Feedback control of the absorber poloidal field

R. Raman, B.A. Nelson

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1. Calculations using the XFLUXNSTX code shows absorber poloidal field coils can reduce the stray field in the absorber.

2. These coils are approximately the same dimensions as the PF coils used on HIT-II.

3. Plans are to control these coils using a modified version of the power supply used for the coils on HIT-II.

4. Possible locations for new absorber PF coils on NSTX will be identified after the initial engineering assessment of the modified NSTX absorber is completed. Locations for magnetic sensors near the absorber will also be identified.

5. The feedback system will measure absorber poloidal field magnitudes and reduce it by driving current in the absorber PF coils, independent of the feedback control requirements for boundary shape control.

Present absorber calculation

Two new PF coil locations were used in Brian Nelson's XFLUXNSTX code.

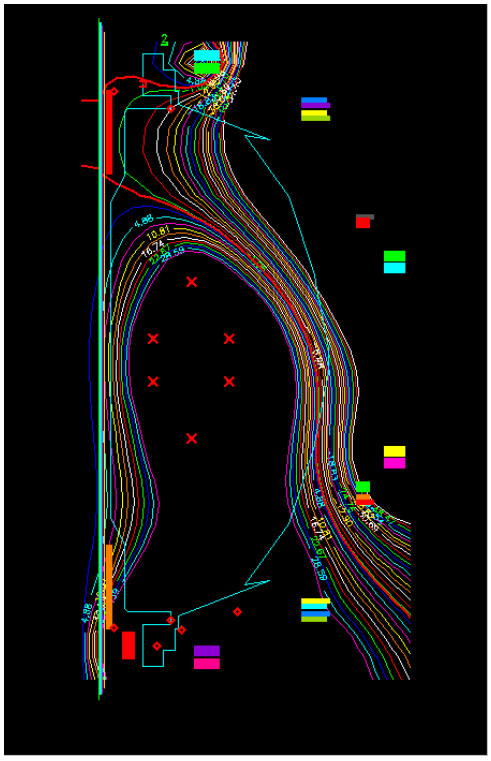
The first coil at (R1, Z1) = (53, 200.8 cm) is 14 cm above the absorber insulator. [Coil 1 and 2 labels in the text are not the same as the labels that appear in the plots]

The second coil located at (R2, Z2) = (39, 175.4 cm) is 13 cm below the absorber insulator and about 25 cm less in radius than the absorber insulator.

The coils were assumed to have a thickness of 4cm and a width of 4 cm and contain 16 turns.

A representative high current discharge that ends in an absorber arc is used to calculate the field conditions during an absorber arc (SN 103508 at 210ms).

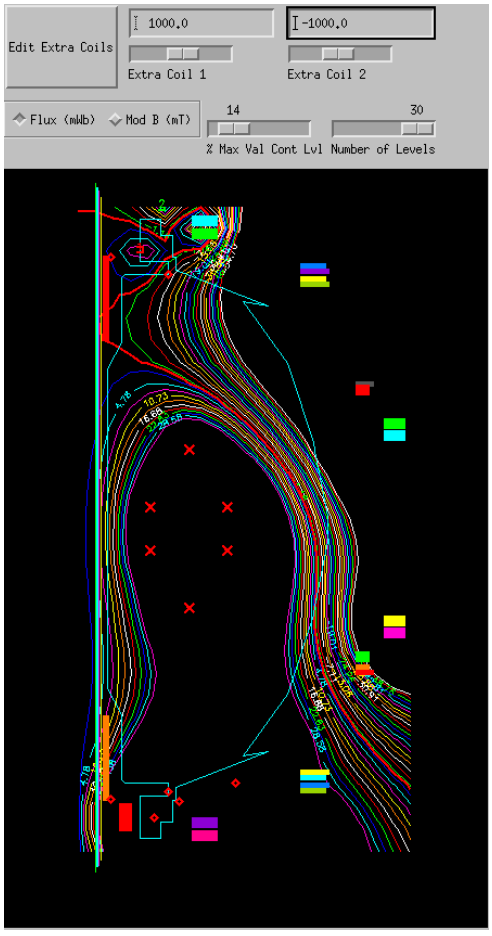
Calculations show that coils in the absorber can reduce the magnitude of unwanted magnetic field in the absorber and thereby assist a longer insulator in making the absorber more resistant to arcs.

