Transverse spin effects in SIDIS at 11 GeV with transversely polarized target using the CLAS12 detector

(A CLAS12 experiment proposal for PAC38)

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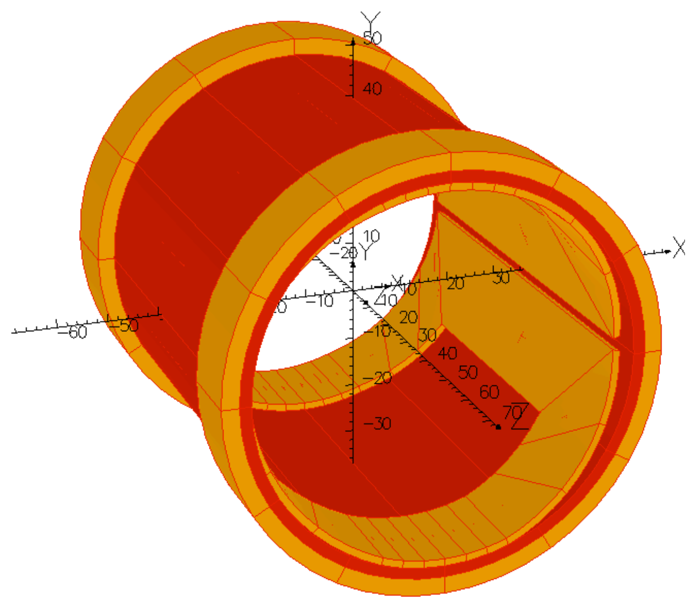
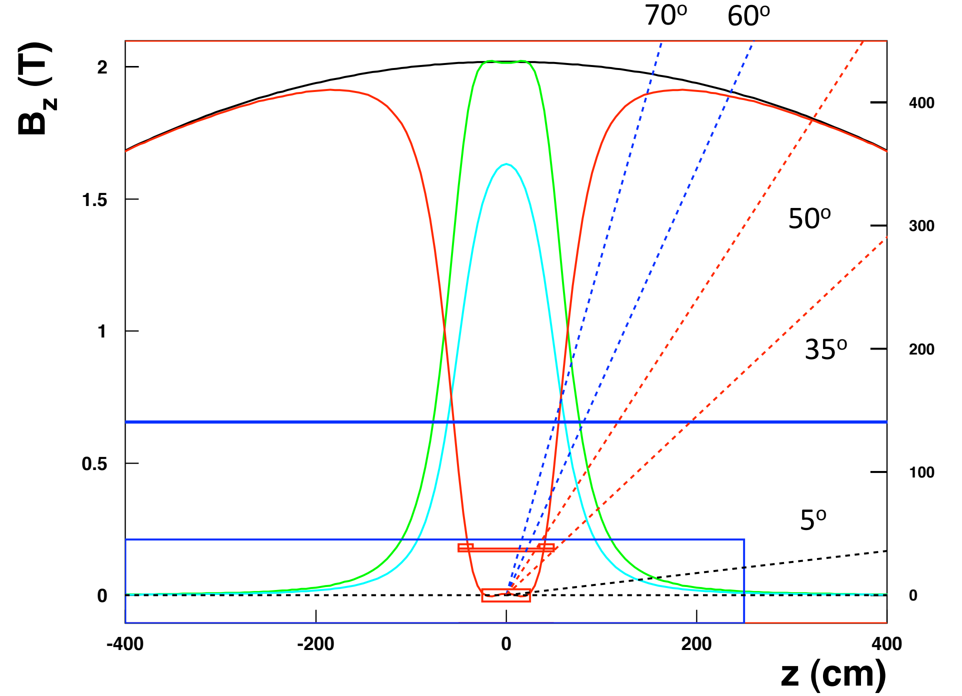
Magnetic configuration

