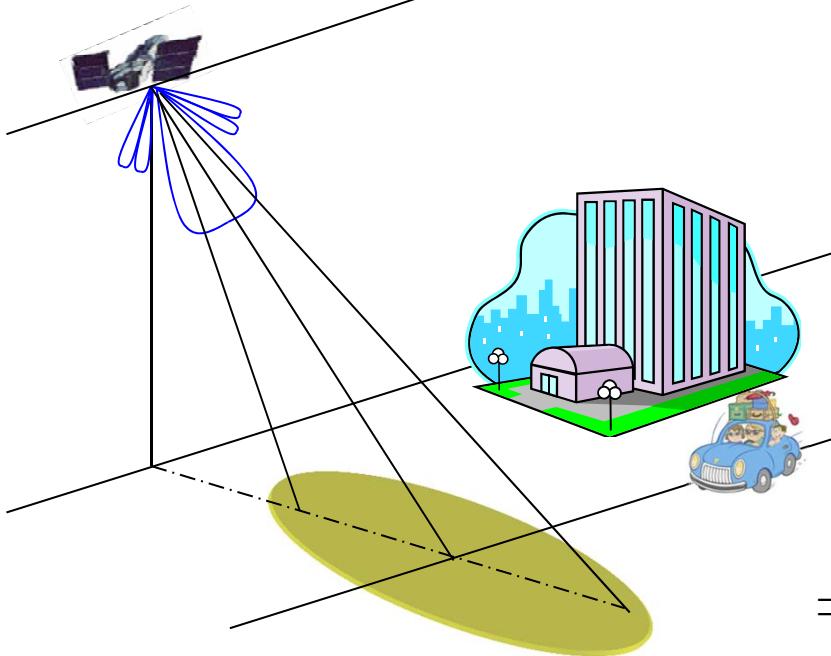

Introduction to ISAR imaging systems Parte II

Moving targets in SAR images (1/2)



SAR focusing

- Correct focusing of **stationary background** (e.g. buildings)
- Defocusing of **moving targets** (e.g. vehicles)

Radial velocity
causes Doppler shift
⇒ target misplaced in azimuth

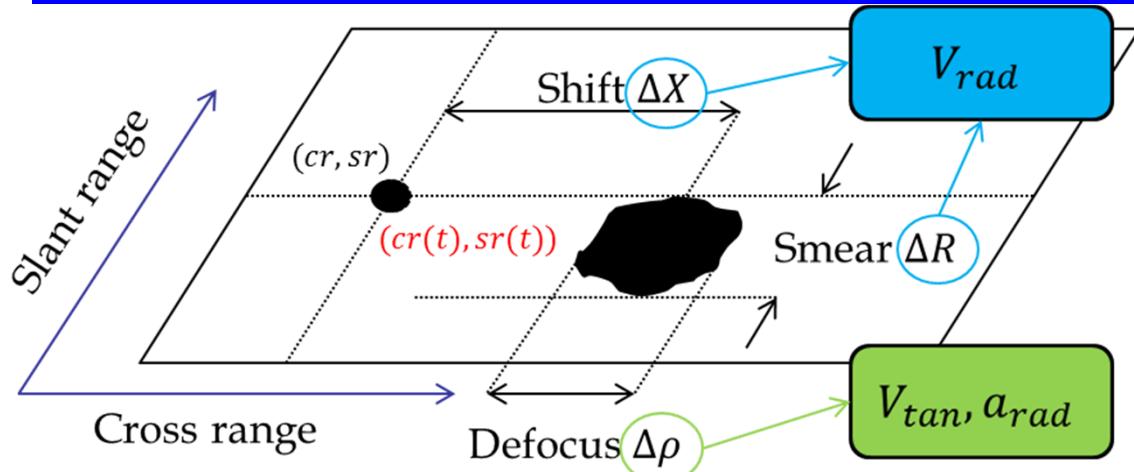
Along-track gives rise to mis-match in azimuth processing

Degradation of the quality of the image of the moving target (even for low mis-match)

Losses in the detection of the movers (for medium high mis-match)

Many times we deal with hybrid SAR/ISAR ...

