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NAZIONALE SIMRI**  
*il respiro: scienza e terapia per la salute del bambino*

20

**Torino**  
10-12 ottobre 2024

# Ventilazione non invasiva in pediatria dalla teoria alla pratica



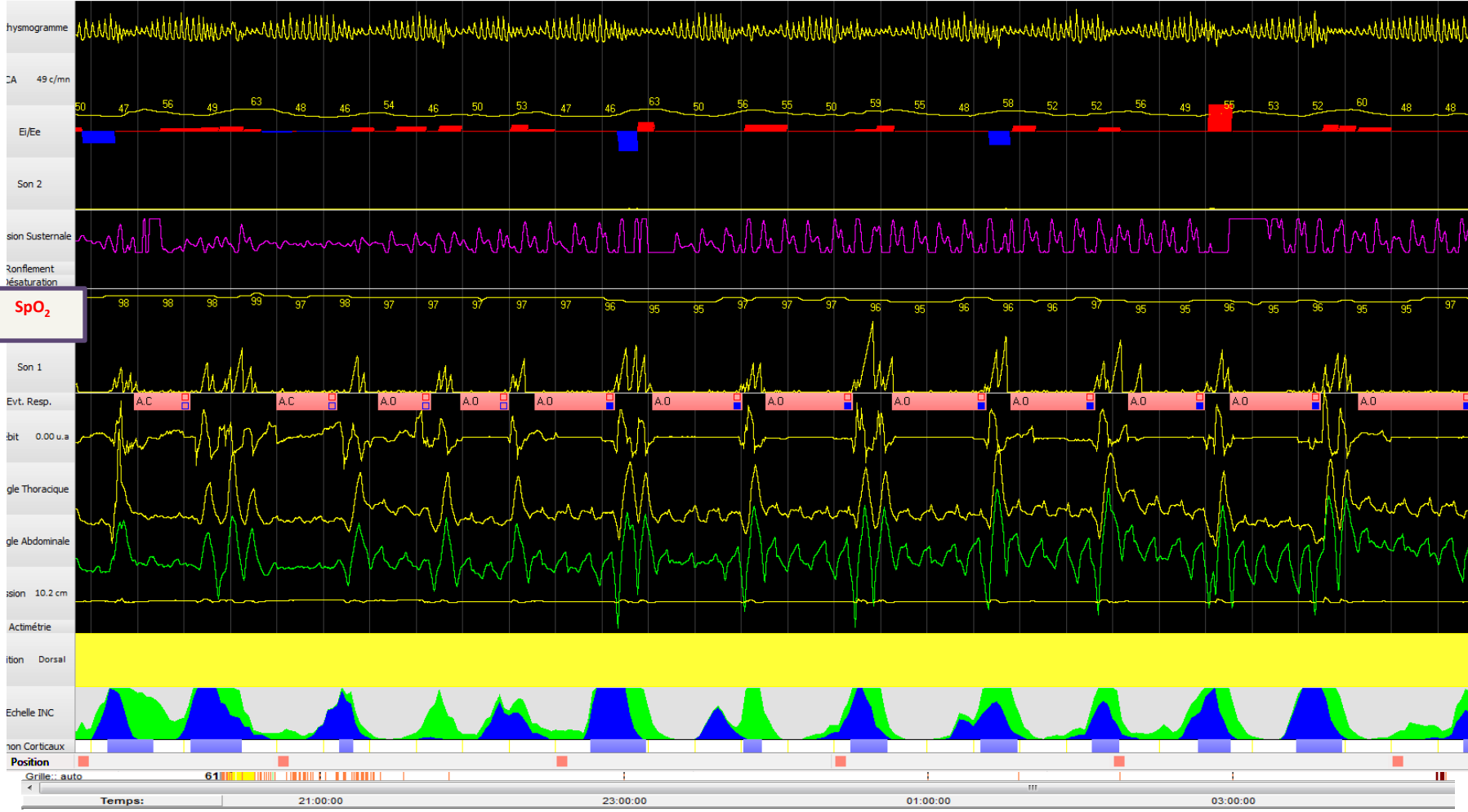
**UNIVERSITY  
OF TRIESTE**

Dott. Alessandro Amaddeo  
IRCCS Burlo Garofolo, Trieste



# Mattia, 2 anni, malattia di Niemann Pick type A

- Diagnosi a 6 mesi di vita per ritardo ed epatosplenomegalia
- CPAP per OSAS severa (AHI 56/h) all'età di 18 mesi



# Mattia, 2 anni, malattia di Niemann Pick type A

- Che ventilatore scegliereste e perchè?

# TASK FORCE VENTILAZIONE NON INVASIVA A LUNGO TERMINE

## VENTILATORI FASCIA ALTA

- **MODALITA' DI VENTILAZIONE**
  - CPAP
  - NIV
  - IV
- **PROGRAMMI IMPOSTABILI:** più di uno (es. Notte, giorno, fisioterapia, acuzie)
- **BATTERIA INTERNA:** maggiore di 6 ore
- **ALLARMI:** si
- **BUILT-IN SOFTWARE:** si
- **OMOLOGATI PER PESO:** > 2.5 kg.
- **STRUTTURA:** pesanti ed ingombranti
- **UMIDIFICATORE:** esterno

## VENTILATORI FASCIA INTERMEDIA

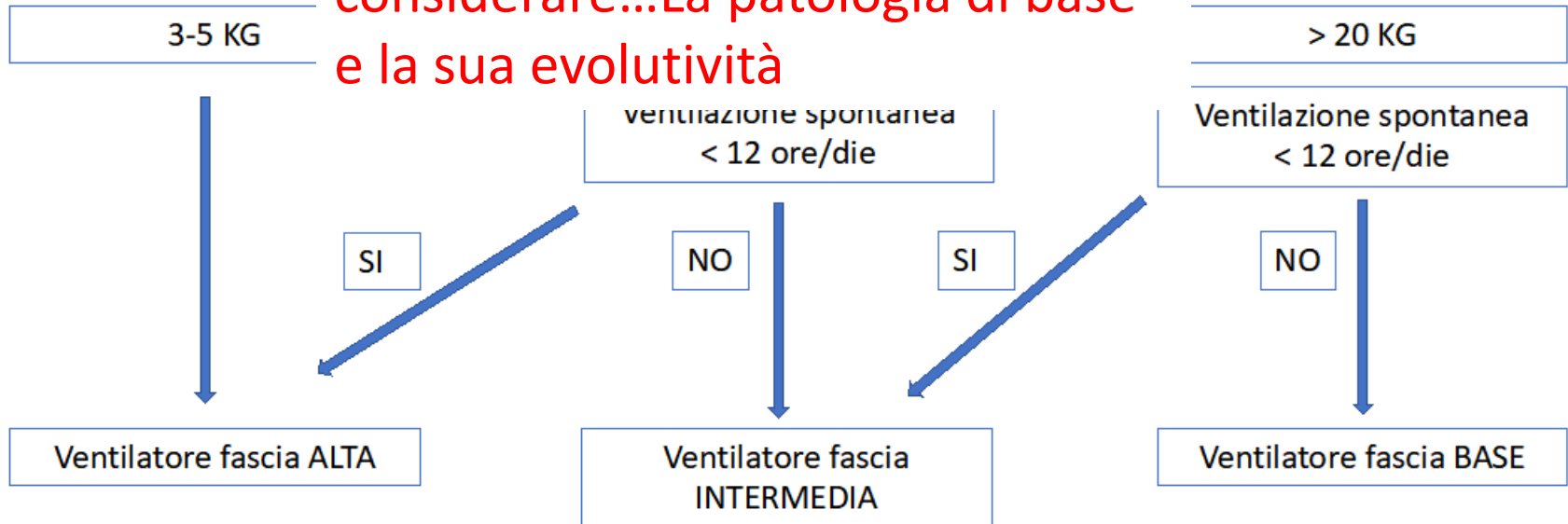
- **MODALITA' DI VENTILAZIONE**
  - CPAP
  - NIV
- **PROGRAMMI IMPOSTABILI:** più di uno (es. Notte, giorno, fisioterapia, acuzie)
- **BATTERIA INTERNA:** 4-6 ore
- **ALLARMI:** si
- **BUILT-IN SOFTWARE:** si
- **OMOLOGATI PER PESO:** > 10/15 kg.
- **STRUTTURA:** dimensione intermedia
- **UMIDIFICATORE:** integrato/esterno

## VENTILATORI FASCIA BASE

- **MODALITA' DI VENTILAZIONE**
  - CPAP
  - AUTO-CPAP
  - NIV
- **PROGRAMMI IMPOSTABILI:** uno
- **BATTERIA INTERNA:** no
- **ALLARMI:** no
- **BUILT-IN SOFTWARE:** si
- **OMOLOGATI PER PESO:** > 30 kg.
- **STRUTTURA:** dimensione ridotte
- **UMIDIFICATORE:** integrato/esterno

