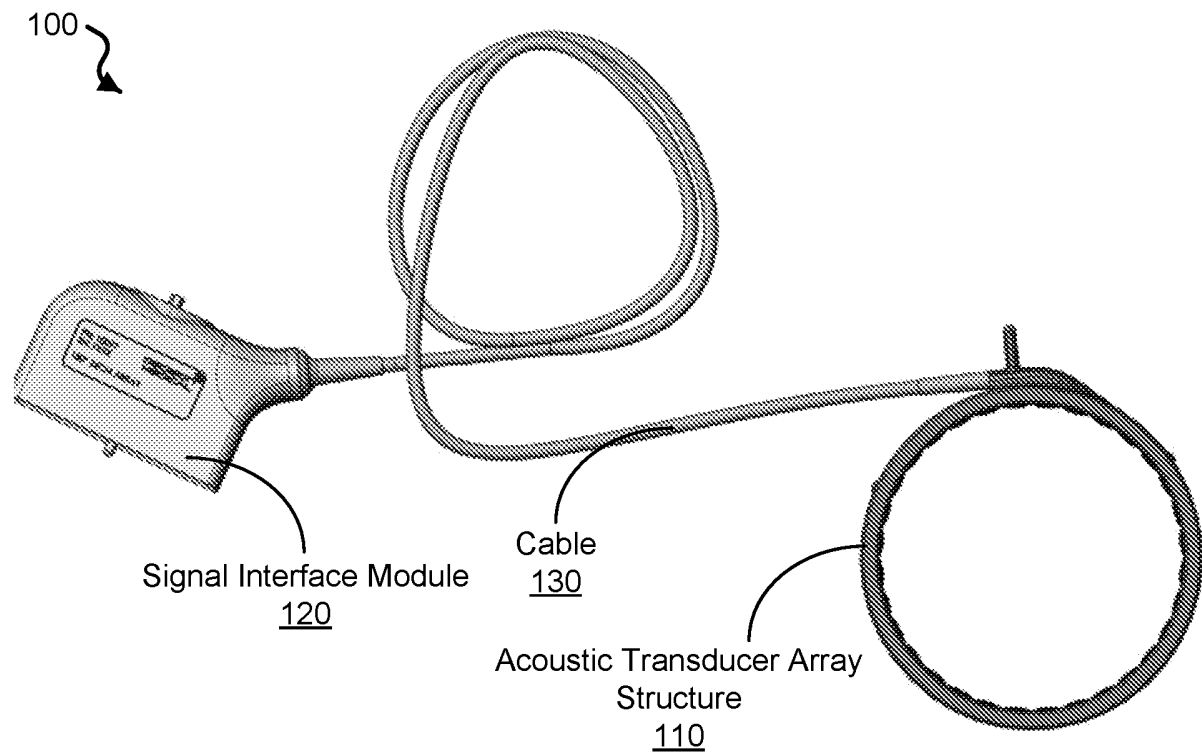
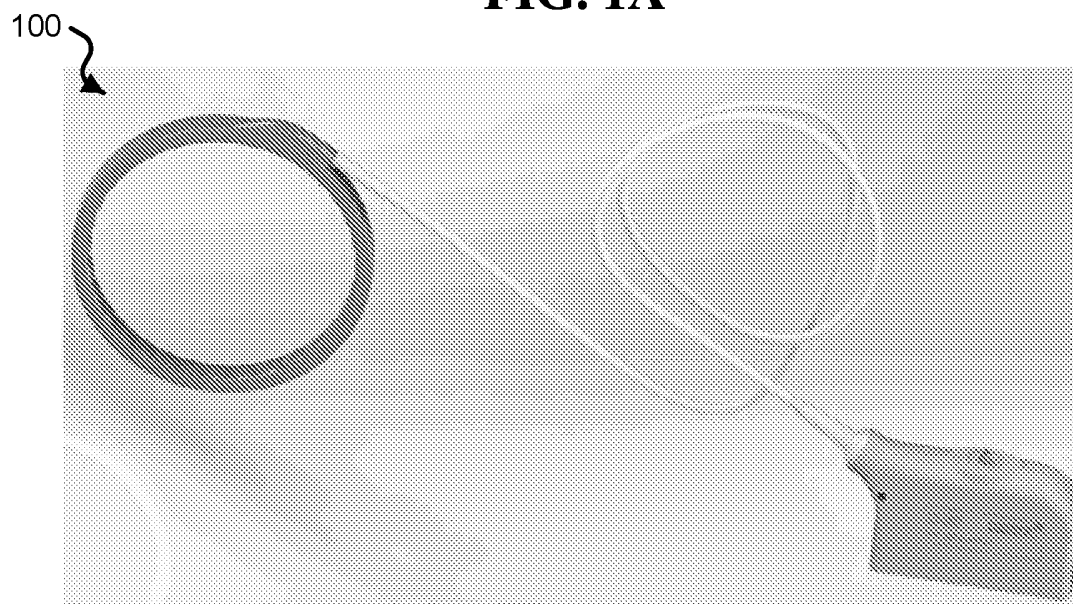


**FIG. 1A**

- Unique Arrays for Femur, Tibia, Hip (Iliac Crest)
- Low Cost (potentially disposable) Sterile Section
- Adhesive/compressive coupling to patient
- Cable transitions from sterile to unsterile environment

FIG. 1B

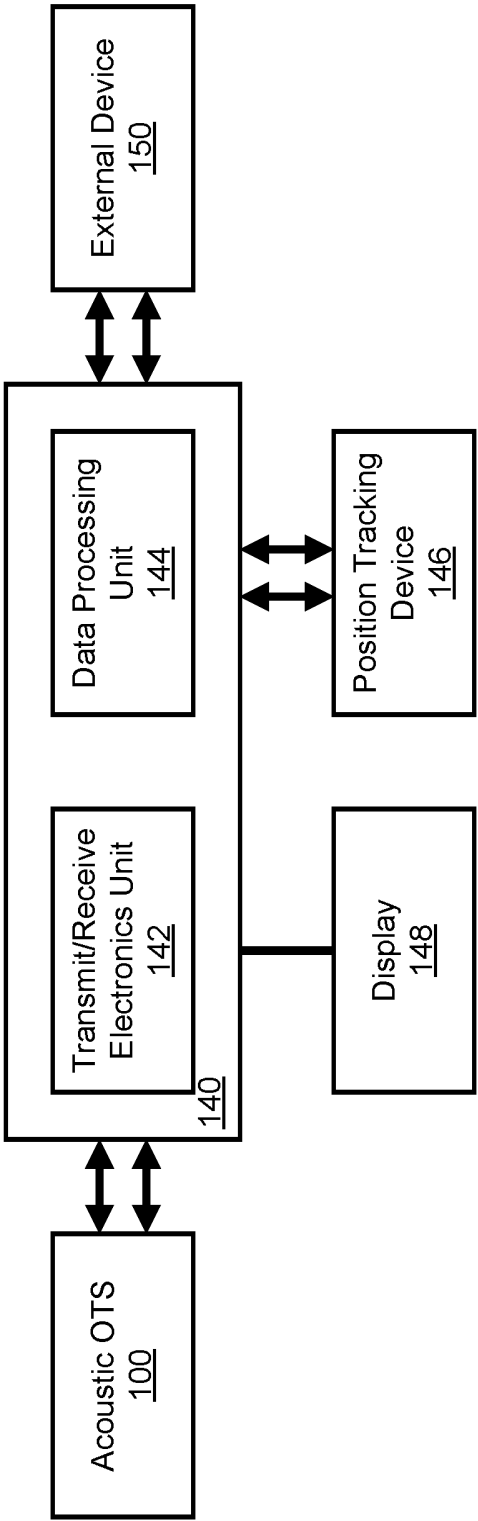


FIG. 1C

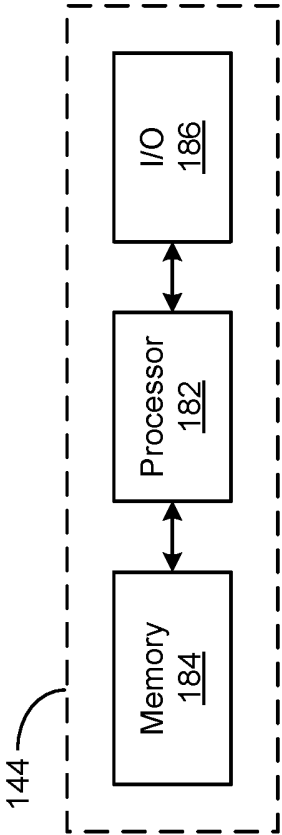
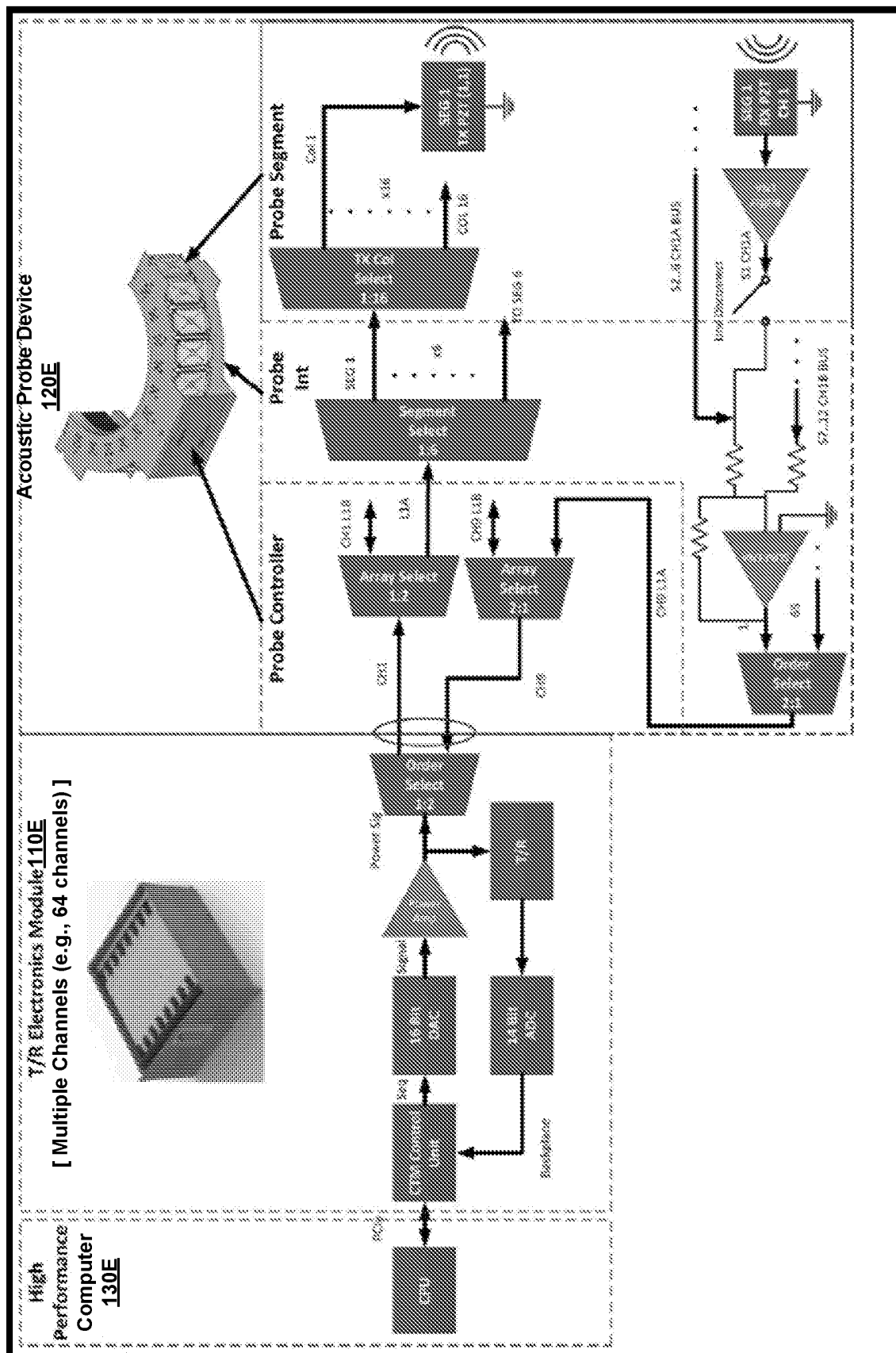


