

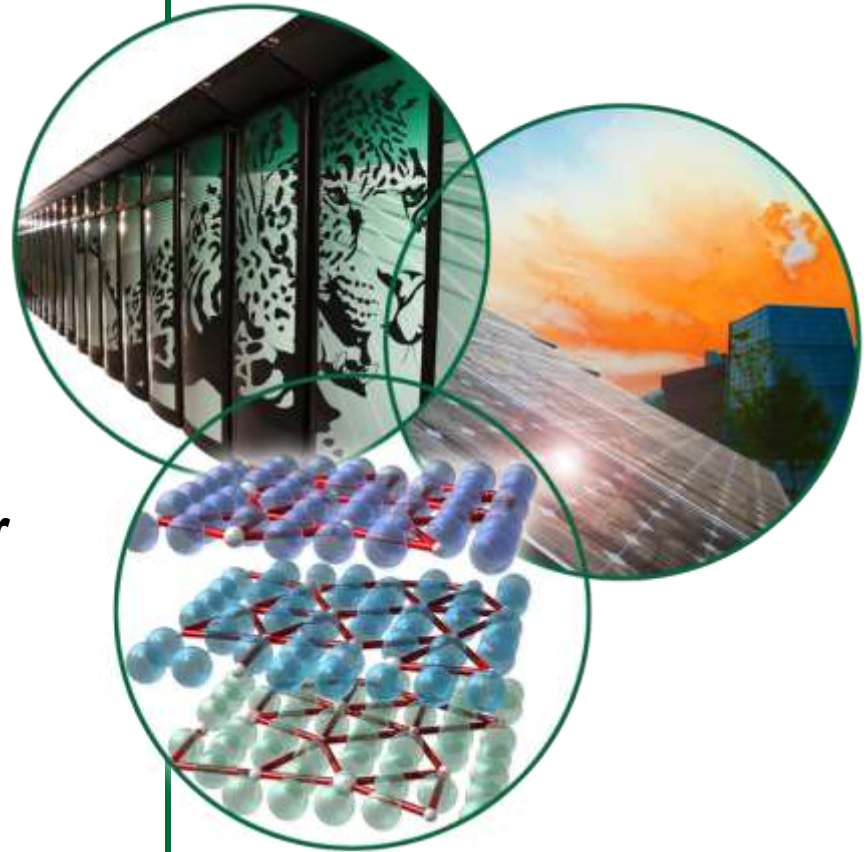
# Maintenance Planning and Execution

**Mario Giannella**

**RAD Maintenance Integration Manager**

**Accelerator Advisory Committee**

**January 2012**



# Yearly Schedule

## Run Schedule for FY 2012

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
1		1	1	1	1	1	1	1	1	1	1	1
2		2	2	2	2	2	2	2	2	2	2	2
3		3	3	3	3	3	3	3	3	3	3	3
4		4	4	4	4	4	4	4	4	4	4	4
5		5	5	5	5	5	5	5	5	5	5	5
6		6	6	6	6	6	6	6	6	6	6	6
7		7	7	7	7	7	7	7	7	7	7	7
8		8	8	8	8	8	8	8	8	8	8	8
9		9	9	9	9	9	9	9	9	9	9	9
10		10	10	10	10	10	10	10	10	10	10	10
11		11	11	11	11	11	11	11	11	11	11	11
12		12	12	12	12	12	12	12	12	12	12	12
13		13	13	13	13	13	13	13	13	13	13	13
14		14	14	14	14	14	14	14	14	14	14	14
15		15	15	15	15	15	15	15	15	15	15	15
16		16	16	16	16	16	16	16	16	16	16	16
17		17	17	17	17	17	17	17	17	17	17	17
18		18	18	18	18	18	18	18	18	18	18	18
19		19	19	19	19	19	19	19	19	19	19	19
20		20	20	20	20	20	20	20	20	20	20	20
21		21	21	21	21	21	21	21	21	21	21	21
22		22	22	22	22	22	22	22	22	22	22	22
23		23	23	23	23	23	23	23	23	23	23	23
24		24	24	24	24	24	24	24	24	24	24	24
25		25	25	25	25	25	25	25	25	25	25	25
26		26	26	26	26	26	26	26	26	26	26	26
27		27	27	27	27	27	27	27	27	27	27	27
28		28	28	28	28	28	28	28	28	28	28	28
29		29	29	29	29	29	29	29	29	29	29	29
30		30	30	30	30	30	30	30	30	30	30	30
31		31	31	31	31	31	31	31	31	31	31	31

