

3D Equilibrium Reconstruction for NSTX

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STELLOPT 3D Reconstructions

- Developed for W7-AS by M. Zarnstorff
- Development continued for LHD
 - MSE, XICS, Line Integrated Density
- Applied to DIII-D
 - Non-stellarator symmetry, charge exchange
- NSTX

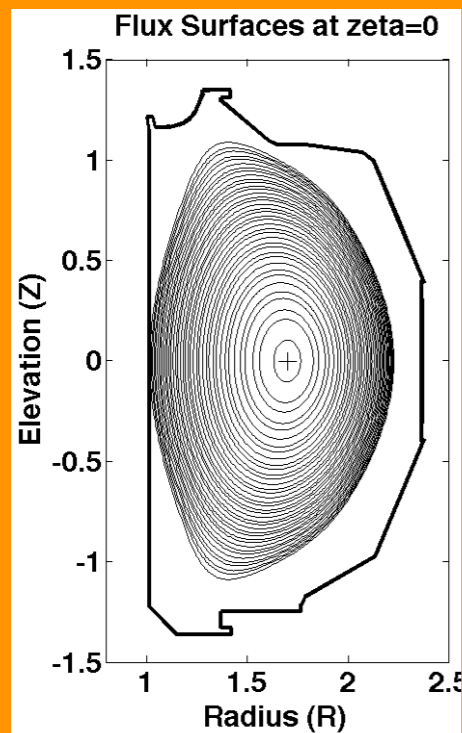
Schematically what are we doing?

Input Parameters

- Currents
- Vacuum Fields
- Pressure, etc.

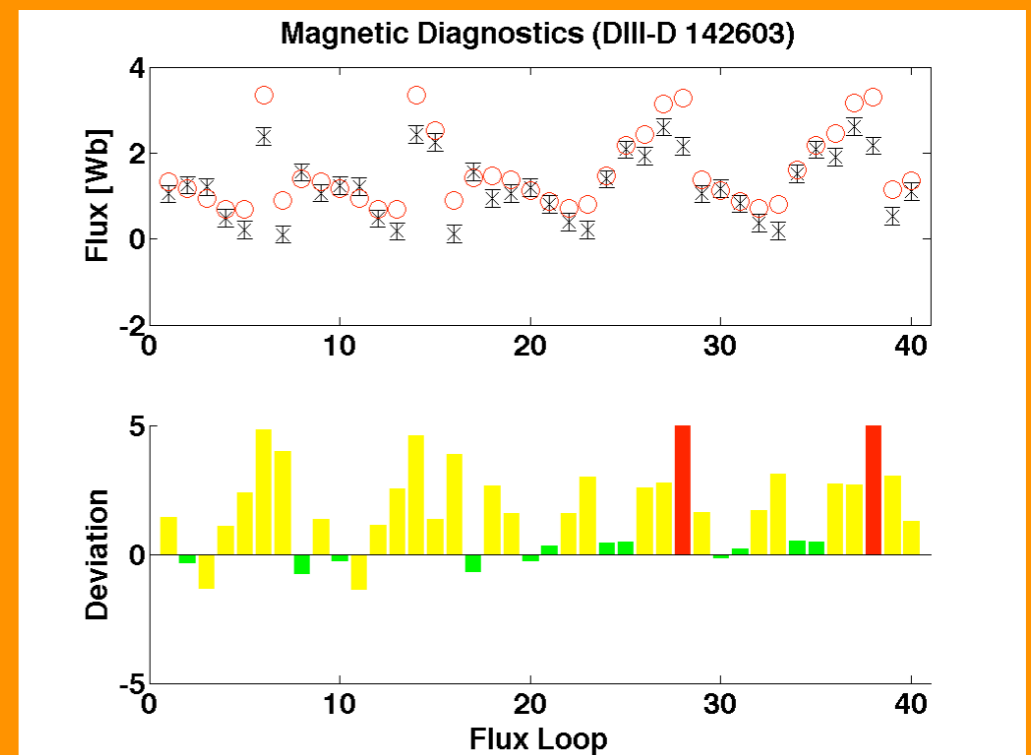
← These need to result in a good match to these.

