



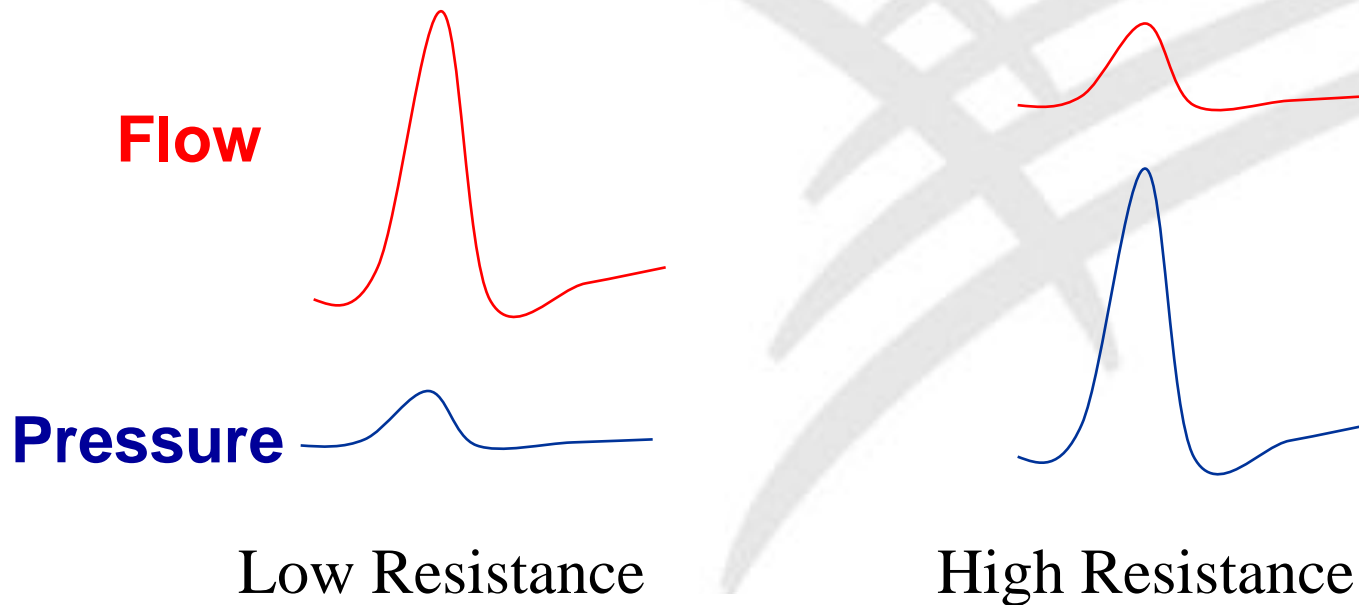
AIRWAY RESISTANCE BY IMPULSE OSCILLOMETRY

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Cardinal Health Canada Inc.**



AIRWAY RESISTANCE

- The relationship between pressure and flow tells us about airway resistance.





What Value Is It ?

- FEV1, MEF etc are all **RESULTS** of airways resistance.
 - Why measure the result when you can measure the cause.
 - Airway resistance changes **BEFORE** changes are seen in Spirometry
-





BODY PLETHYSMOGRAPHY

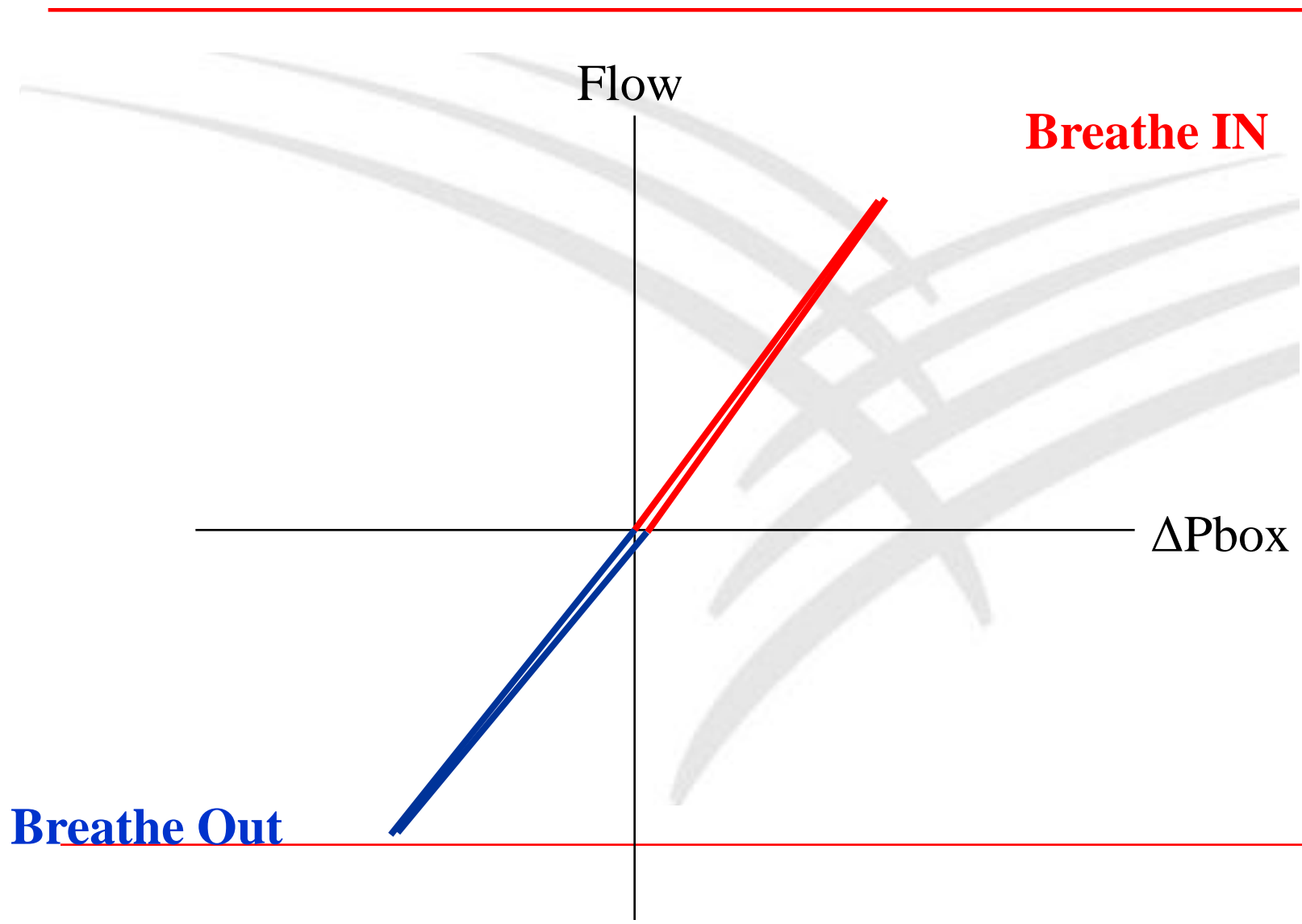


Airways Resistance

- When we breathe in and out, the change in box pressure is relative to the amount of gas compressed in the lungs.
 - This compressed gas should be instantaneously measured as flow at the mouth.
 - The relationship between box pressure and flow at the mouth indicates airways resistance
-

