

# Validation and evaluation of respiratory movements

- Patients after major surgery
- Frequent use of depressant analgesic agents e.g. morphine
- Useful monitor would reliably transduce rate, and also indicate obstruction.
- Complications are frequent and poorly detected: 10 to 15% of patients with opioid infusions.
- Overdyk FJ, Carter R, Maddox RR, Callura J, Herrin AE, Henriquez C. Continuous oximetry/capnometry monitoring reveals frequent desaturation and bradypnea during patient-controlled analgesia. *Anesthesia and Analgesia* 2007; 105: 412-8

# Respiratory rate monitoring in clinical practice

- Routine post-operative monitoring
- Early warning of respiratory distress (use with SpO<sub>2</sub>)
- Early warning of sepsis
- Early warning of cardiovascular decompensation
- Monitoring in patients with neuromuscular disease (eg GBS)
- Monitoring in patients with central sleep breathing disorders

# Measurements of respiration Surgical Patients

Drs Grant, Waite, Drummond  
WGH, RIE

# Postoperative breathing

Opioids are the mainstay of analgesia  
Opioids frequently depress breathing  
And cause episodes of hypoxaemia

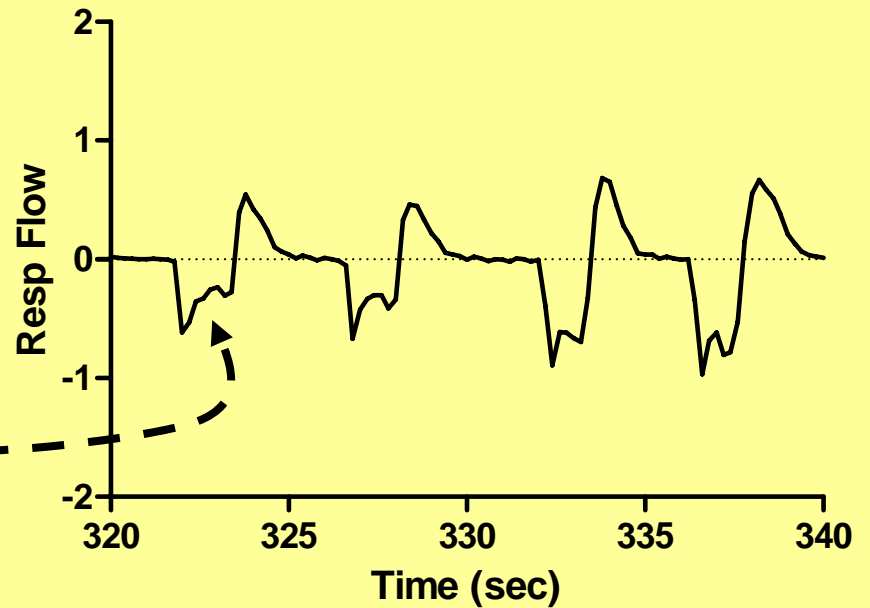
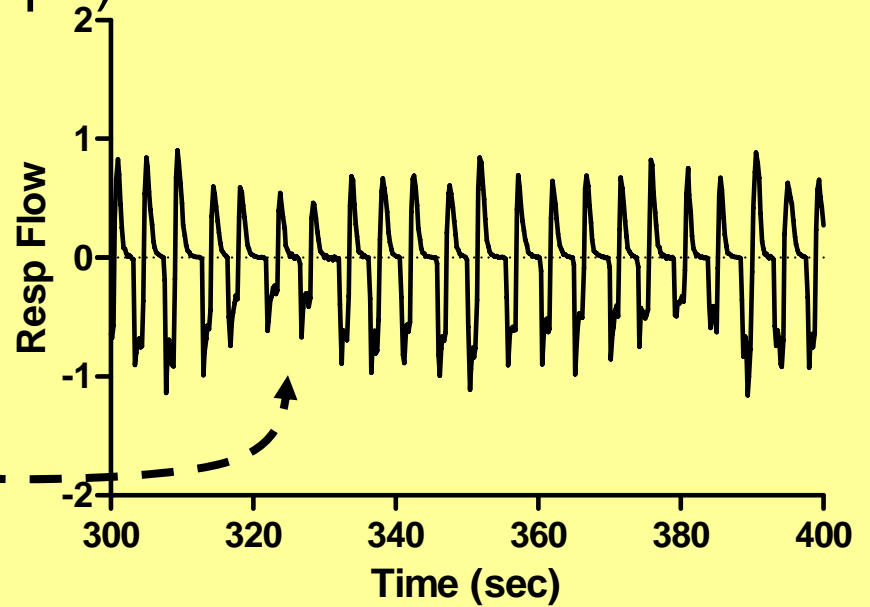
We have studied breathing in these patients using simple pressure monitors

e.g. European Journal of Anaesthesiology 2009 **25** 9-15

Note: Variable breathing (size, shape)

