

# Ion Bernstein Wave Experiments on TFTR

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**J. H. Rogers**

*Princeton Plasma Physics Laboratory*

**American Physical Society, Division of Plasma Physics**

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**R. E. Bell, S. Bernabei, J. C. Hosea, B. LeBlanc, R. Majeski, R. Nazikian,  
M. Ono, C. K. Phillips, G. Schilling, G. Taylor, J. R. Wilson**  
*Princeton Plasma Physics Laboratory*

**C. Bush, G. Hanson: *Oak Ridge National Laboratory***

**F. Paoletti: *Columbia University***

**R. Cesario: *Associazione Euratom-ENEA***

**T. Intrator: *University of Wisconsin***

**D. A. D'Ippolito, J. R. Myra: *Lodestar Corporation***

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# Ion Bernstein Wave (IBW) Direct Launch

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- **A Core High confinement (CH) mode triggered with IBW was demonstrated on PBX-M.**
- **Theory predicted that only 1-2 MW of IBW is required to form a transport barrier on TFTR**
- **Installed a four strap IBW antenna for the last run on TFTR to test the theory for velocity shear flow driven transport barriers.**

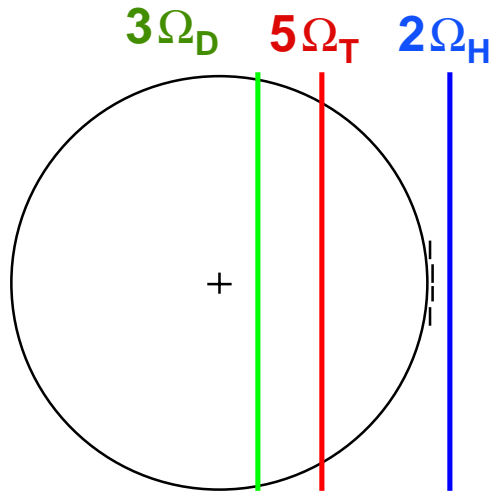
# IBW Direct Launch Results

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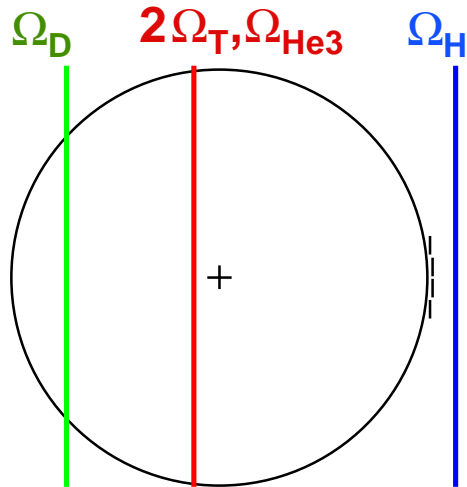
- **Coupled ~300-400 kW of the RF power to the plasma core.** (poster: P2.25, R. Ellis)
- **Measured IBW induced poloidal velocity shear.** (poster: P2.22, B. LeBlanc)
- **Data consistent with edge mode coupling limiting IBW power.** (poster: 2.26, J. Myra)

