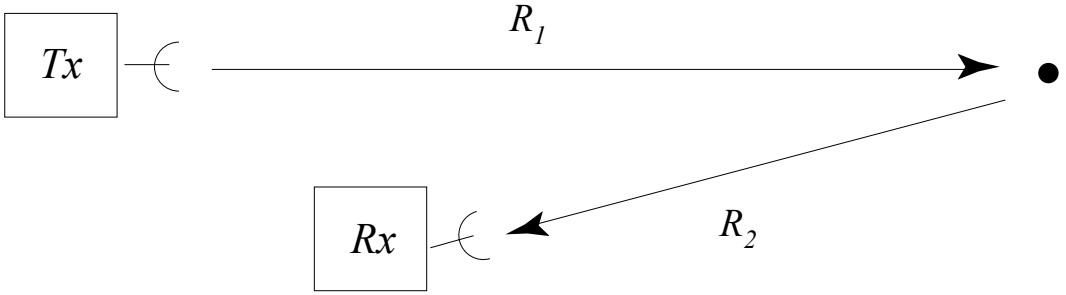
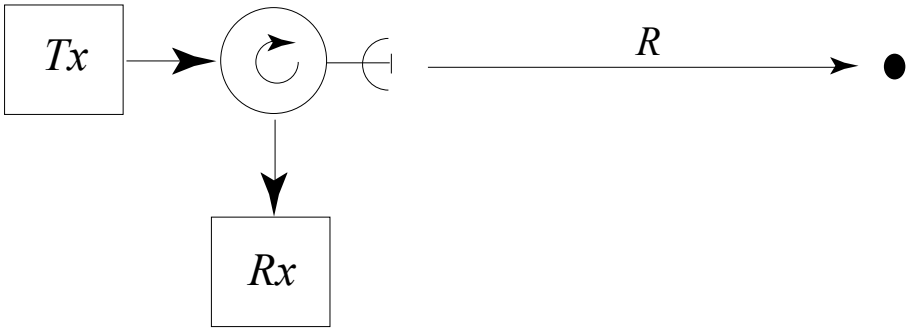
RADAR
(RAdio Detection And Ranging)

