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SNS Ring Diagnostics Production Plan

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SNS RING DIAGNOSTICS PRODUCTION PLAN

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SNS RING DIAGNOSTICS PRODUCTION PLAN

EXECUTIVE SUMMARY

The SNS accumulator ring has a circumference of 248 meters and is filled sixty times per second with 1 msec long proton pulses injected from the linac. The ring is designed to support above 1 MW beam power operation at the design energy of 1.0 GeV and should be able to support much higher beam power at 1.3 GeV. Most components in the ring are presently designed, constructed and procured to support 1.3 GeV operations. The ability to push the beam power as high as possible in the ring does require a very sophisticated set of beam diagnostics instruments in order to diagnose and eventually overcome all possible beam intensity and beam power limitations in the ring. This suite of instruments is under full development at Brookhaven National Laboratory (BNL) and will be deployed and largely installed before CD4. During a recent review (Diagnostics Advisory Committee, 02/05/04) at BNL it became clear though, that the ability to deploy all diagnostics equipment simultaneously strains the available resources to a point that successful on time completion of the basic systems required to support commissioning in July of '05 is endangered. At this point it becomes necessary to redirect resources to focus on the main system to guarantee on time completion and installation of these systems.

INTRODUCTION

The ring diagnostic systems span a wide field of applications, all of which are required to ultimately achieve the maximum beam power. Beam losses in the ring will most likely determine the maximum current that can be stored and therefore all possible tools to diagnose and minimize these losses are required. As the first two years of operation allow for a gradual ramp up of the beam power it will be necessary during this time to understand, integrate and optimize the available diagnostics tools. Tables 1 & 2 list all diagnostics tools that are under development for the linac and the ring with its 320-meter long transport lines (HEBT and RTBT).

Table 1 - Vacuum Hardware Deliverables

Detectors	Quantity	Comments	Description
BPM	96	Dual plane	Beam position monitors
BLM	-	Ion chamber	Beam loss monitor
FBLM	-	PMT Assembly	Fast beam loss monitor
BCM	11		Beam Current Monitor
Foil video	2		
WCM	1	RF system scope	Wall current monitor
E-detector	5	ANL style	Electron detector
BIG-CoherentTune	1	Kicker	Tune – Beam-in-gap monitor
Incoherent Tune	1	Kicker; added scope	Dipole
Incoherent Tune	1	Pick-up; added scope	Dipole

Incoherent Tune	1	Kicker; added scope	QMM
Incoherent Tune	1	Pick-up; added scope	QMM
Damper	2	Kickers; added scope	-
Wire scanner	21		(two provided by LANL)
IPM	2	One in each plane	Ionization profile monitor
Halo Scraper	2	Added scope	

Table 2 - Electronics Deliverables

Detectors	Quantity	Comments	Description
BPM	61	Dual plane	Beam position monitors
BLM	295	126FE+169 RingSys	Beam loss ion chamber
FBLM	18	PMT Assembly	Fast beam loss monitor
BCM	12	(plus 3 for diff curr)	Beam Current Monitor
Foil Video	2		
WCM	1	For RF	Wall current monitor
E-detector	5	Added scope	ANL style
Coherent Tune-Big	1	Kicker/Pickup	Tune – Beam-in-gap monitor
Incoherent Tune	0	Dipole/QMM	-
Damper	0		-
Wire scanner	0		-
IPM	2	One in each plane	Ionization profile monitor
Halo Scraper	0		

All diagnostic systems are advanced in their development and in various stages of completion. Most importantly, the ring beamline components (vacuum chambers in general) are most advanced and in many cases close to completion. In order to close the ring vacuum system, all beamline components will be required and the present delivery schedule is consistent with the installation schedule maintained at ORNL/ASD. Apart from the beamline components, each diagnostic system requires its own, typically custom developed, electronic interface, plus a software package that handles the readout as well as the preparation of the data.

In a series of meetings lead by the Accelerator Physics Group, all systems have been discussed in detail. Prioritization of the systems results in four systems that will be required to begin commissioning of the ring in July ’05, consistent with the present IPS (Integrated Project Schedule, vers.: IPS14R450). These items are listed (in bold) in tables 1&2 and have very near term deliverables that will be described in the schedule later on. The effort on all other systems has been deemphasized and those activities will restart as resources become available and go as far as the remaining resources allow.

A plan detailing the milestones that need to be achieved on the main systems before restarting the remaining systems is included.

STATUS AND PRODUCTION PLAN FOR VACUUM COMPONENTS OF ALL DIAGNOSTICS SYSTEMS

Priorities have been established to complete delivery of all major equipment in support of the SNS/OR installation plan. In a best effort agreement, every attempt will be made to support installation of the RF straight section first, followed by the Injection SS, Collimator SS and finally the Extraction SS + RTBT line (see Appendix 4). Thus, the diagnostic vacuum components (less internal IPM pick-ups which will be addressed separately with electronics) will be re-prioritized in our Shops to meet the September 30, 2004 milestone for RF Installation.

A) BPM: The design is complete. The majority of vacuum components (over 50) have been shipped to ORNL. Only four more units need to be assembled at BNL. Deliveries will be complete in December 2004.

B) BLM: No Vacuum Components

C) FBLM: No Vacuum Components

D) BCM: All eleven transformers are in house at BNL. Design of the shroud for the ring device is near completion. Design of all other shrouds is complete. All other hardware is at BNL. The HEBT and RTBT systems have been shipped to ORNL. The Ring BCM will ship in June 2004.

E) WCM: The design is complete and all parts are at BNL. It is presently being assembled and is expected to ship early in June, 2004.

F) E-detector: Mechanical design is complete and components are presently being fabricated. Deliveries will be complete in December 2004. (One for RF by September, 2004)

G) Coherent Tune: Drawings have been released for cost estimates. Deliveries are expected to be complete in December 2004.

H) Incoherent Tune: Drawings have been released for cost estimates. Deliveries are expected to be complete in December 2004. (RF by September, 2004)

I) Wire Scanner: Vacuum chamber design is complete. Deliveries are expected to be complete in September 2004.

J) BIG: Design is near completion. Final revisions are in process. Deliveries are expected in December 2004.

K) IPM: Design of the production unit is underway. Deliveries are expected to be complete in September, 2004.

L) Halo Scraper: Incorporated into IPM, design of the device is underway. Deliveries are expected in September, 2004.

M) Foil video: Incorporated into the injection foil assembly, design of the device is underway. Deliveries are expected in August 2004.