# SCELTA DEL VENTILATORE CPAP

Ulteriore fattore da considerare...La patologia di base e la sua evolutività



Devices		CPAP/AutoCPAP	Bilevel PAP	Min weight
<b>ResMed</b>				
Airsense 10	(std)	yes	no	30kg
Lumis	(std)	Constant CPAP	yes	13kg / 30kg (iVAPS)
Stellar	(interm)	Constant CPAP	yes	13kg / 13kg (iVAPS)
Astral	(LS)	Constant CPAP	yes	5kg
<b>Philips Respironics</b>				
DreamStation	(std)	yes	no	30kg
BIPAP AVAPS	(std)	Constant CPAP	yes	10kg / 20kg (AVAPS)
BIPAP A40	(interm)	Constant CPAP	yes	10kg / 20kg (AVAPS)
Trilogy EVO		Constant CPAP	yes	2.5kg
<b>F &amp; P</b>				
Icon	(std)	yes	no	30kg
<b>Lowenstein</b>				
Prisma 20	(std)	yes	no	30kg
PrismaVent 40	(interm)	Constant CPAP	yes	10kg
PrismaVent 50	(LS)	Constant CPAP	yes	10kg

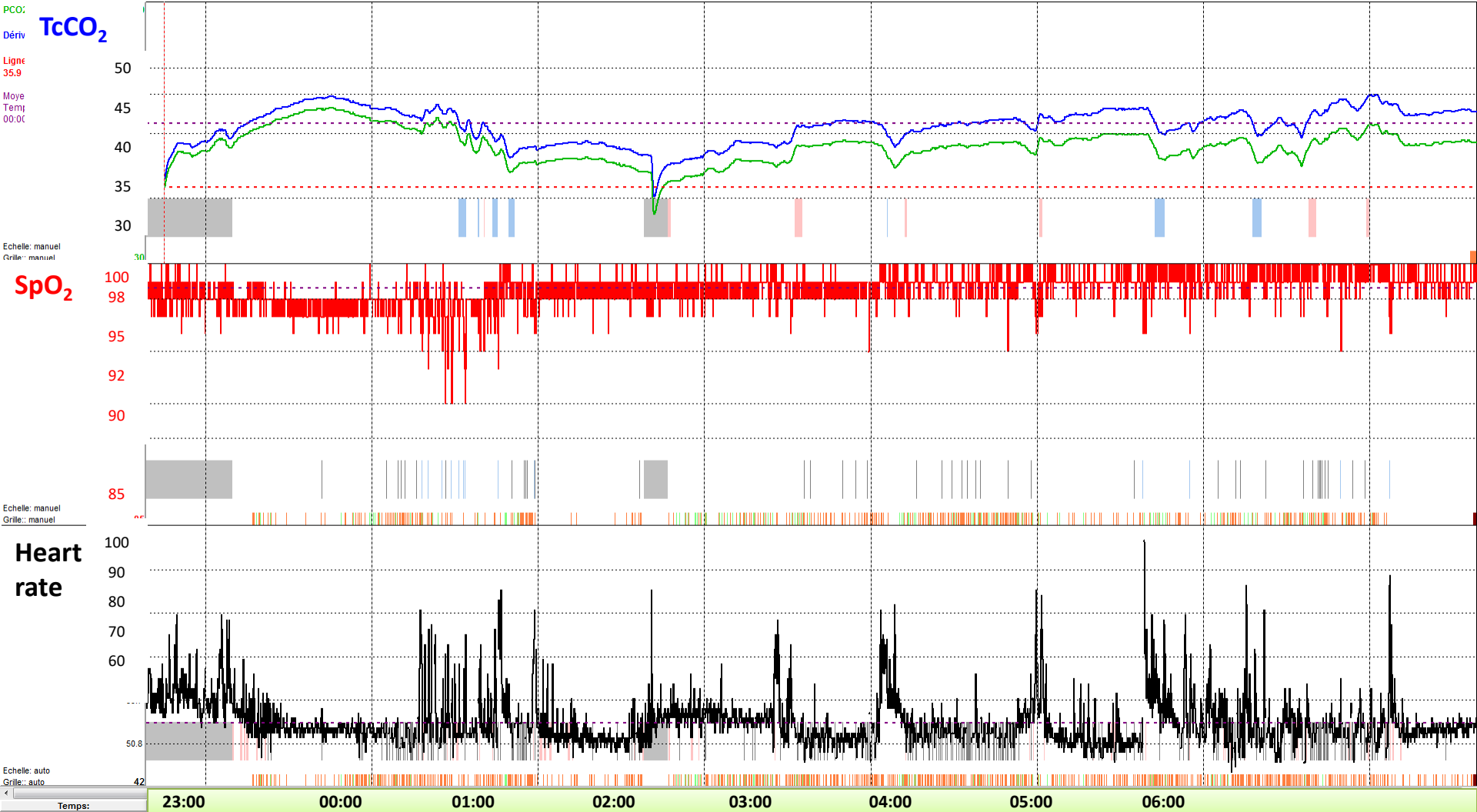
# Q1: Che ventilatore scegliereste e perchè?

1. Fascia “base” perchè deve fare solo una CPAP
2. Fascia “intermedia” perchè deve fare una CPAP ma voglio poter essere sicuro di monitorarlo correttamente
3. Fascia “alta” perchè anche se deve fare una CPAP devo essere sicuro di poterlo monitorare e di passarlo a una ventilazione a due livelli se necessario

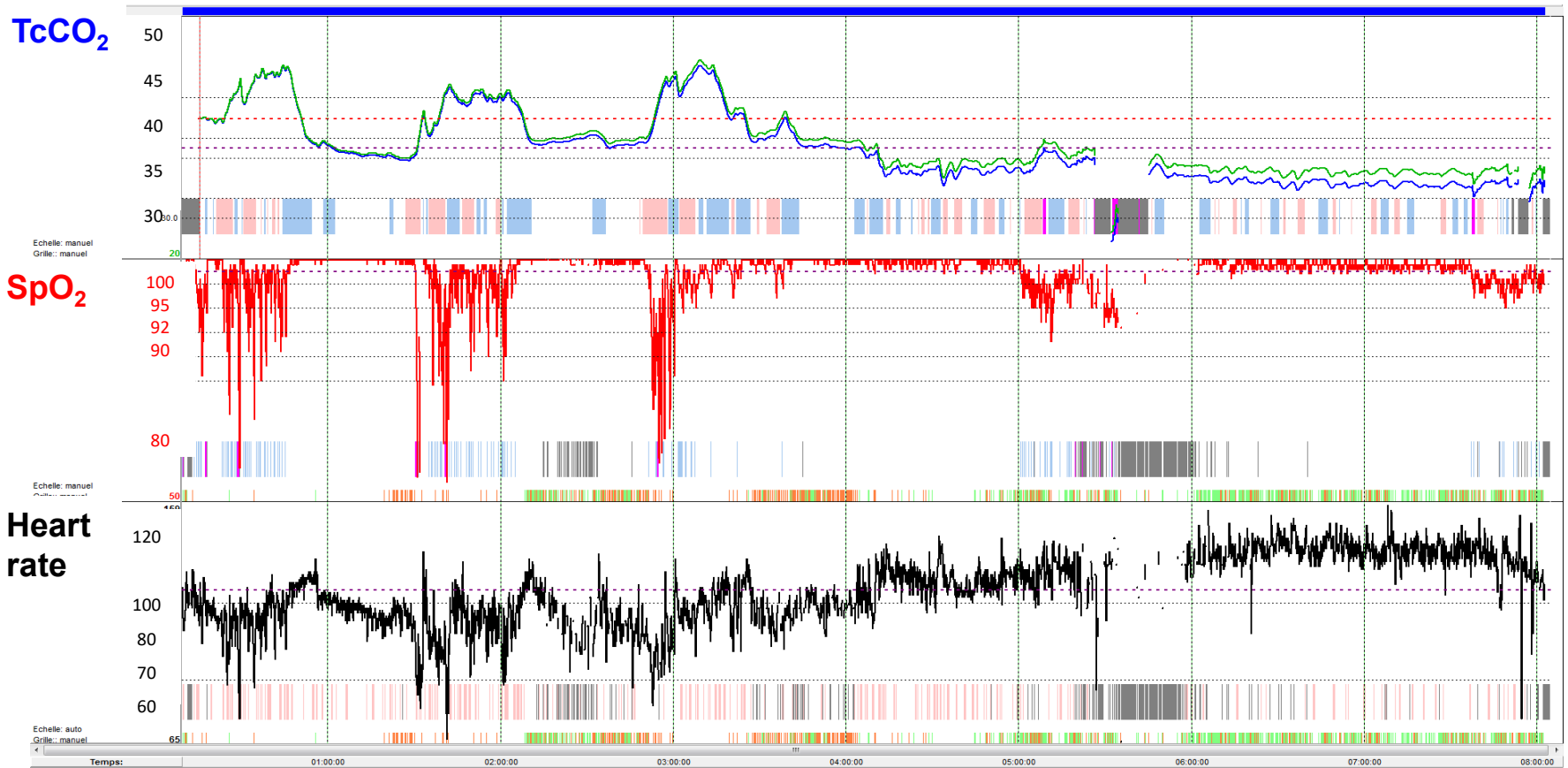
# La nostra scelta

- Ventilatore alta fascia: Trilogy EVO
- Umidificatore esterno
- Maschera nasale (mettere foto)