Equilibrium Model



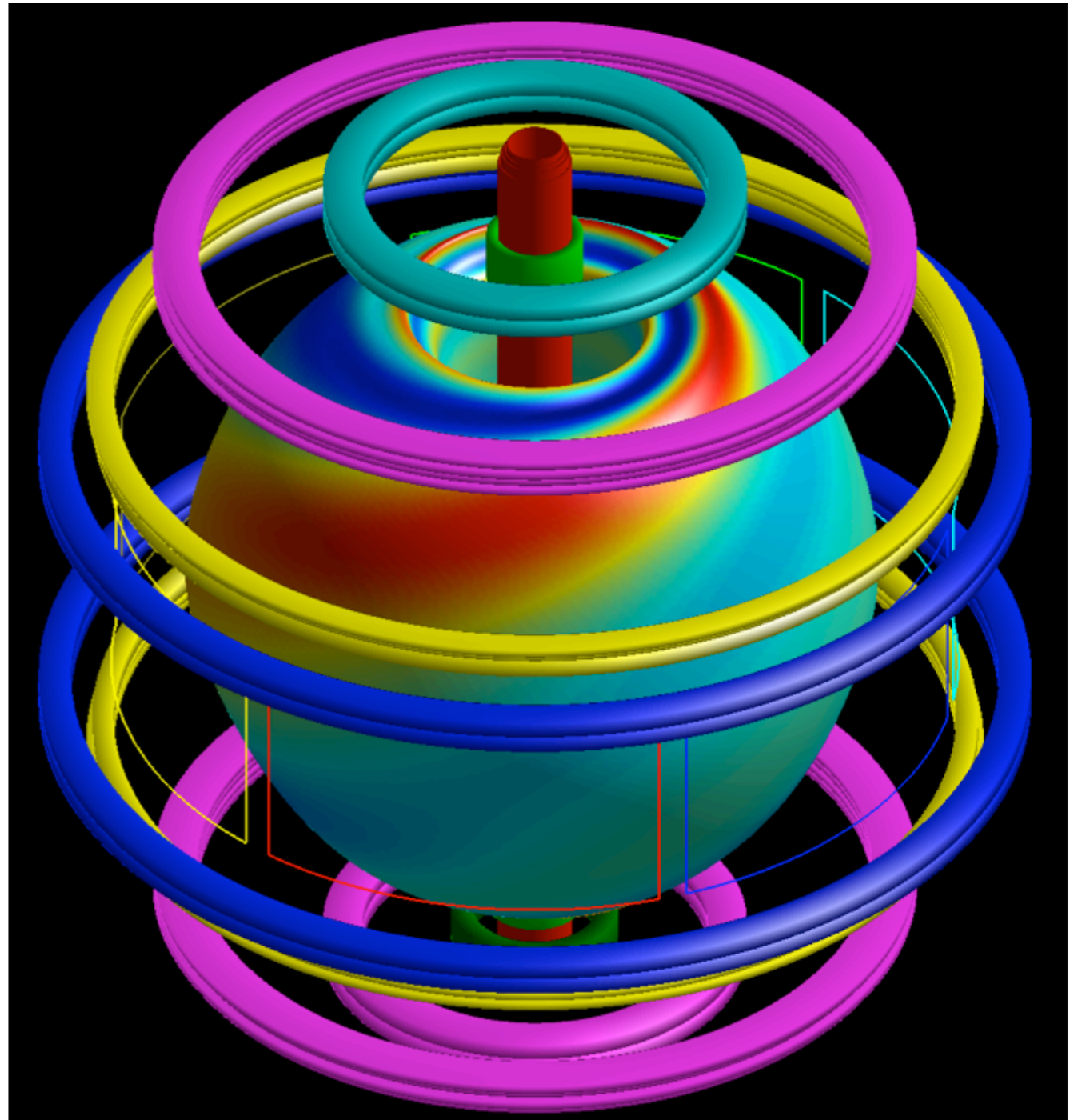
Synthetic Signals

Measurements

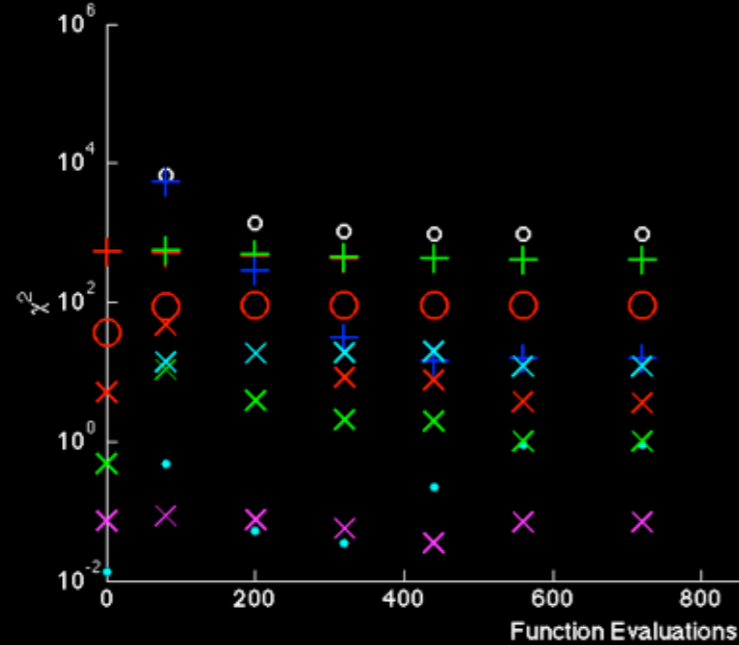
