Identifying Ventilator Dyssynchronies via Waveform Assessment

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Intelligent Ventilation since 1983

Disclosures

- Currently an employee of Hamilton Medical Inc.

Objectives

- Explain Importance of ventilator synchrony
- Identify common synchrony issues via waveform
- Define Synchrony vs Dyssynchrony
- Learn how to make basic vent changes to marry the vent to the patient

Why is synchrony important

- Patient comfort
- Less sedation
- Less time on the vent
- Less alarms

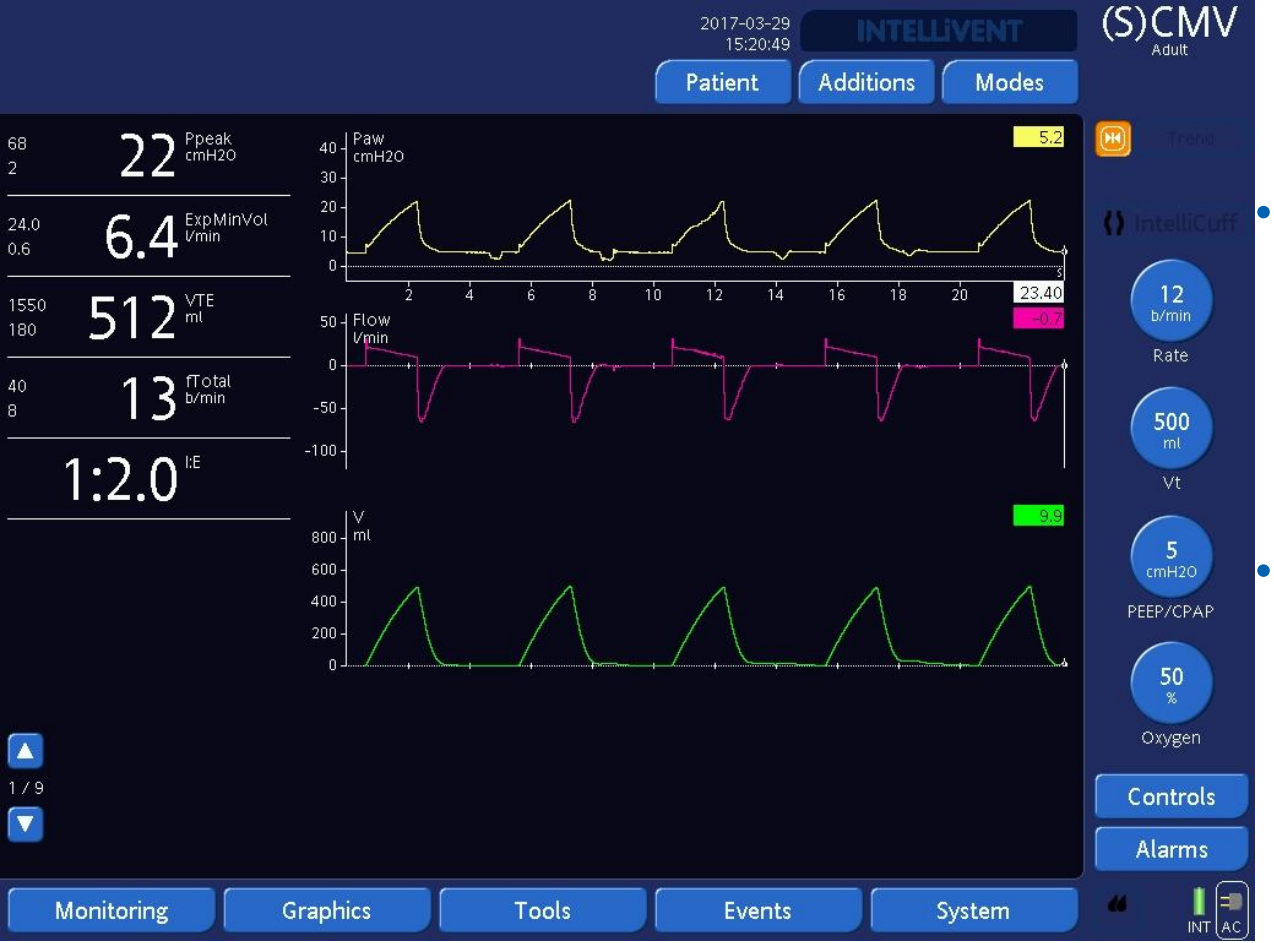
Definitions for ventilator/patient interactions

- Synchrony- vent and patient are in phase working together

- Dyssynchrony- vent and patient not in phase. Typically vent is not responding to changes in patient conditions

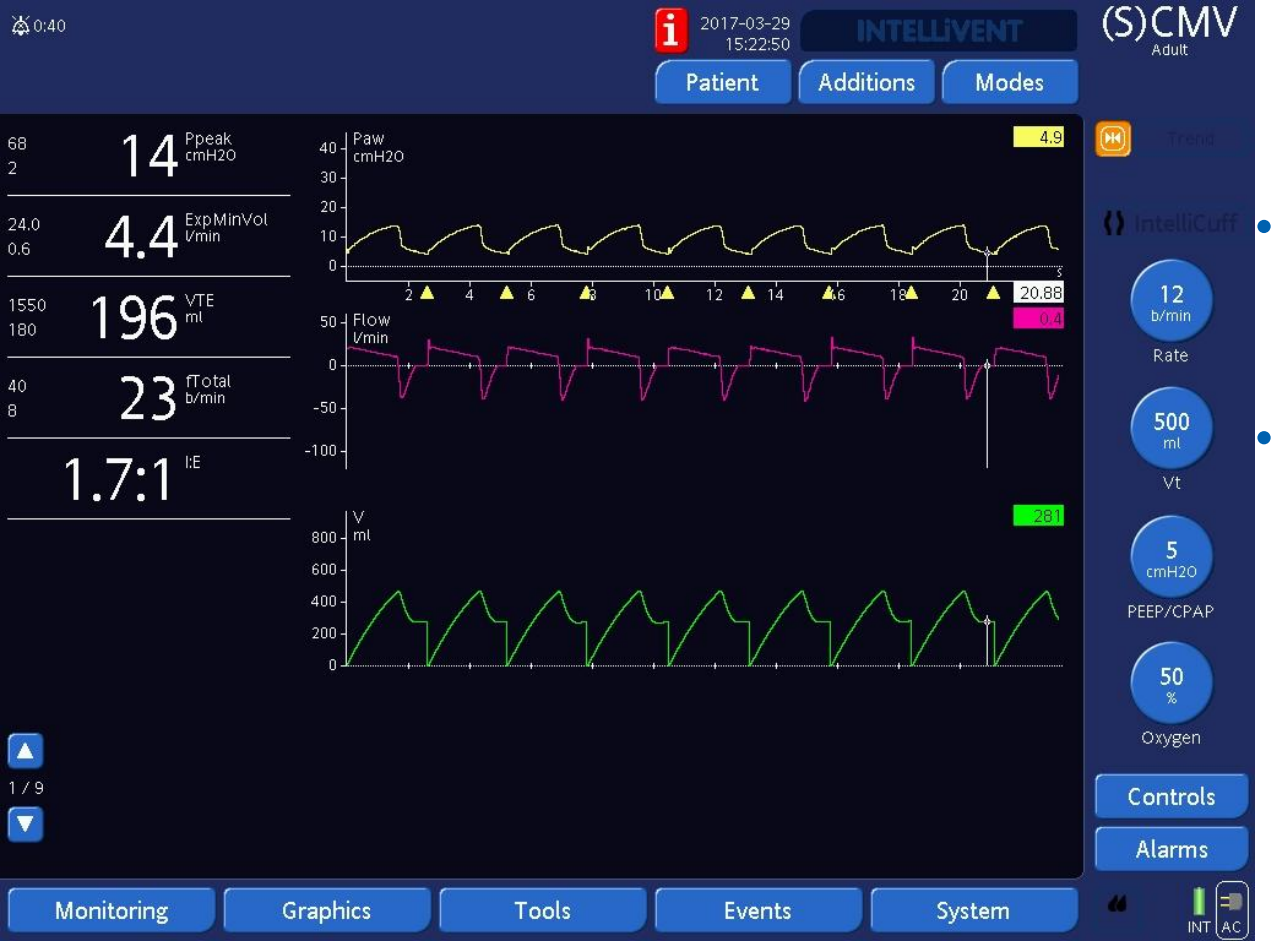
Pulmonary Mechanics

- P0.1- Pressure at the first .1 seconds of a breath. Measures a patient's central drive to breath. The more negative the number the higher the drive.
- Compliance
  - Chest wall vs Lung
- Resistance
  - Inspiratory- measures force prior to lower airways (Asthma)
  - Expiratory- measure force during exhalation. Collapsed airways (COPD)
- RC_{exp} Expiratory time constants
  - Longer for COPD
  - Shorter for ARDS



