

Hydrogen and Helium Edge-Plasmas

Comparison of high and low recycling

**T.D. Rognlien and M.E. Rensink
Lawrence Livermore National Lab**

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Outline

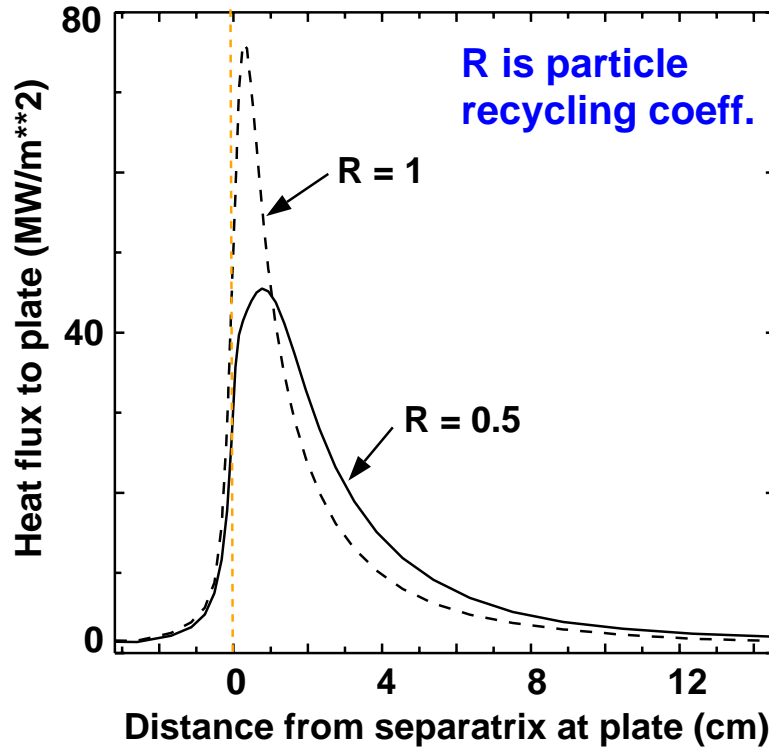


- 1. High- and low-recycling hydrogen plasmas**
- 2. ARIES-RS results**
- 3. Helium spatial concentrations**

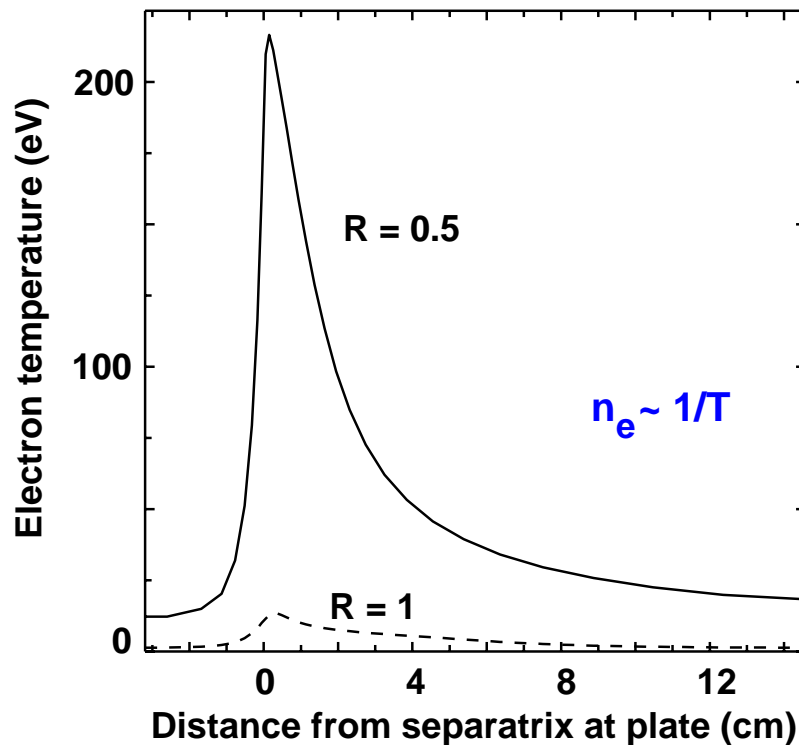
High and low recycling have similar plate heat flux profiles



