

Study of Angular Momentum Transport due to Magnetic Fluctuations by the Dynamo Probe Head

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NSTX Research Forum

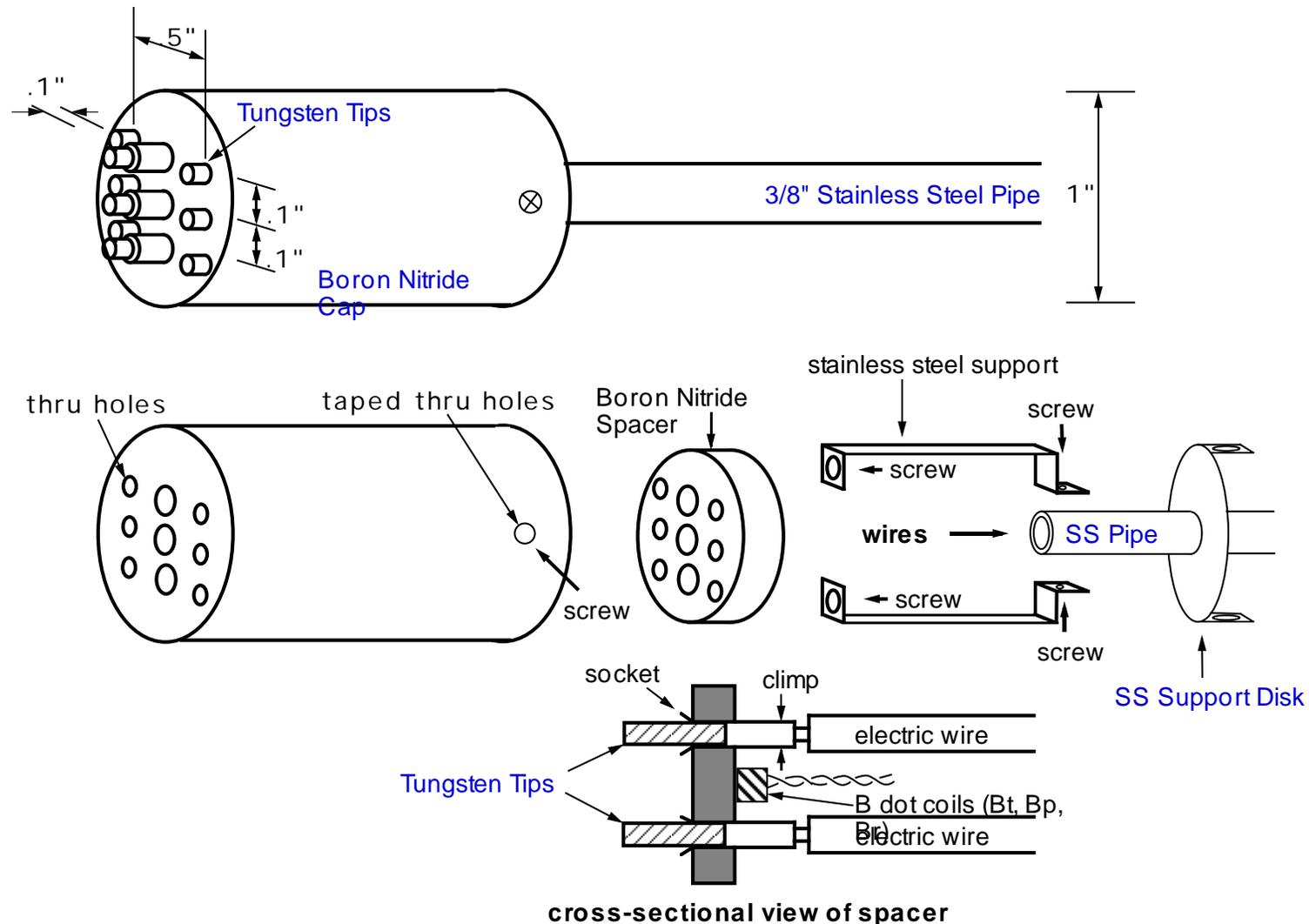
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Introduction

- **Significant angular momentum measured at NSTX.**
- **Understanding transport mechanism(s) of angular momentum may provide important clues for ion dynamics in a small aspect ratio and is possibly related to the high ion temperature.**
- **Two models proposed for the momentum transport:**
 - Reynolds stress --- can be purely electrostatic
 - Magnetic Reynolds stress --- fully electromagnetic, could be more relevant to high-beta plasmas
- **The dynamo probe head will provide crucial information on these models by directly measuring the candidate terms due to fluctuations.**

Conceptual Design of The Probe

(Consisting of 3 Triple Probes and 3 Magnetic Probes)



Measured and Deduced Quantities

- **Measured Fluctuations:**

- $(\tilde{\phi}_f, \tilde{T}_e, \tilde{n})$ at 2 poloidal and 2 radial locations
- $(\tilde{B}_\theta, \tilde{B}_\phi, \tilde{B}_r)$ at one location

- **Deduced Fluctuations**

$$\left(\tilde{E}_\theta \approx -\frac{\Delta \tilde{\phi}_s}{r \Delta \theta}, \tilde{E}_r \approx -\frac{\Delta \tilde{\phi}_s}{\Delta r} \right)$$

- **The terms needed to determine momentum transport are**

$$T_{\theta r} = \frac{\langle \tilde{E}_\theta \tilde{E}_r \rangle}{B_0^2} - \frac{\langle \tilde{B}_\theta \tilde{B}_r \rangle}{\mu_0 m_i n}$$

Reynolds stress
(available already)

magnetic Reynolds stress
(new measurements)

Proposed Activities in FY04

- Finish manufacturing and installation (J. Boedo, H. Ji)
- Onsite conditioning and system-debugging (J. Boedo, H. Ji, H. Kugel)
- Preliminary tests (H. Ji, J. Boedo)
- Initial measurements (H. Ji, J. Boedo, G. Tynan, T. Carter)

Collaborative research among 2 universities and PPPL