# Capnografia con CPAP a 8 cmH2O



# Capnografia con CPAP a 8 cmH2O un anno dopo



Dati terapia Prescrizione Attrezzatura Registro attività

Sommario **Dettagli dati** Modalità d'uso Cronologia impostazioni dispositivo

Trilogy Evo  
H2908972289A5

giorni  
7 14 30 personalizza

data di inizio data di fine  
mm/gg/aaaa mm/gg/aaaa

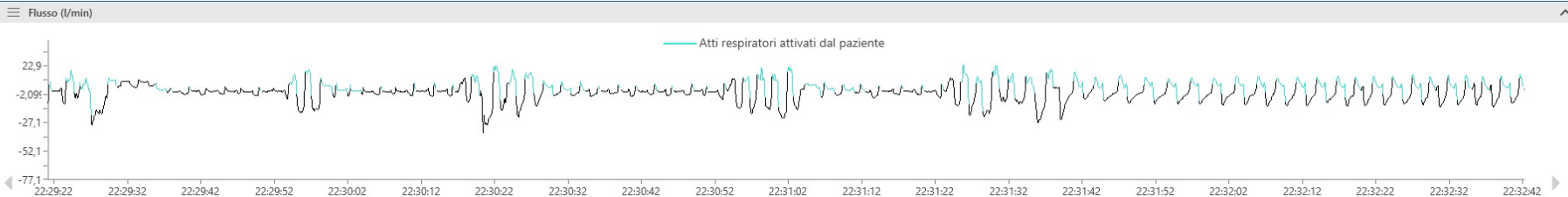
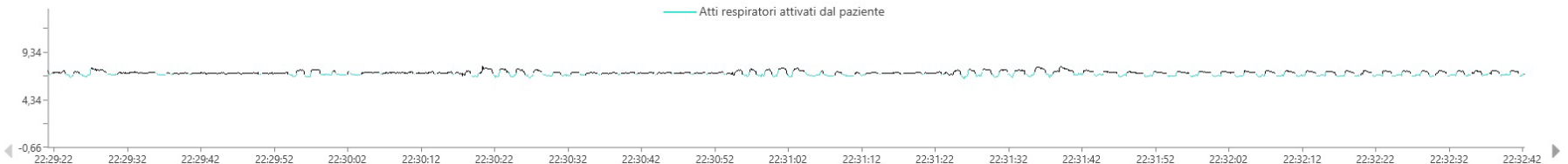


Serie selezionata: 26/05/2023 22:29 - 26/05/2023 22:32

Grafico selezionato: Perdita involontaria (l/min)

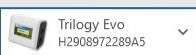
Torna a Tendenzia < 26/05/2023 >

Mostra valori sommario  Off



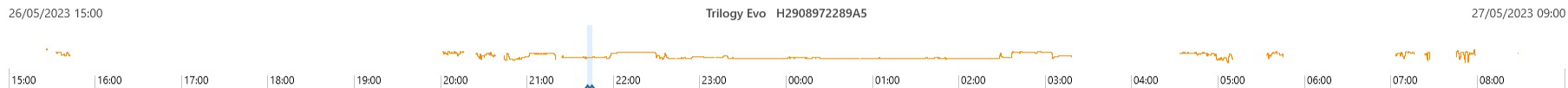
Dati terapia Prescrizione Attrezzatura Registro attività

Sommario **Dettagli dati** Modalità d'uso Cronologia impostazioni dispositivo



giorni  
7 14 30 personalizza

data di inizio data di fine  
mm/gg/aaaa mm/gg/aaaa

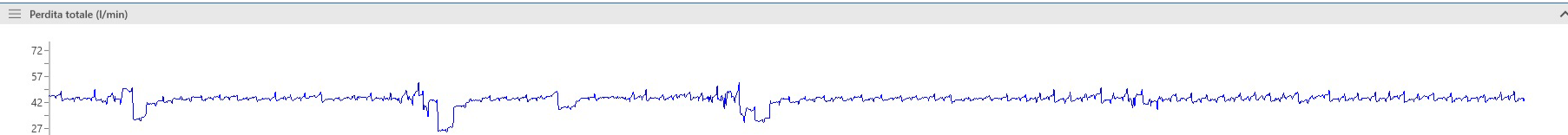
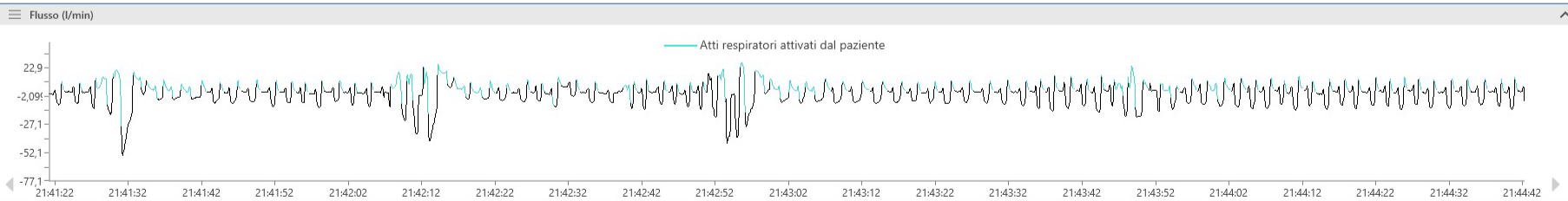


Serie selezionata: 26/05/2023 21:41 - 26/05/2023 21:44

Grafico selezionato: Perdita involontaria (l/min)

Torna a Tendenza 26/05/2023

Mostra valori sommario Off



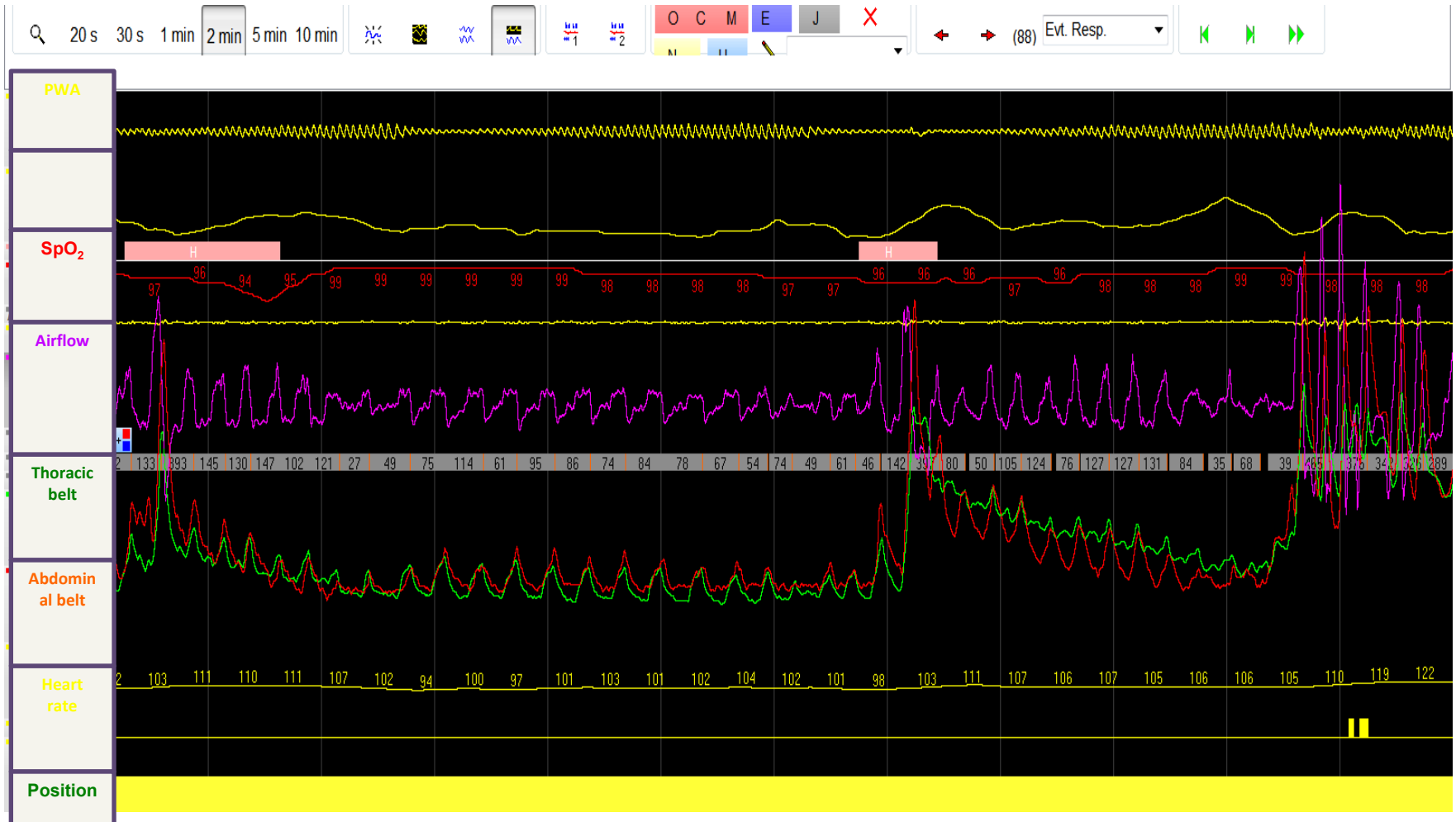
## Q2: OSAS in peggioramento, cosa fate?