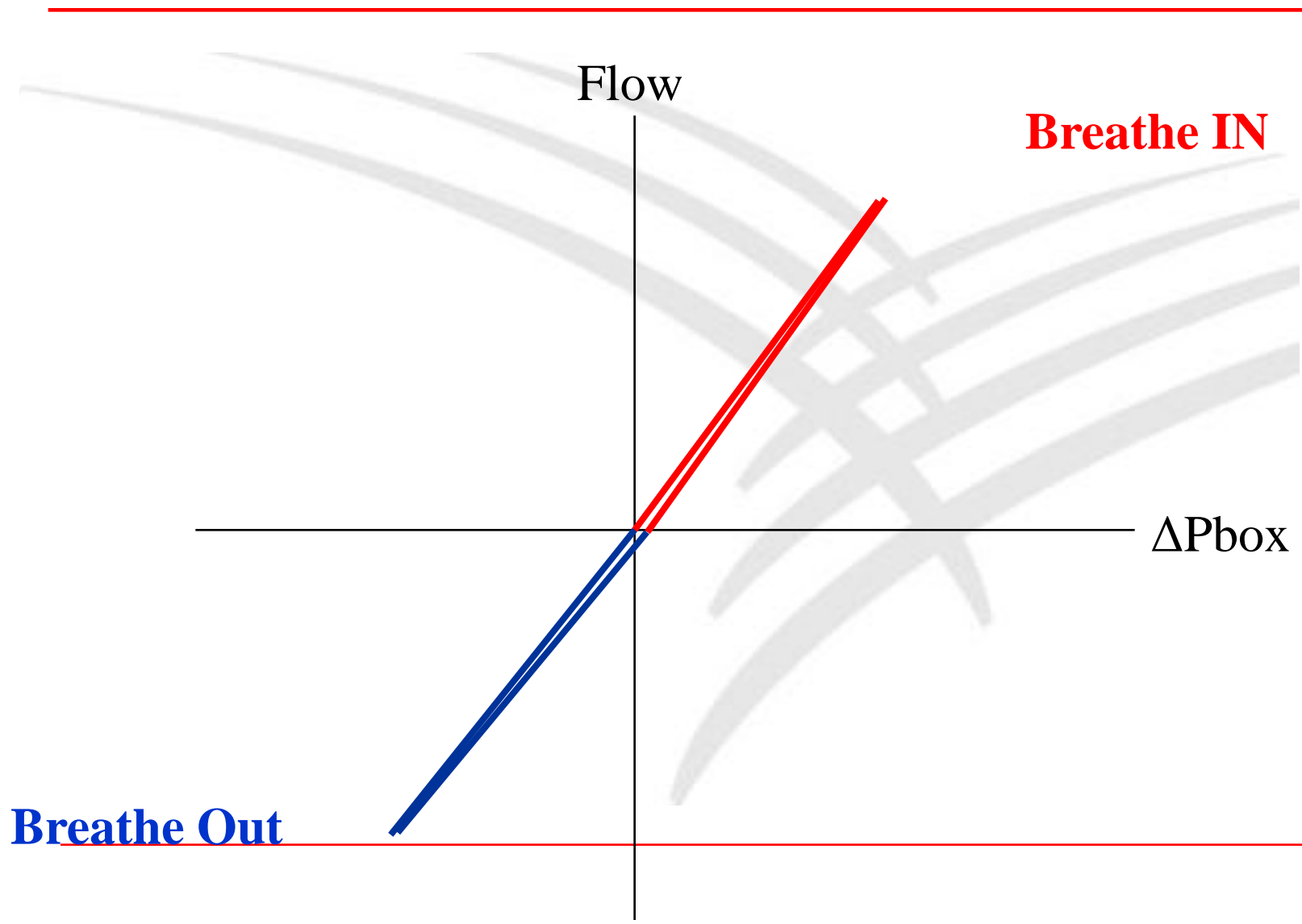


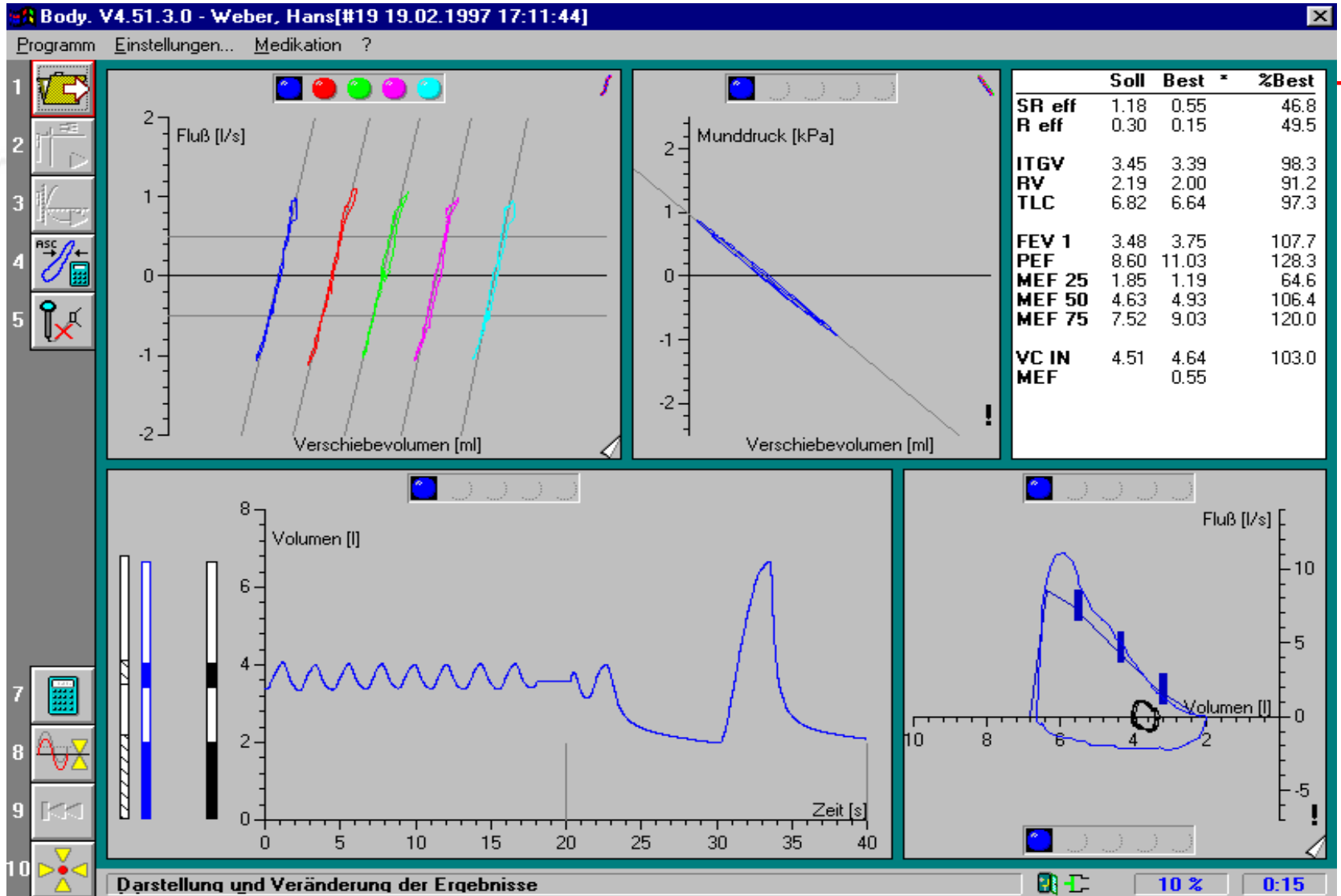
Airways Resistance





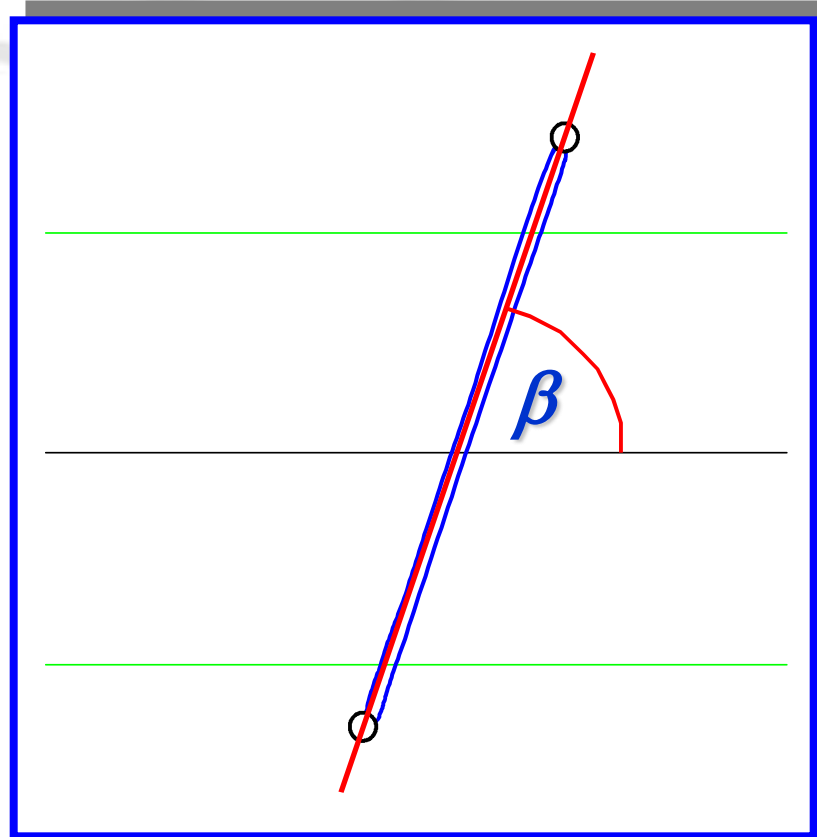
Airways Resistance



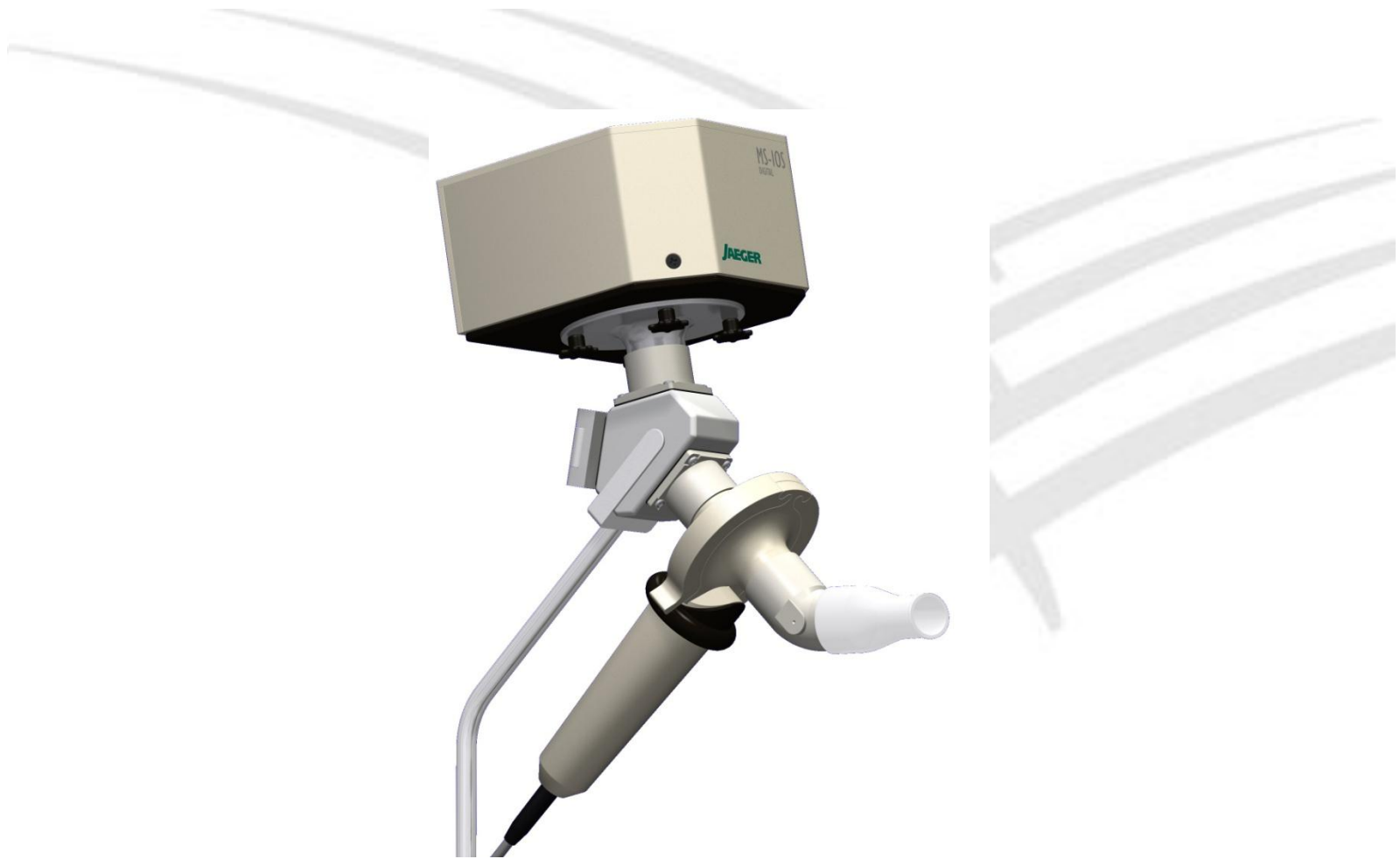




Resistance (Beta)



IMPULSE OSCILLOMETRY





IOS

The Easiest,

Most Sensitive,

Most Specific,

Airway Resistance and
Lung Reactance.



IOS

- Very Simple to Perform
 - No Special Breathing Necessary
 - Minimal (no) Co-operation Required
 - Useful in Young Children
 - Even Possible with Animals
 - No Forced Maneuver Necessary
 - No Box Necessary
 - Peripheral and Central Resistance Separated
-