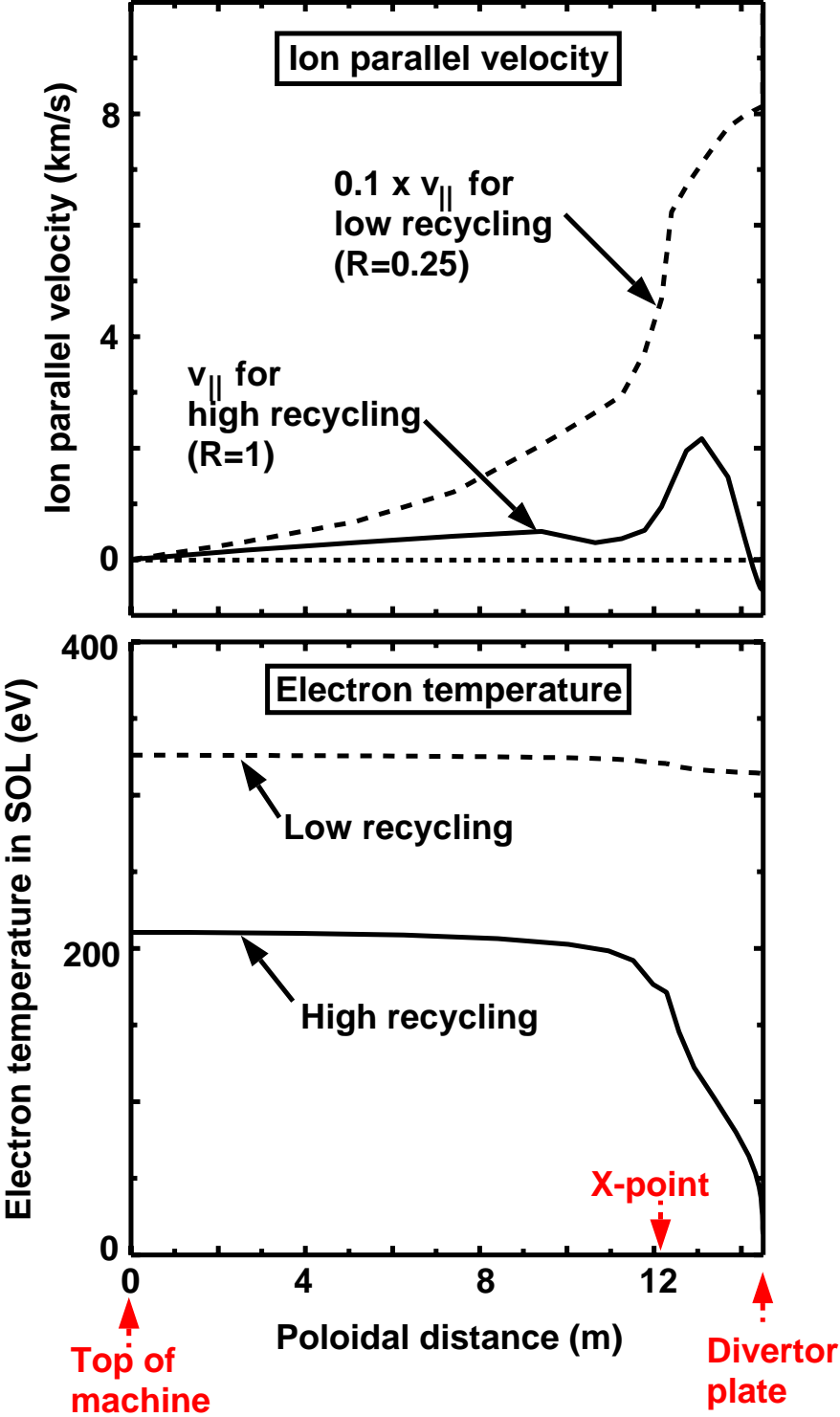
ITER-like geometry with 150 MW into SOL



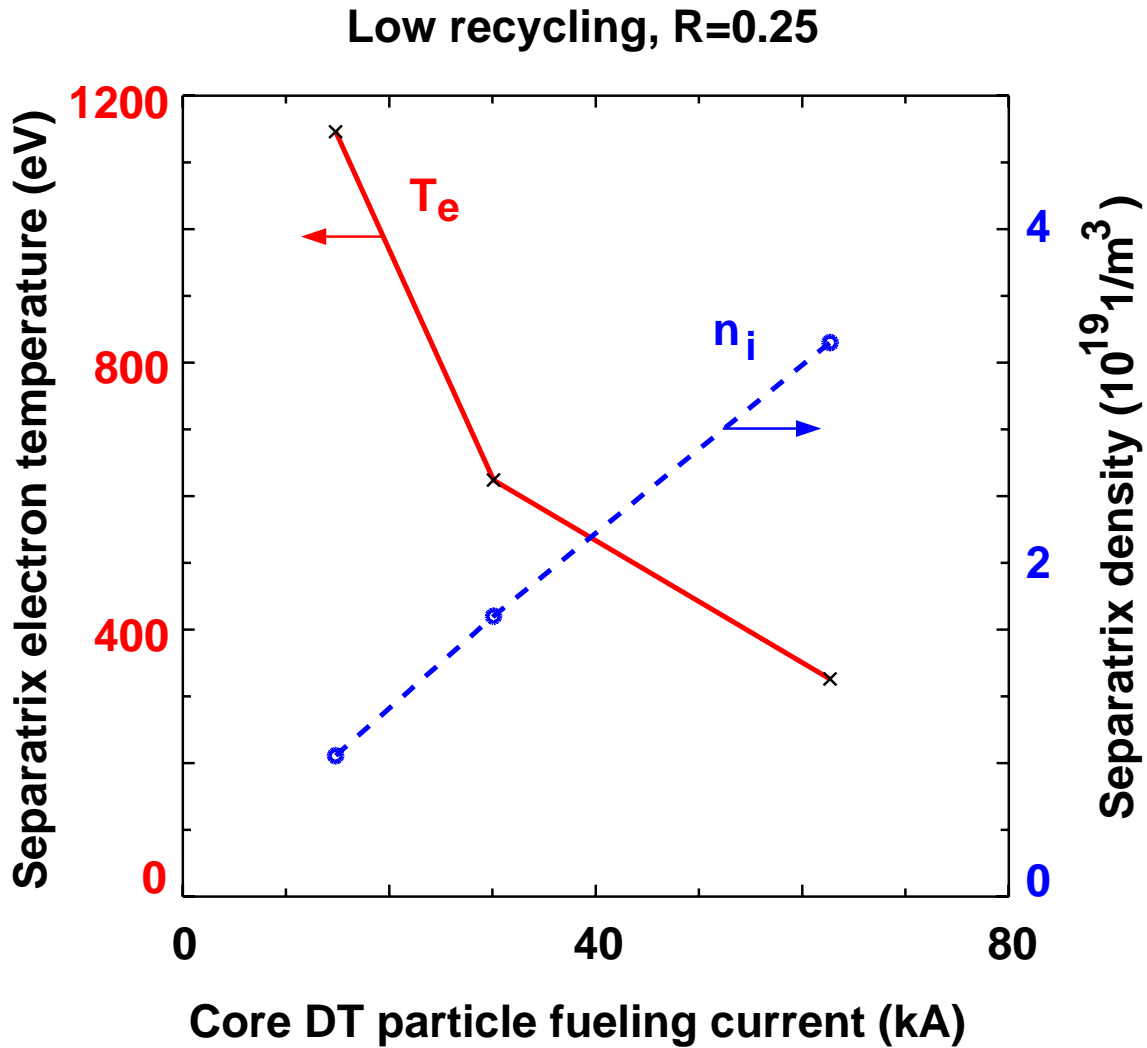
1-D plasma pressure balance is broken by radial transport for $R=0.5$ case