1. Cambio maschera
2. Aggiungo O2
3. Aumento CPAP a 10 e controllo con built-in software e capno
4. Switch a una NIV

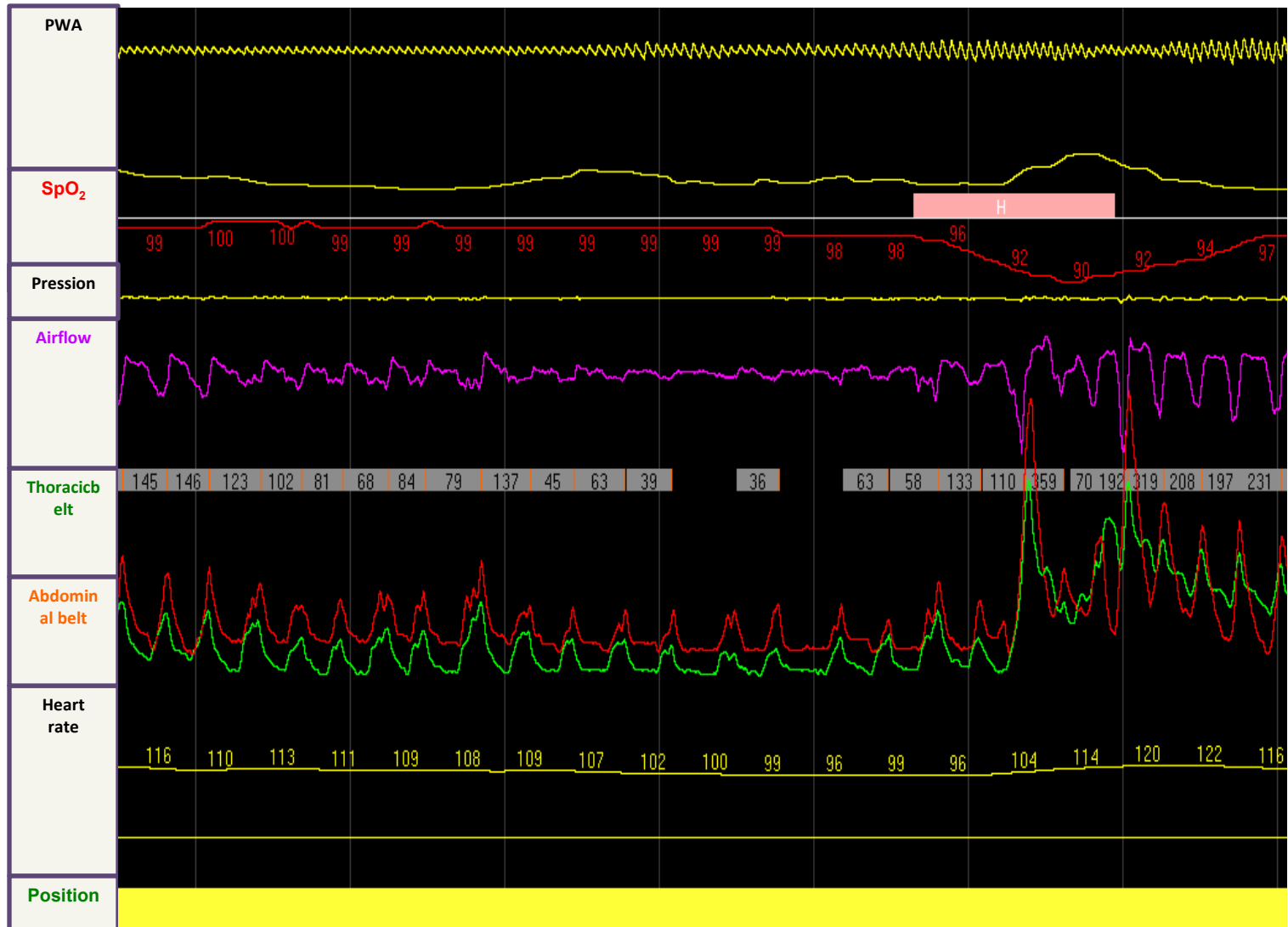
## Q2: OSAS in peggioramento, cosa fate?

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# Poligrafia con CPAP 10 cmH<sub>2</sub>O



# Poligrafia con CPAP 10 cmH<sub>2</sub>O



# Che parametri scegliereste?

1. PS +/- Vts

2. PCV

3. Altro

# La nostra scelta

1. Ventilatore: Trilogy Evo
2. Interfaccia: Maschera total face
3. Settings: S/T AVAPS
  - IPAP 12/16
  - EPAP 6
  - Vt 100 mL
  - rampa 2
  - Insp Trigger 2L/min, Exp trigger 20%
  - FR 16/min
4. Monitoraggio con built-in software e PG

Therapy Data Prescription Equipment Activity Log

Summary Data Details Patterns of Use Device Settings History

Trilogy Evo O2  
H288966932168

days  
7 14 30 custom

start date  
dd/mm/yyyy

end date  
dd/mm/yyyy

Selected Range: 19/07/2022 23:21 - 19/07/2022 23:23

Reference graph: Pressure (cmH<sub>2</sub>O)

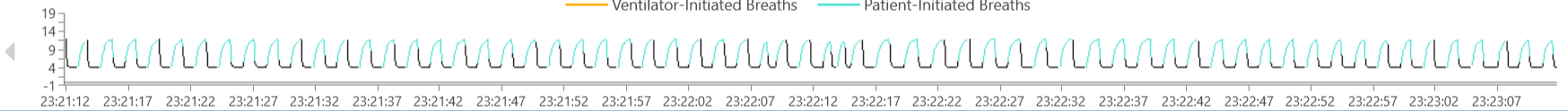


Back To Trend 19/07/2022 H288966932168 Trilogy Evo O2

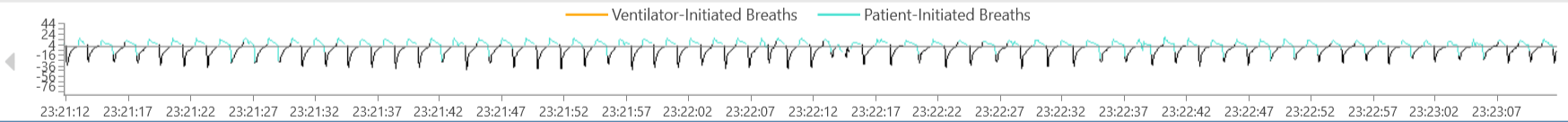
Show Summary Values Off

Pressure (cmH<sub>2</sub>O)

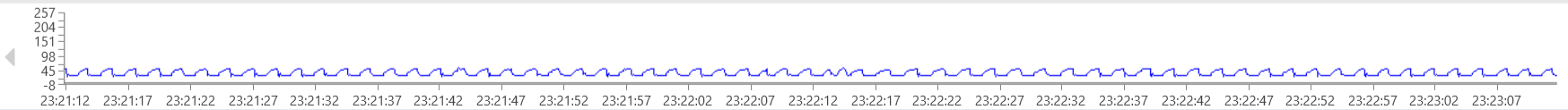
Mode: S/T



Flow (l/min)



Total Leak (l/min)



Mean Airway Pressure (cmH<sub>2</sub>O)

Unintentional Leak (l/min)

Tidal Volume (ml)

Minute Vent (l/min)

Therapy Data Prescription Equipment Activity Log

Summary Data Details Patterns of Use Device Settings History

Trilogy Evo O2  
H288966932168

days  
7 14 30 custom

start date  
dd/mm/yyyy

end date  
dd/mm/yyyy

Selected Range: 19/07/2022 23:35 - 19/07/2022 23:37

Reference graph: Pressure (cmH<sub>2</sub>O)

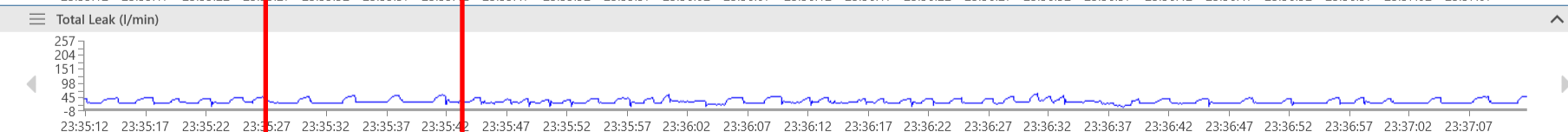
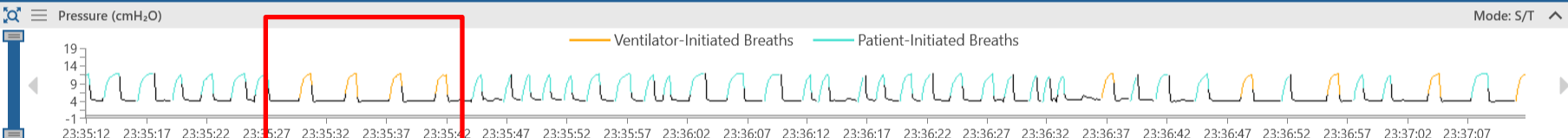


