ndt
a worldwide response

Introduction to Ultrasonic Testing SD 218

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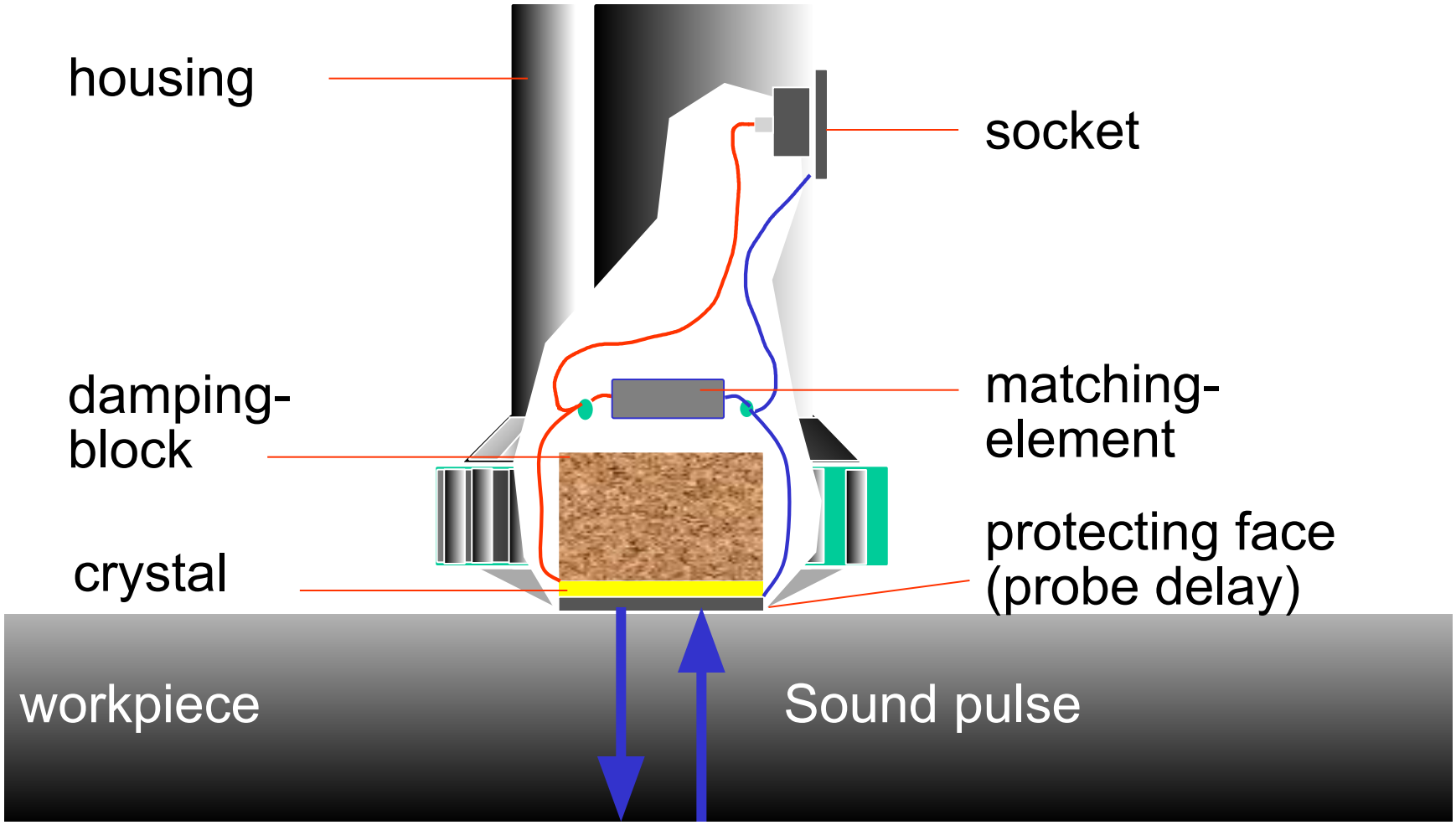
Agfa NDT GmbH, Hürth, Germany
1994 - 2002

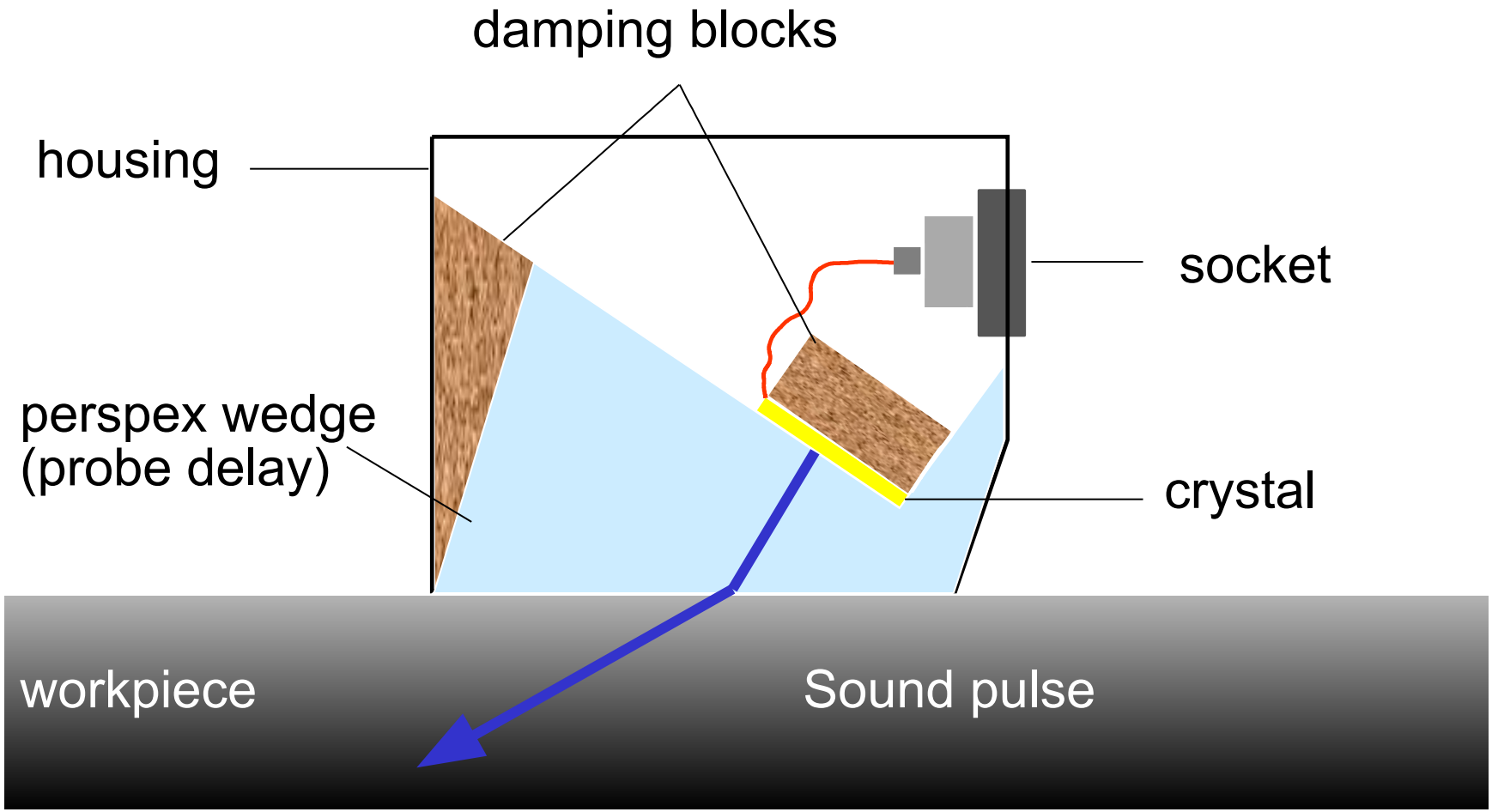
Krautkramer NDT Ultrasonic Systems

AGFA

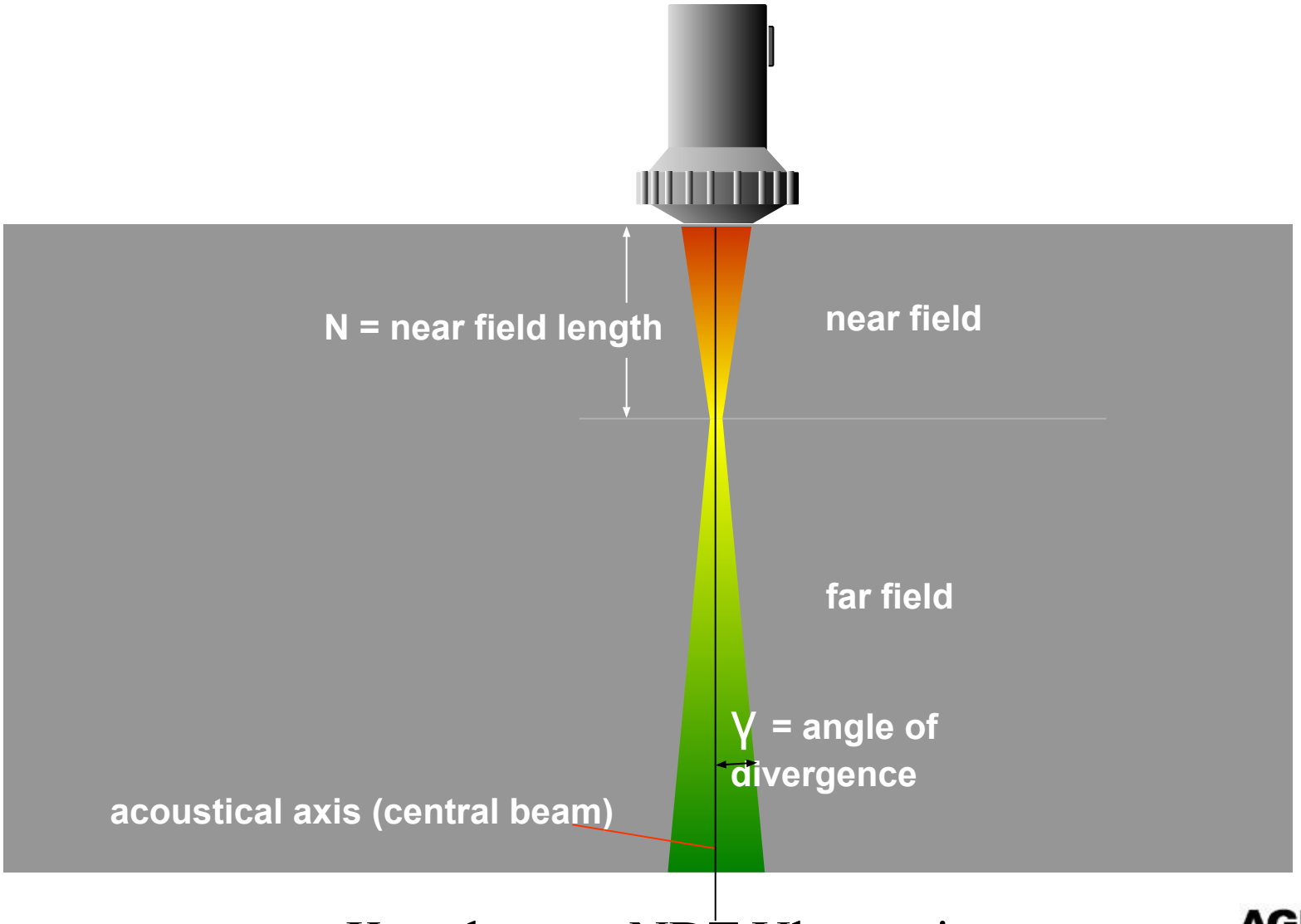
Straight beam probe



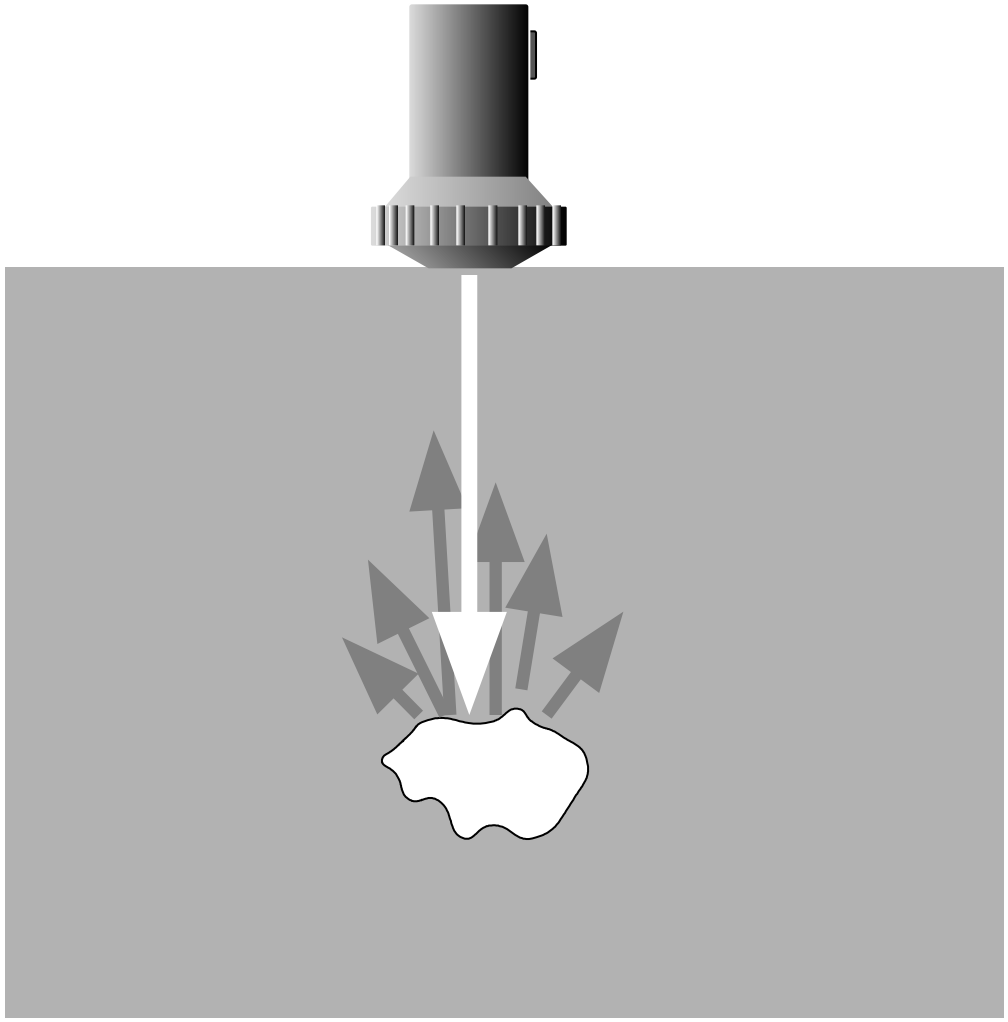
Angle beam probe



Sound field


N = near field length
near field
far field
γ = angle of divergence
acoustical axis (central beam)

Flaw detection



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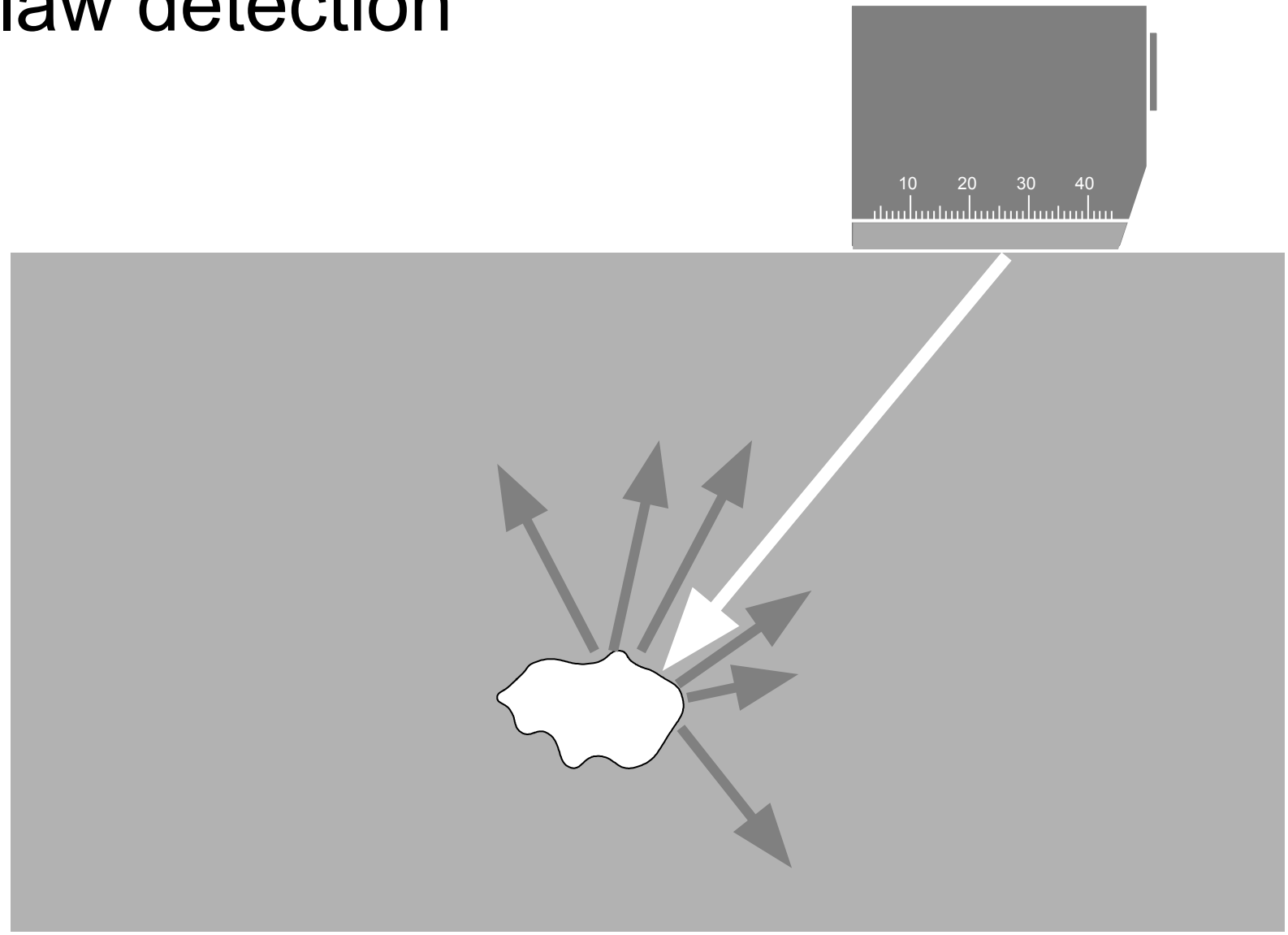
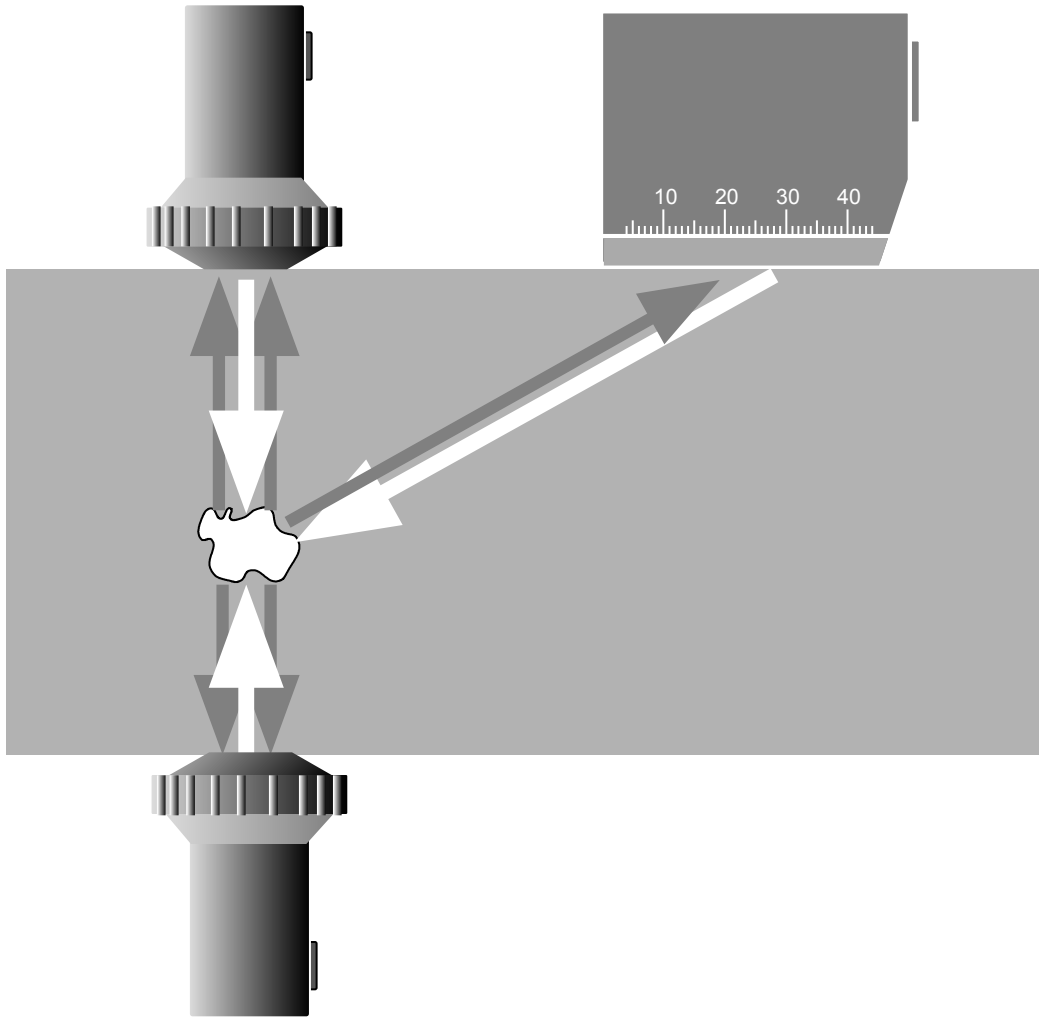
Flaw detection



Flaw detection



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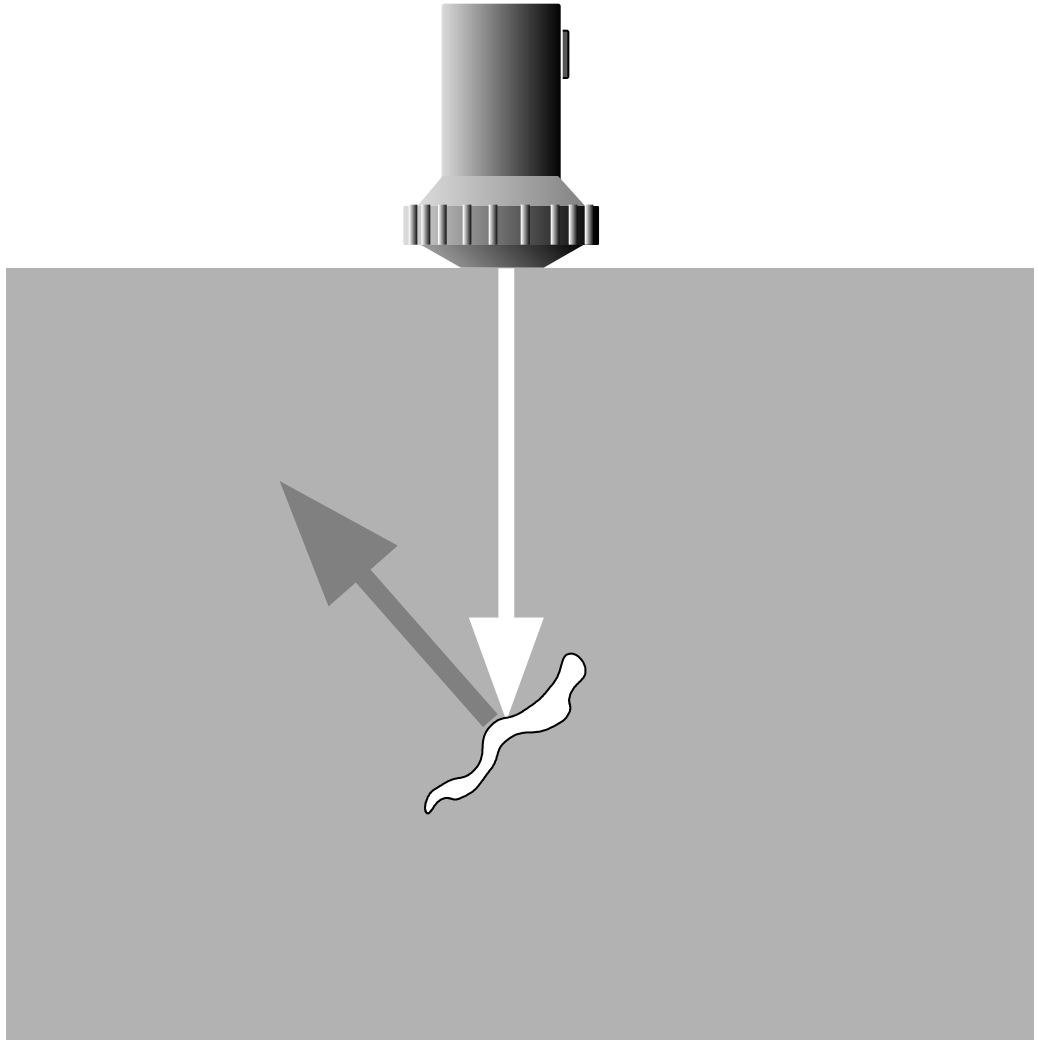
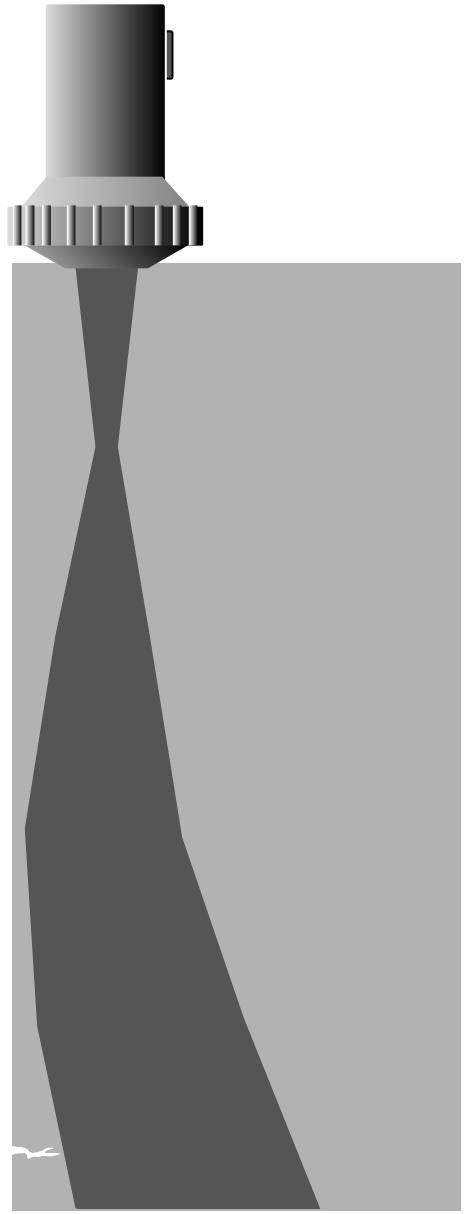
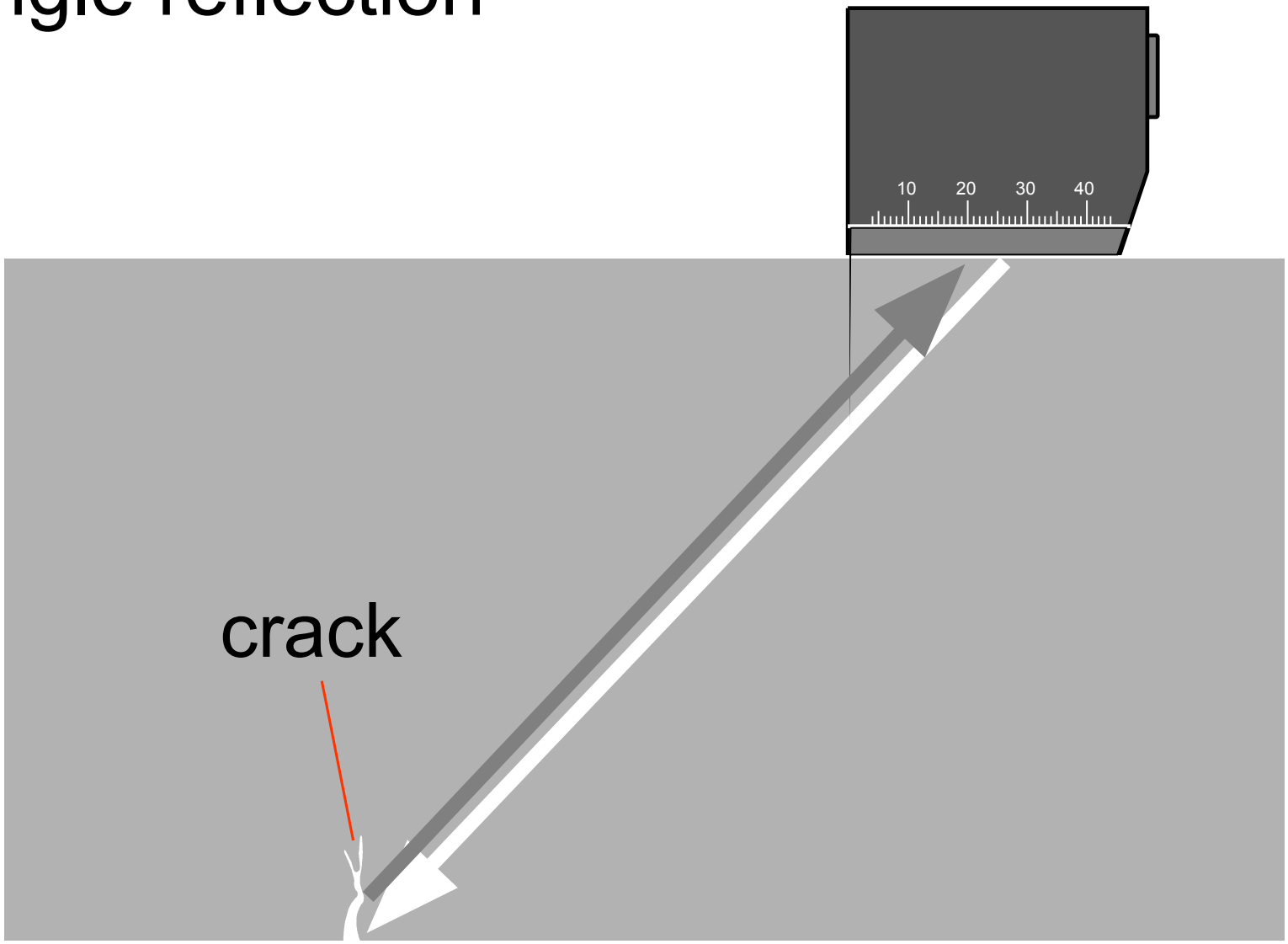
Bad flaw orientation