STATUS AND PRODUCTION PLAN FOR ELECTRONICS AND SOFTWARE OF THE BLM, BPM, BCM, AND FBLM SYSTEMS

N) BPM: The electronics consist of three boards housed in a host PC. These are the PCI / Base Band board, Power Supply board and RF board. A modified version of the existing RHIC timing card will be used. Presently the PCI / Base Band board and the first RF board are complete and have been tested individually. They are now being tested together. It is expected that testing will take several weeks. The low level drivers are now being written. Work will begin shortly on the required LabView software. One system is expected to be ready for testing during the April '04 commissioning run of DTL3. Fifty PC's have been ordered for this (and the BCM) system and ten will arrive shortly for evaluation before production of the final units is authorized. An additional fifty PC's will be ordered shortly if delivery of the final systems is to be in 2004. Verification of the design during initial beam testing in the spring is necessary before an order is placed for the remaining units. In addition, a test stand is planned to be built at BNL to further validate the design and test production units.

O) BLM / FBLM: A pre-production AFE chassis has been tested. The remaining fifteen units are expected to be fabricated in approximately one and a half months after the release to Vendor. Fifty electronics cards are required. The pre-production units are now being tested and it is expected that the final order will be released to the Vendor during spring '04. Card fabrication and assembly should take approximately one month and it is planned to take one and a half months to test all the units. An outside vendor will fabricate 325 detectors. Thirty are in house now and being tested. The vendor is expected to deliver 20 bottles per week beginning in March. BNL will perform a go-no-go test on all detectors and ORNL will perform the final calibration.

P) BCM: The BCM electronics consists of three boards, the PCI board, the Daughter Board, and the Calibrator. All boards have been built and tested, though the calibrator tested was a prototype design. Problems have occurred with the daughter board. Although the daughter board has been extensively tested at BNL and operated successfully at LBL it has failed several times at ORNL. We have been unable to duplicate these failures at BNL even when run in electrically noisy environments. A new revision of the board has been built with additional protective devices and has been

tested in a very noisy equipment house during the present AGS run. It has performed well. All components for the present design have been purchased.

For linac commissioning, ORNL has deployed a commercial digitizer in place of the daughter board, and this solution is now the baseline design. BNL will still provide the PCI board and Calibrator board. The remaining work needed on these cards includes completion of the calibrator and refinement of the timing interface. Operational software for the equipment is fully functional but will require changes to fit in the new ORNL template.

Responsibility for the final BCM electronics will be shared by BNL and ORNL. BNL is responsible for the calibrator board, PCI timing board, low level software for these boards, and PC chassis procurement. ORNL is responsible for commercial digitizer procurement, high level software, and overall system performance.

A preproduction review of the linac electronics will be completed by the end of May, 2004. A similar review of the ring electronics will be completed by the end of July, 2004. Hardware production will be completed by the end of February, 2005.

STATUS FOR ELECTRONICS AND SOFTWARE OF "ALL OTHER SYSTEMS"

Q) WCM: Testing of the first article is near completion. The production will proceed as planned.

R) E-detector: The electronics design is in its early stages and is now on hold.

S) Coherent Tune: The electronics and software design will be based on the BPM system with some modifications and additions. The conceptual design of the pulser and the required post processing of BPM information is now on hold.

T) Incoherent Tune: The electronics and software design will be based on the BPM system with some modifications and additions. The conceptual design of the pulser and the required post processing of BPM information is now on hold.

U) Wire Scanner: No BNL supplied electronics.

V) BIG: The electronics and software conceptual design is now on hold.

W) IPM: This system will be based on the RHIC design with higher frequency preamplifiers. The electronics and software conceptual design is now on hold. Delivery of the internal pick-ups will be accelerated to better match the vacuum hardware deliveries.

X) Halo Scraper: No BNL supplied electronics

Y) Foil Video: Two cameras and supporting electronics are in the baseline. A vacuum view port will be provided for future video of the electron collector.

RESTART PLAN FOR PHASED SYSTEMS

Work on electronics for all other systems has been suspended since the BNL work package meeting held on Dec 8, 2003. This was done for two reasons:

1. To assure that resource conflicts would not affect progress on the 3 critical systems
2. To build up contingency within the BNL Diagnostics work package

We plan to ultimately deploy all systems. In preparation for restart, each system will be reviewed against the following criteria:

- Priority for commissioning and early operations
- Impact on critical systems due to shared resources
- Impact on the contingency analysis for BNL Diagnostics
- Cost of delayed restart

An initial restart review for all phased systems will be completed by May 2004. To support installation planning, a restart review of cabling for the phased systems will be completed by May 2004, after the new BNL Diagnostics estimate-to-complete is available. In March, 2004, ORNL decided to restart cabling of all phased systems.

SUMMARY

Beam diagnostics systems for the ring and transport lines are designed to support high-intensity, high-power machine performance beyond 1 MW. Beamline components of all diagnostics systems will be produced and installed before the start of initial ring commissioning. Present production progress of beamline components at BNL supports the early-installation schedule requested by ORNL/ASD.

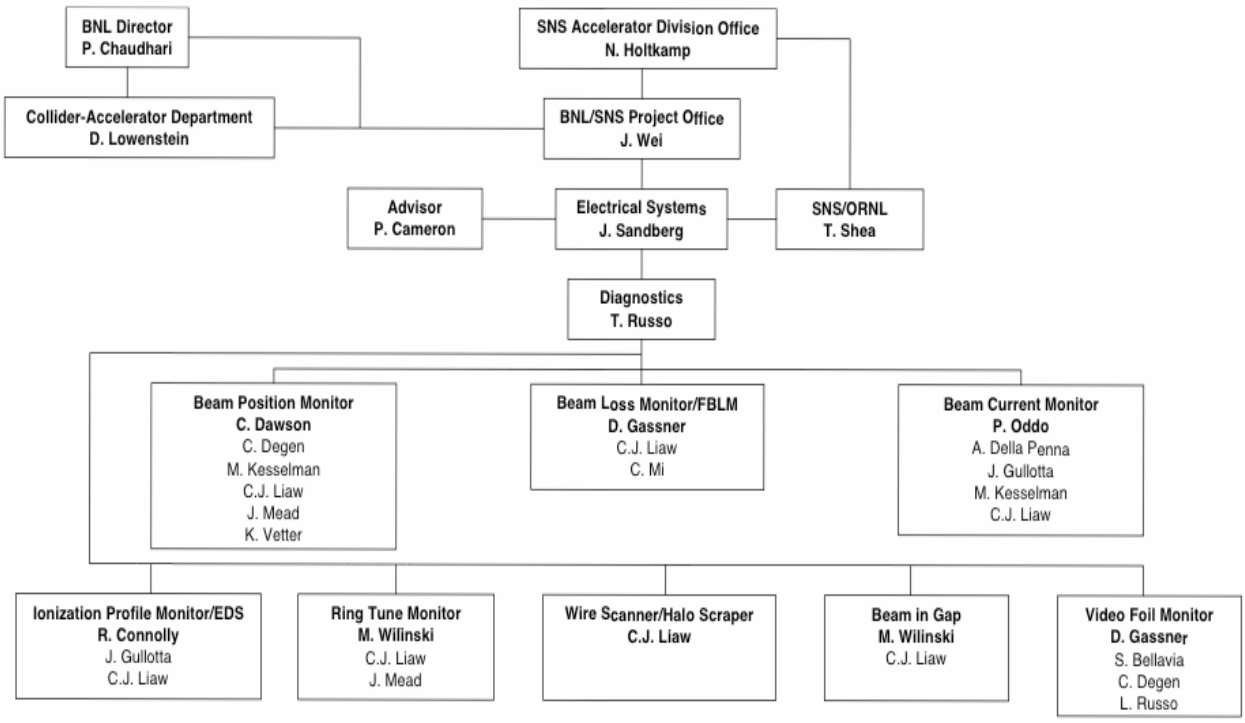
In order to fully support the on-time completion, installation, and commissioning of critical diagnostics systems (BPM, BLM/FBLM, BCM) in July 2005 with limited resources, the ring diagnostics team redirects its focus following the recommendations from the Diagnostics Advisory Committee. The redirected plan postpones the development of non-beamline components of some low-priority systems, and concentrates the team's effort on essential systems. With full support from the management and the Collider-Accelerator Department of the Brookhaven National Laboratory, the diagnostics team at BNL is significantly strengthened both with organizational leadership and technical capability/availability.

