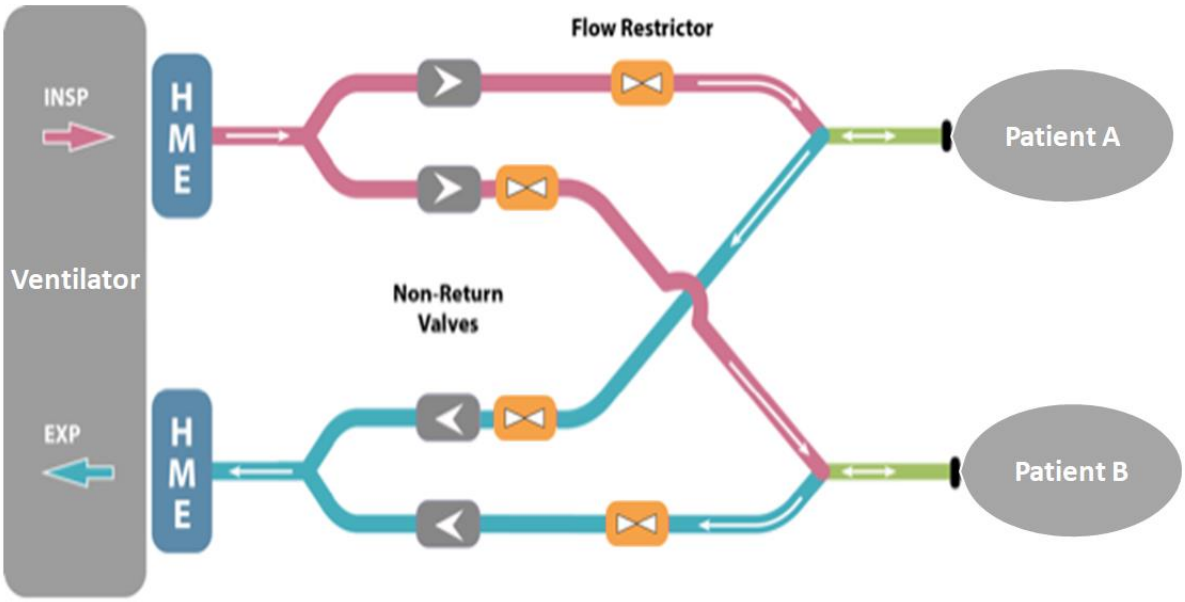
Dual Patient Ventilation: Restrictor selection using Bath RC model

V2 ARP 25/4/2020. © University of Bath

We assume there is a (linear) flow restrictor in each line, adjustable from zero resistance upwards. 'RC_restrictor_curves.m' displays the full range of possible resistances which will give a specified tidal volume and PEEP for each patient, plotting against ventilator settings (Pinsp, PEEP, and inspiration and expiration time durations).



Example parameters:

Ventilator tubing parameters

```
vent.R        = 22;          % cmH2O/(L/s)
vent.C        = 0.004;       % L/cmH2O
```

Patient 1 ('compliant')

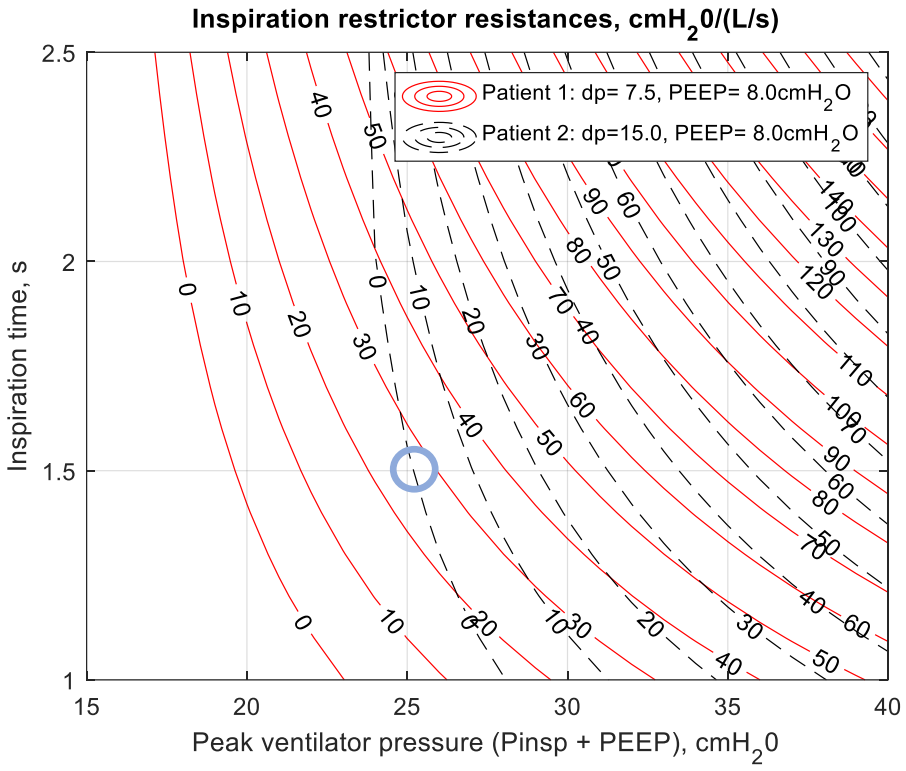
```
pat(i).Ri         = 12;      % cmH2O/(L/s) Inspiration airway resistance
pat(i).Re         = 12;      % cmH2O/(L/s) Expiration airway resistance
pat(i).C          = 0.040;   % L/cmH2O     Lung compliance
```