Moving targets in SAR images (2/2)



- ΔX : range shift
- $\Delta \rho$: azimuth defocus
- ΔR : range smear

Azimuth chirp rate :

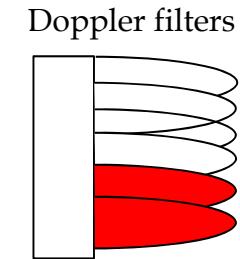
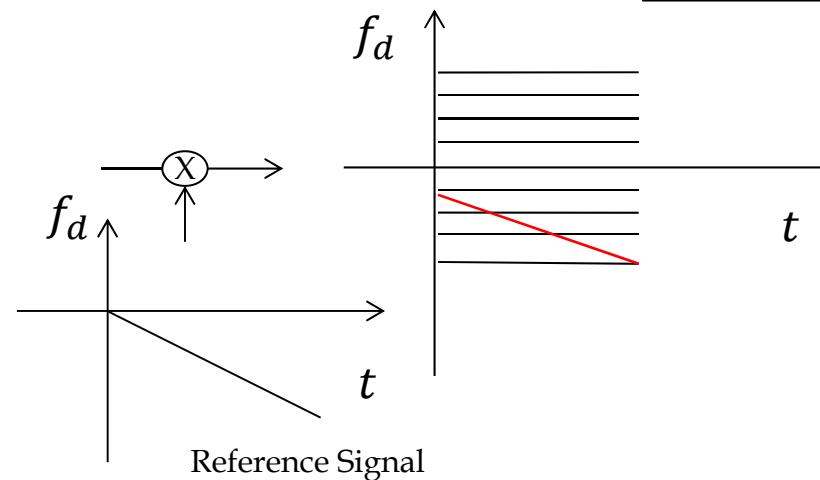
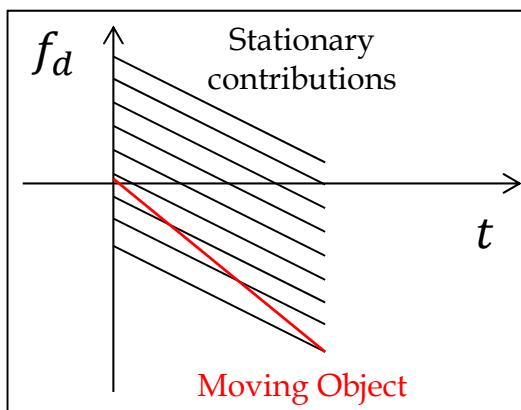
$$\bullet \quad \beta = \frac{2V^2}{\lambda R_0}$$

Stationary scene:

$$V = V_p$$

Moving objects:

$$V = V_p \pm V_{tan}$$



Sistemi Radar

Moving vehicles in CSK SAR images (1/4)



COSMO-SkyMed E-Spotlight
SLC SAR image.
Data provided by Italian Space Agency.

