Leeds Test Objects
medical imaging phantoms

Unit 9
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Quattro
Respiratory Motion Phantom

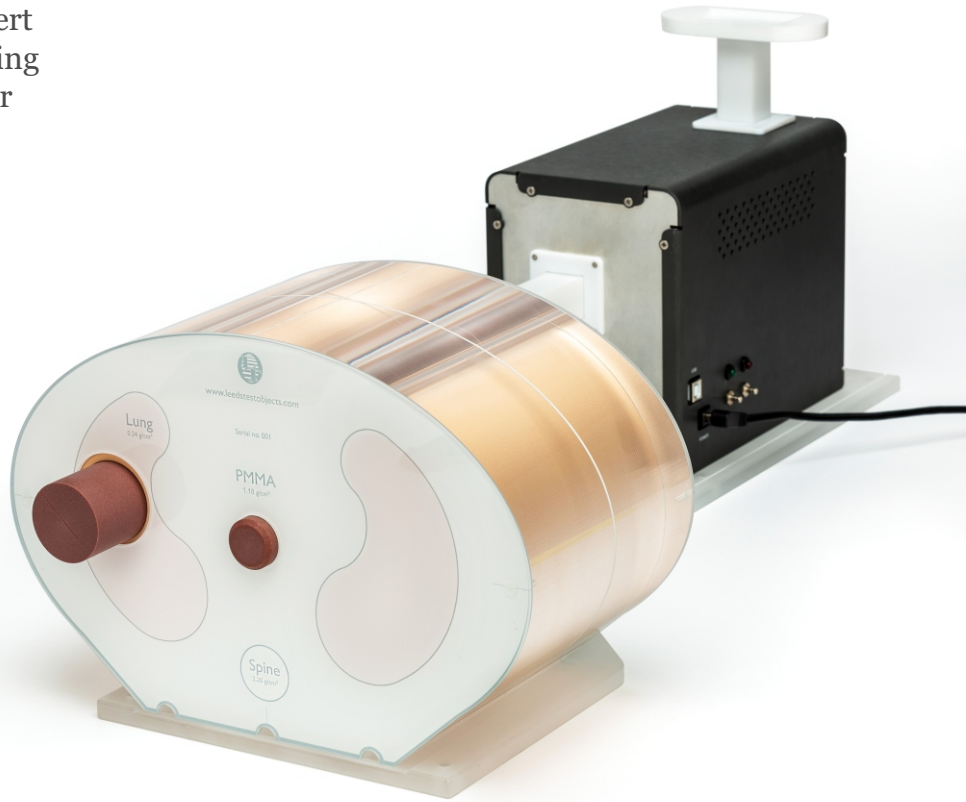
QUATTRO is a programmable 3-axis respiratory motion simulation phantom comprising a motion arm and semi-anthropomorphic, tissue equivalent chest phantom and software.

QUATTRO enables three simultaneous types of motion:

Vertical motion for breathing surrogate motion
e.g. reflective block on Varian RPM

Horizontal motion for inserts within the phantom to be imaged/treated
e.g. simple 'tumour', TLD/film dosimetry, PET 'lung' insert, etc

Twist motion of the horizontal insert providing continuous rotation enabling different outward and return path for simulated tumour inserts.



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1 2 3 4 5

The QUATTRO respiratory motion phantom is available with a choice of inserts depending on the user's requirements

QUATTRO
includes the following inserts.
1 - film dosimetry (1x insert with slit for film)
2 - ion chamber dosimetry (2x halves with recess machined to conform to ion chamber)
3 - PET sphere (2x halves + fillable sphere)
4 - TLD dosimetry (1x insert with TLD tray)
5 - Simulated tumour (1x insert with embedded tumour)

QUATTRO ESSENTIAL
includes the following insert.
5 - Simulated tumour (1x insert with embedded tumour)

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Features
Programmable Z-axis motion (speed 0 - 7.5cm/s, distance range of 6cm)
Maximum error in timing of 1.4%, typically within 0.3% of intended
Clamp to affix cylindrical inserts
Mains powered
USB interface
Start and Reset buttons
Stores last program uploaded
Free software
Semi-anthropomorphic phantom including lung, spine and soft tissue
Central ion chamber insert (Wt1 water equivalent material)
Series of inserts for QC of 4DCT, dosimetry, PET etc.
Positioning base
Power supply
Storage and transport case

Benefits
Dynamic image quality scoring for CT and PET

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QUATTRO protective case
Model shown is QUATTRO with all test inserts.

