The heavy ion beam probe on the Madison symmetric torus (MST)

**ABSTRACT**

- Singly charged particles are injected into the plasma
- Equilibria are computed using MSTFit which solves the Grad-Shafranov equation
- Accurate magnetic profiles are needed to compute HIBP trajectories

**BEAM PROBING BASICS**

- Spatially Localized Potential
- Potential Fluctuations
- Density Fluctuations

**QUANTITIES COMMONLY MEASURED**

- Thomson scattering (electron temperature)
- Beam probing basics
- Continuous measurements

**SAMPLE VOLUMES**

- Sample volumes corresponding to magnetic equilibria and sample volume widths
- Center Detectors: φ = 19.5 ± 1.1
- Top Detector SVs

**DETECTED SECONDARY IONS**

- Using a single beamlet, secondary ions are detected and then back scattered as a function of time

**SUMMARY**

- The electric potential is measured simultaneously by the center and top detectors
- The plasma potential at 10.5 ms is ~ 1.1 kV
- The data correspondents in the temporally evolving sample volumes are correlated

**OPERATIONAL AND PLASMA SIGNALS**

- Three apertures to the analyzer admit secondary-ions
- The beamlets are deflected by the electric field of the plasma

**QUANTITATIVE QUANTITIES EVOLVE CONSIDERABLY DURING IMPROVED CONFINEMENT DISCHARGES**

-固定资产和等离子信号
-脉冲和通量信号
-密度扰动信号

**THE MAGNETIC EQUILIBRIUM CHANGES AS A FUNCTION OF TIME**

- Accurate magnetic profiles are needed to compute HIBP trajectories
- Equilibria are computed using MSTFit which solves the Grad-Shafranov equation
- Data used to construct the flux surface include bootstrap current data, i.e., for a Mio", and additional magnetic field models

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**THE ELECTRIC POTENTIAL IS POSITIVE**

- The electric potential is measured simultaneously by the center and top detectors
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**PERIODIC PULSED POLAROID CURRENT DRIVE (PPCD)**

- Accurate magnetic profiles are needed to compute HIBP trajectories
- Equilibria are computed using MSTFit which solves the Grad-Shafranov equation
- Data used to construct the flux surface include bootstrap current data, i.e., for a Mio", and additional magnetic field models

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**The potential at the inner SV is (on average) larger than that at the outer SV**

- The plasma potential at 16.5 ms is ~ 1.1 kV
- The electric potential is measured simultaneously by the center and top detectors
- The data correspondents in the temporally evolving sample volumes are correlated

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**Temporal beam displacements during improved confinement**

- A single PPCD discharge is used to illustrate the changes in the magnetic potential, sample volumes, and secondary ion signals

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**TOolar Plasma Potential During Improved Confinement Discharges**

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**Potential Inference**

- The difference in energy between the detected and injected ions is
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**Forward looking goals**

- Profile of the potential and electric field will be measured using an improved focused ion gun (IFG)
- Enhanced analysis of the plasma potential will be correlated with the selection of data that result in sample volume correlation

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**Temporal beam displacements during improved confinement**

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**Sample volumes and secondary ion signals**

- Sample volumes corresponding to magnetic equilibria and sample volume widths
- Center Detectors: φ = 19.5 ± 1.1
- Top Detector SVs

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**Continuous Measurements**

- Secondary ion signals are acquired throughout PPCD
- Signal-to-noise ratios in the sample volume are correlated

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**Temporal beam displacements during improved confinement**

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**FIGURE 9**

- Data from 17 and 20 ms originate from proximal sample volumes
- The potential at 16.5 ms is ~ 1.1 kV
- The electric potential is measured simultaneously by the center and top detectors
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**The temporal beam displacement in the vicinity of the outer SV**

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