Booster steering procedure

PITZ Physics Seminar
Zeuthen, 12.06.2015

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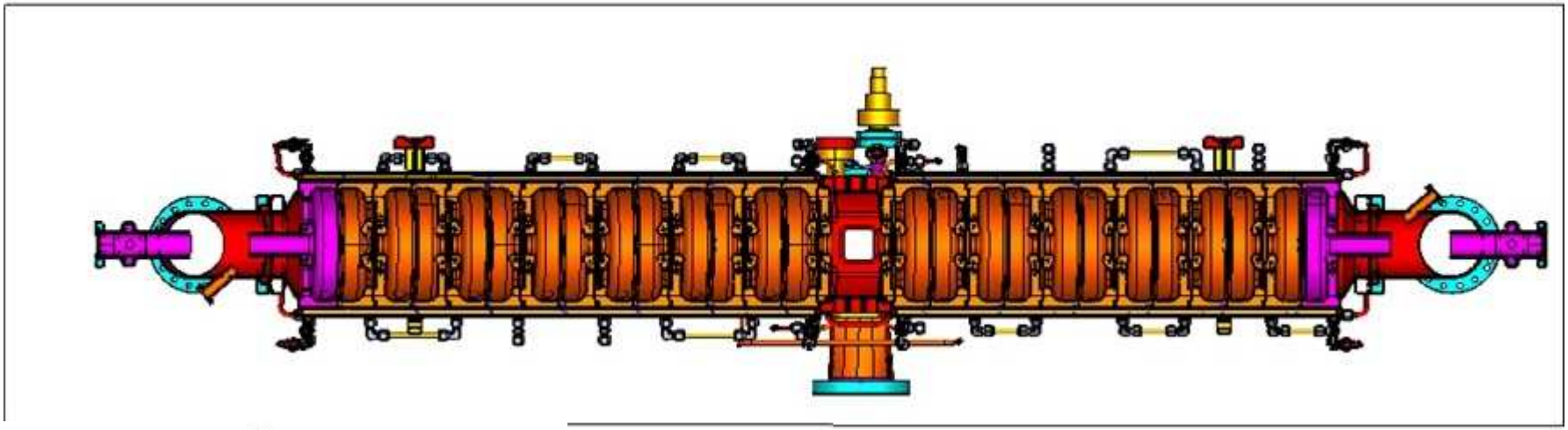
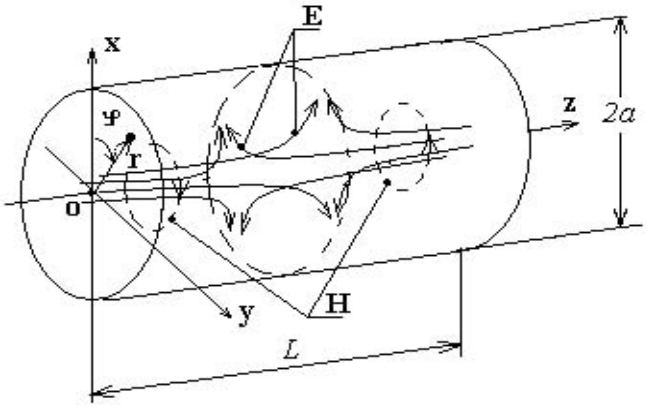
DESY

Content

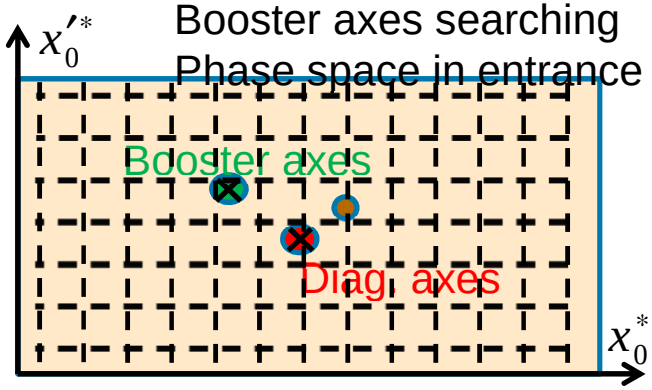
- Introduction to problem
- Procedure for steering (steps, algorithm)
- About BOOSTER steering application
- First results
- Some analyses of the results
- Coordinate observation method
- Outlook

