

A scenario for steady-state low-aspect-ratio
RFP sustained by pressure-driven and
RF/NBI-driven currents

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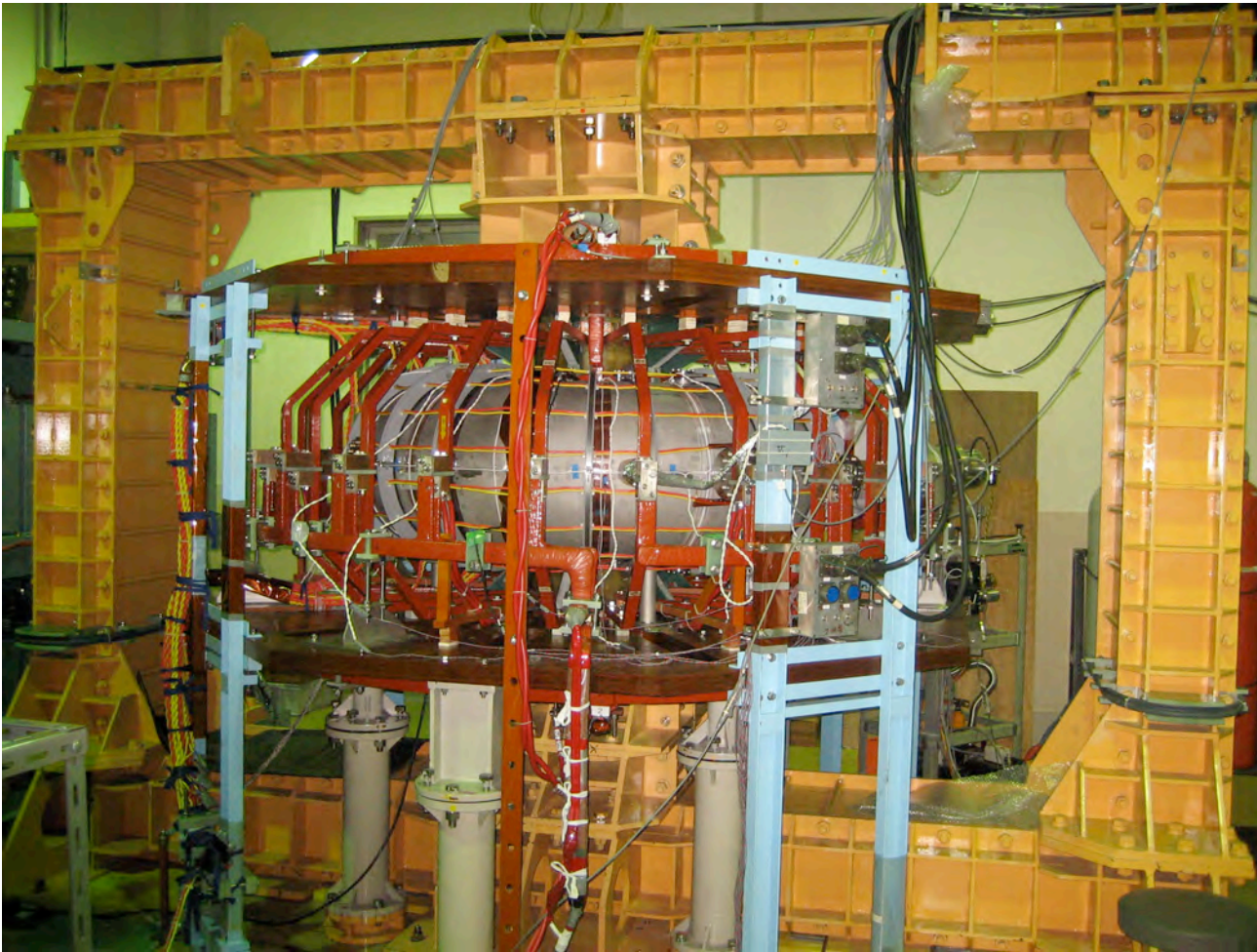
Some challenges for the RFP