Based on installation/commissioning demand at ORNL and resource capability/availability at BNL, a delivery schedule has been developed (see appendix). The diagnostics teams at BNL and ORNL are intimately working together to meet the

milestones with successful production and delivery to support the installation and commissioning of essential diagnostics systems at the early stage of beam commissioning.

For the critical systems, this production plan allows the Diagnostics team to meet the system completion dates contained in the current Integrated Project Schedule (IPS). For the secondary systems, timely restart followed by phased deployment will assure that there is no impact on commissioning milestones.

Appendix 1: Organization Chart



Responsibilities:

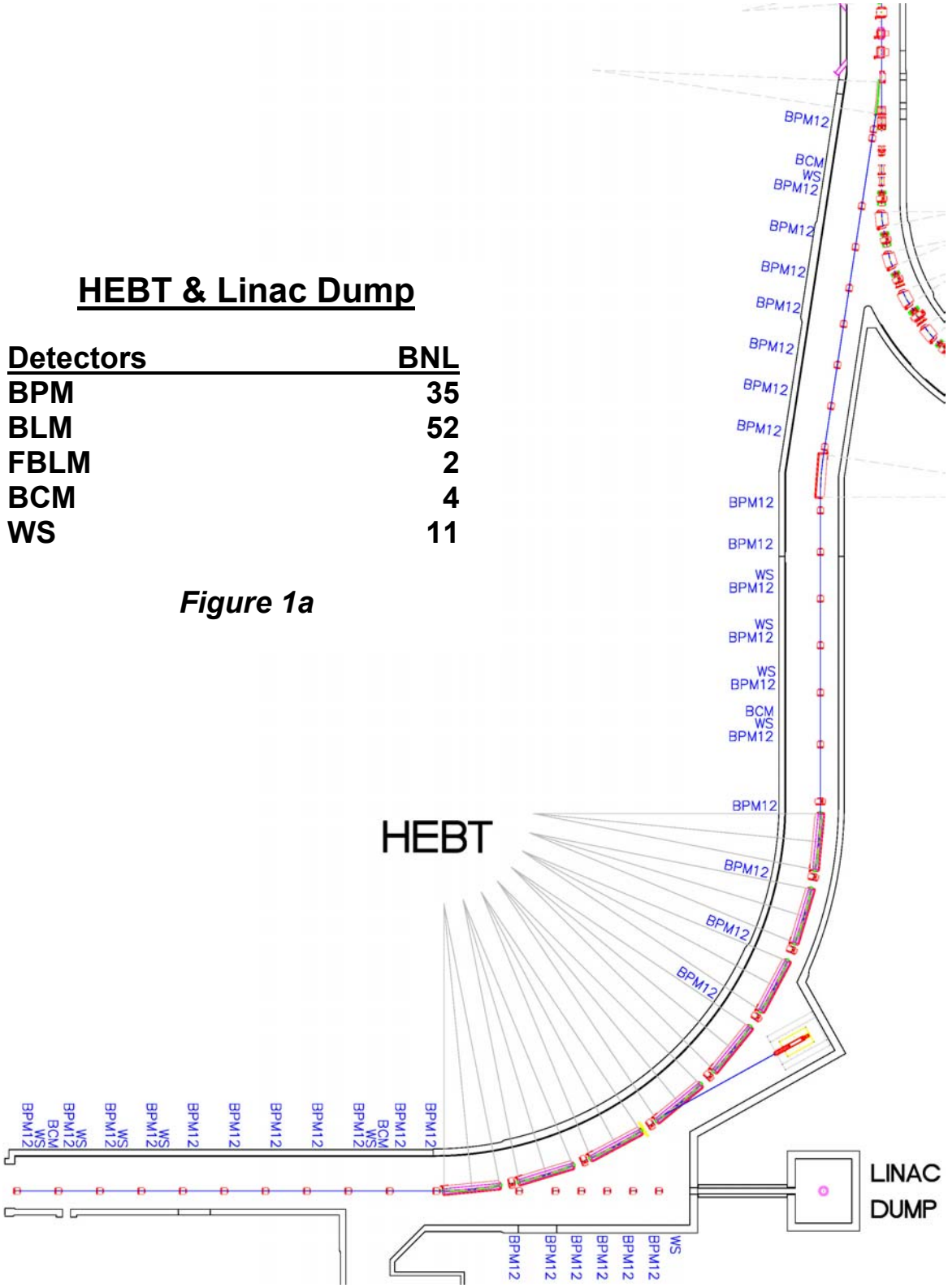
S. Bellavia – Mechanical
R. Connolly – Electrical
C. Dawson – Electrical
C. Degen – Labview
A. Della Penna – Electrical
D. Gassner – Electrical
J. Gullotta – Electrical
M. Kesselman – Electrical
C.J. Liaw – Mechanical, Vacuum
J. Mead – Software
C. Mi – Electrical
P. Oddo – Electrical
L. Russo – Mechanical
K. Vetter – RF
M. Wilinski – Electrical

Appendix 2:
HEBT, Ring & RTBT Diagnostic Vacuum Devices & Deliverables

HEBT & Linac Dump

Detectors	BNL
BPM	35
BLM	52
FBLM	2
BCM	4
WS	11

Figure 1a



Appendix 2:

HEBT, Ring & RTBT Diagnostic Vacuum Devices & Deliverables

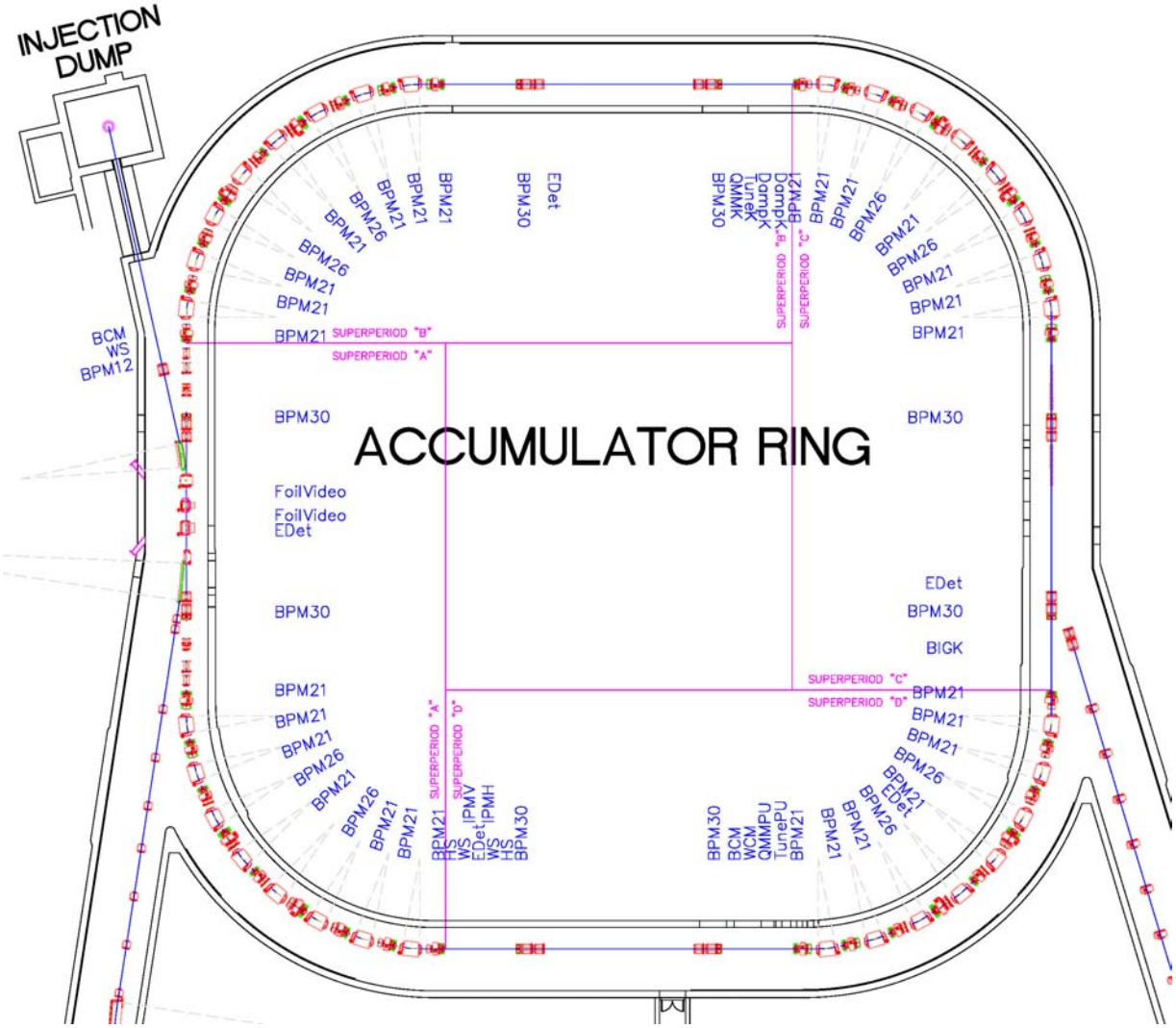
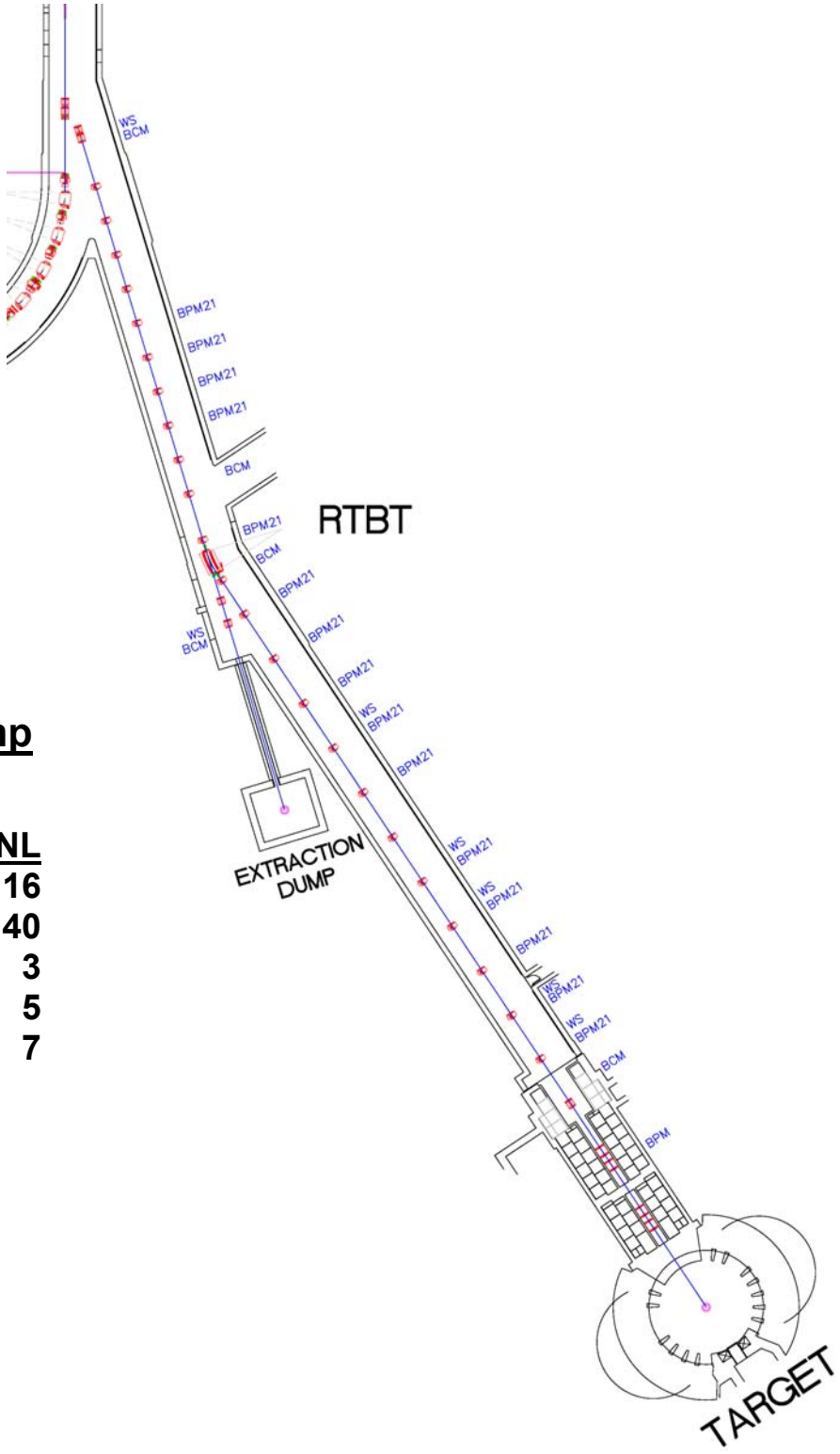


