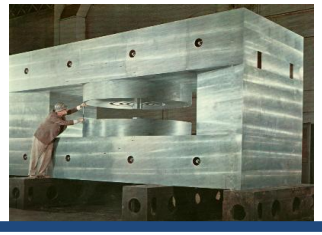
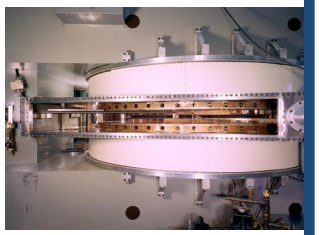
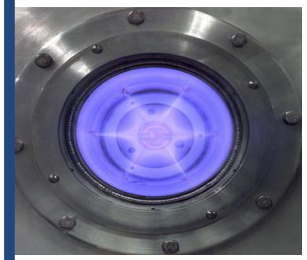
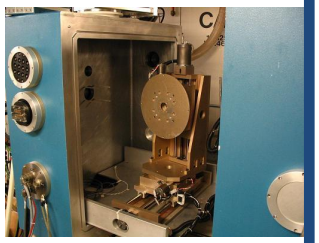
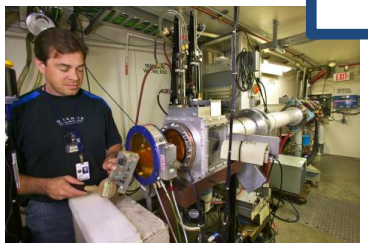
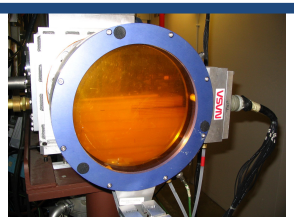
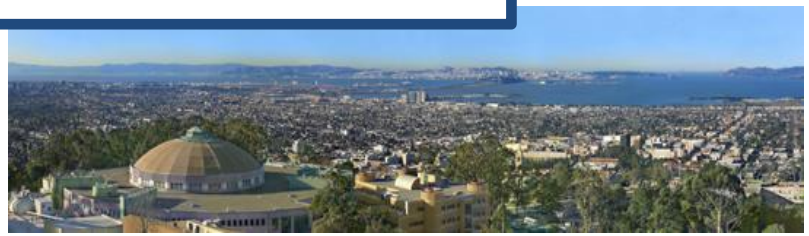
Investment plan







BERKELEY LAB

Larry Phair

Topics

- Cost to run facility for DOE-NP
  - Scenario 2 (SHE)
  - Scenario 4 (2,800 hours)
- Full cost recovery analysis
- Budget for each scenario
- Investment plan
- Carryover analysis

Cost to run NP, salaries

	Scenario 2	Scenario 4
Total hours	4,000	2,800
Total FTEs	19.60	17.81
DOE salaries	$ 5,397K	$ 4,877K
BASE salaries		
total salaries	$ 5,397K	$ 4,877K

Both DOE-only Scenarios (2,4)

Rates for DOE-only scenarios

- Scenario 2 (4,000 hours)
  - DOE: $1,792/hour
- Scenario 4 (2800 hours)
  - DOE: $2,168/hour

Operators

Scenario 2: 10/4 schedule, 5 operators

Scenario 4: 8/6 schedule, 4.4 operators (need operator-techs, crew chief also sits shifts). “Seasons” of 10/4 running.

Scenario 3: 5,500 hours. Clear operational efficiency comes from running 12/2. Allows for delivery of required beam hours in fewer calendar weeks, lengthening the shutdown periods. Largest call on manpower is during the shutdown periods, when maintenance and improvement activities must be completed under strict time constraints. 3 operators + 3 operator-techs

Power cost (5B)

Power

- Consumption rates
  - 1.25 MW when the cyclotron is running
  - 0.3 MW when the cyclotron is off
- Use $0.107 per kW*hr
  - Includes LN usage ($60K to 90K per year)

	Scenario 1	Scenario 2	Scenario 3
Power hourly rate:	$ 175	$ 171	$ 152

Power cost continued (5B)

Scenario 3

- The cost of power is approximately $836K per year for 5,500 hours, assigned proportionally to DOE-NP, Air Force, NASA, MDA and Work-For-Others, according to their share of beam hours used.