- Improving confinement
- Sustaining current

Possibilities for RFP plasmas at low R/a

- Accessing, enhancing “QSH”
- Generating bootstrap current

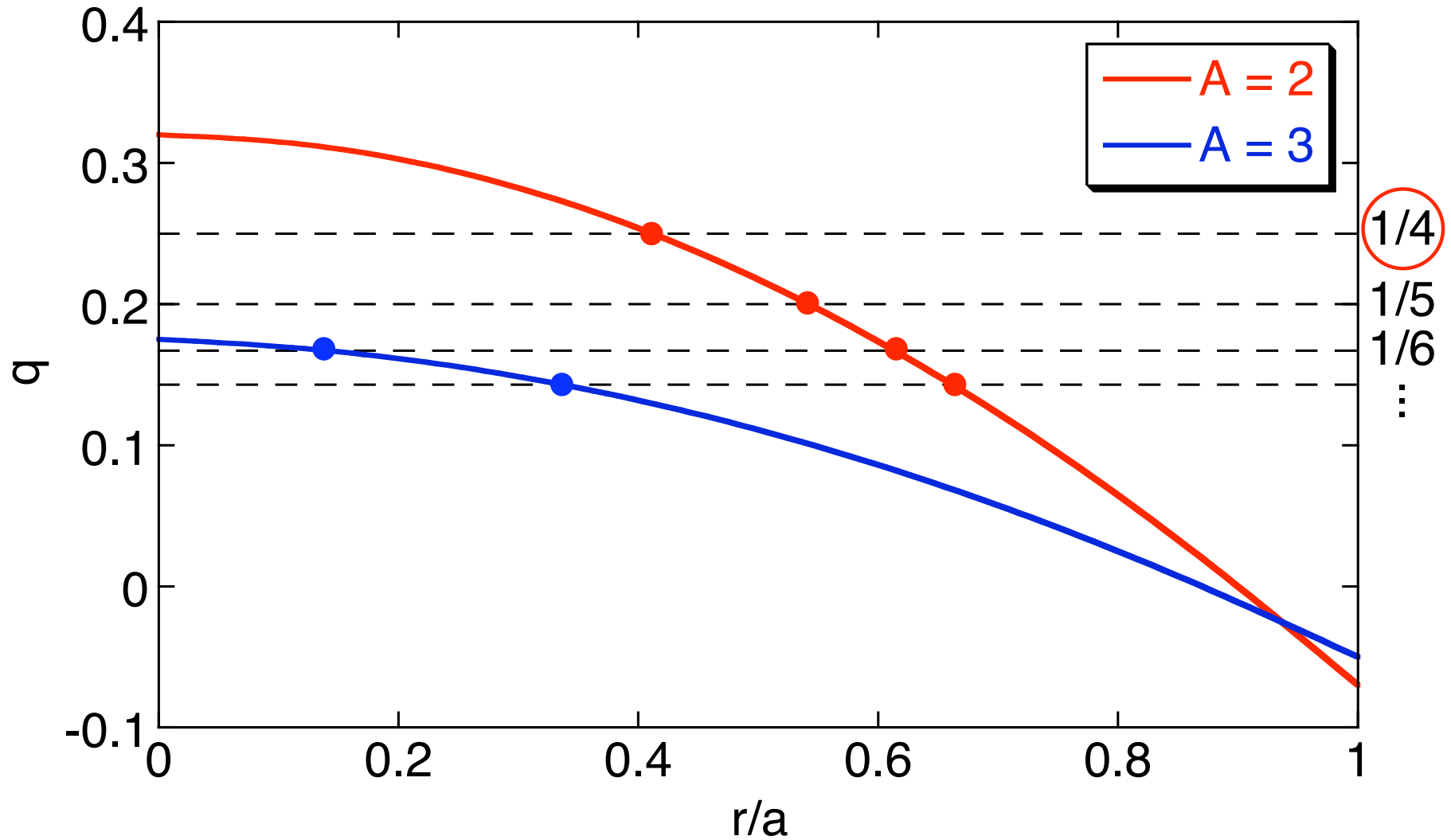
REversed field pinch of Low-Aspect ratio eXperiment



