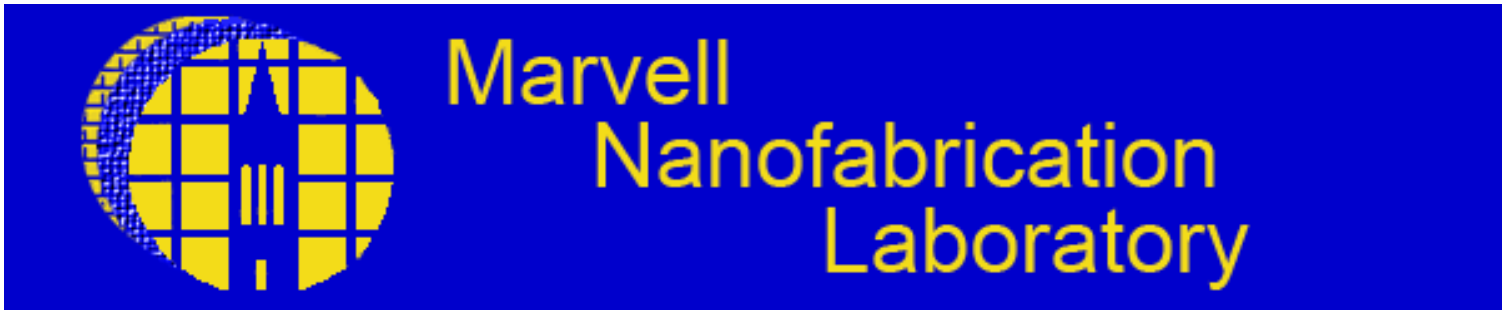


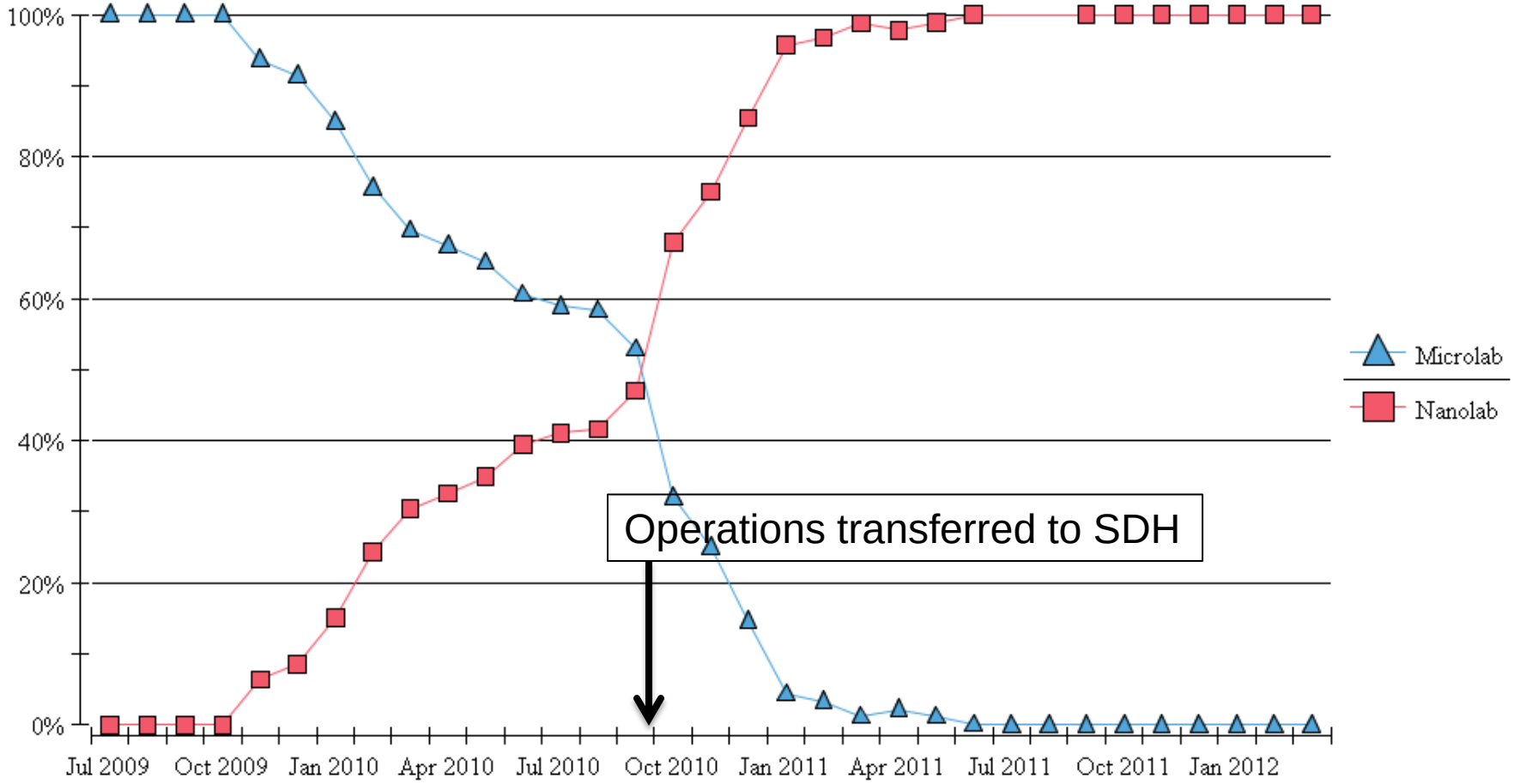
2012 Principal Investigators Meeting

Professor Tsu-Jae King Liu	Interim Faculty Director and EECS Chair
Professor Ming C. Wu	Faculty Director on Leave through Jan 2013
Bill Flounders	Executive Director and Operations Manager