Figure 1b - Ring & Injection Dump

Detectors	BNL
WS	3
QMM	2
BCM	2
WCM	1
Tune	2
E-Det	5
Damper Kicker	2

Detectors	BNL
BIG	1
IPM	2
BPM	45
BLM	77
FBLM	13
Foil Video	2
Halo Scraper	2

Appendix 2:
HEBT, Ring & RTBT Diagnostic Vacuum Devices & Deliverables



RTBT & Extraction Dump

Detectors	BNL
BPM	16
BLM	40
FBLM	3
BCM	5
WS	7

Figure 1c

Appendix 3: Diagnostics' Production Schedules

Table 1 - Beam Position Monitor system

ID	Task Name	Duration	Start	Finish
6	Sole Source approved	1 day	Thu 2/12/04	Thu 2/12/04
7	Rackmount P.O. placed	1 day	Wed 2/18/04	Wed 2/18/04
8	Rackmount deliveries	1 day	Tue 3/30/04	Tue 3/30/04
9	Power supply design/build/test prototype	25 days	Mon 2/23/04	Fri 3/26/04
10				
11	Software development	220 days	Mon 2/9/04	Fri 12/10/04
12	Software Initial Release	1 day	Fri 3/26/04	Fri 3/26/04
13	Software status review (internal)	0 days	Mon 5/3/04	Mon 5/3/04
14	Software status review (internal)	0 days	Mon 8/2/04	Mon 8/2/04
15	Software status review (internal)	0 days	Mon 11/1/04	Mon 11/1/04
16	Software Final Release	1 day	Fri 12/10/04	Fri 12/10/04
17				
18	Hand carry prototype to ORNL	1 day	Wed 3/31/04	Wed 3/31/04
19	Prototype at ORNL	0 days	Thu 4/1/04	Thu 4/1/04
20	Initial ORNL test results	1 day	Fri 4/16/04	Fri 4/16/04
21	Prototype Testing	30 days	Mon 4/5/04	Fri 5/14/04
22				
23	Redesign RF/Baseband/PCI	25 days	Mon 5/17/04	Fri 6/18/04
24	First Pre-production unit	1 day	Mon 6/21/04	Mon 6/21/04
25	Testing of pre-production unit	30 days	Tue 6/22/04	Mon 8/2/04
26	Order materials for production	30 days	Mon 7/19/04	Fri 8/27/04
27	BPM Test Stand Complete	0 days	Thu 7/15/04	Thu 7/15/04
28	Production/Testing	140 days	Mon 8/2/04	Fri 2/11/05
29				
30	deliveries	137 days	Fri 8/20/04	Mon 2/28/05

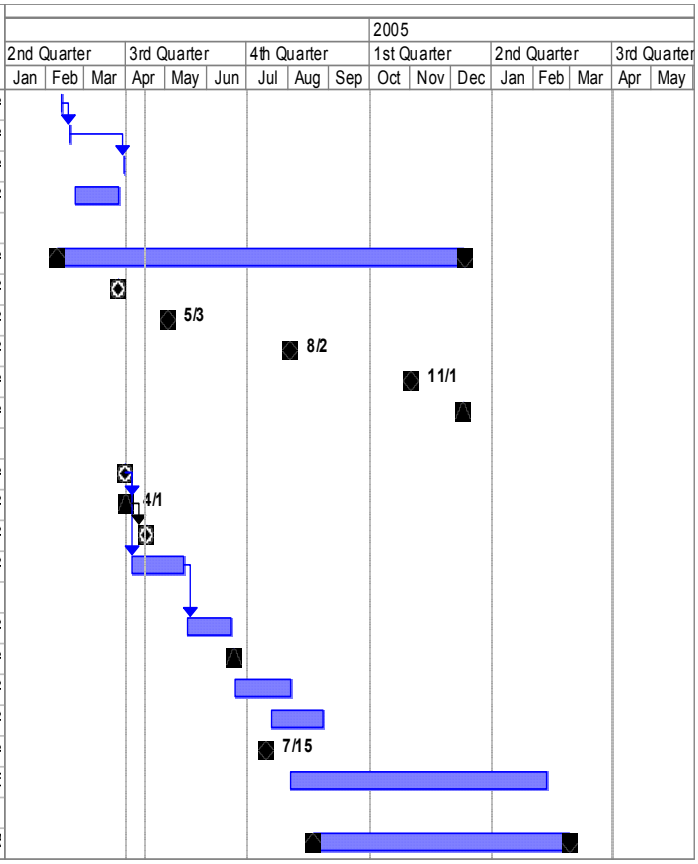


Table 2 - Beam Current Monitor system

ID	Task Name	Duration	Start	Finish
1	BCM	169 days	Mon 2/9/04	Thu 9/30/04
2	delivery of vacuum mechanical hardware	100 days	Fri 2/13/04	Thu 7/1/04
3	troubleshoot BNL design	10 days	Fri 3/5/04	Thu 3/18/04
4	BNL design decision point	0 days	Fri 3/19/04	Fri 3/19/04
5	Acqiris inquiries	8 days	Wed 2/11/04	Fri 2/20/04
6	Acquiris Performance Assessment	1 day	Wed 2/25/04	Wed 2/25/04
7	Decision point to use modified RHIC timing card	0 days	Mon 4/5/04	Mon 4/5/04
8	Modification/Integration	60 days	Mon 4/12/04	Fri 7/2/04
9	order parts/material	60 days	Mon 5/10/04	Fri 7/30/04
10	Order PCs	0 days	Tue 6/15/04	Tue 6/15/04
11	Submission of Timing Card Modifications	0 days	Tue 6/1/04	Tue 6/1/04
12	Production	60 days	Tue 6/1/04	Mon 8/23/04
13	Deliveries	59 days	Mon 7/12/04	Thu 9/30/04