# Two Launch Scenerios Demonstrated

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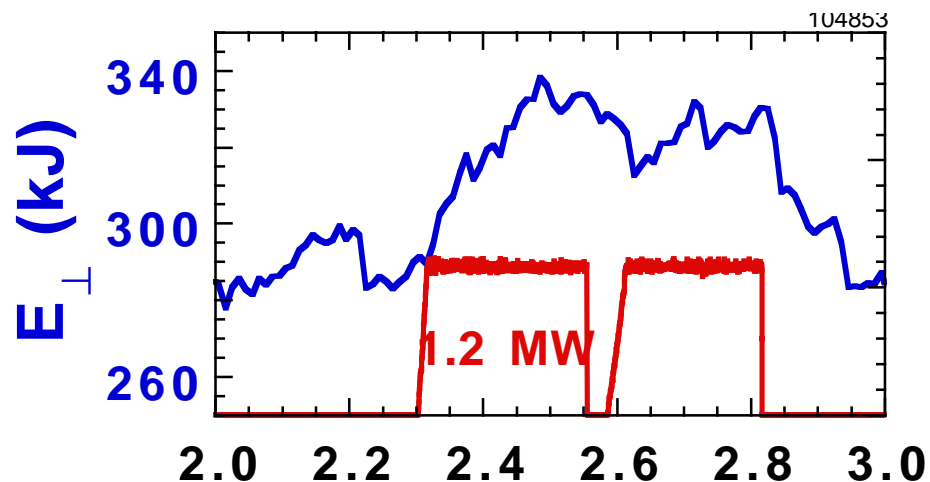


- **Electron Plasma Wave (EPW)**
  - > ion resonance damping consistant with driving poloidal flow
  - > launch sensitive to edge density profile

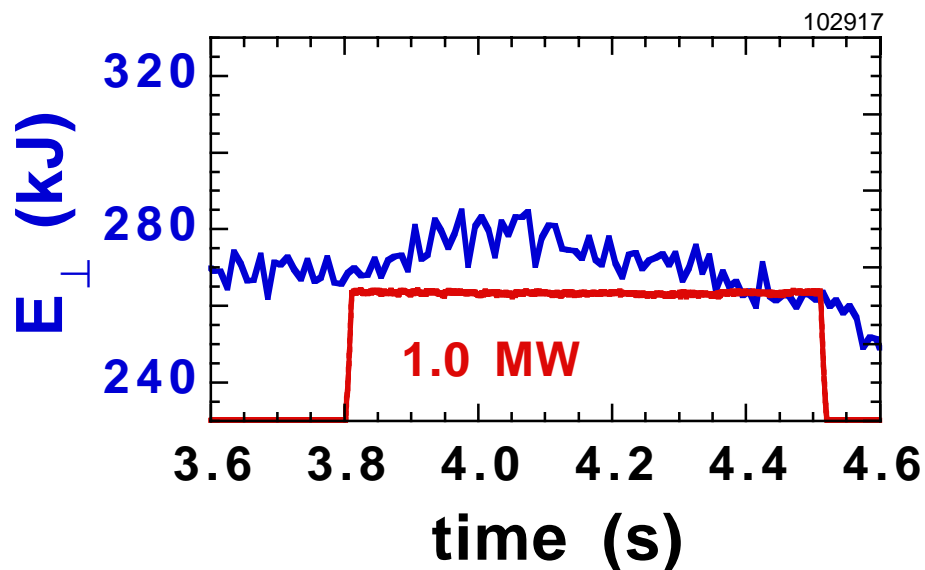


- **Cold Electrostatic Ion Cyclotron Wave (CESICW)** (poster P2.27, R. Cesario)
  - > launch weakly dependent on edge density profile
  - > electron Landau damping, not good for driving poloidal flow

