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Micro/Nano Technology Center



Micro/Nano Technology Center (MNTC)

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FY15 Annual Report

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Meet Our Staff



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Director



Dr. Shamus McNamara
Associate Director



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MNTC Cleanroom
Manager



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Senior Process Engineer



Dr. Xiaojin Wang
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Curtis McKenna
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Mary Watson
Administrative Assistant

FY15 Annual Report

This document serves as the MNTC's official annual report for the FY15 fiscal year ending June 30, 2015. The University of Louisville's Micro/Nano Technology Center (MNTC) is a recharge or service center officially established in 2004. The \$30M 10,000 ft² cleanroom facility is used for the fabrication of novel materials and devices. The facility includes a 1,000 ft² packaging and characterization lab with a 300 ft² design/layout/simulation lab for MEMS and IC devices. University of Louisville faculty utilize the facility for research while the MNTC also provides micro and nanofabrication services to external clients ranging from industry and other academic institutions well beyond its borders.

The MNTC ended FY15 with a deficit of (\$85,920) as compared to (\$17,156) of FY14. This unfavorable trajectory was primarily attributed to increased salary expenses implemented at the beginning of the FY15. Table 1 is an itemized listing of the center's operating expenses without salaries of \$121,654.38. The three largest categories were liquid nitrogen, chemicals and equipment maintenance. A \$14,223 reduction was realized in the consumption of liquid nitrogen in FY15 by an audit of provided gas lines, leaking valves, lack of reimbursement of nitrogen provided to laboratories and conservation of the facility during weekends and extended holidays.

Table 2 lists salary expenses at \$109,555.86 for FY15 or 47.4% of expenses and was the highest value in the center's history. Corrective action was taken mid-year FY 15 to reverse the trend of increasing debt. However, it will most likely be near the end of FY17 before the MNTC is operating without debt and function again as a non-profit center.

Internal revenue, external revenue and outreach programs from Figure 1 totaled to \$160,742.21. While internal revenue has been slowing a strengthening trend of external income and outreach became a historical high for the center in FY15. This was also the first year where external revenue and outreach programs (57%) outpaced internal research (43%) of overall revenue.

Table 3 is an itemized breakdown of internal revenue by faculty and group (\$92,213.33), where Dr. Kevin Walsh was the largest faculty user of the facility. Figure 2 shows the Electrical and Computer Engineering (ECE) department as the largest departmental user of the facility (\$37,199.10). Table 4 is an itemized breakout of external revenue by client (\$49,913.88) and outreach camps (\$18,515.00) totaled to \$68,428.88. For FY15 the MNTC expanded its outreach program to include an after school laboratory and continued its summer camp programs. All camps were extremely well received and will be offered again in FY16 with a shift to demonstrate additional fabrication techniques and exposure to the Arduino programmable microcontroller.

Figure 3 and Table 5 show similar historical data of internal and external revenue with outreach programs from FY04 to FY15. Two key items noted from this data. First, a 50% drop in internal revenue from FY14 to FY15 became evident. This was attributed to the conclusion of a large research effort in FY14. Second, a historical high of external revenue and outreach programs was unmatched in prior years and outpaced internal revenue. Total accumulation of income since FY04 by the center is noted in Table 5 at \$2,107,684.

Figure 4 and Table 6 summarize the operating and salary expenses required to effectively operate the MNTC. Figure 4 is a graphical comparison of FY04 to FY15 of operating expenses and salary expenses. Due to an overall increase in spending primarily due to salaries cost cutting measures were implemented in FY15. Operating expenses for FY15 were notably lower since the opening of the facility FY04, Table 6, underscoring an increase of operating efficiency and a reduction in research performed by faculty. This is overshadowed by the large salary expenditures for FY15, but will be more prominent in FY16.

Table 7 is an itemized listing of students, faculty and external businesses that performed processing inside the facility and their number of access events showing that ECE students entered the facility more than any other department. Figure 5 is a breakdown by percentage of each department utilizing the facility with the ECE department again accessing the facility most frequently. A noteworthy item for Figure 5 and Table 7 is these data do not include microfabrication services or processes performed by the MNTC staff for faculty or external clients.