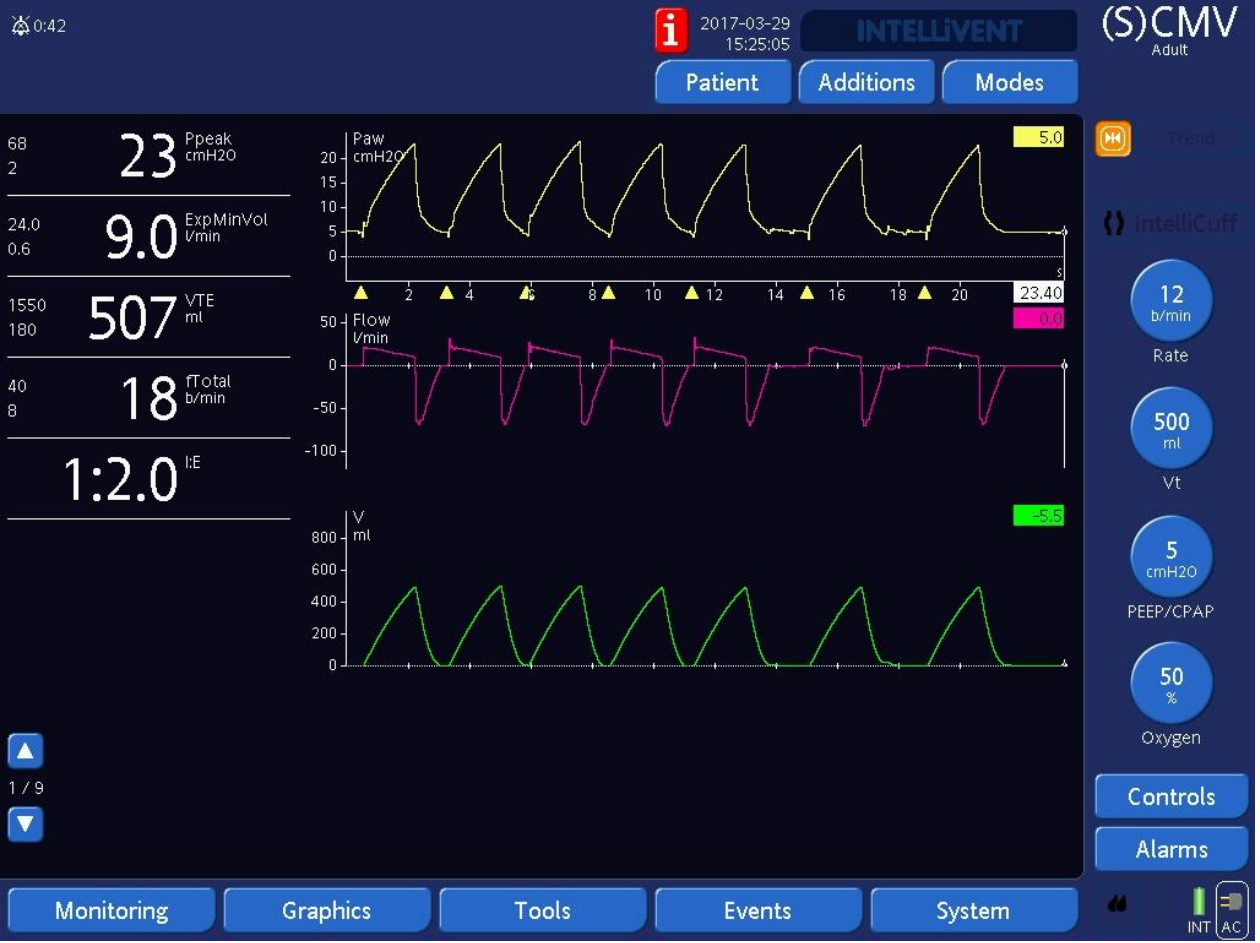
Missed inspiratory attempts

- Assess
  - P0.1
  - Pt effort
  - Trigger setting
  - Autopeep
- Intervention
  - ↓trigger setting
  - ↑ PEEP to match or decrease VE



Inadvertent Triggering (leak)

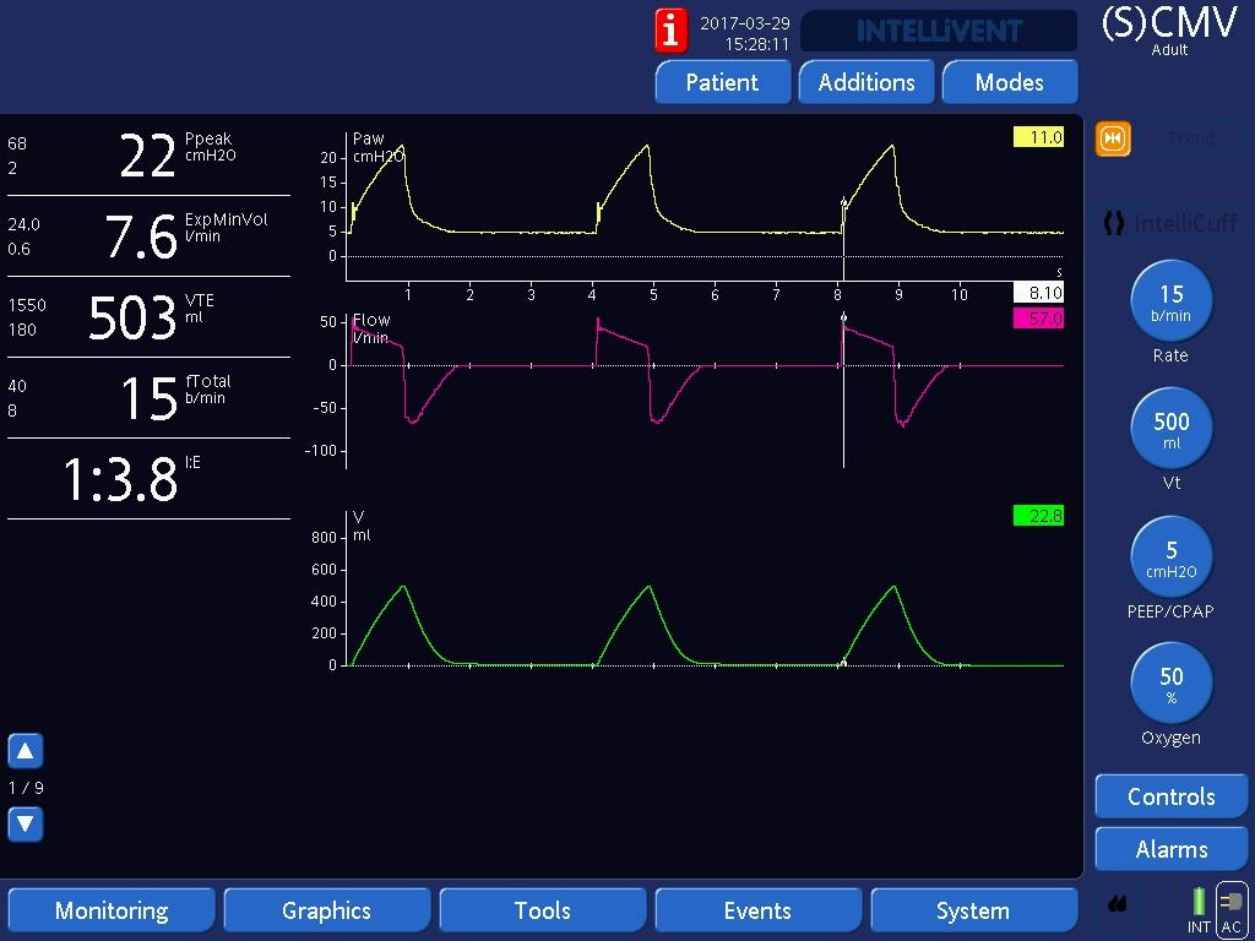
- Assess
  - Patient effort, check P0.1, circuit integrity
- Intervention
  - Increase Trigger setting
  - Fix leak