# Coupling improved with $0/0/\pi/\pi$ phasing



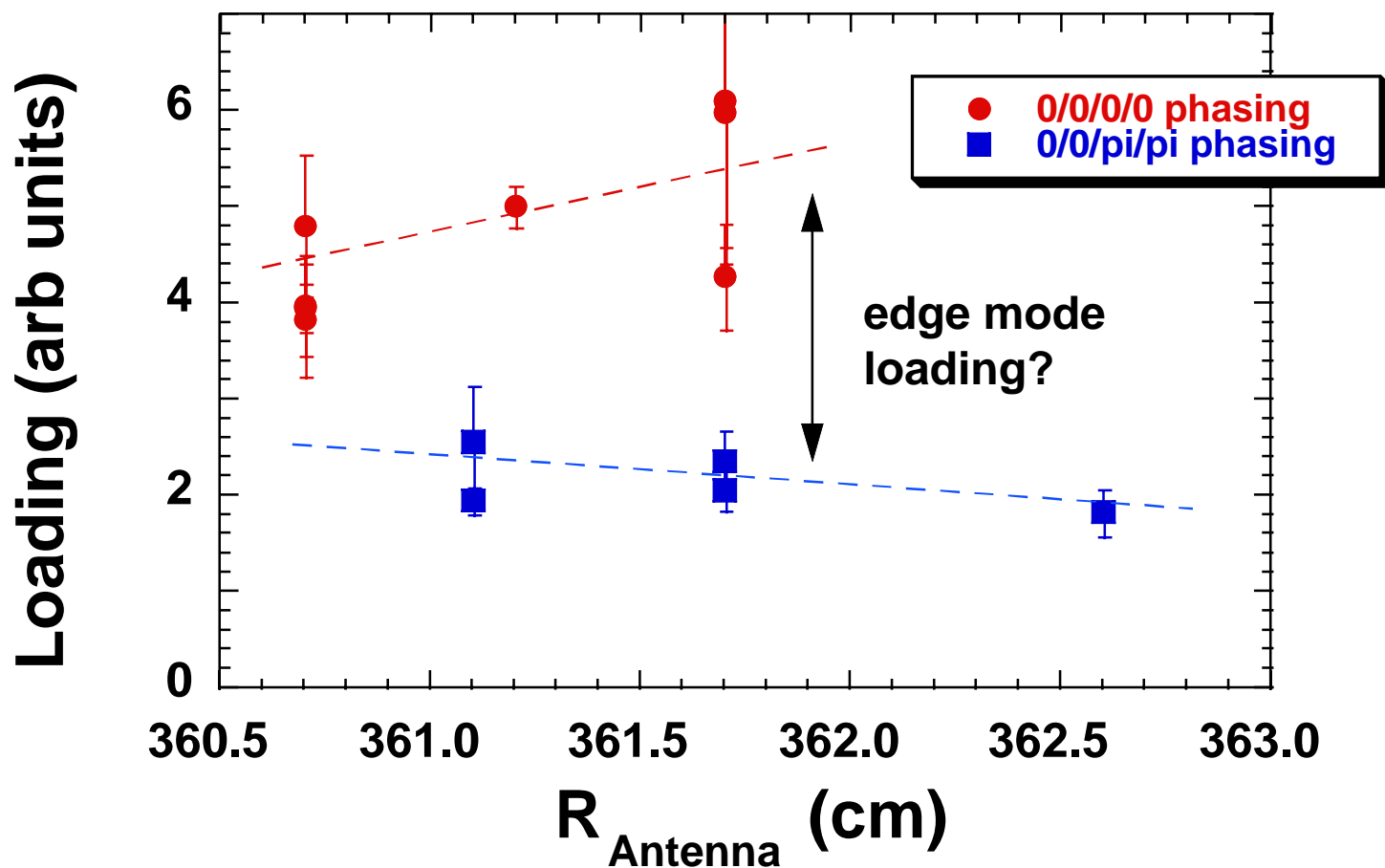
- $0/0/\pi/\pi$  phasing  
> EPW launch



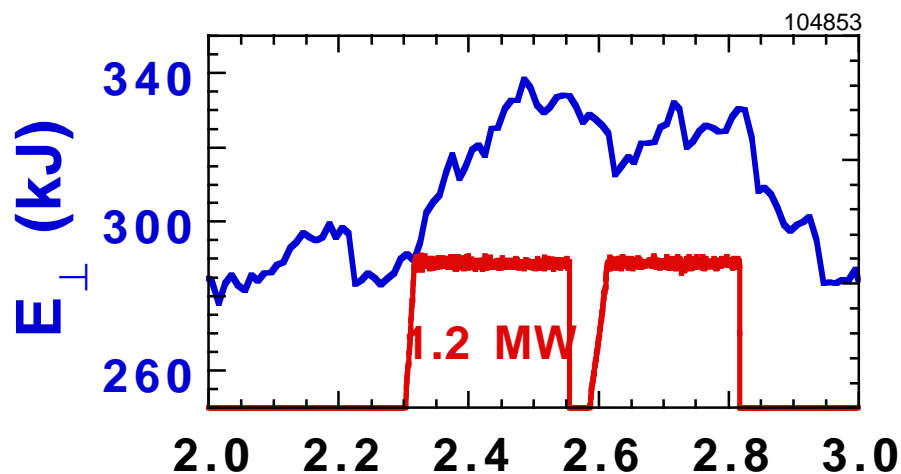
- $0/0/0/0$  phasing  