FIG. 1D

**FIG. 1E**

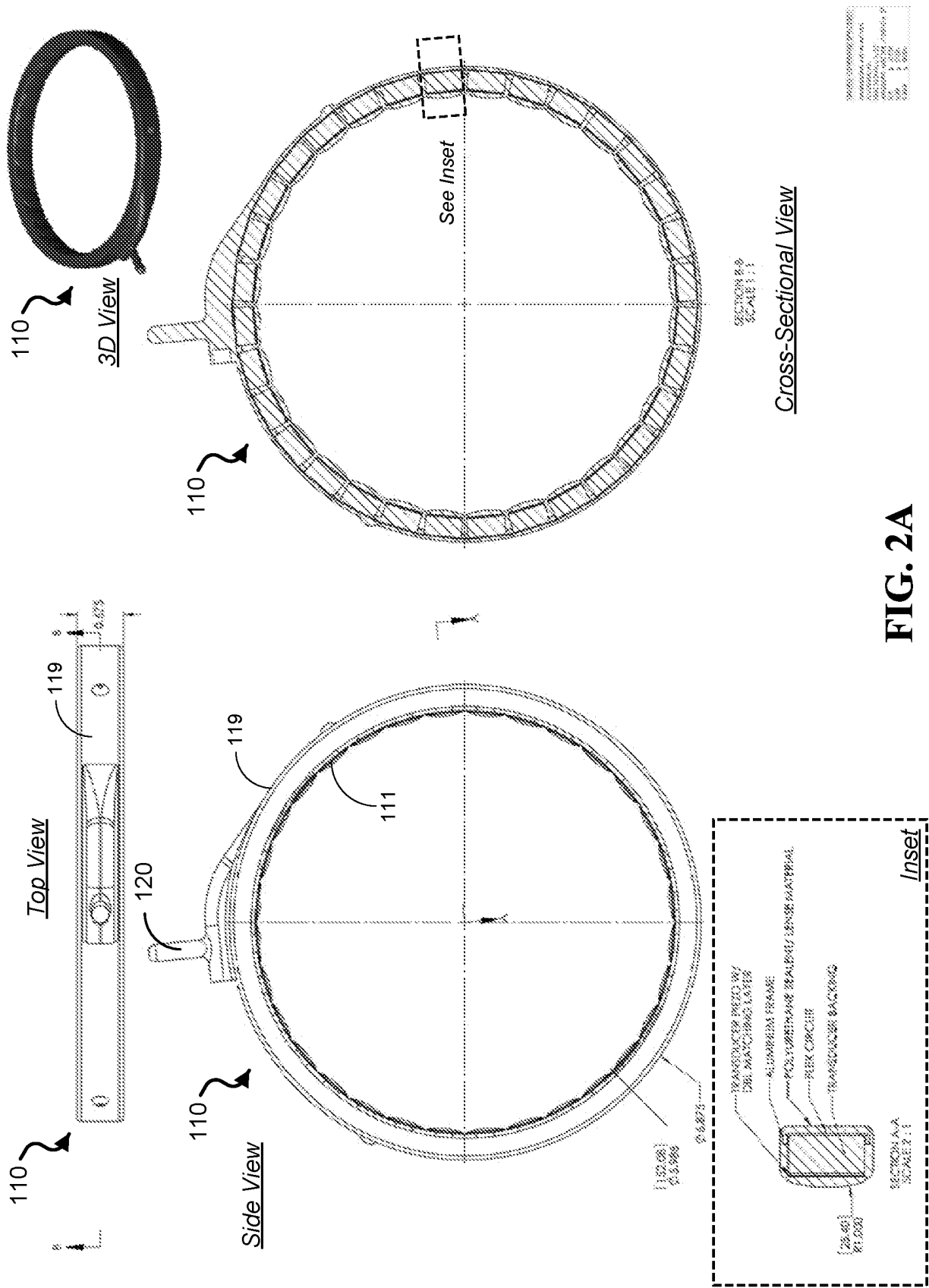


FIG. 2A

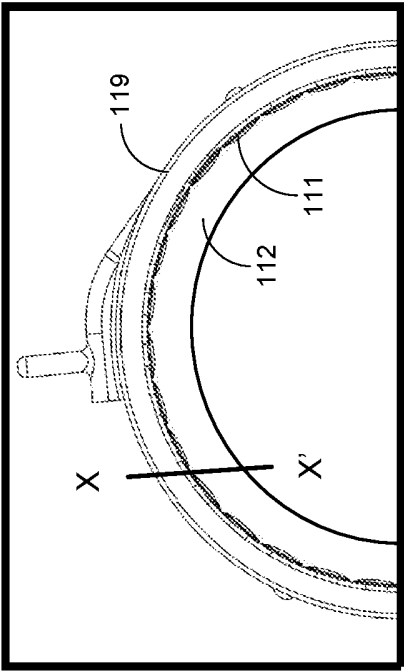
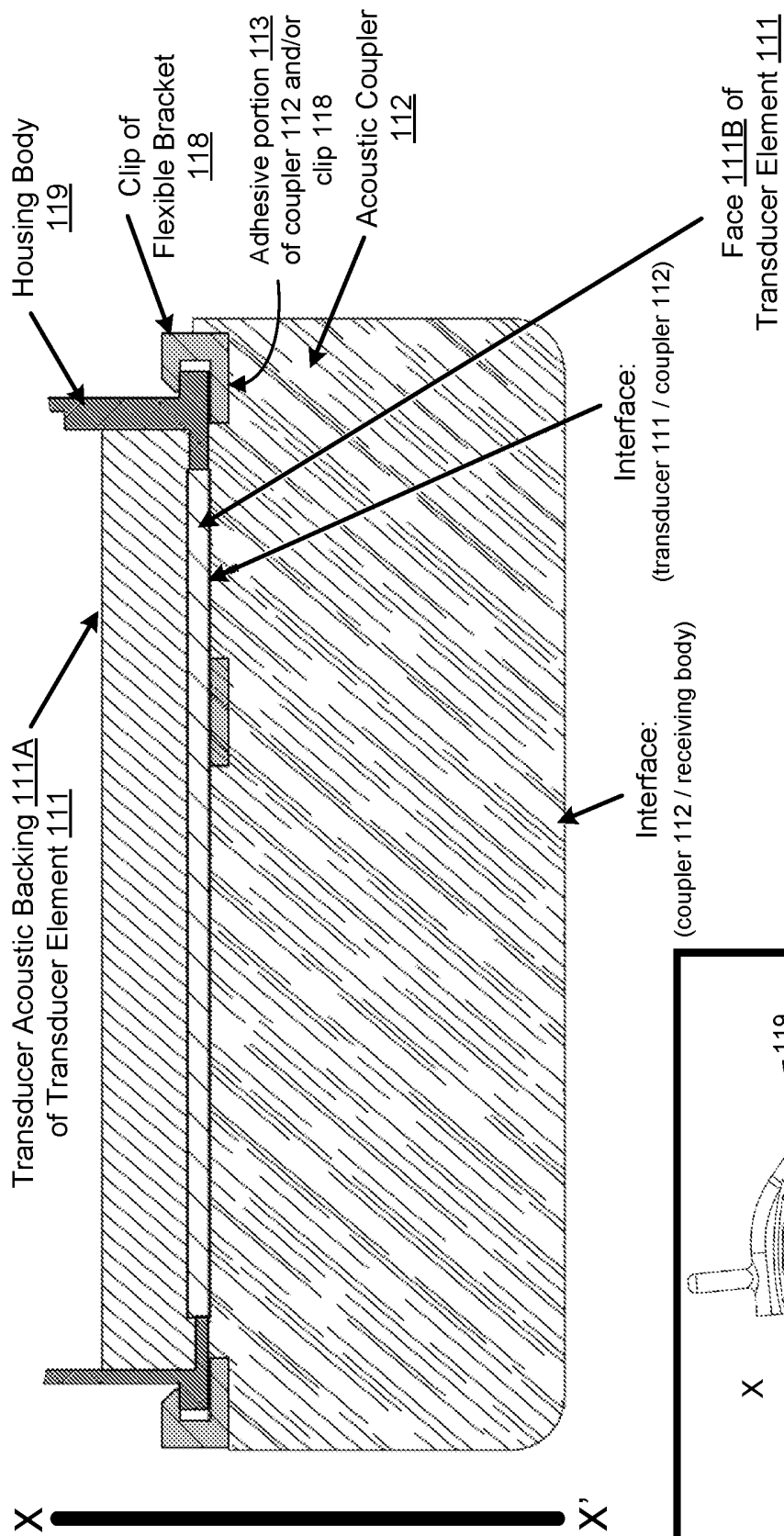