The Technology



- Pressure generator
 - Terminating Resistor
 - Pneumotach
-

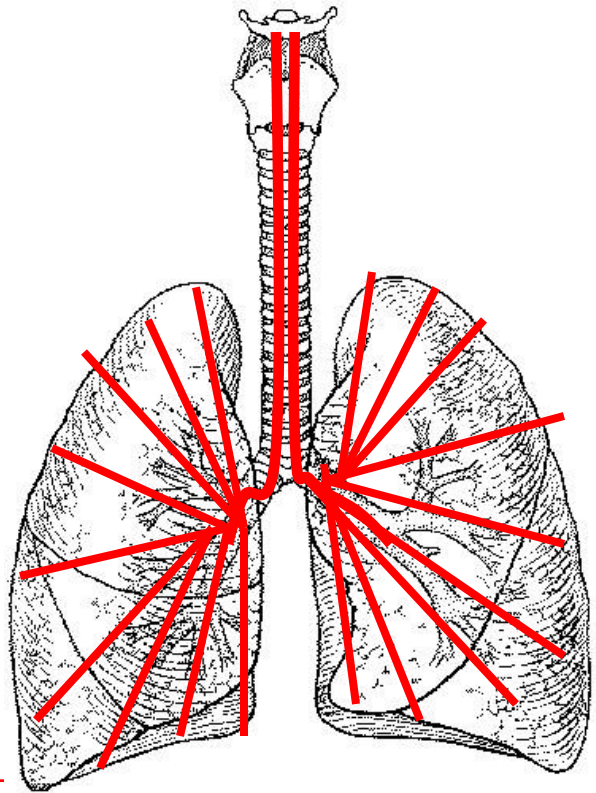
NOT A LOUDSPEAKER



Impulse Penetration

Slow Impulses

5Hz

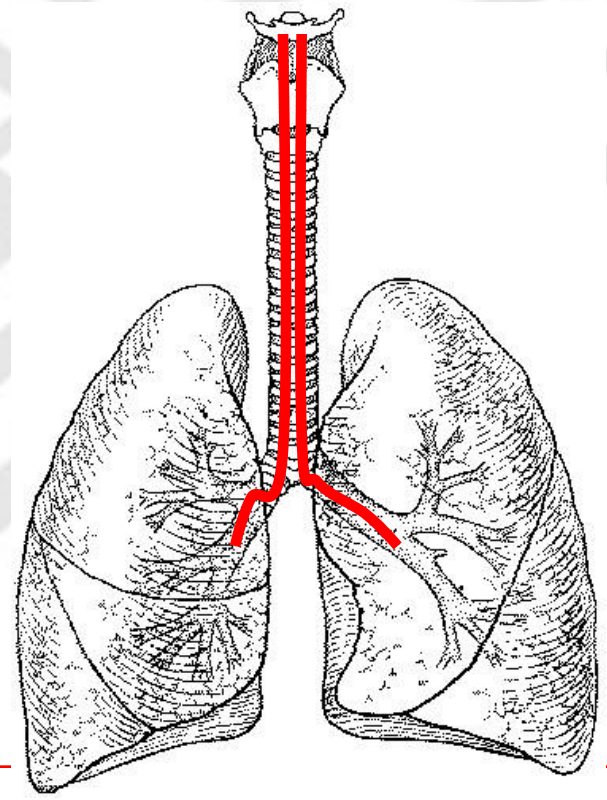




Impulse Penetration

Fast Impulses

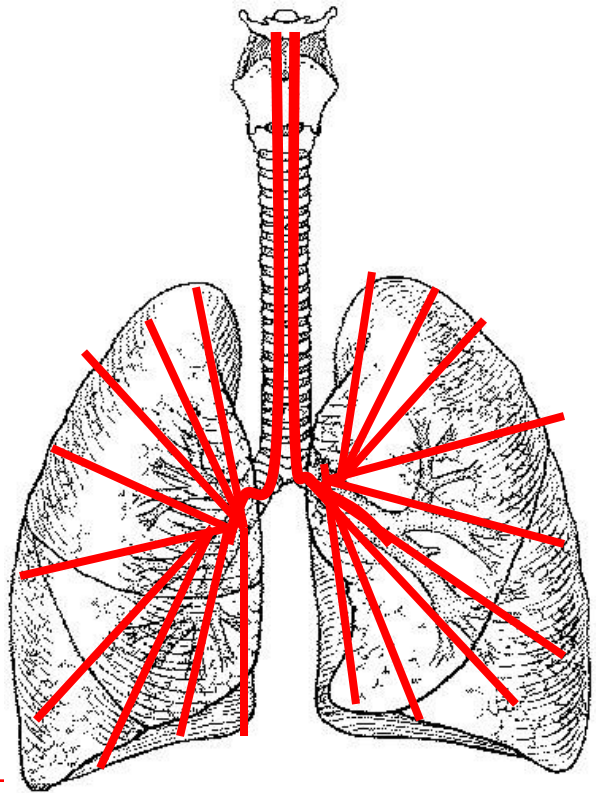
20Hz



Impulse Penetration

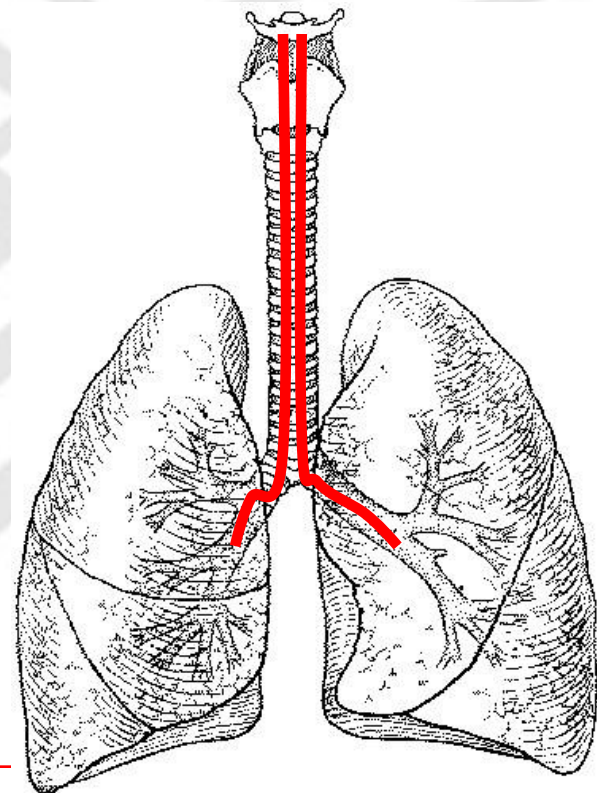
Slow Impulses

5Hz



Fast Impulses

20Hz





Simultaneous Impulse Penetration

- Flow and Pressure from slow impulses

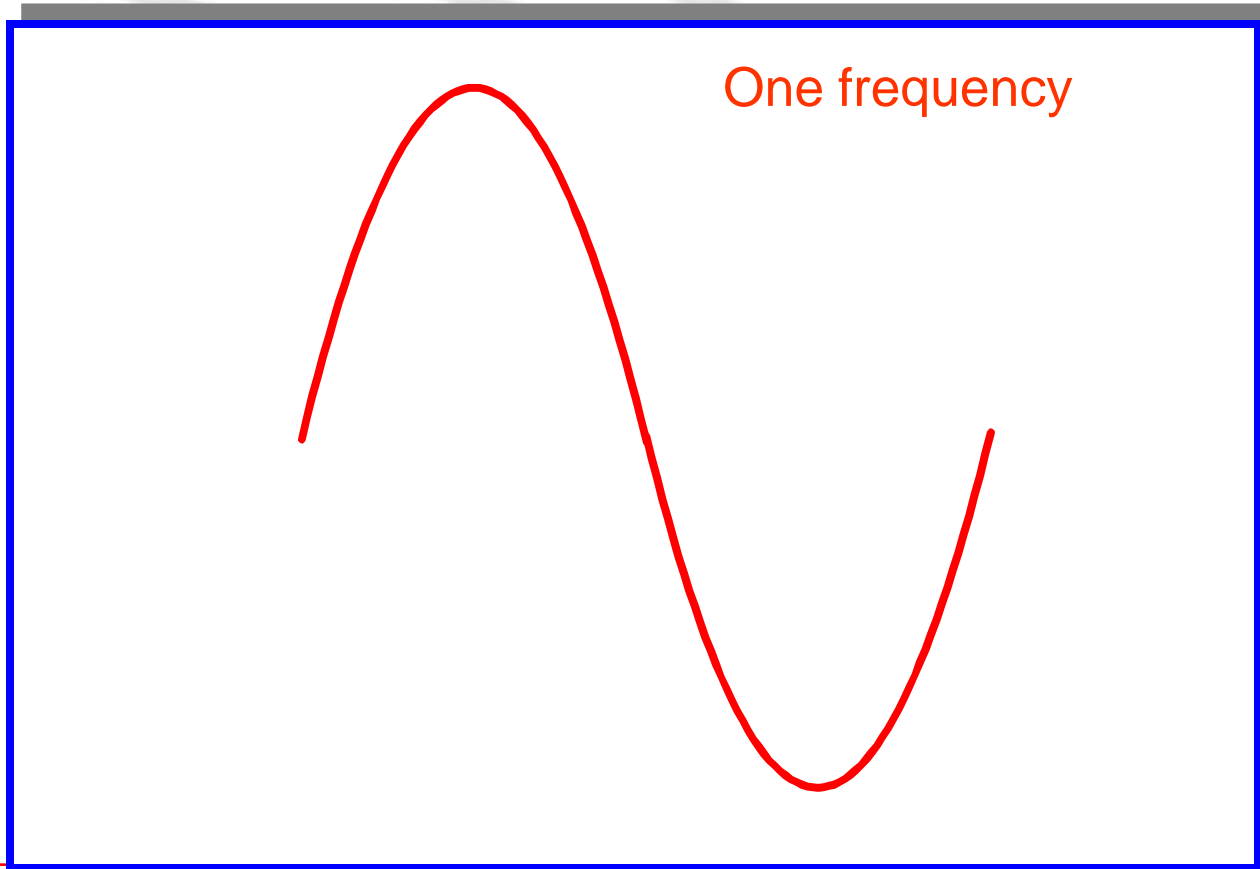
R5: CENTRAL AND PERIPHERAL AIRWAYS

