Characterization of Target acquired in different polarizations through Radar GB-SAR Ka-Band

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INTRODUCTION TO SAR TECHNOLOGY

What is a SAR Radar?

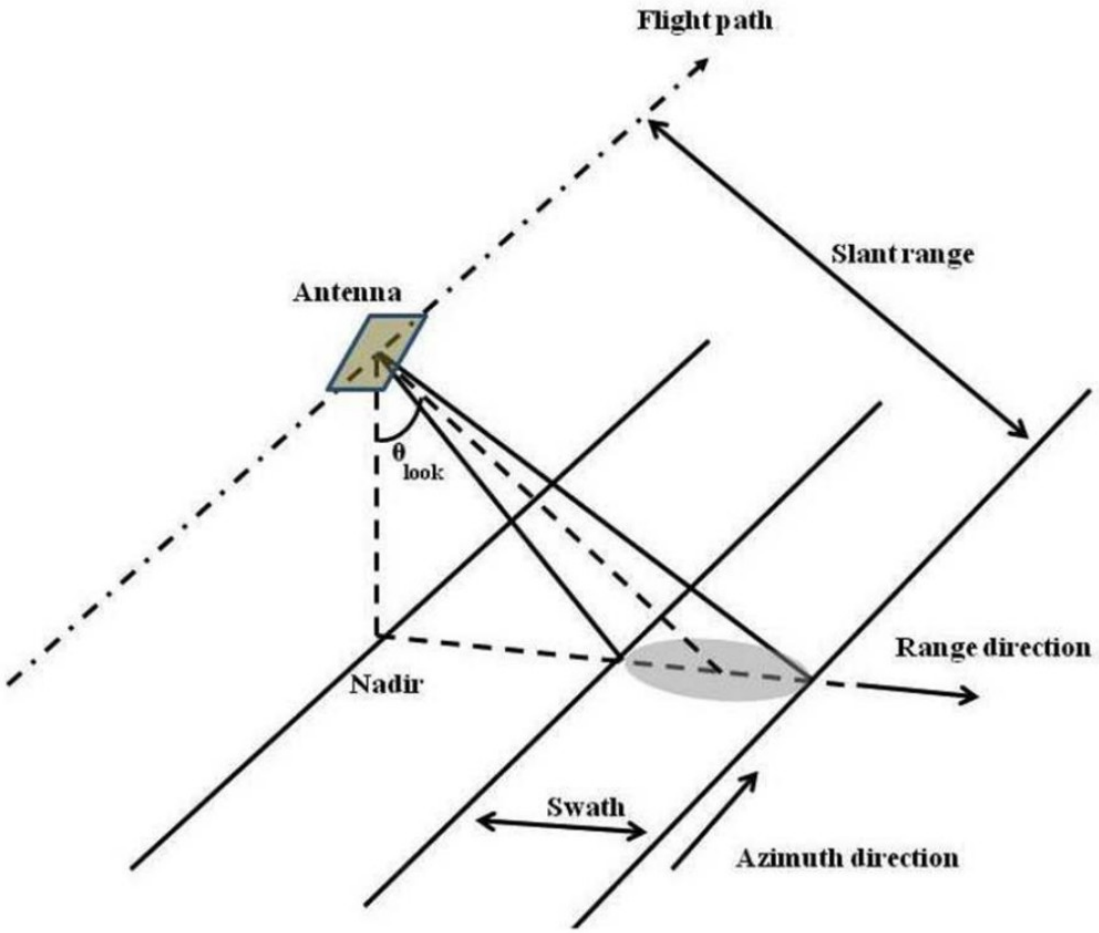


Figura 1: Modello semplificato di sistema SAR.

GB-SAR Systems

Pro:

- **Easy to install**
- **Millimetric accuracy**
- **High temporal resolution**
- **Remotely controlled**

2
ENVIRONMENT AND TOOLS

Environment

Tools 1/3

Set-up utilizzato:

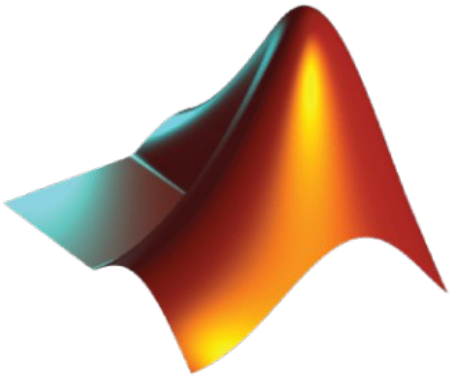
- **[A] Radar IBIS**
- **[B] Personal Computer**
- **[C] Tripod with rotating head**
- **Generator 12V**