FIG. 2B

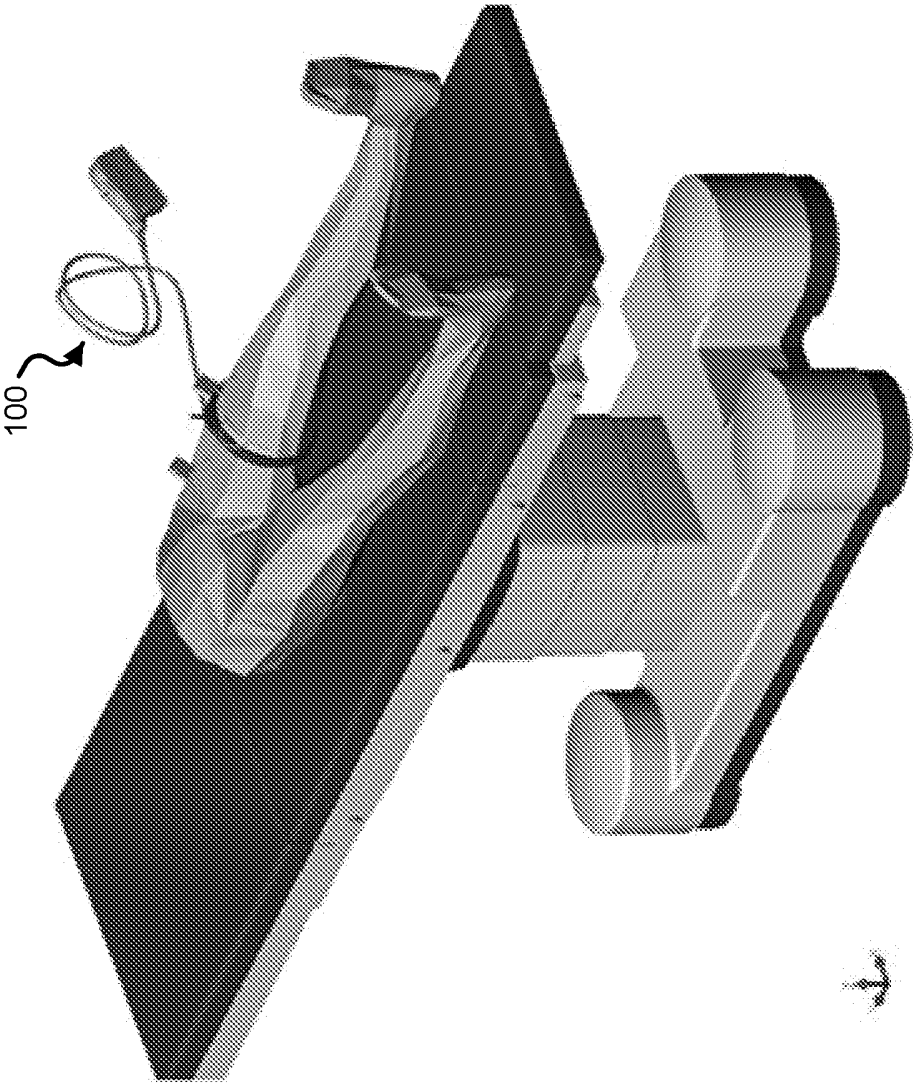


FIG. 3A

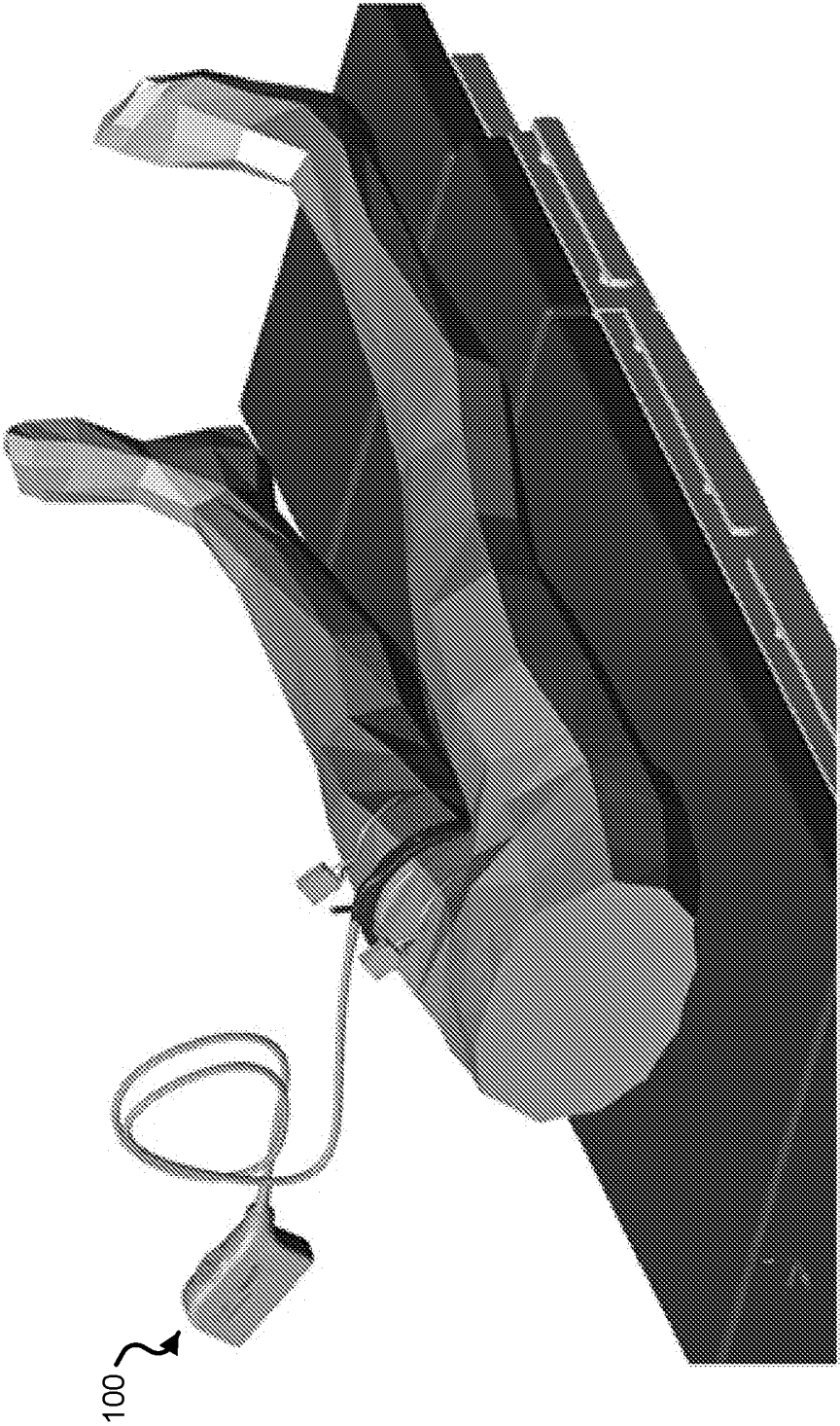
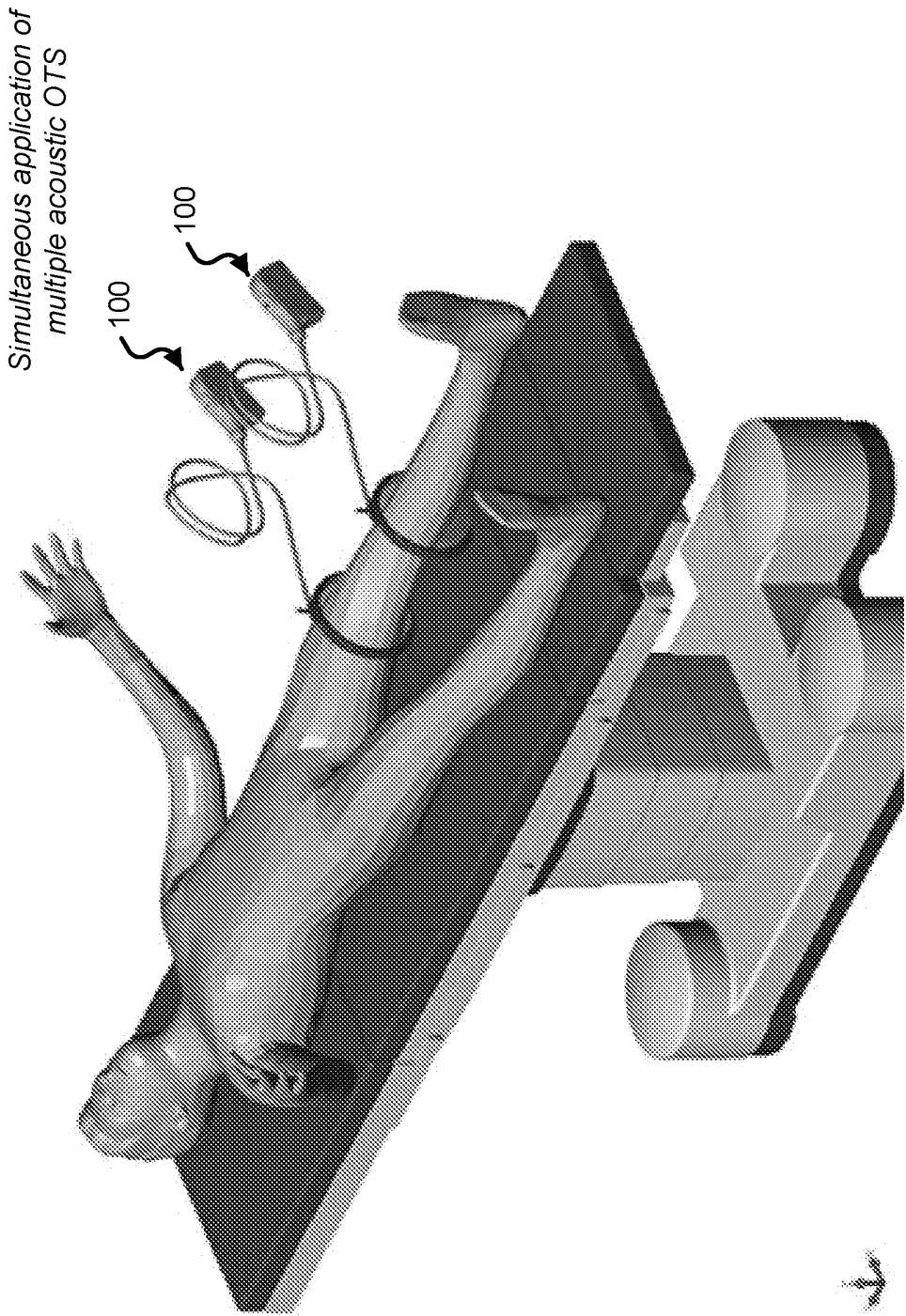