	Accelerator Physics		Optional Maintenance Periods		Machine Downtime Major Periods(Maintenance/Upgrades)
	Accelerator Startup/Restore		Neutron Production		Scheduled Maintenance
					Holiday



# Weekly Maintenance (Tuesdays) During Run Period (Three Flavors)

- 1. Optional Limited Maintenance Shift – 2 per month:
  - Maintenance Shift 8 am – 4pm, immediately after Neutron Production
  - 1 recovery 8 hr. shift allocated
  - Avoid entry into Radiation Areas if possible
    - Time limited for necessary Radiological Cool-down & Surveys, Magnet LOTO
  - If little or No pressing Maintenance needs:
    - Partial Day Maintenance
    - Accelerator Physics Studies
    - Neutron Production

Run Schedule	
	Oct
1	Green
2	Green
3	Green
4	Blue, Orange
5	Green
6	Green
7	Green

# Weekly Maintenance (Tuesdays) During Run Period (Three Flavors)

- 2. Full Maintenance Shift

- (8am-4pm) Preceded by Neutron Production – 1 per month
- 2 “Recovery Shifts” allocated
- Same start-up schedule constraints as a used “Optional Day”, more recovery time allowed for “Deeper” maintenance

20			
21			
22			
23			
24		Blue	Orange
25	Orange		
26			
27			
28			
29			

- 3. Full Maintenance Shift

- (7am-3pm) Preceded by Accelerator Physics – 1 per month (Possible early start for Target / Instrument Maintenance or on Backup Systems)
- Much lower average beam currents during AP allow for some Radiological Cool-down time
- 6am Early Start for Radiological Surveys and Magnet LOTO
- Typically used for Ion Source Replacement and Startup, Preventative and Corrective Maintenance
- 2 “Recovery Shifts” allocated

	June		
1			
2			
3		Yellow	Yellow
4	Yellow	Yellow	Yellow
5	Yellow	Blue	Orange
6	Orange		
7			
8			

# Recovery Time from Maintenance Shift

Full Maintenance Days	Maintenance time	Recovery Time	AP Time	Unscheduled Down Time	total hours	notes
Schedule (hours) FY 10 and FY 11	8.0	8.0	8.0	0	24.0	Looking at 24 hour transition period
Average wrt scheduled time	7.0	5.1	11.1	0.9	24.0	
FY 10 and FY 11 Median	8.0	5.7	10.9	0.4		

- **5.1 / 5.7 hrs Average / Median recovery time from FULL Maintenance Shift**
- **Even Less for Limited Maintenance Shifts**
- **16 hours are scheduled – difference is given to Accelerator Physics or Neutron Production (“Easier to Give Back than to take away”)**

# Semi-Annual Maintenance Periods

- 2 Extended Maintenance Periods per year
- Typical Pattern:
  - ~ 3 days Accelerator Physics after Neutron Production Ends
  - ~ 6 weeks down (not counting holidays)
  - ~ 1 week Startup / Accelerator Physics before Neutron Production Begins
- Target Changes (currently 2 per year)
- Upgrades e.g. Larger Ring Injection Dump Beamline Aperture (prior), New Stripper Foil Changer Mechanism (future)
- Extended Repairs and Preventive Maintenance

**FY 2012**

	Dec		Jan		Feb
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	
10		10		10	
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23		23		23	
24		24		24	
25		25		25	
26		26		26	
27		27		27	
28		28		28	
29		29		29	
30		30			
31		31			

# Yearly Schedule


- Reasons for possible future changes
  - Target changes needed > 2 per year
  - Long (~4 ½ month) run period too long for instrument personnel (constant Experiment preparation and turnaround)
  - Consolidate Weekly maintenance shifts into less-often, longer 2-day shutdown (less shutdown / startup overhead, more total useful maintenance hours per month)
  - Aging equipment may need more Preventive Maintenance to maintain Reliability >90%
  - Longer Summer shutdown (2-3 months) to save money in the peak power charge months

# Long Semi-Annual Maintenance Periods: Planning Resources

- “DataStream” Maintenance Management System
  - Interactive Reports by Resource (e.g. Research Mechanics, Welders, Riggers, etc.), Group (e.g. Electrical), Team (e.g. HVCM, Power Supplies, Power Distribution, etc.), Task Leader, Area, etc.
  - Typically focus on tight resources:
    - Electrical Research Mechanics (~15)
    - Mechanical Research Mechanics (~15)
    - Vacuum Technicians (~5)
    - Riggers/Operator (3, shared with HFIR and ORNL)
  - Tight Budget: Overtime Limited to critical needs



