Magnetic Diagnostics for the Lithium Tokamak Experiment (LTX) at PPPL

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Fusion, LTX, and Us

- Why is it useful?
- How does it work?
- What does LTX contribute?
- What did I contribute to LTX?

Fusion Energy

- High energy per reaction
- Abundant, cheap fuel
- Safe
- Environmentally friendly
- Need three things:
  - High temperature (T)
  - High density (n)
  - Long confinement time (τ)

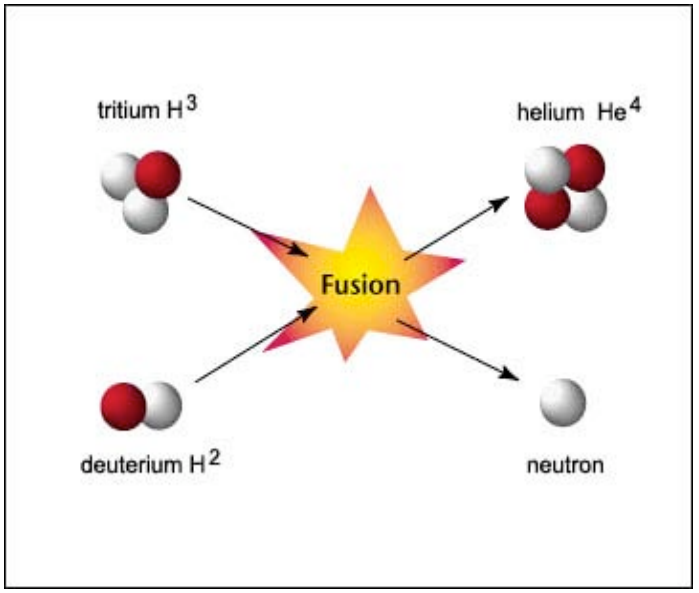
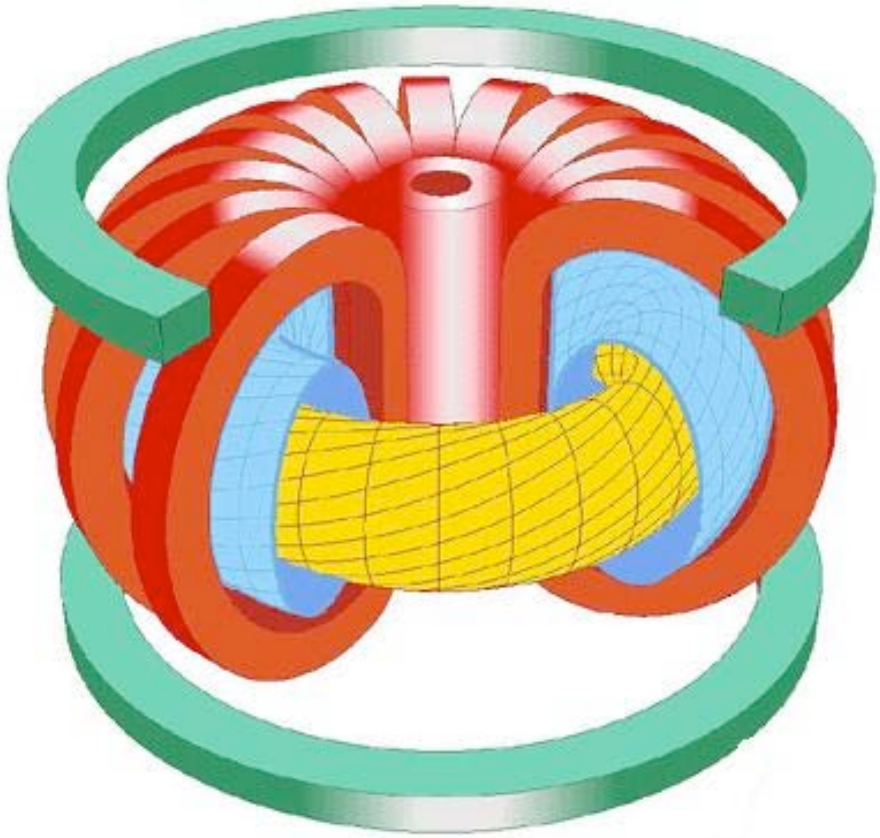


