Experimental Study on Full-Polarization Micro-Doppler of Space Precession Target in Microwave Anechoic Chamber

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1. Introduction
2. Wide-band Scattering Properties
3. Full-Polarization Micro-Doppler Model
4. Experiment Results Analysis

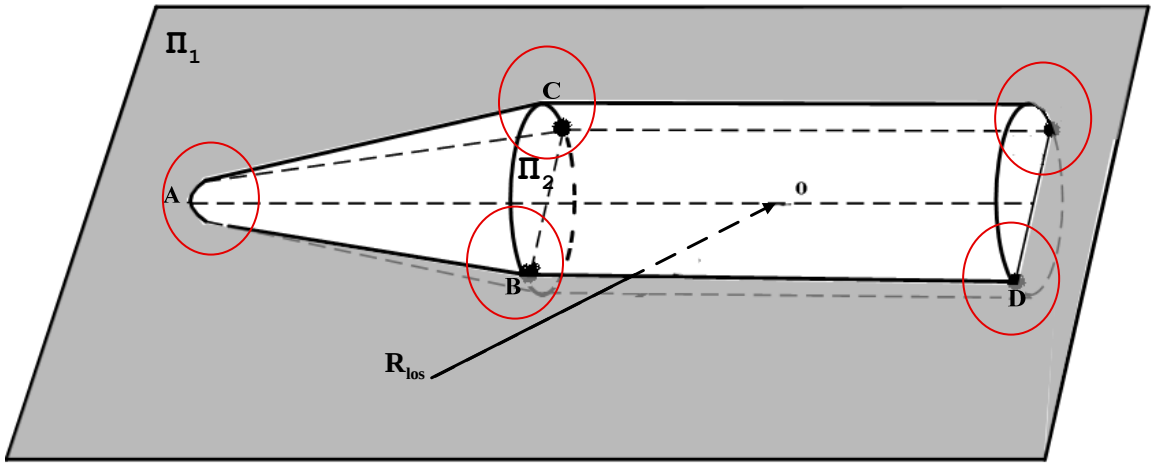
1. Introduction

Micro-Motion

Micro-Doppler **Target Polarization**

