Testing advanced divertors on NSTX

- **Propose to test divertors that optimize divertor geometry factors *near the target plate* using 2nd X-pt near (but behind) the plate**
  - →Optimizes:
    - Flux expansion at the plate
    - The distribution of line length to region near to the plate
    - Flaring of field lines near the plate
  - →All of these should facilitate detachment near the plate, and assist in keeping the cold, radiating region close to the plate (and away from the H-mode barrier where it can degrade confinement)
- **Thorough examination of advanced divertors is crucial since they:**
  - →May be crucial to divertor operation on ST-FNSF
  - →May assist particle control
  - →May allow lower operating density, benefiting advanced integrated scenarios (current drive efficiency)
    - Allow tolerable plate conditions at lower density
  - →Qualitatively similar configurations possible on ITER; examination on NSTX-U to clarify basic physics
    - Of course ITER geometry not as favorable (***much*** less flexible than NSTX-U)

★IFS

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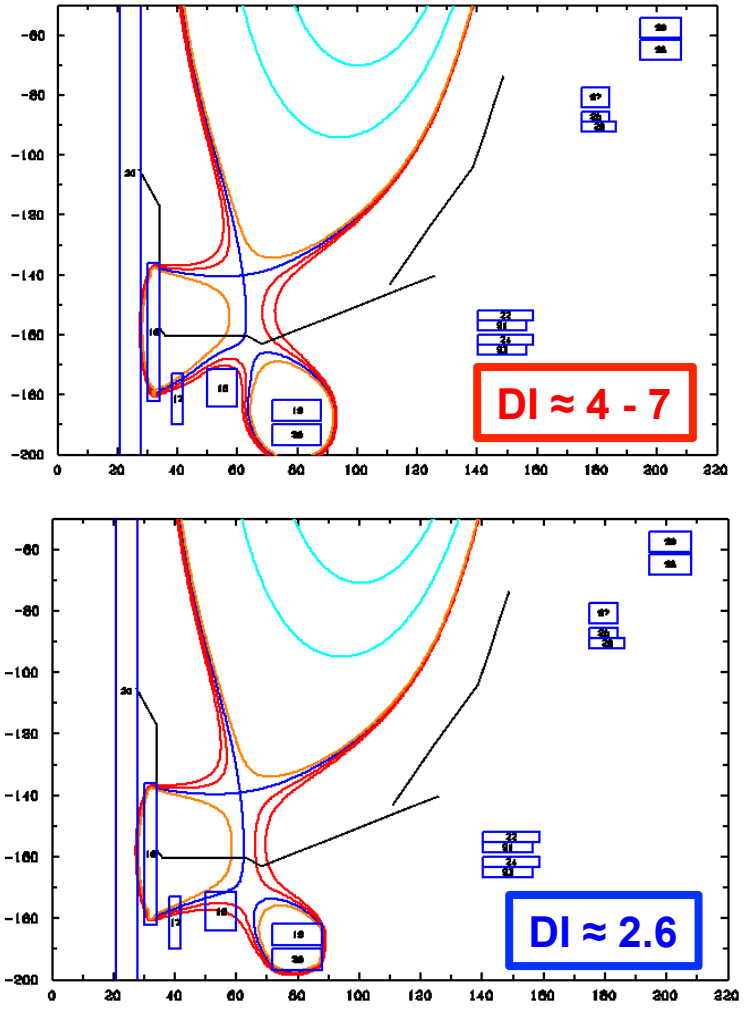
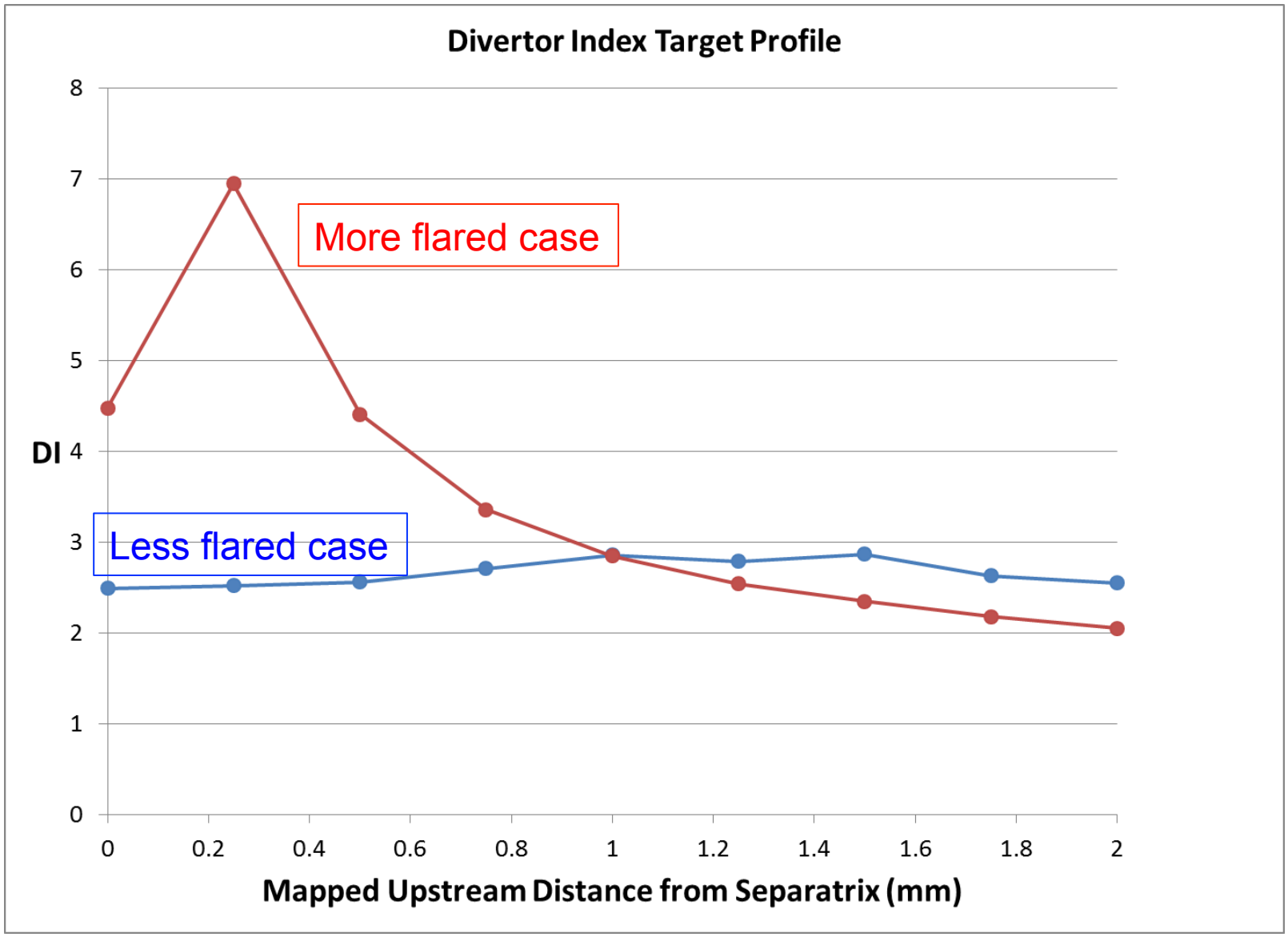
Early CORSICA equilibria for NSTX-U:

- ***Vary the relevant geometrical parameters (flaring, line length distribution and flux expansion) by varying the 2nd X-pt distance from plate***
  - →Changes the field line flaring (visually and as measured by metrics such as DI)
  - →Find how changing flaring near plate affects in addition to heat flux:
    - Detachment density
    - Migration of the radiating region as detachment progresses
    - Amount of confinement degradation as degree of detachment is increased (Confinement = pedestal pressure, total thermal energy and/or H-factor)



★IFS


Divertor Index Target Profile
DI
8
7
6
5
4
3
2
1
0
More flared case
Less flared case
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Mapped Upstream Distance from Separatrix (mm)

Testing advanced divertors on NSTX

- ***Time permitting, would like to test:***
  - →varying the length of the divertor throat (distance of the core X-pt from the plate)
    - While keeping flux expansion (or DI) constant (if possible?)
  - →differences between puffing in divertor region vs other locations for flared geometries
  - →Find how these variations change the properties of interest:
    - Detachment density, radiation migration, confinement degradation, *as well as* the target plate heat flux

- ***SOLPS simulations will be run***
  - →To help interpret the data
  - →Perhaps to assist in experimental design

Testing advanced divertors on NSTX

- ***Sketch of program***
  - →Density ramps to find detachment density
    - Possibly slower ramp rates to linger near densities of interset
  - →Do this on multiple divertor geometries (including “standard divertor) with very similar core geometry (κ,δ, I_p, B, etc.)
  - →Verses density, examine degree of detachment (probes), plate heat flux, radiation distribution for each geometry
  - →Correlate with confinement parameters (pedestal stored energy, total stored energy, H-factor)
  - →Compare the ability of each geometry to attain the strongest detachment/ lowest heat flux with minimal confinement loss and at the lowest density
  - →SOLPS runs to interpret