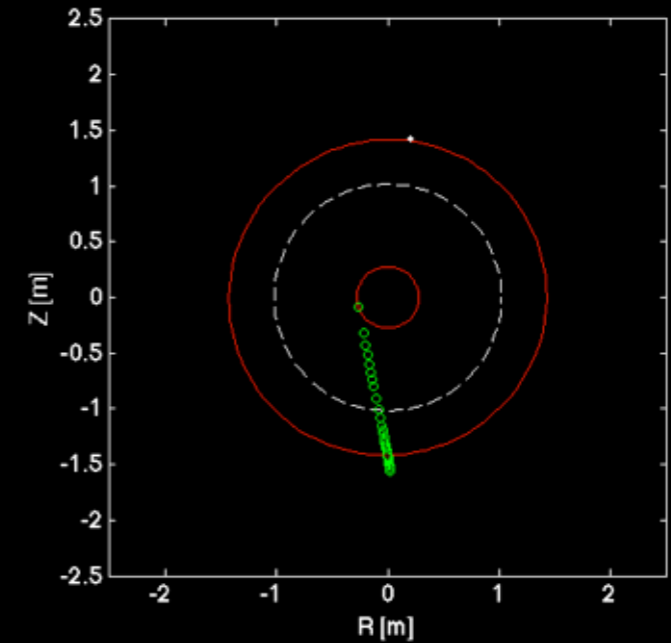
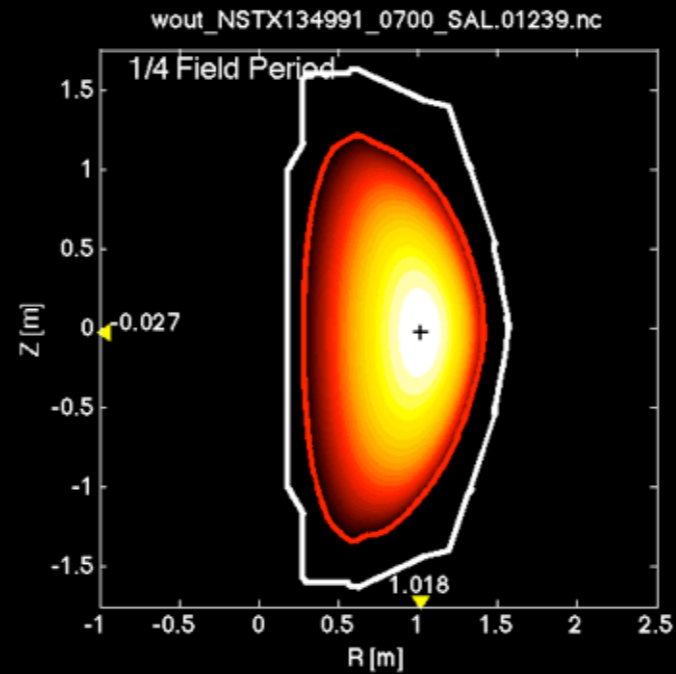
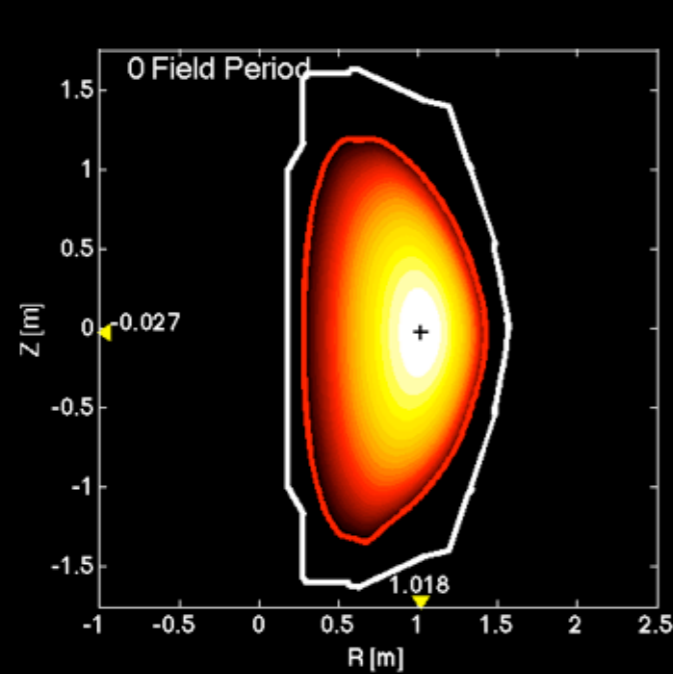