Edge plasma changes from low to high recycling



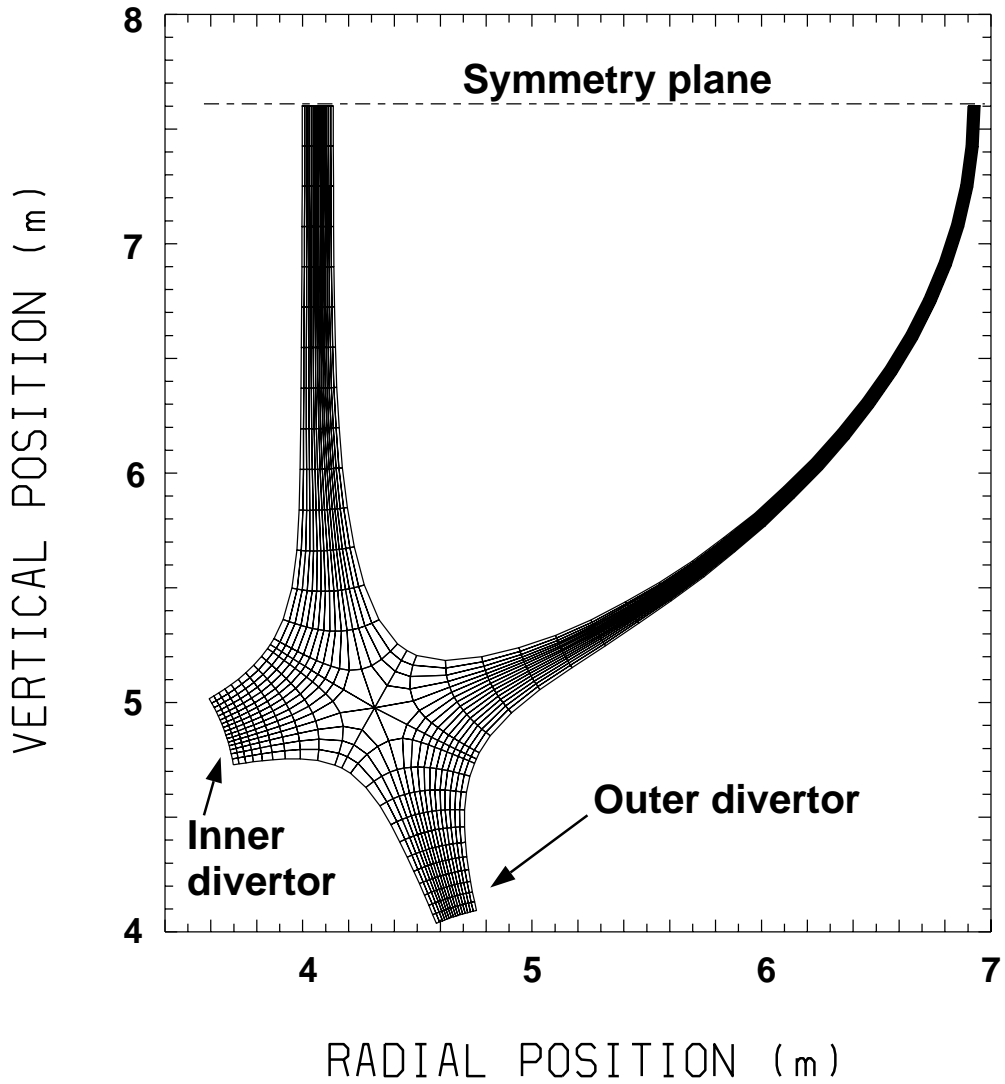
Low recycling yields hot edge plasma unless there is very large DT particle fueling



