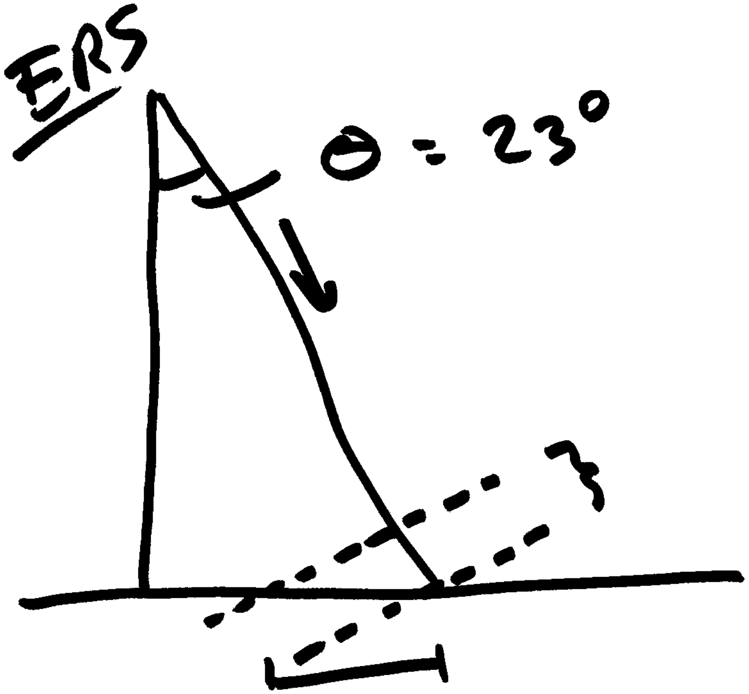


Range Resolution

$$\frac{c\tau}{2} = \frac{c}{2B}$$

τ: effective pulse width

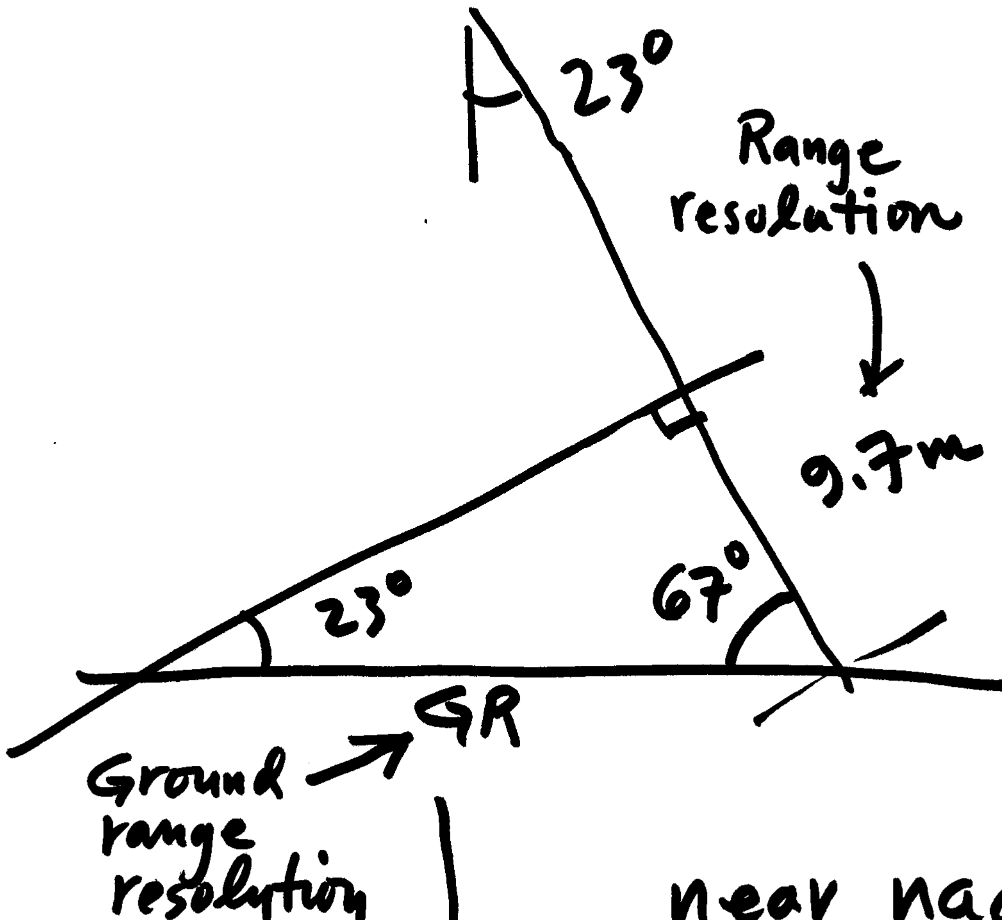
B: bandwidth

$B_{ERS} = 15.6$ Mhz

Range Resolution $= \frac{c}{2B}$

$$\frac{3 \times 10^8}{2 \cdot 15.6 \times 10^6} = \underline{\underline{9.7\,m}}$$