Tools 2/3

TARGET	POLARIZATION
PLATE	VV
DIHEDRAL	VV,HH,HV,VH
CYLINDER	VV,HH,HV,VH




Tools 3/3



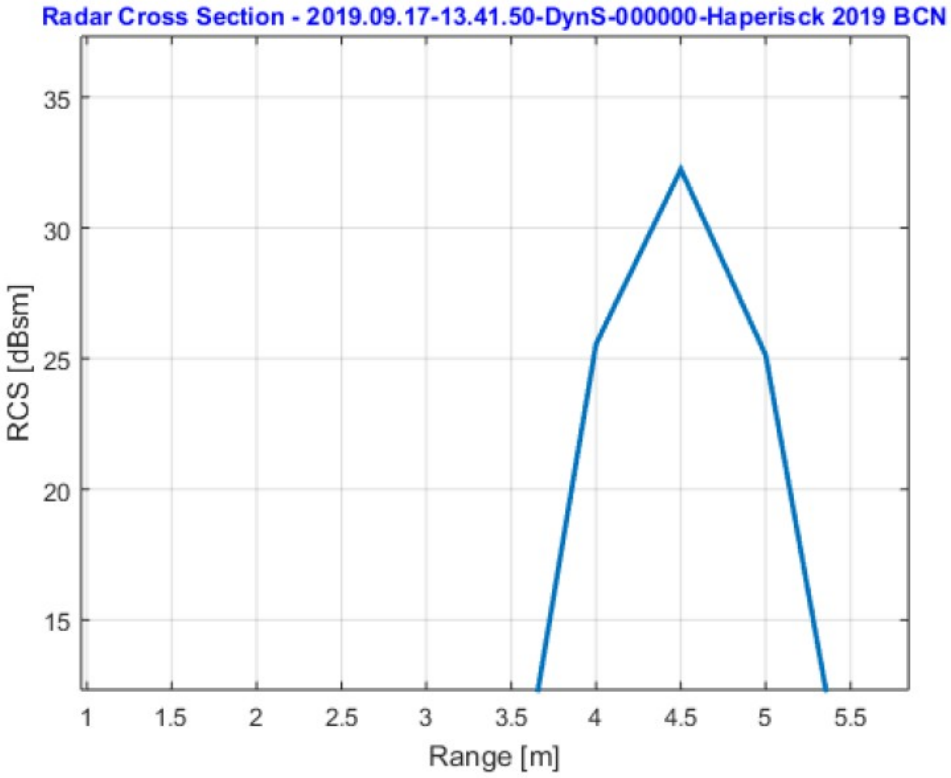
MATLAB

IDS GeoRadar

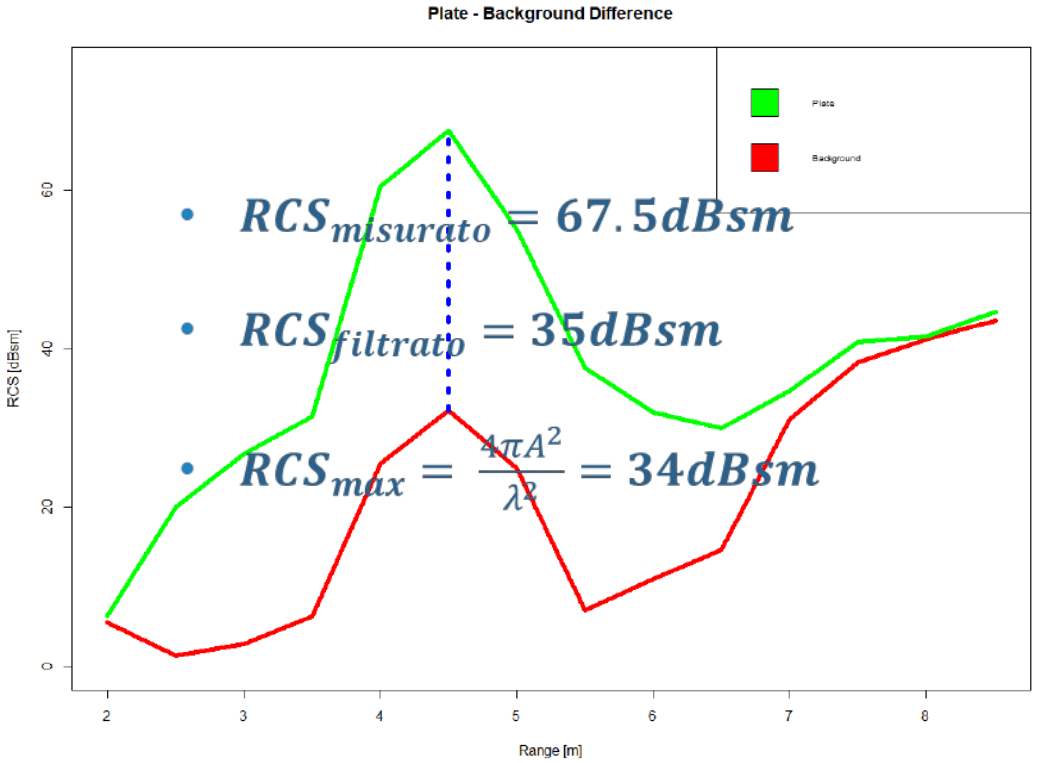
3