Mesh obtained for standard ARIES-RS with symmetric double-null divertor



EFITD 02/05/98 # 99326 , 600ms

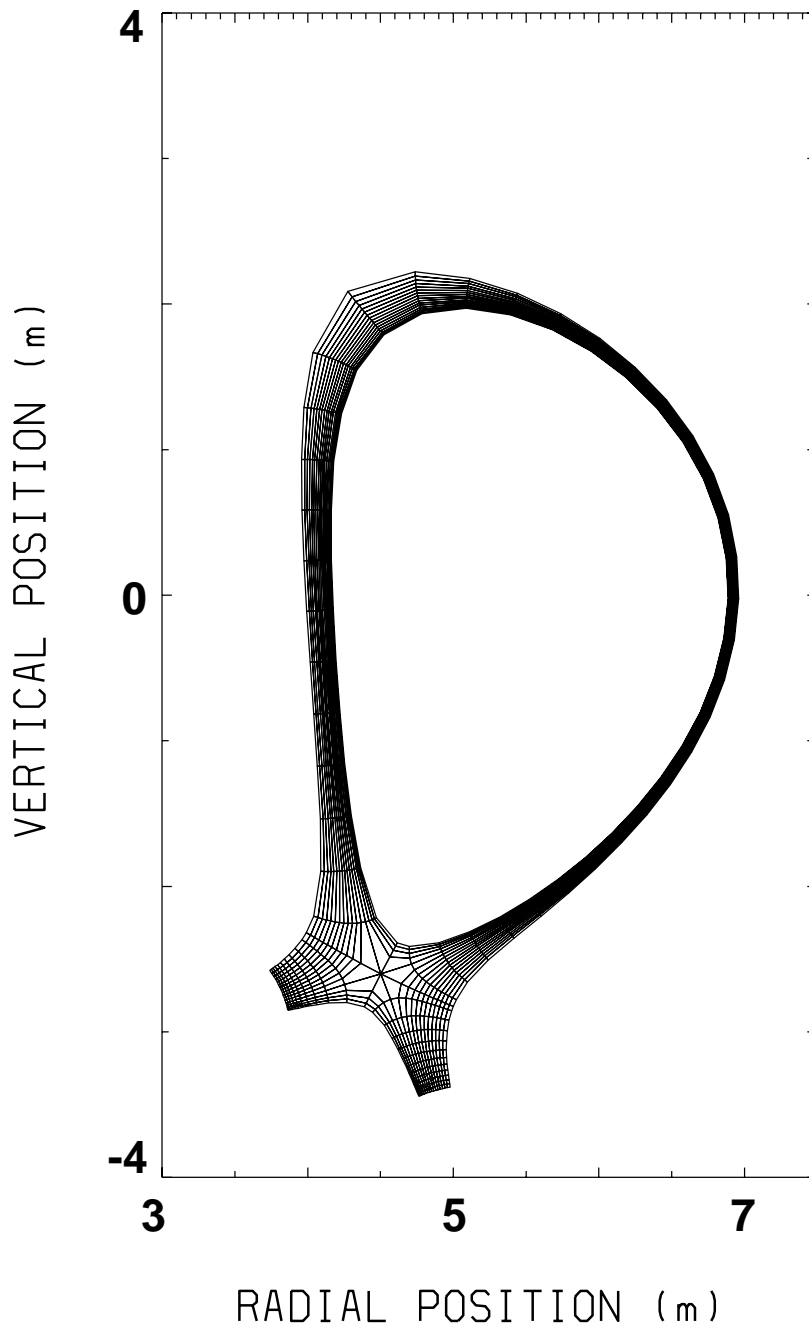


Small modification to poloidal B-field coils used to produce single-null configuration