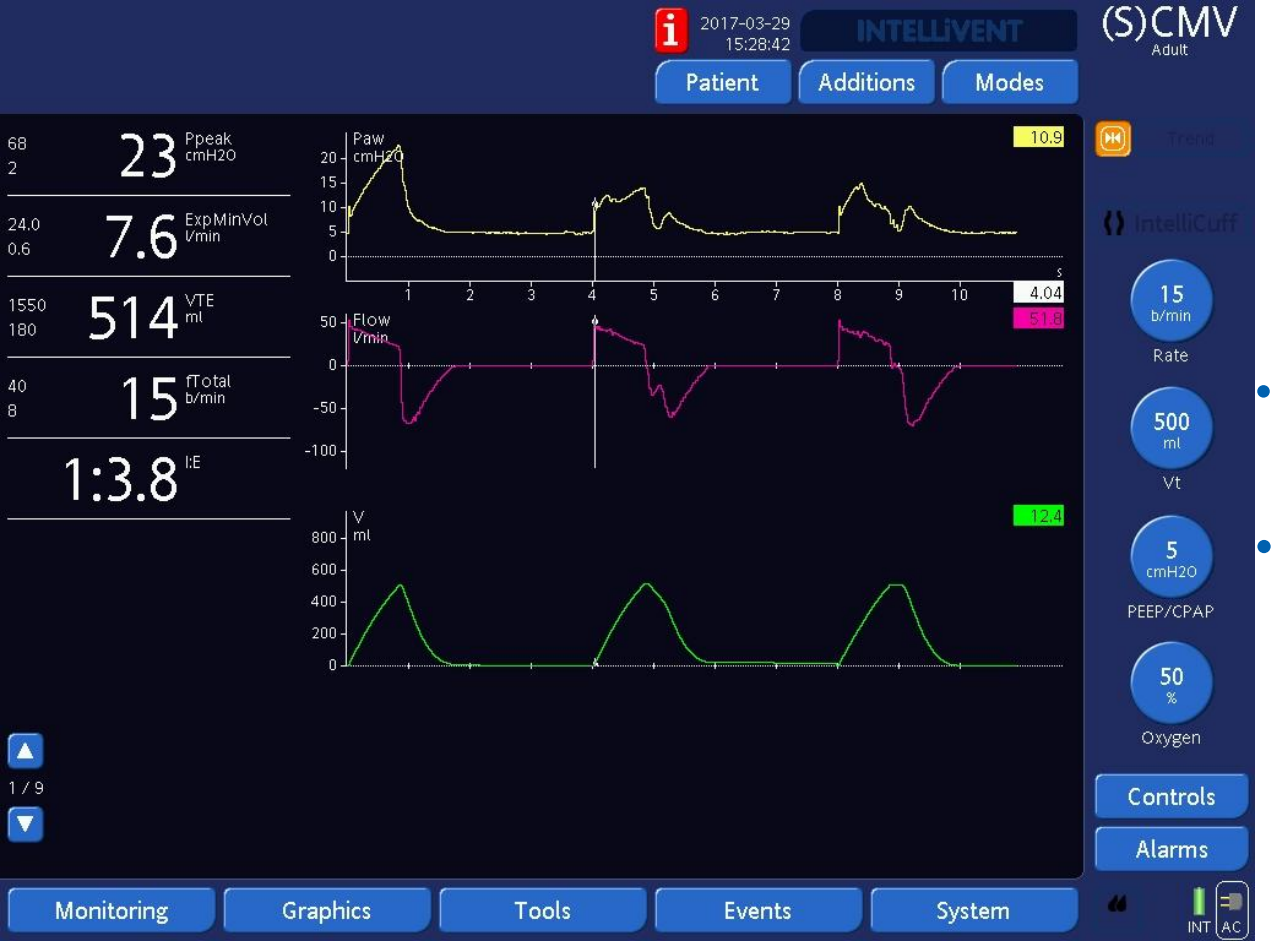
Inadvertent Triggering

- Assessment
  - Assess drive, check P0.1,
- Causes
  - Heart Rate
  - External Device
    - Pacemaker
- Intervention
  - Increase trigger setting
  - Manipulate external device

CMV No patient effort

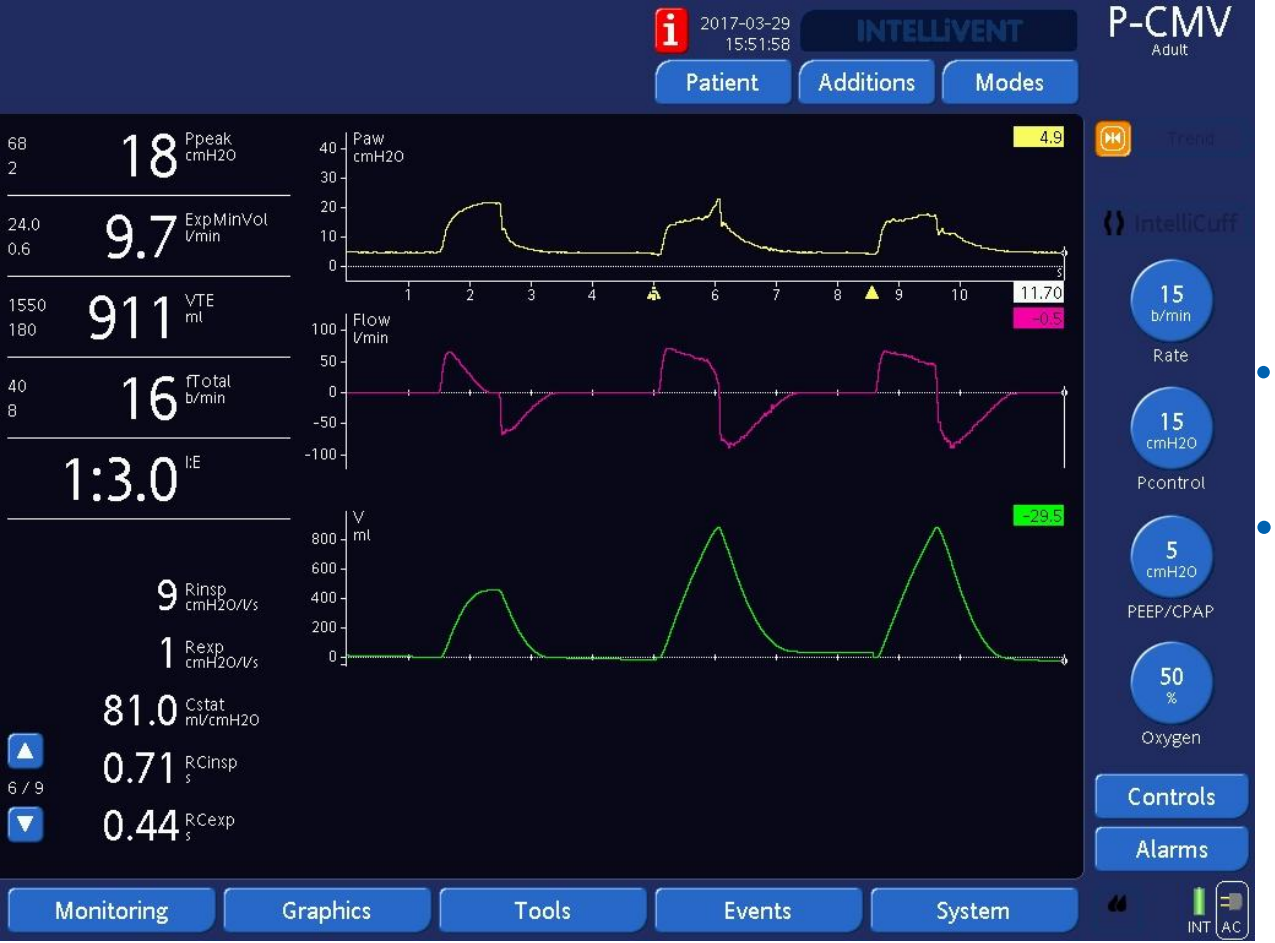


Flow Starvation in Flow Controlled modes



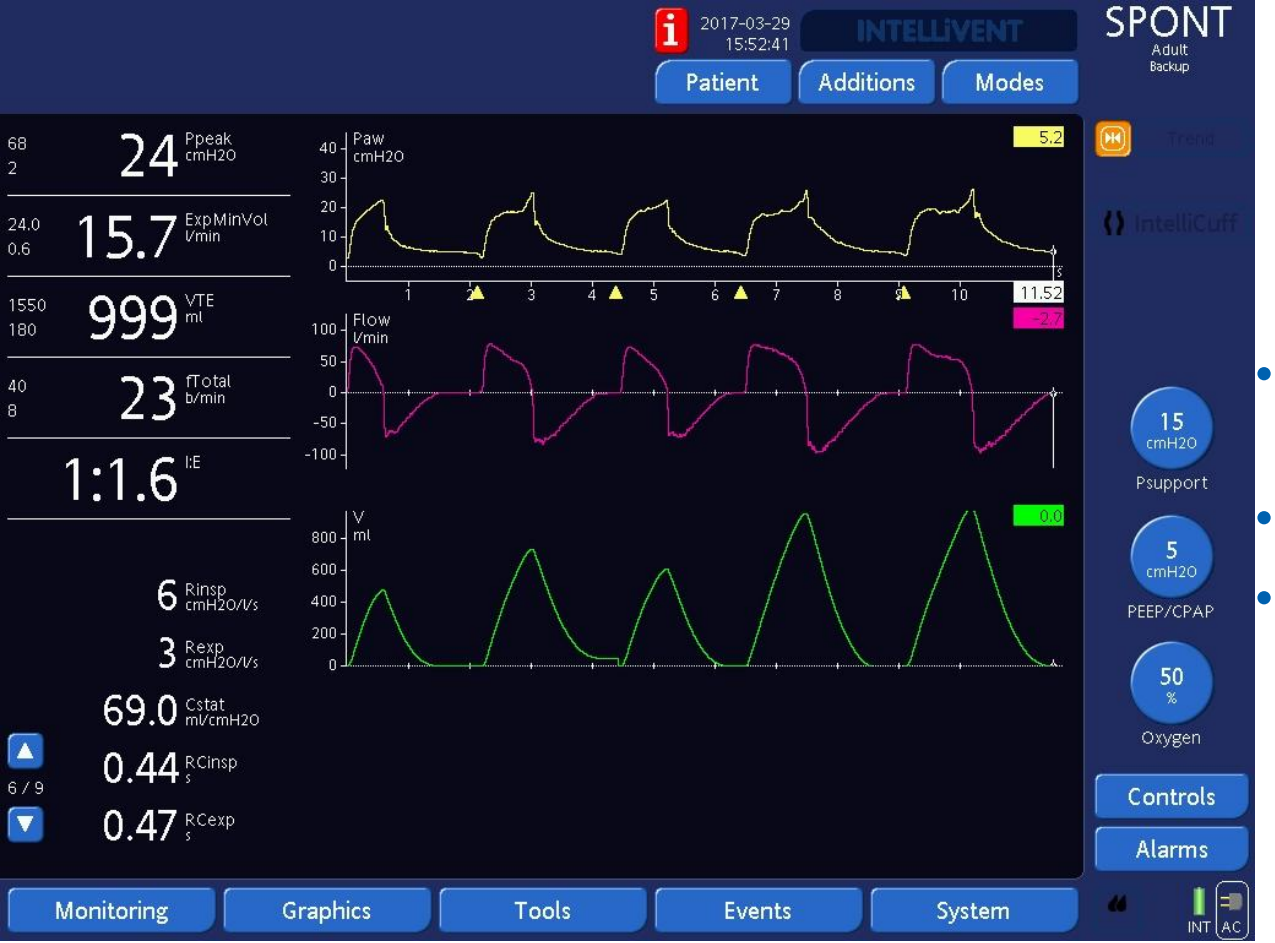
- Assess P0.1, Pminimum
- Actions
  - ↑ PF
  - Switch to Flow variable mode (PCV, Spont)

