Current state of some automatic procedures at PITZ

D. Kalantaryan

Some automatic procedures at PITZ

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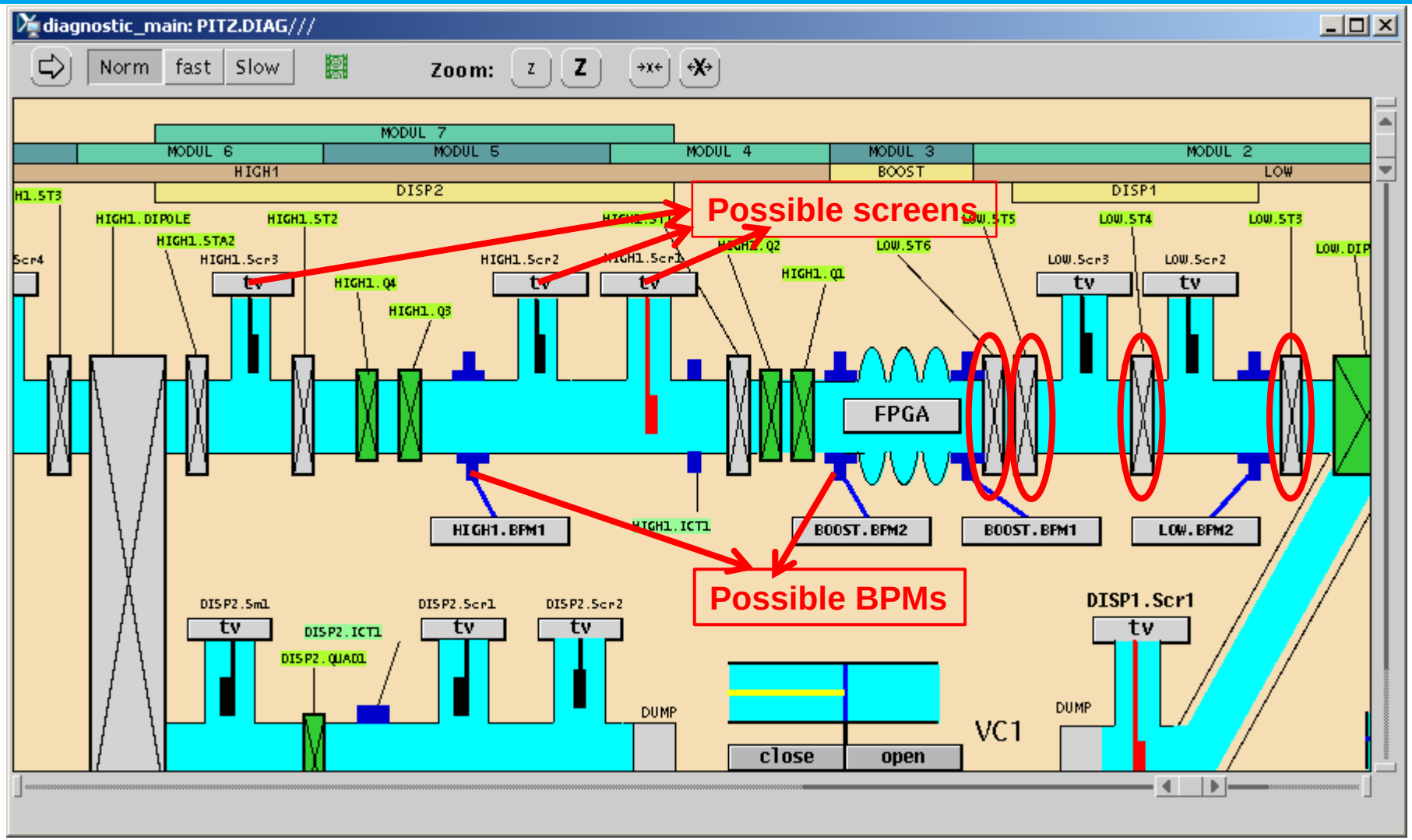
HELMHOLTZ ASSOCIATION

DESY

Content

- Steering procedure. First release
- Examples of usage of MATLAB version
- Degaussing procedures
- Consideration of problems observed by physicist