Feedback from clients and increased revenue trends for service work has demonstrated that most clients prefer to utilize the experience of the MNTC's professional staff. The number of external clients physically processing in the cleanroom extremely low. Yet, the number external clients continues to grow, Table 4. Additionally, Figure 6 and Table 8, show a historical low in the number of students processing in the cleanroom despite the highest number of faculty using the facility.

A summary of the data shows the MNTC is on a path of becoming more financially sustainable by increases and decreases in the following areas.

Increases

- External Revenue
- Outreach Revenue
- External Clients
- Number of Faculty Using the Cleanroom
- Fabrication services performed by MNTC Engineers

Decreases

- Number of students processing in the cleanroom
- Internal Revenue

While these trends are helping the facility to become more financially sustainable the original intent and mission of the MNTC to develop and cultivate a technology base and future workforce for reinvestment into the state and local economy continues to become out of reach. Projections for FY16 are that internal research will continue to decline, external revenue and outreach activity will increase and the cleanroom will further become a service oriented. Discussions have begun to develop an exploratory committee of faculty to investigate development of a Research Center of Excellence with specific areas of expertise in micro/nanotechnology.

MNTC Expense Breakout**Table 1. FY15 Operating Expenses without salary expenses.**

Travel	\$ 2,605.88
Laboratory	\$ 8,324.52
Chemicals	\$ 27,530.16
Liquid Nitrogen	\$ 39,641.45
Demurrage	\$ 1,591.70
Office Supplies	\$ 1,527.16
Software	\$ 249.95
Maintenance Supplies	\$ 2,320.87
Equipment	\$ 4,950.00
Legal Fees	\$ 4,842.91
Criminal Background Checks	\$ 91.10
Postage	\$ 2,127.58
IT Services	\$ 3,842.19
Physical Plant Services	\$ 595.14
DEHS	\$ (3,000.00)
Equipment Maintenance	\$ 19,254.51
Software Maintenance	\$ 652.12
Registration	\$ 335.00
Subscriptions	\$ 1,038.40
Grant Dues, Memberships, Subscriptions	\$ 616.20
Processing Fees	\$ 295.00
Credit Card Fee	\$ 95.00
Promotional Activities	\$ 939.96
Business Meals	\$ 154.45
Publicity and Promotion	\$ 125.00
Prizes & Awards	\$ 908.13
TOTAL	\$121,654.38

Table 2. FY15 Salary Expenses

Name	Salary	Fringe	Total	Percentage
McKenna, Curtis	\$ 9,898.93	\$ 3,729.48	\$ 13,628.41	12%
Moiseeva, Evgeniya	\$37,230.07	\$11,232.07	\$ 48,462.14	44%
Sanchez, Ana	\$19,423.66	\$ 7,353.15	\$ 26,776.81	24%
Watson, Mary	\$14,366.14	\$ 6,322.36	\$ 20,688.50	19%
TOTAL	\$ 80,918.80	\$ 28,637.06	\$109,555.86	100%

FY15 TOTAL EXPENSES (Operating Expenses + Salary) = \$231,210.24

MNTC Income Breakout

Internal Revenue	\$92,213.33
External Revenue	\$49,913.88
Outreach Revenue	\$18,515.00
Total	\$160,742.21

