Speed of EMW on Cable

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For the course "**Communications**"

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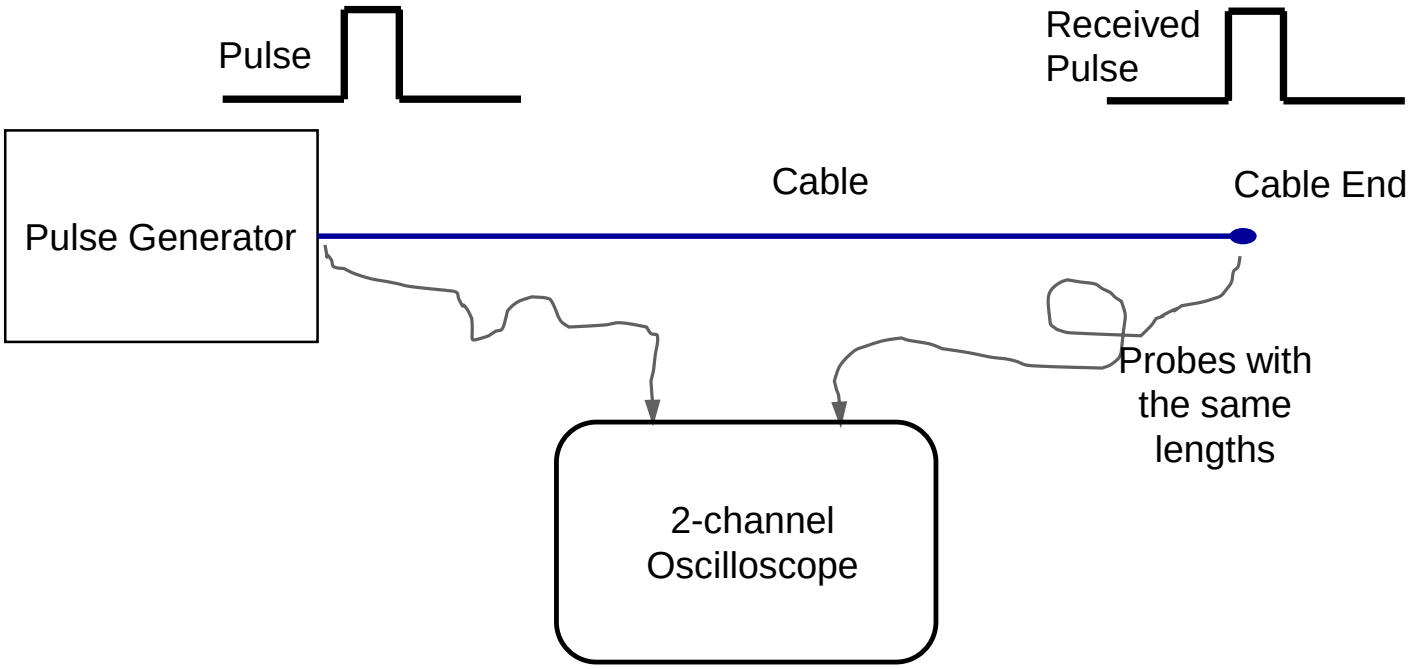
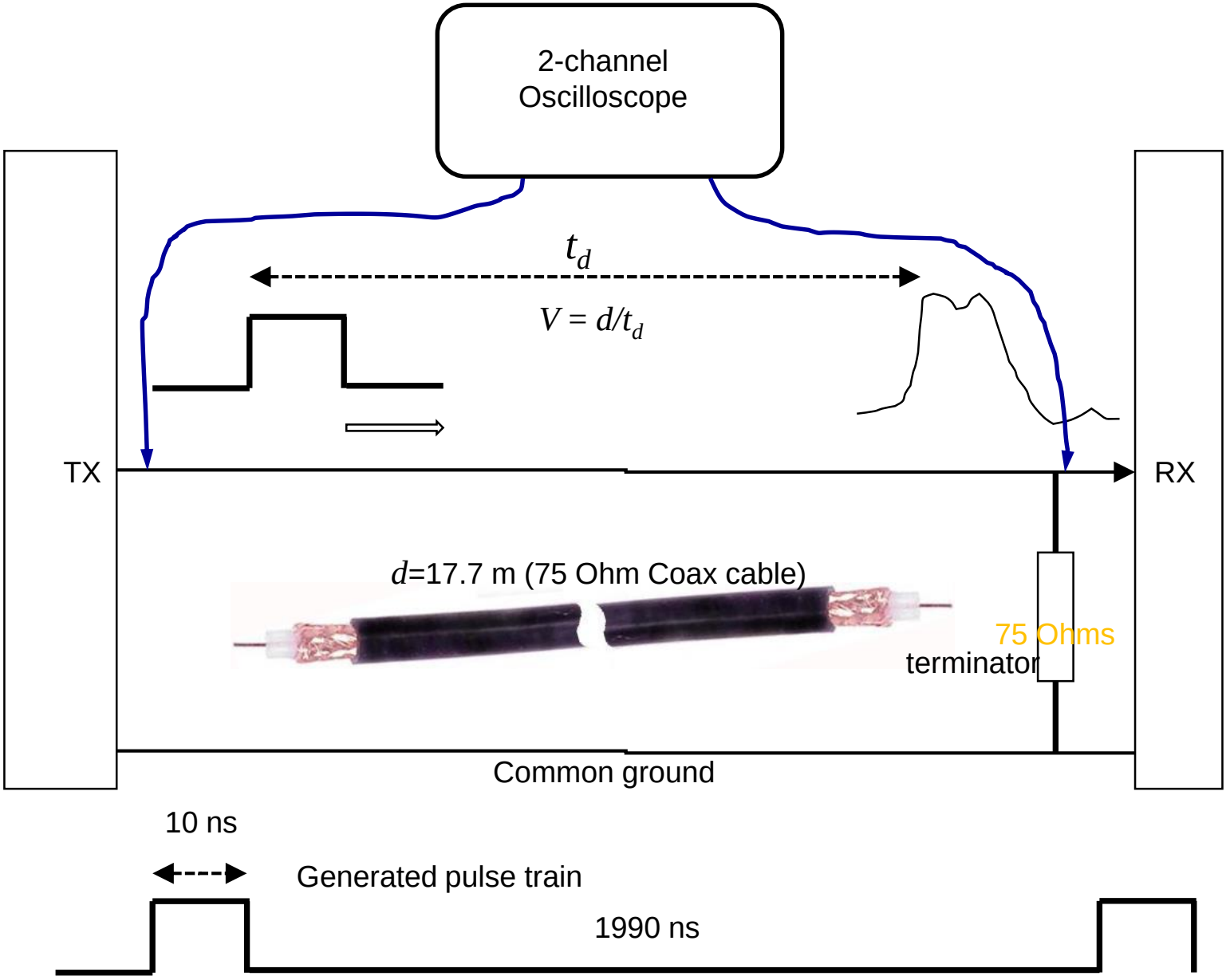
Finding out Speed of Electromagnetic Wave Travelling on Coax Cable