Introduction to steering procedure





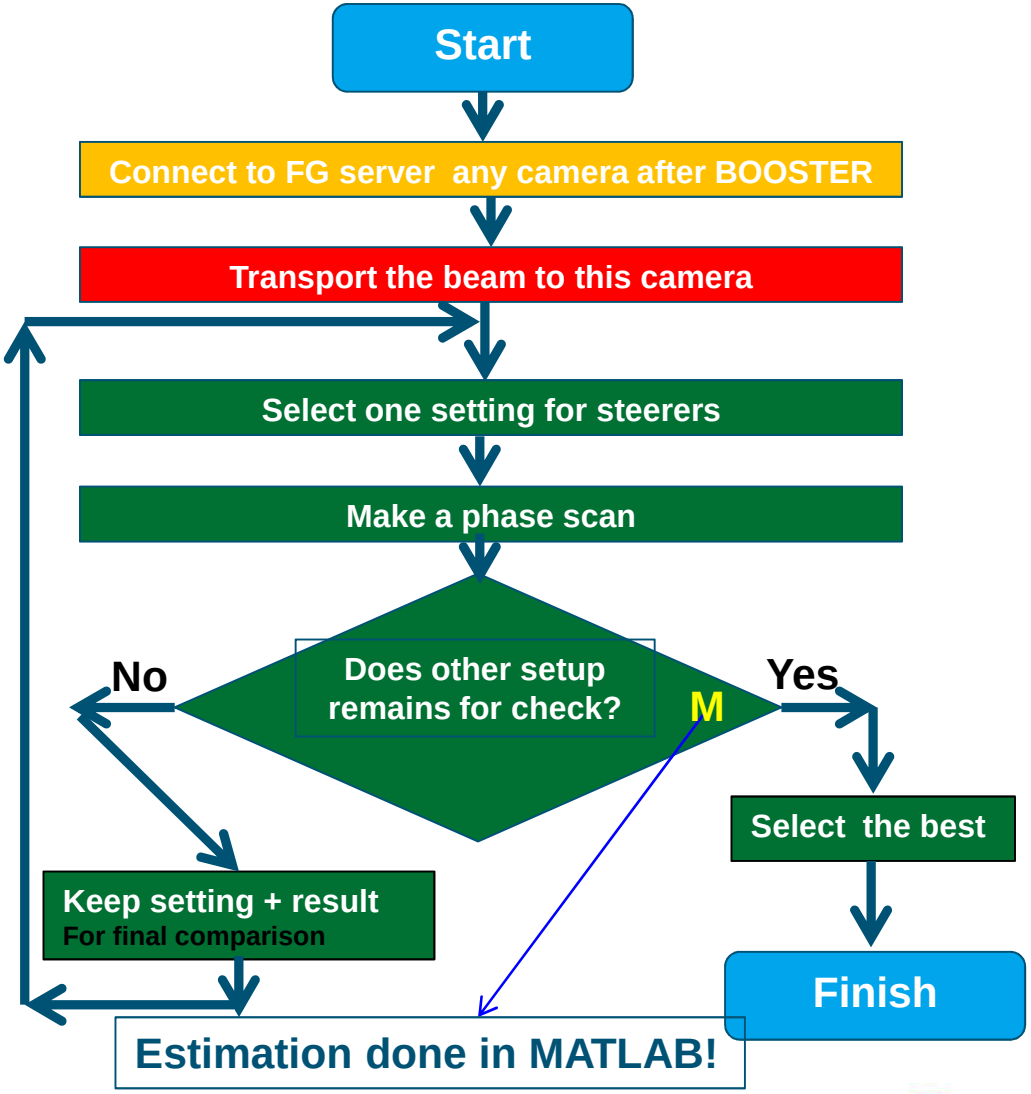
BOOSTER steering means transport the beam through booster in such a way, that dependence of transverse coordinate (in the exit of booster) on booster phase is minimum.



Algorithm of steering (manually or by some procedure)