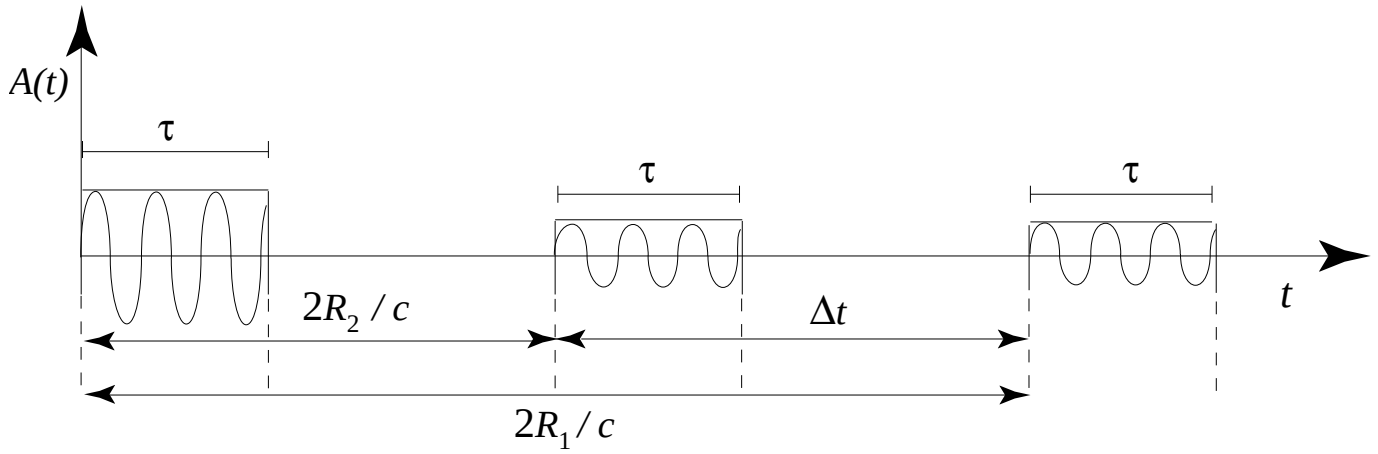




$$\Delta T = \frac{2\,R}{c}$$

$$R = \frac{c\,\Delta T}{2}$$

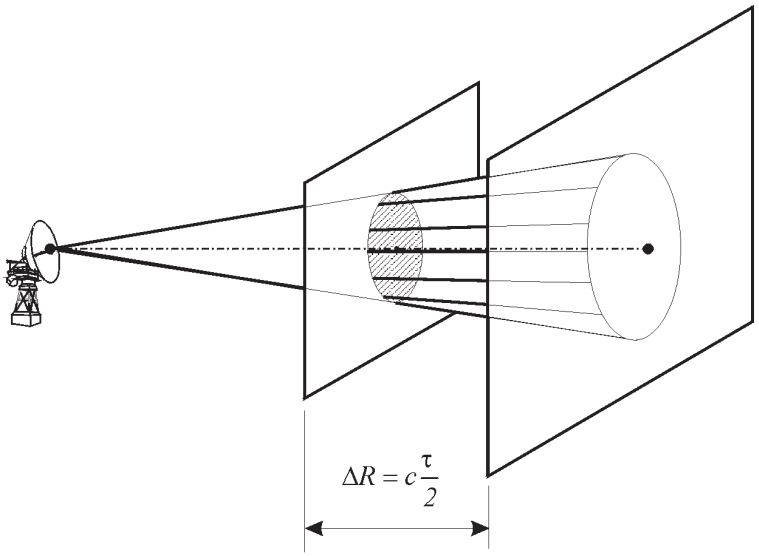
RISOLUZIONE IN DISTANZA



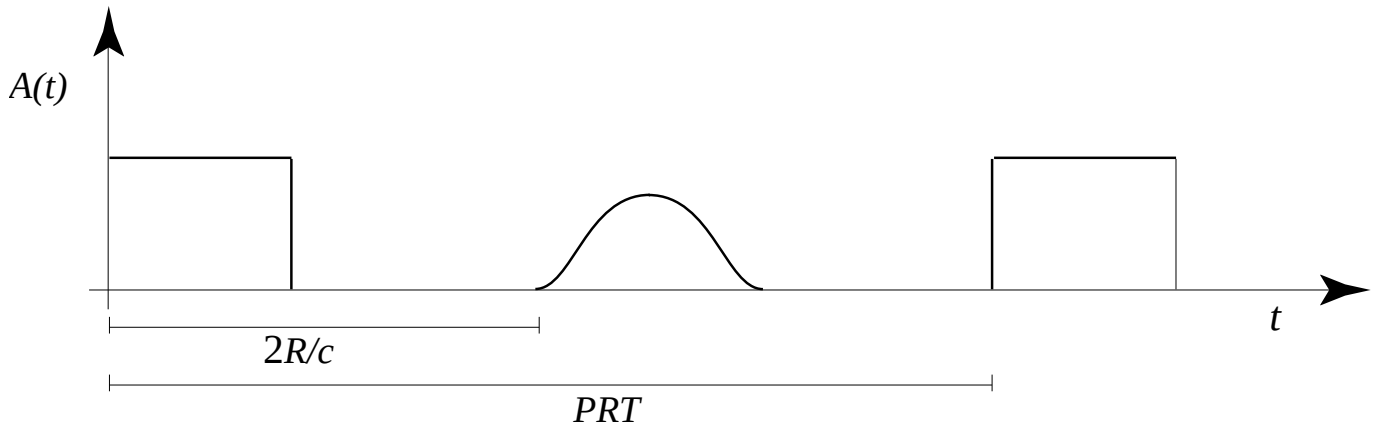
$$\Delta t = \frac{2\,R_1}{c} - \frac{2\,R_2}{c} = \frac{2\,(R_1 - R_2)}{c} > \tau$$

$$R_1 - R_2 > R_{\text{min}} = \frac{c\,\tau}{2}$$

τ	=	1 μs	R_{min}	=	150 m
τ	=	0.5 μs	R_{min}	=	75 m
τ	=	0.1 μs	R_{min}	=	15 m



cella di risoluzione spaziale



T	=	PRT	Pulse Repetition Time
	=	PRI	Pulse Repetition Interval
$\frac{1}{T}$	=	PRF	Pulse Repetition Frequency
d	=	$\frac{\tau}{\text{PRT}}$	duty cycle