Increased Patient work in Pressure Targeted modes



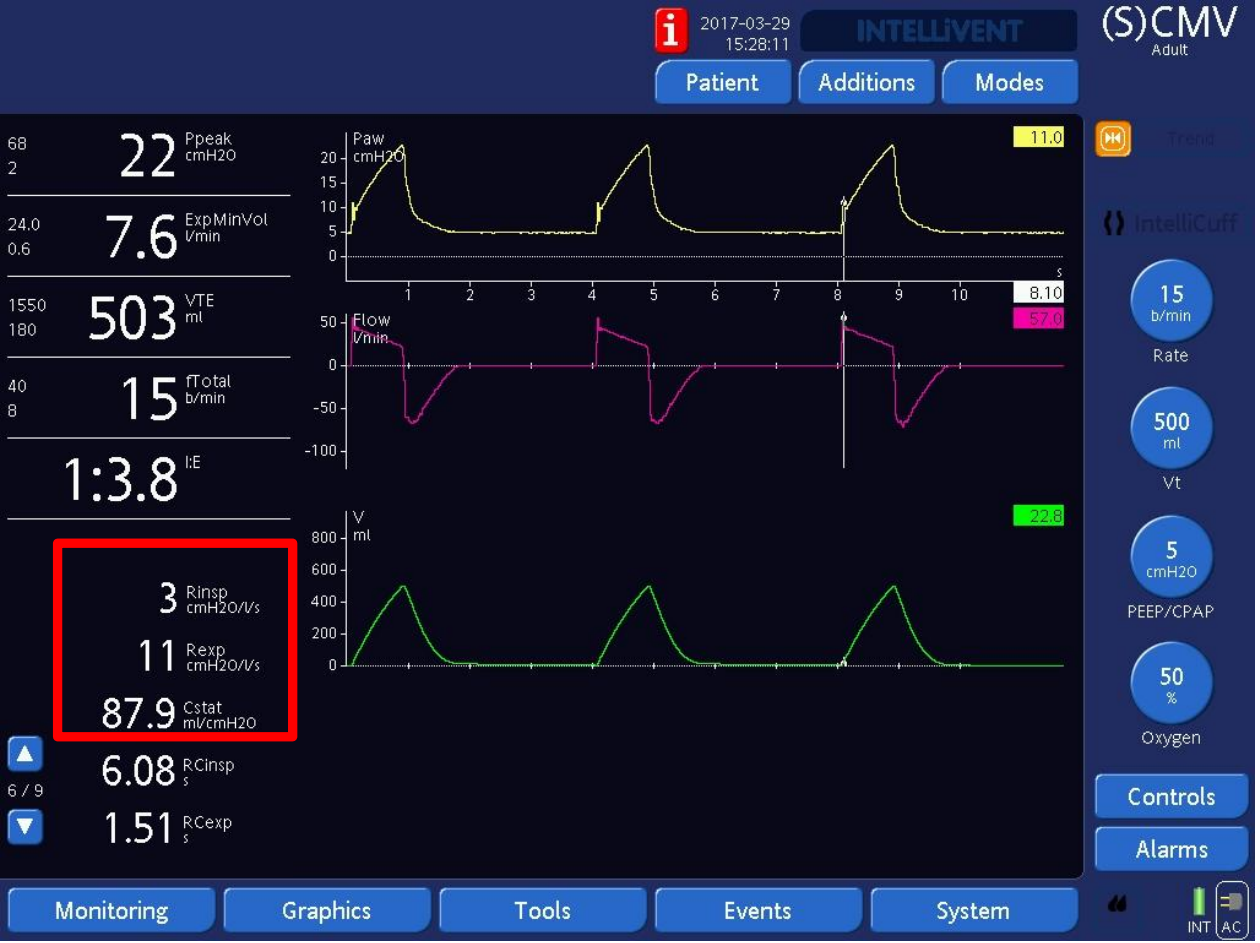
- Assess P0.1
- Actions
  - ↑ support until flow waveform decelerates if significant patient work is observed

Increased Patient work Spontaneous mode

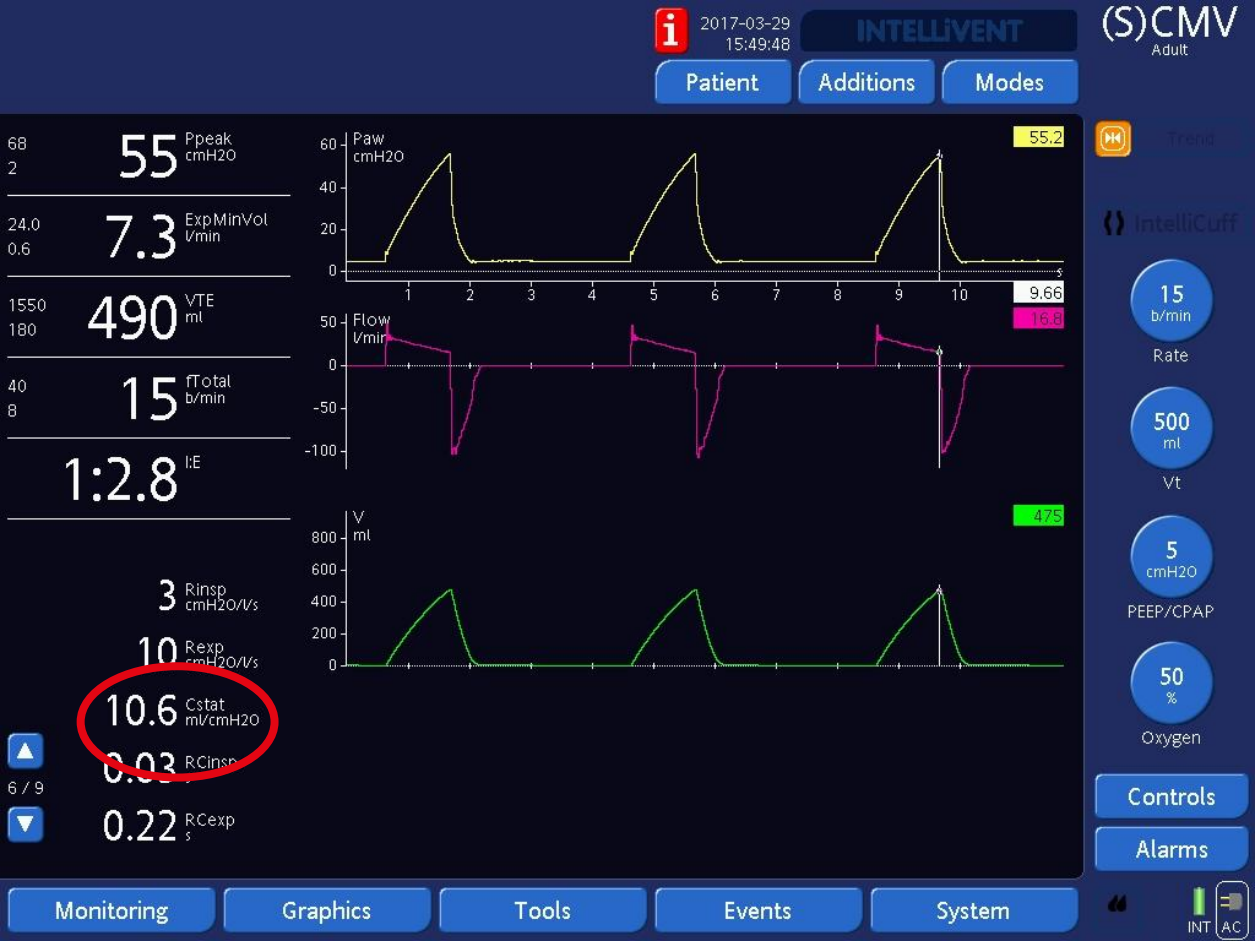


- Check flow waveform for full deceleration
- Assess P0.1
- Actions
  - ↑ support until flow waveform decelerates if significant patient work is observed

