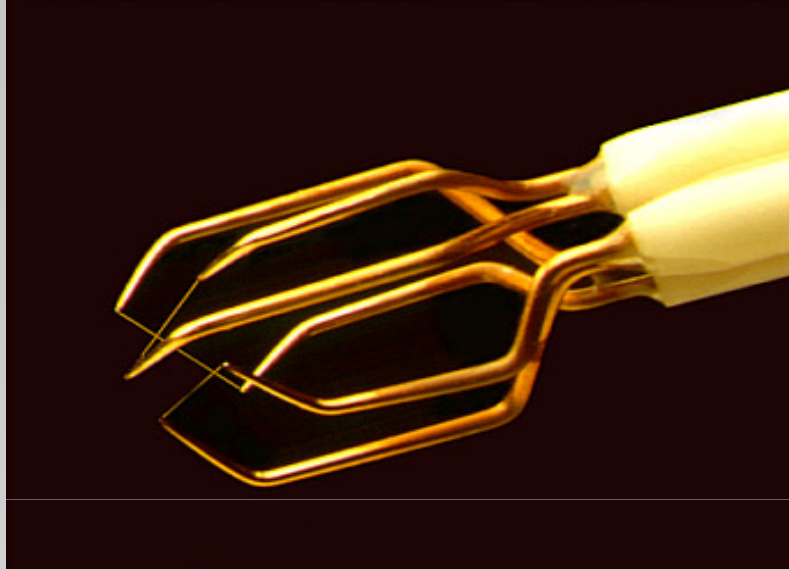


Hot-Wire Anemometry

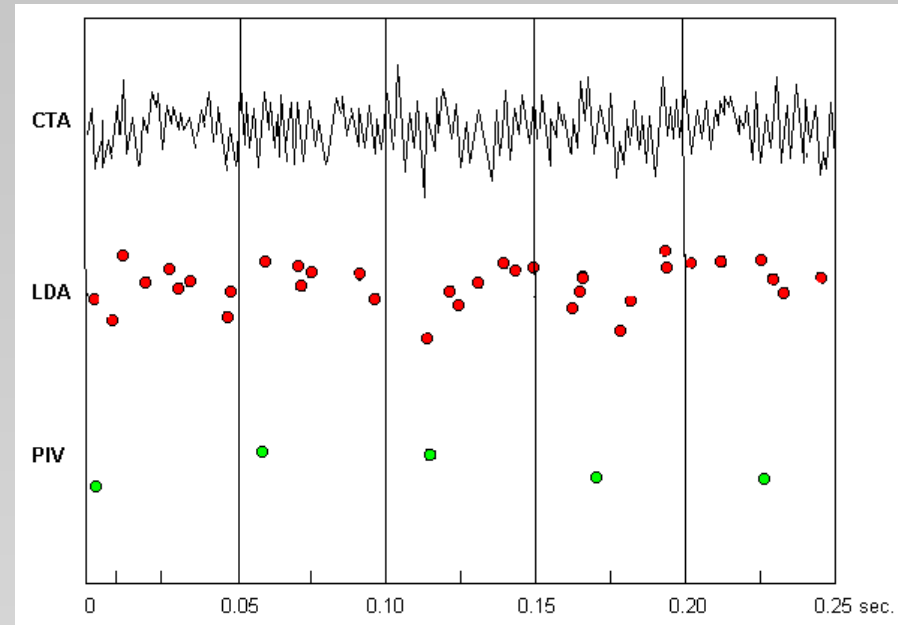


- **Purpose:**
to measure mean and fluctuating variables in fluid flows (velocity, temperature, etc.): mean velocity, turbulence characteristics

Anemometer signal output

The thermal anemometer provides an analogue output which represents the velocity in a point. A velocity information is thus available anytime.

Note that LDA signals occur at random, while PIV signals are timed with the frame grapping of illuminated particles.