Kinematic Feature **Geometric Feature**

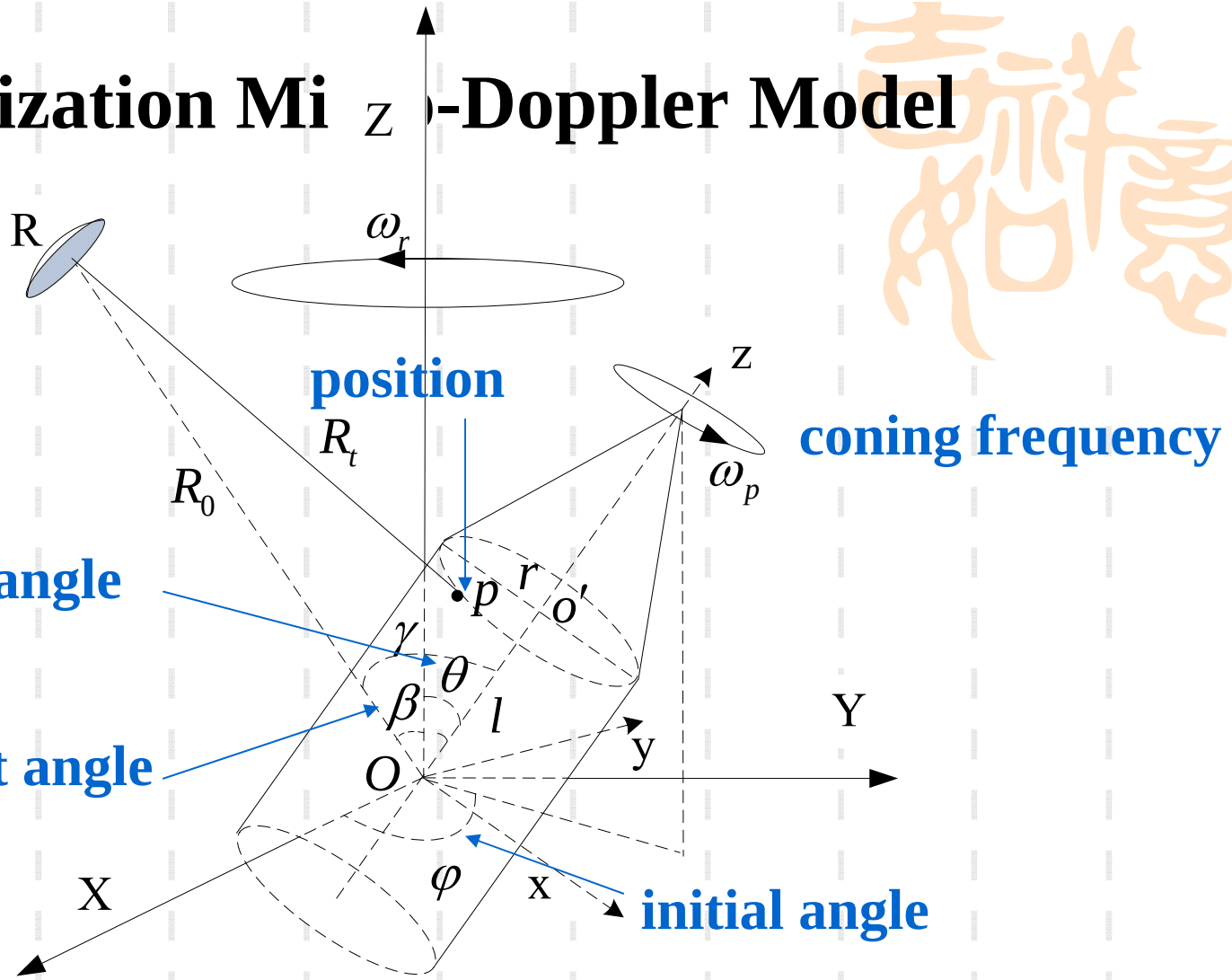
2. Wide-band Scattering Properties



Nose structer: Ideal scatterer

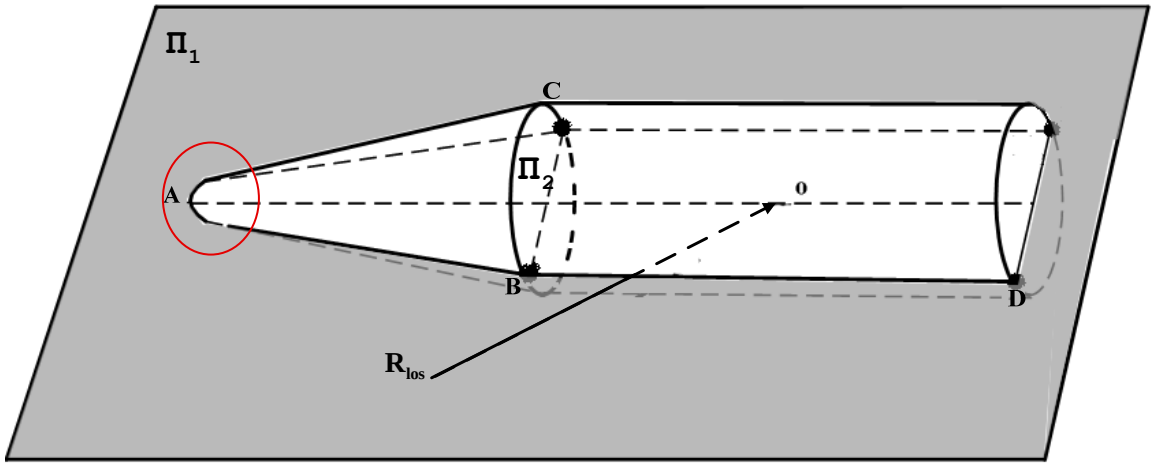
Ring structer: Sliding scatterer

3. Full-Polarization Mi Z -Doppler Model



$$\mathbf{s_r}(t) = \begin{bmatrix} s_{HHr}(t) & s_{HVr}(t) \\ s_{VHr}(t) & s_{VVr}(t) \end{bmatrix} = \mathbf{S}(t)\exp(j2\pi\frac{2f_0R_t}{c})$$