FIG. 3B



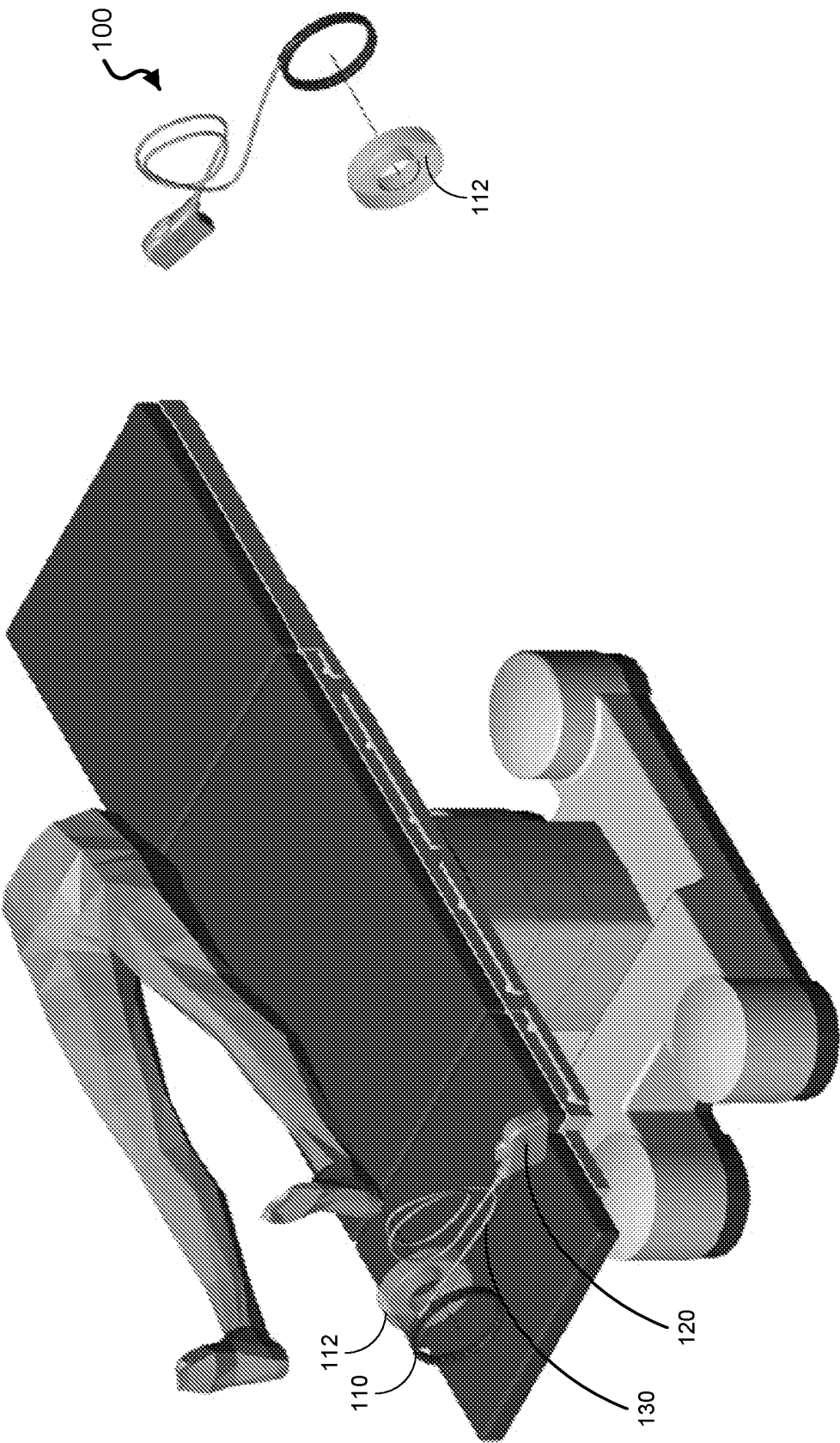
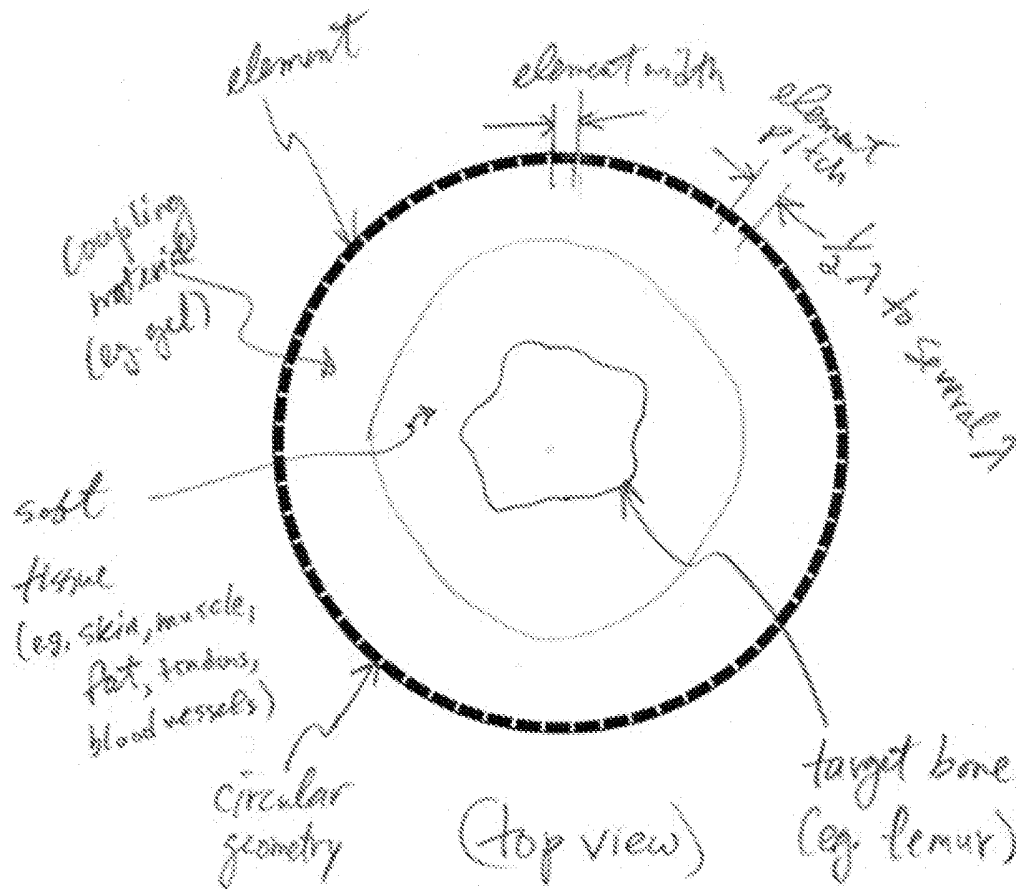
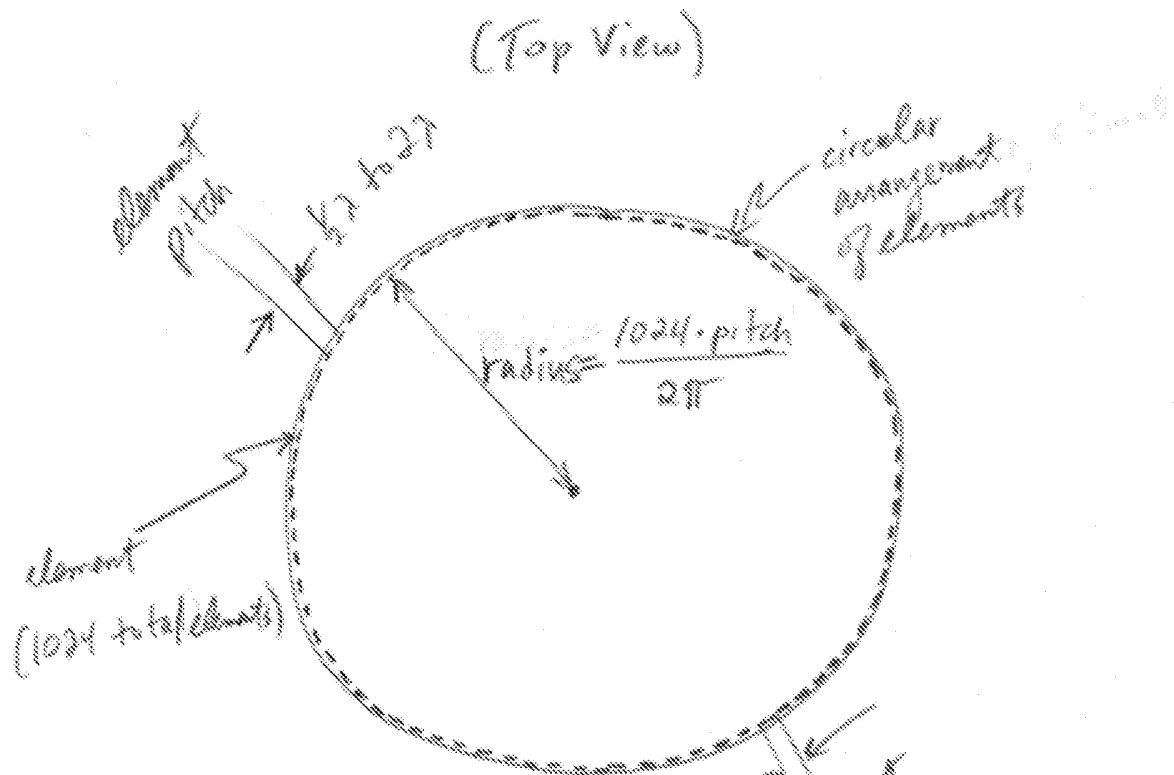
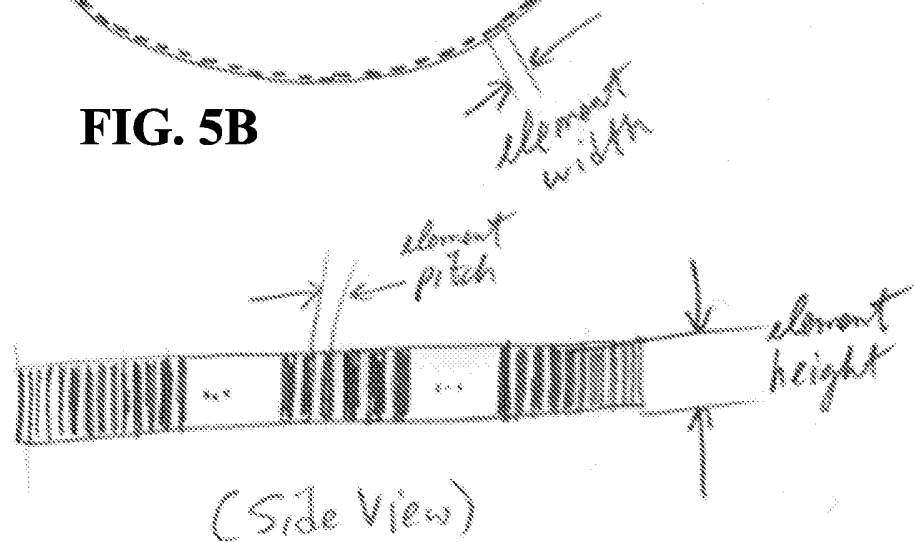
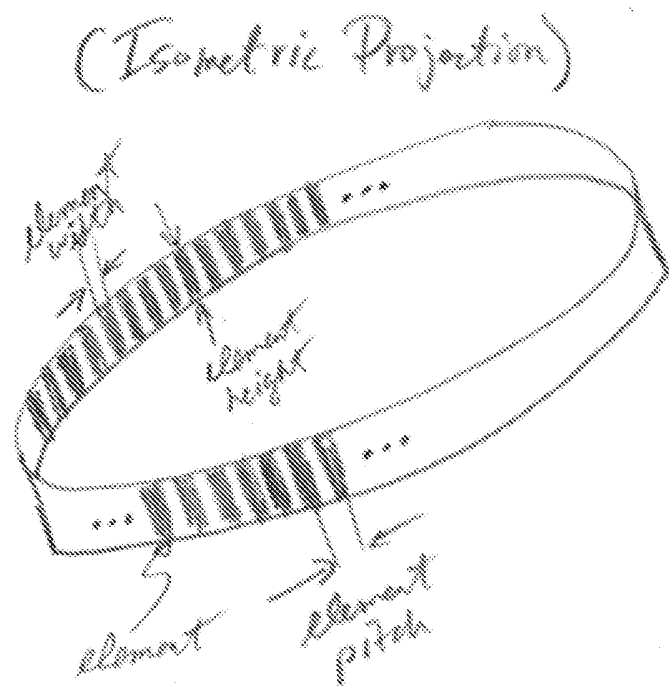
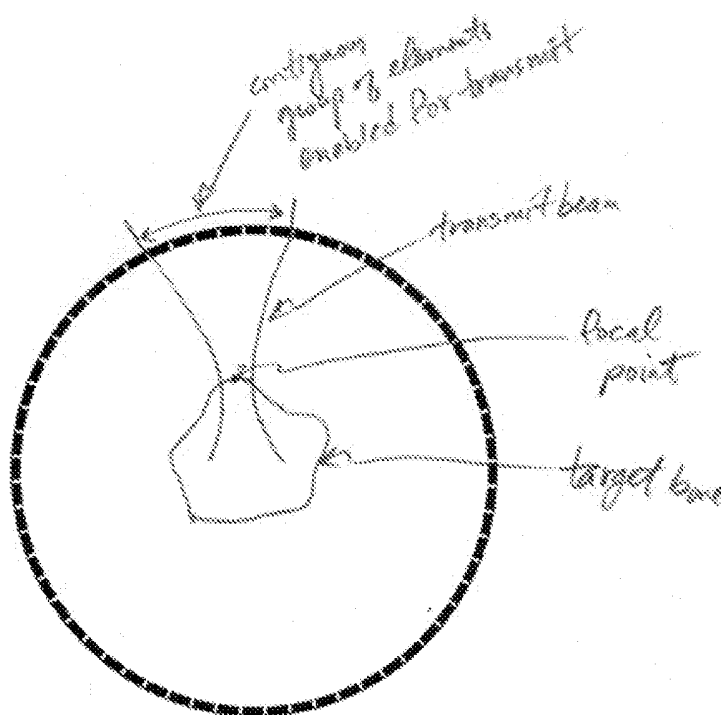
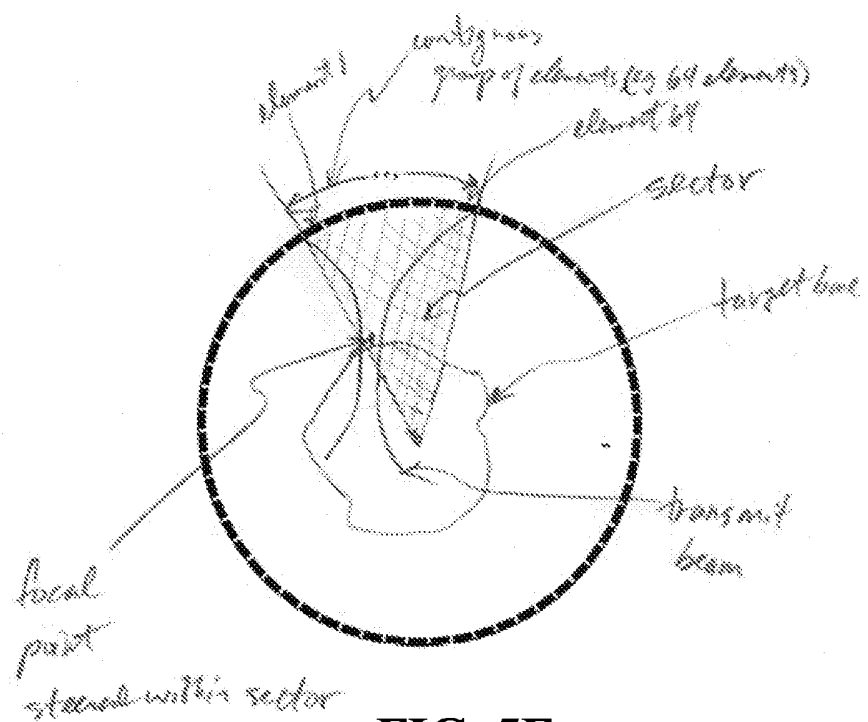
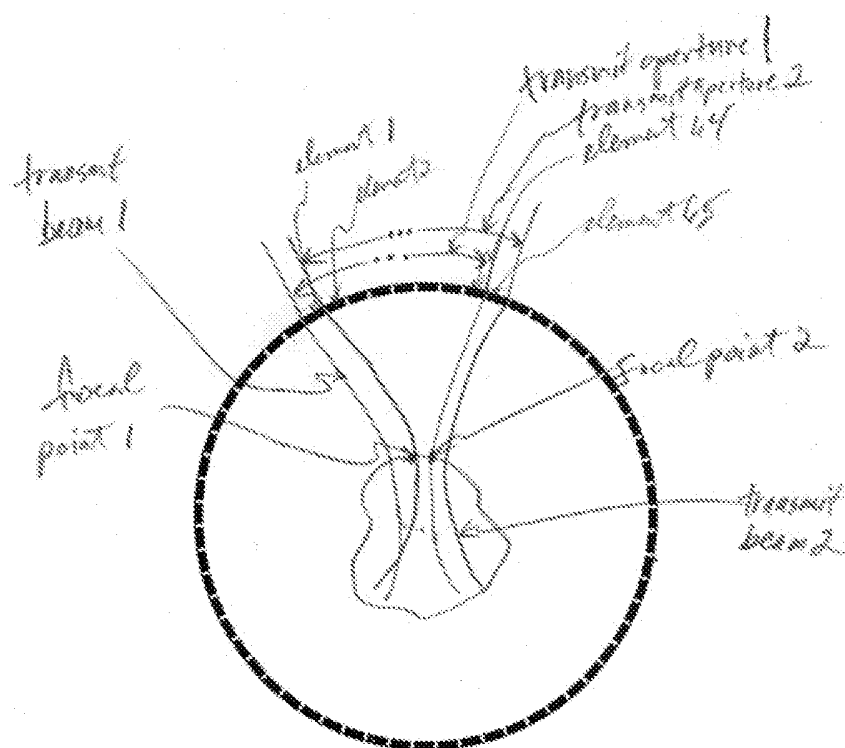