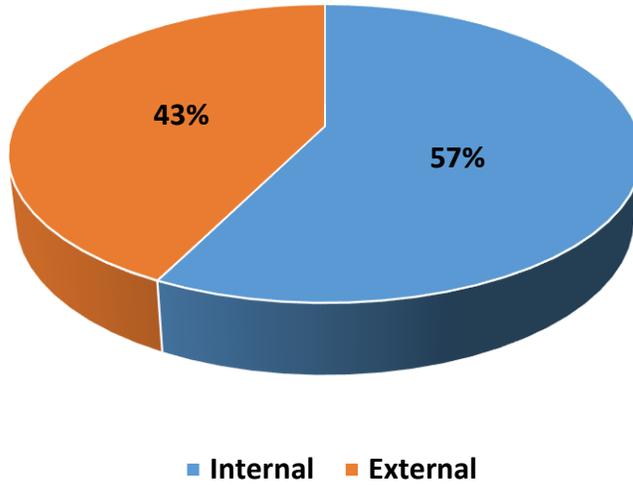
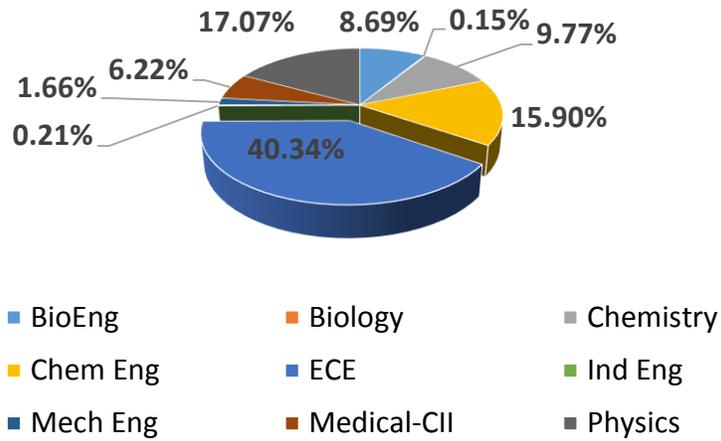


Figure 1. Internal versus external revenue as a percentage.

Table 3. Itemized internal income.

Alphenaar	ECE	\$ 5,749.00
Baldwin	CHEM	\$ 410.00
Berfield	ME	\$ 665.00
Burns	CHEM	\$ 1,810.00
Keller	MED - CII	\$ 5,427.63
Lorkiewicz	MED - CII	\$ 310.00
Cohn	ECE	\$ 420.00
ECE 544 Laboratory	ECE	\$ 8,842.60
Fried	CHEM	\$ 25.00
Fu	CHEM	\$ 8,383.20
Gamini	PHYSICS	\$ 220.00
Giridharan	BE	\$ 25.00
Grapperhaus	CHEM	\$ 770.00
Gutierrez	PHYSICS	\$ 322.00
Harnett	ECE	\$ 6,148.60
Keynton	BE	\$ 7,853.40
Larin, Alex	PHYSICS	\$ 4,103.00
Machuta	CHEM	\$ 45.00
McNamara	ECE	\$ 3,439.00
Mendes	PHYSICS	\$ 1,420.00
Panchapakesan	ME	\$ 615.00
Remold	BIOLOGY	\$ 135.00
Smadici	PHYSICS	\$ 9,675.00
Soucy	BE	\$ 135.00
Stolowich	CHEM	\$ 3,010.00
Sunkara	CHEM	\$ 5,210.00
Walsh	ECE	\$ 12,600.00
Williams	ME	\$ 250.00
Yang	IE	\$ 190.00
Zamborini	CHEM	\$ 2,965.00
Zhang	CHEM	\$ 1,040.00
TOTAL		\$92,213.33



BioEng	8.69%
Biology	0.15%
Chemistry	9.77%
Chem Eng	15.90%
ECE	40.34%
Ind Eng	0.21%
Mech Eng	1.66%
Medical-CII	6.22%
Physics	17.07%

Figure 2. FY15 Internal income as

a percentage.

Table 4. FY15 itemized external revenue.