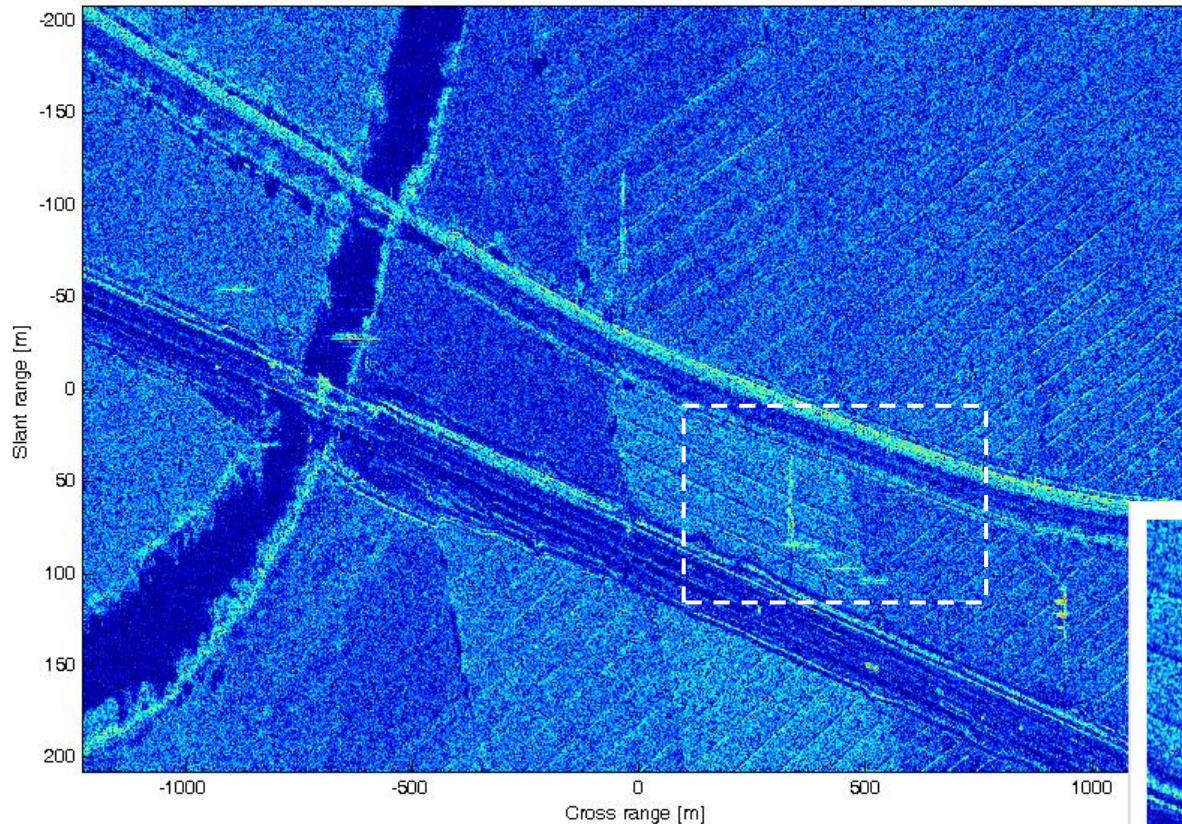
■ Dataset properties :

- Product Level : 1A SSC
- Acquisition Mode : E-Spotlight
- Covered Area : $D_{cr} \times D_{sr}$ (10.01×6.22) [km]
- Spatial resolutions : $r_{cr} = 1.13$ [m]; $r_{sr} = 0.48$ [m]
- Acquisition duration : 1,39 [s]

■ Scene features :

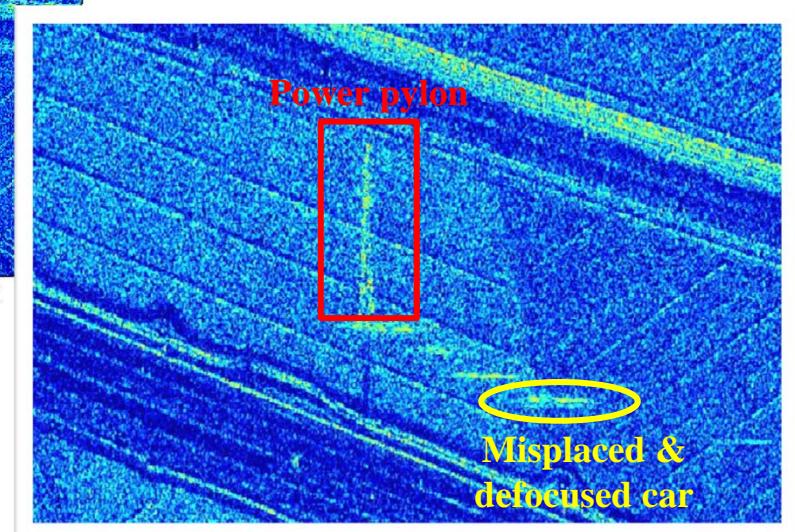
- Area location : North of Rome
- Acquisition date : May 5 2010
- Acquisition time : 18:01:21
- Image content : A1 motorway (Milan-Naples), Tiber river

