

| Bill of Materials           |                   |                                    |           |                       |  |   |                   |                                      |   |  |
|-----------------------------|-------------------|------------------------------------|-----------|-----------------------|--|---|-------------------|--------------------------------------|---|--|
| Team D4                     |                   |                                    |           |                       | TPD-SIMS D5  |   |                   |                                      |   |  |
| Part #                      | Part Name         | Qty                                | Unit Cost | Description           | Functions  | Material  | Dimensions        | Base Cost                            | Link to Cost Estimate   |  |
| Sample Holder               | 1                 | Copper Clamps                      | 2         | -                     | Rectangular clamps with holes drilled in in various places | Holds Sample in place   | Copper            | 25mmx12mm                            | -   | <a href="https://www.mcmaster.com/#metal-balls/=1ak31jo">https://www.mcmaster.com/#metal-balls/=1ak31jo</a>  |
|                             | 2                 | Sample                             | 1         | -                     | Rectangle material sent by Sandia                          | Used for experimentation  | Stainless Steel   | 25mmx50mm                            | -   | -  |
|                             | 3                 | Sample Holder Base                 | 1         | \$416.22              | Circular base with various depressions and holes           | Hold clamps in position   | Alumina           | R-25mm                               | \$416.22  | <a href="https://www.msdirect.com/product/details/31959877">Rod:https://www.msdirect.com/product/details/31959877</a>  |
|                             | 4                 | Wedge                              | 1         | -                     | Thin, circular plate base with two angled legs             | Gives sample holder a flat surface with in circular chamber                   | Stainless Steel   | 75mm (R-35mm) x 2.5mm                | -   | <a href="https://www.mcmaster.com/#metal-balls/=1ak31jo">printing7ads_cmpid=944938934&amp;ads_adid=54805084264&amp;ads_matchtype=b&amp;ads_network=q&amp;ads_creative=228914145323&amp;utm_t</a> |
|                             | 5a                | Ball Bearings Size A               | 3         | \$0.06                | Small, solid sphere  | Align sample holder to wedge and allow for height variation of sample holder  | Stainless Steel   | D-4mm                                | \$5.52  | <a href="https://www.mcmaster.com/#metal-balls/=1ak31jo">https://www.mcmaster.com/#metal-balls/=1ak31jo</a>  |
|                             | 5b                | Ball Bearings Size B               | 3         | \$0.07                | Small, solid sphere  | Align sample holder to wedge and allow for height variation of sample holder  | Stainless Steel   | D-4.5mm                              | \$7.05  | <a href="https://www.mcmaster.com/#metal-balls/=1ak31jo">https://www.mcmaster.com/#metal-balls/=1ak31jo</a>  |
|                             | 5c                | Ball Bearings Size C               | 3         | \$0.08                | Small, solid sphere  | Align sample holder to wedge and allow for height variation of sample holder  | Stainless Steel   | D-5mm                                | \$8.38  | <a href="https://www.mcmaster.com/#metal-balls/=1ak31jo">https://www.mcmaster.com/#metal-balls/=1ak31jo</a>  |
|                             | 6                 | Clamp/Sample Screw                 | 2         | \$0.09                | Small hex head screw                                       | Allow clamp to hold sample tightly  | Stainless Steel   | M4x0.7mm                             | \$8.52  | <a href="https://www.mcmaster.com/#91287a182/=1aldjx">https://www.mcmaster.com/#91287a182/=1aldjx</a>  |
|                             | 7                 | Clamp/Power Wire Screw             | 2         | \$0.29                | Small set screw  | Hold wires against copper clamp   | Stainless Steel   | M2.5 x 0.45 mm                       | \$7.35  | <a href="https://www.mcmaster.com/#92015a097/=1akz64">https://www.mcmaster.com/#92015a097/=1akz64</a>  |
|                             | 8                 | Tightening eyebolt                 | 2         | \$1.11                | A bolt with a ring shaped head                             | Align sample holder to the wedge  | Stainless Steel   | 5/8"x3/4"                            | \$5.55  | <a href="https://www.mcmaster.com/#9489152/=1allntt">https://www.mcmaster.com/#9489152/=1allntt</a>  |
|                             | 9                 | Spring                             | 2         | \$0.03                | Small compression spring                                   | Hold down the tightening eyebolt  | Stainless Steel   | D-5.3mm                              | \$1.63  | <a href="https://www.mcmaster.com/#93805a286/=1akzeu3">compression:https://www.mcmaster.com/#93805a286/=1akzeu3</a>  |
|                             | 10                | Alignment Bolt                     | 2         | \$0.40                | Small hex head screw                                       | Align sample holder to the wedge  | Stainless Steel   | M5x0.8                               | \$4.00  | <a href="https://www.mcmaster.com/#91828a211/=1akzcpa">https://www.mcmaster.com/#91828a211/=1akzcpa</a>  |
| 11                          | Nut               | 2                                  | \$0.06    | Chamber assembly nuts | Tighten spring onto bolt                                   | Stainless Steel   | M3x0.5mm          | \$5.55                               | <a href="https://www.sigmaaldrich.com/catalog/product/aldrich/gr05482852?lang=en&amp;region=US">https://www.sigmaaldrich.com/catalog/product/aldrich/gr05482852?lang=en&amp;region=US</a> |  |
