

ECT for LNG III

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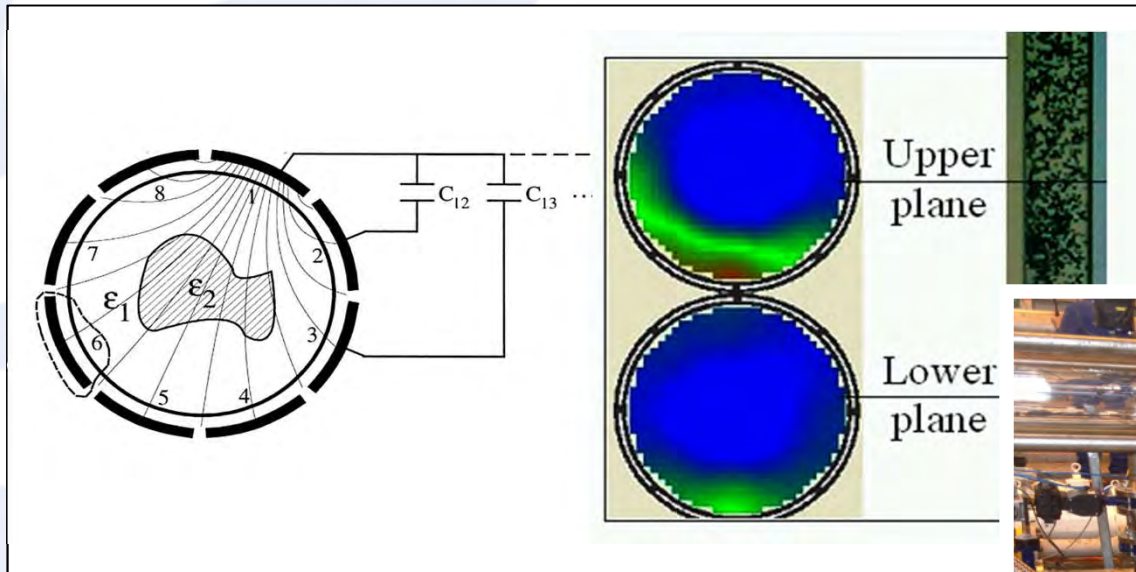
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Electrical Capacitance Tomography

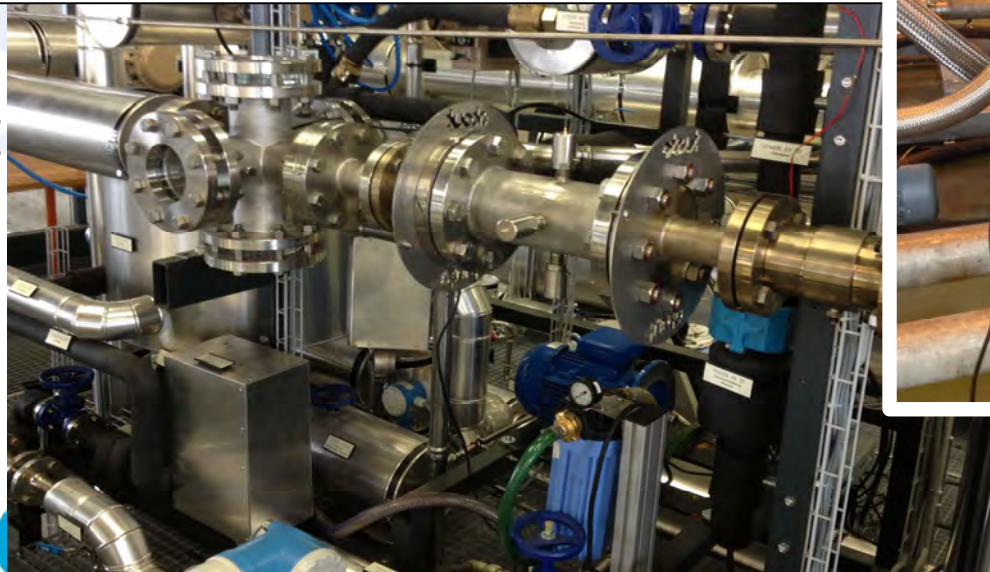
- A 'body scanner' for pipes
 - 2500 images per second
- Can measure density distribution in pipes and tanks
- LNGIII focuses on designing suitable ECT sensors for LNG use