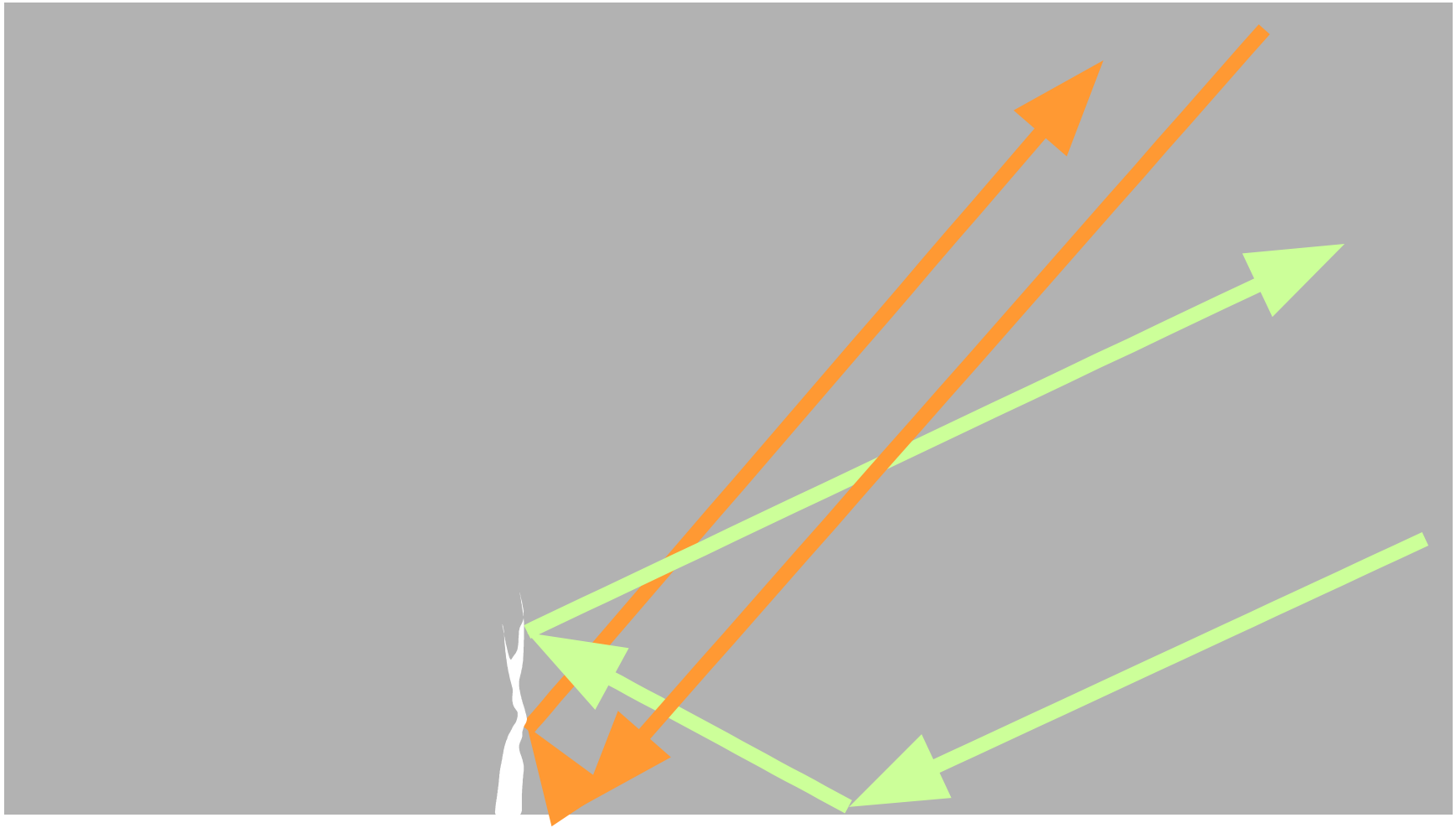
Improper flaw location



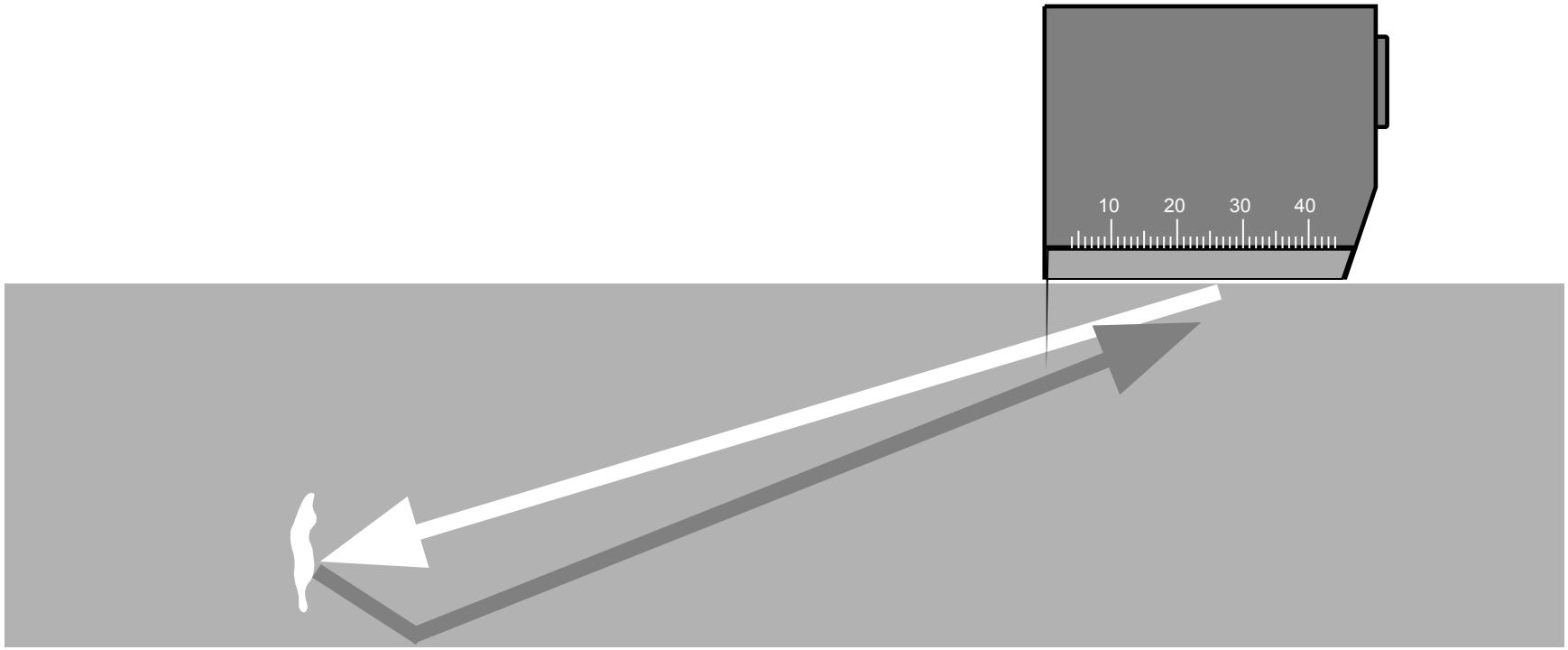
Angle reflection



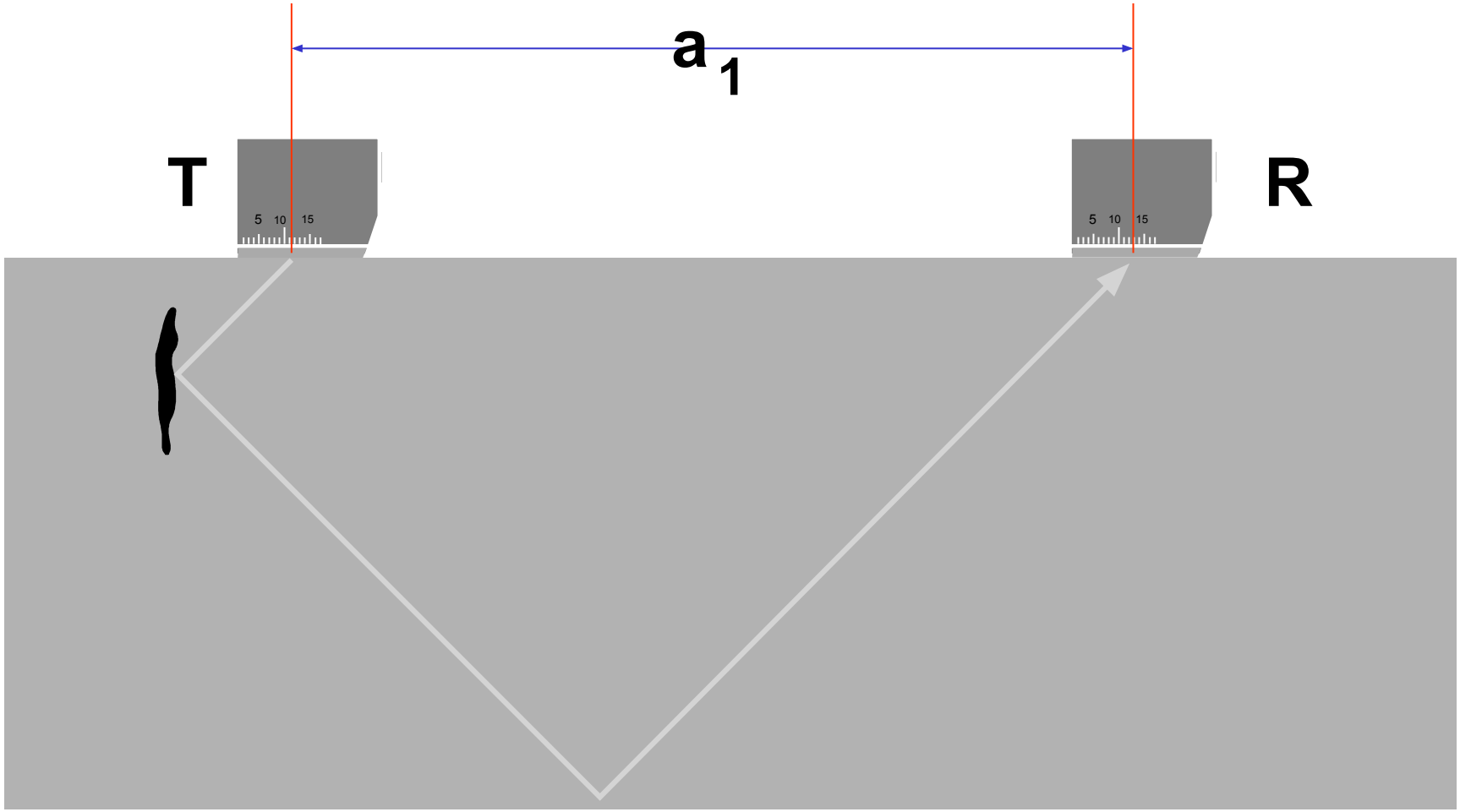
Angle reflection



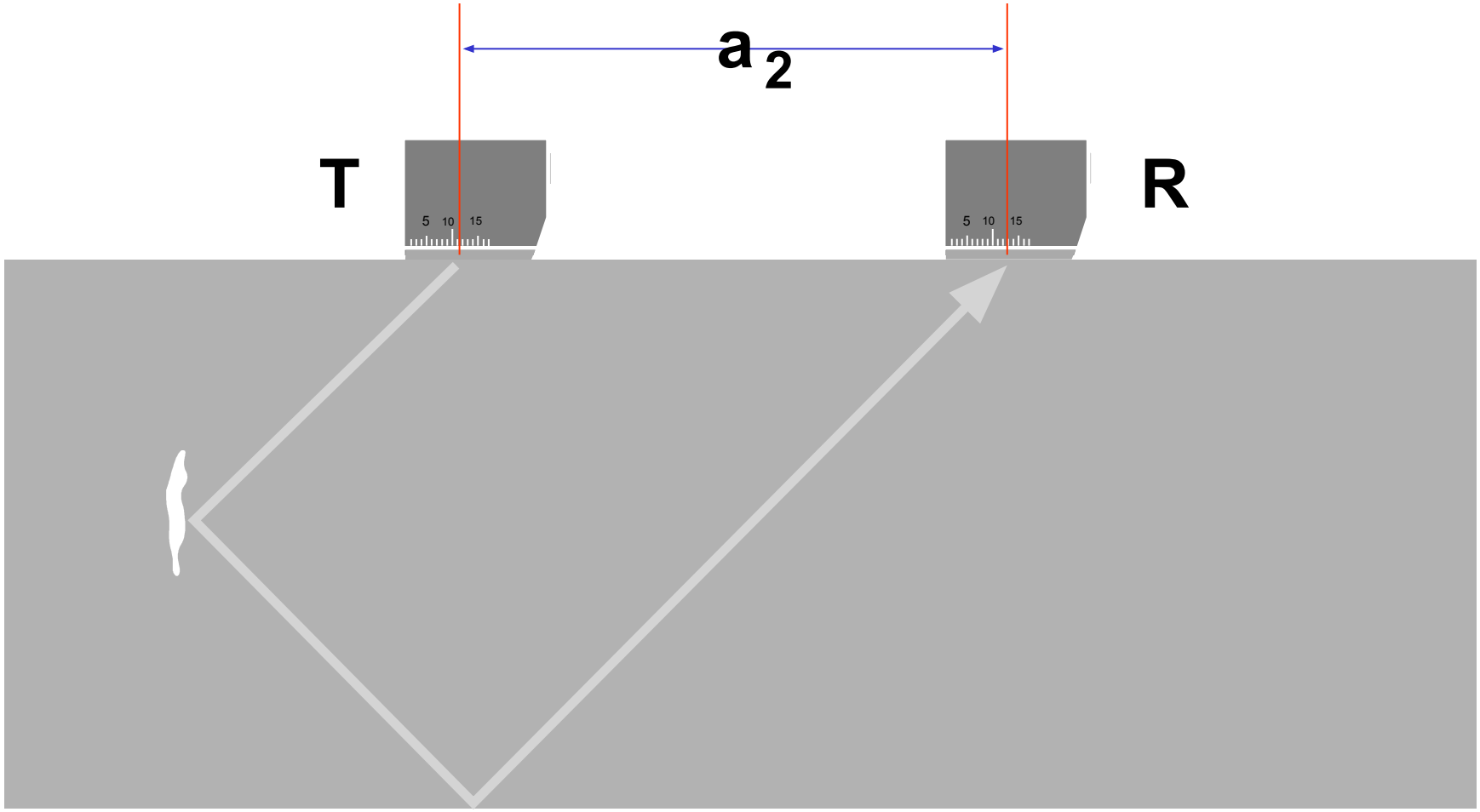
Vertical, near surface flaw



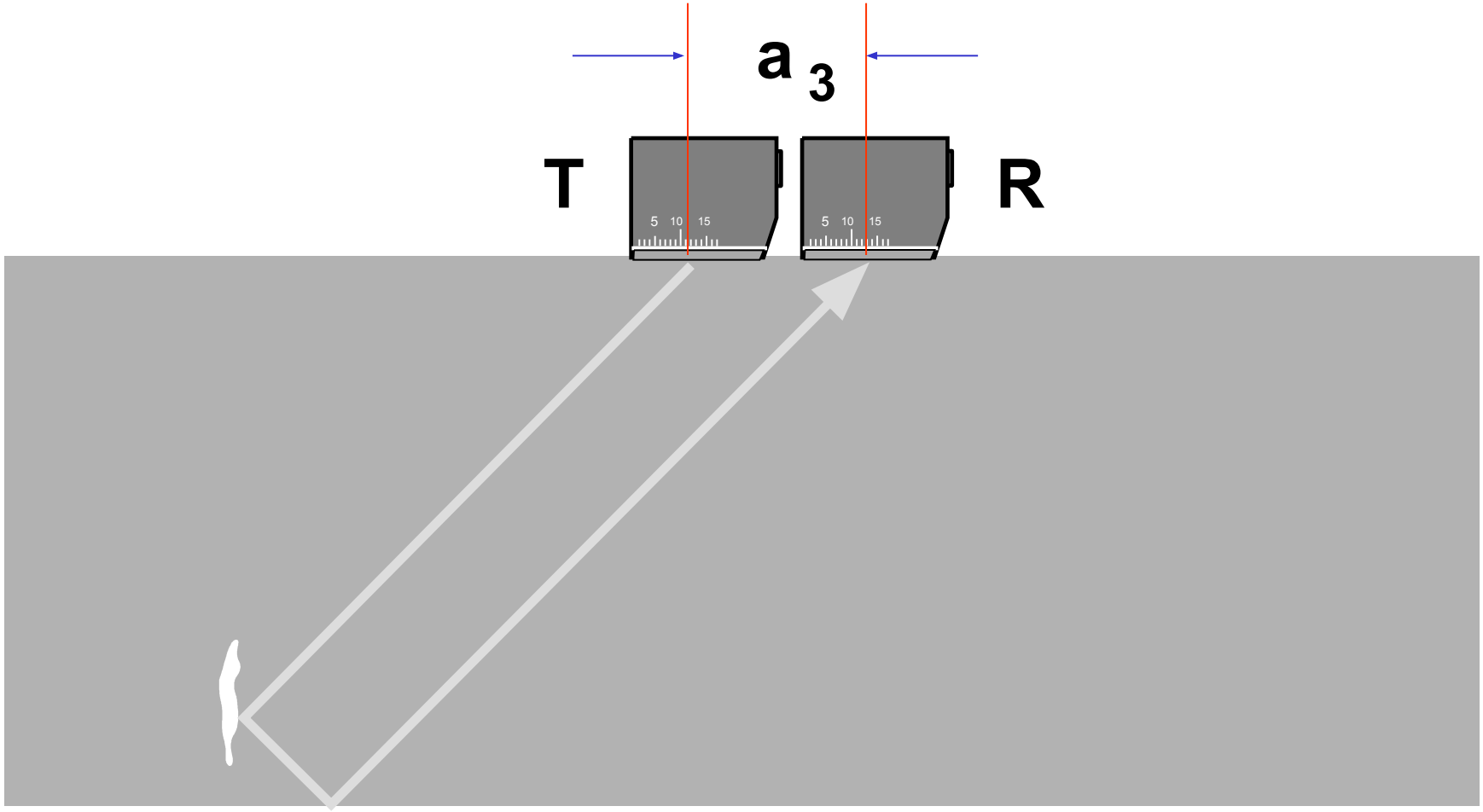
Tandem technique (top)



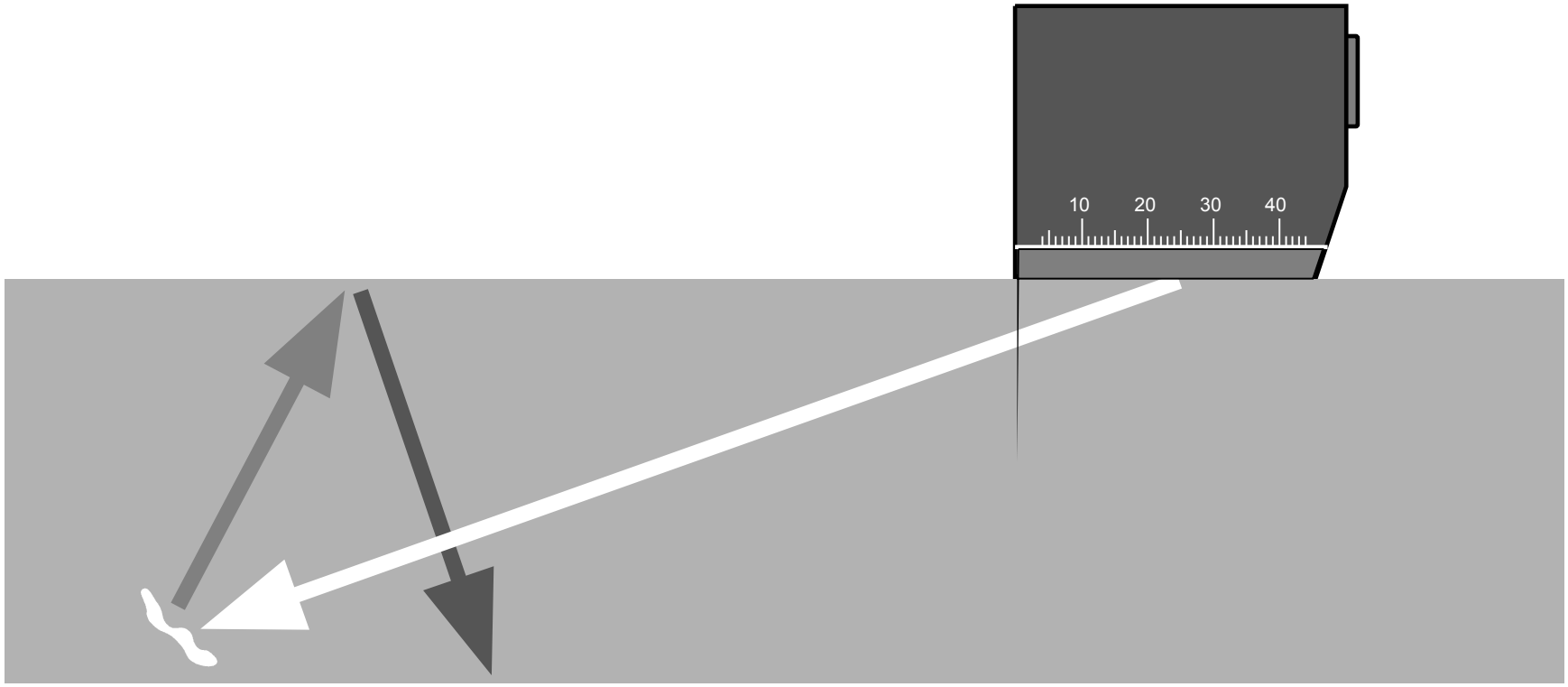
Tandem technique (middle)



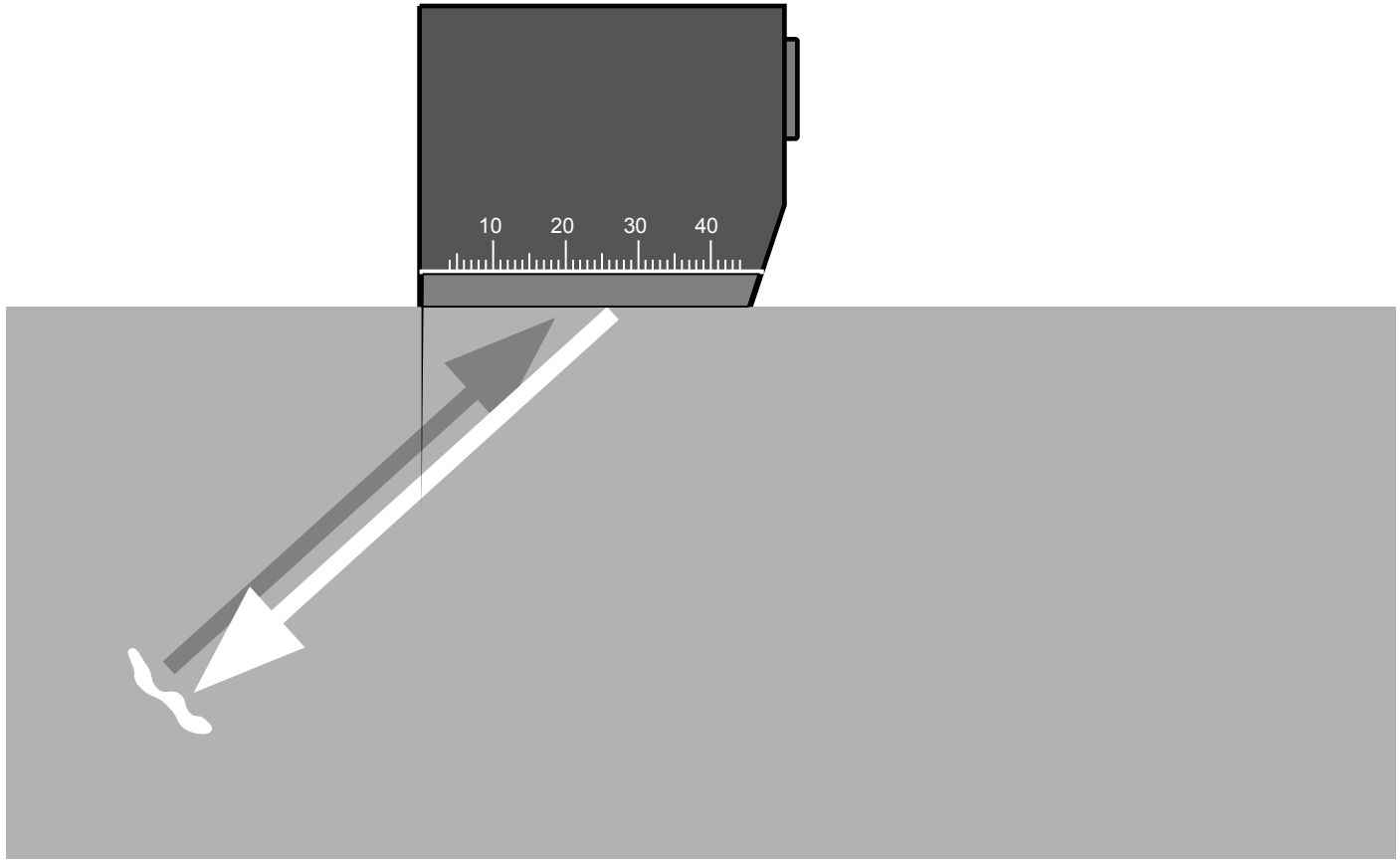
Tandem technique (bottom)