CMV No patient effort



P_{aw} Increase because of compliance changes



Paw increase at end inspiration

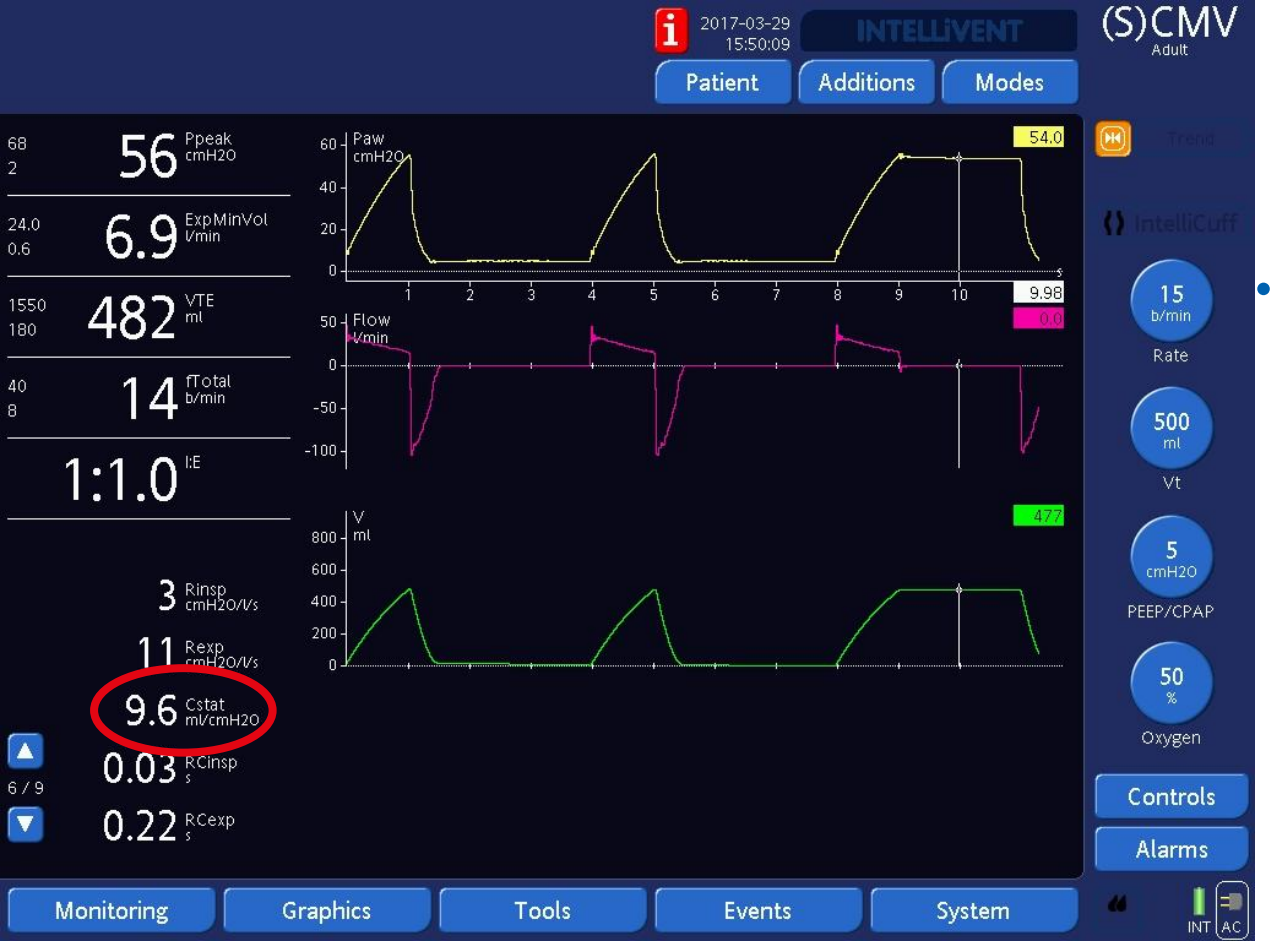
- ARDS
- Fibrotic
- Chest wall compliance issues

Actions

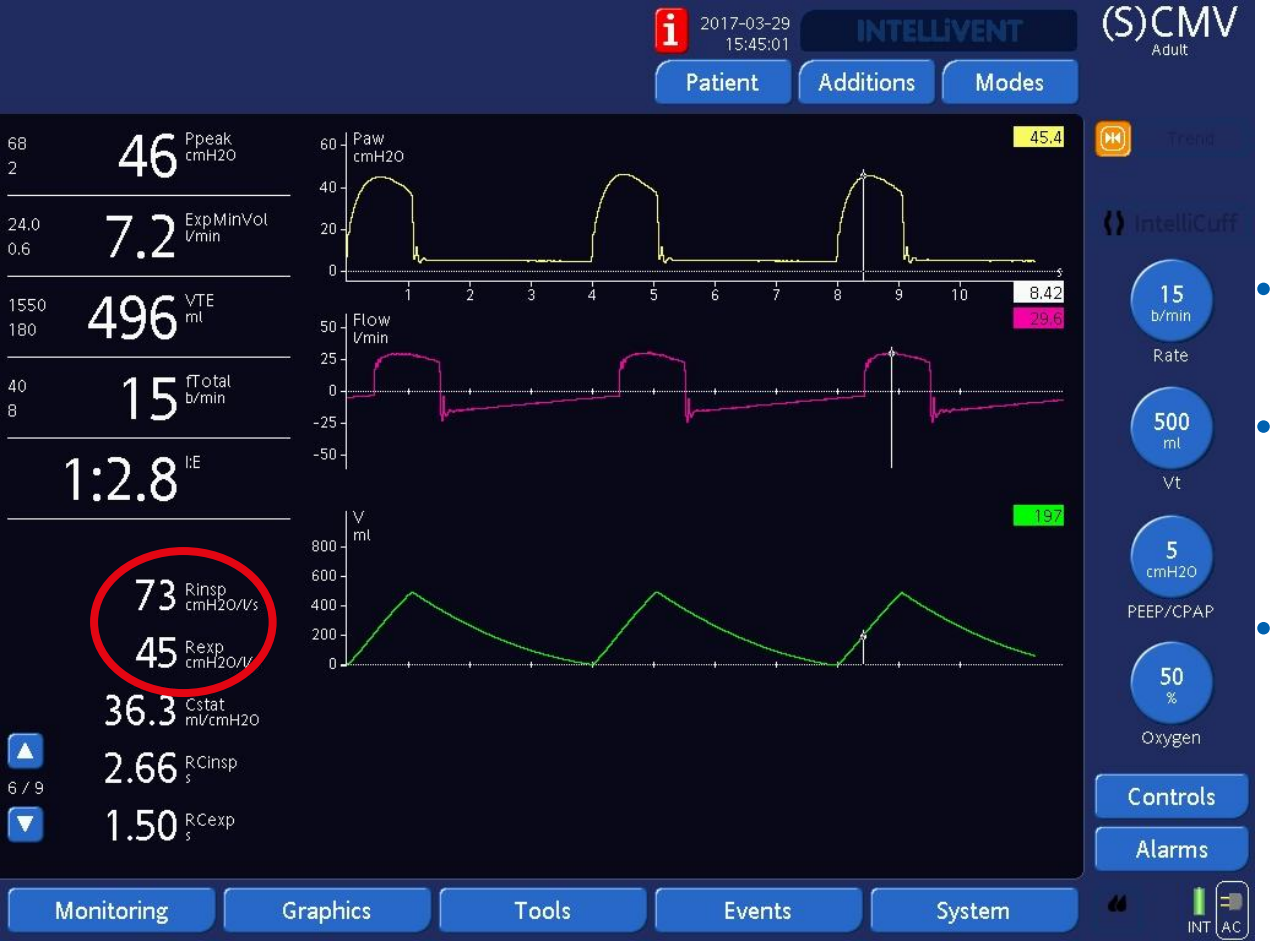
- Increase PEEP (if early ARDS or chest wall issues)
- Check Tidal volume