| 12                          | Cantalever Spring | 1                                  | \$861.00  | Silicon rectangle     | Hold thermocouple against sample                           | Silicon   | 50 mm D-2mm       | \$861.00                             | <a href="https://www.omnivac.de/components/electron-sources/flood-source/index.html">https://www.omnivac.de/components/electron-sources/flood-source/index.html</a>                       |  |
| Other Devices               | 13                | Flood Gun                          | 1         | \$10,000.00           | Shoot ions   | Ionizes particles on sample   | -                 | 146mm incertion depth                | \$10,000.00   | <a href="https://www.omnivac.de/components/electron-sources/flood-source/index.html">https://www.omnivac.de/components/electron-sources/flood-source/index.html</a>                              |
|                             | 14                | Thermocouple and Power Feedthrough | 1         | \$258.00              | Two thermocouple wires and power wires with current supply | Measure the temperature and heat the sample                                   | -                 | 2.75"CF                              | \$258.00  | <a href="https://www.lesker.com/newweb/feedthroughs/fluropower_singleend.cfm?pgid=cf">hs/thermocouple_feedthroughs_tyepek_minip_luopower_singleend.cfm?pgid=cf</a>                               |
|                             | 15                | Zero Length adaptor                | 1         | \$109.00              | Bolt on CF flanged adapter for vacuum chambers             | Allows for Thermocouple to attach to Chamber                                  | Stainless Steel   | 4-1/2" OD 2-3/4" 1.5 Bore 1.6" thick | \$109.00  | <a href="https://www.lesker.com/newweb/flanges/flanges_cf_reducer.cfm?pgid=std">https://www.lesker.com/newweb/flanges/flanges_cf_reducer.cfm?pgid=std</a>  |
|                             | 16                | Thermocouple Wires                 | 2         | \$3.50                | K-Type thermocouple wire                                   | thermocouple/Power feedthrough to the sample to measure temperature of sample | Chromel+ /Alumel- | 0.05"                                | \$3.50  | <a href="http://www.lesker.com/newweb/feedthroughs/wire_thermocouple.cfm?pgid=0">http://www.lesker.com/newweb/feedthroughs/wire_thermocouple.cfm?pgid=0</a>                                      |
|                             | 17                | Power Copper Wires                 | 2         | \$4.73                | Copper wire  | Conduct current from power supply to heat sample                              | Copper            | 24-Gauge                             | \$4.73  | <a href="https://www.amazon.com/Artistic-Wire-24-Gauge-Copper-10-Yards/dp/B003WLU6N0">https://www.amazon.com/Artistic-Wire-24-Gauge-Copper-10-Yards/dp/B003WLU6N0</a>                            |
| Miscellaneous               | 18                | Power Supply for Eletron Gun       | 1         | -                     | Power supply included with electron gun purchase           | Power supply used for Electron gun to operate                                 | -                 | -                                    | -   | <a href="http://www.omnivac.de/components/electron-sources/flood-source/index.html">http://www.omnivac.de/components/electron-sources/flood-source/index.html</a>                                |
|                             | 19                | Power Supply for Heating Sample    | 1         | \$6,200.00            | Box with heat capability and wire connectors               | Power supply used for Thermocouple to operate                                 | -                 | 482mmx133mm                          | \$6,200.00  | <a href="http://www.lesker.com/newweb/process_instruments/dc_powersupply_kjlc_series.cfm">http://www.lesker.com/newweb/process_instruments/dc_powersupply_kjlc_series.cfm</a>                    |
|                             | 20                | Vacuum Epoxy                       | 1         | \$52.00               | UHV safe adhesive  | Stabilize Sample holder to Chamber  | -                 | 7.8g BIPAX                           | \$52.00   | <a href="http://www.lesker.com/newweb/fluids/sealants_epoxy.cfm?pgid=k1320k">http://www.lesker.com/newweb/fluids/sealants_epoxy.cfm?pgid=k1320k</a>  |
|                             | 21                | Gate Valve                         | 1         | \$1,768.00            | Vacuum compatible gate valve for turbo pump                | Shield turbo pump from ion gas  | Stainless Steel   | ISO63-F                              | \$1,768.00  | <a href="http://www.lesker.com/newweb/menu_valves.cfm?section=gateSS&amp;init=skip">http://www.lesker.com/newweb/menu_valves.cfm?section=gateSS&amp;init=skip</a>                                |
|                             | 22                | Software                           | 1         | -                     | UHV compatible software                                    | Analyze TOF Data  | -                 | -                                    | -   | -  |
|                             | 23                | Computer w/ DSP board              | 1         | -                     | Software compatible board                                  | Run Anytical Software   | -                 | -                                    | -   | -  |
| <b>Total Cost Estimate:</b> |                   |                                    |           |                       |  |   |                   | <b>\$19,726.00</b>                   |   |  |