Agenda

- Transition Overview
- Move Expenses & Summary
- New Recharge Rates
  - Academic
  - BNLA
- New Equipment Summary
- UGIM Conference

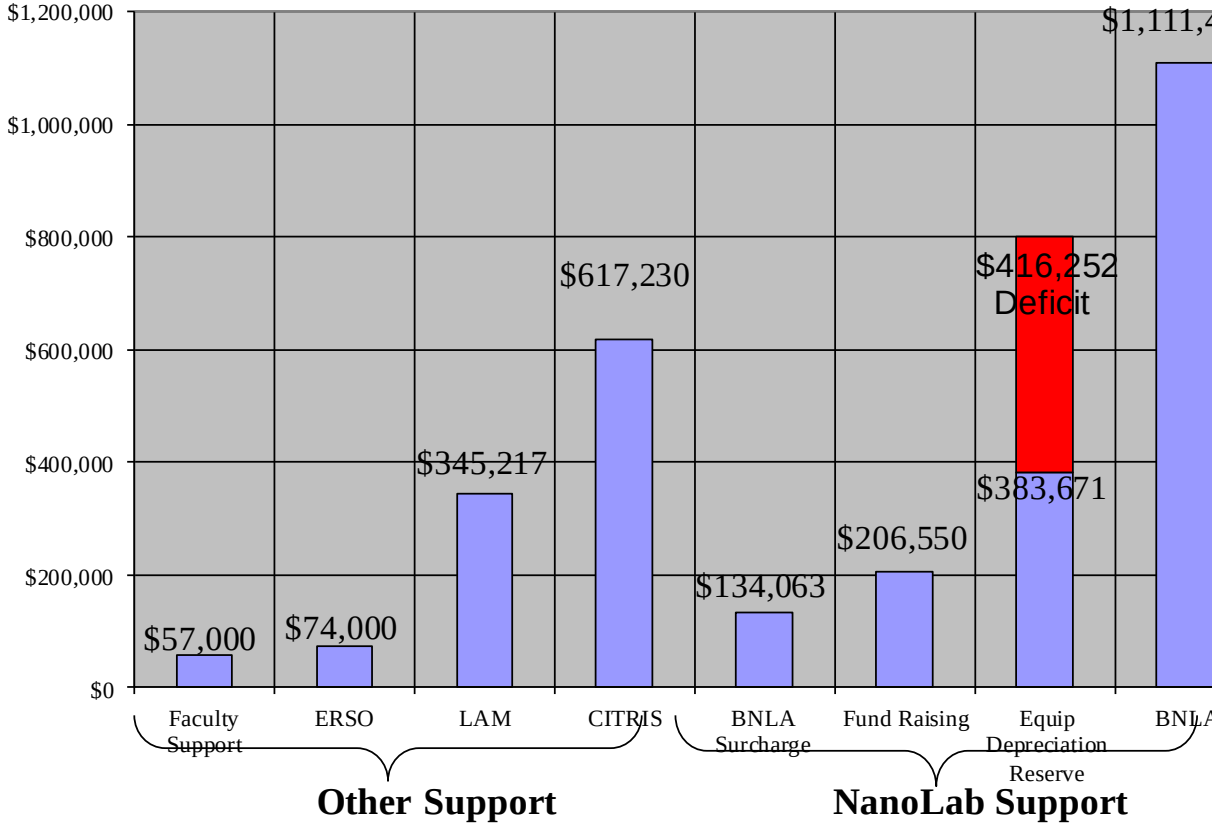
Micro/NanoLab % of Total Recharge During Transition

