

# FIDA Blue/Red Shift XP (#917)

*Motivation: Resolve discrepancy between FIDA & FIDA simulation code in special quiet plasmas so we trust it for instability studies*

**Goal:**

**Validate predicted differences between red-shift & blue-shift**

*Approach: Use low voltage to avoid fast-ion instabilities; modest density ( $3-4 \times 10^{13}$ ), vary field-line pitch and TF to alter theoretical red:blue ratio; deuterium fill gas*

# Field Line Helicity Asymmetry

*Geometry:  $B_T$  is clockwise;  $I_p$  is counter-clockwise; FIDA views vertically downward*

Beam Population: Nearly all in co-direction

At large major radius, co-going ions come up towards lens  $\rightarrow$  blue shift larger than red-shift

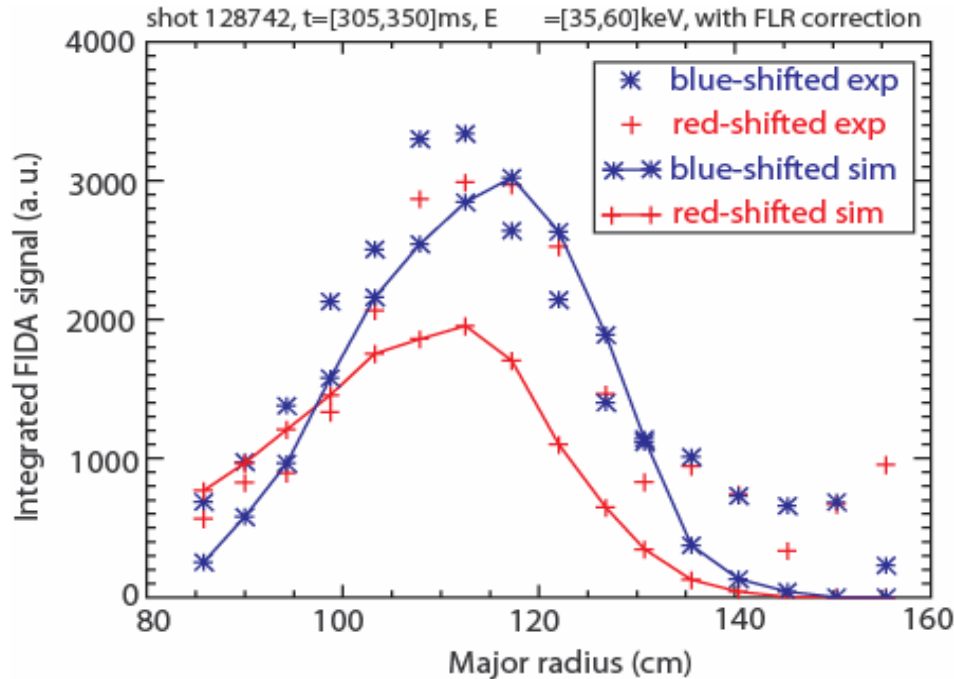
# Finite Larmor-radius Effect

*Consider a spatially peaked guiding center distribution.*

For clockwise  $B_T$ , fast ions gyrate downward at large major radius, upward at small major radius

→ red-shifted profile shifts outward (relative to guiding center); red-shifted profile shifts inward

# Poor agreement in this comparison



- Predicted blue larger than red (pitch effect)
- Predicted FLR effect opposes pitch effect
- Little difference in experimental red & blue profiles but data quality is poor

# Experimental Plan

1. **Baseline Condition** Source B @ 65 keV & 50% duty cycle;  $I_p=0.8$  MA; 5.5 kG, deuterium,  $3-4 \times 10^{13}$  (2 shots); Source A at before & after for MSE
2. **Toroidal Field Scan** 4.5 kG, 3.5 kG (2 shots)
3. **Plasma Current Scan** 0.5 MA, 1.2 MA at 5.5 kG (2 shots)
4. **Source C** Substitute for Source B in condition with largest observed red/blue asymmetry (1 shot)
5. **Filter Scan** Scan angle of f-FIDA bandpass filter in favorite condition (3 shots)