- Flow and Pressure from fast impulses

R20: CENTRAL AIRWAYS

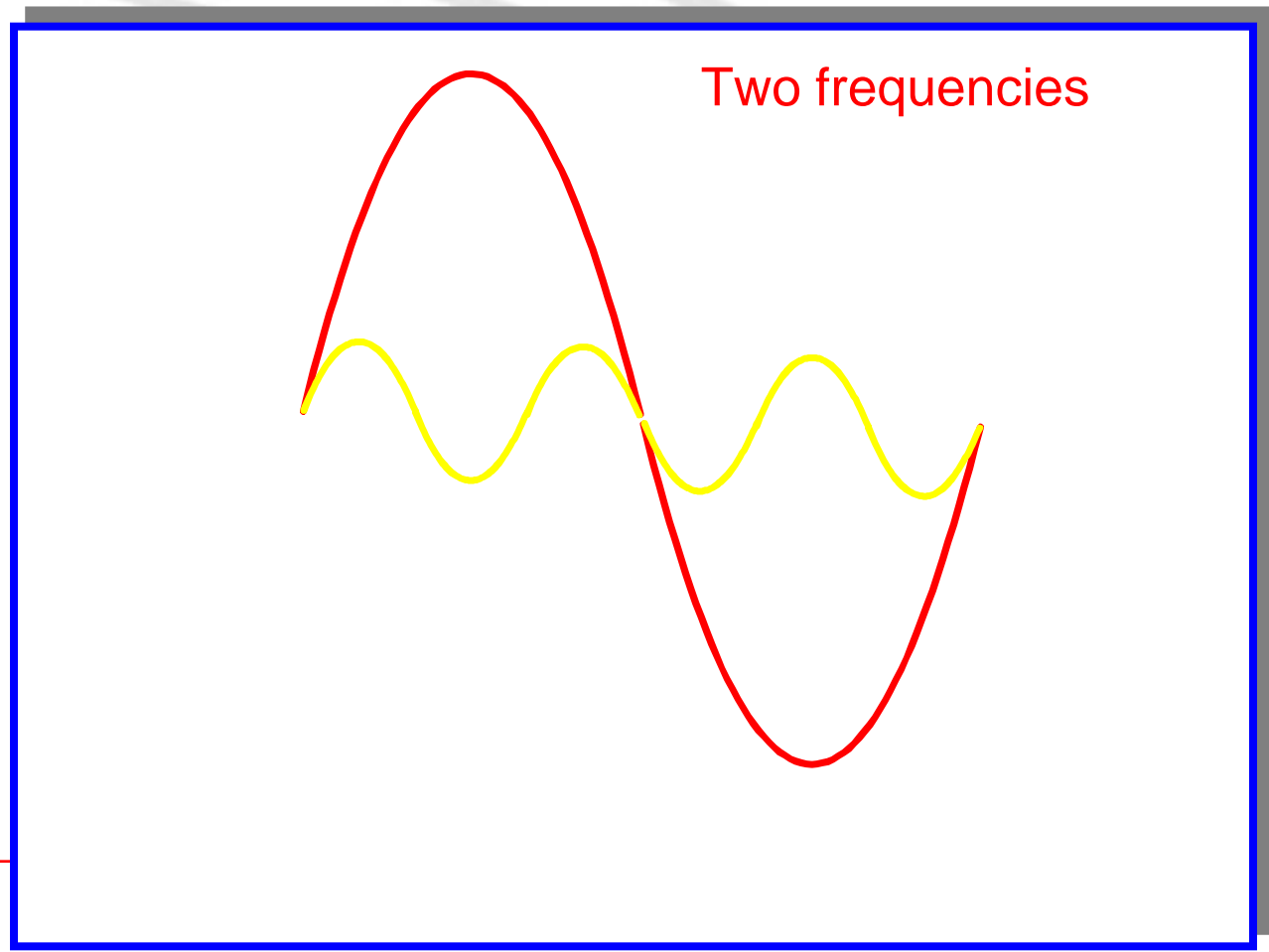


Frequencies



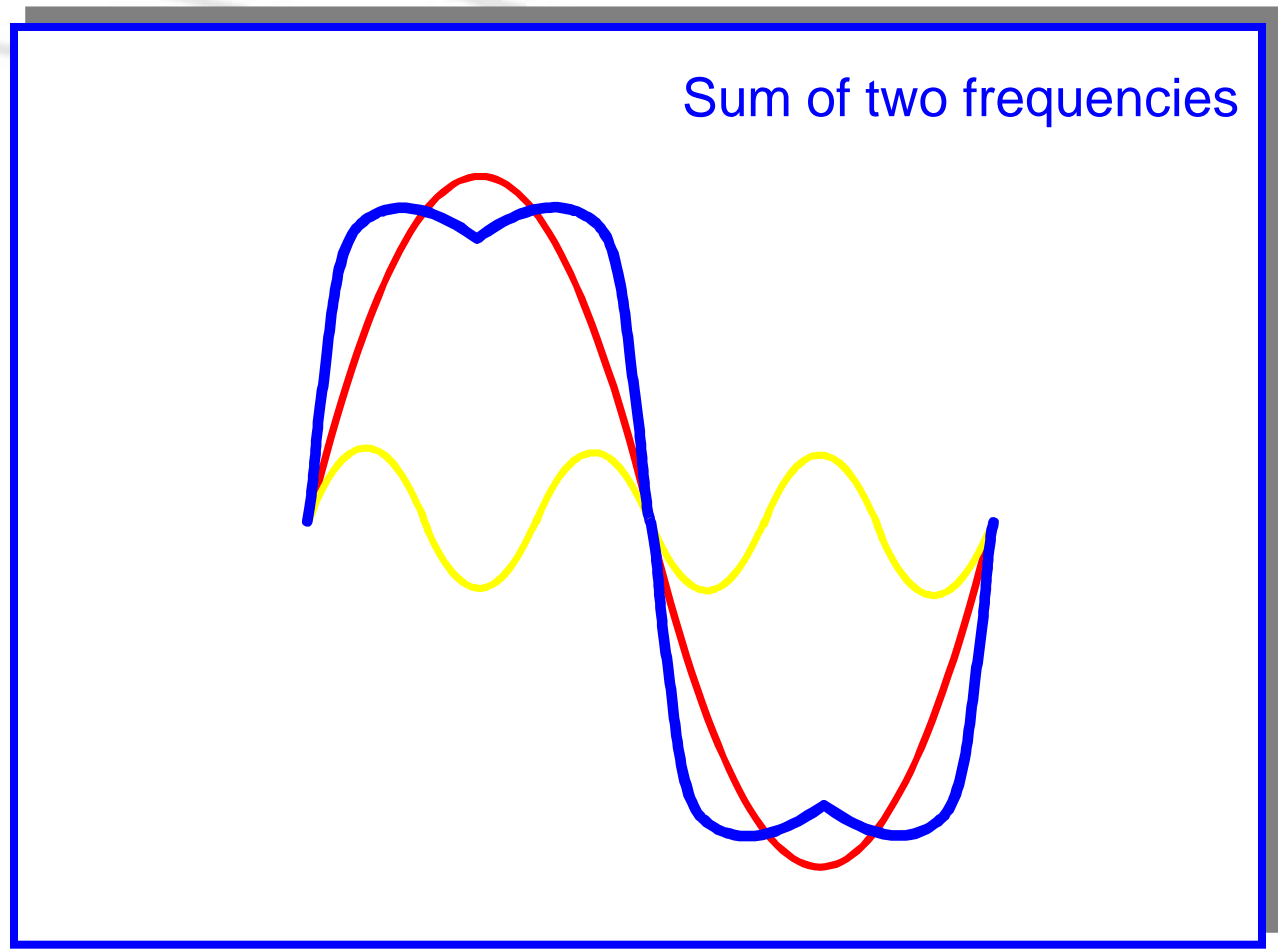


Frequencies





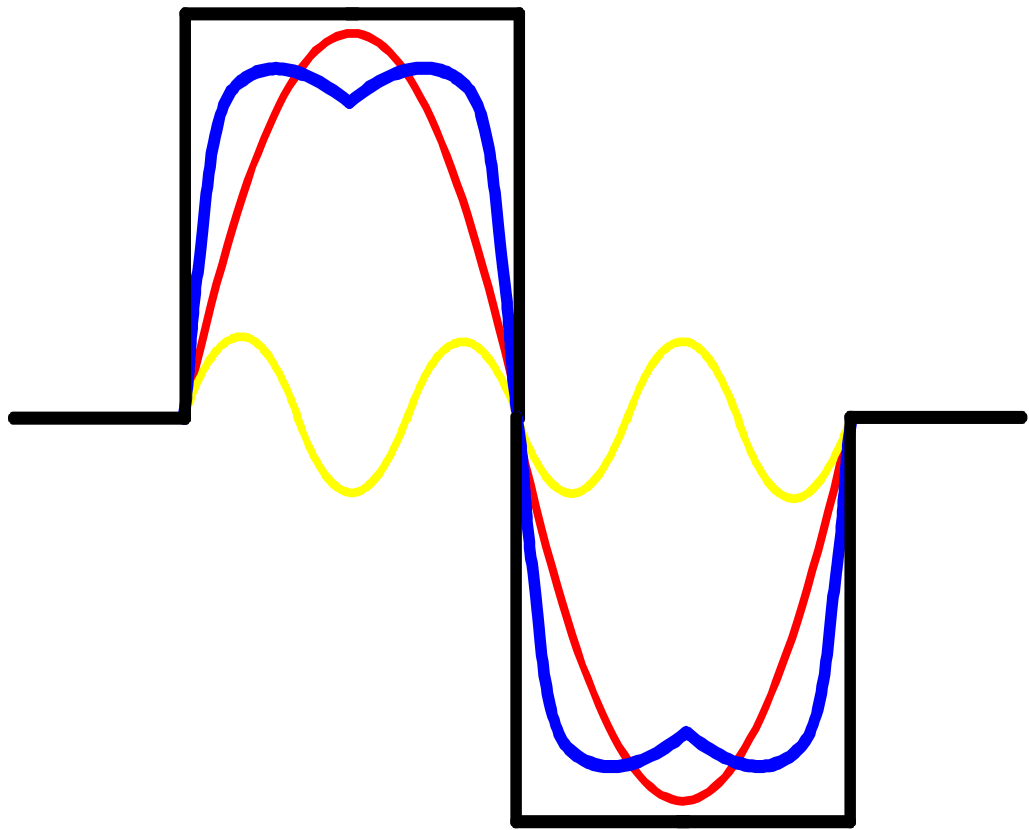
Frequencies





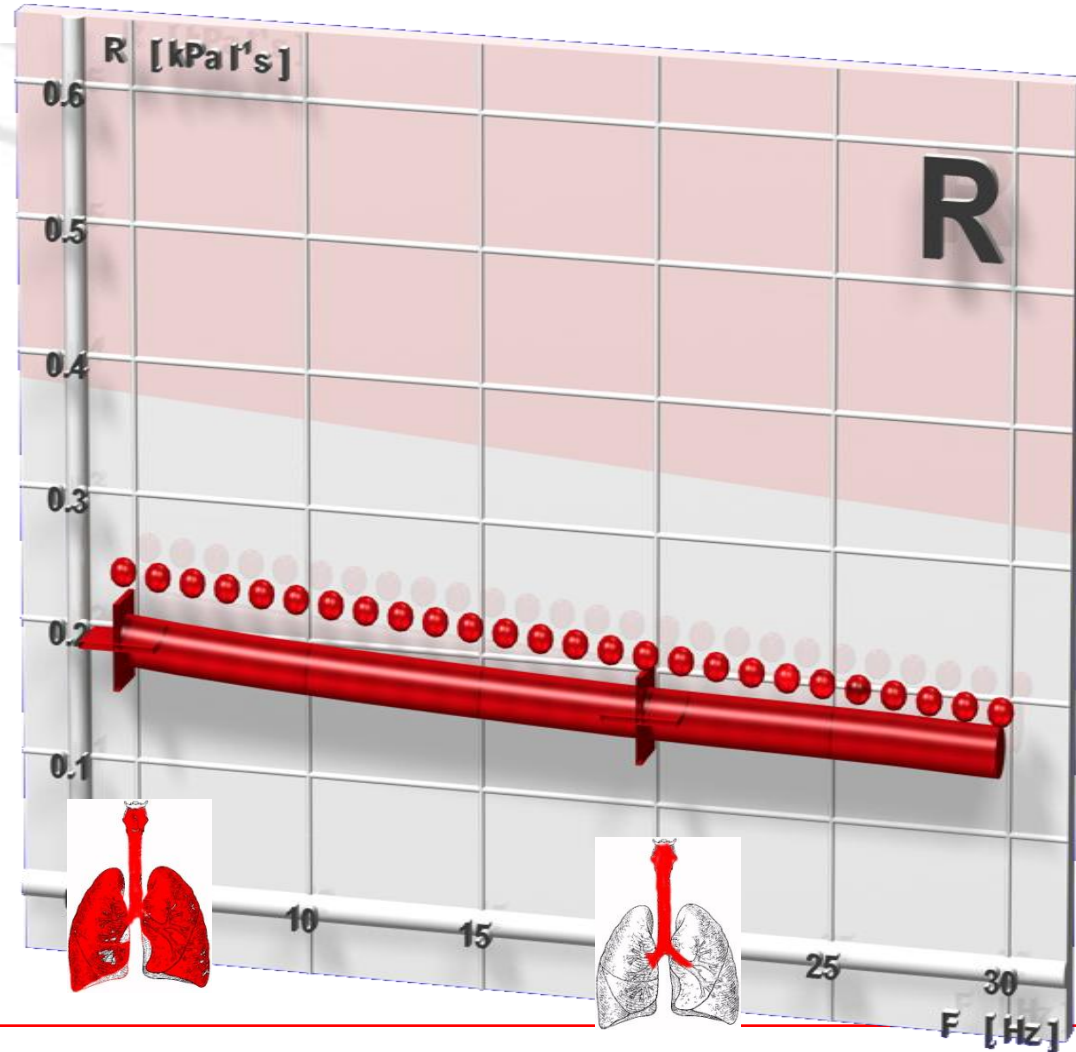
Impulse Oscillometry

Rectangular pulse: all frequencies



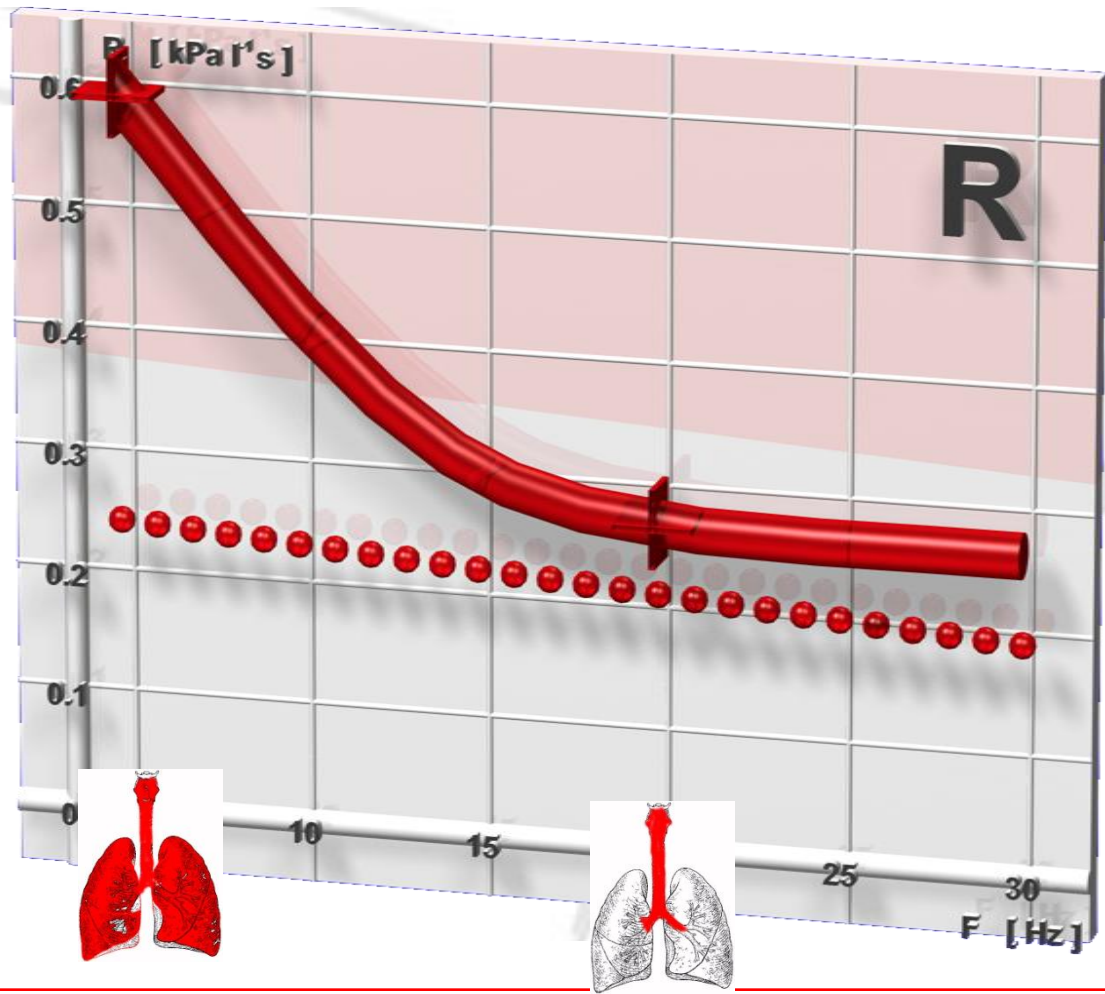


Normal Resistance



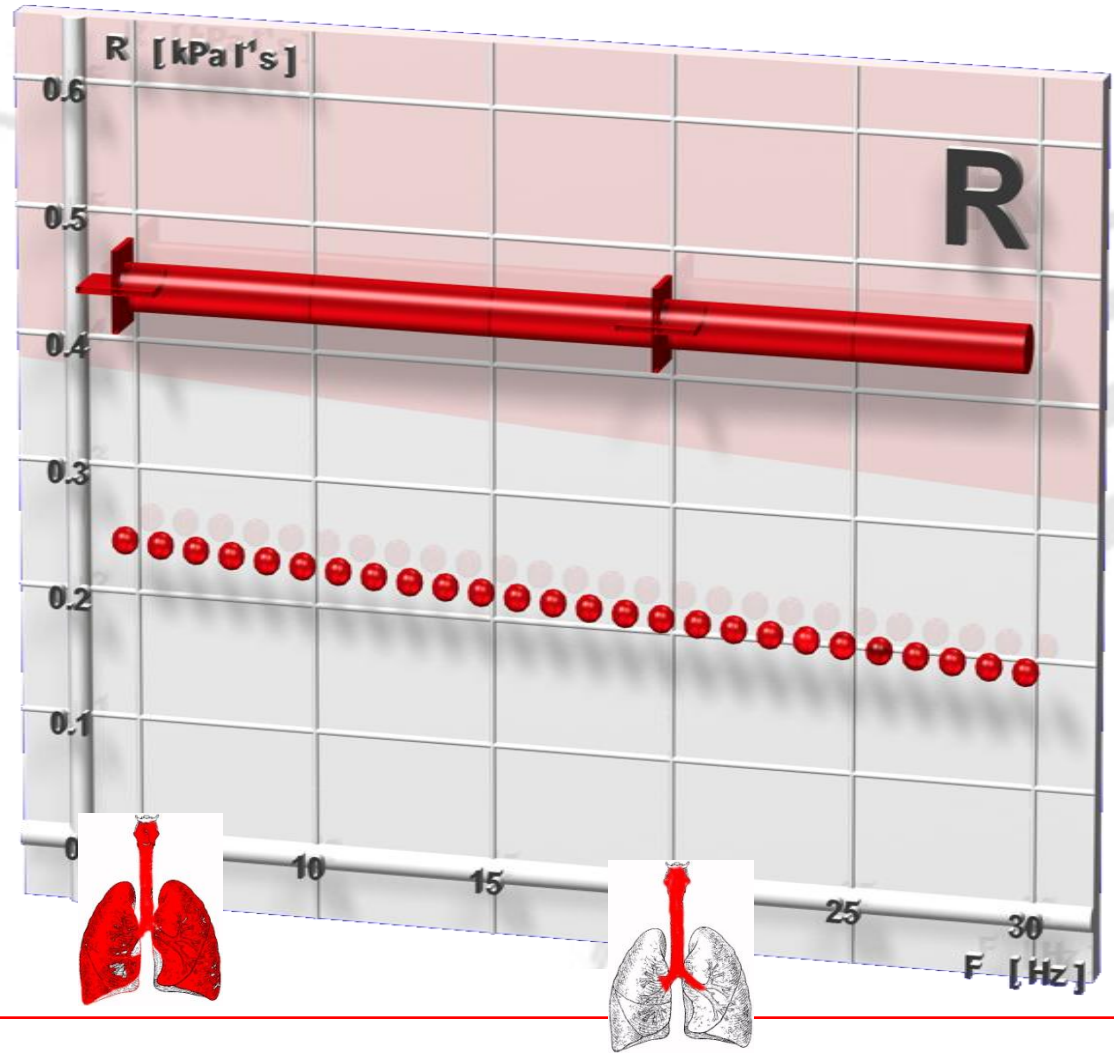


Peripheral Resistance





Central Resistance





Lung Reactance



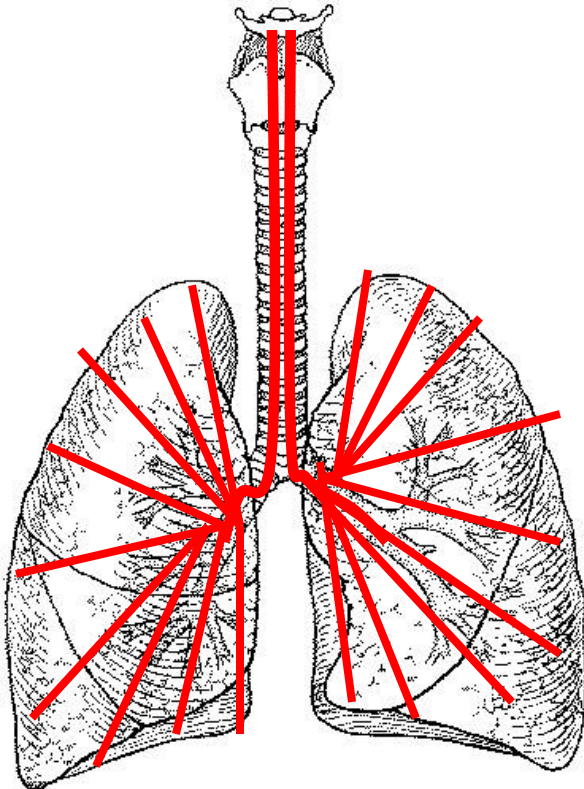