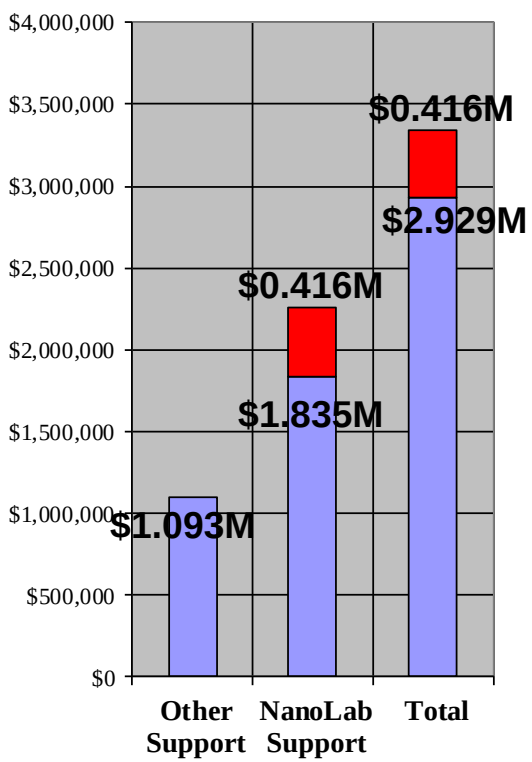


NanoLab Fitup Contributions and Expenditures

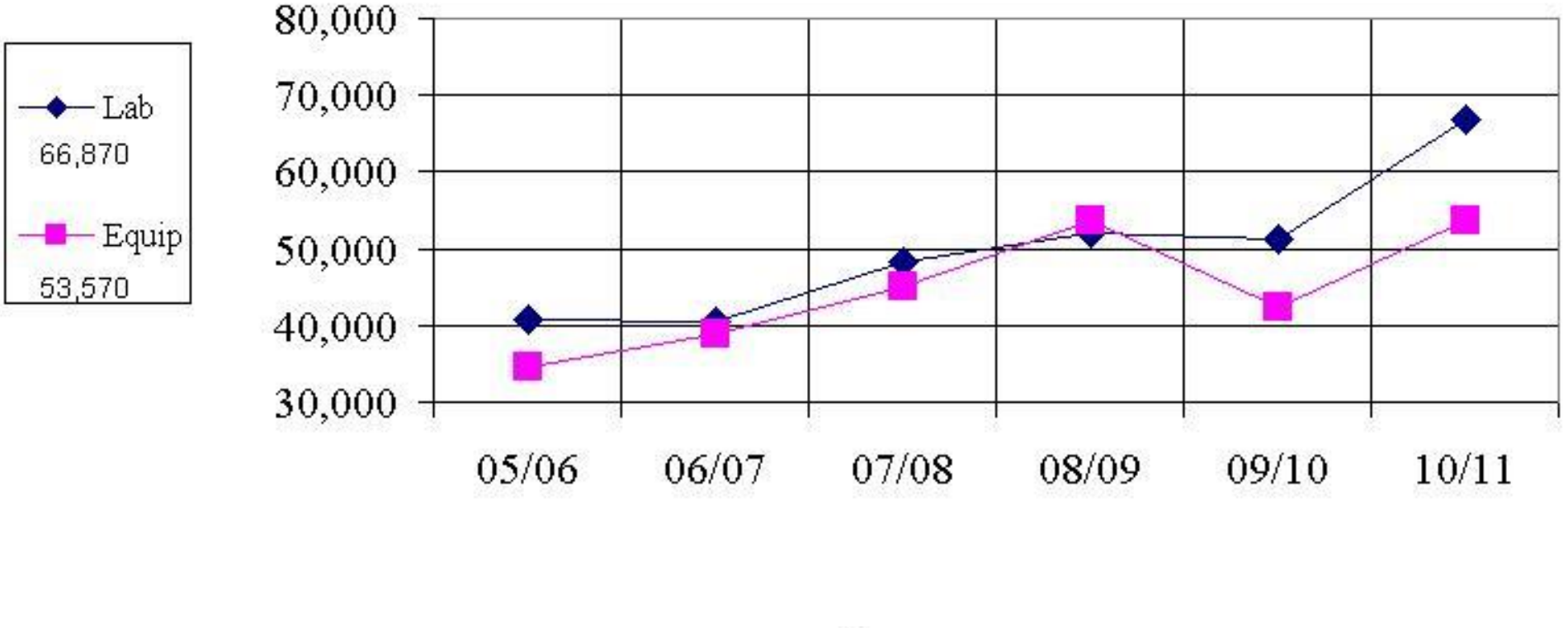
FY 08-09 to FY 11-12

Total Exp: $3,345,422 Budget: $3,281.558

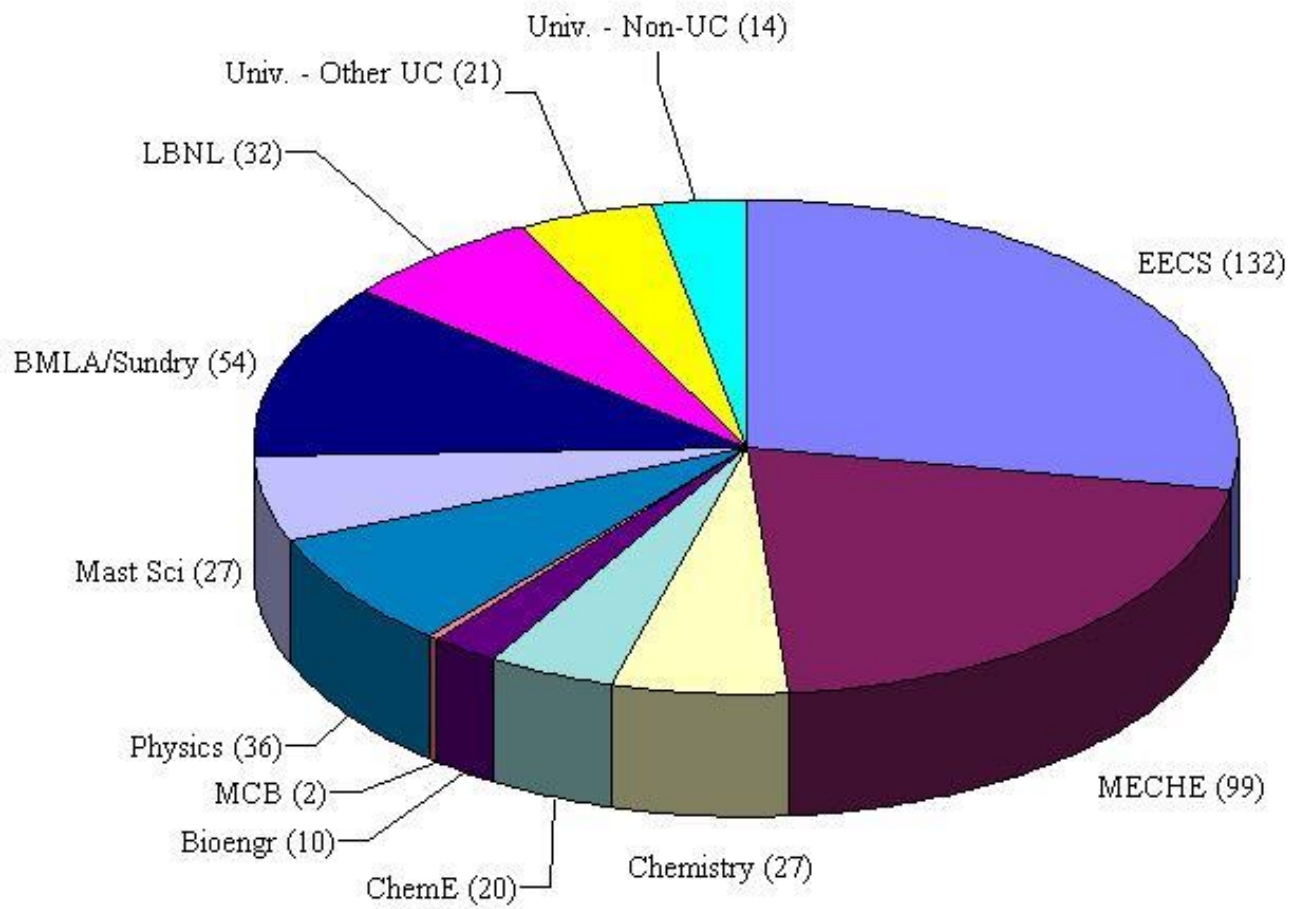




Laboratory and Equipment Use Hours
Fiscal Year 05/06 - 10/11



Lab Members by Department
Total Members FY 2010/2011 = 474



Academic Recharge Rates

	Present	New
Access Fee	**$89.00/month**	**$89.00/month**
General Lab Use Rate (Includes 87 operating systems) **Max**	**$40.20/hr** **$1260/month**	**$41.40** **$1300/month**
