

## Progress Report 6: March 2 to March 8, 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

- With the research amassed since Wednesday, we will use our class time on Friday, March 2nd, to assemble our preliminary final design for the prototype.
- With this final design, we hope to notify our client of parts that we would like ordered so that we can soon begin the initial steps of construction.
- Also, we will begin discussing the midsemester presentation, assembling the Powerpoint presentation, and dividing the components of the midsemester paper between the team members for completion.

#### Summary of Accomplishments

- On Friday, March 2, we discussed our findings for the week and consulted with Professor Ogle. She referred us to Professor Justin Williams in the Biomedical Engineering Department as a resource for assistance with designing a pressure valve, and we elected to wait to make a decision concerning the final design until after talking with him. Also, we began organizing our ideas into both a component design matrix and a ranked design matrix to be implemented during our midsemester presentation.
- On Saturday, March 3, we met as a group to finalize our design matrices and begin organizing the Powerpoint presentation. Although the custom-built sprayer system was a design that we were considering, we decided to present the single-action airbrush design as our finalized plan, as we had that idea well-developed and were confident that it can be successfully implemented. We also tentatively divided the Powerpoint presentation with regard to which group member would present each topic.
- On Monday, March 5, we held a meeting to finalize the order of the Powerpoint, as well as which group member would assemble each portion of the presentation. Each member was responsible for sending a rough draft of their slides to Jenna by Wednesday afternoon so that she could assemble the presentation. Specifically, Kellen created slides for the title page, problem statement, design criteria, future work, and tentative budget; Holly edited the slides for the component design matrix and made drawings of the final design; Laura assembled slides to present background

information about MALDI imaging; and Jenna edited the slides concerning the ranked “Mega-matrix” and volunteered to assemble the presentation.

- On Tuesday, March 6, Holly and Laura met briefly with Dr. Ogle to receive input concerning the design matrices. She believed our method of presentation would be effective and not too confusing, so we decided that the matrices we had assembled thus far would be those employed in the presentation.
- On Wednesday, March 7, the team met to begin editing the initial Powerpoint and discuss the formal details of the presentation. Also, we began discussing continued research that had been occurring throughout the week. Notably, Holly located a motor that meets the criteria of our design and only costs \$20. In addition, Kellen investigated a spray gun instead of an airbrush, and found a model that is fully automatic, mountable, and has a variety of sprayer options, including nozzles with a 4” to 5” spray diameter. She followed-up with a phone conference with a Paasche representative, and the system costs only \$123. We decided at this point to pursue the spray gun system as the spraying mechanism for our final design, as we still had not amassed much information on how to assemble a custom pressure-vessel.
- On Thursday, March 8, we met to practice the presentation.

### The Week’s Goals

- After many group meetings and much time spent assembling the midsemester Powerpoint, we hope to give an effective presentation detailing our work thus far for the other groups and our advisors on Friday, March 9.
- After the presentation, we will divide the components of the midsemester paper between the group members and set a date for assembling the rough draft. After editing, this paper will be submitted for grading on Wednesday, March 14, along with the Peer and Group Evaluations and our design notebooks.
- With the decisions made thus far, we will submit a list of parts to order to our client. If the parts should arrive within the week, we will begin assembly of our prototype.

### Project Difficulties

No difficulties related to the project were experienced this week.

### Activities

Team Member	Activities	Time for Week	Total Time
Holly	Personal Research of Design Alternatives (motors), team meetings, assembly of Powerpoint slides	13 hours	36.5 hours
Jenna	Research of Design Alternatives (spray nozzle pressure-valve system), team meetings, assembly of presentation	13 hours	34 hours
Kellen	Research of Design Alternatives (apertures), investigation of spray gun mechanism, team meetings, assembly of Powerpoint slides	13 hours	36 hours
Laura	Research of Design Alternatives (airbrush), team meetings, assembly of Powerpoint slides, Progress Report 6	13 hours	35.5 hours



Design Matrices:

Component Matrix:

Feature	Ideas				
<b>Sprayer</b>	Single-action airbrush	Nozzle-valve with pressure vessel	Nebulizer	Pneumatic sprayer	Produce irrigation system
<b>Method of Application</b>	Movable sprayer, Stationary plate	Stationary sprayer, Movable plate			
<b>Enclosure</b>	Fume hood	Integrated covering	Detached covering		
<b>Orientation</b>	Horizontal spray	Vertical spray			

Ranked Matrix:

		Spraying Component				
Criteria	Rank	<i>Nebulizer</i>	<i>Nozzle-valve and pressure vessel</i>	<i>Single-action airbrush</i>	<i>Pneumatic sprayer</i>	<i>Produce irrigation system</i>
<i>Reliability</i>	0.25	1	3	4	5	2
<i>Adjustability</i>	0.25	1	4	5	5	2
<i>User Interaction</i>	0.20	5	4	4	5	3
<i>Cost</i>	0.15	4	3	5	1	3
<i>Maintenance</i>	0.10	1	3	3	4	2
<i>Ease of Manufacture</i>	0.05	1	3	4	1	2
<b>Total</b>	1.00	2.25	3.45	4.30	4.10	2.35

		<b>Method of Application</b>	
<b>Criteria</b>	<b>Rank</b>	<i>Movable Plate Stationary Sprayer</i>	<i>Stationary Plate Movable Sprayer</i>
<i>Reliability</i>	0.25	3	3
<i>Adjustability</i>	0.25	3	3
<i>User Interaction</i>	0.20	4	2
<i>Cost</i>	0.15	4	2
<i>Maintenance</i>	0.10	3	3
<i>Ease of Manufacture</i>	0.05	3	1
<b>Total</b>	1.00	3.35	2.55

		<b>Enclosure</b>		
<b>Criteria</b>	<b>Rank</b>	<i>Fume Hood</i>	<i>Integrated Cover</i>	<i>Detached Cover</i>
<i>Reliability</i>	0.25	-	-	-
<i>Adjustability</i>	0.25	1	5	2
<i>User Interaction</i>	0.20	1	4	4
<i>Cost</i>	0.15	5	2	3
<i>Maintenance</i>	0.10	1	4	5
<i>Ease of Manufacture</i>	0.05	5	3	4
<b>Total</b>	1.00	1.55	2.9	2.45

		<b>Orientation</b>	
<b>Criteria</b>	<b>Rank</b>	<i>Horizontal Spray</i>	<i>Vertical Spray</i>
<i>Reliability</i>	0.25	2	5
<i>Adjustability</i>	0.25	-	-
<i>User Interaction</i>	0.20	-	-
<i>Cost</i>	0.15	-	-
<i>Maintenance</i>	0.10	-	-
<i>Ease of Manufacture</i>	0.05	-	-
<b>Total</b>	1.00	0.5	1.25

Tentative Presentation Guideline:

Slide 1: Title Slide: Kellen (00:10)

Slide 2: Overview/Outline of Presentation: Kellen (00:20)

Slide 3-5: Background: Laura (2:00)

Slide 6: Problem Statement: Laura or Kellen (0:45)

Slide 7: Design Criteria: Kellen (00:45)

Slide 8: Component Matrix: Holly (1:00)

Slide 9 (with extensions): Mega-Matrix: Jenna/ Holly (1:30)

Slide 10: Final Design: Holly (1:00)

Slide 11: Future Work: Kellen (00:30)

Slide 12: References (0:00)

Slide 13: Questions (0:00)

Extra slides in case of questions