# Report: Requested RM Man-Hours

Date Created	Work Order 	Description	Activity_Comments	Status	Tot Man Hours	Act Hrs Remaining	Scheduled Start Date	Scheduled End Date	Type	Priority	Mi I
04-JAN-12	1306425	Beamline 11 hydraulic manifold in the Shutter Drive Equipment Room.	Comment 1 Replace manifold on beam line 11 shutter drive hydraulic system. Adjust shutter stroke times to acceptable times. Operate shutter and inspect for any other problems.	Approved For Planning	12	<u>12</u>	03-FEB-12	31-MAR-12	Routine	High	-
30-DEC-11	1306403	Beamline 11A POWGEN Bush Pump Repair	-	Released	8	<u>8</u>	30-DEC-11	30-JAN-12	Breakdown	High	-
29-DEC-11	1306392	Walk Through/Sample of HEBT SB, RTBT SB, Ring SB , RID SB and Target DI Room	Comment 1 Perform routine daily walk through. Verify resistivity is being maintained within designated parameters. Verify pump skid is operating normal with proper suction & discharge pressure. Verify pump oil level is correct. Perform "Daily Log" on filter skid. Take time to observe the overall condition of the pump room area and for any signs of other equipment problems such as poor lighting or lights not operating, ground water, controls not working properly, etc. Note any unusual odors, sound or noise coming from other equipment in the pump room.	Released	100	<u>100</u>	29-DEC-11	05-FEB-12	Routine	High	-
<p>&lt; Order Activity Report</p>											
20-JUN-08	1115924	ASE_Target Moderators Hydrogen Rupture Disks Five Year Replacement	filings' from entering the system. A saw maybe used on the Outlet side of the rupture disk. Protect System Openings from the introduction of foreign material. Remove the existing rupture disk RD_6105 (RD00031) from the system.	Released	4	<u>4</u>	22-DEC-11	29-FEB-12	Preventative Maintenance	High	-
					<b>Sum: 3620</b>	<b>Sum: 3407</b>					