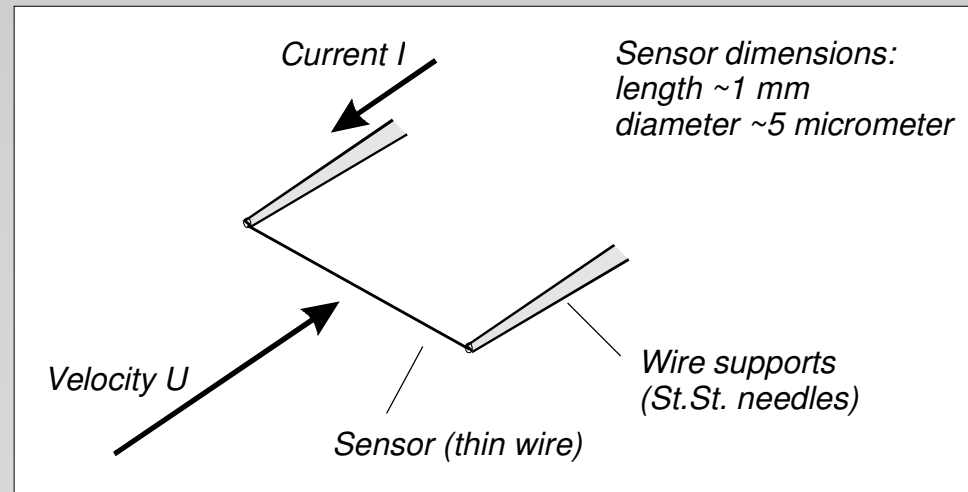


Principles of operation

- Consider a thin wire mounted to supports and exposed to a velocity U .

When a current is passed through wire, heat is generated ($I^2 R_w$). In equilibrium, this must be balanced by heat loss (primarily convective) to the surroundings.

- If velocity changes, convective heat transfer coefficient will change, wire temperature will change and eventually reach a new equilibrium.
- Calibration needed

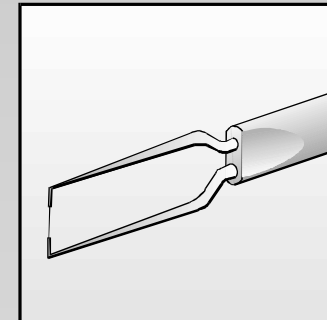
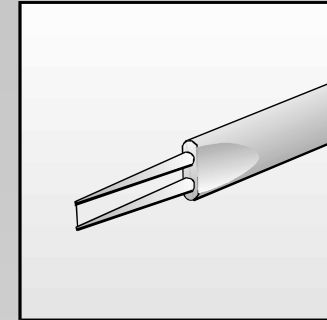


Probe types I

- **Miniature Wire Probes**
Platinum-plated tungsten,
5 μm diameter, 1.2 mm length
- **Gold-Plated Probes**
3 mm total wire length,
1.25 mm active sensor
copper ends, gold-plated

Advantages:

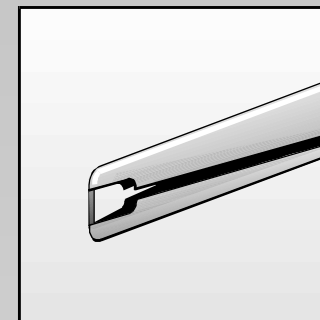
- accurately defined sensing length
- reduced heat dissipation by the prongs
- more uniform temperature distribution along wire
- less probe interference to the flow field



Probe types II

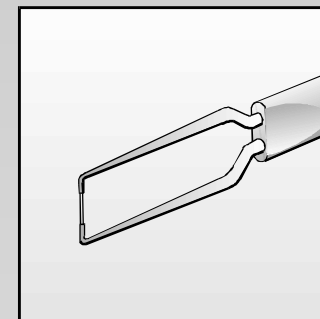
- **Film Probes**

Thin metal film (nickel) deposited on quartz body. Thin quartz layer protects metal film against corrosion, wear, physical damage, electrical action



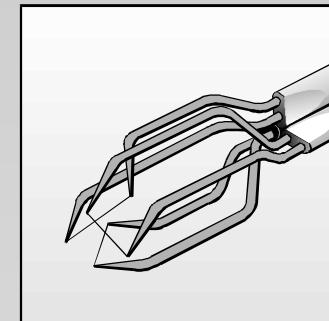
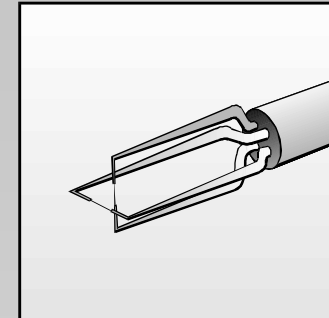
- **Fiber-Film Probes**

“Hybrid” - film deposited on a thin wire-like quartz rod (fiber) “split fiber-film probes.”