June 19 A.W. - Respiration

This breathing also shows partial obstruction to inspiration



# Preliminary study

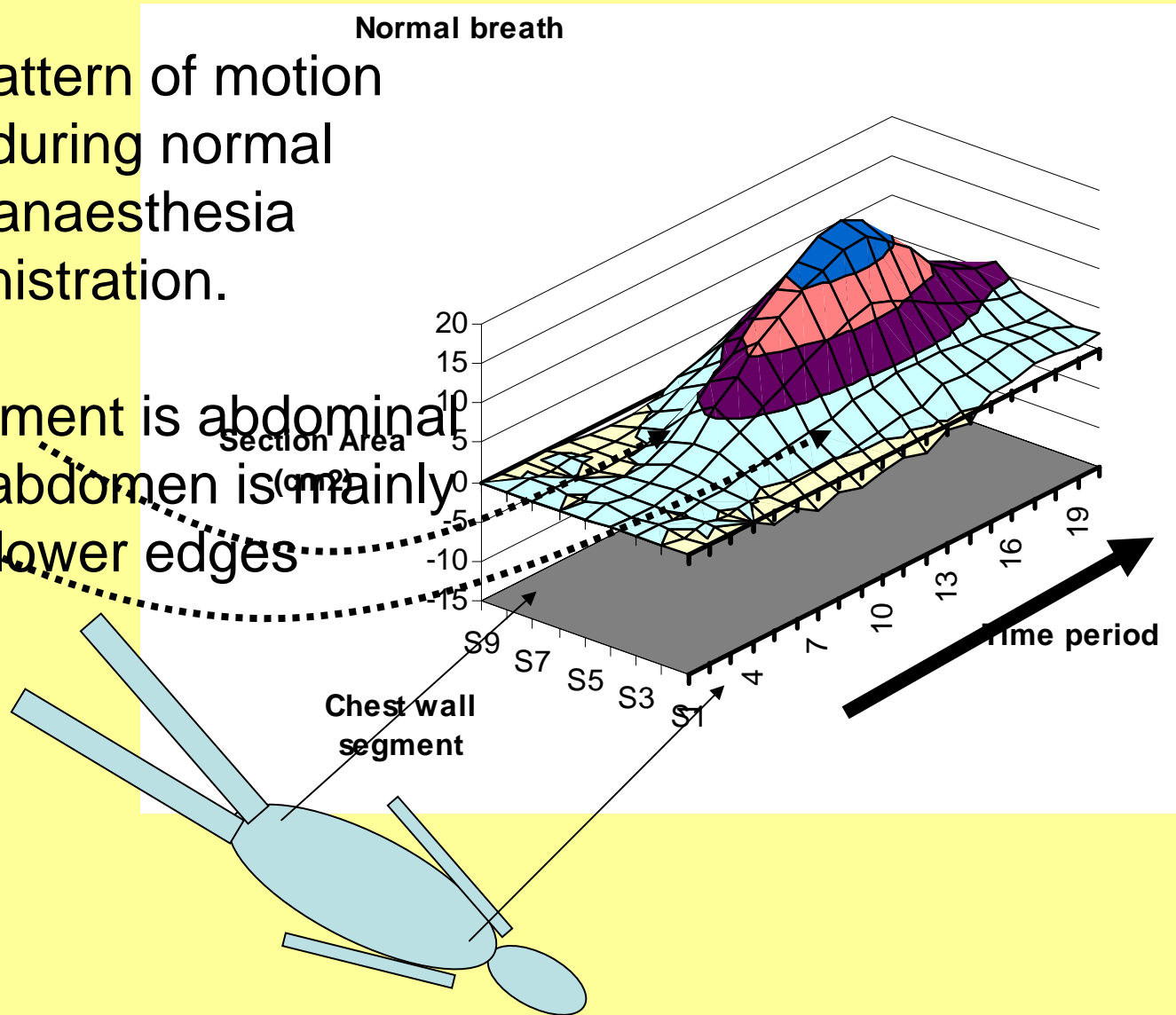
- Patients after major gynaecological surgery
- Monitor respiratory flow
- Monitor chest wall movements
  - Chest
  - Sides of abdomen
- Most movement is abdominal

# Surgical patients

- During and after breast surgery
- Monitors on ribcage and abdomen
- Best signals from abdomen
- Good relation to other signals from anaesthesia monitors

This shows the pattern of motion of the chest wall during normal breathing during anaesthesia after opioid administration.

