AD / Instrumentation Status Mtg.
January 22, 2019

We discussed the status of the many projects that we are working on.

The text below can be expanded or collapsed at the date headings.

## Linac Toroid Firmware Update and Maintenance

### Oct. 30, 2018

Dallas reported that the Linac Toroid system had two digitizer channels, 4 and 8, that were not reading back.

### Nov. 6, 2018

Aisha and Dallas will be installing a new digitizer for the Linac Toroids. There is an issue with the timing when they shorten the number of Booster turns being delivered by the Linac. The problem needs to be reasoned through.

### Nov. 20, 2018

There is a FPGA timing issue with two of the channels on the digitizer boards. In order to provide enough digitizer channels that do not have this issue, a second digitizer was added to the crate. Alexey has given Aisha another version of the FPGA code. This new code is more streamlined than the current code in these boards. Aisha has been running some Matlab simulations on the code for different modes of operation. Mike Kucera is looking at doing some calculations in the Front End processor that are being done now in the FPGA.

### Dec. 4, 2018

All the above problems have been addressed.

Going back to the original effort to upgrade the firmware. There was a first pass on this new firmware and Aisha has provided Alexey with some additional comments on the software and some more modifications.

### Notes from Dec. 14, 2018 email.

1. Back in November there was a timing issue with two of the

digitizer channels at a certain location.

Which Linac devices or location were these channels for?

Are these working the way they should now?

It was reported that L:D7TOR grew “nosier” when the Linac was switching in between modes. After further investigation, Mike Kucera and I suspected there is a setup/hold violation in the FPGA realization of these last 2 channels. The registers were not latching any stable values, although external timing as well as  the beam signal’s amplitude and noise were consistent between the good and bad channels. We confirmed our suspicions by moving the L:D7TOR to the first ADC.  Mike and I regularly fast time plotted L:D7TOR and didn’t see the issue return. This is the only location in which we use almost all the ADC channels; usually only 1 or 2 channels are used. Ultimately, we split the High Energy Toroids across 2 digitizer cards. L:D0-3TOR on one;  L:D4TOR, L:D5TOR, and L:D7TOR on another. In addition, we moved L:D7TOR to ADC1 of the second digitizer. Since then, I have been periodically checking the datalogger and have not seen the issue on any of the High Energy Linac Toroids (L:D0-7TOR).

1. This month there was an issue (at tank 4 ?) where a beam present gate was failing intermittently. Did this get resolve or are you waiting for new FPGA code?

The issue at L:TO4IN is definitely related the edge detector. When the beam present signal fails,

* there are drop outs in the current readout while the intensity is holding constant
* also the scope confirms the beam present signal is absent while there is a no timing and amplitude change in the beam pulse
* as a result of missing the beam present signal, the feedback signal to the LLRF is overdriven and there are sharp increases in the downstream losses as the system tries falsely to correct for missed beam

I have found a few problems at the location, which were quickly corrected. However, none of them improved upon the beam present issues. I have been reviewing/simulating  the edge detector code as well as the schematic for that output, but I have not found any issues yet.

1. I remember hearing that you were close to having a consistent

installation of Firmware in all the toroid systems.

Do I have this right ?

All toroids reading back thru VME systems, with the exception of PXIE and IOTA, are running the same standardized system typology and firmware.

1. Alexey is writing new FPGA code.

Are these modification Linac specific or will they be more general ?

The current implementation only results in intensity measurements. The modifications are to add the current and/or pulse width measurement and the beam present output.  Although these are driven by the present Linac system, the new FPGA code is meant to be a version that can be used as part of the standard system, not location specific. These modifications will also be used at PXIE/PIPIIT

1. Where can I go and look at the Toroid firmware we are using and

intend to use ?

I believe you are referring to documentation with this question… I’ve a collection of documents for toroid systems at [\\beamssrv1\inst.bd\Public\TOROID](file:///%5C%5Cbeamssrv1%5Cinst.bd%5CPublic%5CTOROID) . In addition, Ning has a collection of firmware documentation explained at Y:\Public\NLiu\01\_Information\_on\_the\_other\_folders

### Dec. 18, 2018

Dallas will be working with Mike Kucera on replacing a digitizer for L:TO4IN. They will calibrate this toroid afterwards.

Also Alexey reported that he was working on the changes Aisha asked for and expects to be done in a couple of days.

### What is the status of LINAC edge detection code and the Beam Valid signal ?

### What is the status of the new toroid firmware Alexey has been working on ?

## Current Booster Damper Operation

### Oct. 30, 2018

Nathan was not available to report on this.

### Nov. 6, 2018

Dampers are working, but Booster believes they were working better before the shutdown. The mode 2 damper has been turned off until more analysis can be made as to how the curves are setup.

### Nov. 20, 2018

No change.

### Jan. 22, 2019

Nathan has started spending time on the Booster Damper operation. Booster is wanting to go to higher intensities and need better damping. Nathan says there is no easy fix. The system needs a proper calibration and setup that will take time. He needs a good transfer function measurement.

## PIP2IT ACCT and DCCT New Installation.

### Oct. 30, 2018

Dallas reported that they are waiting for some cable pulls. I believe ACCT and or DCCT devices are being purchased(?).

### Nov. 6, 2018

No change

### Nov. 20, 2018

The ACCT has been purchased and the order for the DCCT is now in purchasing.

Had a visit from Bergoz to talk about CWCTs. Several people thought that this device would be useful, especially for the Muon slow spill extraction. Further consideration should be given, and someone will need to find it sufficiently impelling to put out the money for this. Brian Fellenz is going to see if Bergoz would be willing to lends us one of these devices for testing and evaluating.

### Jan. 7, 2019

Vic reported that the ACCT has been ordered, but the DCCT has not. The DCCT order is being held until the money is found. PIP-II will not run beam until April of 2020. So, money for certain things is not going to be available this year.

We expect to be checking out the new ACCT in April or May of this year. The request for the cables has been put in with Kermit Carlson and Jerry Leibfritz, and it is now up to them as to when these go in. There are many other cables, such as BPM cables, whose cable pulls need to be coordinated.

## FAST IOTA DCCT Calibration

### Nov. 20, 2018

This calibration work has gone on several times. The toroid was picking up a lot of 720Hz noise, even after remounting the toroid and cleaning up the grounding. Power supplies for the machine were fixed and the noise went away, but something was done with the cavity and now the noise is back. This issue is being pursued.

### Jan. 7, 2019

Aisha reported that each time there is an access, it is noisy for a day and then the noise goes away. During the last three accesses, for a half a day after startup it is really noisy, then it quiets down. I have not had a chance to diagnose the problem because every time she goes out there, they are either off, or it is no longer noisy.

### Jan. 17, 2019

At the end of an IOTA meeting to discuss the BPM system, the accelerator physicists wanted to talk about the DCCT readout. Sasha Valishev reported that the noise band on the measurement is approximately 250 micro-amps. Dennis Nicklaus has provided IOTA an averaging parameter, filtering in the HRM to help address this noise (30 MHz RF noise). Dan Broemmelsiek has asked for shielding around the RF cavity to address the noise. Sasha recommends spending time looking for noise from cables and connections to address the source of the noise.

There is still a 720 Hz noise. Aisha proposes going through a full power down of everything and then a sequenced turn on of the different system to identify the system (power supply) causing the 720 Hz noise.

Dan Broemmelsiek also reported that when they change their bend bus current it changes the baseline on the DCCT. Aisha has recommended requesting a synchronized TCLK event to trigger a measurement and/or an adjustment to the baseline in this case.

### Jan. 18, 2019

Asked Aisha to write an email describing her intentions for addressing each of these DCCT issues.

### Email from Aisha on the DCCT Noise Issues

The noise on the IOTA DCCT is dominantly a 720Hz component. The dataloggers are asynchronously under sampling it and shows the readout to just be “noisy”, but the 720Hz is clear when look on a scope or plot N:IBEAM at 10KHz. This signal is routed to the scope and  the 720Hz component has been there since installation, except for 2 times . One is when the IOTA is completely “cold. During controlled access when only the minimal devices are powered off, this signal is still there. The second was during Nov2018 after some work on some power supply cables. I confirmed with Brian, that he too has not seen it change .

What we have already done:

* Verified the grounding at the physical pickup head
* Moved the electronics closer to the copper ground braid; verified grounding at the electronics in the tunnel
* Disconnected the input from the x4 amplifier and verified the noise was not from the upstairs electronics
* Verified the 720Hz at the output of the Bergoz electronics signal
* Verified that 60Hz harmonics are also present in the WCM
* Grounding straps on the electronics in the relay rack as well as the heliax shield
* Added common mode choke on the dcct signal

At this point, the only course left is track down the source and isolate that from the DCCT signal. However, if 60Hz is in the pipe, there is not much to do other than filter it out and reduce the overall BW and response time  of the system.