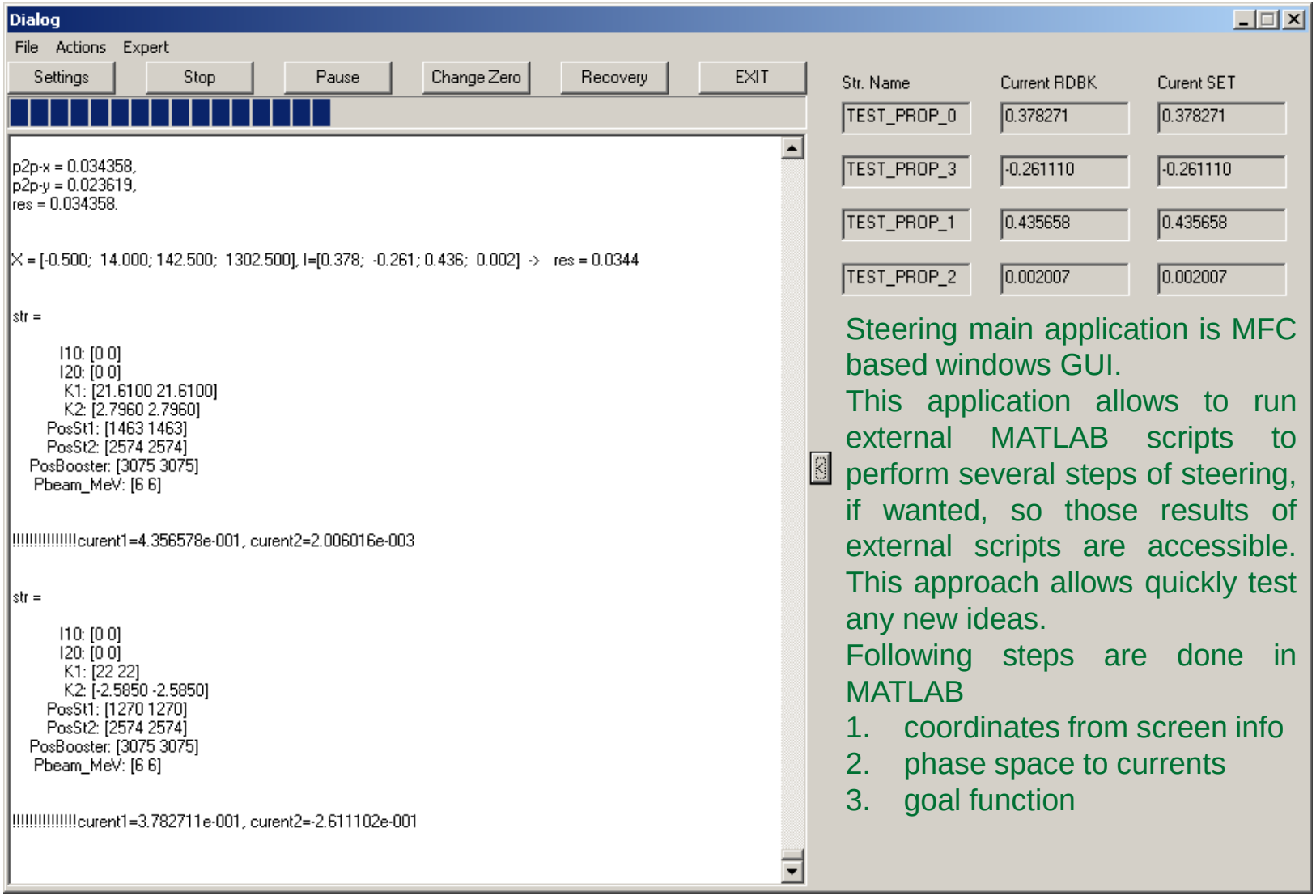
To improve steering one should perform following steps

1. Connect camera after booster to some frame grabber server.
2. Try different inputs before booster (steerers' currents or initial phase space coordinates)
3. Look for a beam after booster and estimate goodness of current input set
4. Repeat steps 2 and 3, until good orbit is found (peak to peak difference is smaller than some threshold)
5. If good orbit is not found, then try all possible input sets, and find best one.
6. Repeat this in smaller and smaller input regions around best input setup founded in previous iteration until point 4 is fulfilled, or region size is minimum