- $R/a = A = 2$
(51 cm/25 cm)
- Optimization in progress

Improving confinement via QSH

Lower A means lower n for dominant m = 1 modes



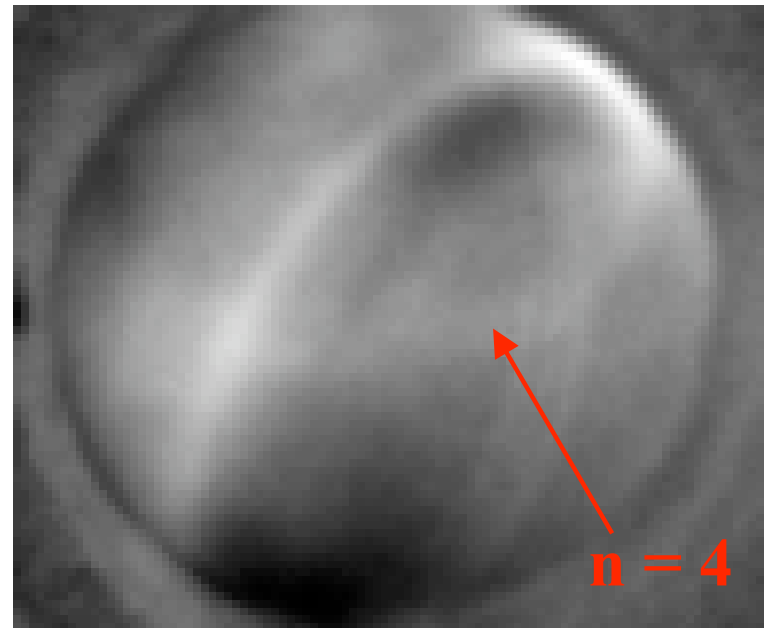
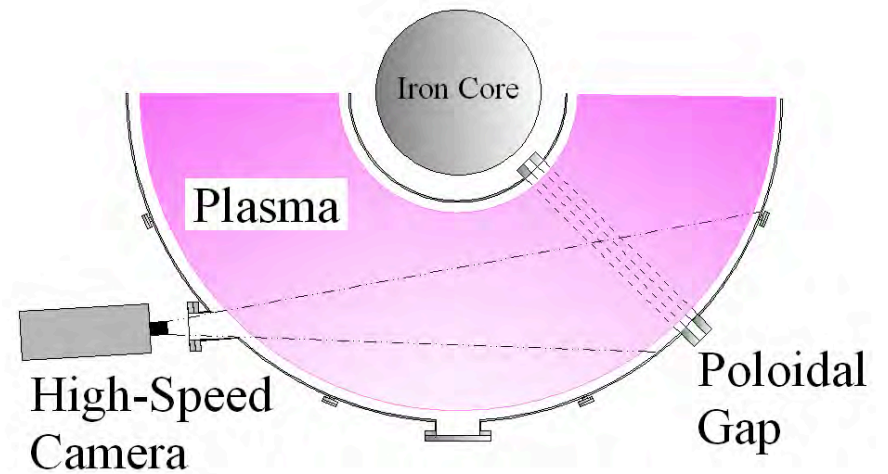
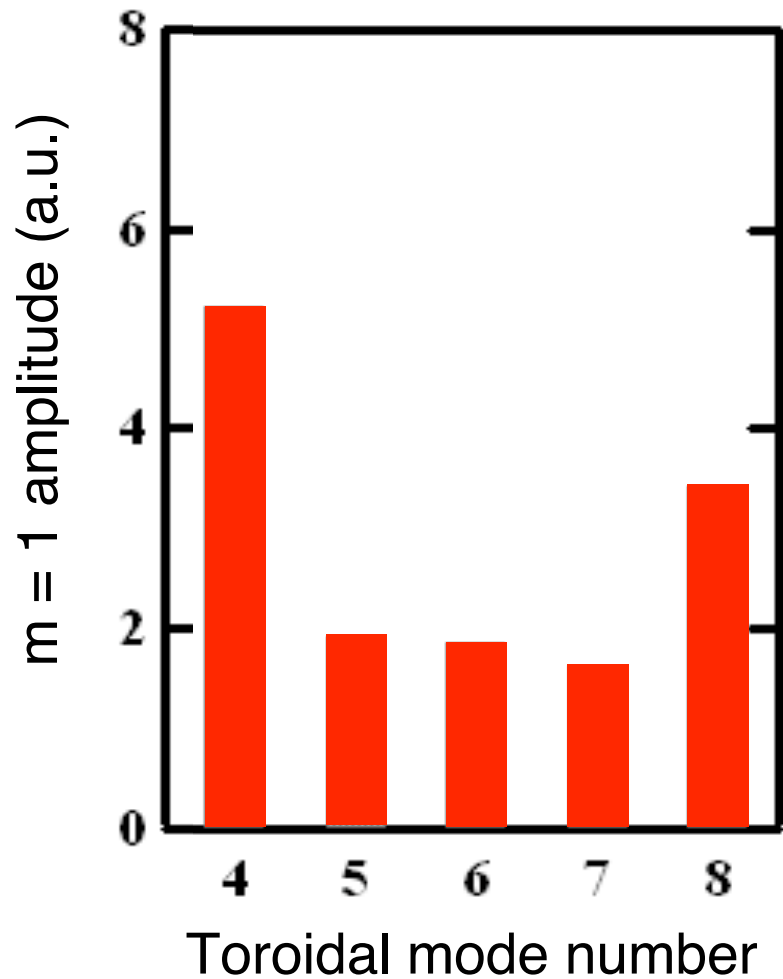
Lower A may enhance “quasi single helicity”