Back To Trend

19/07/2022

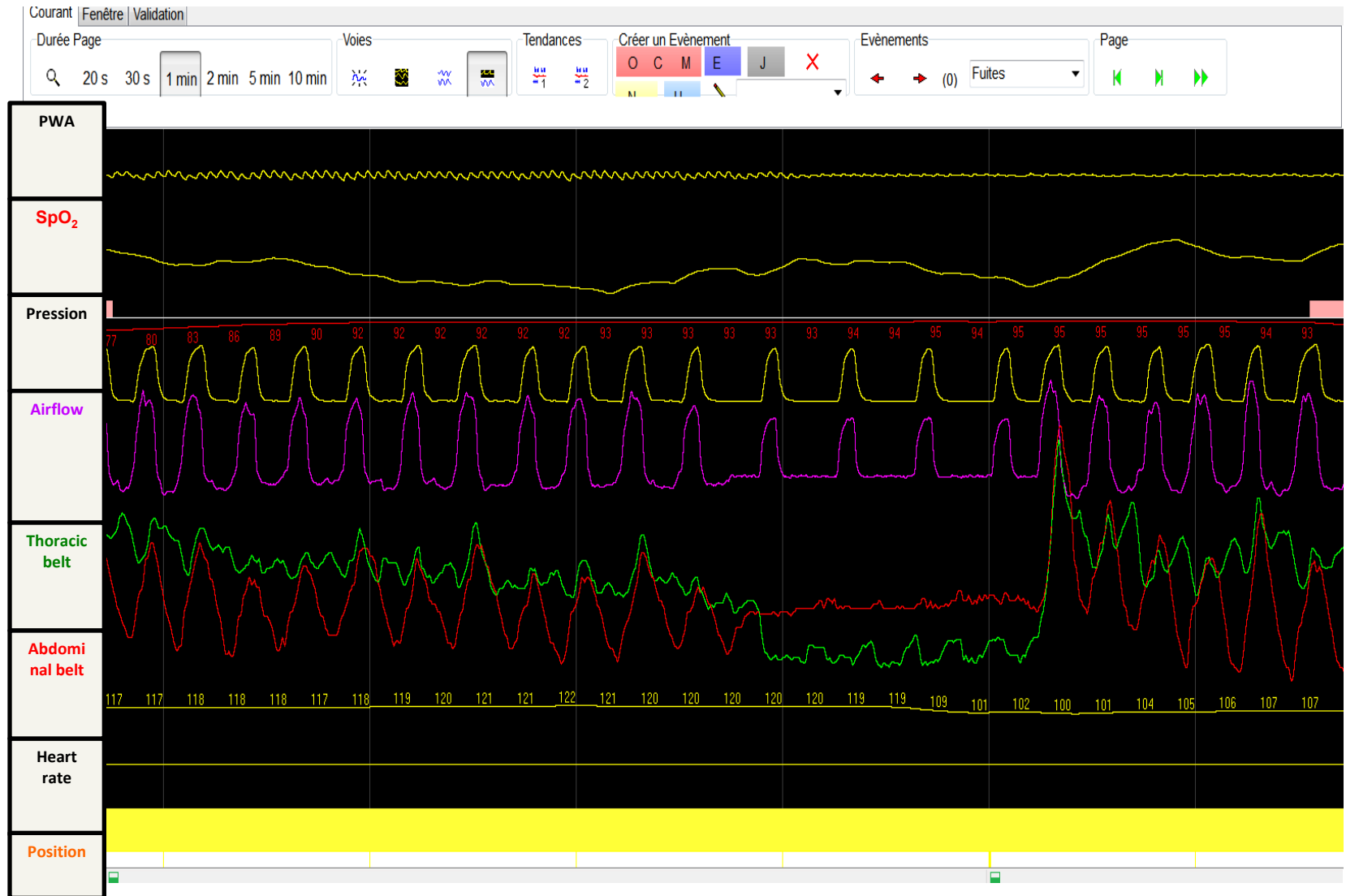
H288966932168 Trilogy Evo O2

Show Summary Values Off



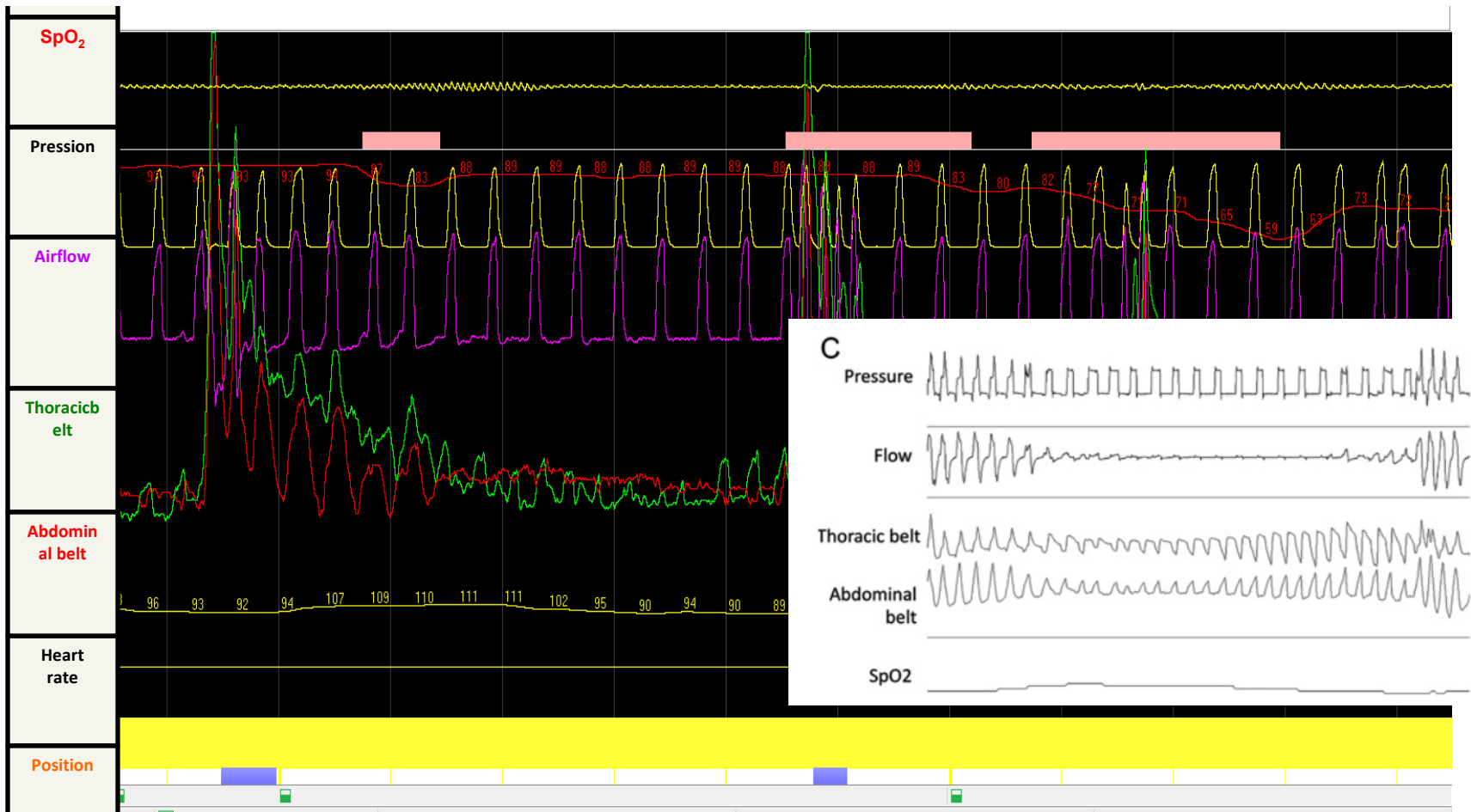
- Mean Airway Pressure (cmH<sub>2</sub>O)
- Unintentional Leak (l/min)
- Tidal Volume (ml)
- Minute Vent (l/min)

# Poligrafia in NIV



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

Thorax 2012;67:546e552



Therapy Data Prescription Equipment Activity Log

Summary Data Details Patterns of Use Device Settings History

Trilogy Evo O2  
H288966932168

days  
7 14 30 custom

start date  
dd/mm/yyyy

end date  
dd/mm/yyyy

Selected Range: 19/07/2022 23:43 - 19/07/2022 23:45

Reference graph: Pressure (cmH<sub>2</sub>O)



Back To Trend

19/07/2022

H288966932168 Trilogy Evo O2

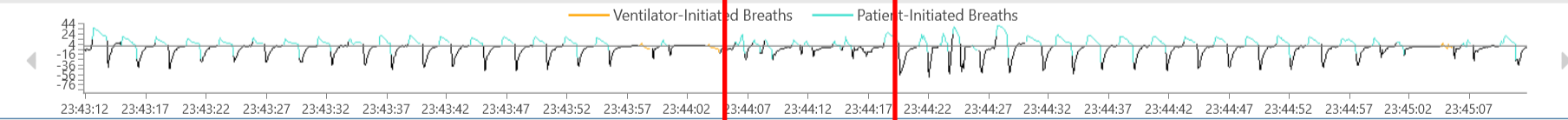
Show Summary Values Off

Pressure (cmH<sub>2</sub>O)

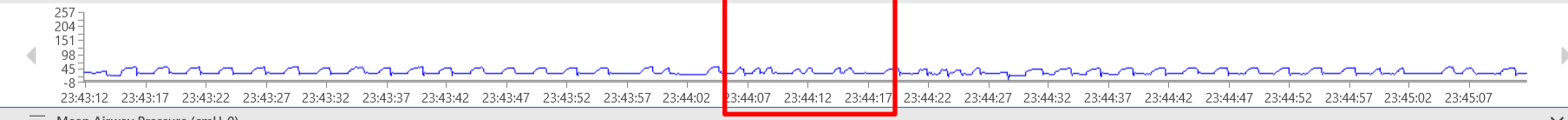
Mode: S/T



Flow (l/min)



Total Leak (l/min)



Mean Airway Pressure (cmH<sub>2</sub>O)