3. Full-Polarization Micro-Doppler Model



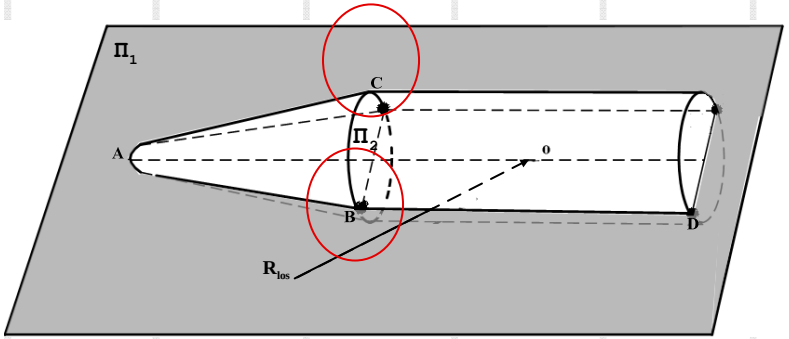
$$f_{dij} = \frac{1}{2\pi}\frac{d\phi_{ij}}{dt} - \frac{2\omega_p f_0 \sin\beta}{c} z\sin\theta\cos(\omega_p t + \varphi) + \frac{2f_0}{c}\frac{d\Delta R_t}{dt}$$