Moving vehicles in CSK SAR images (2/4)

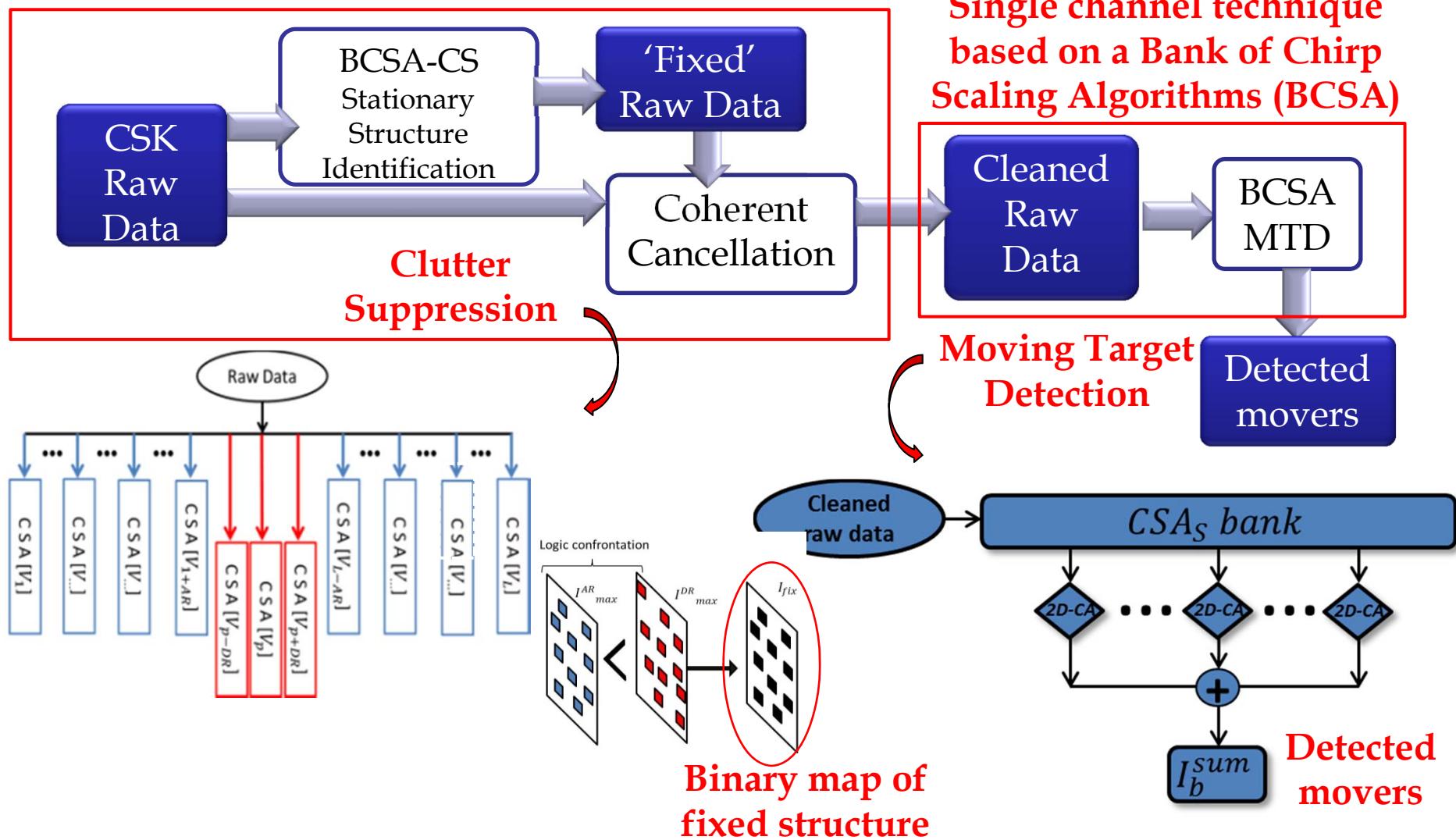


- ❖ Moving vehicles on the motorway are mainly interested by an along track velocity.