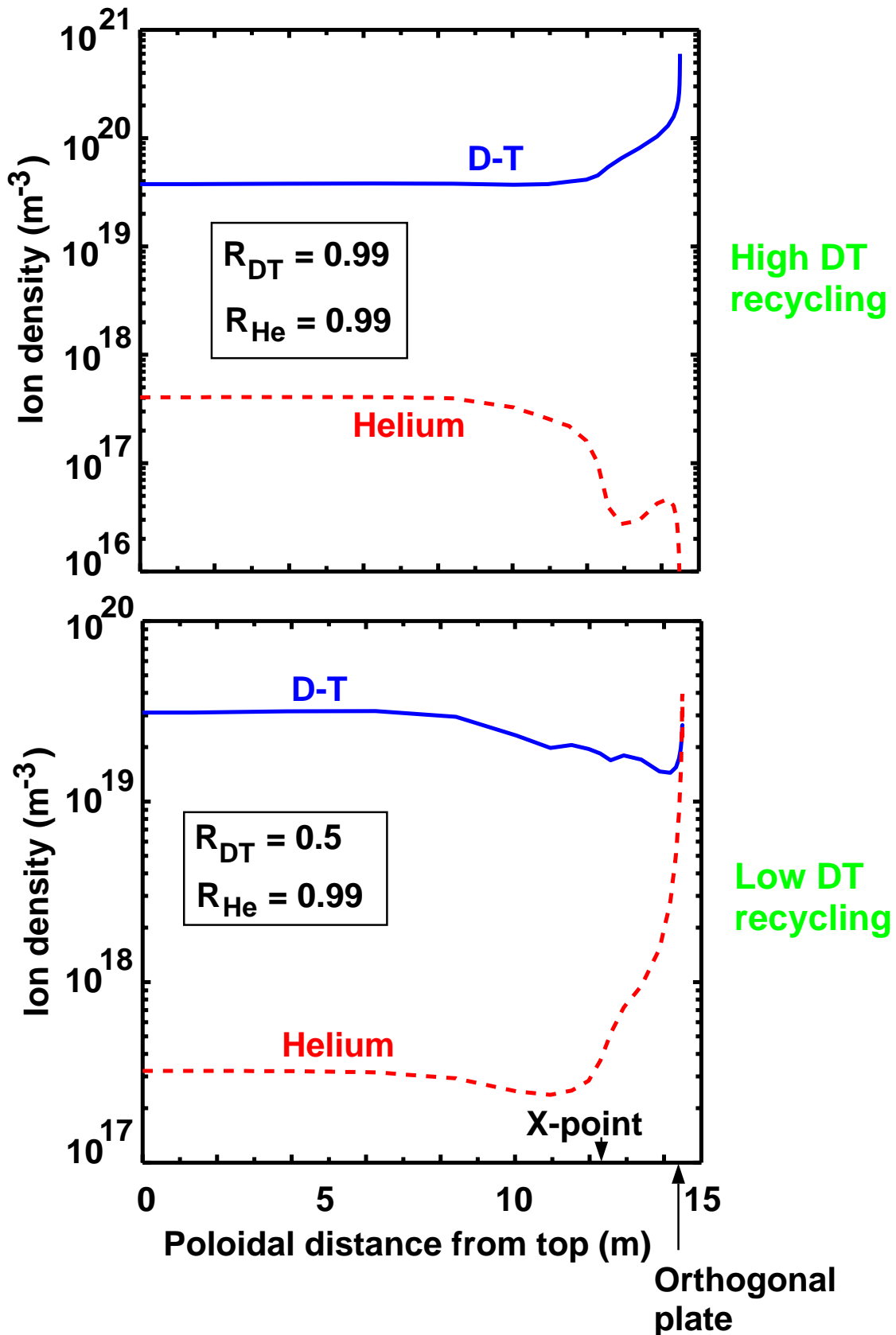
ARIES-RS (SN)