# Long Semi-Annual Maintenance Periods

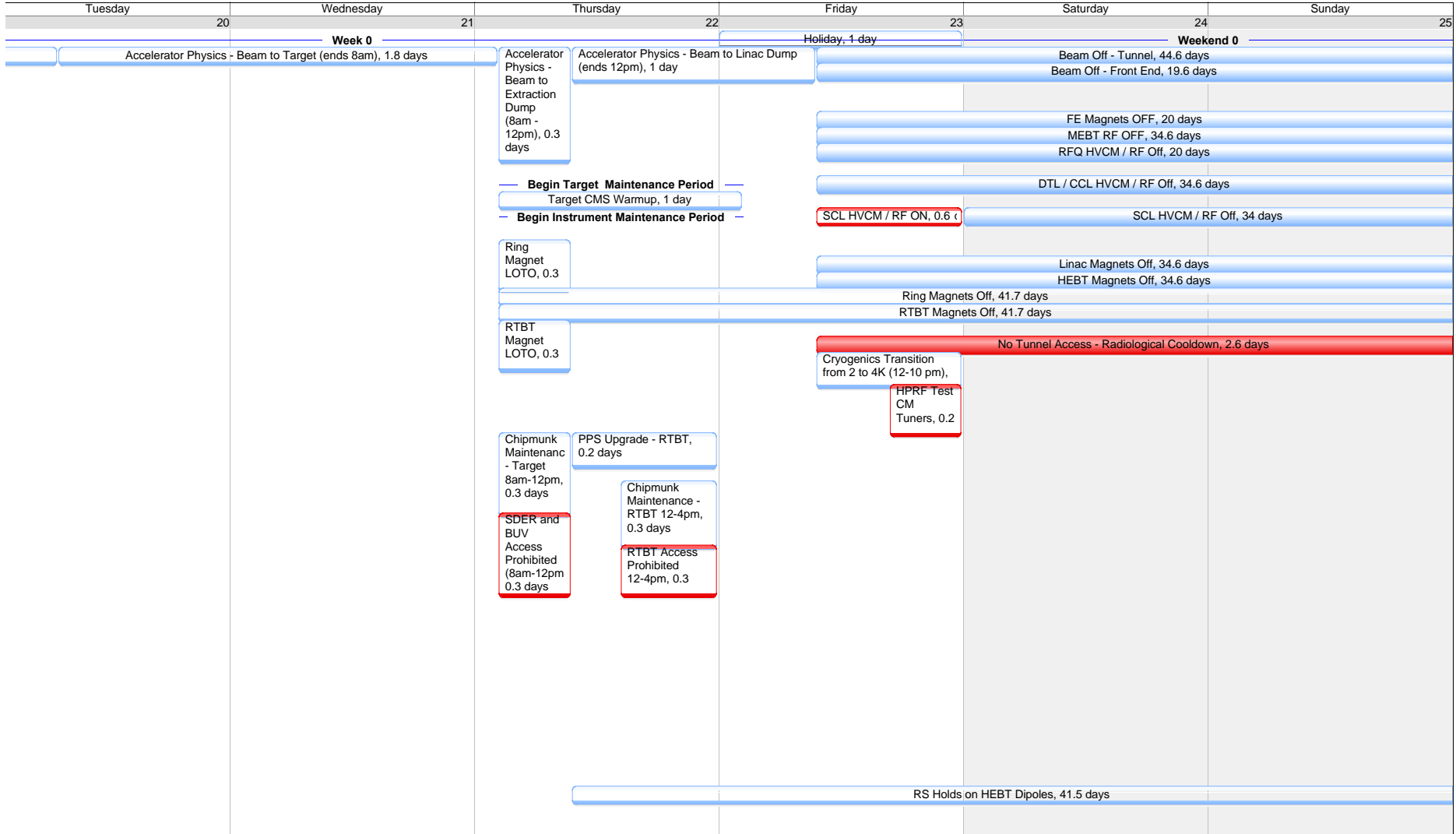
- Growing Maintenance needs for Growing Number of Operational Neutron Instrument Beamlines
- Expanding Preventative Maintenance needs for aging equipment
- Equipment Upgrades for enhanced Operation have decreased, but still need upgrades to replace obsolete / less-reliable equipment
- Tasks are Deferred according to Priority and man-hours available for tight Resources
- Any previously Deferred Maintenance has increased Priority
- Review during weekly Planning and Maintenance meeting

# Planning Overview Schedule Developed

- Transitions from/to:
  - Neutron Production
  - Accelerator Physics
  - Maintenance times for Front End, Instruments, Target, Accelerator
  - Equipment on/off/testing (HVCM/RF, MPS, Magnets, Cryogenics Transitions, etc.)
  - Front End Running Beam to MEBT BS
- LOTO
- Personnel Protection System Certifications
  - Access restrictions
  - Equipment to be controlled off (with Radiation Safety Hold lock and tag)
  - Equipment to be turned on/off (PPS enable/disable testing)
- Outages:
  - Electrical
  - Water Cooling
  - HVAC, Air Handlers
  - Global Controls (Timing, Network, Servers, etc.)