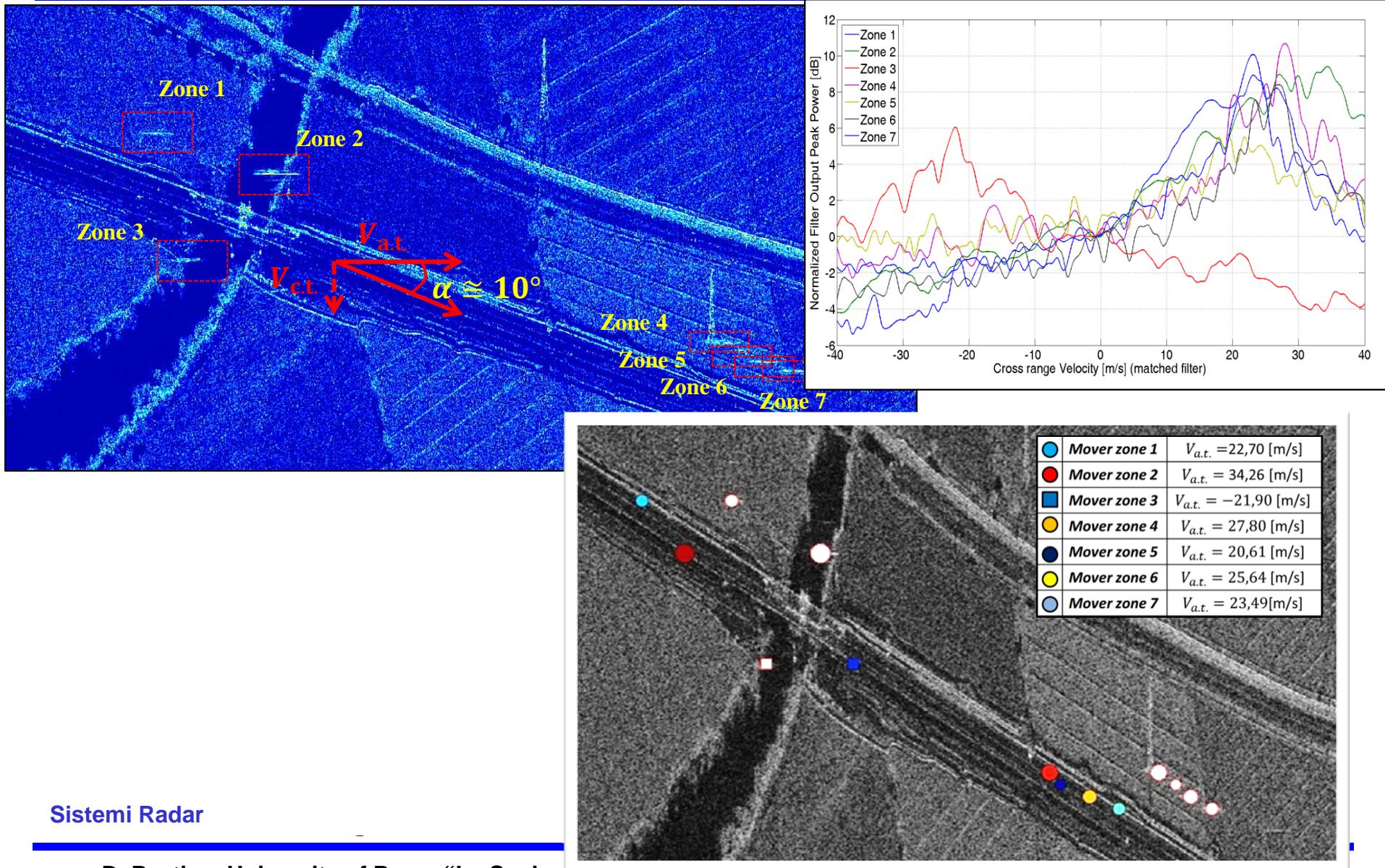
- Main patch features:
 - Predominant distributed clutter presence
 - Sparse man-made stationary structure (e.g. Power pylons in red frames)
 - The motorway is oriented forming an angle of about 10° with the cross-range direction