01/20/00



**Resulting
divertor plasma
parameters
given in a
memo**

Low recycling hydrogen can give much better helium compression in divertor



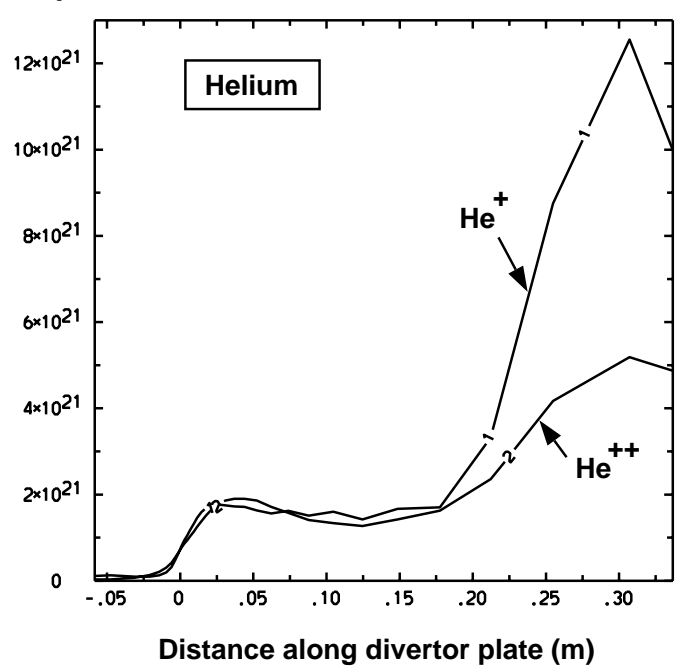
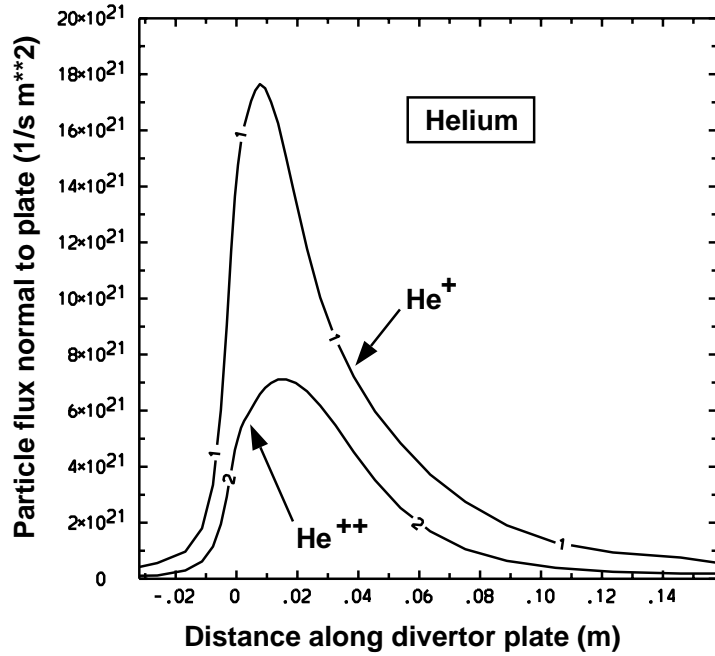
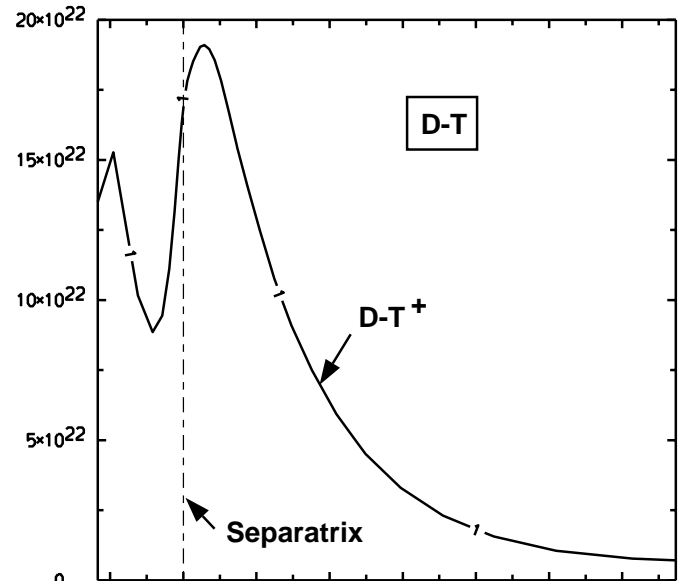
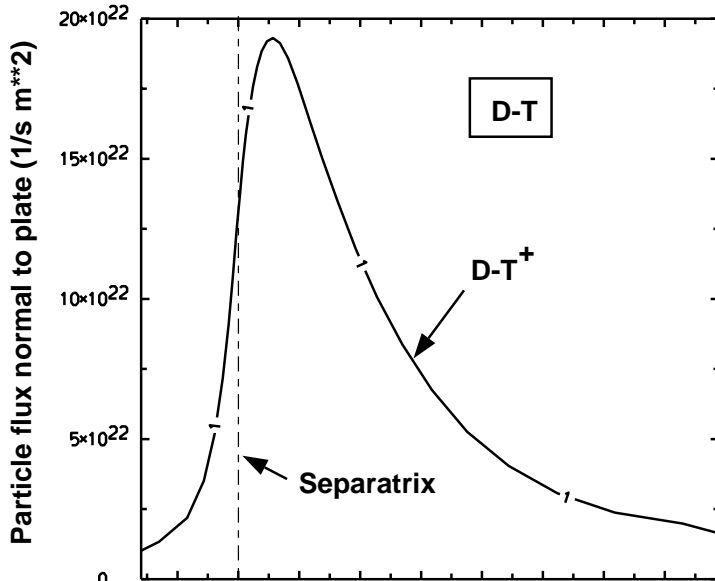
Helium flux displaced toward outer wall for vertical divertor plate