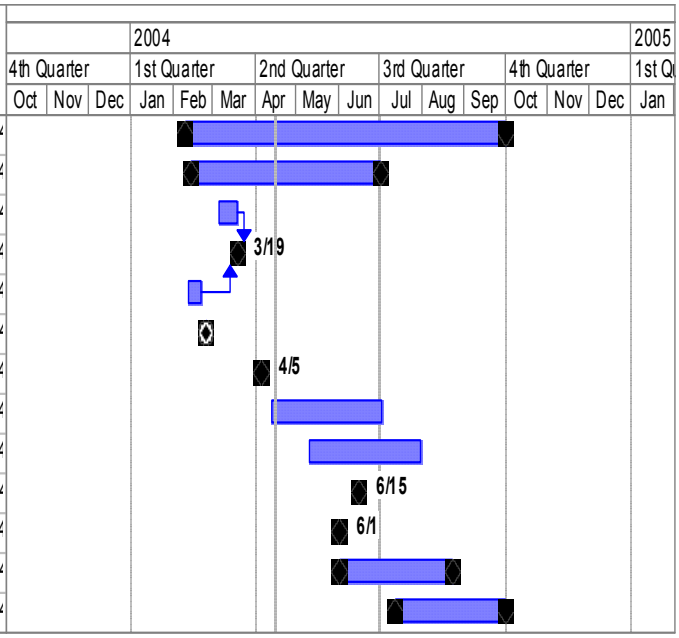
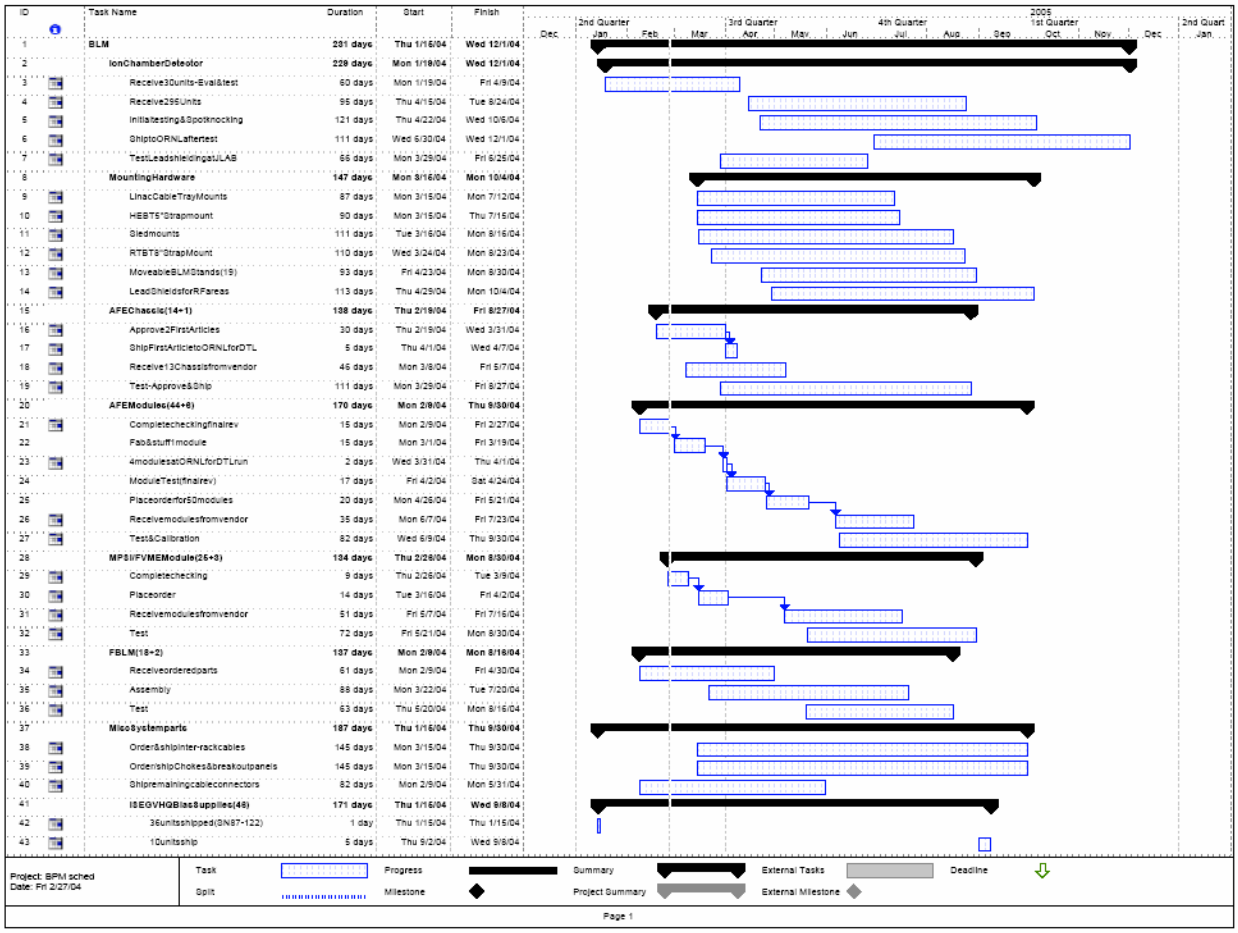
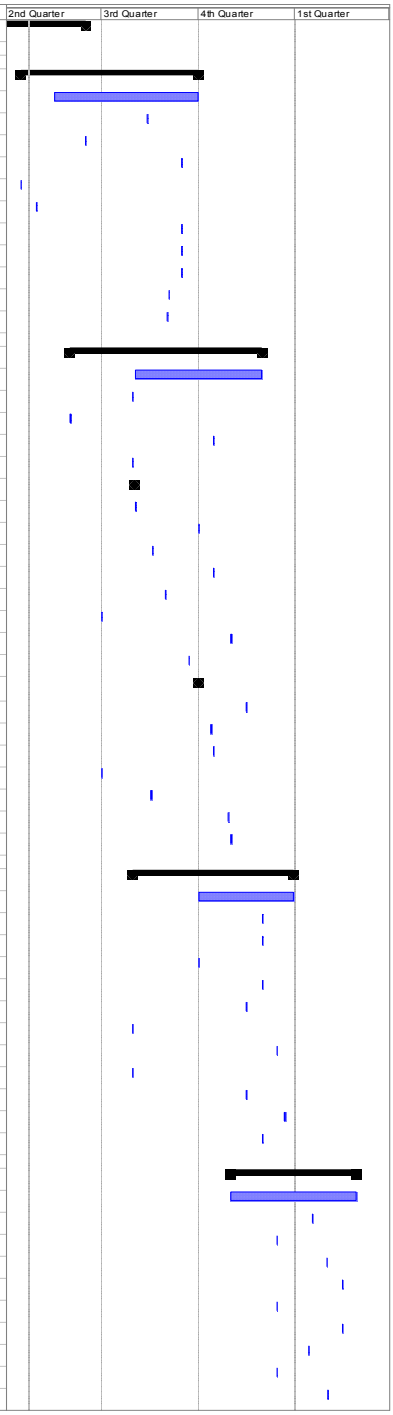


