

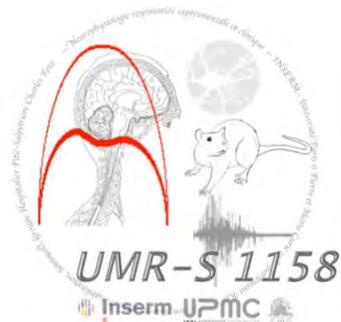
- Séméiologie des interactions patient/ventilateur

Dr Jésus Gonzalez-Bermejo

SSR respiratoire et neurorespiratoire

Service de Pneumologie et Réanimation

Groupe Hospitalier Pitié-Salpêtrière, Paris



SOMNOVNI

Groupe du GAV

Prs, Pepin, Janssens, Rodenstein
 Drs Rouault, Rabec, Perrin, Langevin, Léger,
 Gonzalez-Bermejo



THORAX

Thorax 2010 et revue des maladies respiratoires 2013 >>>
www.splf.org pages du GAV

Non-invasive ventilation during sleep: time to define new tools in the systematic evaluation of the technique

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ABSTRACT
 Non-invasive ventilation (NIV) has been remarkably effective in the management of chronic respiratory failure, despite initially rudimentary equipment and limited understanding of what was actually happening, minute by minute when ventilation was applied. Modern ventilators, controlled by complex algorithms, and with integrated monitoring allow far sophisticated customisation of ventilatory support to an individual. However, if problems with ventilation are not recognised, and their significance understood, they cannot be fixed. Experience of monitoring during sleep from patients predominantly with sleep apnoea can be transferred and extended to patients receiving NIV. This article, the first in a series, explores the rationale for NIV and how its

through the ventilator itself or external stand alone devices. Despite this, monitoring during NIV remains rudimentary. In a patient who is doing well and tolerating NIV, this is usually adequate. However, when the patient tolerates NIV poorly or does not derive symptomomatic benefit, more sophisticated monitoring is required; if a problem cannot be identified it cannot be fixed. This is the first article in a series, which explores these issues in greater detail.

WHAT NEEDS TO BE FIXED BY NIV?

To understand how assisted ventilation helps patients, an understanding of the pathophysiology of ventilatory failure, and the way in which venti-

Nocturnal monitoring of home non-invasive ventilation: the contribution of simple tools such as pulse oximetry, capnography, built-in ventilator software and autonomic markers of sleep fragmentation

Jean-Paul Janssens,¹ Jean-Christian Borel,^{2,3} Jean-Louis Pépin,² on behalf of the SomnoNIV Group

¹Division of Pulmonary Diseases, Geneva University Hospital, Geneva, Switzerland
²Unité Réduction et Physiologie et Laboratoire HPZ, INSERM U917, Université Joseph Fourier, Grenoble, France
³Association médico-technique ASR à dom, Meylan, France

ABSTRACT
 Complex respiratory events, which may have a detrimental effect on both quality of sleep and control of nocturnal hypoventilation, occur during sleep in patients treated with non-invasive ventilation (NIV). Among these events are patient-ventilator asynchrony, increases in upper airway resistance (with or without increased respiratory drive) and leaks. Detection of these events is important in order to select the most

dioxide tension (P_{iCO_2}). The latest generation of home ventilators³ are often equipped with sophisticated built-in software capable of recording a wide range of parameters over several months, and thus offering information to the clinician on items such as compliance and leaks, among many other respiratory parameters. This review describes the contributions, limits and caveats of non-invasive assessment of NIV

Ventilator modes and settings during non-invasive ventilation: effects on respiratory events and implications for their identification

Claudio Rabec,¹ Daniel Rodenstein,² Patrick Leger,³ Sylvie Rouault,⁴ Christophe Perrin,⁵ Jésus Gonzalez-Bermejo,⁶ on behalf of the SomnoNIV group

ABSTRACT

Compared with invasive ventilation, non-invasive ventilation (NIV) has two unique characteristics: the non-hermetic nature of the system and the fact that the ventilator-lung assembly cannot be considered as a single-compartment model because of the presence of variable resistance represented by the upper airway. When NIV is initiated, the ventilator settings are determined empirically based on a clinical evaluation and diurnal blood gas variations. However, NIV is

generally applied at night, nocturnal monitoring seems the best way to assess its effects. Although nocturnal monitoring of continuous positive airway pressure (CPAP) has been codified in the treatment of patients with obstructive sleep apnoea syndrome,⁶ this is not the case with NIV.^{7,8} Nocturnal monitoring of NIV is far more difficult and unforeseen problems arise for many reasons: (1) sleep can induce profound ventilatory changes, in particular in patients with respiratory insuffi-

Proposal for a systematic analysis of polygraphy or polysomnography for identifying and scoring abnormal events occurring during non-invasive ventilation

J Gonzalez-Bermejo,¹ C Perrin,² J P Janssens,³ J L Pepin,⁴ G Mroue,⁵ P Léger,⁶ B Langevin,⁷ S Rouault,⁸ C Rabec,⁹ D Rodenstein,¹⁰ on behalf of the SomnoNIV Group

¹Service de Pneumologie et Réanimation Respiratoire, Hôpital de la Pitié-Salpêtrière, Assistance Publique-Hôpitaux de Paris, EH10 UPMC, France
²Service de Pneumologie, Centre Hospitalier de Cannes, Cannes, France
³Pulmonary Division, Geneva University Hospital, Geneva, Switzerland

ABSTRACT
 Non-invasive ventilation (NIV) is recognised as an effective treatment for chronic hypercapnic respiratory failure. Monitoring NIV during sleep may be preferable to daytime assessment. This paper reports the findings of an international consensus group which systematically analysed nocturnal polygraphy or polysomnographic tracings recorded with either volume-cycled or pressure-cycled ventilators. A systematic description of nocturnal

polysomnography (PSC) or ventilatory polygraphy (VG) during NIV in some patients. However, appropriate analysis of VG or PSC recordings must take into account the type of ventilator used (volume- or pressure-cycled), ventilator settings (ventilatory mode, triggers) and choice of interface (nasal or full face mask)¹² (see paper by Rabec *et al.*¹³ in this series). Recent observations have shown that standard definitions for nocturnal respiratory

SOMNOVNI

Ventilator modes and settings during non-invasive ventilation: effects on respiratory parameters and implications for their identification

Claudio Rabec,¹ Daniel Rodenstein,² Patrick Léger,³ & Christophe Perrin,⁵ Jésus Gonzalez-Bermejo,⁶ on behalf of the SomnoNIV Group



¹Service de Pneumologie et Réanimation Respiratoire, Centre Hospitalier et Universitaire de Dijon, Dijon, France
²Service de Pneumologie, Cliniques Universitaires Saint Luc, Université Catholique de Louvain, Bruxelles, Belgium
³Service de Pneumologie, Centre Hospitalier Lyon Sud, Lyon, France

ABSTRACT

Compared with invasive ventilation, non-invasive ventilation (NIV) has two unique characteristics: the non-hermetic nature of the system and the fact that the ventilator-lung assembly cannot be considered as a single-compartment model because of the presence of variable resistance represented by the upper airway. When NIV is initiated, the ventilator settings are determined empirically based on a clinical evaluation and diurnal blood gas variations. However, NIV is

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Review series

Proposal for a systematic analysis of polygraphy or polysomnography for identifying and scoring abnormal events occurring during non-invasive ventilation

J González-Bermejo,¹ C Perrin,² J P Janssens,³ J L Pepin,⁴ G Mroue,⁵ P Léger,⁶ B Langevin,⁷ S Rouault,⁸ C Rabec,⁹ D Rodenstein,¹⁰ on behalf of the SomnoNIV Group

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ABSTRACT

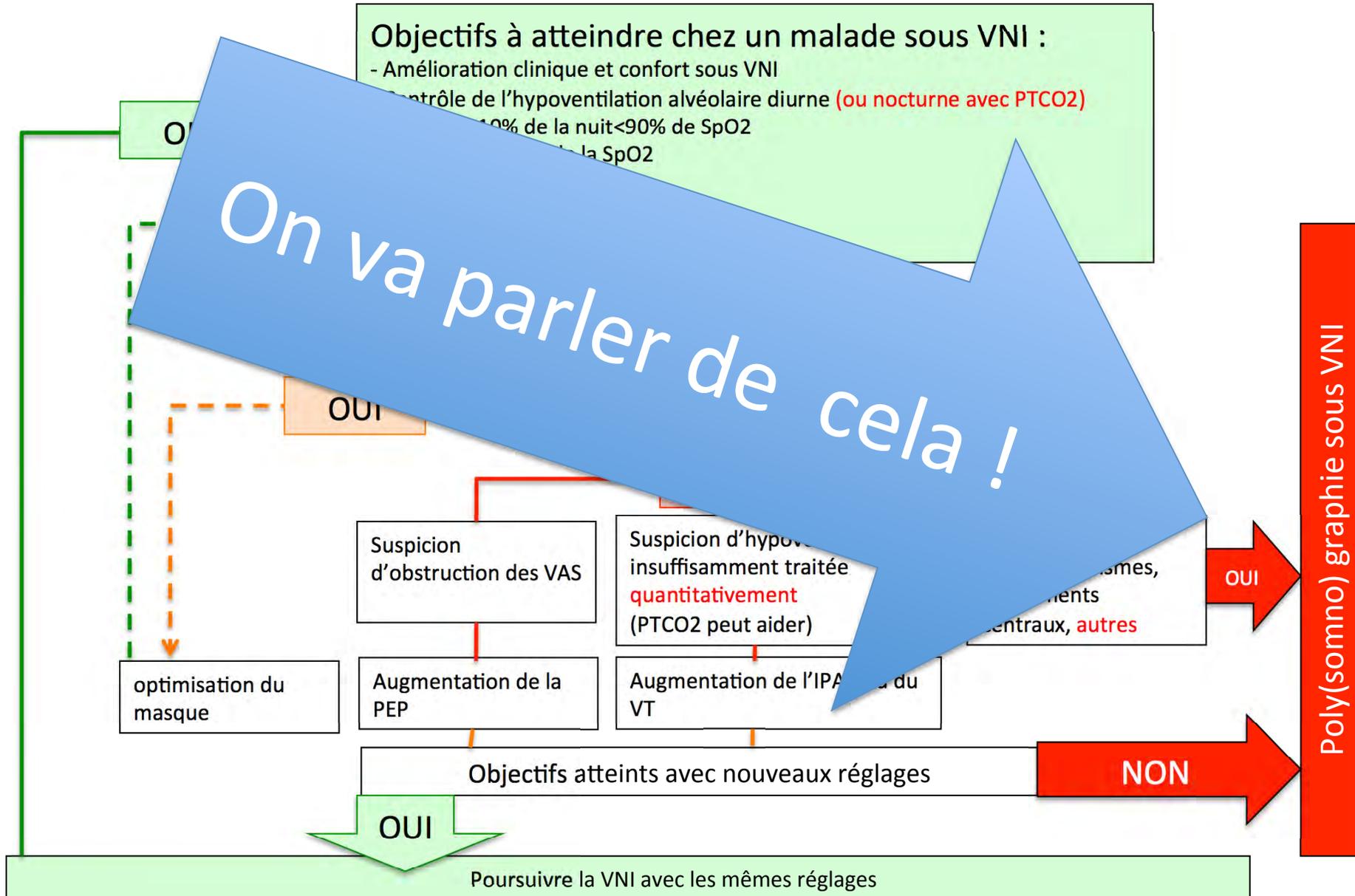
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Logigramme de surveillance de la VNI



Janssens et coll. Thorax 2011

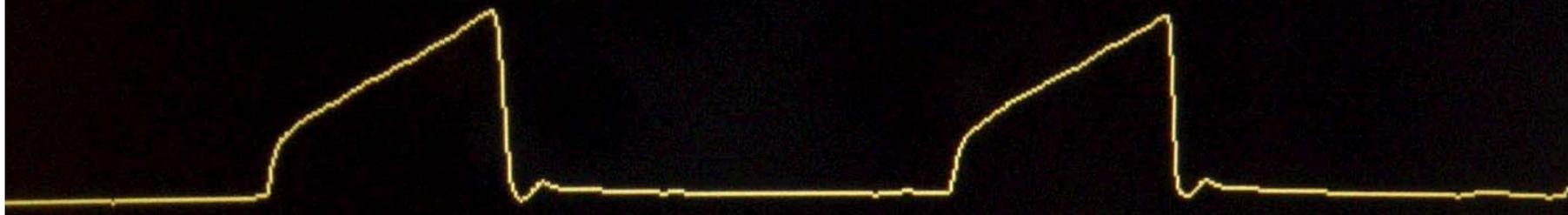


PLAN

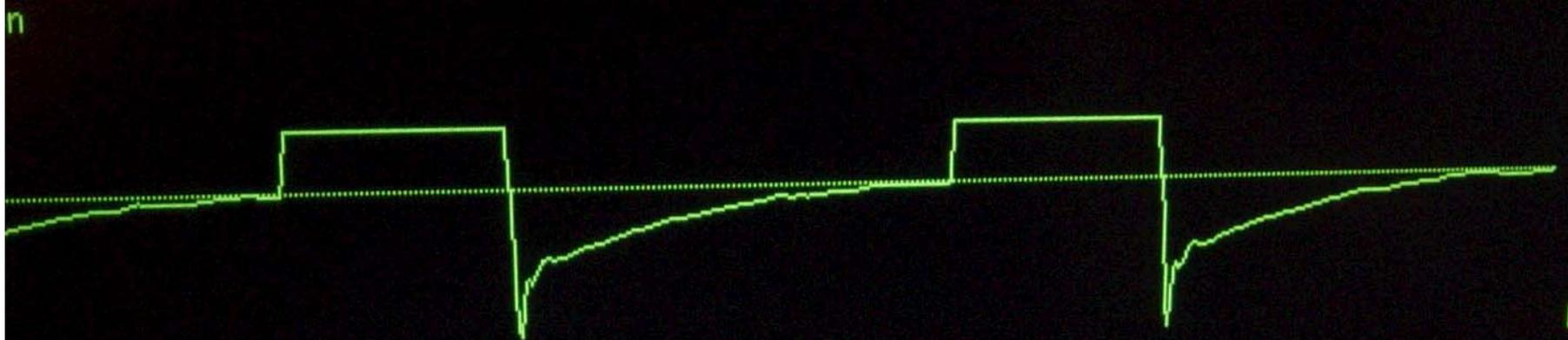
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patient

17
Pcré



Pmoy
(cmH₂O)
PEP
(cmH₂O)



F resp
O₂ (%)



I:E
VMe (l)
C 8
Vc insp.
(ml)
Vc exp.
(ml)