Lung Reactance

- Reactance is how the alveoli, diaphragm, chest wall, all react to the pressure wave.
 - Not resistance – no FLOW.
 - Low reactance means there is little stretch and recoil of the lungs eg COPD
-

Which Impulse For LUNG reactance?

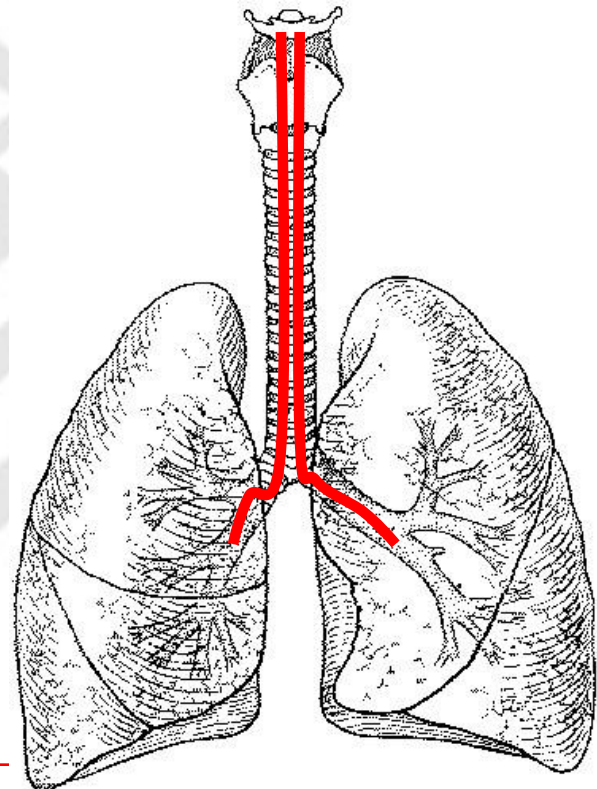
Slow Impulses

5Hz



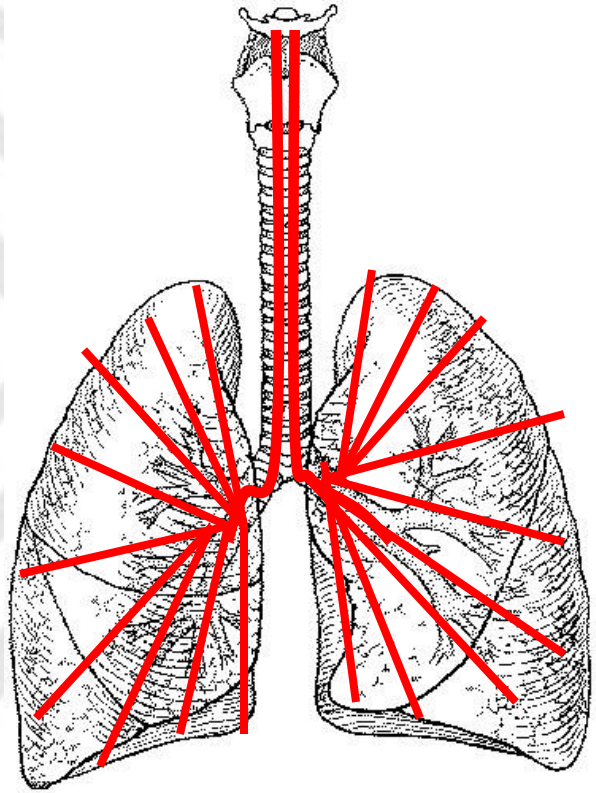
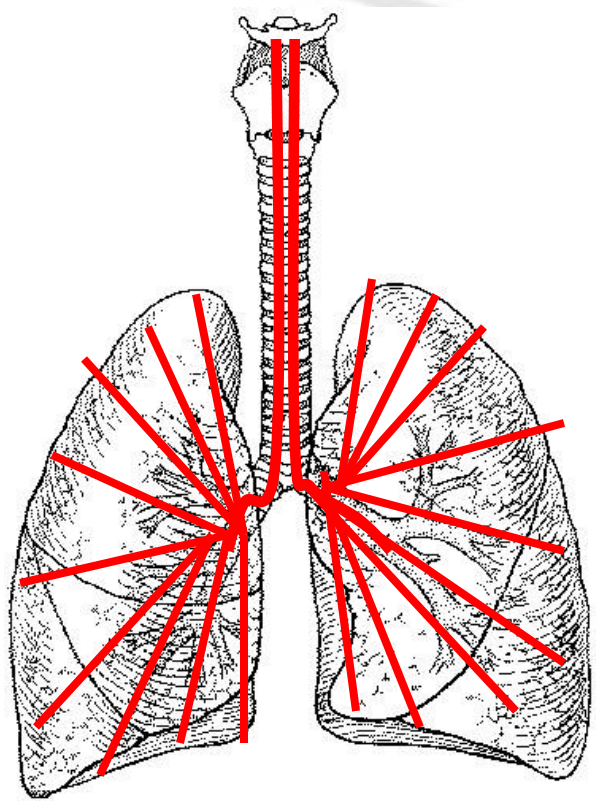
Fast Impulses

20Hz



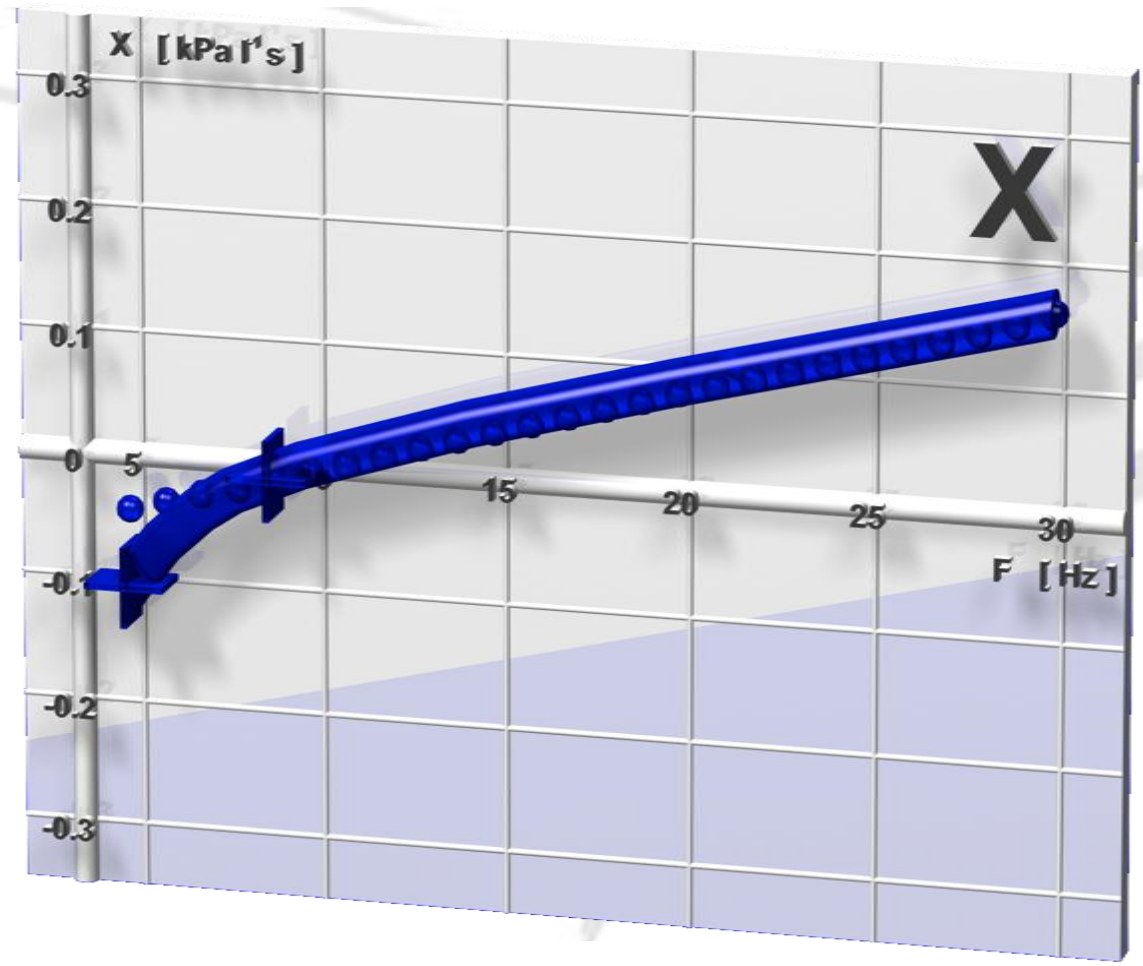


In-phase/Out of Phase



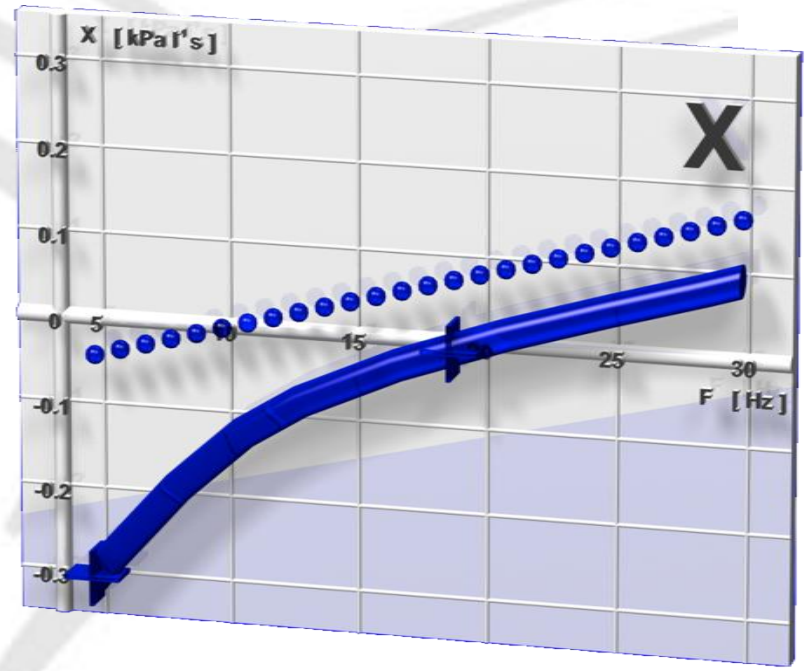
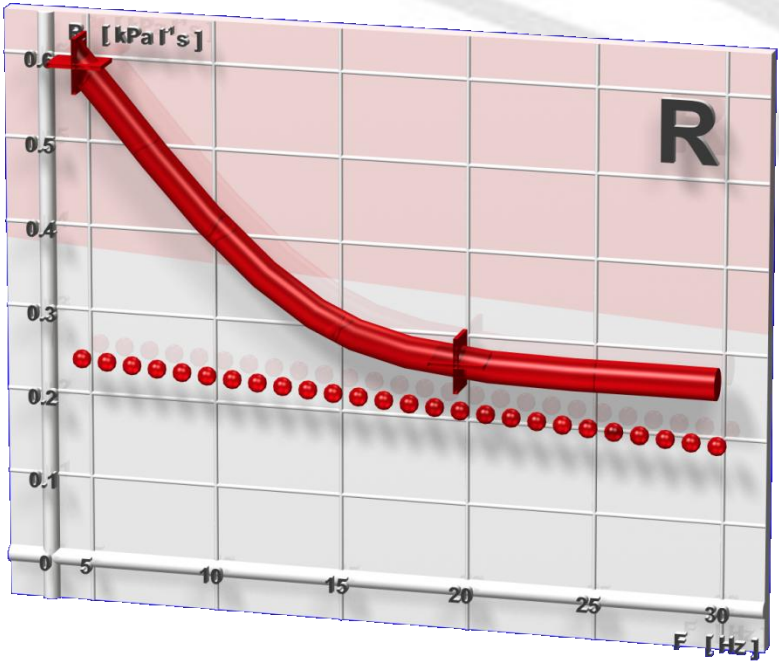