Influence of the polarization matrix phase

Ignorable distance

Sine Function Type

3. Full-Polarization Micro-Doppler Model

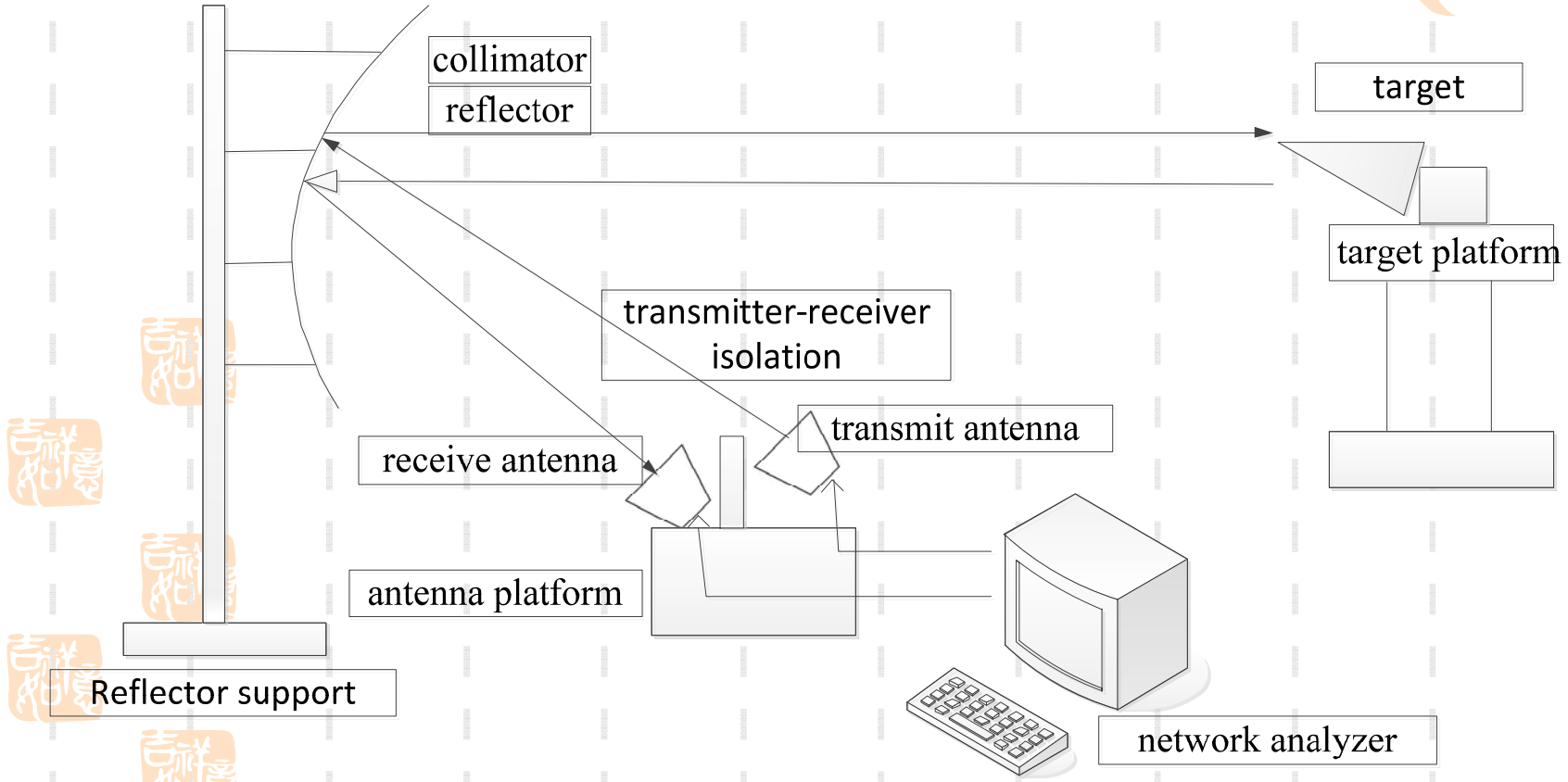


$$f_{1dij} = \frac{1}{2\pi}\frac{d\phi_{ij}}{dt} + \frac{2kf_0}{c}(\omega_p \cos\alpha \sin\beta \sin\theta \sin(\omega_p t + \varphi) - \frac{\omega_p \sin\alpha \sin\beta \sin\theta \sin(\omega_p t + \varphi)(\cos\beta\cos\theta + \sin\beta\sin\theta\cos(\omega_p t + \varphi))}{\sqrt{1-(\cos\theta\cos\beta + \sin\theta\sin\beta\cos(\omega_p t + \varphi))^2}})$$

$$f_{2dij} = \frac{1}{2\pi}\frac{d\phi_{ij}}{dt} + \frac{2kf_0}{c}(\omega_p \cos\alpha \sin\beta \sin\theta \sin(\omega_p t + \varphi) + \frac{\omega_p \sin\alpha \sin\beta \sin\theta \sin(\omega_p t + \varphi)(\cos\beta\cos\theta + \sin\beta\sin\theta\cos(\omega_p t + \varphi))}{\sqrt{1-(\cos\theta\cos\beta + \sin\theta\sin\beta\cos(\omega_p t + \varphi))^2}})$$