> EPW launch

# Antenna Loading higher for 0/0/0/0 than 0/0/ $\pi$ / $\pi$

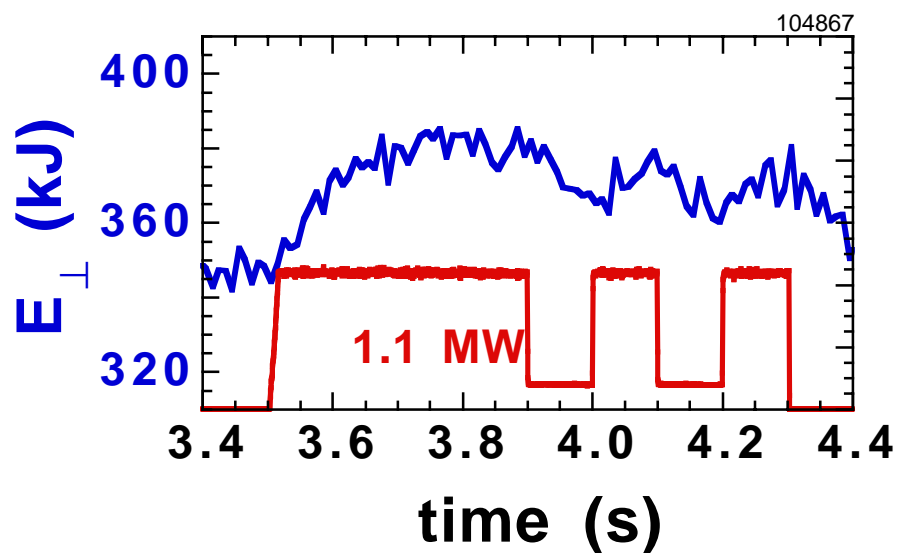
- EPW launch



# Similar Coupling with EPW and CESICW



- EPW launch
