

# Clinical translation of an early-photon imaging system for safe placement of feeding tubes

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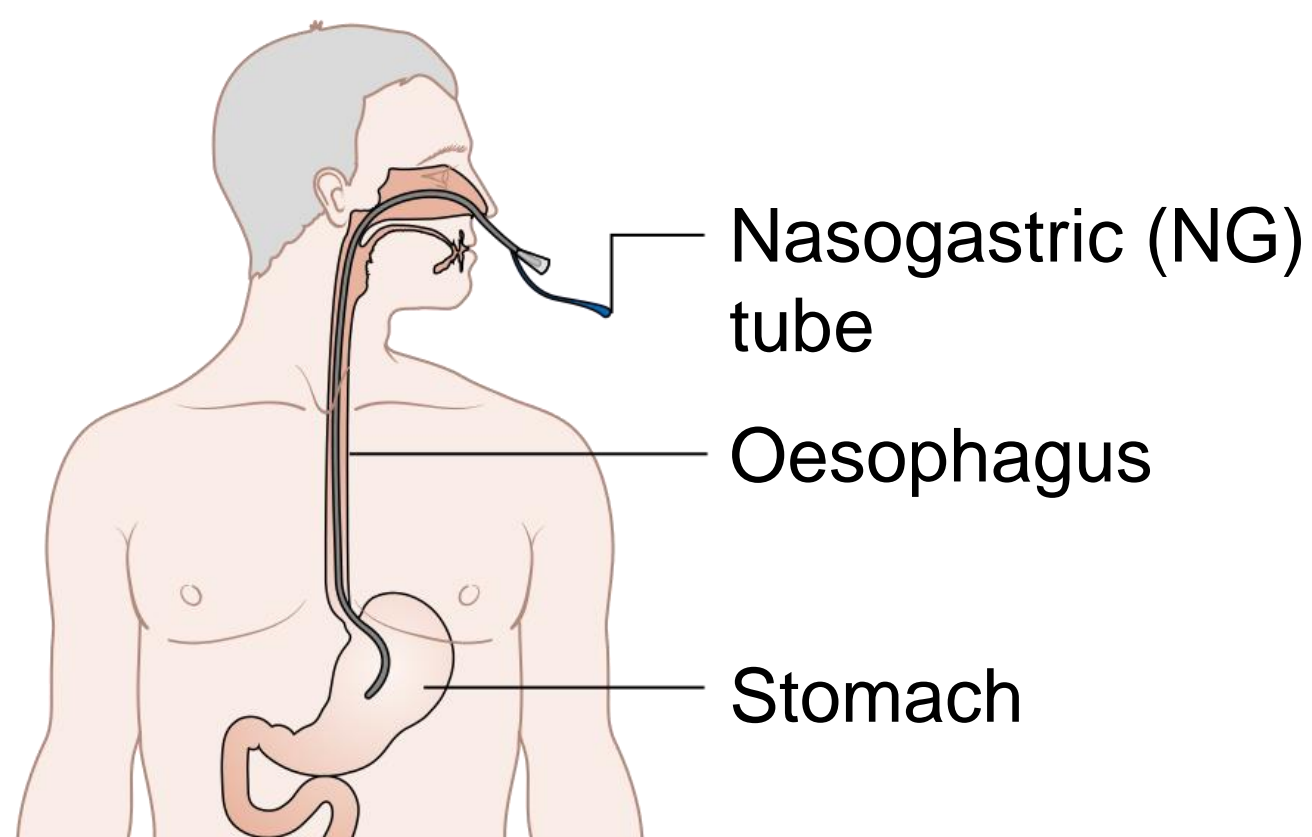
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## Introduction