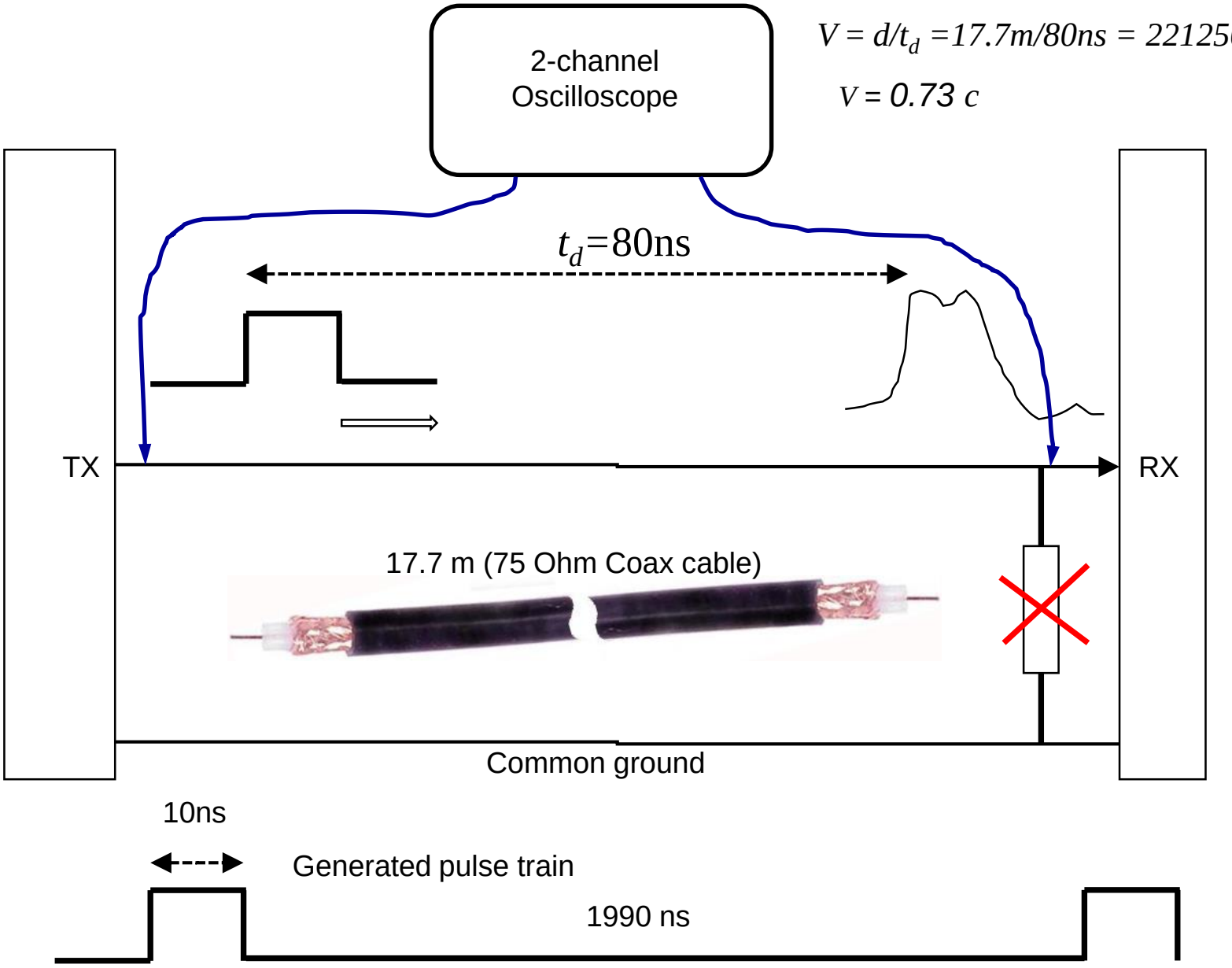
A Simple Demonstration

Why? : Just to be a reminder that receivers always receive a delayed signal

Setup : Send a pulse along the cable and see both sent and received signals.
Also see that the wave is reflected from impedance mismatches