1% helium at the core-edge boundary
 $R_{\text{hydrogen}} = 0.5$, $R_{\text{helium}} = 0.95$

Orthogonal divertor plate

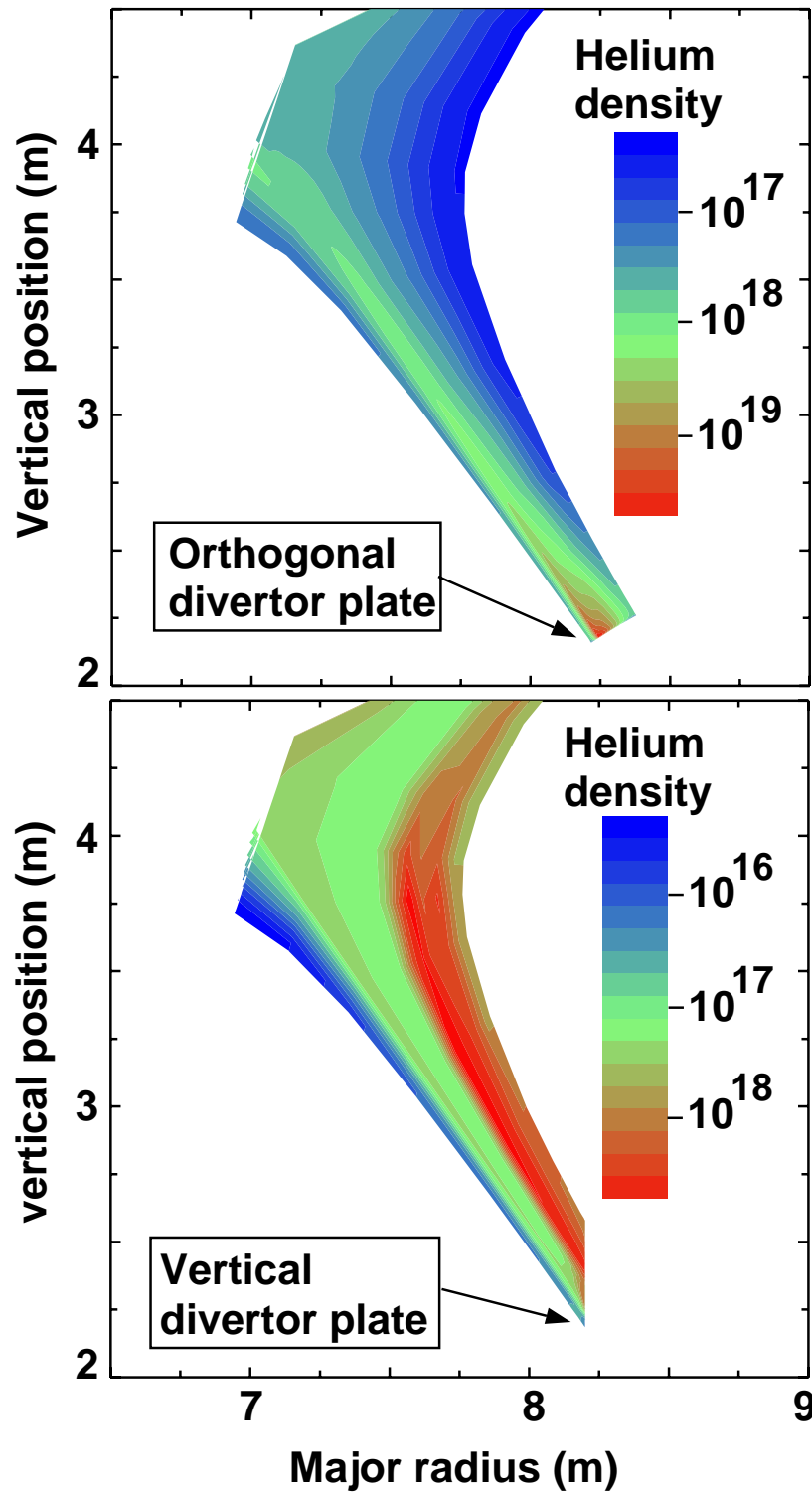
Vertical divertor plate



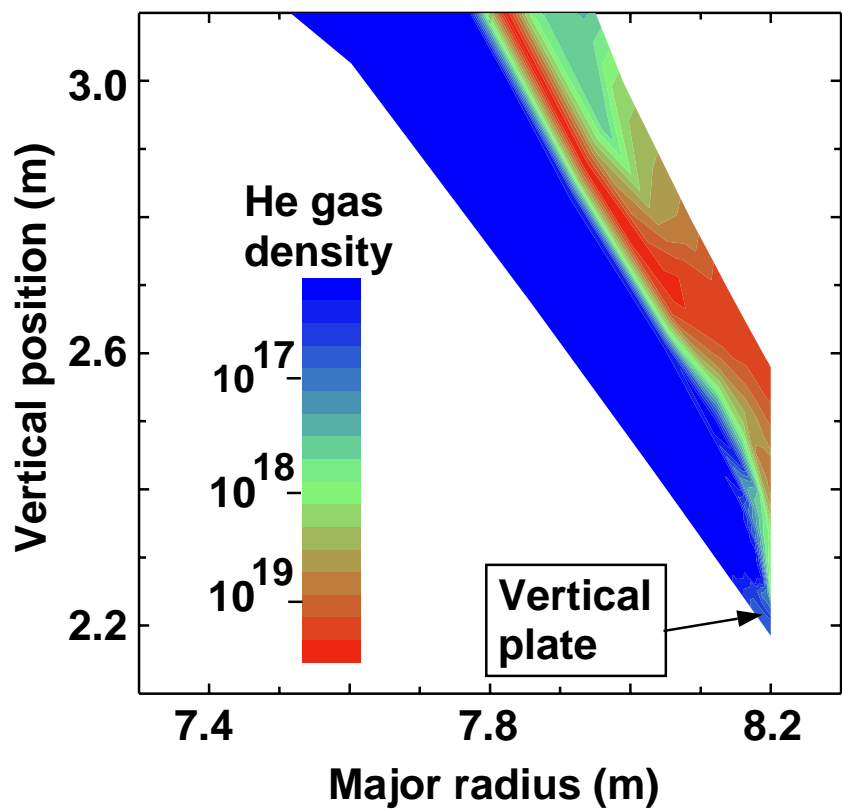
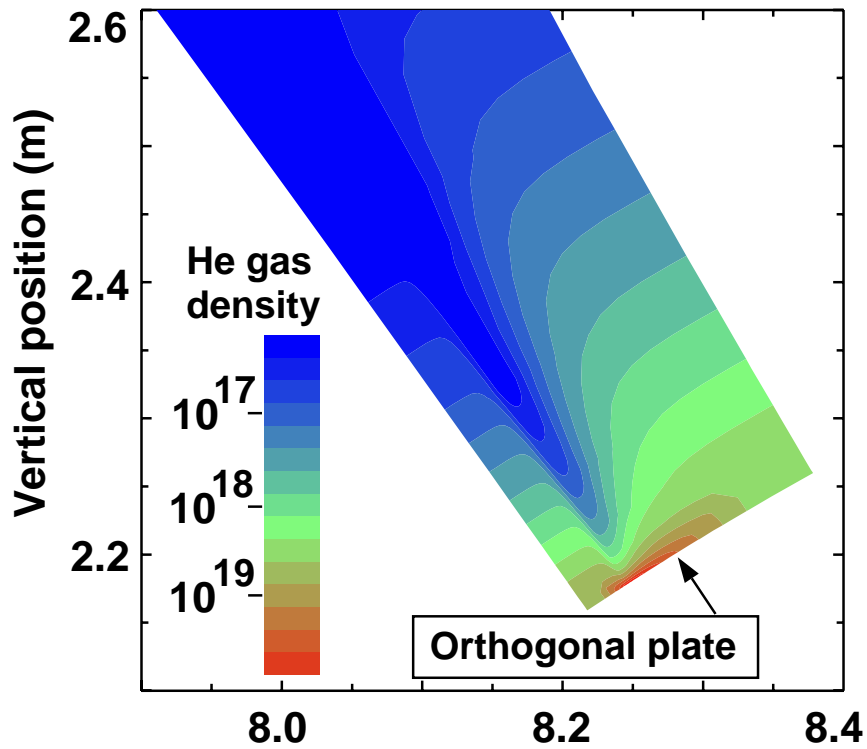
Helium ion density concentrates near wall for vertical divertor plate



$R_{DT} = 0.5$, $R_{He} = 0.99$, n_{He} at core boundary = $4 \times 10^{17} \text{ m}^{-3}$



Helium gas density also concentrates near wall for vertical plate





1. High- and low-recycling hydrogen plasmas

- poloidal flow toward divertor much reduced for high recycling plasmas - major impact on impurities
- edge density for low recycling is controlled by fueling; more analysis of cases with low edge density needed

2. ARIES-RS results

- an MHD equilibrium for single null now available
- divertor plasma weakly attached assuming 90% of core power radiated; strongly attached otherwise

3. Helium spatial concentrations

- low recycling with large fueling causes large helium densities near the plate - enhances duct pumping
- tilted divertor plate forces helium toward outer wall