Green steps are automated

Application for steering



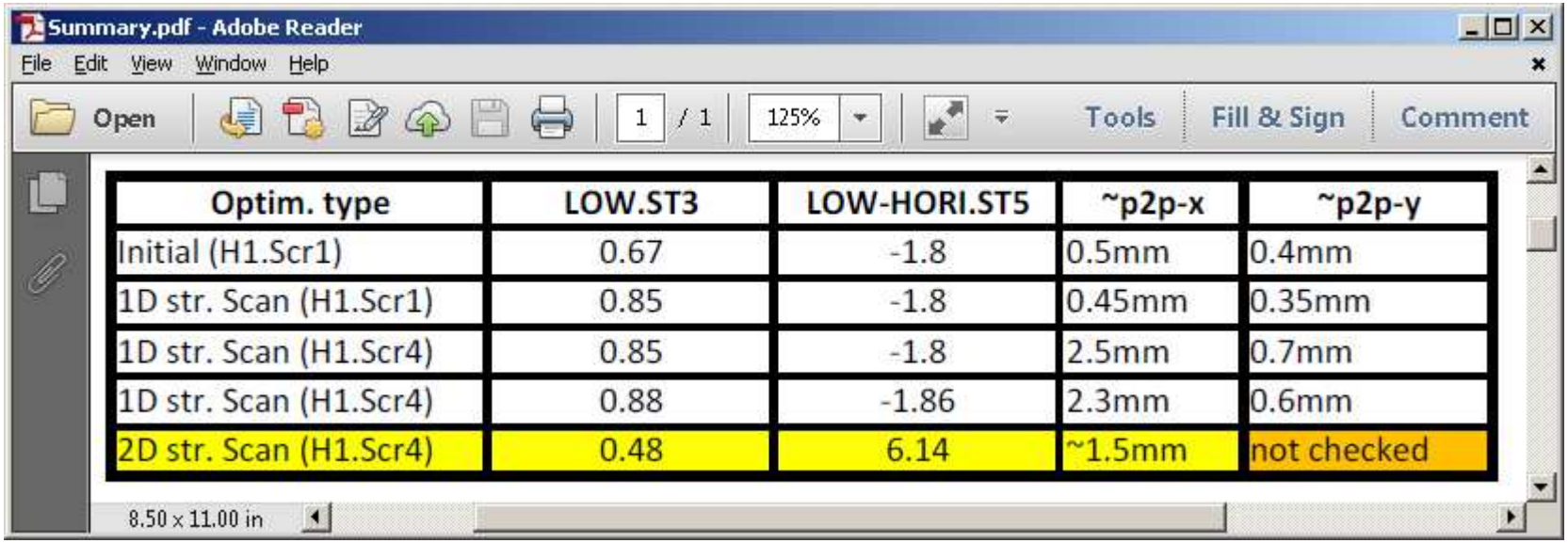
Steering main application is MFC based windows GUI.

This application allows to run external MATLAB scripts to perform several steps of steering, if wanted, so those results of external scripts are accessible. This approach allows quickly test any new ideas.

Following steps are done in MATLAB

1. coordinates from screen info
2. phase space to currents
3. goal function

First results



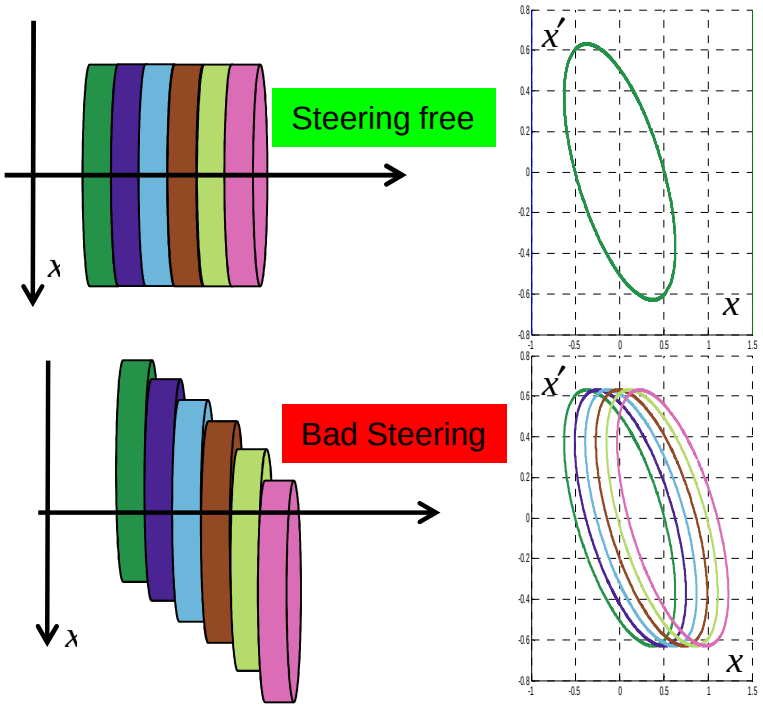
Optim. type	LOW.ST3	LOW-HORI.ST5	~p2p-x	~p2p-y
Initial (H1.Scr1)	0.67	-1.8	0.5mm	0.4mm
1D str. Scan (H1.Scr1)	0.85	-1.8	0.45mm	0.35mm
1D str. Scan (H1.Scr4)	0.85	-1.8	2.5mm	0.7mm
1D str. Scan (H1.Scr4)	0.88	-1.86	2.3mm	0.6mm
2D str. Scan (H1.Scr4)	0.48	6.14	~1.5mm	not checked

