

# Effect of interlobular septa on stress-strain characteristics of pleura

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## 1. Introduction

### Pleura Characteristics

- General → **Isotropic**
- Some previous study include **anisotropic** data.



Any **factor** affect pleura characteristic?

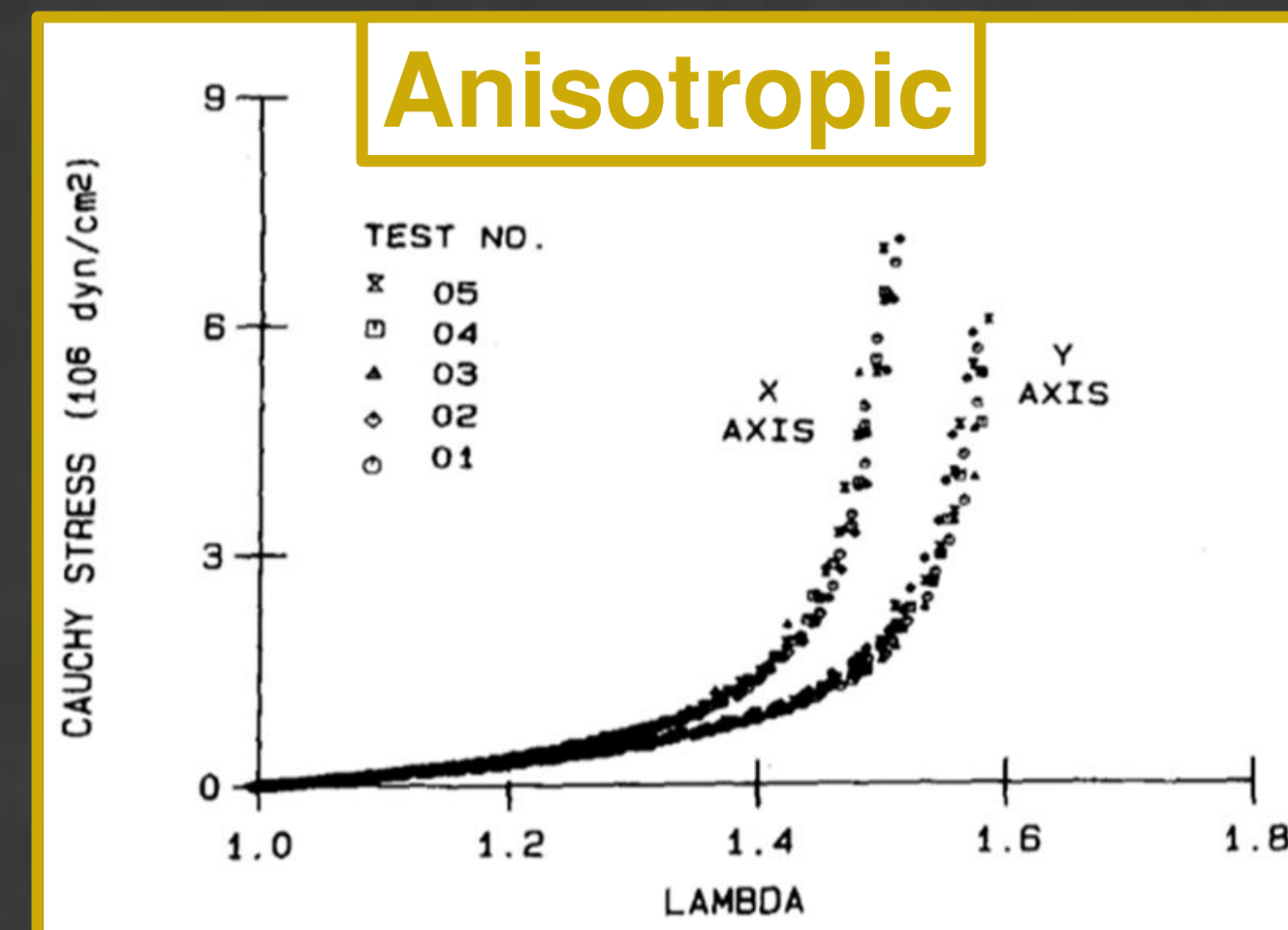
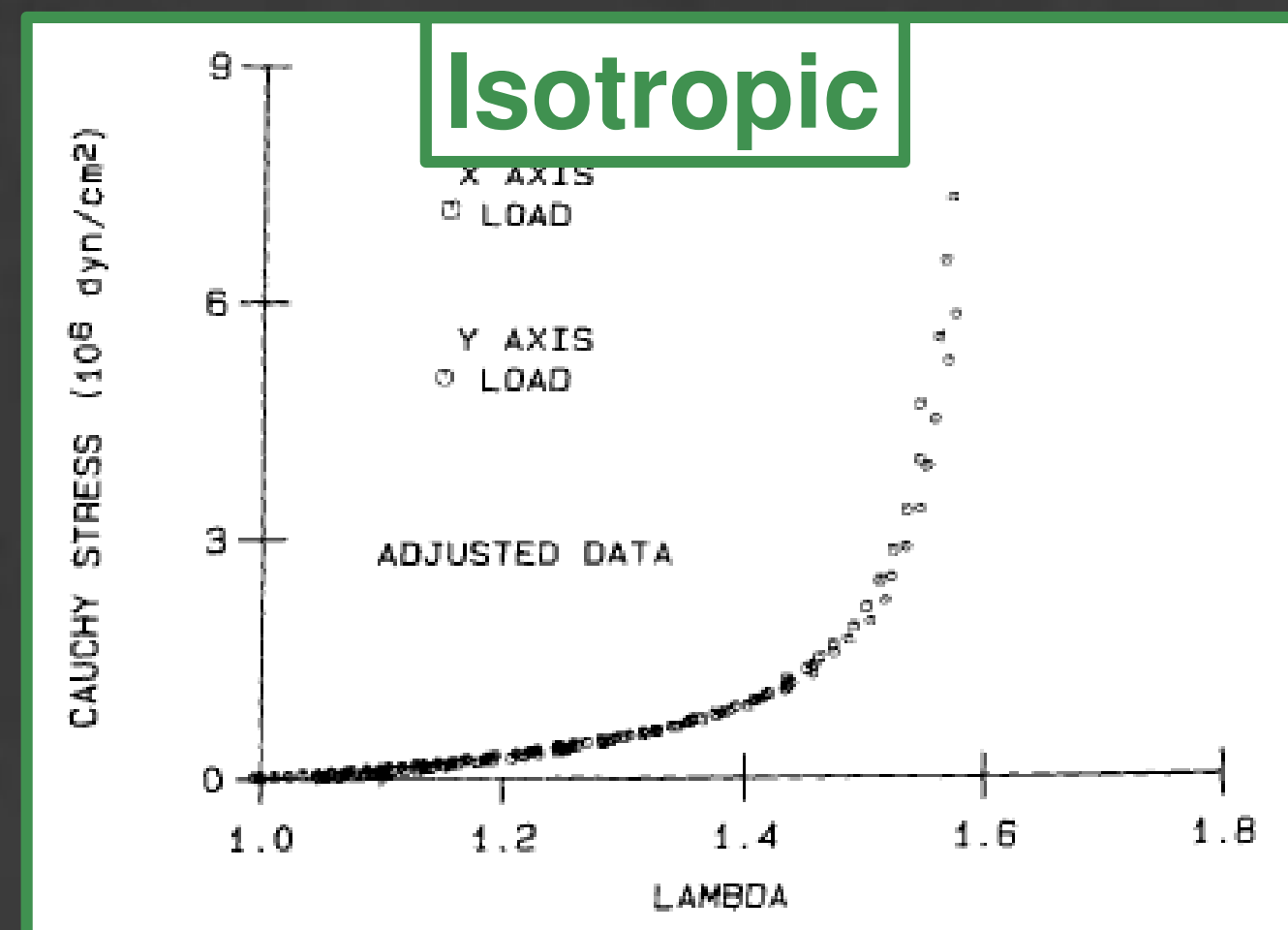