Table 3 - Beam Loss Monitor system



APPENDIX 4: DELIVERY SCHEDULE
-VACUUM EQUIPMENT-

ID	Task Name	Start	Finish
1	**Installation SS String Mock-up**	**Thu 4/1/04**	**Tue 6/15/04**
4			
5			
6	**RF Straight Section**	**Thu 4/15/04**	**Thu 9/30/04**
7	Installation effort	Mon 5/17/04	Thu 9/30/04
8	PU Chamber Ass'y (QMM/BCM/Tur	Fri 8/13/04	Fri 8/13/04
9	Wall Current Monitor	Tue 6/15/04	Tue 6/15/04
10	Quad Doublet (1)	Wed 9/15/04	Wed 9/15/04
11	RF Cavity #2	Thu 4/15/04	Thu 4/15/04
12	RF Cavity #3	Fri 4/30/04	Fri 4/30/04
13	RF Cavity #4	Wed 9/15/04	Wed 9/15/04
14	Quad Doublet (1)	Wed 9/15/04	Wed 9/15/04
15	IPM/WS/ScraperChamber Ass'y (2)	Wed 9/15/04	Wed 9/15/04
16	Electron Detector (1)	Fri 9/3/04	Fri 9/3/04
17	Vacuum hardware and adaptors (x)	Wed 9/1/04	Wed 9/1/04
18			
19	**Injection Straight Section**	**Tue 6/1/04**	**Tue 11/30/04**
20	Installation effort	Mon 8/2/04	Tue 11/30/04
21	Injection kicker long (2)	Fri 7/30/04	Fri 7/30/04
22	Injection kicker short (1)	Tue 6/1/04	Tue 6/1/04
23	Quad Doublet (1)	Fri 10/15/04	Fri 10/15/04
24	Injection Septum (1)	Fri 7/30/04	Fri 7/30/04
25	Progress review with ASD	Sun 8/1/04	Sun 8/1/04
26	Injection Chicane #1	Mon 8/2/04	Mon 8/2/04
27	Chicane #1 VC	Fri 10/1/04	Fri 10/1/04
28	Injection Chicane #2	Wed 8/18/04	Wed 8/18/04
29	Chicane #2 VC	Fri 10/15/04	Fri 10/15/04
30	Foil Assembly (1)	Mon 8/30/04	Mon 8/30/04
31	Injection Chicane #3	Thu 7/1/04	Thu 7/1/04
32	Chicane #3 VC	Mon 11/1/04	Mon 11/1/04
33	Injection Chicane #4	Wed 9/22/04	Wed 9/22/04
34	Progress review with ASD	Fri 10/1/04	Fri 10/1/04
35	Chicane #4 VC	Mon 11/15/04	Mon 11/15/04
36	Dump Septum (1)	Wed 10/13/04	Wed 10/13/04
37	Quad Doublet (1)	Fri 10/15/04	Fri 10/15/04
38	Injection Kicker Short Assembly (1)	Thu 7/1/04	Thu 7/1/04
39	Injection Kicker Long (2)	Tue 8/17/04	Tue 8/17/04
40	Electron Detector (1)	Fri 10/29/04	Fri 10/29/04
41	Vac hardware and adaptors (x)	Mon 11/1/04	Mon 11/1/04
42			
43	**Collimation Straight Section**	**Fri 7/30/04**	**Thu 12/30/04**
44	Installation effort	Fri 10/1/04	Thu 12/30/04
45	Moveable Scraper	Wed 12/1/04	Wed 12/1/04
46	Scraper Chamber	Wed 12/1/04	Wed 12/1/04
47	Primary Collimator	Fri 10/1/04	Fri 10/1/04
48	Collimator Shielding	Wed 12/1/04	Wed 12/1/04
49	Quad Doublet (1)	Mon 11/15/04	Mon 11/15/04
50	Collimator #2	Fri 7/30/04	Fri 7/30/04
51	Drift Pipe	Wed 12/15/04	Wed 12/15/04
52	Collimator #3	Fri 7/30/04	Fri 7/30/04
53	Quad Doublet (1)	Mon 11/15/04	Mon 11/15/04
54	Kicker VC Ass'y (QMM1/Tune1/Dan	Wed 12/22/04	Wed 12/22/04
55	Vacuum hardware and adaptors (X	Wed 12/1/04	Wed 12/1/04
56			
57	**Extraction Straight Section & RTBT**	**Mon 11/1/04**	**Mon 2/28/05**
58	Installation effort	Mon 11/1/04	Mon 2/28/05
59	Extraction Kicker Assembly - K1	Mon 1/17/05	Mon 1/17/05
60	Quad Doublet (1)	Wed 12/15/04	Wed 12/15/04
61	Extraction Kicker Assembly - K2	Mon 1/31/05	Mon 1/31/05
62	Lambertson (1)	Tue 2/15/05	Tue 2/15/05
63	Quad Doublet (1)	Wed 12/15/04	Wed 12/15/04
64	BIG/Tune Kicker Chamber Assemb	Tue 2/15/05	Tue 2/15/05
65	RTBT 21 cm Vacuum Chambers (X	Fri 1/14/05	Fri 1/14/05
66	RTBT Collimator Shielding (2)	Wed 12/15/04	Wed 12/15/04
67	Vacuum Hardware and adaptors (X	Tue 2/1/05	Tue 2/1/05



APPENDIX 5: RING DIAGNOSTICS DRAFT ACCEPTANCE CRITERIA

Acceptance of each diagnostic system will proceed in two phases: first article acceptance followed by production unit acceptance. Examples of acceptance criteria that have been developed by ORNL / LANL are listed below in draft format.

Draft Baseband BPM Acceptance Criteria

AP requirements:

Intensity:	5e10 to 2e14 Protons
Pulse Length	0.3 to 1000 uS
Range:	+/- 20 mm
Accuracy:	1% of half aperture
Resolution:	0.5% / 1% of half aperture, averaged / turn-turn

1st Article Test Test at BNL – Witnessed by ORNL

- Map 1 of each size PUE
- Simulate input signals
- Measure noise and record
- Measure bandwidth and record
- Calibrate Gains – record all gains (conversion constants)
- Demonstrate Control using EPICS interface
- Burn in for 2 weeks (no failures)
- Include test equipment certification with the traveler
- Documentation to supply with 1st article
    - Schematics
    - PC artwork (Gerber files)
    - FPGA programs
    - Jumper position information for all modes

Acceptance tests:

- No witness by ORNL required
- Simulate input signals
- Measure noise and record
- Measure bandwidth and record
- Calibrate Gains – record all gains (conversion constants)
- Demonstrate Control using EPICS interface
- Burn in
- Include test equipment certification with the Traveler

BPM PUEs:

- Traveler for PUE included with half cell
- All mechanical operations:
    - Leak test
    - Coating
    - Bake out

Draft BCM Acceptance Criteria

BCM Electronics Specification:

1% accuracy

0.5% resolution (based upon rms noise) <41 counts rms (<246 counts peak to peak)