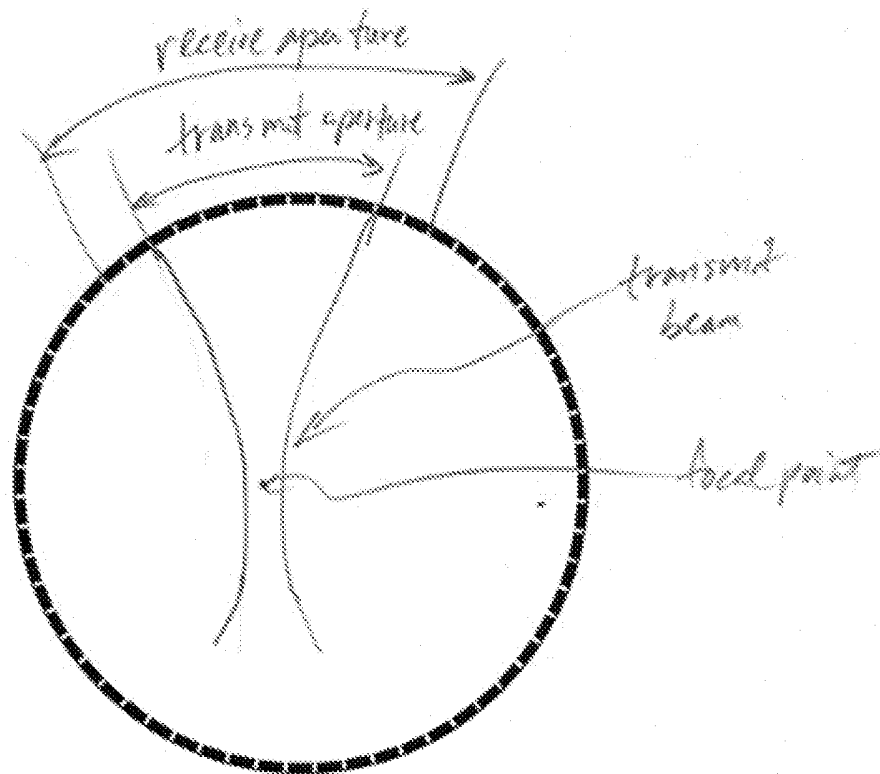
FIG. 3D

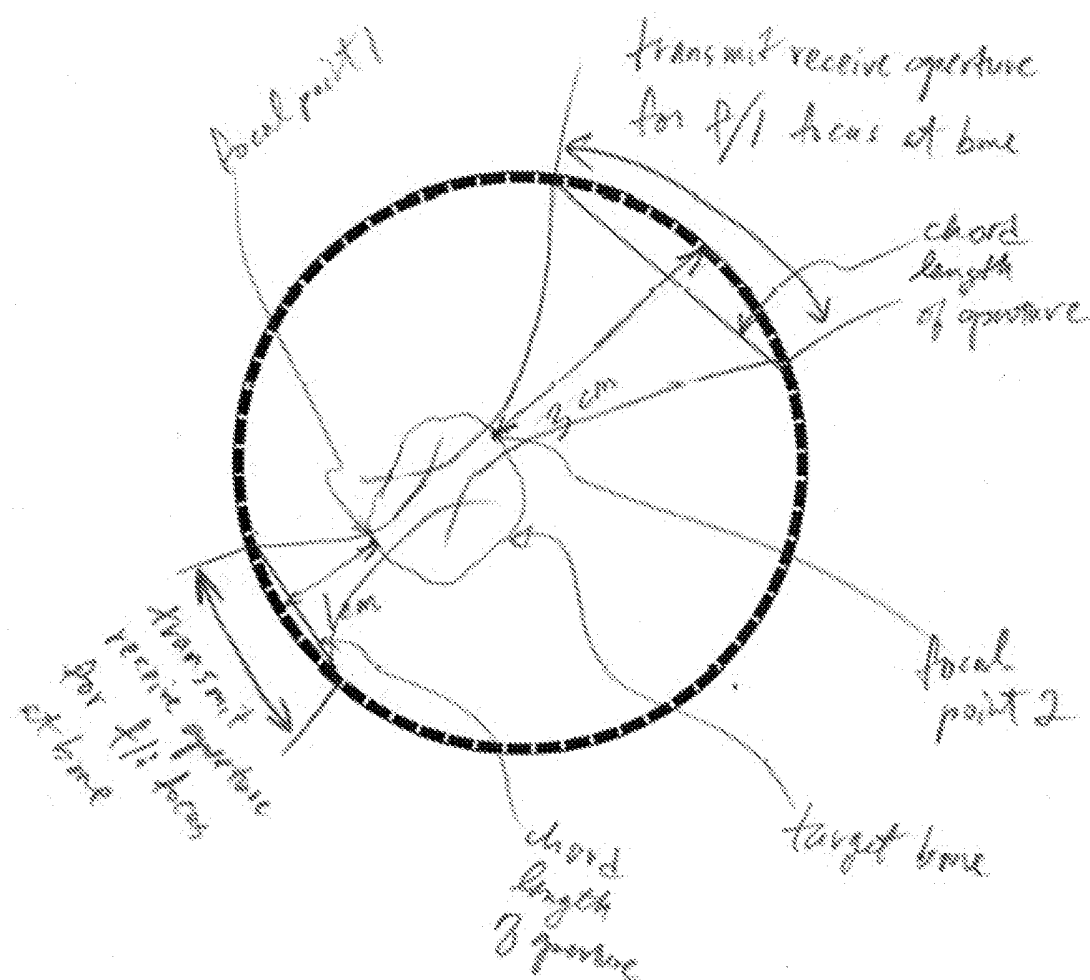
**FIG. 5A**

**FIG. 5B****FIG. 5C**

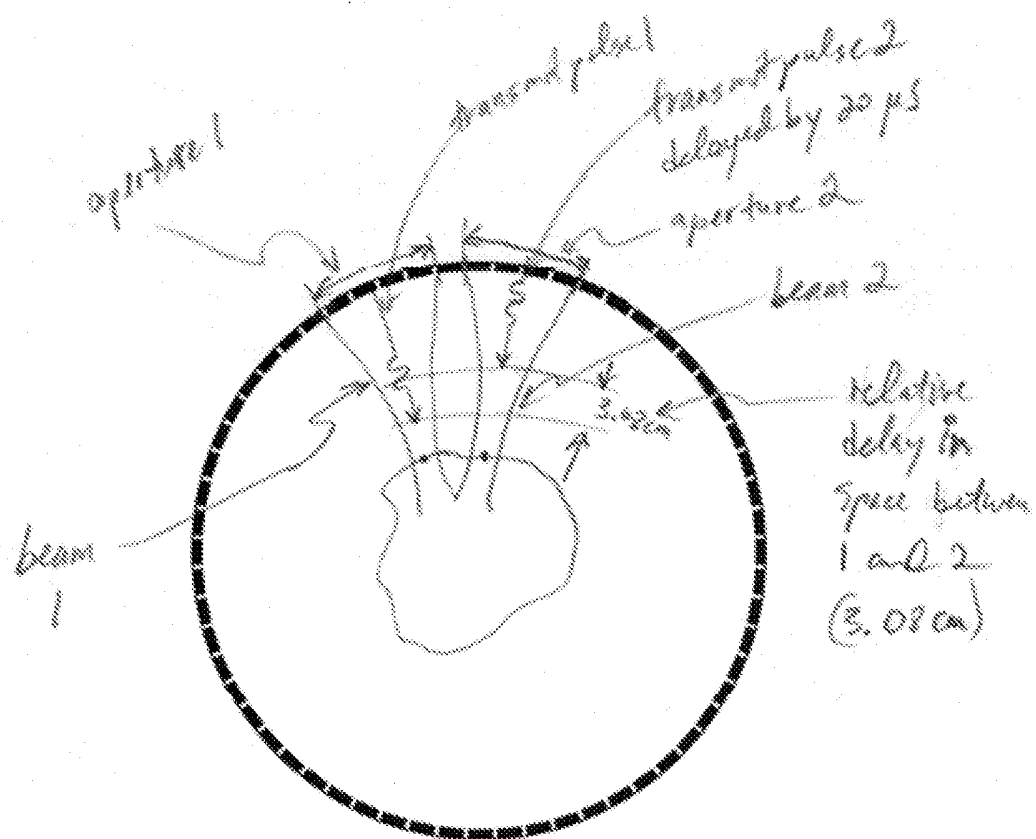
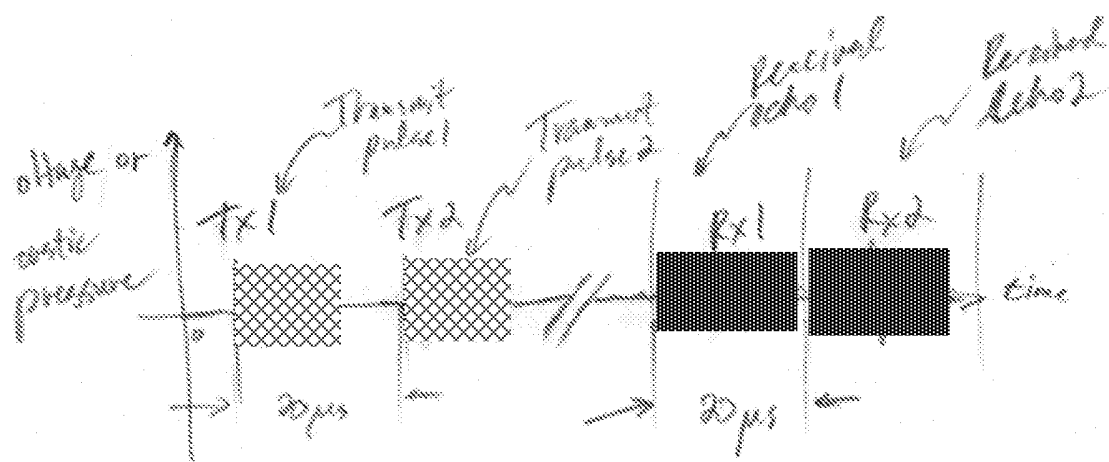
**FIG. 5D****FIG. 5E**