Fig.1 Humphrey's canine pleura data <sup>1)</sup>

### Pleura Structure

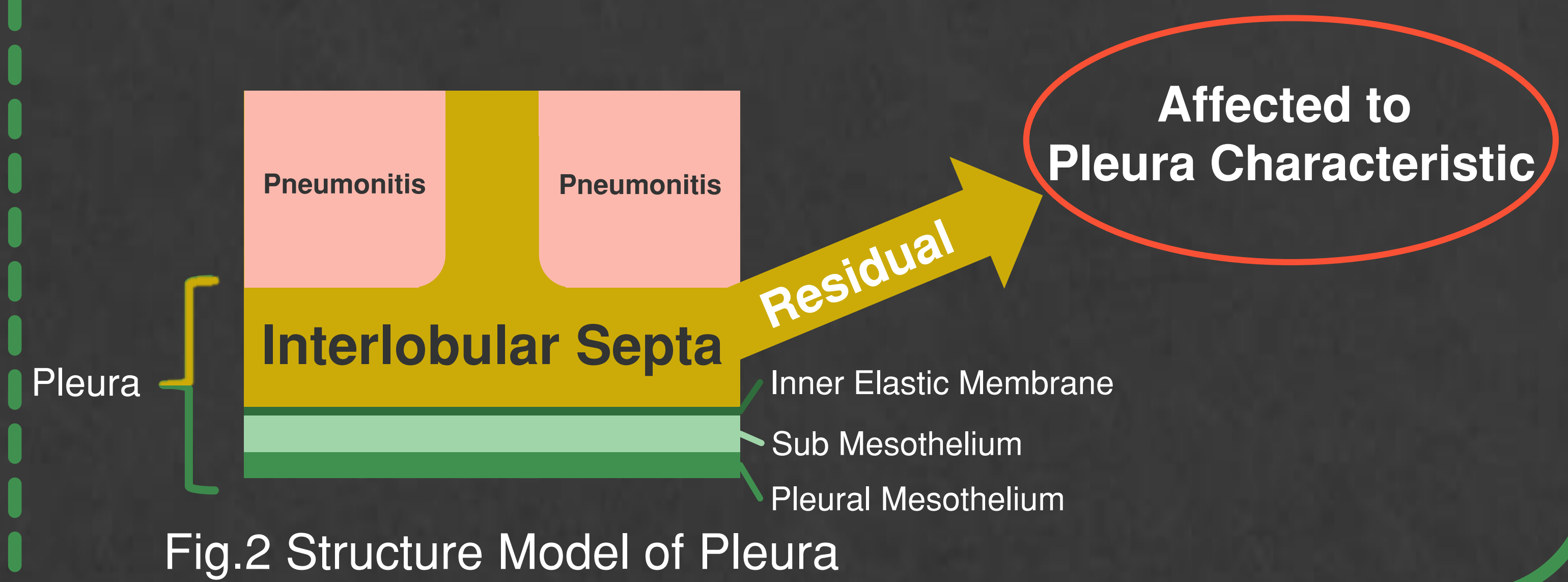


Fig.2 Structure Model of Pleura

## 2. Methods

### Sample

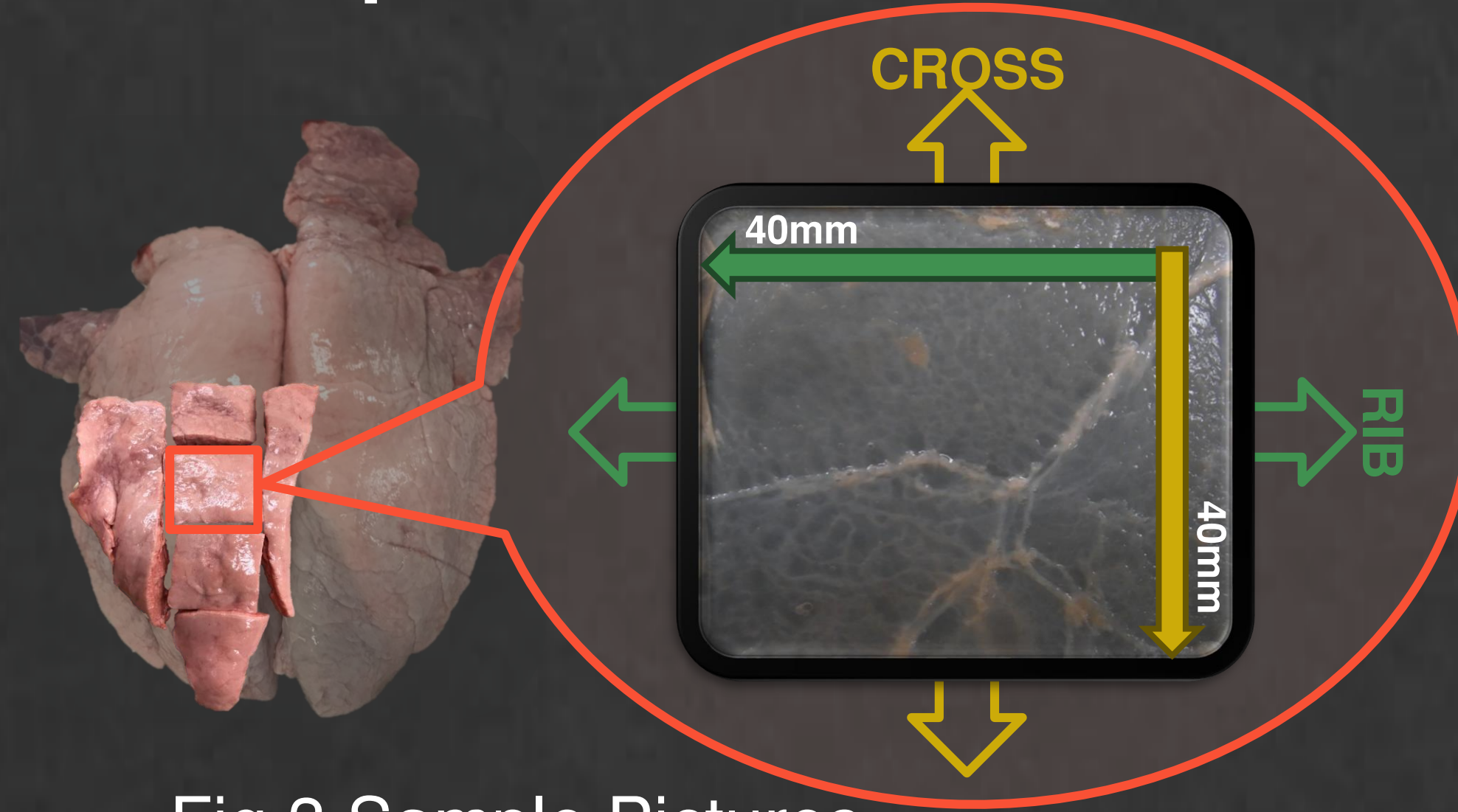


Fig.3 Sample Pictures

- Pleura were removed from the lungs of pigs.
- Pig lungs are similar in volume and thickness to human lungs.
- The pigs were processed at the slaughterhouse on the test day.
- Dimension of a specimen size is 40 x 40 x 0.040 mm.