Probe types III

- **X-probes for 2D flows**
2 sensors perpendicular to each other.
Measures within $\pm 45^\circ$.
- **Split-fiber probes for 2D flows**
2 film sensors opposite each other on a quartz cylinder. Measures within $\pm 90^\circ$.
- **Tri-axial probes for 3D flows**
3 sensors in an orthogonal system. Measures within 70° cone.



Constant Temperature Anemometer CTA

- **Principle:**

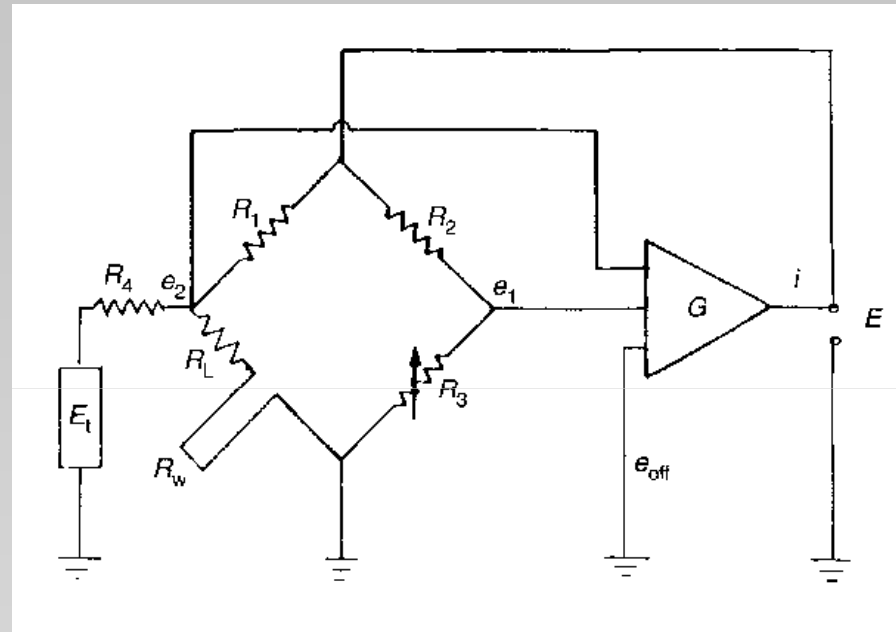
Sensor resistance is kept constant by servo amplifier

- **Advantages:**

- Easy to use
- High frequency response
- Low noise
- Accepted standard

- **Disadvantages:**

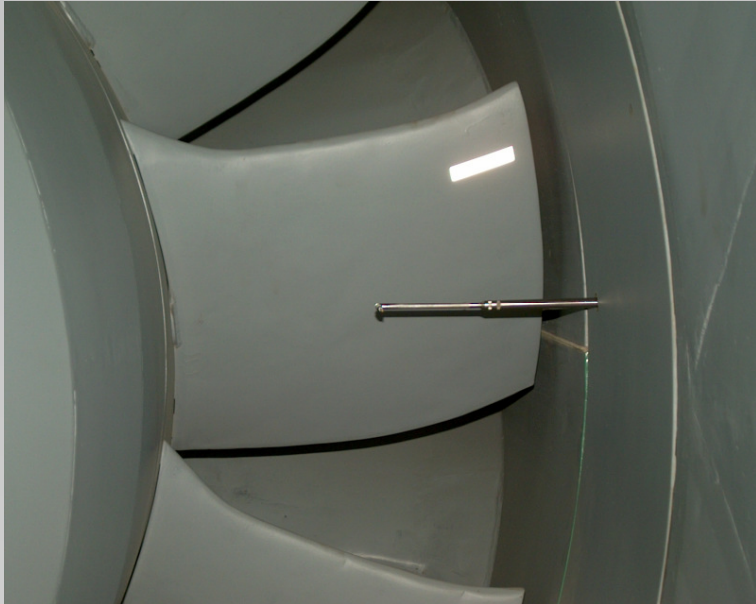
- More complex circuit



Flow velocity deduced from heating voltage

Axial fan:





Measurements upstream



Measurements downstream

