

4D LABS – FYE 2017 Year in Review

1. Introduction

4D LABS is Simon Fraser University's \$65M Institute for Advanced Materials Science & Engineering Research. We are a central, open-access, user facility and service many departments and faculties at SFU and other universities. A broad range of academic and industry users access the institute to take advantage of the equipment and services 4D LABS offers. These users come from a variety of departments and faculties, including archeology, biology, BPK, chemistry, earth science, engineering, MBB, mechatronics, physics, and others.

4D LABS has recently restructured into a core facility of Simon Fraser University. This report serves as an annual update to the community about our operations over the last year. It will highlight new capabilities, key events, usage statistics, and financial information. If you have any questions, please send them to the Director of Operations (Nathanael Sieb) or the Scientific Director (Neil Branda) of 4D LABS.

2. Key milestones

In the last year we have brought online several new tools in the Characterization facility. Our new ICPMS system is now available for users, including the laser ablation add-on. This new tool provides users the ability to measure trace amounts of elements in their solid or liquid samples. We also have a number of new sample preparation tools in the imaging lab. These tools include a new coating system, embedding system, polisher, and cryo-microtome. The new capabilities will allow users to prepare a wide range of samples for electron microscopy. All of these new tools complement our existing set of capabilities and allow us to serve a diverse range of applications.

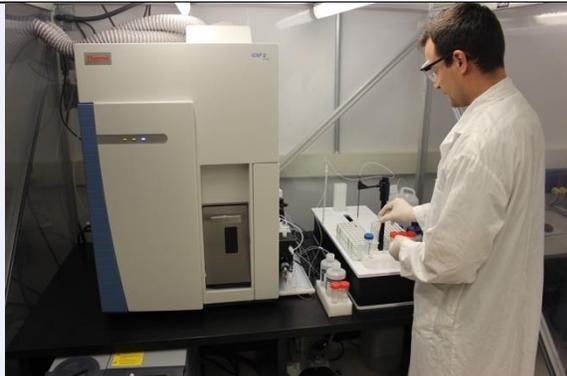


Figure 1: New ICPMS system with laser ablation capability (not pictured).



Figure 2: Grinding and polishing machine for microscopy sample prep.



Figure 3: Microtome with cryo-capability for TEM sample prep.



Figure 4: Sputter system for carbon and iridium coating for SEM sample prep.

We have also worked on developing new capabilities for our existing tools. In the Fabrication facility, we are working on improving our electroplating process to replicate high aspect-ratio microstructures in a nickel stamp. In the Characterization facility, we are working on developing cryo-TEM capabilities on the Osiris tool. We are also continuing to develop recipes and processes for our other tools. These capabilities will continue to provide value to our users.

3. Events

4D LABS hosts several events throughout the year. We have had guest speakers, workshops, social events, and a symposium. Over the last year, 4D LABS has hosted 10 of these events. In May, over

250 attendees were able to attend the Nanolytica 2016 event to see a number of talks and posters focused on the interface of analytical sciences and nanotechnology. FEI came to 4D LABS in June to give a workshop on the visualization software for our electron microscopes. In September, we were pleased to host Prof. George Whitesides from Harvard to give a talk on commercialization of Technology. In the same month, we also hosted our first 4D LABS poster competition. This competition highlighted the research that students and post-docs are doing in 4D LABS. These events have been a great way to foster connections among the community and highlight the research done in 4D LABS.



Figure 5: Nanolytica 2016 held on May 5, 2016.



Figure 6: Professor Jacob Schmidt giving the keynote address at Nanolytica 2016.

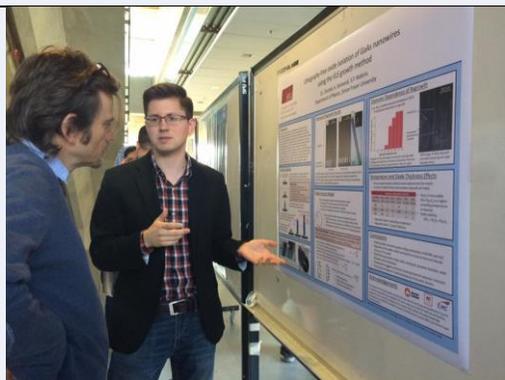


Figure 7: David Dvorak discussing his poster at the 2016 4D LABS Poster Competition.

