Cryopump Diagnostics

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Summary:

1. Particle balance important to evaluate cryopump effectiveness
2. Need fast pressure gauge near cryopump for exhaust estimate
3. Need divertor tile Langmuir probes for particle flux, n_e and T_e

PARTICLE BALANCE CAN BE ESTIMATED IN NSTX

PARTICLE BALANCE

SOURCES:

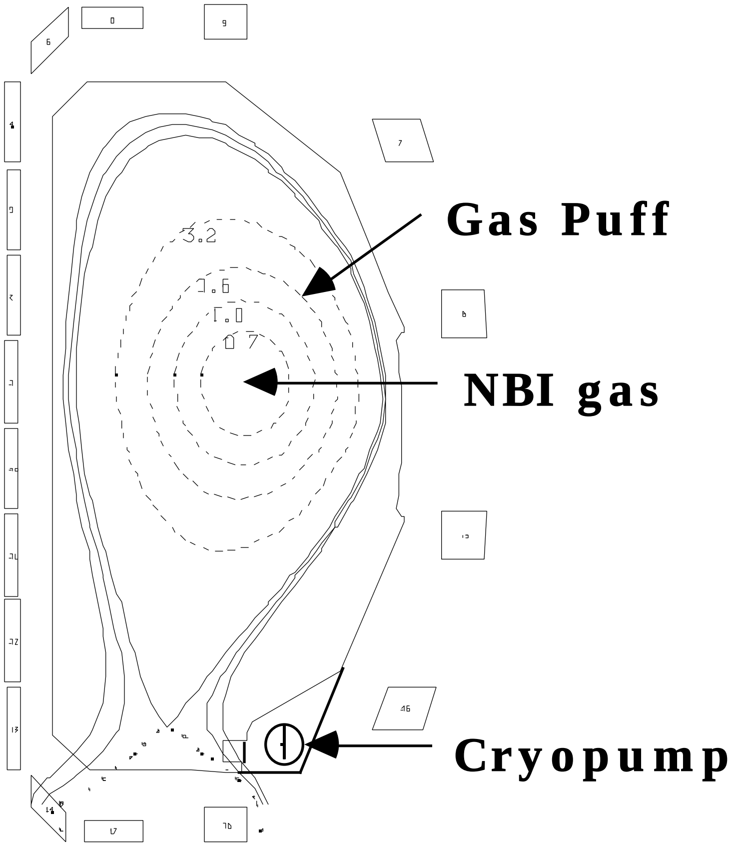
NBI Gas

Gas Puff

SINKS:

Cryopump

Plasma

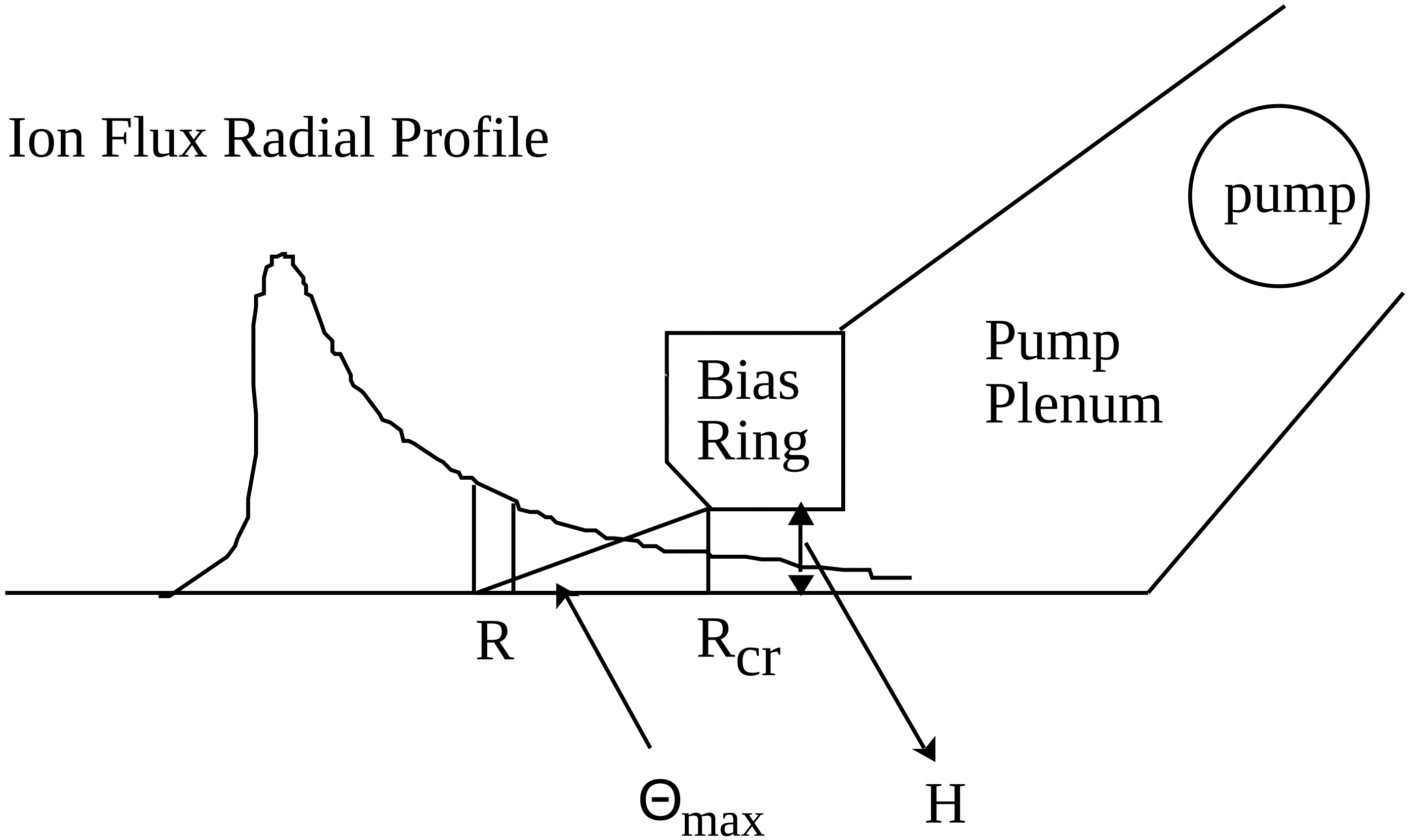


DIII-D CROSS-SECTION

$$\frac{dN_e}{dt} = S_{NBI} + S_{gas} - S_{cryo} - \frac{dN_o}{dt} - S_{wall}$$

FIRST FLIGHT NEUTRAL TRANSPORT MODEL APPROXIMATES PLENUM AS APERTURE

R. Maingi, et. al., Nucl. Fusion **39** (1999) 1187.



FIRST FLIGHT NEUTRAL TRANSPORT MODEL COMPUTES SOLID ANGLE FACTOR AND ATTENUATION

$$I_0^{plen} = \int_{R_{\min}}^{R_{\max}} \Gamma_i^{\parallel}(r) * \sin(\Theta_B(r)) * 2\pi R_m(r) * F(r) * A(r) * dr \tag{1}$$

