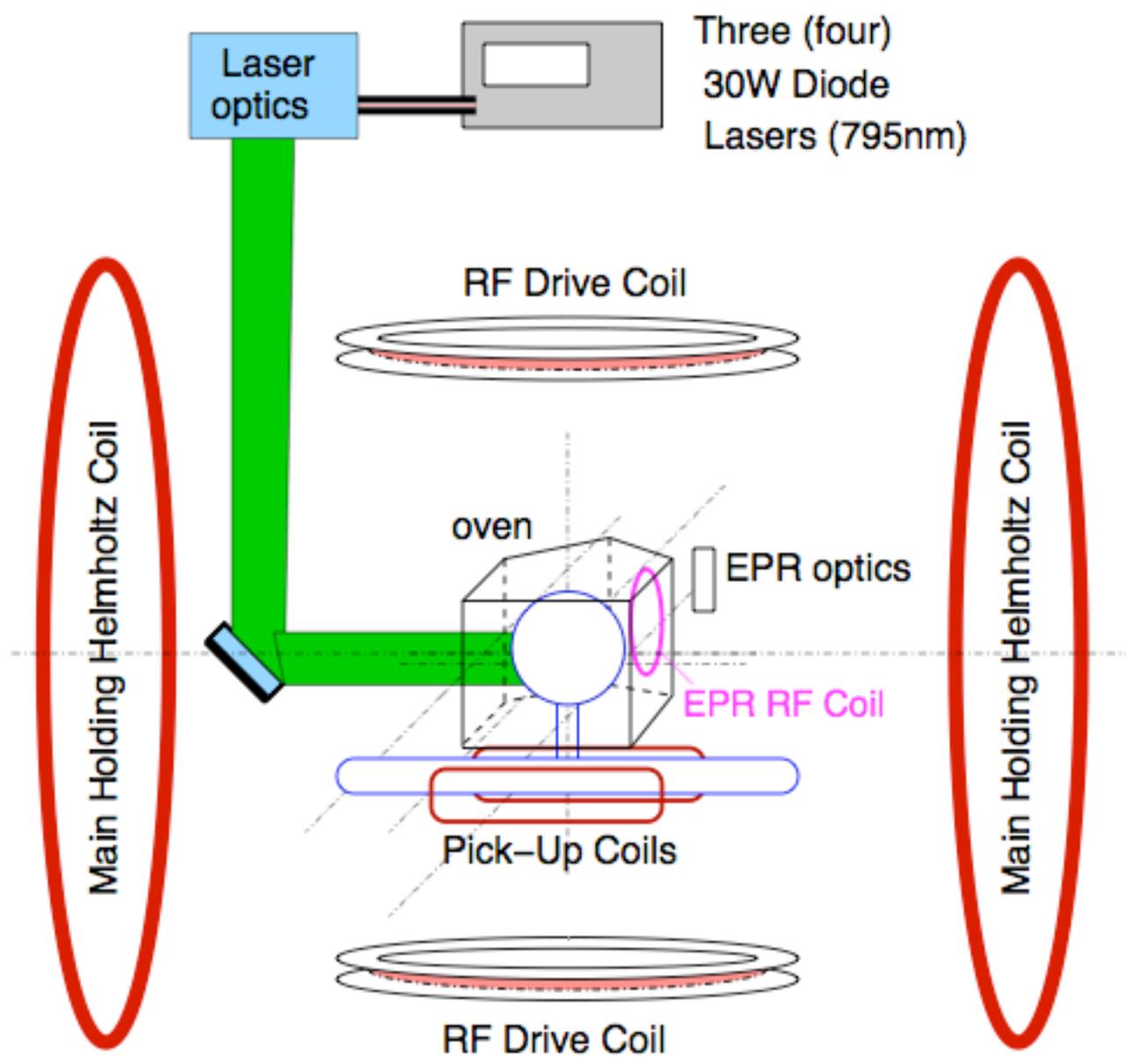


# Next-Generation Polarized $^3\text{He}$ Target

T. Averett, J.P. Chen, J. Katich, A. Gavalya, design group

- In Fall 2007, a series of 4(5) polarized  $^3\text{He}$  experiments will run back-to-back.
- E06-010, E06-011 --Transversity.
- E06-014, Measure  $g_2^n/d_2^n$  ; Higher-twist physics.
- E05-102, Polarized quasi-elastic  $^3\text{He}(e,e'd)$  to study nuclear wavefunction.
- E05-015, Target single-spin asymmetry; two-photon physics for nucleon structure.