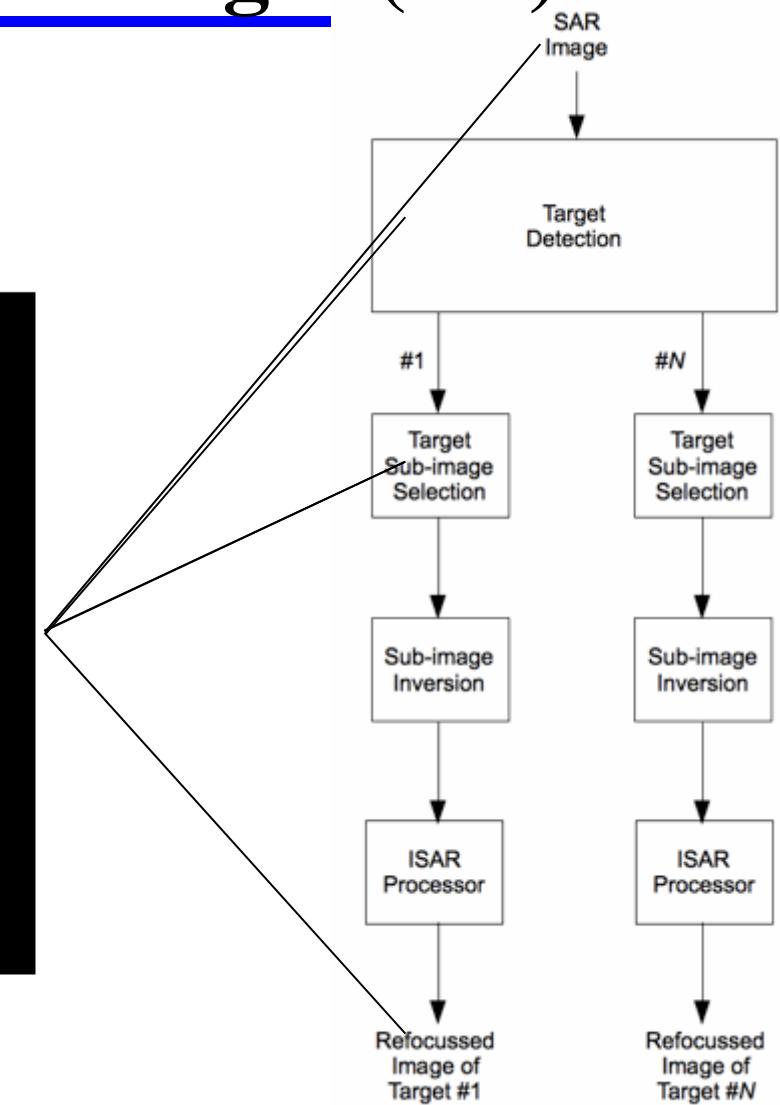
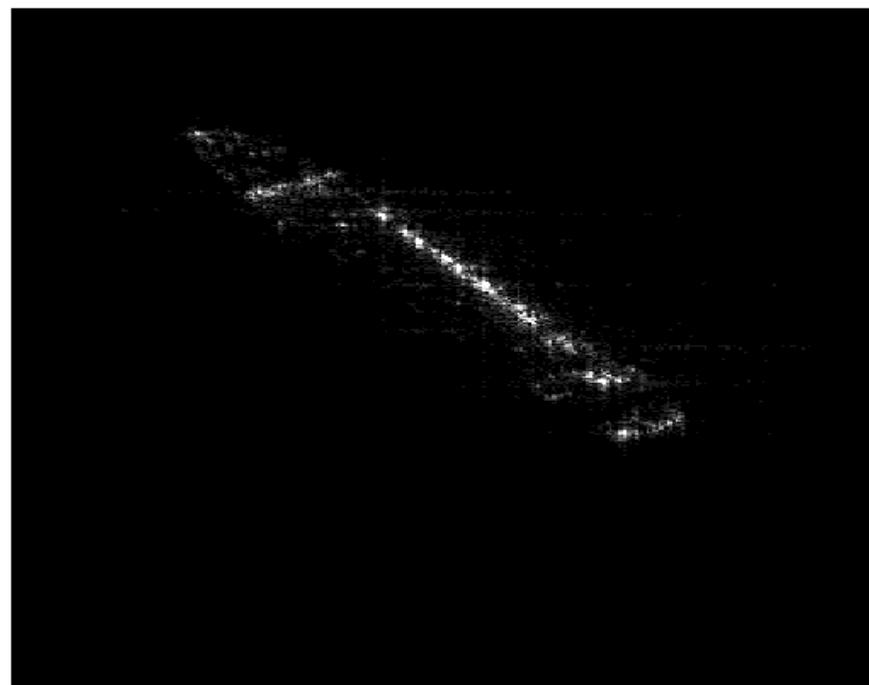
Moving vehicles in CSK SAR images (3/4)



