ERATO Meeting Feb.24

1- Digital Holographic Microscopy Using SHG

2- Phase-sensitive detection by Lock-in amplifier

By

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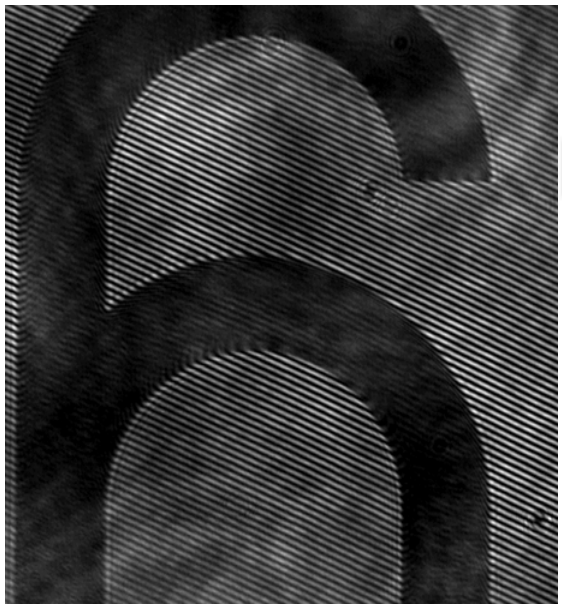
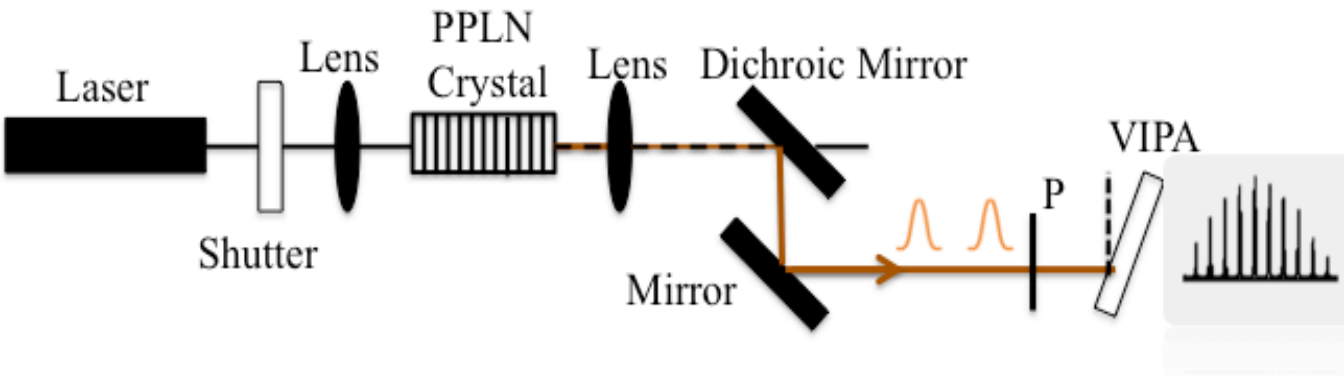
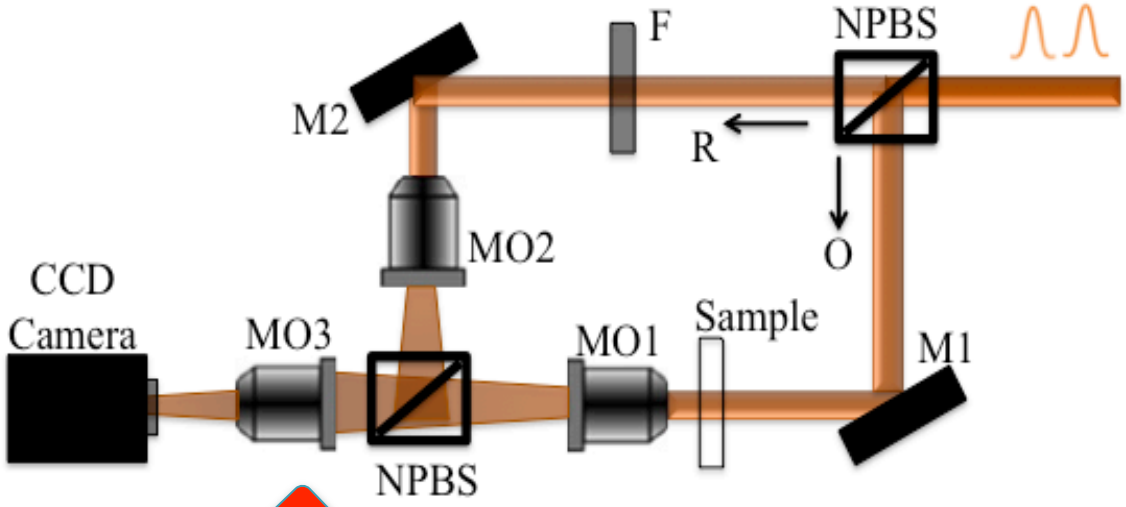
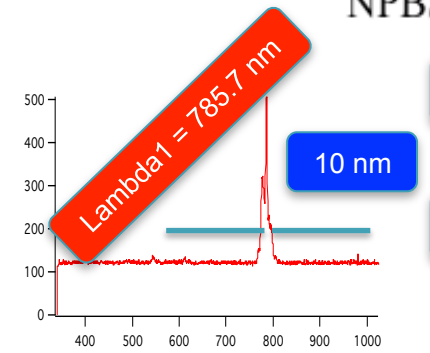
1- Digital Holographic Microscopy Using SHG









