Plan for re-commissioning the

Linac Bunch Length Detector

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In Linac transition region, at 116 MeV, there is one Bunch Length Detector (BLD). This device is known BLD03. In 2012 the Linac Group Leader initiated the request to the Instrumentation Group to have this system resurrect, evaluate its performance and if necessary update to a more modern and reliable technology. Since then, a modest effort was spent on this system, mainly during the 2013 summer shutdown with the help of a Fermilab Summer Student. At that time, some system functionality was verified, such as wire motor drive, signal collection and wire integrity. An example of a scan performed and signal collected are presented in figure 1.

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Below we describe our plan for getting it to produce some sort of bunch-length signal.

1. Verify ACNET parameters for
   1. Motor driving the wire into the beam
      1. L:D03BDM – BLD 03 motor position
         1. Status: working conditions. Last time checked June/2014
   2. Motors on the mechanical trombones in the Linac Diagnostic Room
      1. L:DDMOTn, where n=1, 2, 3, and 4.
   3. L:DDMOT3 – Stepper motor 3HVPS parameters for the focusing/deflecting plates
      1. L:D03HV1 – BLD 03 left lens voltage
      2. L:D03HV2 – BLD 03 right lens voltage
   4. Timing of the RF pulser trigger
      1. L:BLDRFE – BLD RF gate event
      2. L:BLDRFG – BLD RF gate delay
      3. L:BLDRFW – BLD RF gate width
2. Get ready to drive the cavity with 805 MHz power
   1. Obtain 100W amplifier – Kalmus model 1800LC-CE
   2. Obtain RF pulser
   3. Verify that the amplifier is amplifying a pulsed signal
3. Drive the BLD cavity with 805MHz power. See that there is some transmitted power (there are two RF loops in the cavity: one to drive the cavity and one to see the RF in the cavity). Measure S11 and S12 for RF loops.
4. Verify that the wire target can be moved into the beam by observing the losses.
   1. Status: working conditions: Last time checked June 2014.
5. Get signal in the electron multiplier tube (EMT)
   1. Turn off 805 MHz RF power to cavity
   2. Turn on the HVPS for the wire. 10 kV
   3. Turn on the HVPS for each deflecting plate.
   4. Turn on the HVPS for the EMT. 1.9 kV
   5. Place the wire at the edge of the beam (where we begin to see losses). Should place wire on slit side of beam.
   6. Adjust the plate HV power supplies to attempt to get a signal in the EMT. This is adjusting the focus and steering of the electrons to the EMT.
   7. When signal is achieved, create ACNET plots of
      1. Signal vs. HVPS – Left plate
      2. Signal vs. HVPS – Right plate
      3. Signal vs. wire HVPS
      4. Signal vs. HVPS for EMT
6. Turn on RF power and repeat step 5.
   1. In addition, create this plot:
      1. Signal vs. RF Power level. Range of 1 W to 20 W?
         1. Manual adjustment of RF power level with NIM module.
         2. We don’t have the RF power level in ACNET. Maybe we should put low-level RF from NIM module into a sample and hold channel.
7. Study of signal versus RF phase
   1. Set voltages to nominal values
   2. Plot signal vs. RF phase by scanning motorized trombone

From Doug Davis (2013 summer student) paper

TABLE I. A list of all parameters for BLDØ3 and there function. These parameters exist on page L20 of ACNET. The page contains parameters for all BLD’s at Fermilab. We focus on BLDØ3 here because it is the subject of this report.

Parameter Name Function Can be set / Can be read

L:D03BDM Tungsten wire position Yes / Yes

L:DDMOT1 Stepper Motor I Yes / Yes

L:DDMOT2 Stepper Motor II (non functional) No / Yes

L:DDMOT3 Stepper Motor III Yes / Yes

L:DDMOT4 Stepper Motor IV Yes / Yes

L:D03BDS The electron multiplier tube signal No / Yes

L:D01WHI The tungsten wire high voltage current Yes / Yes

L:62FT07 The sample and hold trigger for the electron multiplier tube signal Yes / Yes

L:D03WHI The tungsten wire high voltage maximum current Yes / Yes

L:D03WHV The high voltage setting for the tungsten wire Yes / Yes

L:D03HI1 The maximum current for the left lens DC supplied plate Yes / Yes

L:D03HV1 The high voltage setting for the left lens DC supplied plate Yes / Yes

L:D03HI2 The maximum current for the right lens DC supplied plate Yes / Yes

L:D03HV2 The high voltage setting for the right lens DC supplied plate Yes / Yes

L:BLDRFG The gate delay for the BLD system Yes / Yes

L:BLDRFW The gate width for the BLD system Yes / Yes

L:BLDRFE The gate event for the BLD system Yes / Yes