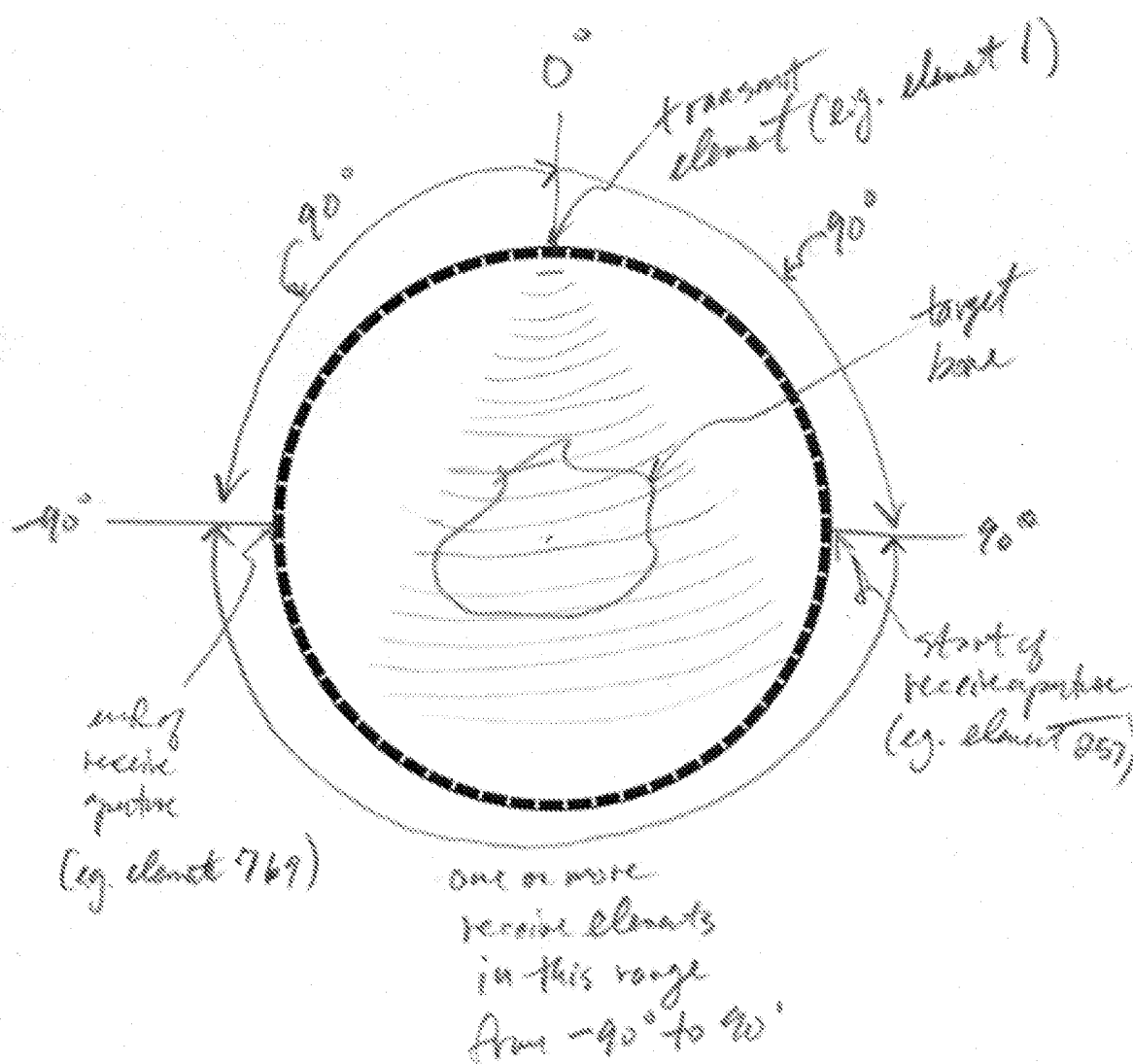
**FIG. 5F****FIG. 5G**

**FIG. 5H**

**FIG. 5I**

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**FIG. 5J****FIG. 5K**

**FIG. 5L**

5 MHz US RF Echoes from Human Femur sampled at 0.5 degree

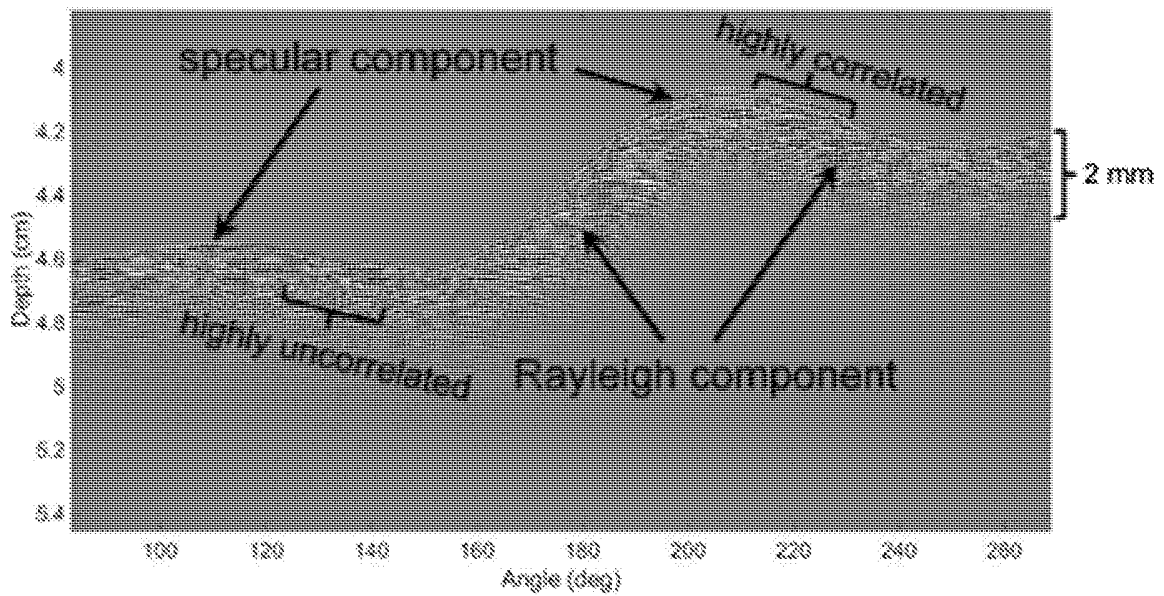


FIG. 6A

Line w/ Circles = Excellent CT pattern match to specular component
Solid Line = Poor CT pattern match to specular component

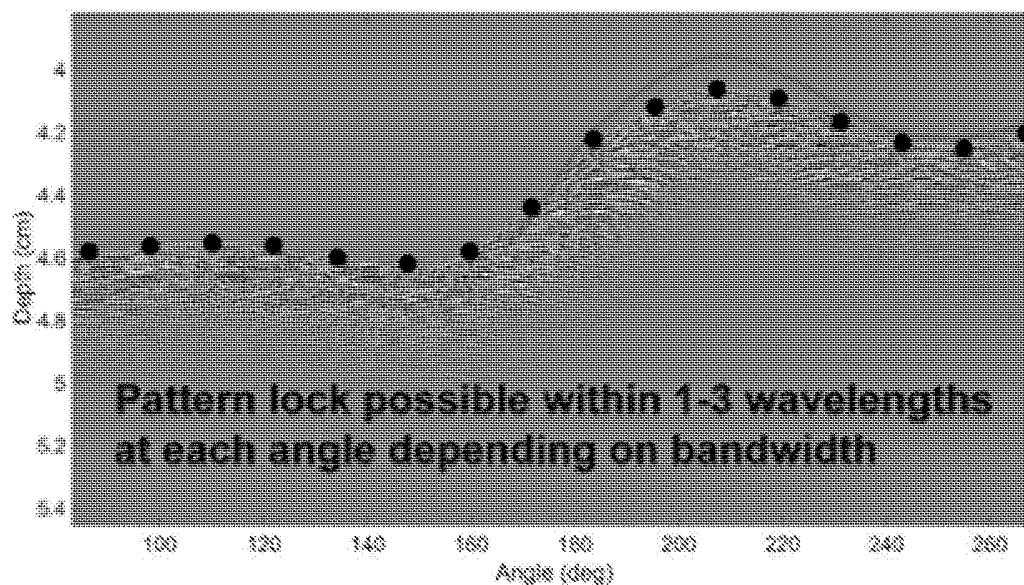


FIG. 6B

Femur: radii vs. length

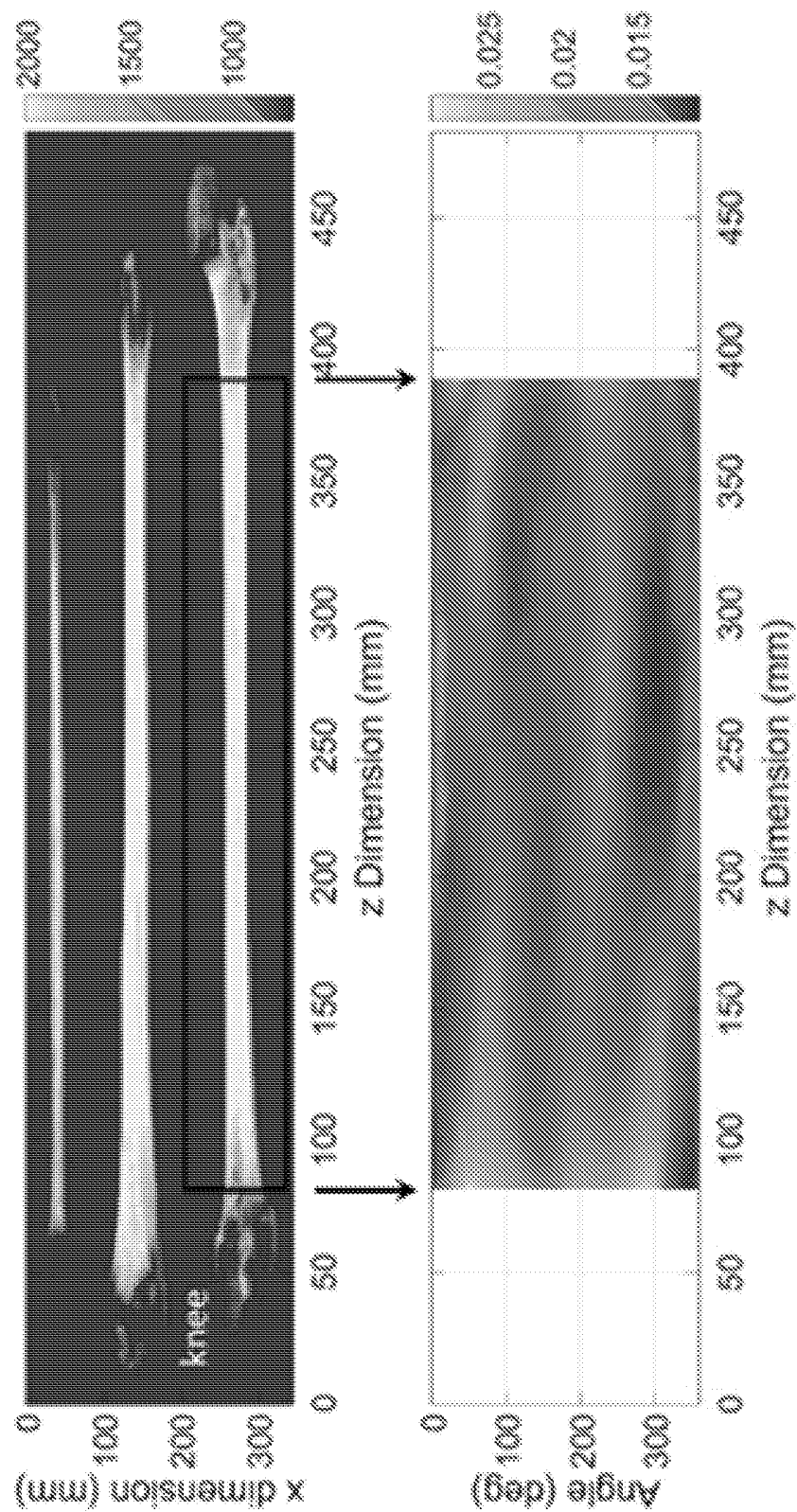
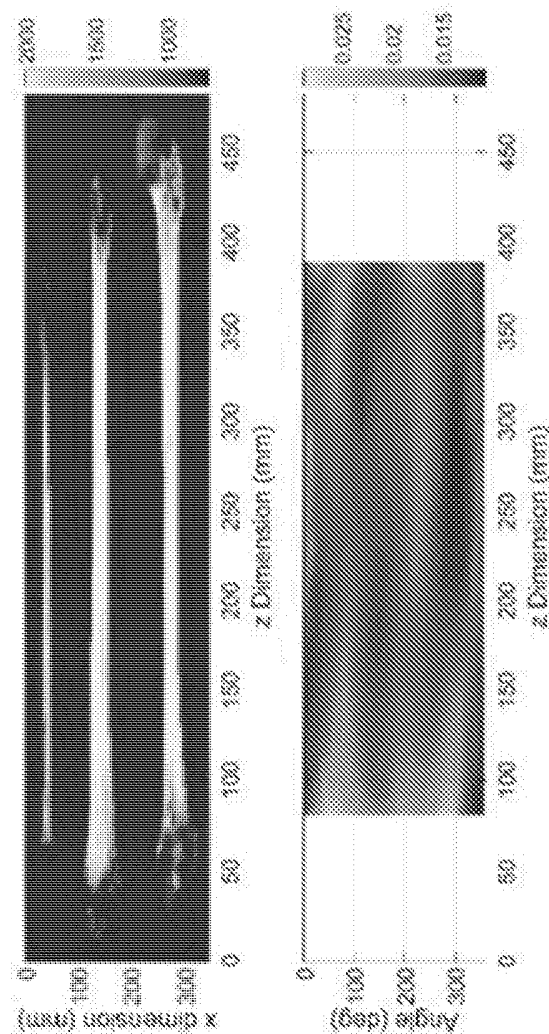
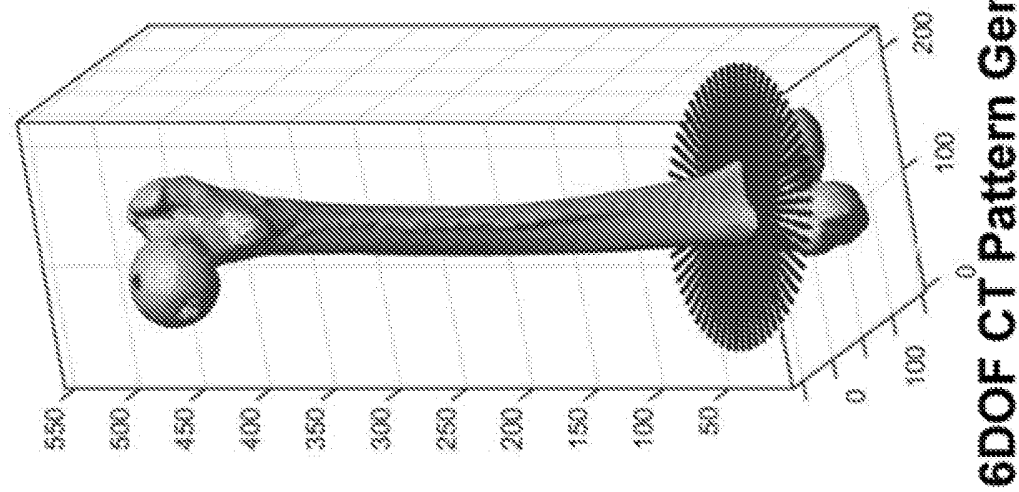


FIG. 7A

- High rate ultrasound specular bone response to locate bone surface w.r.t. array
- Correlate Surface Features with US echoes to determine US array position w.r.t. CT coordinate system