26/Apr/2012 15:54:40





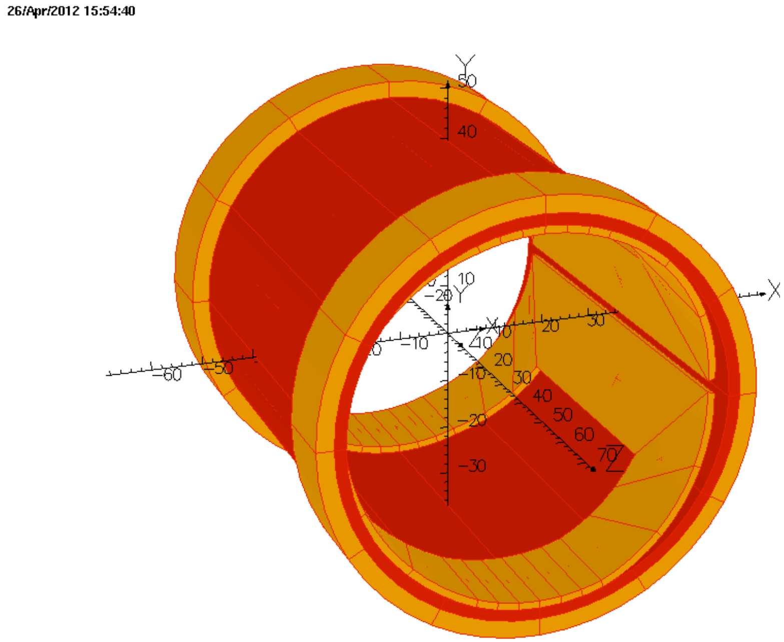
- **N111 (5 cm target):**
  - ✔ *Mild Field for low Lumi*
  - ✔ *Coils above 35°*
  - ✔ *Long. Component < 5mT*
  - ✔ *Transv. Homogeneity ~ 10%*

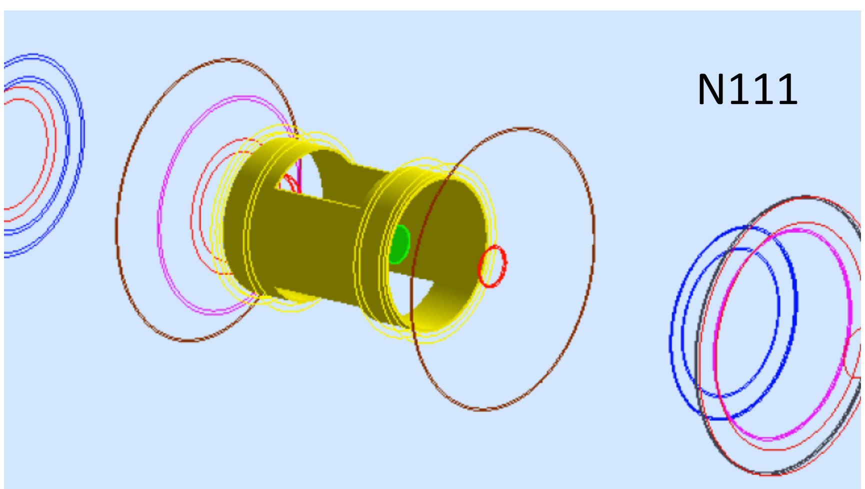
- Good compensation (homogeneity)
- Untouched 35° forward acceptance
- Material budget at large angles
  - ~ 7 mm from 35 to 50 degrees
  - ~ 3 mm above 50 degrees

Major Issues

- Luminosity & Polarization
  - ➔ 5 10^{33} $cm^{-2}s^{-1}$ 60%
- Tracking resolution
  - ➔ refined material
  - ➔ modified IBC geometry
- Field homogeneity needed
  - ➔ Beam depolarization effects
- Magnet configuration stability
  - ➔ Static and misalignment forces