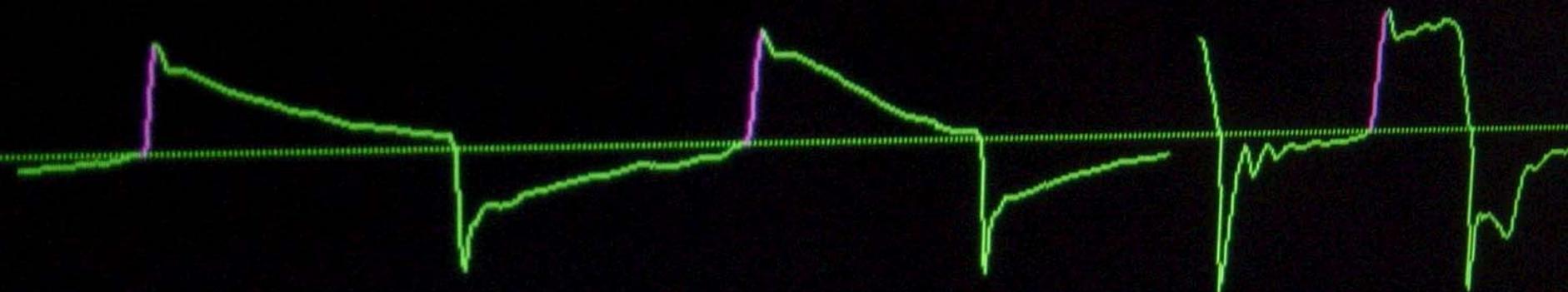
à temps courant

Ventilation d'apnée

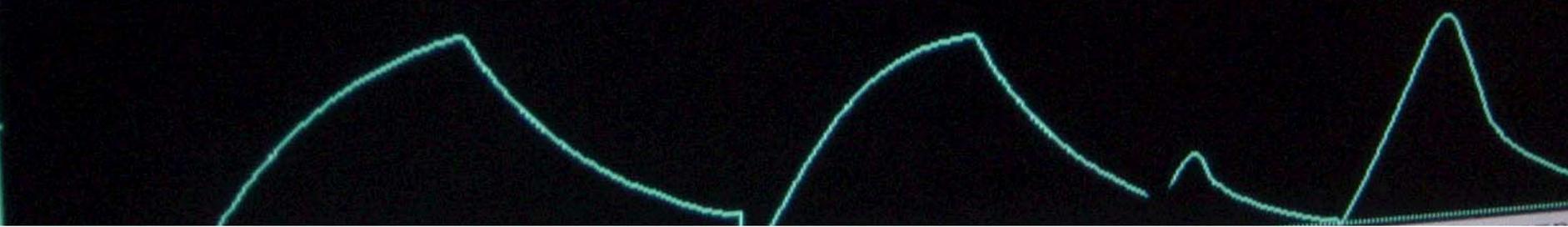
40 cmH₂O



80 l/min



-80
700 ml



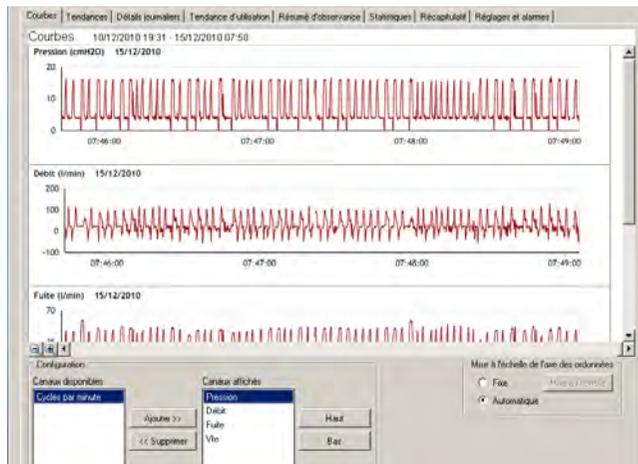
Les logiciels des ventilateurs sont de plus en plus perfectionnés Avec des courbes! (voir Atelier Dr Rabec)

RESScan® (Resmed) 2002

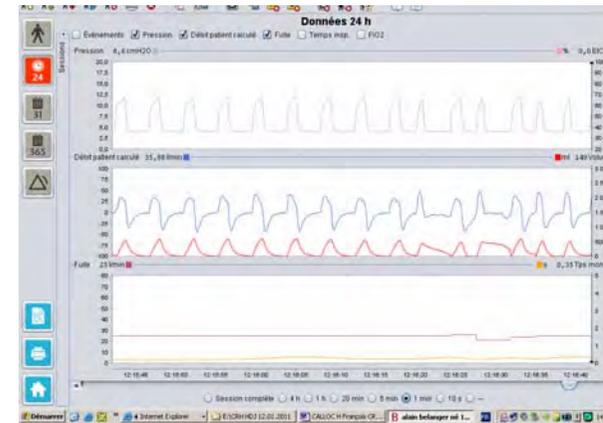


Rabec et coll. ERJ 2009,

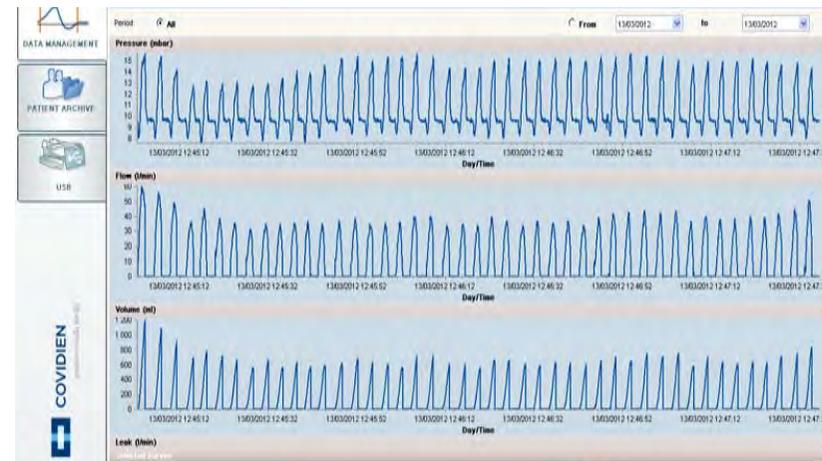
DirectView® (Respironics) 2009



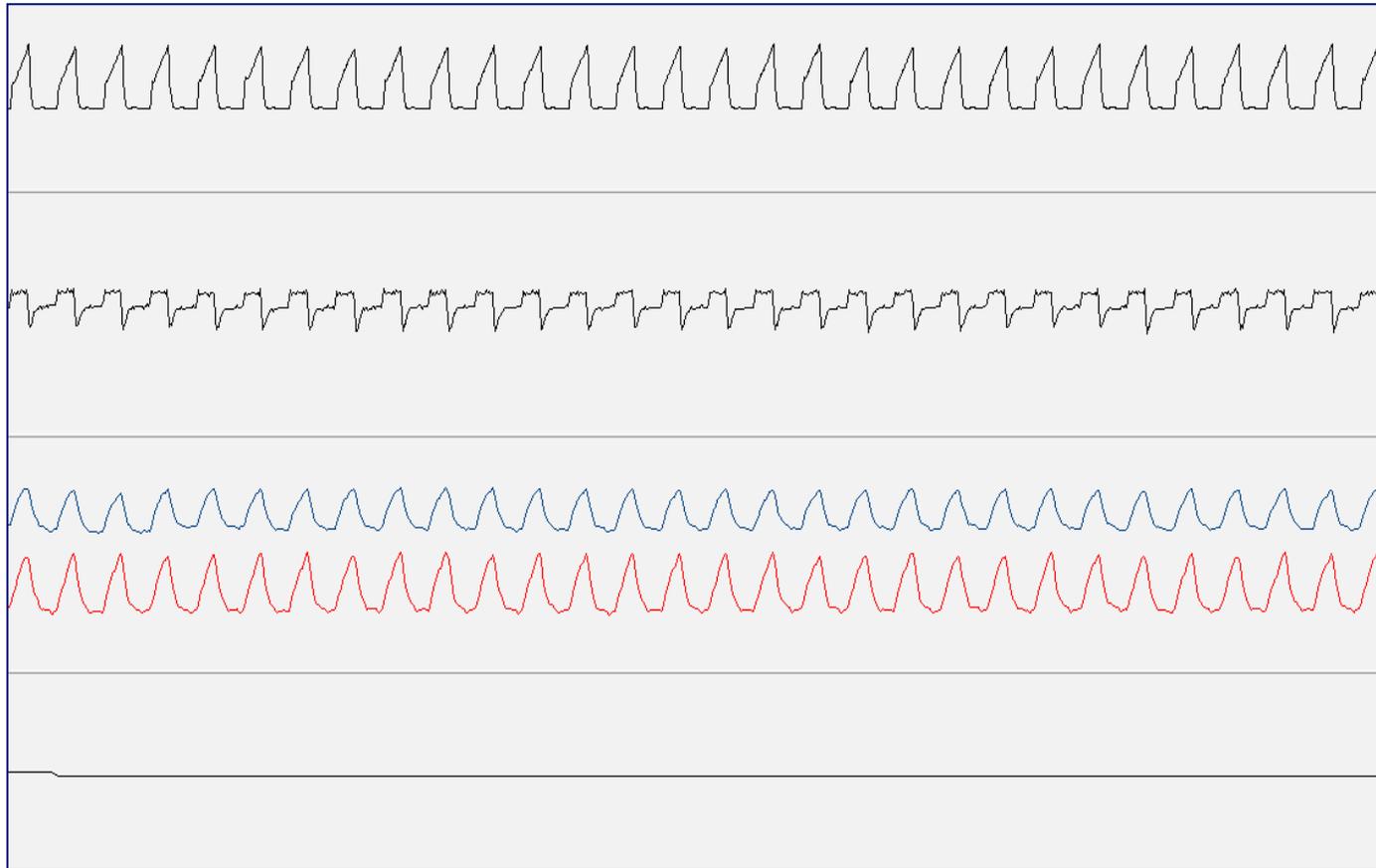
ViVo50® (Breas) 2007



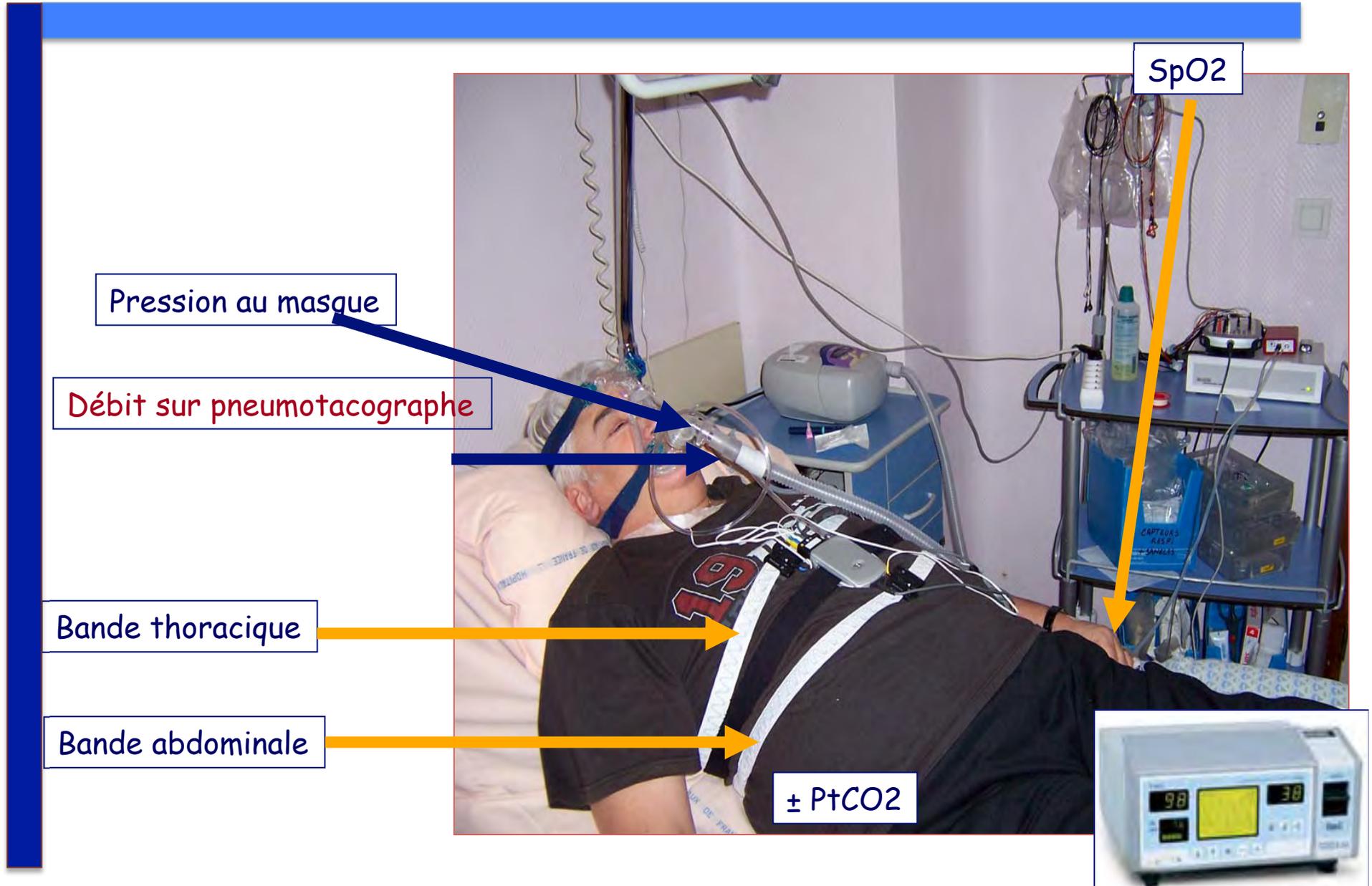
RIS (Covidien) 2011



la polygraphie, et donc les tracés sous ventilation mécanique reste le Gold standard à apprendre (Voir Atelier Dr Perrin)



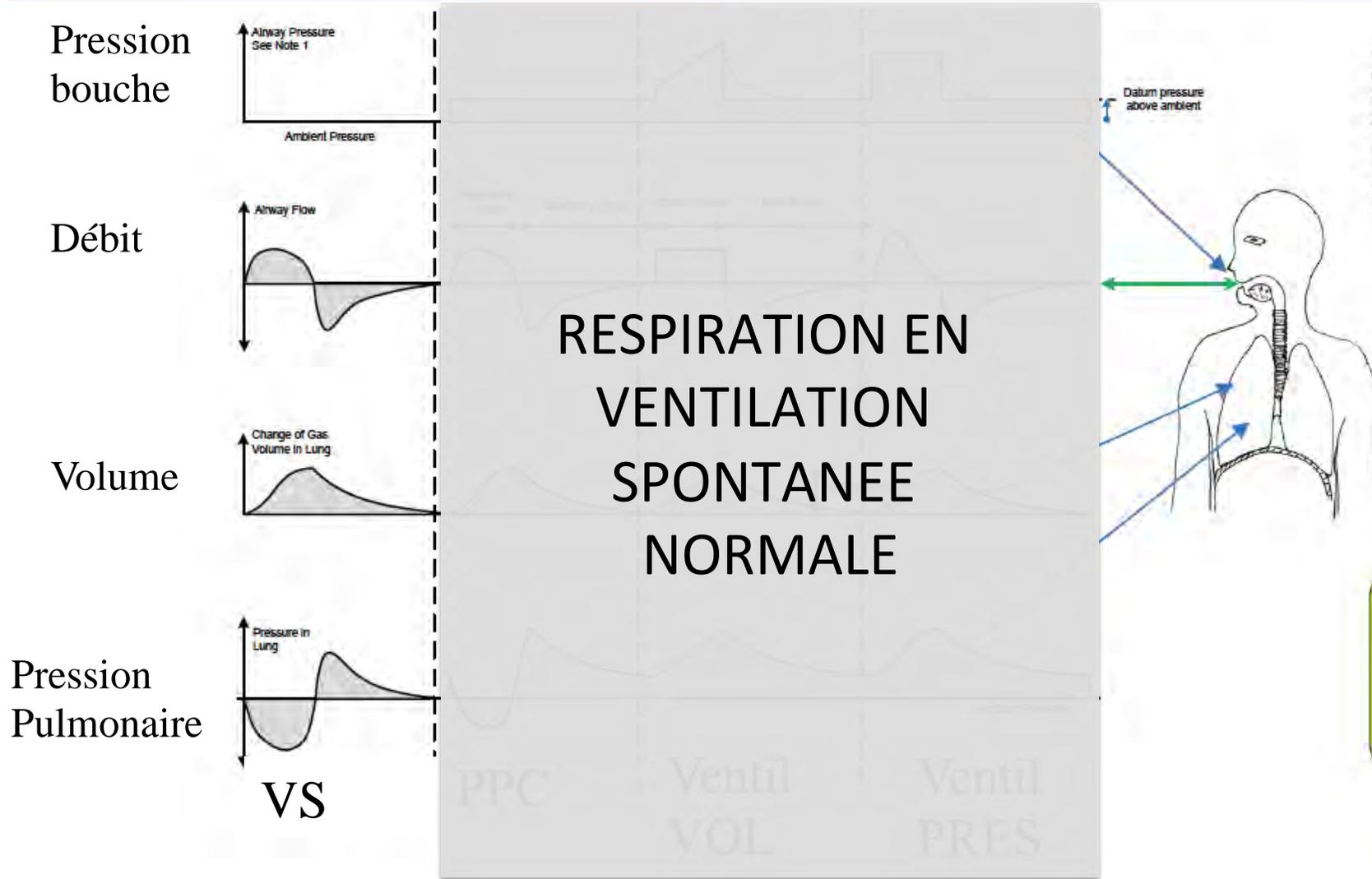
ATTENTION AUX signaux minimaux dans la polygraphie PRESSION ET DEBIT avec 2 capteurs différents