X5 : Reactance at 5Hz



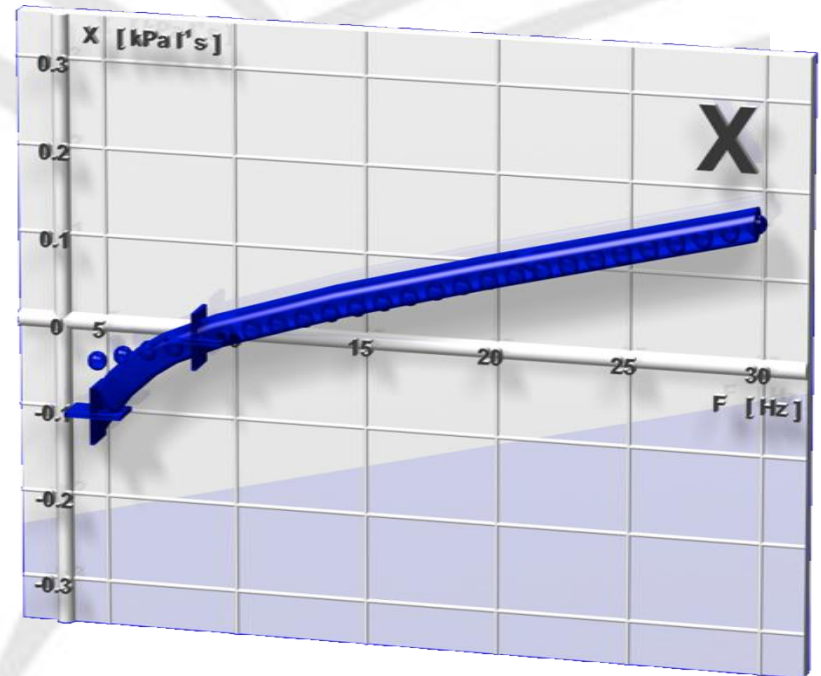
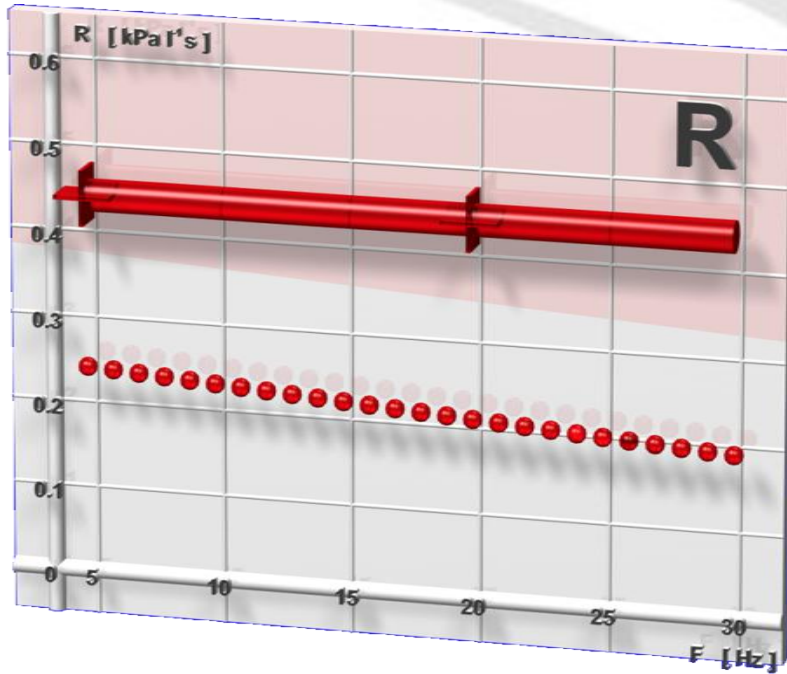


COPD...



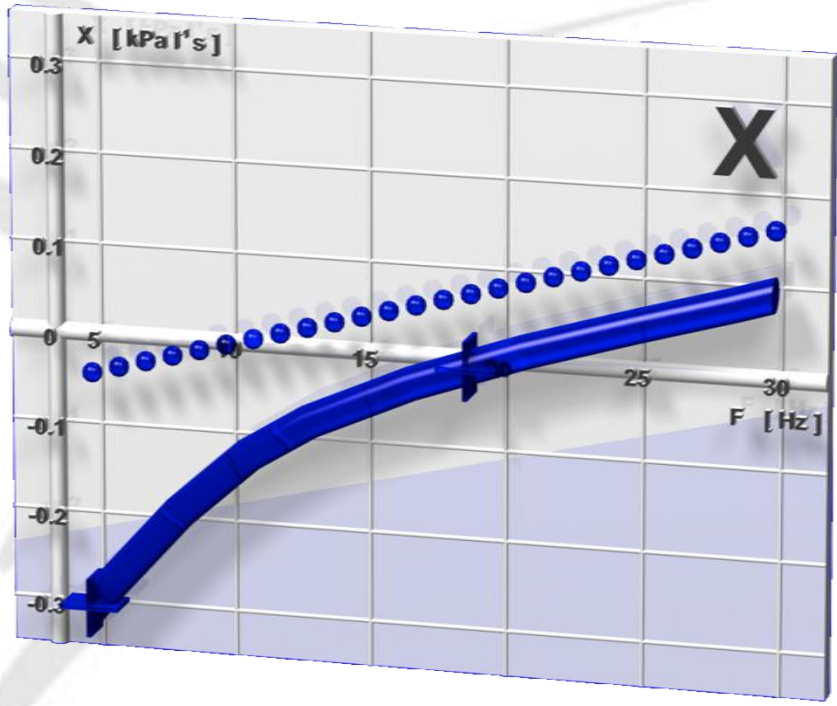
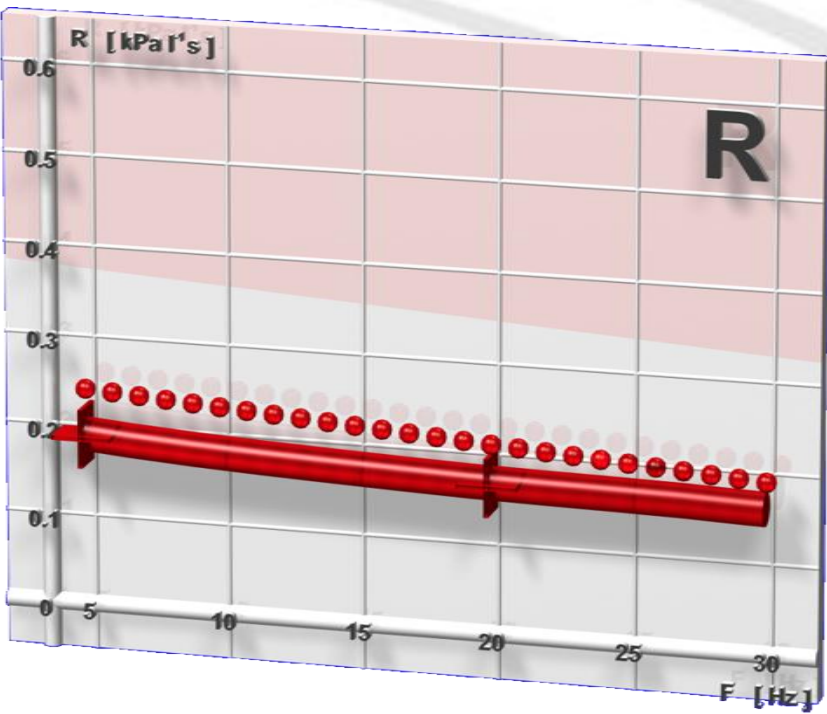


