The European Spine Phantom QRM-ESP is now the standard for quality control - accuracy and reproducibility - in spinal BMD quantification for more than a decade [3]. Its design is closely anthropomorphic by its outer measures and internal lumbar vertebrae inserts such that standard patient protocols can be utilized, both in DXA and QCT.

The phantoms main body consists of water-equivalent resin, the three inserts contain varying amounts of calcium hydroxyapatite (CaHA) to cover the full physiological range of spongyous and cortical bone densities for all age groups.

QRM-ESP allows to check reproducibility and accuracy with the following quantities:

- bone mineral content (BMC) in g for DXA
- bone mineral area density (BMD) in g/cm² for DXA
- trabecular and cortical bone mineral density in g/cm³ for QCT
- cortical thickness in mm for QCT
- positioning accuracy in QCT

Cross-sectional view of the three vertebrae

<table>
<thead>
<tr>
<th></th>
<th>Spongious:</th>
<th>Cortical:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>50 HA (mg/cm³)</td>
<td>800 HA (mg/cm³)</td>
</tr>
<tr>
<td>L2</td>
<td>100 HA (mg/cm³)</td>
<td>800 HA (mg/cm³)</td>
</tr>
<tr>
<td>L3</td>
<td>200 HA (mg/cm³)</td>
<td>800 HA (mg/cm³)</td>
</tr>
</tbody>
</table>

QCT images of the QRM-ESP. Scans of the midvertebral selections with automatically determined ROI for spongyous and cortical bone superimposed.
European Spine Phantom

**Specification**

Dimensions of phantom ................. 260 x 180 mm  
H = 110 mm  
Base material .................. water-equivalent plastic  
Spongious bone densities ........... 50, 100, 200 HA (mg/cm³) for Q-CT  
HA in cortical structures and spinal process:  
400, 800 HA (mg/cm³)  
Area density of vertebrae (AP): for DXA  
0.5, 1.0, 1.5 (g/cm²)  
Accuracy ......................... ±3% of specified values  
±1% of certified values

**References**