PLAN

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Physiologie de la mécanique ventilatoire



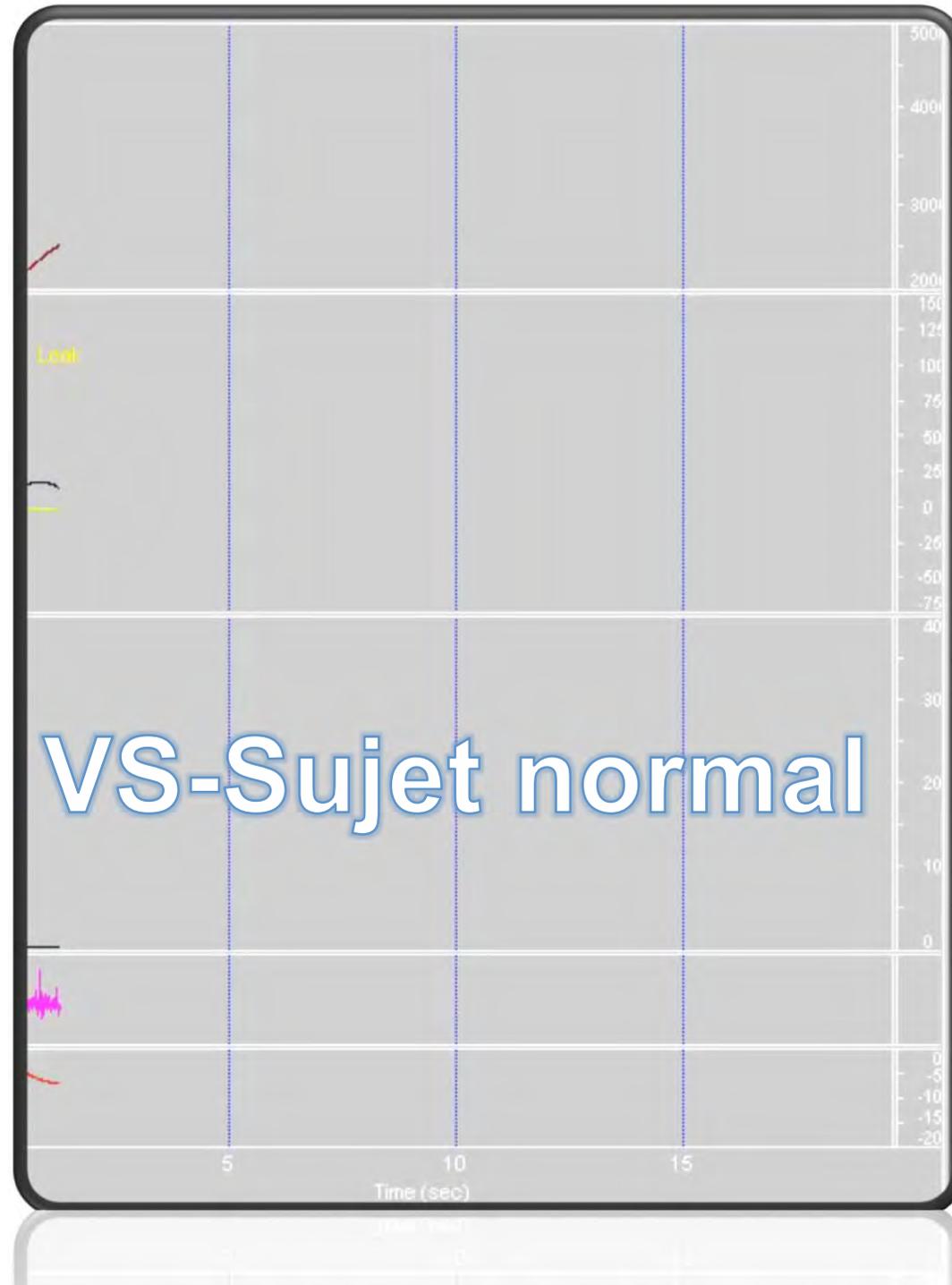
Volume

Débit

Pression
bouche

EMG

Pression
Pulmonaire



Volume

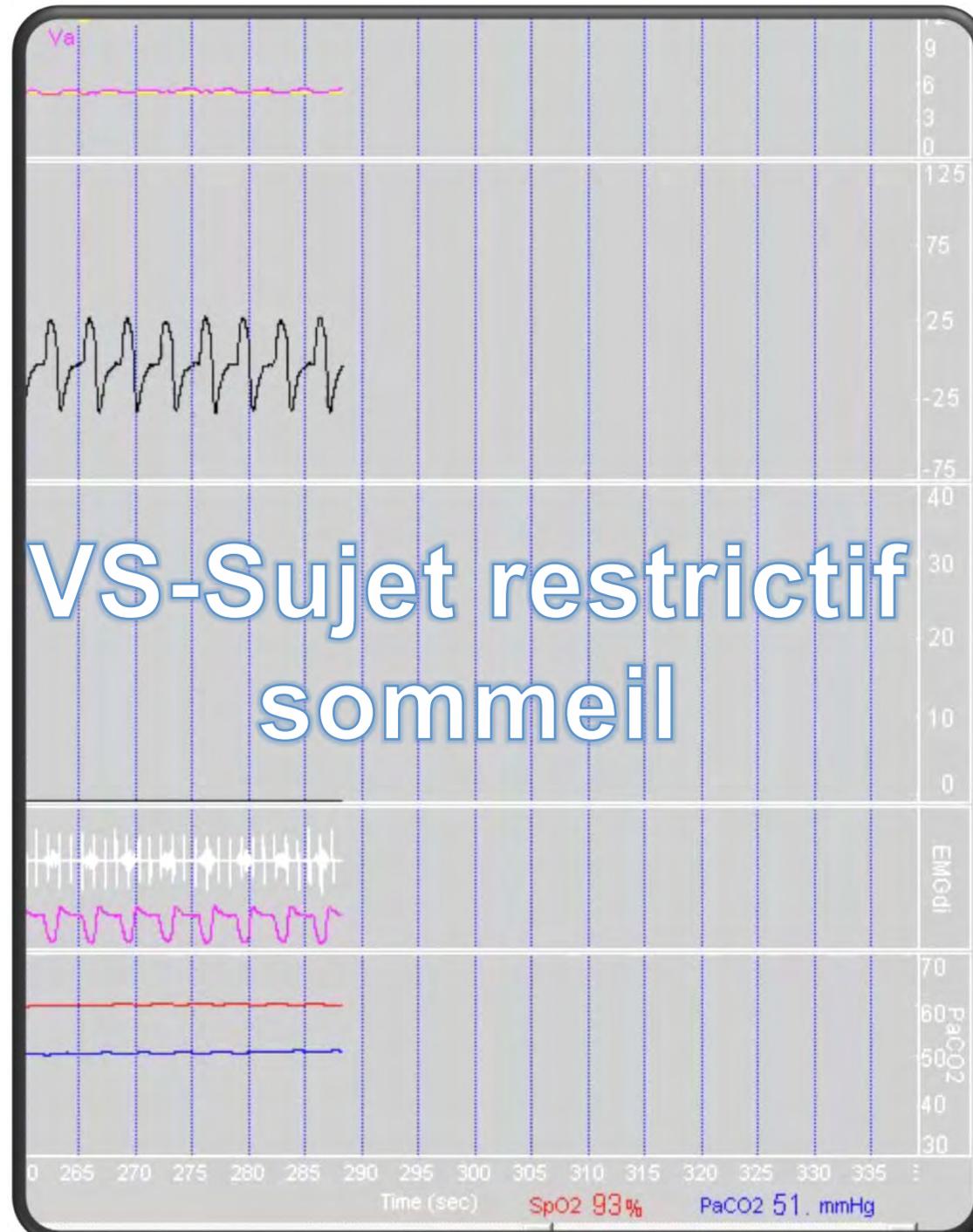
Débit

Pression
bouche

EMG

Pression Pulmonaire

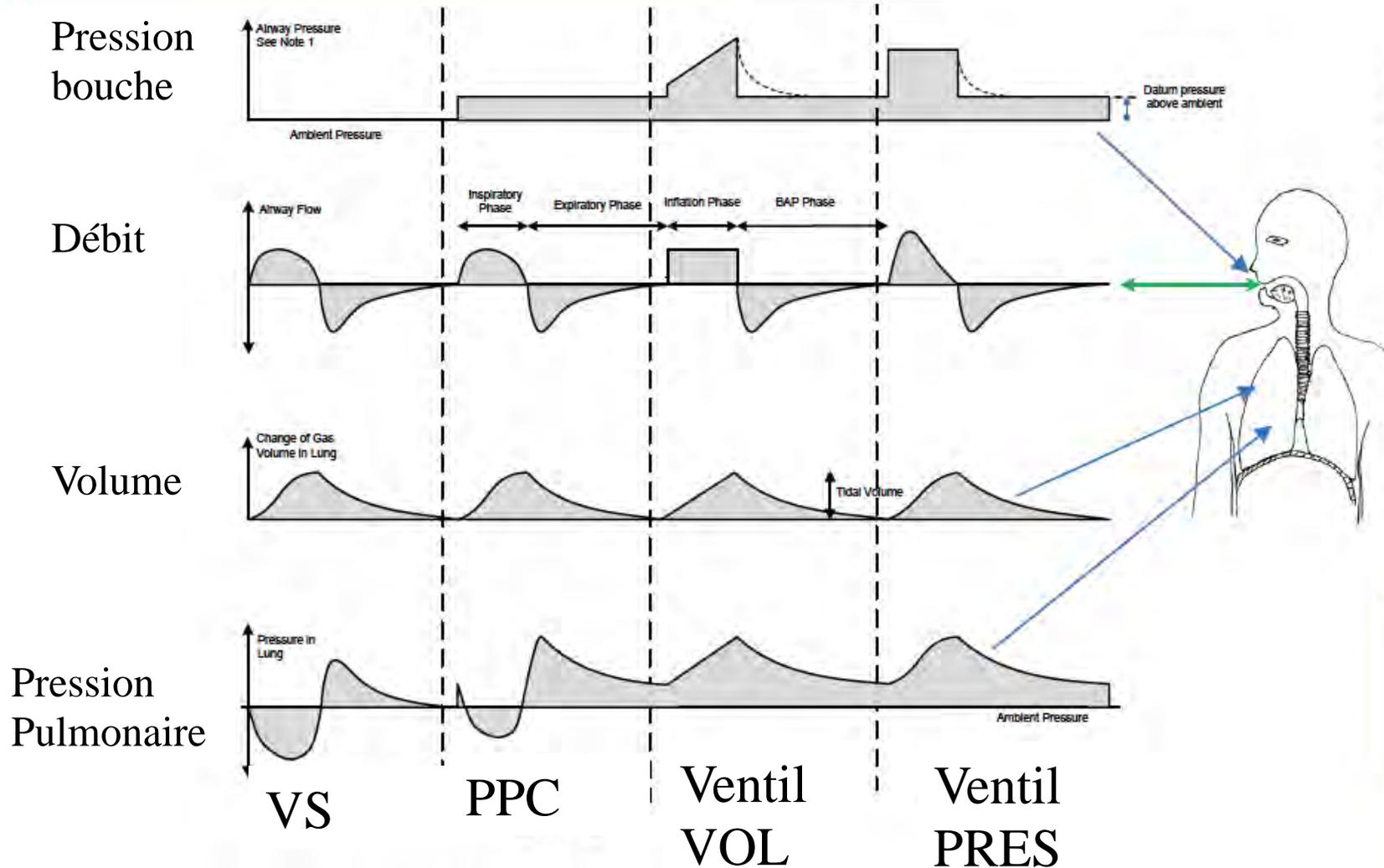
SpO2
PCO2



PLAN

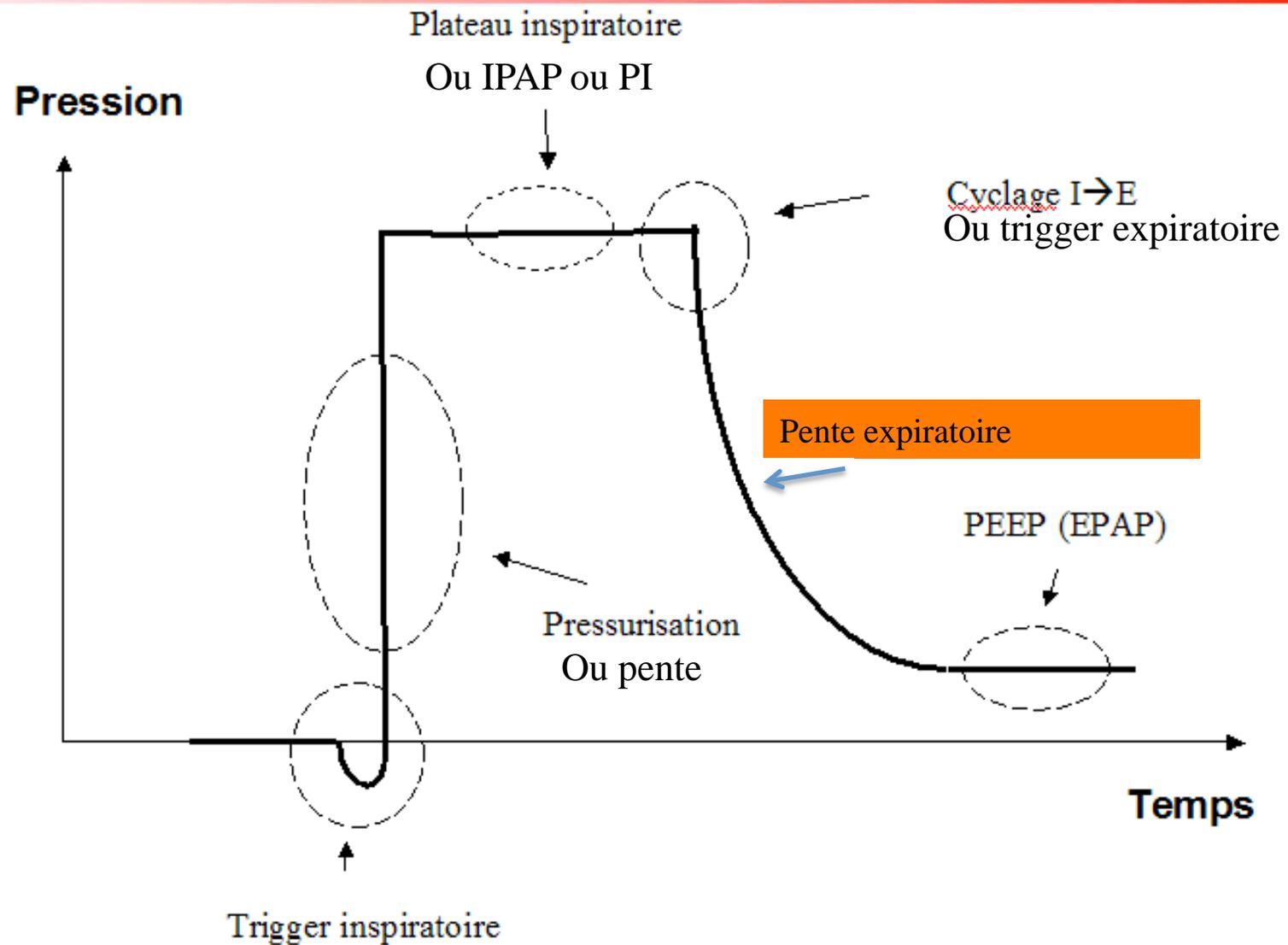
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Courbes sous ventilation mécanique



Rabec et coll. Thorax 2011
RMR 2013

Vocabulaire de base du cycle ventilatoire



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1ere étape de lecture : quel réglage?