Most of the movement is abdominal. The tilting of the abdomen is mainly at the upper and lower edges.

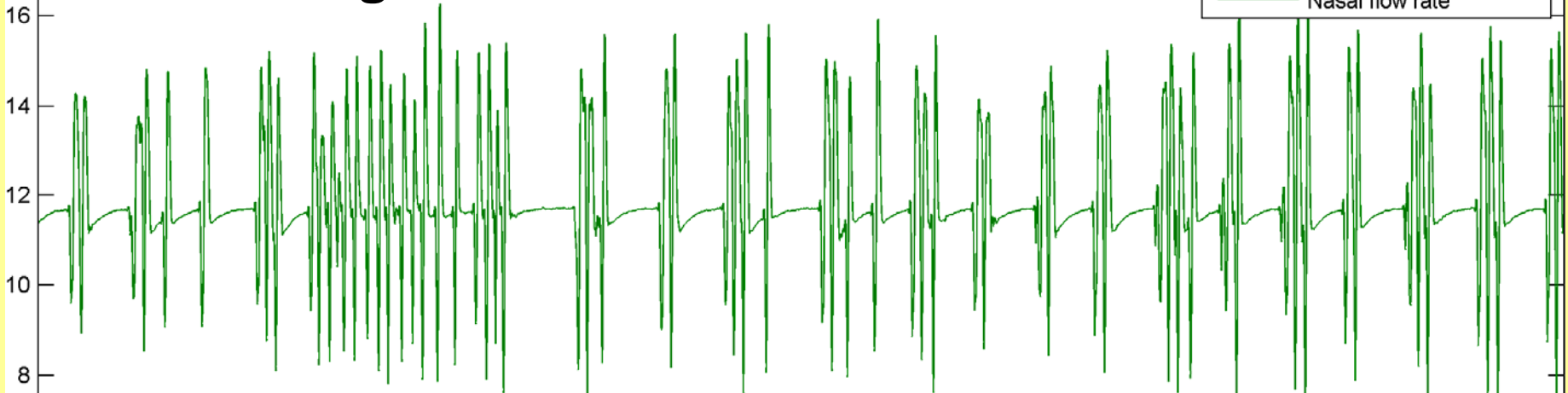
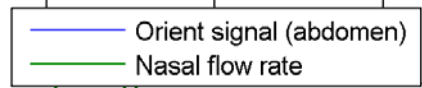


These data suggest the optimal placement for position sensors.