I have already request from Dennis to recreate a moving average device. Since the OAC can only sample at 15Hz,max, with 16 samples, the response time would be about a second. If he is able to sample on a $0F, this would give slightly better performance, since it is line locked.

I will also speak to him if we can request an event on which the N:IBEAM can be sampled on no-beam times. This is traditionally how we have handled baseline shifts in the MI/RR.

Aisha

###  Jan. 22, 2019

### What is the status of the FAST IOTA DCCT noise issue ?

### Aisha pointed out that the bandwidth of the DCCT is not going to see 30 MHz from the RF cavity. Nathan explained that there is a cable connected to the cavity. We will need ways to make rigorous baseline measurements.

## MI / RR DCCT Update Obsolete Chassis.

### Oct. 30, 2018

This job is in progress. The requisition for PCBs for the transition modules has just gone out.

### Nov. 6, 2018

Work in progress. Actually, ICs on the transition modules are obsolete so a replacement is being fabricated.

### Nov. 20, 2018

New PCBs have arrived, and they are waiting on a few more parts.

### Jan. 7, 2019

Dallas is waiting on a couple of parts to come in before assembling the boards.

### What is the status of the new MI/RR DCCT circuits?

### Jan. 22, 2019

No change.

## Delivery Ring RFKO Slow Extraction

### Oct. 30, 2018

There was recently a Construction Readiness Review. The reviewers asked about the fiber optic cable that will be used for transmitting data. This cable will be run through beam enclosures and will be subjected to radiation. Peter said that they expect to use a rad-hard multimode fiber. Some have suggested using a cable used by CERN. They will be deciding on the cable soon.

### Nov. 6, 2018

No change

### Nov. 20, 2018

Approval from the Construction Readiness Review has come, and Peter and Aisha are able to spend some money now. The project allocation for the Front-End programmers’ time is being reviewed and will need to be increased to 1.5 FTE. Vladimir is trying to work this in, but the budget manager is not directly approving this. They are expecting that John Diamond and Kevin Martin will be working on this, but not in FY19.

The first efforts on this system will involve learning to use the Xilinx tools with the new hardware and working out the method of communication between the various parts of the system. There may be some need for John’s time 6 months from now.

Some of the collaborators for the project do not want us to use the old Tevatron QPM nodes. However, no one is currently willing to put up the money for something else.

### Jan. 7, 2019

When asked about the radiation hard fiber optic cable, Peter reported that they have a cable that was used before, but he believes that something else will be considered. Vic said that he had evaluated cable like this and said he could give Peter information on these.

Aisha reported that evaluation hardware has been ordered that they have received a couple evaluation boards and the Kintex board. They are waiting for the Artix7 to come in.

Peter said that there is a project timeline indicating when different tasks in the project are projected to start and stop. Peter said he will send Craig this timeline.

### Jan. 22, 2019

Aisha had gone out the California to the US-Japan Collaboration Meeting <https://indico.fnal.gov/event/19438/>

Some discussion of using machine learning with the extraction system has started. Peter was saying that with the information they were getting from J-Lab, people were learning that this is not a trivial problem. Aisha said that the Japanese are further along. They are working to get rid of their power supply ripple harmonics. They have implemented some machine learning in their control system. However, their machine is setup different from ours. Their spill is 2 seconds long where ours is only 45 milli-seconds, hence they have different effects they have to address. Peter said that the Japanese decohere the beam at flat top. In our case we have beam in buckets, and we take bites out of the emittance space of the buckets which will cause the butches to tumble and cause variations in the extracted intensity. Aisha said that one of the advantages that the Japanese have is that all of their pickups are fully instrumented. They have a very fast simulator, so they are not using their DCCT. They have put a lot of money into this. They have current measurements on all their power supplies. They, hence, have many inputs they can use in their control system.

## Muon Toroid Upgrade

### Oct. 30, 2018

Dallas and Aisha may be meeting with Muon to discuss this upgrade soon.

### Nov. 6, 2018

Dallas and Aisha met with Dave Peterson to discuss upgrading the older toroid electronics in Muon. Aisha reported that our green integrator modules are much like these old electronics they want to replace. Once funding is available, they can start installing the newer electronics.

### Nov. 20, 2018

Aisha had provided Jerry Annala an updated cost estimate for the equipment and electronics need to build an upgraded system. Nothing has proceeded from this point.

The trigger for TORF16 had been removed so that Bobby Santucci could work on the Front-End associated with this toroid. Aisha has reconnected everything and recalibrated the toroid.

### Jan. 7, 2019

Any money yet ? What is involved with calibrating what we have, including Dave Petersen’s toroid electronics ? Aisha replied that Dave’s systems are not standardized. The gains and filtering for each of the toroid pickups are different. it would take a solid man-week to be sure that they have the right calibrations signals going in to make everything look the same. Craig asked if Dave Petersen was responsible for calibrating these toroids. He is and he has to respond when things break, but his response to most issues is that these toroid systems were designed for different applications. He is not expected to work to standardize what is there.

Craig suggested contacting Dave Petersen to help determine the calibration details.

### Jan. 22, 2019

Dallas and Sushma went out with David Petersen to look at the toroid calibrations. There were some issues with the equipment at that time and they will need to go back out again. They will be working to produce a written calibration procedure for Dave’s electronics. Aisha will be going out to check calibrations on the toroid electronics designed by AD Instrumentation tomorrow, Jan. 23. Dallas had checked the DCCT’s calibration.

## 125 MHz Digitizer Firmware Upgrade

### Nov. 20, 2018

Alexey says that we will need to make a plan to update all of the 125 MHz digitizers in the field with the latest firmware. We should consider developing the ability to remotely update the firmware in these modules.

### Jan. 7, 2019

Alexey is not yet back from vacation.

### Any plans yet ? Are we ready to have a planning meeting with the knowledgeable folks?

## PIP2IT BPM Electronics Upgrade

### Oct. 30, 2018

John Van Bogaert reported that the PIP2IT BPM system is expected to inherit transition boards from FAST and FAST will be making new ones. They are currently procuring 5 prototype transition boards.

Parts are being bought for 35 new 250MHz digitizers using a combination of Booster and PIP-II money. John also warned that distributors have long lead-times on many discrete components like capacitors. If you are needing these components for a project you should check the lead-times early.

### Nov. 6, 2018

No change

### Nov. 20, 2018

PCBs for these 35 digitizers have been received and we are waiting on a few of the components before sending these boards out to be assembled. Alexey has test stands for testing these boards when they are received from the assembler. These are the 250Mhz, 16 bit, 8 channel, Arria FPGAs type digitizers. These were bought using a mix of PIP2IT and Booster money. The PCBs were fabricated by San Francisco Circuits. John mentioned that we need to be careful about the materials that we make our PCBs with. These materials, like FR-408, need to be rated for the temperatures experienced in the assembly processes, the temperature profiles for the parts going on the board.

### Dec. 18, 2018

John Van Bogaert reported that they are waiting on PIP2IT money to send out the digitizers for assembly. All of the parts are now in.

There are five prototype transition boards and 10 existing boards from PIP2IT are moving over to FAST/IOTA. The boards that are taken from PIP2IT need to be replaced by someone other than PIP2IT since they will not pay for these boards again (Vic). John Van Bogaert mentioned that there are FAST transition boards that they expect to make that can go back to PIP2IT. Vic mentioned that if new boards are being made that will go back into PIP2IT that there may be some modifications that can be made. There were details that Vic and John and Brian and Nathan will be considering.

### What is the status of the transition boards ? Status of Digitizers ? Status of John’s Fill-In ?

### Jan. 7, 2019

John Van Bogaert reported that there are Issues with getting money from FAST. We are waiting on filters to install the five transition boards taken from PIP-II into FAST, but they cannot pass the requisition through until the money is found. There is a coupling between PIP-II and FAST with regard to the transition boards. They are sharing transition boards and they are looking to develop new transition boards for PIP-II (with somebodies’ money?).

The 35 new PIP-II digitizers are out for assembly now. They are expected to be in by the end of January.

## Future PIP-II Instrumentation System Specification

### Dec. 18, 2018

The question as to what the final digitizer / FE processor / data link configuration is going to be, was brought up. The current VME backplane data transfer is not expected to be the future system. Nathan offered that the ethernet connection on each digitizer could be used through a switch. This is something that could be tested. John Diamond said that we could also consider a direct PCIe connection to the processor card through a daughter board, like what is proposed for the delivery ring extraction.

Nathan said that he would like to demonstrate the ethernet to switch to processor topology in either Booster or IOTA in the near future.

Craig proposed that we start having meetings starting in mid-January. There was general agreement to this.