Laser optics

Three (four)  
30W Diode  
Lasers (795nm)

RF Drive Coil

Main Holding Helmholtz Coil

oven

EPR optics

EPR RF Coil

Pick-Up Coils

Main Holding Helmholtz Coil

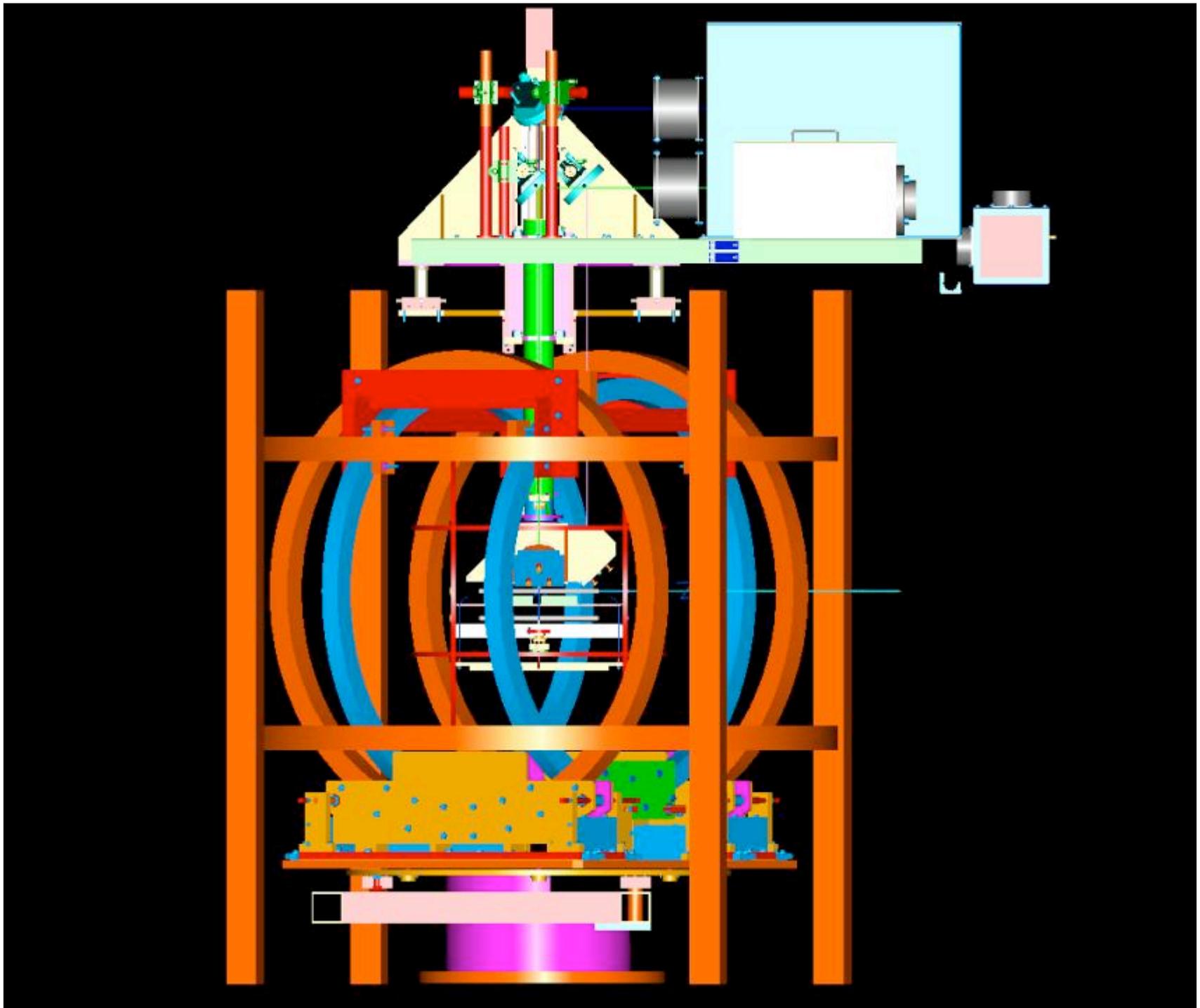