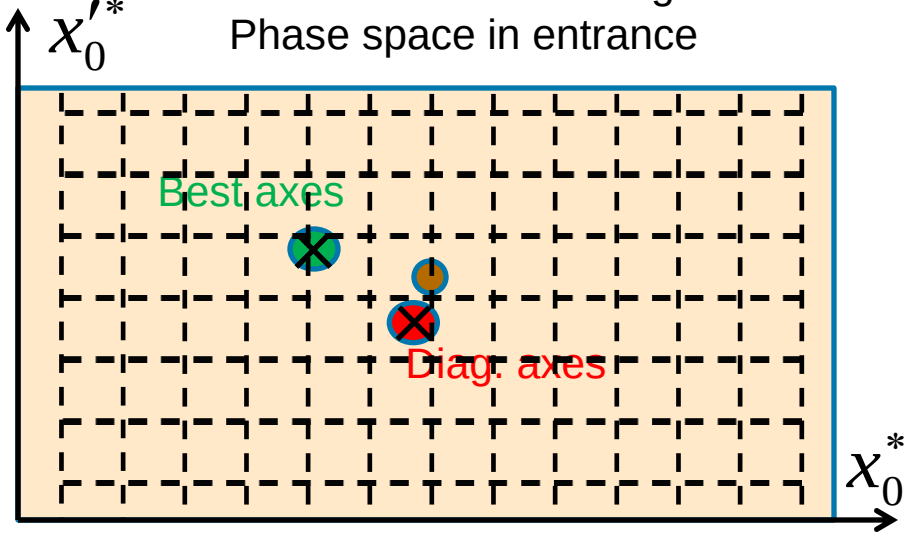
Booster region snapshot from ddd panel



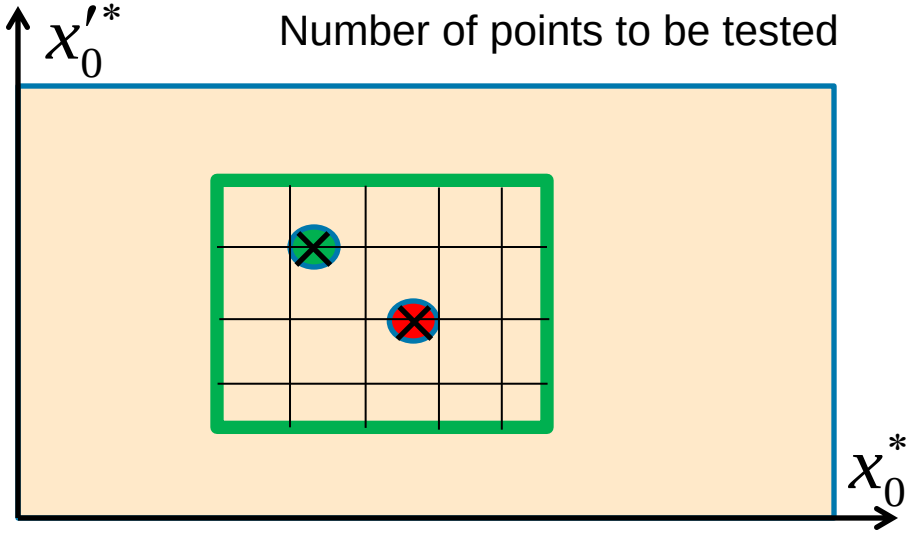
Degree of freedom is 4 (x, x', y, y') therefore for correct transportation of beam 4 steerers are needed.

Illustration of steering procedure

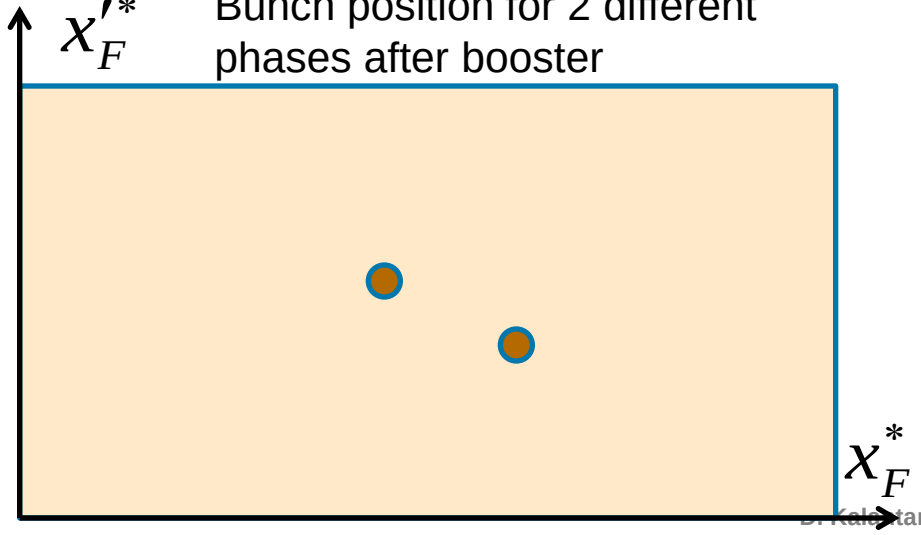
Booster axes searching
Phase space in entrance