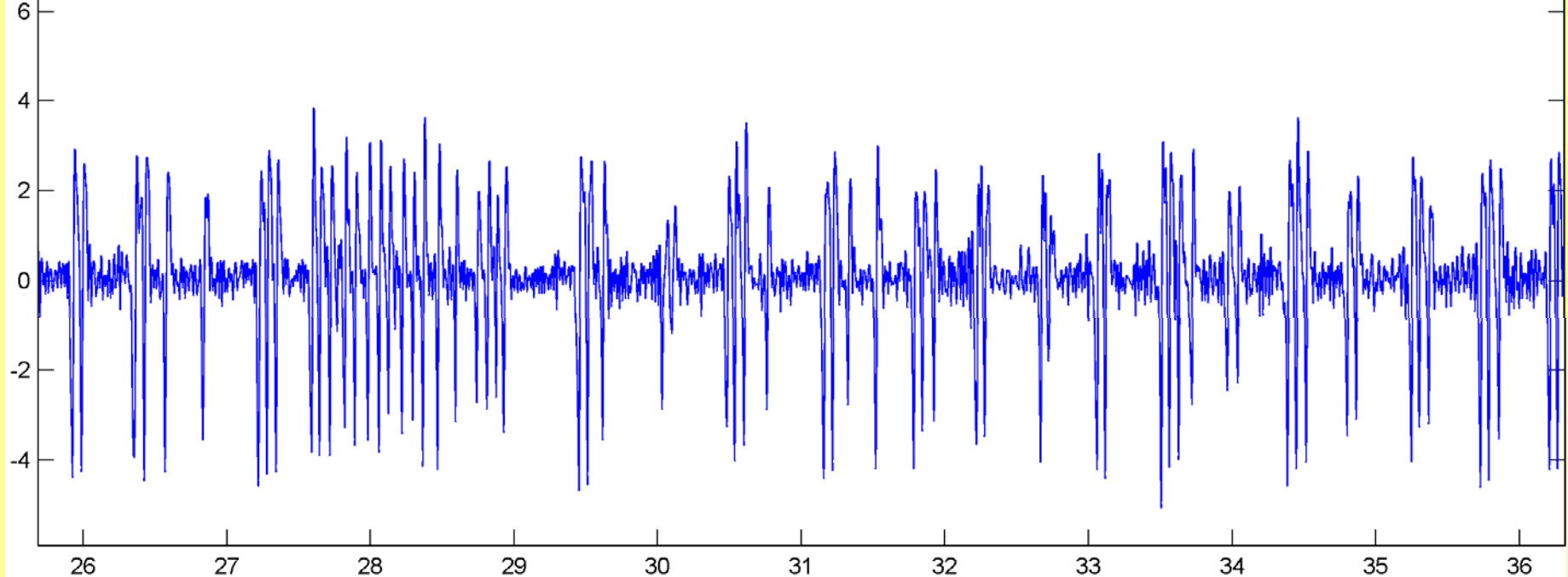
$\times 10^{-3}$

### GD5 Respiration Signal

# Orient signal



# Nasal flow

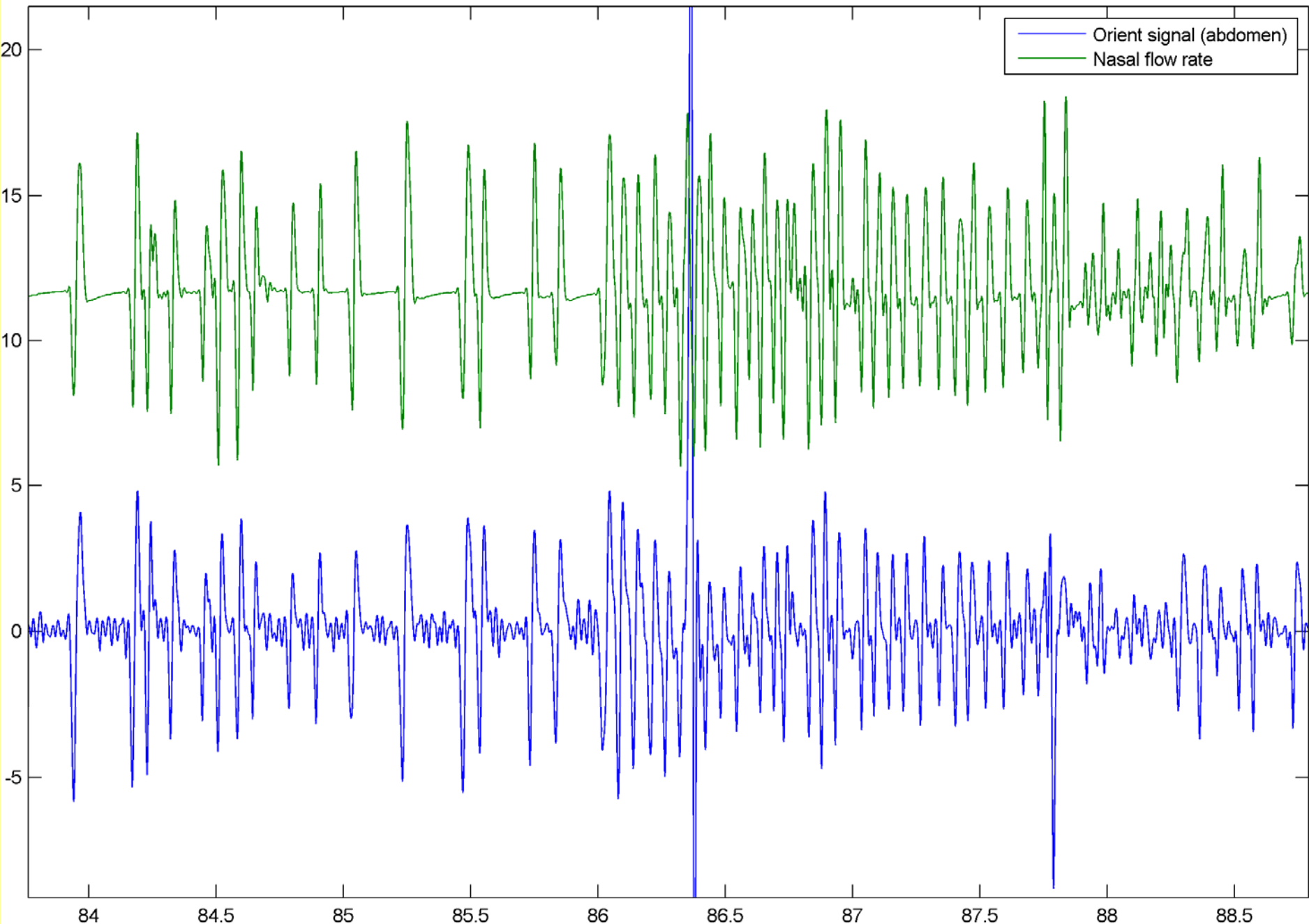


Time (mins)

# GD5 Respiration Signal

$\times 10^{-3}$

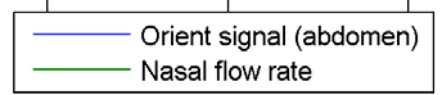
- Orient signal (abdomen)
- Nasal flow rate



Time (mins)