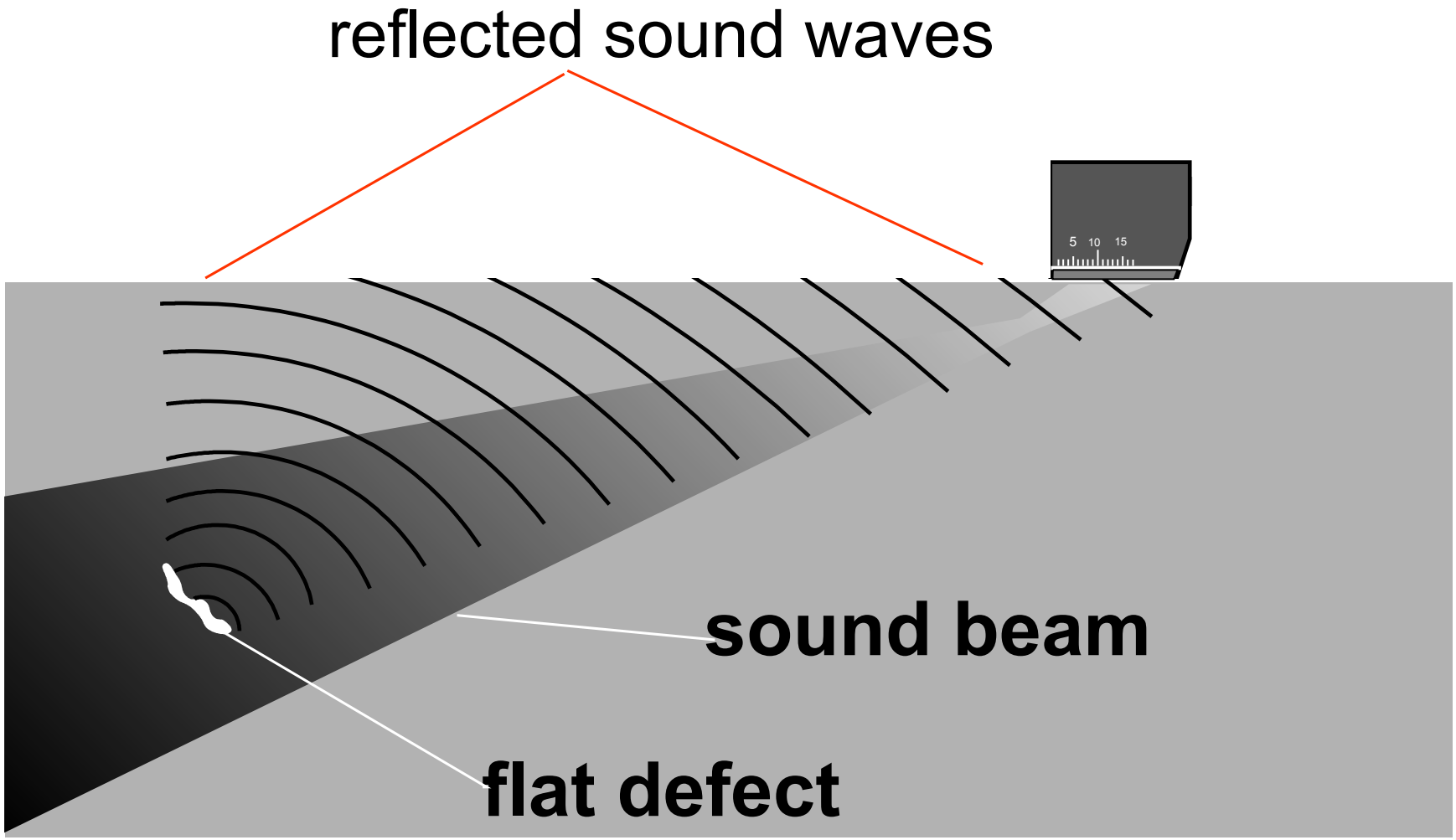
Improper flaw orientation



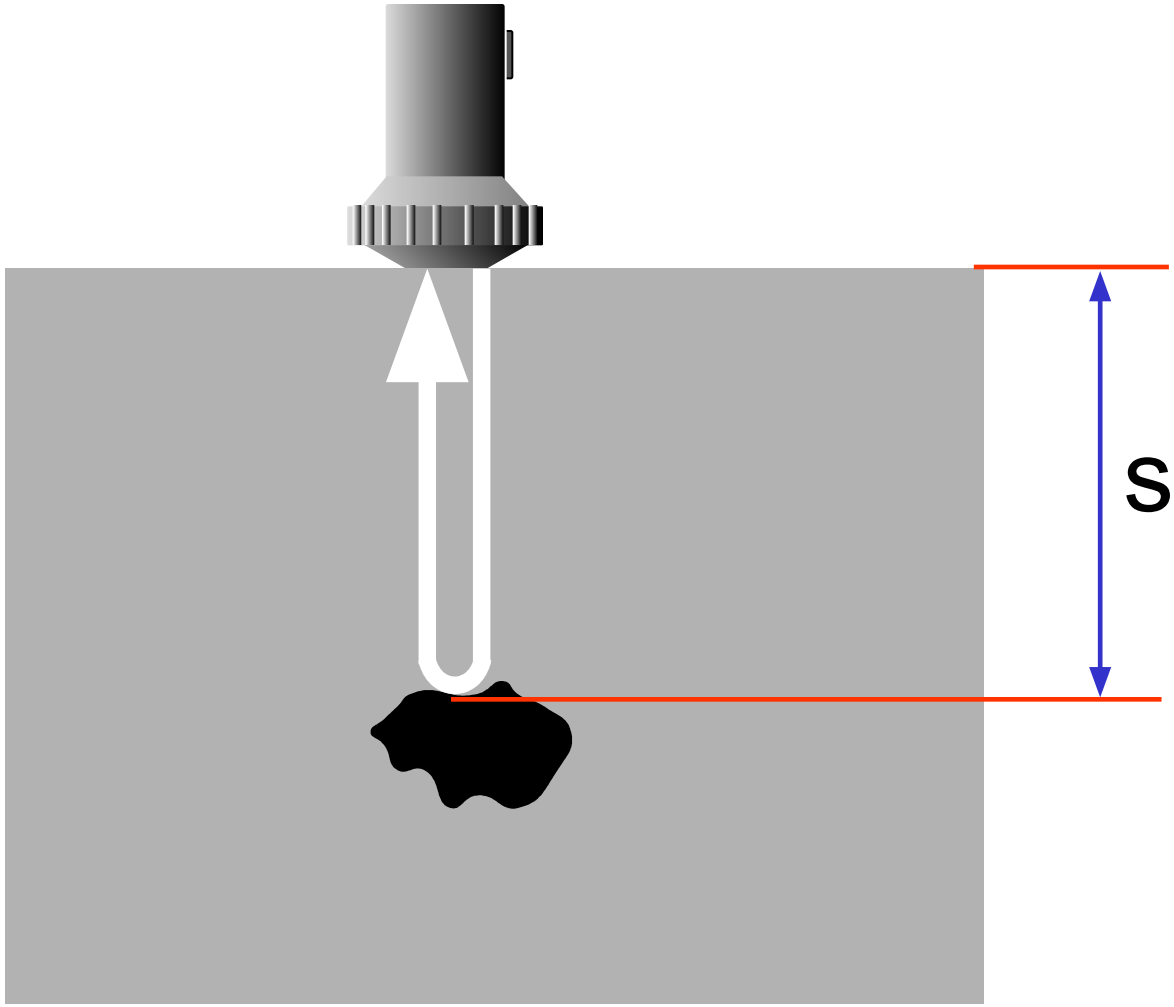
Perfect flaw orientation



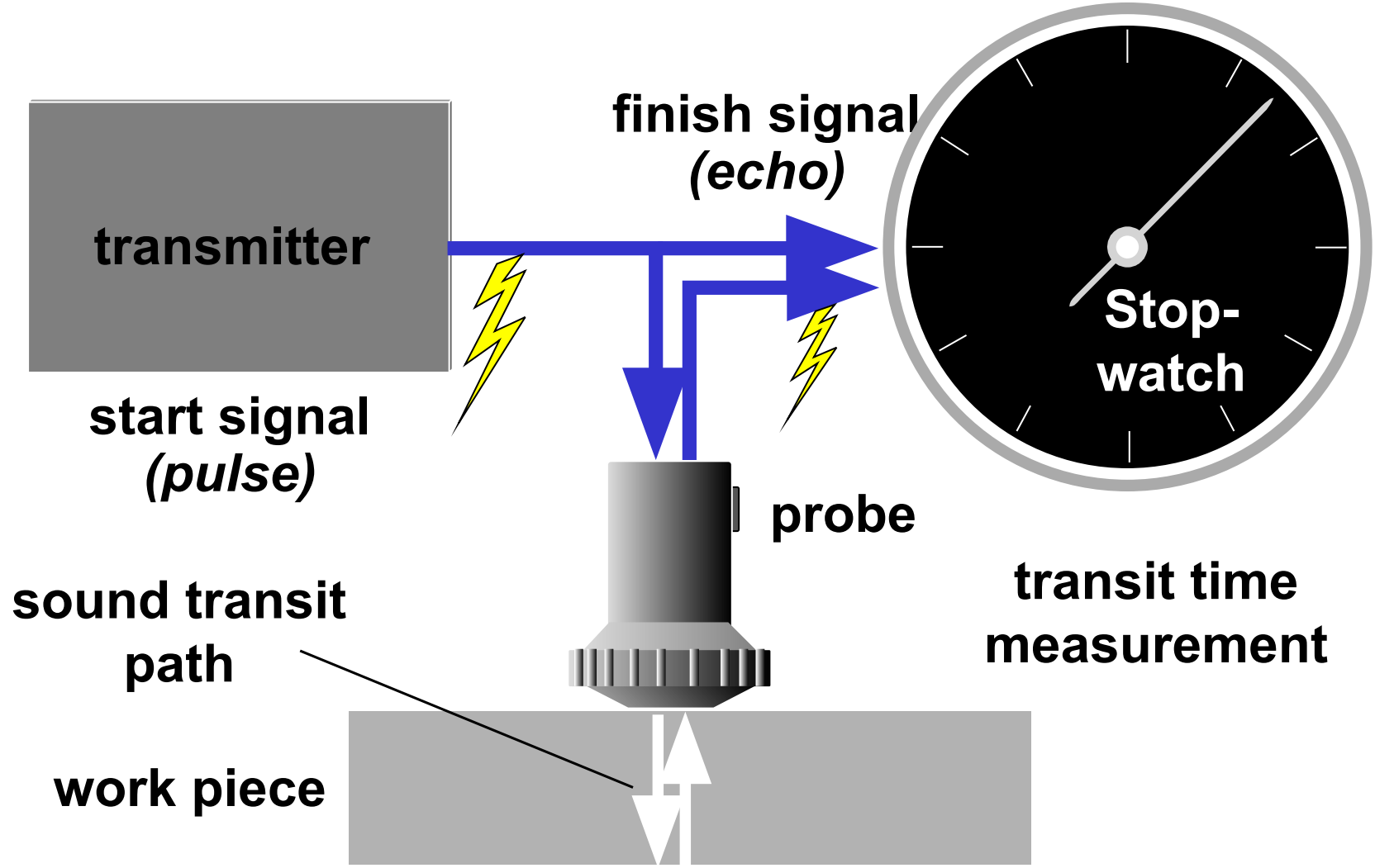
Flaw detectability with improper flaw orientation



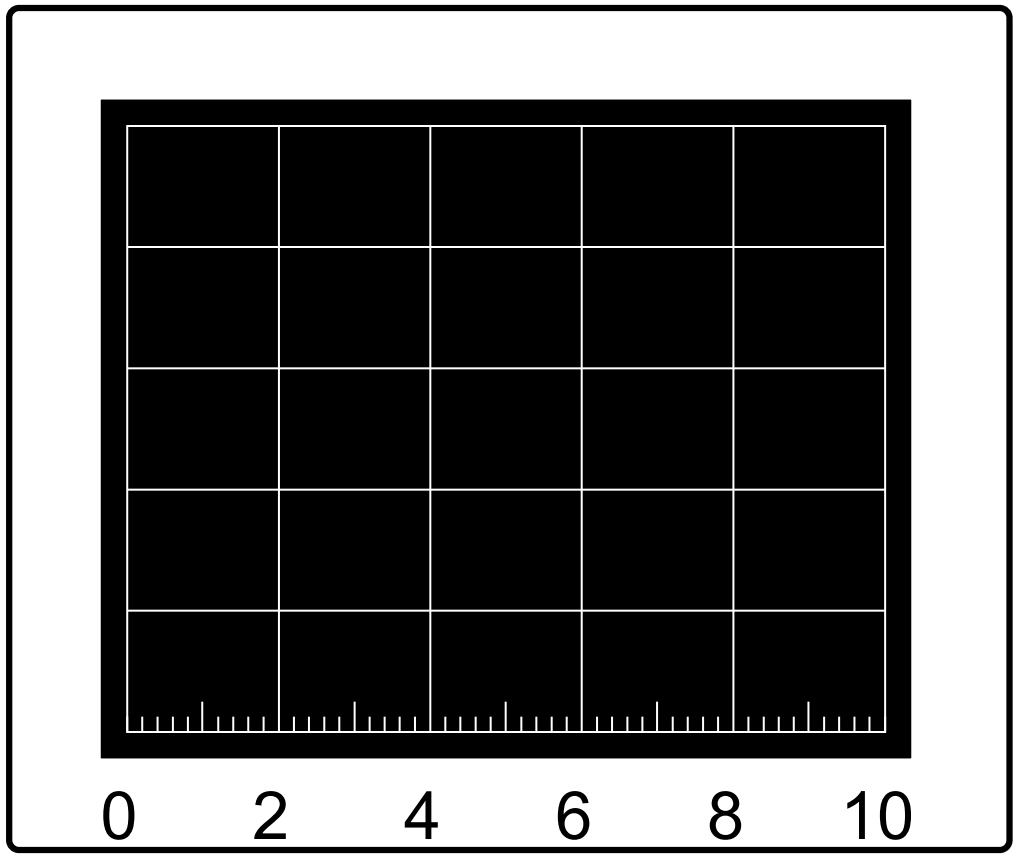
Flaw distance



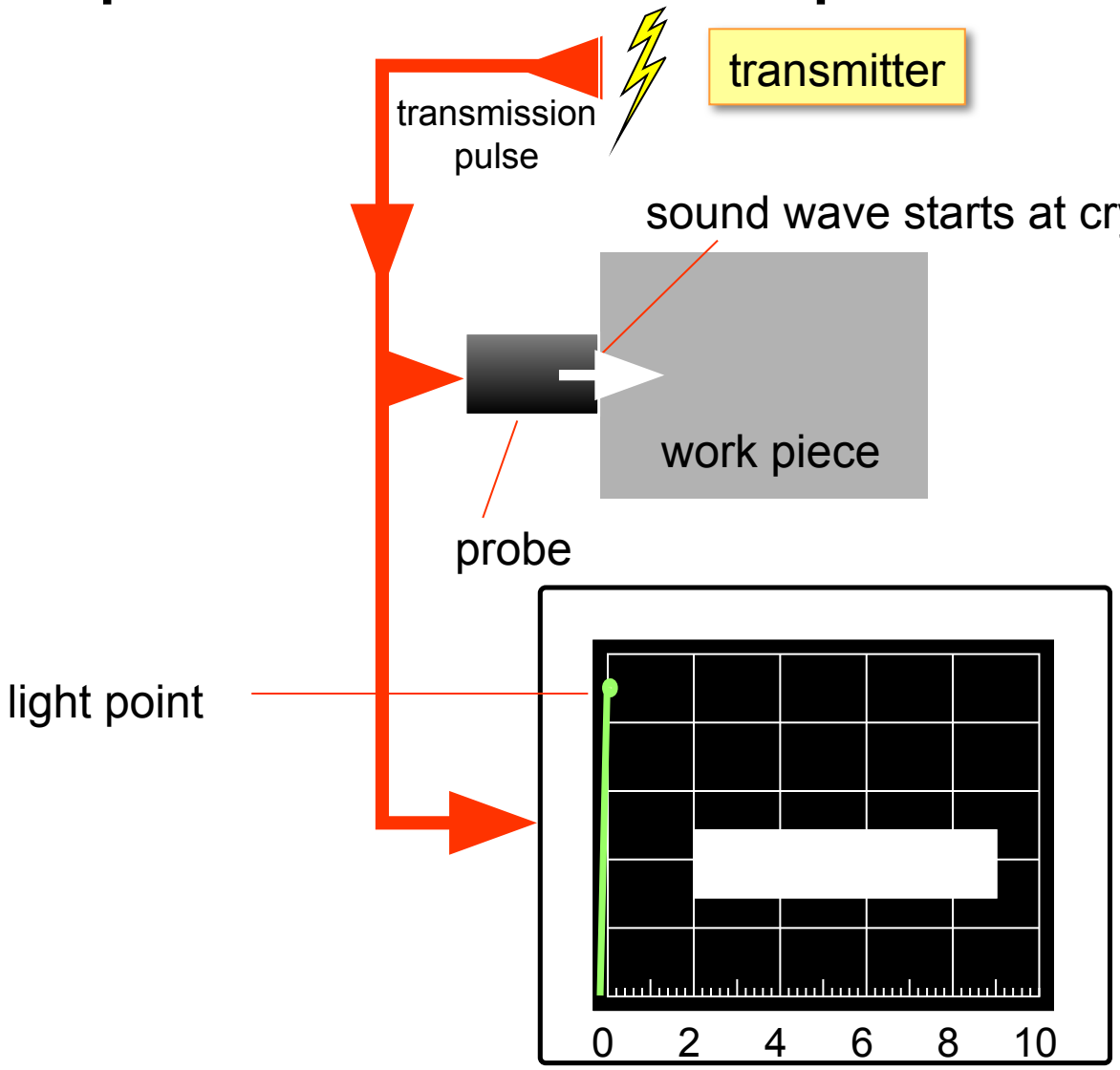
Principle of transit time measurement



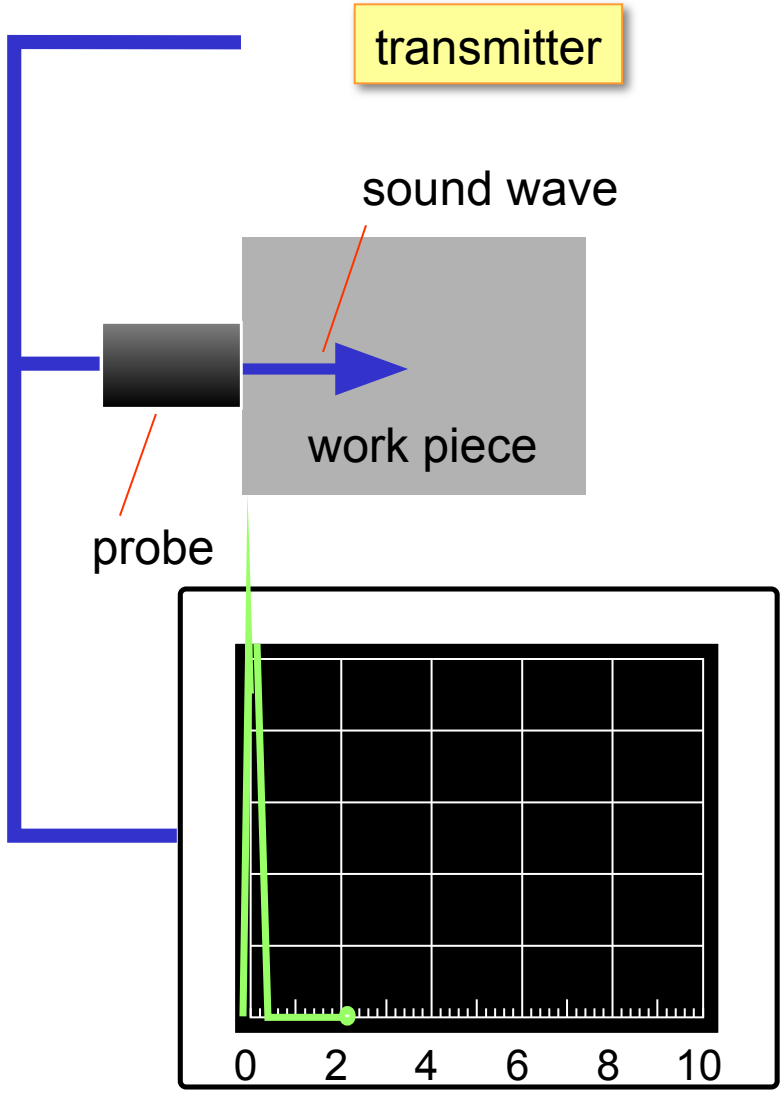
CRT / A-scan display



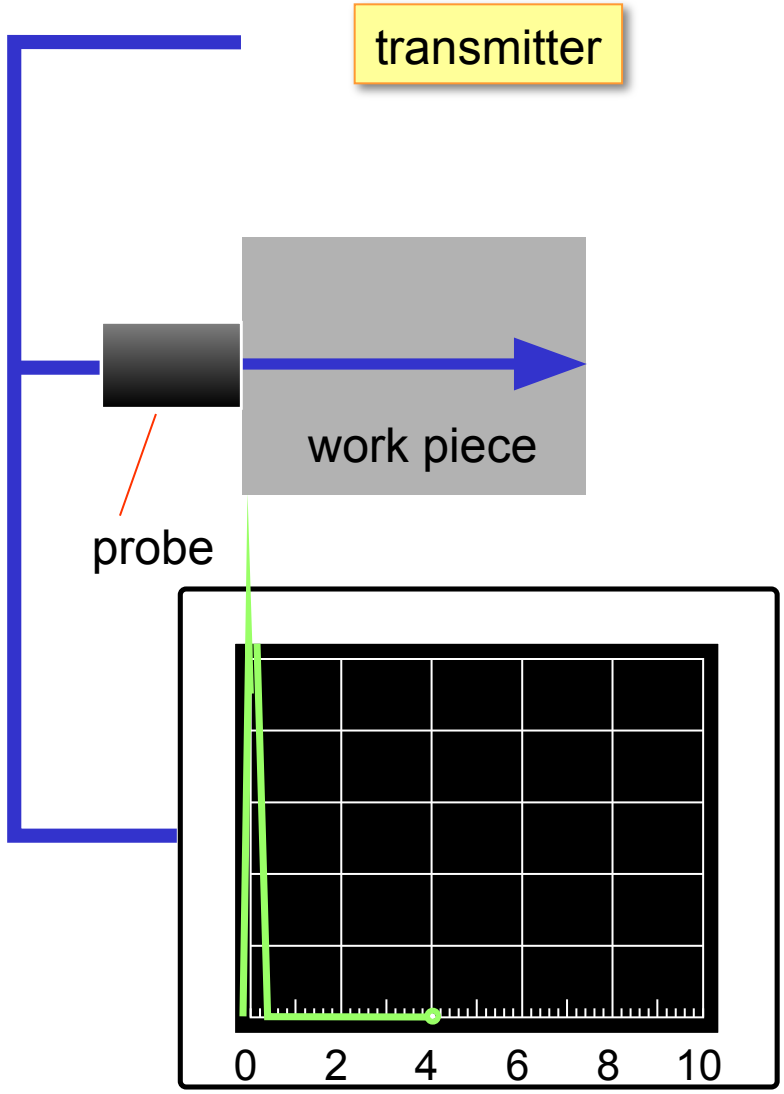
Priciple, transmission pulse



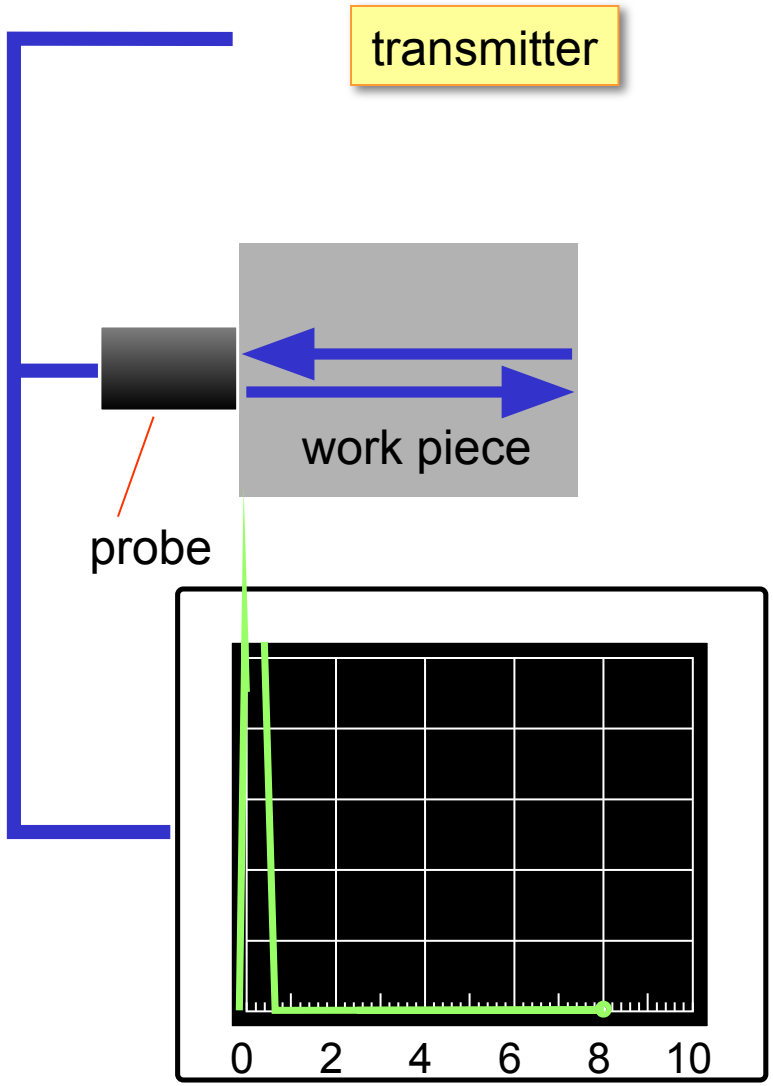
Priciple, sound wave in the workpiece



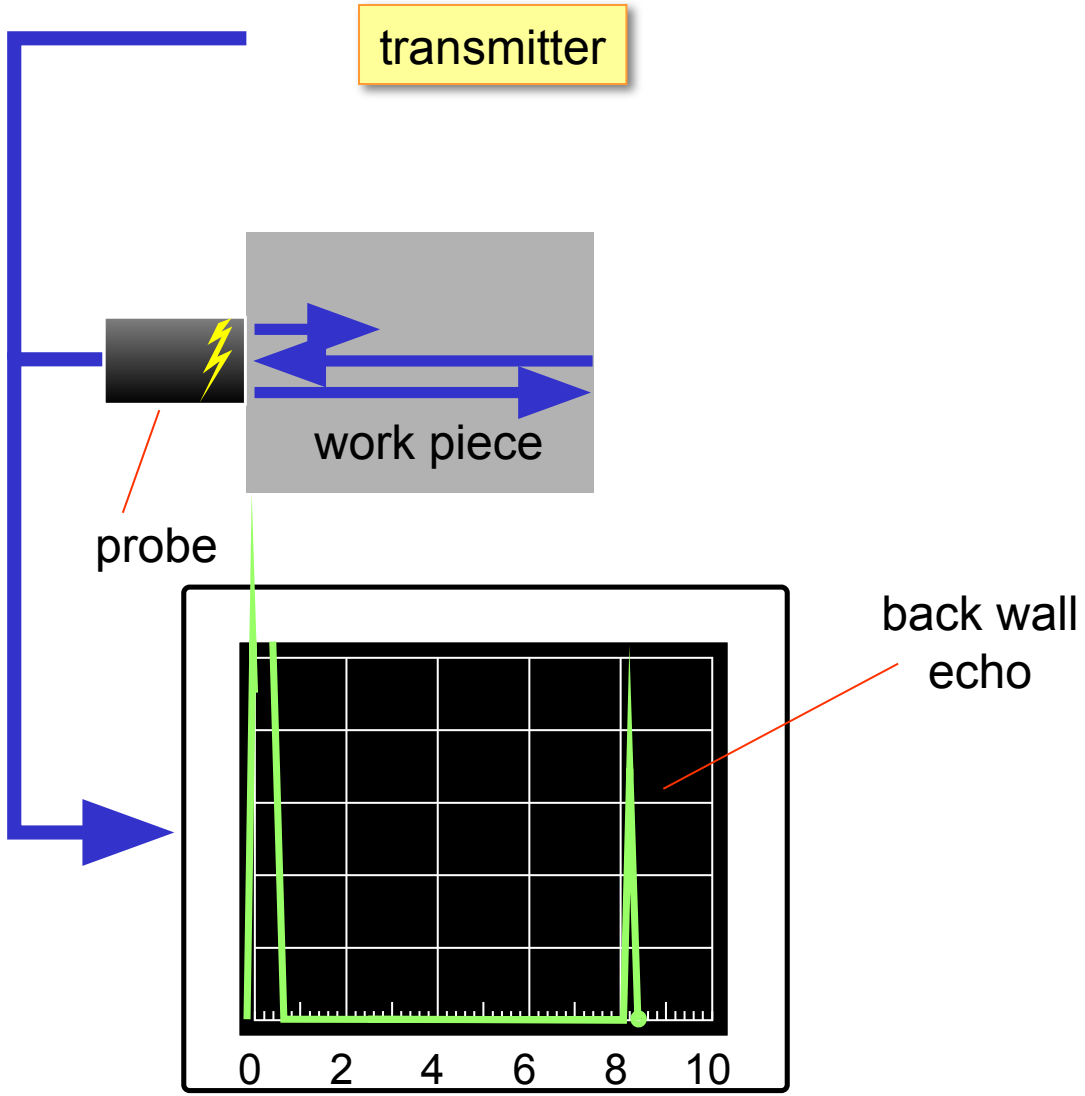
Priciple, sound pulse at the back wall



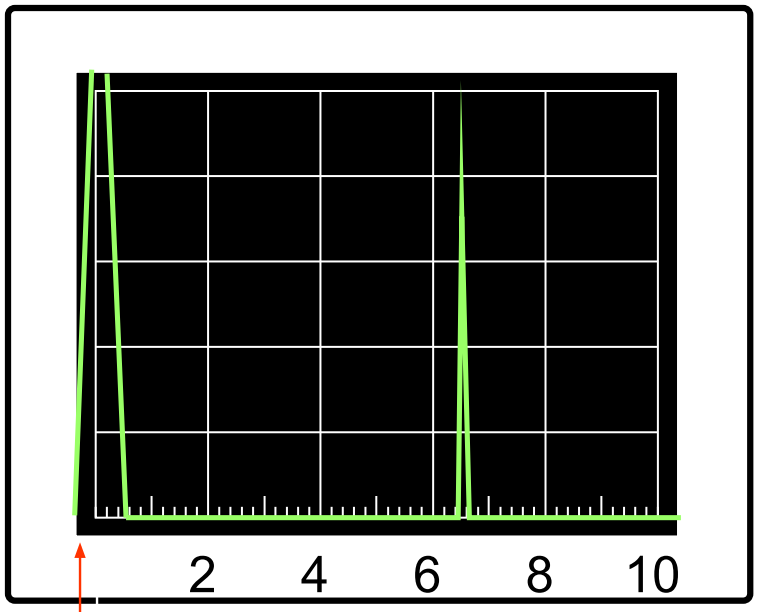
Priciple, sound pulse at the coupling surface

