

Brief Purpose of Test

Our ability to calculate beam profile and match to target with BPAM can be considerably enhanced with the ability to use previously accumulated data, or to incorporate extra quads in the matching process. Within the BPAM framework this can be made possible with a recent Multiharp Tool feature upgrade by Michele Joyce (Atlis 4261 completed). It would be advantageous to try out this new technique in either Injector or Hall B during the Feb. startup. The proposal is to incorporate this into the Benesch reconfiguration plan, and it is expected to take about 0.5 hour or less to get the needed data, and maybe another 0.5 hour offline, if preferred, to compare results, with the possibility of achieving more efficient and satisfactory matching results.

I think it should be more like 10 minutes in addition to normal quad scan.

Anticipated Benefits

Enhanced capability for future emittance measurement and matching efforts.

Special Beam Conditions Required

None

Hardware and/or Software Changes Required

None

Special Hazards/Safety Considerations (enter ""None"" if not applicable)

None

Setup Procedure

Standard setup requirements to perform beam matching (INJ or Hall)

Test Procedure

- Perform standard Multiharp procedure to obtain matching data.

- Turn off beam

~~- Calculate via standard path matching solution~~

- Now all quads are back at initial value.

- Select quad(s) outside dispersive region and ~~not part of matching quads~~ (does not need to be contiguous).

For example, with 0L06-0L10 being the matching quad range, vary **ANY COMBINATION** of **ANY SUBSET** of these quads. Only requirement is that it is not dispersive.

Of course it may be easier to keep track by varying 0L10 while using 0L06-09 as matching quads, or varying 0L06 while using 0L07-10 as matching quads, or do both and keep track of each.

- Change this (these) quad(s) in steps of 10%-20% either way. No need to cycle or re-steer (remember there is no beam). Do the following for each step:

- Use new button to acquire model & quad file

Ops Menu → Optics Tools Menu → Get Model Data for BPAM

Each of these steps should not take more than 2 minutes. The only limitation may be the time-stamp on the model file, with minute-granularity. Never tried this within one minute before. So maybe space them apart by more than a minute.

- Note down directory name of new model data acquired each time.
- If changing more than one quad, restore all changed quads before changing again.
- No need to cycle or re-steer at any point (there's no beam). Only the quad set points need to change for Art++ to pick it up. Art++ now updates its calculation when this button is pushed, so in principle one needs not wait at each step.

- A table like this may be handy.

	OL06	OL07	OL08	OL09	OL10	Model directory
Step 1	1	2	4	4	5	200706181106
Step 2	6	8	8	9	10	200706181107
Step 3	11	12	18	25	36	200706181108

- If needed, give beam back to OPS and go offline.

- Use BPAM to recalculate matching solution

- Select all quad scan data, plus one acquired by the Ops Menu button.
- If you feel comfortable, you can load ALL the extra directories at the CALC WIDTH stage, and only move the selection of propagation optics from one model to another later. This will save time between later selection/de-selection of these directories, and should not hurt anything (They don't contain harp data, and thus will not pull the fit).
- Of course there is no harp data under the extra "scan" slots. Proceed as usual.
- **Before pressing CALC TWISS, choose the one extra model as active for propagation optics (red arrow in picture below).**

- Proceed with Twiss fitting and matching calculations. **Caution:** The fit point must be set before ALL quads affected in this entire procedure.

- Compare all solutions and decide on the best.

- Once the best solution is identified, the quad values to download are those corresponding to the quad values used for the fake scan of interest, superseded by the quad scan solution. For example, if the solution for fake model [200706181106](#) was selected in the above table,

	0L06	0L07	0L08	0L09	0L10	Model directory
Step 1	1	2	4	4	5	200706181106

which led to best matching solution,

	0L06	0L07	0L08	0L09
Solution	5	8	-3	-2

Then the final quad values are

	0L06	0L07	0L08	0L09	0L10
Download	5	8	-3	-2	5

Note in such cases the BPAM auto-generated BURT download file will be missing the 0L10 quad, and thus can't be used unless 0L10 is changed by hand.

- Go back on the machine and download as part of normal procedure.

Recommendation

A look at the global envelope display ([plot](#) button in BPAM) might shed light on how these extra quads should be changed. For example, if it shows a huge β_x coming out of the CM and diverging, maybe 0L06 should be cranked more positive in these fake scans for a better solution on 0L07-0L10?

Backout Procedure

None other than that for standard matching