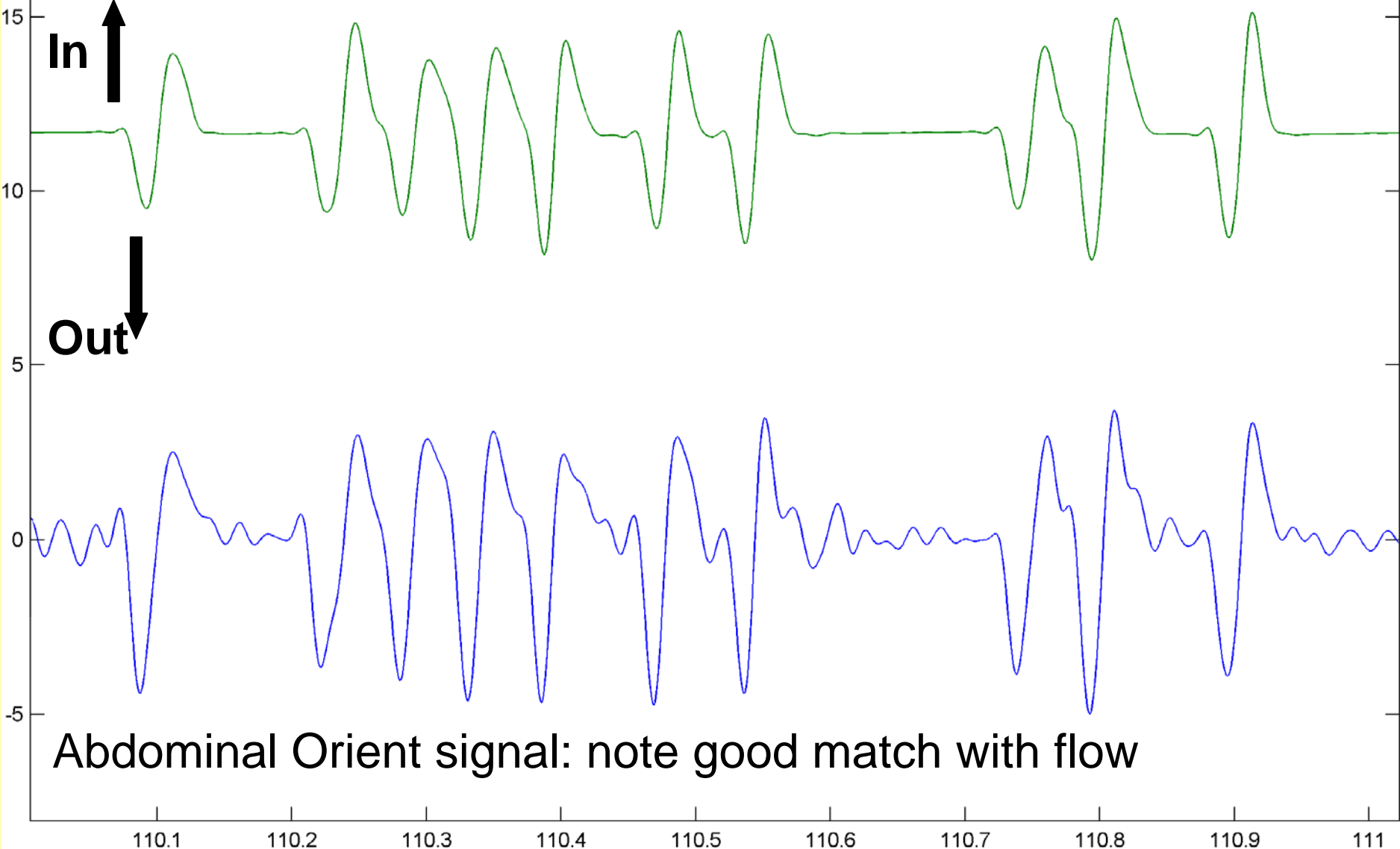
$\times 10^{-3}$

### GD5 Respiration Signal