### Tensile Test

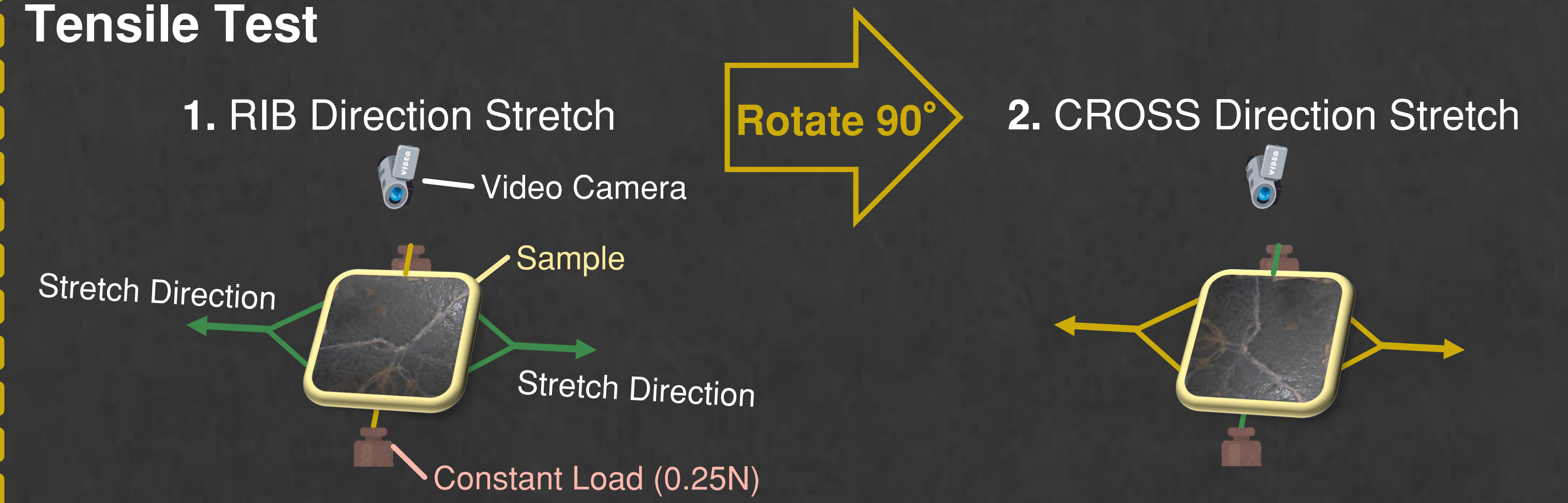


Fig.4 Tensile Test Model (RIB)

Fig.5 Tensile Test Model (CROSS)

