DRAFT

Measurement of Beam Transverse Properties in the Wiggler Insertion Line

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Procedure Overview

This procedure describes how to measure beam emittance and Twiss parameter in the wiggler insertion line. The Twiss parameters and transverse emittance are given at the compressor chicane exit. The method used is the multi-monitor method using the 5 following OTR profile monitors: ITV2F01, ITV2F03, ITV2F03A, ITV2F03B, and ITV2F05.

Prerequisites

1. Set the charge to 135 pC (resp 60pC)
   Pulse length 250 µsec
   Rep rate of 1 Hz (resp 2 Hz) at 18 MHz

Procedure Steps

1.0 Calibration of the OTR's (not required at every measurement)

1. For each of the OTR located in the wiggler insertion line (See list above), do the following steps
2. Insert the OTR monitor
3. Turn on the light
4. Open the ~mccops/*max_video/calib.adl* screen
5. Using the slider bars, and looking at the maxvideo VGA screen, position the X Scale1 and X Scale2 cursors on two vertical edges of the OTR radiator frame, or in the case of the wiggler OTRs, on the edges of the circular hole. Enter the distance it corresponds to (in mm) in the X box.

   NOTE: The diameter of the holes in the wiggler are 1 mm (and this is what you see in X and Y)

NOTE: The diameter of the frame on standard OTRs is 19 mm (so what you see is 13.43 mm in the horizontal direction and 19 mm in the Y-direction).

6. Redo latter step using the *Y-Scale*
7. Enter the name corresponding to the viewer you have calibrated with a *".cal"* extension (e.g.: ITV0F04.cal) in the entry widget "store file to:"
8. Once everything is updated change back the "store file to:"-entry to otr1 (otherwise other users might erase your calibration by mistake)

2.0 Loading the optics

1. Download the file ***** to create a significant betatron variation (and small beam size) on the three wiggler chamber OTRs and to create an orbit bump in the trajectory inside the wiggler to prevent the beam from going trough the holes drilled in the OTRs.
2. Insert each of the above listed viewer
   a. Make sure there is no saturation (if there is you should reduced the micro-pulse repetition frequency or call an expert)
   b. Verify you can see the whole beam spot on the OTRs and check the signal over noise is large enough e.g. use the maxvideo digitizer to look at the profile.

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3.0 Measuring the beam emittance

1. Start the emittance code *beast.tcl*
2. From the main menu, initialize the measurement (push the "**Initialize"** button)
3. Select the **"Wiggler-Multi-Monitor"** method from the main menu. This will open a second screen:
   a. **In the "Beam Info" section:** Enter a comment in the "Info"-entry, the charge in the "Charge per bunch (pC)"-entry, and the momentum in the "Beam Momentum (MeV/c)"-entry
   b. **In the "Beamline info" section:** You can change the resolution from the "OTR Resolution (mm)"-entry. Note that nominally the resolution in NOT read from this entry but from a file that contains estimate or measured resolution for each OTRs.
   c. **In the "Measurements & Data Reduction" section:** Enter the number of cycle you wish to perform: a cycle corresponds to a full measurement using the 5 OTRs (i.e. all the OTR are inserted once, and the parameters calculated). To improve the statistics, you should perform several cycle (five is a good number).
   d. To start the measurement you should push the **"Start Cycling OTRs"**-button
   e. Once all the cycles are completed, each of them are gathered in a separate line of the arrays below.
   f. The first array corresponds to the X-measurements whereas the second one contains informations relative to the Y-measurements.

g. Using the **"Plot Sigma_x...."** button you can see the beam sizes measured along the beamline for all the cycle and thereby identify bad measurements.

h. Using the check-button in the array, you can select the cycles you wish to keep for the final (averaged) measurement

i. Finally, clicking on **"Compute Average Emittance &...."** will provide the emittance and Twiss parameters.

j. Then using the **"Plot Envelope"** button you can see the fitted β– and α–function along the beamline

4. Note the computed emittance and Twiss-parmaters

4.0 Recovery from the experiment

1. Quit *beast.tcl* (from the main menu click on "Quit")
2. Restore all the initial settings for the quadrupoles and correctors
3. Make sure all the OTRs are withdrawn

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