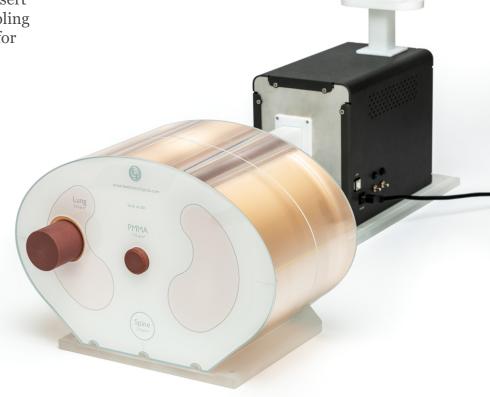# Quattro
Respiratory Motion Phantom

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.

Leeds Test Objects
medical imaging phantoms

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Quattro
Respiratory Motion Phantom

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-anthropomrphic phantom
Series of inserts for QC of 4DCT, dosimetry, PET etc.

Benefits

Dynamic image quality scoring for CT and PET

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File builder

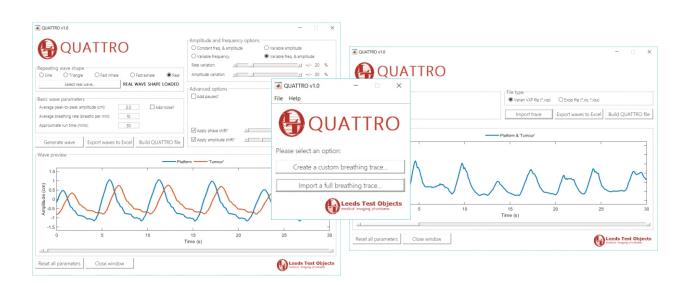**Define simple waveforms for the phantom**
e.g. sine wave, 2 cm peak-to-peak amplitude at 10 breaths per minute for simple QA testing

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

```
 forDemo                          —   □   ×
File Setup Help

  forDemo
// FAST INHALE WAVE
// Peak-to-peak amplitude: 2 cm
// Breathing rate: 10 cycles per min
// Approximate run time: 10 min(s)

// AMPLITUDE AND FREQUENCY OPTIONS
// Constant frequency
// Constant amplitude

// ADVANCED OPTIONS
// Pauses equivalent to 30% of cycle length
// 80% chance of pausing on each cycle
// Platform and 'tumour' moving in phase
// Platform and 'tumour' have same amplitude
// Noise added to waveform

// Generated: 30-Sep-2018
```

Ask for optional items:
Bespoke phantoms and layouts