

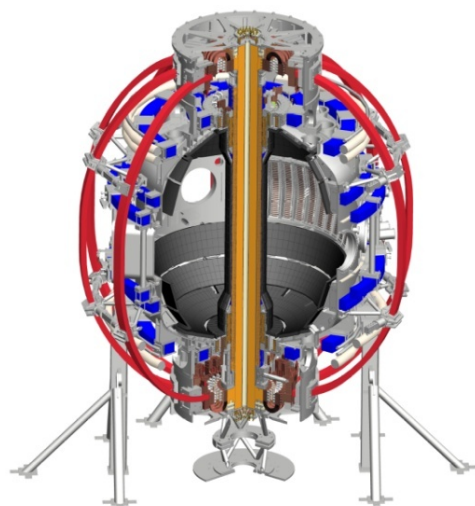
Neutron diagnostic calibration transfer XMP

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and the NSTX Research Team

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Control Room Annex
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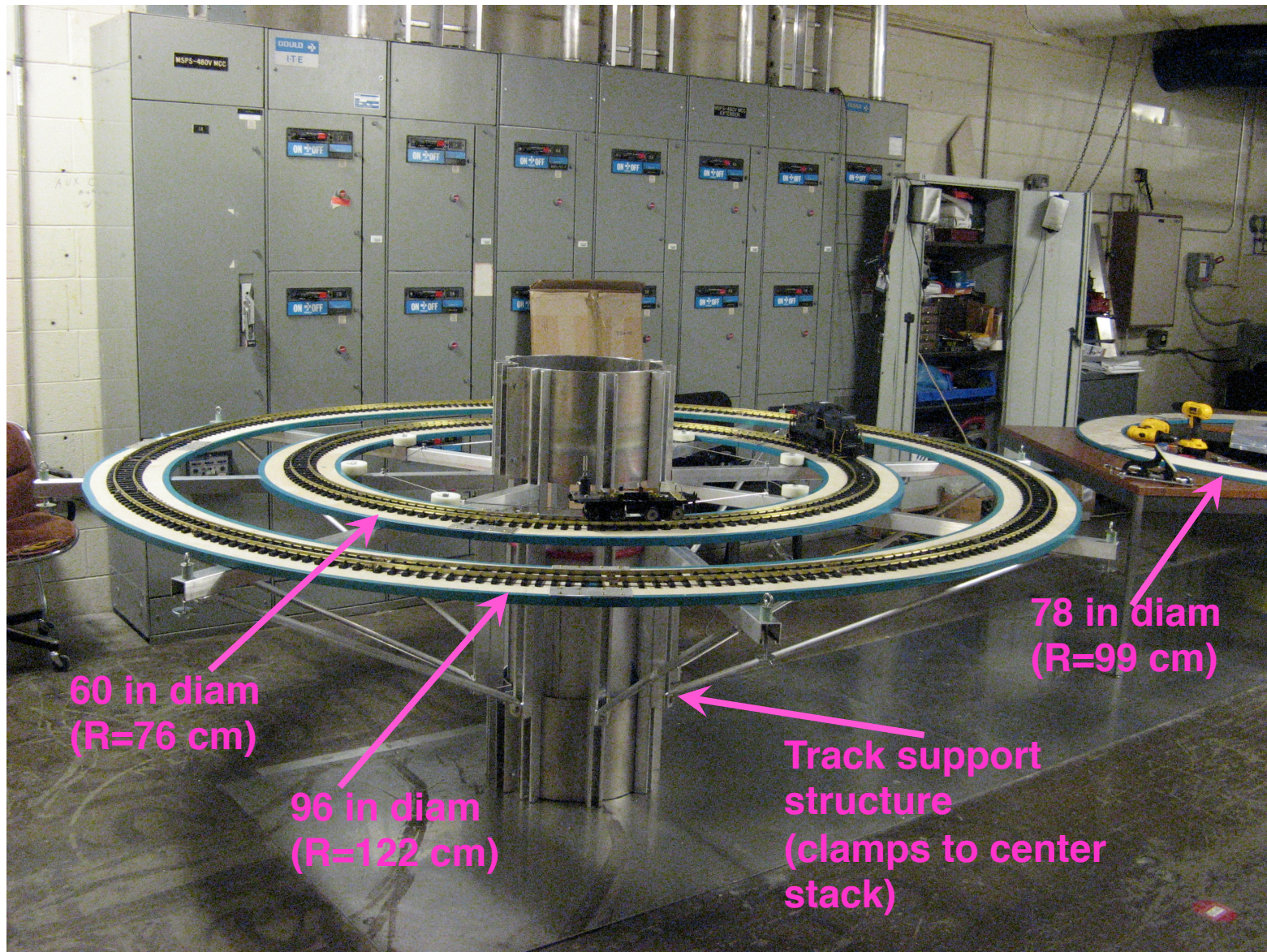


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3 fission chambers presently installed and functioning

- Sensitivity of individual chamber plus its distance from plasma determines its overall response to plasma neutrons
- Each fission chamber can run in count mode, where it counts individual fission events induced by individual neutrons, or in current mode, where a high count rate merges into a current output