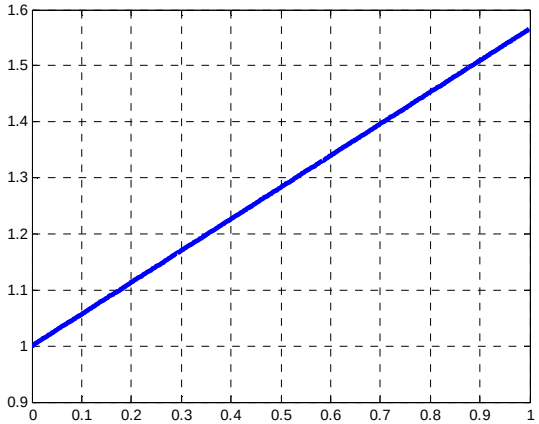
http://pitzlb.ifh.de:8080/PITZelog/jsp/show.jsp?dir=/2015/21/24.05_M&pos=2015-05-24T11:26:57

Logbook entry

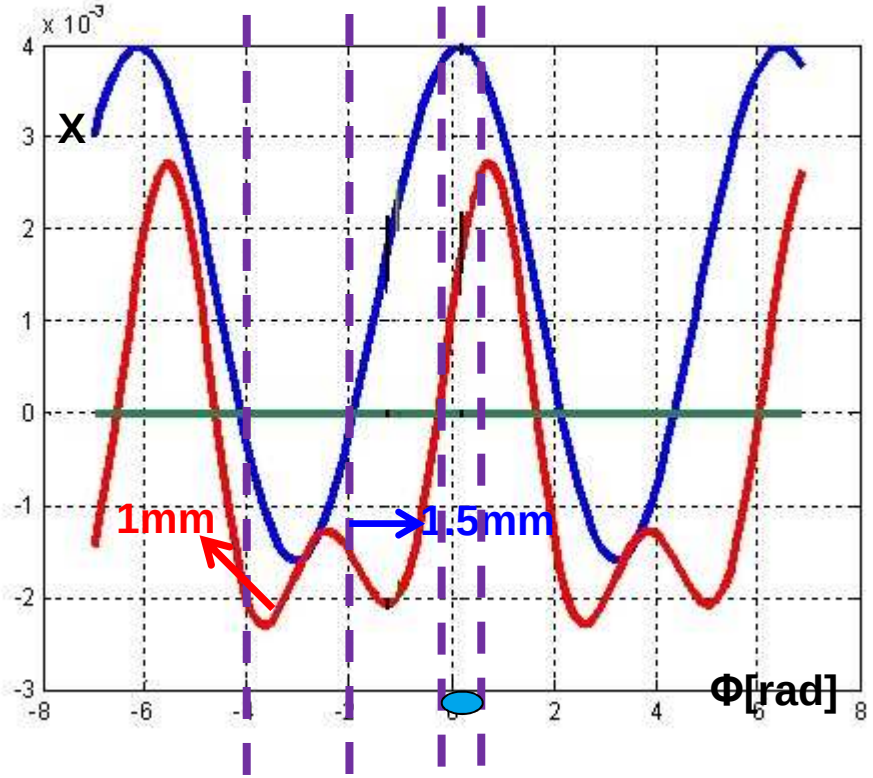
Conclusion: emittance comparable (slightly higher) in X, considerably higher in Y, but the Y has been measured after IL (phase?)
In general, the optimal point is only a bit better wrt. booster steering and slightly worse wrt. emittance. We could not find any significant improvement in booster steering (means we are close to (a local?) minimum).

Some analyses of results





X=1mm,Xph = 0 X=1mm, Xph = 1.5mrad



Phase range to scan should correspond to the bunch position. Then probably better booster phase dependence will lead to better emittance!

Coordinate observation method

- From BPM
- Based on data from screen. Currently MATLAB function is used for this method

Reading coordinate from BPM makes procedure much faster!!!

Outlook (to be done)

- Check if software work normally, fix the bugs (beam time is needed for this)
- Try to optimize used algorithms (this does not prevent usage of application)
- Try to find phase range so, that less peak to peak always correspond to better emittance.