Accelerator Hardware Reliability

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Outline

Reliability Statistics

- CATER database.
- MTTF, MTTR, Availability.
- Statistical data.
- Discussion of trends.

Opportunistic Maintenance

- How we do business at SLAC.
- SML.
- RODs.

CATER Database

- Operators and others enter reports for all hardware malfunctions.
- An engineer edits the CATER reports to enter or correct the associated downtime.
- "Bookkeeping CATERs" are entered retroactively as needed.
- Urgent maintenance work is dispatched from CATER reports; reports are closed by supervisors when work is completed.
- Area Managers review other CATERs; add jobs to "Standby Maintenance" or "ROD" lists.

Example of size of data set:

- 4132 hardware CATERs recorded between January 10, 2000 and September 30, 2001.
- 733 (18%) report lost beam time ("revealed failures").
- 82% correspond to identified problems that have not interrupted the scheduled program.

Definitions:

CATERs: entries in database reporting hardware malfunctions.

Revealed failures: malfunctions resulting in lost beam time. Also called "events".

Unscheduled down time: hours lost from scheduled program due to malfunctions.

Mean Time to Fail:

$$MTTF = \frac{\text{Scheduled beam time}}{\text{Events}}$$

Mean Time to Repair:

$$MTTR = \frac{\text{Unscheduled down time}}{\text{Events}}$$

$$\text{Availability} = 1 - \frac{\text{Unscheduled down time}}{\text{Scheduled beam time}}$$

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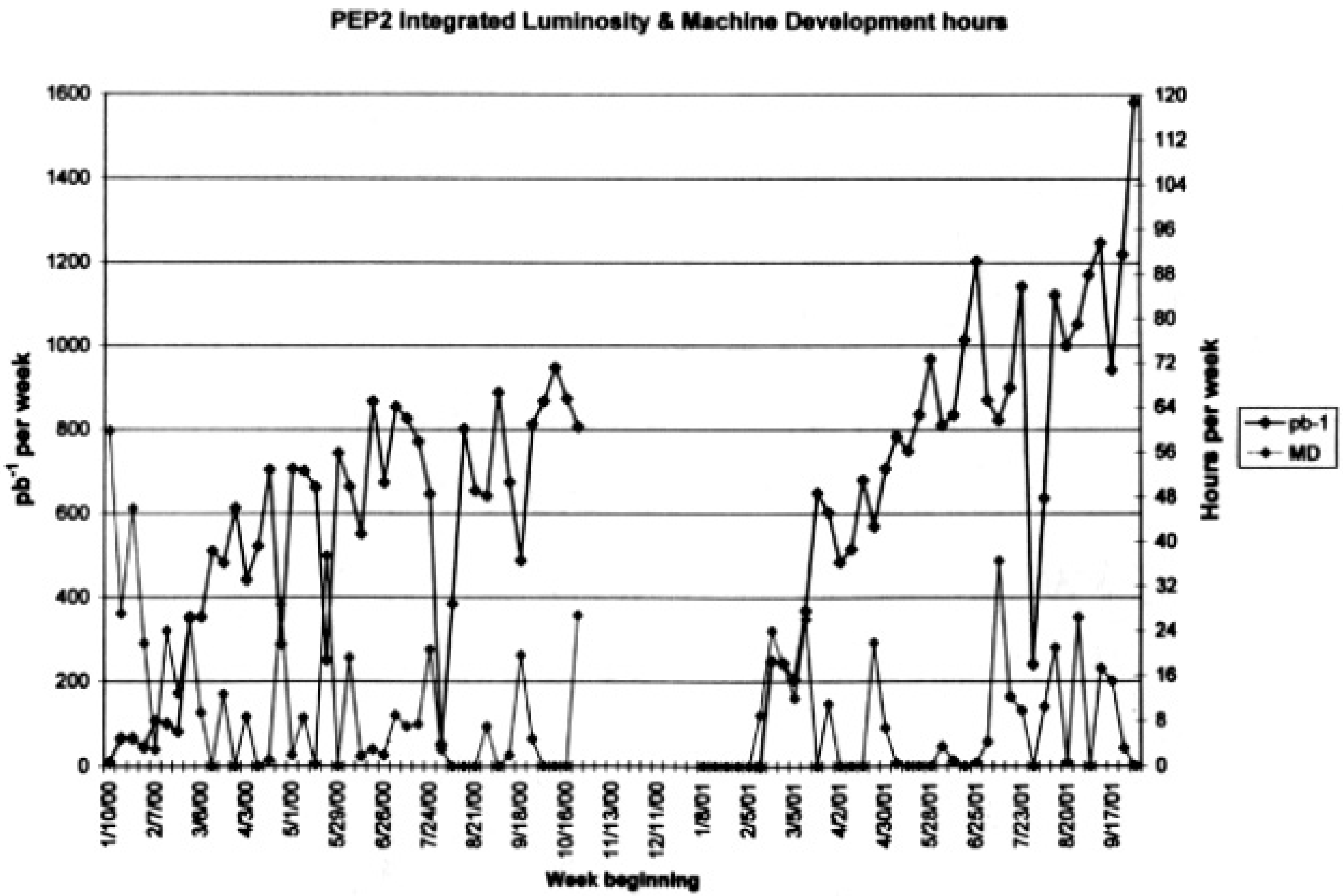
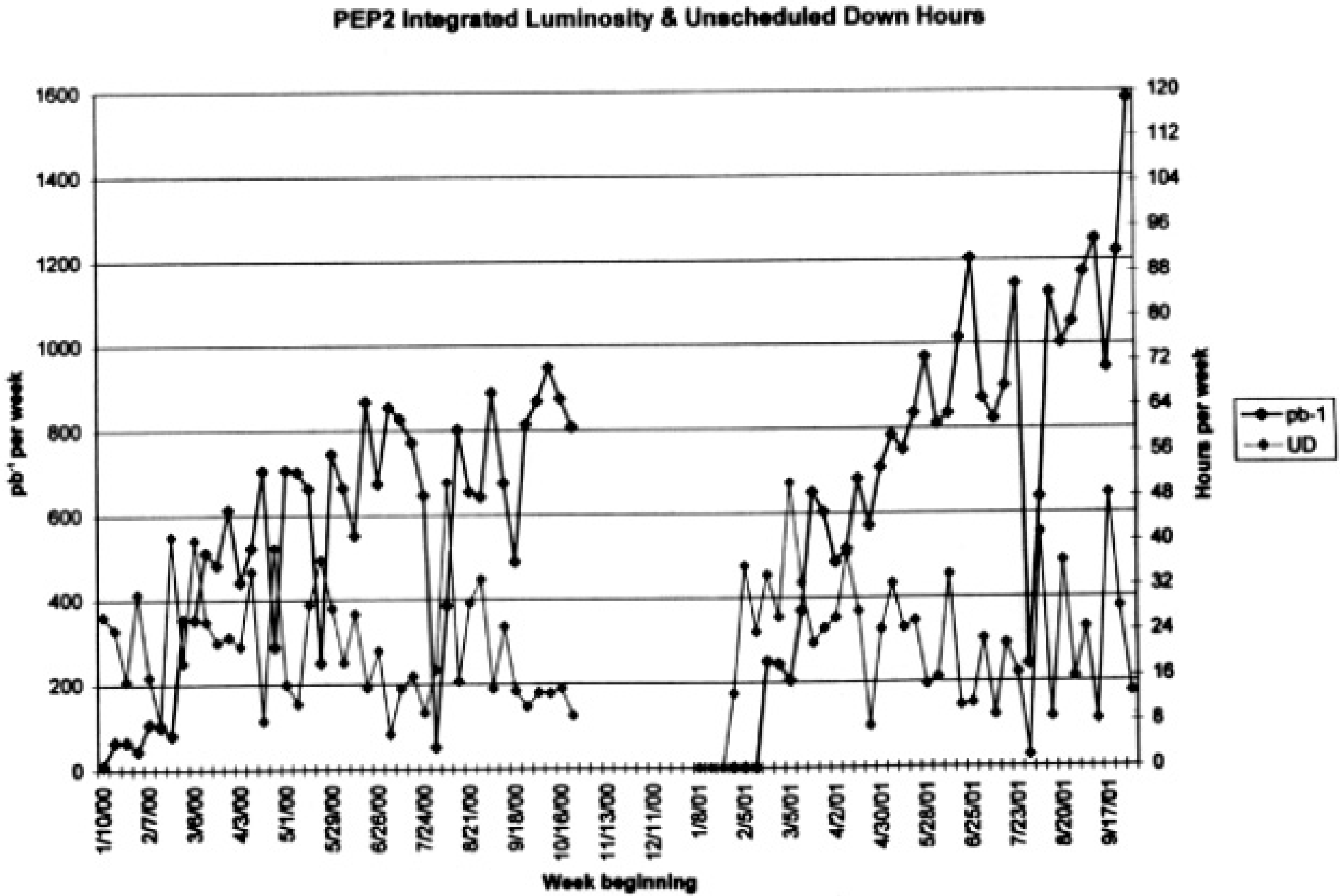