Fission chamber count rate absolute calibration previously determined from use of Cf source in vessel (Nov. 2014)

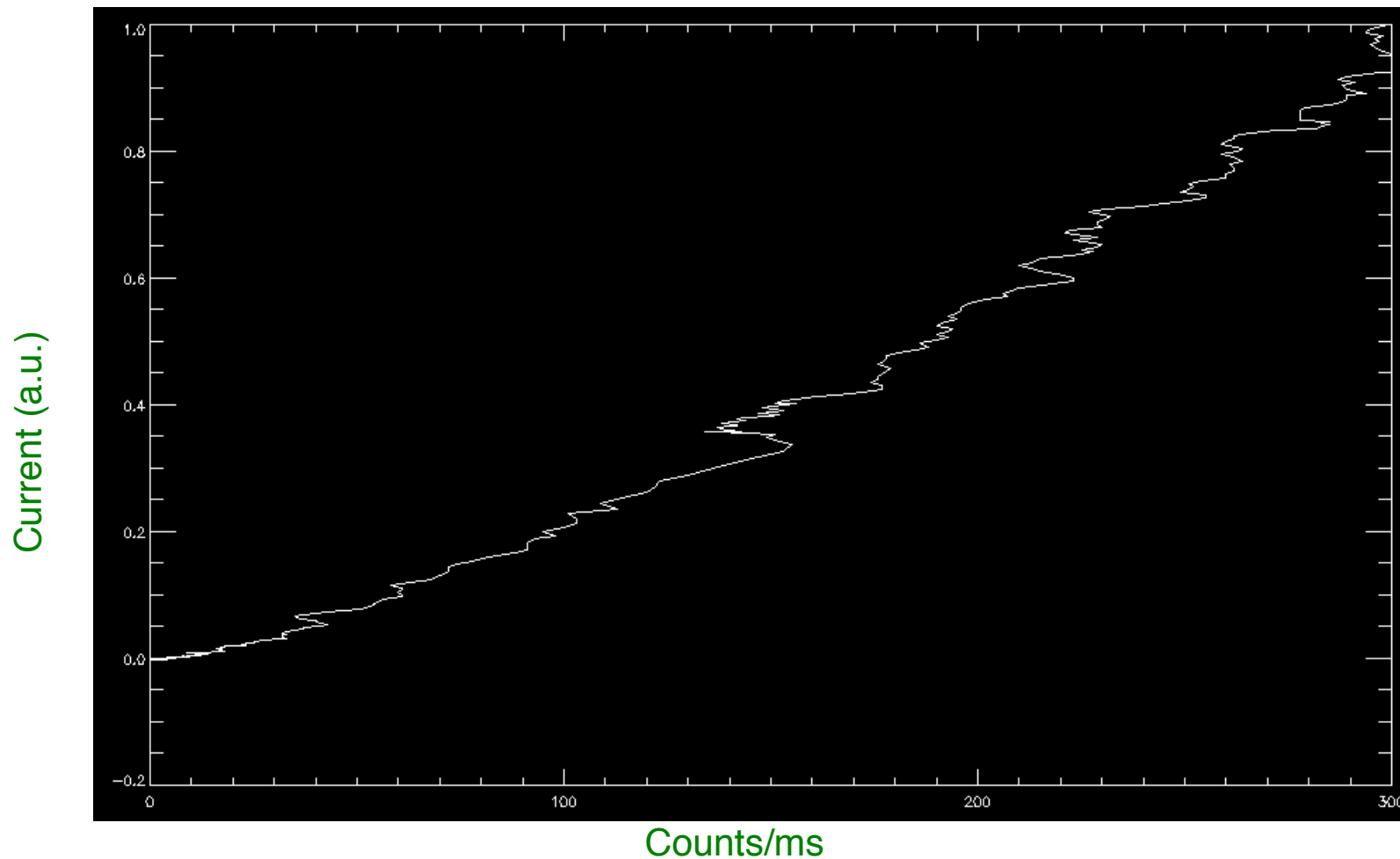


Count rate calibration must be transferred to current mode in order to provide calibrated signals during campaign

- Count rate output saturates well below neutron rate of typical NSTX plasma, hence current mode calibration needed
- Current mode calibration is then transferrable to scintillator detectors (which have faster time response)
- BUT, need to have neutron production level that hits 'sweet spot': lower sensitivity fission chamber still in count mode but highest sensitivity fission chamber clearly in current mode
- Also, require detector in count mode to have count rate ≤ 150 counts/ms to avoid nonlinearities due to pulse pile up and dead time

Example transfer plot

- Current (Bay E chamber) vs count rate (Bay C/D chamber)



Several parameters available to control total neutron rate

- Drop beam voltage to 45 kV in one or more sources
- Run at low I_p : ≤ 700 kA
- Puff some He along with D to dilute discharge
- Use any or all of these to obtain count rate output in desired range for a total duration of at least 0.5-1.0 sec (could be accumulated over intervals from several discharges)
- Prefer low MHD to have slowly varying neutron signals (avoids issues with time response of current mode output, which has ~ 10 ms time constant)