Etape 1 : la séméiologie des tracés dépend du type et du mode de fonctionnement du ventilateur >>> avant la lecture avoir les renseignements sur les réglages du ventilateur et surtout si le ventilateur est en VOLUME ou en PRESSION

si vous n'avez pas l'information vous pouvez le retrouver sur le tracé

TRUC 1 :

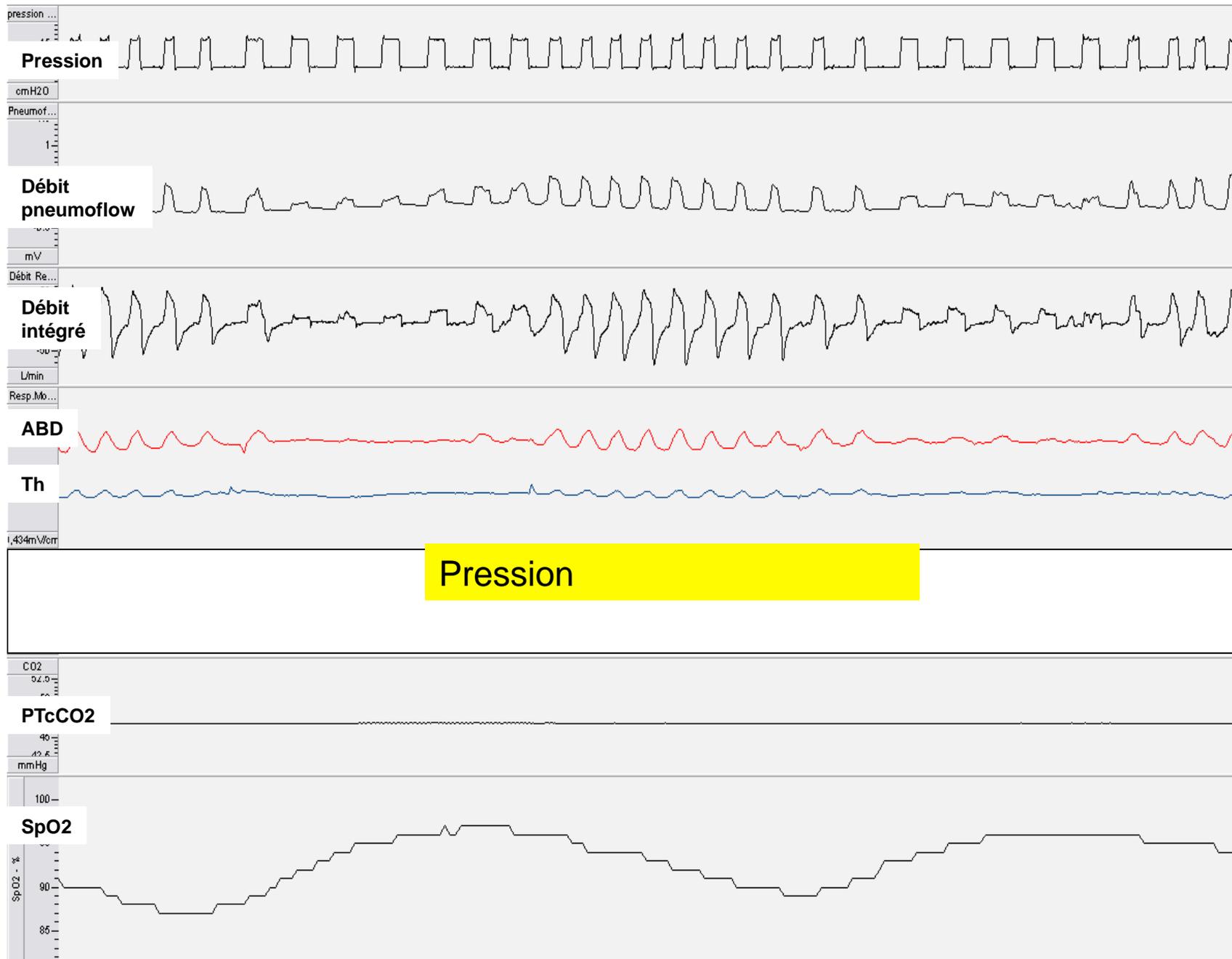
Vous cherchez le signal qui ne varie pas....ou qui varie le moins

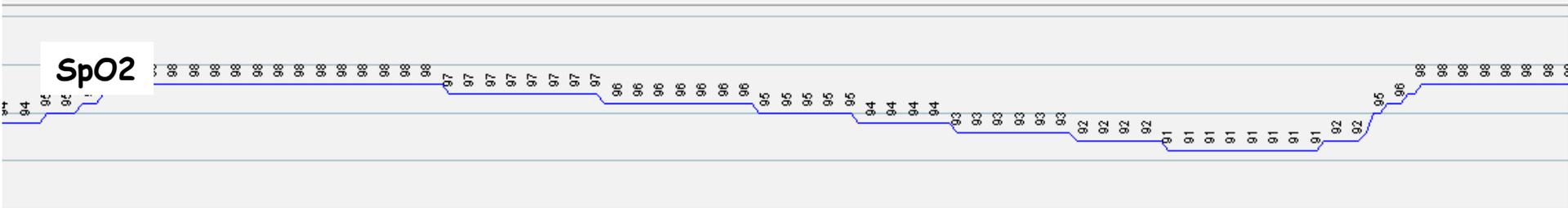
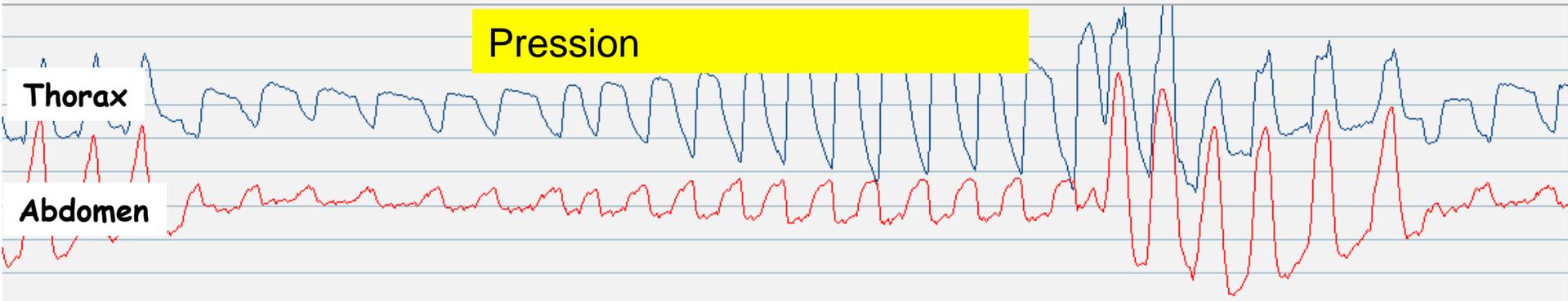
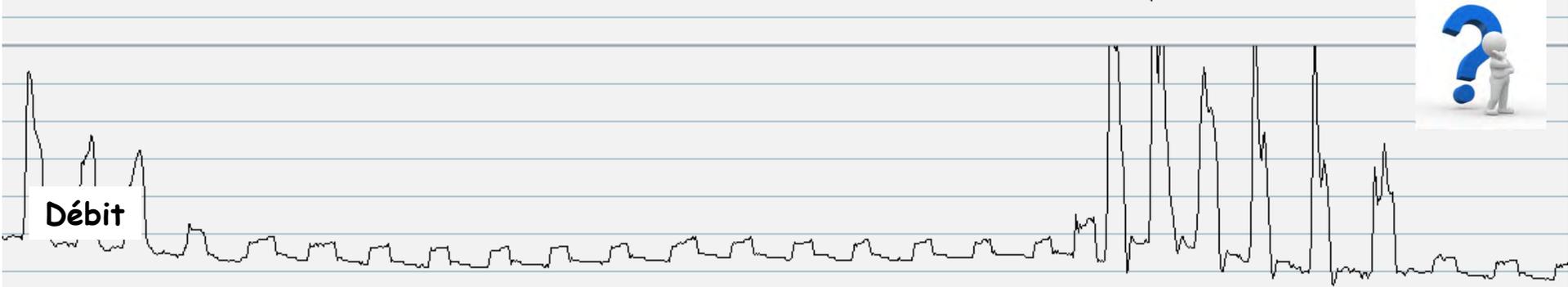
Si c'est le signal de pression, c'est un réglage en PRESSION

Si c'est le signal de débit, c'est un réglage en DEBIT (ou volume)

TRUC 2 :

Vous cherchez le signal qui l'aspect le plus carré



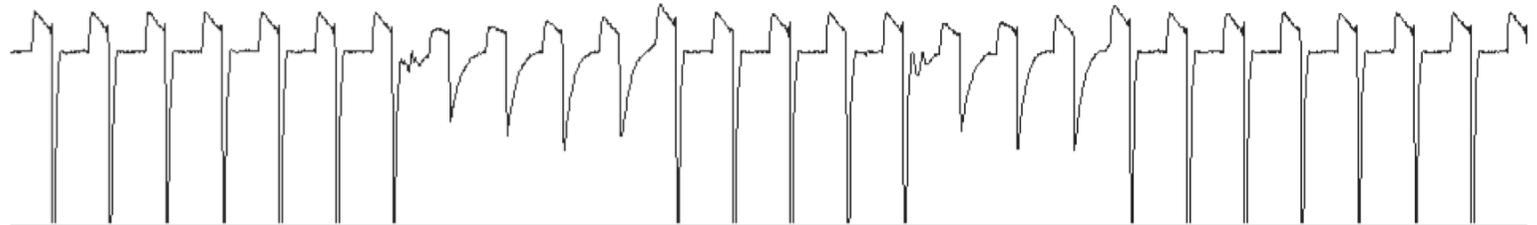


Volume (= débit)

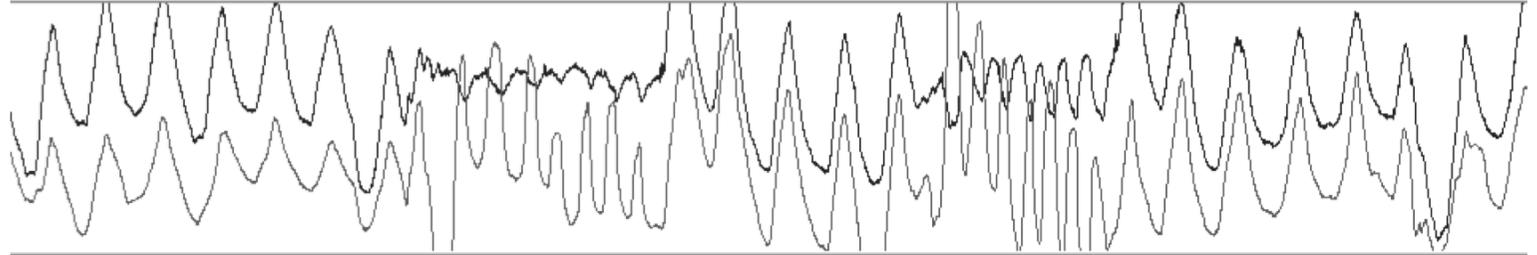
Pressure



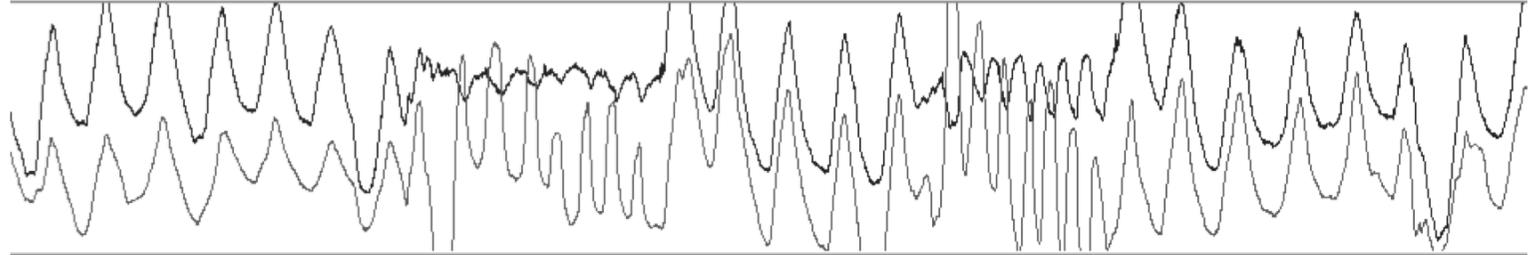
Flow



Thoracic belt



Abdominal belt



SpO2





Pression



Débit



Volume (= débit)