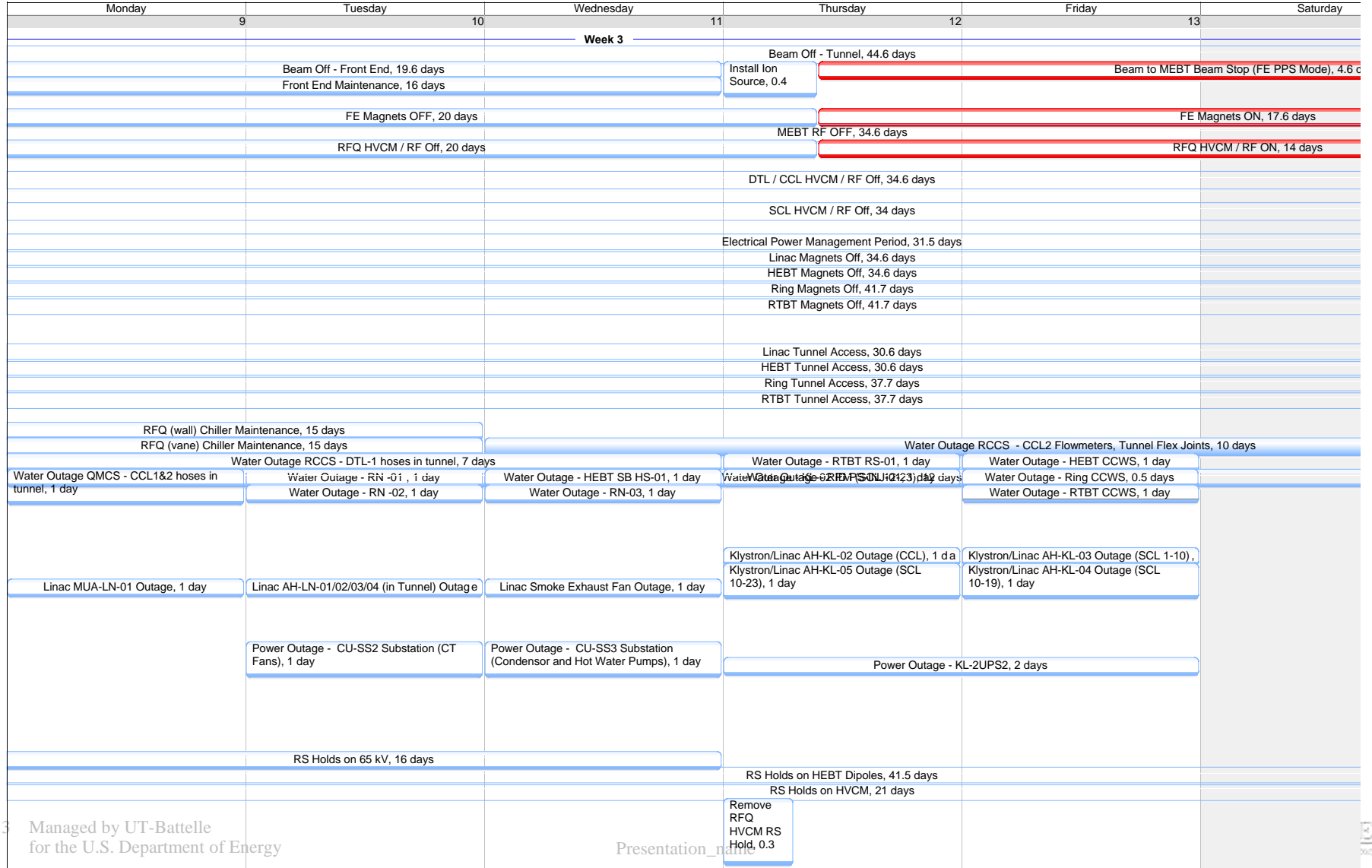
# Overview e.g. Week 0: Transition from Operations to Maintenance