- QSH: single large $m = 1$ tearing mode (innermost resonant) produces nonchaotic helical structure
- Precursor to SH -- larger structure



- Lower A , $m = 1$ spectrum peaks around lowest n (*Ho, 1995*)
- Lower n , larger structure width (*Martin, 1999*)

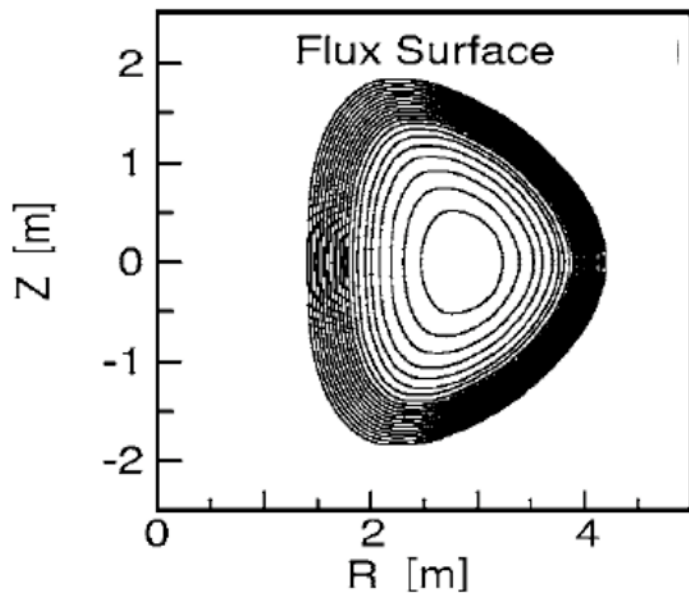
Helical structure already observed in RELAX