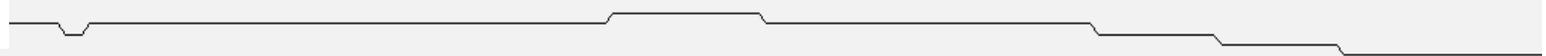
Th



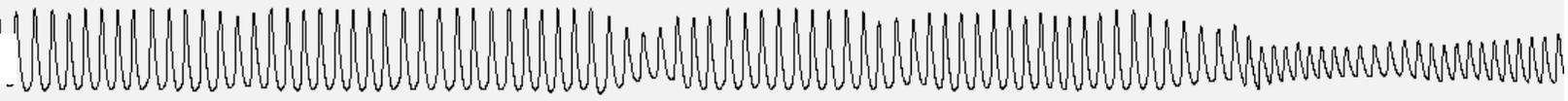
ABD

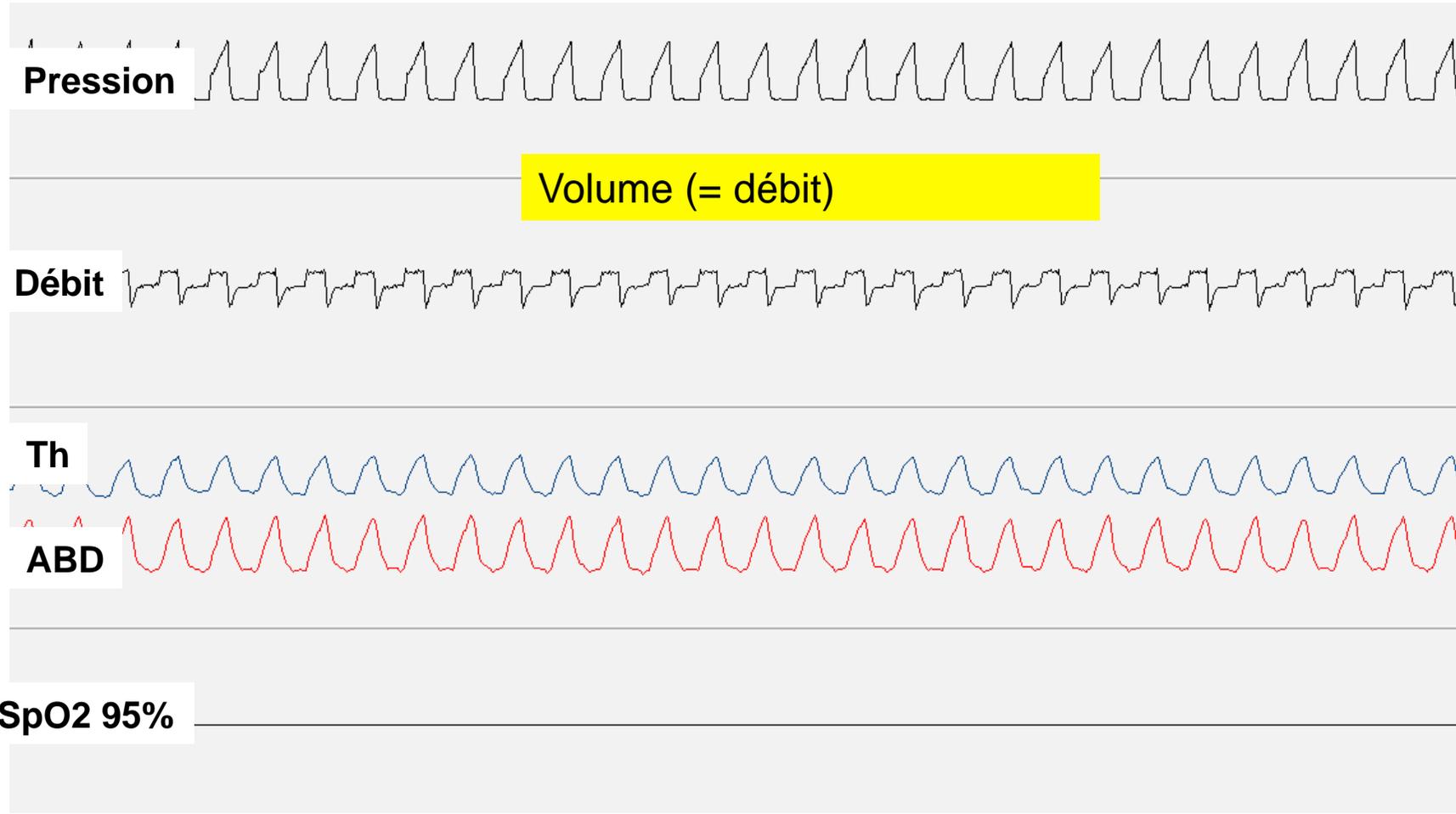


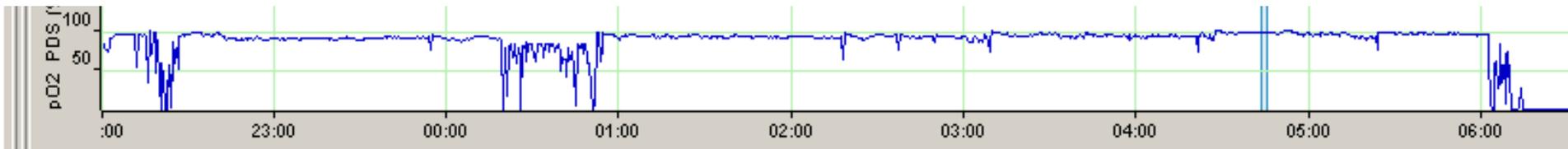
SpO2 95%



Pouls



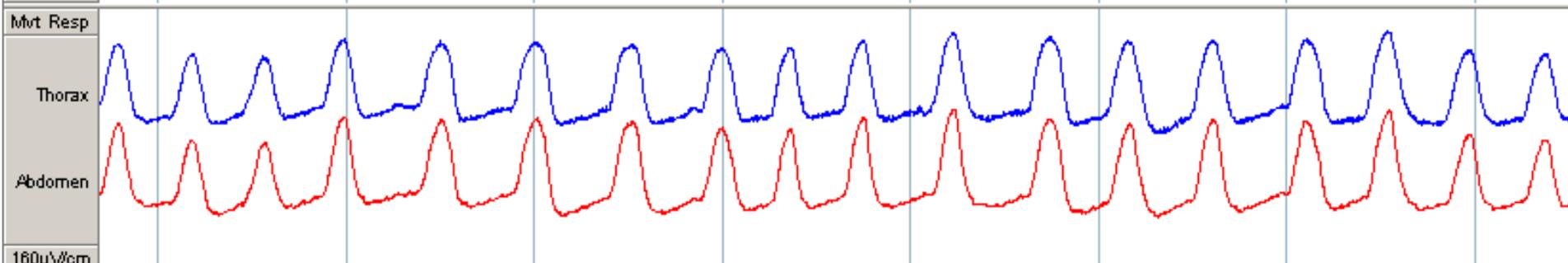
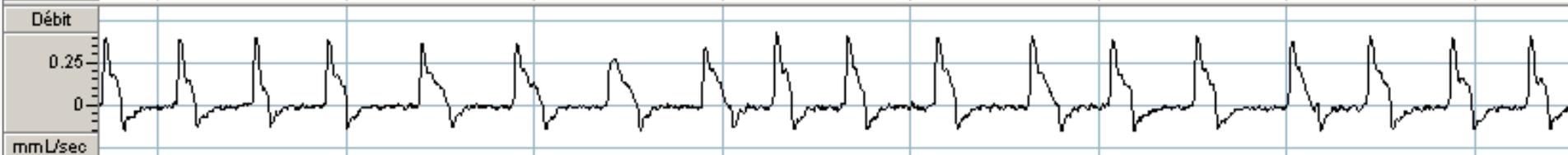
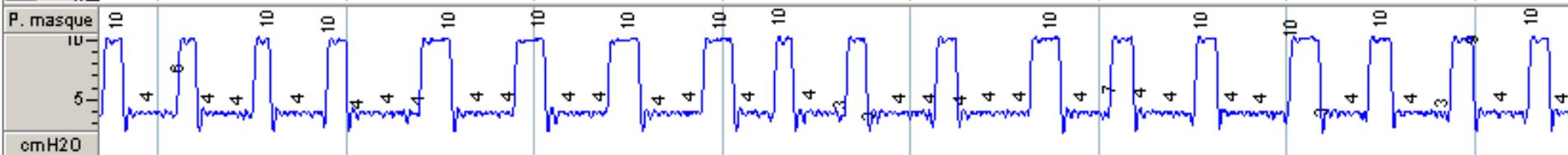
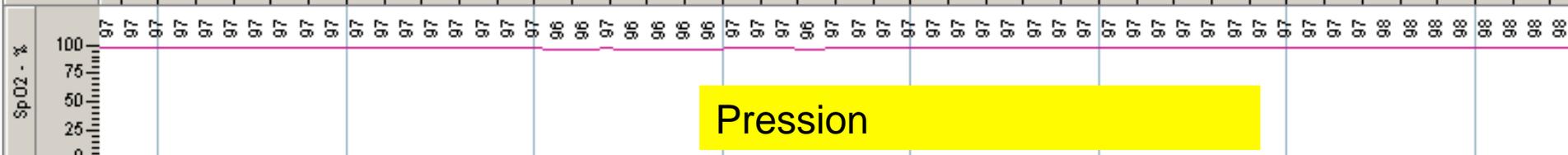




VNI

98,76s

04:43:50 04:44:00 04:44:10 04:44:20 04:44:30 04:44:40 04:44:50 04:45:00



2ème étape de lecture : Où est l'événement respiratoire?



Etape 2 : Un événement respiratoire est une baisse de la ventilation qui a entraîné une rupture de l'état clinique du malade (réveil, désaturation, augmentation PTCO₂...)

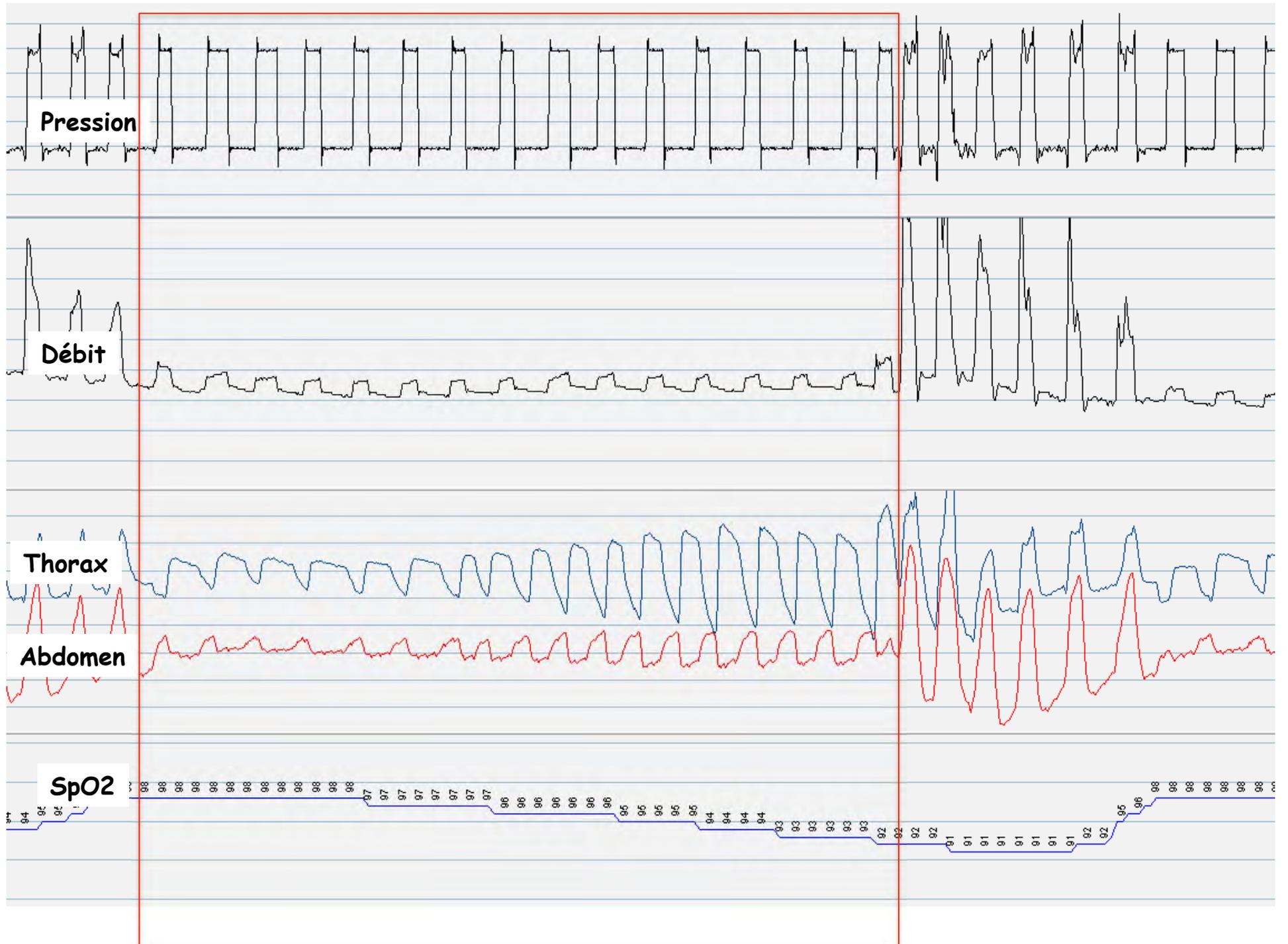
Il faut toujours chercher l'événement respiratoire avant de l'analyser

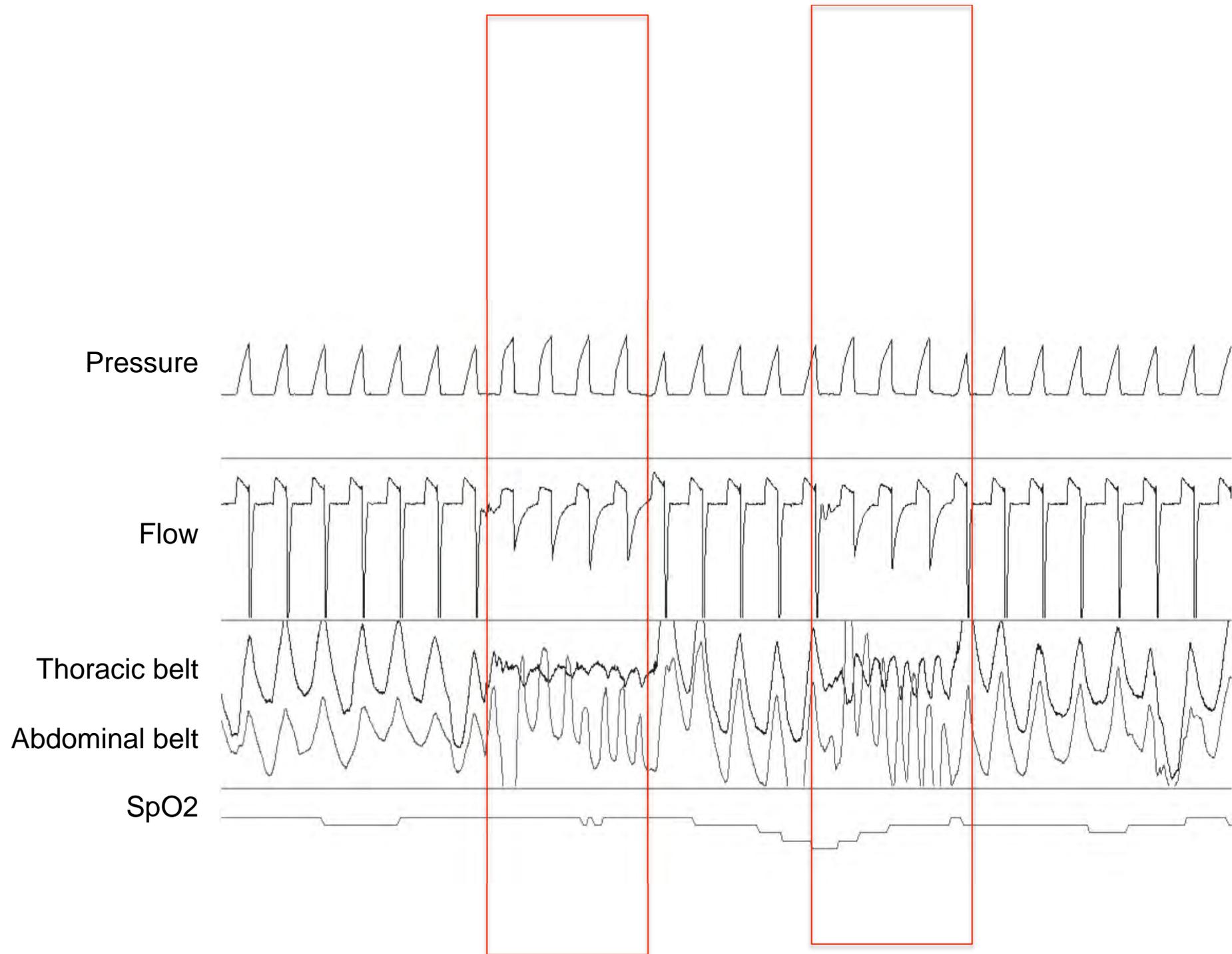
TRUC 1 :