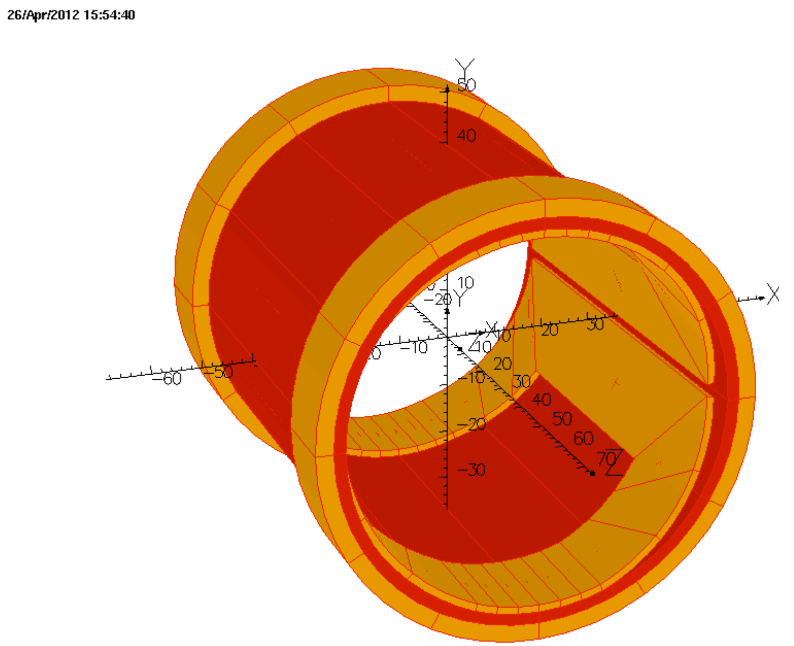
Material budget

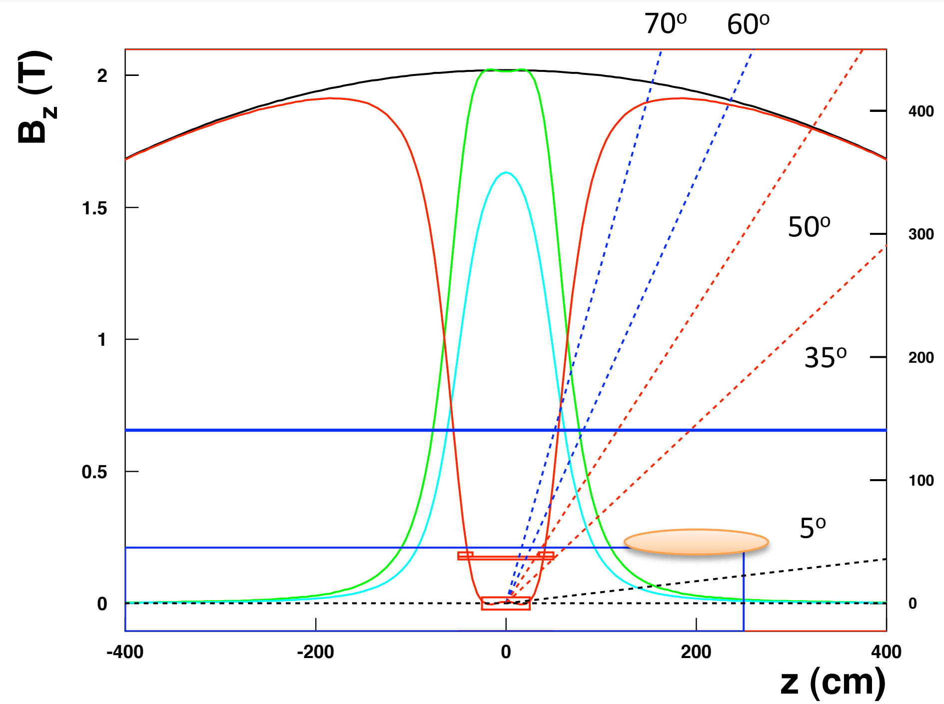


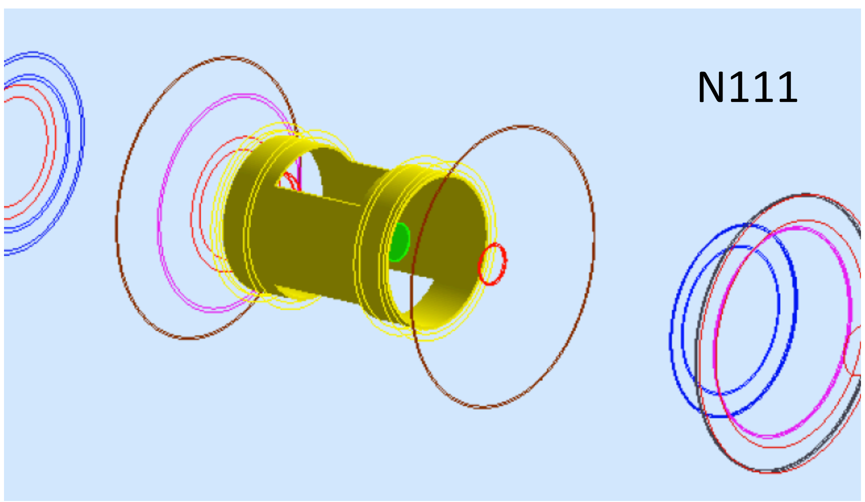


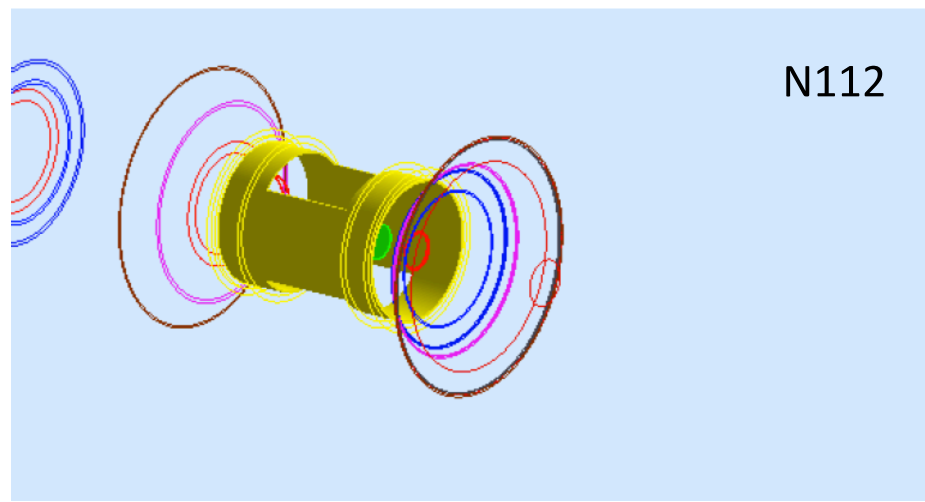
- **Refined material:**
  - ✔ *lH_2 → HDice*
  - ✔ *Cu → NbTi wire (25% gain in X_0)*
    1.3 Cu : 1 NbTi
  - ✔ *Al → KelF (C_2ClF_3)*