The NSTX Device

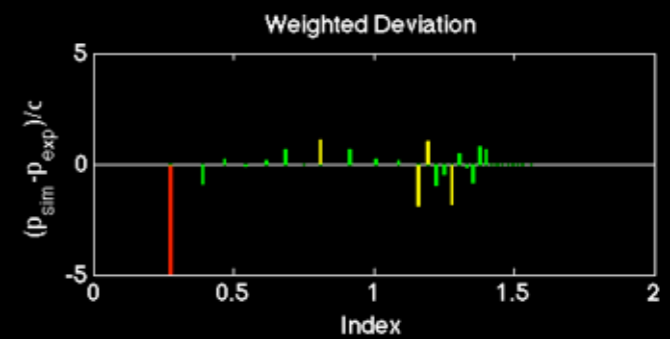
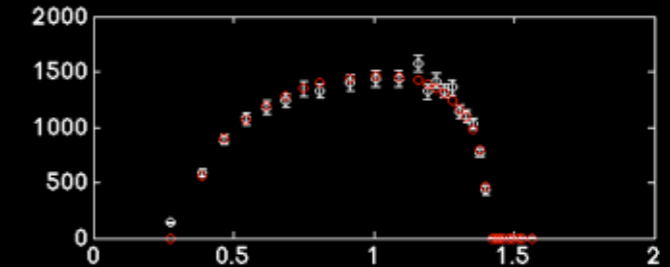
- 3D Coil Set (+eddy)
- Flux Loops
- B-Field Probes
- Thomson
- Charge Exchange
- MSE
- FIRETIP??????



Sample Reconstruction



- Total
 - Toroidal Current
 - + Elec. Den.
 - + Elec. Temp.
 - + Ion Temp.
 - MSE
 - × BPROBES
 - × FLUXLOOPS
 - × EXTCUR
 - × SEPARATRIX
- $\chi^2_{total} = 3.5368e-01$
 $\chi^2_{tor} = 4.1422e+02$
 $\chi^2_{elec} = 4.1398e+02$
 $\chi^2_{Te} = 1.5113e+01$
 $\chi^2_{TI} = 9.0502e+01$
 $\chi^2_{MSE} = 3.9153e+00$
 $\chi^2_{BPROBES} = 1.0342e+00$
 $\chi^2_{FLUXLOOPS} = 1.0815e+01$
 $\chi^2_{EXTCUR} = 6.2600e-02$
 $\chi^2_{SEPARATRIX} = 6.2600e-02$
 $\langle \beta \rangle = 14.70\%$, $\beta_0 = 60.11\%$
 $I_p = 996.71 kA$, $P_{tot} = 1.20 MW$



Future Work

- Examining 134991 EP H-mode shot for boundary discrepancy
- FIRETIP / ECE Density
- Error Field Model
- Support????