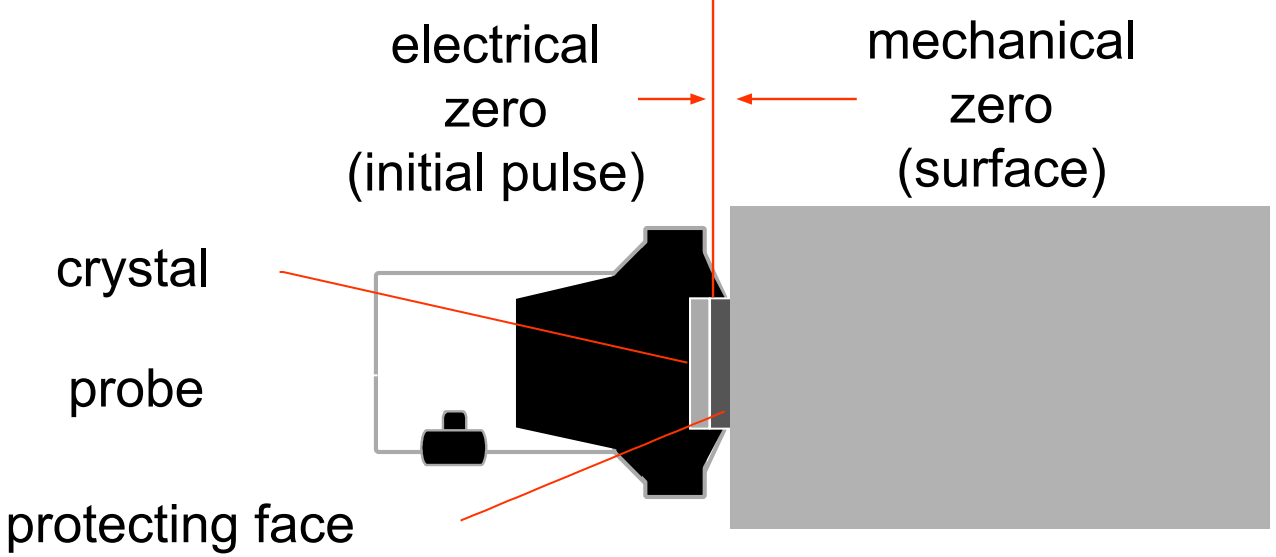


Priciple, echo display and 2nd run

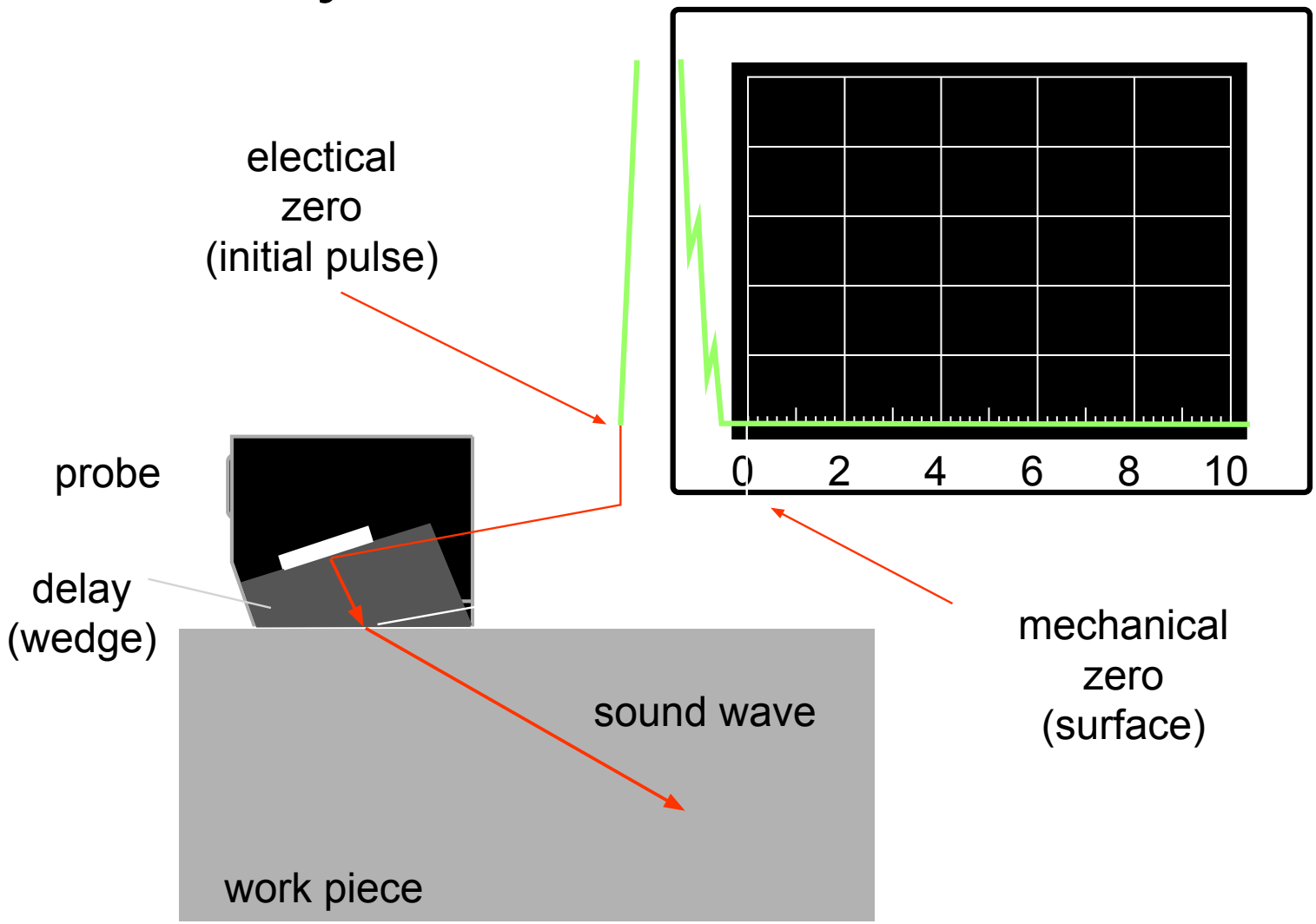


Probe delay

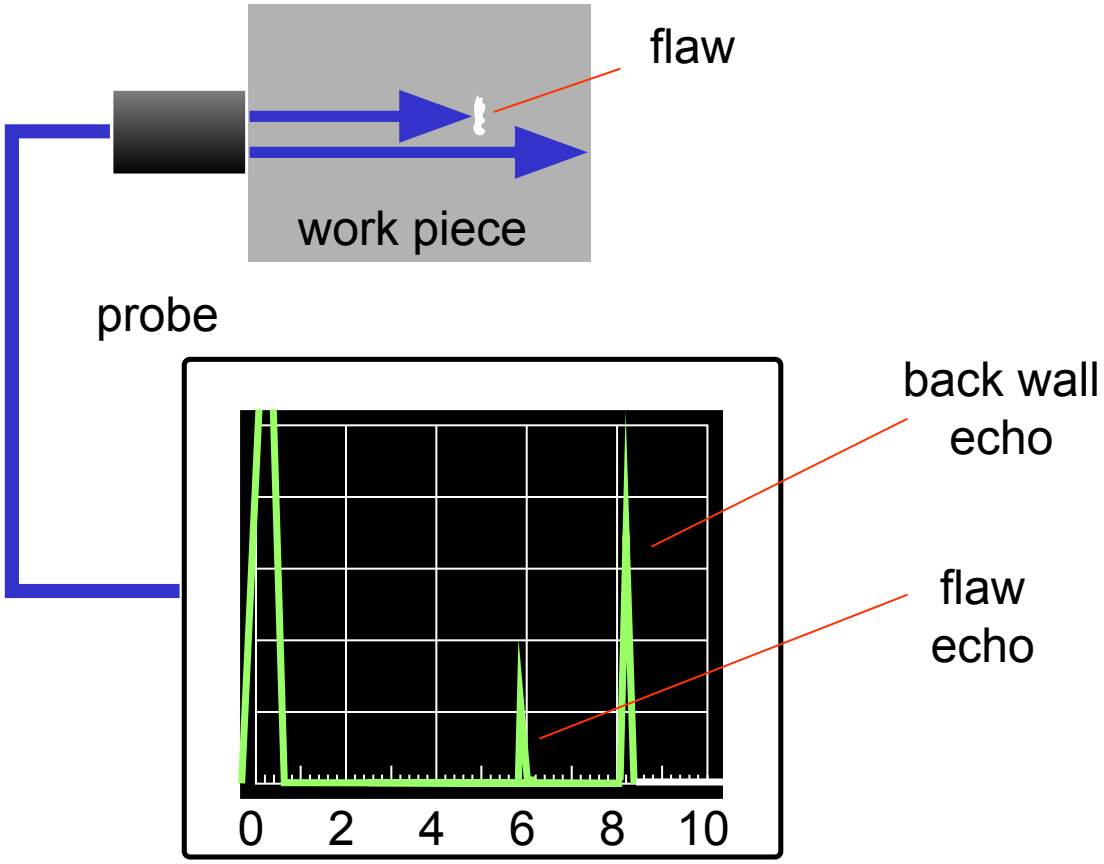

2
4
6
8
10


electrical
zero
(initial pulse)
mechanical
zero
(surface)
crystal
probe
protecting face