Special Equipment Use Rate **Max**	**$37.80/hr** **$1470/month**	**$39.00/hr** **$1500/month**
Staff Services Rate	**$69.00/hr**	**$72.60**

BNLA Recharge Rates

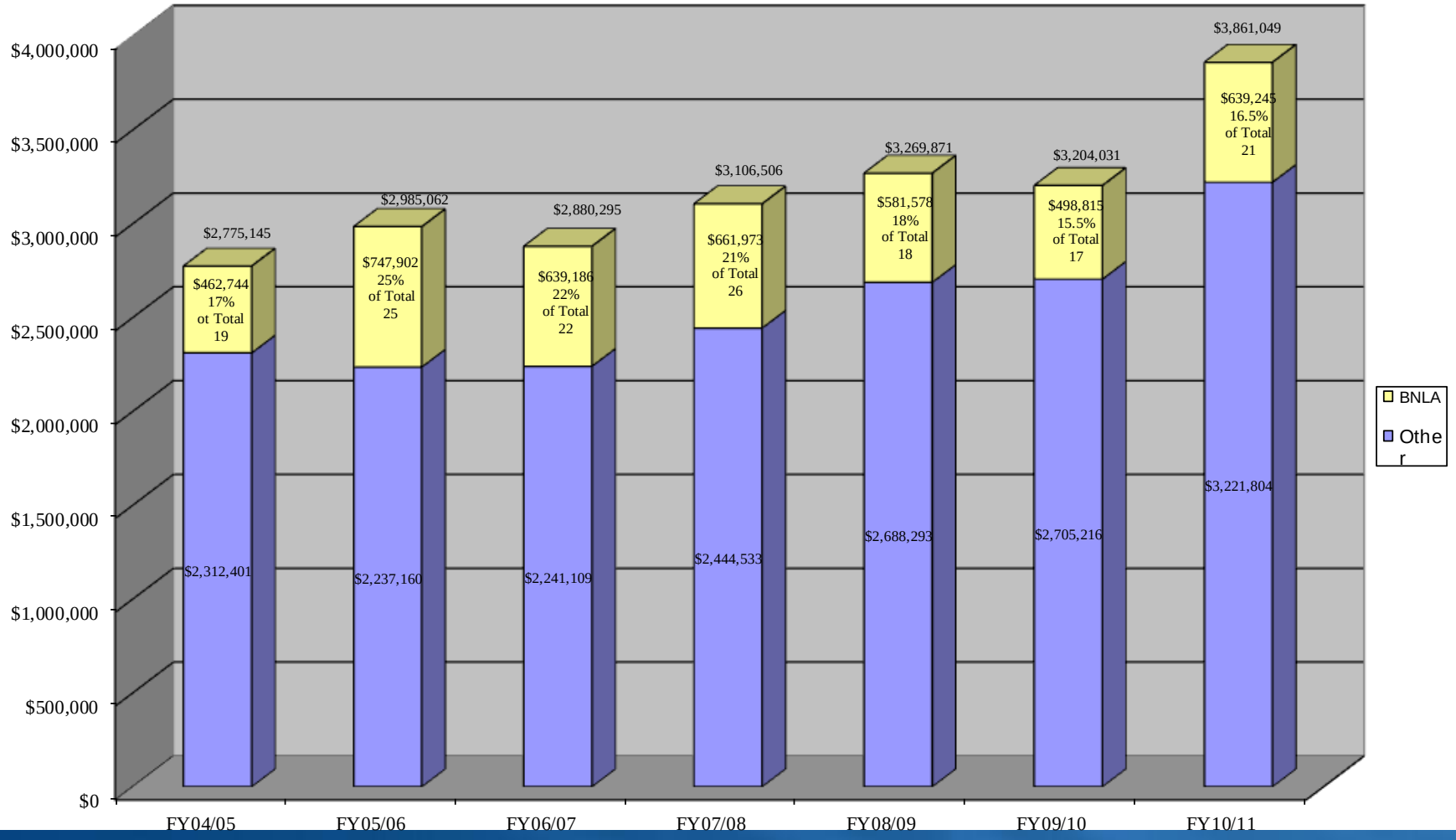
	Present	New
Access Fee	**$89.00/hr**	**$89.00/hr**
General Lab Use Rate (Includes 87 operating systems) **Max**	**$40.20/hr** **$1680/month**	**$41.40** **$2100 Jan2012**
Special Equipment Use Rate **Max**	**$37.80/hr** **NA**	**$39.00** **NA**
Staff Services Rate	**$69.00/hr**	**$72.60**