Plateau and Peak are the same

- Perform inspiratory hold

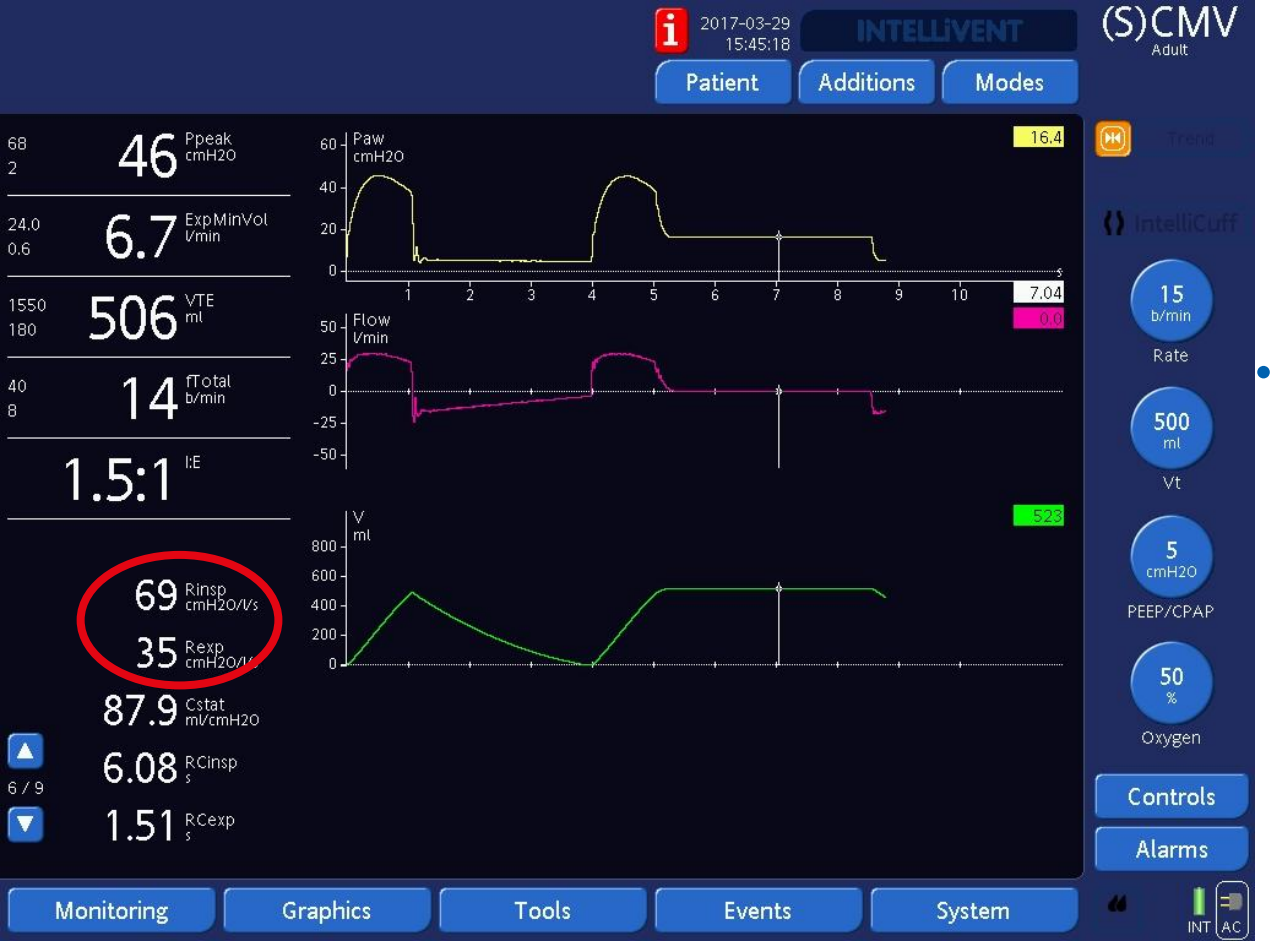


P_{aw} increase because of airway resistance



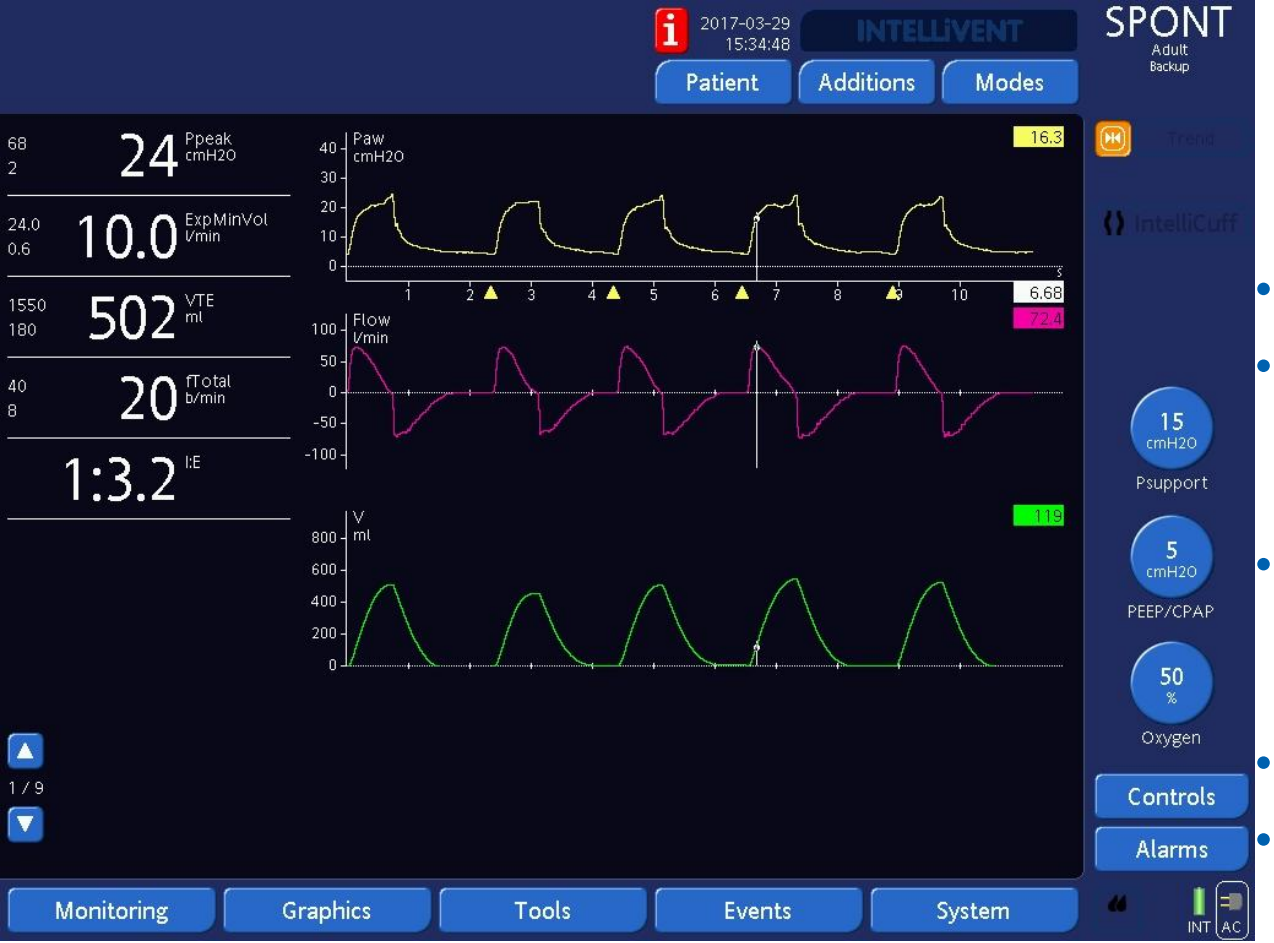
- Paw increase is in the beginning of Inspiration
- Causes:
  - COPD, Asthma, small ET tube
- Interventions
  - Bronchodilator
  - Heliox
  - Consider larger tube
  - Increase PEEP

Plateau with increase in Resistance



- Plateau is significantly less than Paw

ETS (Expiratory Trigger Sensitivity)



- ETS 5%
- Once flow decelerates to 5% of initial flow exhalation starts
- If PF is 100 lpm once flow decelerates to 5 lpm exhalation starts
- I-time is longer
- Vt is larger

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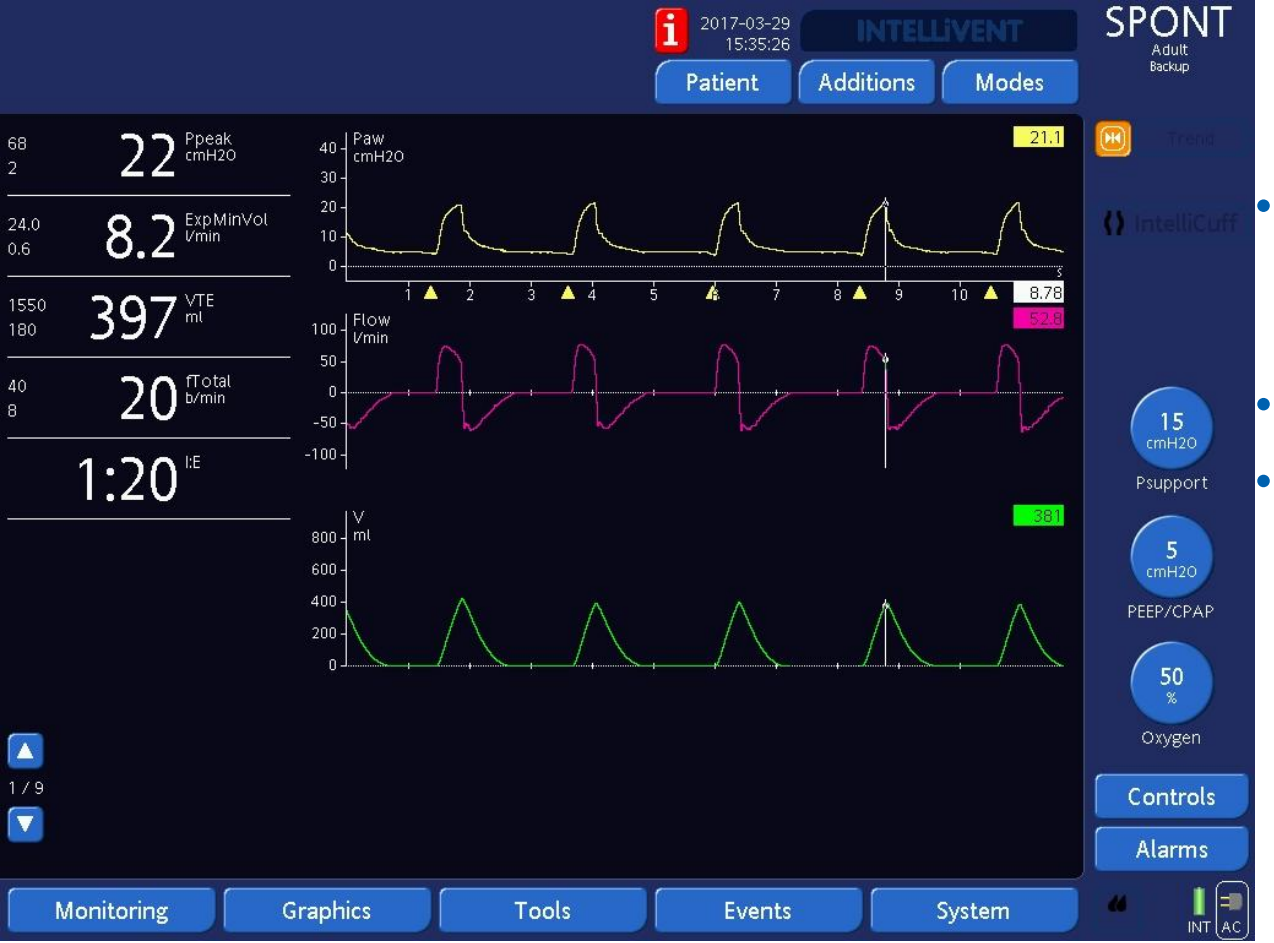
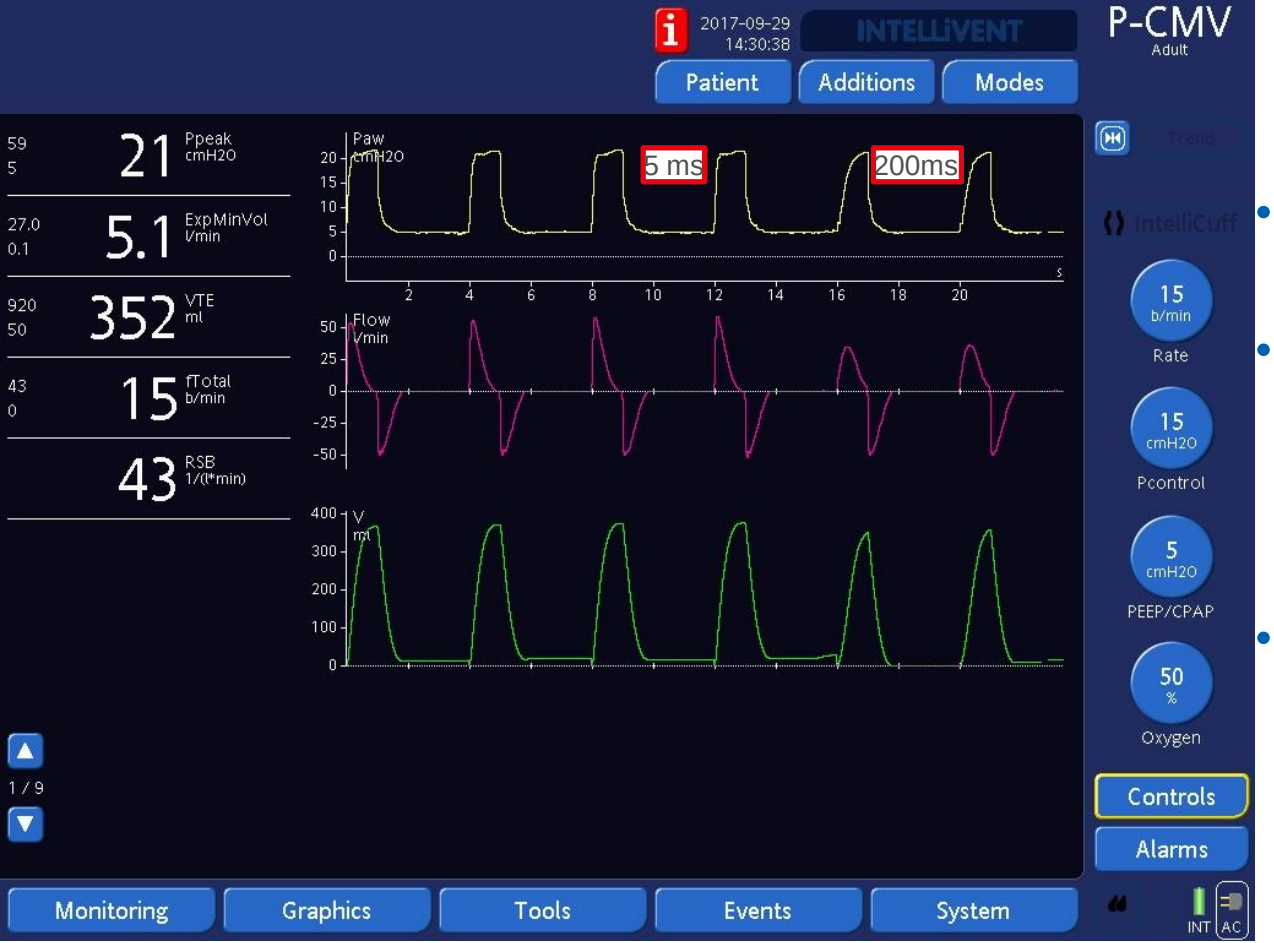
ETS 70%

