Opportunities with nuclei using a 2nd focus in IR8 - introduction

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2nd detector WG meeting,

September 30, 2022

A 2nd focus in IR8 greatly improves forward acceptance

- New physics opportunities
- Complementarity with Detector 1 (EPIC) @ IR6
- Potential for synergies with Detector 2 and IR8 forward instrumentation

Key features include

- Excellent low-p_T acceptance for protons and light nuclei from exclusive reactions
- Detection of target fragments makes it possible to
  - veto breakup to study coherent processes
  - study the final state when breakup occurs

→ Focus of todays meeting

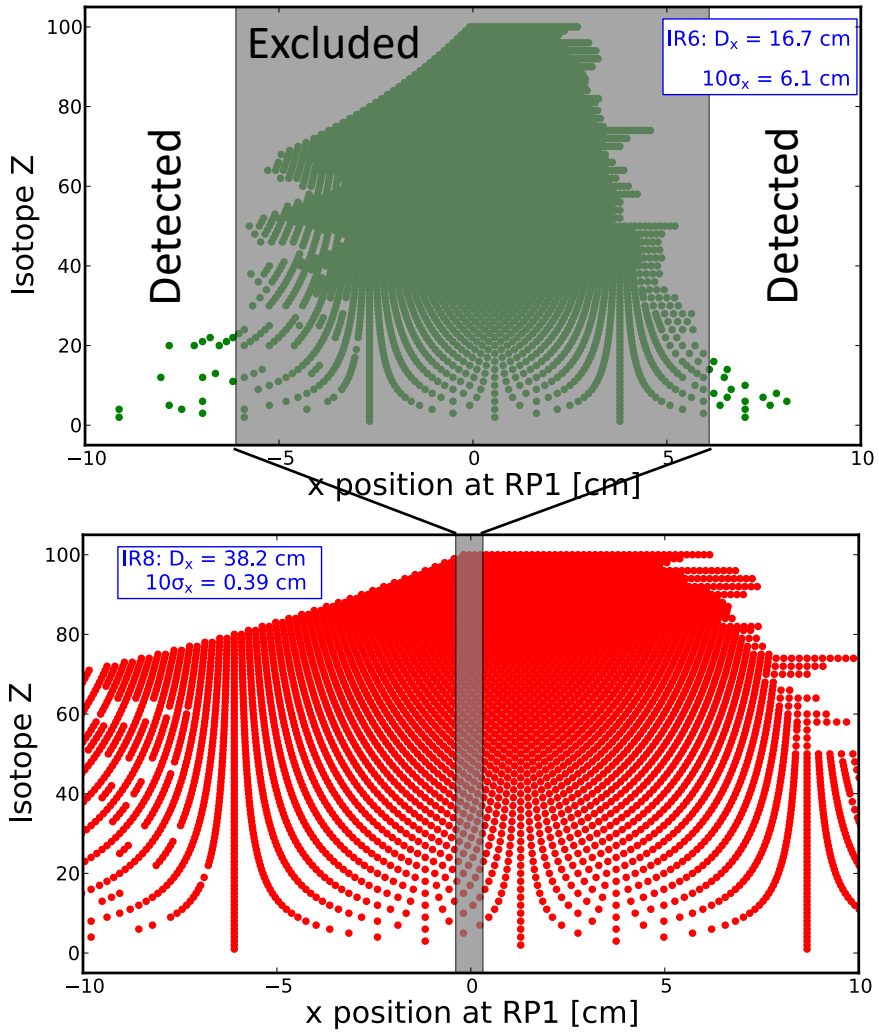
Also, note that the acceptance is much better than in fixed-target experiments like CLAS12 or SoLID, making Detector 2 particularly attractive for JLab users.

Today's presentations

- Charles Hyde
  - DVCS on nuclei
- Mark Baler
  - Coherent diffraction with A-1 tagging
- Barak Schmookler
  - Rare isotopes

Far-forward acceptance with and without a 2nd focus

Ion fragments from U-238



Without 2nd focus:
(EPIC @IR6)

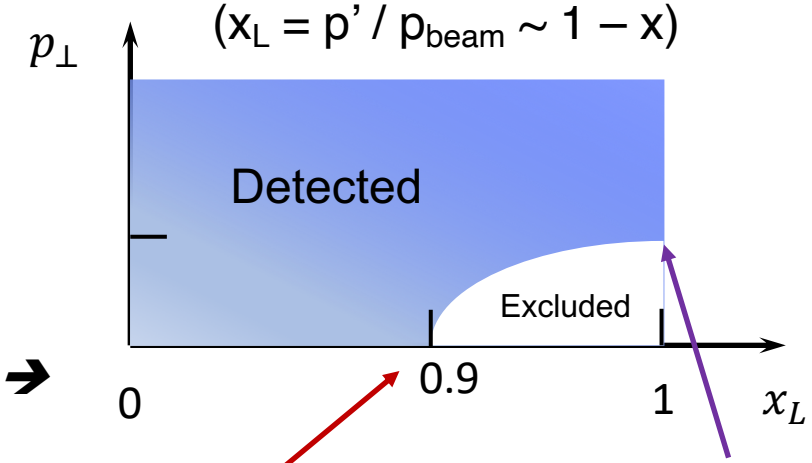
← Z' vs x_{RP}

$p_\perp$ vs x_L →

With 2nd focus:
(Detector 2 @ IR8)