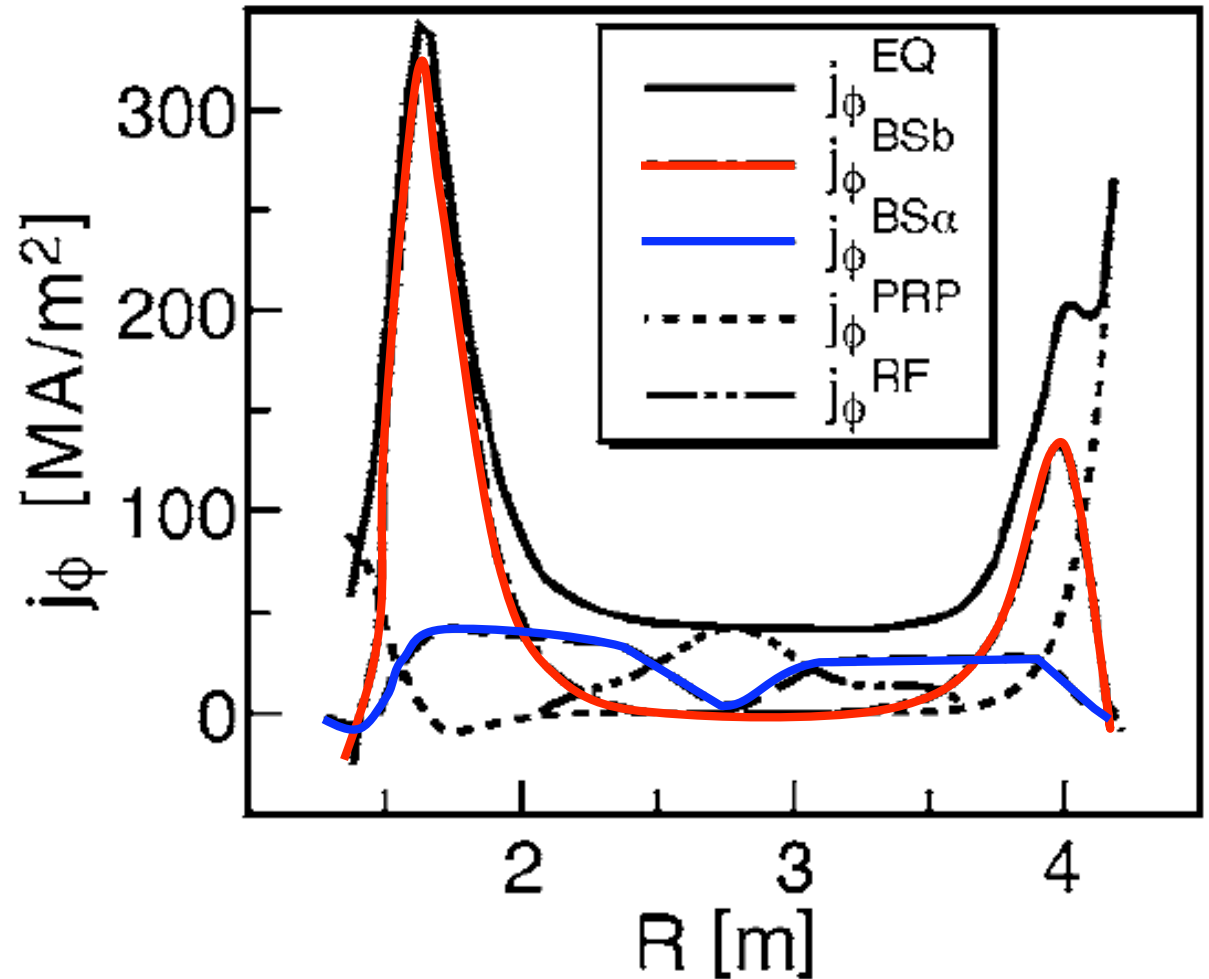
Adding bootstrap current for
discharge sustainment