MEBT, Linac, HEBT	15ma to 52ma
Ring, RTBT	15ma to 100amp

First Article **-** Test at BNL – Witnessed by ORNL

- Simulate mini-pulses
- Measure noise and record
- Measure bandwidth noise and record
- Calibrate calibrator and record
- Calibrate Gains – record all gains (conversion constants)
- Measure droop of sample transformer – record/compare to earlier measurements
- Demonstrate Control using EPICS interface
- Burn in for 2 weeks (no failures)
- Documentation to supply with 1st article
    - Schematics
    - PC artwork (Gerber files)
    - FPGA programs
    - Jumper position information for all modes

Acceptance tests **-** Test at BNL **-** No witness by ORNL required

- Simulate minipulses
- Measure noise and record
- Measure bandwidth and record
- Calibrate calibrator and record
- Calibrate Gains – record all gains (conversion constants)
- Measure droop of sample transformer – record/compare to earlier measurements
- Demonstrate Control using EPICS interface
- Burn in for 2 weeks (no failures)

BCM PUEs (all info on traveler)

- All mechanical operations - Leak test, etc.
- Attach copy of Bergoz's transformer calibration information
- Test transformer before installation in PUE shroud
    - Signal in to calibration winding-signal out of transformer

- Test transformer after installation in PUE shroud
    - Signal in to calibration winding-signal out of transformer
- Test transformer – last step before shipping
    - Signal in to calibration winding-signal out of transformer

Draft BLM Acceptance Criteria

- System meets Accelerator Physics requirements

- Detectors

    - Traveler for each unit
        - "Typical response" test on receipt from manufacturer
        - Detailed test following connectorization by local assembler
    - Documentation
        - Paper copy of calibration
        - Electronic file of calibration test data
- Analog Front End (AFE) Electronics
    - Traveler for each unit
        - "Typical response" test
        - Detailed test on receipt from board manufacturer and mounting in module
        - Listing of modules (s/n) in crate
    - Module Documentation
        - Paper copy of calibration
        - Electronic file of calibration test data
- IOC Crate
    - Traveler for each crate
        - Listing of modules (s/n) in crate
        - Functional test with AFE test set-up
        - Functional test with AFE crate
    - Documentation
        - Paper copy of calibration
        - Electronic file of calibration test data

Draft Video Foil Monitor Acceptance Criteria

AP REQUIREMENTS

Ring System Diagnostics AP Requirements (11/05/2002)							
Device	Location	Intensity	Range	Accuracy	Resolution	Data Structure	Comments
Foil Video	Ring	5e10-2e14	Visible-Near IR	+/-1mm	+/-1mm	Standard Video data	2 systems (Primary& Secondary) Includes phosphor

Phosphor screen, mechanical (mounted in stripping foil assemblies).

Radiation hard video Cameras meets calibration for Standard RS-170 video. (Calibration data from manufacturer Dage-MTI).

Neutral Density Filter assembly, remote control (relay & ps) mechanical actuation. ND filter element calibration from manufacturer.

Camera lens, appropriate optics.

Functionality of Camera, ND filter, & lens mount, on drawer slides for optical alignment and recessing in cubby hole.

Functionality of remote control illumination lamps (relay & ps).

Rack mount PC with NI-1409 PCI cards & Dig I/O interface performs required tasks.

- Image acquisition & analysis
- Control & readback of ND filter position
- Control of Lamp
- Accepts external timing trigger.

Video to Ethernet signal converter functionality, for real time video in MCR.

Rack mounted Video monitors for local viewing in ring service building.

System test:

A test image will be viewed by the VFM system at the appropriate distance from the camera, +/- 1mm resolution will achieved by the PCI framegrabber.

Draft Incoherent Tune system Acceptance Criteria

Traveler for each pickup and kicker, showing leak check, impedance check, S21 of resonant response

Meets applicable BPM Acceptance Criteria

Meets AP specifications

Amplifier meets output requirements

Successful BTF measurement of test resonator

Draft Ionization Profile Monitor Acceptance Criteria

Step	Task	Values	Lab		Passed
1	Vacuum tests				
	Chamber	10^{-10} tor l/s	BNL		
	Flange	10^{-10} tor l/s	BNL		
	Assembly	10^{-10} tor l/s	BNL		
2	Hi Pot transducer	40 kV	BNL		
3	Magnet				
	Middle Magnet Field 2 kGauss uniformity	B field runout from center detector to end <10% of spacing (2.8mm)	BNL		
	Map field (beam optics)	To be determined	BNL		
	Beam trajectory correction	< 1 mrad (To be confirmed)	BNL		
	Amplifiers Gain uniformity	5%	BNL		
4	RMS Noise	20 mV	BNL		
	Gain	2V per 300nA	BNL		
	Bandwidth	5 MHz	BNL		

	Rad Hardness	1 Mrad expected, TBD (100k rad/year) > 5 year lifetime	BNL		
	Calibration				
5	Uniformity MCP gain	< 5% over collector channels	BNL		
	Overall to digitizer				
	Software				
6	EGA calibration source	<5% over collector channels	BNL/ORNL		
	Supports all Pvs	List complete	BNL/ORNL		
7	Documentation	Complete	BNL/ORNL		
	Program Modes				
	Vertical integration at BNL		BNL/ORNL		
	Test robustness	7 days continuous operation at full cycling but inactive MCP			
	Installation at ORNL				
8	Alignment		ORNL		
	Cable pull		ORNL		
	Commissioning		BNL/ORNL		

Table 1

Visits		
System lead to BNL	At step 4	1-2 days
System lead to BNL	At step 7	1 week
BNL to ORNL	At step 8 (commissioning) Installation, dry test, beam test	1-2 weeks (split if required by schedule)

Issues:

(1) Existence of consumables:
   a. micro channel plate

   b. pre-amps
2) Specs on magnetic field
   a. Linearity
3) Diagnostics
   a. Magnet field (hall probe, current readback)
   b. Actual high voltage readback
4) VME<->PCI
   a. Cost
   b. VME data plus LabVIEW analysis setup

Draft Beam in Gap (BIG) & Coherent Tune systems Acceptance Criteria

(1) Meets applicable BPM Acceptance Criteria

(2) Meets AP specifications:

Tune measurement accuracy: +/- 0.001

Tune measurement resolution: +/- 0.0005

Averaging required for tune measurement

BIG range: 0 – 0.1A

BIG accuracy: 20%

(3) Pulser meets output requirements for both BIG & Tune systems:

Pulser delivers +/- 7kV output to kicker

1MHz burst of 10 pulses (max) repeated at 60Hz (Tune)

1MHz burst of 100 pulses (max) repeated at 60Hz (BIG)

Output polarity changed on turn-by-turn basis

Selectable plane to kick

Reconfigurable for quadrupole kick

(4) LabVIEW software for BIG & Tune written