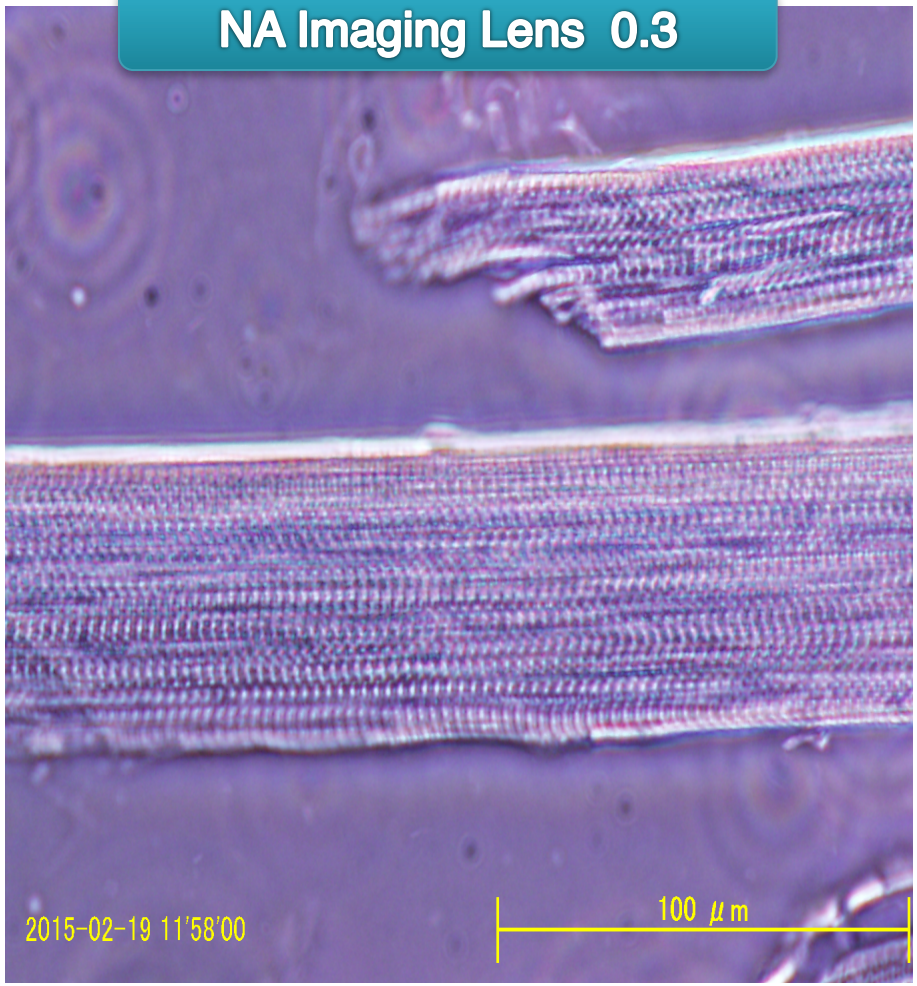
Obj 50x NA=0.42 Ref 20x NA=0.42

Imaging 20x NA = 0.25