RESULTS ANALYSIS

Background Noise Evaluation

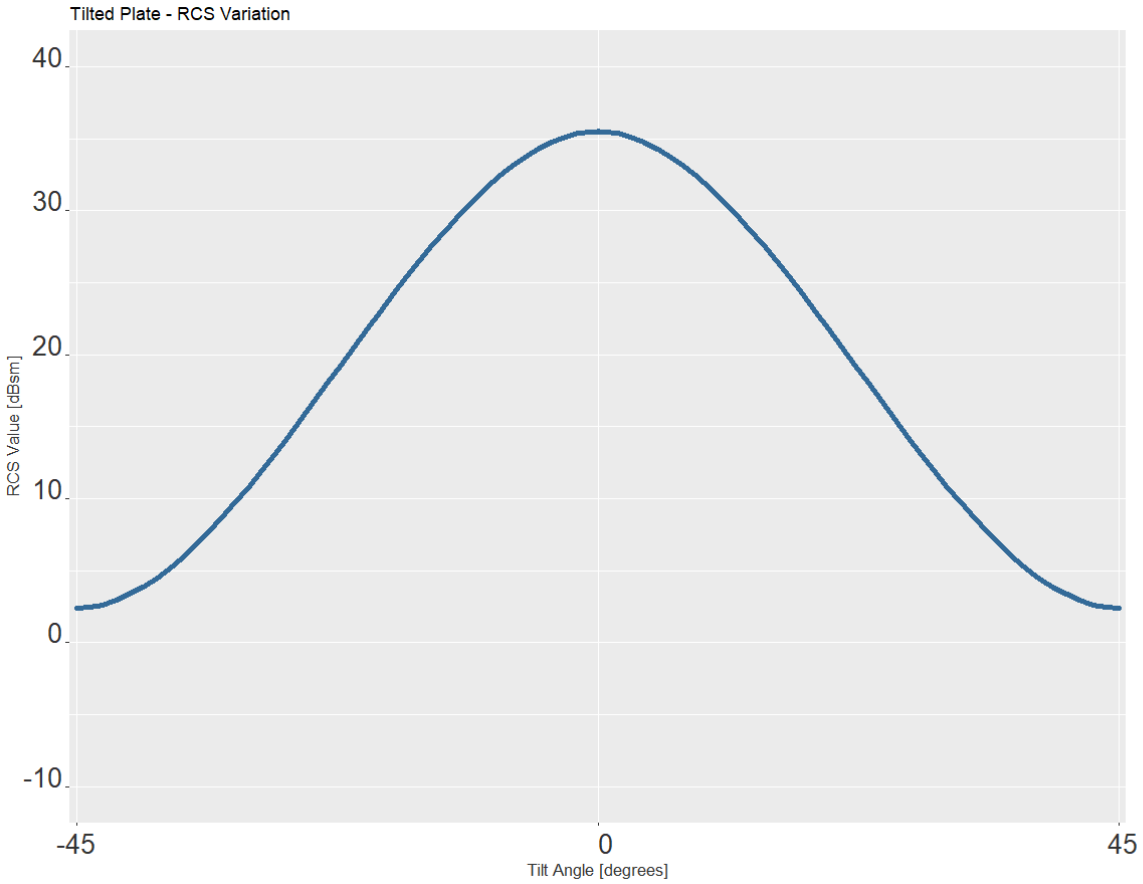


Metallic Plate 1/2



- $RCS_{misurato} = 67.5dBsm$
- $RCS_{filtrato} = 35dBsm$
- $RCS_{max} = \frac{4\pi A^2}{\lambda^2} = 34dBsm$