## 3. Results & Discussion

### Stress - Strain Diagram

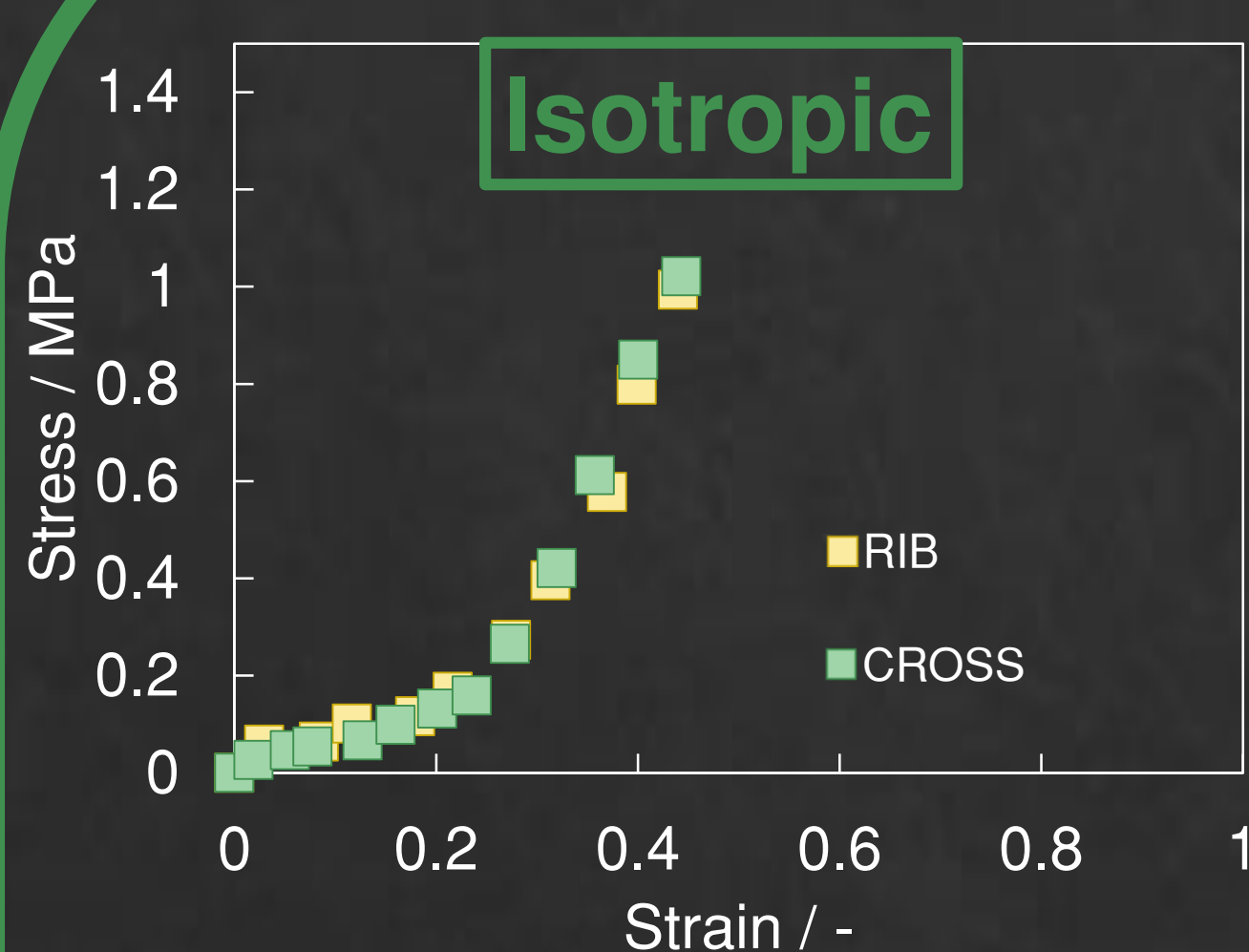


Fig.6 Example of Isotropic Results

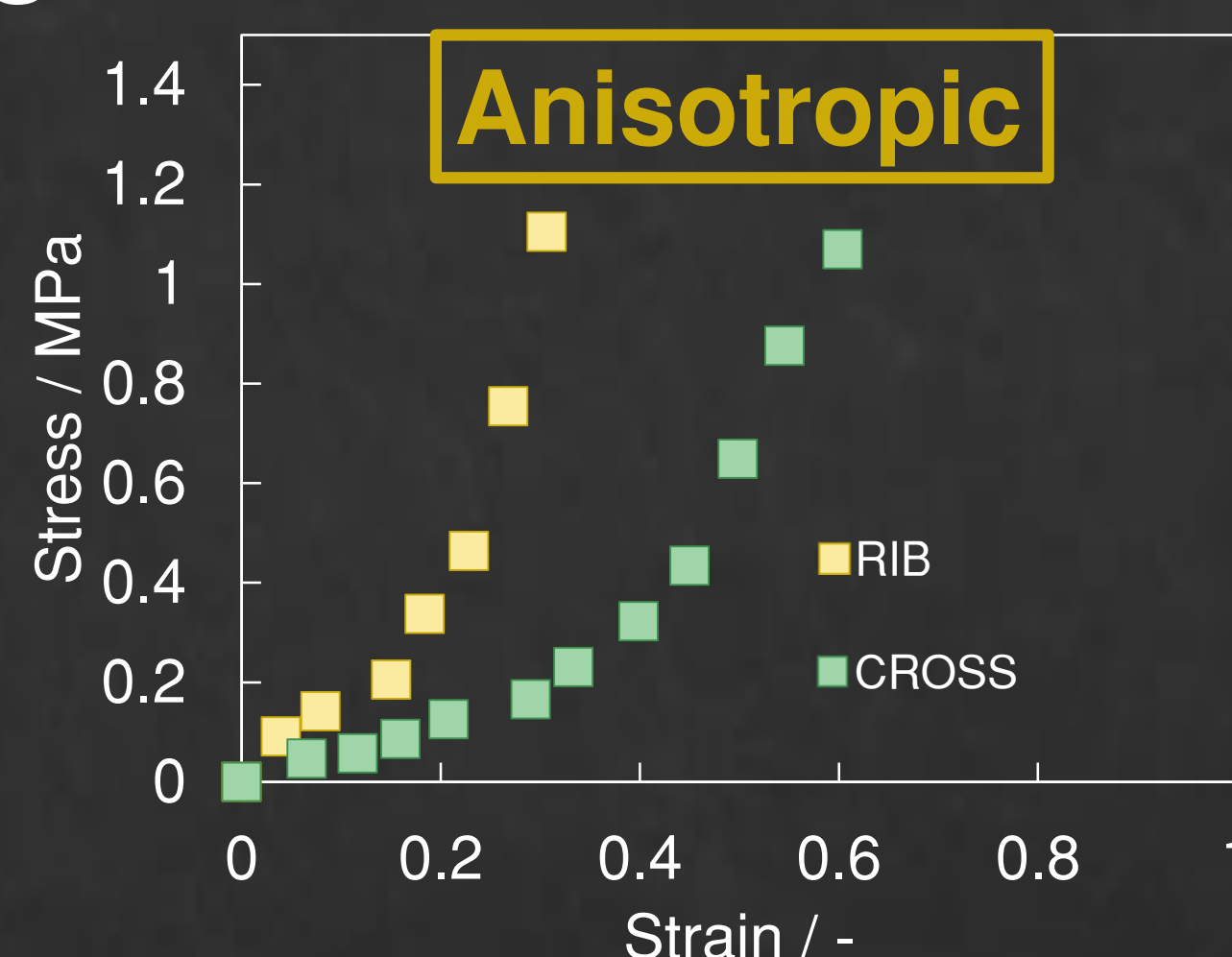


