

**Cost analysis for pixellated, 1000 micron thick, silicon sensor wafers (req. 298339)**

April 19, 2019

Details are provided below, but the estimated cost to produce a set of 15 sensor wafers with the required characteristics is $150,000.

**Wafers:**

Very special silicon wafers must be custom ordered for this procurement. They must be very high resistivity of greater than 10,000 Ohm-cm, which requires high-purity, float-zone material. It must be grown in crystals with a diameter greater than 150 mm, so that the final wafers can be cut out of it. Both major surfaces of the wafers must be polished to a smoothness level of a few nanometers and the total wafer thickness variation must be less than 10 microns. To produce 15 finished wafers requires starting with at least 20 due to yield loss. Based on prices on [www.universitywafer.com](http://www.universitywafer.com).

**Cost of bare wafers = $2,000**

**Photo-mask plates:**

Must have 1 mask plate for every photolithographic step or 6. Since these plates are brought into physical contact with the wafers, two complete sets of plates are needed to maintain acceptable device yield for a total of 12 plates. Based on quotes and recent SLAC procurements, the cost is about $1,150 per plate.

**Cost of Masks = $13,500**

**Ion Implantation:**

Need 3 implants. Recent SLAC procurements and quotes gives a cost per implant of $850.

**Cost of Implants = $2,550**

**Equipment Use:**

Stanford industry rates are about $10,000 per month of access to the micro-fabrication cleanroom. Processing of the wafers takes 5 months.

**Cost of Equipment Use = $50,000**

**Engineer Labor:**

Fabricating the sensor devices on the wafers takes about 4 months of full time effort. Using an average of SLAC’s AIR TID engineer and technician rates with overhead, gives a cost of $177/hour. Assume 160 hours per month.

**Cost of Engineer and Technician Labor = $113,000**

**Summing the cost of photo-masks plates, implantation, wafers, equipment use, and labor gives an estimated cost to deliver the sensor wafers covered by this procurement is $181,000.**