Electrical Capacitance Tomography

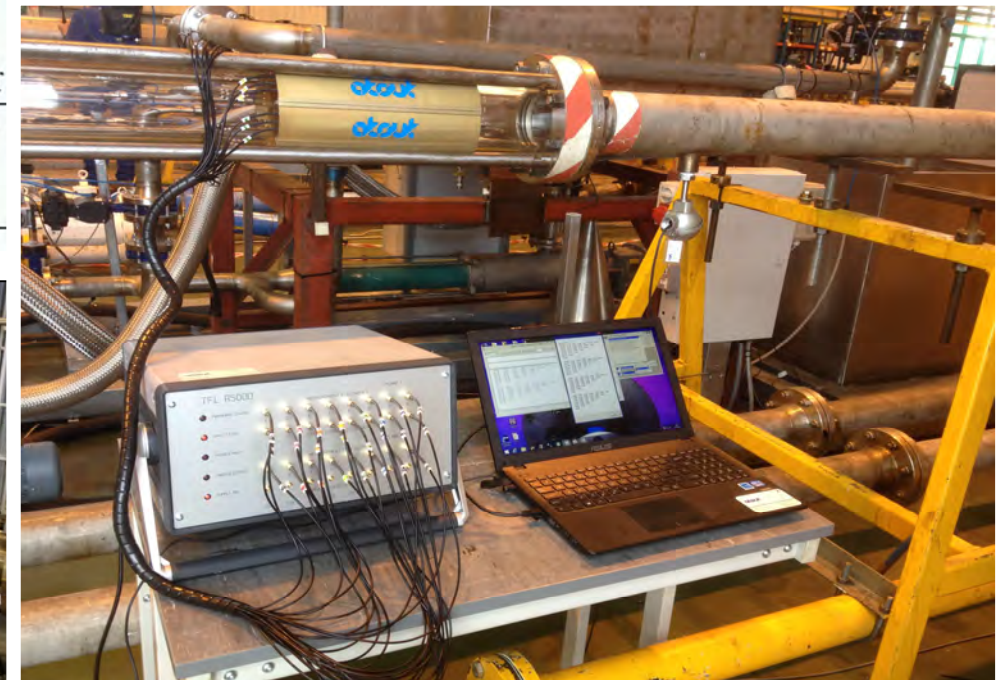


Dry Solids

Oil and gas



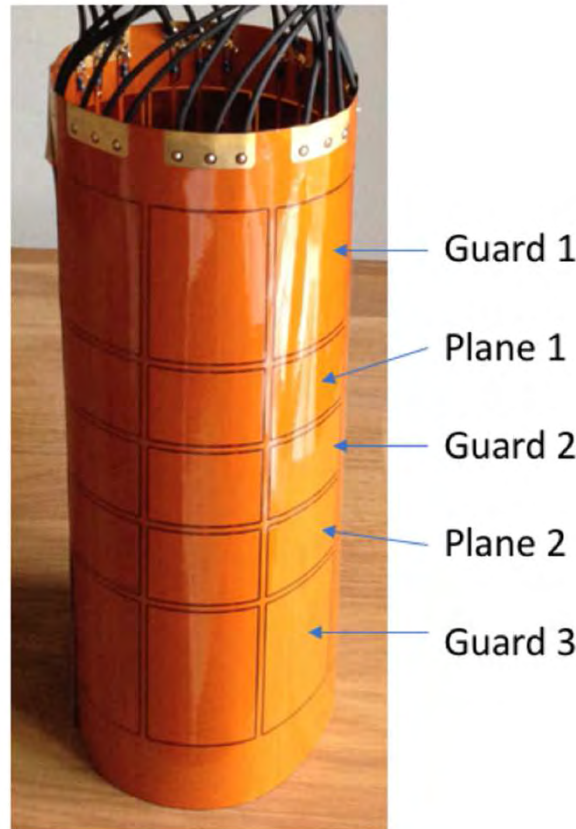
Wet
steam



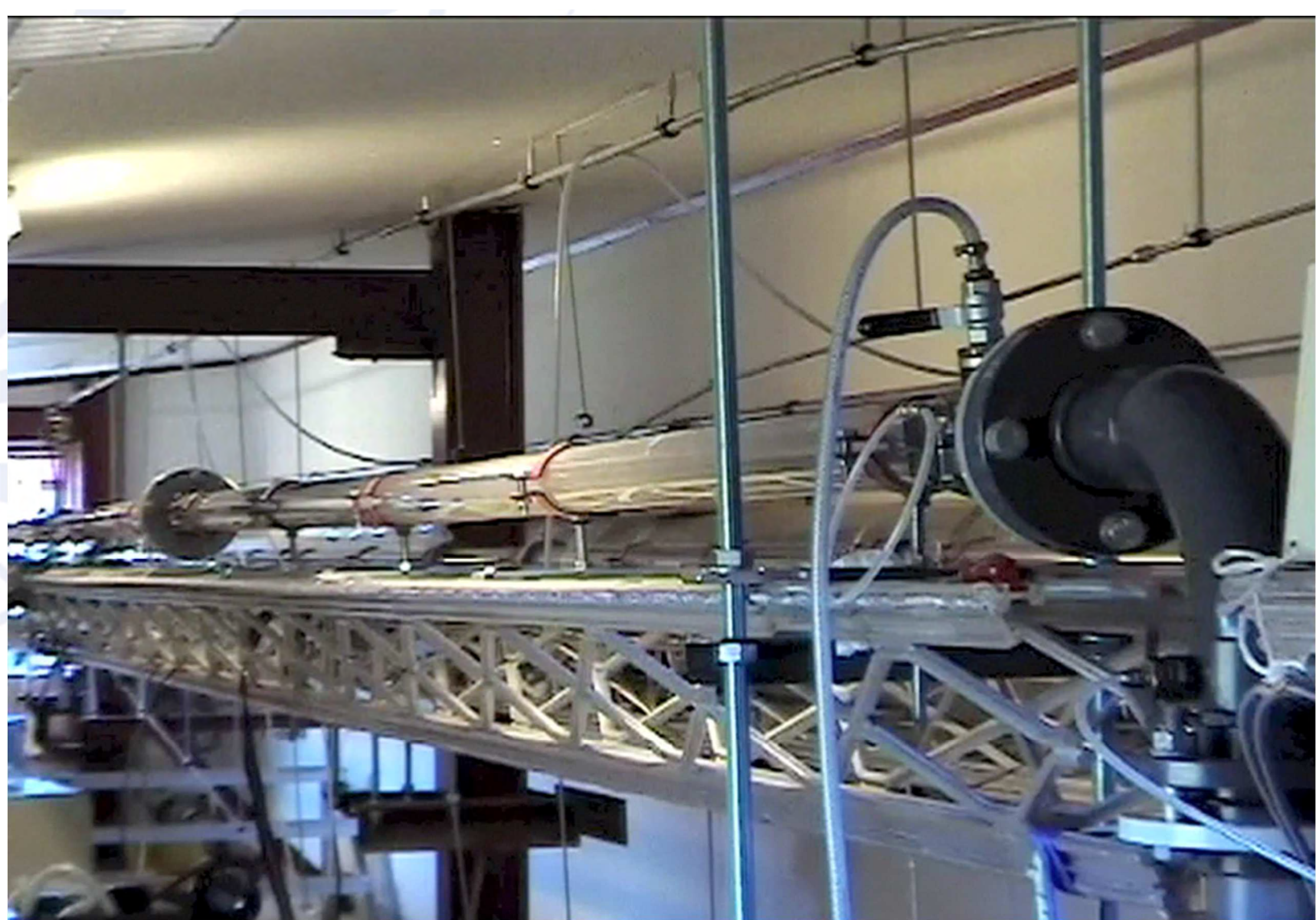
Hunt A. (2014) Weighing without Touching: Applying Electrical Capacitance Tomography to Mass Flowrate Measurement in Multiphase Flows; **Measurement and Control** 47: 19-25.