### Jan. 7, 2019

Craig still has not arranged this meeting and is now hoping to schedule the first meeting by mid-February. Additionally, we are hoping to have a meeting to develop specifications for a new UCD, universal clock decoder module to be designed by AD/Controls.

### Jan. 22, 2019

Nathan mentioned his idea for trying rackmount PC boxes. Craig said that we should consider a written specification first, but the PC idea is a contender. We discussed specifying Gbits per second or samples per second or … .

## Universal Clock Decoder Support Discussions

### Jan. 21, 2019

Meetings are being arranged.

## PIP2IT BPM Linux Upgrade

### Oct. 30, 2018

We will need to procure more processors. This is waiting on PIP-II money. To develop the code, they will need specifications regarding the firmware on the digitizers and soon after some digitizers running the firmware to develop/test the new code.

### Nov. 6, 2018

No change

### Dec. 18, 2018

New processors are still waiting on PIP-II money. Vic mentioned that the PIP2IT schedule has them running beam in April 2020. We need to have things put together by then.

### Jan. 7, 2019

Any money for processors yet ?

Vic said that there is no money for this yet since the beam run has been delayed until next year (April 2020), but if something is needed for development, they can see what can be done.

### Jan. 22, 2019

Craig asked whether we will need to request money to buy processors to work on this this year. John Diamond did say that he will be talking to Vic about getting some money this year. John and Nathan concluded that this crate will need an all new front-end with new drivers. John will need to buy an 8100 processor.

## IOTA BPM Operation

### Oct. 30, 2018

Brian Fellenz reported that they will need new transition boards next year when they expect to switch from accelerating electrons to accelerating protons. This will be a new transition board circuit for which they do not have all the information for yet. We should discuss with Jerry Leibfritz whether they have money in their project for these.

### Nov. 6, 2018

Nathan reported that IOTA was previously only measuring the injected beam, but now need beam position measurements for the orbit and kicked beam. He estimated a week of work to start getting these measurements. They currently have new firmware and they need to get the new FE software to go with this.

### Nov. 20, 2018

There have been some Firmware updates. Alexey mentioned that they are working to keep the digitizer sampling in sync with the beam, but there have been changes to the RF that forced them to go back into the FPGA code. It was previously expected that the RF would be at a fixed frequency.

### Below is a note from Nathan just before Thanksgiving week.

Hello,

The new firmware for digitizers and timing board has been installed in IOTA. The new system allows injection tbt, stored beam tbt via kick (trigger not hooked up yet), and stored beam orbit tbt. The stored beam measurements rely on the injection measurement for timing and to calculate baseline for each adc channel for background subtraction. For the background subtraction to work properly, the ring needs to be empty on injection – ie, inject with no beam to clear ring, then inject with beam. Preliminary software was also installed today which collects the injection data on the $A6 nml clk event and reports the data back to ACNET. The plan –

- Fix some issues found with current readout (John working on)

- Implement scheme to request stored beam tbt (orbit tbt) via the system state device (John and Chip can set this up)

- Implement the stored beam kick measurements after Thanksgiving

The data for each measurement is readback via array devices for each bpm as before

- N:IBxxxH[0:2095] horizontal position

- N:IBxxxV[0:2095] vertical position

- N:IBxxxS[0:2095] intensity

Where 0 is a placeholder for the future and element 1 is the first turn, etc. The devices should update after each measurement.

I didn’t get a chance to adjust the analog input attenuators. To improve S/N on stored beam these can be set to 0. Brian Fellenz can set this for the A2R-A2L bpms on request. Note, the A1C bpm is a special case and can be set via the nmlbp3 front-end using the board 2 address.

I will be reachable via text or email if trouble shooting is needed. The local experts –

System Infrastructure (pickups, cables, etc) – John Van Bogaert

Analog Modules – Brian Fellenz

Digitizers – Alexey Semenov

Front-end and ACNET – John Diamond

Backdoor diagnostics – Duane Voy

Regards,

n

### Dec. 18, 2018

There has been some success with improving the signal to noise on the IOTA BPMs by adding a pre-amplifier. At this time there are 6 BPMs with pre-amplifiers. With these they were able to collect TBT data and measure a tune for the first time.

There was also a non-linearity found in the log intensity measurement being made on the BPM transition board. They are considering, possibly, linearizing each module with a look up table. The solution is still under consideration. The linearity issue had not shown up in the original bench testing, but the changing beam intensity uncovered the response.

### Procurement Issue Raised by Jerry Leibfritz

**From:** Jerry R Leibfritz <leibfritz@fnal.gov>
**Sent:** Wednesday, December 19, 2018 2:49 PM
**To:** Craig C Drennan <cdrennan@fnal.gov>; Alexander A Valishev <valishev@fnal.gov>
**Cc:** Jerry R Leibfritz <leibfritz@fnal.gov>
**Subject:** Fwd: Purchase Requisition is ready for FAST BPM's - for additional channels.

Hi Sasha and Craig,

I just received a couple req’s from Bogie for FAST BPM’s ($2.6k & $2k).  Year to date we have spent ~ $16k on BPM hardware for FAST and these will bring that total to ~ $20k.  With the potential scope changes at FAST/IOTA due to budget issues, I wanted to make sure that everyone was on the same page as to what the plan is for BPM’s this year.  I personally am not sure what the current plan is, so that is why I am sending this email.  I will hold off on approving these until I receive further guidance.

Thanks,

- Jerry

### Jan. 7, 2019

An IOTA BPM Technical Review was held. This was informative and helpful in addressing questions on how to move forward, but more meetings will be needed to determine the scope of the near term work.

Minutes for the Review are available at <https://indico.fnal.gov/event/19299/> and the minutes of a follow-up meeting on are available at

<https://beamdocs.fnal.gov/AD-private/DocDB/ShowDocument?docid=6955>

Brian reported on what they were currently working on. They will continue to pursue using the RF detector, working in the most linear range of the device. He expects to be doing linearization/calibrations of each RF detector channel. The beams doc document linked above has many more details.

### Jan. 22, 2019

John is working on the new software now. He was having trouble getting the Timing board to send a trigger to the digitizers. The soft trigger is not working. They had found out that some of the pre-amps had inductors and some didn’t, causing different responses. This was causing millimeter offset in some of the positions. They saw this during the quad scans. They removed all the inductors. Nathan is also looking into the difference over sum calculations for the firmware and looking into the modifications needed for the analog front-end boards.

## Booster BPM Upgrade

### Oct. 30, 2018

Many things have been fixed. There is currently a data collection problem where data collection will fail between 1 minute to 30 minutes after starting. Peter mentioned an issue related to when they give an enable to acquire the data.

Peter believes the problems with the Timing Cards have been solved.

The port of the Linux Front-End to the 8100s is completed and John Diamond is happy with the way it has been working. All the BPM houses in booster are using the 8100s now. They have reclaimed all the x86 nodes.

### Nov. 6, 2018

Peter reported that the previous data collection failures have been cleared up. Now they are troubleshooting an issue with differences between when sets of data from different houses are collected and/or time stamped. The are seeing 2ms differences between houses on event $1D Booster cycles and as much as 100ms on event $13 Booster cycles. John Diamond is spending time on this.

### Nov. 20, 2018

Peter has been working to design the perfect TClk decoder for his timing module, but things work upstairs but not in the Booster Gallery. He has requested some hands on help from Greg Vogel in AD/Controls.

### Dec 18, 2018

Booster BPM front-end processing has an issue where a process is getting into a loop taking to much time. John Diamond is currently working on this. Otherwise the system is taking data and we are now looking into calibrations of the individual BPM measurements.

### Jan. 7, 2019

Are there still timestamp issues ? Any other issues ? Are calibrations in the list of things to do next ?

John Diamond reported that they still have a “sticky” ACNET problem. John said that the problem does not involve AD/Controls at this level.

John was able to fix things up well enough to satisfy Booster for now (?). John was able to switch back to doing IOTA software things, along with things Elliott was doing for IOTA.

### Jan. 22, 2019

John says that it appears that all of the Booster BPM issues have been solved.

## PIP2IT RF Interlocks (HWR / SSR1)

### Oct. 30, 2018

Jim Galloway has been procuring parts and preparing to build one of the boards for the HWR interlocks. This is a lowpass filter on the forward/reflected power measurement (?). They are currently not working on the FPGA board. The RF interlocks for the HWR need to be ready to test in January 2019. The SSR1 RF interlock system still needs a budget and we are not cleared to purchase parts for this system.

### Nov. 6, 2018

In progress.

### Nov. 20, 2018

Jim Galloway is continuing to build and test boards for the interlocks. John Seraphin has been designing and has ordered top feedthrough panels for the electronics racks.

Peter also made a request for some of Yesenia’s time for assembly of RF interlock boards.

The current schedule for RF testing where the RF interlocks need to be in place is April 1, 2019 for the HWR testing and January-February 2020 for the SSR1.

