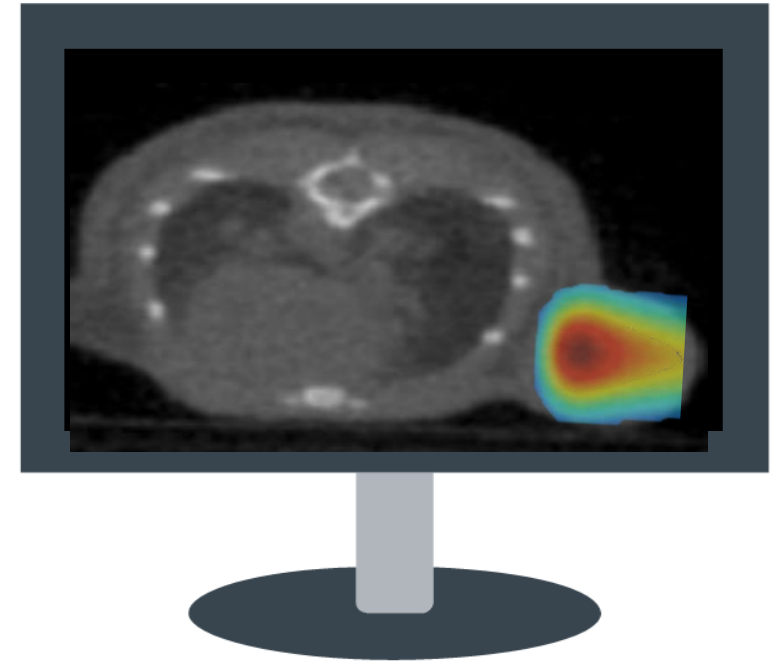
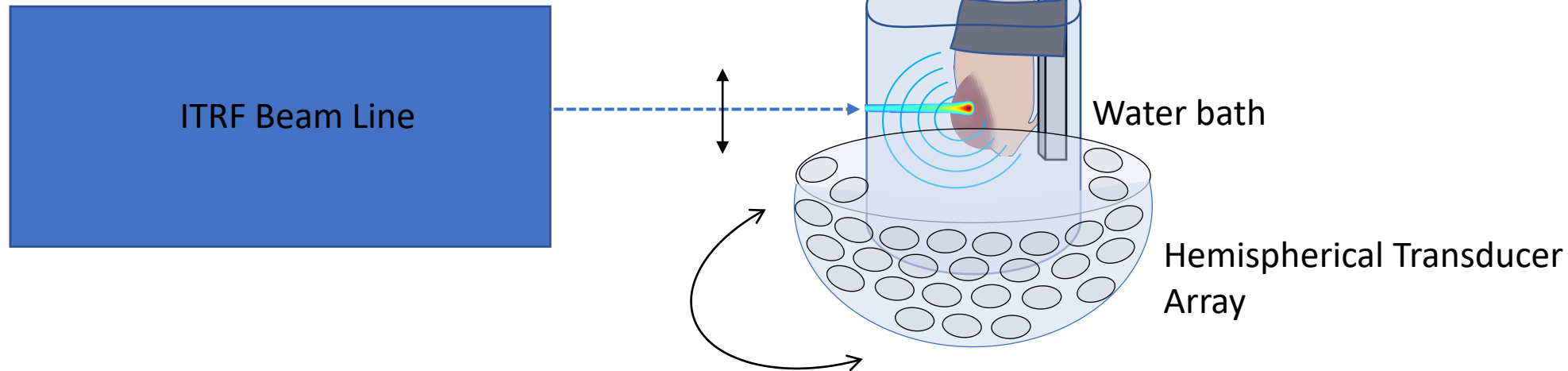


# Future Vision – in vivo facility

- Pulse-by-pulse dose mapping and adaptation.