Central Airway Obstruction



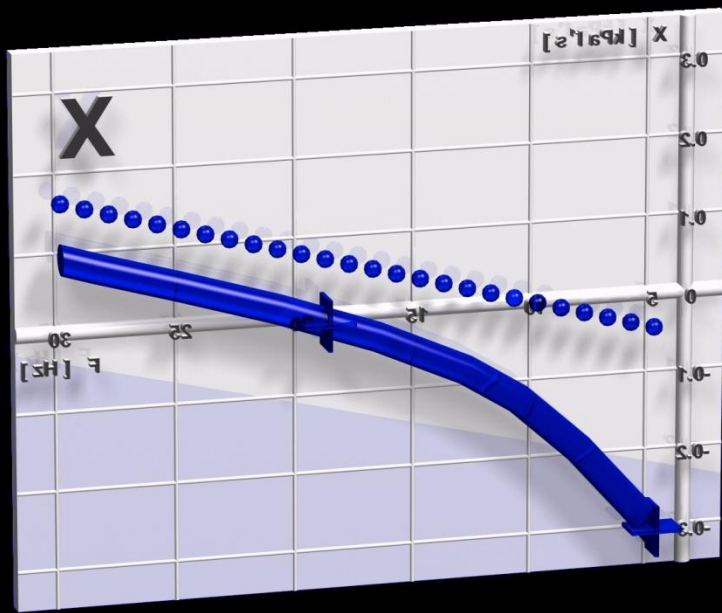


Restrictive Lung Disease



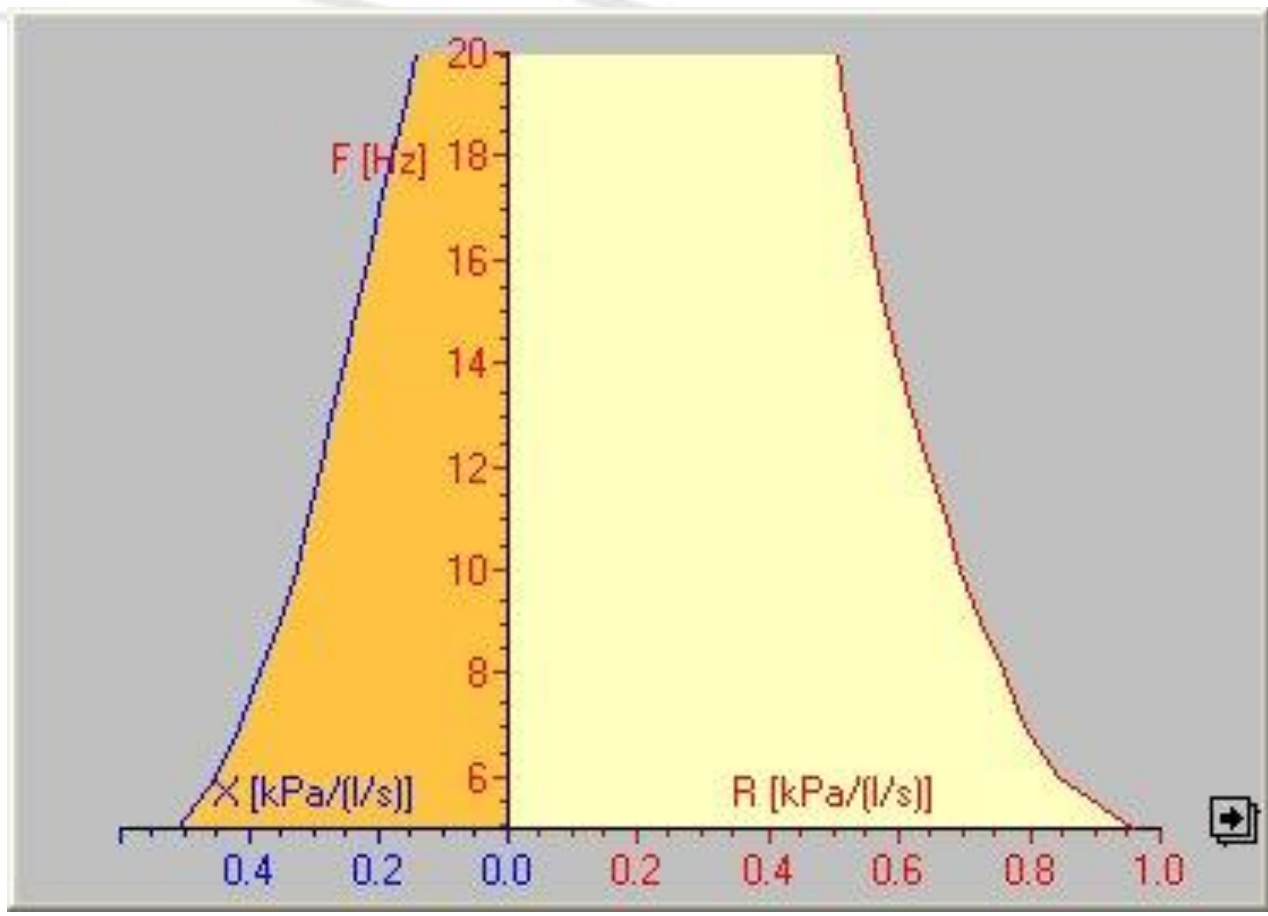


Asthma Intelligence Graph



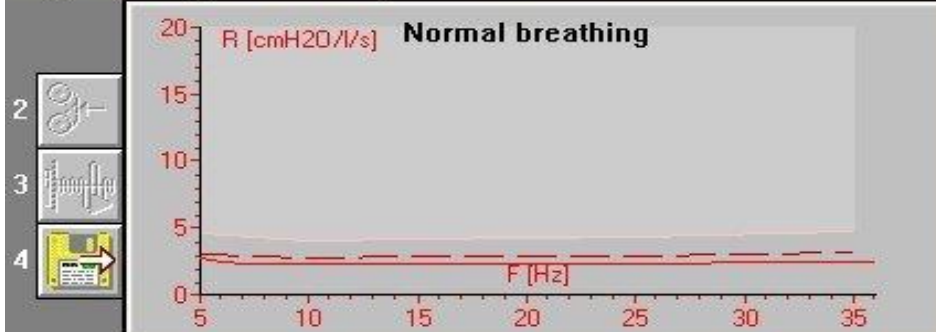


Asthma Intelligence

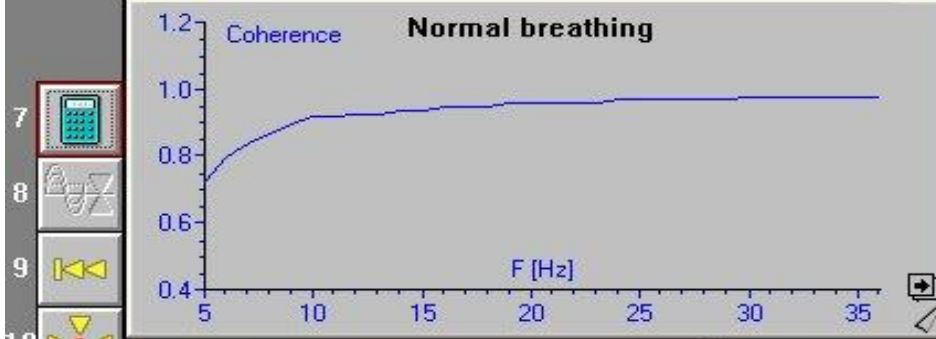
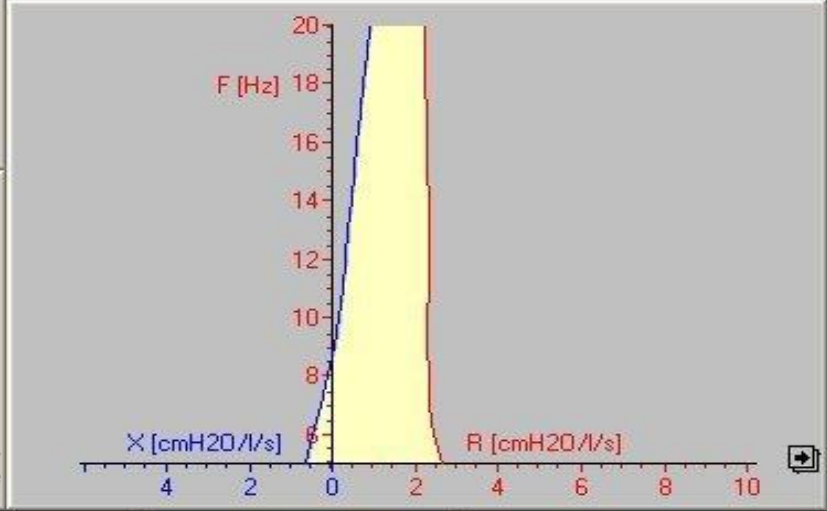
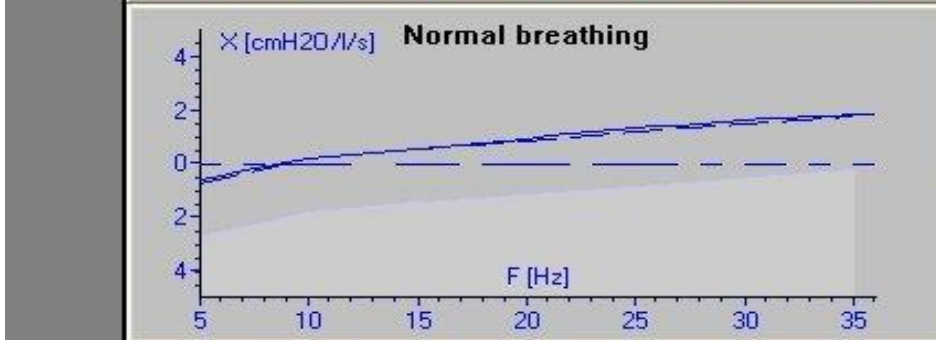




Program Settings Zoom Utility functions Medication ?



	Pred	Test	%Pred
R5Hz	0.30	0.26	87.1
R20Hz	0.28	0.22	79.3
X5Hz	-0.07	-0.06	
Fres.		8.72	
AX		0.11	
CO5Hz		0.6	
CO20Hz		1.0	



7

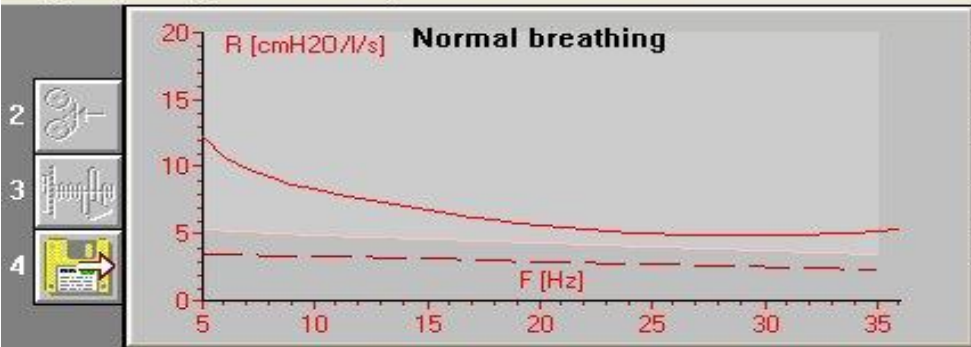
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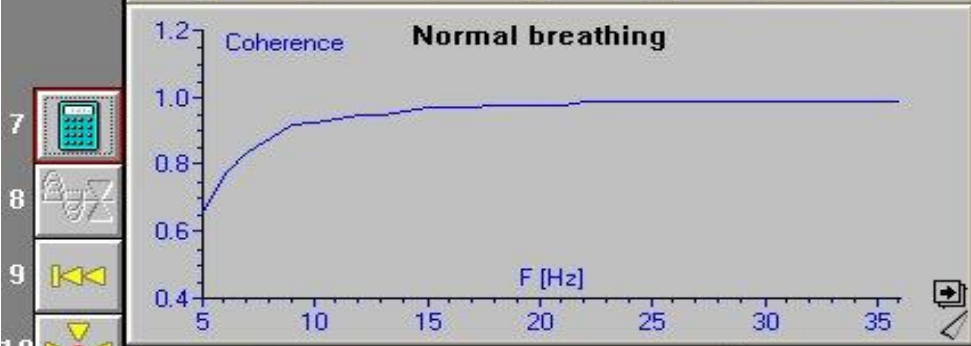
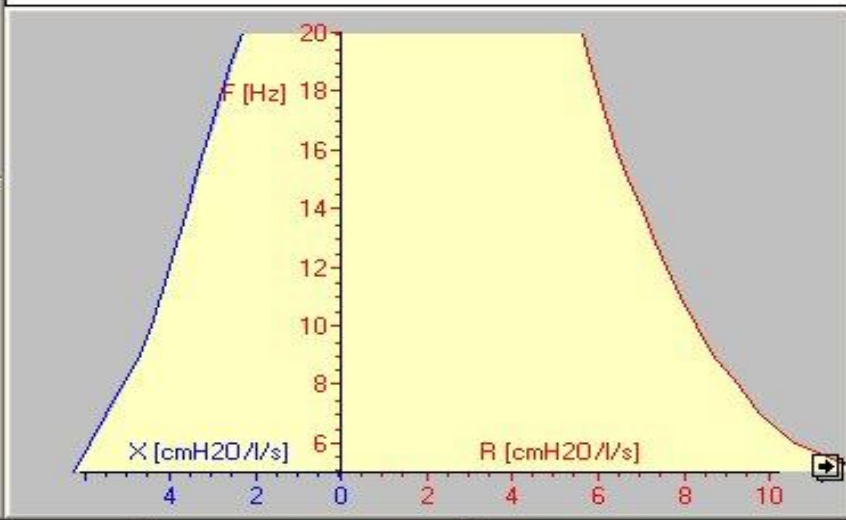
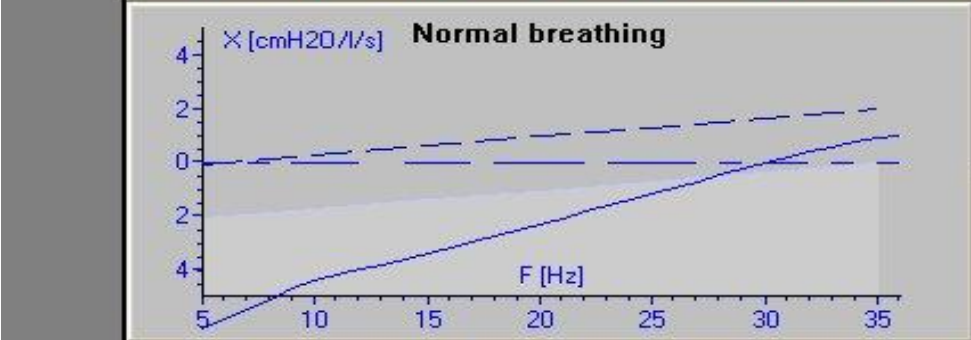
10



Program Settings Zoom Utility functions Medication ?