### Dec. 18, 2018

The PO’s for the SSR1 are being made. We are waiting for PIP2IT money to by the PCBs and assembly for the HWR interlocks. HWR interlocks are expected to be in place by April 1, 2019.

Peter is redesigning the Quench Protection Circuits. Peter did some tests with Elvin, quenching the LCLS system. He could see the signals so that he understood the signals he needs to design inputs for. Brian Fellenz will be re-laying out some input channels for Peter.

### Jan. 7, 2019

Did the RF Interlock boards get assembled ?

Jim Galloway reported that work has just been approved in the FY19 budget so things can now move forward. We currently have a requisition in to have the boards assembled on the outside. The PCBs and the components are in hand.

Quench Protection ?

Peter reported that they had done some tests and found some gaps in the firmware and went ahead and rewrote it. Peter and Elvin will be testing this code that afternoon.

Brian Fellenz re-laying out some boards?

Jim reported that Brian had completed the layout of the “Fan-Out Board” and that he has put together the requisitions to get the PCBs fabricated. Peter had a quench protections circuit that he wants added to the “Multi-Trip board” (aka the Forward Reflection board). He has asked Brian Fellenz to add it to the Multi-Trip board. Brian had not started on this modification yet.

This added quench protection circuit is part of the SSR1 interlocks and is critical to this cavity because the power levels in the SSR1 are higher, in the 3kW, 5kW range. Peter considers the SSR1 as the test bed for the PIP-II, and that is where he really wants to prove the quench protection system

### Jan. 22, 2019

Jim Galloway is still putting together the kit for the Fan-Out boards to have them sent out for PCB fabrication and assembly. Requisitions for this work have been put in. These are being done at “Best Proto” in Elgin.

Peter was able to detect a quench with the new quench protections circuit. Peter is reworking the circular buffer that he has in the firmware of the Multi-trip board. We are still waiting for Brian Fellenz time to put this circuit into the PCB design of the Multi-trip board /Forward Reflection board.

## Mu2e Delivery Ring BPM Upgrade (Future)

### Oct. 30, 2018

Mu2e needs to come up with money and help provide a specification of the new system. Niral reported that the current system is only able to record up to 7 turns of beam. Duane Voy has looked at the code and felt that they may be able to get up to 15 turns, but no more.

### Nov. 6, 2018

No change

### Nov. 20, 2018

Niral mentioned that they finally have been going around the delivery ring without losing its structure and they will now start looking more closely at the BPMs. Last week they had found BPM channels not working. There were 3 bad ones in the transfer line. Two of these were due to cable/connector issues that Yesenia helped fix. Then they had to change out some electronics in the delivery ring. There was also a bad power supply capacitor on a backplane.

Craig asked about how digitizer channels typically fail. Alexey said that it is often a broken connector or a component on the backside of the board that was damaged while inserting or removing the boards.

Q: Delivery Ring BPM system remote reboot? DBPM50 (Duane)

### Dec. 4, 2018

Niral is planning to setup test stands for developing this Mu2e BPM upgrade.

### Jan. 7, 2019

Niral said that they have not had any more meetings. Vic asked why the BPM system was limited to 15 turns. Peter replied that originally the Echotek boards used in the delivery ring used FIFO memory, unlike the ones in the Main Injector that used Dual-Ported RAM. It takes more time to get the data out of these FIFO memories. There was an issue with the DMA process and the FIFOs.

Here, Peter is hoping to upgrade the recycler to new digitizers and use the newer old Echoteks to support the Delivery Ring and provide more spares to extend the Main Injector BPMs.

This would be one option.

## Current Delivery Ring BPM FE Code

### Oct. 30, 2018

Waiting. Peter mentioned that we were going to try to write code to build a closed orbit with the system we have now.

### Nov. 6, 2018

No change

### Nov. 20, 2018

No change.

### Dec. 4, 2018

Niral reported that they had met with the machine folks last Friday. There was a request to be able to provide an on demand orbit snapshot measurement. Duane has been working on this.

### Dec. 18, 2018

Currently we are unable to get the enough of the UCD PMC timing boards we need for the Delivery Ring BPM systems. The machine physicists are requesting more orbits be measured. Craig McClure is currently redesigning his TCLK decoder. There is a concern that he will be leaving town next week.

### Jan. 7, 2019

Did we solve our software and UCD board issues ?

Niral was saying that Duane Voy had been off over the holidays. He said that Craig McClure had some more UCD modules, but they needed to be tested. Niral wants to update the UCD modules in service now because they are not all running the same firmware. With Duane’s help he needs to test Peter’s new closed orbit filter.

Craig will be setting up a meeting with the Controls group to discuss UCD support issues and future clock decoder strategies.

Niral is still working to put together a test stand but needs another UCD timing board.

### Jan. 22, 2019

I need to talk to Duane to see where the issues are.

## VxWorks 5.5 to 6.4 Conversion

### Oct. 30, 2018

Bobby Santucci has joined us and has started on this effort. He has begun inventorying the nodes that need the conversion. He has identified 100+ front-ends.

### Nov. 6, 2018

In progress

### Nov. 20, 2018

Bobby has been setting up crates to prepare for testing three types of systems. He has code compiled for these three different systems that is ready for testing. The three systems are Recycler BPMs, MI Beam and MI BPMs. He has the test stand mostly setup and is waiting to cable in timing signals.

### Dec. 4, 2018

The work is progressing. There are Kernel issues. Bobby is putting together a list of the things that need to be addressed. He is hoping to develop a general purpose Kernel (MVME 5500). These things are being discussed with Dennis Niklaus. There are issues with the licensing and the platforms we are using VxWorks on. Mike Slizniak is working on these things for some time. One issue is that Recycler and Main Injector BPM systems use a kernel written by the Computing Division separate from the AD/Controls department. As a result, there are issues trying to use the 6.4 5500 kernal from the Controls department for these BPM systems.

Currently, the only programmer in the Controls department is Mike Slizniak. We are trying to raise the level of attention for this kernel work.

### Dec. 18, 2018

The list of things to address with the MI/RR BPM 5500 kernel is getting longer. Bobby is find some work arounds to move forward until a new kernel is available.

### Jan. 7, 2019

Bobby Santucci reported that things were going well. The Recycler BPMs are upstairs running on a test node. There is one issue they are trying to solve with the Data Pool Manager (DPM) before pushing out the new code to all the houses.

With regard to kernel support, with version 6.4, the issue is running out of memory. Bobby is not sure what is in the last 100 Mbytes of the kernel they are using, but they just can’t get to it. They are getting around this by decreasing the number of buffers that they allow from 400 to 300. Things are working, but when they get access to the 100 Mbytes, they can raise the number again.

### Jan. 22, 2019

Bobby tested out some of the nodes last week. They are still having kernel issues. John and Bobby will be meeting with AD/Controls about this. One of the kernel problems is that the memory window for the VME A32 address space is not large enough. There was a trade-off made between IO space and RAM space in the A32 address space. Bobby is looking to set up a Main Injector test stand in one of the crates upstairs.

## PIP2IT Wire Scanner Negative-Bias Circuit and PIP2IT Intensity Monitors (Scrapers, Ring Pickups, Faraday Cup, etc.) 50 Ohm Modifications

### Oct. 30, 2018

Andrea is working on this currently and needs to complete this project by January 2019.

### Nov. 6, 2018

In progress.

### Nov. 20, 2018

Andrea has designed a negative biased version of the transimpedance amplifier circuit. She is getting close to sending out for the new PCB.

Additionally, there is absorber instrumentation to be put together, as well as updates to the Machine Protection System.

### Dec. 4, 2018

Andrea has recently made changes to the schematic and board layout. She is ordering the new PCBs and will soon be ordering the parts for the boards and then the parts for the chassis.

### Dec. 18, 2018

Parts have been ordered, boards are on order. There was some difficulty ordering the parts from Newark, through eMarketPlace. Andrea is currently working with Mechanical for the chassis layout. Vic pointed out that the run schedule for PIP2IT had changed from running in Jan. 2019 to April 2020. Andrea said she wants to push ahead and get this project completed.

### Jan. 7, 2019

Andrea is waiting on parts to arrive.

### Jan. 22, 2019

Andrea had some trouble getting parts from Newark.

## PIP2IT Schedule

### Nov. 20, 2018

### >>> New Project Schedule

**From:** Fernanda G Garcia <fgarcia@fnal.gov>
**Sent:** Saturday, November 17, 2018 1:49 PM
**Subject:** PIP2IT program - New end date \*\*OCT'20\*\* to support HB650 protoCM test

Hi all,

After a careful and extensive discussion among Project Office members and all L2s, the plan for PIP2IT was changed yesterday.