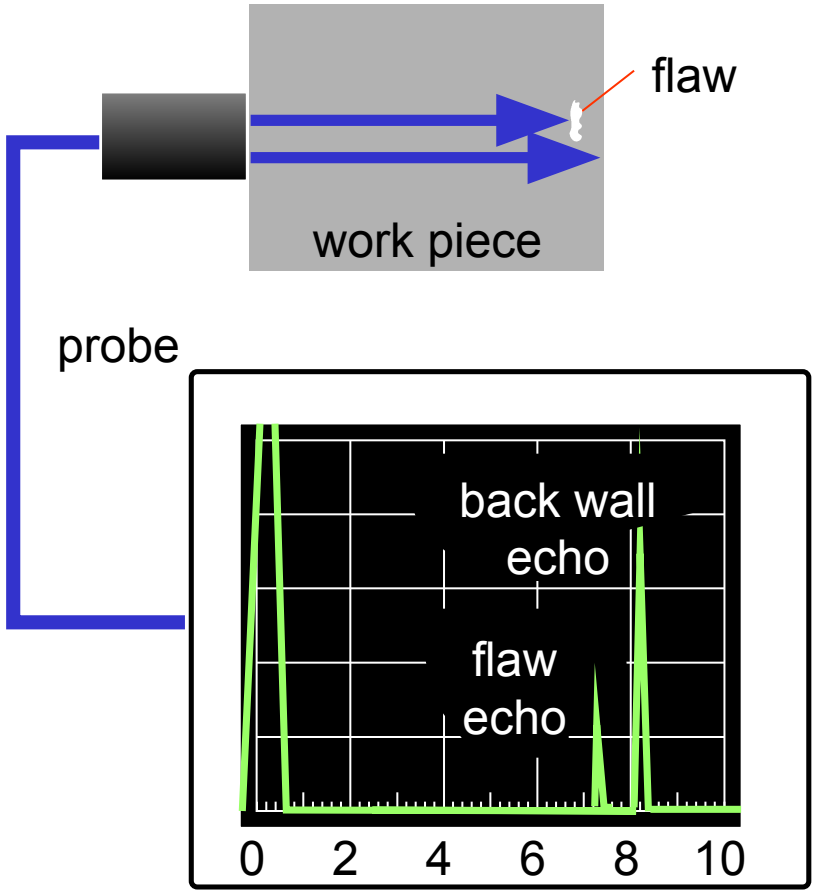
Probe delay



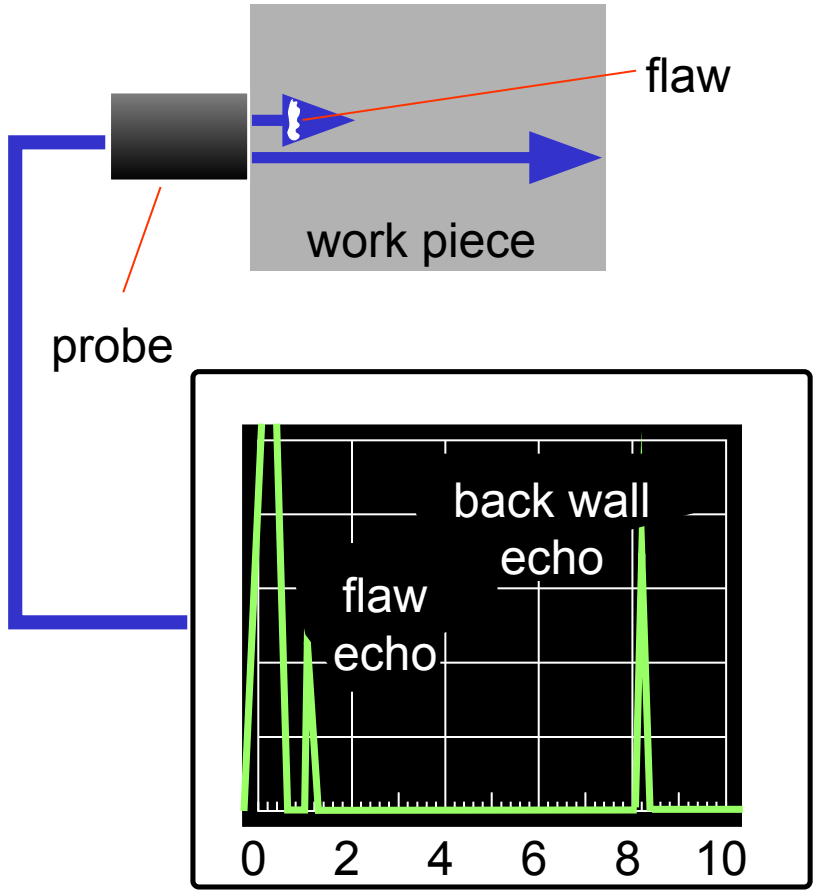
Flaw location and echo display



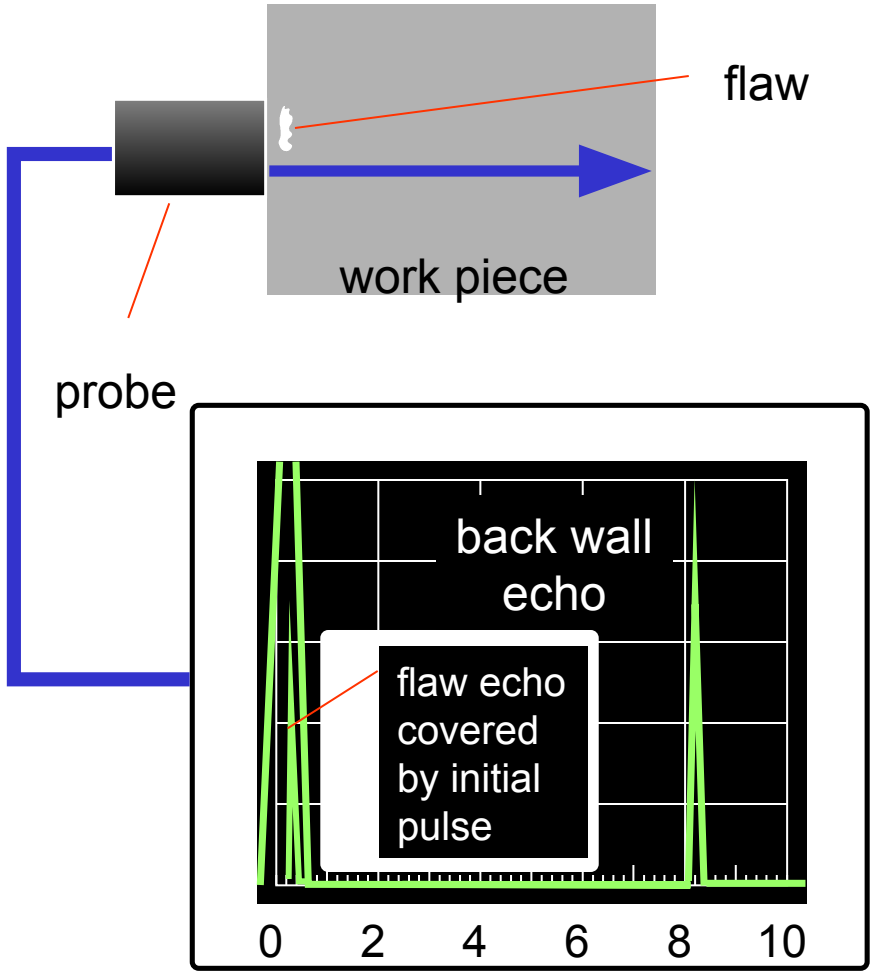
Flaw location and echo display



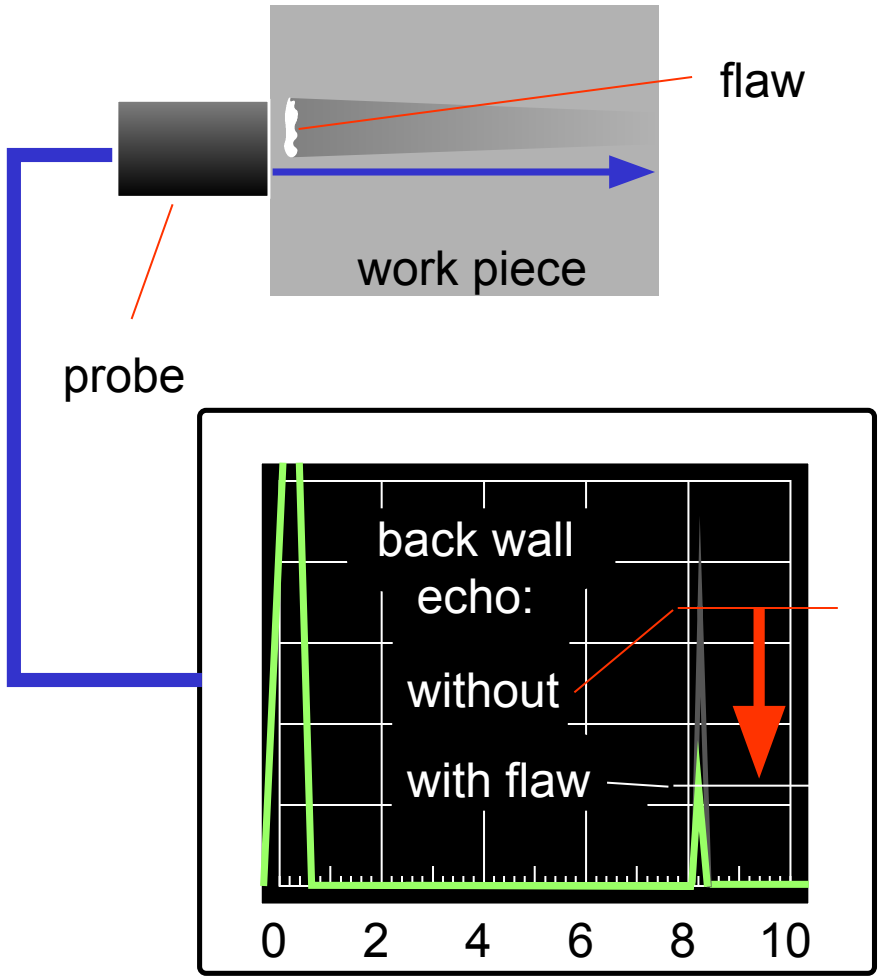
Flaw location and echo display



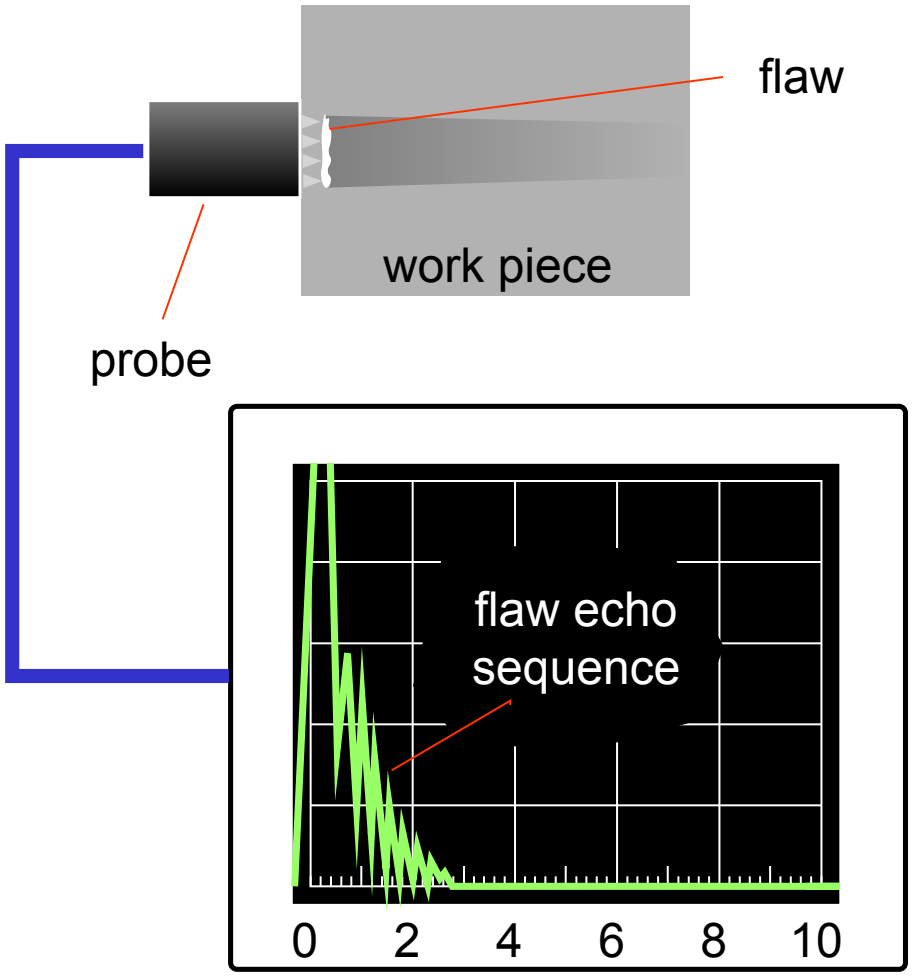
Flaw location and echo display



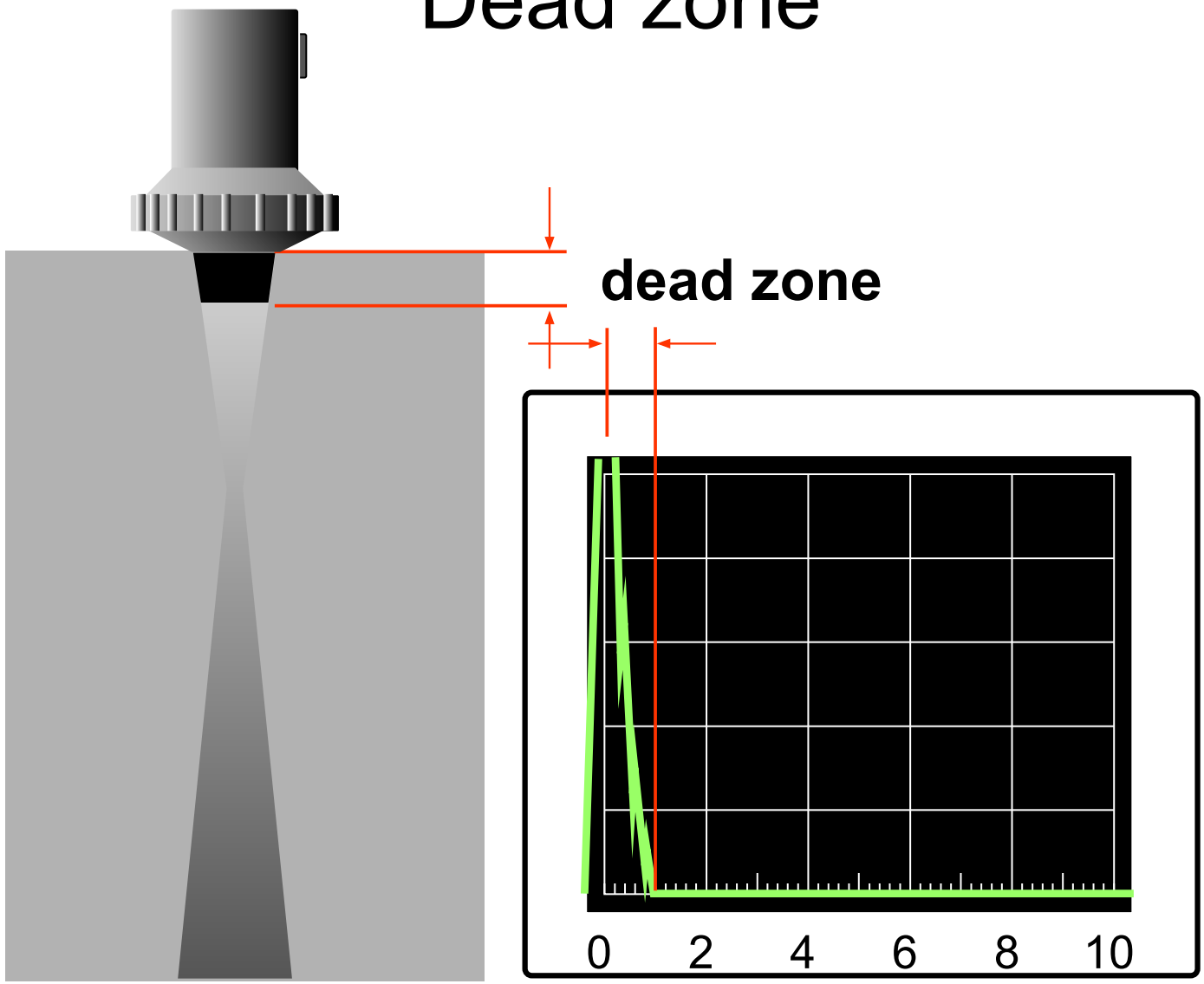
Flaw location and echo display



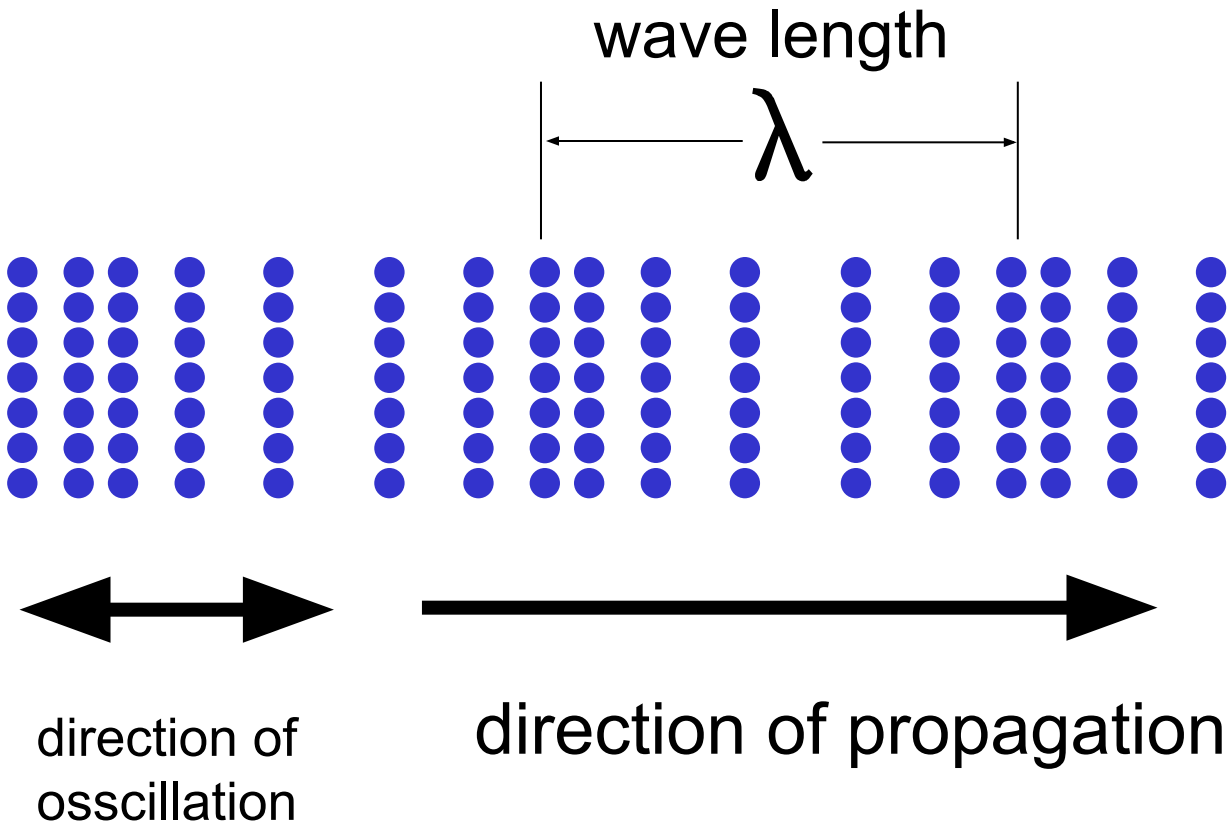
Flaw location and echo display



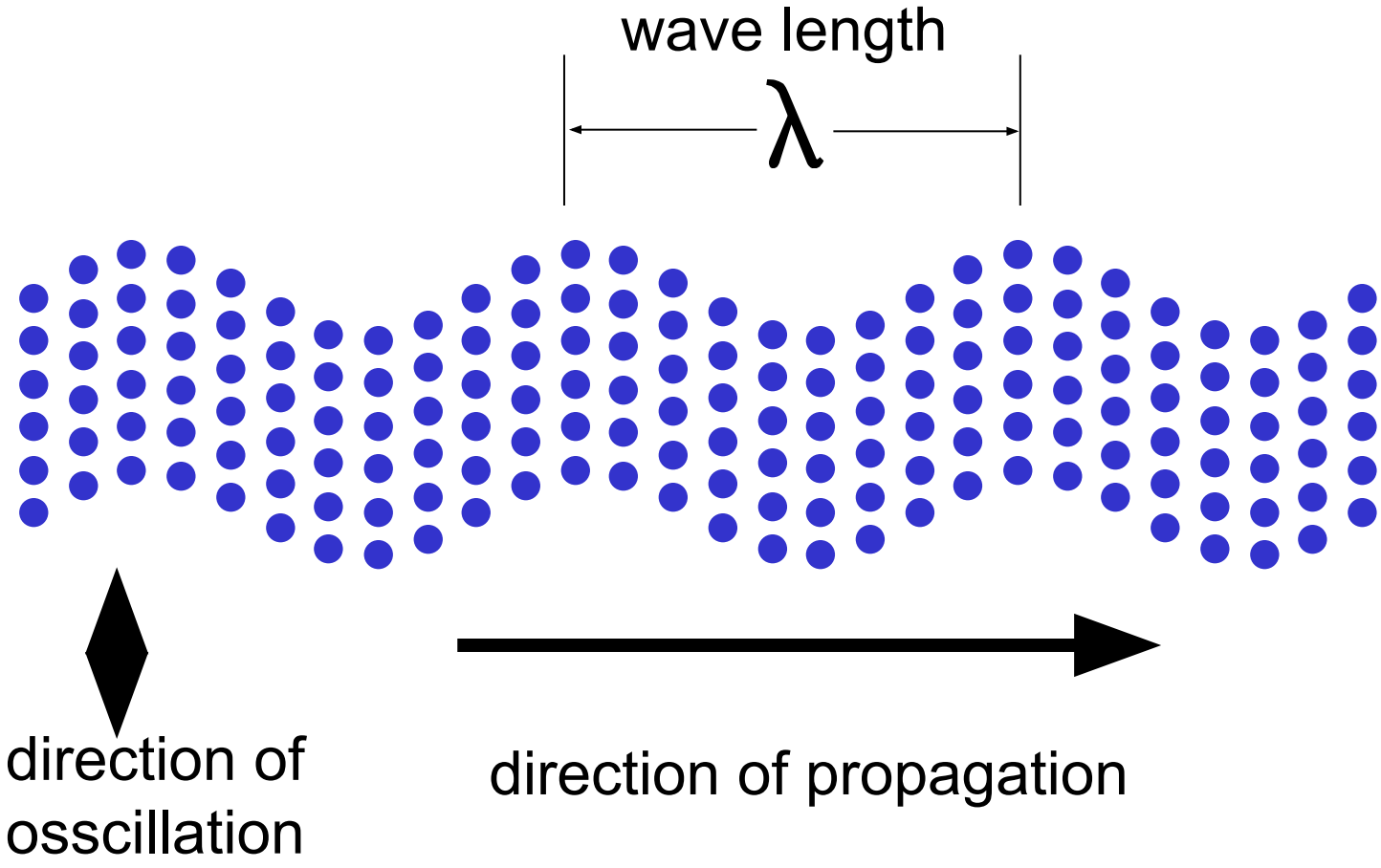
Dead zone



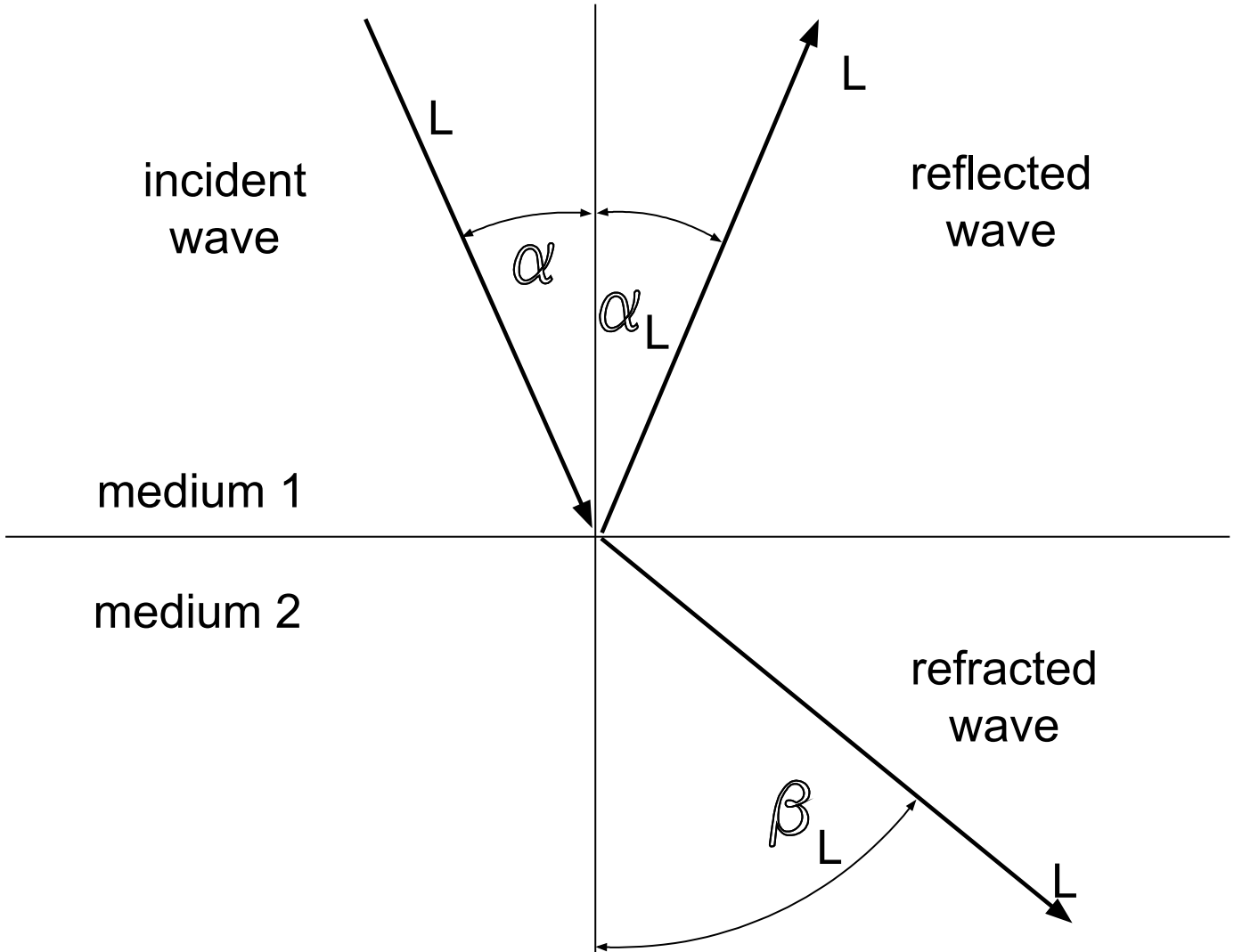
Longitudinal wave



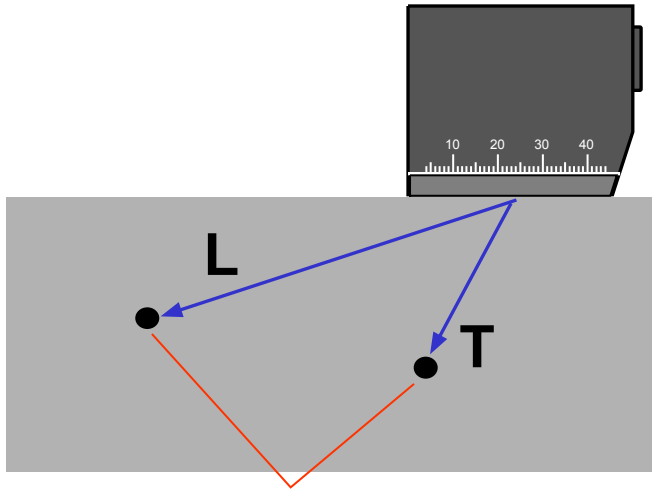
Transverse wave



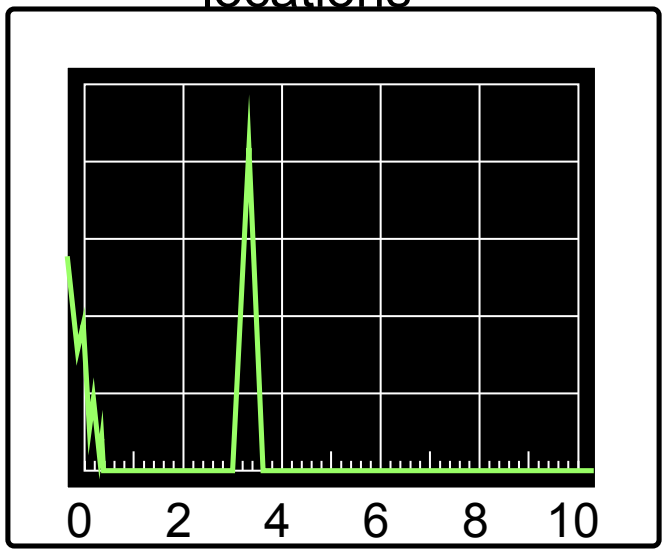
Relection and refraction



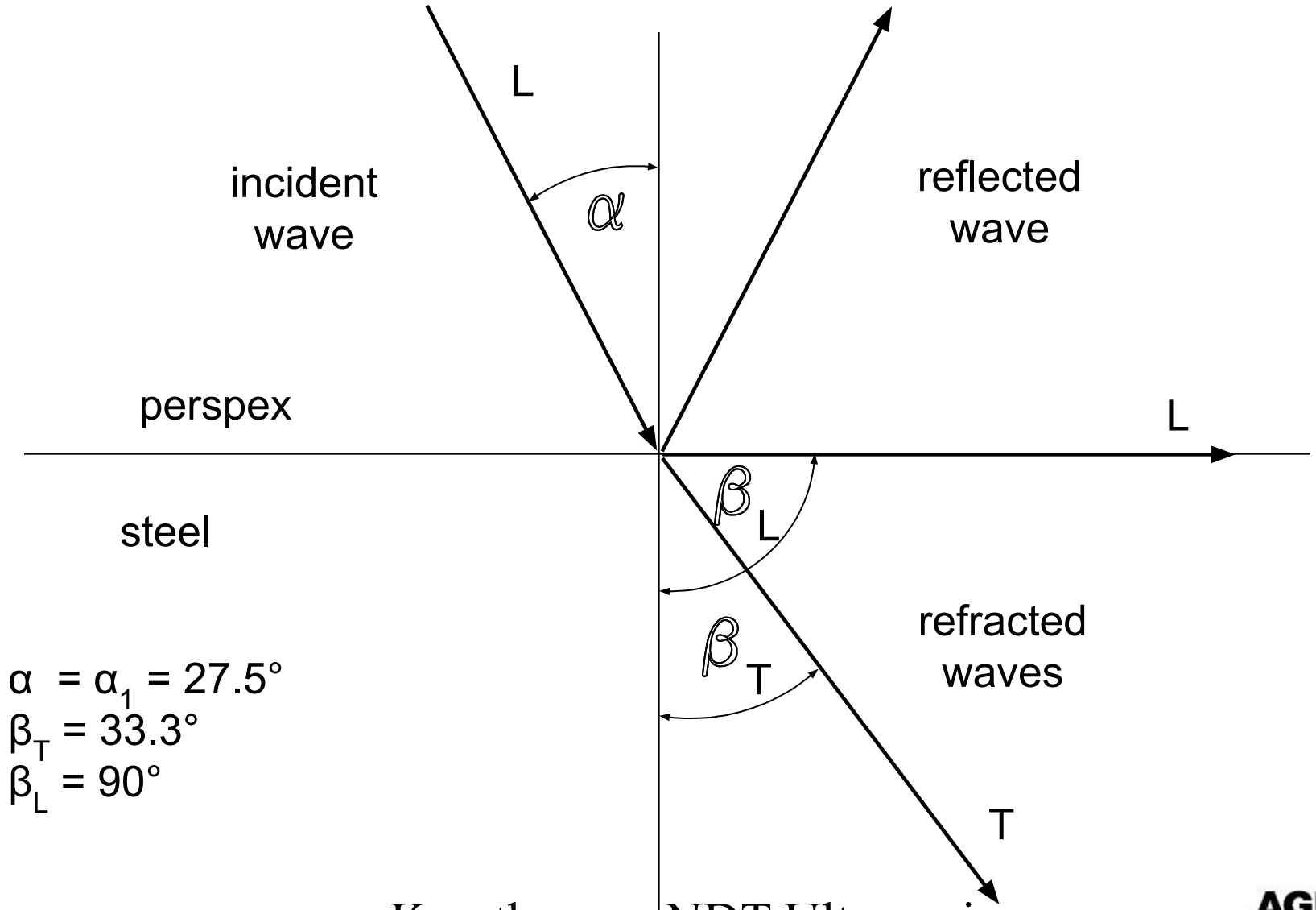
Angle beam probe with both wave types



possible flaw locations

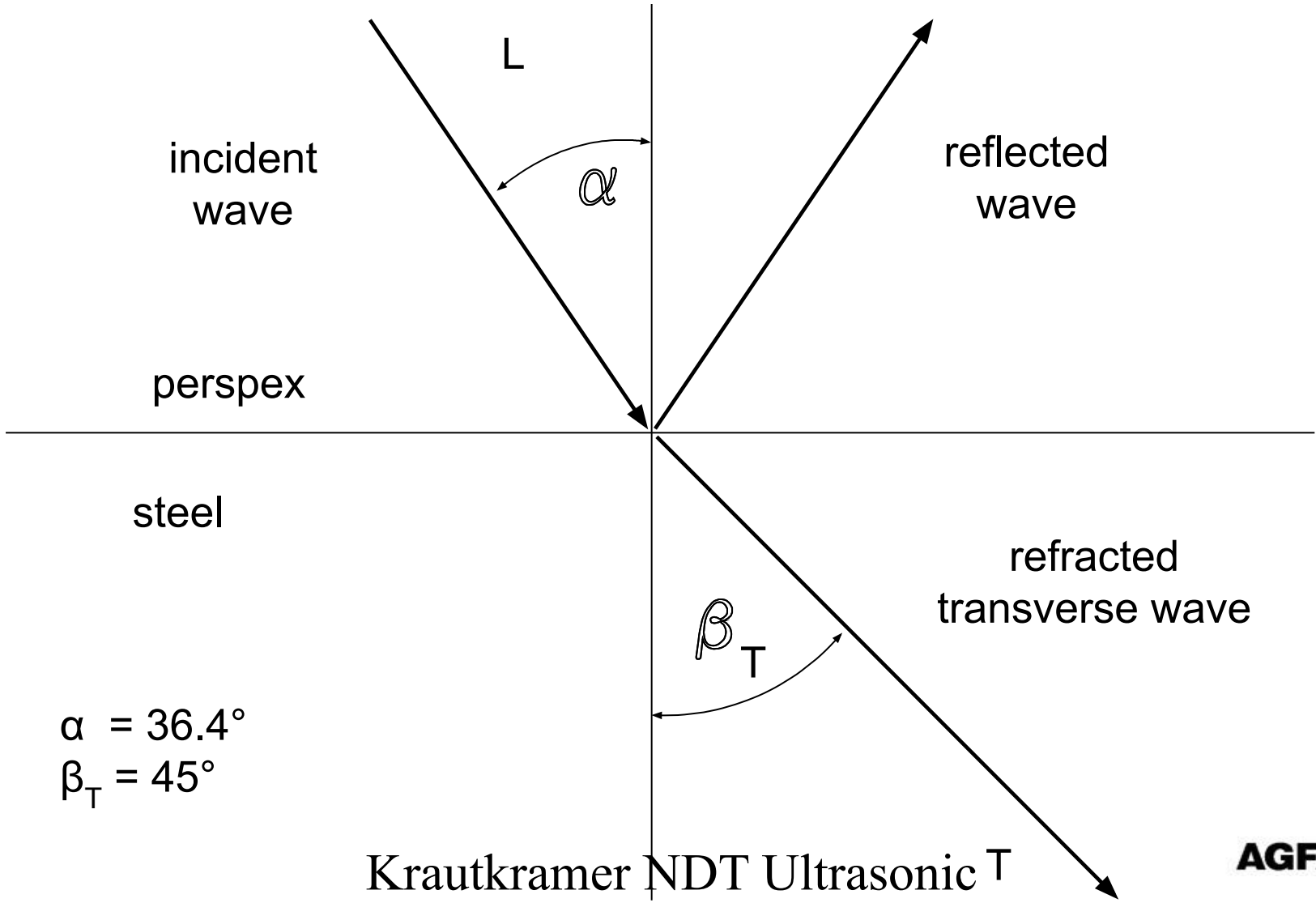


Longitudinal surface wave



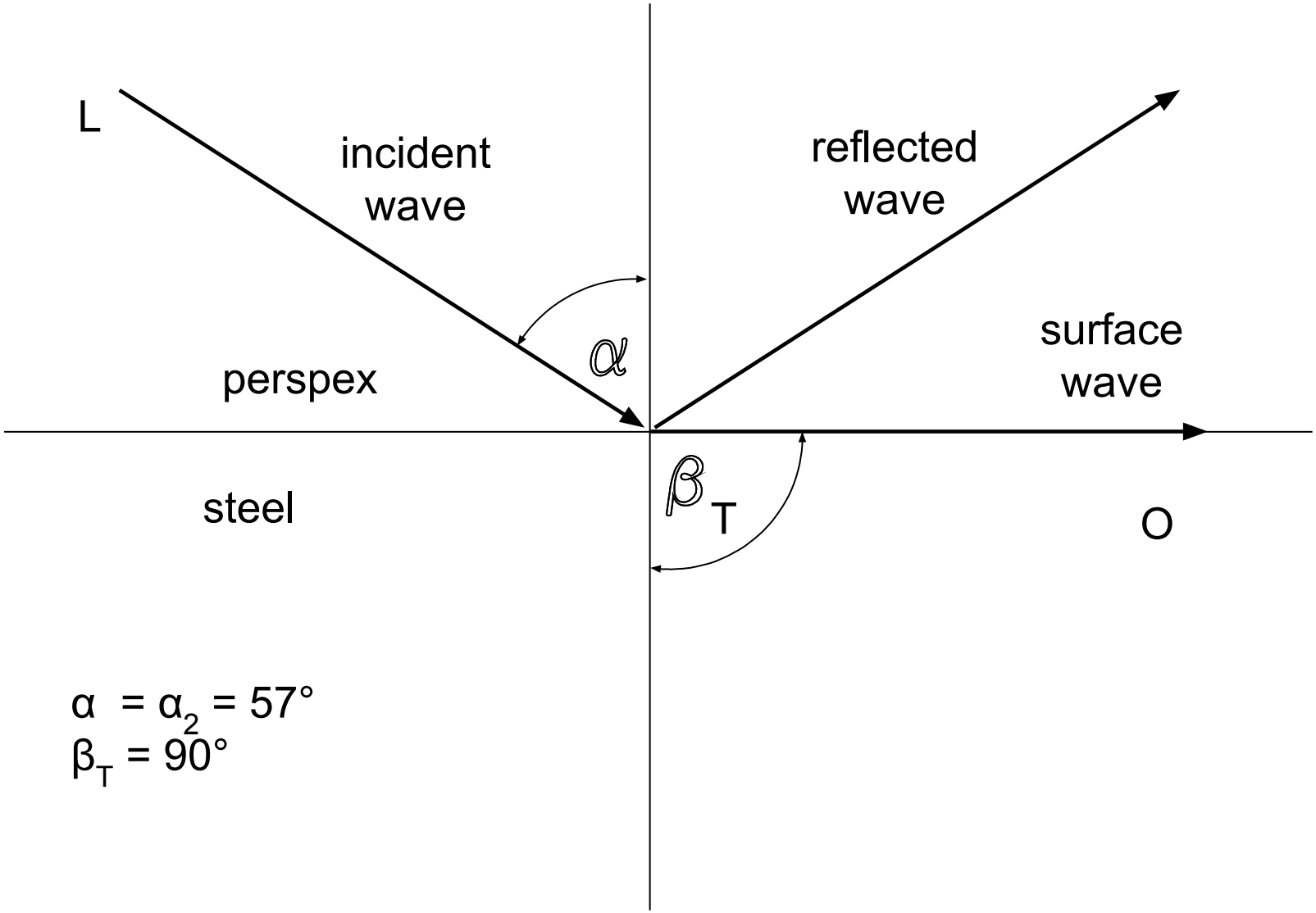
α = α_1 = 27.5°
β_T = 33.3°
β_L = 90°

45° transverse wave in steel



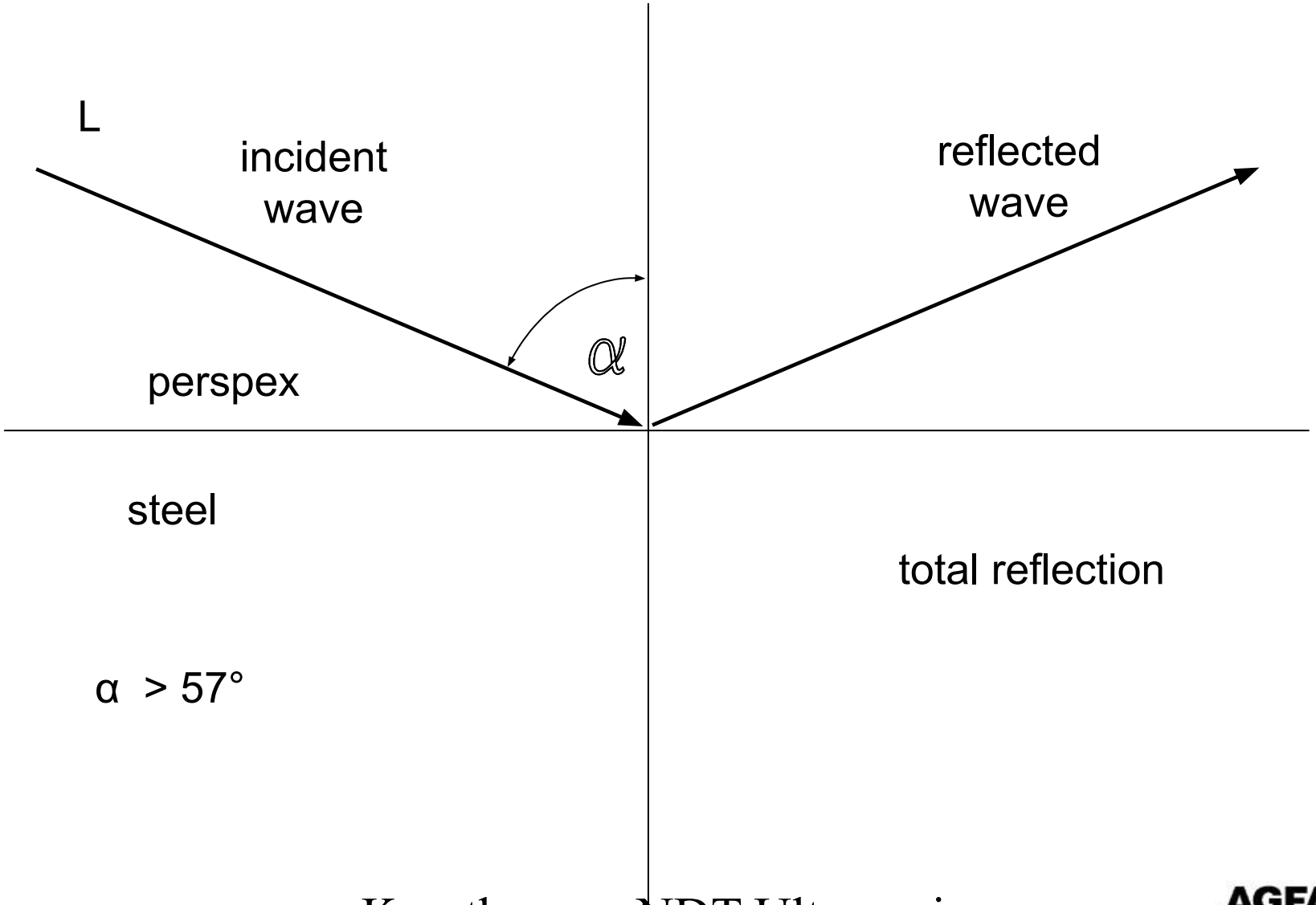
α = 36.4°
β_T = 45°

Transverse surface wave



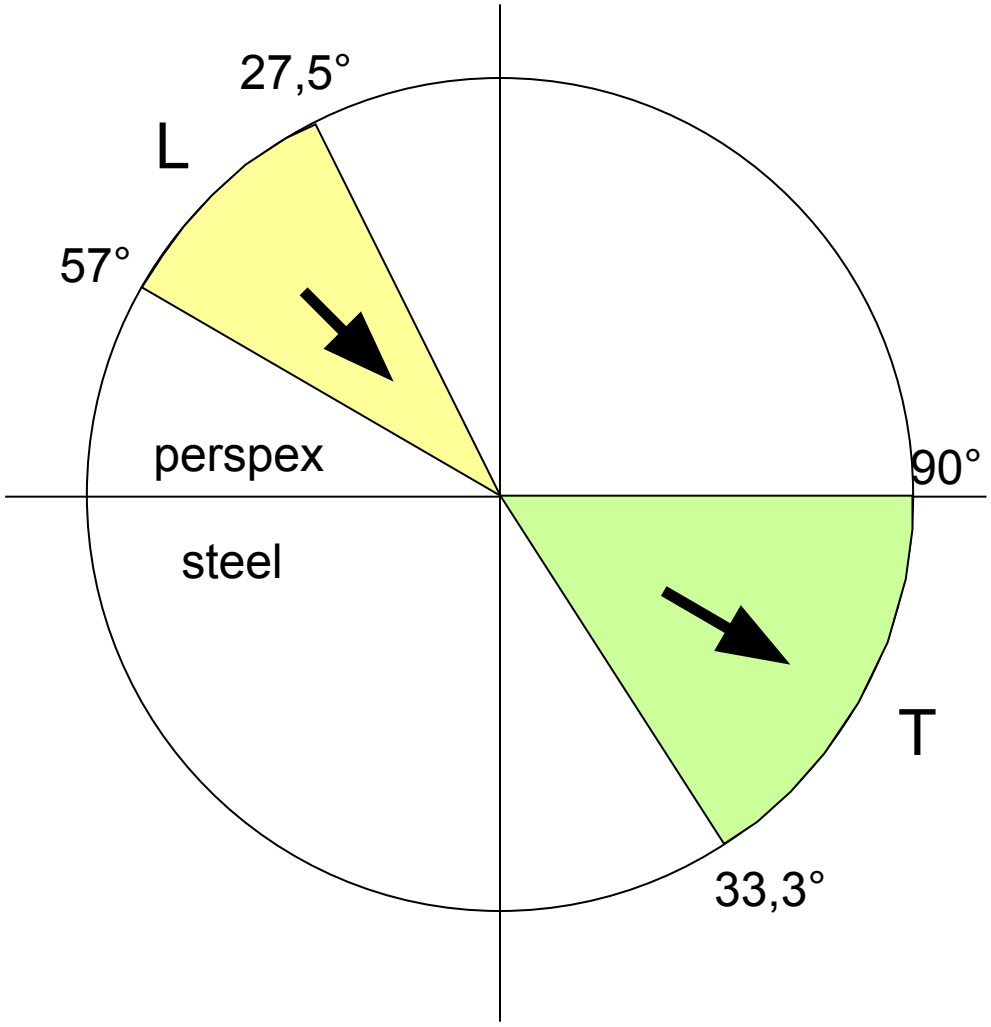
$\alpha = \alpha_2 = 57°$
$\beta_T = 90°$