  - > 0 / 0 /  $\pi$  /  $\pi$
  - > 50.65 MHz
  - >  $B_0=2.4$  T

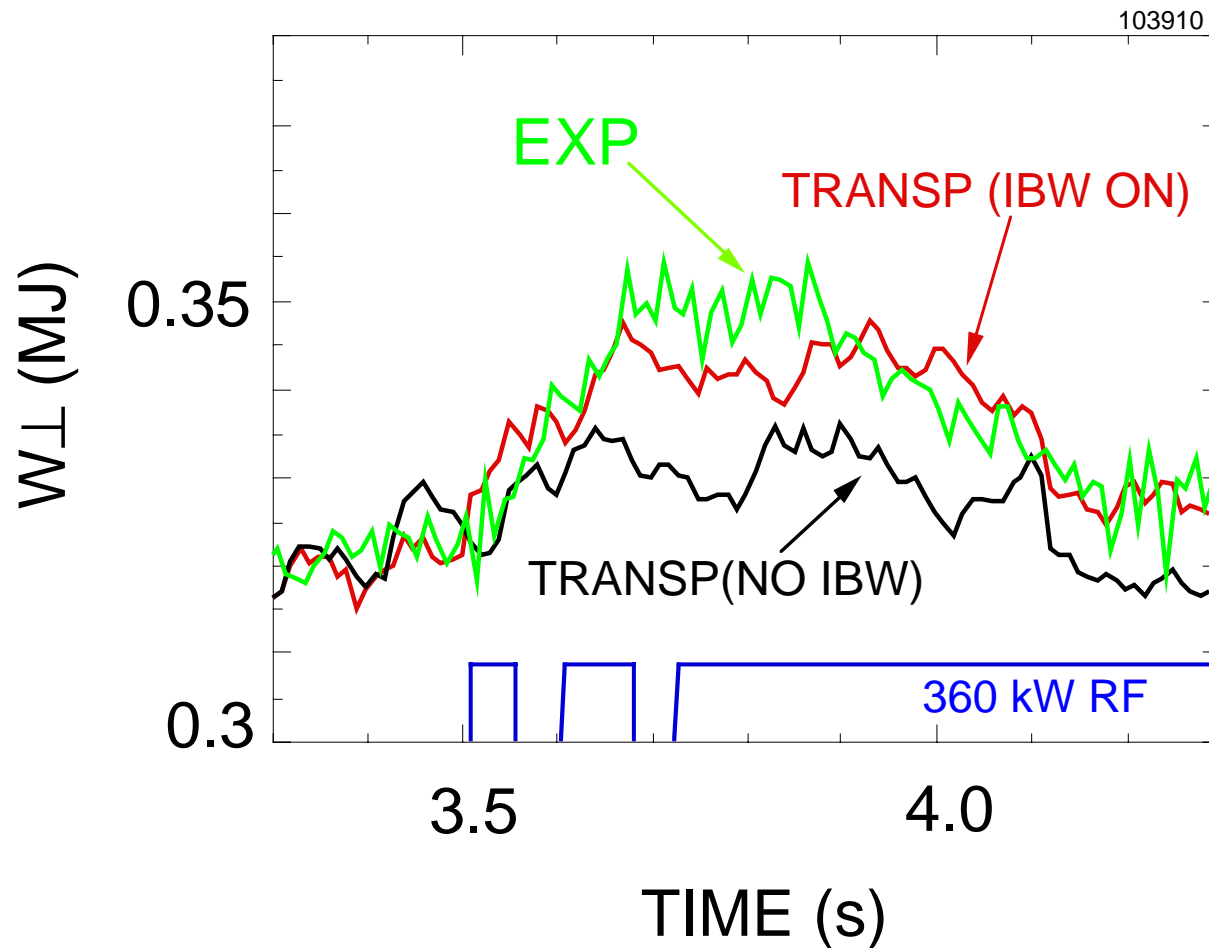


- CESICW launch
  - > 0 / 0 /  $\pi$  /  $\pi$
  - > 50.65 MHz
  - >  $B_0=4.7$  T