External Clients	Percentage	Amount
AC Forensics	1.70%	\$ 1,156.00
Advanced Semiconductor Processing	4.00%	\$ 2,729.72
Assenti, LLC	0.90%	\$ 627.00
Dukkipati, Venkat	0.30%	\$ 174.00
Bradley University	0.60%	\$ 380.00
Fujifilm	0.40%	\$ 246.78
KY Science & Technology	0.20%	\$ 136.00
Lakeshore	0.70%	\$ 492.00
Lexmark	1.80%	\$ 1,206.00
MEMStim	10.30%	\$ 7,040.64
Meridian Bioscience	5.40%	\$ 3,710.00
Nauganeedles, LLC	9.40%	\$ 6,433.88
Osman Safa Cifici MRL Mat. Res. Lab.	0.80%	\$ 517.88
Purelight Labs, LLC	0.40%	\$ 276.00
Steel Dynamics	1.10%	\$ 760.00
Techshot	8.20%	\$ 5,635.32
The Micro Werks, LLC	0.30%	\$ 200.00
Thin Metal Parts	18.00%	\$ 12,368.22
Universal Display Corp	5.20%	\$ 3,594.00
UK-Absher	0.60%	\$ 422.68
UK-Trinkle	0.20%	\$ 136.00
UK-Young	0.90%	\$ 611.00
Wolf Engineering Solutions, Inc.	0.80%	\$ 564.00
Yale University	0.70%	\$ 496.76
Total External Client Revenue		\$49,913.88
<u>Outreach</u>		
Residential Summer Camp	8.40%	\$5,785.00
Summer Day Camp	13.90%	\$9,550.00
After School Laboratory	4.60%	\$3,180.00
Total Outreach Revenue		\$18,515.00
TOTAL		\$68,428.88

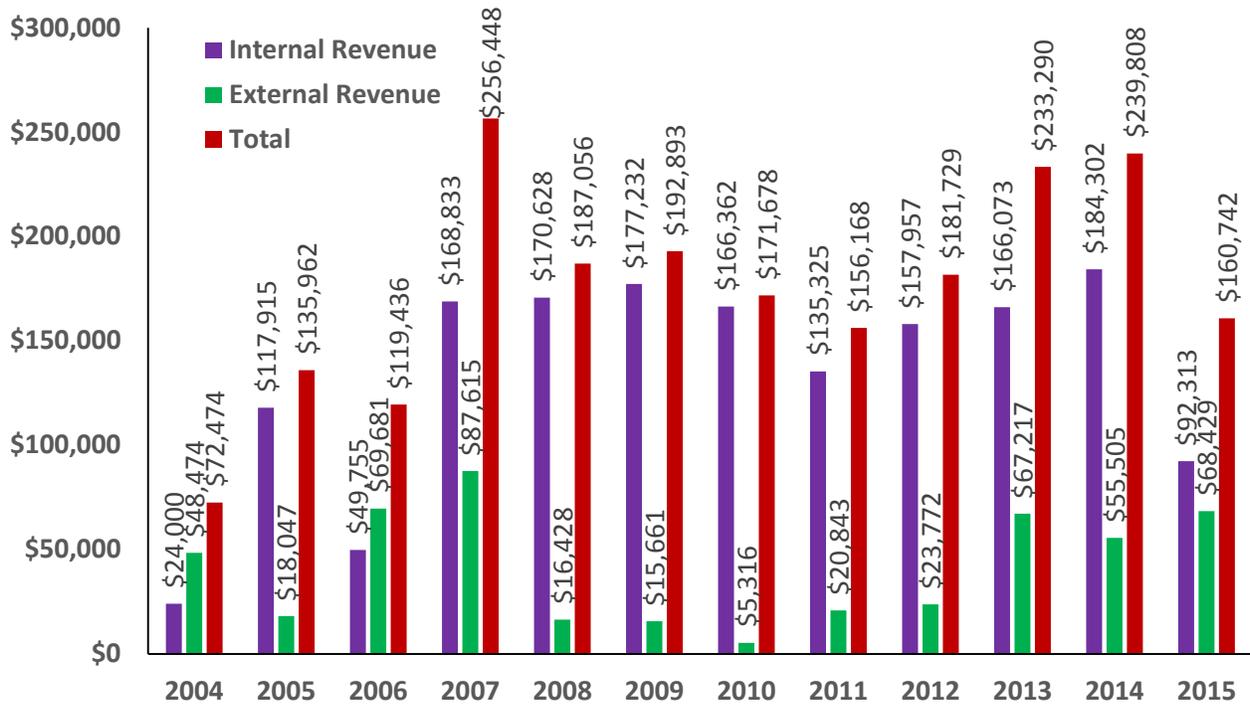


Figure 3. Annual comparison of internal and external revenue from FY04 through FY15.