Modifications:
1) Beam run period originally scheduled for Jan-Mar'19 was canceled
2) PIP2IT will run beam thru both HWR and SSR1 as schedule in **April'20**
3) Beam running period will be **6 mths** rather than 12 mths
4) PIP2IT program **ends late Q4FY20**

With these changes, the Resonance Control and LW, which are part of the critical technology map, will be demonstrated by end of FY20.

Based on all scenarios discussed, I am glad that we were able to secure the 25 MeV beam running demonstration at PIP2IT. We are positive that with the continue support of all of your hard work and dedication to the project, the next beam run period will be as successful as the previous one.

Cheers,
Fernanda and Paul

### Dec. 4, 2018

Nathan mention that if PIP2IT will not be running beam this year he may borrow the BPM transition modules for use in IOTA.

Jan. 7, 2019

Vic said that they are still expecting to put the HWR in around April 2019 and SSR1 to follow soon after that. They will cool them down and try to run RF in them. Beam will not be run until April 2020.

## High Radiation Cables and Connectors

### Nov. 20, 2018

Andrea is investigating the procurement of radiation hardened connectors that use Rexolite instead of Teflon. SHV Connectors using Rexolite have been used by the vacuum pumps and found to last longer. Andrea is currently trying to get a distributer and a quote for buying some of these connectors. There is not currently a known part number for a BNC version of the connector (true?).

Andrea is also looking into the other sorts of rad hardened connectors.

### Dec. 18, 2018

Andrea got a price from Winchester on some connectors that would be $130 each. Vic mentioned that the high radiation components would apply to the rewiring of the **PIP2IT dump**. He expects this area to be hard hit in the future. The dump will get a lot of beam and become very hot. The current dump will be reused.

### Jan. 7, 2019

Andrea has been looking at an additional company, Huber and Suhner.

## Laser Profile Monitor

### Oct. 30, 2018

Vic was not available to comment, but Todd Johnson reported that he had provided Vic some CCD sensors. They plan to have more discussions soon.

### Nov. 6, 2018

Vic reported that they are putting together pieces of the laser profiler in the A0 laser lab and doing some testing. The laser hut is together, and they are needing to do some work on the design of the interlocks. PIP2IT is not expecting beam until early 2020.

### Jan. 7, 2019

Not much has been done in the last 6 weeks. This does have money in FY19 to work on this.

## Linac Laser Notcher

### Oct. 30, 2018

Todd reported that they had made some timing changes before they reinstalled it and that has improved the readbacks of the laser posit*ion*. Working on the new laser notcher LDRD.

Todd has received additional requests from NOVA to resurrect the old Tevatron hydro static level for their beam line. He has found some of the heads and some of the readback chassis. He is hoping to hand this all over to NOVA people. He has also received requests from Mu2e to provide temperature readbacks for their target.

### Nov. 6, 2018

Todd reported that nothing new has been done with the laser notcher this week, but it has only been running at half power since it was turned on after the shutdown. They have a crack in one of their stacker crystals. They are expecting to receive a replacement in the next week or two.

### Nov. 20, 2018

Todd Johnson reported that they have received the spare/replacement for the cracked stacker crystal. This cracked crystal has been preventing them from running the laser notcher at full power. They will need a couple hours of down time to install this. Dave Johnson is wanting to prepare a spare cavity just in case the mirrors are burned again when they go to full power. They are currently setting up a test stand at A0 to get this cavity aligned and ready to go.

### Dec. 4, 2018

Todd Johnson is waiting for an opportunity to install a new cavity with a new stacker crystal into the Laser Notcher system. The current one is cracked preventing them from running at more that half power. This is expected to be a quick change.

There are thermal effects causing movement of the laser trajectory position detectors. The opening of the roll-up doors is contributing to the temperature swings. This is not completely unmanageable since the RFQ will trip off, with the temperature change before the laser notcher.

### Dec. 18, 2018

Todd Johnson was able to access the laser notcher and replace the stacker crystal and a special mirror component whose coating had begun to peel off. An email on this is below. The laser notcher is back in service.

### From: Todd R Johnson <tjohnson@fnal.gov>

Sent: Thursday, December 13, 2018 9:58 AM

To: Craig C Drennan <cdrennan@fnal.gov>

Subject: Laser damage FYI

Hi Craig.

   I thought you'd be interested in seeing what the problem was with the notcher on Monday.  This is the first mirror after the final amp stage, but it's not the highest power density point in the system.  The coating was hanging off in shreds.

We have determined that this mirror came from a different mfr than most of the ones we use, and their damage specs are quite a bit lower than the other mirrors. This one had probably seen almost a year of service though.  One remaining problem to address is that we were sending leakage light from the back of this mirror to a photodiode and integrating sphere, and these devices seem to have suffered a bit. I guess they didn't like getting 70% of the laser power instead of 0.1%.

We'll probably open things up again on Tuesday during the maintenance period, check the other mirrors, and swap out the photodiode.

### Jan. 7, 2019

Todd Johnson reported that the Laser Notcher had been running well. They have been in discussion with some of their amplifier vendors working on specifications for the momentum collimation application.

## Laser Notcher Labview

### Dec. 4, 2018

David Slimmer has been working on the Labview code for the Laser Notcher. We will eventually need to train someone else in maintaining the code, or we will need a replacement readout system.

### Jan. 7, 2019

Dave Slimmer had installed another version of the LabView software that morning. It appears to be working well.

The laser notcher has been stable. The only issues are related to some readback calibrations and that, occasionally, the dump energy meter stops reading back. There have been some changes to how this is reset.

### Jan. 22, 2019

The laser notcher has been working well. There had been some readback issues, but Dave Slimmer tightened up some loose USB connections and now everything appears to be reading back.

## Laser Working Group

### Nov. 6, 2018

Vic is currently organizing a laser working group. Their first meeting may take place next week. The email list for this group currently includes Vic Scarpine, Randy Thurman-Keup, James Santucci, Todd Johnson, David Johnson and Craig Drennan.

### Jan. 7, 2019

Vic said that they should probably have another meeting in the near future.

## Laser Momentum Collimation LDRD (FLN, Future Laser Notcher)

### Dec. 4, 2018

With regard to the new LDRD to investigate the laser momentum collimation, a requisition for some custom optics had been made, but it was found that procurement had not yet put the PO in. There is expected to be an 8 week lead time on this order. The requisition was put in 8 weeks ago. It seems that there was a typo on the part number and procurement had set it aside and not contacted Todd to correct the part number.

### Jan. 22, 2019

Dave Slimmer has been helping Dave Johnson with Labview things for this project.

## Muon Schottky Tune Measurement

### Oct. 30, 2018

Brian and Vic will be trying to coordinate beam studies in the Muon beam line.

### Nov. 6, 2018

Vic is planning to give Brian Drendel and the rest of the Muon people a plan with regard to the beam requirements for doing the testing. 8GeV protons in the delivery ring are required.

### Nov. 20, 2018

Muon Schottky detector measurements are being made this week. 8 GeV beam has been established. Brian Fellenz was finally able to see a tune signal. The signal levels are extremely low. The operators would detune the ring and he was able to see the tune signal move. The detector is tuned to a specific, narrow, frequency range and they modified the RF frequency to be within this range. The tune was found at 0.85, where they were expecting it to be at 0.65. The revolution frequency is around 590kHz. They look between the 36th and 37th harmonics of the revolution frequency (~21MHz). There is an issue of the pre-amplifiers saturating. More study will be going on next week.

### Dec. 4, 2018

Brian Fellenz reported that previously they had been looking at the lower tunes and then they moved the detector resonance to capture the upper tunes. The upper tunes came up stronger. They are currently looking at the signals above 21 MHz. Last Friday, Nov. 30th, they down-converted this 21 MHz signal down to baseband (~300kHz to 400kHz). Vic Scarpine had bought a 24 bit digitizer evaluation module. Craig asked about the expectation to create a requirements document that spells out the trade off between achieving a certain signal to noise for the measurement versus how fast the measurement can be made.

### Dec. 18, 2018

Vic and Brian have the 24 bit ADC eval wired in, but they have not had a chance to test this yet. A lot of time has been taken by PIP-II meetings and other things. They have been talking to the Mu2e people to get some more study time to get some better numbers, to complete the system design. They hope to go out again this week. After g-2 experiment starts up again, study time for the Schottky measurement will be rare.

### Jan. 7, 2019

Vic reported that they have not been out to make any more measurements because of the loss of the 2.5 MHz RF. They do have the 2.5 MHz running again. They will be looking to go out and look at things again soon. It does appear to be working. He is currently having trouble downloading the software for his ADC evaluation board. Vic is considering putting in a help ticket and going to get help from Nino.

## PIP2IT New RWCM / Toroid

### Oct. 30, 2018

This wall current monitor has not been decided on yet and specification will be needed before Brian can move forward with this.