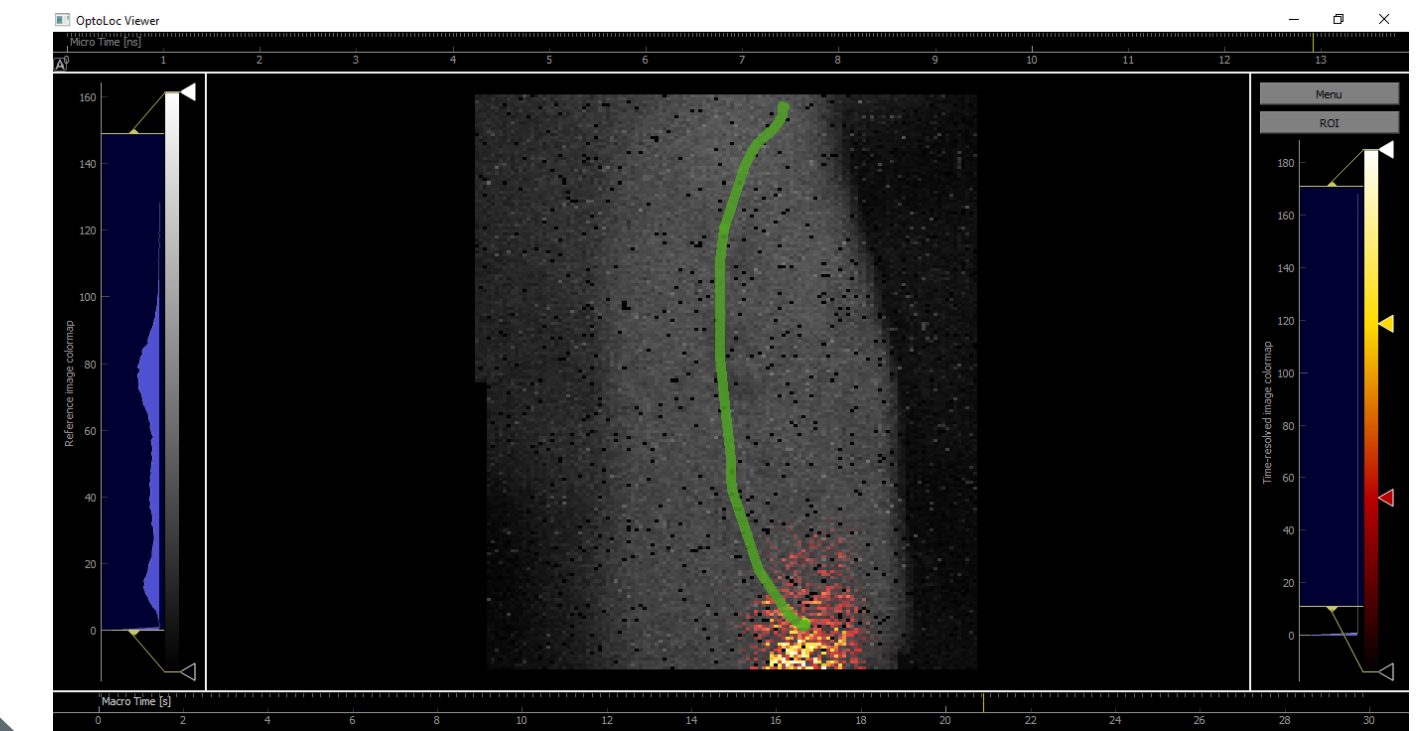
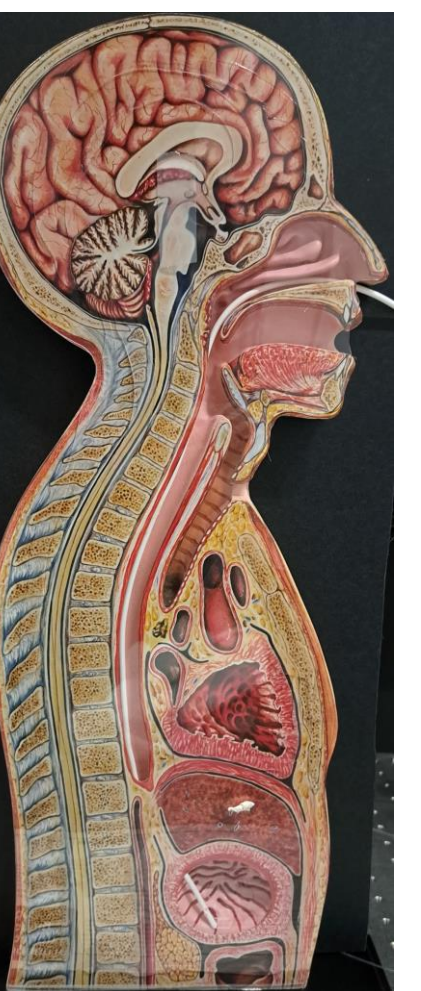
Source: <https://oxfordmedicaleducation.com/clinical-skills/procedures/nasogastric-ng-tube/>

- NG tubes are used to deliver food and drugs to patients who cannot take nutrition orally
- NG tube placement is a routine procedure, but misplacement (e.g., in lung) could be fatal
- Common practice: **X-ray confirmation**
  - Ionising radiation
  - Delay to feeding
  - Burden on resources

## Implementation - Software

We wrote a software interface, that

- Displays videos and image sequences immediately after acquisition
- Enables visualisation of light scattering over micro and/or macro time
- Offers simple processing steps (background subtraction, temporal/spatial binning, etc.) during video playback
- Written in python/cython, and the PyQt library