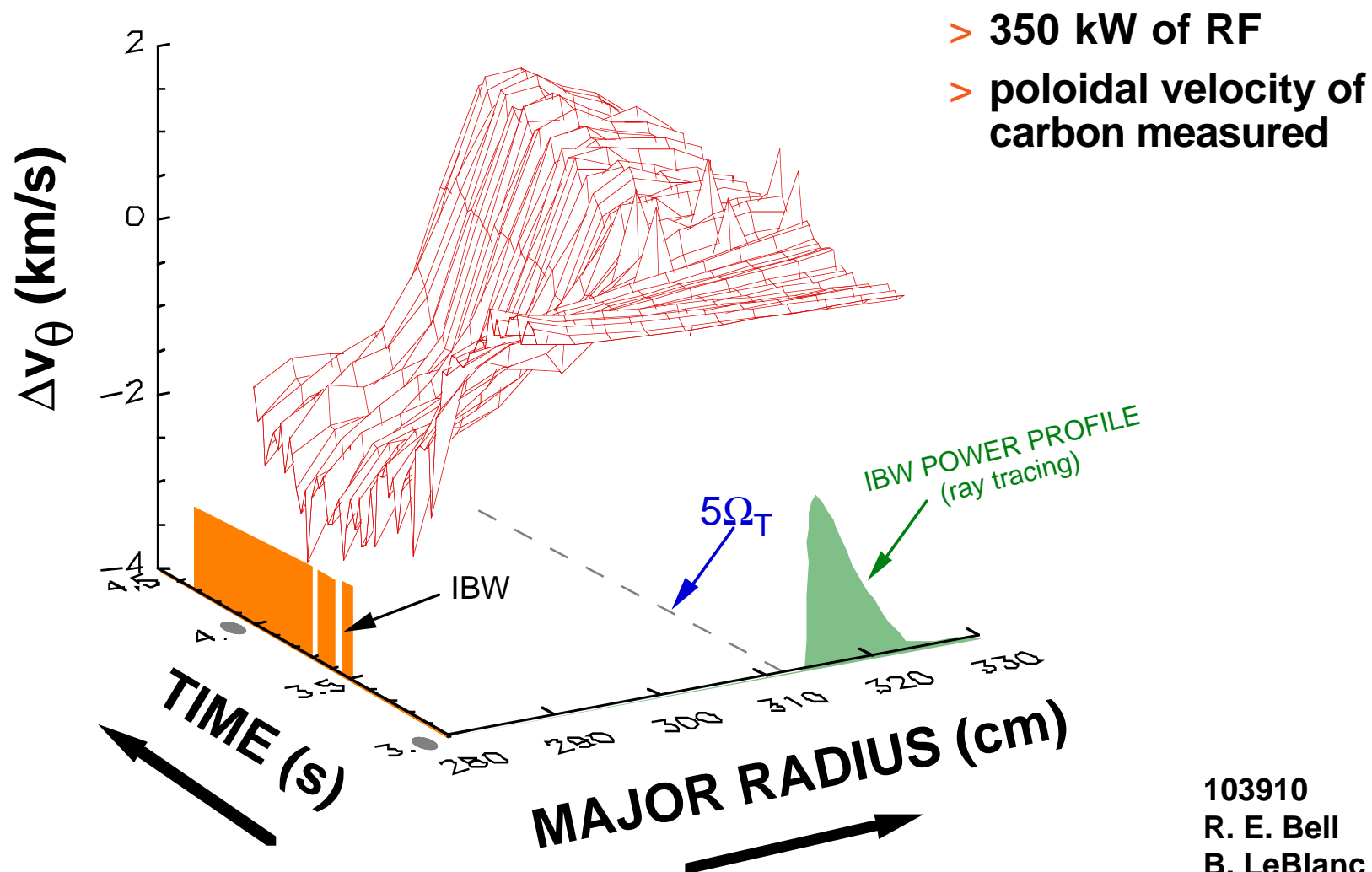


# large fraction of power coupled in one shot

- EPW launch,  $5\Omega_T$  damping,  $0/0/\pi/\pi$  phasing, antenna pushed in beyond main limiter.