### Nov. 6, 2018

Vic reported that a new wall current monitor is going to be designed. Brian Fellenz and Aisha will be involved in the design work.

### Nov. 20, 2018

No change

### Dec. 18, 2018

Vic has money in the budget estimates for this wall current monitor, but whether they get it or not is not yet known.

### Jan. 7, 2019

This has been put off until 2020. Vic will talk to Brian Drendel because they may need to order pieces of it before then. Vic remembers there being some long lead time items.

## MI BLM Code Modifications & Studies

### Oct. 30, 2018

Randy will be looking to do turn-by-turn loss studies in the future.

### Nov. 6, 2018

No Change

### Nov. 20, 2018

No Change

### Jan. 7, 2019

Randy was approached by Dave Vander Meullen about resurrecting a feature of some kind that Randy believes the new system could do.

### Jan. 22, 2019

no change.

## LBNF Hadron Monitor

### Oct. 30, 2018

Randy has been holding monthly meetings. There are no plans yet, to do prototyping or prototype testing here at Fermilab.

### Nov. 6, 2018

No Change

### Dec. 18, 2018

Randy reported that the Chinese are working on their physical mockup of the monitor strips to test for sag and deformity due to temperature changes. He has held off having meetings until they get results from this test.

### Jan. 7, 2019

Randy will check up on the Chinese. He will schedule another meeting when he returns from UPAS.

### Jan. 22, 2019

Meeting will be after the Chinese New Years week.

## Muon Beam Loss Monitor (BLM) work.

### Nov. 20, 2018

The Muon BLM work is still proceeding. All of the cables have been run but has only been terminated with ion chambers installed where beam line elements had been installed during the shutdown or previously. We are in need of assembled and tested ion chambers. All ion chambers need to be put under high voltage for an extended amount of time and observed to see if the capacitors are going to leak. Some ion chambers need to be radiation source tested. Some ion chambers need to have their connectors repaired.

### Dec. 18, 2018

No Change

### Jan. 22, 2019

Randy said that Brian has asked that one house in the delivery ring be switched from the scintillator/PMT style loss monitors to the ion chamber type BLM detectors. The delivery ring is setup with both types. Cables just get moved and scale factors changed (?).

## NUMI Target Alignment BLMs

### Oct. 30, 2018

Gianni reported that the target alignment BLMs will be undergoing refurbishment and testing at TSB. Katsuya, from the Target Systems Department will be developing new testing procedures to be used before the BLMs are installed for future target alignments.

### Nov. 6, 2018

Waiting for access to retrieve the BLM detectors from the target hall. Then they will do a post-mortem on these detectors.

### Nov. 20, 2018

Gianni and Dan have been working with YONEHARA, KATSUYA to develop these alignment BLMs. They have been looking into calibration of the detectors and readouts.

### Dec. 17, 2018

Dan and Gianni are working on the NUMI horn BLM testing and rebuild for Hiep Le.

### Jan. 7, 2019

Dan talked to Hiep Le about the BLM and their assembly. They intended to get together again soon. Katsuya is still looking to calibrate the BLMs. Dan recommended the Radiation Calibration Physics group as opposed to putting devices into test beams. Randy agreed with Dan that the best place to do the calibration would be the radiation facility. Randy said that they will be calibrating a set of BLM ion chambers in the near future.

### Jan. 22, 2019

Dan has not heard any more. Dan will be going out to talk to Heip Le to ask about the detector construction, when he has time. There are some changes to how these are wired and the connectors that go on them.

## Meson Ion Chamber and Digitizer Upgrade and Meson Electronics Update. ($50k in FWP)

### Oct. 30, 2018

Craig related that Tom Kobilarcik had specified money for upgrades in the FWP budget document. Dan said that he had not heard of a need for new BLM electronics, but had gotten requests for new Ion Chambers and SEMs. All the new digitizers for these devices have already been built. These are calibrated and ready to go. Ion chambers will need to be assembled. Dan said he is just waiting for the go ahead from the M-Test / Switchyard people. When the money comes through, they can send out for the parts for the SEMs. We can get the parts in house, get the SEMS assembled and go out and install them.

### Nov. 6, 2018

No Change. Dan has not heard anything new for this.

### Dec. 17, 2018

Dan is preparing for the replacement of the fixed target ion chambers and current digitizers. Dan has components ready to be assembled. Tom Kobilarcik or the machine people have not provided details on what should be upgraded first.

### Jan. 7, 2019

Dan had spoken with Adam Watts about changing ion chamber scale factors.

### Email About Scale Factor Change

On 1/14/2019 4:45 PM, Jason Michael St.John wrote:

Hi Dan,

Would you be free for a quick chat about 8:30 am Tuesday? From Adam's studies we know we will want our digitizers to have a 200 ms time constant (need it fast, so that 10 constants elapse before the device is read as we already do).

And we probably want S-F about 50 or 100 counts/nC because we need the resolution for our delicates, 2E11-per-pulse beam line. Over-scale is much less of a concern, and that pulse intensity is far lower than the highest that Adam was running.

Regards,

-jmsj

On Fri, Dec 21, 2018 at 9:43 AM Daniel P Schoo <schoo@fnal.gov> wrote:

We need to discuss the digitizer scale factors. Adam did the studies in the Switchyard dump line and gathered valuable data on the liability to saturate the detector / digitizer with beam intensity. For SEM service I use a scale factor of 500 counts per nanocoulomb on the digitizer. An ion chamber has roughly 400 times more charge out than a SEM for the same beam flux. Changing the scale factor to 1 pulse per nanocoulomb for an ion chamber would probably be pretty safe from overscale and still get you a good usable readout. I believe this was the requested S-F for the Switchyard dump test. Comments?

I will get some ion chambers built. We have parts, it's a matter of getting them assembled. The digitizers are done and ready except for changing the scale factor which is a one resistor modification. FYI Rick Pierce, who assembles our ICs and SPWCs, is away from the Laboratory until January. Early in January he is taking necessary medical leave for several weeks. I don't know by who or when the ion chamber assembly will be done, probably me, but you should be aware that any requests you make could be delayed for an unspecified amount of time. I will do everything I can to respond to requests but it is possible only the most high priority jobs can be serviced for several months.

I will be away from the Laboratory until January 2nd. See you next year and have a Merry Christmas.

On 12/13/2018 1:21 PM, Jason Michael St.John wrote:

Hi Dan and Rick,

We have four Ion Chambers we'd like to replace with the newer models, and switch them over to the new Current Digitizer II as well. Do they already exist, and are they paid for?

Anything else (other than access time) which will be needed to install these?

Candidates are:

S:F1SEM

F:MC1SEM

F:MC6IC

F:MT4IC (was MT4SEM)

Thanks,

-jmsj

###  Jan. 22, 2019

A list has been put together of ion chambers and SEMs that they want replaced with the newer versions. They will also be replacing all the old digitizers.

## MI-8 (BNB) Horn 4 Target Multiwire (cable termination)

### Oct. 30, 2018

Dan reported that they want to replace the 10 foot ribbon cable connection with discrete wires. Dan has gotten cost estimates for this. Chris Kelly was contacted for approval and will give Dan the cost code to go ahead and order the wire.

### Nov. 6, 2018

No Change

### Dec. 18, 2018

Dan expects to begin working on this project in the near future. Tom Kobilarcik wants to replace the ribbon cables on the multiwire with individual wires. This will require pulling and terminating 100 little wires and terminating them on both ends with 50 pin DSUB connectors. This will probably require electricians. Horn 4 is a spare for Horn 3 and needs to be ready when Horn 3 fails or otherwise reaches its end of life. Horn 3 is fairly new and might work for a couple more years, but we need to be ready.

### Jan. 7, 2019

Dan says he has the parts for this and will be working on this soon, going out and wiring up this target multi-wire.

### Jan. 22, 2019

no change

## SpinQuest Experiment SWIC and Ion Chamber Installation

### Dec. 18, 2018

Dan has this job on his list.

### Jan. 7, 2019

No change

### Jan. 22, 2019

Spoke with Gianni on Monday, January 28. He said that Carol Johnstone and Rick Tesarek were asking for an additional PWC. Gianni and Dan asked for drawings showing cable lengths. Cables will need to be pulled and terminated, electronics will be needed for upstairs and the gas line will need to be extended.

Dan ordered pressure sensors so Mech Support will know when bottles need changing.

## UTA Multiwires (6 each)

### Oct. 30, 2018

Dan reported that there are 6 University of Texas multiwires that can be refurbished. These may cost $2k each to refurbish, plus the cost of new motors.

### Nov. 6, 2018

No Change

### Jan. 7, 2019

When asked about the availability of money to do this job, Dan said that there has not been a request from users yet. We previously did not know that two of these existed. Four of them were recently moved from the 8 GeV line. This is a job that Tyler Drendel know how to do, because he had worked with Dan to refurbish the others. Tyler is at NWA. Bill Diamond is head over at NWA.