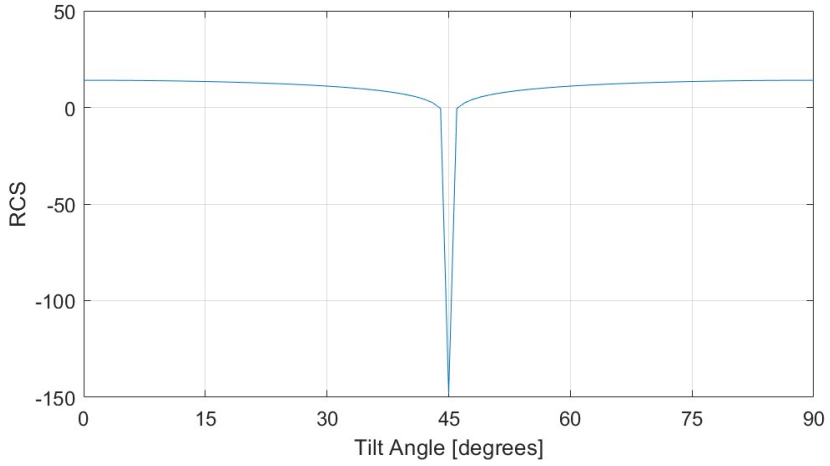
Metallic Plate 2/2



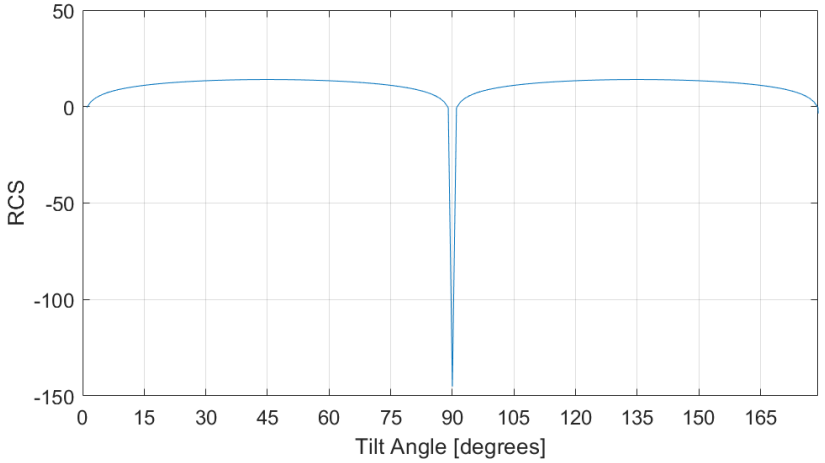
Metallic Dihedral 1/5

$$S(\vartheta) = \sqrt{S_{vert}} \begin{pmatrix} -\cos(2\vartheta) & \sin(2\vartheta) \\ \sin(2\vartheta) & \cos(2\vartheta) \end{pmatrix}$$

$$\begin{pmatrix} E_v \\ E_h \end{pmatrix} = S(\vartheta) \cdot \begin{pmatrix} E'_v \\ E'_h \end{pmatrix}$$