Dec 19, '11 - Dec 25, '11



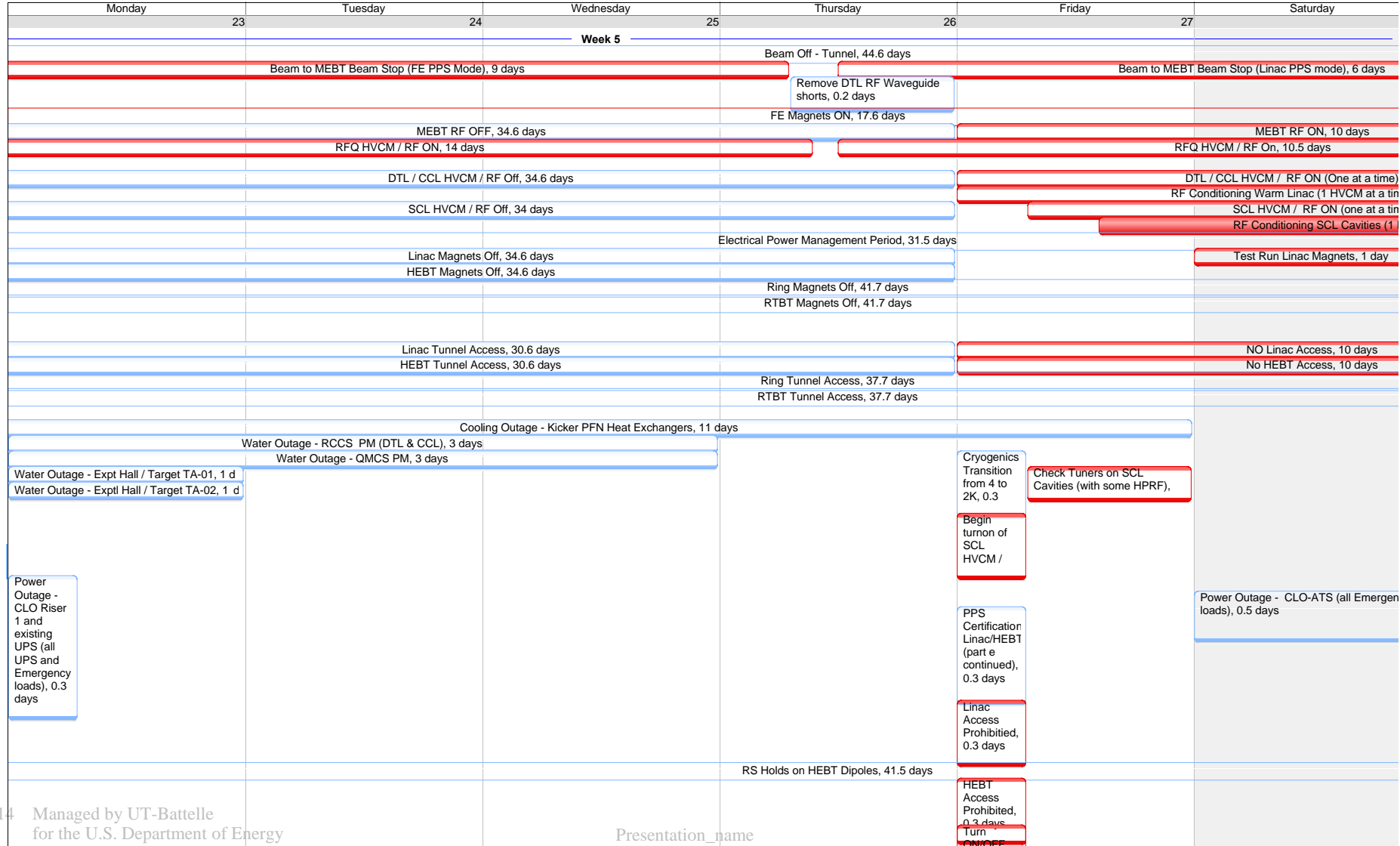
# Overview e.g. Week 3: Transition to Beam to MEBT Beam Stop Running

Jan 9, '12 - Jan 15, '12



# Overview e.g. Week 6: End of Maintenance, Start Equipment Turn-on

Jan 23, '12 - Jan 29, '12



# Meetings for Updates, Adjustments

- Daily (during the extended Maintenance Periods):
  - Plan of the Day (with 2-day look-ahead)
    - Safety
    - Operations Overnight / Weekend report
    - Coordination overview slide
    - Area Coordinators' slides: summarize / coordinate work in each area
    - Technical Group reports
  - Plan of the Eve
    - What went differently than POD, adjustments for next day
    - Systems / Equipment to be monitored overnight
  - Resource Allocation Meeting
- Weekly (before and during Maintenance Period):
  - Planning and Maintenance
  - Area Coordination

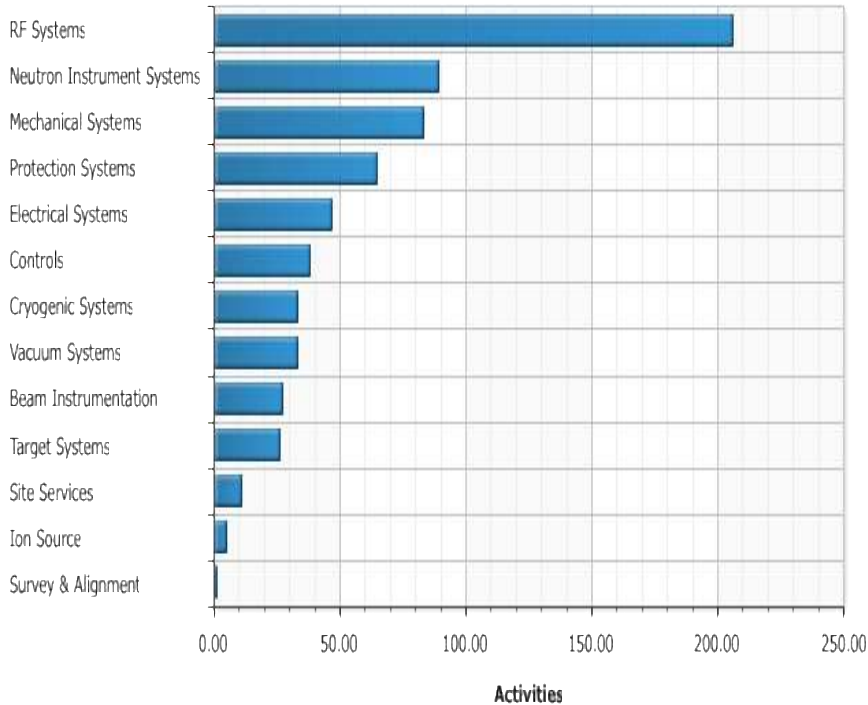
# For the Current Maintenance Period: Total Number of “Activities” (Note: not all activities equal)