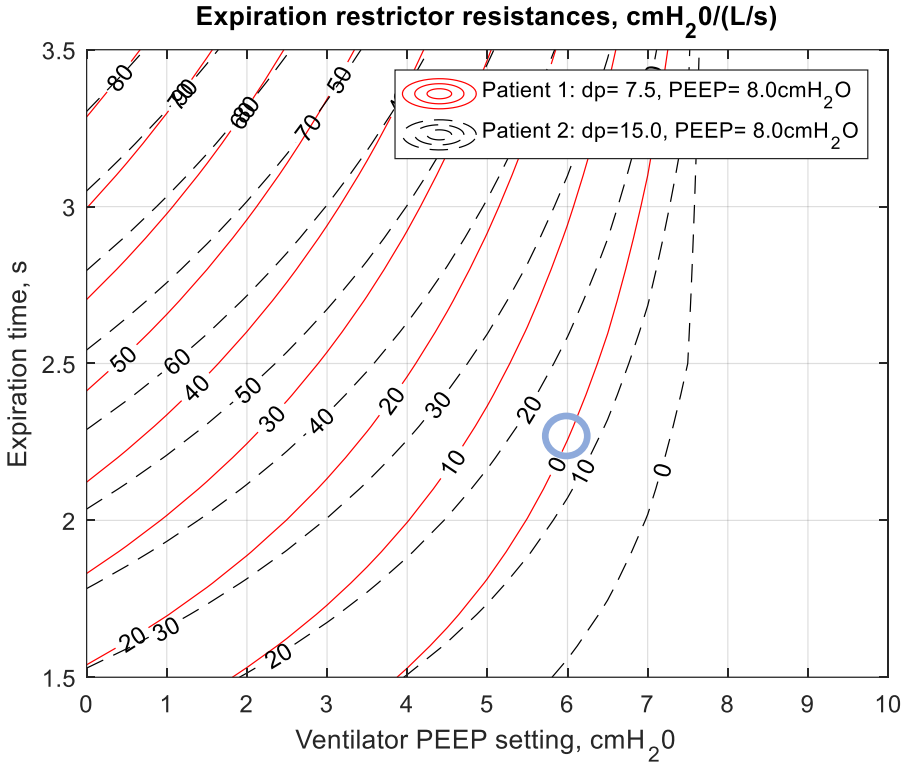
Patient 2 ('stiff')

```
pat(i).Ri         = 10;      % cmH2O/(L/s) Inspiration airway resistance*
pat(i).Re         = 10;      % cmH2O/(L/s) Expiration airway resistance*
pat(i).C          = 0.020;   % L/cmH2O     Lung compliance
```

Say we want both patients to have a tidal volume of 0.3L, and a PEEP of 8cmH20 (taken as minimum lung pressure, so not including any pressure drop through airway due to remaining flow at the end of expiration). The required lung pressure change (dp) for Patient 2 is double that for Patient 1 due to increase stiffness.

The full combination of inspiration time period, pressure and restrictions is given in the first figure, and the full combination of expiration time period, pressure and restrictions is given in the second figure.





One possible set up (ringed in blue) is to have :

- First figure: Patient 1 inspiration restrictor set to 27cmH20/(L/s), no Patient 2 inspiration restrictor (zero)
- Second figure: no patient 1 expiration restrictor (zero), Patient 2 expiration restrictor 14cmH20/(L/s)
- Ventilator PEEP = 6 cmH20, Pinsp = 19 cmH20; Tinsp=1.5s and Texp = 2.25s, i.e. RR=16 and I:E = 2:3.