Scenario 2

- $685K for 4,000 hours

Scenario 1

- $664K for 3,800 hours

Full cost recovery (5B)

Pieces

- Salaries (discussed in staffing talk)
- Power
- M&S
- Investments (starting in FY19)

Full cost recovery: M&S (5B)

M&S for repairs

- Proportional to time run
- Estimated at $172/hour, all scenarios

Investment M&S for improvements (per year, starting in FY19)

Type of investment	Scenario 1	Scenario 2	Scenario 3
shared (DOE and BASE)	150K	400K	400K
BASE-only	185K		500K

BASE-only investments:

- Spare FPA (Final Power Amplifier) for the RF system
- Portable beamline power supply
- VENUS hot rack (for sputter probe)
- Spare microwave generator (21.5 GHz)
- Replace M43, M41 & M42 power supplies

Risk Description (or condition to repair)	Risk	Shared cost?	Mitigation Cost to Prevent or Recover (k$)	Time to Implement Mitigation
Basement water loop failing because of corrosion	3	yes	50	3 months
A1000s have failed, no longer serviceable (replace)	3	yes	250	4 months
Spare Final Power Amplifier	3	BASE	125	6 months
Mild to Serious water leak destroying cyclotron vacuum	3	yes	300	1 year
LN guard vac failure	3	Yes, AIP	500	6 months
Cooling tower is failing	3	BASE, AIP	600	1 year
Corrosion kills ALCW pipes	2	yes	50	3 months
Safety incident with deflector rails	2	AIP	100	6 months
PS fails on any beam line optics	1	BASE	200	1 year
Old wiring below cyclotron fails	3	yes	250	2 years
Air exchange fails in the vault	2	yes	30	3 months
Hot rack for VENUS, PSs for the sputter probe.	2	BASE	100	3 months
28 GHz gyrotron fails	2	BASE	350	1 year
Safety incident with deflector rails (positioning)	1	yes	25	1 month
He compressor fails	2	yes	350	2 months
PPS fails (repair)	1	yes	20	6 months
PS fails on BASE beamline	1	BASE	500	1 year

Highest risk concerns and opportunities

Major investments proposed (priority order, Scenario 1)

Shared: $150K yearly

FY20: ($1050K)(=150K + 900K from carryover)

- Cooling tower replacement (~$600K, our estimate)
- Repair VENUS LN fill ($50K)
- Replace corroded water headers for ALCW circuit ($50K)
- A1000 replacement (amplifier that drives the RF system) ($250K)
- Spare deflector rails ($100K)

FY21: ($300K)(=150K + 150K from carryover)

- Additional pumping on RF tank ($300K)

FY22: ($375K)(=150K + 225K from carryover)

- He compressor (single point of failure for 88 vacuum system, $350k)
- FARO arm (align deflector rails w/out worker exposure, $25K)

BASE: $185K yearly

FY20: ($125K, 60K balance)

- Spare FPA (Final Power Amplifier) for the RF system (for BASE, $125K) *

FY21: ($200K, 45K balance)

- Portable beamline PS (for BASE, $200K)

FY22: ($100K, 130K balance)

- VENUS hot rack (sputter probe, for BASE, $100K)

Major investments proposed (priority order, Scenario 3)

Shared: $400K yearly, starting FY21

FY20: ($1050K)(same as Scenario 1)

- Cooling tower replacement (~$600K, our estimate)
- Repair VENUS LN fill ($50K)
- Replace corroded water headers for ALCW circuit ($50K)
- A1000 replacement (amplifier that drives the RF system) ($250K)
- Spare deflector rails ($100K)

FY21: ($300K, 100K balance)

- Additional pumping on RF tank ($300K)

FY22: ($375K, 125K balance)

- He compressor (single point of failure for 88 vacuum system, $350k)
- FARO arm (align deflector rails w/out worker exposure, $25K)

BASE: $500K yearly, in FY21

FY20: ($125K, 60K balance, S1)

- Spare FPA (Final Power Amplifier) RF system ($125K)

FY21: ($300K, 260K balance)

- Portable beamline PS (for BASE, $200K)
- VENUS hot rack (sputter probe, for BASE, $100K)

FY22: ($760K, 0K balance)

- Spare microwave generator (21.5 GHz, 350K)
- Replace M43, M41 & M42 power supplies (410K of 500K)

Major investments proposed (priority order, Scenario 2)

DOE-only: $400K yearly, starting FY21 (SAME AS SCENARIO 3)

