

Obtain 2D divertor density image using Lithium

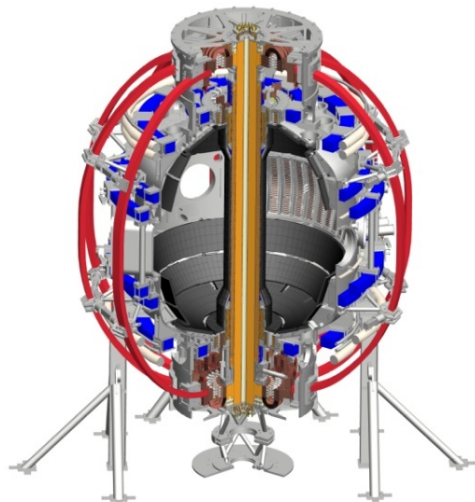
Oliver Schmitz

Joon-Wook Ahn, Kurt Flesh, Heinke Frerichs, Rajesh Maingi,
Jorge Munoz-Burgos, Vlad Soukhanoskii, Ian Waters

... not a concrete XP/XMP but a piggyback study to explore feasibility!

NSTX-U Research-Forum – Boundary group

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Beam attenuation on thermal Lithium has been used successfully at TEXTOR for electron density measurements

Setup at TEXTOR

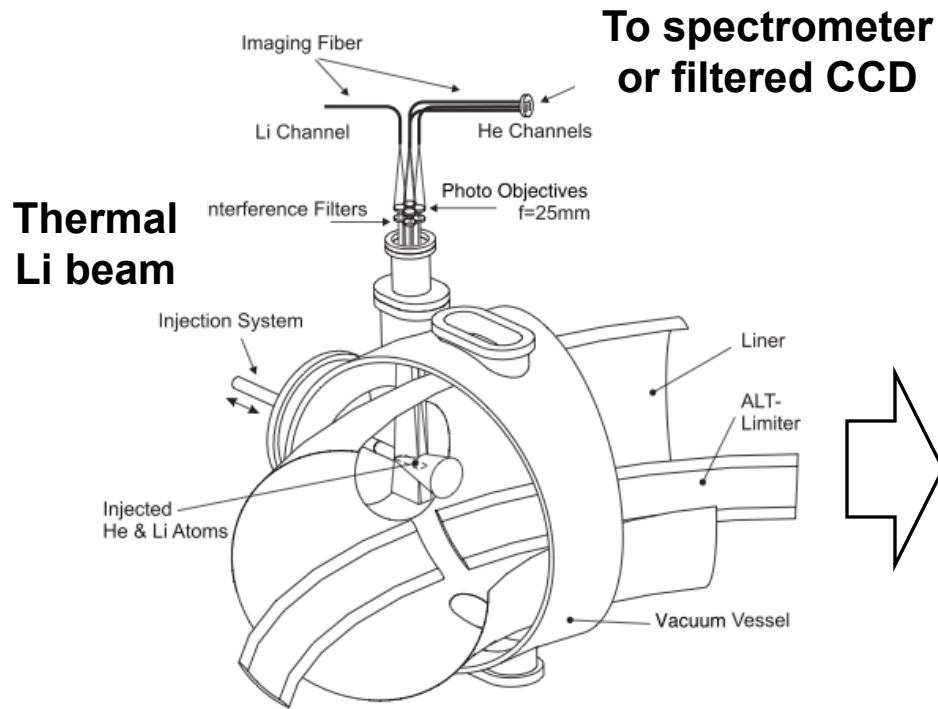
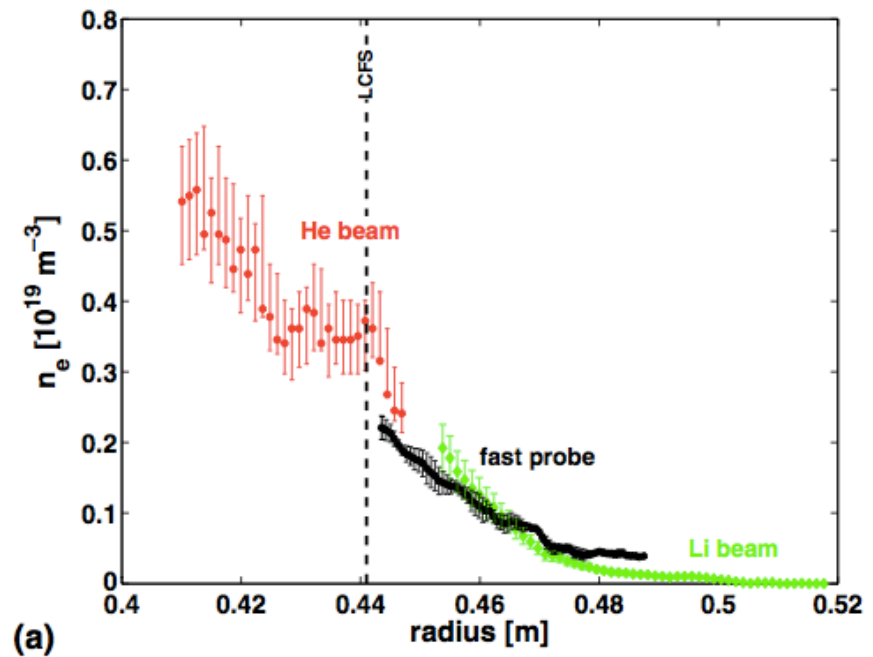


Figure 1. Setup of the combined Li and He thermal atomic beams.