BNLA Membership Fees

	Yearly BNLA Fee	
Lab Members/Company	**Previous/Current** (since 2001)	**Effective 7/1/12**
1	**$15,000**	**$17,500**
2	**$25,000**	**$27,500**
3 - 4	**$35,000**	**$37,500**
5 - 6	**$50,000**	**$55,000**

BNLA Collected Income, FY04/05 - FY10/11
(Includes Materials, but not OH)

BNLA is a consistent ~20% of total operation

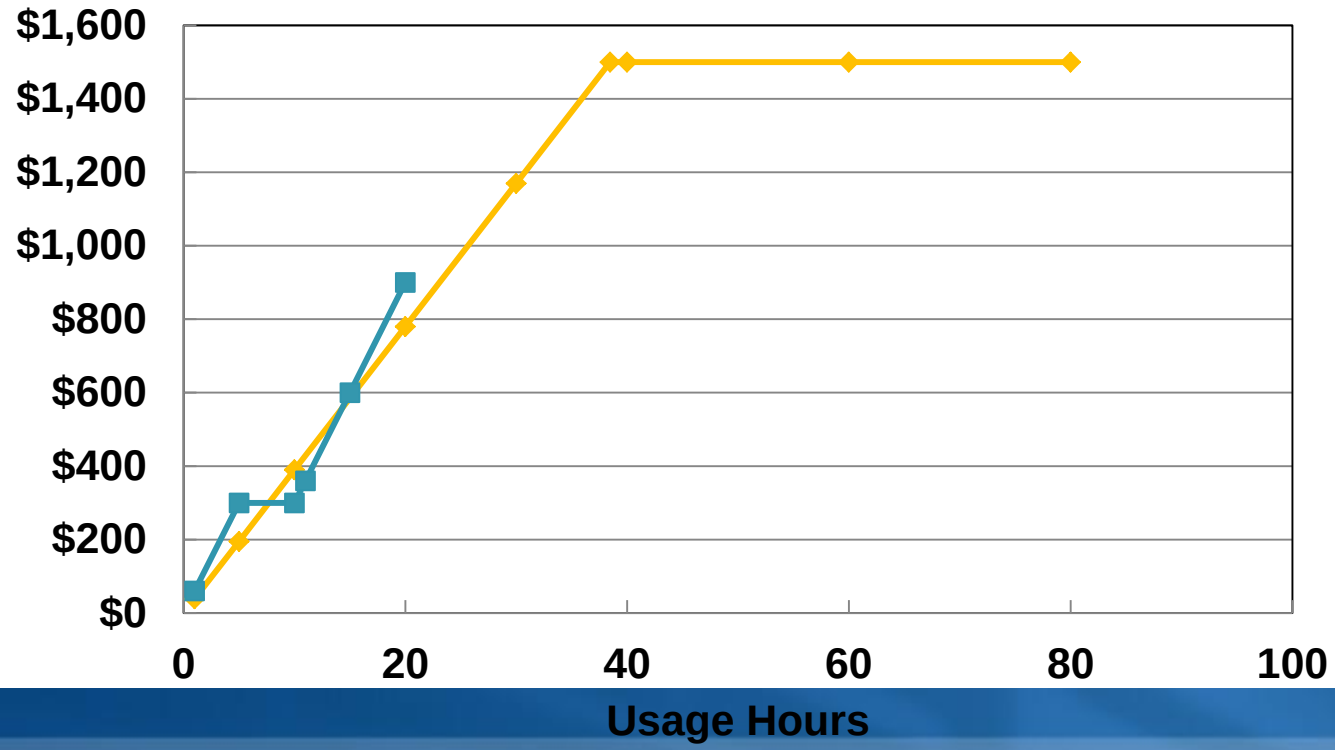


FEI NanoSEM650
Delivered Mar 2012

- **Thanks to E3S**
- **Original location NanoLab**
- **Preferred location 1st floor SDH. NanoLab traded 2nd floor support space for dedicated SEM room. ~$20k prep**
- **Start up June 2012**