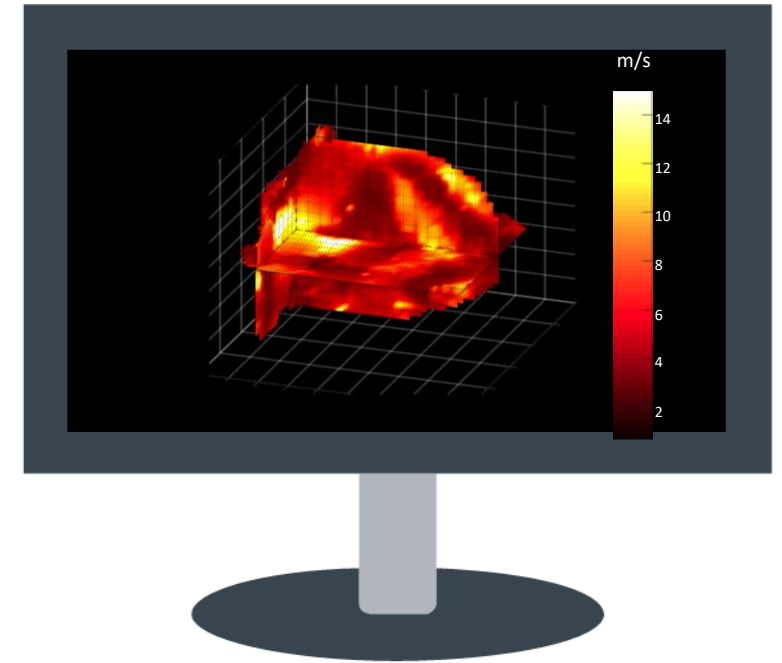
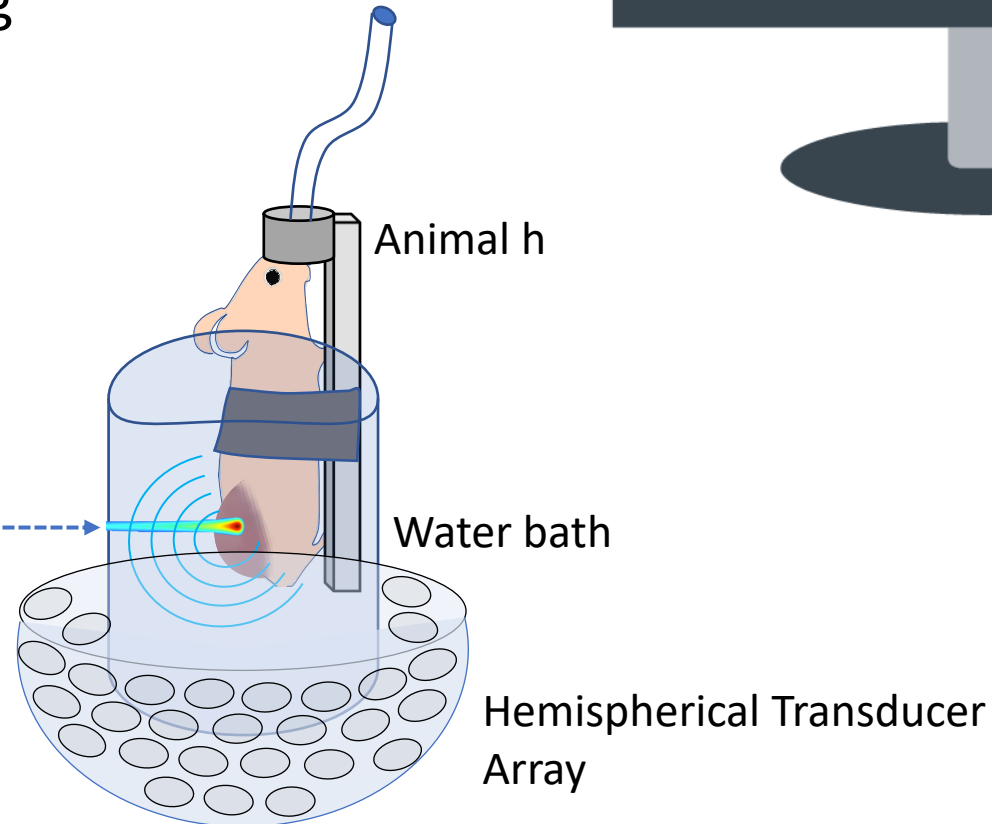


Accurate record of 3D dose for histopathological correlation

# Future Vision – in vivo facility

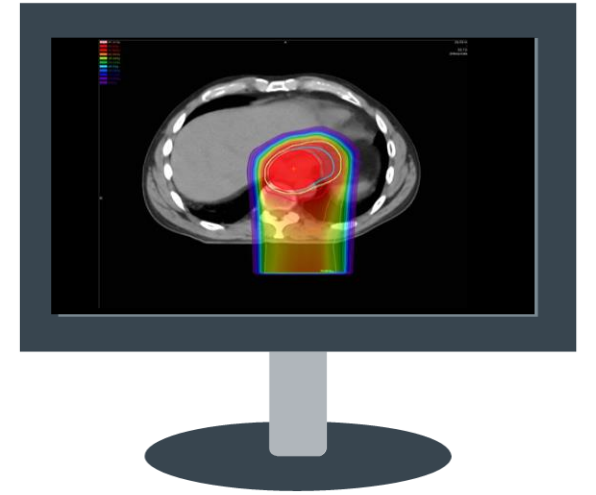
- Functional ultrasound imaging
  - Contrast – vasculature
  - Elastography – stiff EMC/stroma
  - Molecular – biological targeting
- Ultrasound therapy
  - HIFU
  - Microbubbles

