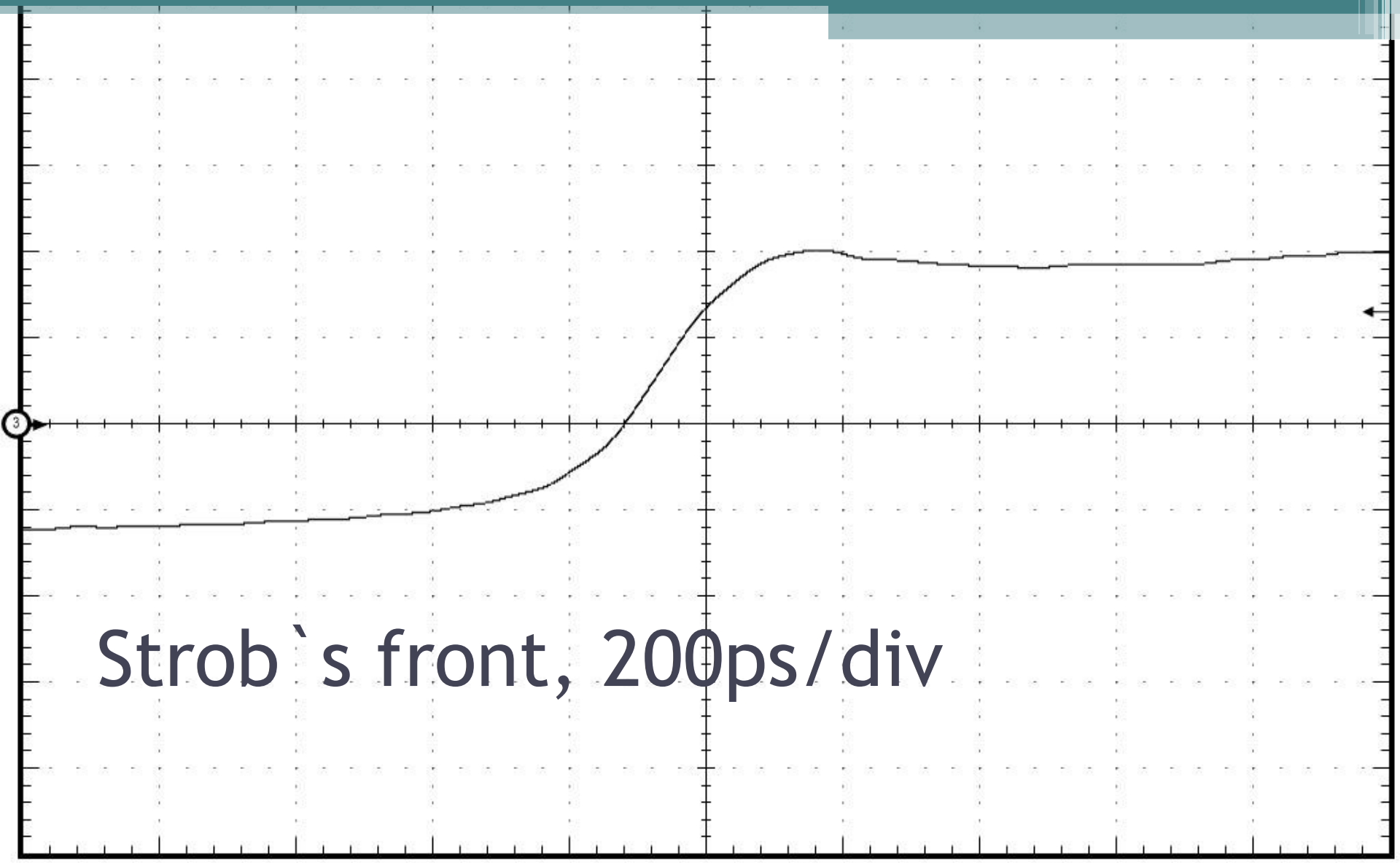
Positive SRD`s front, 4ns/div

Negative SRD`s front, 400ps/div