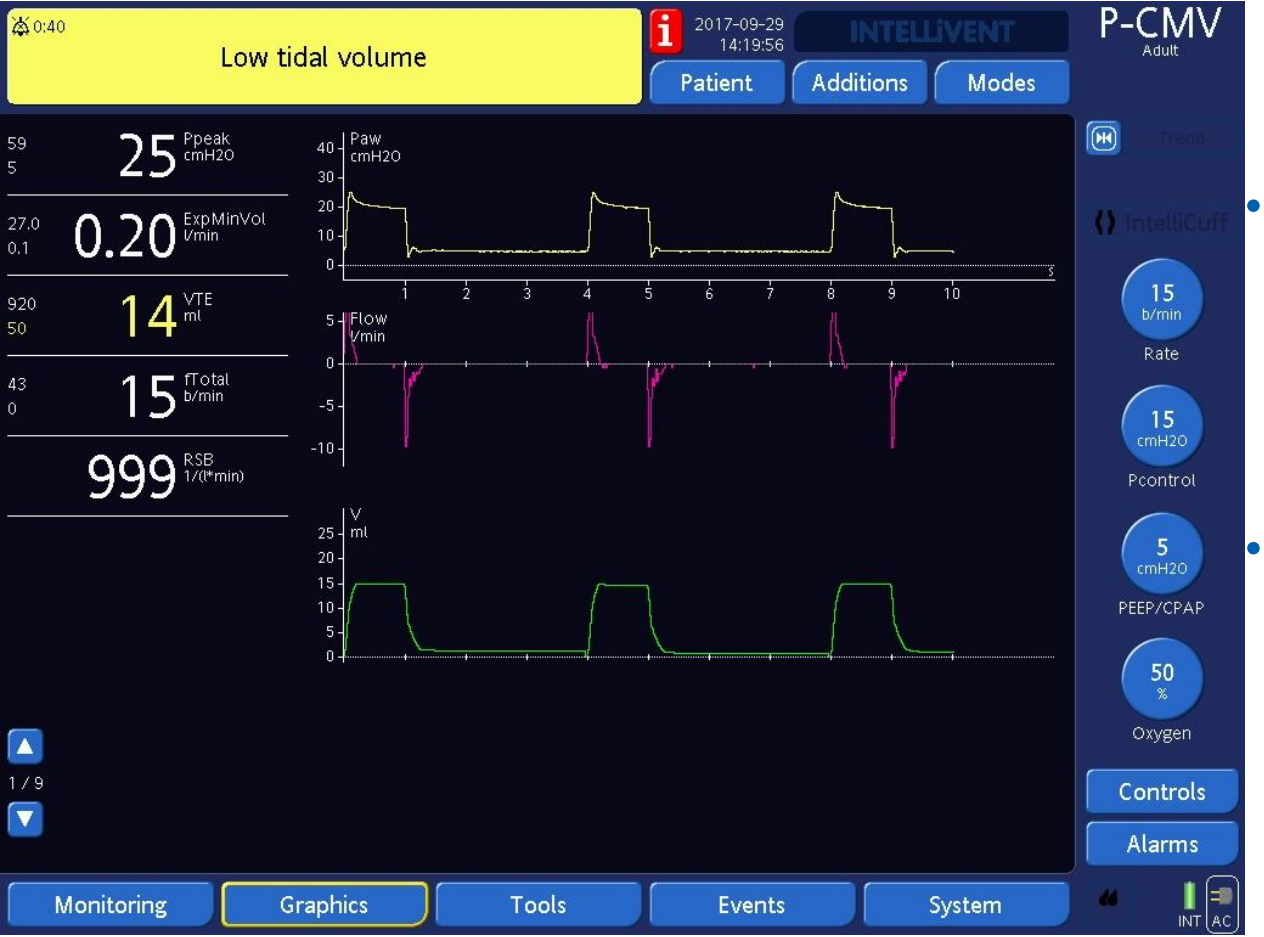


- Once flow decelerates to 70% of initial flow exhalation starts.
- I-time is shorter
- Vt is lower

Pramp (Pressure Ramp)



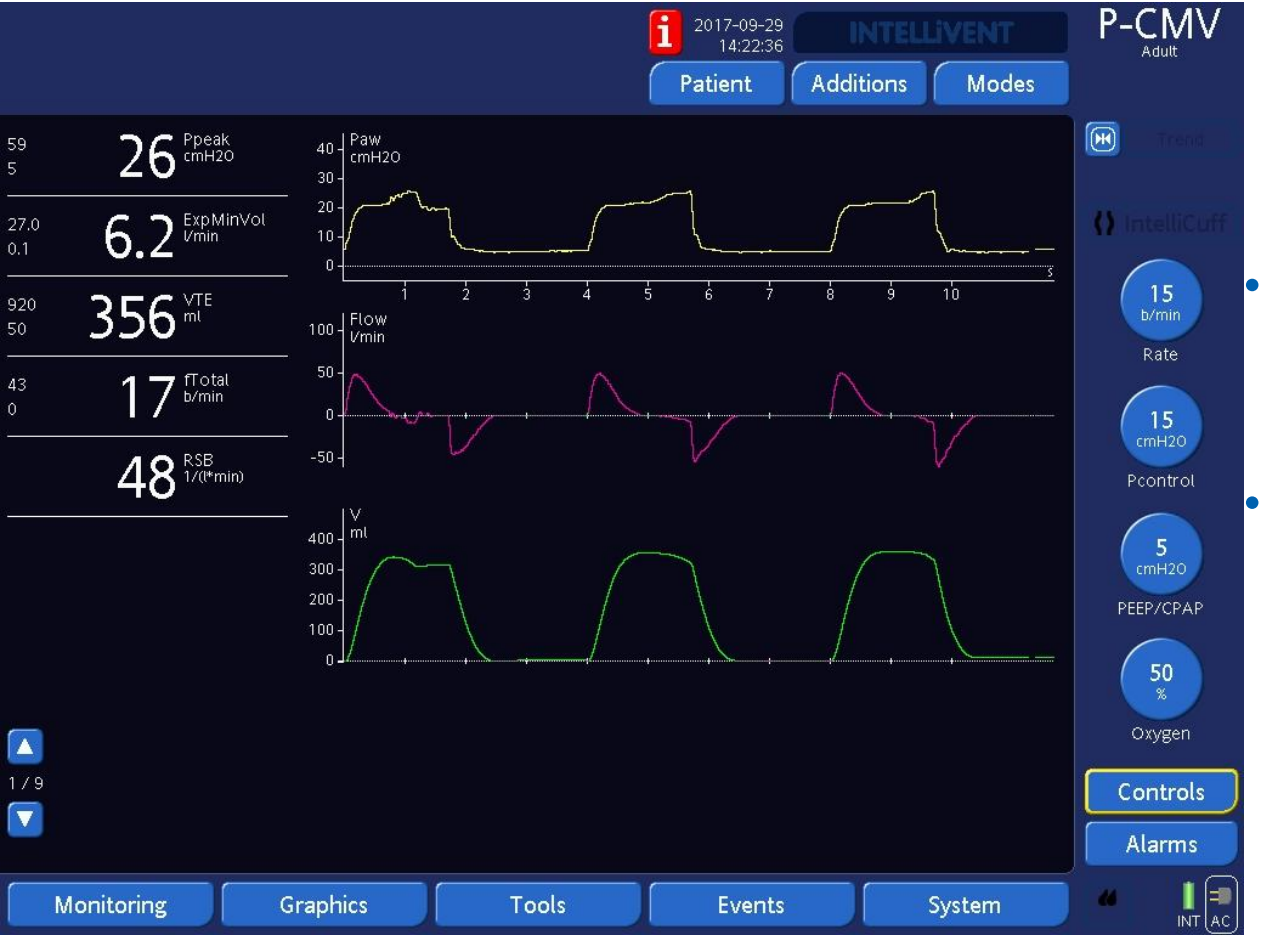
- How fast pressure setting is reached
- Pramp of 5 ms
  - Initial flow is higher
  - Vt is higher
- Pramp of 200
  - Initial flow is lower
  - Vt is lower
  - Paw max is delayed