Non-Sine Function Type

4. Experiment results analysis



4. Experiment results an

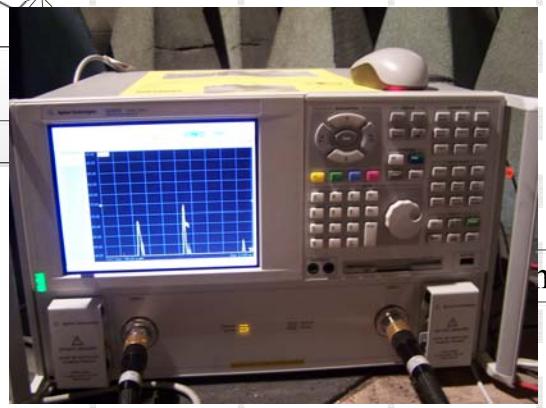
transmitter-receiver isolation

transmit antenna

receive antenna

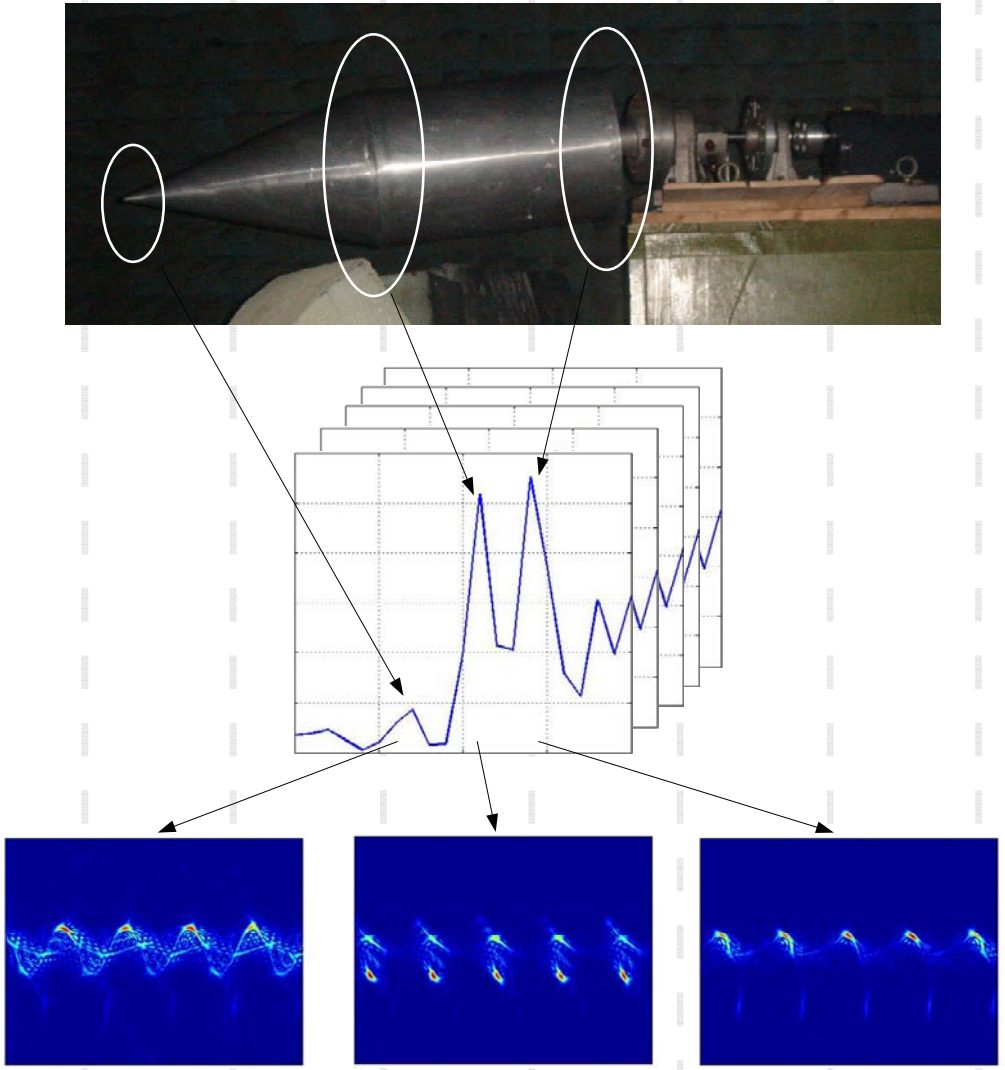