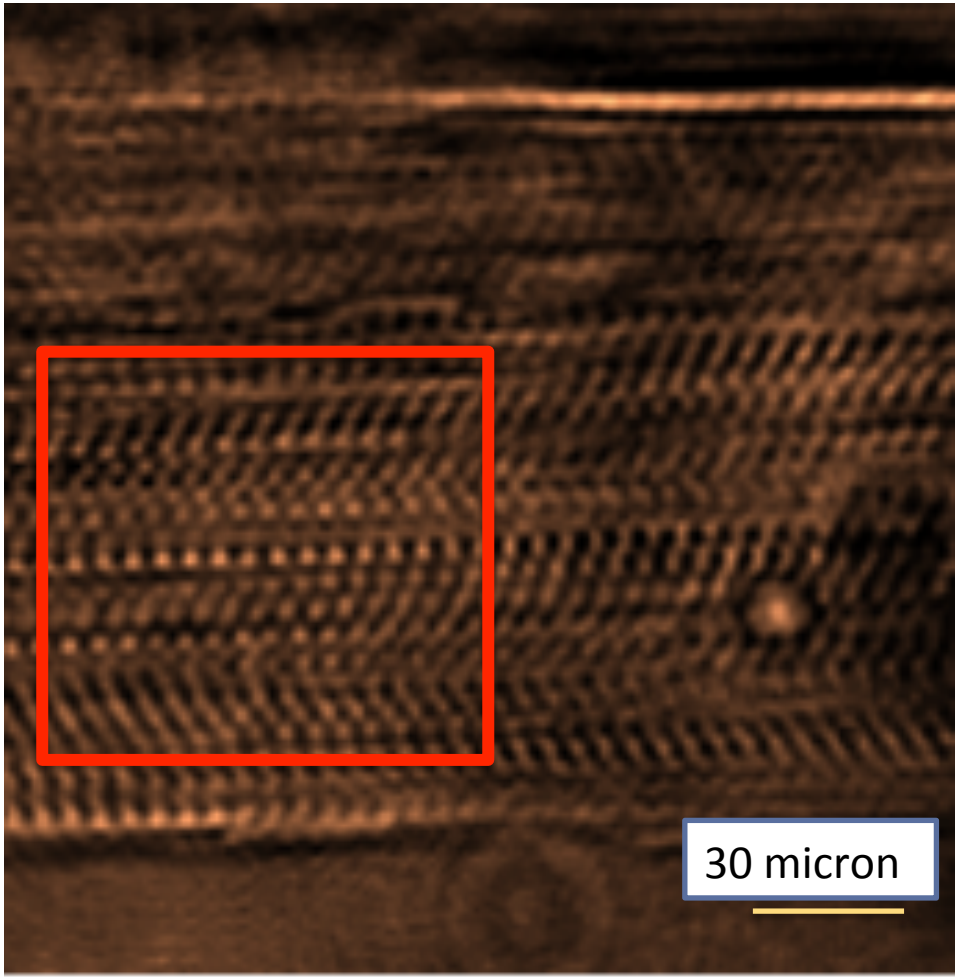
Results

Phase Contrast | 40x

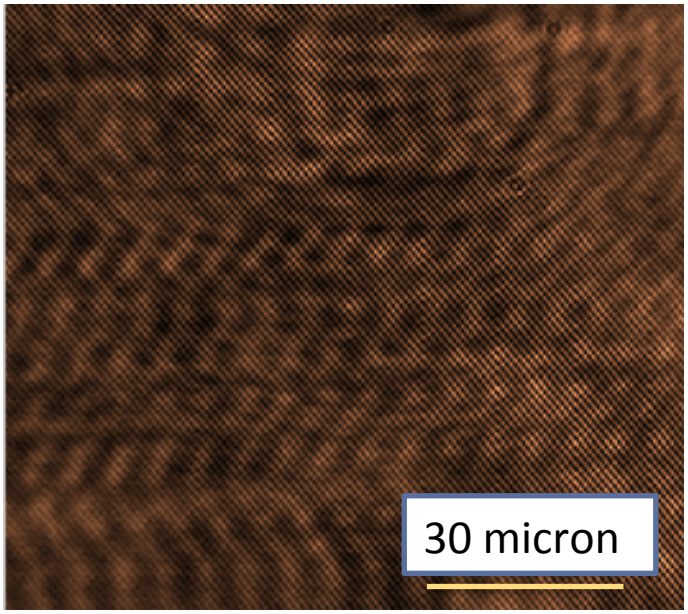