Total reflection



α > 57°

Ranges for incident waves



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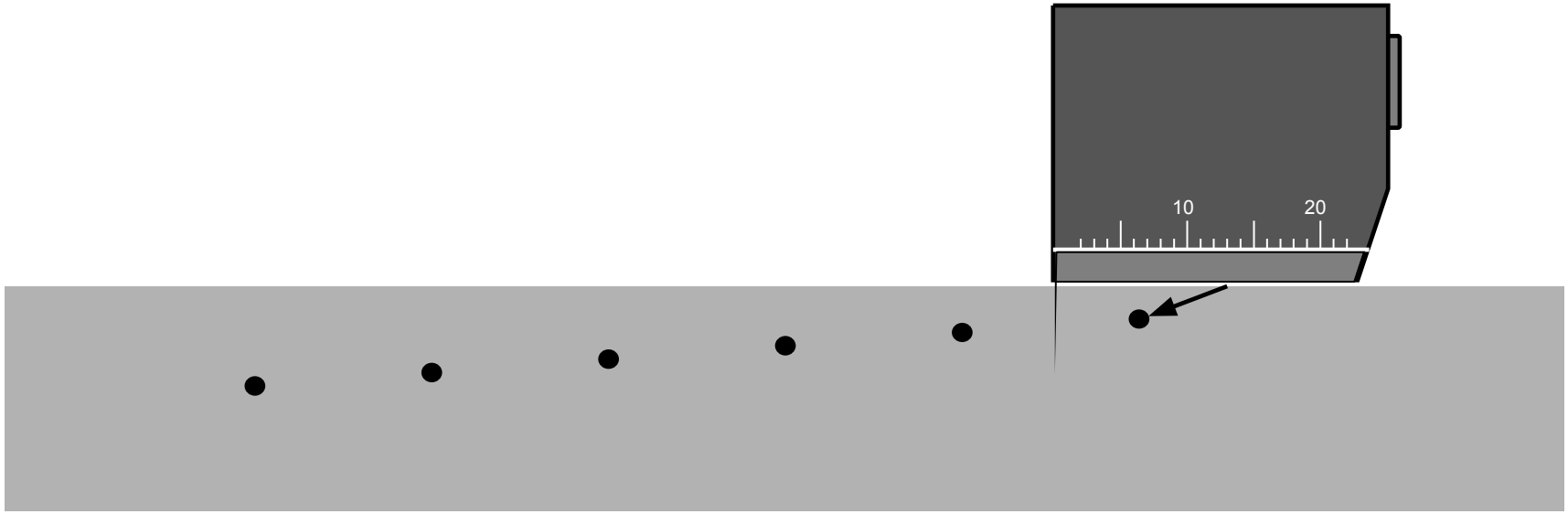
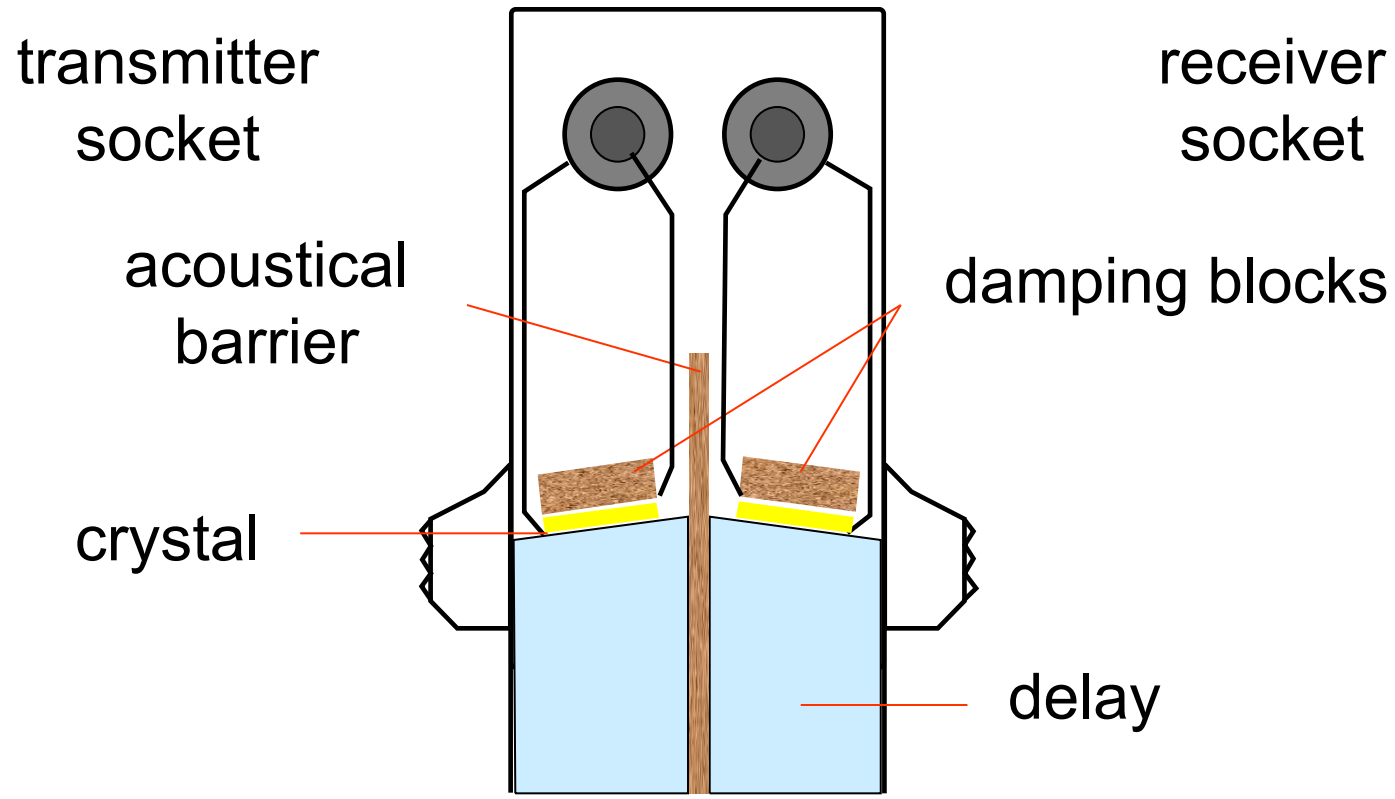
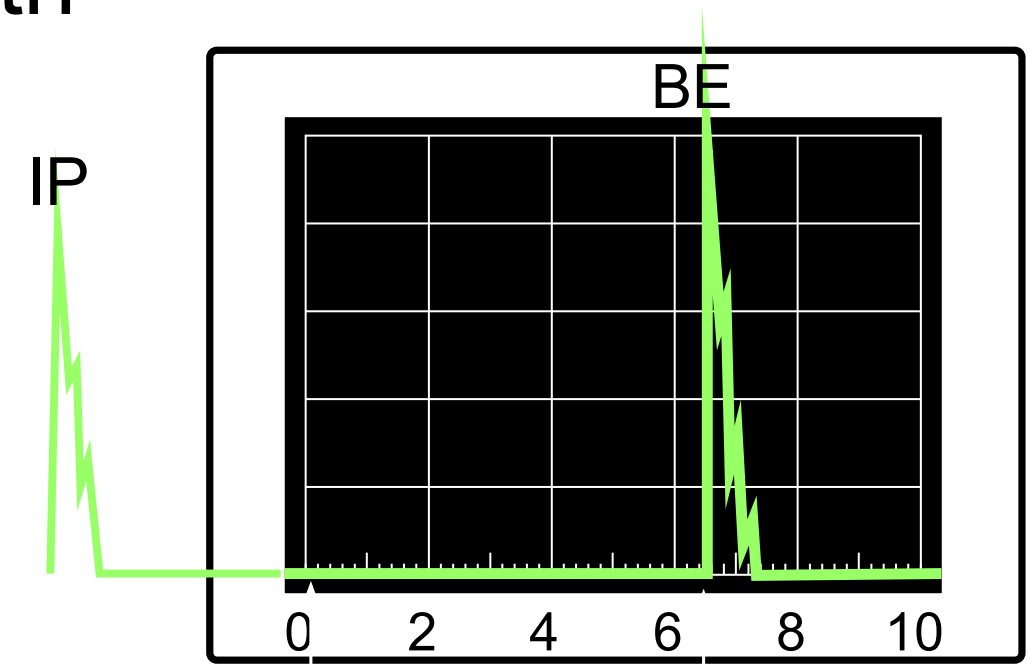
Near surface detectability with angle beam pobes

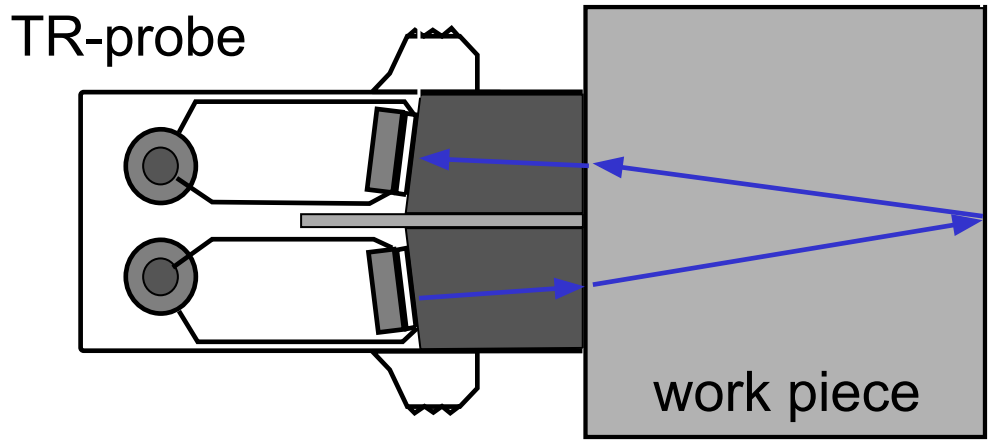


TR-probe / dual crystal probe

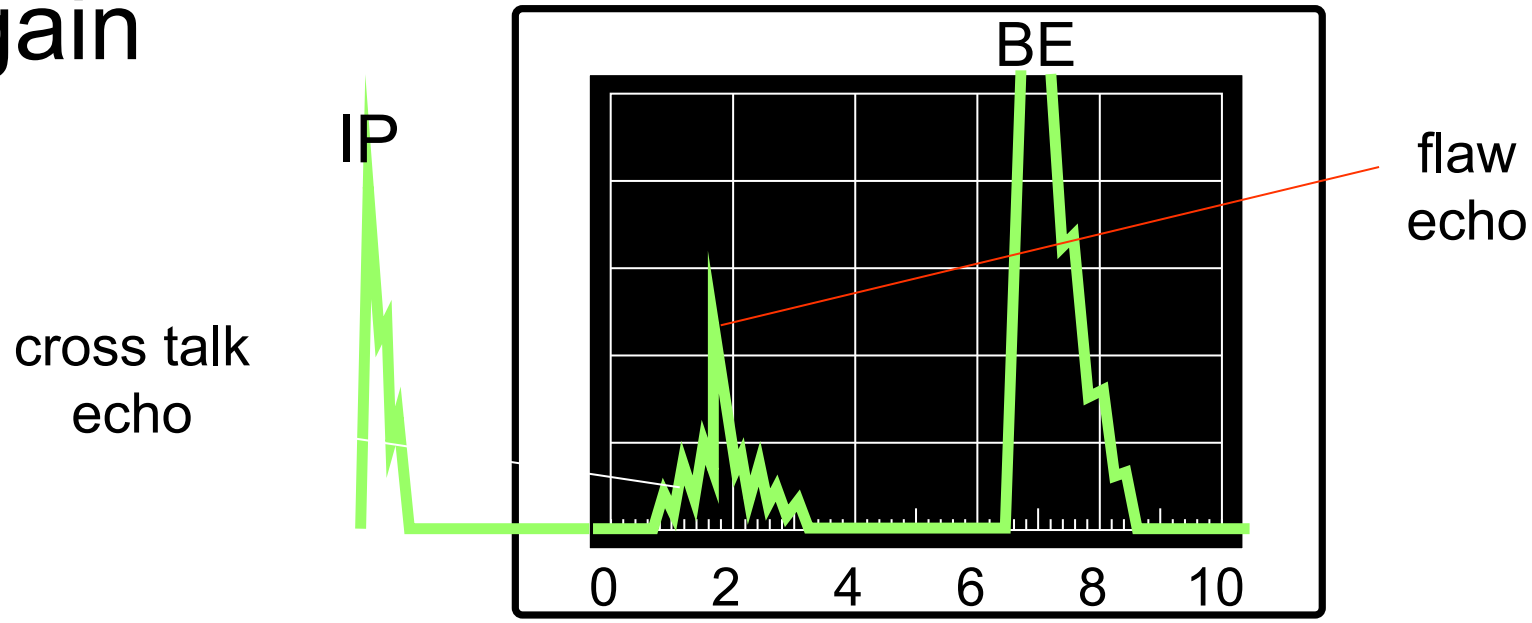


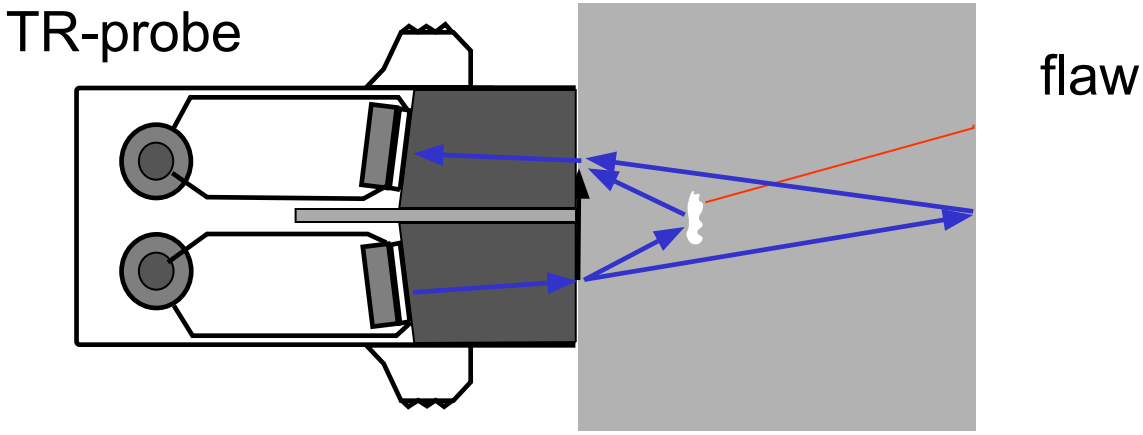
Probe delay with TR-probes



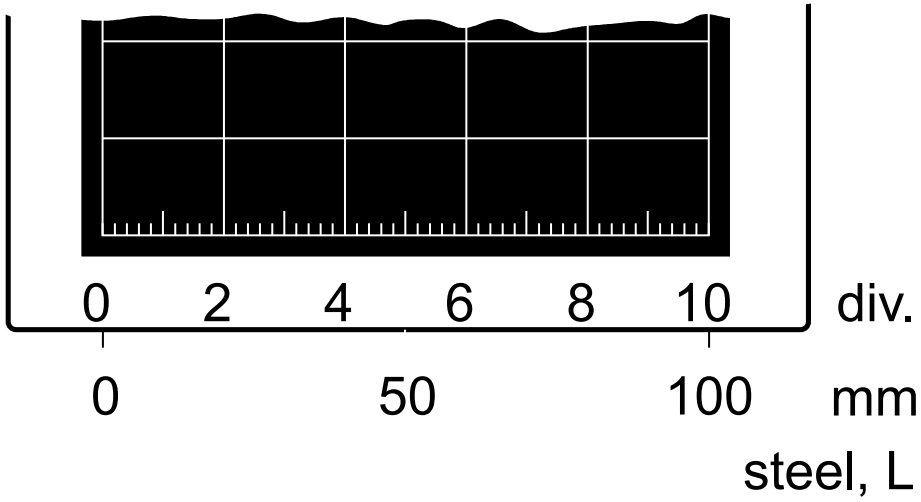


Cross talk at high gain

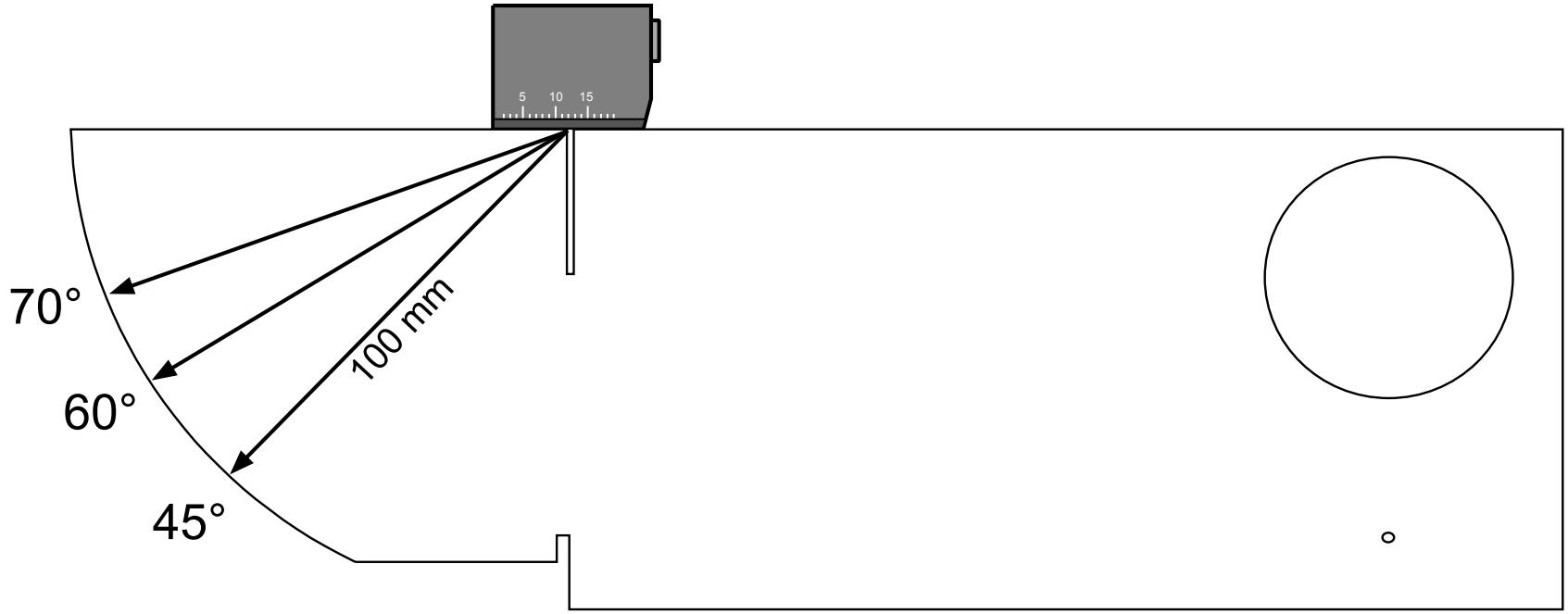




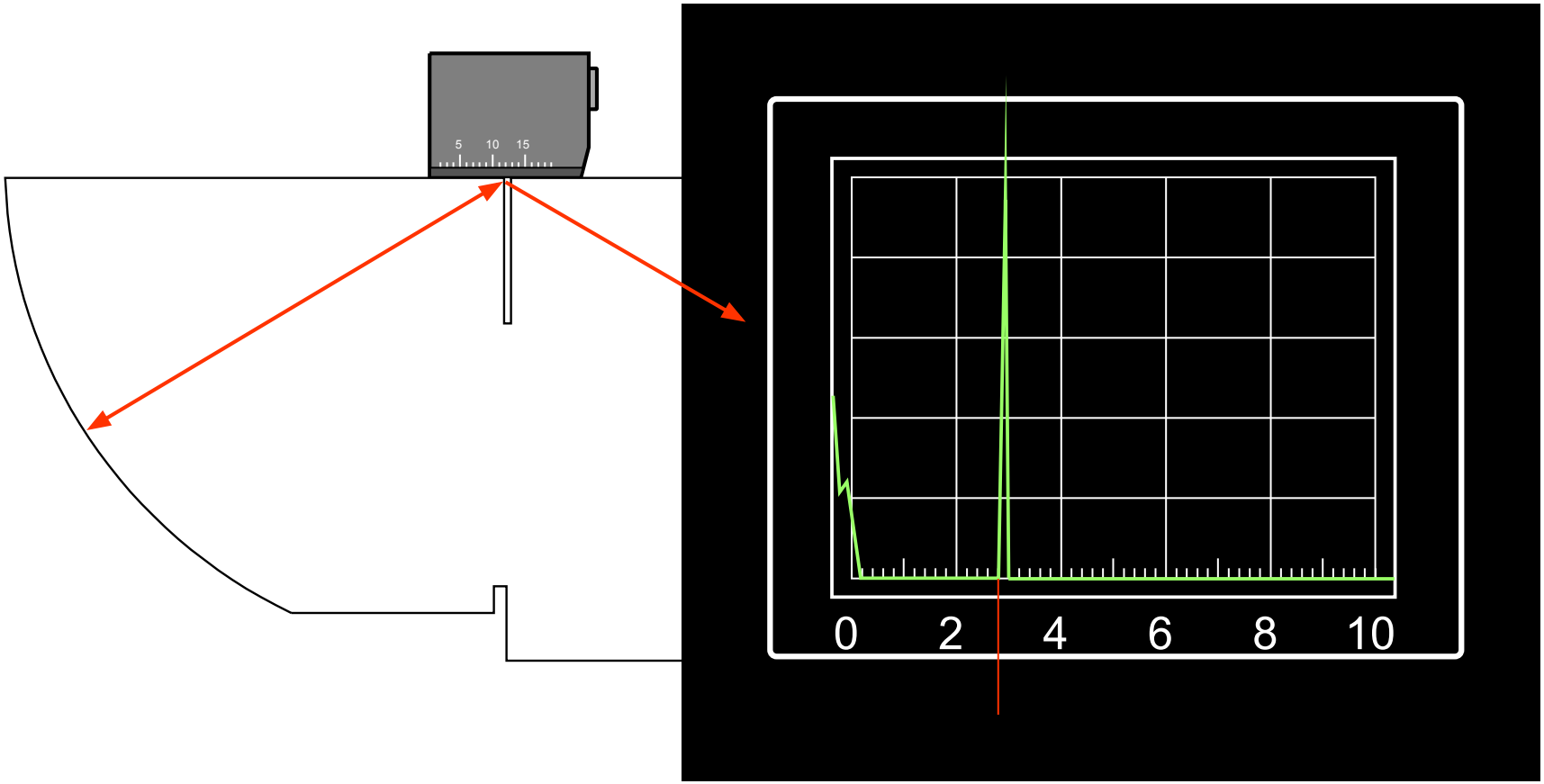
Range calibration



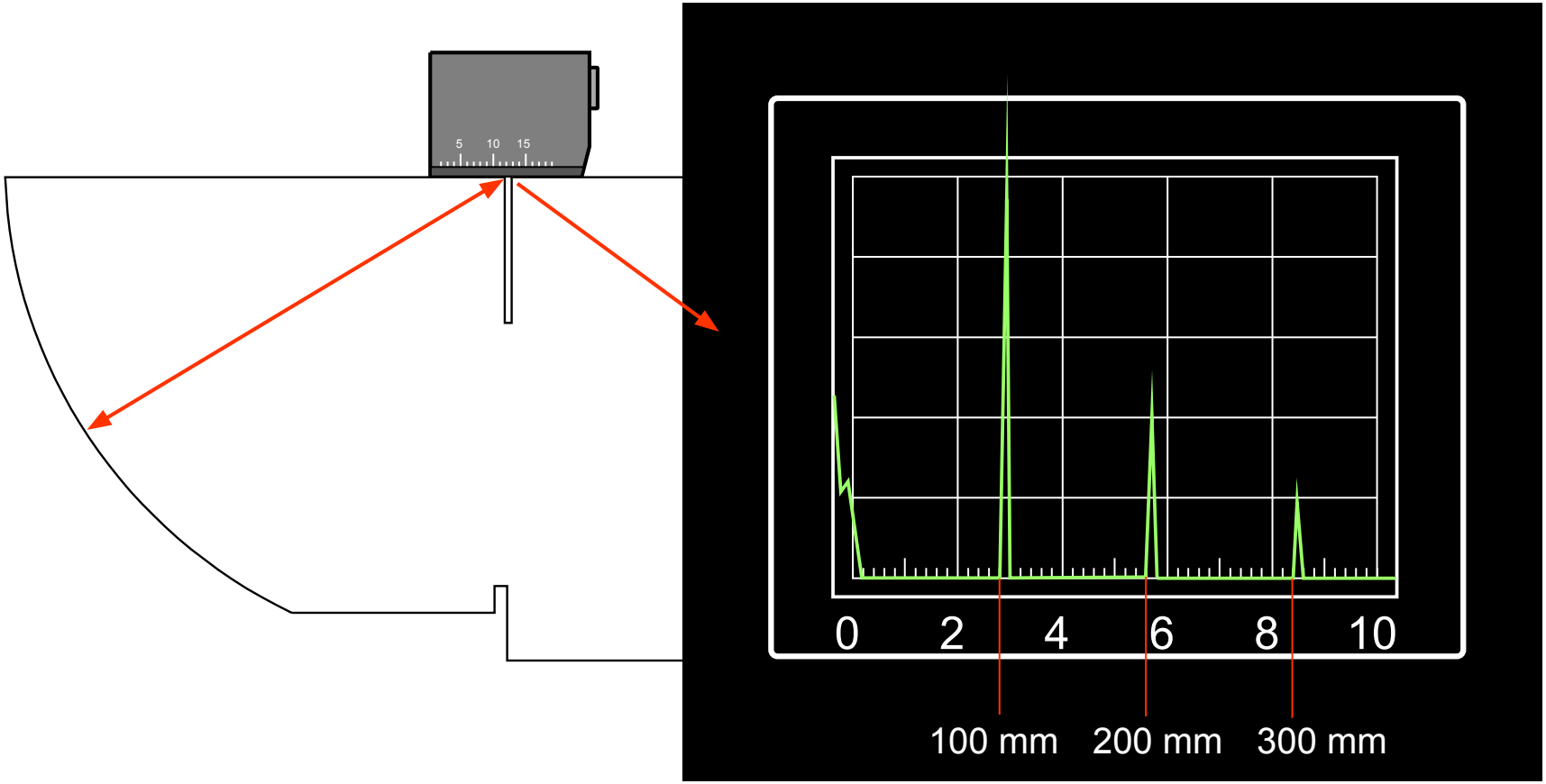
Calibration block 1 with angle beam probes



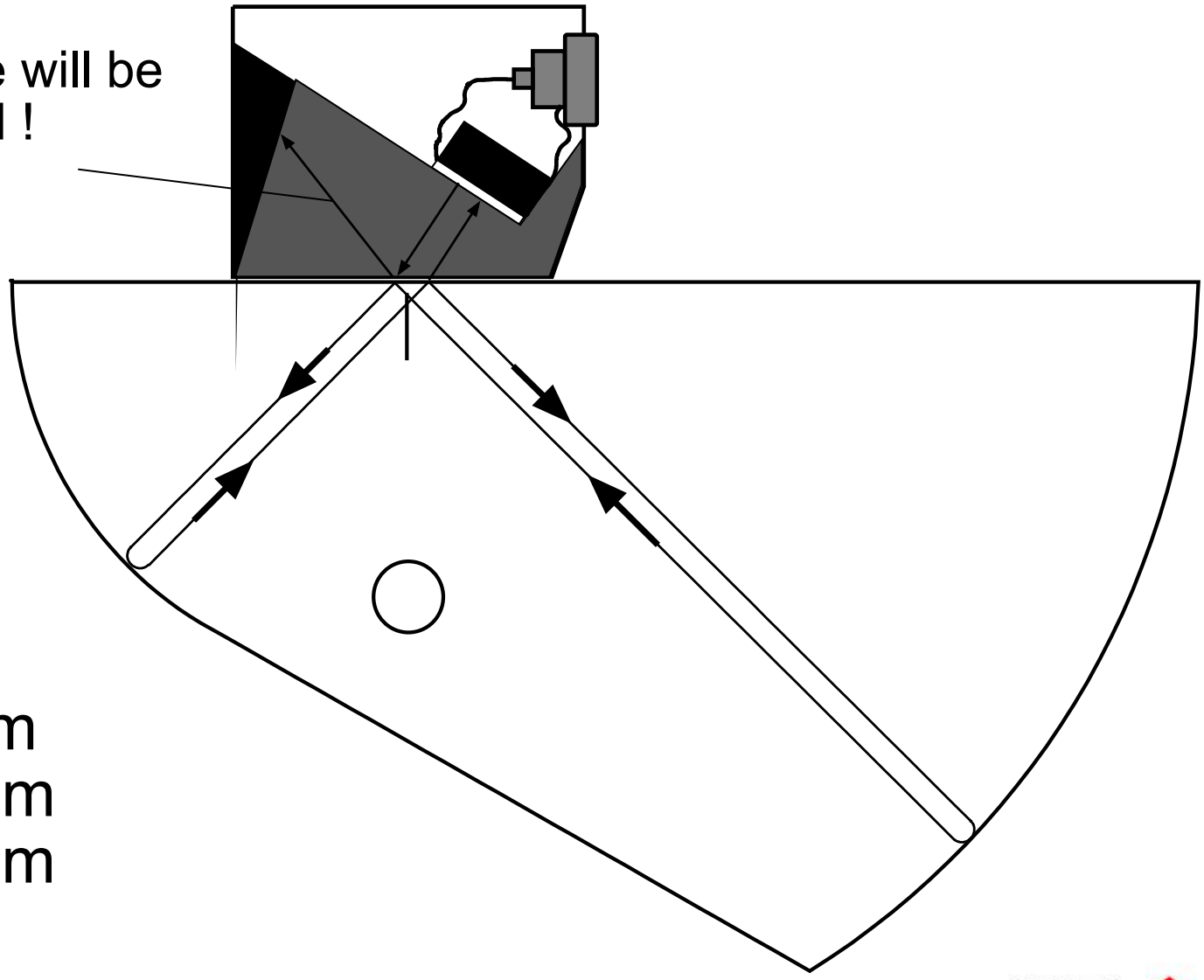
1st echo from circular section



Echo sequence from 100 mm radius

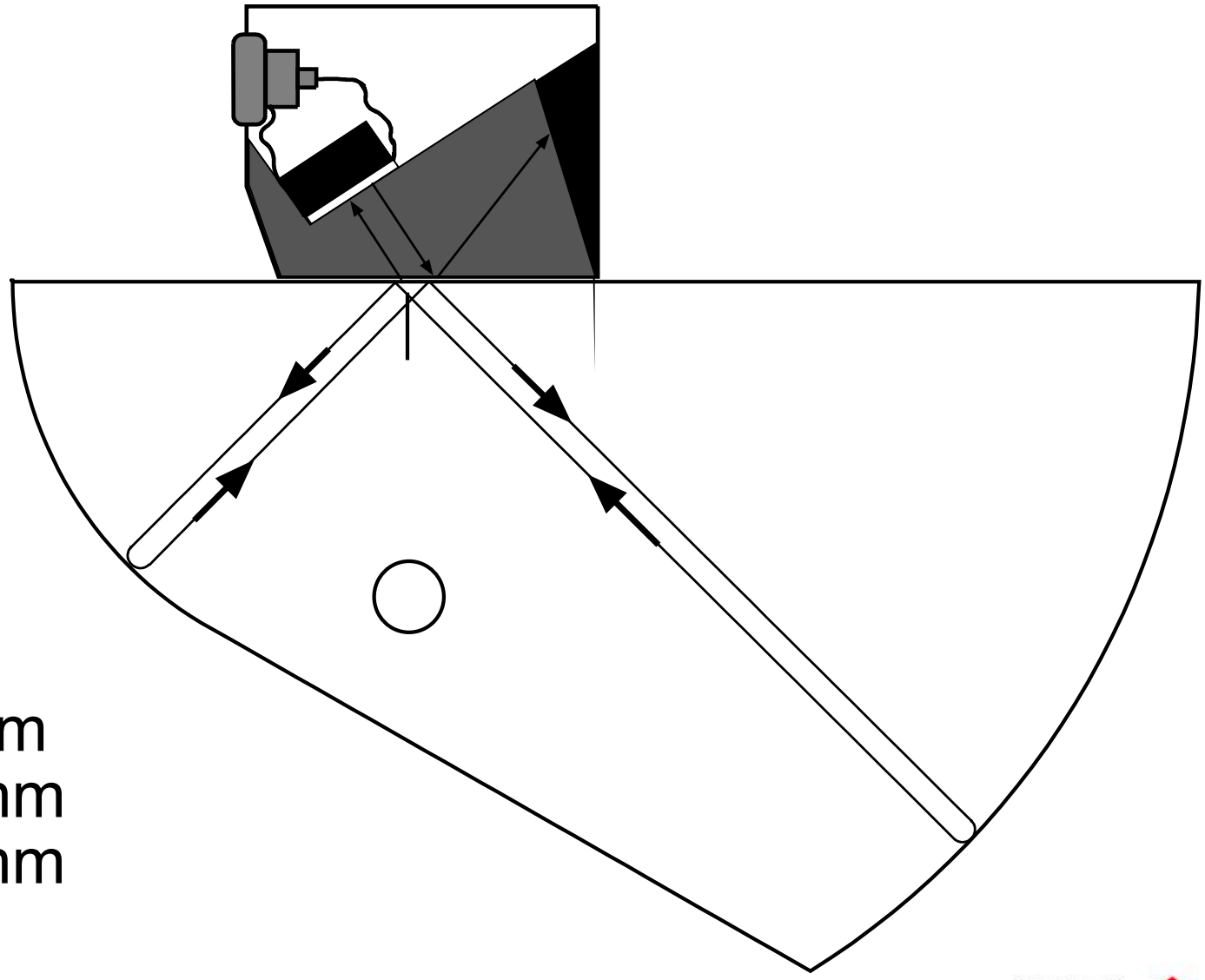


25 mm radius of calibration block 2



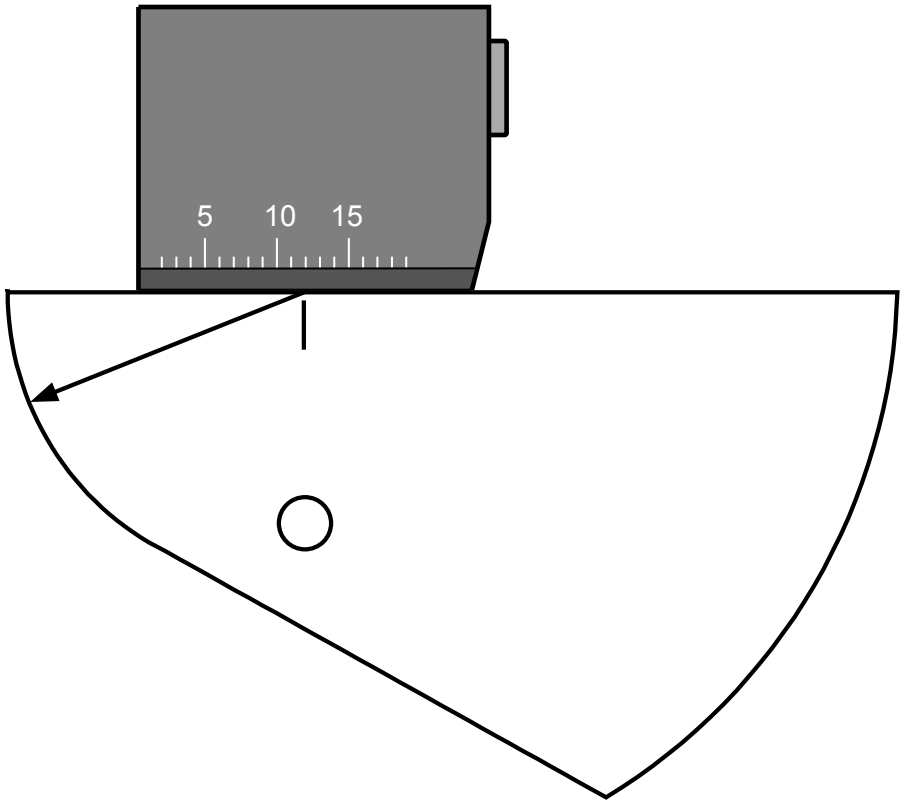
s_1 = 25 mm
s_2 = 100 mm
s_3 = 175 mm
etc.