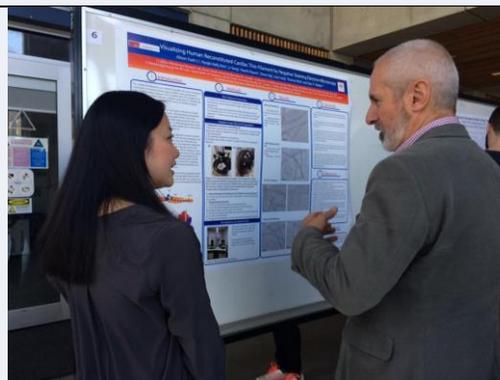


Figure 8: Dr. Stephen Campbell from NanoOne participating in the Poster Competition.

In addition to the events 4D LABS hosts, we also give tours and meet with various industry and government partners throughout the year. The school tours we run include demos of different technologies developed in 4D LABS to give elementary and secondary school children insight into what we do here

and potential career directions. The meetings throughout the year help to attract new customers and investment to 4D LABS. The tours and meetings are critical components of our outreach efforts to promote 4D LABS.

4. Usage

The use of 4D LABS has continued to grow over the last year. We have registered and trained a number of new industrial and academic users. The number of people actively in the facility over the last year has also grown. Our users come from a diverse range of institutions and companies. Overall, we grew approximately 15% last year.

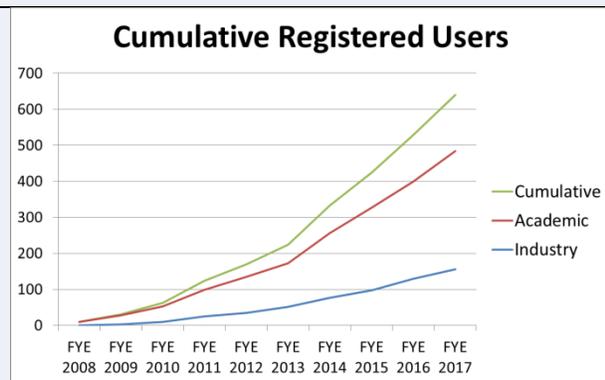


Figure 9: Segmentation of the users of 4D LABS and growth in our user base over the last 9 years.

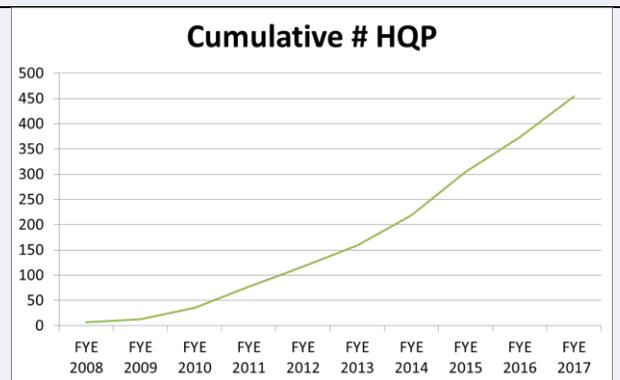


Figure 10: Growth in the number of trained personnel over the last 9 years.

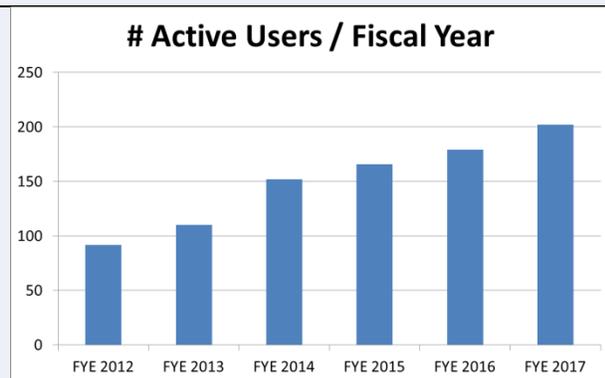


Figure 11: The total number of active users in 4D LABS each year from FYE 2012 – FYE 2017.