RF Drive Coil

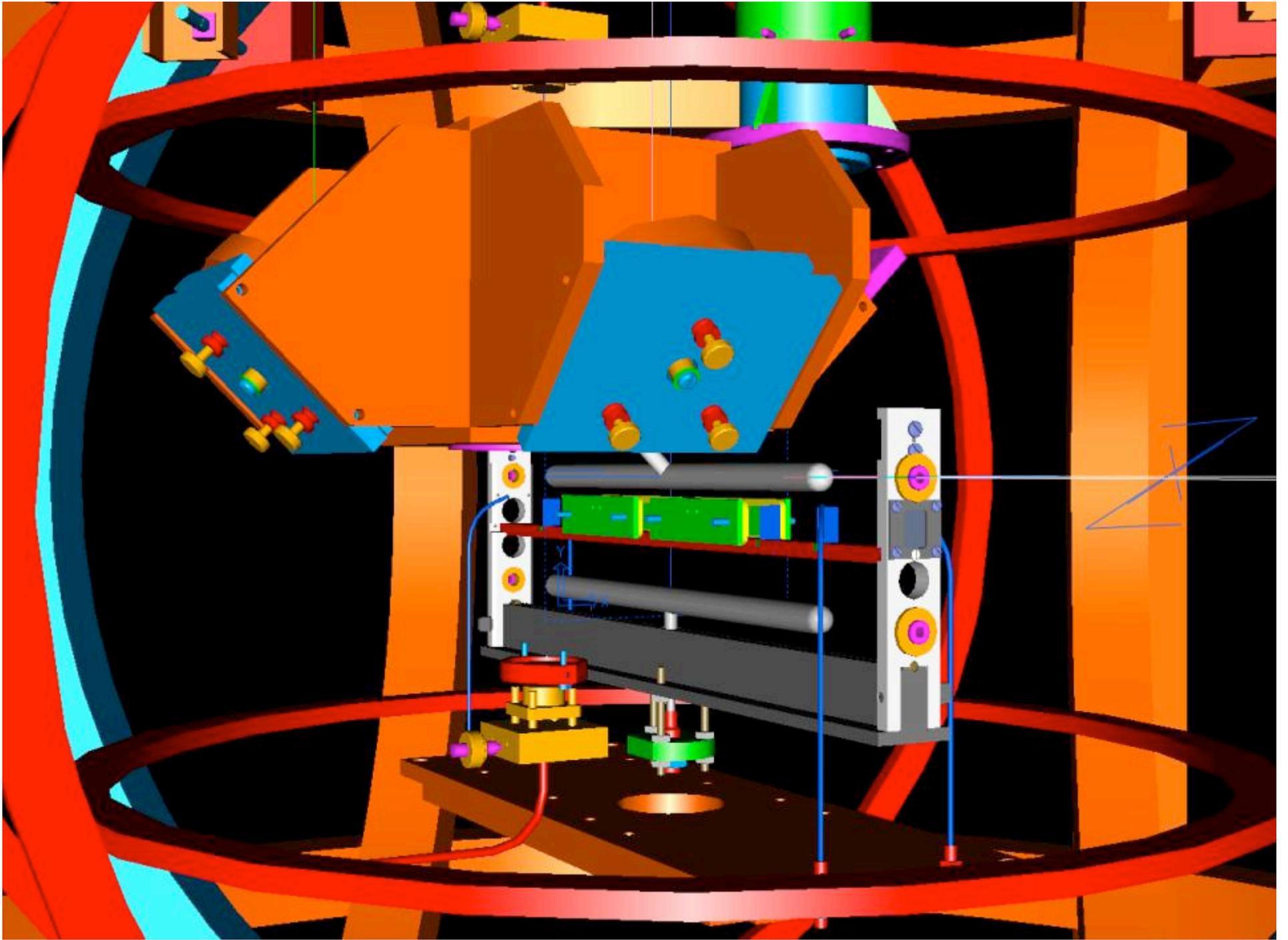
# Requirements

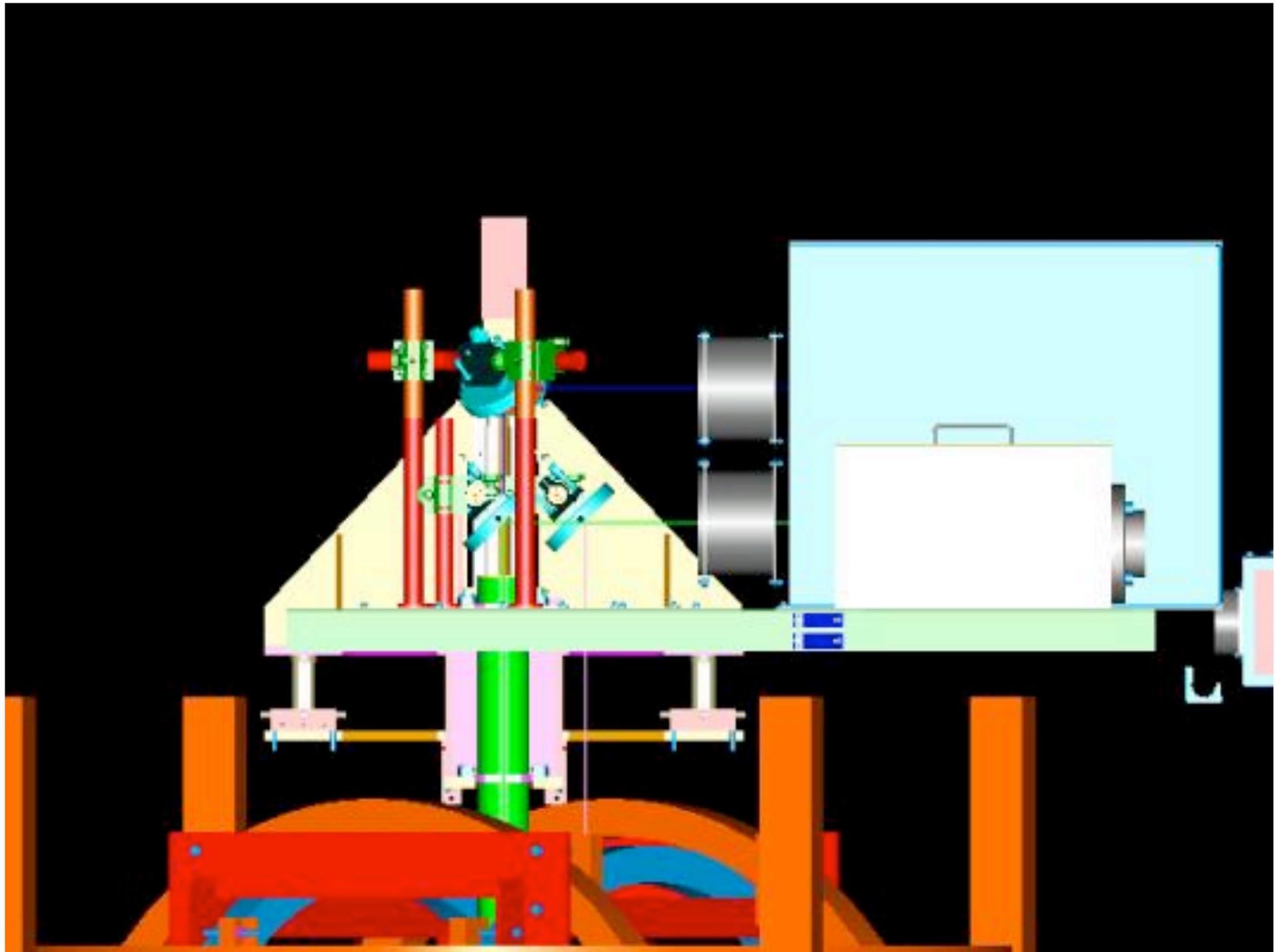
EXPERIMENT	TARGET POLARIZATION DIRECTIONS	BigBite Angle	(HRS <sub>L</sub> , HRS <sub>R</sub> ) (deg, deg)
Transversity	vertical transverse	-30 deg.	(16,--)
$g_2/d_2$	longitudinal transverse	-45 deg.	(45,--)
( $e, e'd$ )	longitudinal transverse	-72.8 deg.	(15,12.5)
$A_y$	vertical	not used	12.5-20, both

