

TACTILE SENSORS FOR CLINICAL APPLICATIONS

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Tactile Imaging Probe (TIP)

Smartphone-based Compression-Induced Sensor-Direct (SCIS-D)

Smartphone-based Compression-Induced Sensor-Indenter (SCIS-I)

Applications

Tactile Imaging Probe (TIP) is developed for breast cancer screening in remote regions, which can complement the current subjective method of clinical breast examination. It estimates the size and stiffness of suspicious lesions to come up with the malignancy information.

Smartphone-based Compression Induced Sensing-Direct (SCIS-D) is the smartphone-based version of TIP developed to characterize the tissue's mechanical properties using a smartphone camera, its communication system, and the tactile sensor. SCIS-D is used for tumor characterization in breast cancer applications.

Smartphone-based Compression Induced Sensing-Indenter (SCIS-I) is the new acquisition mode of SCIS, which measures the tissue recovery pattern from the compression against the tissue. The indirect sensing principle of SCIS-I designed to measure tissue elasticity changes due to the body fluid volume variation.

Sensing Principle and Design

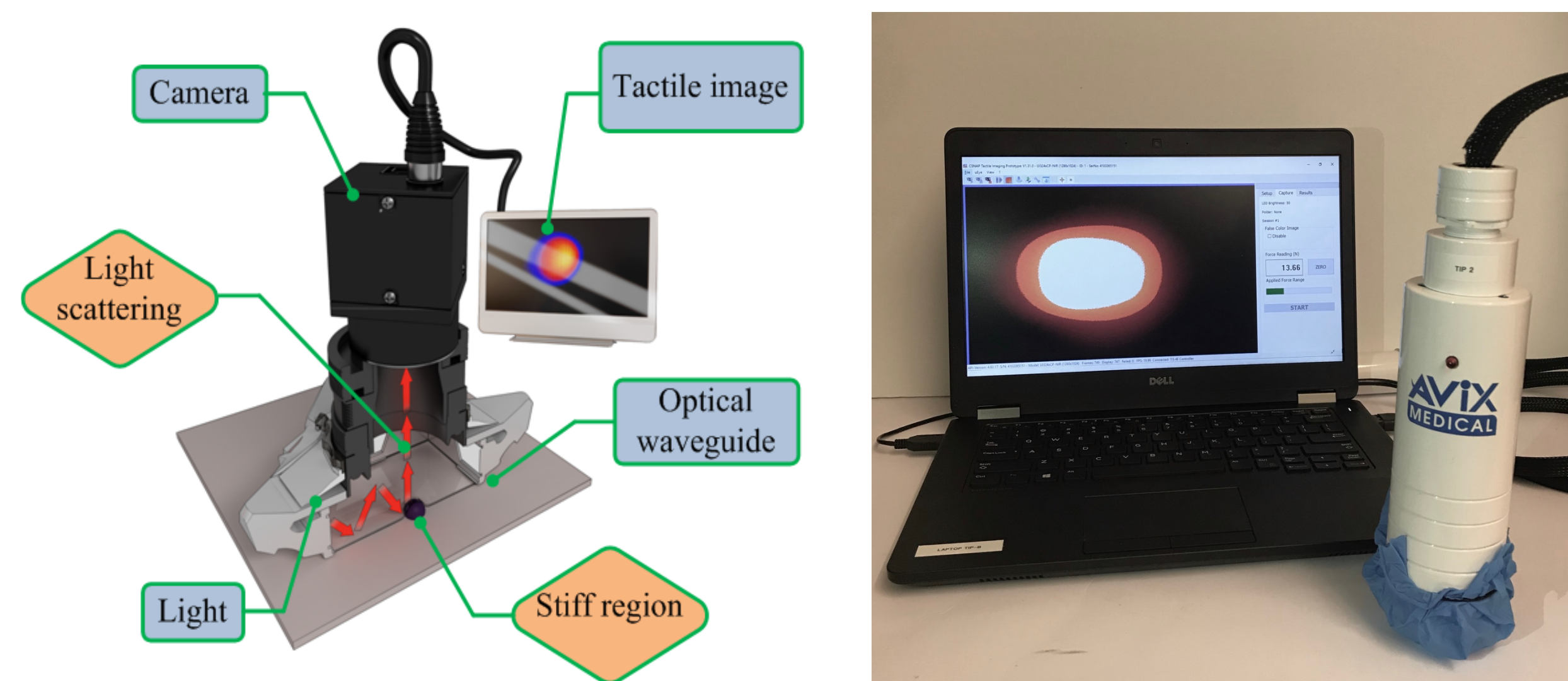


Fig. 1: TIP, Direct Compression Prototype

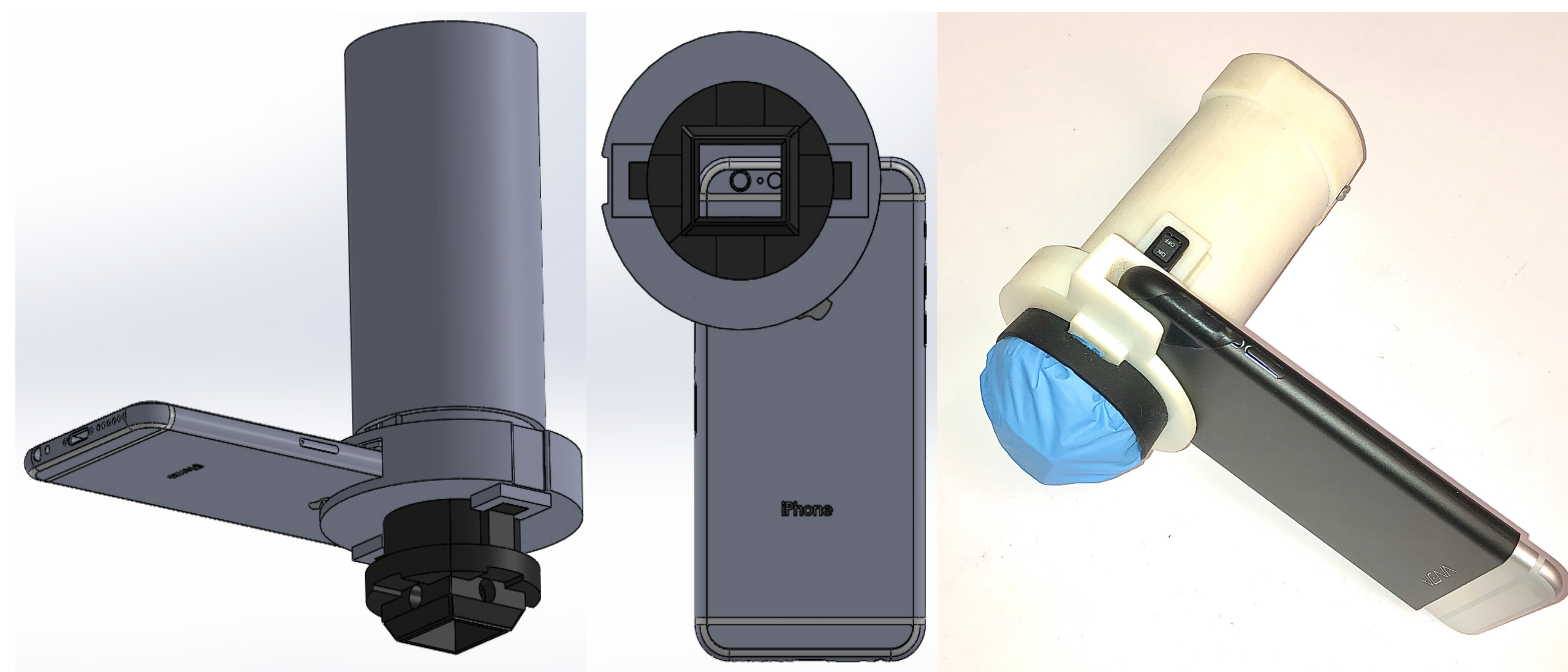


Fig. 2: SCIS-D, Direct Compression Prototype

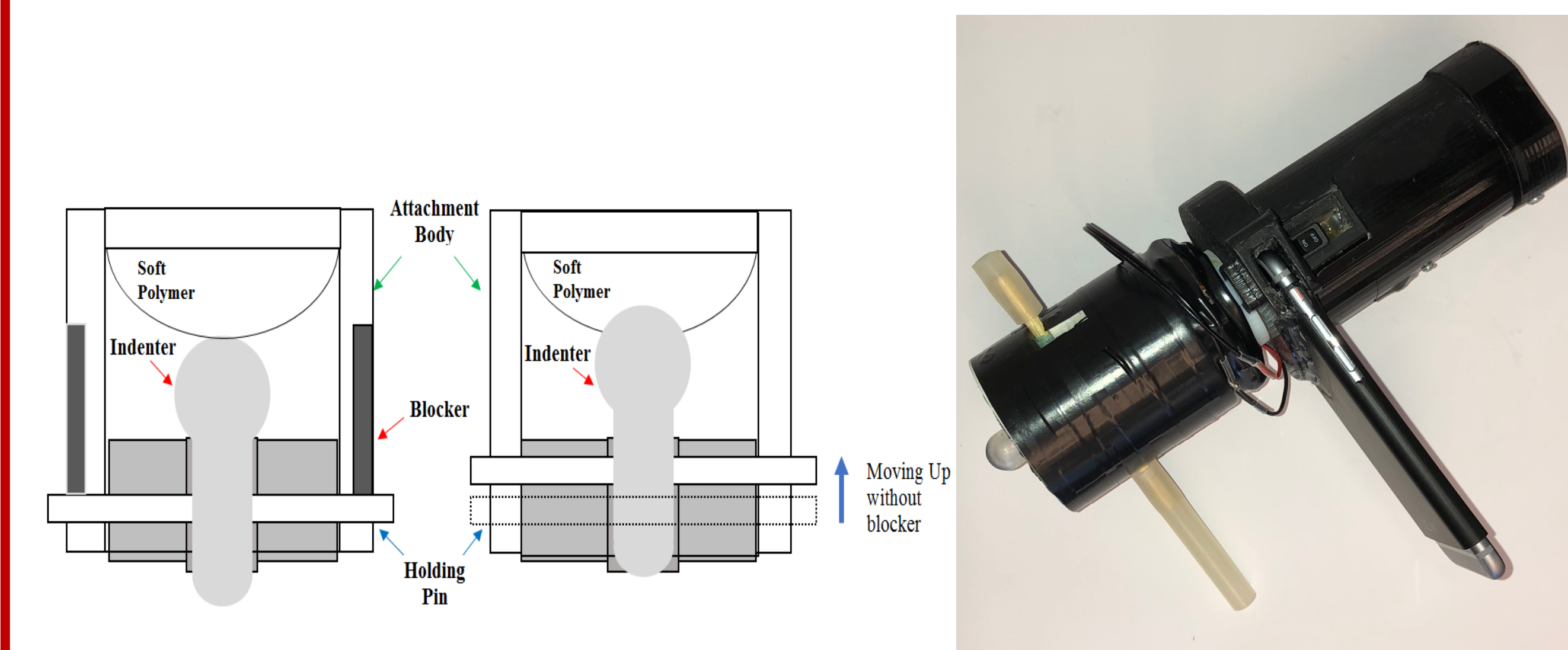


Fig. 3: SCIS-I, Indenter Compression Prototype

Preliminary DEMO Results

Table 1: TIP Preliminary Results

Sample	TRUE		Size Estimation		Deformation Index (10 ⁶)	Score
	Size, mm	YM, kPa	Size, mm	Error, %		
1	12.00	271	10.70	10.81	1.20	1.65
2	16.24	>250000	15.66	3.55	2.74	3.55
3	18.00	94	11.99	33.37	1.47	1.99
4	19.23	250000	18.93	1.54	3.42	4.43

Table 2: SCIS-D Preliminary Results

Sample	TRUE		Size Estimation		Deformation Index (10 ⁶)	Score
	Size (mm)	YM (kPa)	Size (mm)	Error (%)		
1	12.00	271	14.90	24.17	0.64	1.49
2	16.24	>250000	19.10	17.61	6.35	4.93
3	18.00	94	16.80	6.67	0.91	1.79
4	19.23	250000	19.80	2.96	8.52	4.98

Table 3: SCIS-I Preliminary Results

Sample	YM (kPa)	Pitting Depth (mm)	Rebounding Force (N)	Rebounding Speed (mm/sec)
I	355.59	4.0225	7.1908	0.9287
II	266.37	4.6968	6.2208	0.8393
III	221.35	6.4557	4.8098	0.6074
IV	185.91	7.9984	3.7948	0.3698

