

**Recycler BPM Software
Priorities & Projects**

Introduction

The following outline identifies the major software elements that must be developed or enhanced for the Recycler BPM Project. Software elements that already exist in library form are not included. The outline runs roughly in order of priority for implementation (with 1.0 the highest) to assure meaningful system operability at the earliest date. The established priorities are influenced by the decision to follow an evolutionary path from the existing BPM implementation to the new design – the *evolutionary approach*. This approach seeks to reuse as much of the existing front-end and application software as possible.

Elements in sections 1.0 and 2.0 of the outline should be completed to support installation and commissioning of the BPM system at the Recycler ring. Elements in sections 3.0 and 4.0 must be completed to fulfill the requirements specified in the “Recycler BPM System Upgrade - Functional Specification” document. The functional specification allows that elements in section 4.0 are not necessary to make meaningful measurements during installation, commissioning, validation and early operation of the new system.

The outline also indicates the responsible individual for each element. The following table is a key to codes used in the outline:

- BH – Brian Hendricks - Controls
- CB – Charles Briegel - Controls
- DN – Dennis Nicklaus - Controls
- DV – Duane Voy - Instrumentation
- LW – Lin Winterowd – Controls
- MI – Main Injector Responsibility at Their Discretion
- MY – Ming-Jen Yang – Main Injector
- SP – Stephen Pordes - Instrumentation
- TBD – To Be Determined
- UNK – Unknown – Computing Division
- VAR – Various Unspecified Individuals

Software Development Priorities

1.0 Provide Functionality of Current 2.5 MHz System

1.1 Port Front-end code to VxWorks 5.4 on PowerPC (DV)

1.2 ADC Module for Digital Receiver

1.2.1 ECDR-GC814 I/O Drivers (CB)

1.2.2 Analog Signal Processing (CB)

1.2.3 Front-end (DV)

1.3 Digital Receiver Clock

1.3.1 Digital Receiver Clock I/O Drivers (DN)

1.3.2 Front-end (DV)

2.0 Enhance Existing Functionality

2.1 Calibration System

2.1.1 Calibration Waveform Generator I/O Drivers (DN)

2.1.2 Front-end Calibration Mode (DV and/or DN)

2.1.3 Application Support (BH)

2.1.4 New Calibration Application (SP and **UNK**)

2.2 Diagnostic Measurement

2.2.1 ADC Class (CB)

2.2.2 Front-end (DV)

2.2.3 Application Support (BH)

2.2.4 New Engineering Support Application (**UNK**)

2.3 Intensity Proportional (Sum Signal)

2.3.1 Front-end (DV)

2.3.2 Application Support (BH)

2.3.3 Flash Application (LW)

2.3.4 Turn-by-turn Application (MY)

2.4 Turn-by-turn for All Channels

2.4.1 Front-end (DV)

2.4.2 Application Support (BH)

2.4.3 Turn-by-turn Application (MY)

2.5 Engineering Parameters in ACNet

2.5.1 Front-end All Elements (CB, DN & DV)

2.5.2 New Engineering Support Application (**UNK**)

3.0 Implement New Modes/Measurements

3.1 Multiple Digital Receiver Filter Management

- 3.1.1 ADC Class (CB)
- 3.1.2 Front-end (DV)
- 3.1.3 Application Support (BH)
- 3.1.4 Flash Application (LW)
- 3.1.5 Turn-by-turn Application (MY)

3.2 Background Flash Circular Buffer

- 3.2.1 Front-end (DV)
- 3.2.2 Application Support (BH)
- 3.2.3 Analysis and Display Software (MI)

4.0 Implement Event Triggered Data Acquisition

4.1 Tclk Event Handler

- 4.1.1 Front-end (DV)
- 4.1.2 Application Support (BH)
- 4.1.3 All Measurement Application Programs (VAR)

4.2 Acquisition Specifications

- 4.2.1 Front-end (DV)
- 4.2.2 Application Support (BH)
- 4.2.3 All Measurement Requesting Application Programs (VAR)

4.3 Readout Specifications

- 4.3.1 Front-end (DV)
- 4.3.2 Application Support (BH)
- 4.3.3 All Display Application Programs (VAR)

Software Development Projects

The outline above includes elements of eleven identifiable and interdependent software development projects. The eleventh project “Circular Buffer Analysis” is not part of the Recycler BPM project (will be handled by the Main Injector Department) but is included for completeness. A responsible developer has been assigned to each project. A detailed schedule for these software projects is included in the Recycler BPM project schedule document. The following outline lists the eleven software development projects and may be used as initial input to the high level project schedule.

1.0 Front-End

1.1 BPM Front-end (DV)

1.1.1 Initial Dependencies: N/A

1.1.2 Elements:

1.1 – port old code to VxWorks 5.4 on PowerPC

1.2.3 – adapt BPM to accommodate ACD class for digital receiver

1.3.2 – new initialize/control digital receiver clock

2.1.2 – new calibration measurement mode

2.2.2 – new diagnostic measurement mode

2.3.1 – new intensity values for all data types

2.4.1 – new values for all channels of turn-by-turn data

2.5.1 – new make all engineering parameters available to ACNet

3.1.2 – new measurement request for all beam types

3.2.1 – new background flash circular buffer & trigger

1.1.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for full BPM front-end functionality including:

- Measurement control from ACNet,
- Background Flash (Circular Buffer) mode,
- Flash mode,
- Closed Orbit mode,
- Turn-by-turn mode,
- Calibration mode,
- Diagnostic mode and
- Data Reply to ACNet for all modes.