NA Imaging Lens 0.3

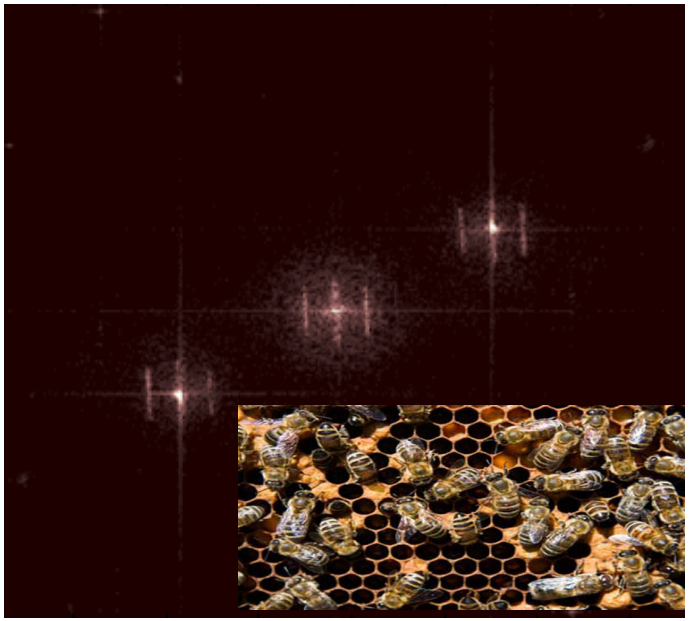


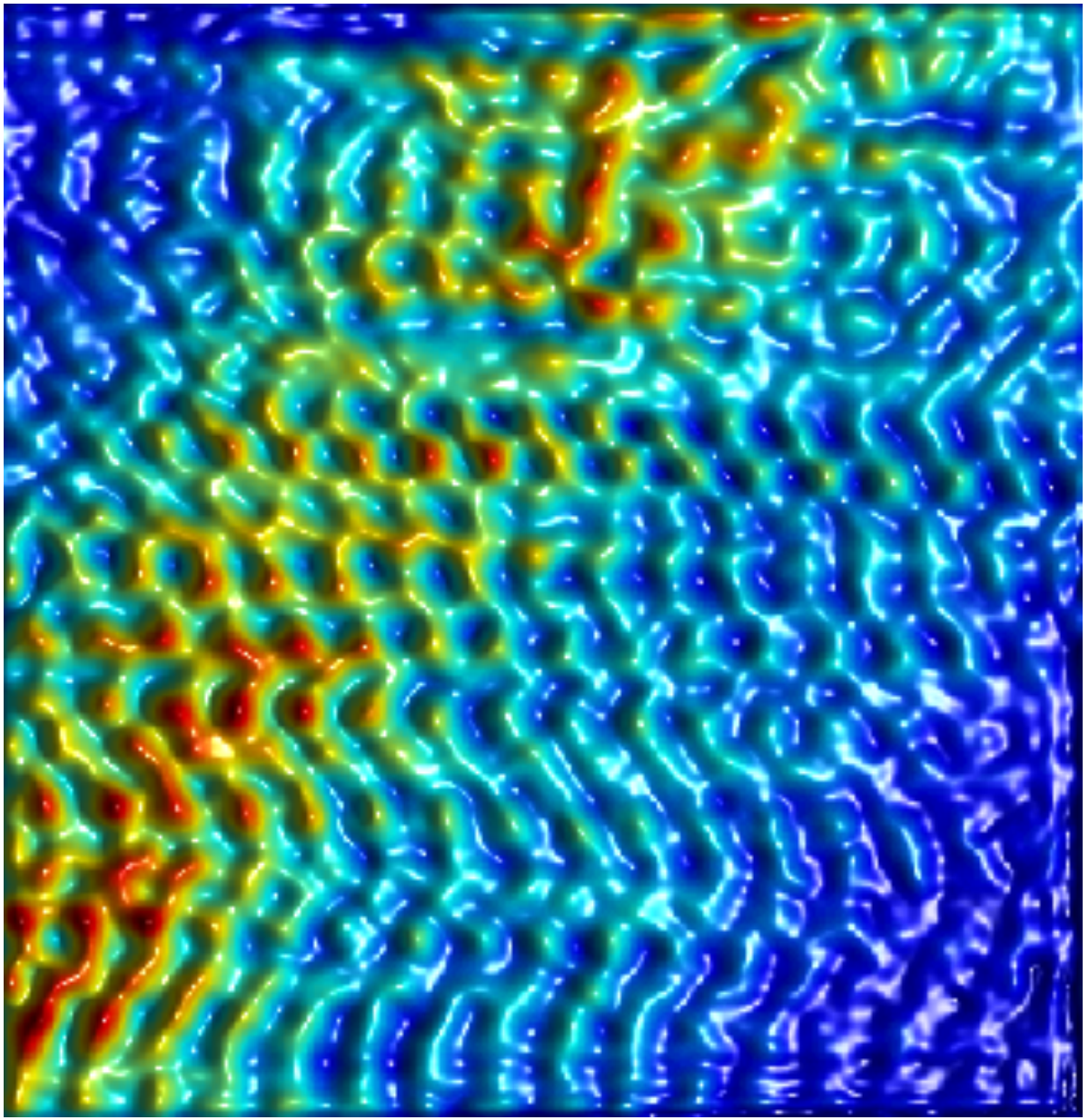