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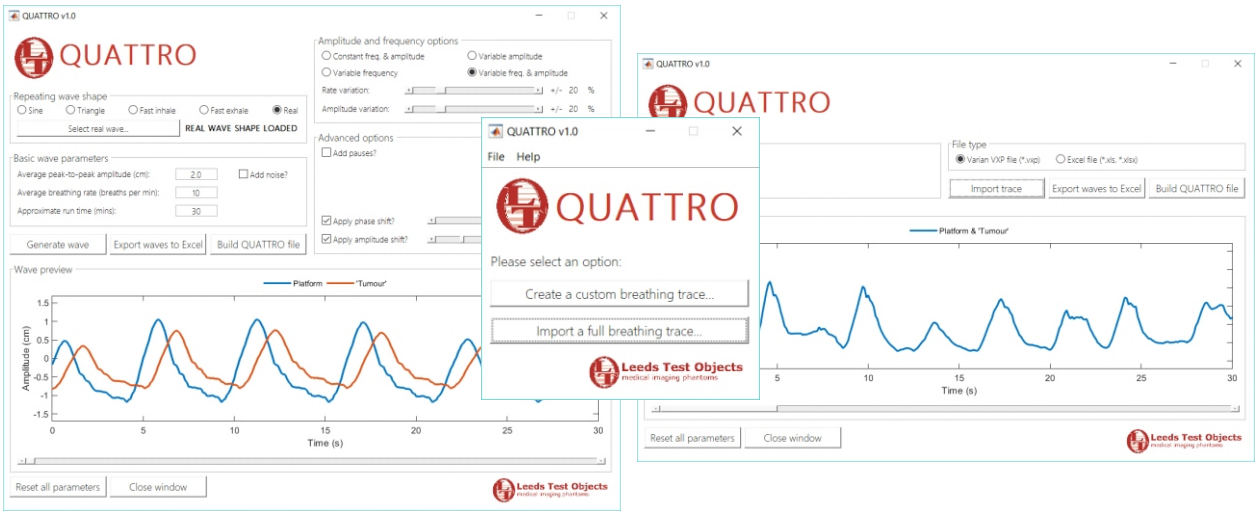
File builder

Define simple waveforms for the phantom
e.g. sine wave, 2 cm peak-to-peak amplitude at 10 breaths per minute for simple QA testing

Generate complex waveforms
e.g. real breathing pattern at nominal 2 cm amplitude and 10 breaths per minute (but with random variations in amplitude and rate), random pauses, offset motion, etc.

Import real breathing traces
i.e. exported from motion management system
Currently able to directly import Varian (.vxp) and Excel (.xls, .xlsx) files



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For sine waveform, 6 cm amplitude at 23 bpm is possible

Note, additional options may impact on performance but software always informs the user if a waveform is not deliverable

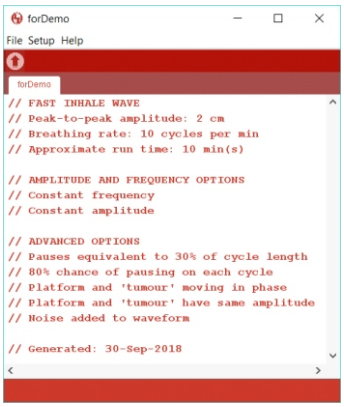
With real patients, 1-2 cm amplitude/ 6-20 bpm is more typical

For 2 cm amplitude, the QUATTRO can go up to 80 bpm for a sine wave!

Uploader

Can create a library of files offline and then upload when required with separate software tool

Upload tool also has a set of simple 'Examples' built in, ready for upload to the phantom e.g. sine and triangle waves of varying amplitude and speed



Ask for optional items:

Bespoke phantoms and layouts