Fig.7 Example of Anisotropic Results

### Stress - Strain Diagram Analysis

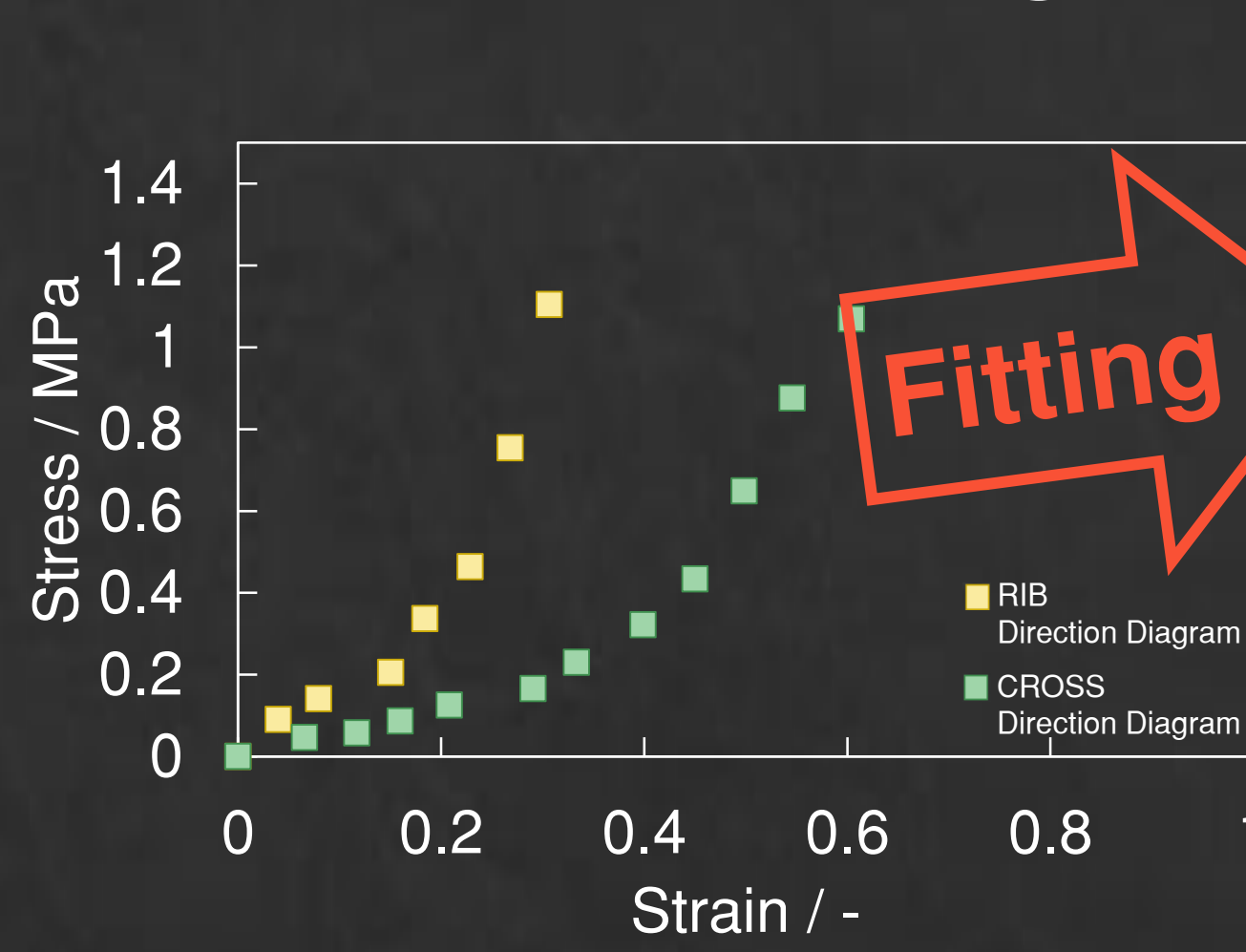


Fig.8 Example of Anisotropic Results

Fung's equation<sup>2)</sup>