$$W_{\text{m}} = \frac{E}{T} = W_T \frac{\tau}{T}$$

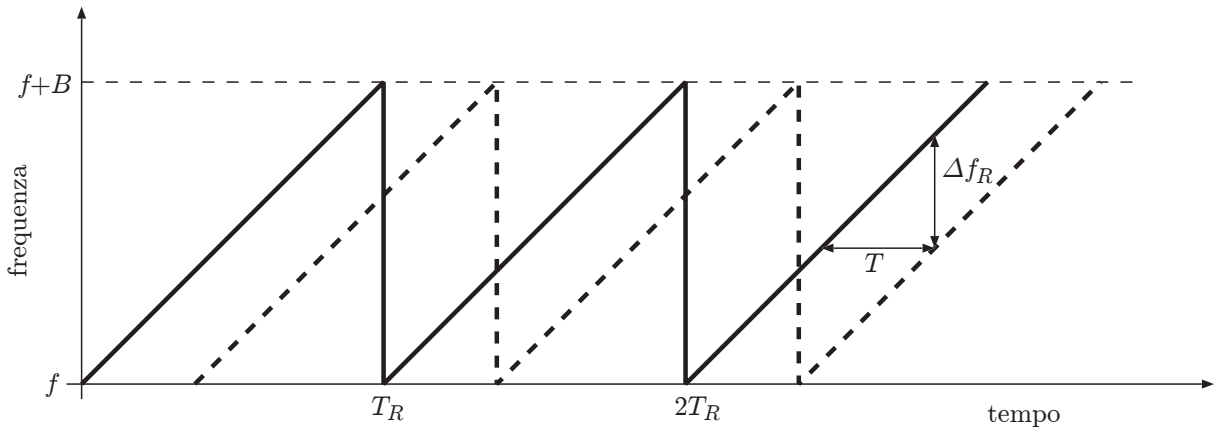
W_{m}: potenza media
W_T: potenza di picco (efficace)
E: energia dell'impulso

$W_T = 0.5$ MW $\quad d = 0.001 \quad W_{\text{m}} = 500$ W

sistemi per il controllo del traffico aereo:

$\tau = 1\ \mu$s $\quad T = 1$ ms $\quad d = 0.001$

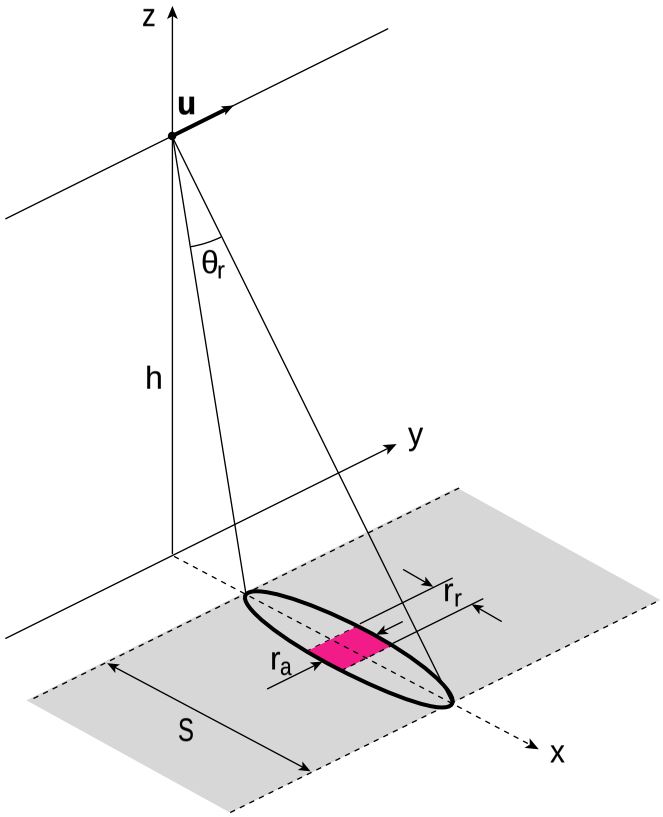
RADAR FM

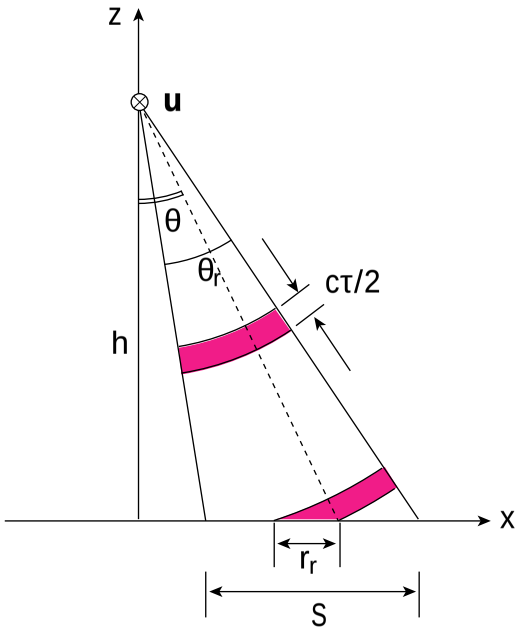


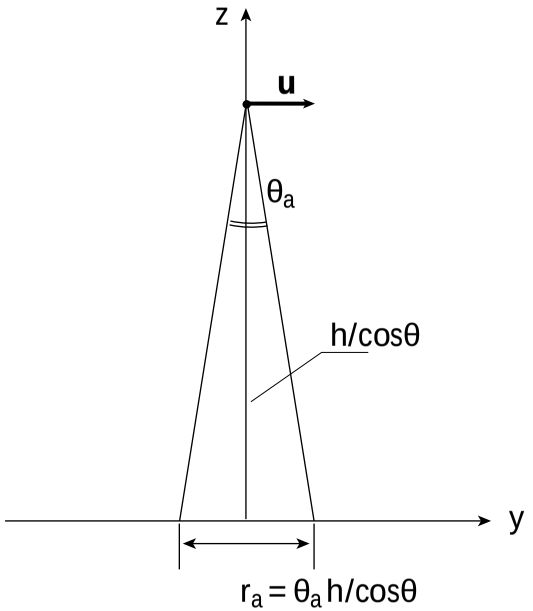
$$\Delta f_R = \frac{df}{dt} T = \frac{B}{T_R} T = \frac{B}{T_R} \frac{2\,R}{c}$$

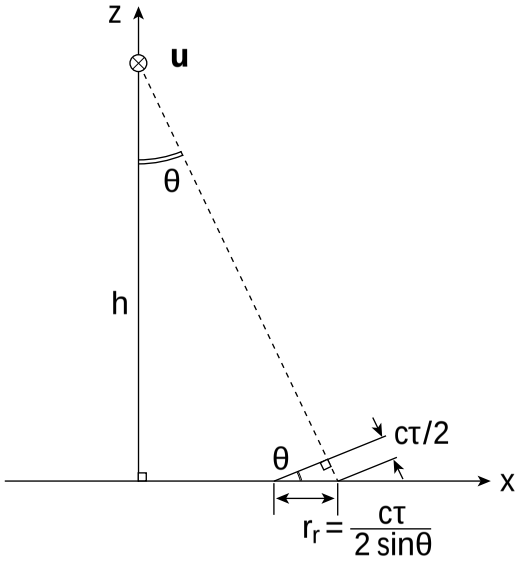
$$R = \frac{c\,T_R}{2\,B} \Delta f_R$$

T_R: WRT (Waveform Repetition Time)



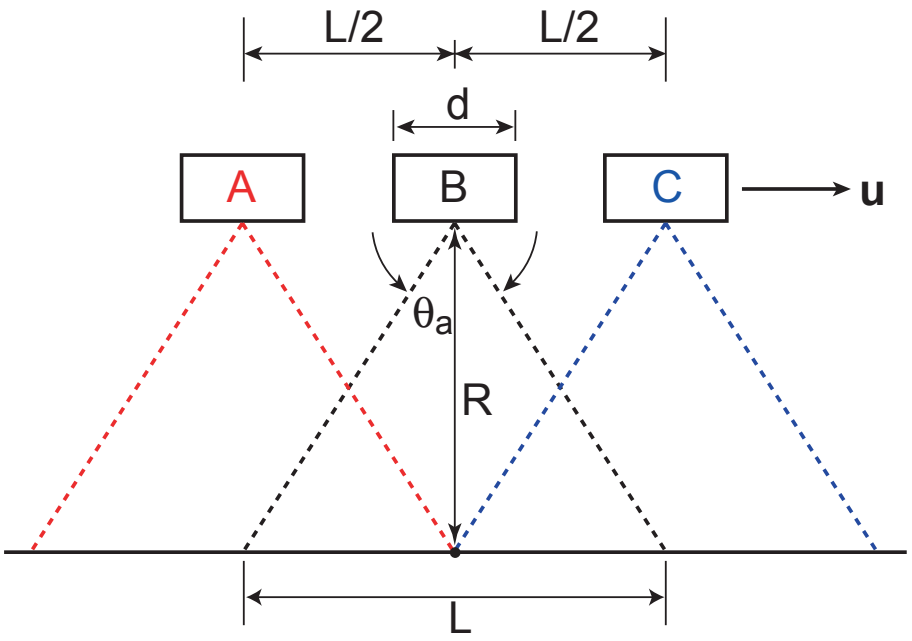






geometria di osservazione per uno
SLAR (Side Looking Airborne Radar)