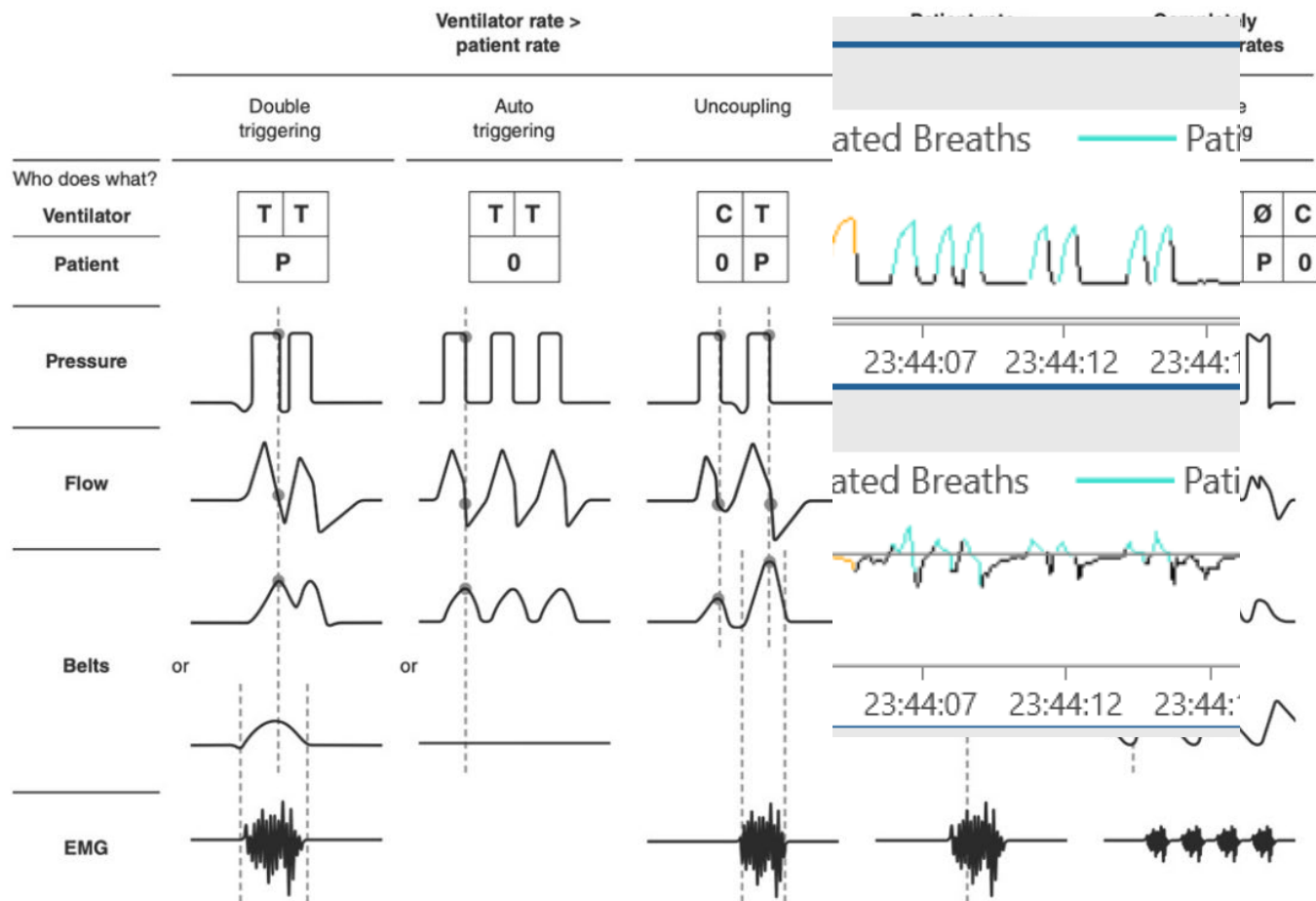
Unintentional Leak (l/min)

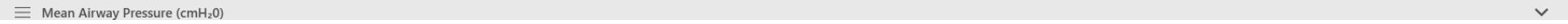
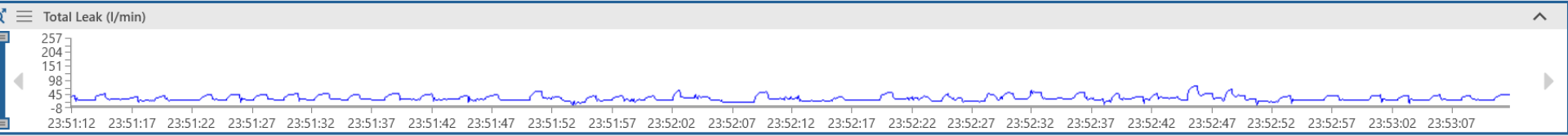
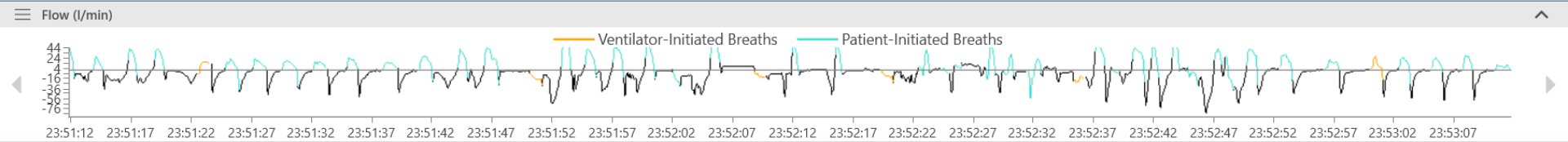
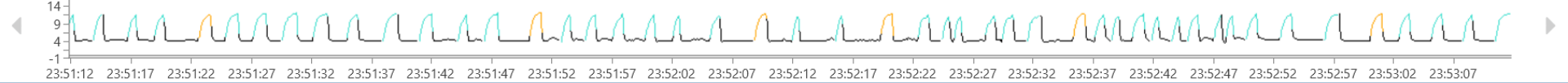
Tidal Volume (ml)

Minute Vent (l/min)

# Framework for patient-ventilator asynchrony during long-term non-invasive ventilation

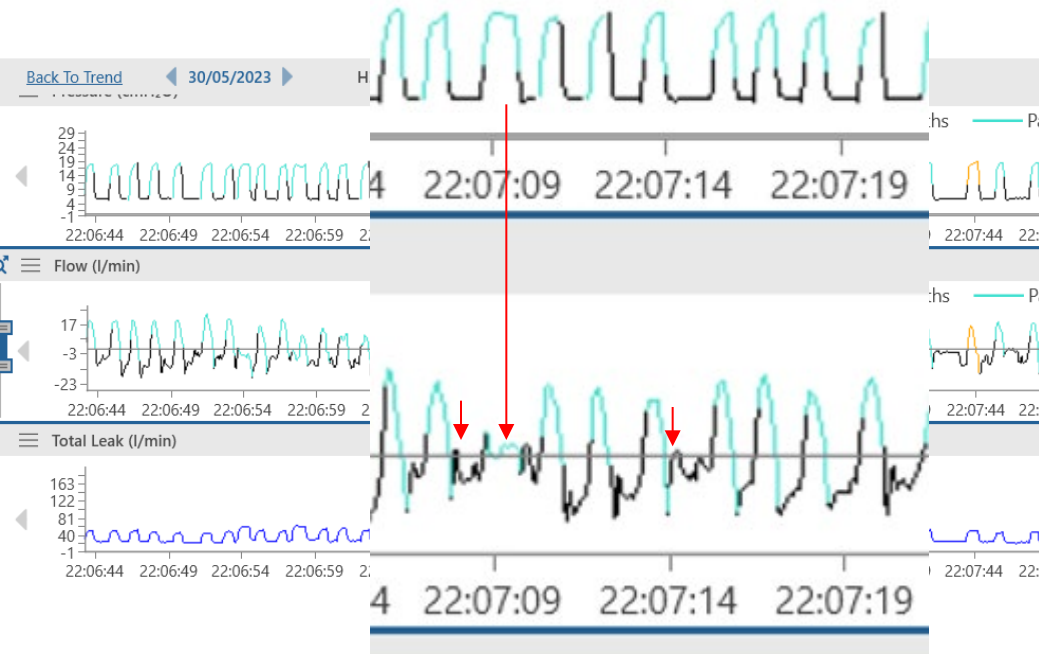
Gonzalez-Bermejo J, et al. Thorax 2019



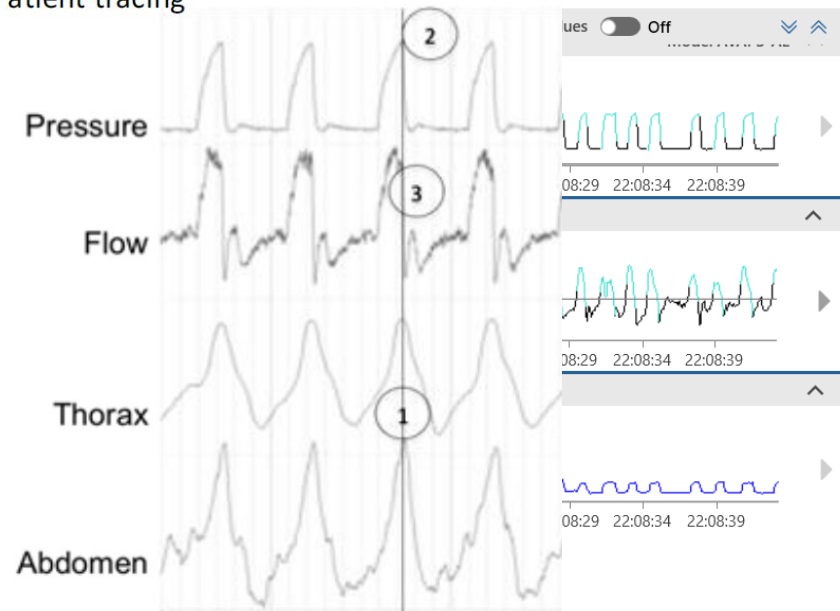


	Ventilator rate > patient rate		Patient rate > ventilatory rate		Completely dissociated rates
	Double triggering	Auto triggering	Uncoupling	Ineffective efforts	Complete uncoupling
Who does what?					
Ventilator	T T	T T	C T	∅	∅ C ∅ C ∅ C
Patient	P	∅	∅ P	P	P ∅ P ∅ P ∅
Pressure					
Flow					
Belts	or	or			or
EMG					

