

## Progress Report 12: April 27 to May 3, 2007

### MALDI-MSI Tissue Coating Device

Client: Dr. Amy Harms, Ph.D., Biotechnology Center

Advisor: Professor Brenda Ogle, Biomedical Engineering

Team Members: Laura Piechura (Leader)

Kellen Sheedy (Communicator)

Holly Liske (BWIG)

Jenna Spaeth (BSAC)

#### Problem Statement

Matrix-assisted laser desorption/ionization mass spectrometric imaging (MALDI-MSI) is an imaging method that allows for label-free spatial analysis of biological tissue samples. This technology can be used to identify and quantify proteins, monitor protein biomarkers, and sequence polypeptide chains, techniques that can be applied to proteomic analysis of disease formation. However, sample preparation methods, especially with regard to the application of the matrix tissue coating, are difficult to control but require accuracy and precision. A device must be developed to apply a fine, uniform coating of light-absorbing compounds in order to simplify the sample preparation process. The goal is to provide a reliable tool to enhance the MALDI-MSI technique in order to speed and simplify potentially life-saving research.

#### Last Week's Goals

- On Thursday, April 26, Laura and Holly will meet with Professor Jim Barner of the Electrical and Computer Engineering Department to discuss building custom-made time-delay relays. Plans for the relays have been obtained from a book, but hopefully discussion with Professor Barner will facilitate their construction.
- On Friday, April 27, we will meet to continue construction of the prototype, with the goal of completing the prototype by Sunday, April 29. However, this goal is contingent upon the assumption that the conveyor components will arrive from smallparts.com at some point prior to Friday.
- By Tuesday, May 1, we will have conducted preliminary testing of the finished prototype in our client's lab, if her schedule permits it. Also, by Tuesday, May 1, we will have completed the poster for our presentation, and will turn it in to College Library to have it printed.
- On Wednesday, May 2 and Thursday, May 3, we will meet to practice our presentation in front of our poster and make any final adjustments to the prototype

#### Summary of Accomplishments

- On Thursday, April 26, Laura and Holly met with Professor Jim Barner of the ECE Department and discussed the possibility of incorporating time-delay relays into the circuitry that we had already designed. However, after some discussion, the idea seemed to be beyond our means, and it will remain a component of the design that can be incorporated later if Dr. Harms would like us to invest the additional time and funds.
- On Friday, April 27, after our meeting with Dr. Ogle, we used the rest of classtime and the open hours of the shop to begin constructing our prototype. While we had hoped to wait to cut the plastic panels for the enclosure until after we were certain that the belt and pulleys would have enough room to function correctly, because the parts had still not arrived, we elected to begin construction. We were able to cut all of the pieces out of the 4' by 4' sheet of polyester for the box and begin assembling them. In addition, we created a template for our poster, and began to fill in its contents. A formalized to-do list was also formed, to ensure that we stayed on a schedule and completed the prototype on time.
- On Saturday, April 28, the team assembled at 9:00 am to continue constructing the prototype. As we had still not received the belts and pulleys from smallparts.com, we decided to construct all of the prototype that could be completed without these pieces. By the end of the evening, we had completed construction of the encasing to house the motor, began fusing the enclosure together with ethylene dichloride, figured

out the circuitry, and began soldering the final wire connections. In addition, more progress was made on the poster.

- On Sunday, April 29, the team assembled briefly to glue more of the polyester panels together and evaluate the deadlines for the week.
- On Monday, April 30, Holly and Kellen took a trip to the hardware store to purchase a few detail pieces for the prototype, like a door handle, corner pieces for the plate holder, and a door latch. Later in the day, we received notification from our client that the belt and pulleys had arrived, but upon picking them up, we found that only one of the pulleys had been sent. We elected to complete construction with only one pulley, and special ordered the second to arrive the next day. With the one pulley and belt, we mapped out the track for the plate, placed all of the corresponding pieces in position, and assembled the plate holder-belt apparatus.
- On Tuesday, May 1, still without the second pulley, we elected to conduct formalized testing of the spraying device. Using glass microscope slides, and a mixture of ethanol, water, and food coloring, we made 10 slides of 1, 2, 3, 4, and 5 passes using the sprayer and the airbrush. Using an Olympus IX52 microscope and SimplePCI software, we obtained images of these slides, which we used to qualitatively analyze droplet-size consistency and quantitatively observe overall percent coverage. In both respect, the sprayer performed better, and this data was placed on the poster, which completed the overall template.
- On Wednesday, May 2, the second pulley arrived from smallparts.com, and we were able to complete construction of the prototype. The switches were mounted to the track, the pulleys were bolted in place, and the conveyor system was completed. We ran a few practice demonstrations, and the prototype seems to work just as we intended. In addition, the poster was sent out for printing, set to arrive in Madison by 3:00 pm on Thursday. Finally, we divided up the speaking portions of the poster that we will present on Friday.
- On Thursday, May 3, we completed final work on the prototype, cleaning it up and making it presentable for tomorrow. We took some photographs for the web-site, and we met to practice the presentation with our completed poster and prototype.