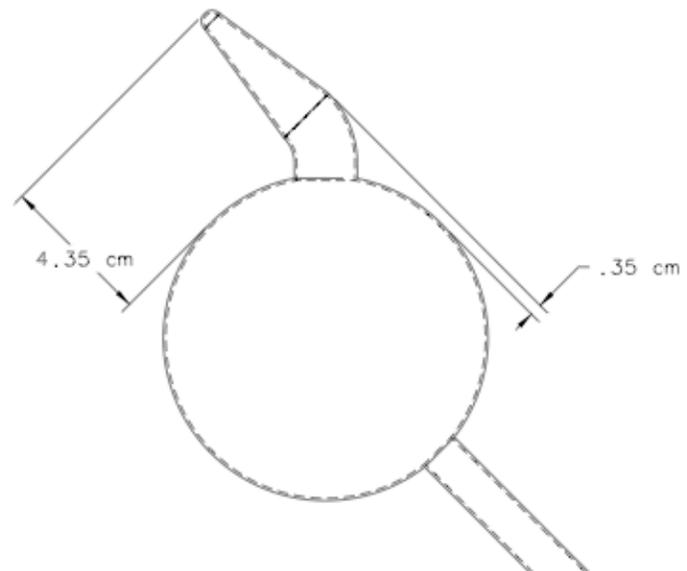
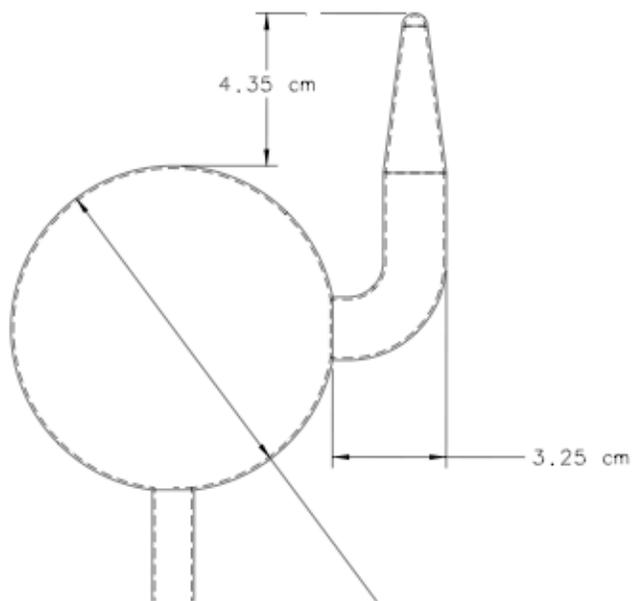
# Target Requirements