50x | Holographic Microscopy



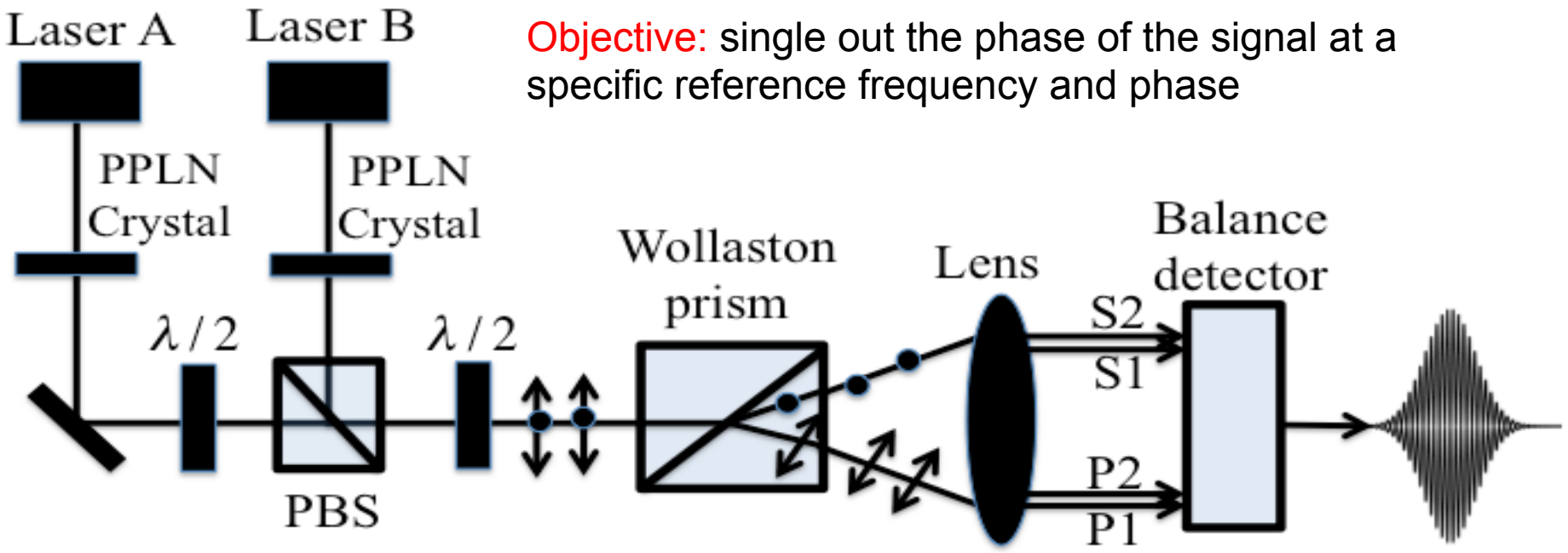
Results



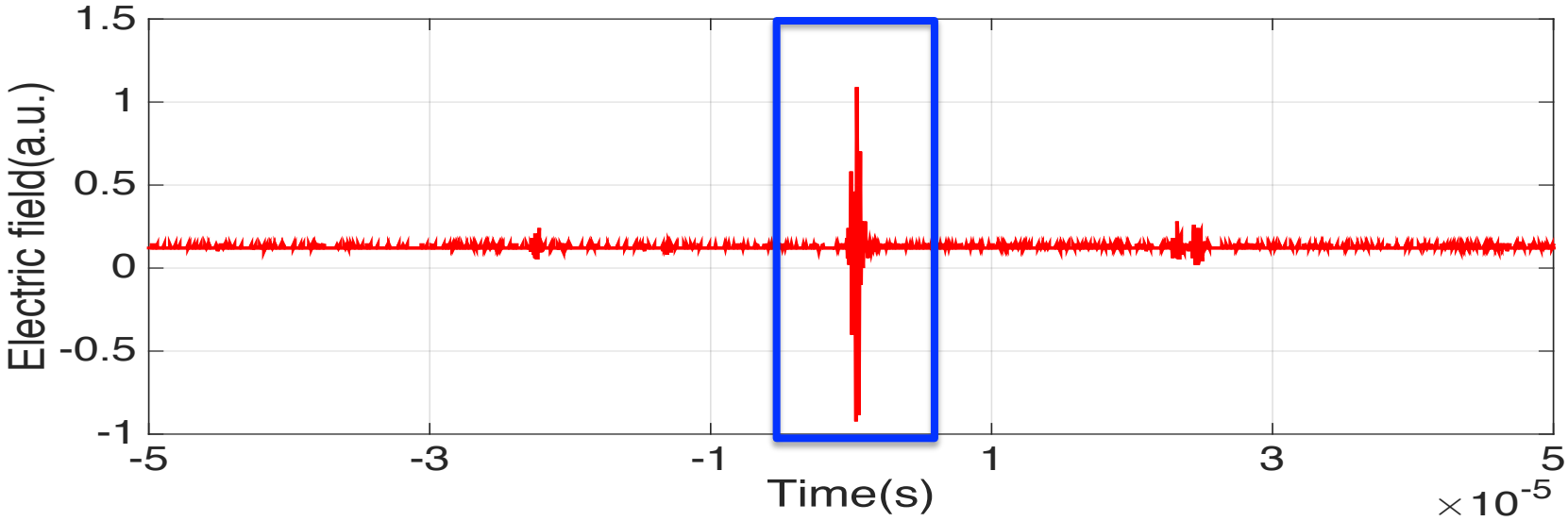