risoluzione in *azimuth* per un SAR (Synthetic Aperture Radar)



$$L = \theta_a R$$

$$\theta_{as} = C_s \frac{\lambda}{2\,L}$$

$$r_{as} = \theta_{as} R = \frac{C_s\,\lambda\,R}{2\,L} = \frac{C_s\,\lambda}{2\,\theta_a}$$

$$\theta_a = C_r \frac{\lambda}{d}$$

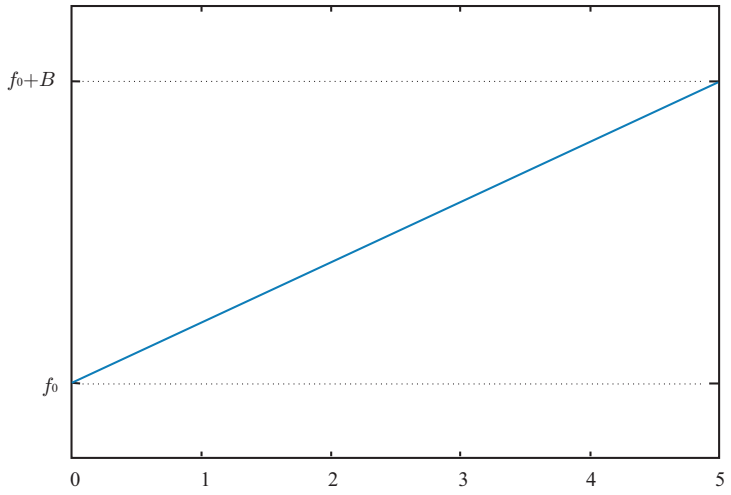
$$r_{as} = \frac{C_s\,\lambda\,d}{C_r\,2\,\lambda} = \frac{C_s}{C_r}\frac{d}{2} \simeq \frac{d}{2}$$

$$r_{ar} = \theta_a R = \frac{C_r\,\lambda\,R}{d} \simeq \frac{\lambda\,R}{d}$$

modulazione CHIRP

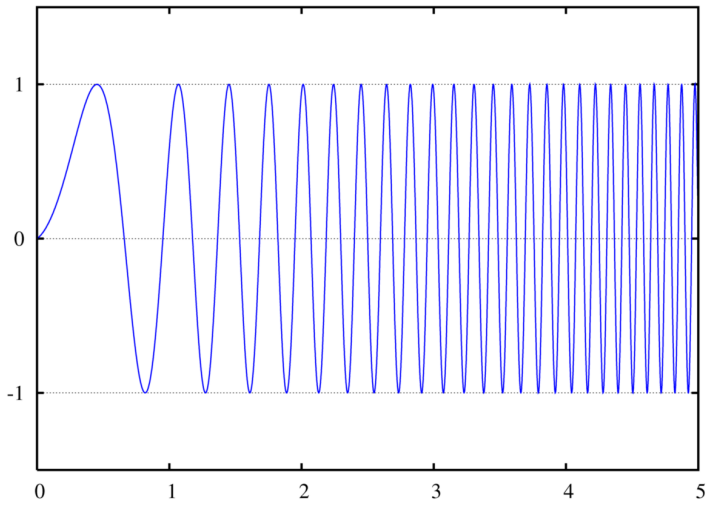
frequenza istantanea in modulazione CHIRP lineare:

$$f(t) = f_0 + k\,t \quad (f_0 < f(t) < f_0 + B)$$



segnale modulato:

$$x(t) = \sin\left[2\pi \int_0^t f(t')\,dt'\right] = \sin\left[2\pi(f_0 + k\,t)t\right]$$



durata equivalente di un impulso radar modulato: $\tau_e = \dfrac{1}{B}$

$$\Downarrow$$

risoluzione in distanza: $R_{\text{min}} = \dfrac{c\,\tau_e}{2} = \dfrac{c}{2\,B}$