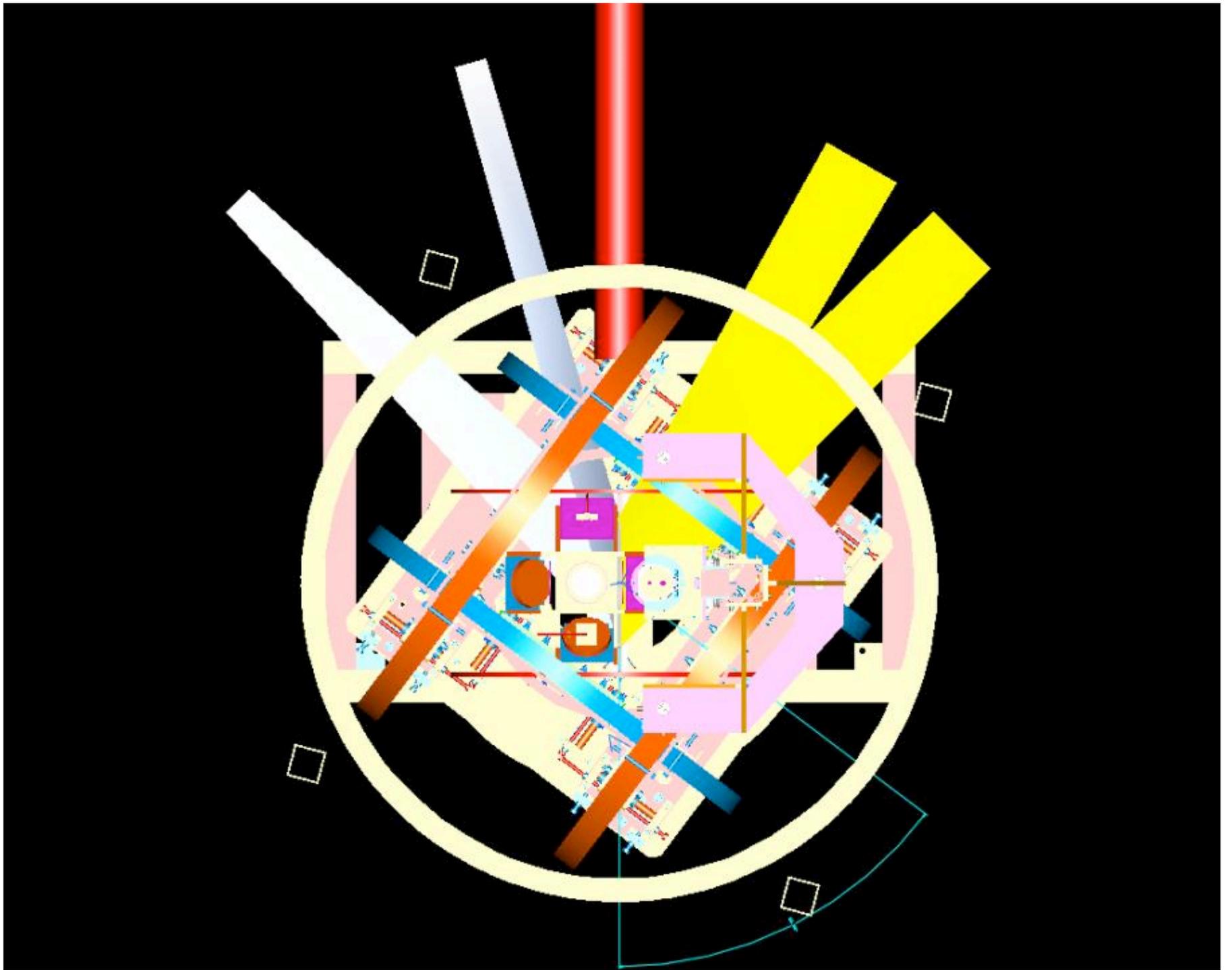
- Multiple scattering angles for all 3 spectrometers.
- Optical pumping in three orthogonal directions.
- Capable of pumping in all target positions.
- Rapid spin flips for SSA experiments.