$$\sigma = \alpha(\epsilon - \epsilon_s)^\beta$$

RIB Diagram  $\beta$

CROSS Diagram  $\beta$

$\beta$  ratio eq.(1) by directions / -

### Residual Interlobular Septa Analysis

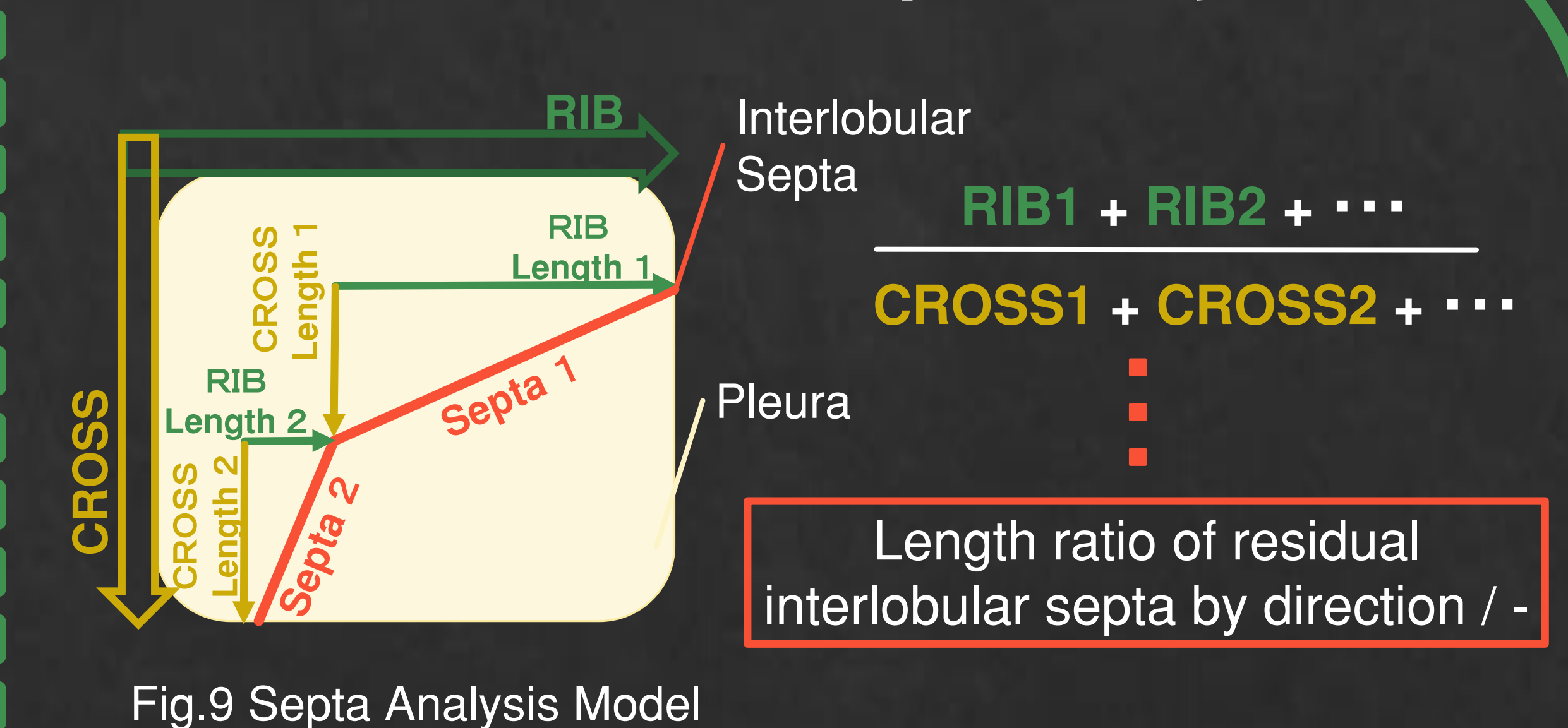