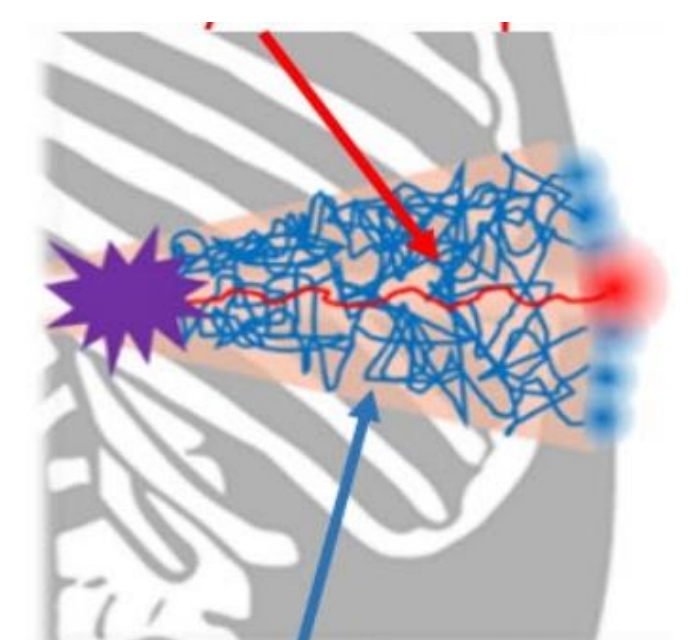
## Proposed solution

1. NG tube with optical fibre to emit light pulses from the tube location / path
2. Camera outside the patient to pick up the light from the body, scattered through tissue