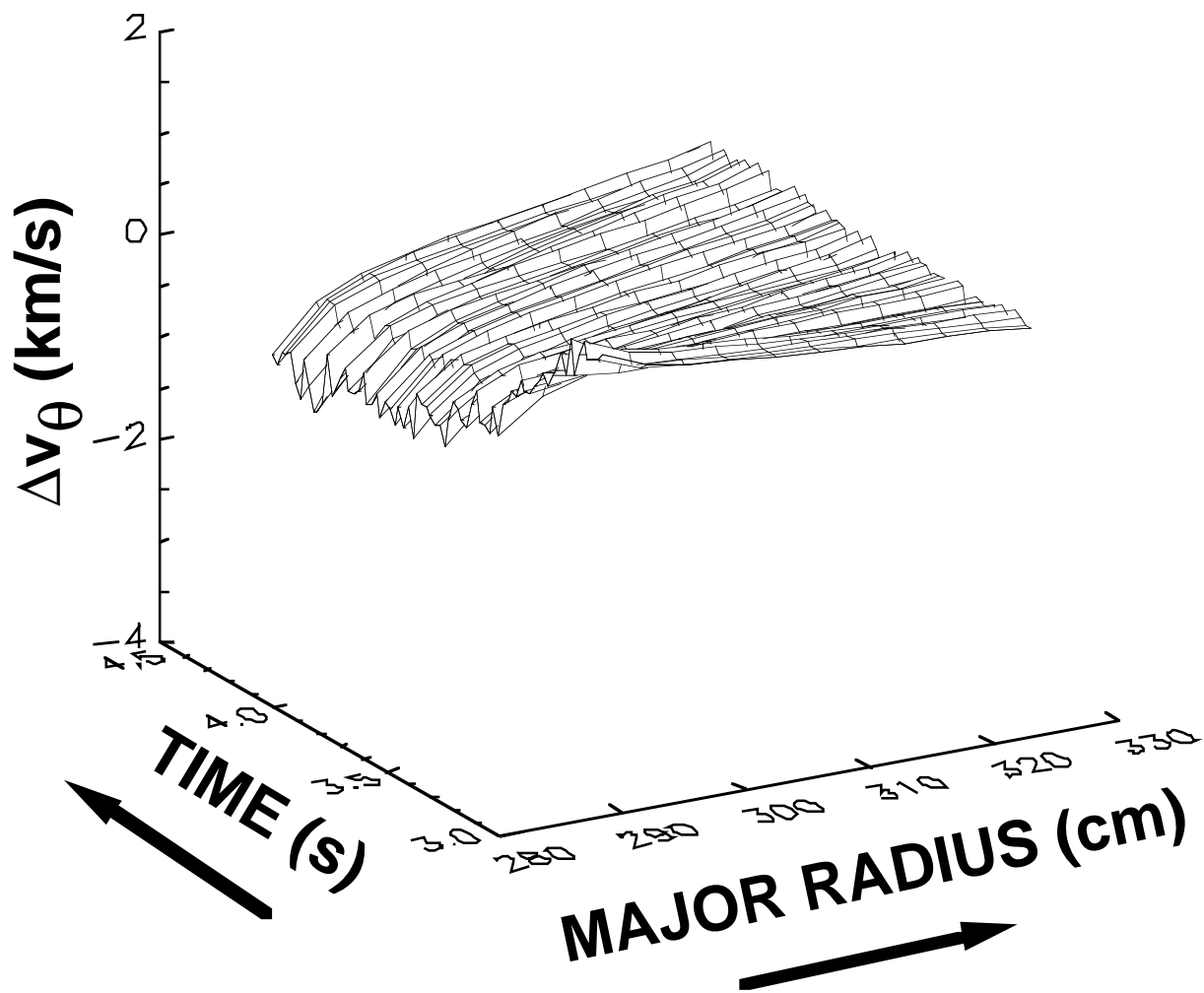
# IBW induced poloidal velocity shear



103910  
R. E. Bell  
B. LeBlanc

# no RF comparison shot

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# Coupling Difficulty: Driving Edge Modes

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- **Probably not Parametric Decay Instability**
  - > RF probes only sometimes measured small off-frequency signals.
- **Probably not Sheaths**
  - > Some power may have dissipated in RF sheaths, however no thermal heating was observed in the limiter closest to the IBW antenna.
- **Could be Surface waves**
  - > Change in antenna loading/coupling with poloidal phasing
  - > Core reflectometer measuring an RF signal on the high field edge, past an ion resonance.
  - > RF probe measurement of the fundamental frequency having no toroidal dependence.

# Summary

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- **Preliminary results encouraging.**
- **Poor coupling consistent with launching edge modes.** ([poster P2.26, J. Myra](#))
- **More efficient IBW coupling with phasing for high poloidal mode number.**
- **Observed sheared poloidal velocity driven by IBW, consistent with modeling.**