Bones have unique features

FIG. 7B

Tibia: radii vs. length

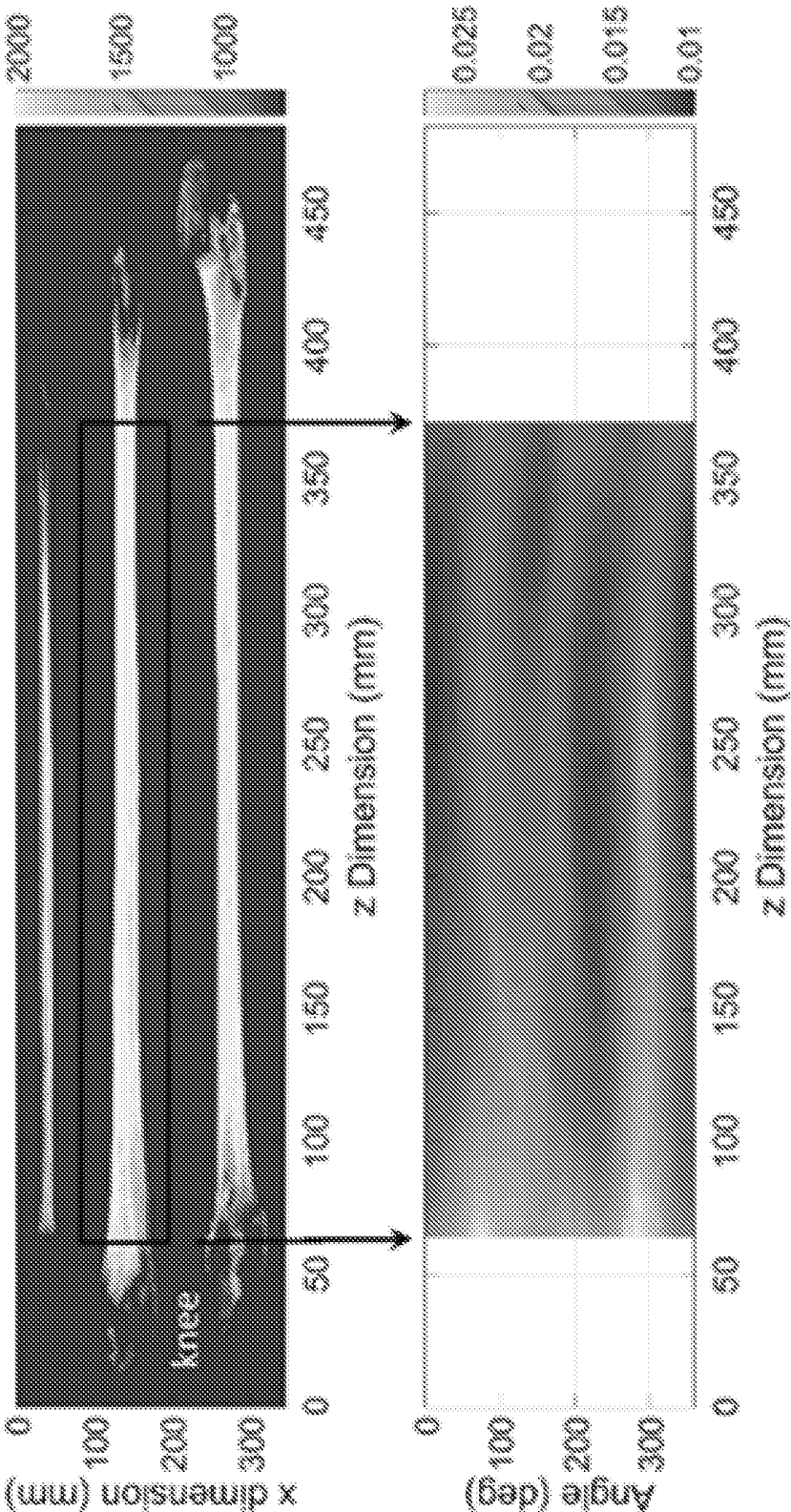


FIG. 7C

Femur: perimeter vs. length

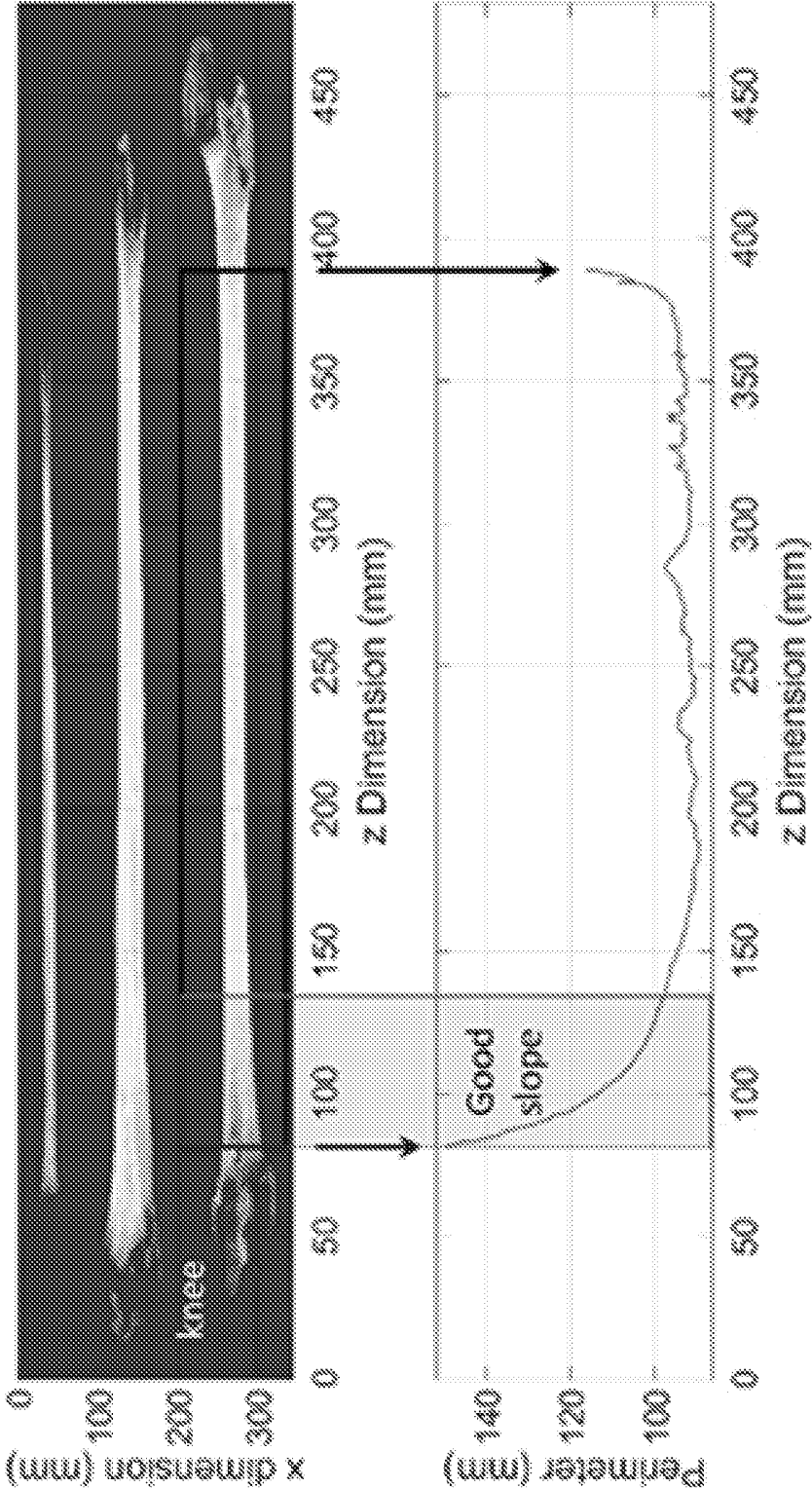


FIG. 7D

Tibia: perimeter vs. length

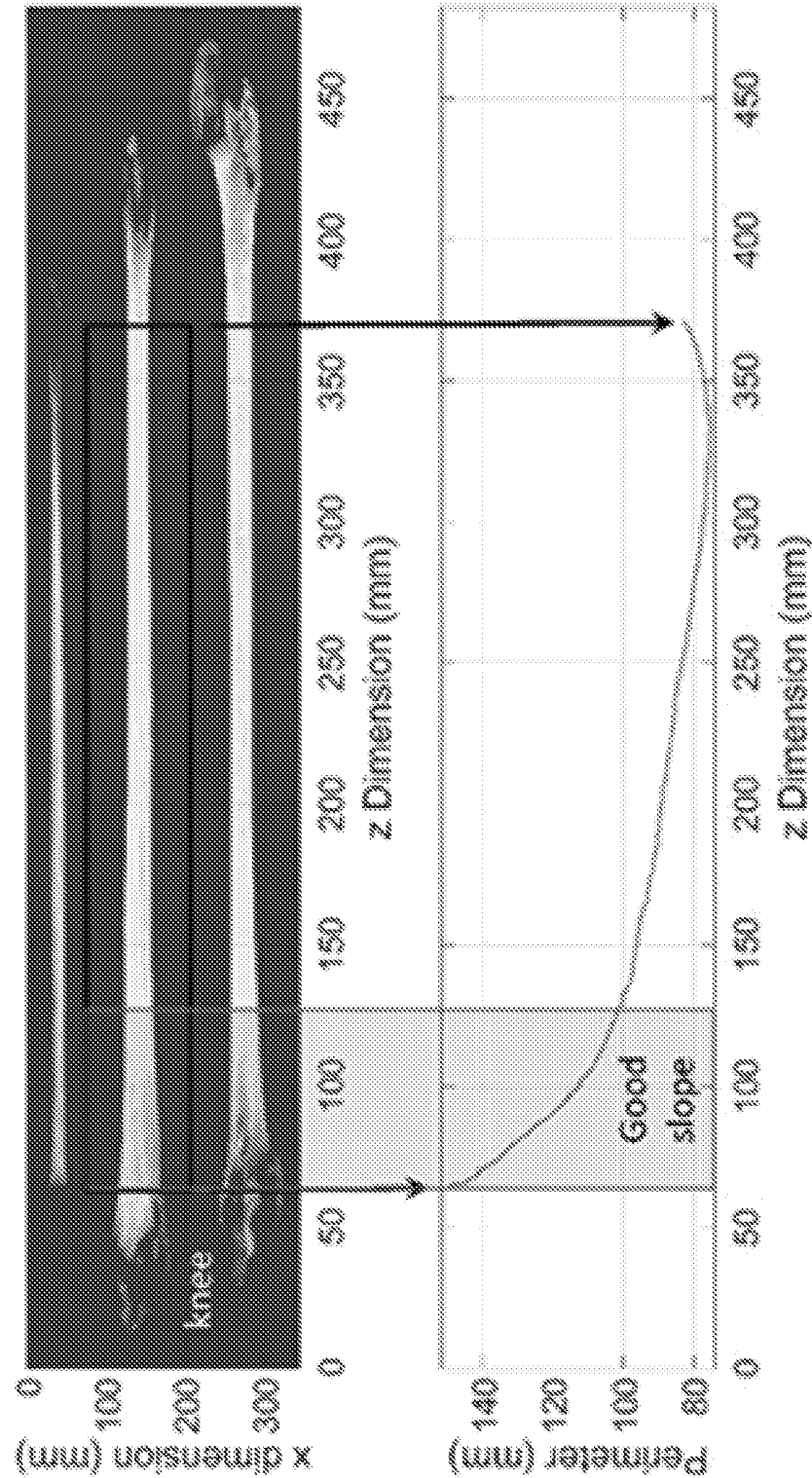


FIG. 7E

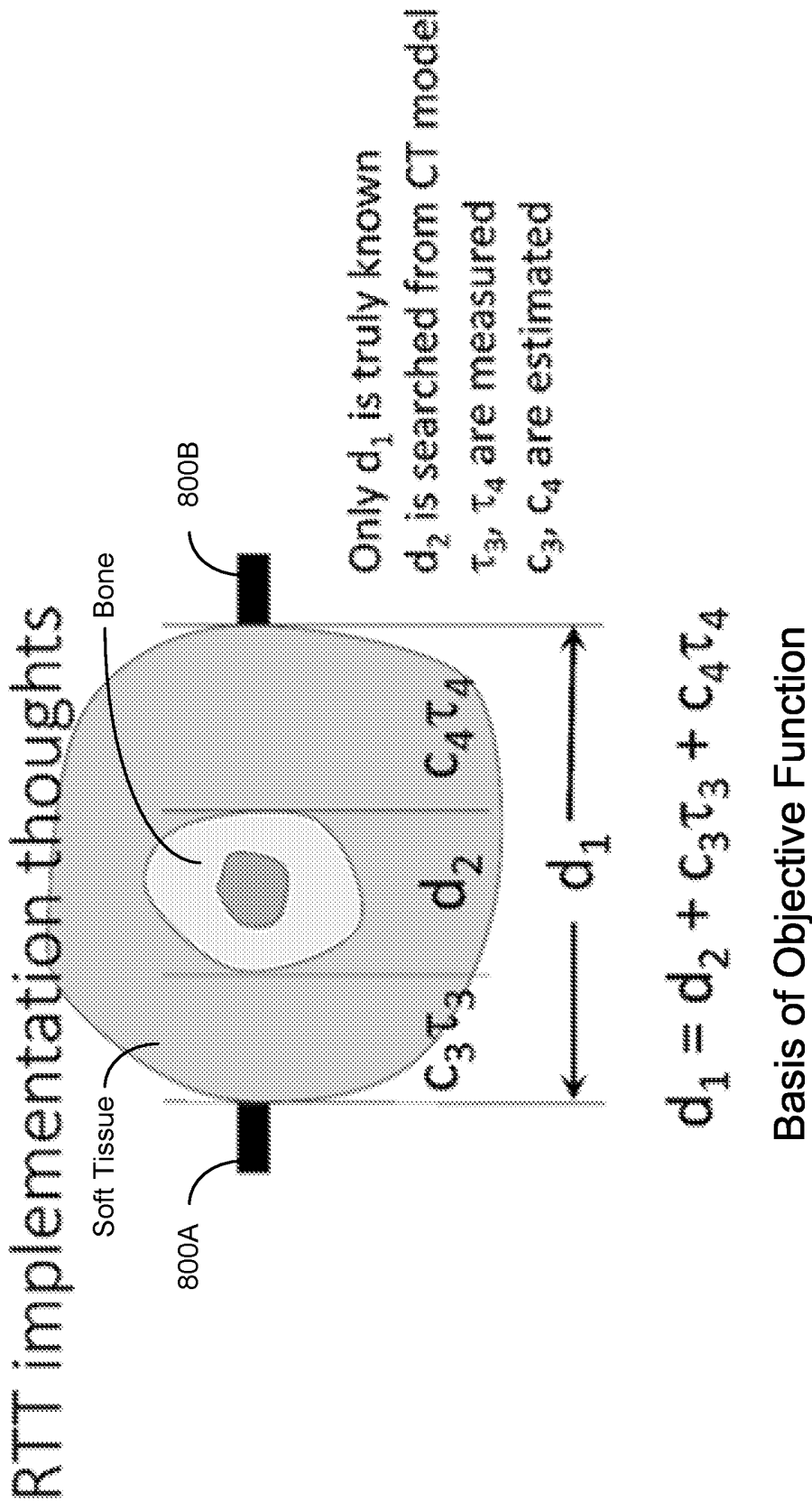


FIG. 8A

n^{th} objective function for N pairs of elements

$$f_n = d_{n,1} - d_{n,2}(x,y,z,\phi,\theta,\psi) - c_{n,3}\tau_{n,3} - c_{n,4}\tau_{n,4}$$