Material budget

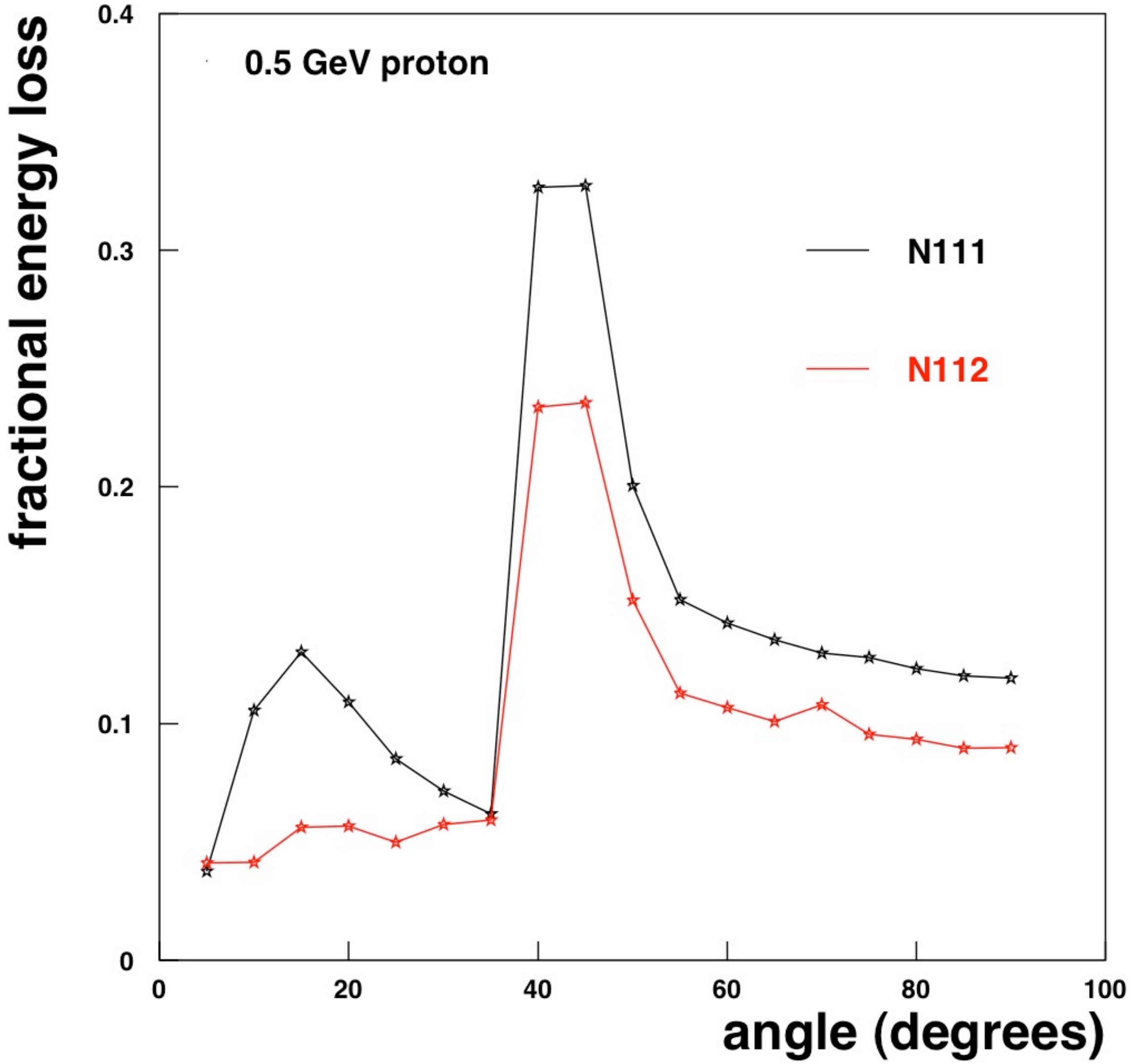




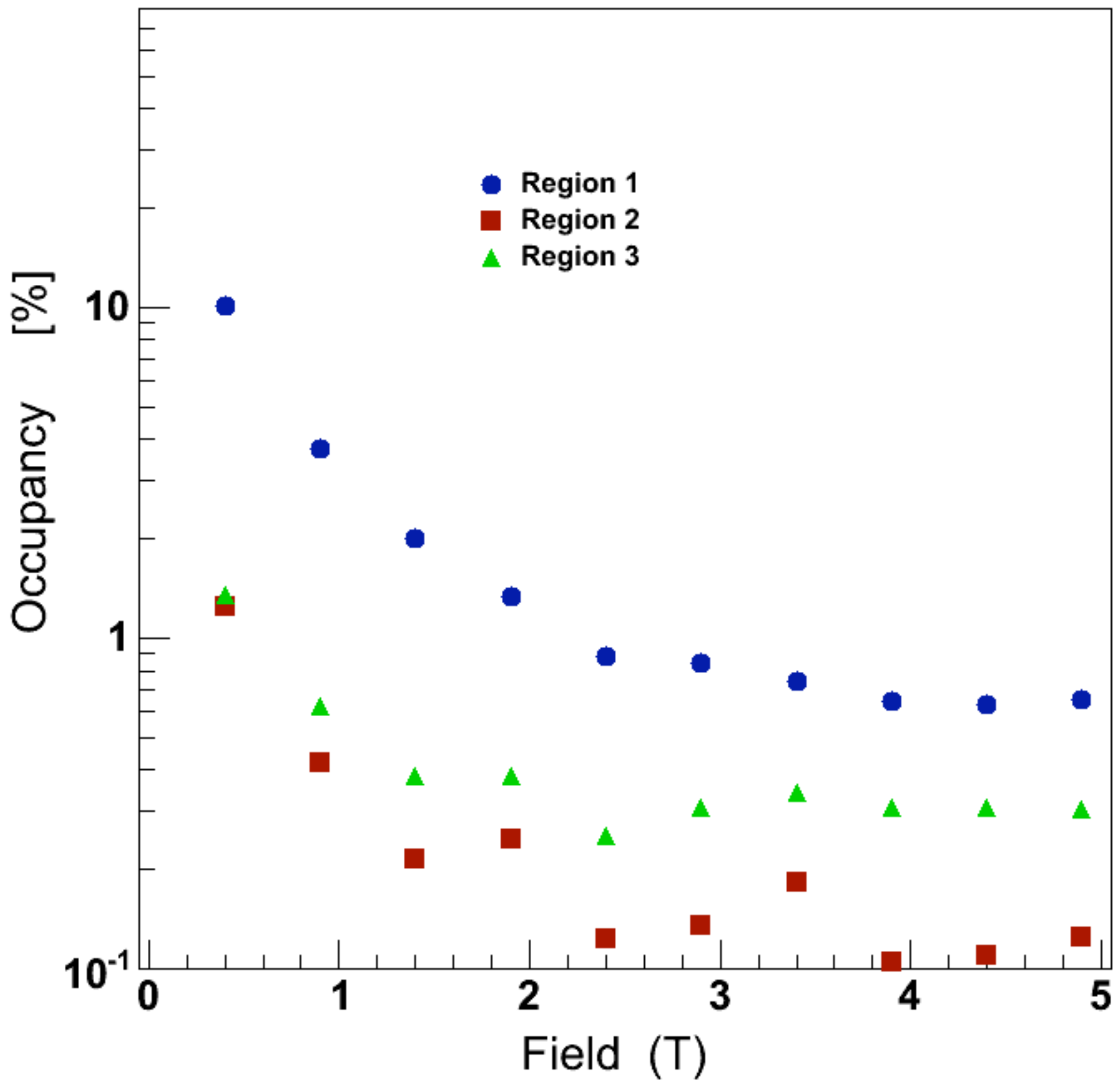




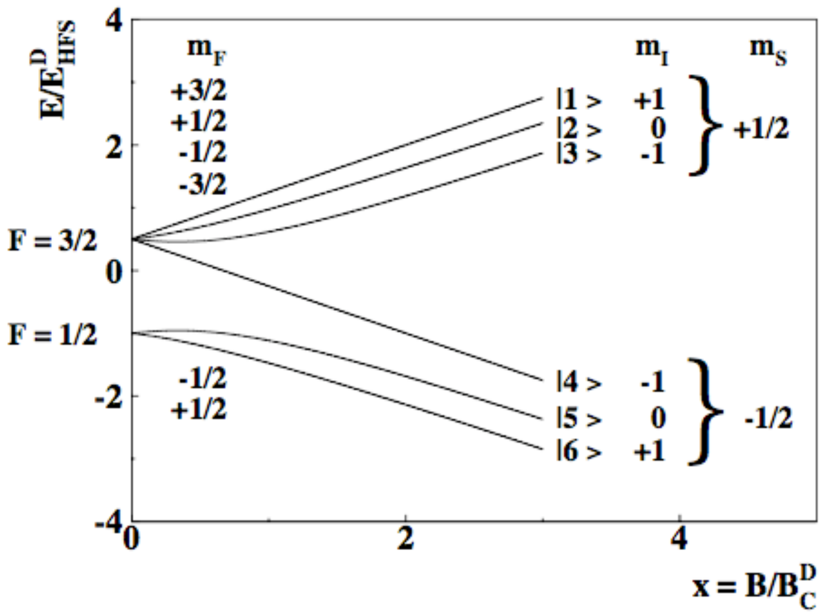