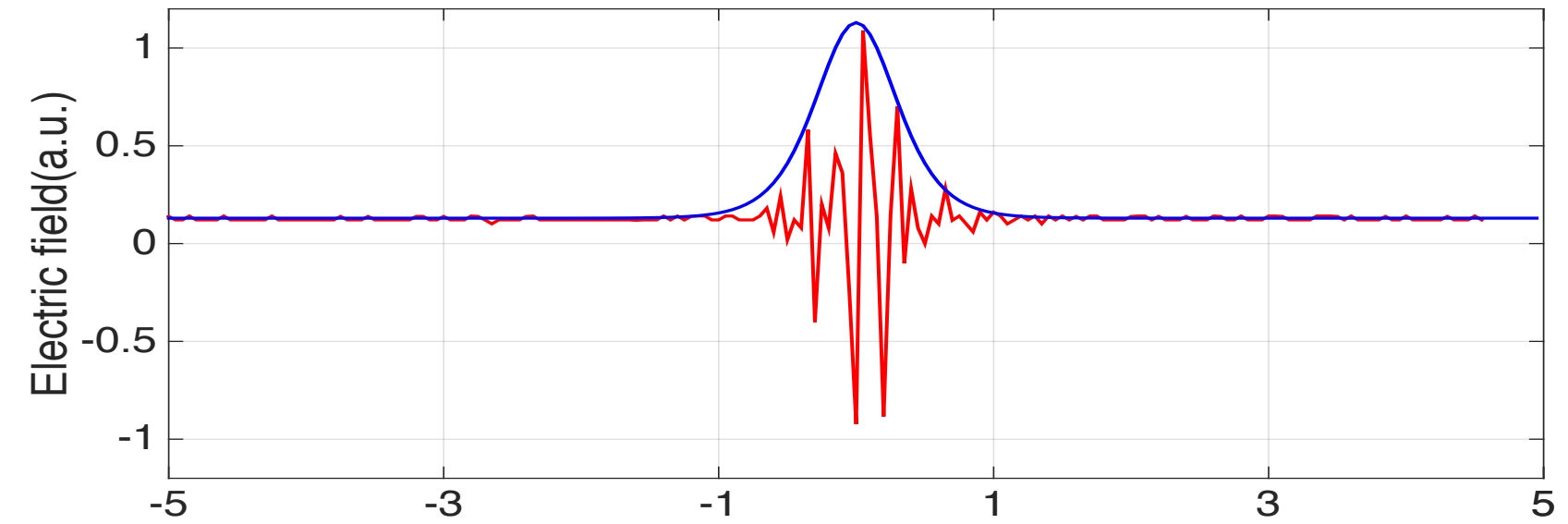
2- Phase-sensitive detection by Lock-in amplifier