3. Temporal filtering of highly scattered photons with no or minimal spatial information

Direct / shorter path



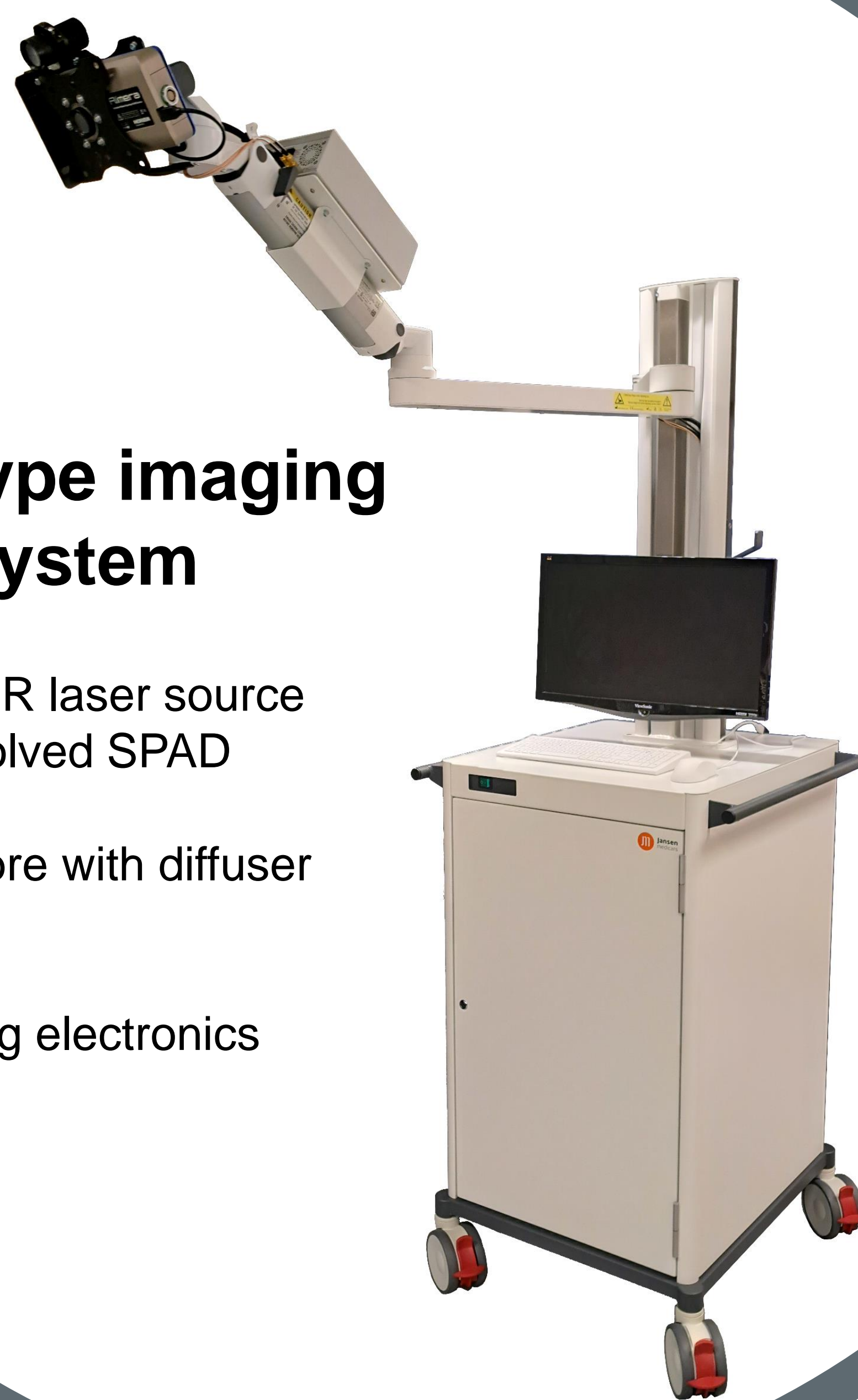
Scattered / longer path

4. Location determined from **early-photon** image.

Ultimate goal: immediate feedback for dynamic tracking and **tactile optically guided feeding tube placement**

## Prototype imaging system

- Pulsed NIR laser source
- Time-resolved SPAD camera
- Optical fibre with diffuser tip
- NIR LED
- Controlling electronics