Fig.9 Septa Analysis Model

### Relationship between Septa and Anisotropic

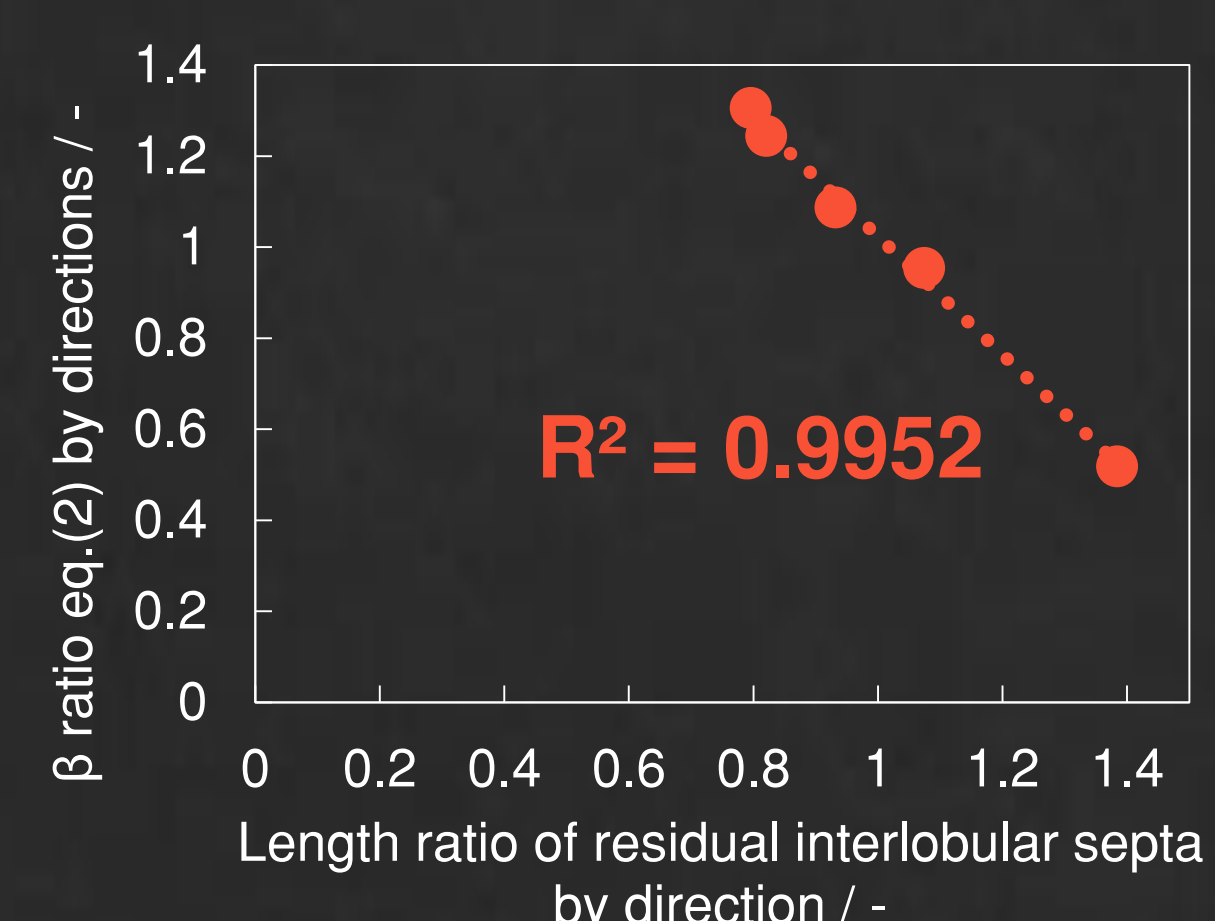
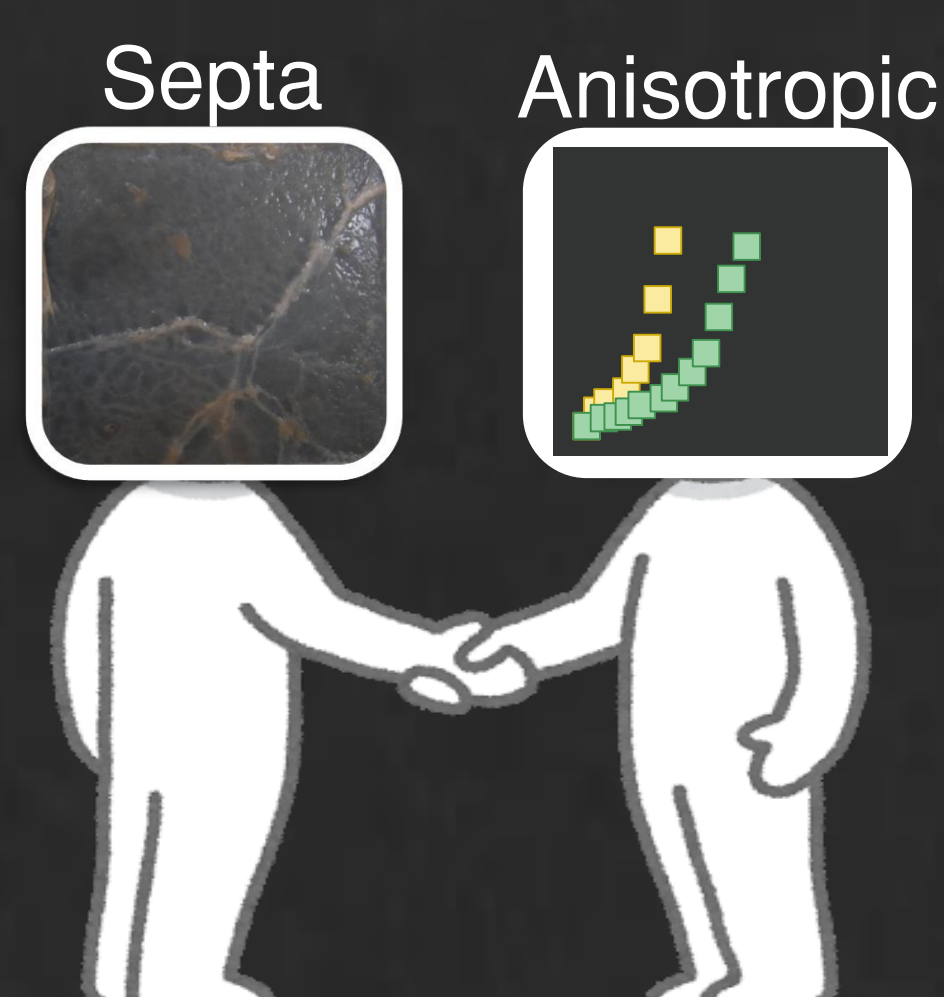