Moving vehicles in CSK SAR images (4/4)



Moving ships in CSK SAR images (1/3)

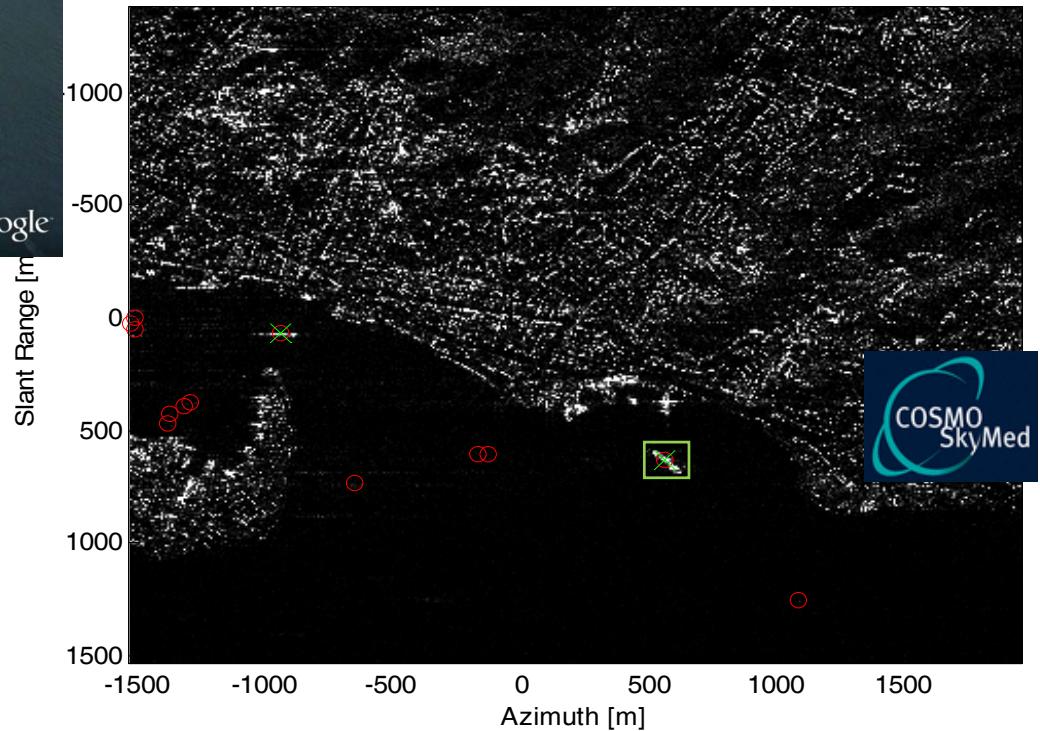


Moving ships in CSK SAR images (2/3)



Ship targets detected in SAR scenes can be properly focused in order to feed ATR procedures.

Example: ship target near Messina harbour



Data provided by ASI (Italian Space Agency).

Moving ships in CSK SAR images (3/3)

Autofocus applied to the patch of the CSK image containing the defocused target.