- Perf\_When = 'Planned Outage'
- Status != 'Closed'
- Status != 'Completed'
- Status != 'On Hold'
- Status = 'Released'
- Wo\_Type = 'Preventative Maintenance'
- Group\_Nm
- Area1

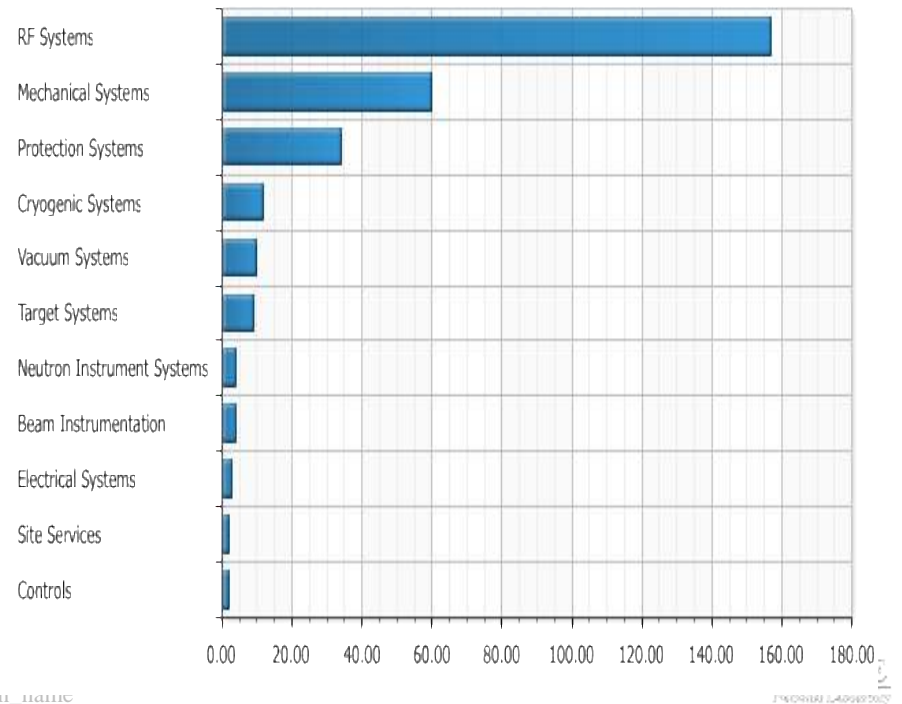
[Edit Chart](#) [View Report](#)

- Perf\_When = 'Maintenance Day'
- Perf\_When = 'Planned Outage'
- Status != 'Closed'
- Status != 'Completed'
- Status != 'On Hold'
- Status = 'Released'
- Wo\_Type = 'Preventative Maintenance'
- Group\_Nm
- Area1

[Edit Chart](#) [View Report](#)