Number of points to be tested



Bunch position for 2 different phases after booster



In the worse case number of points in grid by each direction is derived from ratio of acceptance in specified direction of the accuracy in same direction.

$$N_i = \frac{Accept_i}{Accuracy_i}$$

Where i is one of the possible coordinate

Functionalities needed for steering

- Loading information about steerers and diagnostic devices from ini files (loadstrall)
- Selecting 4 steerers for beam transportation (SelectSteerers)
- Selecting 1 or 2 (depend on orbit goodness criteria) diagnostic devices (BPMs or screens) (SelectDiagDevices).
- Selecting initial booster phase, final booster phase and step for changing phase (SelectPhases).
- Performing best orbit searching procedure. This searching procedure can be 1D or 2D or 4D. This step can be repeated several times with smaller and smaller regions (stroptimize1X, stroptimize1XPh, stroptimize1Y, stroptimize1YPh, stroptimize2X, stroptimize2Y, stroptimize4D)

Texts colored magenta are the names of functions for performing corresponding actions

Functions that will be frequently used 1

- loadstrall : for loading information about steerers and diagnostic devices, also some libraries for optimization algorithms.
- SelectSteerers(4, 'Ix', 5, 'I', 4, 'Iy', 3, 'I') : For selecting steerers and corresponding properties for beam transportation. Same steerer can be used for X and for Y transportation with different properties.
- SelectDiagDevices(2, 1) : Selecting diagnostic devices (BPMs or screens), for beam monitoring.
- **stroptimizeND(Vect_Nx1_Mins, Vect_Nx1_Maxs, Vect_Nx1_Steps)** or

  stroptimizeND(Vect_Nx1_Mins, Vect_Nx1_Maxs, Vect_Nx1_Steps, Vect_4x1_Init_Coord) or

  stroptimizeND(Vect_Nx1_Mins, Vect_Nx1_Maxs, Vect_Nx1_Steps, Vect_4x1_Init_Coord, Vect_NxM_Init_Guess) : This functions will perform N dimensional (N=1 or 2 or 4) good orbit searching. 1) First argument is vector with N elements from all minima in all dimensions 2) Second argument is vector from all maxima 3) third argument is vector from grid step in all dimensions. Also 2 additional arguments can be passed to function: 4) Initial point, that will be set before optimization starts. 5) Two dimensional [NxM] vector from M initial guesses (this argument is needed if searching algorithm is genetic algorithm)

Functions that will be frequently used 2

- stroptimize1X(-7.5, 7.5) or stroptimize1X(-7.5, 7.5, [0 1 0 0]) or stroptimize1X(-7.5, 7.5, [0 1 0 0], [1; 2; 3]) : This command will perform 1D optimization on X direction. Also 1D optimization can be performed in X_ph, Y and Y_ph (stroptimize1XPh, stroptimize1Y, stroptimize1YPh).

- stroptimize2X([-7.5 -4.385], [7.5 4.385], [0.5 0.5]) or stroptimize2X([-7.5 -4.385], [7.5 4.385], [0.5 0.5]) or stroptimize2X([-7.5 -4.385], [7.5 4.385], [0.5 0.5], [1 2; 3 3.2]) : This function will perform 2D optimization on (X,Xph). Also there is a function existing for optimization (Y,Yph) (stroptimize2Y).

- **stroptimize4D([-7.5 -4.385 -7.5 -4.385], [7.5 4.385 7.5 4.385], [0.5 0.5 0.5 0.5])** or **stroptimize4D([-7.5 -4.385 -7.5 -4.385], [7.5 4.385 7.5 4.385], [0.5 0.5 0.5 0.5], [0 0 0 0])** or **stroptimize4D([-7.5 -4.385 -7.5 -4.385], [7.5 4.385 7.5 4.385], [0.5 0.5 0.5 0.5], [1 0 0 0.5; 1.5 0 0 0.5])** : This function will perform 4D optimization on (X,Xph,Y,Yph).