M. Stanek 10/11/01



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Trends in PEP-II Reliability Data
(includes injection systems)

Data were examined from last two years:
January 10, 2000 through September 30, 2001.

Machine development time (MD) was scheduled roughly twice a month for 8 to 16 hours at a time during smooth running periods.

General trends

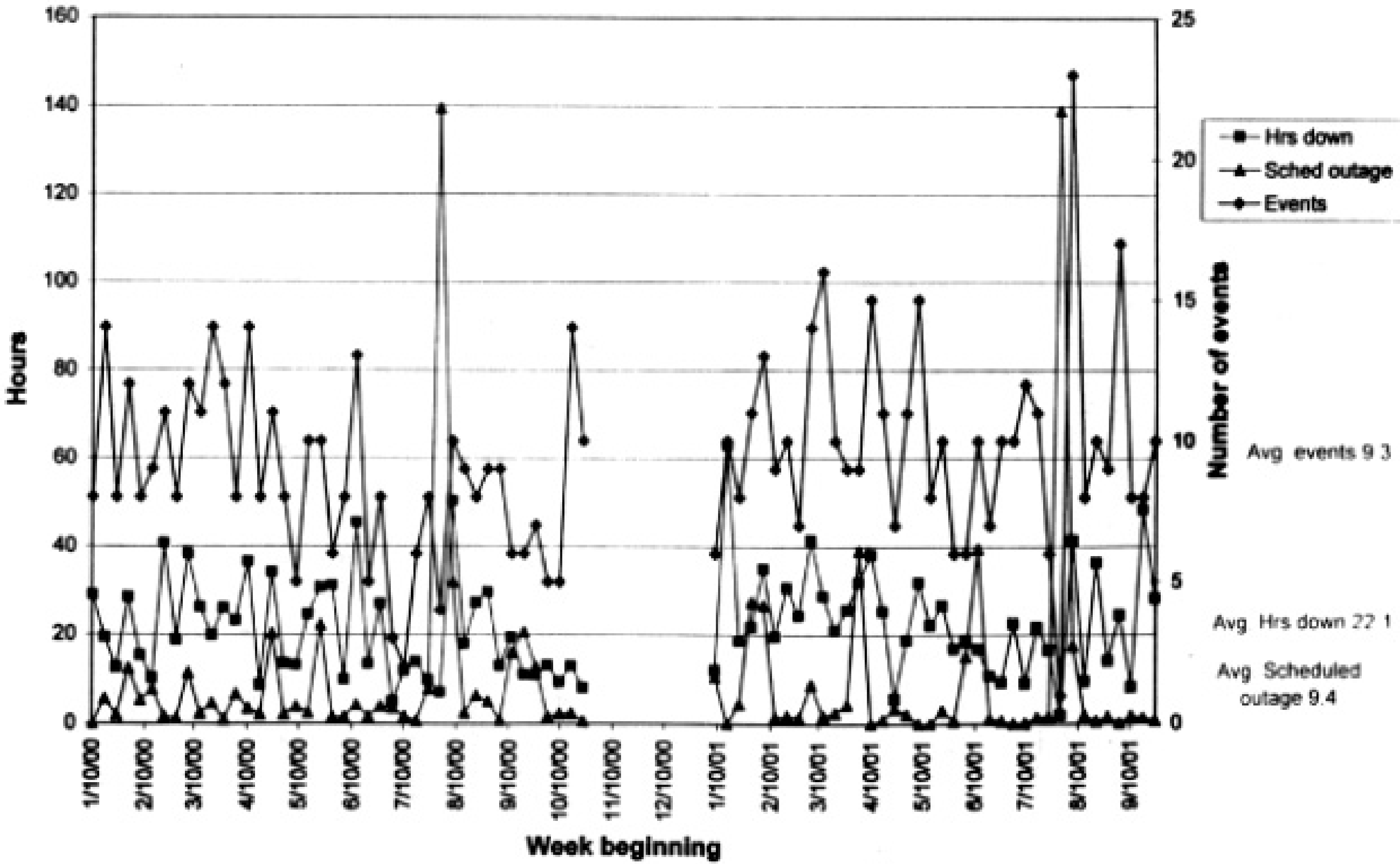
Following a 3-month downtime:

- *Integrated luminosity/week starts low and improves for about three months to restore previous performance.*
- *Unscheduled downtime/week drops slowly over a few months.*

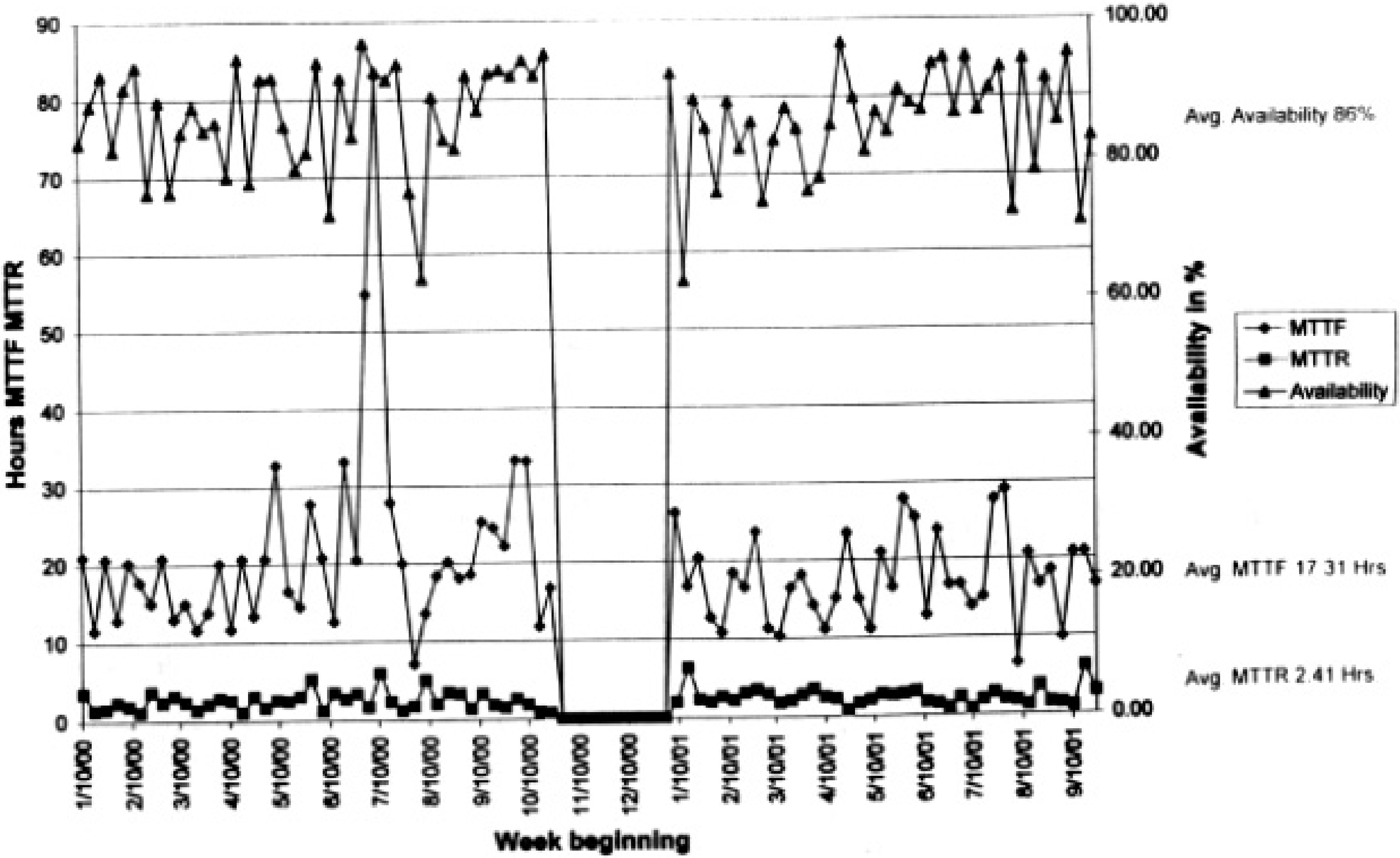
Following a 1-week downtime:

- *The integrated luminosity the week after a downtime is about half that of the week before the outage, but it's fully restored the following week.*
- *Unscheduled downtime doubles for the first week following, but returns to previous trend the following week.*

Weekly number of events, hours down, and hours of scheduled outage



Weekly MTTF, MTTR, and Availability



January 10, 2000 to September 30, 2001 Revealed Failures

MTTF	**17.31**		**Scheduled Operating Hrs**	**12685.90**
MTTR	**2.41**		**Total Events**	**733**
Availability	**86.09%**		**Total Hrs down**	**1764.75**