### Jan. 22, 2019

Waiting to see if anyone requests these multiwires.

## Ion Profile Monitors, IPMs

### Nov. 6, 2018

Greg Saewert is currently working on a high voltage switch for the control grid of the IPM’s. Alex Lumpkin visited Argonne last week to talk with the folks who are doing the refurbishment, recoating of the micro-channel plates (MCPs). Alex reported that Argonne has an atomic layer deposition system with which they can recoat MCPs, up to 8 inch squares. He also found out that HEP Detector Development Group at Argonne has an MCP detector lab.

### Note on MCPs from Alex Lumpkin

Hi Randy and Carl,

  I visited ANL last week and in the course of a tour of their MCP lab with Junqi Xie (HEP), we discussed their microchannel plate (MCP) characterization options and also atomic layer deposition (ALD) done by Anil Mane (Energy Syst.). It is proposed that rejuvenating the FNAL MCPs that have too low gain with ALD techniques should work.

  Junqi asked for manufacturer (Hamamatsu or other), MCP dimensions, core or channel diameter, and thickness of plate. He has a MCP gain test setup for items up to 33 mm diam (?), but may be able to adjust to the larger FNAL samples. I resisted Junqi's initial comment to cut the MCP to size  for gain testing, but Randy has indicated a sacrificial test sample may be discussed.

  In a telecon with Anil on Monday, he noted he can coat up to 8" square MCPs in his system with either Aluminum oxide (low gain, 10^5) or Magnesium oxide (high gain, 10^6). The MCPs need to have some proper high resistance and not be shorted. In this case in another run, he could probably coat two FNAL ~3-4" size MCPs in one run.

    At the moment, it is proposed that the one test MCP sample be provided by FNAL with the gain pretest, coating, and final gain test  being done as an ANL courtesy in a collaborative effort in the next 2-3 weeks. (Junqi was to check with Bob Wagner.) If the test case is successful, FNAL would prepare a purchase order/contract to cover the ANL costs of more FNAL MCP rejuvenations. It is expected this option will be less than the purchase of new MCPs.

    Hopefully, I have presented the ANL perspective properly from my notes, and you can contact Junqi (630-252-1868) and Anil (630-252-7014) or by email for details and when to provide the MCP sample for the ALD test.

    Good luck to all,

Alex L.

### Dec. 4, 2018

Randy with help from Alexey has been looking into the operation of the IPM board that provides a gate to bias grid switch. Troy Petersen had made some firmware modifications just before he left the lab, but the boards were still not completely debugged. Alexey Semenov had a look at the firmware and fixed it.

### Dec. 18, 2018

Alexey fixed the IPM switch controller.

### Jan. 7, 2019

No change

### Jan. 22, 2019

Randy will take over as the owner of the Labview licenses for IPMs.

## FAST Linac Short Range Wake Field Study Proposal

### Dec. 4, 2018

### Note from Alex Lumpkin

Hi Sasha, Dan, and Giulio,

 I attach a draft studies proposal on the topics of TESLA Cavity short range wakefield effects within a micro-pulse  (y-t) and an assessment of E-t longitudinal phase space in the linac beam. Both experiments rely on the X121 synchroscan streak camera viewing OTR from the X121 screen and the X124 screen (with the new optical transport), respectively. We indicate we may need adjustments of Q118-120 to match to X121 or X124, higher charges, and 1-50 b. I included some of the calculated cavity transverse wakefield kick angles within a micro-pulse  from V. Lebedev.

  Please advise if other information is needed. We propose to start with three shifts on each topic.

Thank you,

Alex Lumpkin

### Jan. 7, 2019

Looking to have some cables pulled or pulled back to attach some RF filters to the HOM detector boxes.

### Jan. 22, 2019

No change.

## Switchyard Resonant BPM Repairs

### Nov. 6, 2018

Niral reported that he and John Seraphin will be working to repair a noisy resonant BPM, HP100. He will be getting this job on the worklist and will be waiting for an access.

### Nov. 20, 2018

The noise problem did not change after the BPM cable connections were repaired. It was found that there was a problem with two of the digitizer channels on the 125MHz digitizer they use in the application. The BPM signals were moved to two other channels on the same board and the Front-End and ACNET devices were modified to readout this BPM.

**Niral is now programming a spare digitizer to swap the bad digitizer out. This is at location TG9.**

### Dec. 18, 2018

Kyle Hazelwood and Adam Watts has been pushing to get the instrumentation in the Switchyard working so that the beam line auto-tune program would work. Elliott McCrory has made some progress on this BPM Front-End. Elliott is still working on this. The firmware in the digitizers were first done by Ning Liu and then handed off to Troy Petersen. It is believed that there may be an overflow in the FIR filter in the firmware. The problem shows up as what seems like good position data but is not actually tracking beam. We have not started digging into the firmware, yet.

### Jan. 22, 2019

Elliott reported that Adam and Kyle seem to be happy right now. Elliott gave them a way to reset the BPMs and a way to see when the BPMs are misbehaving. They are using the auto-tune to some extent now. Niral was asked to look at the firmware. This is a 125 MHz digitizer application.

## Switchyard BLM Pedestal Issues

### Nov. 20, 2018

A couple weeks ago Gordon Koizumi got help from Randy to have a new Ion Chamber installed. The previous one had a bad pedestal bias.

Randy also mentioned that he believes that there are some software things that could be done for the switchyard BLMs.

### Jan. 22, 2019

No change.

## Updating Firmware in the 125MHz Digitizers

### Nov. 20, 2018

Alexey brought up that there are many 125MHz digitizers being used in various applications and there is now a new version of the firmware that runs in these digitizers. We will try to hold a meeting to discuss the plan and manpower for loading and testing this new firmware version in all our 125MHz boards.

### Jan. 22, 2019

We need to have a meeting to update 125 MHz firmware. There are standard FPGA functions that have been updated, but each application needs their own customized functions. The Toroid FPGA code has been standardized in the update and will be the first systems to be updated. John Diamond and Aisha will be involved with Alexey to make the plan for installing the new code. Updated modules will be tested on a test stand then implemented in the field.

The first specific application to be updated is the Toroids. Alexey and Aisha have been working on this and it is ready to go.

Next, we will need to identify the next application to address, and then a complete list of the applications and locations needing a firmware update.

## Updating Firmware in the 80 MHz, 16 chan. Digitizers

### Jan. 22, 2019

Alexey said that the 80 MHz 16 chan. digitizers used for the IPMs will also need an update.

## Cabling up the Cryo-Modules for LCLS

### Nov. 6, 2018

John Seraphin had reported that a lot of work was being done to cable up the new cryo-modules for LCLS out at CMTF.

### Jan. 22, 2019

John and Jim Galloway will need to go out and cable up another LCLS cryomodule in another month.

## Broken VME Crates

### Jan. 22, 2019

John Seraphin reported the he and Yesenia had fixed two more VME Dawn crates. The next crate has a bad fan or two. They are trying to figure out how to get at these. The have a bad Dawn Rush power supply controller. We need to figure out how to fix these. They just have one other broken VME crate to fix.

## LabView Motion Control for BPM Wire Scanner

### Dec. 4, 2018

The BPM wire scanner test stand is used to map the response of BPM detectors. The motion control for this test stand uses PCI cards and a LabVIEW interface. Jim Fitzgerald stated that there were driver support issues with National Instruments and that this needs to be investigated. The new PC we got to upgrade the computer for this test stand only had one PCI slot and we need more for the current setup. We will look into USB motion controllers or some other solution to carry us forward.

### Jan. 7, 2019

Jim has been working on finding up to date motion control for the BPM wire scanner. Craig asked Jim to put together a cost estimate so he could start identifying the money. Jim said he is wanting to determine a calibration method so the test stand can be easily program it. He is still expecting to use LabView. Jim is looking into ways to make the Windows 10 computer he recently received useful. Jim had found a PCIx (PXI ?) adapter board he believes will be helpful.

# **INACTIVE PROJECTS**

## Booster CHG-0 Bergoz DCCT.

### Oct. 30, 2018

Craig reported that Mary Convery told him that the AIP for this device will not be going through this year.

## Booster Damper AIP (Transverse / Longitudinal)

### Oct. 30, 2018

Craig reported that Mary Convery told him that the AIP for this device will not be going through this year.

### Nov. 20, 2018

Chandra mentioned that the AIP for these devices will be going through this year

## Recycler BPM Data Upgrade

### Oct. 30, 2018

Waiting.

## Recycler BPM Calibrations

### Oct. 30, 2018

Waiting. Could not recall what the issue here is.

## Switchyard Resonant BPM Intensity Calibration

### Oct. 30, 2018

Waiting.