<https://www.researchgate.net/publication/281970207>

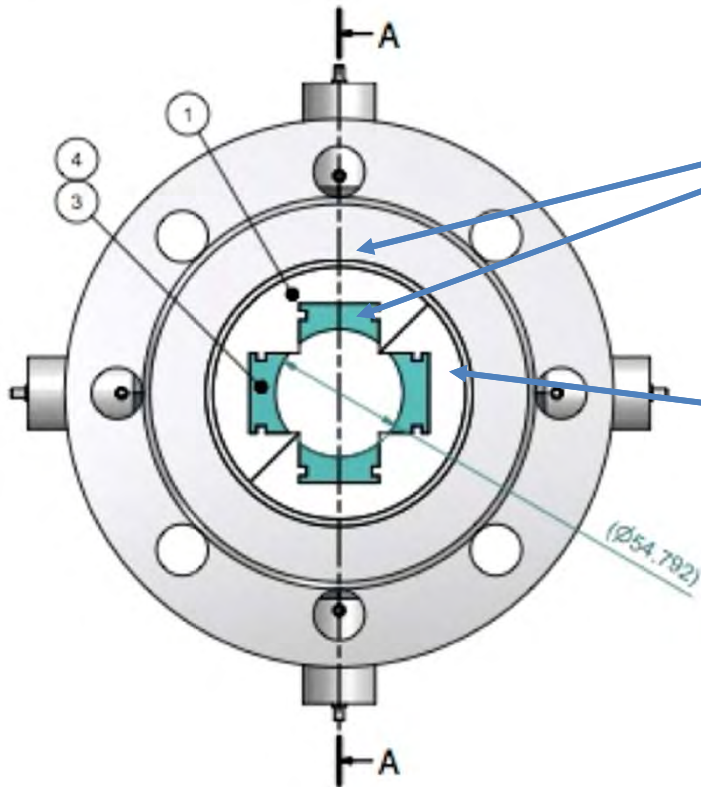
Commercial ECT Systems



- Measure capacitances on two-planes of electrodes
- Produce images of concentration and velocity
- Integrate to give flowrate in two-phase flows



