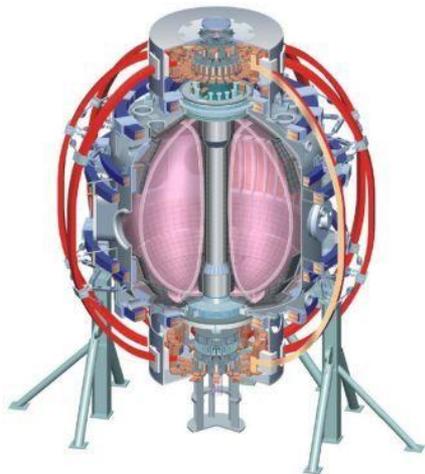


# Density pump-out by 3-D field application in L-mode

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# Motivation and goals of experiment

Density pump-out is a prominent phenomenon accompanying many RMP experiments. All of these experiments had **low edge collisionality ( $\nu_e^* < 0.5$ ) and good pitch angle alignment**

- NSTX H-mode has high pedestal collisionality ( $\nu_e^* > 1$ ). L-mode plasmas would be better for low  $\nu_e^*$  ( $n_{e,edge} \sim 0.5e19m^{-3}$ ,  $T_{e,edge} \sim 150eV$ ). Maintain gas puffing minimal
- How to achieve better alignment?
  - Vacuum modeling showed low q95 will be beneficial for better alignment in NSTX (J.-K. Park). High  $I_p$  in Ohmic plasmas is limited
  - MAST found an optimum Bt for bigger pump-out (not clear if q95 was kept constant). Bt scan for a given q95 will change the alignment, hence the size of edge  $b_{r,res}$
  - Need vacuum modeling to check beforehand

# Effects to check if density pump-out

- Screening effect due to toroidal rotation? Compare the size of pump-out for Ohmic and beam heated L-modes. NBI injection (1MW) using the source with bigger tangency radius
- Effect of density and coil current on the size of pump-out
- Effect on edge turbulence and  $E_r$  (any  $I_{\text{coil}}$  threshold effect?) – reciprocating probe??, good for low power L-mode shots
- Reflectometer (Kubota) – Density fluctuation, turbulence
- BES (Smith) for beam shots – Long wavelength turbulence

Possible piggy back experiments:

- XP1125 (D. Clayton): Impurity transport
- XP1xxx (J.-K. Park):  $n=2$  application (different spectrum)??