## Premature cycling in a patient



### Patient tracing



# Eventi ostruttivi con riduzione del drive respiratorio e asincronismi, cosa facciamo?

1. Niente
2. Aumentare la pressione
3. Aggiungere O<sub>2</sub>
4. Aumentare la sensibilità del trigger

	Prescription 1
Circuit Type	Passive
Device Mode	AVAPS-AE - None
Name	Prescription 1
Circuit Size	Pediatric (14-18 mm)
AVAPS Speed	5 cmH <sub>2</sub> O/min
AVAPS	
Tidal Volume	110 ml
Pressure Control	
PEEP	
Pressure Support Min	14 cmH <sub>2</sub> O
Pressure Support Max	20 cmH <sub>2</sub> O
EPAP Min	6 cmH <sub>2</sub> O
EPAP Max	9 cmH <sub>2</sub> O
Breath Rate	20 bpm
Inspiratory Time	0.8 seconds
Inspiratory Time Min/Max	On
Inspiratory Time Min	0.6 seconds
Inspiratory Time Max	1 seconds
Trigger Type	Flow Trigger
Flow Trigger Sensitivity	1 l/min
Flow Cycle Sensitivity	20%
Rise Time	1
Active Humidification	Off
Low Tidal Volume Alarm	Off
High Tidal Volume Alarm	Off
Low Minute Ventilation Alarm	Off
High Minute Ventilation Alarm	Off
Low Respiratory Rate Alarm	Off
High Respiratory Rate Alarm	Off
Circuit Disconnection Alarm	Off

Therapy Data Prescription Equipment Activity Log

Summary Data Details Patterns of Use Device Settings History

Trilogy Aeris Evo  
H321543394922

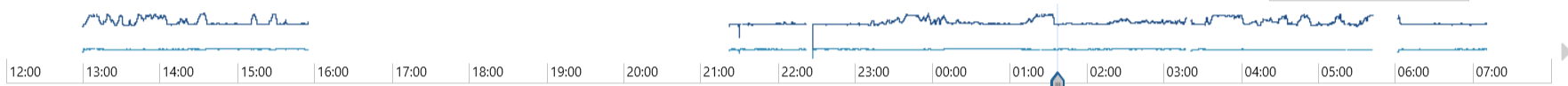
days  
7 14 30 custom

start date  
dd/mm/yyyy

end date  
dd/mm/yyyy

Selected Range: 31/05/2023 01:36 - 31/05/2023 01:37

Reference graph: Pressure (cmH<sub>2</sub>O)

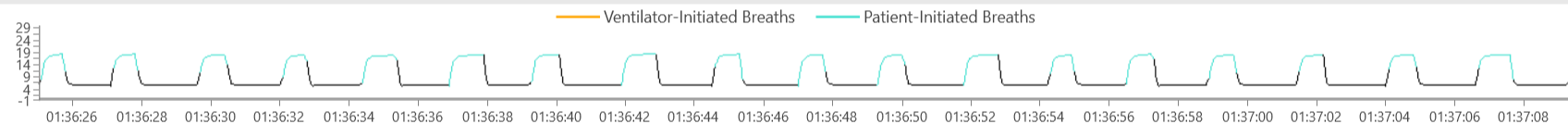


Back To Trend 30/05/2023 H321543394922 Trilogy Aeris Evo

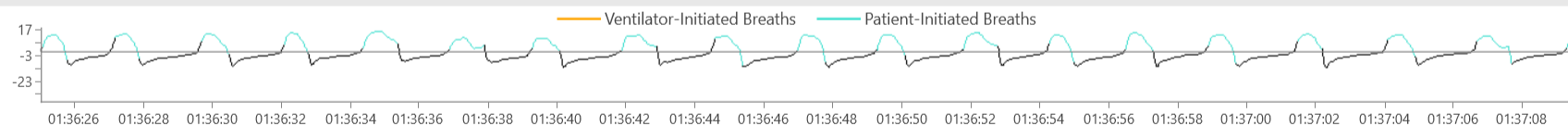
Show Summary Values Off

Pressure (cmH<sub>2</sub>O)

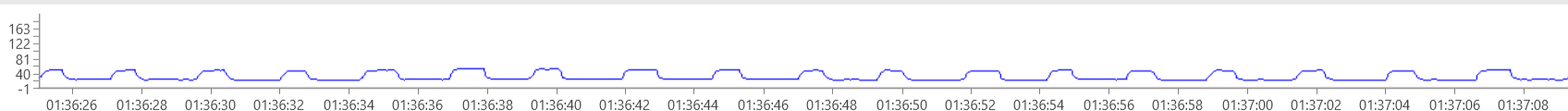
Mode: AVAPS-AE



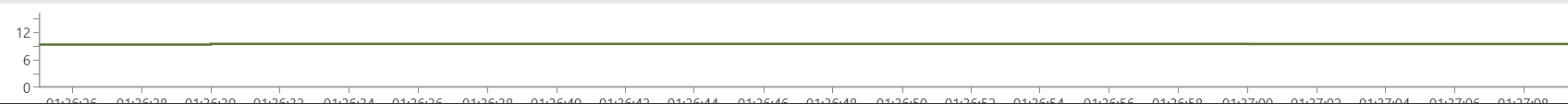
Flow (l/min)



Total Leak (l/min)



Mean Airway Pressure (cmH<sub>2</sub>O)



		<u>30/04/2023</u>	<u>07/05/2023</u>	<u>14/05/2023</u>	<u>21/05/2023</u>	<u>28/05/2023</u>
PIP	Min	0.0	0.0	0.0	0.0	0.0
	Average	19.2	19.6	19.2	19.0	19.3
	Max	24.3	24.0	24.0	24.2	24.4
PEEP	Min	0.0	0.0	0.0	0.0	0.0
	Average	8.1	8.1	8.1	8.2	8.2
	Max	8.4	8.5	8.5	8.7	8.7