Scheduled Operating Hrs = 13440 - Scheduled Outage

Scheduled Outage : 754.1

Subsystem Data

Power Supplies	204	440.45	62.19	2.16
Magnets	33	122.9	384.42	3.72
RF	127	265.35	99.89	2.09
Vacuum	39	139.3	325.28	3.57
Utilities	99	298.05	128.14	3.01
Cryogenics	2	15.6	6342.95	7.80
Controls	172	308.8	73.76	1.80
Safety	2	10.05	6342.95	5.03
Other	55	164.25	230.65	2.99
Totals	733	1764.75	17.31	2.41

Area Data

Inj/S0&1	45	141.50	281.91	3.14
NDR	54	149.80	234.92	2.77
SDR	61	160.55	207.97	2.63
Linac	95	179.80	133.54	1.89
E+	38	77.10	333.84	2.03
PEPII/Inj	20	44.90	634.30	2.25
BSY	12	16.30	1057.16	1.36
HER	221	449.00	57.40	2.03
LER	112	323.80	113.27	2.89
ESA	1	3.00	12685.90	3.00
MCC	21	36.85	604.09	1.75
Other	50	175.75	253.72	3.52
FFTB	3	6.40	4228.63	2.13
	733	1764.75	17.31	2.41

CWA 10/12/01

PEP Revealed Failures by Subsystem
Three six week periods during 2000 and 2001
(Includes Injection systems)

	September 18, 2000 to October 29, 2000	March 12, 2001 to April 22, 2001	August 20, 2001 to September 30, 2001
Scheduled operating hours	969.8	959.1	1002.1
Scheduled outage hours	38.2	48.9	5.9
Availability	92 %	83 %	84 %

Power Supplies	17	18.9	57.05	1.11	22	39.1	43.60	1.78	14	46.8	71.58	3.34
Magnets	0	0			7	28	137.01	4.00	3	10.7	334.03	3.57
RF	10	29.9	96.98	2.99	8	18.3	119.89	2.29	6	6.7	167.02	1.12
Vacuum	1	0.8	969.80	0.80	5	13.3	191.82	2.66	4	9.6	250.53	2.40
Utilities	7	9.6	138.54	1.37	8	27.5	119.89	3.44	15	41.7	66.81	2.78
Cryogenics	0	0			0	0			2	15.6	501.05	7.80
Controls	11	20	88.16	1.82	12	17.5	79.93	1.46	13	19.1	77.08	1.47
Safety	0	0			0	0			0	0		
Other	1	2.5	969.80	2.50	4	24.1	239.78	6.03	6	11	167.02	1.83
Total	**47**	**81.7**	**20.63**	**1.74**	**66**	**167.8**	**14.53**	**2.54**	**63**	**161.2**	**15.91**	**2.56**

Question Raised in Mid-April 2001:

Why hadn't PEP-II recovered fully after three months of running?

Compare 6-week periods of operation:

1. Best (last) six weeks of 2000.
2. Six weeks of spring 2001.

Trends:

- *Twice as much downtime/period in 2001.*
- *Availability down from 92% to 83% in 2001.*
- *MTTF worse in 2001 than in 2000 for all subsystems (except RF) and all areas (except LER).*

PEP Revealed Failures by Area
Three six week periods during 2000 and 2001
(Includes Injection systems)

September 18, 2000 to October 29, 2000		March 18, 2001 to April 22, 2001		August 20, 2001 to September 30, 2001	
Scheduled operating hours	969.8	Scheduled operating hours	959.1	Scheduled operating hours	1002.1
Scheduled outage hours	38.2	Scheduled outage hours	48.9	Scheduled outage hours	5.9
Availability 92 %		Availability 83 %		Availability 84 %	

Inj/S0&1	2	10.6	484.90	5.30	6	14.9	159.85	2.48	2	1.3	501.05	0.65
NDR	1	0.6	969.80	0.60	4	11.9	239.78	2.98	7	30.4	143.16	4.34
SDR	2	0.4	484.90	0.20	6	22.4	159.85	3.73	3	10.9	334.03	3.63
Linac	5	4.4	193.96	0.88	6	9.9	159.85	1.65	7	7.3	143.16	1.04
E+	3	4	323.27	1.33	6	5.9	159.85	0.98	1	1	1002.10	1.00
PEPII/Inj	1	0.8	969.80	0.80	2	4	479.55	2.00	3	4.5	334.03	1.50
BSY	0	0			1	4.8	959.10	4.80	1	0.3	1002.10	0.30
HER	22	29.6	44.08	1.35	23	55.3	41.70	2.40	14	23.7	71.58	1.69
LER	9	25	107.76	2.78	8	21.6	119.89	2.70	13	26.4	77.08	2.03
ESA	0	0			0	0			0	0		
MCC	1	3.8	969.80	3.80	3	5.1	319.70	1.70	1	1.4	1002.10	1.40
Other	1	2.5	969.80	2.50	1	12	959.10	12.00	11	54	91.10	4.91
FFTB	0	0			0	0			0	0		
Total	**47**	**81.7**	**20.63**	**1.74**	**66**	**167.8**	**14.53**	**2.54**	**63**	**161.2**	**15.91**	**2.56**

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Now compare to recent 6-week period (August 20 – September 30, 2001) when there was no secondary program.

The integrated luminosity/week was much improved, but availability, MTTF, and MTTR were all about the same as the "bad" period last spring!

Possible (but not convincing) explanations of degraded availability in spring 2001:

- Interference from other programs? (Linac beams to fixed target programs in spring 2001, but not in fall 2000.)

  The other programs were an additional burden for Operations staff and maintenance groups. This burden might account for the increased MTTR, but is not related to MTTF in any obvious way.

- Loss of several skilled employees?

- Bad luck?

  Examples:
  A large buried water pipe broke after 35 years.
  A quadrupole cooling manifold clogged after years of trouble-free operation.

No simple explanation found in CATER lists, although most of the increased trouble was in injection systems (source, damping rings, linac, BSY).

Comparison between SLC and PEP-II:

- Last long run of SLC:
  July 1997 – June 1998.

- Most recent two years of PEP-II:
  January 2000 – September 2001.