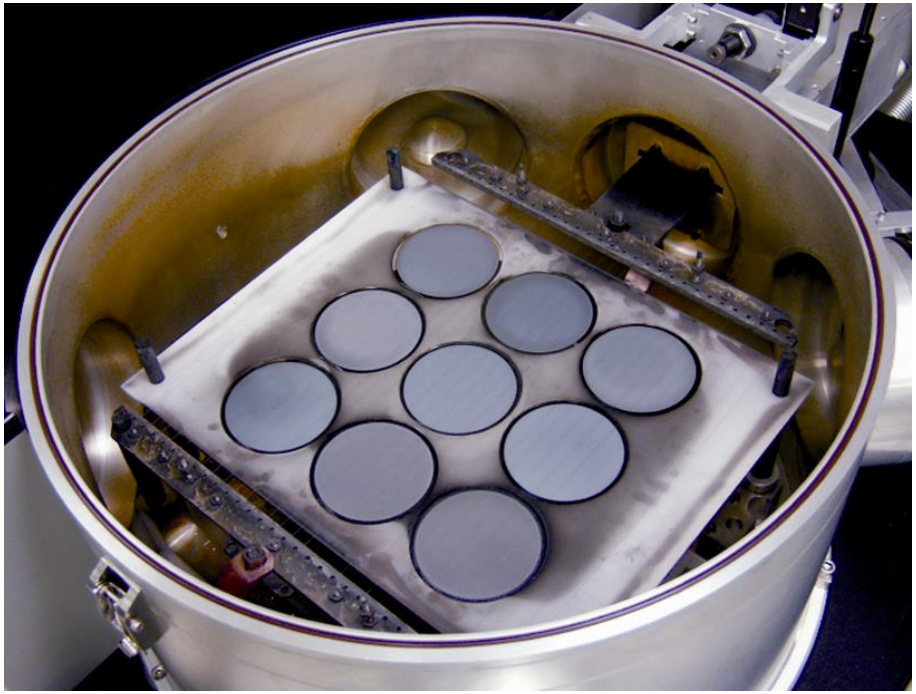
FEI NanoSEM650
Recharge Proposal

- **Separate equipment charge: $60/hour**
- **Separate equipment cap: $300/month**
- **After 10hours recharge restarted**



SP3 diamond deposition tool

- Thanks to Prof Nguyen
- Install / release Nov 2011 - Mar 2012
- Hot filament CVD deposition CH_4 / H_2



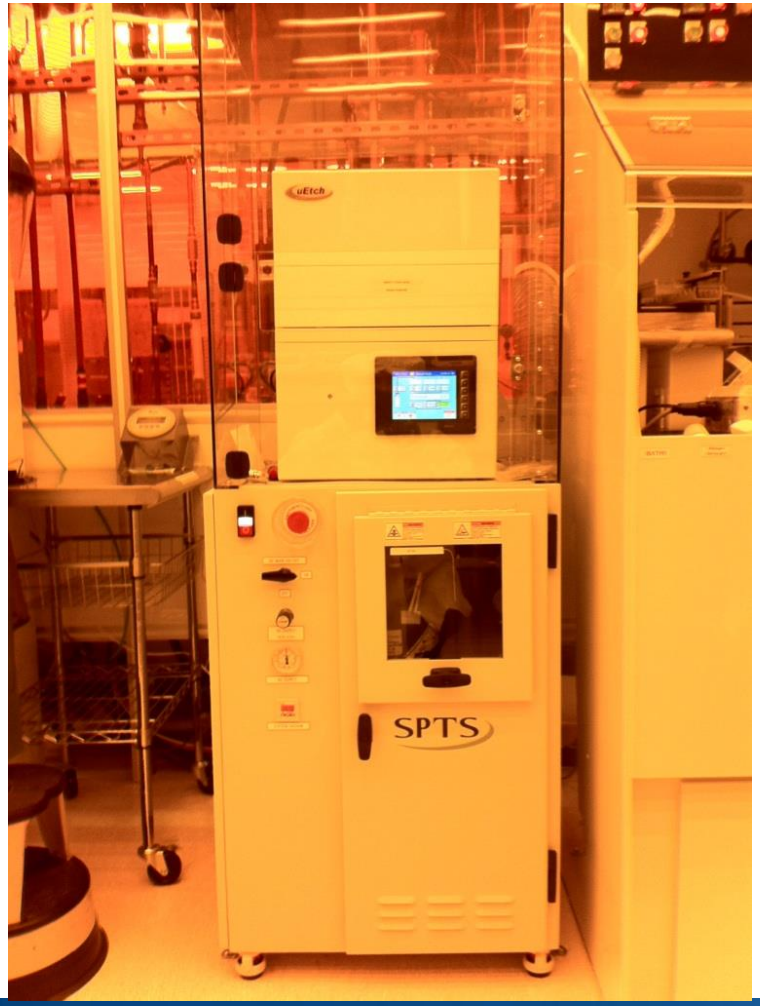
Disco Dicing Saw

- **Funded by BMLA and 40% donation**
- **Install /release Nov – Dec 2011**
- **Restored reliable dicing to the NanoLab**
- **Disco Lab available for Stealth subsurface laser dicing**