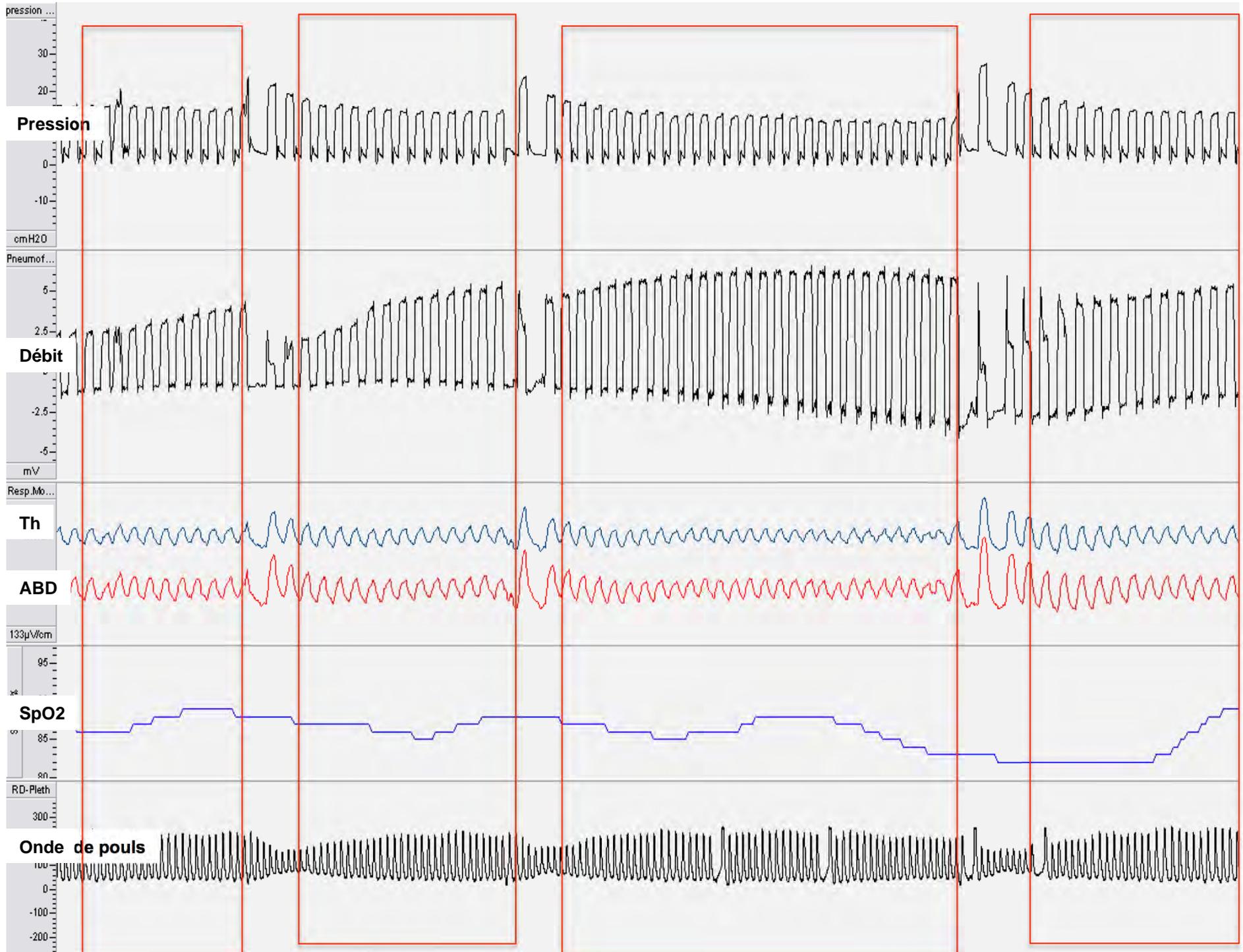
Vous cherchez le moment où les sangles bougent moins, mal, peu, pas qui a entraîné la rupture clinique

TRUC 2 :

Attention, selon le signal clinique l'événement sera immédiatement avant (EEG), quelques secondes avant (SpO₂) quelques minutes avant (PTCO₂)









Pression



Débit



Thorax

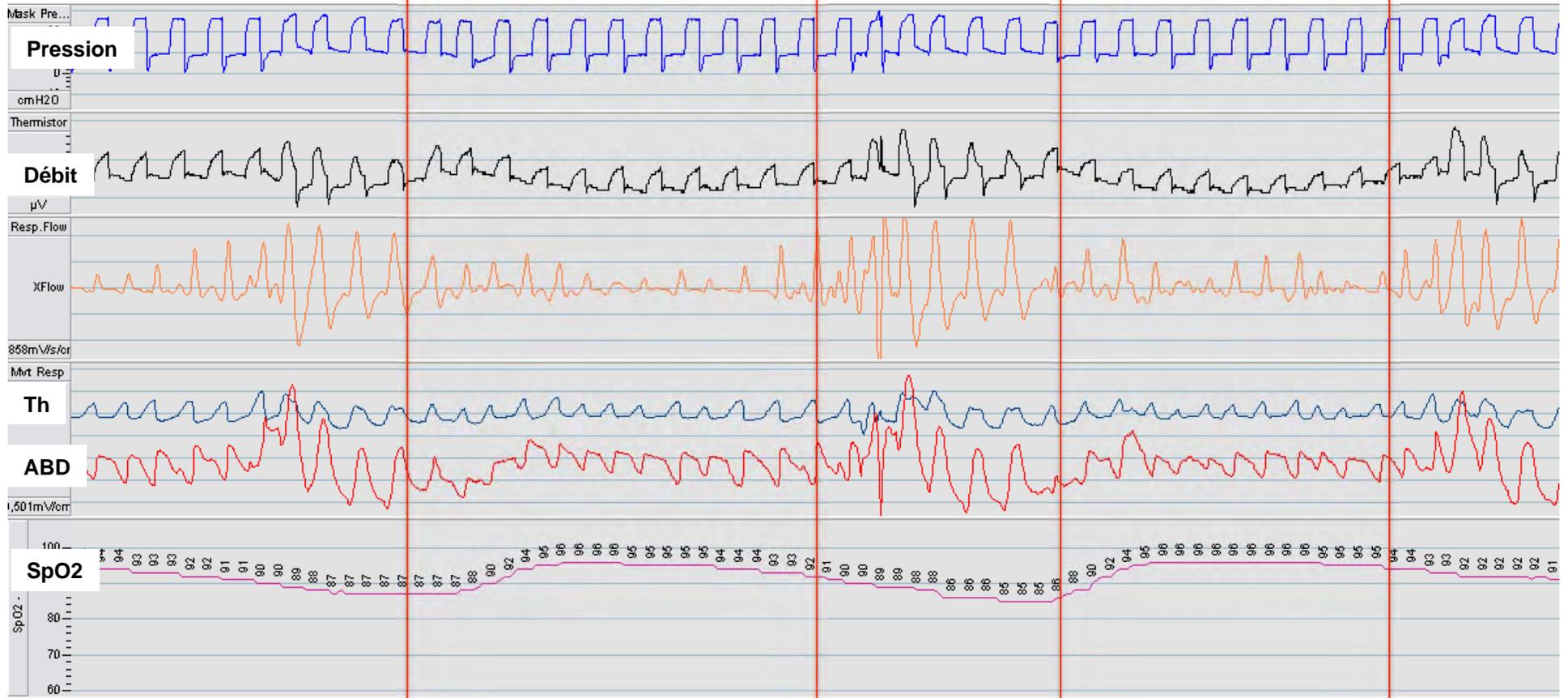


Abdomen



SpO2





3^{ème} étape de lecture

Avoir un plan de lecture



Dans l'ordre rechercher

- 1) Fuites ?
- 2) Obstruction des VA ?
- 3) Avec diminution de la commande ou maintien de la commande?
- 4) Asynchronisme?
- 5) Problèmes technique?

3^{ème} étape de lecture

Avoir un plan de lecture



Dans l'ordre rechercher

1)Fuites ?

2)Obstruction des VA ?

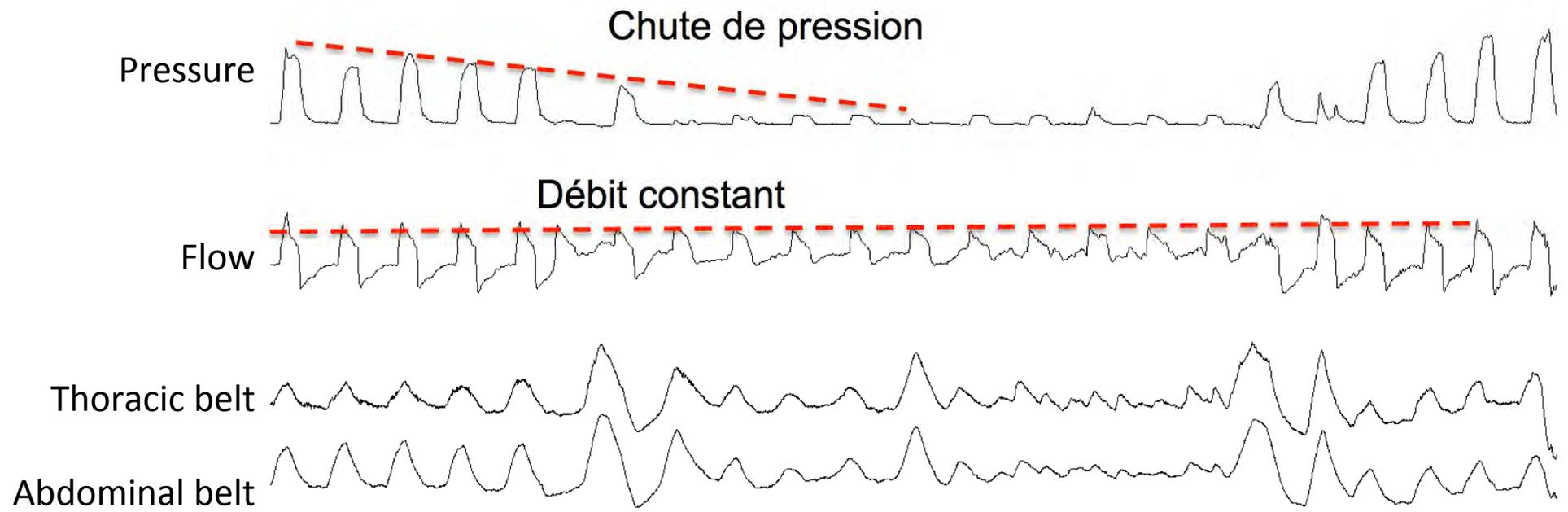
3)Avec diminution de la commande ou
maintien de la commande?

4)Asynchronisme?

5)Problèmes technique?



	FUITES NON INTENTIONNELLES	
	Pression	Volume (ou débit)
VENTILATEUR BAROMETRIQUE	Stable (sauf si fuite massive)	
VENTILATEUR VOLUMETRIQUE		Stable (sauf si fuite massive)



3^{ème} étape de lecture

Avoir un plan de lecture



Dans l'ordre rechercher

1) Fuites ?

2) Obstruction des VA ?

3) Avec diminution de la commande ou maintien de la commande?

4) Asynchronisme?

5) Problèmes technique?



	OBSTACLE	
	Pression	VTi/débit
VENTILATEUR BAROMETRIQUE	<i>constante</i>	
VENTILATEUR VOLUMETRIQUE		<i>Constant</i>

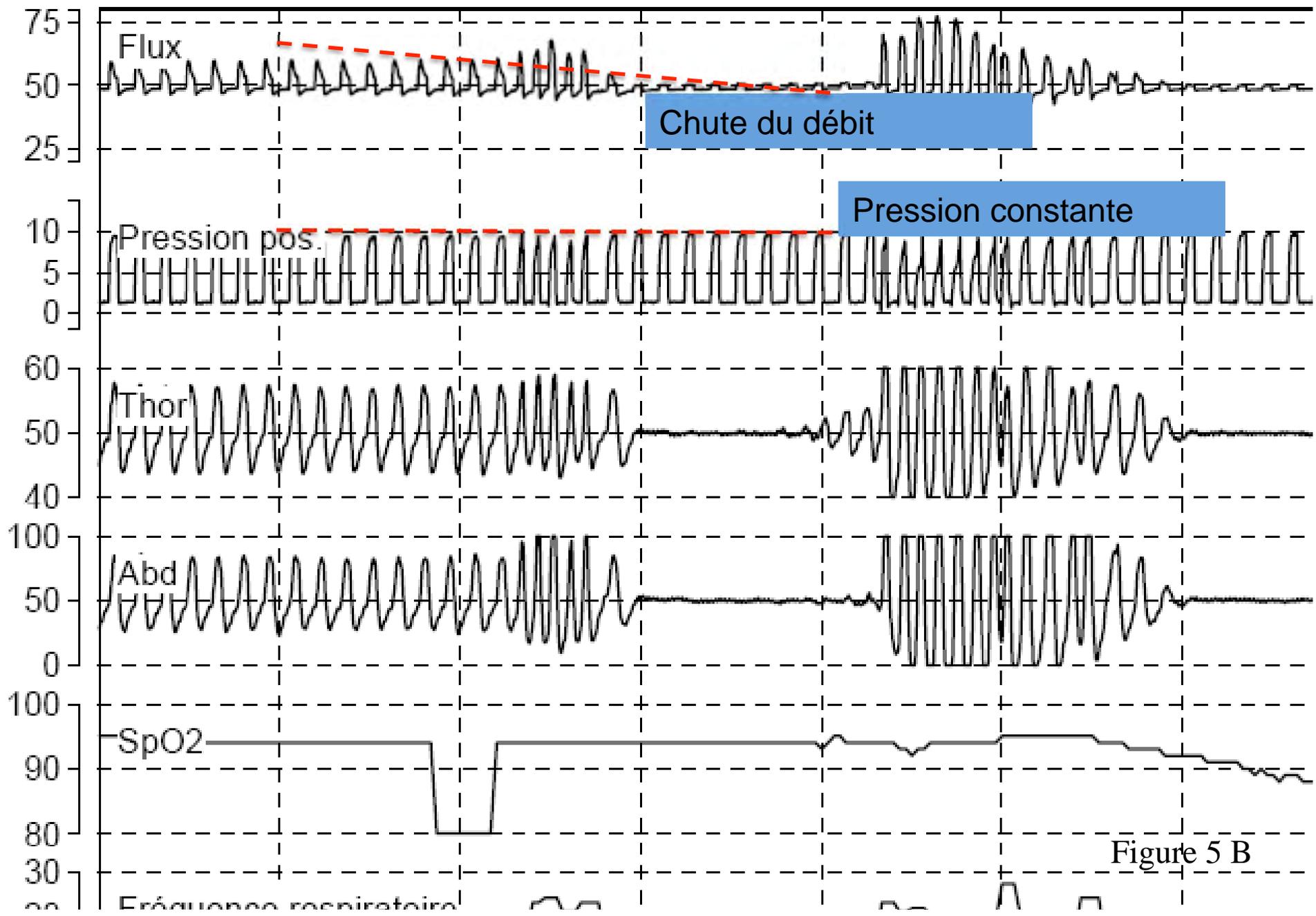
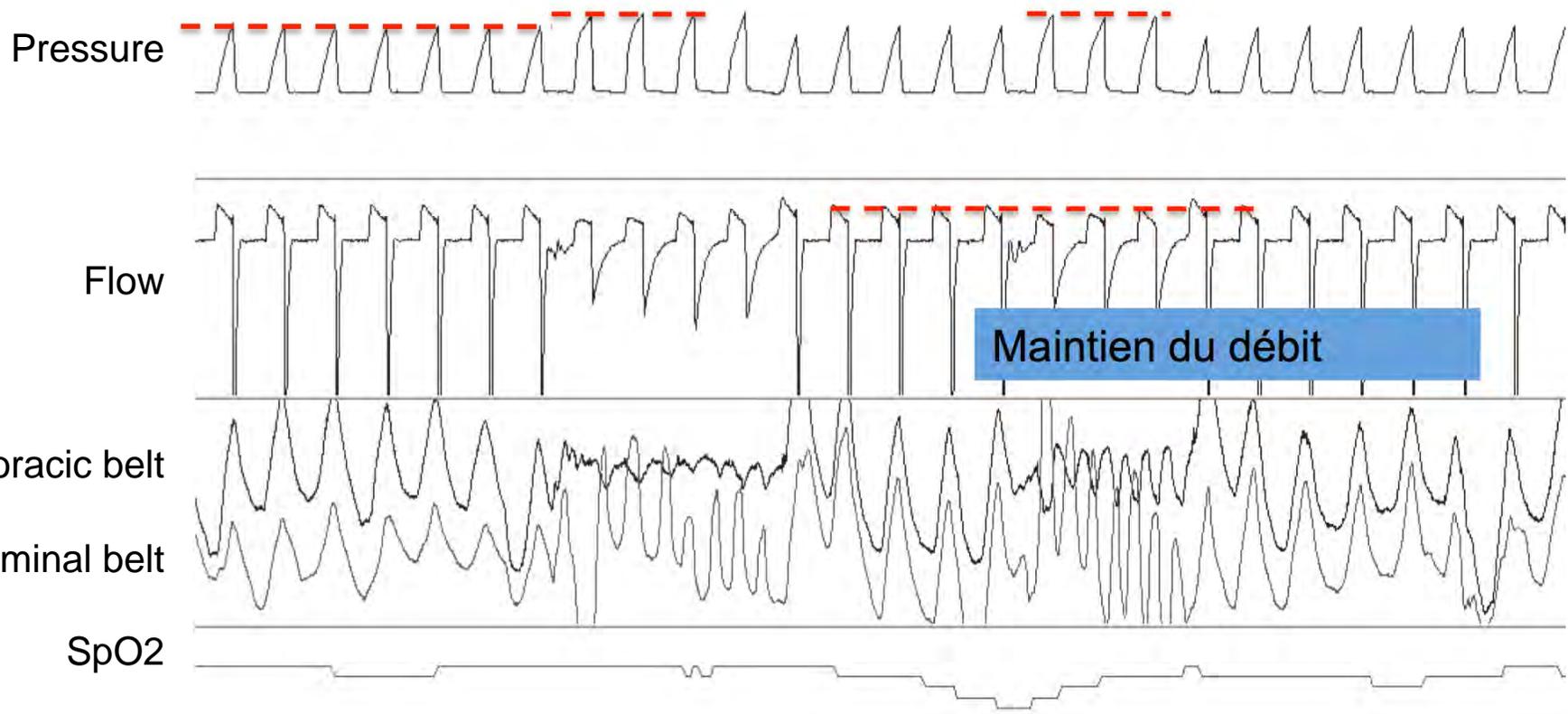


Figure 5 B



Augmentation de la pression



3^{ème} étape de lecture

Avoir un plan de lecture



Dans l'ordre rechercher

1) Fuites ?