Degaussing procedures. Why new GUI has been created?

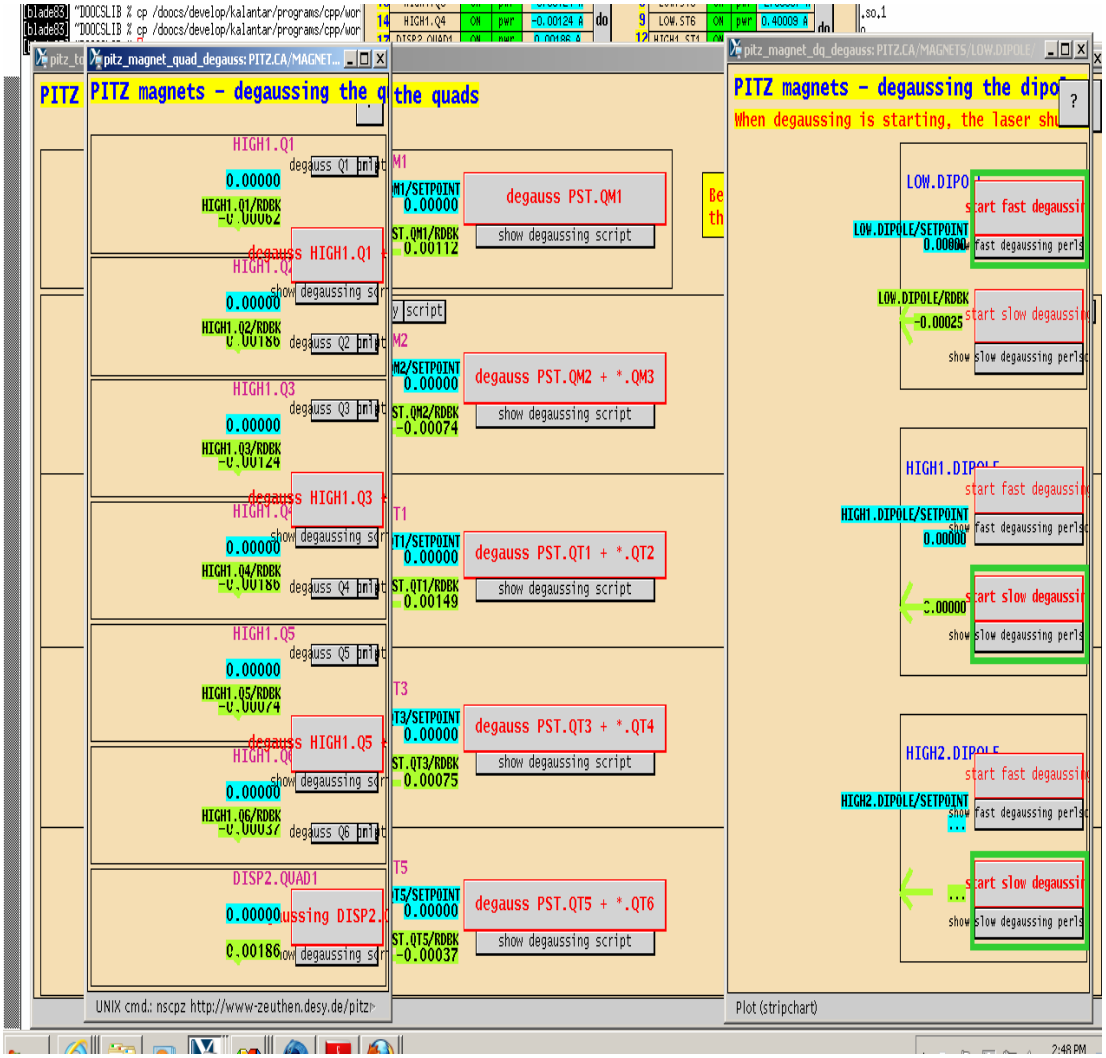
Currently 2 degaussing procedures for PITZ magnets are available