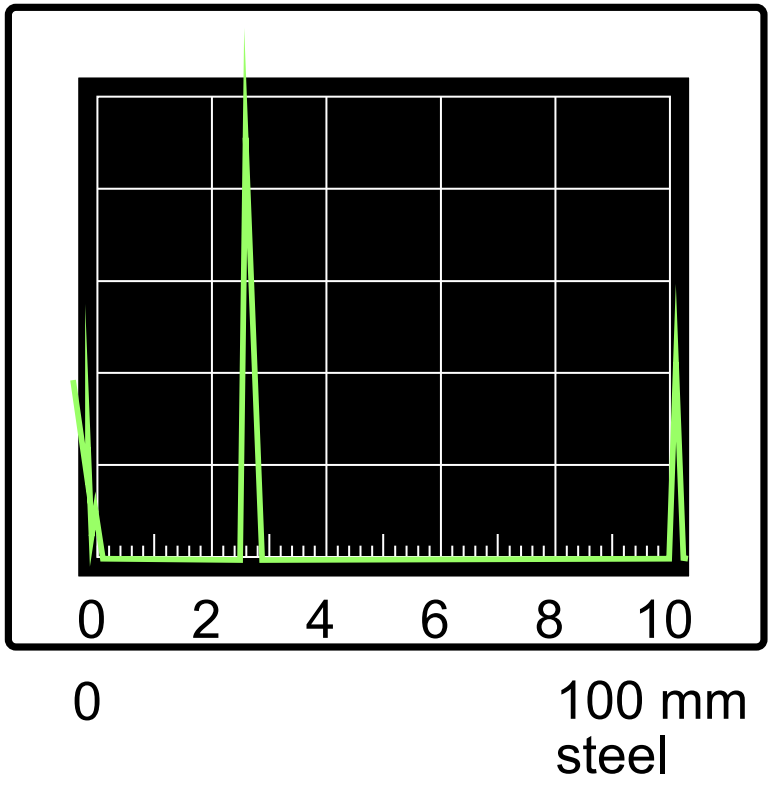
50 mm radius of calibration block 2



s_1 = 50 mm
s_2 = 125 mm
s_3 = 200 mm
etc.

100 mm range calibration on K2

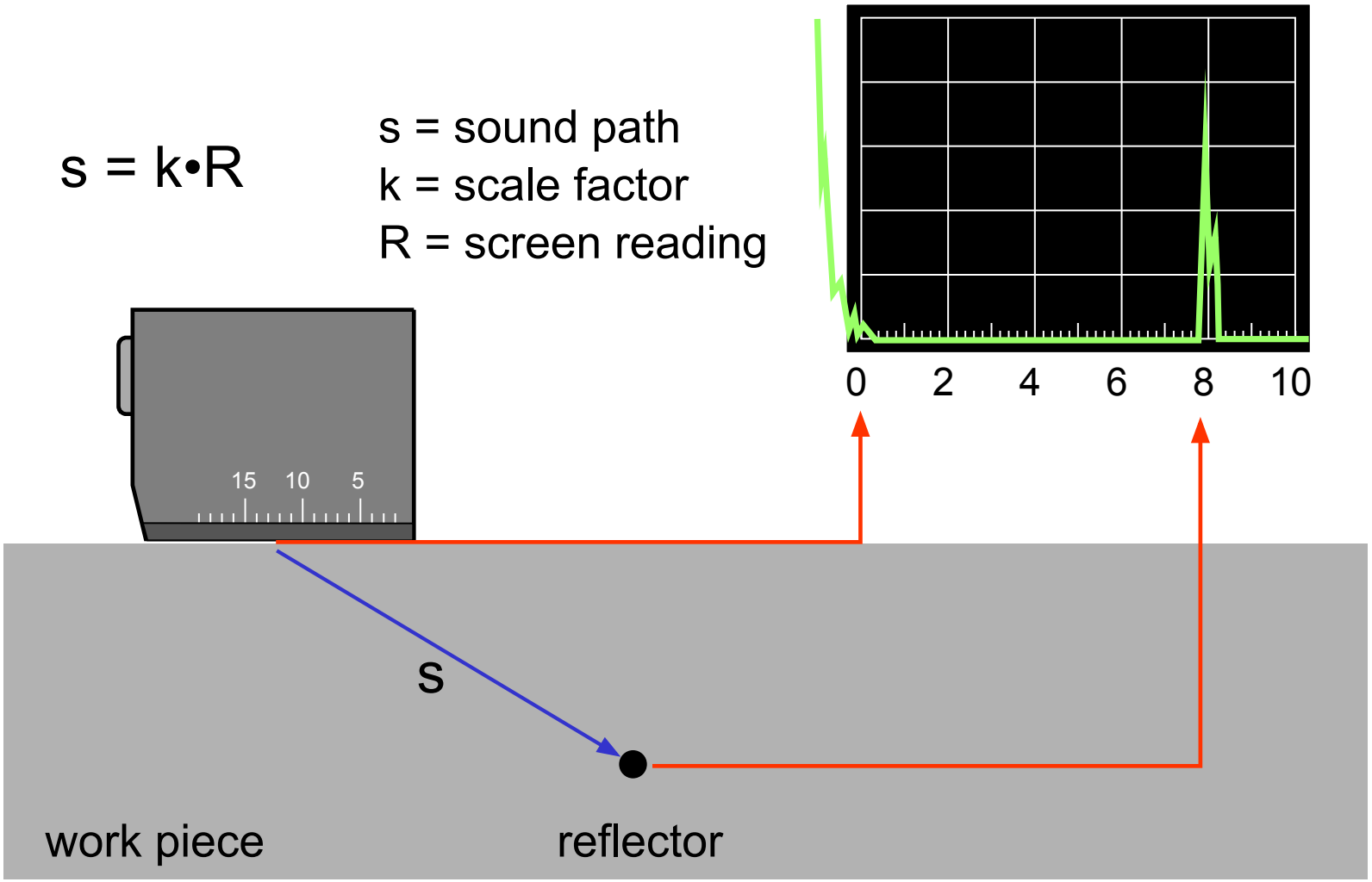




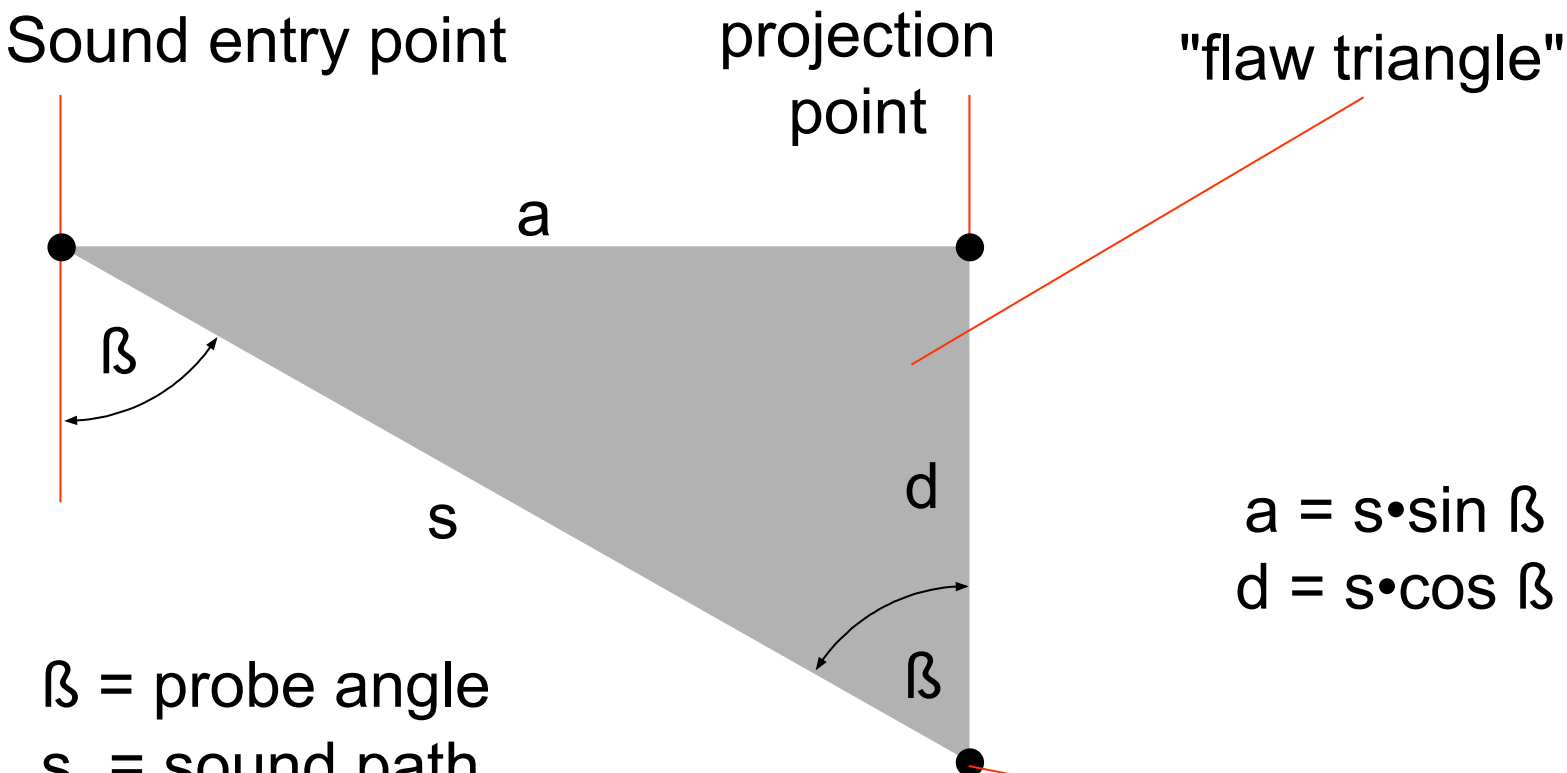
Flaw loaction

$s = k \cdot R$

s = sound path
k = scale factor
R = screen reading



Flaw location with angle beam probes

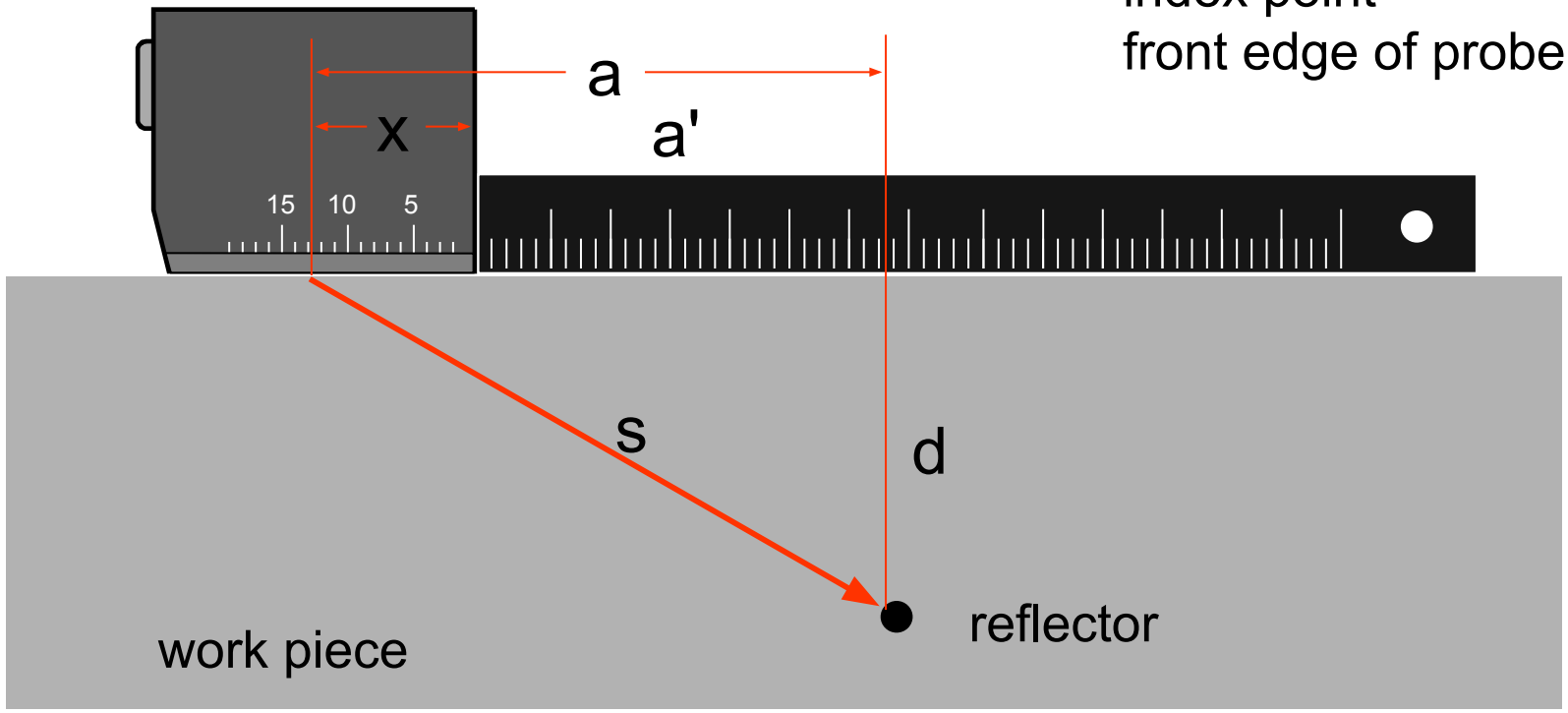


a = s•sin ß
d = s•cos ß

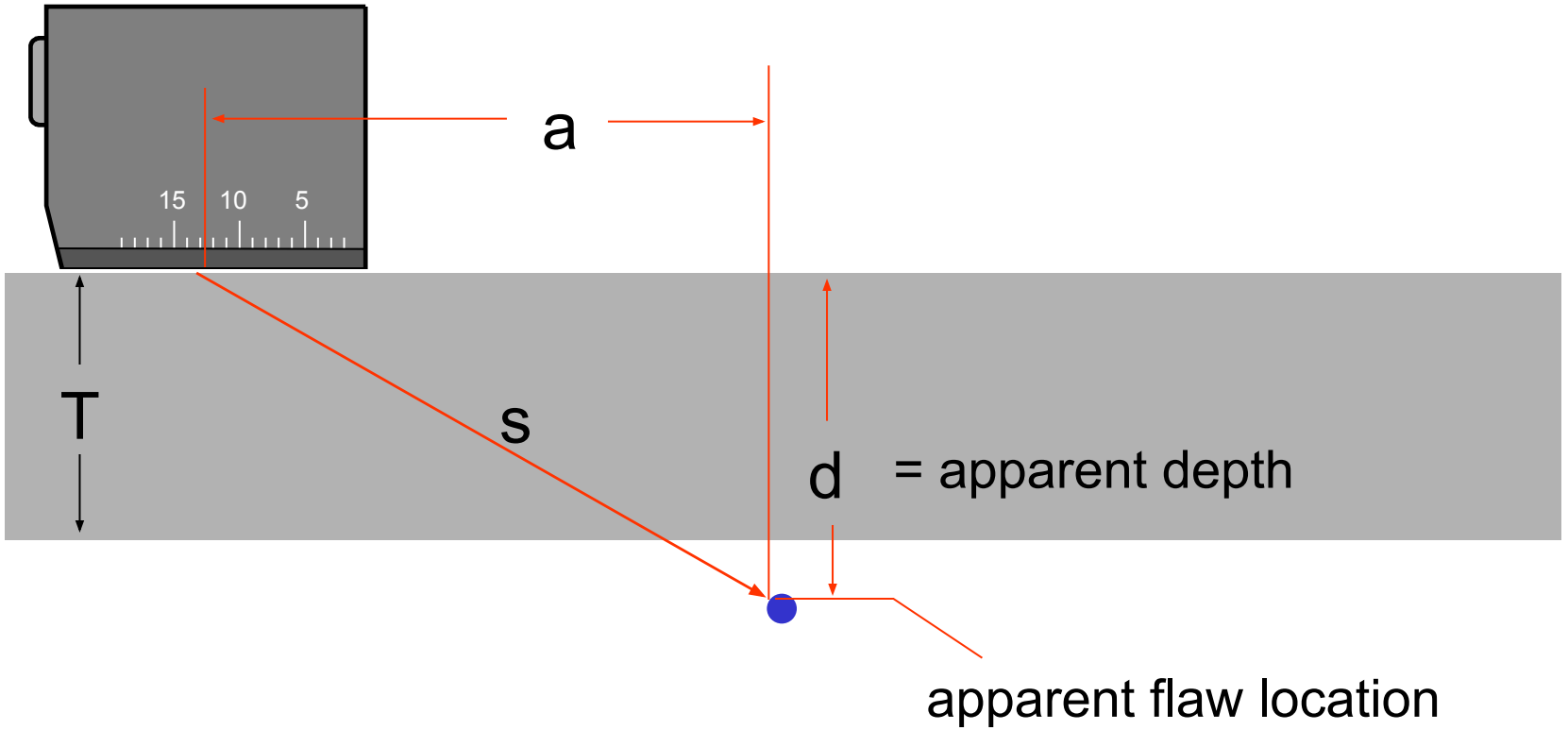
ß = probe angle
s = sound path
a = surface distance
d = depth

Flaw location with angle beam probes

a = surface distance
a' = reduced surface distance
x = x-value = distance:
index point -
front edge of probe



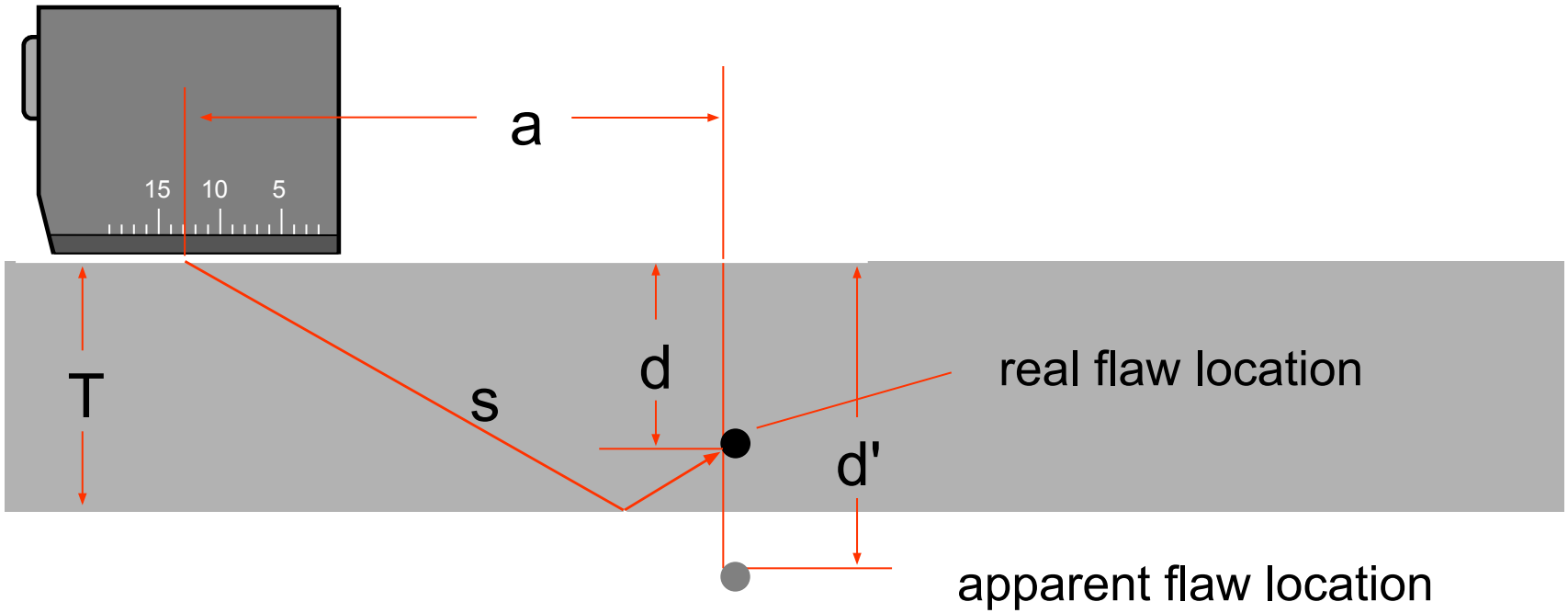
Flaw location with an angle beam probe on a plate



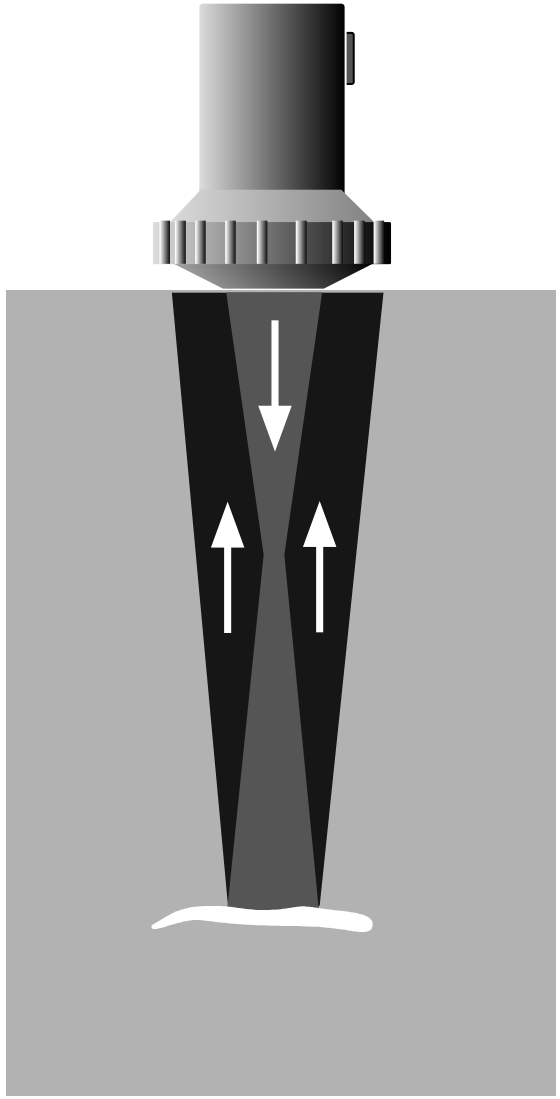
Flaw location with an angle beam probe on a plate

d' = apparent depth
d = real depth
T = work piece thickness

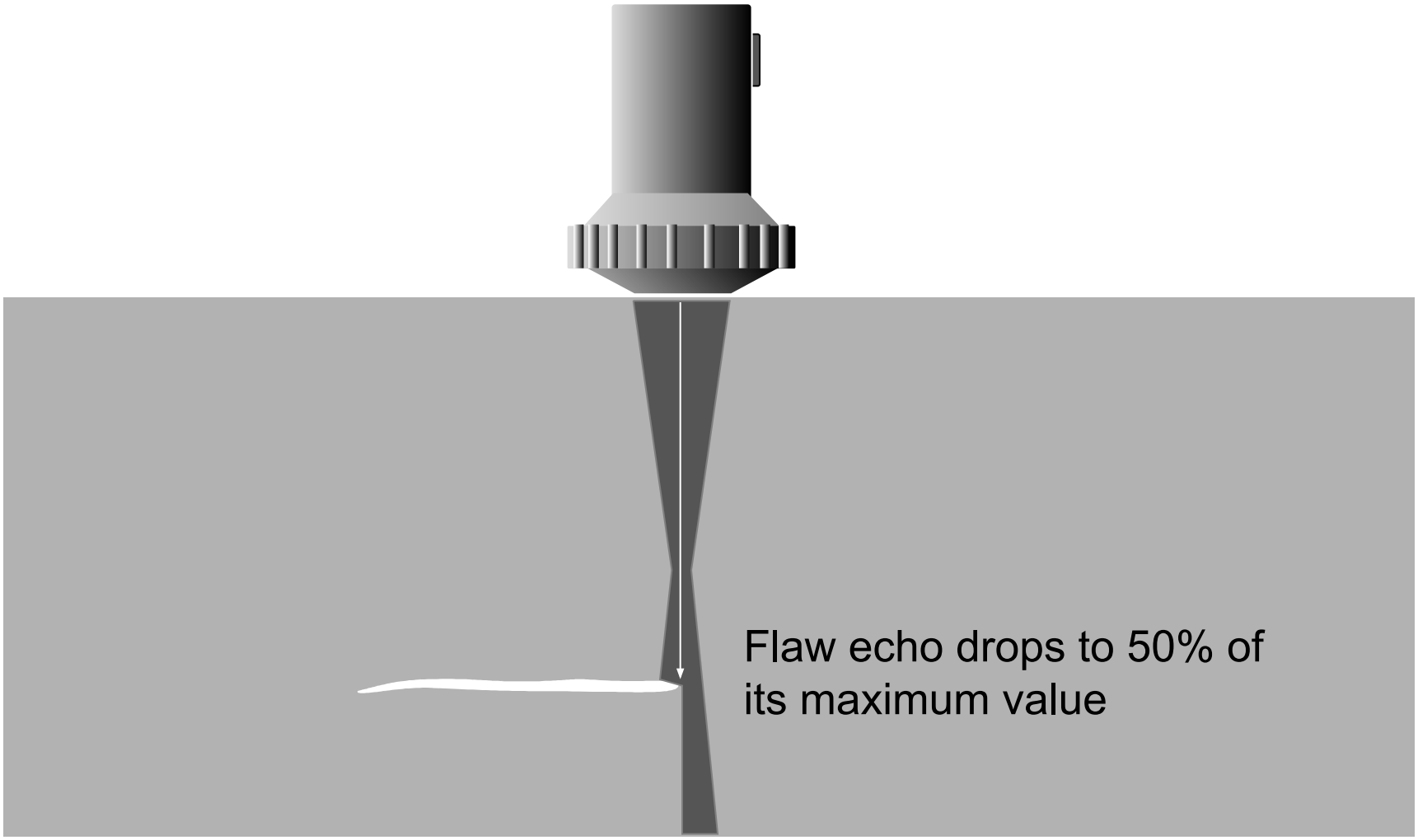
$a = s \cdot \sin\beta$
$d' = s \cdot \cos\beta$
$d = 2T - d$