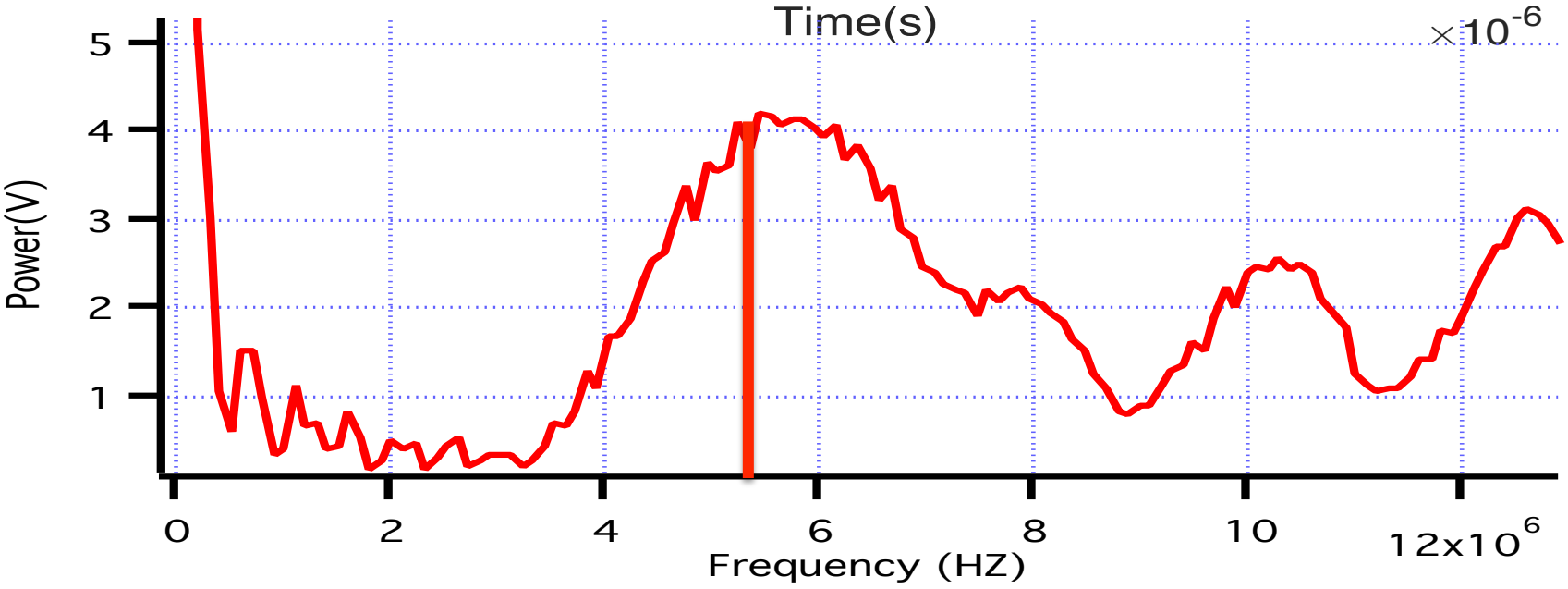


Objective: single out the phase of the signal at a specific reference frequency and phase