Technical Issues:

- Injection system for PEP-II uses front end subsystems of SLC (Source/ injector, Damping rings, Linac, Positron source)

- Linac rep rate:
  30 Hz for PEP-II.
  120 Hz for SLC.

- Charge/bunch for PEP < half SLC.

SLC and PEP Revealed Failures by Subsystem

SLC	PEP
July 14, 1997 to June 8, 1998	January 10, 2000 to September 30, 2001
Scheduled operating hours 7452.8	Scheduled operating hours 12685.9
Scheduled outage hours 483.2	Scheduled outage hours 754.1
Availability 77 %	Availability 86 %

[redacted]									
Power Supplies	231	359.75	32.26	1.56		204	440.45	62.19	2.16
Magnets	27	265.8	276.03	9.84		33	122.9	384.42	3.72
RF	151	254.75	49.36	1.69		127	265.35	99.89	2.09
Vacuum	65	355.3	114.66	5.47		39	139.3	325.28	3.57
Utilities	72	144.25	103.51	2.00		99	298.05	128.14	3.01
Cryogenics	6	4.7	1242.13	0.78		2	15.6	6342.95	7.80
Controls	201	289.6	37.08	1.44		172	308.8	73.76	1.80
Safety	3	2.1	2484.27	0.70		2	10.05	6342.95	5.03
Other	23	41.9	324.03	1.82		55	164.25	230.65	2.99
Total	779	1718.15	9.57	2.21		733	1764.75	17.31	2.41

SLC and PEP Revealed Failures by Area

SLC

July 14,1997 to June 8, 1998

Scheduled operating hours 7452.8

Scheduled outage hours 483.2

Availability 77 %

PEP

January 10, 2000 to September 30, 2001

Scheduled operating hours 12685.9

Scheduled outage hours 754.1

Availability 86 %

Inj/S0&1	73	116.3	102.09	1.59		45	141.5	281.91	3.14
NDR	132	541.35	56.46	4.10		54	149.8	234.92	2.77
SDR	104	254.45	71.66	2.45		61	160.55	207.97	2.63
Linac	179	196.55	41.64	1.10		95	179.8	133.54	1.89
E+	79	136	94.34	1.72		38	77.1	333.84	2.03
PEPII/Inj	2	0.8	3726.40	0.40		20	44.9	634.30	2.25
BSY	35	47.3	212.94	1.35		12	16.3	1057.16	1.36
HER	0	0				221	449	57.40	2.03
LER	0	0				112	323.8	113.27	2.89
ESA	5	2.9	1490.56	0.58		1	3	12685.90	3.00
MCC	32	66.7	232.90	2.08		21	36.85	604.09	1.75
Other	13	38.85	573.29	2.99		50	175.75	253.72	3.52
FFTB	2	3.3	3726.40	1.65		3	6.4	4228.63	2.13
ALL Other	123	313.65	60.59	2.55		0	0		
Total	**779**	**1718.15**	**9.57**	**2.21**		**733**	**1764.75**	**17.31**	**2.41**

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Observations:

- *MTTF (all PEP-II) almost 2 times SLC.*
- *MTTF (injection systems only) 3 times SLC.*

  During PEP-II operation, some problems can be fixed between fills; then no loss to program.

- *MTTR hasn't changed much!*

Ranking of Most Troublesome Subsystems

- **Most irritating (shortest MTTF)**

  1. Power supplies
  2. Controls
  3. RF
  4. Utilities
  5. Vacuum
  6. Magnets

- **Most difficult to repair (longest MTTR)**

  1. Magnets
  2. Vacuum
  3. Utilities
  4. RF
  5. Power Supplies
  6. Controls

The rankings above were true for both 2000-2001 PEP-II data and for 1997-1998 SLC data!

The second list is approximately reverse order of the first!

Magnet and vacuum problems usually require tunnel entries.

Power supplies and controls can usually be fixed "upstairs".

- **Most painful (most lost beam time)**

SLC	PEP-II
1. Power Supplies	Power Supplies
2. Vacuum	Controls
3. Controls	Utilities
4. Magnets	RF
5. RF	Vacuum
6. Utilities	Magnets

Power supplies top both lists.

Comments on safety systems and cryogenic systems

- These systems have been extremely reliable (very high MTTF) compared to other subsystems, and are not included in the lists above.

- The high reliability comes at substantial cost. Testing of safety systems requires about three months/year, and is incompatible with beam operations.

Good (longer) MTTF requires:

- Conservative designs.
- Robust hardware.
- Redundancy.
- Preventive maintenance.

Good (shorter) MTTR requires:

- Skilled personnel – up to date call-in lists.
- Availability of experts – "escalation" plans.
- Spare parts – compatible, ready to use.
- Documentation – accurate and accessible.
- Easy access to equipment – segregate areas with special hazard controls.
- Keep other systems powered on.

Managing the other 82% of the problems

- Some labs schedule maintenance interruptions at regular intervals:
  Cornell/CESR every week.
  KEK and SSRL/Spear: one day every third week.

- Others practice "Run 'til it blows": FNAL

Scheduled maintenance requires entries to accelerator housings.
The problem: end effects.

1. Ramp down power supplies and RF.
2. Rad cool-down time: typically 1 hour.
3. Health physics radiation surveys.
4. Safety procedures (lock&tag, work permits)
5. Carry out maintenance tasks.
6. Search housing if necessary.
7. Safety inspections and/or interlock tests.
8. Restore power.
9. Wait for thermal equilibrium if necessary.
10. Standardize magnets.
11. Re-tune beams.

Malfunctions can still stop the program at unscheduled times, despite a conscientious maintenance program.

The alternative? Opportunistic maintenance

Opportunistic maintenance
a.k.a. "event-driven" maintenance.

- Daily meetings with representatives of all maintenance shops and Operations staff to review and classify:
  - CATERs.
  - Deferred repairs.
  - Preventive maintenance requirements.
  - Upgrade projects.

- Standby Maintenance List ("SML") of job requests (with est. time and special requirements) is updated daily.