Image from www.atomicarchive.com

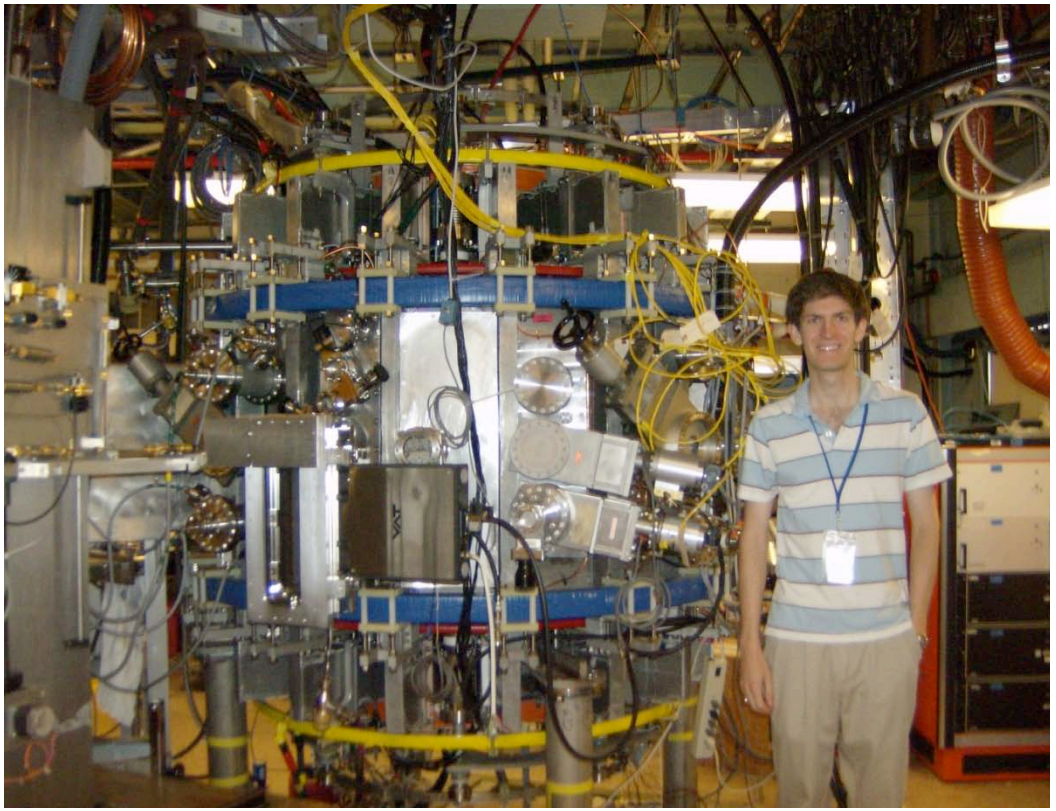
Tokamaks

- Changing magnetic fluxes accelerate particles
- Magnetic fields provide confinement
- Toroidal geometry--no open ends



LTX

- Liquid lithium-walled tokamak
- Flat temperature profile
- Low recycling
- Decreased structural damage

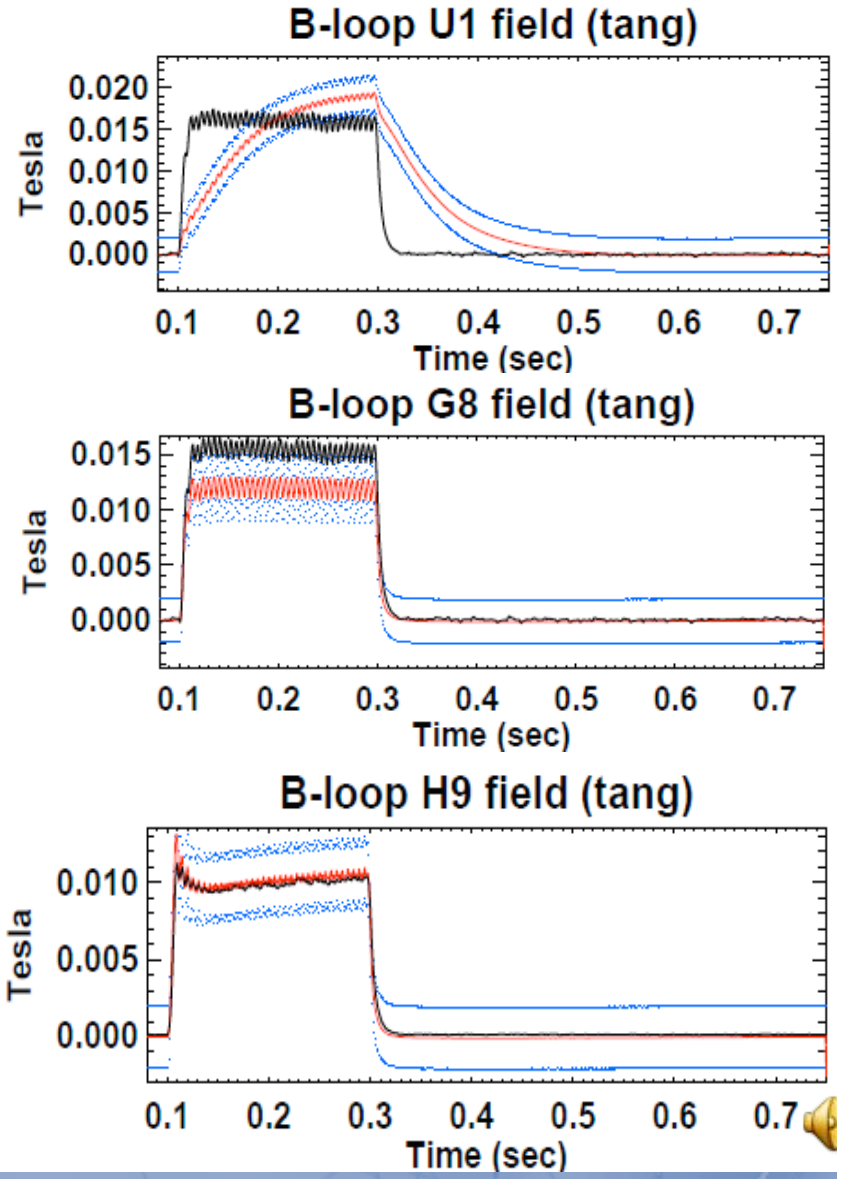


Magnetic Diagnostics

- Non-invasive sensors for data acquisition
- Changing magnetic fluxes cause voltage
- Hardware integrator circuits yield local magnetic flux
- Digitizers output to computers
- Measured flux compared to calculated flux for toroidally symmetric system (LRDFIT)

Calibration

- Integrator gains vary unpredictably
- Gain factors obtained via comparison of simulated to measured flux
- Only reliable where model captures behavior well



Automation

- Analyzed fit of model behavior to data
- Wrote calibration script to take in data from LTX and check for regions of good behavior agreement
- Calibration gain factor automatically calculated, output in readable format
- Used in future to calibrate sensors via LRDFIT or new three-dimensional code

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