Table 5. Itemized listing of internal and external revenue + outreach from FY04 through FY15.

Fiscal Year	Internal Revenue	External Revenue + Outreach	Total
2004	\$24,000	\$48,474	\$72,474
2005	\$117,915	\$18,047	\$135,962
2006	\$49,755	\$69,681	\$119,436
2007	\$168,833	\$87,615	\$256,448
2008	\$170,628	\$16,428	\$187,056
2009	\$177,232	\$15,661	\$192,893
2010	\$166,362	\$5,316	\$171,678
2011	\$135,325	\$20,843	\$156,168
2012	\$157,957	\$23,772	\$181,729
2013	\$166,073	\$67,217	\$233,290
2014	\$184,302	\$55,505	\$239,808
2015	\$92,313	\$68,429	\$160,742

Accumulated Internal Income	\$1,610,695
Accumulated External Income	\$496,988
Total Accumulated Income	\$2,107,684

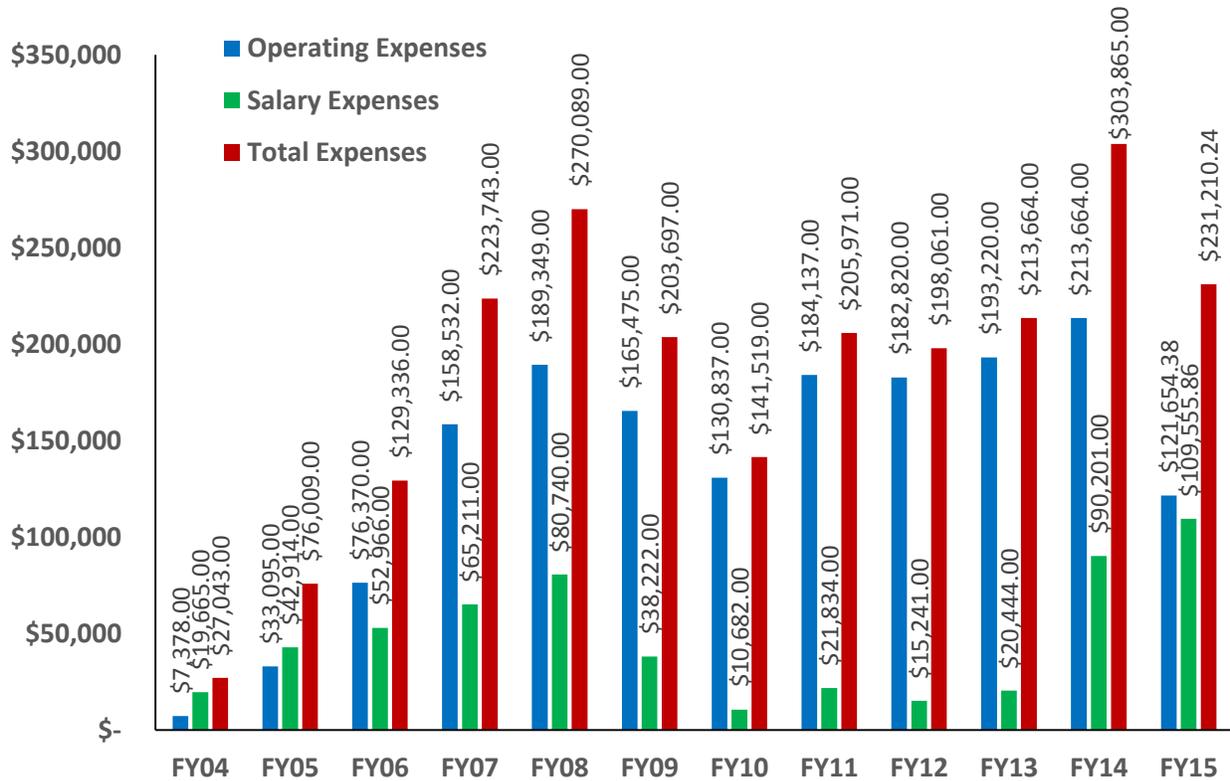


Figure 4. Annual comparison of operating and salary expenses from FY04 through FY15.