- SML list used by Ops staff to initiate maintenance jobs whenever opportunities arise; i.e. when a malfunction interrupts the program.

- Repair Opportunity Days (RODs) are scheduled when pending problems (or new installations) justify a planned interruption.

  Typical driving events for RODs:
  - Certification tests of safety systems.
  - Experimenter-requested access to detector.
  - New hardware installation.
  - Deferred repair of imminent show-stopper.

  Three RODs and one ROW so far in 2001.

24 Hour Report for Operations
October 8, 2001
Program: BaBar

DAY

1 PEP: 1550x925mA, peak lum=$4.15x10^{33}cm^{-2}s^{-1}$.
2 Aborts: (2) SVT fast sig 12, (1) HER/LER dI/dt.

	Delivered	MD	Tuning	Down	Off	pb^{-1}
BaBar	6.5		1.5			84.8

SWING

1 Collisions to BaBar. 1550mAx920mA, peak L=$4.09x10^{33}cm^{-2}s^{-1}$.
2 Aborts: (2) LER RF 4-4 KlysArc/Transformer Arc/Crowbar, (2) SVT radiation when beams went out of collision, (1) Fast BW Sig 12 abort, (1) LER RF 4-3 Vacuum fault.

	Delivered	MD	Tuning	Down	Off	pb^{-1}
BaBar	6.4		1.6			81.1

OWL

1 Delivered to BaBar: 1615x925 L=$4.16x10^{33}cm^{-2}s^{-1}$.
2 Aborts: (1) dI/dt abort.
3 Ongoing LI15 crate 1 trouble. LGPS goes to zero occasionally, SAMs stop reading occasionally.

	Delivered	MD	Tuning	Down	Off	pb^{-1}
BaBar	7		1			92

TOTAL DELIVERED LAST 24 HOURS

	Delivered	MD	Tuning	Down	Off	pb^{-1}
BaBar	19.9	0	4.1	0	0	257.9
	0	0	0	0	0	

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Monday, October 8, 2001 CATER list (Sorted by Area)

http://ad-maint.slac.stanford.edu:8080/

1) 65234 LINAC C	AMW LI27	KLYSTR SBST 1	Hard Imm *	Subbooster 27 died at about 7 pm 6-Oct.	CLOSED
2) 65229 LINAC C	HDWR LI27	CAMAC CRAT 3	Hard Schd	LI27 crate 3 is failed on temperature. Temperature goes 0ct 4 on swing shi ft.	CLOSED
3) 65238 LINAC S	HDWR LI15	CAMAC	Hard Imm *	All magnets in LI15 occasionally reading ADC error. SAM reset fixes probl em temporarily.	SOLVED
4) 65230 LINAC U	AMW LI11	KLYSTR KLYS 71	Hard Late	Couldn't get PFN signal.	
5) 65237 LINAC U	AMW LI12	KLYSTR KLYS 61	Hard Late	K-13 loose and wiggly.	
6) 65239 LINAC U	AMW LI09	DC MAG QUAD 201	Hard Schd	LI09 Quad Bypass chassis has water leaking from a heat sink. The water is not getting onto any	
7) 65240 LINAC U	AMW LI17	DC MAG YCOR 303	Hard Schd	LI03 YCOR 303 is drifting out of tolerance.	
8) 65231 POSIT S	AMW EP02	DC MAG QUAD 521	Hard Schd	See cater 65013. Problem happened once today. Quads 521-528 and 604-629 went out of tol. After a short period (less than 2 minutes) they returned to their BDES values on their own.	SOLVED
9) 65235 POSIT U	AMW EP02	DC MAG QUAD 521	Hard Schd	EP02 QUADs 521-528 and 604-629 intermittant BACT drops. Affects beam while out of tol but recovers by itself after a few minutes.	
10) 65233 BSY C	FAC	FIRE A	Hard Late	Bookkeeping CATER, see the EOIC log dated 10/06/01 page 50. BSY fire alarm , ANALASER system will not reset, accessed BSY to investigate.	CLOSED
11) 65228 PEPII-I U	AME PI11	DC MAG YCOR 6418	Hard Schd	Unit will not trim. Reposts errors with trimming or not change des.	
12) 65236 HER U	CTL PR04	OTHER	Hard Schd	Thermocouple PR04 T9142QUA caused a HER abort when it jumped from its normal value to 18 degrees. It has aborted the beam several times in the past months. Each time it caused an abort the history buffer failed to catch any change in the temperature. It would be easy to lower the low trip	
13) 65232 OTHER C	SEMK	ELECTR	Hard Late	Bookkeeping CATER, see the EOIC log dated 10/04/01 page 44. PG&E power dip most NDR magnet power supplies and a significant fractionof HER intermediate power supplies...	CLOSED

Shops should follow up on active CATERs. If corrective action is required determine all necessary saftey requirements, shop priority, potential program impact, personnel requirements, and parts and materials needed. Contact the appropriate Area manager and arrange for the job to be added to the ROD, SML or Downtime maintenance list.

Area Manager(s)	Area / systems	Area Manager(s)	Area / system
J. Sodja / T. Galetto	CID Sec 0 & 1 WTA GTL	A. Baker	BSY FFTB ARCS
K. Burrows	NDR SDR DRIP	R. Gray	HER LER
P. Smith	Positron PEPII Injection	B. Allen / M. Stanek	MCC
T. Graul	LINAC	?????	NLCTA

The Operations Section Maintanance Office will be generating an E-mail distribution list. This list will be used to distribute routine and priority information. Attachments will be Adobe Acrobat PDF documents. If you would like your name added to the list, please send your E-mail request to ballen@slac.stanford.edu. If you have any questions, please stop by my office (Trailer 006A room A107).

Remember! Do it Safe, Do it Right, and, only then Do it Fast

Standby Maintenance List

Your Standby Maintenance List search has found 42 jobs.

Today is 10/08/2001 at 12:16:19

The list has been sorted by job number.

"*" Ongoing.