## Preventative Maintenance ONLY



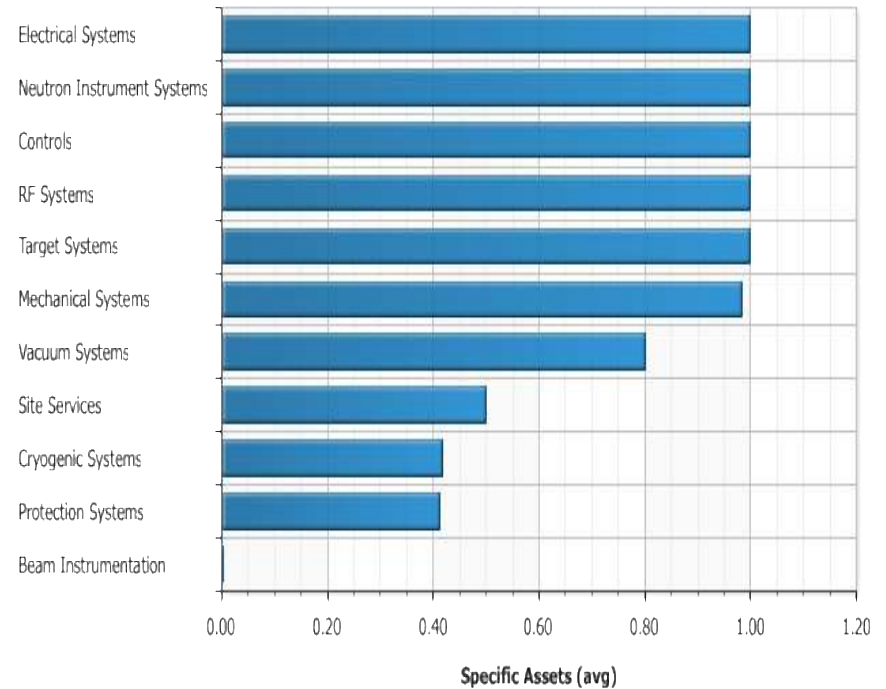
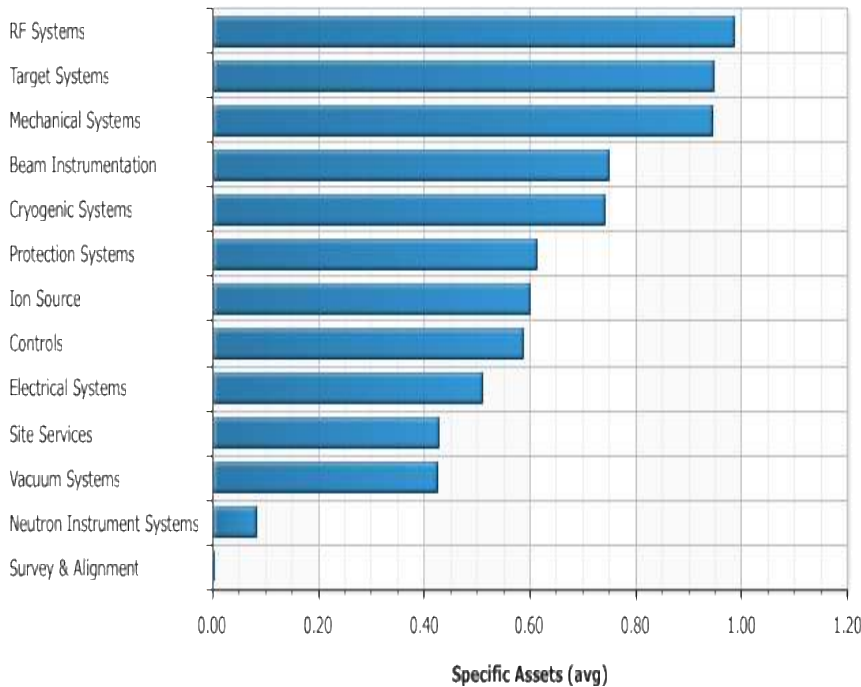


# Use of "Specific Assets" for Equipment Tracking

Saved Report = "Outage"  
 Perf\_When = 'Maintenance Day'  
 Perf\_When = 'Planned Outage'  
 Status != 'Closed'  
 Status != 'Completed'  
 Status != 'On Hold'  
 Status = 'Released'  
 Wo\_Type = 'Preventative Maintenance'  
 Group\_Nm  
 Area1  
[Edit Chart](#) [View Report](#)

Perf\_When = 'Maintenance Day'  
 Perf\_When = 'Planned Outage'  
 Status != 'Closed'  
 Status != 'Completed'  
 Status != 'On Hold'  
 Status = 'Released'  
 Wo\_Type = 'Preventative Maintenance'  
 Group\_Nm  
 Area1  
[Edit Chart](#) [View Report](#)

## Preventative Maintenance ONLY



# Opportunities for Improvement

- More Efficient/Better-matched Yearly Schedule for Maintenance Needs
- Deferred Maintenance / Tight Resources
- Configuration Control – Equipment Tracking / History (working on “Specific Assets”)
- Set-up More Regularly Scheduled Predictive/Preventive Maintenance
- We have ~ 120 Task Leaders in ~ 47 “Teams” that create Work Orders
  - Still too many for effective coordination
  - Too many Task Leaders independently asking for Shared Resources
  - Consistency of Work Package
- Identifying Resources needed and working with resource managers to identify “real” estimate hours and people
- Prioritization between Operations / Development / Construction