antenna platform

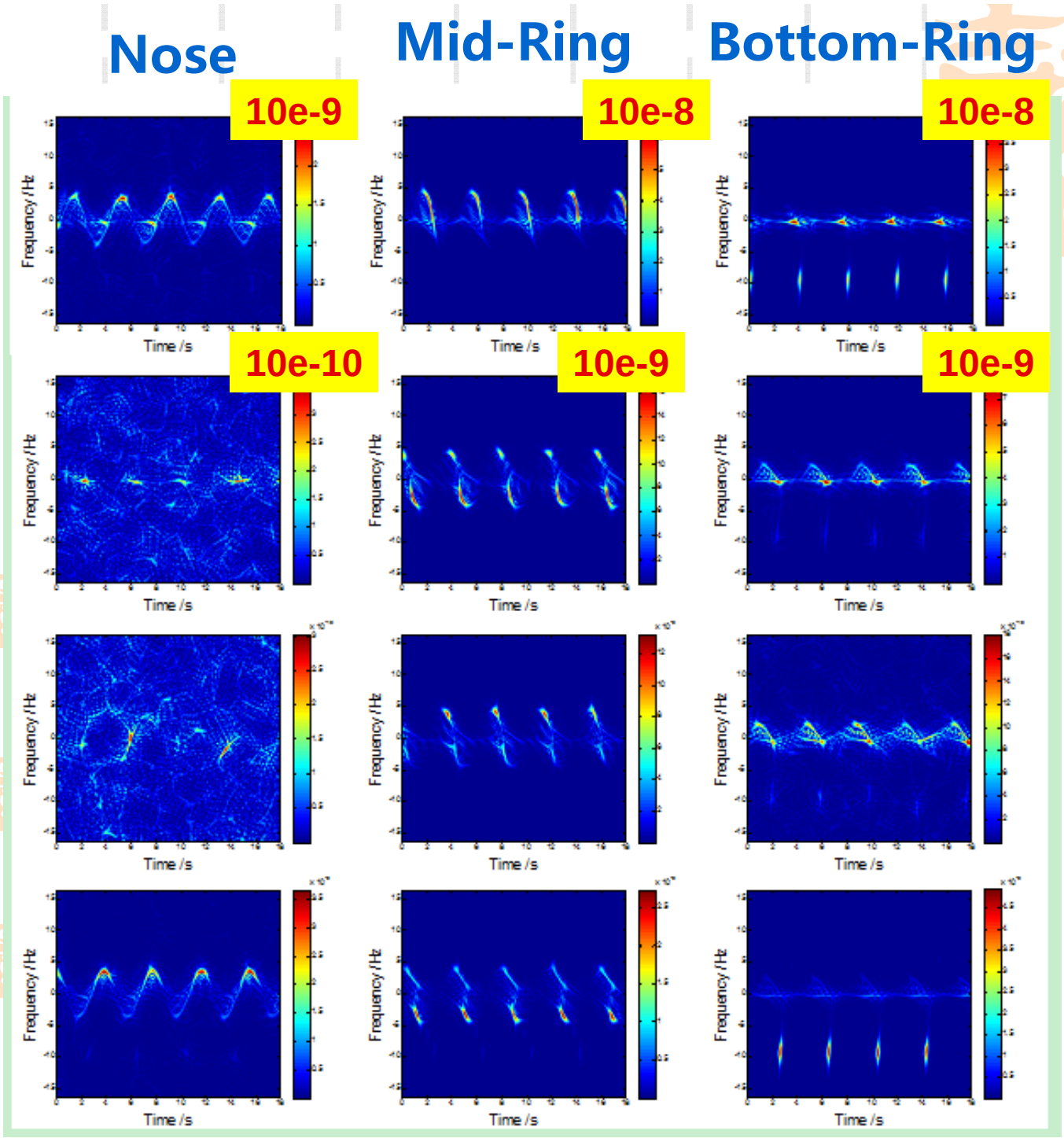
Reflector support



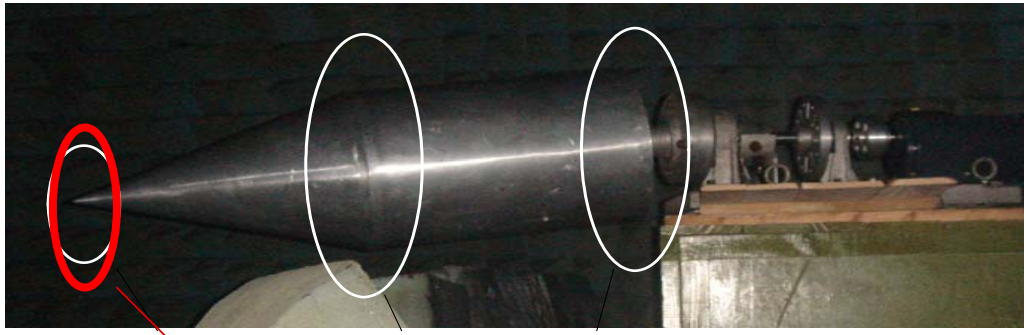
nalyzer

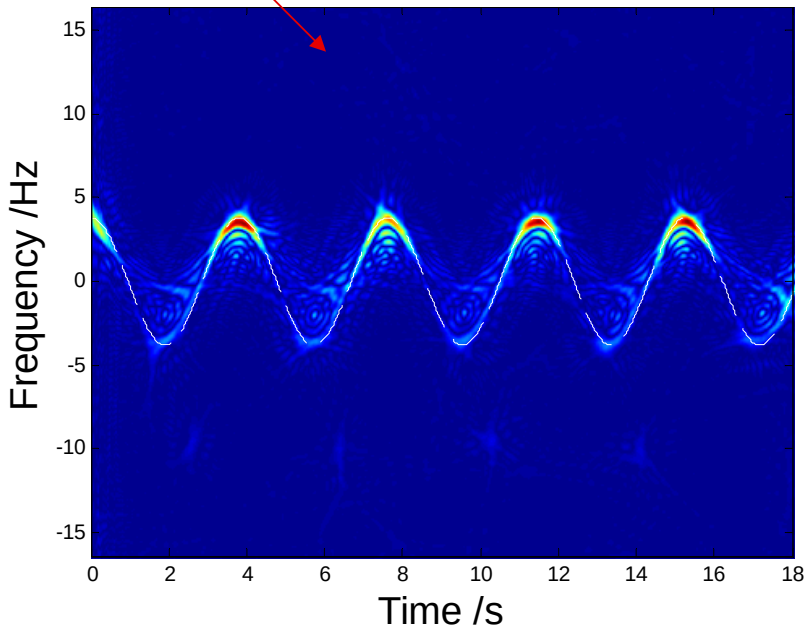
4. Experiment results analysis




Nose