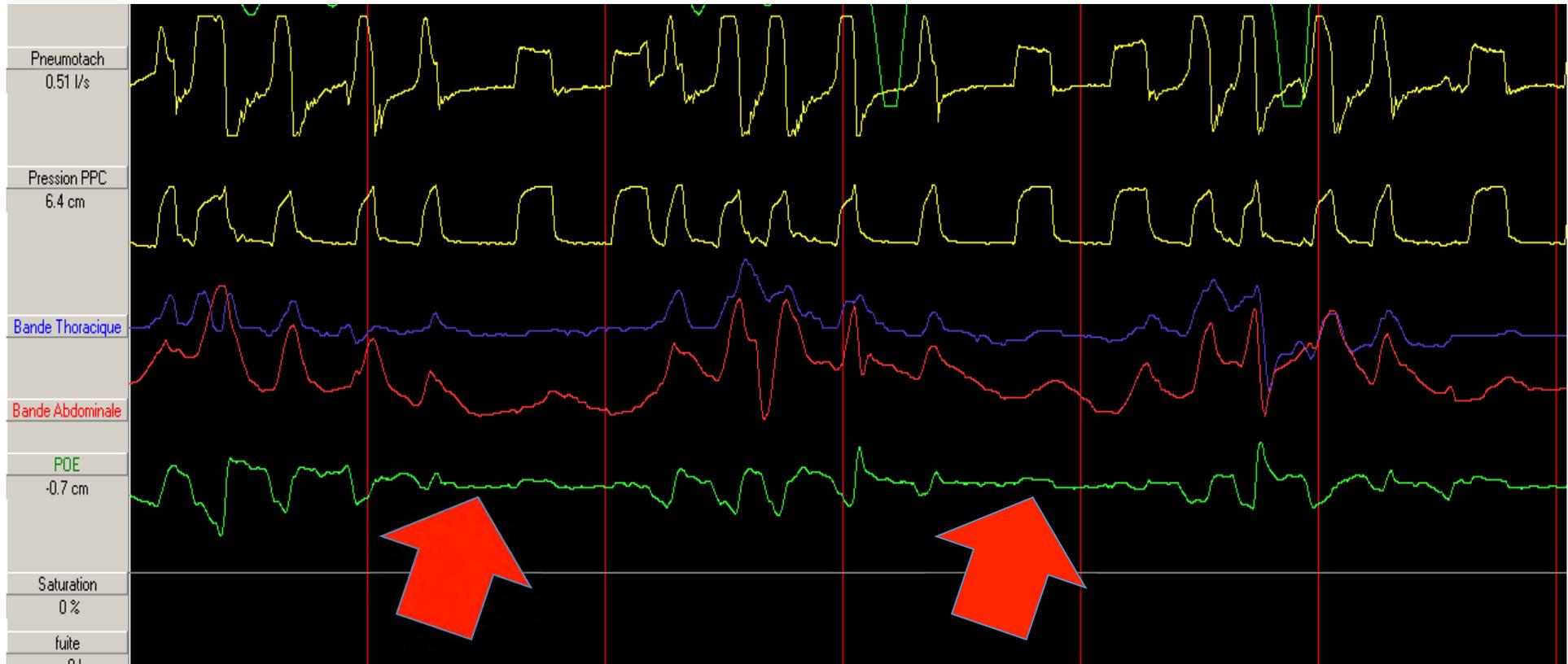
2) Obstruction des VA ?

3) Avec diminution de la commande ou maintien de la commande?

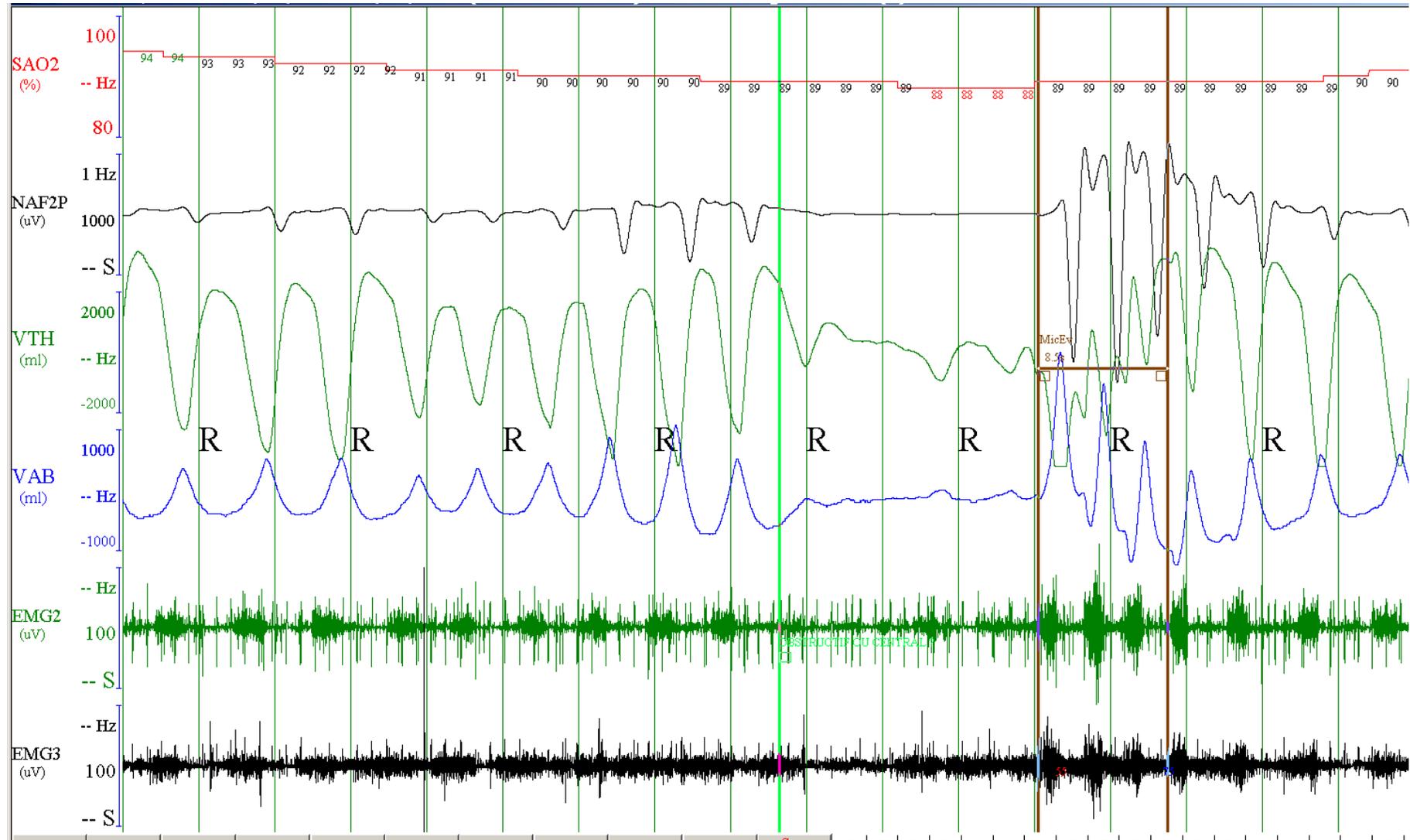
4) Asynchronisme?

5) Problèmes technique?

Pour suivre la commande : le gold standard La pression oesophagienne



Pour suivre la commande : Signes indirects : les sangles ou l'EMG



3^{ème} étape de lecture

Avoir un plan de lecture



Dans l'ordre rechercher

1) Fuites ?

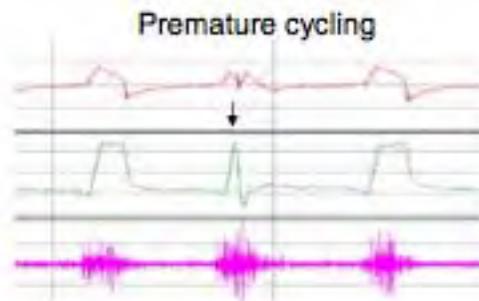
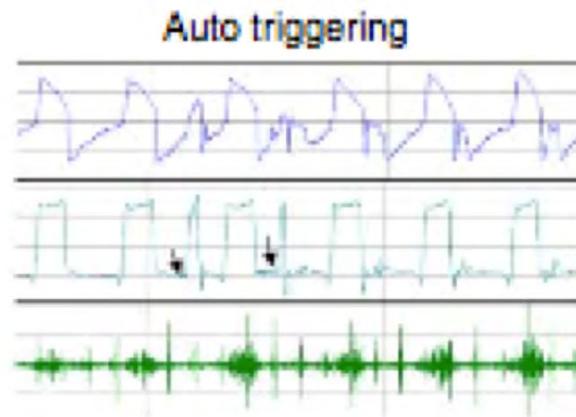
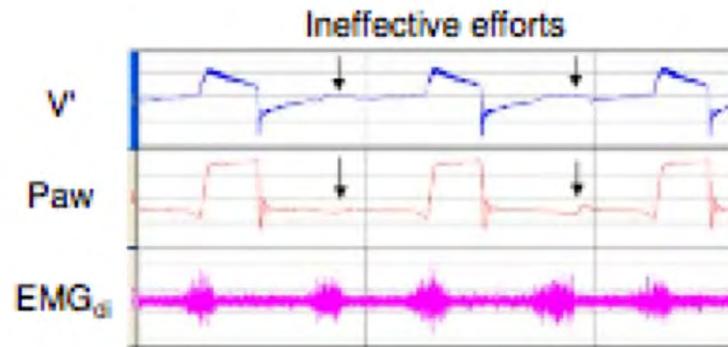
2) Obstruction des VA ?

3) Avec diminution de la commande ou maintien de la commande?

4) Asynchronisme?

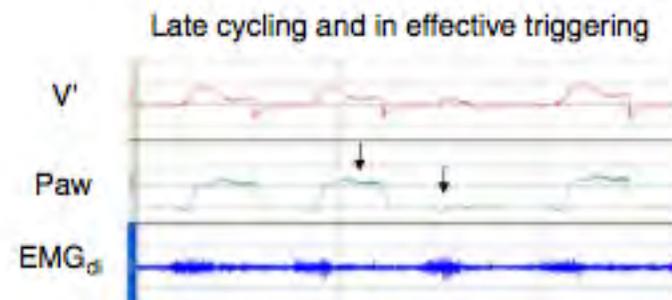
5) Problèmes technique?

Asynchronisme : 5 types



Vignaux, intensive care 2009
En réanimation

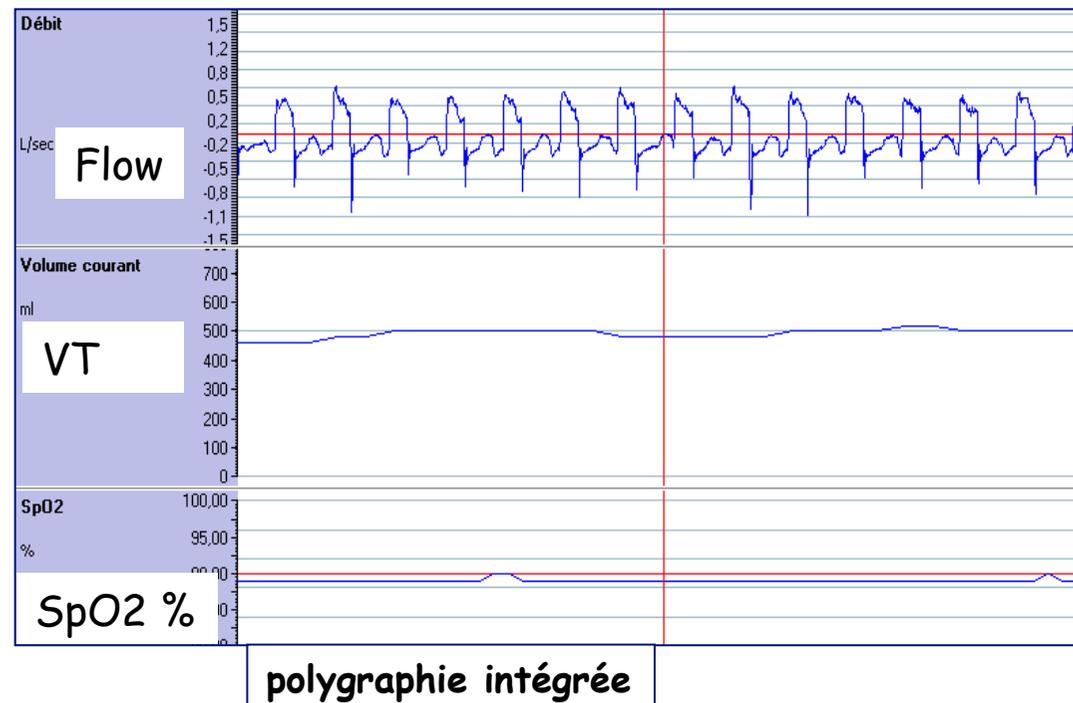
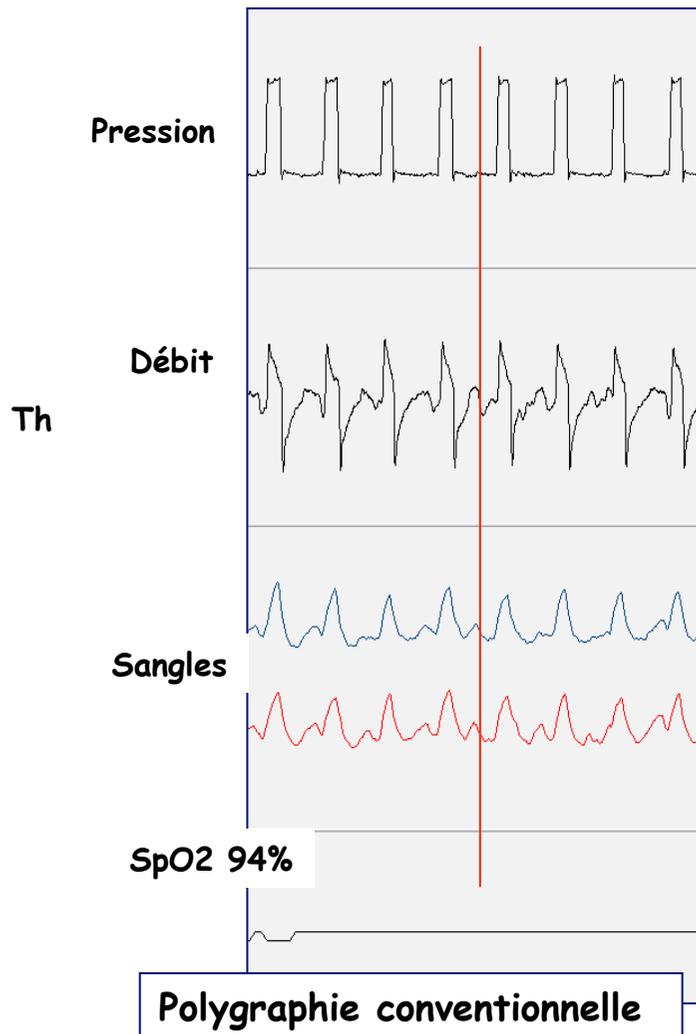
En cours de publication à
domicile par SOMNOVNI