#	* Area	Shop	Work Title	Per. Resp.	Access	Time	CATER#	Safety	O
B4783	CID	CTL	Set up traps for Pol Gun HV trip when SDR/DRIP set to REST/CONT	P. Bong	Controlled	1.0	64203	No	1
B5153	CID	MFD	Replace VACP485 Pow Sup to correct Digital Status	Bostic	Any	0.5		No	1
B5311	CID	MFD	Investigate VP408 SCP history readback changes	D. Bostic, T.G. Porter	Any	1.0	65153	No	1
B5340	CID	FAC	Adjust CID HVAC parameters to better regulate Humidity in CID Laser Rm.	M. Jones	Any	4	65209	No	1
B5316	Sect. 0/1	CTL	Replace BPM501 Module in LI01/Cr3-S17	V.Brechin	Any	0.5	65173	No	2
B5364	Sect. 0/1	CTL	Replace BPM 842 module in LI01/CR06-S19	V. Brechin	Any	0.5	65217	No	2
B5283	WTA	CTL	Replace BPM Processor LI01 Crate 4 Slot 15	Bob Traller	Any		65107	No	2.
B5286	NDR	AMW	Replace meter for NLTRB regulator/controller.	Hilliard, C.	Any	.5	65105	No	3
B5267	DRIP	MEA	Realign wakefield collimator box, 1.4 mm too low.	King, T.	Controlled	4		Yes	5
			Replace TCM						

B5324	DRIP	OPS	module in DR01, Cr.2, M=12 for DR01 TORO 241 not reading.	Thompson, D.	Any	.5	65176	No	5
B5330	DRIP	AMW	Hi-pot SLTR QF string tripping on ground current.	Hilliard, C.	NO	1.0	65216	No	5
B4885	LINAC	AMW	TS/R Quads Fail To Calibrate (LI10, QUAD 301)	Hilliard, W.	Any	0.5	63051	No	6
B5251	LINAC	CTL	Replace Main Manifold Gauge Controller (LI09, MMGC)	Porter, T. G.	Any	4.0	64186	No	6
B5303	LINAC	AMW	Replace pwr-ten (35-20) For Dead Fan (LI18, QUAD 501)	Hilliard, W.	Any	1.0	65145	No	6
B5304	LINAC	AMW	TS/R Bad Meter in emhp Controller Chassis (LI11, LGPS 1)	Hilliard, W.	Any	1.0	65132	No	6
B5308	LINAC	CTL	Investigate Reference Voltage Remote Control to VVS 1B (LI02, VVS 1B)	Tilghman, A.	Any	1.0	65130	No	6
B5166	POSITRON	AMW	Check PS-20 FS Interlock	Crash Hilliard	NO			No	7
B5185	POSITRON	CTL	Inspect Connections BPMS 1140 on Positron Return Line LI19	V. Brechin	Permitted			Yes	7
B5197	POSITRON	CTL	Investigate valve controller 2663, LI04.	Tom Porter	Any		64900	No	7
B5223	POSITRON	OPS	Run extraction line magnets at 30GEV for thermal test		NO	4		No	7
B5180	PEPII	CTL	Reduce Operating Voltage for PEP Injection Vacuum Pumps	Dorel Bernstein	Any			No	8
B5182	PEPII	CTL	TS&R VACV PPS Permissive LI08, Remove Bugger.	E. Hamner, P. Bong	NO		64862	No	8

B5203	PEPII	CTL	TS&R Pump/Cable VACP 6205 PI00-NIT CTL/MFD	D. Bernstein, D. Bostic	Controlled		64928	Yes	8
B5282	PEPII	CTL	Replace ADC Module LI19 Crate 3 S-17 for BPMS 4931	V. Brechin	Any		65108	No	8
B5350	PEPII	AME	Inspect BLP- and BR10, Bends 6316 and 6355 in PI11	Serge Ratkovsky	Controlled			Yes	8
B4679 *	HER	AMG	Tinker with SLM in region 7 (access Z8)	A. Fisher	Controlled	.5		Yes	1(
B4912	HER	MFD	Install cooling on feedthroughs for kickers in region 4 (access Z4)	Giannini	Controlled	3		Yes	1(
B5257	HER	AME	Reposition termination resister in HVPS at RF station 8-3 (day shift)	Ratkovsky	Any	4		No	1(
B5258	HER	AME	Reposition termination resister in HVPS at RF station 12-1 (day shift)	Ratkovsky	Any	4		No	1(
B5259	HER	AME	Reposition termination resister in HVPS at RF station 12-3 (day shift)	Ratkovsky	Any	4		No	1(
B5273	HER	AME	Replace voltage divider on RF HVPS 8-1 (day shift)	Ratkovsky	Any	8	65080	No	1(
B5281	HER	KLY	Install active limiters to all RF stations (beam off)	Hill / Browne	Any	.5		No	1(
B5287	HER	CTL	Remove attenuator from fan-in distribution box on mezzanine in region 2 (no beam)	D. Thompson	Any	0.25		No	1(

B5315	HER	CTL	Replace PR04 TPLD SAM (requires beam off)	Duane Thompson	Any	0.5		No	1(
B5325	HER	CTL	Replace RInQ module at PR12/CR08-S15 BPMS 9122 (Zone 12 access)	V. Brechin	Controlled	0.5	65203	No	1(
B5331	HER	AME	Replace rectifier filter caps in RF station 12-1	Ratkovsky	Any	8		Yes	1(
B5332	HER	AME	Replace rectifier filter caps in RF station 12-3	Ratkovsky	Any	8		Yes	1(
B5333	HER	AME	TS&R PR06 XCOR 9022 (zone 4 access)	Ratkovsky	Controlled	2	65205	Yes	1(
B5162	LER	AME	Check cable plant associated with open load on corrector XCOR PR02-3011 (access Z2)	S.Ratkovsky, D.Macnair	Controlled	1.0	64821	No	1:
B5261	LER	AME	Reposition termination resister in HVPS at RF station 4-4 (day shift)	Ratkovsky	Any	4		No	1:
B5262	LER	AME	Reposition termination resister in HVPS at RF station 4-5 (day shift)	Ratkovsky	Any	4		No	1:
B5349	LER	AME	Replace MCOR module for PR12 SOLN 3052	Ratkovsky	Any	.3	65218	No	1:

Owners : Bill Allen and Wayne Lineberger

Maintenace Home Page

SLAC ***Last modified:Sept. 21, 1998 by Wayne Lineberger***

OAD ANALYSIS FOR POSSIBLE
OF 10/12/01 2:28:56 PM

NUMBER OF JOBS	TOTAL hrs.
7	26.30
12	34.25
1	2.00
23	17.50
5	30.00
23	19.25
1	0.50
2	6.00
3	7.00
13	45.50
1	0.50
9	24.00
2	3.00
21	71.00
2	8.30
125	295.10

Updated 10/8/01 4:09 PM

Do it Safe, Do it Right, and only then Do it Fast.