Substantial $J_{\text{bootstrap}}$ may be possible in low-A RFP

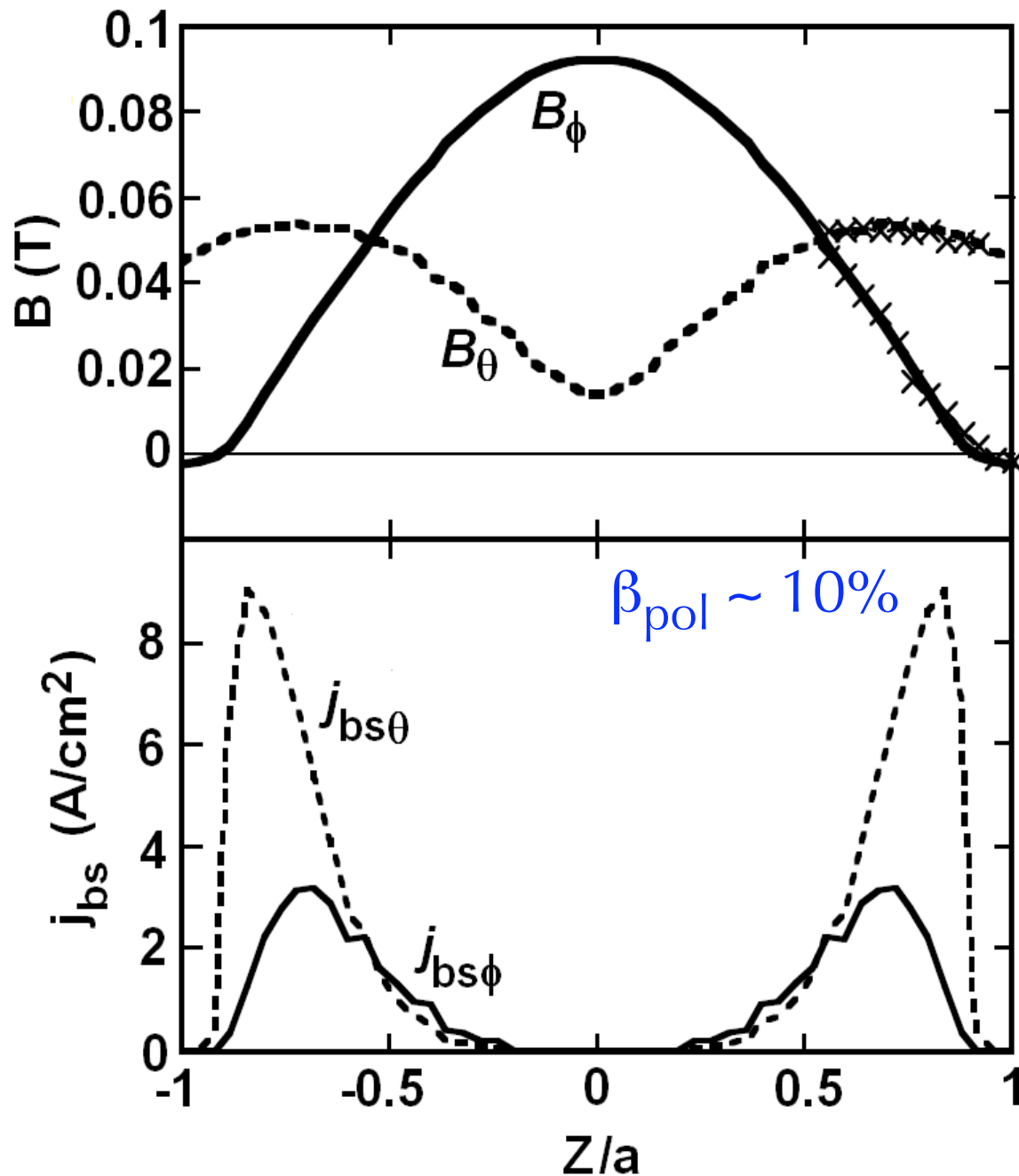
$$A = 2, \beta_{\text{pol}} = 45\%$$



Toroidal Current Densities



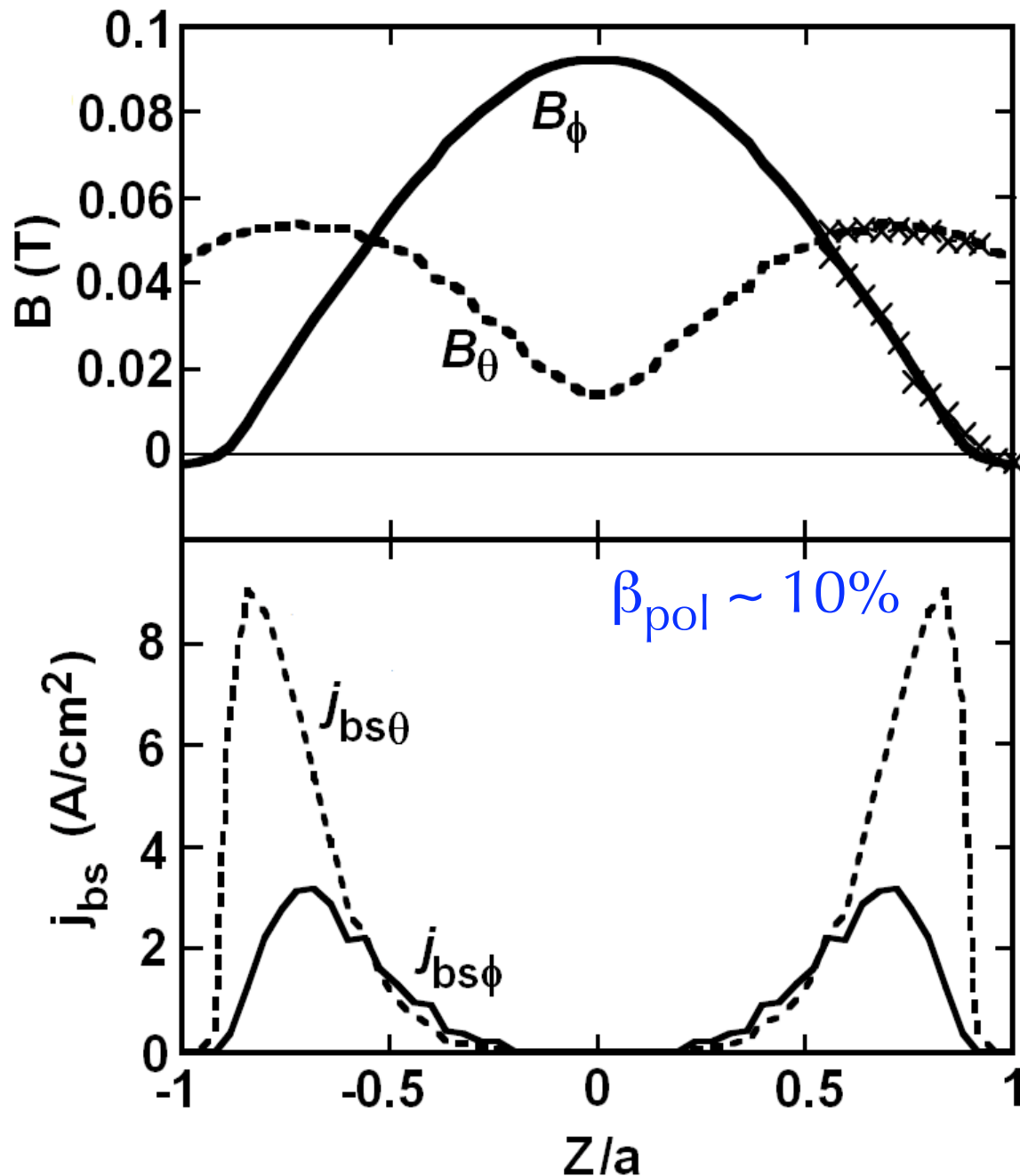
Already some evidence of $J_{\text{bootstrap}}$ in RELAX



Measurements
+ RELAXFit

$\beta_{\text{pol}} \sim 10\%$
Bootstrap current
fraction $< 5\%$

Already some evidence of $J_{\text{bootstrap}}$ in RELAX



Measurements
+ RELAXFit

Bootstrap current
fraction $< 5\%$

For 25% bootstrap,
 $\beta_{\text{pol}} \sim 30\%$

$\beta_{\text{pol}} \sim 10\%$

Summary

- $A = 2$ plasmas established in RELAX
- Helical structure in core, consistent with QSH
- Finite bootstrap current estimated in edge