Fig.10 Relation between the ratios of the effective length of interlobular septa and the factorial  $\beta$  in Fung's eq. by direction.



**Strongly Effect**

### Residual Interlobular Septa

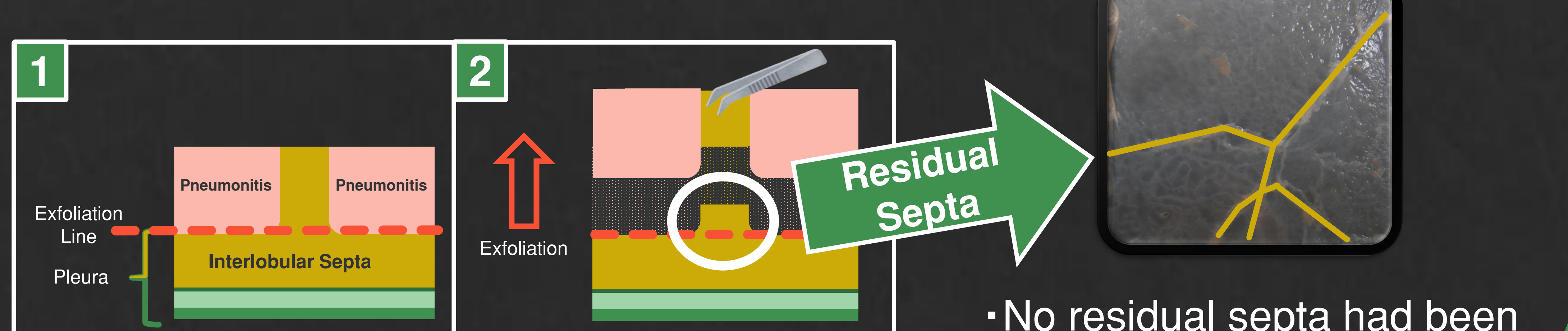


Fig.11 Sample Model

• No residual septa had been noticed in the past report.

## 5. Conclusion

- The residual interlobular septa on the pleura strongly affect the stress-strain characteristics.
- The stress is higher when pulling in the direction of the residual interlobular septa.

## 6. Future Prospects

- Measure the distribution of interlobular septa on lung.
- Establishment of a new analysis method that includes the lobular interventricular septa.