## NUMI Button BPM FE Code

### Oct. 30, 2018

Waiting. There needs to be new hardware, firmware, processors and application specifications for this effort. NUMI has hopes to use these BPM in their machine protection at some point.

### Nov. 6, 2018

No change

## 8 GeV BPM FE Code Upgrade

### Oct. 30, 2018

Currently waiting on a specification and then people to work on it.

## 8 GeV BLM Log Amp Boards

### Oct. 30, 2018

Andrea will be working on this later in the year, after the PIP2IT run is completed.

## MI-62 Electron Beam Profiler

### Oct. 30, 2018

Waiting

## FAST Bunch Length System Studies

### Oct. 30, 2018

Waiting for machine approval to do the studies.

## MTA Refurbishment (2 BLMs, 9 multiwires)

### Oct. 30, 2018

Re-establishing MTA as a user’s radiation testing facility is still just a rumor as far as we know.

## Upgrade Gloor Multiwires to Gloor II (8 each)

### Oct. 30, 2018

This is not an active project but is on the back burner.

## BNB Expand Target Cooling Instr. Rack

### Oct. 30, 2018

This is a long term item that is waiting. This will probably not be done this year.

### Nov. 6, 2018

No Change

### Dec. 18, 2018

Dan will be working on the BNB target cooling documentation soon.

### Jan. 7, 2019

Dan had spoken with Tom Kobilarcik about the rack not being able to expand further without re-laying out the rack. This project is not expected to be done anytime soon.

## BNB Horn 5 Multiwire (money?)

### Oct. 30, 2018

This is waiting. Tom Kobilarcik has mentioned that he would like to change the design of the multiwire but has not come back with how he wants it.

### Nov. 6, 2018

No Change

### Jan. 7, 2019

This is far down the road.

# **COMPLETED PROJECTS**

## MI-8 Multiwire Repairs (switch, cable swap)

### Oct. 30, 2018

Waiting for access.

### Nov. 6, 2018

These issues will be addressed during this week’s shutdown on Wednesday

### Nov. 20, 2018

This item was corrected.

## MI12A Dehumidifier Sensors

### Oct. 30, 2018

Dan reported that this work is now complete. Munter dehumidifiers in the upstream of MI-12

## MI-12B Target Sump Water Level

### Oct. 30, 2018

Dan reported that this has been installed.

## M-Test Fiber PWCs

### Oct. 30, 2018

Dan reported that old scintillator profile monitors in the M-Test line are being replaces with PWCs. There will be some time on Wednesday, November 7, to go down and finish the hookup of these PWCs. Dan is interfacing with Jason St. James.

### Nov. 6, 2018

These issues will be addressed during this week’s shutdown on Wednesday

### Nov. 20, 2018

Investigations and preparations for the hook-up of M-Test PWCs has been going on during the one-day shutdowns. Final hook-up is expected tomorrow.

### Nov. 21, 2018

### Project was completed.

On Wed, Nov 21, 2018 at 12:18 PM Daniel P Schoo <schoo@fnal.gov> wrote:

Gianni and I removed the experimental SPWC in the air gap just downstream of MT5FP1 and transferred the services; gas, bias, wire plane signals and motor control, back to the SPWC in the original MT5FP1 location. At the MT4FP location there used to be a Fenker Proportional Wire Chamber and all of the services were still there at that location. Gianni and I reconnected everything to the new SPWC. MT5FP2, the third FPM, is still in place but no longer in service.

Everything should be ready to go when you get beam. We set the HV bias on MT5PF1 down to 1000 volts That should be good to start.

From: Jason Michael St. John <stjohn@fnal.gov>

Sent: Saturday, November 24, 2018 11:16 AM

To: Daniel P Schoo <schoo@fnal.gov>

Subject: Re: Meson beam off Wed

Thanks again, y'all. New instruments are being called MT4FP and MT5FP1, and they read out very nicely. See the profiles they contribute in the window-grab at https://www-bd.fnal.gov/Elog/?orEntryId=144539.

When I get a chance, I might be able to tweak the HV level this coming week.

Cheers,

-jmsj

## Flying Wire Storage

### Dec. 18, 2018

Carl Lundberg has these stored out at the warehouse.

## Multiwire Work for Others

### Oct. 30, 2018

Gianni mentioned the multiwire slides (linear positioner) that Gianni and Matt Alvarez are designing for Japan

Two prototype multiwires for a university in Finland. The process of getting approvals through the DOE has been difficult.

### Nov. 6, 2018

Gianni is putting together an up-to-date cost estimate and then should be able to finalize everything. He believes that by the end of December they will be able to start ordering parts for the multiwires. Two to three months later, they should be able to start building the wire-plain assemblies.

### Dec. 18, 2018

Gianni reported that the paperwork for the Finland wire planes has been completed and after some signatures, the will begin to order the components to build these wire planes.

## NUMI Toroid Calibration / Re-scaling

### Oct. 30, 2018

Dallas reported that we are still waiting for access to make the modifications that extend the high end of the measurement range of the E:TOR101 and E:TORTGT devices.

Michelle A Ibrahim

Tue 10/23, 12:33 PM

Back in 2012, the integrators for the mi/rr abort and ring toroids were modified to a full-scale of 6E13; however, somehow the numi toroids were missed.

We found a couple spares this morning and can have them ready in a week. We would probably need at a least 4hrs (though 6-8hrs would be preferred) of no beam to swap the modules and do a calibration. E:TOR101 is instrumented in MI60N and E:TORTGT is at U65.  I will put a worklist entry today, but the job could be put off until we reach higher intensity.

In addition, I would strongly urge moving the NUMI toroid to the newer VME system, which all of MI/RR and MB are using. If desired (and space permitting), we can also run the VME system in parallel with the old MADC readouts.

Philip Schlabach

Tue 10/30, 1:30 PM

For now, I have configured the ~~target profile monitor~~ (E:TORTGT?) for the NUMI beam
permit protection in place of the 101 toroid. It allows a limit of
54e12. We only need one or the other for protection and there is no
reason to prefer one over the other. Phil

### Nov. 6, 2018

This calibration of the NUMI toroids is expected to be done tomorrow, Wednesday, Nov. 7th.

### Nov. 20, 2018

All NUMI toroids were calibrated during the shutdowns over the last two weeks. Calibrations were made and double checked.

## Ming-Jen Secondary Emission Sweeping Field Test

### Dec. 18, 2018

Ming-Jen has asked Dan and Gianni to apply a high voltage to one of the planes in one of the new 8GeV multiwires. Dan made up some adapters and has applied a bias voltage to the vertical wires (disconnected from the scanner). Ming-Jen will readout the horizontal wires to see the effect of the bias voltage. This particular multiwire is acting differently from the others, so they are looking to see if there is a secondary emission problem.

### Jan. 7, 2019

Dan has completed this. Ming-Jen said this action eliminated the problem he was looking at but he did not know why. Ming-Jen will consider this more.

## Muon PWC and Ion Chamber work.

### Oct. 30, 2018

All the PWCs and Ion chambers have been hooked up except for PWCs 020, 021, 025 and ion Chamber 025. These are waiting for access.

### Nov. 6, 2018

Waiting for access.

### Nov. 20, 2018

Muon had some reverse polarity PWC they wanted to use and had the application software modified. They had trouble seeing displays after this and asked Dan, Rick and Gianni to source test the PWCs and wring-out their electronics. The applications developer finally found an error in their code and corrected the problem.

There is a PWC currently being assembled at NWA. Dan and Gianni are expecting to go out there today to run some corona tests on this unit. They will also be doing a source test.

There is another PWC going into Muon that has 48 wires instead of the usual 30 wires. Dan is looking into the best way to cable this up top the scanners.

ADDITIONALLY:

There has been some on-going work to keep the gas from the Fixed-Target style PWCs used by the Muon beam lines from leaking into the high vacuum of the Muon beam pipe. The PWC seals and cans were designed for use in lower vacuum applications. People are currently experimenting with different gases. They are using nitrogen purges in the secondary vacuum (the vacuum between the wire space where the gas is and the vacuum of the beam pipe.

### Dec. 18, 2018

PWCs 020, 021, 025 and ion Chamber 025 were on hold waiting for access. There is new safety training that must be taken to gain access. Brian Drendel may have gone in on his own to do some of the work. Dan and Rick and or Carl will be going out in the near future. Brian Drendel has a status update meeting on January 3rd.

### Jan. 7, 2019

Carl Lundberg has been doing some work at MC-1. Carl said that the PWCs 020, 021, 025 and the Ion Chamber 025 are cabled and connected to the gas system and ready to go.

Rick Pierce will be gone for several weeks. We have transferred the task of purchasing and changing out gas bottles to AD / Mechanical Support Department.

### Jan. 22, 2019

These are all ready to go and measure profiles.