Result from TEXTOR



Can the recycled Lithium be used as “intrinsic thermal Li beam”

Beam attenuation as work horse can give quantitative density information quite immediately

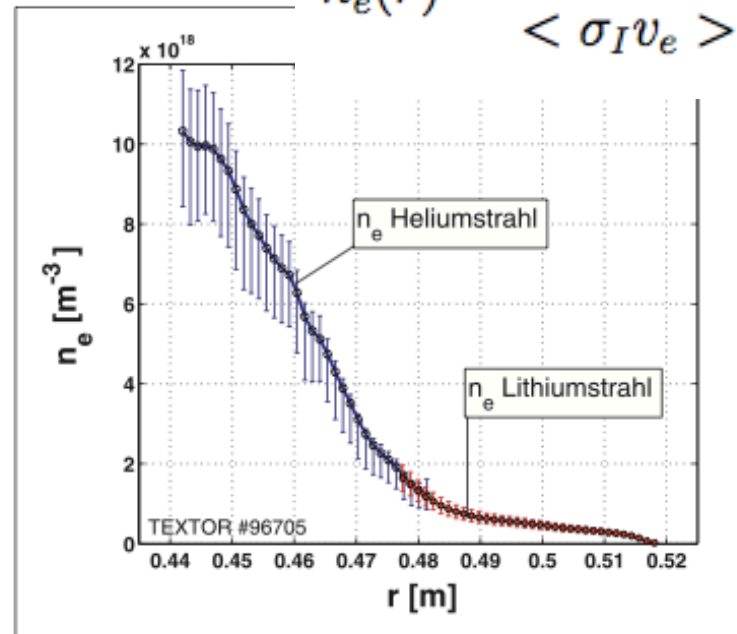
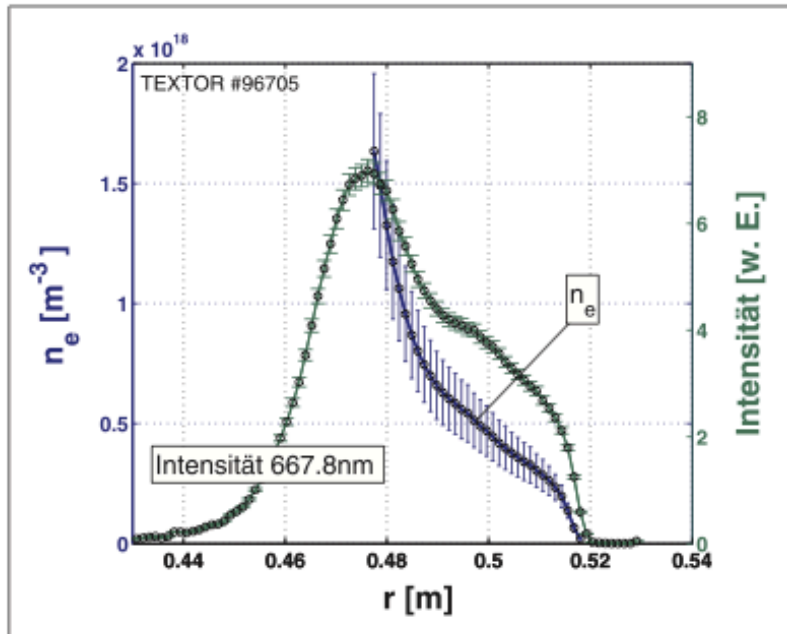
$$\frac{dn_A(r)}{dr} = -n_A(r)n_e(r) \frac{\langle \sigma_I v_e \rangle}{\bar{v}_A} \Rightarrow$$

$$n_A(r) = \int_{r_0}^r n_A(x)n_e(x) \frac{\langle \sigma_I v_e \rangle}{\bar{v}_A} dx$$



$$I_A(r) = \frac{V}{4\pi} n_A(r)n_e(r) \langle \sigma_{In} v_e \rangle$$

$$n_e(r) = \frac{I_A(r)\bar{v}_A(r)}{\langle \sigma_I v_e \rangle \int_0^r I_A(x) dx}$$



Enhanced interpretation capability enabled using an appropriate collisional radiative model (available and under validation at UW Madison)

Questions to clarify for testing feasibility

- **Observation geometry:** *is tangential view with limited line integration effect available?*
- **Observation geometry:** *is a tomographic view available? This will enable 2D density maps in $[R,Z]$ and maybe also in $[R, \phi]$.*
- **Spectroscopy:** *do we have sufficient setup of spectrometers or filtered CCD camera for 2D attempts?*
- **Initial data:** *get data of most feasible systems (tbd, see above) and model as synthetic emission in EMC3-EIRENE?*
- **Interpretation:** *we are validating an existing CRM for Li using LIF and we are implementing it into EMC3-EIRENE -> would be ready quite soon to use initial data for assessing feasibility?*
- **Machine time:** *all piggy back, but needs to be compatible with requests of spectroscopic systems, Lithium wall conditioning required?*