## Nasal flow

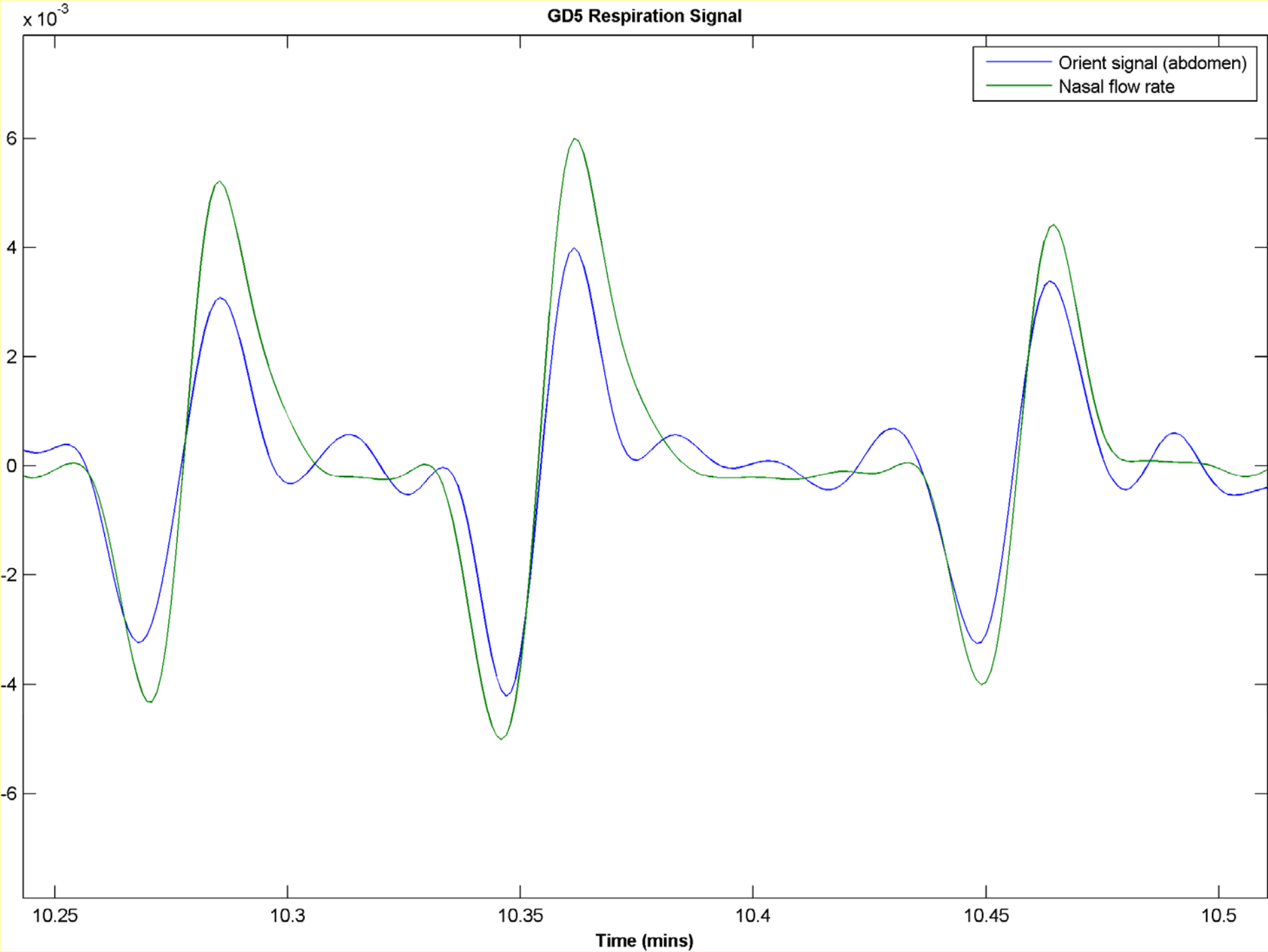
In ↑  
Out ↓