ITRF Beam Line



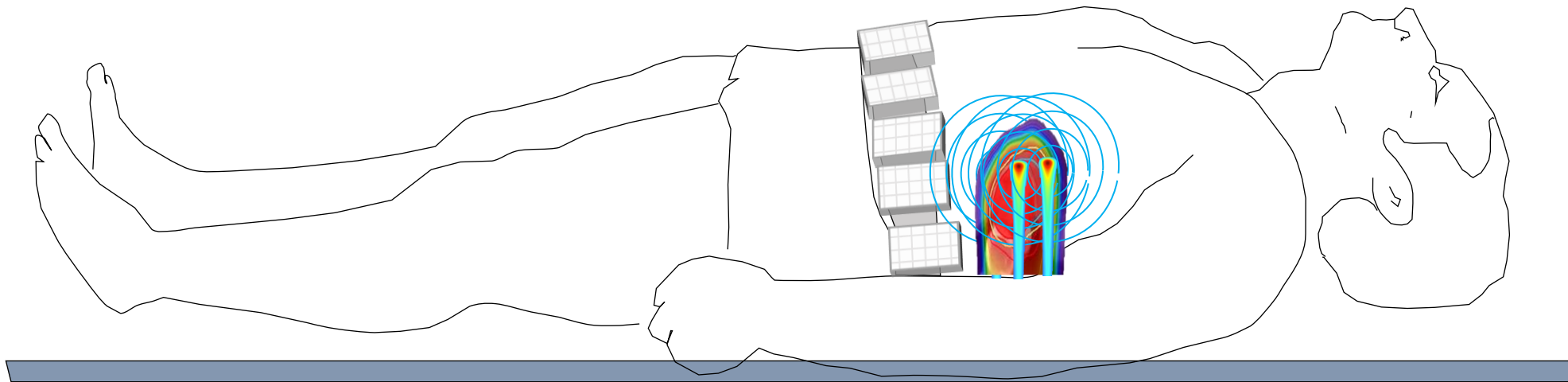
# Future Vision – clinical dosimetry

- Range verification
- Pulse-by-pulse dose mapping
- Real-time adaptation to dose and motion



Real-time Adaptive Replanning

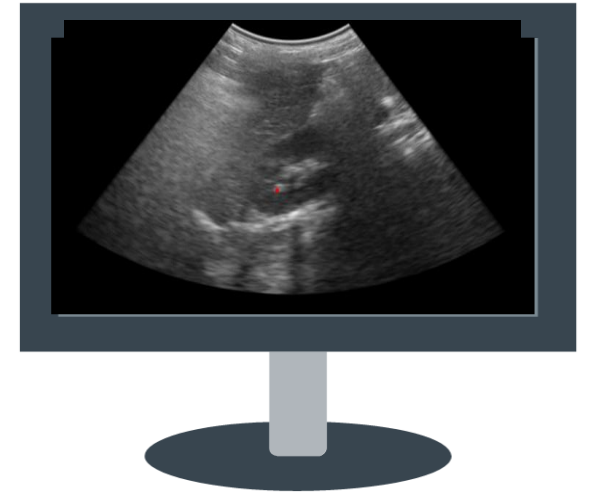
Conformable device  
comprising multiple 1D or 2D  
arrays



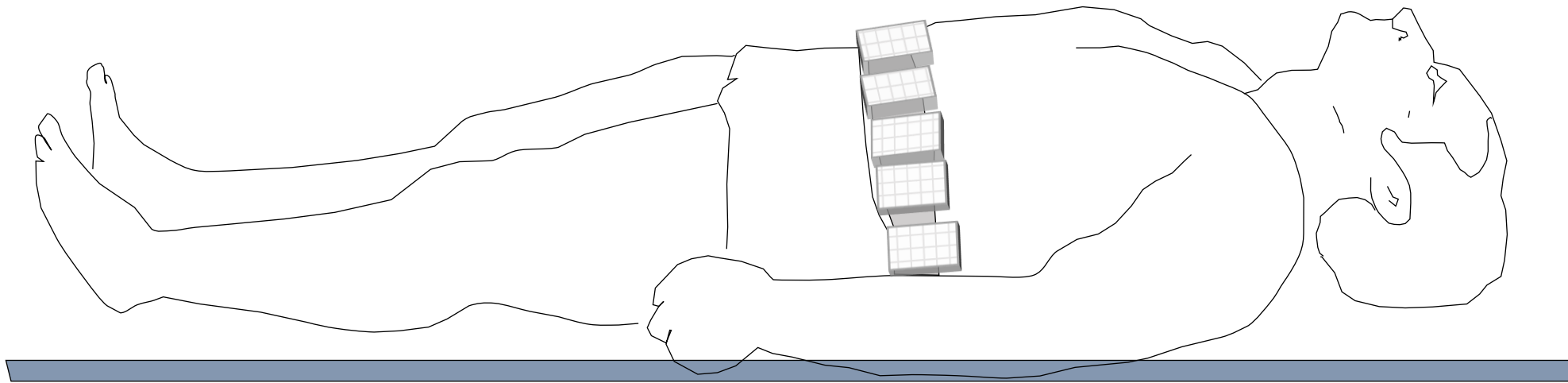
Beam

# Future Vision – clinical dosimetry

- Target localisation
- Motion management



Motion management



Beam

# Impact

- **Academic:** New approaches to ionacoustics.
  - New understanding of ionacoustic signals versus beam parameters.
  - Distributed sensors and 3D image/dose reconstruction.
  - Optimised sensors – broadband and high spatial precision.
- **Societal:**
  - Enables **safe delivery** of alternative ion sources – support. Innovation in trials of exploiting novel radiobiology.
  - Proton therapy to moving targets or those close to organs at risk.
  - Real-time functional image guidance.
  - Exploitation of novel combination therapy.