Material budget



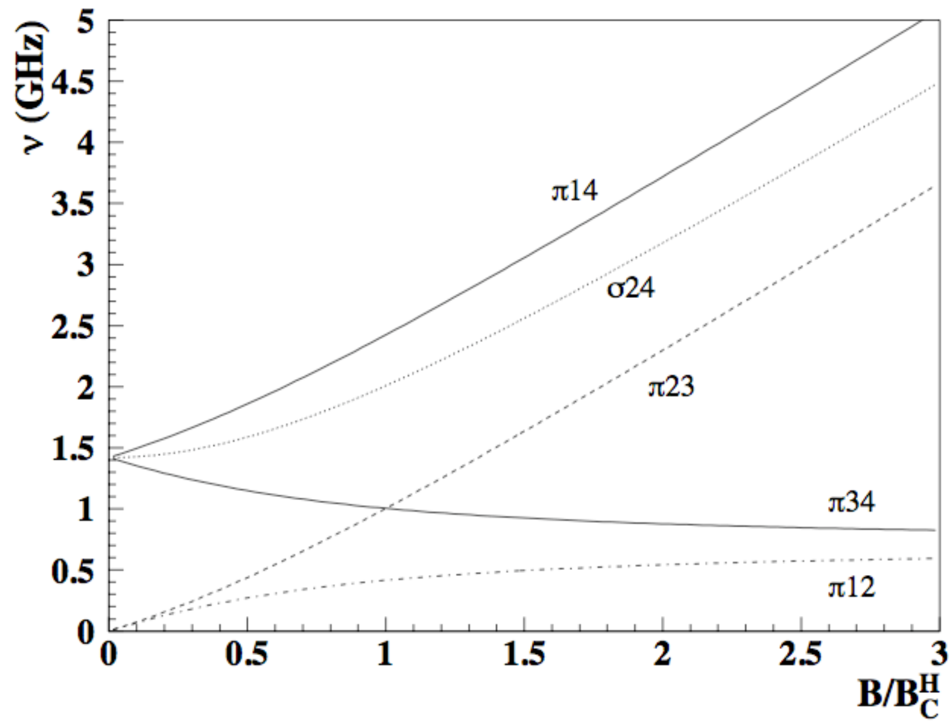
Moeller background



H hyperfine states