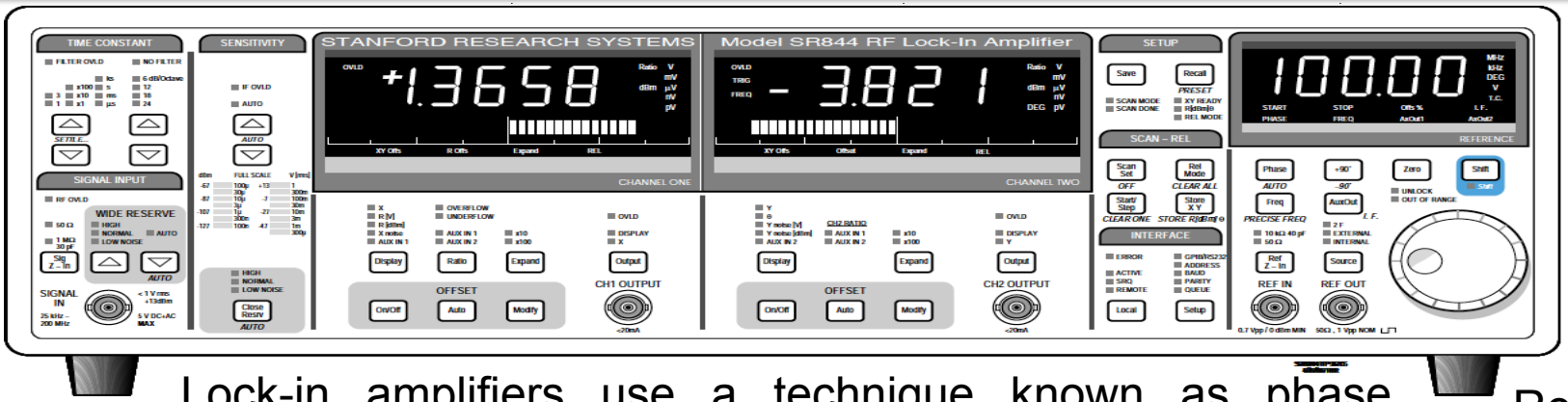


Theoretically

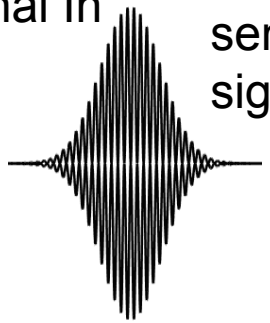




Practically



Signal In

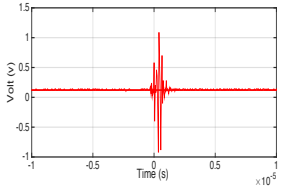


Lock-in amplifiers use a technique known as phase sensitive detection to single out the component of the signal at a specific reference frequency

Ref In

$$V_{M1} = V_I V_R \sin(\omega_R t+\theta_I)\sin(\omega_R t+\theta_R)$$

$$= \tfrac{1}{2} V_I V_R \cos(\theta_R-\theta_I) + \tfrac{1}{2} V_I V_R \sin(2\omega_R t+\theta_R+\theta_I)$$



$$V_{M1+FILT} = \tfrac{1}{2} V_I V_R \cos(\theta_R-\theta_I)$$

$$V_{M2} = \tfrac{1}{2} V_I V_R \cos(\theta_R-\theta_I-\pi/2) + \tfrac{1}{2} V_I V_R \sin(2\omega_R t+\theta_R+\theta_I-\pi/2)$$

$$V_{M2+FILT} = \tfrac{1}{2} V_I V_R \cos(\theta_R-\theta_I-\pi/2)$$

$$= \tfrac{1}{2} V_I V_R \sin(\theta_R-\theta_I)$$

$$\text{Amplitude} \quad R = (2/V_R) \times \sqrt{[\,(V_{M1+FILT})^2 + (V_{M2+FILT})^2\,]}$$

$$\text{Phase} \quad \theta_R - \theta_I = \tan^{-1}(V_{M2+FILT}/V_{M1+FILT})$$

Thank you for listening.
Any questions or suggestions?

Results