Actually 6 unknowns in CT model orientation
Constrain unknowns so solver can make a lock

FIG. 8B

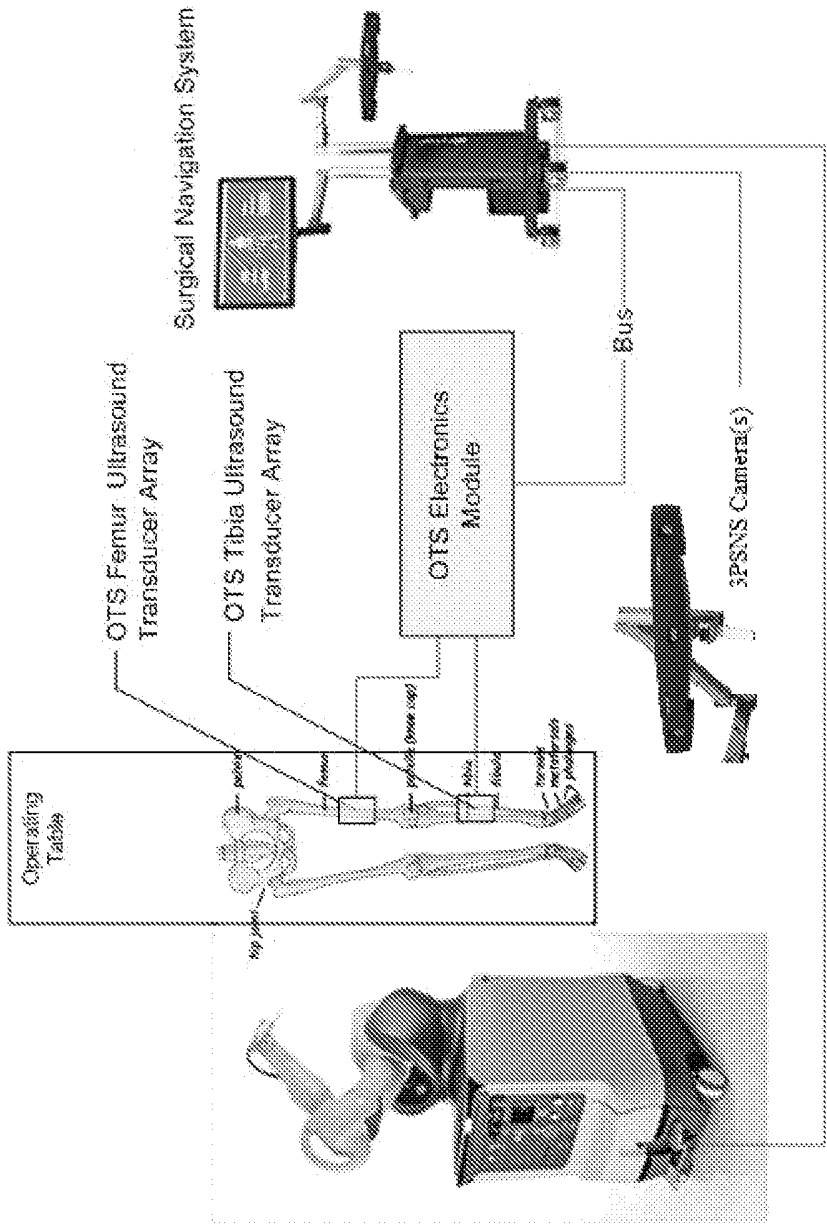


FIG. 9

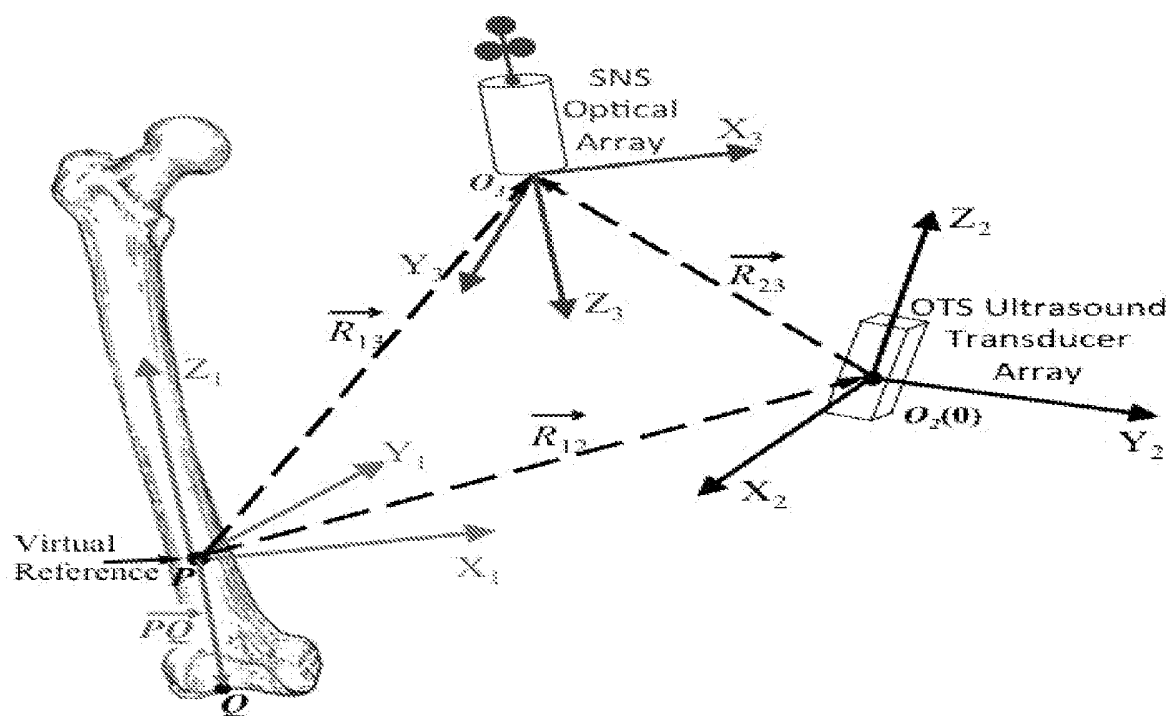


FIG. 10A

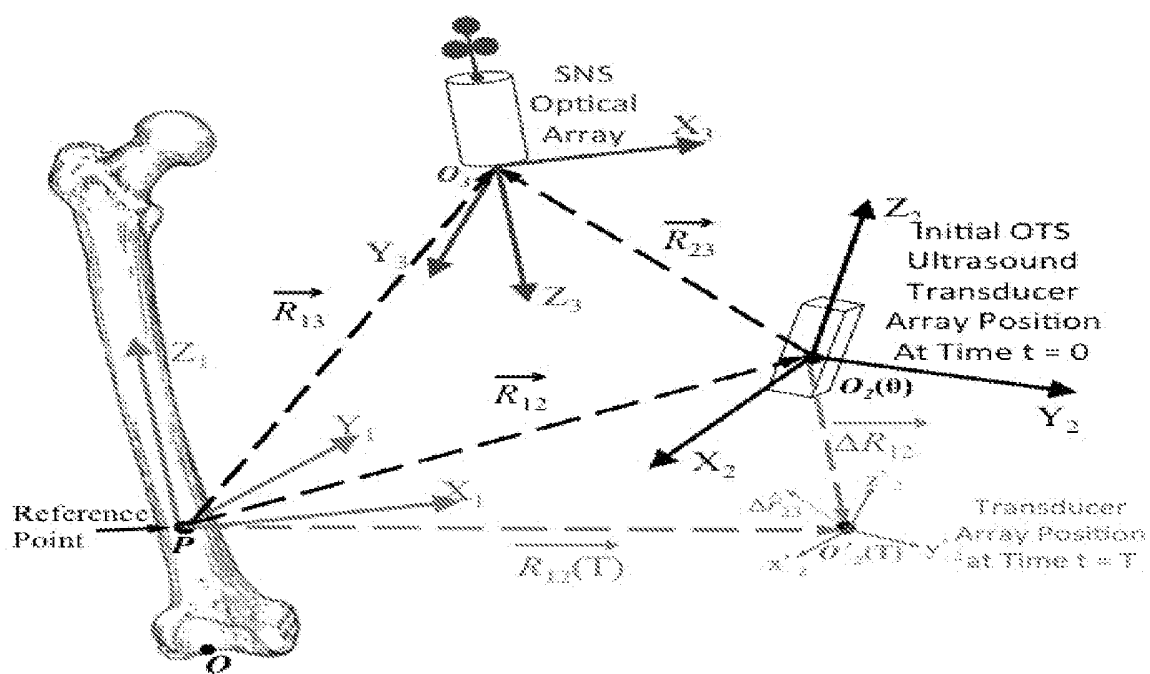
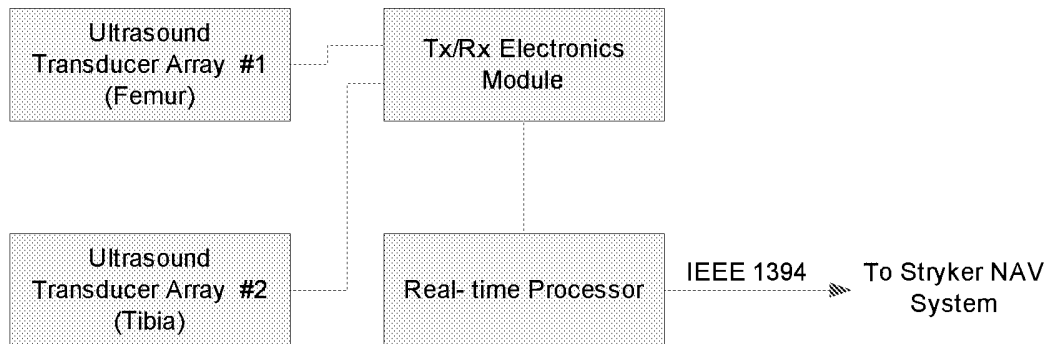
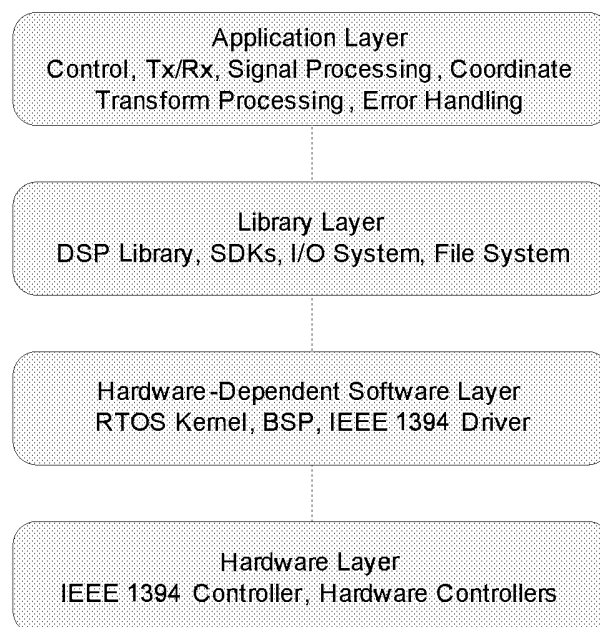


FIG. 10B

**FIG. 11****FIG. 12**