SEMEIOLOGIE DE LA POLYGRAPHIE SOUS VNI

Asynchronisme : 5 types :

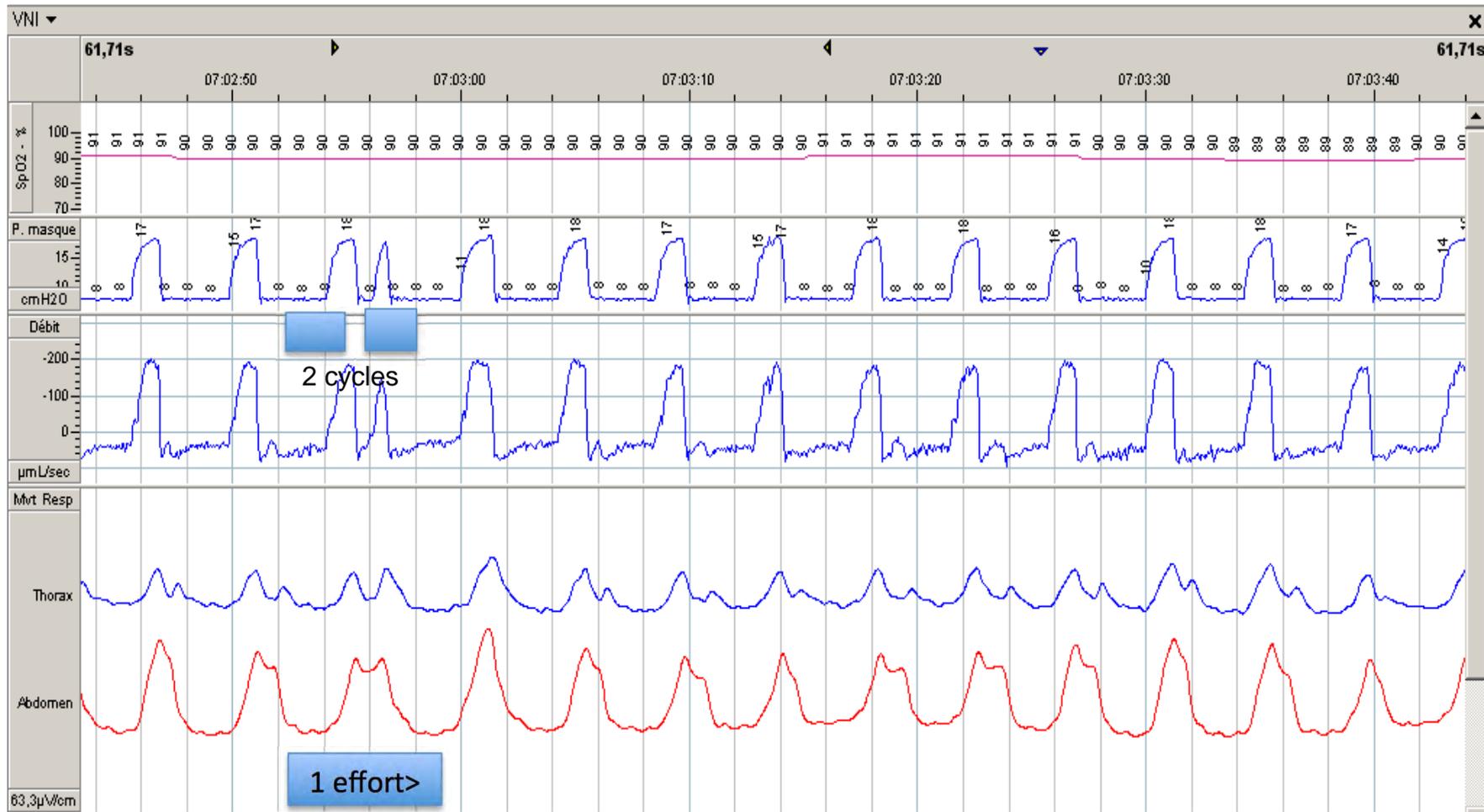
1) Effort non récompensé



SEMEIOLOGIE DE LA POLYGRAPHIE SOUS VNI

Asynchronisme : 5 types

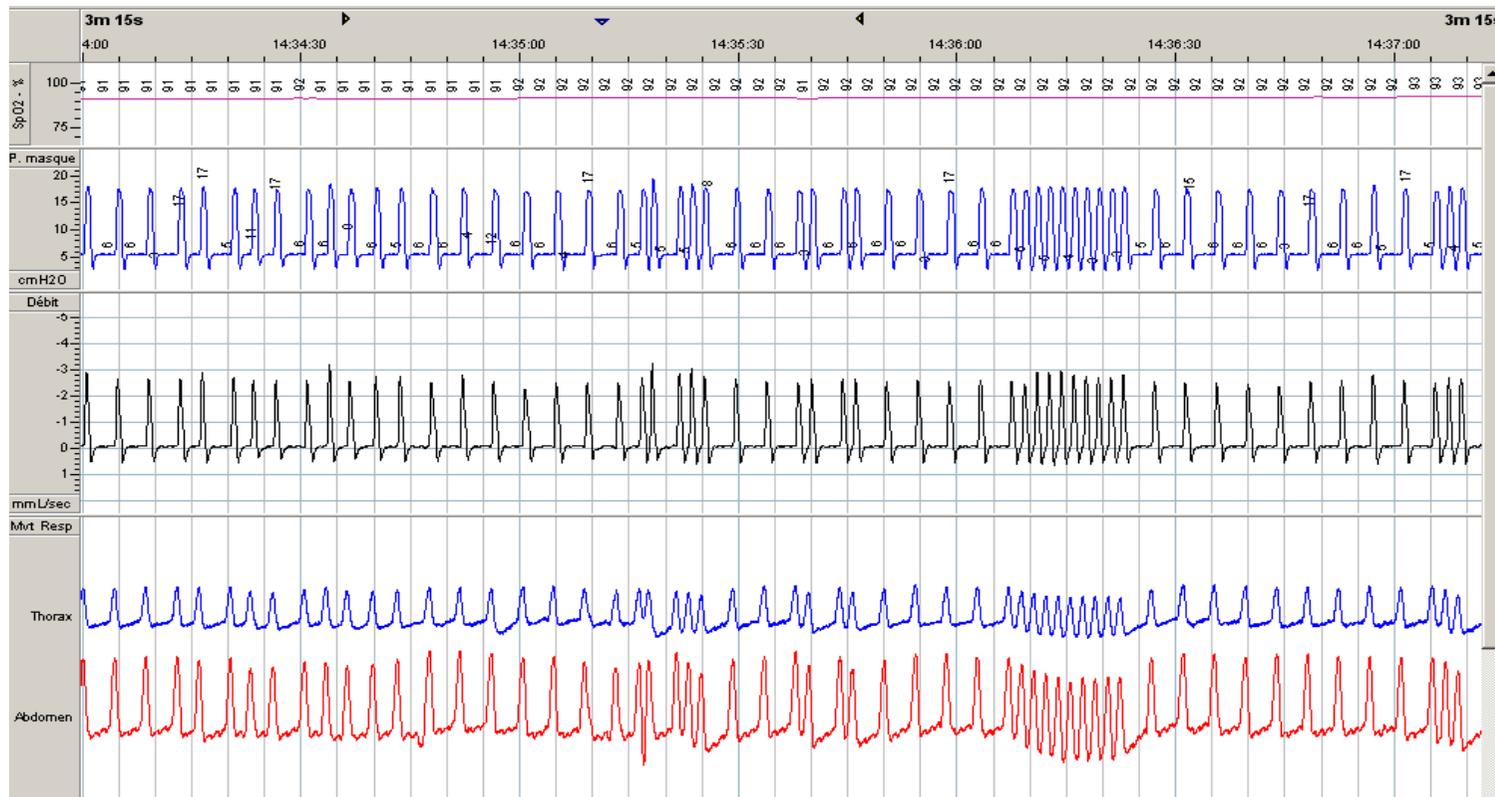
2) Double déclenchement : 2 cycles pour 1 effort sous jacent



SEMEIOLOGIE DE LA POLYGRAPHIE SOUS VNI

Asynchronisme : 5 types

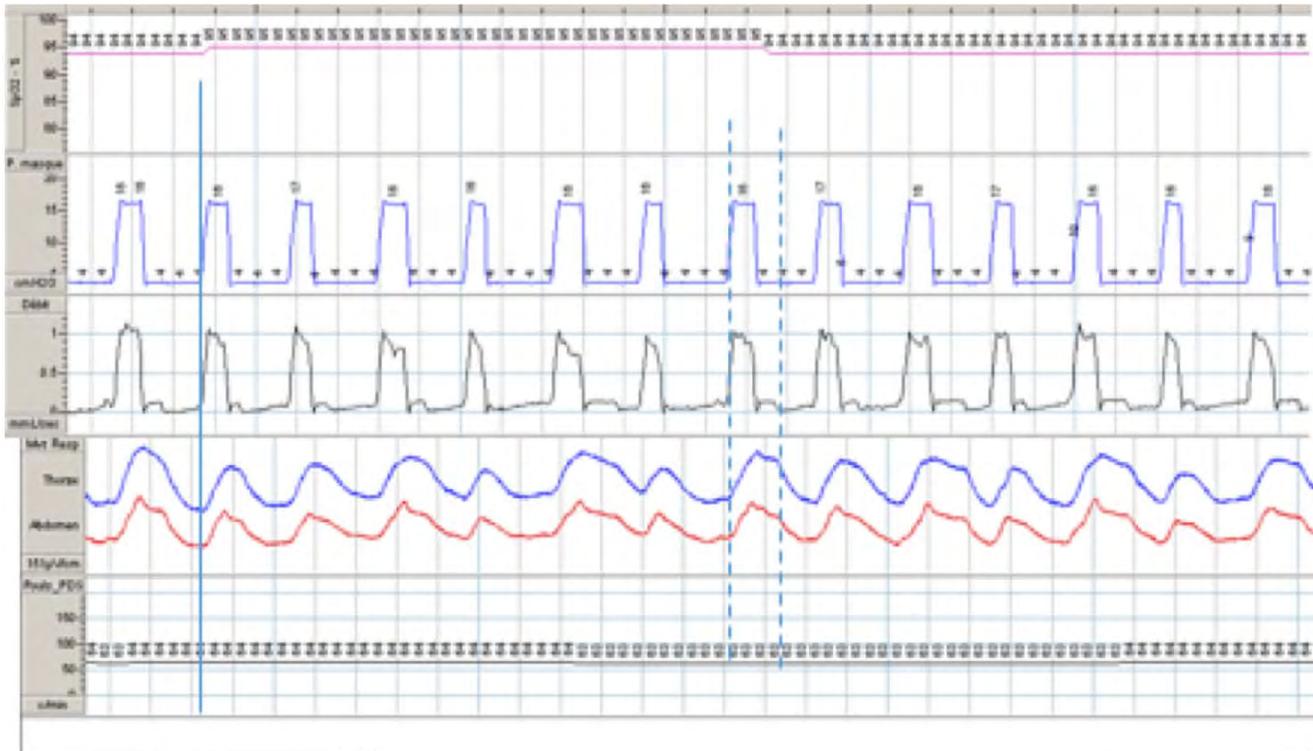
3) Autodéclenchement : 2 ou plus de cycles pour un seul effort au départ



SEMEIOLOGIE DE LA POLYGRAPHIE SOUS VNI

Asynchronisme : 5 types

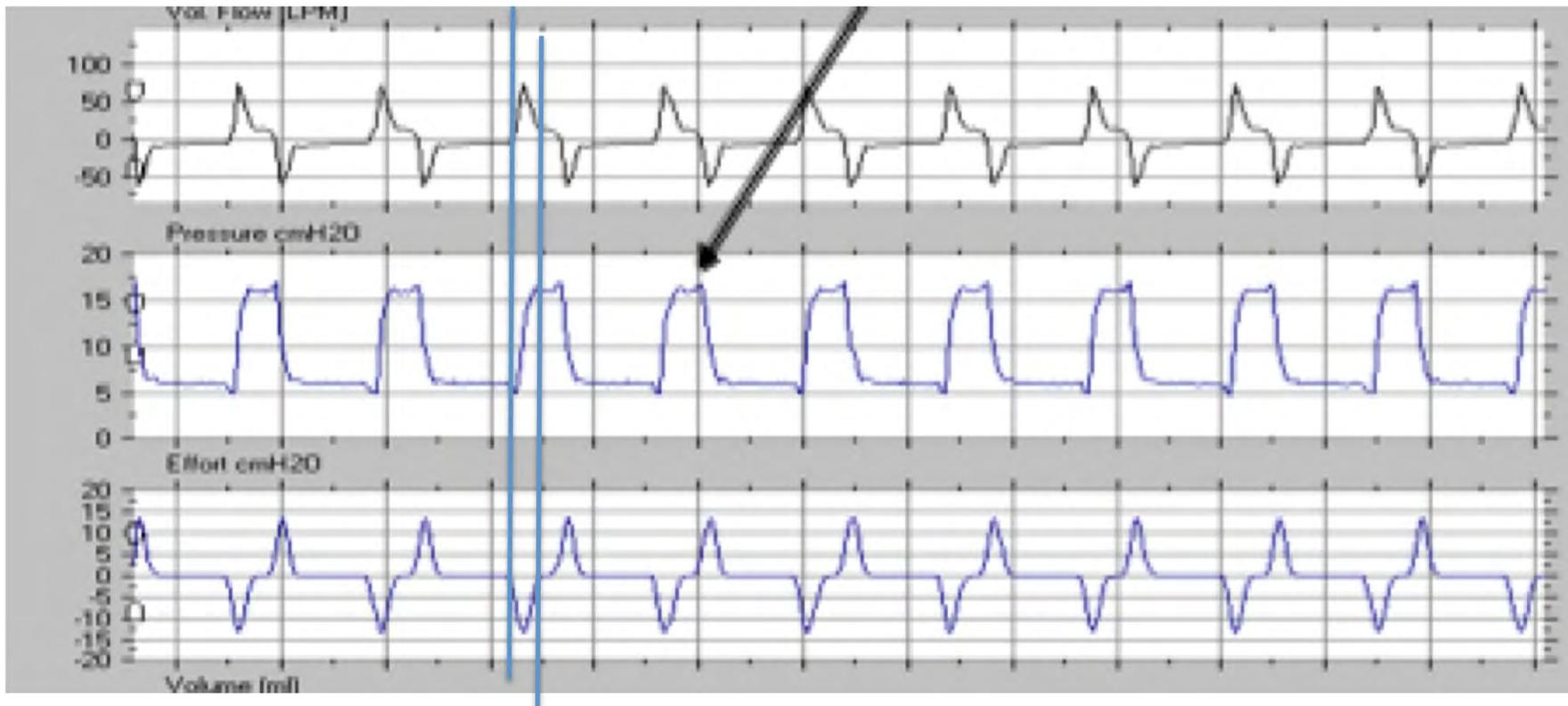
4) Cyclage précoce (effort malade plus long que le cycle machine)



SEMEIOLOGIE DE LA POLYGRAPHIE SOUS VNI

Asynchronisme : 5 types

4) Cyclage tardif (effort malade plus court que le cycle machine)



Logigramme de surveillance de la VNI



Janssens et coll. Thorax 2011