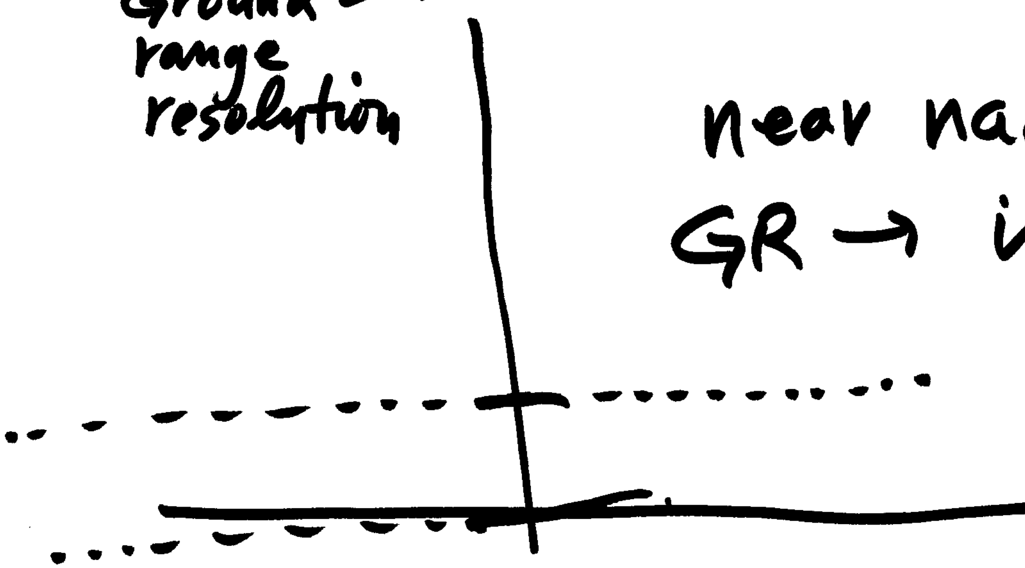
Really Slant Range Resolution



$$\frac{9.7}{GR} = \cos 67^\circ$$

$$GR = \frac{9.7}{\cos 67^\circ}$$

$$GR = \underline{24.8m}$$

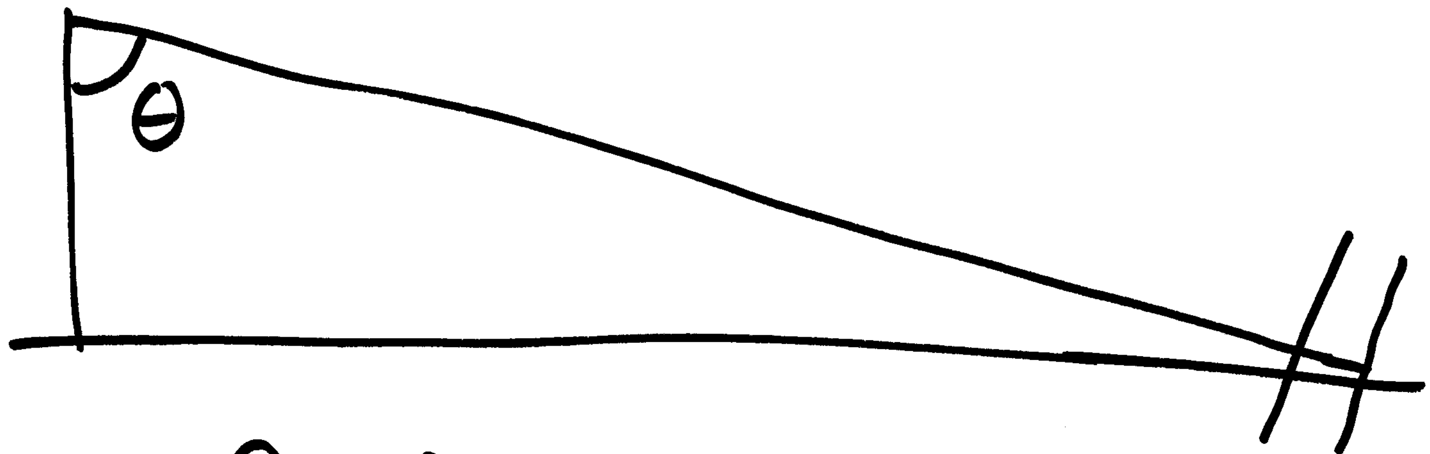


near nadir line of sight

GR → infinite

⇒ cannot look at nadir

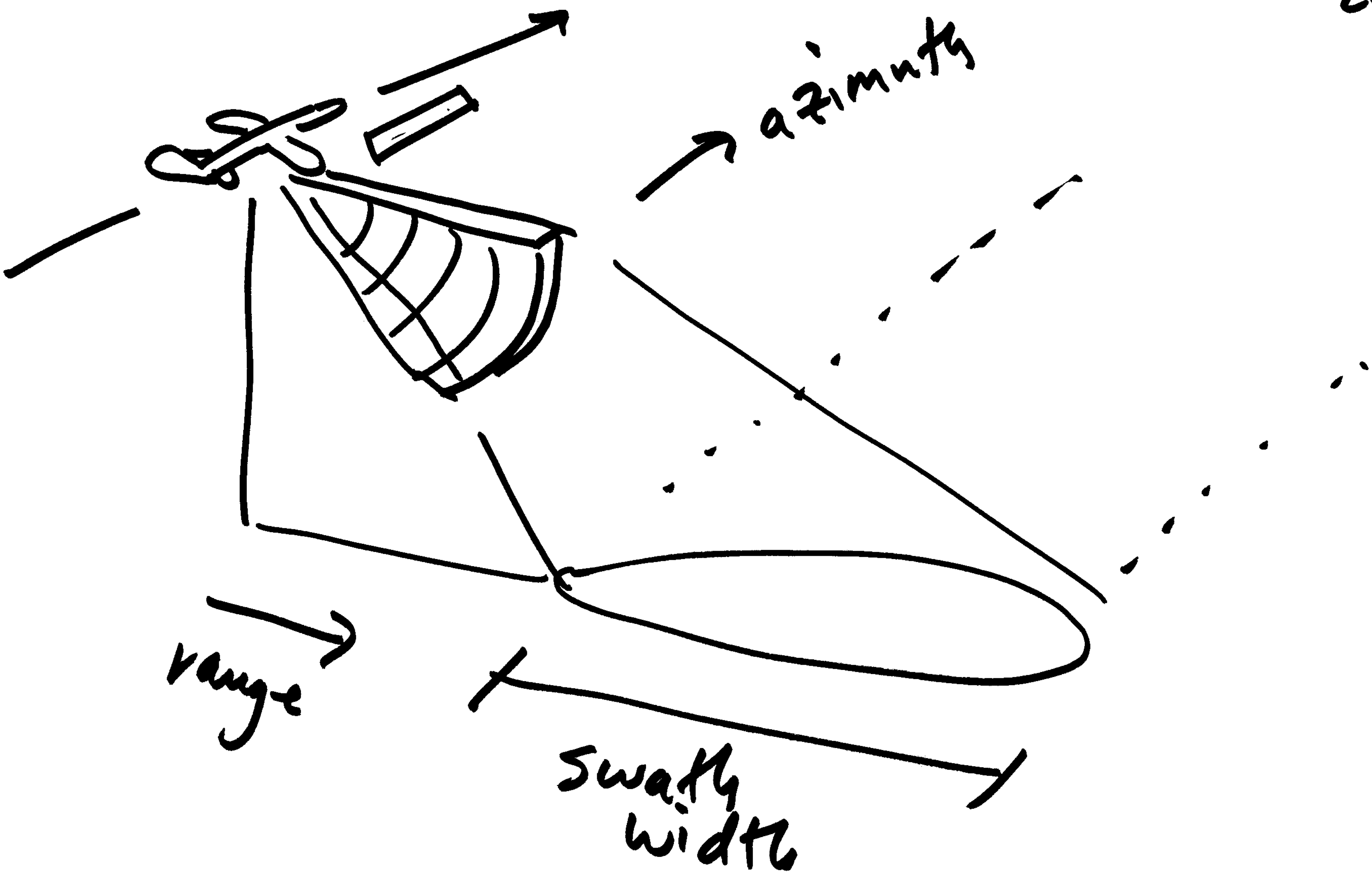
must look to <u>side</u>