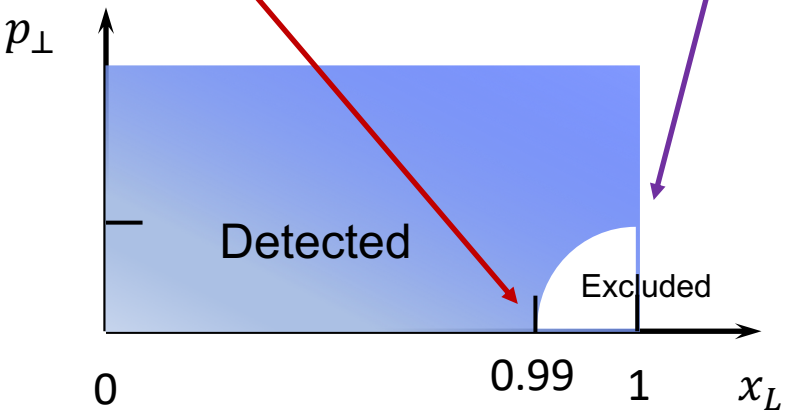
Order-of-magnitude improvement in forward acceptance

Exclusive protons
(x_L = p' / p_{beam} ~ 1 – x)

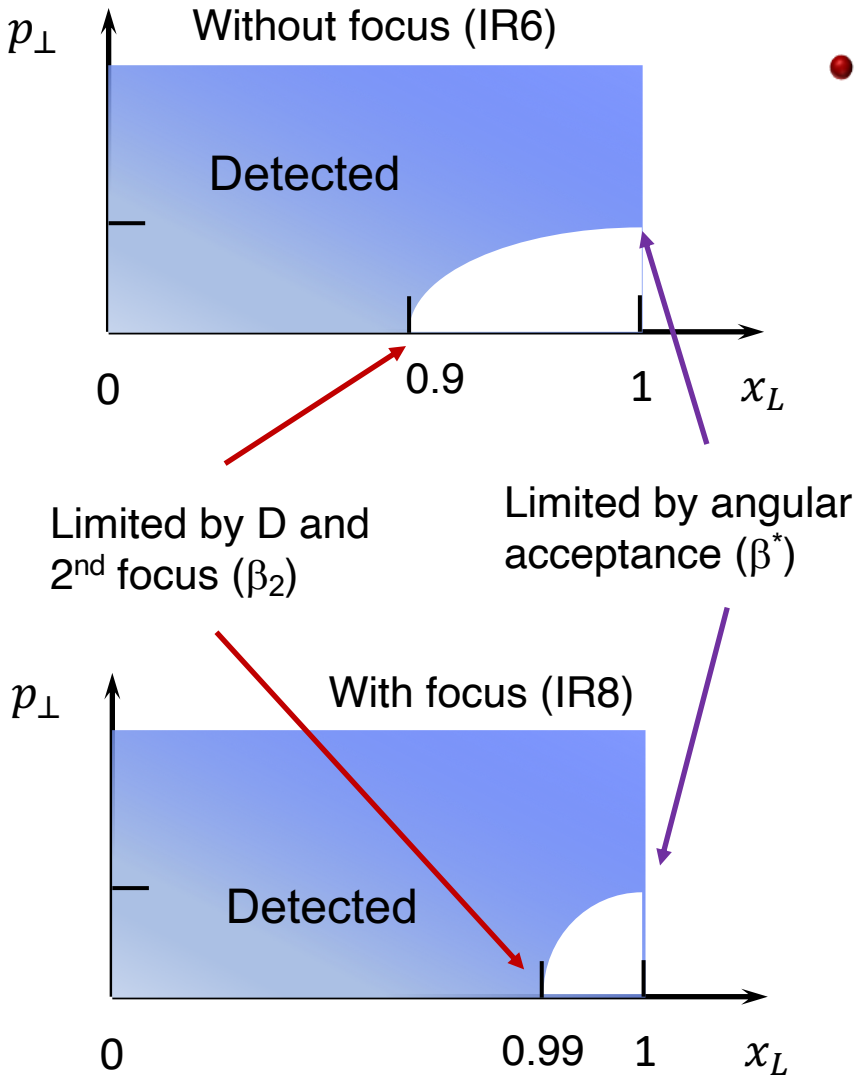


Limited by D and 2nd focus (β_2)

Limited by angular acceptance (β^*)



p_T-acceptance for protons and its connection to luminosity



- Luminosity increases with stronger focusing (smaller β*)
  - But a smaller β* also increases angular divergence: $L \propto \sigma_x^* \sigma_y^*$
  - A 2nd focus makes it possible to improve acceptance without any loss in luminosity, and may allow IR8 to operate at a higher luminosity than IR6