Lung motion modelling to simulate dosimetry during cancer treatment

**Context**
hadrontherapy necessities:
  - accuracy
  - organ motion detection
  - customised treatment

**Mechanical parameters**

**Compliance**
(physiological parameter)

**Young modulus**
(mechanical parameter)

**Geometrical parameters**

- **3D CT scans**
  - voxel size:
    - 0.94 x 0.94 x 5 mm³

- **right-lung mesh**
  - voxel size:
    - 7.5 x 7.5 x 5 mm³

**Continuous Media Mechanics laws**

- balance equation
- kinematics equation
- constitutive equation
- boundary conditions

computed with finite element method

**Next step : Dynamic Dosimetry**

- time dependant ionising ray propagation (ion or X-ray)
- static dosimetry calculation:
  - according to the beam position through the thorax
  - at different times
- dynamic dosimetry = integration over the time

**Mechanical problem to solve**

Motions and displacements inside the lung due to environmental constraints

**Our solution**

A uniform pressure around the lung is applied, at forced expiration state, until the simulated surface matches the final state

**Results :**

External surface variation during total lung inflating

**Conclusion**

- work based on medical collaborations
- clinical validation and lung environment integration required
- limits : anisotropy and heterogeneity