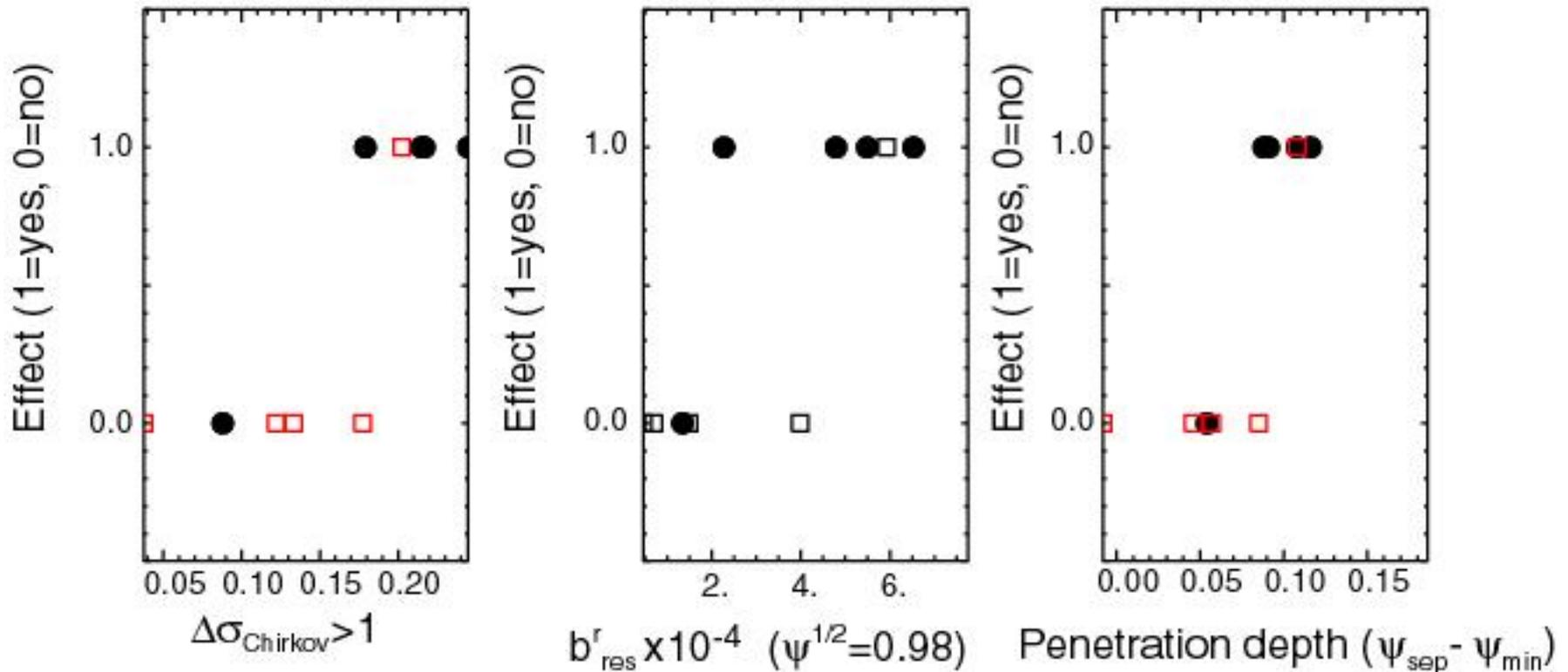
# Experimental plan

- Reproduce a reference L-mode shot (134718) and apply a DC 3-D field ( $n=3$ )
- $q_{95}$  scan via  $B_t$  scan, ie  $B_t=0.55, 0.5, 0.45, 0.4, 0.35T$ , (5 shots)
- Density scan beginning from the lowest density,  $n_{e,edge}=0.5, 1, 1.5e19$  (6 shots)
- Coil current scan:  $n=3$  DC 3-D field ( $I_{3-D}=500A, 1kA, \text{ and } 1.5kA$ ) (3 shots)
- L-mode with 1MW NBI injection at  $n_{e,edge}=0.5e19$  and  $I_{3-D}=1kA$ , with 3  $B_t$  points (3 shots)

# Parameters associated with L-mode density pump-out in MAST

Lmode, even coils ●  
odd coils □

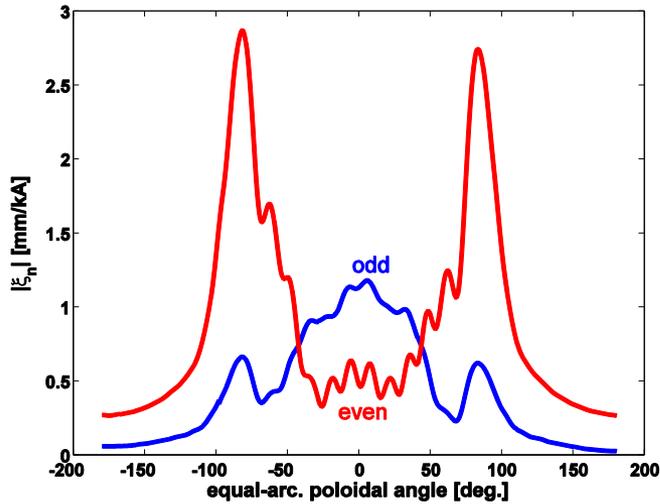
To be presented by P. Denner at SFP 2011



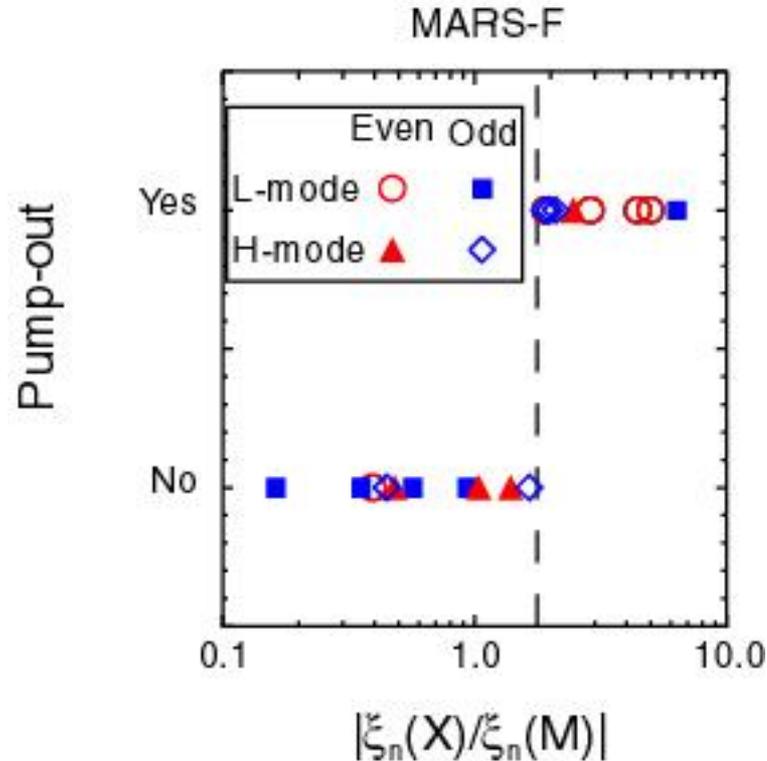
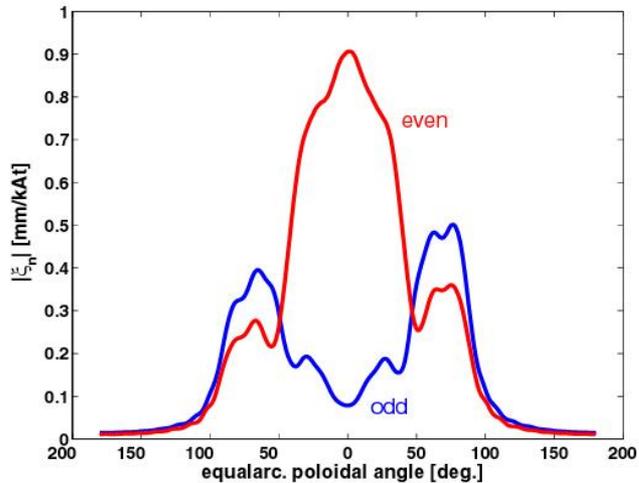
**Several parameters from vacuum calculations are loosely correlated with whether or not a density pump out is observed in L-mode**

# Plasma response modeling (MARS-F) in MAST

Even parity pump out



Odd parity pump out



*In all L-mode and H-mode plasmas studied pump out is only observed when the plasma displacement is greater at the X-point than at the mid-plane*

A. Kirk, PPCF (2011)