$$P_0^{plen} = \frac{I_0^{plen}}{(S_{pump} + C) * 7e19} \tag{2}$$

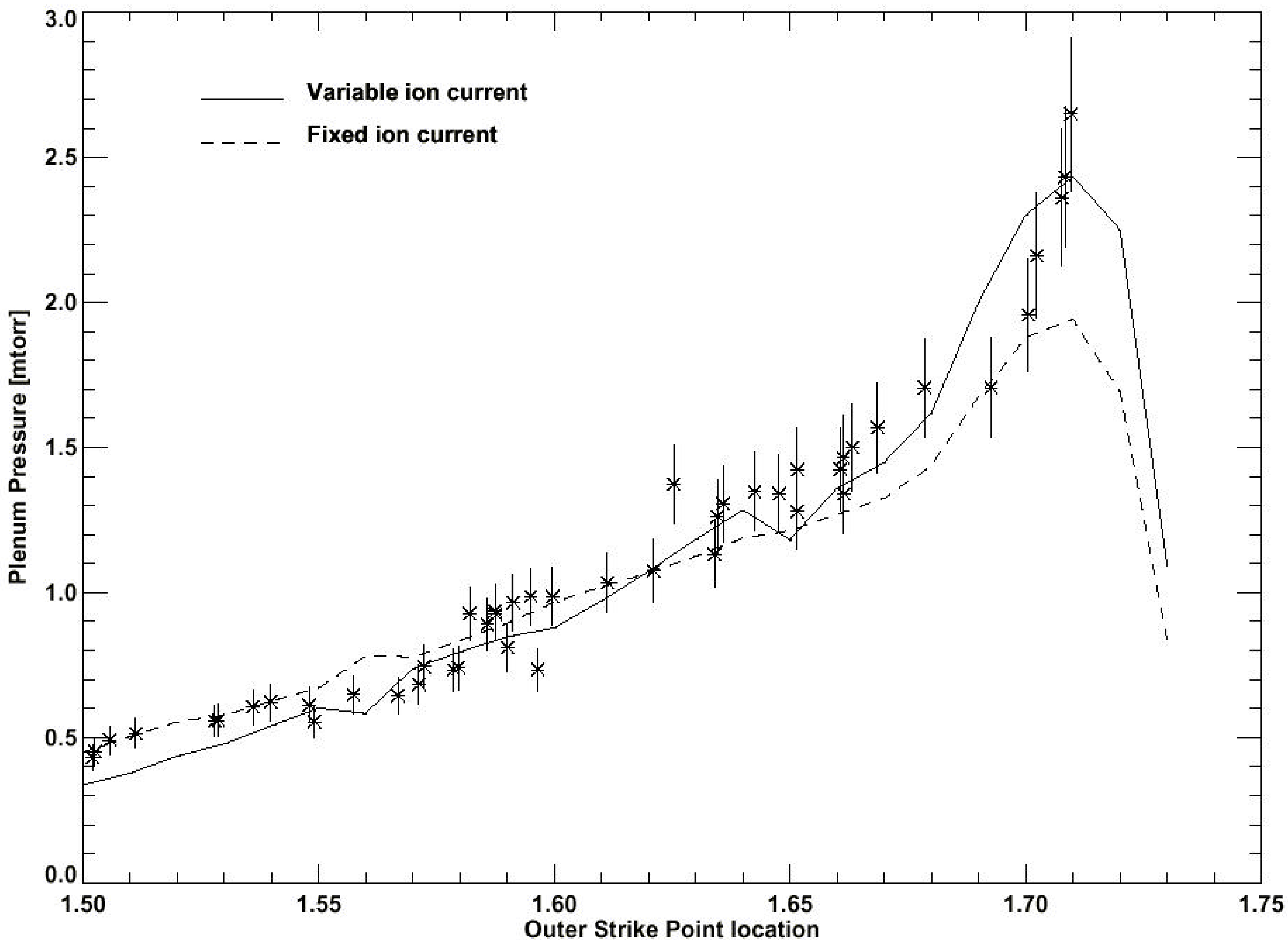
$$F = \frac{\int_0^{\Theta_{\max}} I(\Theta)\, dV(\Theta)}{\int_0^{\pi} I(\Theta)\, dV(\Theta)} \tag{3}$$

$$\Theta_{\max} = \tan^{-1}\left(\frac{\mathrm{H}}{\mathrm{R} - \mathrm{R}_{cr}}\right)$$

$$F(R) = \frac{\int_0^{\Theta_{\max}} \sin(\Theta)\, d\Theta}{2} = \frac{1 - \cos(\Theta_{\max})}{2} \tag{4}$$

$$A = \frac{I_0^{plen}(R_{\max})}{I_0^{plen}(R)} = \exp\left[-\frac{1}{v_0} \left(\int_R^{R_{\max}} n_e < \sigma \upsilon >_{EII}\, dr \right) \right] \tag{6}$$

FIRST FLIGHT NEUTRAL TRANSPORT MODEL MATCHES DATA FROM BAFFLE FAST PRESSURE GAUGE



FIRST FLIGHT NEUTRAL TRANSPORT MODEL USES DATA FROM DIVERTOR LANGMUIR PROBES