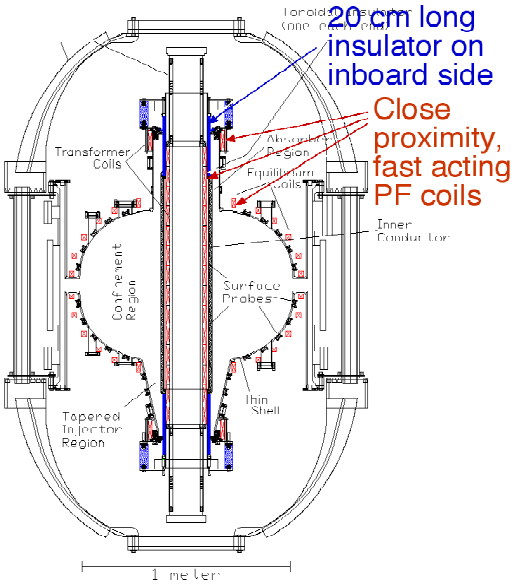


Top left: With 150kA of simulated Ip filaments, the maximum flux inside the absorber is ~12 mWbr

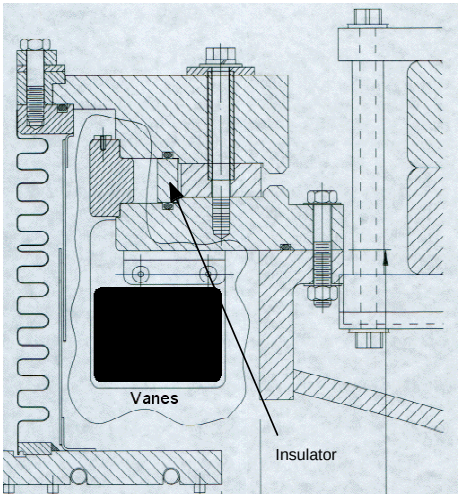
Bottom left: Adding 1000x16 Amps in coil 2 and -1000x16 Amps in coil 1, reduces the maximum value of the flux contour inside the absorber to about 5 mWb.

Bottom right: The maximum in the mod-B drops from about 60 mT to about 30ms. The closer these coils are to the critical areas of the absorber, the less will be the magnitude of currents in these coils.

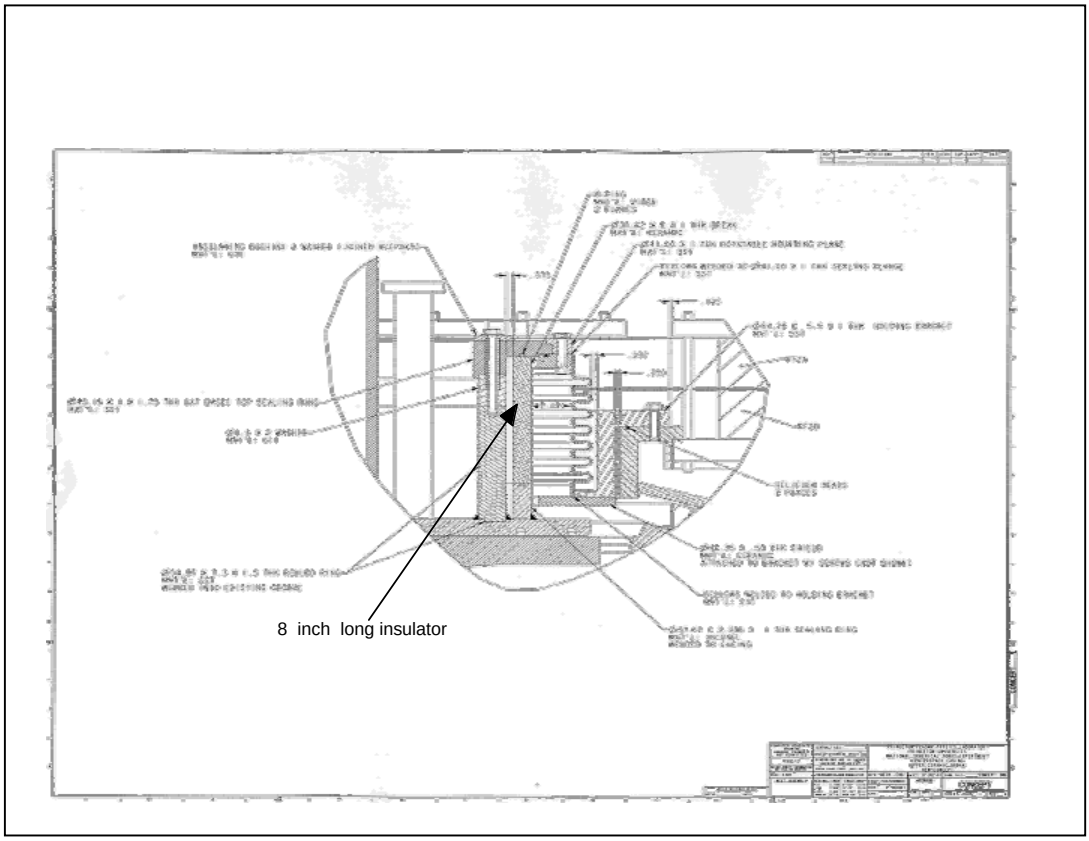




The HIT-II absorber region showing the long insulator and close fitting PF coils.



The present NSTX absorber region. The length of the 1.5 inch long insulator needs to be increased and the insulator needs to be positioned on the high field side as on HIT-II. New fast acting PF coils are needed.



Drawing of the preliminary design for the new NSTX absorber. The primary features are the 8-inch long insulator on the inboard (high field side) as on HIT-II. A study by the NSTX engineering team shows that there are no significant issues with this design.