1.2 Digital Receiver I/O and Processing (CB)

1.2.1 Initial Dependencies: Filter Design

- 1.2.2 Elements:
 - 1.2.1 –I/O drivers for multiple digital receiver modules
 - 1.2.2 –analog processing for flash, turn-by-turn and diagnostic data types
 - 2.2.1 –diagnostic data type
 - 2.5.1 - make all engineering parameters available to ACNet
 - 3.1.1 – multiple beam type measurements
- 1.2.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for the BPM analog input processing subsystem functionality including:
 - Echotek ECDR-GC814 digital receiver I/O drivers,
 - Analog processing and filter control,
 - Analog signal processing and scaling, and
 - ACNet control/monitor interface.
- 1.3 Digital Receiver Clock (DN)
 - 1.3.1 Initial Dependencies: Hardware Selection
 - 1.3.2 Elements:
 - 1.3.1 –I/O drivers for digital receiver clock module
 - 2.5.1 - make all engineering parameters available to ACNet
 - 1.3.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support the BPM digital receiver clock subsystem functionality including:
 - TBD clock generator I/O drivers and
 - ACNet control/monitor interface.
- 1.4 Calibration System (DN)
 - 1.4.1 Initial Dependencies: Hardware Selection
 - 1.4.2 Elements:
 - 2.1.1 –I/O drivers for calibration waveform generator
 - 2.1.2 - calibration measurement mode
 - 1.4.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for the BPM calibration subsystem functionality including:
 - TBD calibration signal generator I/O drivers,
 - Calibration mode algorithms and
 - ACNet control/monitor interface.
- 1.5 Triggered Data Acquisition (DV)
 - 1.5.1 Initial Dependencies: Completion of elements in 1.0, 2.0 and 3.0
 - 1.5.2 Elements:

- 4.1.1 –event arming event handlers
- 4.2.1 –event measurement requests
- 4.3.1 –event data requests
- 1.5.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support the BPM event driven measurement subsystem functionality including:
 - Event configuration,
 - Event data acquisition methods,
 - Multiple data request support,
 - SDA support and
 - ACNet control/monitor interface.

2.0 Application Programs

2.1 Application Support (BH)

- 2.1.1 Initial Dependencies: Front-end Design
- 2.1.2 Elements:
 - 2.1.3 – new request/reply for calibration data
 - 2.2.3 - new request/reply for diagnostic data type
 - 2.3.2 – add intensity values to all data types
 - 2.4.2 – add multiple channel capability to turn-by-turn data
 - 3.1.3 – new measurement request for multiple beam types
 - 3.2.2 – new request/reply for background flash circular buffer data type
 - 4.1.2, 4.2.2, 4.3.2 - new request/reply for event triggered measurements
- 2.1.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for upgrading the ACNet application program utility library for BPM control and data acquisition functionality including:
 - Measurement request API for all defined BPM modes and
 - Data retrieval API for all defined BPM data types.

2.2 Flash (LW)

- 2.2.1 Initial Dependencies: Front-end Design
- 2.2.2 Elements:
 - 2.3.3 – new intensity display
 - 3.1.4 – new request/display multiple beam types
 - 4.1.3 – new request/display acquisition event and type
 - 4.2.3 – new request measurement with acquisition specification
 - 4.3.3 – new request data with readout specification

- 2.2.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for upgrading the ACNet Flash mode console application program including:
- Measurement request for Background Flash, Flash and Closed Orbit modes and
 - Data analysis and display, including intensity discrimination, for all BPM Background Flash, Flash and Closed Orbit data types.

2.3 Turn-by-turn (MY)

2.3.1 Initial Dependencies: Front-end Design

2.3.2 Elements:

2.3.4 - new intensity display

2.4.3 – new display data for all channels with single measurement

3.1.5 - new request/display multiple beam types

4.1.3 - new request/display acquisition event and type

4.2.3 - new request measurement with acquisition specification

4.3.3 - new request data with readout specification

- 2.3.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for upgrading the ACNet Turn-by-turn mode console application program including:
- Measurement request for Turn-by-turn mode and
 - Data analysis and display, including intensity discrimination, for all BPM Turn-by-turn data types.

2.4 Calibration (SP & **TBD**)

2.4.1 Initial Dependencies: Hardware Design & Front-end Design

2.4.2 Elements:

2.1.4 - request/display for calibration data

4.1.3 - request/display acquisition event and type

4.2.3 - request measurement with acquisition specification

4.3.3 - request data with readout specification

- 2.4.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for the developing a new ACNet Calibration mode console application program including:
- Calibration mode configuration,
 - Calibration measurement request,
 - Calibration data TBD analysis,
 - Calibration data display and

- TBD.

2.5 Engineering Support (**TBD**)

2.5.1 Initial Dependencies: Front-end Design

2.5.2 Elements:

2.2.4 - request/display for diagnostic data

2.5.2 - engineering parameters PMI

4.1.3 - request/display acquisition event and type

4.2.3 - request measurement with acquisition specification

4.3.3 - request data with readout specification

2.5.3 Description: Provide design, appropriate documentation, implementation, testing and commissioning support for developing a new ACNet Engineering Support console application program including:

- Diagnostic mode configuration,
- Diagnostic measurement request,
- Diagnostic data TBD analysis,
- Diagnostic data display,
- control interface for all BPM engineering parameters,
- monitor interface for all BPM engineering parameters and
- TBD.

2.6 Circular Buffer Analysis (MI)

2.6.1 Initial Dependencies: Front-end Design

2.6.2 Elements:

3.2.3 – any TBD analysis and display

2.6.3 Description: TBD

End.