### **This Week's Goals**

- On Friday, May 4, we will present our completed prototype and poster to our client, advisors, faculty members, and peers. Hopefully, the presentation will be effective in conveying the amount of work we've put into our design, and that our general audience will feel it has been a successful endeavor. After the presentation, we will divide up the portions of the final paper to type up over the weekend.
- Completed portions of the paper will be e-mailed to Laura by Monday, who will assemble the final paper, and then send it out to the group for proofreading.
- The final paper, our design notebooks, the peer-self evaluations, and our client evaluation will all be turned in for grading on Wednesday, May 9.
- On Friday, May 11, we will meet with Professor Ogle and discuss the happenings of the semester, and with this meeting, complete the Biomedical Engineering Design 201 experience.

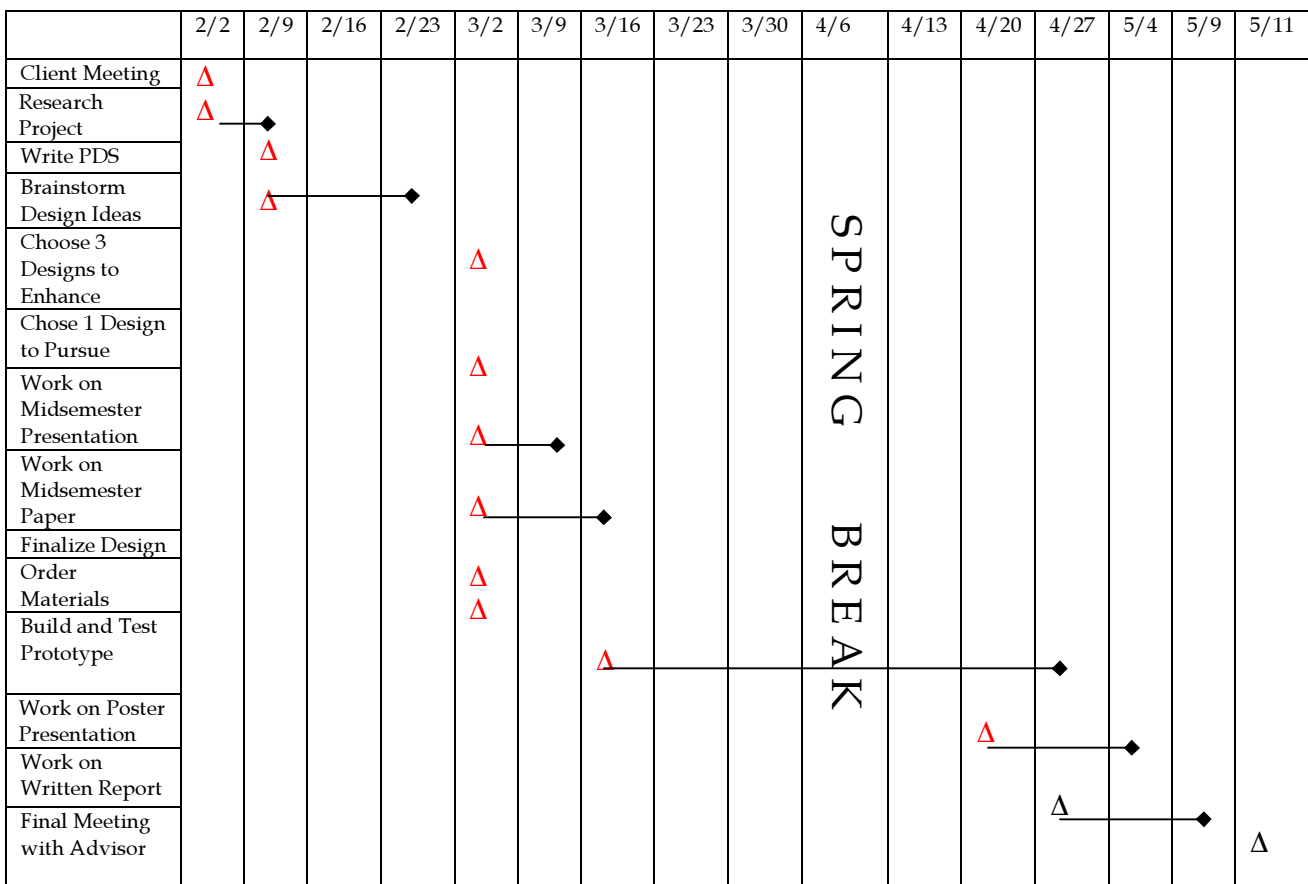
### **Project Difficulties**

The main difficulty of the project this week has been waiting for the belts and bands for the conveyor to arrive. They were ordered from smallparts.com on Monday, April 16, and did not arrive until Monday, May 1. This drastically altered our construction schedule, but we were able to re-evaluate and complete the project on-time.

## Activities

| Team Member | Activities  | Time for Week | Total Time  |
|-------------|---|---------------|-------------|
| Holly       | Initial construction, time-delay relay research, plastic coating research                     | 50 hours      | 116.5 hours |
| Jenna       | Initial construction, time-delay relay research, plastic coating research                     | 45 hours      | 110 hours   |
| Kellen      | Initial construction, time-delay relay research, plastic coating research                     | 47 hours      | 112 hours   |
| Laura       | Initial construction, time-delay relay research, plastic coating research, Progress Report 11 | 50 hours      | 117.5 hours |

## Project Timeline



\*Red triangles denote completed events.