Mid-Ring
Bottom-Ring
10e-9
10e-8
10e-8
10e-10
10e-9
10e-9
HH
HV
VH
VV
Frequency /Hz
Time /s

4. Experiment results analysis





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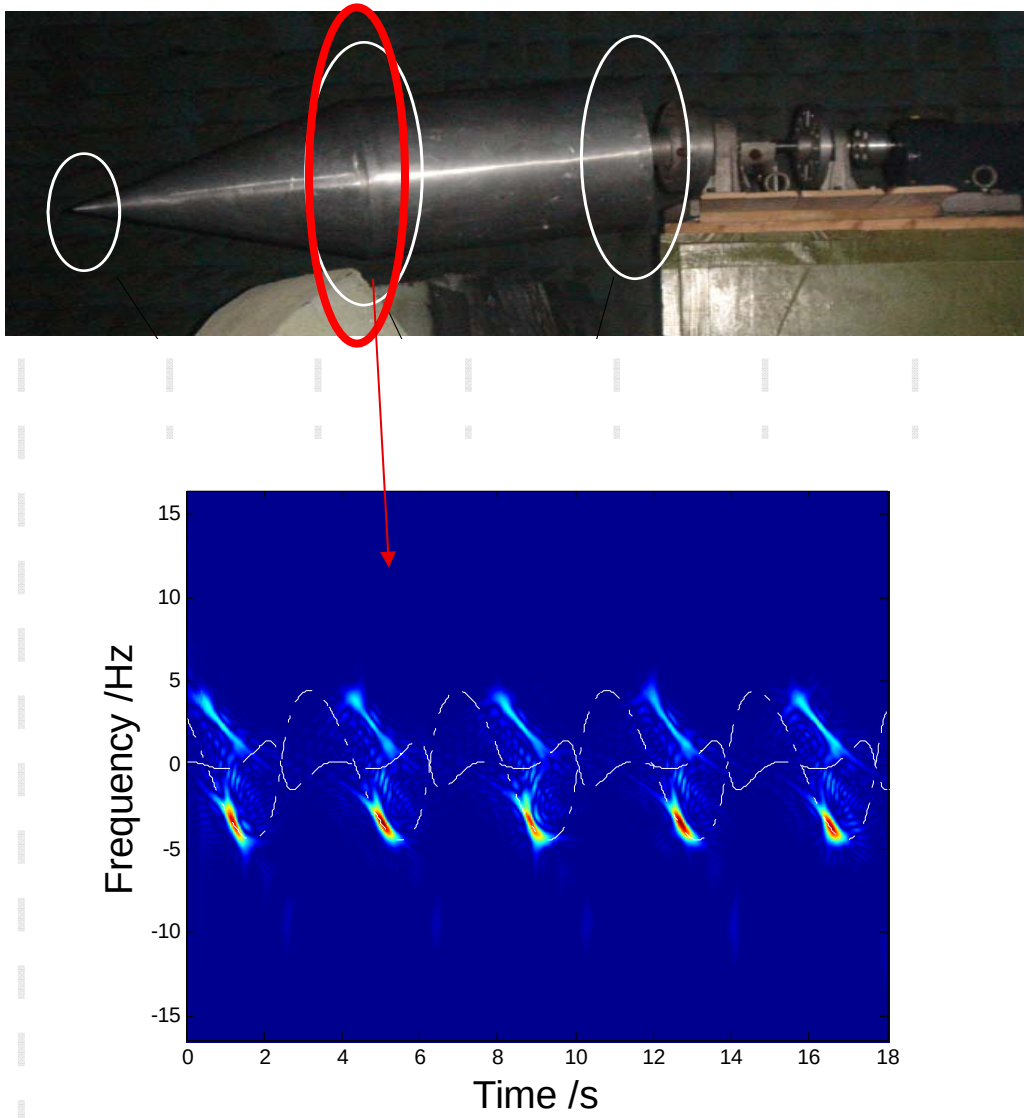