Table 6. Itemized listing of operating and salary expenses from FY04 through FY15.

Fiscal Year	Operating Expenses	Salary Expenses	Total
FY04	\$ 7,378.00	\$ 19,665.00	\$ 27,043.00
FY05	\$ 33,095.00	\$ 42,914.00	\$ 76,009.00
FY06	\$ 76,370.00	\$ 52,966.00	\$ 129,336.00
FY07	\$ 158,532.00	\$ 65,211.00	\$ 223,743.00
FY08	\$ 189,349.00	\$ 80,740.00	\$ 270,089.00
FY09	\$ 165,475.00	\$ 38,222.00	\$ 203,697.00
FY10	\$ 130,837.00	\$ 10,682.00	\$ 141,519.00
FY11	\$ 184,137.00	\$ 21,834.00	\$ 205,971.00
FY12	\$ 182,820.00	\$ 15,241.00	\$ 198,061.00
FY13	\$ 193,220.00	\$ 20,444.00	\$ 213,664.00
FY14	\$ 213,664.00	\$ 90,201.00	\$ 303,865.00
FY15	\$ 121,654.38	\$ 109,555.86	\$ 231,210.24

Table 7. Itemized listing of cleanroom clients.

Name	Advisor	Department	Number of Access Events to the Cleanroom
Nguyen_Dung_M	Giridharan	BE	1
Crain_Mark_M	Keynton	BE	13
Marei_Mohamed_M	Keynton	BE	16
Yuan_Hanwen	Keynton	BE	17
Martin_Michael_D.	Fried	Chem Eng	2
Li_Mingxiao	Fu	Chem Eng	39
Li_Qi	Fu	Chem Eng	44
Ogunwale_Mumiye_A.	Fu	Chem Eng	9
Hickman Robert	Sunkara	Chem Eng	6
Kolli, Sowmya	Alphenaar	ECE	49
Lin_Ji-Tzuoh	Alphenaar	ECE	1
Beharic_Jasmin	Harnett	ECE	39
Harnett_Cindy	Harnett	ECE	8
ECE 637	McNamara	ECE	17
McNamara, Shamus	McNamara	ECE	5
Schneider_Joseph_D.	McNamara	ECE	32
Benken_Alex_C.	Walsh	ECE	3
ECE 544	Walsh	ECE	11
Gartner, Christopher	Walsh	ECE	3
Johnson_Angelique_C	Walsh	ECE	17
Martin_Michael_D.	Walsh	ECE	12
Ratnayake_Dilan	Walsh	ECE	83
Rinehart, Sean	Walsh	ECE	9
Shuvra_Pranoy_Deb	Walsh	ECE	38
Trada_Hiren	Walsh	ECE	45
Walsh_Kevin_M	Walsh	ECE	11
AC Forensics		External Client	33
MEMStim, LLC		External Client	62
Gu_Hengfeng	Yang	IE	2
Lassell_Austin_J	Yang	IE	1
Chen_Jubin	Berfield	ME	3
Hoang_Trung_V.	Berfield	ME	4
Khosravi_Farhad_1	Panchapakesan	ME	6
Larin_Alexander_A	Dobrokhotov	Physics	54
Smith_Scott_W	Mendes	Physics	9
Adnani, Moein	Smadici	Physics	19
Hoveyda Marashi_Seyedeh Farza	Smadici	Physics	11
Smadici_Serban	Smadici	Physics	8
		Total	742