VV



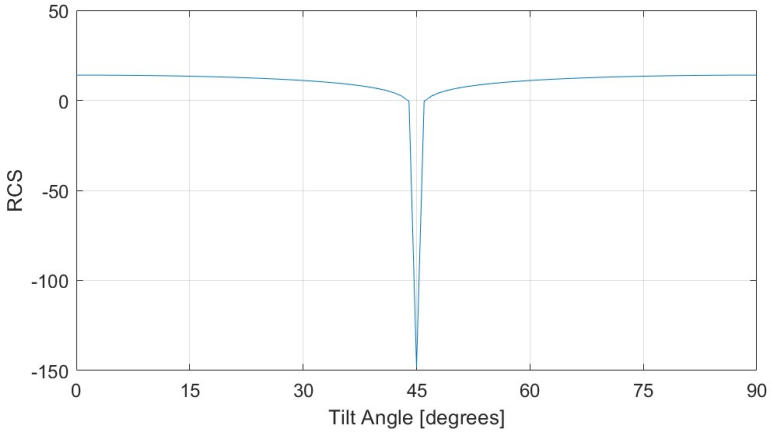
HH

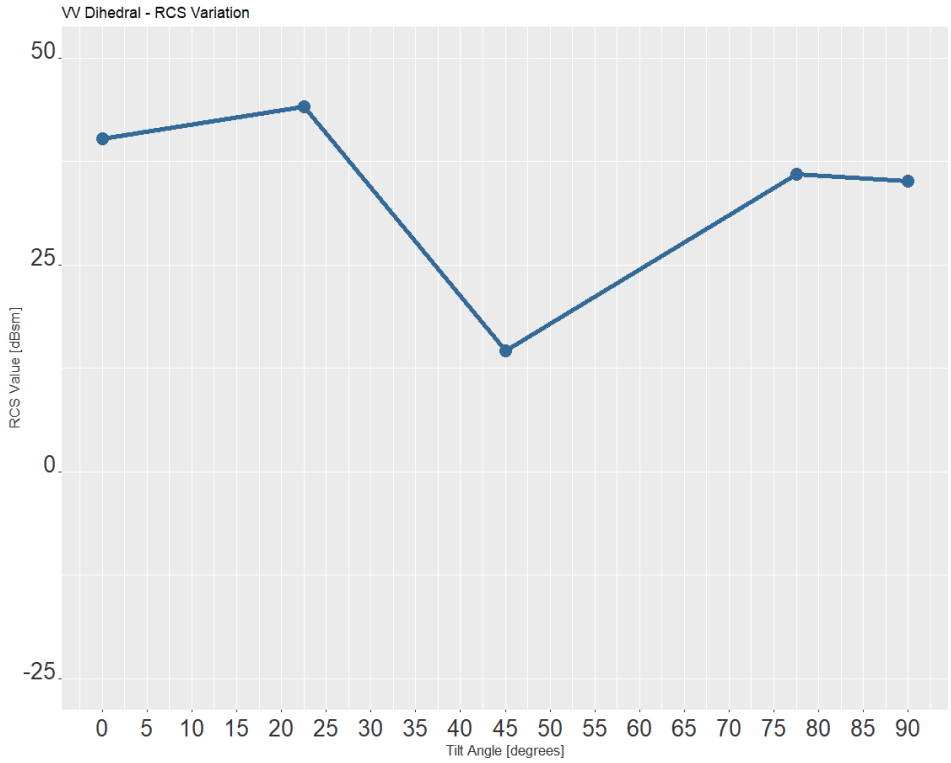
Metallic Dihedral2/5

- $RCS_{misurato} = 66dBsm$
- $RCS_{filtrato} = 40dBsm$
- $RCS_{max} = \frac{8\pi A^2}{\lambda^2} = 25dBsm$

Metallic Dihedral 3/5

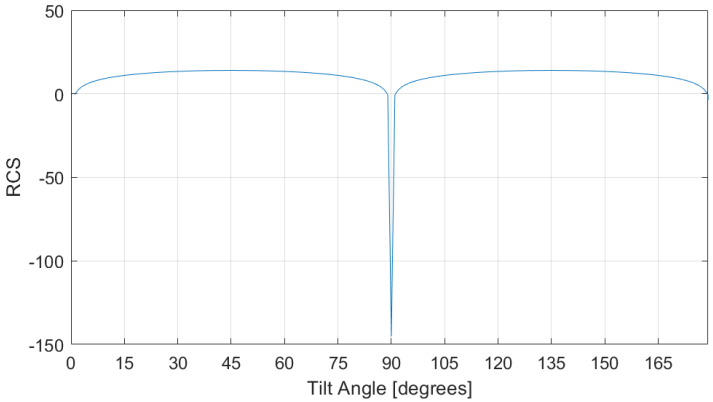
Polarization VV:

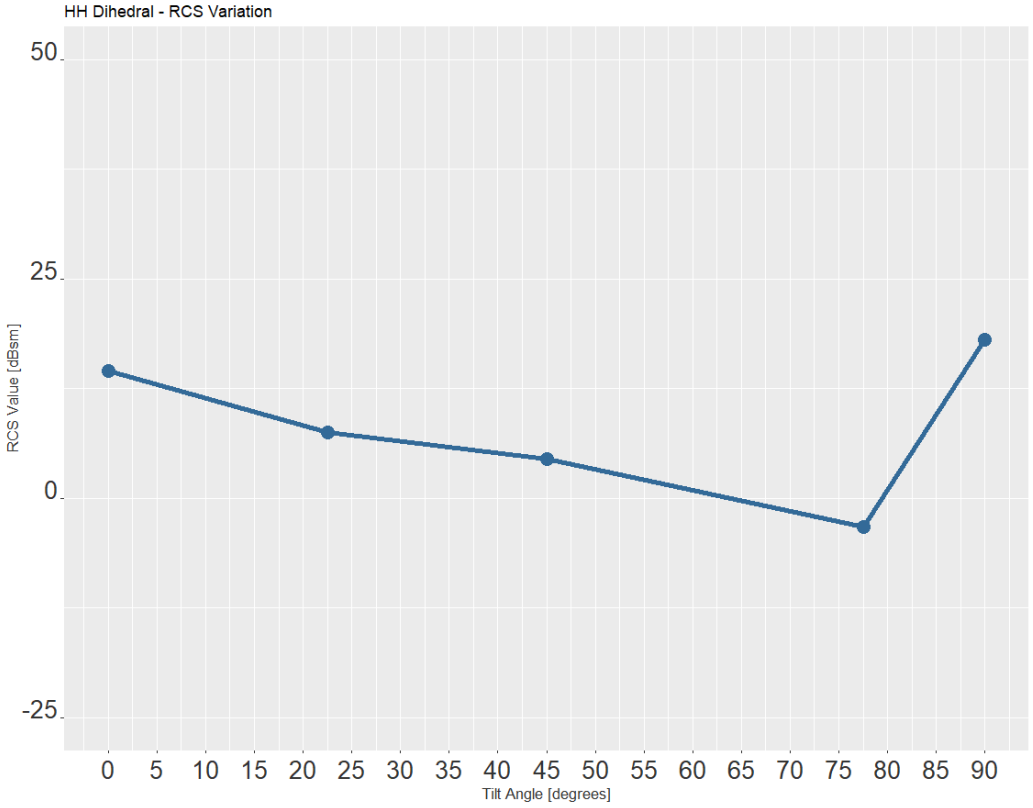




Metallic Dihedral 4/5

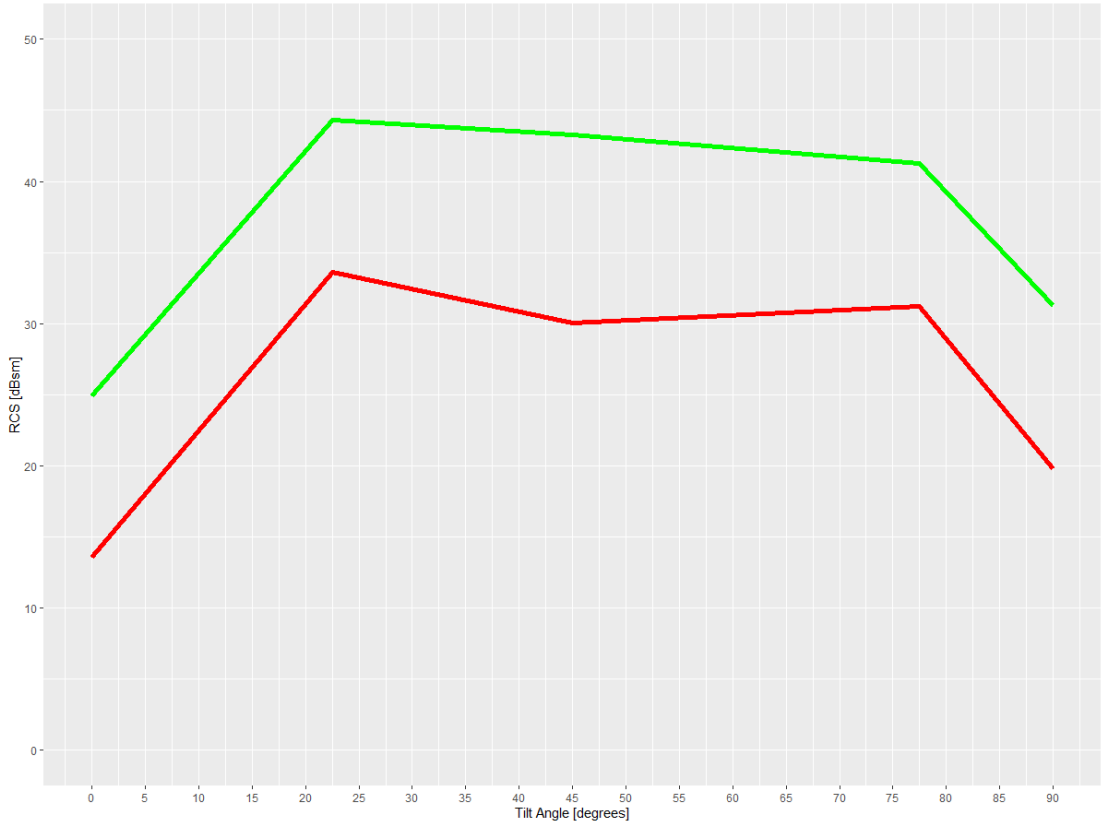
Polarization HH:





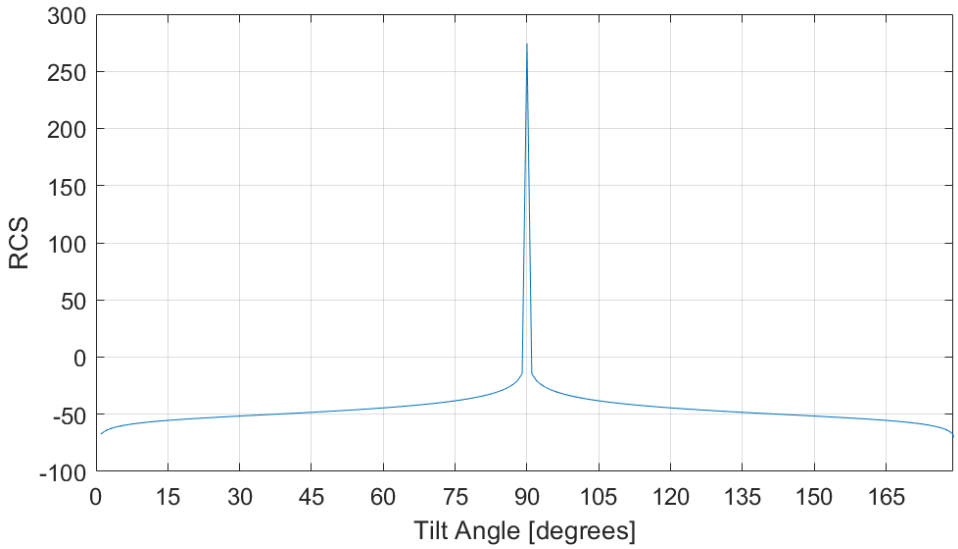
Metallic Dihedral 5/5

Polarization HV and VH:



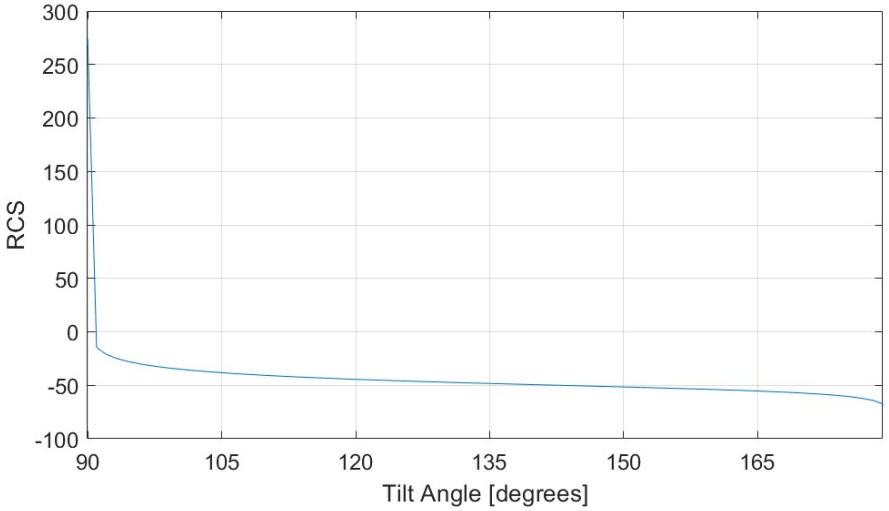
Metallic Cylinder 1/3

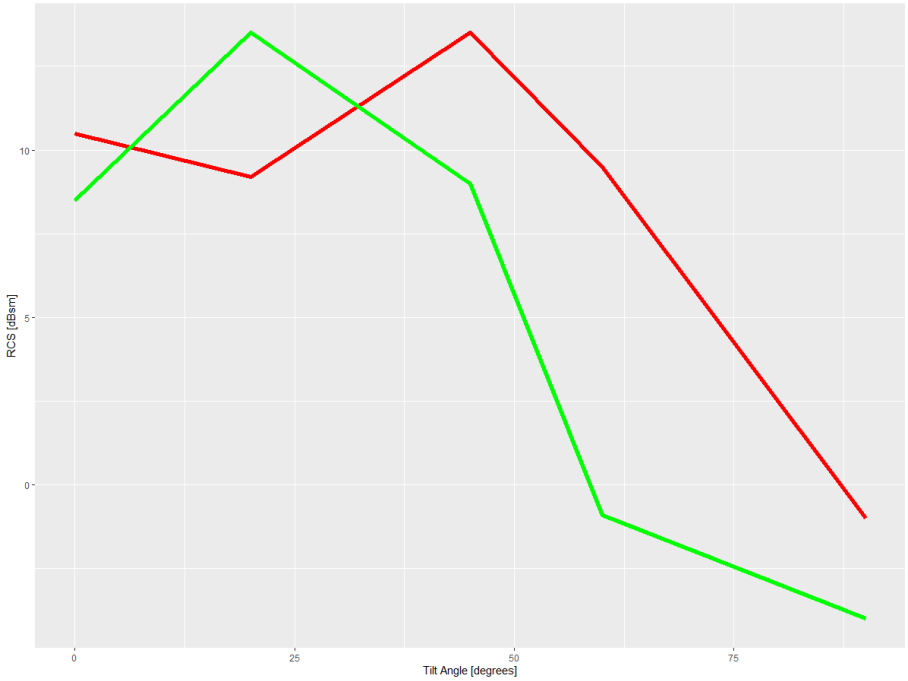
$$RCS = \frac{\pi r sin(\vartheta)}{8\pi \cos(\vartheta)}$$



Cilindro Metallico 2/3

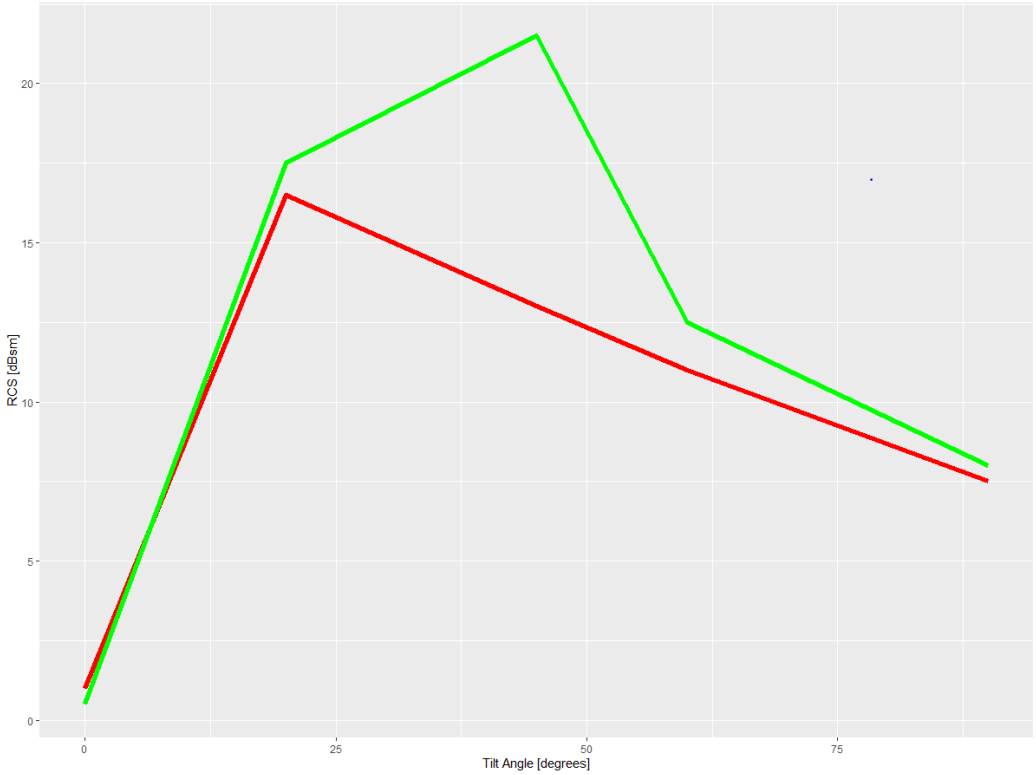
Polarization VV and HH:





Cilindro Metallico 3/3

Polarization VH and HV:



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CONCLUSION

What I did:

- **Theoretical analysis of the RSC of the targets**
- **Measurements on field and anechoic chamber**
- **Gathering and analysis of Data**

Future developments:

- **Visualization of data on a Cloude-Pottier diagram**
- **Development of an algorithm able to characterize objects in a SAR image and categorize them based on similarities with ideal target analysed in this report**

Thank you!