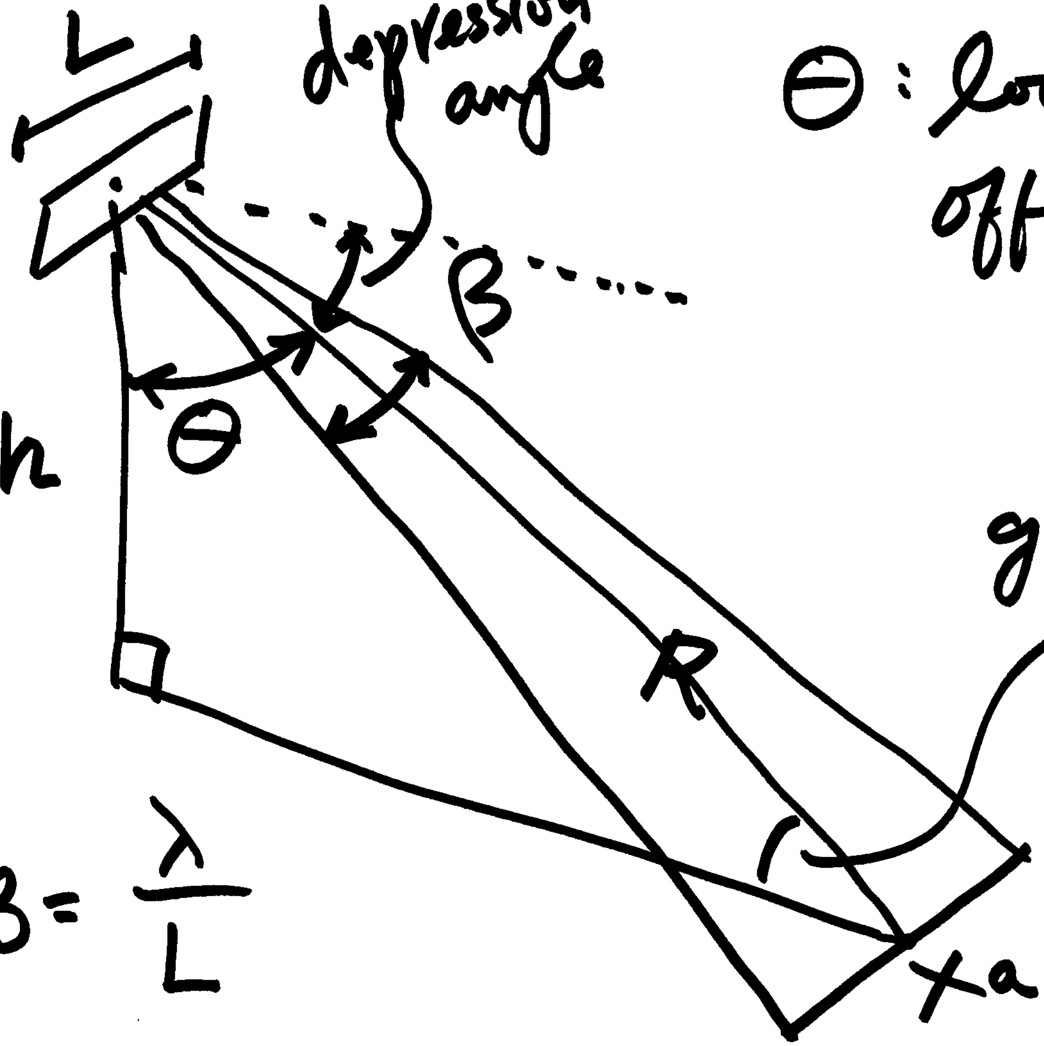


near $\theta \approx 90$

GR becomes = Slant Range resolution

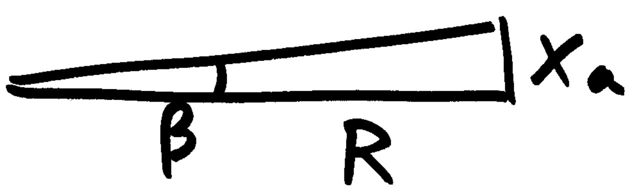
Azimuth Resolution


azimuth
range
swath
width



Θ : look angle off nadir

$$\beta = \frac{\lambda}{L}$$



$$\frac{x_a}{R} = \tan\beta, \quad x_a = R\tan\beta$$

$$h/R = \cos(\Theta)$$

$R = h/\cos\theta \qquad X_a = R\tan\beta$

$$X_a = \frac{h}{\cos\theta}\cdot\tan\beta$$

assume small β

$\tan\beta \approx (\beta)$

$$X_a = \frac{h\cdot\beta}{\cos\theta}, \qquad \beta = \frac{\lambda}{L}$$

$$\boxed{X_a = \frac{h\lambda}{L\cos\theta}}$$

Azimuth Resolution for <u>Real</u> <u>Aperture</u>

EXAMPLE (1) (airborne)