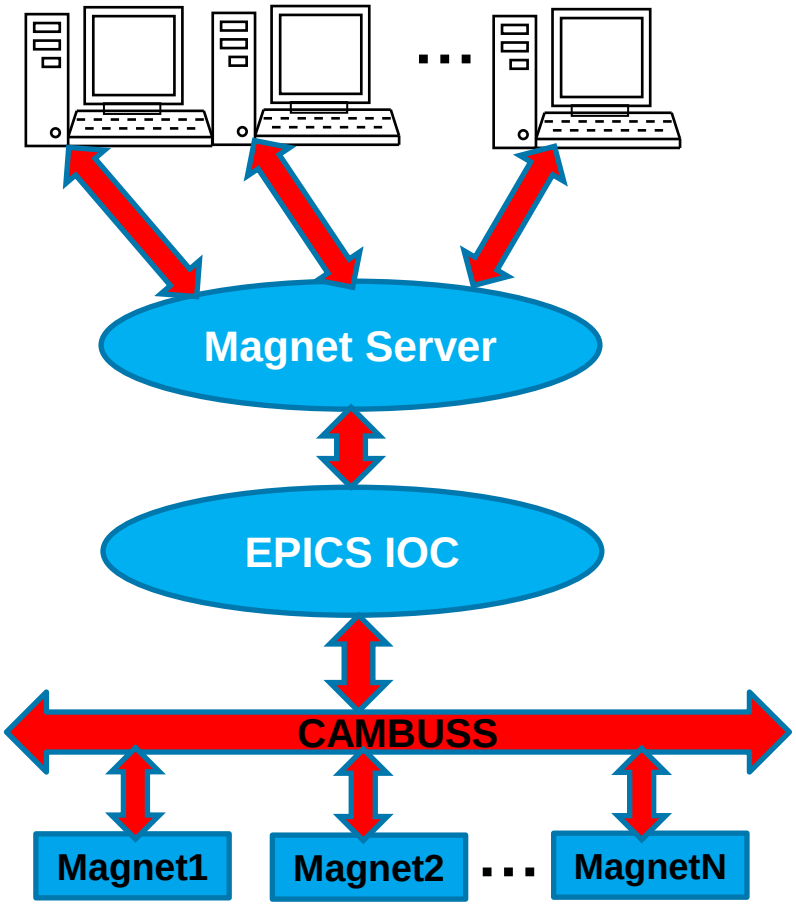
- Scripts for degaussing magnets
- Degausser GUI

The following problems were the reasons for creating new procedure

- Simultaneously degaussing of many magnets was not possible (on next slide the assumed reason will be illustrated)
- Degaussing procedure was possible to start even if magnet is fully degaussed
- During degaussing of a magnet, there was no blocking mechanism to prevent another degaussing process of same magnet.
- Error handling, if any, was very bad.
- There was no guaranty, that readback reached to set value.
- There were a lot of scripts with similar text. this is error prone and difficult to support (in case of necessity all of them must be edited separately).