FY20: ($1050K)(same as Scenario 1)

- Cooling tower replacement (~$600K, our estimate)
- Repair VENUS LN fill ($50K)
- Replace corroded water headers for ALCW circuit ($50K)
- A1000 replacement (amplifier that drives the RF system) ($250K)
- Spare deflector rails ($100K)

FY21: ($300K, 100K balance)

- Additional pumping on RF tank ($300K)

FY22: ($375K, 125K balance)

- He compressor (single point of failure for 88 vacuum system, $350k)
- FARO arm (align deflector rails w/out worker exposure, $25K)

FY20: ($125K, 60K balance, same as S1)

- Spare FPA (Final Power Amplifier) for the RF system (for BASE, $125K) *

Full cost recovery: staffing (5B)

Staffing assumptions for BASE program

- Primary cost driver at the cyclotron is the staffing level, closely related to the number of hours of beam delivered
- "Mission readiness" means having the staff in place
- Annual planning requires making some assumptions about the total hours.
  - Normally plan for the hours specified in Interagency Agreements (IA).
  - Currently, NASA = 500 hours, MDA = 500 hours.
  - Recently, these IAs have not been fully honored. With sufficient notice (6-12 months), hours can be sold as WFO.

Characteristic time scales:

Operator training - 1 year

Processing a company for beam time - 4 to 6 weeks

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Total hours	3,800	4,000	5,500	2,800
Total FTEs	20.30	19.60	23.29	17.81
DOE salaries	$ 3,858K	$ 5,397K	$ 4,379K	$ 4,877K
BASE salaries	$ 1,866K		$ 2,214K	
total salaries	$ 5,724K	$ 5,397K	$ 6,593K	$ 4,877K
DOE M&S	$ 592K	$1,087K	$ 978K	$ 631K
BASE M&S	$ 441K		$911K	
total M&S	$ 1,033K	$1,087K	$ 1,890K	$ 631K
DOE power	$ 489K	$684K	$608K	$ 563K
BASE power	$ 175K		$228K	
total power	$ 664K	$684K	$836K	$ 563K
Total DOE	$ 4,939K	$ 7,169K	$ 5,965K	$ 6,071K
Total BASE	$ 2,482K		$ 3,354K	
Total	$ 7,421K	$ 7,169K	$ 9,319K	$ 6,071K

Rates for different scenarios

- Scenario 1
  - DOE: $1,764/hour
  - BASE: $2,482/hour
- Scenario 2
  - DOE: $1,792/hour
- Scenario 3
  - DOE: $1,491/hour
  - BASE: $2,236/hour
- Scenario 4 (DOE-only, 2800 hours)
  - DOE: $2,168/hour

COSTS	DOE	AF/MDA/NASA	WFO (1 hour)	Totals
Salaries to run	$ 2,844,228	$ 1,502,695	$ 1,002	$ 4,347,925
Salaries shutdowns	$ 1,011,298	$ 379,237	$ 253	$ 1,390,788
Salaries improvements	$ 523,185	$ 196,194	$ 131	$ 719,510
ECR R&D salaries	(separate funding)	$ 135,869	$ 91	$ 135,959
Total salaries	**$ 4,378,712**	**$ 2,213,995**	**$ 1,476**	$ 6,594,183
BASE specific M&S	$ -	$ 44,970	$ 30	$ 45,000
Shared M&S maint.	$ 687,440	$ 257,790	$ 172	$ 945,402
BASE specific invest.		$ 499,667	$ 333	$ 500,000
Shared M&S invest.	$ 290,856	$ 109,071	$ 73	$ 400,000
Total M&S	**$ 978,296**	**$ 911,498**	**$ 608**	$ 1,890,402
Power (recharges)	**$ 608,225**	**$ 228,084**	**$ 152**	$ 836,461
Total	**$5,965,233**	**$3,353,578**	**$2,236**	$9,321,046
Hours	4000	1500	1	5501
Hourly rate	**$1,491**	**$2,236**	**$2,236**	

Scenario 3, hourly rate breakdown

Role of WFO

- *Ran 602 WFO hours in FY19* (higher than average)
  - Happened because MDA dropped out of two large block buys
- Plan for FY20 is 0 WFO hours (do not rely upon any WFO sold)
  - Due to low MDA hours in Q1, we ran 123 WFO hours in Q1.
  - ~ 80 hours of WFO sold for the remainder of the year

Carryover target

Carryover is needed to cover:

- beginning of year issues (e.g., CR)
- late arrival of IA funds (usually February or March, sometimes as late as July).
- Avoid cash flow issues.