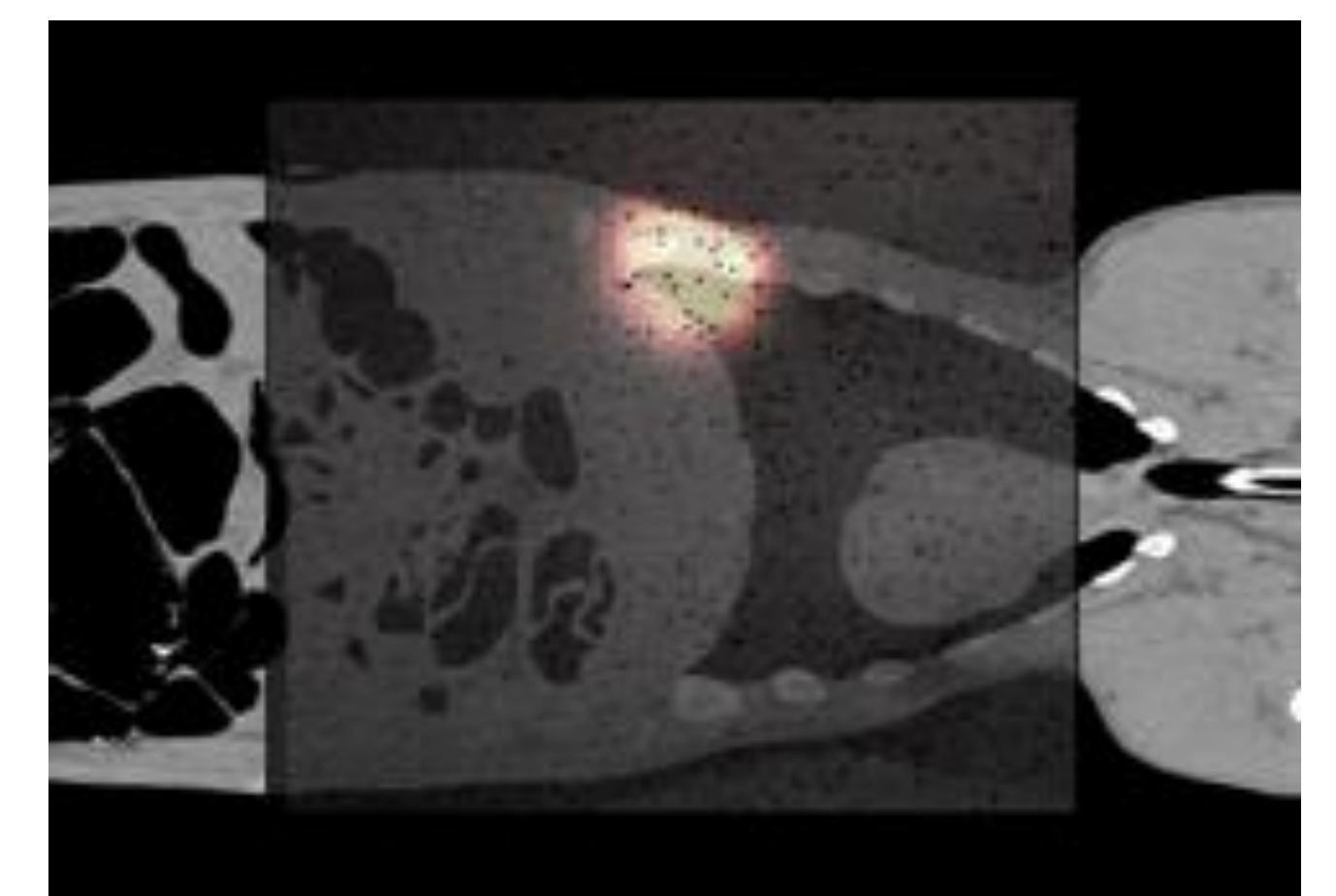
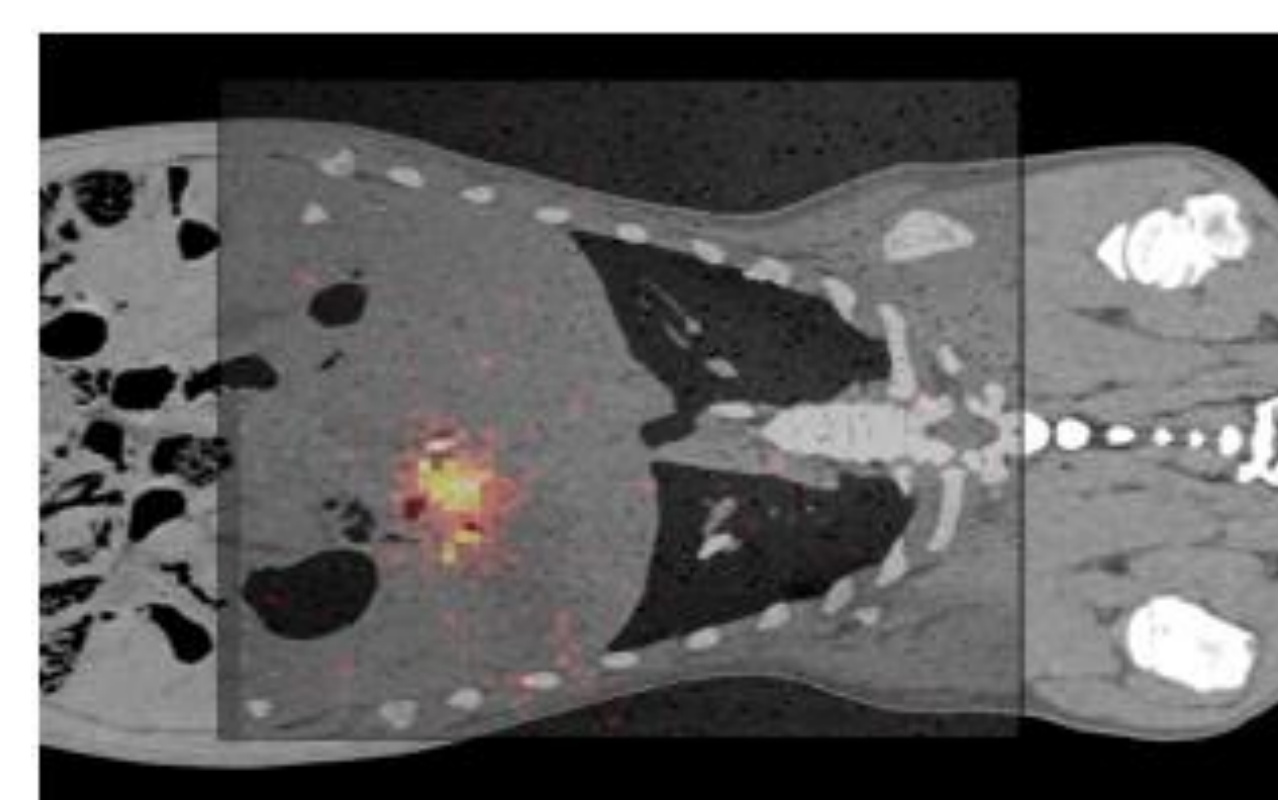


## Preclinical evaluation

We validated device functionality and differentiation between stomach and non-stomach NG tube localisation in porcine models and human cadavers.



Stomach NG tube placement in a human cadaver. The image from our system is overlaid with an X-ray scan.



Stomach (left) and lung (right) NG tube placement in a porcine model. The images are overlaid with CT scans.

## Implementation - Hardware

We built a prototype system from off-the-shelf components and mounted it on a medical trolley.



## Next steps...

We shall shortly be commencing a first in-human clinical study while working on the commercialisation of this technology.