$h = 2000\,m$, $\theta = 35°$

$\lambda = 27\,cm$ (L-Band), $L = 3\,m$

$$X_a = \frac{2000 \times 0.27}{3 \cdot \cos(35°)} = \underline{\underline{220\,m}}$$

(1a) $h = 2000\,m$, $\theta = 35°$

$\lambda = 27\,cm$, $L = ?$, $X_a = 1\,m$

$$1 = \frac{2000 \cdot 0.27}{L \cdot \cos 35°}, \quad \underline{L = 659\,m}$$

<u>ERS satellite</u>

$h = 780$ km

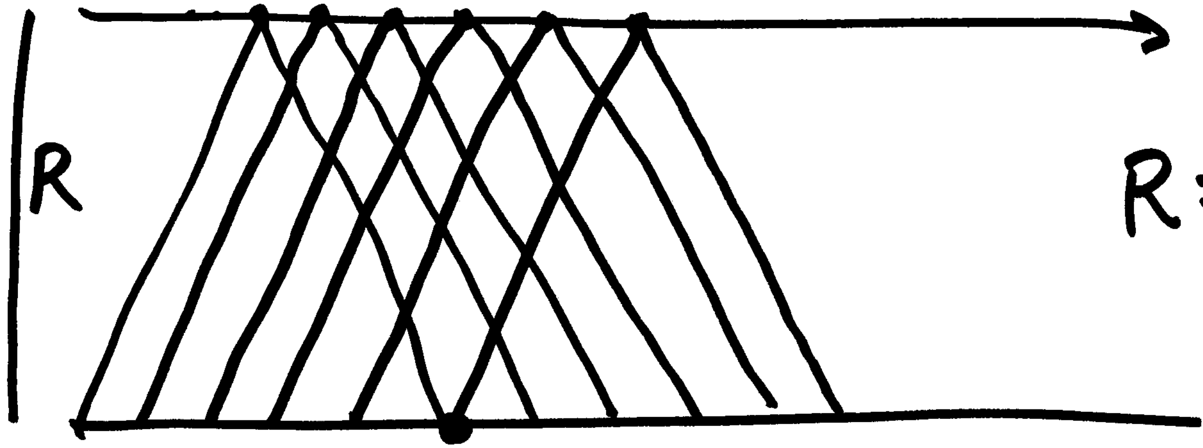
$\lambda = 5.6$ cm

$L = 10$ m

$\theta = 23^\circ$

$$X_a = \frac{780000 \times .056}{10 \cdot \cos 23^\circ} = \underline{\underline{4.7\ \text{km}}}$$

To improve azimuth resolution:



$$R = \frac{h}{\cos\theta}$$

$$\beta = \frac{\lambda}{L}$$

$$\mathcal{L} = R\beta = \boxed{R\frac{\lambda}{L}}$$

beamwidth on ground

$$\mathcal{L} = \frac{h}{\cos\theta} \cdot \frac{\lambda}{L}$$

what if antenna length is $\mathcal{L}$ rather L ?

$$\beta_s = \frac{\lambda}{\mathcal{L}}$$

$$X_{a(s)} = \beta_s R = \frac{\lambda}{L} \cdot R = \frac{\lambda R}{R\lambda / L} = L$$

Synthetic Aperture

azimuth resolution is $\underline{\underline{L}}$

(1) independent of R

(2) proportional to antenna length

Range Resolution

$c/2B$

Azimuth Resolution

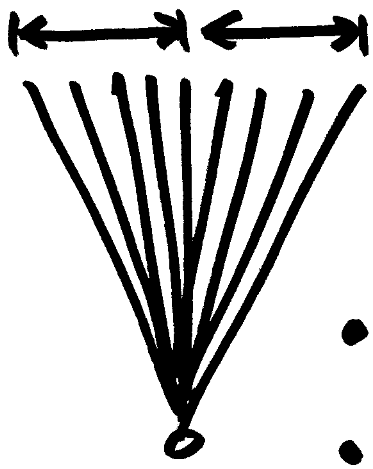
L

} both are independent of range

ERS Range: slant 9.7 m
ground 24.8 m

Azimuth: 10 m

"resolve" discrepancy 10 m vs 25 m



look 1, look 2
multi-look image

- Range + Az. consistent
- diminish speckle