**Introduction**

- Needle-tissue puncture events are important in both diabetes lancing and needle steering
- Immediate objective: Measure forces and torques on the needle during puncture to inform future modeling efforts.
- Long-term goal: Optimize needle tip geometry for desired result (e.g. steering or blood retrieval).

**Lancet Application**

- **Therasense Freestyle** lancing device. Shown with 28 g lancet.

  Goal: Minimize pain while maximizing blood volume extracted

**Steerable Needle Application**

- Trajectories of eight insertions overlaid on example experimental photo. Needle tip appears to deflect initially, then follow constant curvature.

  Goals: Minimize deflection at membranes, increase maximum curvature

**Tip Geometries**

- **Lancet tip geometry**
- **Ground ¼” solid and hollow needles used for initial experiments**

**Experimental Apparatus**

- **Linear slide**
- **Encoder strip**

  Needle punctures in SimTest phantom tissue. (Top, Left) Incisions made by ¼” OD solid needle ground with single-faceted bevel
  (Right) Incisions made by ¼” OD hollow needle ground with single-faceted bevel

  Note: Cuts in all images made with needle points entering at the right

**Preliminary Experimental Data**

- Needle released from 200 mm to simulate lancing, wrench recorded at needle base
- Can reduce velocity for quasistatic cutting
- Damped, second order response evident for SimTest media.