Typical sensor components

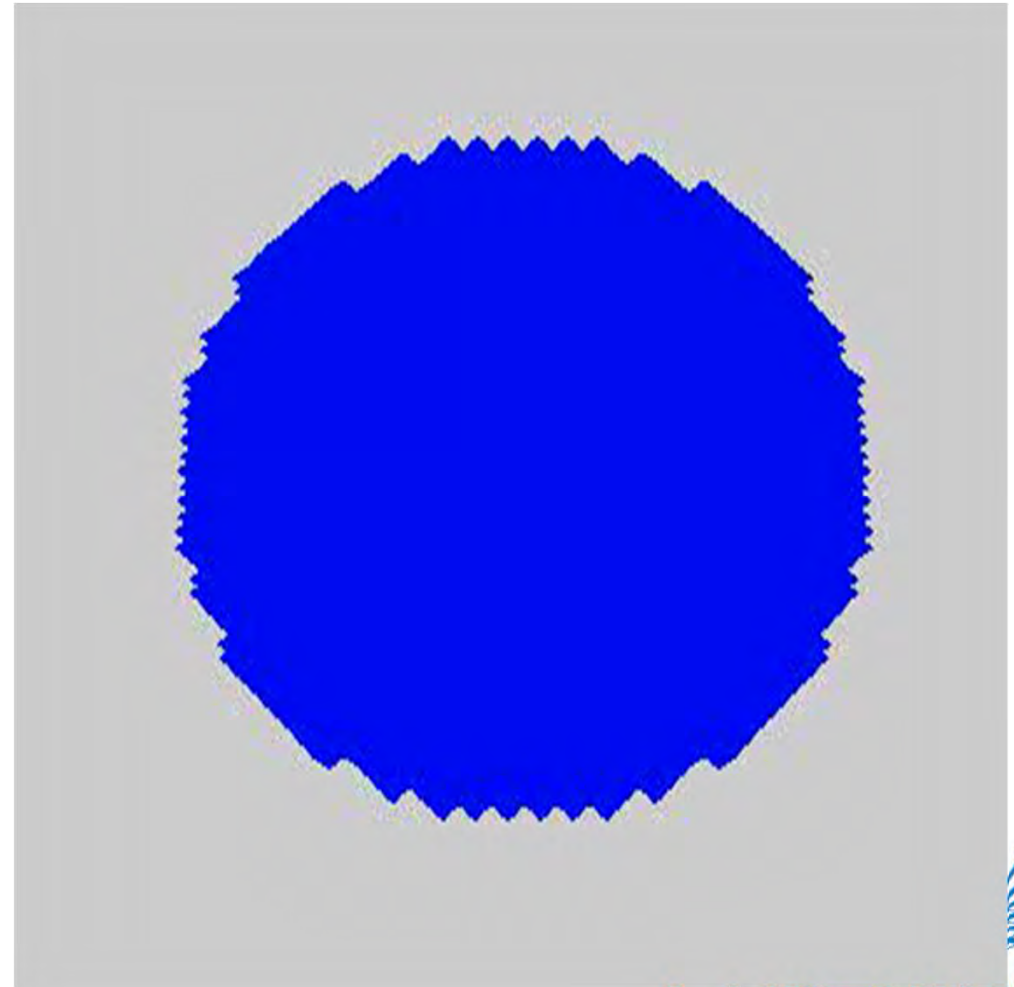


Body and electrodes are
316L Stainless steel

Insulator is PTFE

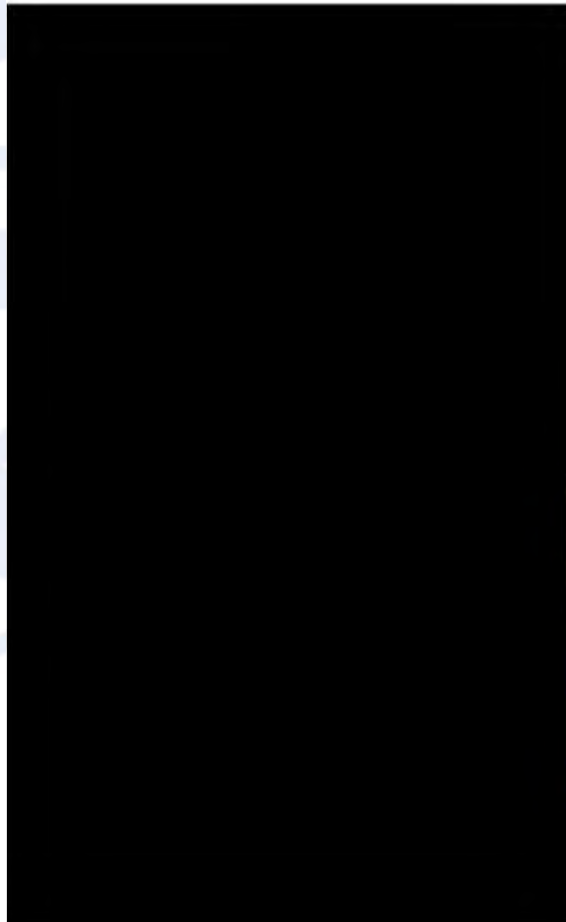
90% of internal bore surface is
stainless steel

Liquid Propane Tank

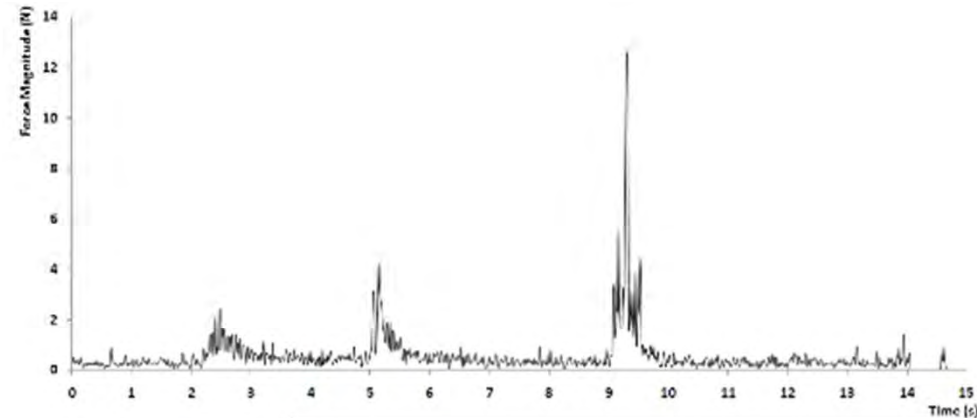


Kerosene tank gauging with ECT showing center of mass (CoM) and force vector

CoM –
side view



CoM –
end view



Cryogenic design challenges

- The body and electrodes of the sensor must be able to withstand cryogenic temperatures without embrittlement and have good corrosion resistance and must have good electrical conductivity.
- The electrodes and connection feed-throughs must be isolated by an electrically non-conducting insulator which must share the mechanical cryogenic requirements.

Development of ECT for LNG III

- Aim to measure accurate images of density distribution in LNG flows,
- Design of sensor body and feedthroughs,
- Material tests, electromagnetic modelling,
- Low temperature tests of existing electrode arrays,
- Develop overall uncertainty budget.