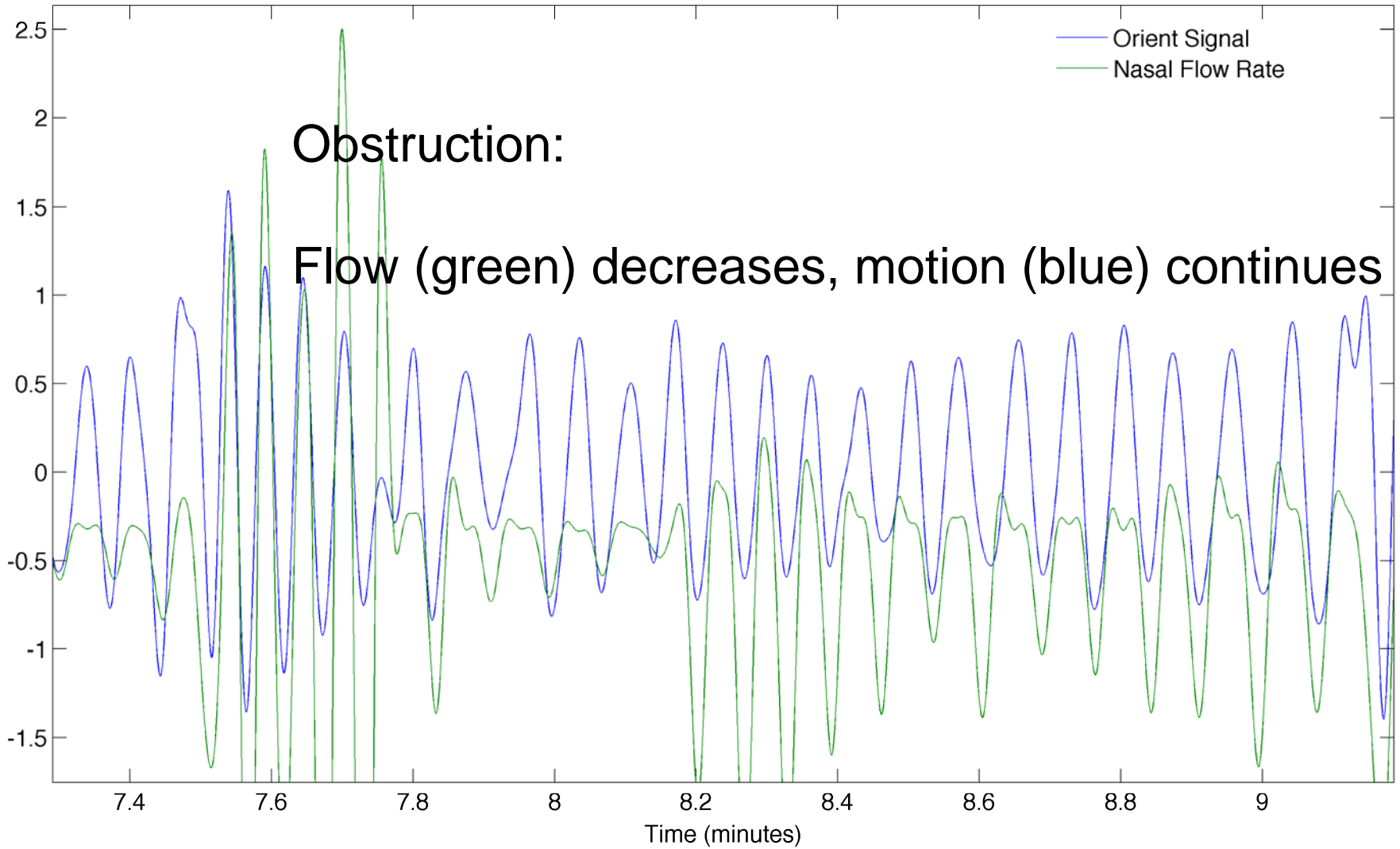
Abdominal Orient signal: note good match with flow