GnP CMP

- Thanks to Prof Dornfeld
- Install /release Jan – Mar 2012
- Adds Metal CMP capability
- Si and SiO2 CMP tool still available separately
- Requests for Cu, Al, Ni

Primaxx HF vapor tool
Installed / released Feb - Mar 2012



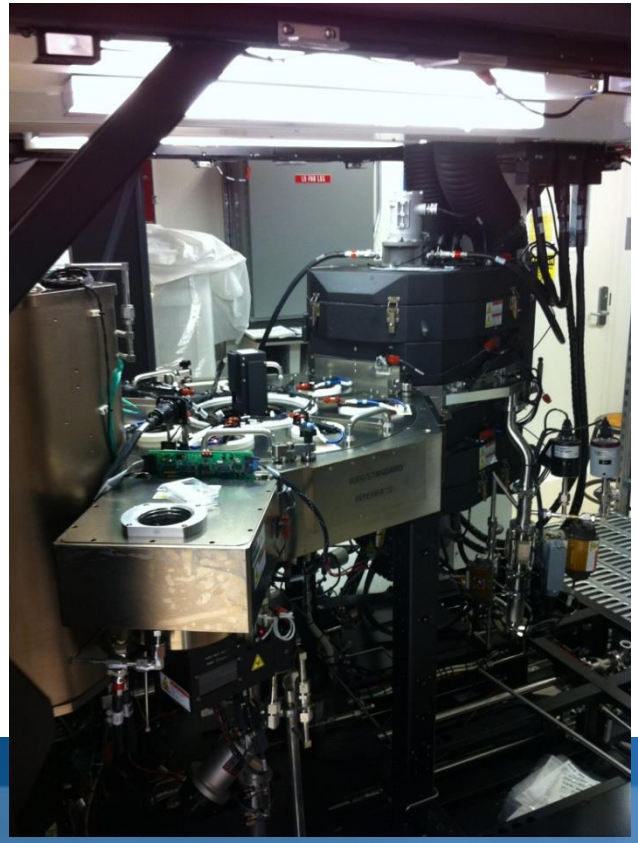
- **Thanks to Profs King, Nguyen and Horsley**
- **Anhydrous HF and sealed chamber provides improved process control and selectivity**

Camridge Plasma ALD

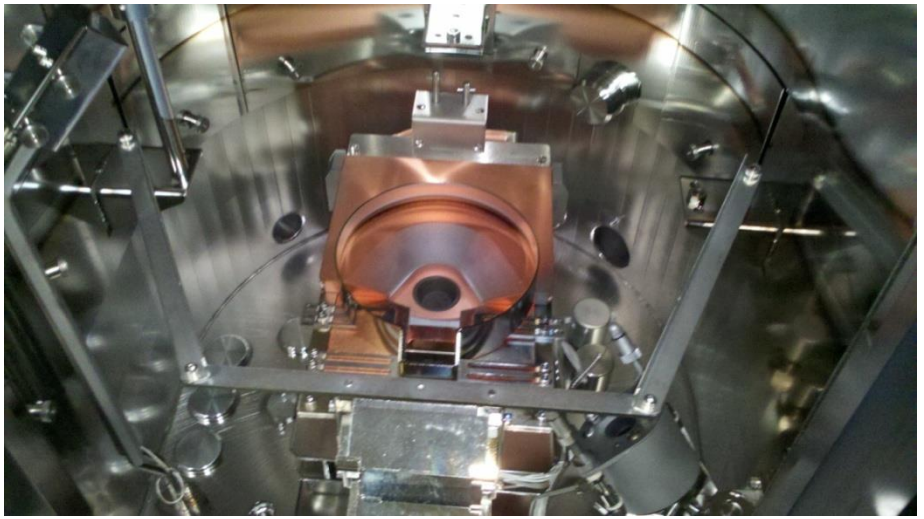
- **Install April 2012**
- **Start up scheduled for week of May 14**
- **Thanks to Profs Nguyen**
- **To be qualified with Ru**
- **Requests for Pt, TiN, SiO2**

AMAT epi-Si Ge deposition

- **Install Start May 2011, utilities complete Feb 2012**
- **Thanks to AMAT Donation**
- **AMAT on site Apr 2012, all robots and vac qualified**