BarBar Detector work, PEP Solenoid winding, and NDR magnet replacement.

Beam Off 05:00

Remember to plan safety into the job!

October 10, 2001 ROD

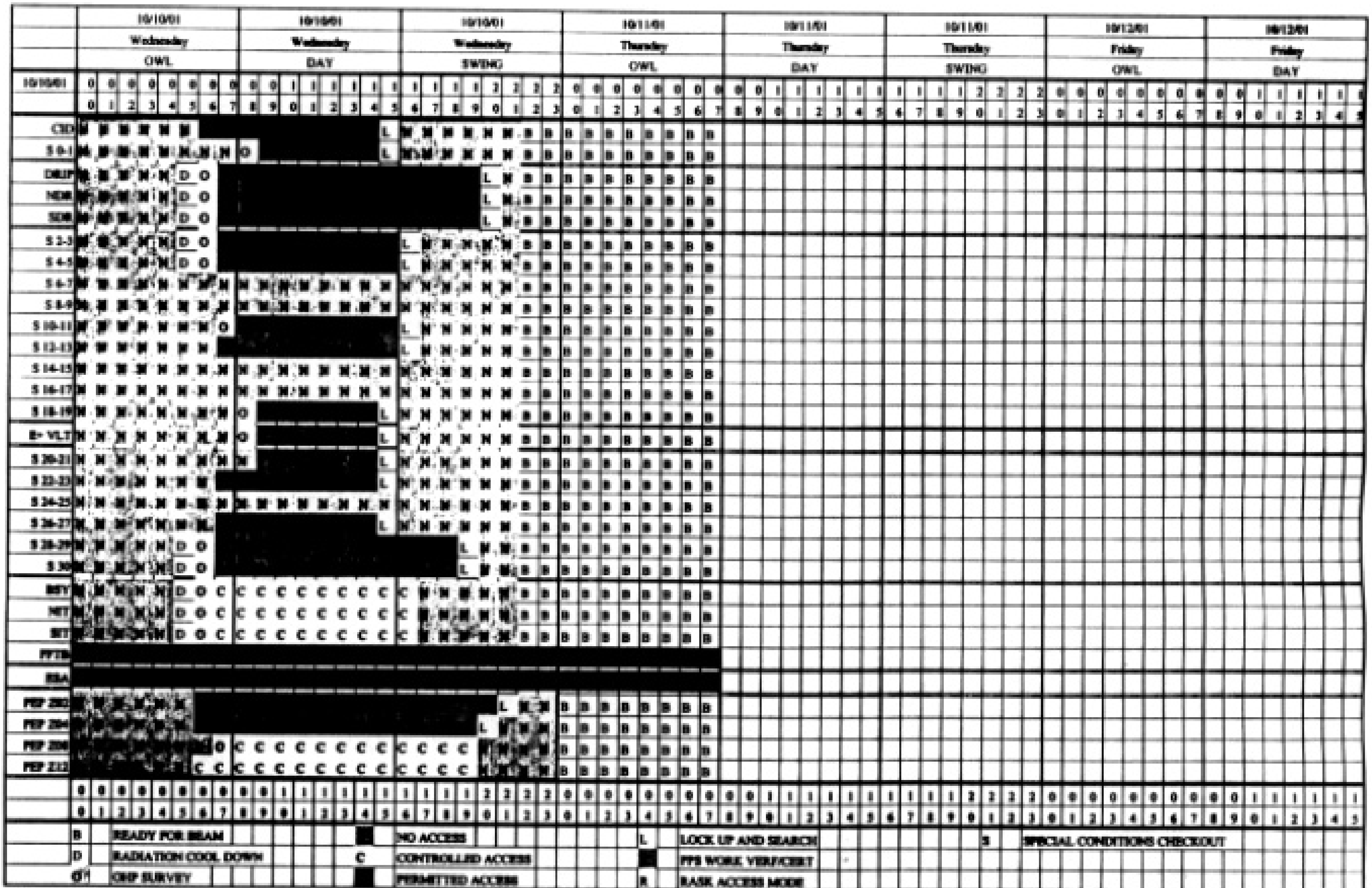
Key Activities

1) : BaBar detector work.
2) : PEP Solenoid winding.
3) : Vent NLTR and replace NDR magnet coils.
4) : Selected maintenance work.
5) :

Important Notes

1) : 05:00 Ramp down Solenoid for 06:00 Access.
2) : 05:00 DAC zero T & P Gun HV Close valves 406, 409, & 465.
3) : After 05:00, Hi-pot SLTR QF string that is tripping on ground current before OHP survey. (Job B5330)
4) : OPS guard BSY big door for access and door maintenance. @ 07:00
5) :
6) :
7) :
8) :
9) : For information onthe Classification of Radiological Areas ((coming to a web site soon)).
10) : Please let MCC and the Area Manager know the status of each job (Done, Roll, Drop).

Machine access states for the October 10, 2001 ROD



Conclusions

- Accelerator reliability is a messy topic, with many variables and hidden correlations.
- When resources are limited (as they always are), reliability must be compromised to achieve peak technical performance.
- An aggressive, well-controlled maintenance program can be effective in optimizing overall facility productivity.