	Pred	Test	%Pred
R5Hz	3.51	12.16	346.2
R20Hz	2.90	5.63	194.3
X5Hz	-0.11	-6.25	
Fres		30.12	
AX		72.37	
C05Hz		0.7	
C020Hz		1.0	



2

3

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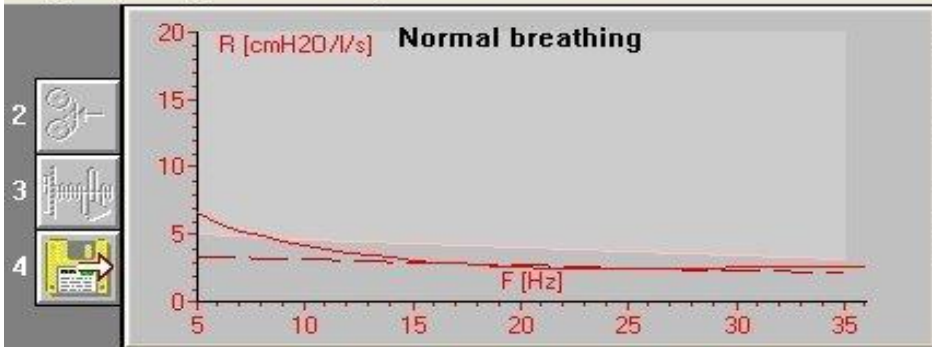
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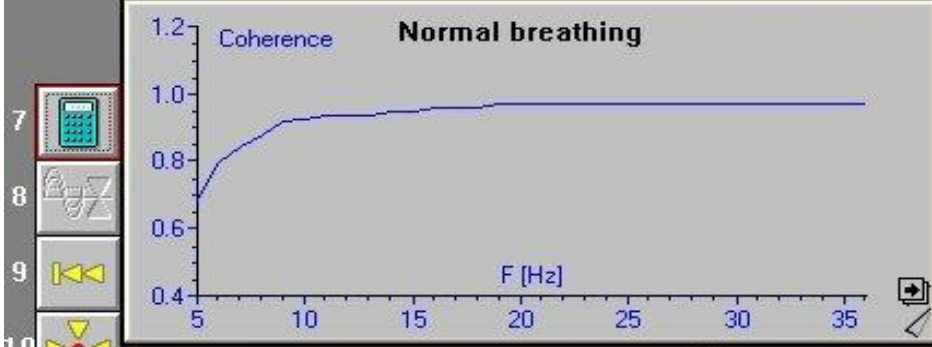
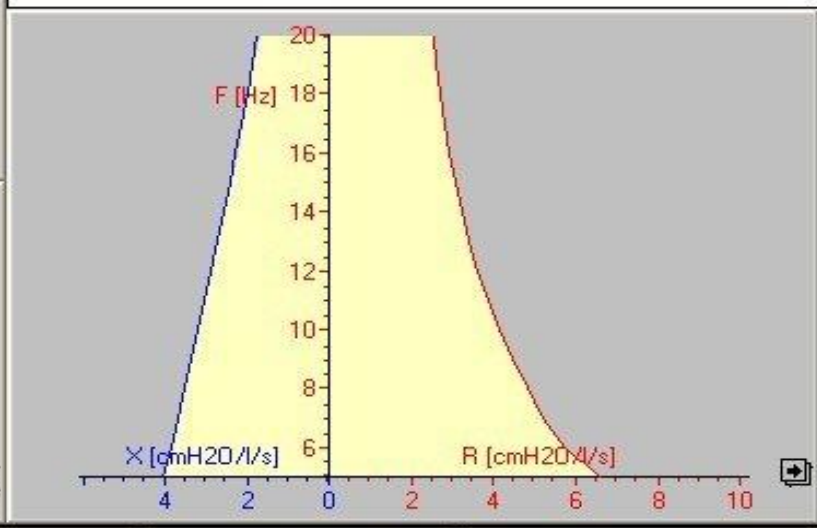
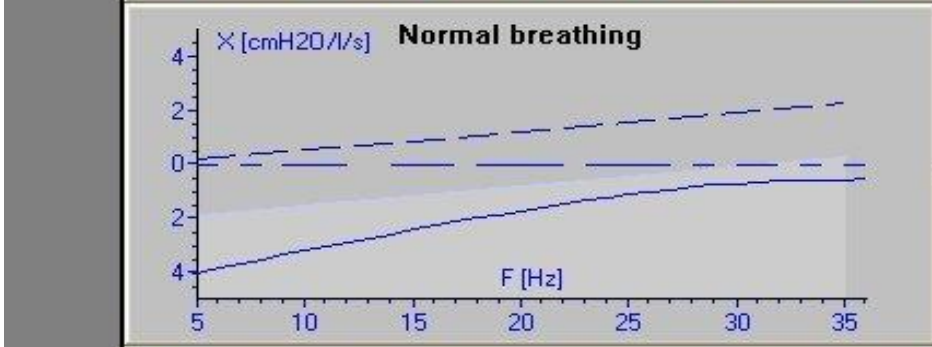
10



Program Settings Zoom Utility functions Medication ?



	Pred	Test	%Pred
R5Hz	3.32	6.60	198.5
R20Hz	2.71	2.57	94.8
X5Hz	0.16	-4.09	
Fres		56.61	
AX		63.24	
CO5Hz		0.7	
CO20Hz		1.0	



7

8

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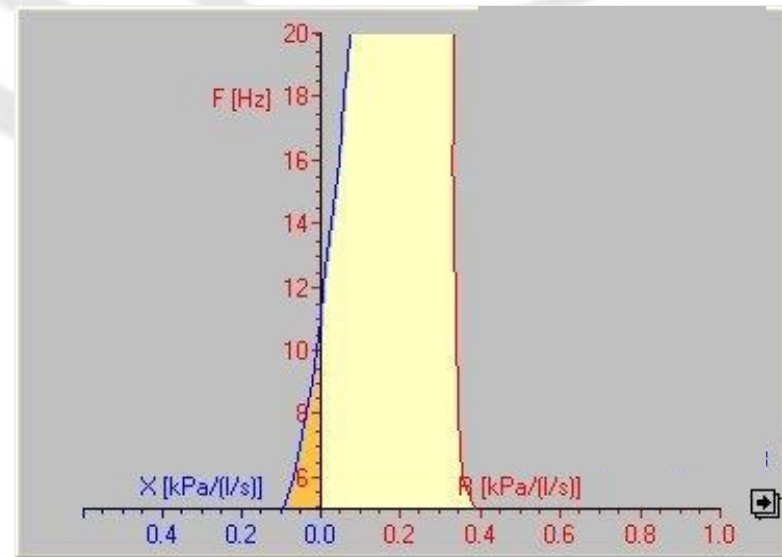
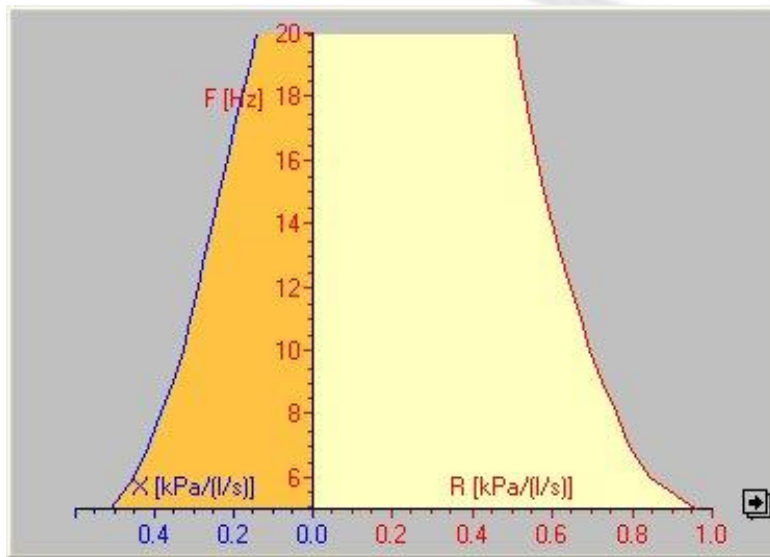
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Provocation/Dilation

- Pre Bronchodilator

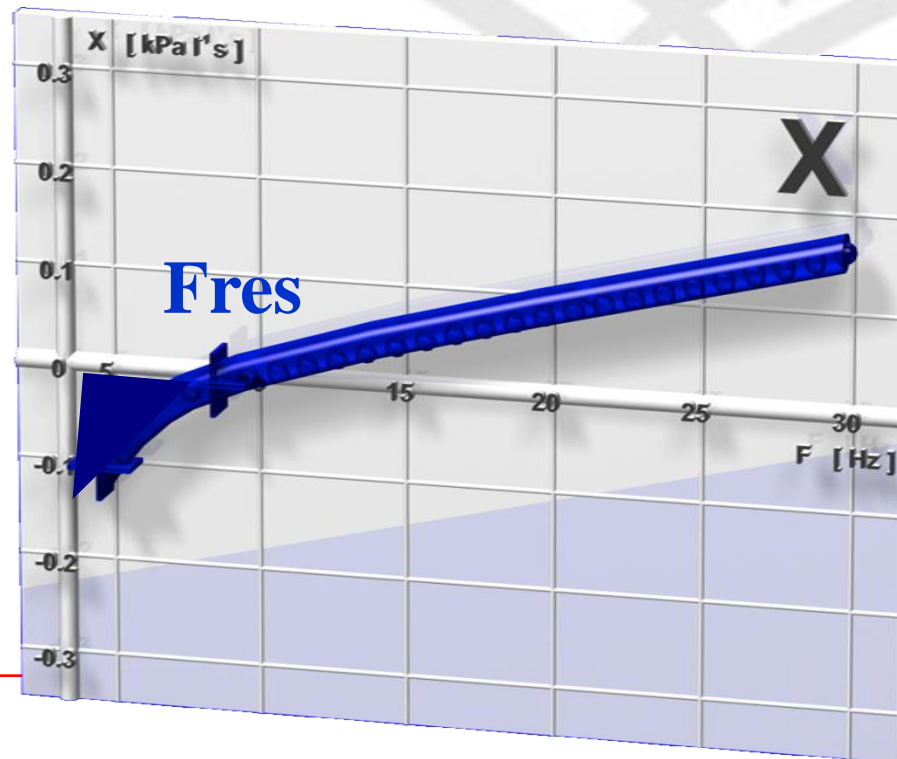
Post Bronchodilator





Fres and AX

- **Fres = Resonance Frequency**
Where the reactance crosses zero
- **AX = Reactance Area**
The area under the reactance curve

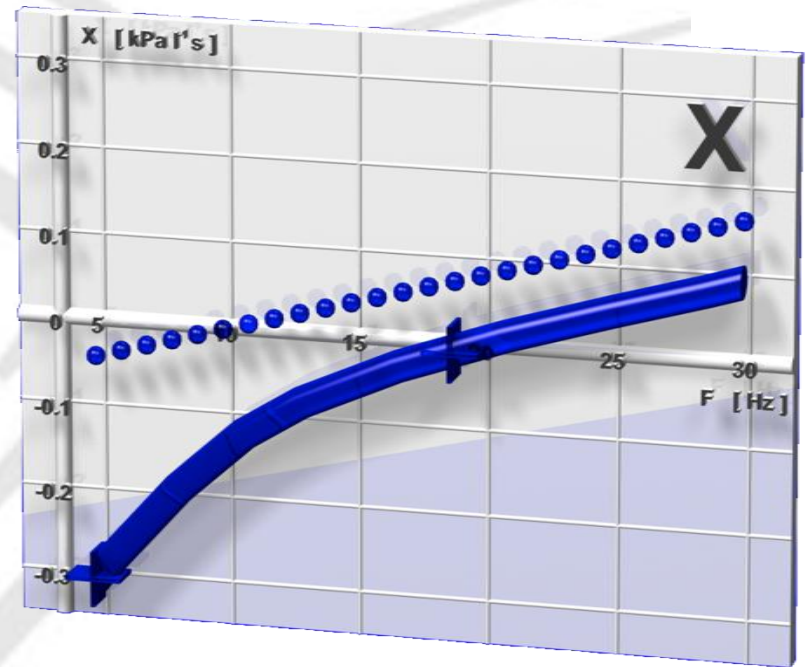
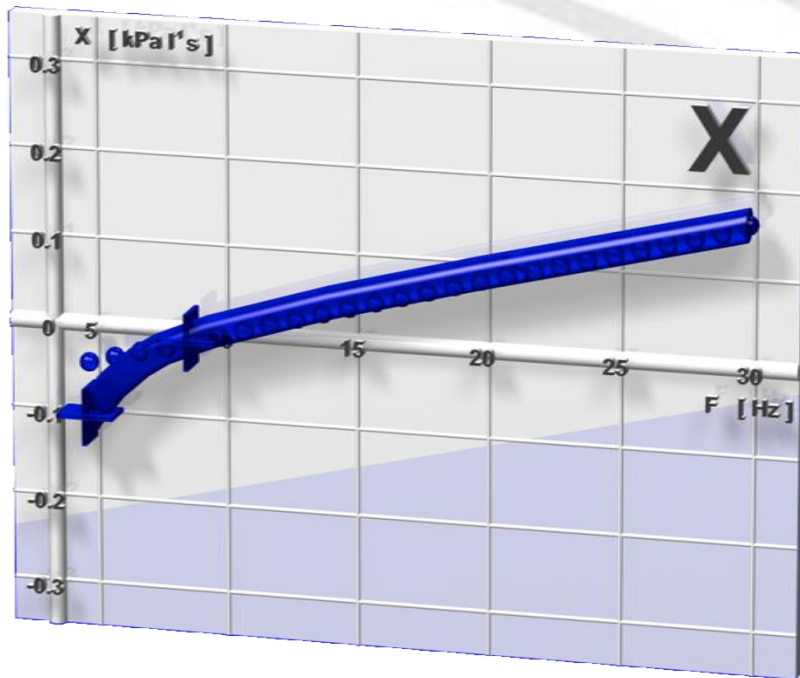




Excellent Trend Measures

PRE Methacholine

Post Methacholine





SUMMARY

- Very Simple to Perform
 - No Special Breathing Necessary
 - Minimal (no) Co-operation Required
 - Useful in Young Children
 - Even Possible with Animals
 - No Forced Maneuver Necessary
 - No Box Necessary
 - Peripheral and Central Resistance Separated
 - Measurement with Just One Impulse Possible
-



QUESTIONS ??????????