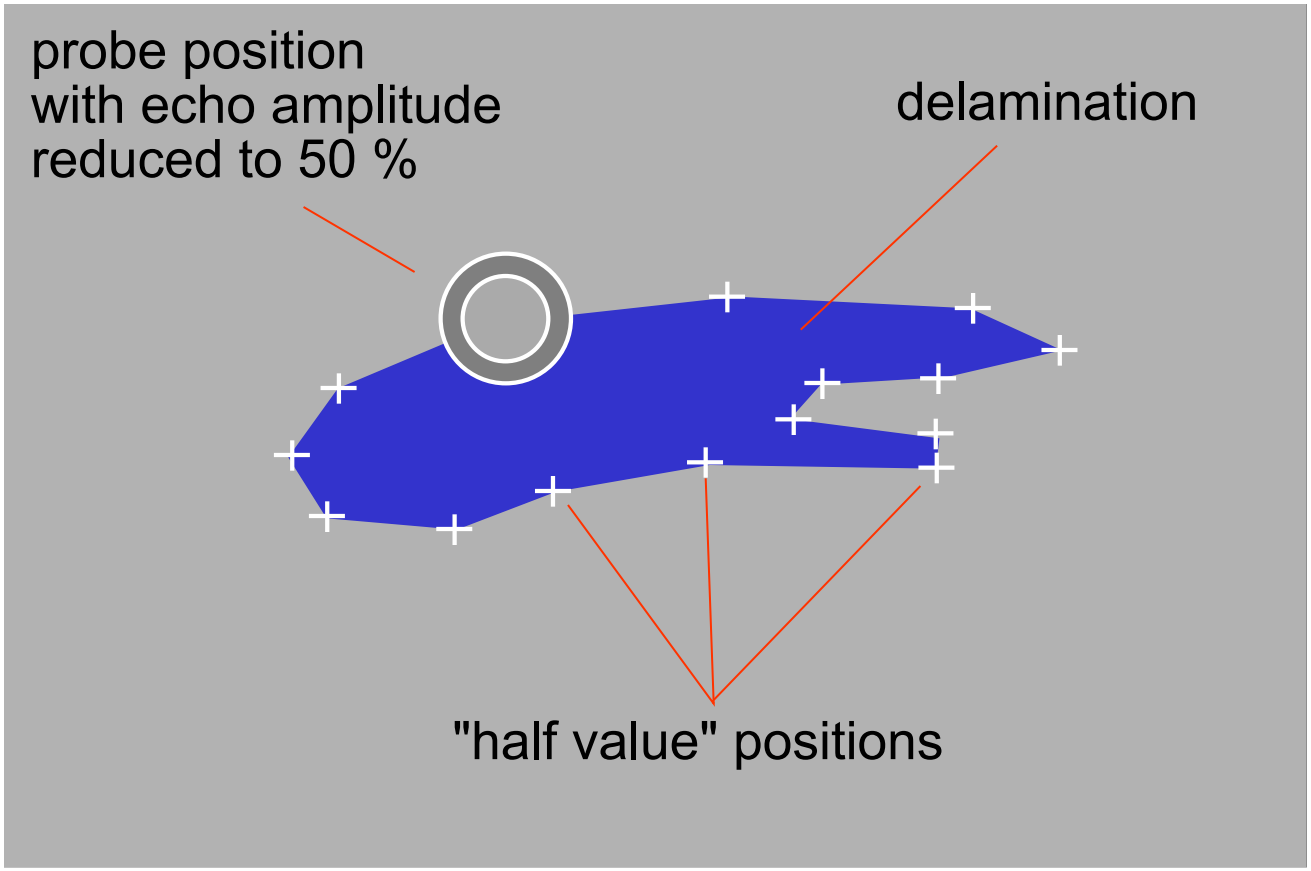
Large defects parallel to the scanning surface



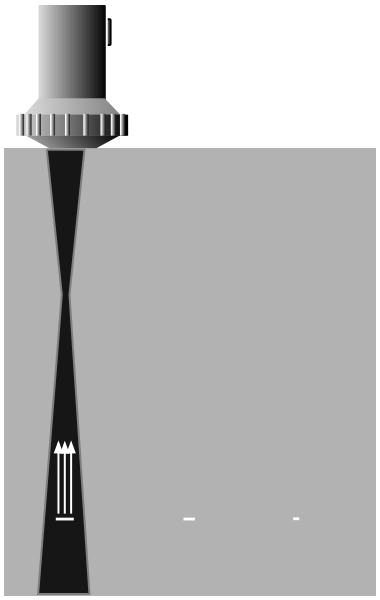
Scanning the edge of the defect

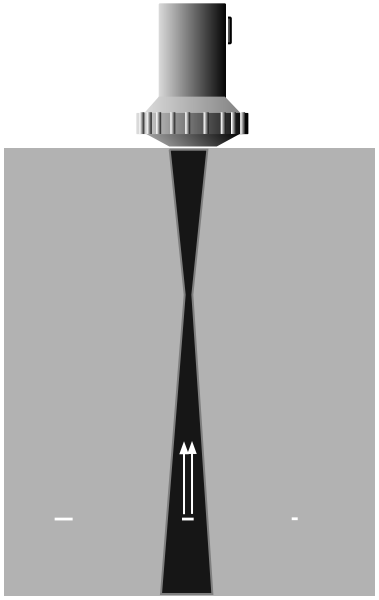


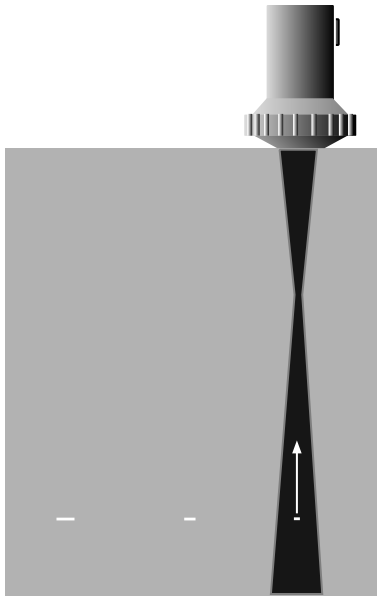
Determination of the defect area

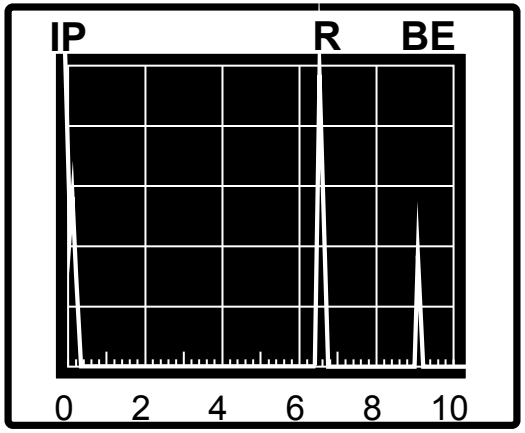


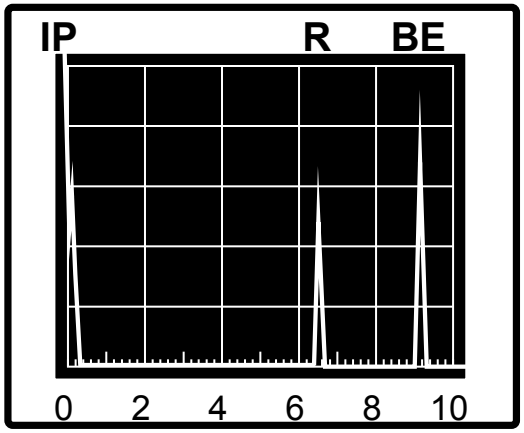
Flaw sizes and echo amplitudes

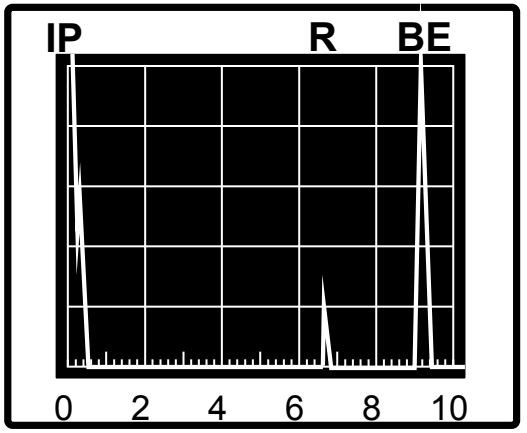




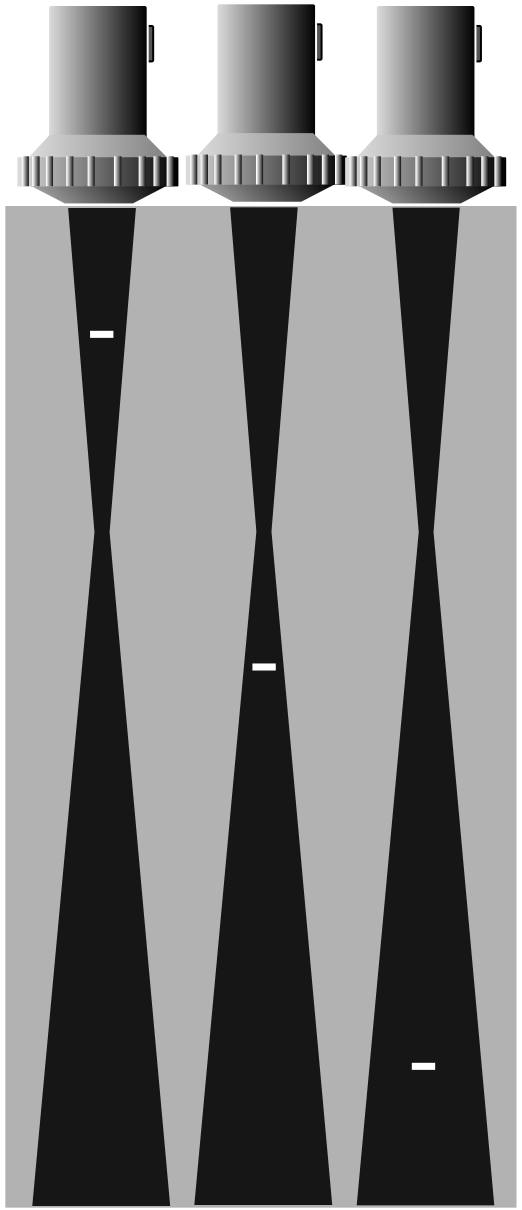


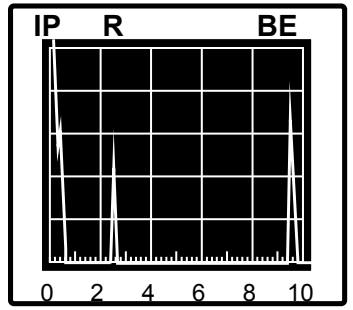


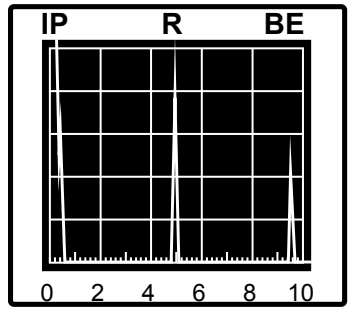


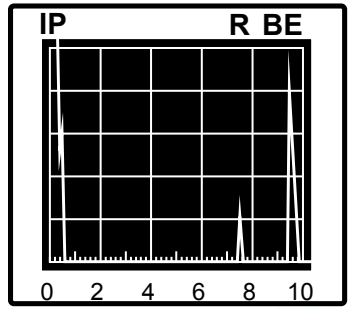


Flaw distances and echo amplitudes

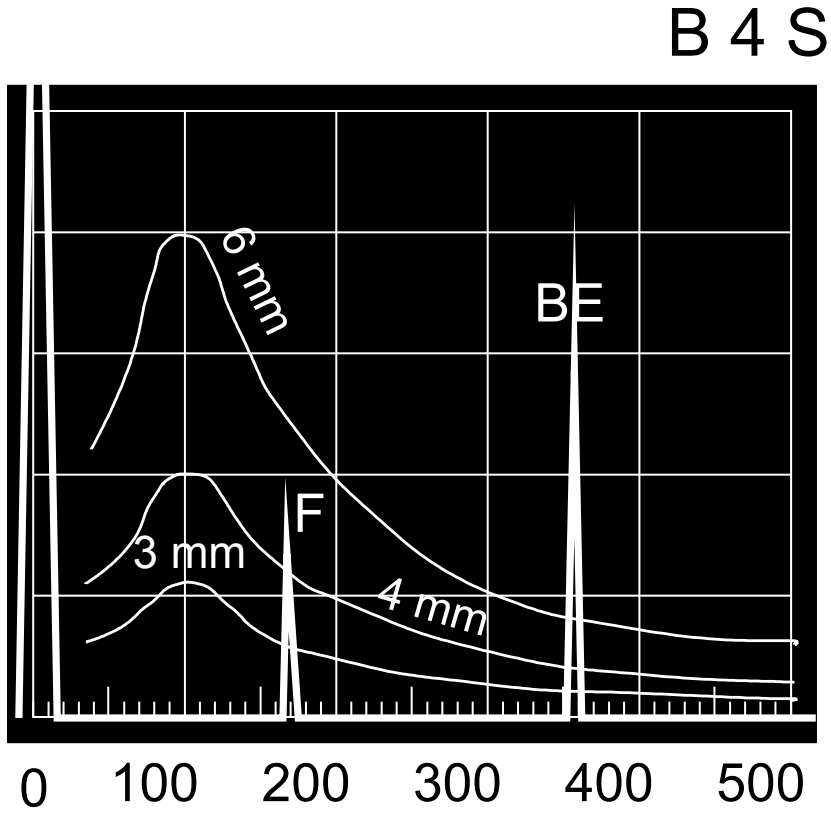




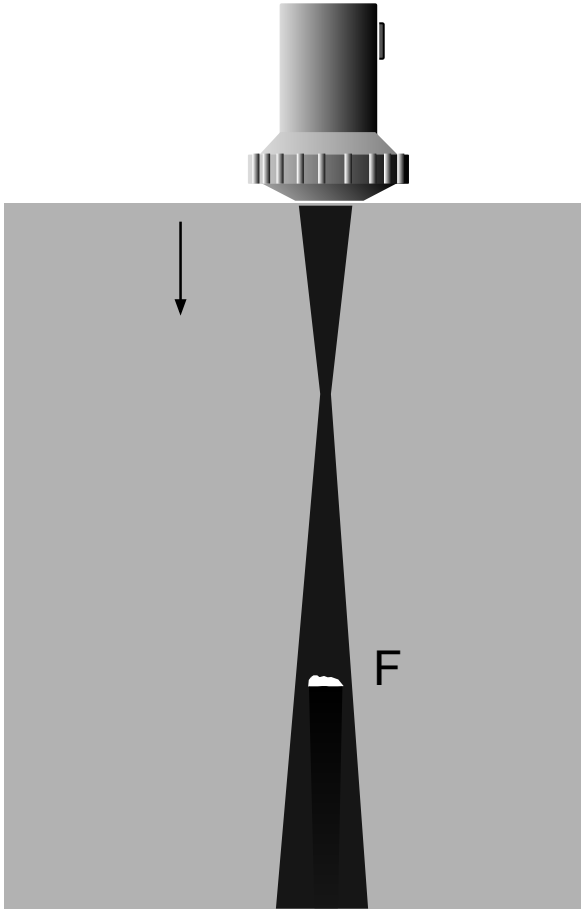




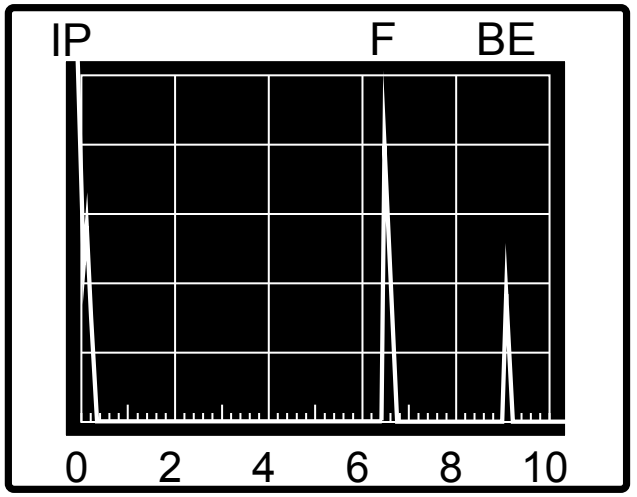
Distance amplitude curves on the CRT screen



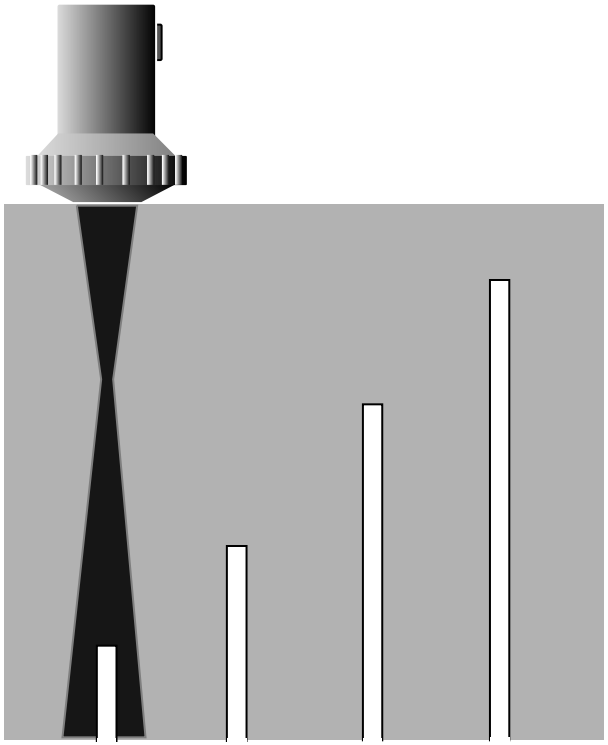
Defect evaluation by comparison - 1



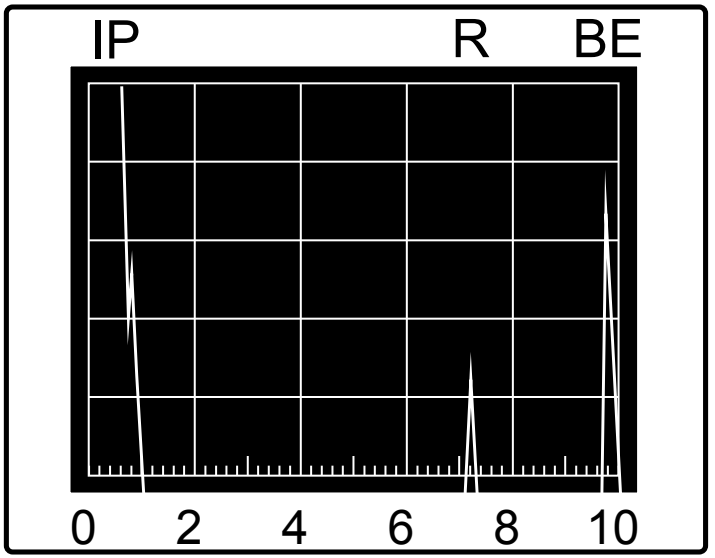
instrument gain: G = 34 dB



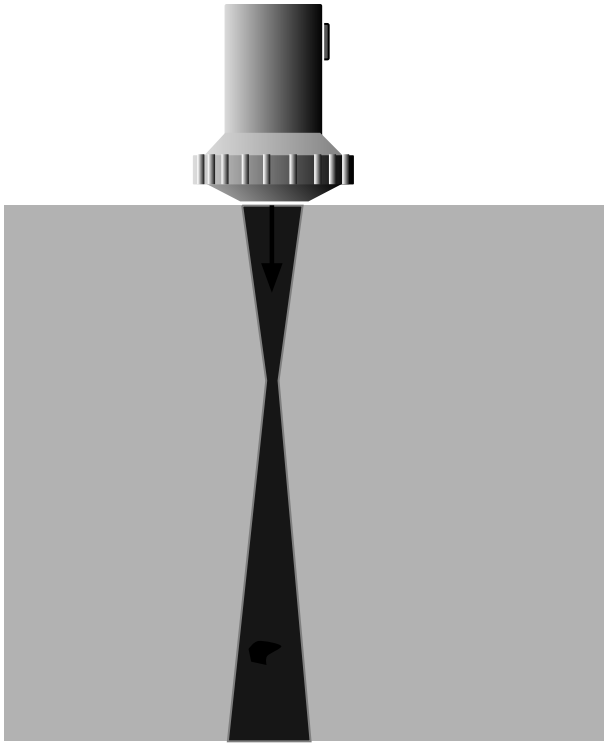
Defect evaluation by comparison - 2

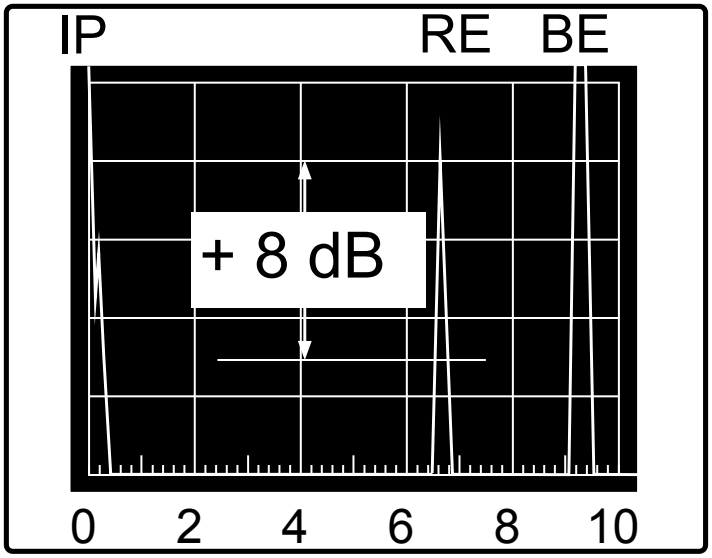


instrument gain: 34 dB



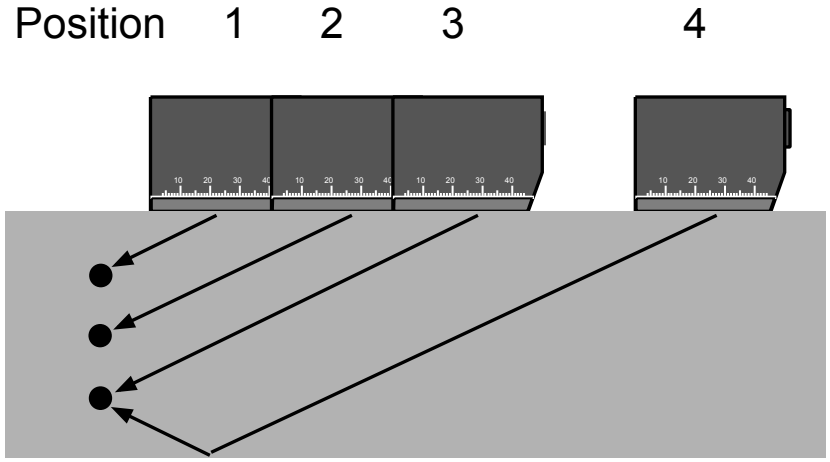
Defect evaluation by comparison - 3

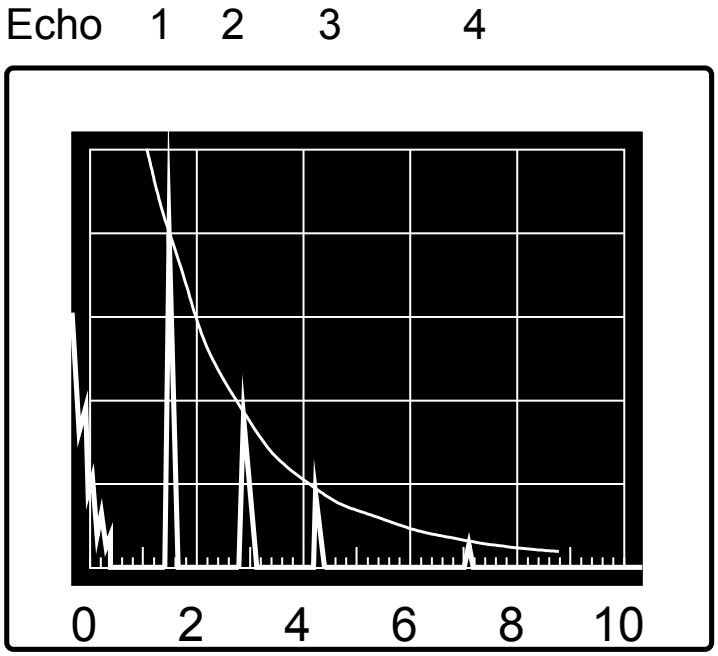




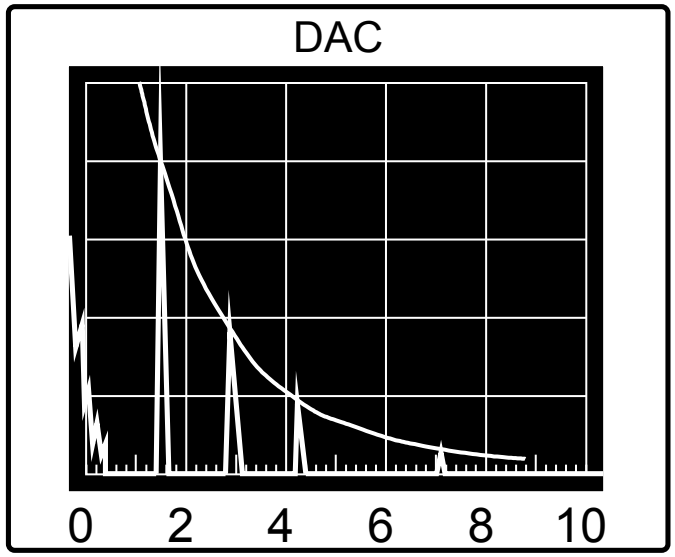
instrument gain: 42 dB

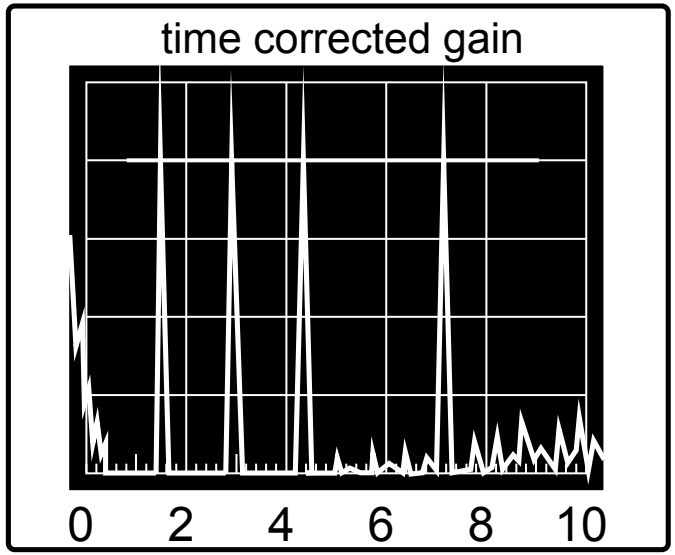
Distance amplitude curve (DAC)





DAC and TCG





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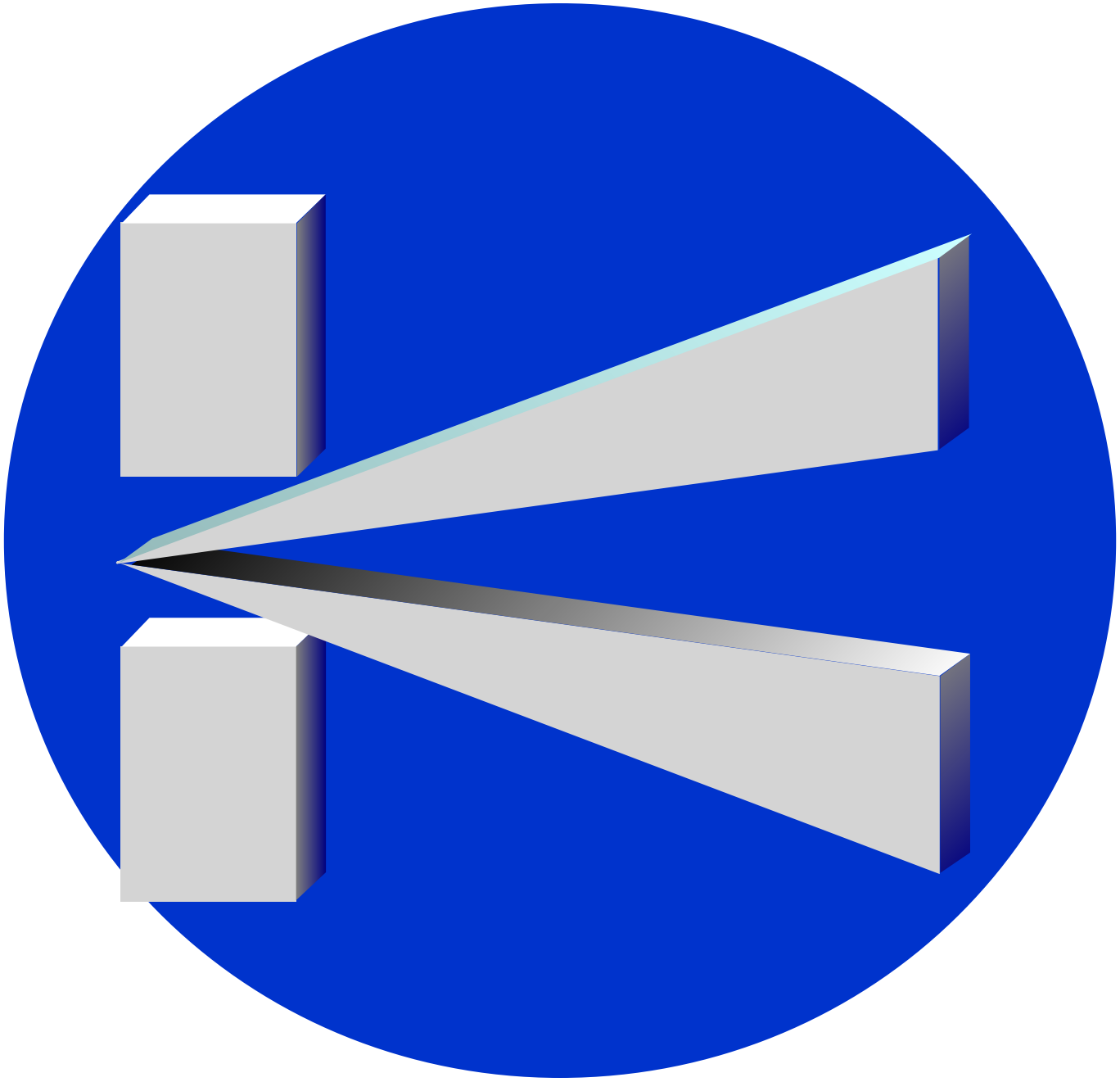
a worldwide response



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