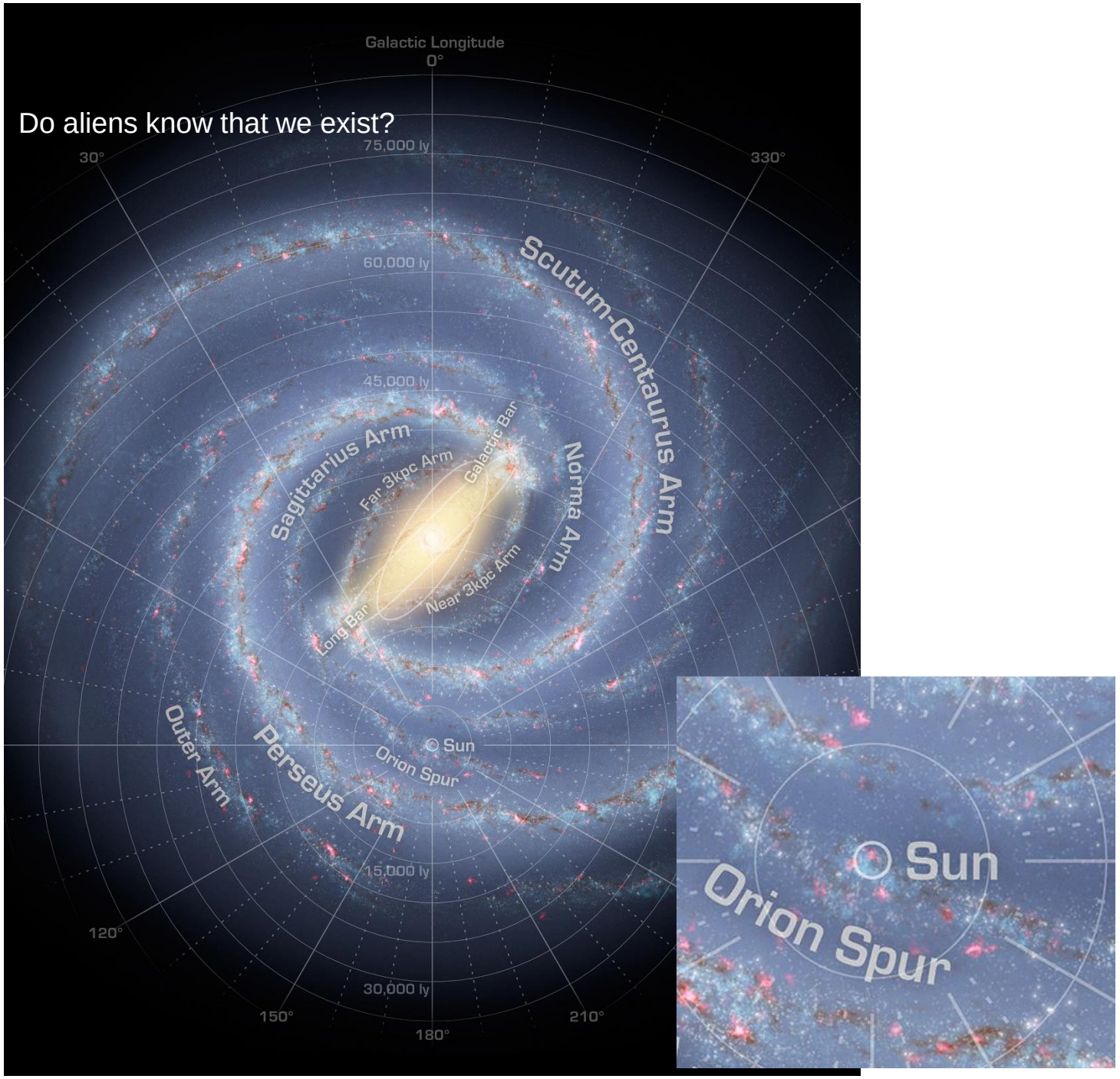



2-channel
Oscilloscope
t_d
$V = d/t_d$
TX
RX
d=17.7 m (75 Ohm Coax cable)
75 Ohms
terminator
Common ground
10 ns
Generated pulse train
1990 ns


2-channel
Oscilloscope
$V = d/t_d$ =17.7m/80ns = 221250 km/s
V = 0.73 c
t_d=80ns
TX
RX
17.7 m (75 Ohm Coax cable)
Common ground
10ns
Generated pulse train
1990 ns

Corollary

Do aliens know that we exist?



How Long?

How long does it take to receive a cable signal from Istanbul?

Distance = 200 km (approx.)

Speed = 221250 km/s

Time = 200 km/221250 km/s = 900 μs

How long does it take to travel a pulse to the other end of a chip ?

Distance = 1 cm (approx.)

Speed = 221250 km/s

Time = 1 cm/221250 km/s ≈ 0.45 ns

Result: With approx 10 GHz rectangular pulses (clock signal) we would receive the opposite duty cycle of the clock on the other hand of the chip (provided that there are no other delays).

END