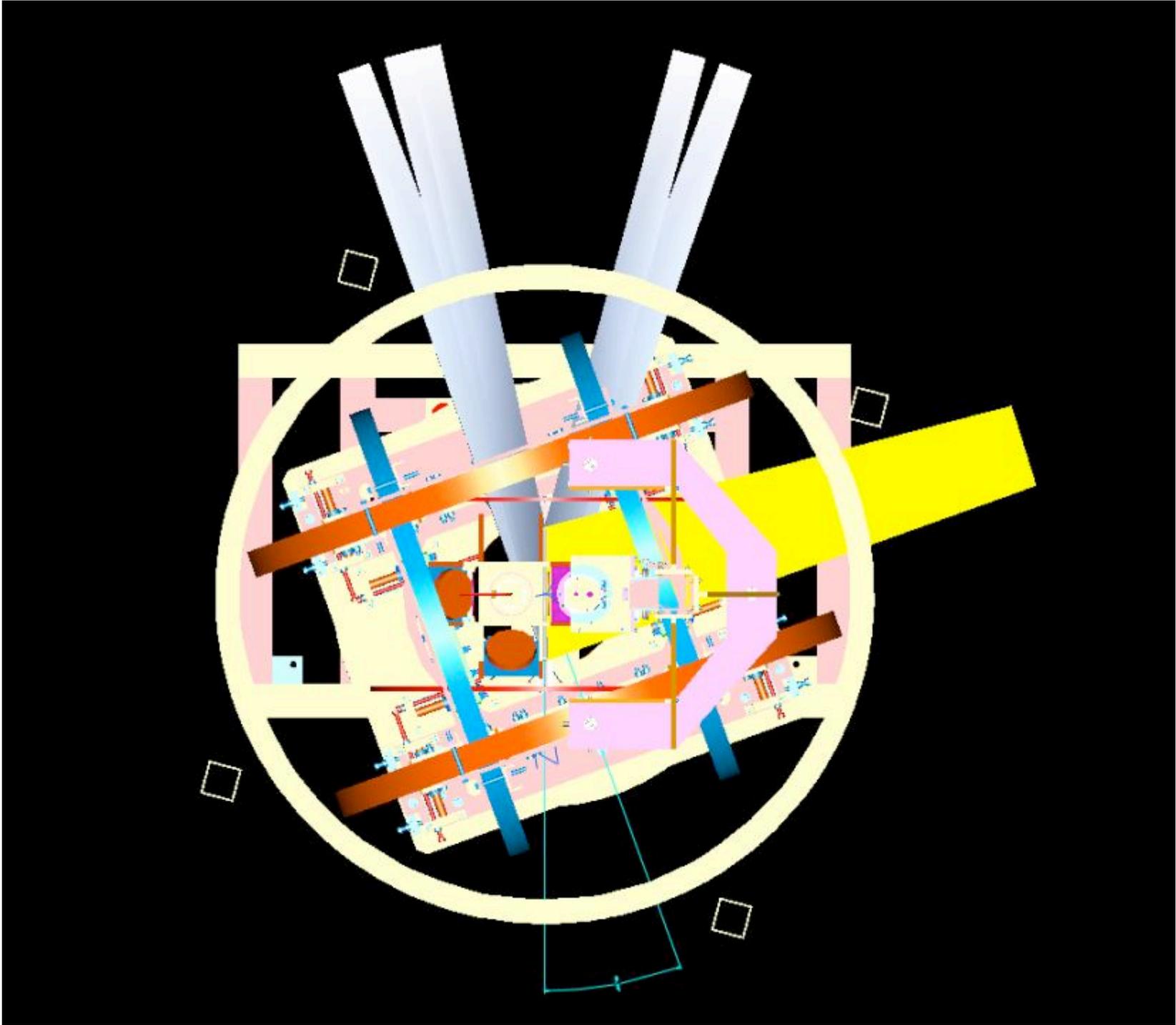


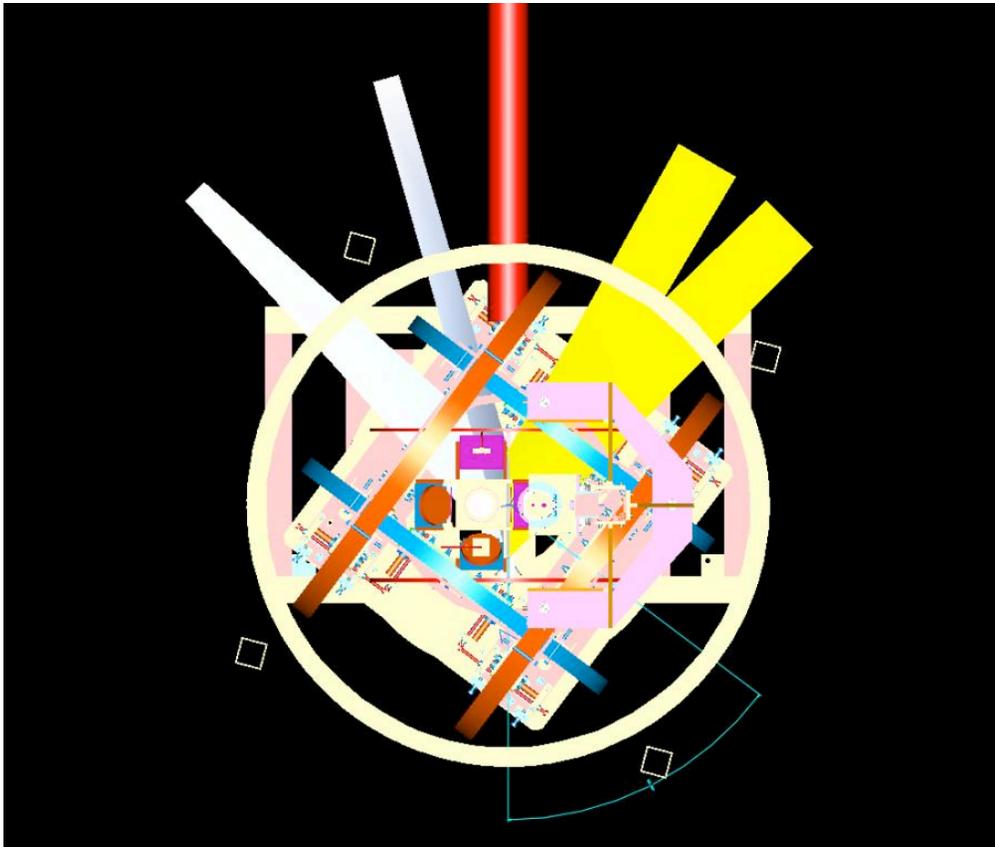




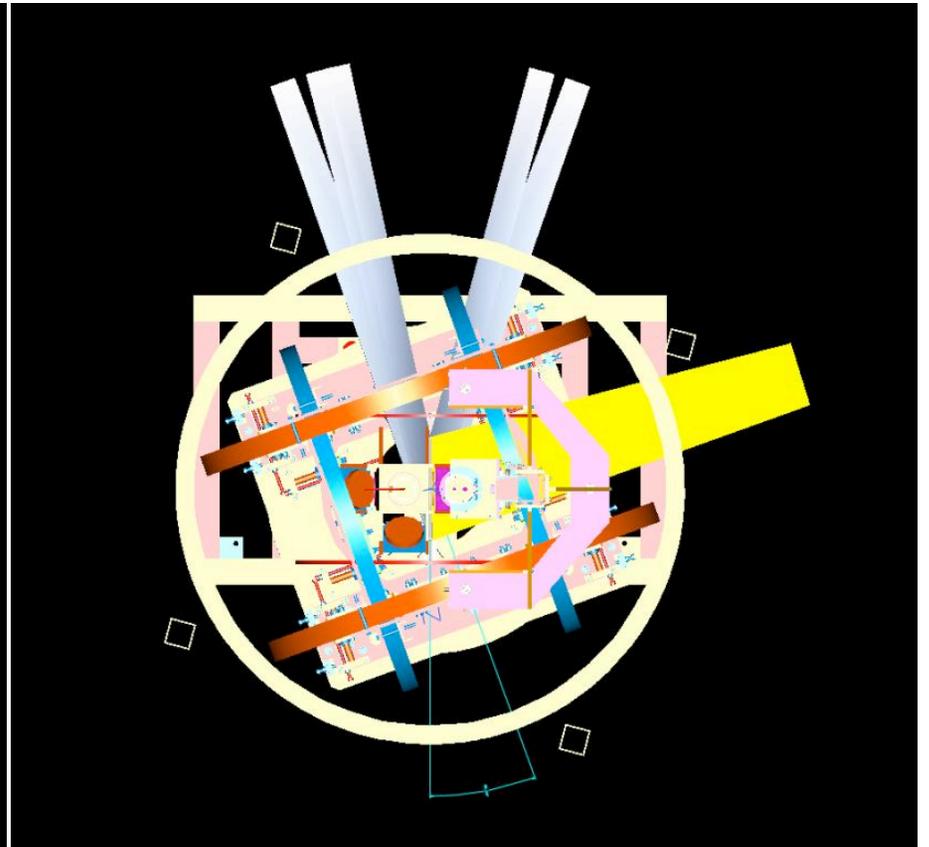








Transversity  
 $g_2^n/d_2^n$



$(e, e'd)$   
 $A_y$

# Target Upgrades

- 'Hybrid' target cells gave "quantum leap" in target performance for  $G_E^n$ .
- Average in-beam polarization above 50%.
- Long lifetime in beam; 4+ weeks at 8uA.
- Larger pumping-chamber.
- Requires hotter oven  $170^{\circ}\text{C} \rightarrow 250^{\circ}\text{C}$
- New fiber-coupled laser system--additional optics constraints.
- New polarimetry issues.

# Target Upgrades

- Off-center oven mounting for vertical pumping.
- Complicated rotation between experiments.
- New cell design—largest cell yet. Uses side pulloff.
- NMR in upper and lower chambers.
- Rapid spin flips using RF sweep.

# Target Studies

- Xiaofeng Zhu, Lingyan Zhu, Huan Yao
- Developed model and subsequently measured depolarization due to rapid spin flips.
- Spin flip every 20 minutes reduces polarization by a factor of 0.9