Hydrogen atom hyperfine states

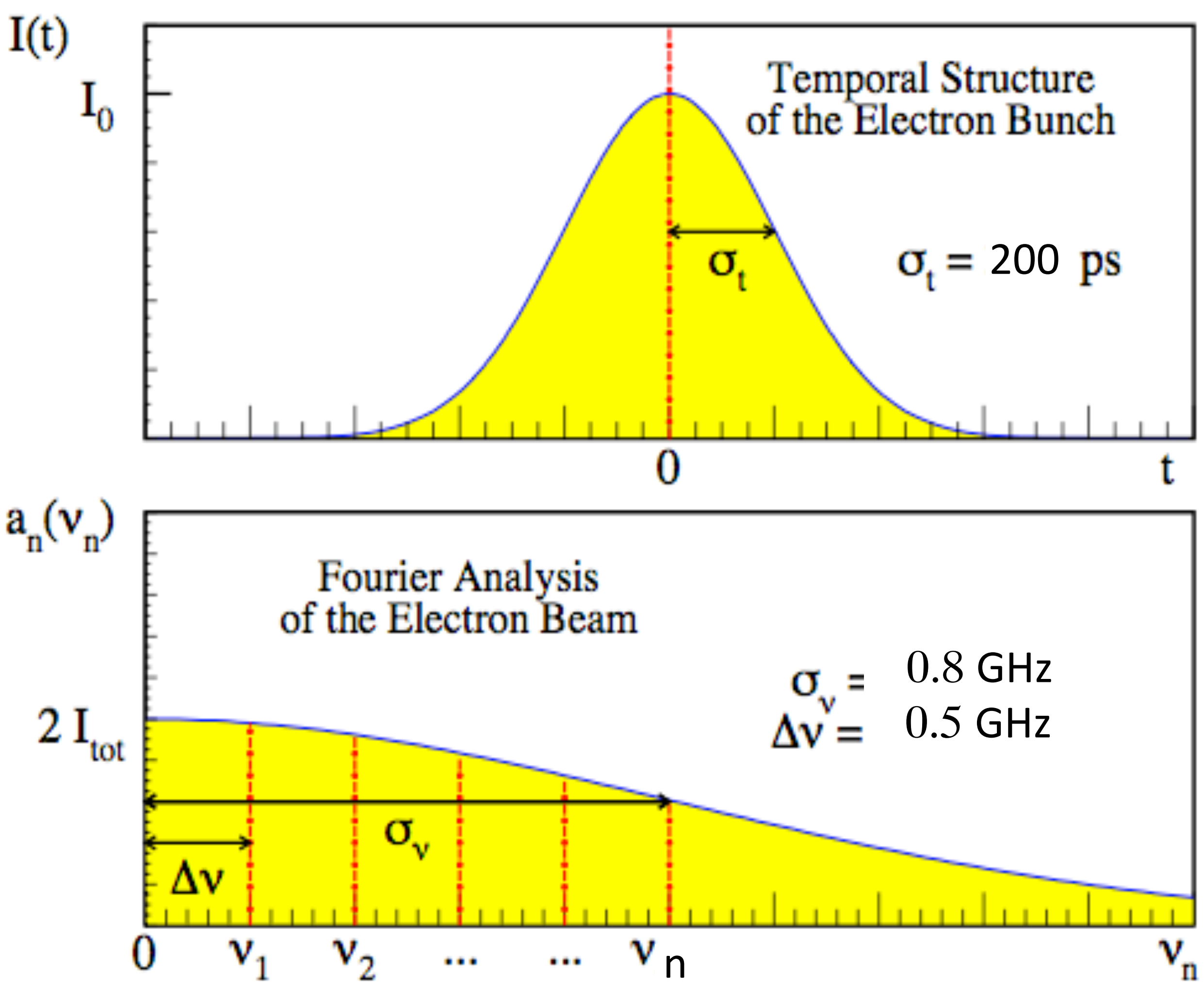


Energy (hν) separation as a function of the static holding field

CLAS12 beam structure

$$I(t) = I_0 \exp\left[-\frac{t^2}{2\sigma_t{}^2}\right] \qquad -\frac{\tau}{2} \leq t \leq \frac{\tau}{2}$$