# La nostra scelta

## 1. Settings: S/T AVAPS

IPAP 19/24

EPAP 8

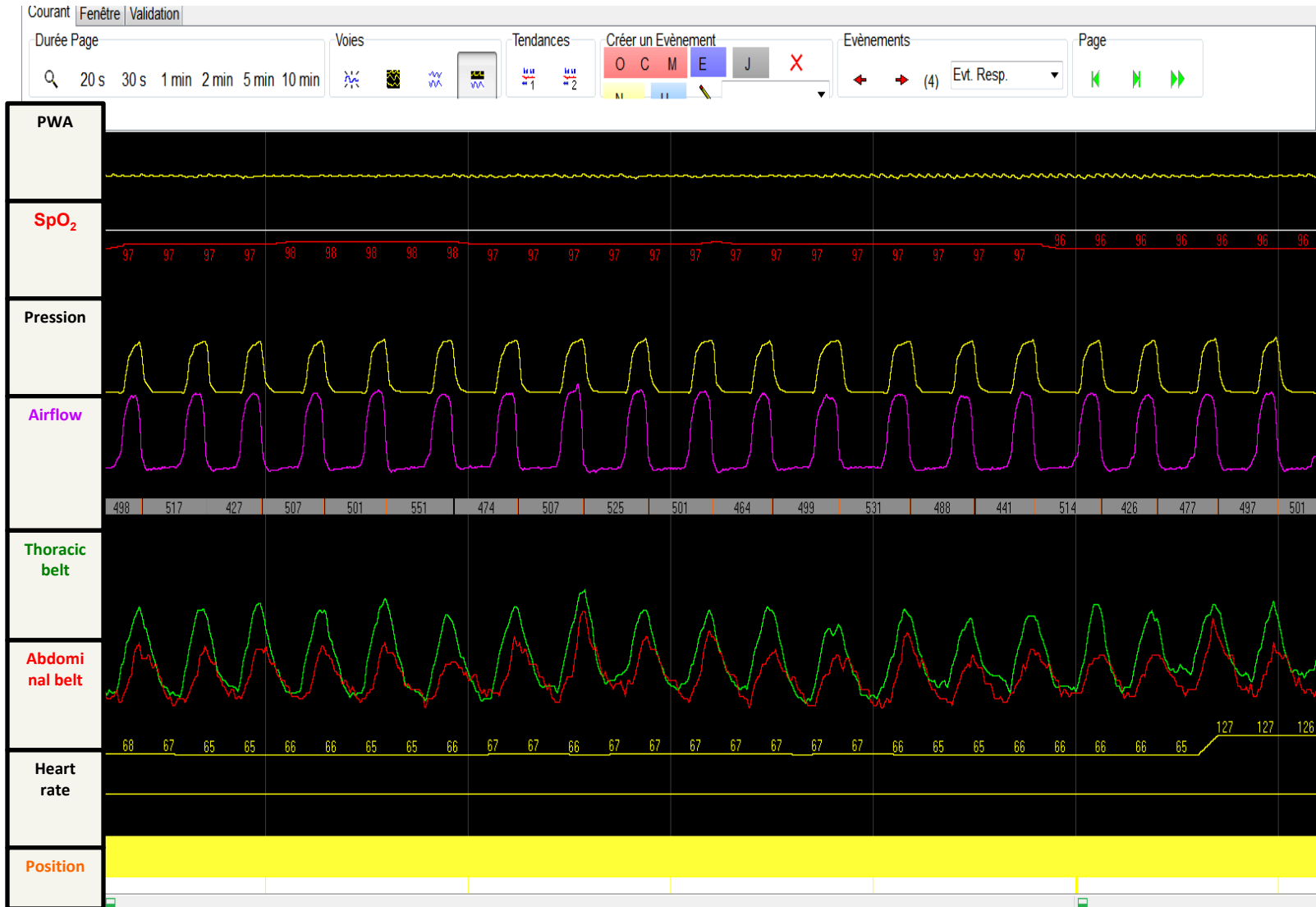
Vt 110 mL

rampa 1

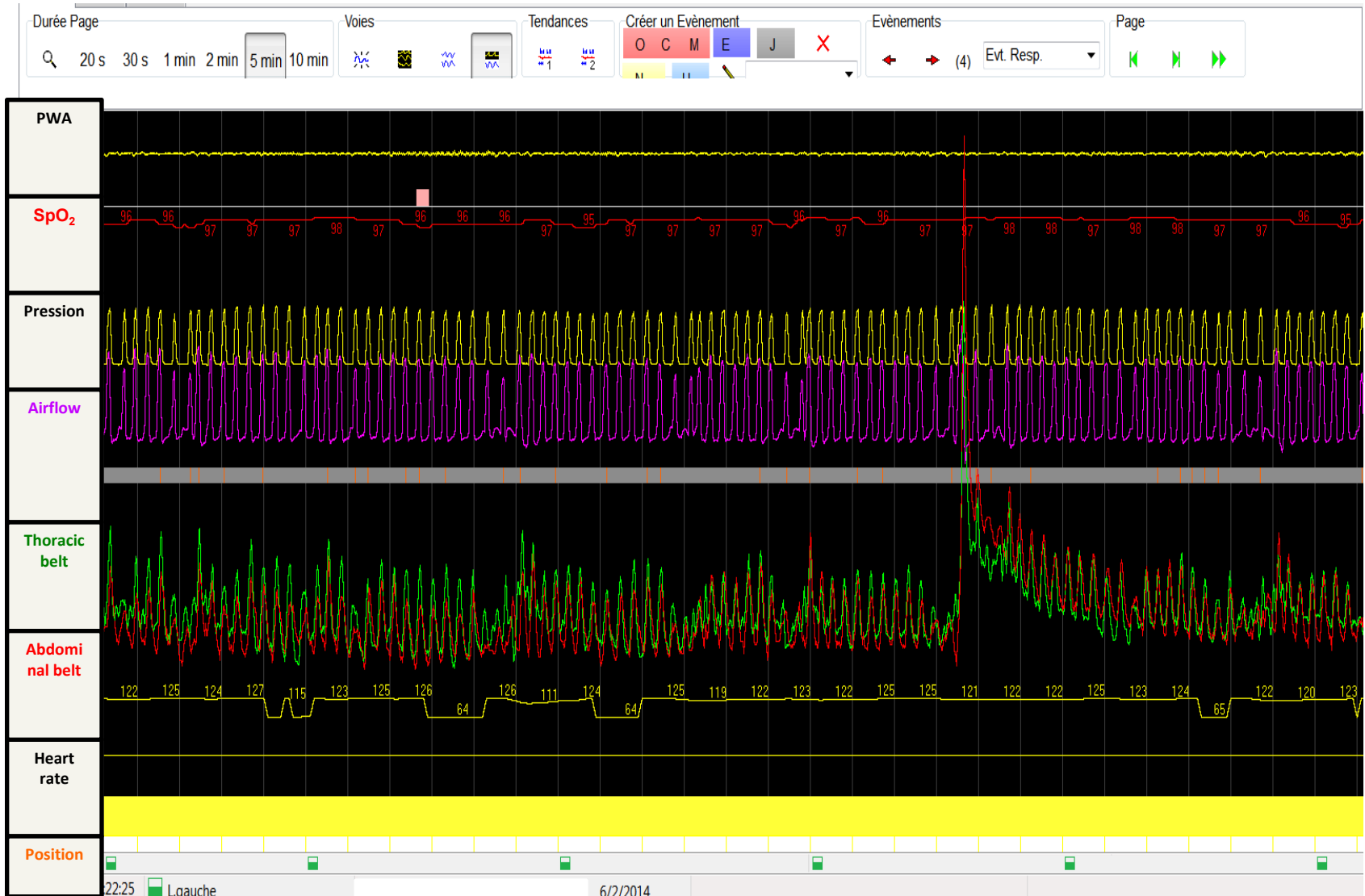
Insp Trigger 1L/min, Exp trigger 20%

FR 20/min

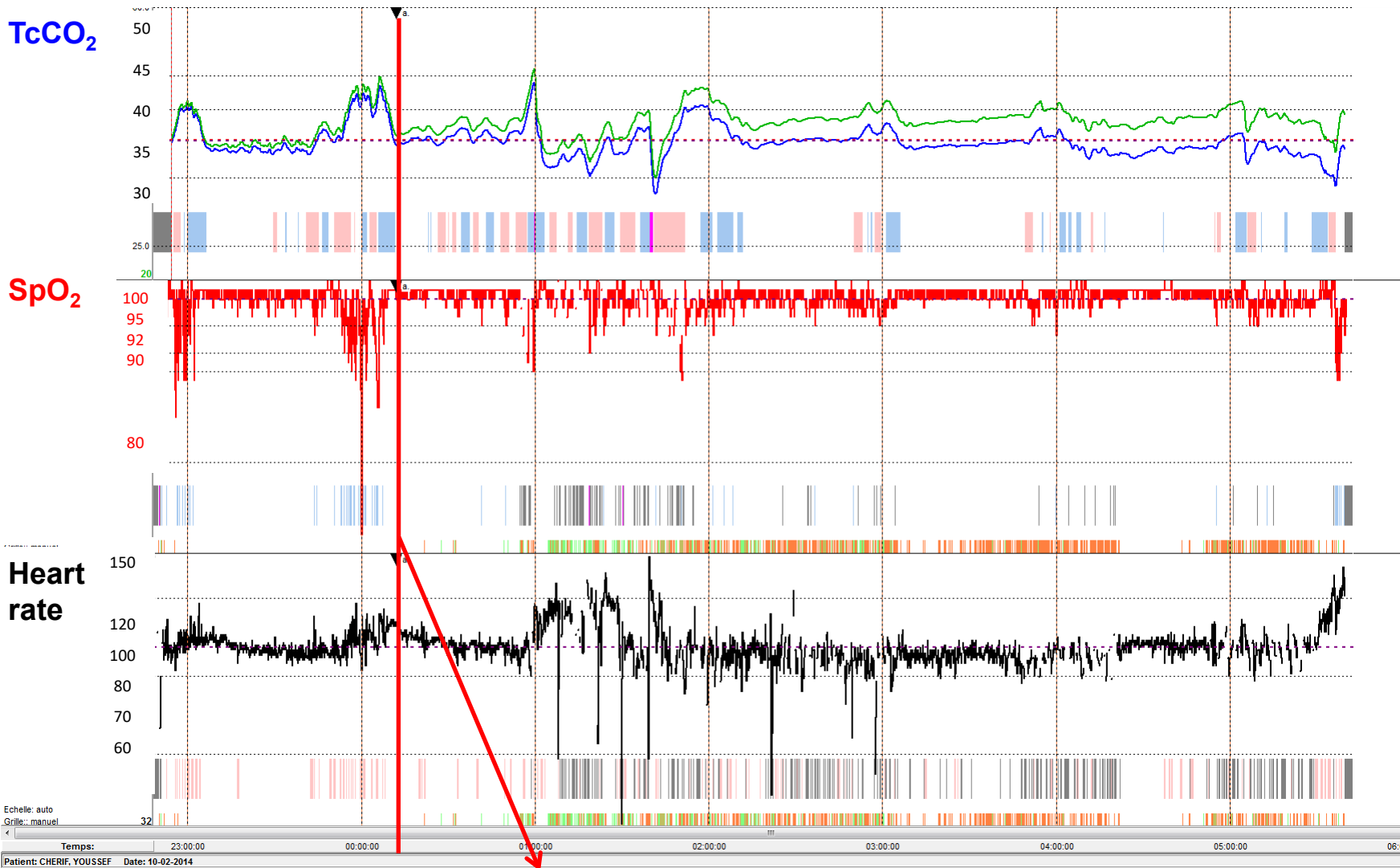
# Poligrafia in NIV



# Poligrafia in NIV



# Capnografia in NIV



NIV started

Domande?