CHA e-beam evaporator



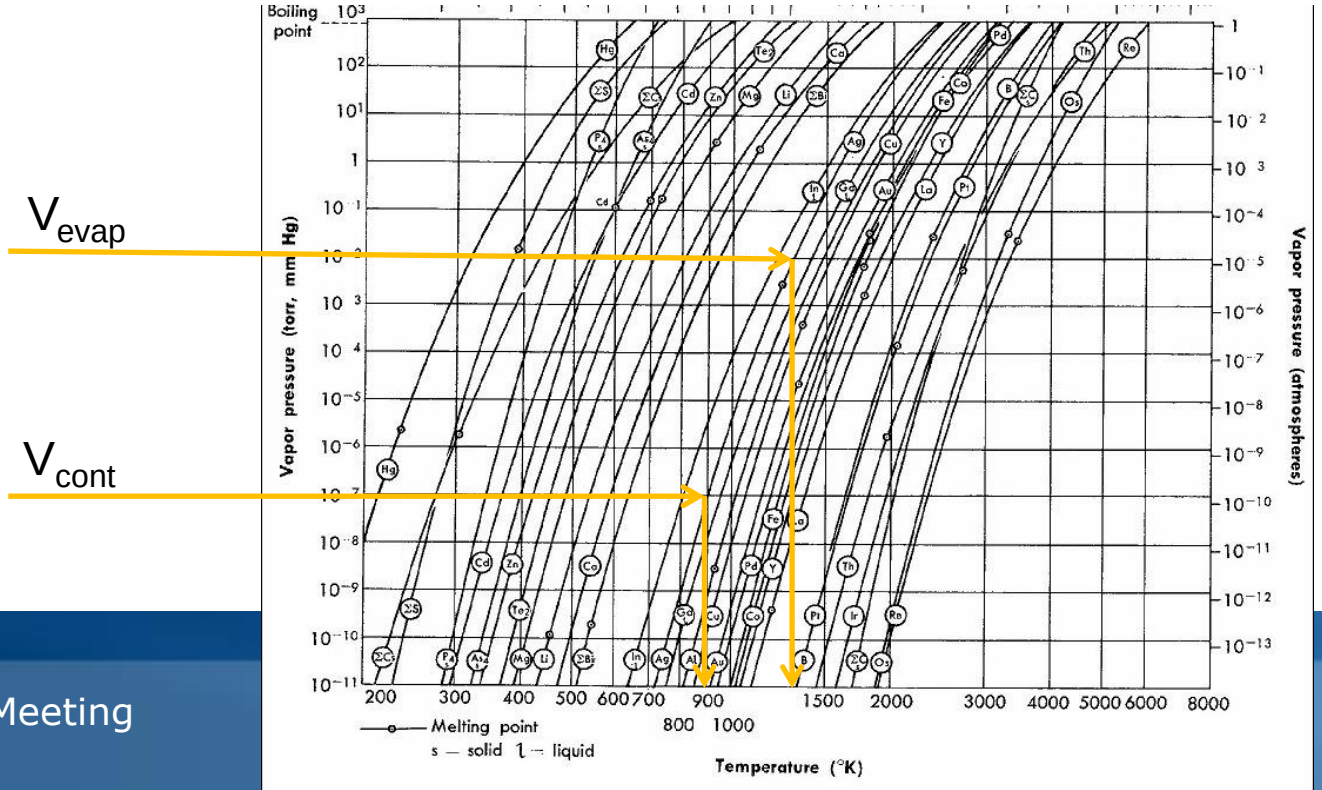
- **Install May 2012**
- **Start up scheduled for June**
- **Thanks to E3S**

NanoLab Evaporator
Reorg based on vapor pressure underway

- Maximum graphite crucible temperature is 2500 °C.
- Metal Evaporation occurs at relevant rates when vapor pressure reaches 10^{-2} Torr.
- Metal vapor contamination can occur at vapor pressures above 10^{-7} Torr.
- Oxygen contamination of melt occurs at oxygen partial pressures > 10^{-8} Torr.
- Primary contamination vector is delaminating flakes falling into melt from the shutter.
- Material restriction policies are based on temperature at which a material's vapor pressure can contaminate the chamber.
- Material allowance policies are based on whether an evaporator can source enough power to vaporize the material.
- Base pressure and ability to change shutters/shields highly affects quality of films.

System Name	Type	Min $T_{contamination}$	Max $T_{evaporation}$	Purpose
CHA-Evap	E-beam	900 K	2773 K	High Purity films
Edwardseb3	E-beam	900 K	2773 K	High Temperature Vapor
Dw	E-beam	450 K	1500 K	Mid Temperature Vapor
Ultek	E-beam	N/A	1000 K	Low Temperature Vapor
Nrc	Thermal	N/A	N/A	Transparent Conducting Oxide
ThermVap	Thermal	900 K	N/A	Refractory Metal filaments

Example: Silver (Ag) is allowed in CHA-Evap, eb3, and dw



T_{evap} = ~1270 K

T_{cont} = ~900 K

- UC Berkeley NanoLab will host UGIM 2012
- Initiated by RIT to showcase microelectronics programs
- Now includes Lab Directors from across the country and around the world. Expect ~150 this year

- 2014 Harvard is likely host
- 2010 Purdue ~150
- 2008 Louisville ~130
- 2006 San Jose
- 2004 Idaho
- 2002 Virginia Commonwealth

RIT (Rochester Institute of Technology) Mascot
RITchie the Tiger
Visited their cleanroom in April, 2012

RIT challenged UGIM participants to do the same

RITchie has a Facebook page…

Oski is coming to the NanoLab
He will gown up and tour
Wednesday May 16, 2012 11am

All Are Welcome

Summary

A majority of the move and fit up was funded by BMLA

The move has not resulted in significant rate increases.

New SEM room significant gain for metrology quality

The lab continues to evolve to meet faculty needs.
Thank you to multiple supporters for new equipment.
Wafer bonding needs faculty champions.

The shared lab model is alive and well thanks to your support.