Illustration of problem that observed during old scripts

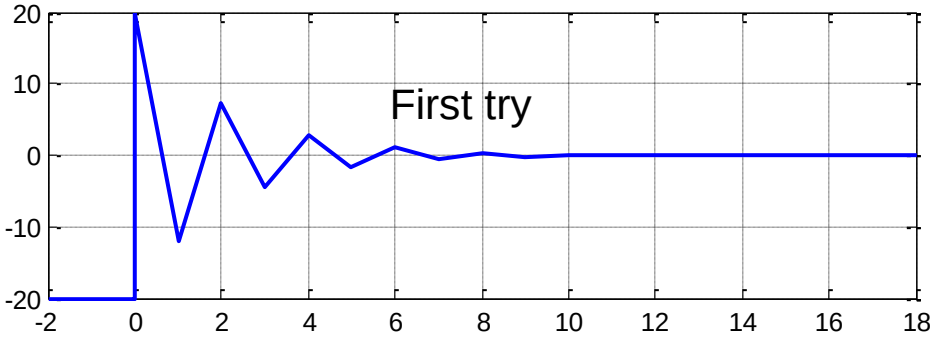


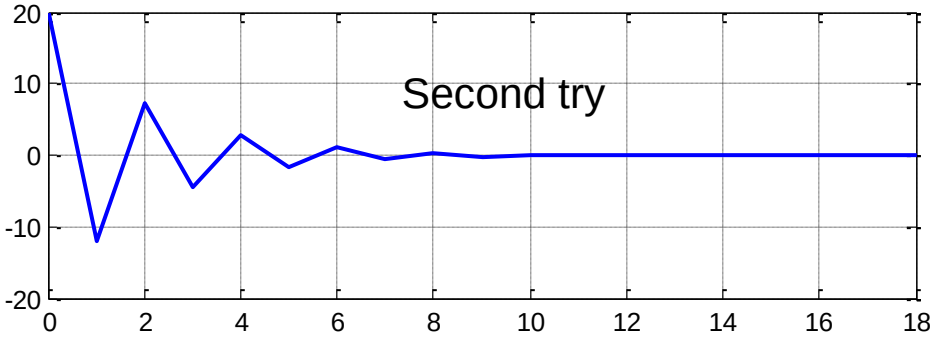


About problems connected to GUI observed by physicist

- During first try of degaussing DISP3.D2 magnet shift group wasn't able to do this, when during second try they succeeded. On the examples I'll try to illustrate this situation and explain how to continue in this case

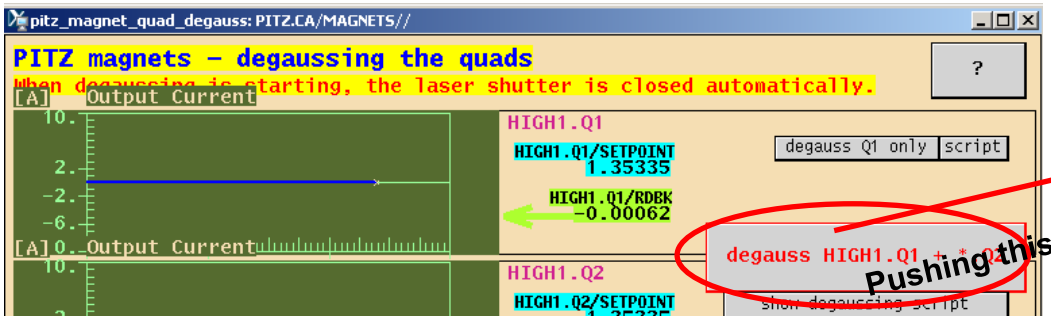
Magnet "DISP2.QUAD1".
configuration error:
maximum wanted current is not achievable

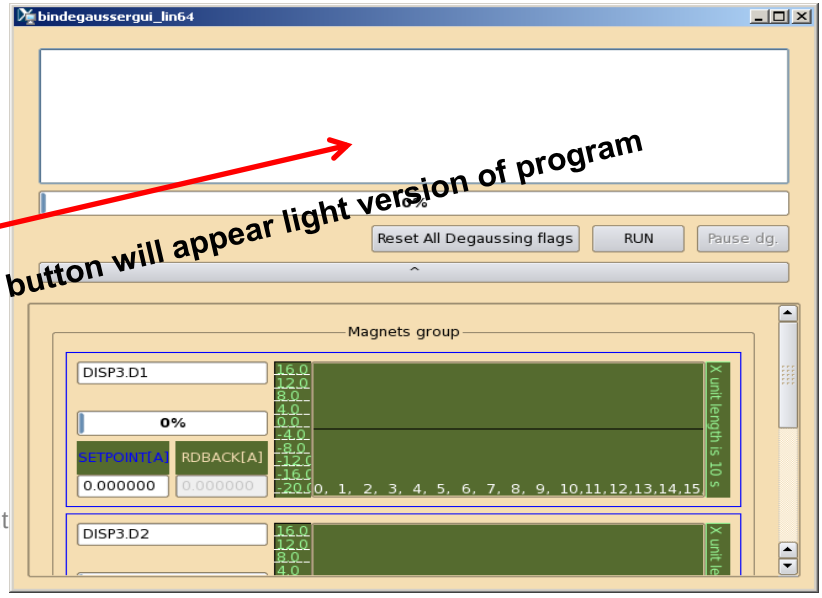




Summary

- Steering tool is ready to use during beam operation (brief manual for MATLAB version is ready)
- Not successful degaussing during first turn is due to bad configuration files. -> Problem can be solved by increasing timeout or accuracy in the config file
- In the case of problem, that is not possible to solve, please write an Email to control group
- Question. Light version of GUI was prepared according to PPS protocol and can be used instead of old scripts. When it will be done?





Pushing this button will appear light version of program