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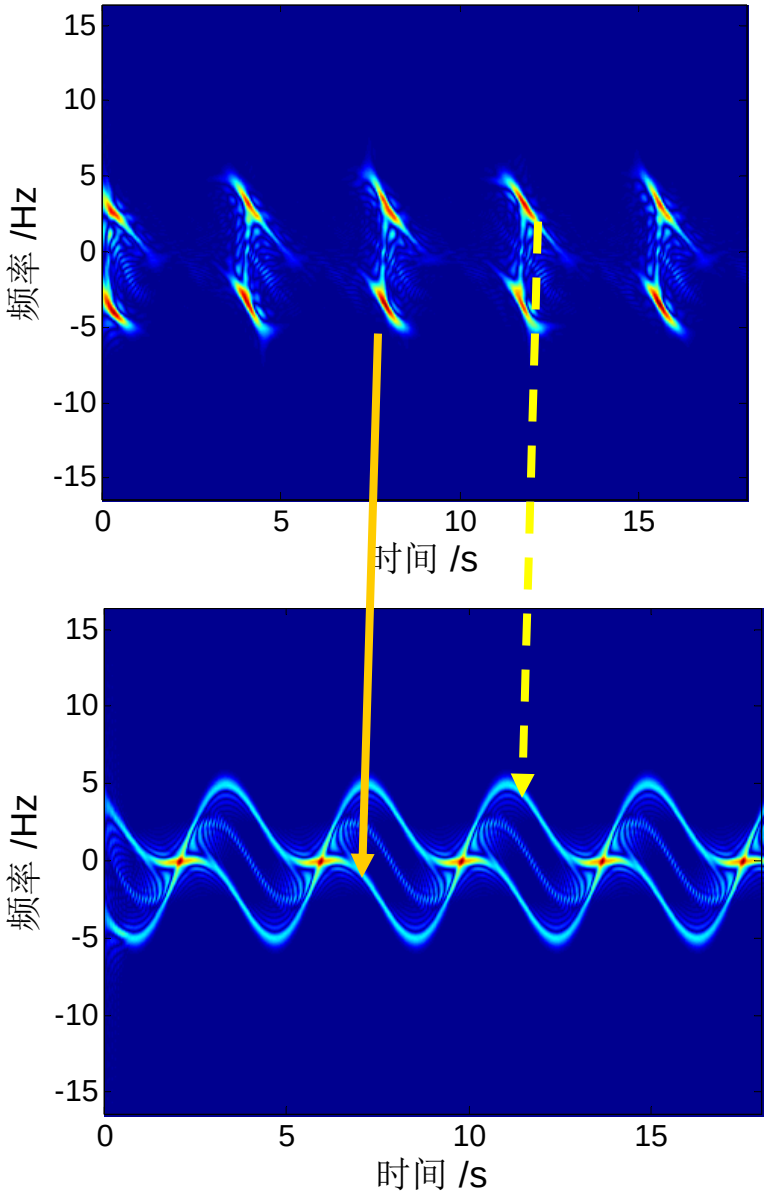

Measuerd

Theoretical

Thank you!