τ = 2 ns, σ_t = 0.2 ns



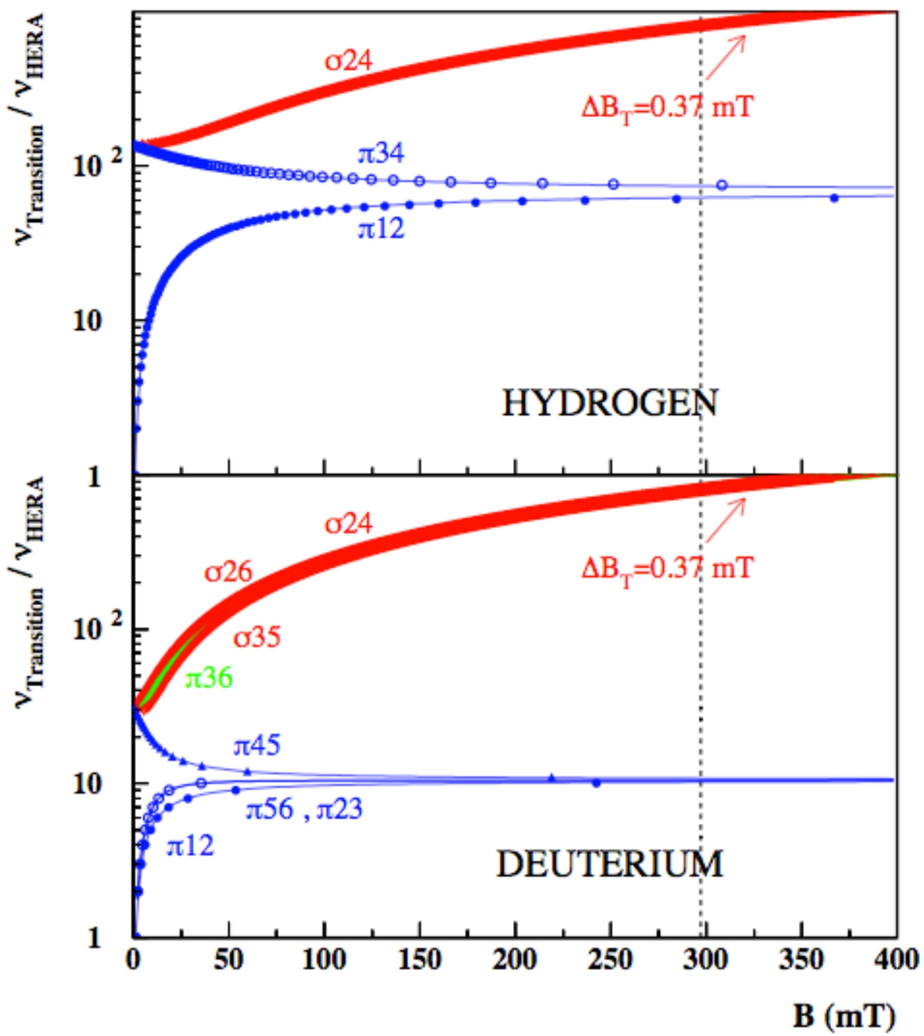
$\Delta\nu = 1/\tau$
= 500 MHz

$\sigma_\nu = 1/2\pi\sigma_t$
= 796 MHz

n @ HERA = 405

n @ CLAS12 ~ 1

Beam induced depolarization



ν HERA = 10.42 MHz

ν CLAS12 = 50 x ν HERA

At CLAS12 50 x separation between resonance frequencies

→ ~ 18 mT

For most challenging σ resonance

Hardly to meet with the short saddle coil

Forces

- **Static Forces:**
  - ✔ *Radial compression on solenoids (< 10 Mpa)*
  - ✔ *Longitudinal compression on the Helmoltz coil (< 3 Mpa)*

cfr 300 Mpa G10 epoxy tensile strengt

  - ✔ *Small variations due to longitudinal misalignments O(mm)*
  - ✔ *Torques due to the transverse field*