Carryover target should be:

- 3 months of running costs (~$1.8M)
- “Seed” amount for WFO running. Not needed currently as we assume 0 hours WFO.

Carryover analysis

- @FY20 start: $2.611M carryover
- With target of $1.5M carryover – could invest $1.1M in facility improvements in FY20. Propose to invest $900K of carryover this year.
- Following the improvement plans (scenario-dependent)

start: $2,611K	yearly investment (shared, BASE) ($K)	FY20 imp. costs (shared, BASE) ($K)	FY20 carryover ($K)	FY21 imp. costs (shared, BASE) ($K)	FY21 carryover ($K)	FY22 imp. costs (shared, BASE) ($K)	FY22 Carryover ($K)
Scenario 1	(150, 185)	(1050, 125)	(1711, 60)	(300, 200)	(1561, 110)	(375, 100)	(1336, 135)
Scenario 2	400	1050	1961	300	2061	375	2086
Scenario 3	(400, 500)	(1050, 125)	(1961, 375)	(300, 300)	(2061, 575)	(375, 760)	(2086, 315)

Assumes no WFO. Any WFO will increase the carryover amount.

See “Major investments” slides, this presentation

Backup

Cooling tower

ID	WBS	Task Name	Duration	Start	Finish	Predecessors	Successors	Resource Names	Cost
1	**1**	**88 Cooling Tower**	**134 days**	**Wed 2/19/20**	**Tue 8/25/20**				**$405,956....**
2	*1.1*	*Start Summer Shutdown*	*0 days*	*Fri 7/3/20*	*Fri 7/3/20*		*47*		*$0.00*
3	*1.2*	*End Summer Shutdown*	*0 days*	*Tue 8/25/20*	*Tue 8/25/20*				*$0.00*
4	**1.3**	**Pre-Contruction**	**114 days**	**Wed 2/19/20**	**Mon 7/27/20**				**$398,976....**
5	**1.3.1**	**Contract Awards**	**109 days**	**Wed 2/19/20**	**Mon 7/20/20**				**$387,336....**
6	**1.3.1.1**	**Cooling Tower Procurement**	**105 days**	**Wed 2/19/20**	**Tue 7/14/20**				**$126,120....**
7	1.3.1.1.1	Request For Quotes from Vendor (Air Products)	10 days	Wed 2/19/20	Tue 3/3/20		27,28,85F+63 days	Project Manager (MJ),Project Engineer (AGH)	$0.00
8	1.3.1.1.2	Award: Cooling Tower	2 days	Thu 5/14/20	Fri 5/15/20	7SF+63 days	10	Program Head (LP),Project Manager (MJ)	$0.00
9	1.3.1.1.3	Award: Cooling Tower Control System	1 day	Fri 5/15/20	Fri 5/15/20	7SF+63 days	11	Program Head (LP),Project Manager (MJ)	$0.00
10	1.3.1.1.4	Vendor Lead Time - Cooling Tower	40 days	Mon 5/18/20	Fri 7/10/20	8	12	Procurement[76.12]	$76,120.00
11	1.3.1.1.5	Vendor Lead Time - Cooling Tower Control System	40 days	Mon 5/18/20	Fri 7/10/20	9	13	Procurement[50]	$50,000.00
12	1.3.1.1.6	RCV: Cooling Tower	2 days	Mon 7/13/20	Tue 7/14/20	10	61	Project Manager (MJ)	$0.00

- ~$600-700K estimate
- Purchasing a custom build tower (~$125K)
- Sprinkler system for fire safety.
- Installation by contractor (TBD)
- Project management by captive labor
- Some purchased cost from LBNL Facilities

M&S funds for maintenance and improvements

Example, Scenario 3

- M&S funds for **maintenance** are charged proportionally to DOE-NP, NASA, MDA, etc. and to Work-For-Others recharges, according to their share of beam hours used. ($172/hour)
- Scenario 3: $945K for 5,500 hours
- M&S funds for **improvements** (see strategic plan) calls for
  - $400K of M&S for shared improvements
  - $500K for BASE-only improvements

Identified list of improvements is finite. Work through the list until it is complete.