Time (mins)

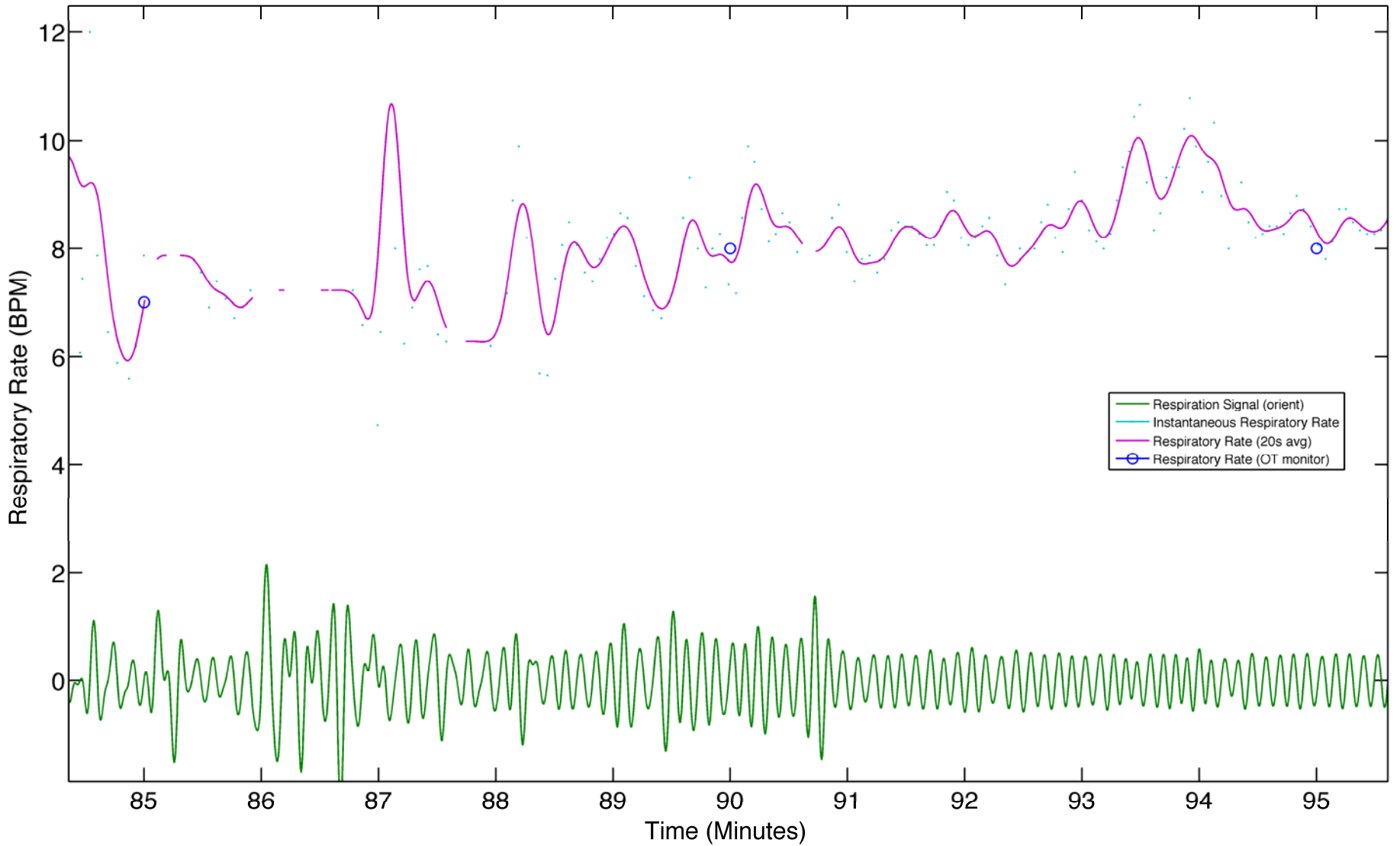
GD5 Respiration Signal



### GD4 Reduced Flow



# Respiratory Rate Measurement in WG OT



# Conclusions

- After appropriate transform, good concordance
- With both signals, episodes of obstruction can be detected
- Abnormal patterns of timing clearly shown
- Better reliability than the SEWs chart
- Further assessments of reliability and specificity are needed.

# Use of specks to monitor respiratory rate

- After initial validation:
- Need for studies of application in different clinical situations, eg
  - recovery room
  - wards
  - home environment