Pramp to Aggressive

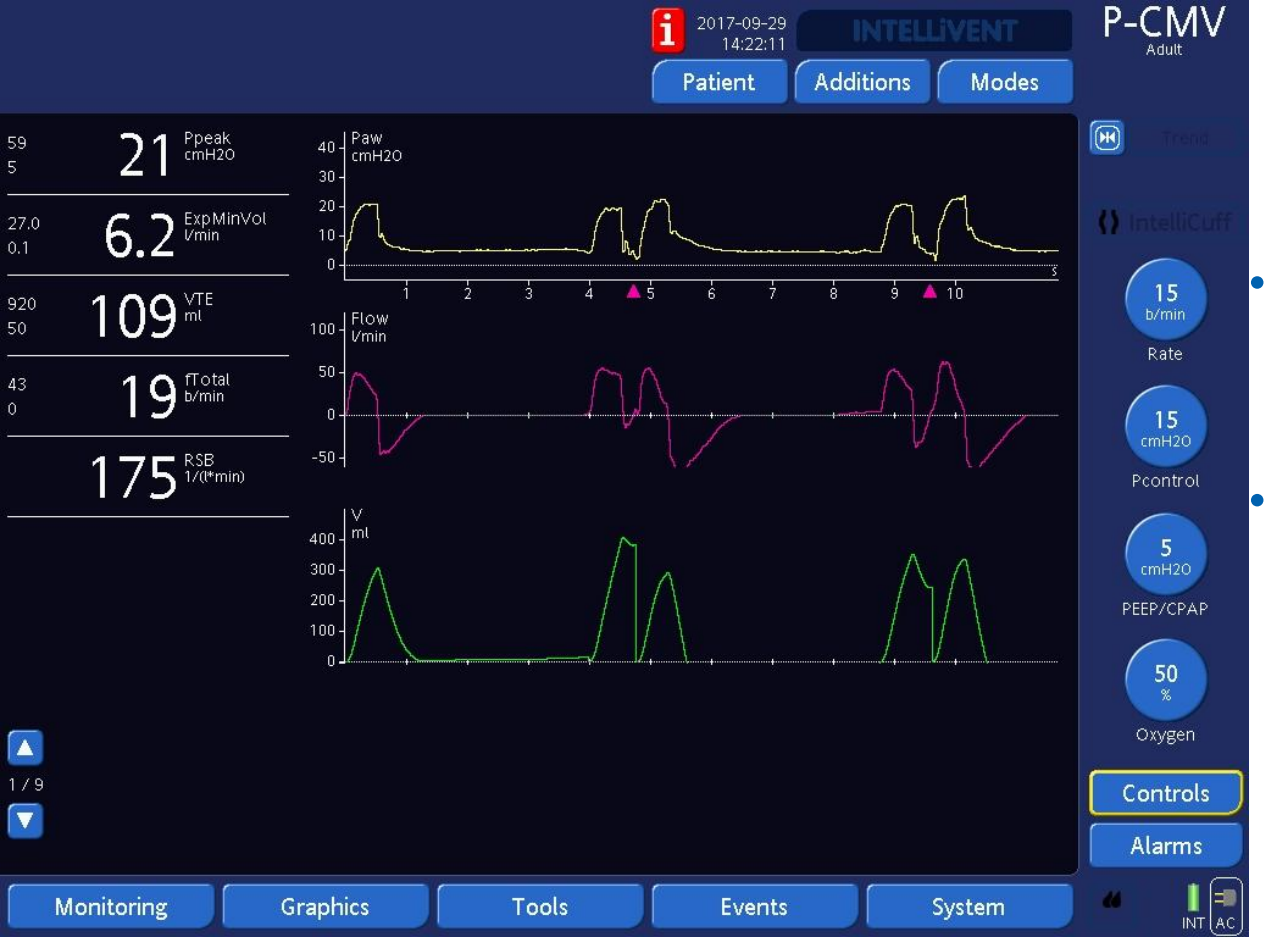
- Assess
  - Look for spike at beginning of inspiration
  - Patient comfort
  - ET tube size
- Intervention
  - Increase Pramp setting till spike goes away

Late cycling



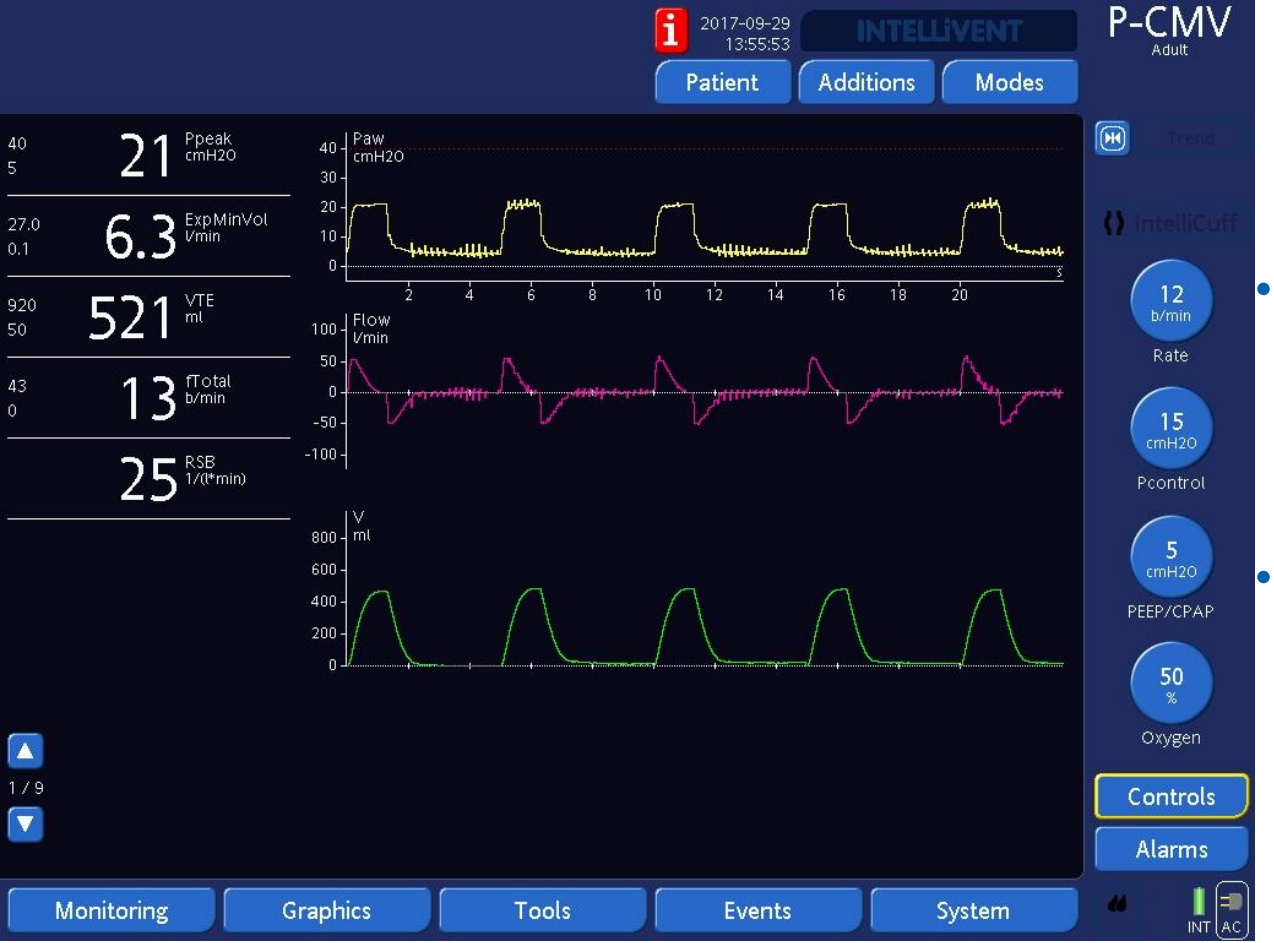
- Assess
  - I-time setting
  - ETS if in spont mode
- Intervention
  - Decrease I-time till bump goes away
  - Increase ETS setting
  - Place in spont mode to assess spontaneous I-time

Early cycling



- Assess
  - I-time
  - ETS if in spontaneous mode
- Intervention
  - Increase I-time till double breaths stop
  - Decrease ETS %
  - Place patient in spont mode to find spontaneous I-time

Oscillations in the respiratory circuitry



- Causes
  - Secretions
  - Condensate
- Intervention
  - Suction
  - Clear Circuit

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Conclusion

- Assess waveforms for synchrony
- Assess waveforms to tweak vent settings

Thank You For Your Time

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