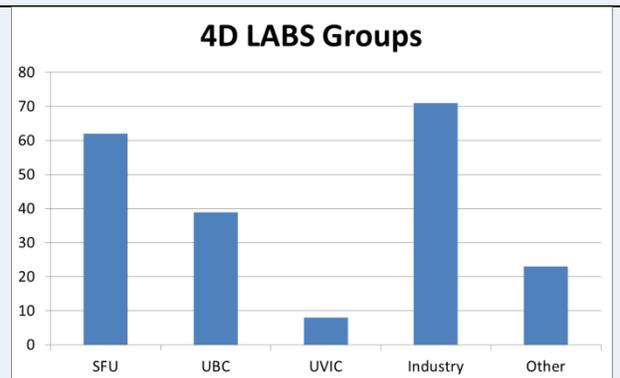


Figure 12: Segmentation of the different groups using 4D LABS as of March 2017.

5. Finances

4D LABS is in a good financial condition. Despite higher than expected maintenance costs, we were still able to keep our operating deficit low through higher than anticipated revenue. As the facility continues to grow, we hope to ultimately reduce our operating deficits to remove our reliance on grant and university support.

Table 1: Profit-loss statements for 4D LABS from FYE 2011 – FYE 2017.

| | FYE 2011 | FYE 2012 | FYE 2013 | FYE 2014 | FYE 2015 | FYE 2016 | FYE 2017 |
|----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Revenues | | | | | | | |
| Services to SFU users | \$ 484,713 | \$ 466,733 | \$ 1,271,120 | \$ 1,092,308 | \$ 92,558 | \$ 158,810 | \$ 205,970 |
| Services to external users | | | | | \$ 538,627 | \$ 573,729 | \$ 623,919 |
| Total Revenue | \$ 484,713 | \$ 466,733 | \$ 1,271,120 | \$ 1,092,308 | \$ 631,185 | \$ 732,539 | \$ 829,889 |
| Expenses | | | | | | | |
| Personnel | \$ 509,690 | \$ 555,392 | \$ 521,863 | \$ 652,602 | \$ 583,008 | \$ 562,014 | \$ 564,776 |
| Maintenance (COGS) | \$ 273,984 | \$ 318,909 | \$ 865,344 | \$ 238,212 | \$ 373,832 | \$ 215,016 | \$ 354,263 |
| Office and Others | \$ 87,406 | \$ 105,085 | \$ 124,782 | \$ 440,773 | \$ 54,939 | \$ 81,816 | \$ 37,701 |
| Total Expenses | \$ 871,080 | \$ 979,387 | \$ 1,511,988 | \$ 1,331,586 | \$ 1,011,780 | \$ 858,847 | \$ 956,740 |
| Operating Surplus/Deficit | \$ (386,366) | \$ (512,654) | \$ (240,868) | \$ (239,278) | \$ (380,595) | \$ (126,307) | \$ (126,851) |
| Grant and University Funding | \$ 719,455 | \$ 232,420 | \$ 439,534 | \$ 310,191 | \$ 140,400 | \$ 179,412 | \$ 244,673 |
| Total Surplus/Deficit | \$ 333,089 | \$ (280,234) | \$ 198,666 | \$ 70,913 | \$ (240,195) | \$ 53,105 | \$ 117,823 |

6. Conclusion and Looking Forward

4D LABS has had a successful year. We have had increasing numbers of users, our financial picture is good, and we have run a number of successful events. 4D LABS continues to offer excellent value to the community. Our \$65mil facility is available to all researchers and is a critical resource for advanced materials research. We look forward to growth in usage and capabilities in the year ahead as we continue to serve the research community.