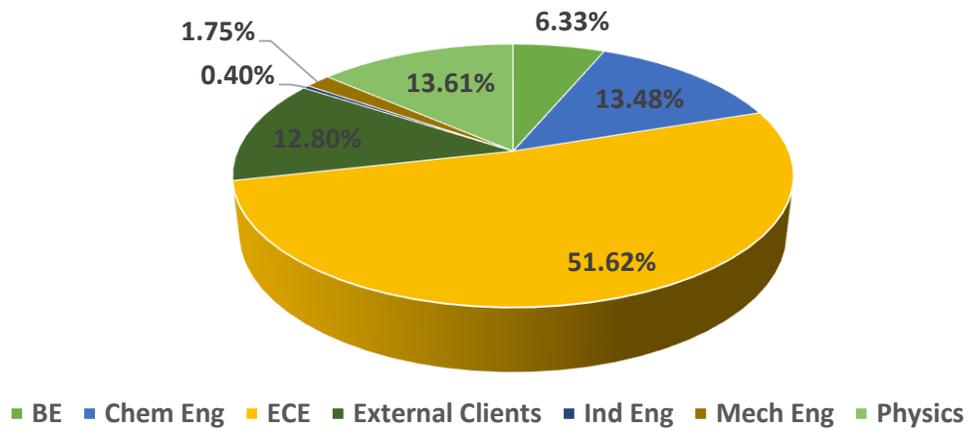


Figure 5. Internal client usage by percentage and department.

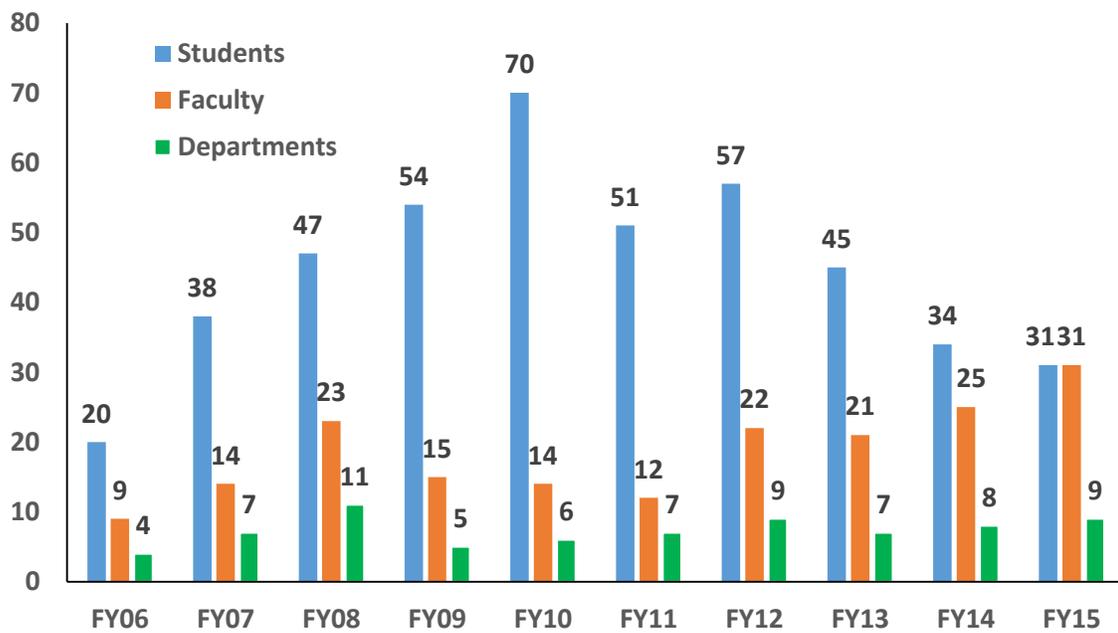


Figure 6. Historical data of internal clients from FY04 through FY15.

Table 8. Itemized listing of students, faculty and departments utilizing the facility.

Fiscal Year	Students	Faculty	Departments
FY06	20	9	4
FY07	38	14	7
FY08	47	23	11
FY09	54	15	5
FY10	70	14	6
FY11	51	12	7
FY12	57	22	9
FY13	45	21	7
FY14	34	25	8
FY15	31	31	9