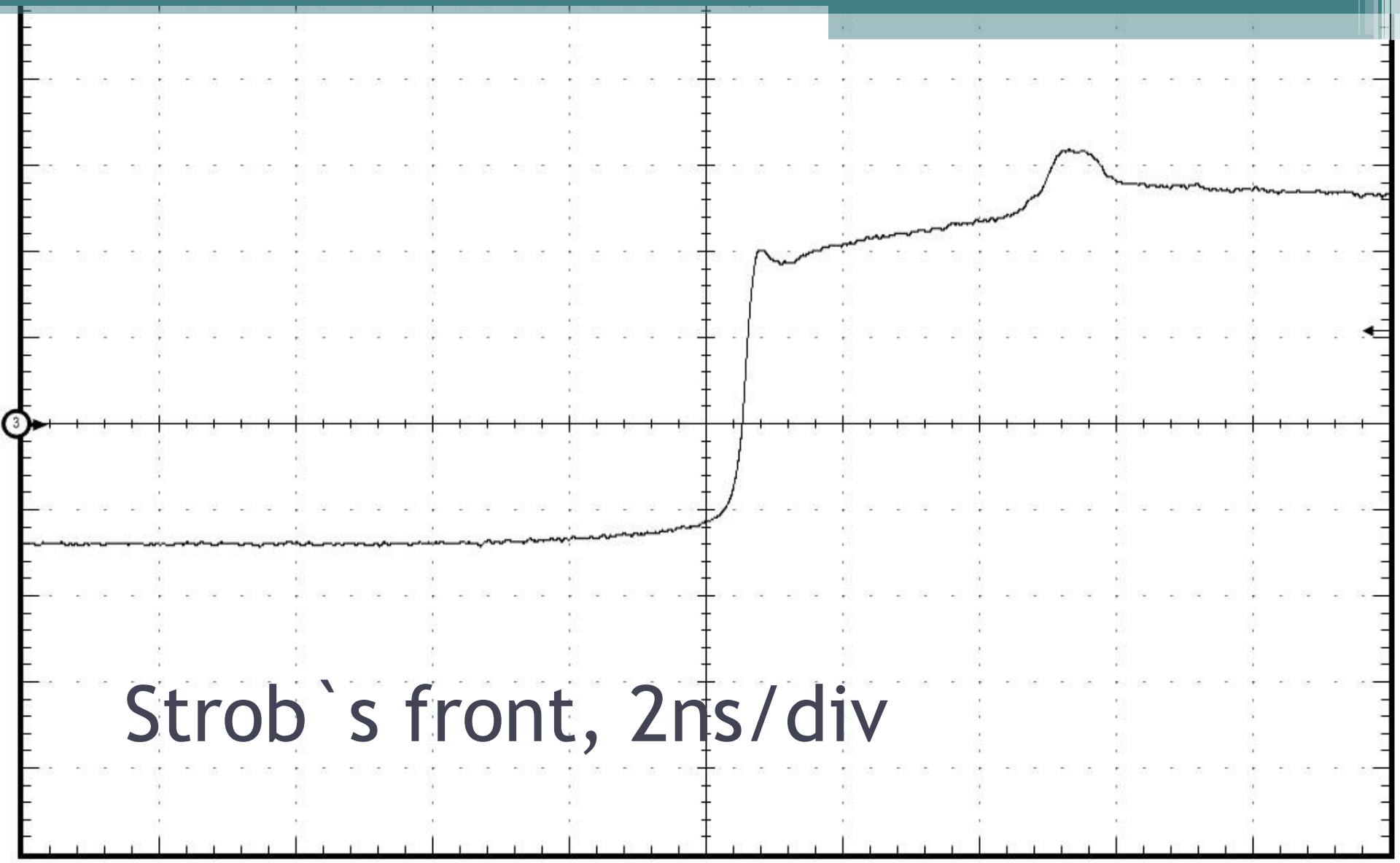


Negative SRD`s front, 4ns/div





Strob`s front, 200ps/div



Strob`s front, 2ns/div