

E12-09-002: Charge Symmetry Violating Quark Distributions via π^+/π^- in SIDIS

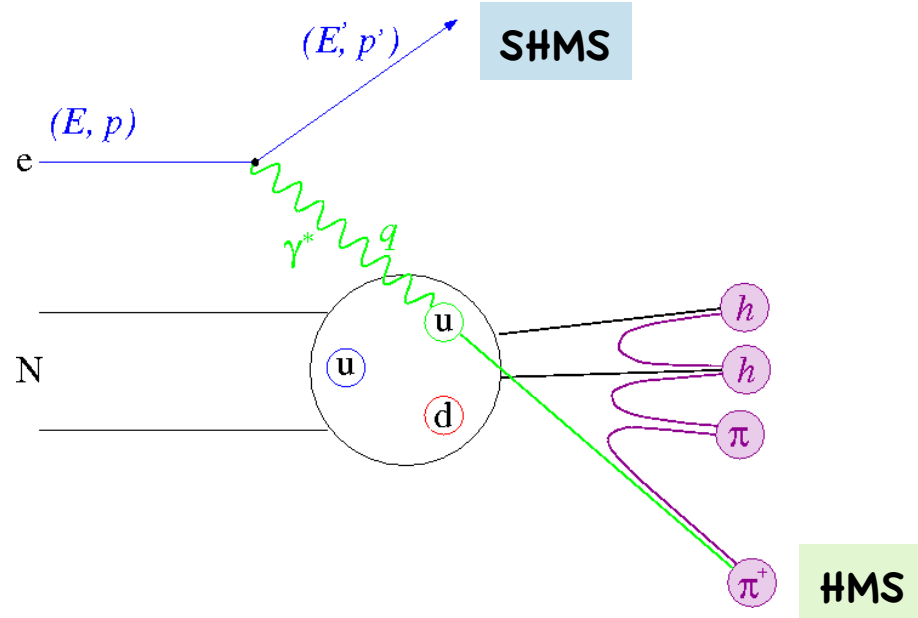
Spokespersons: K. Hafidi, D. Dutta, D. Gaskell

Executive summary:

→ Measure Charged pion electroproduction in semi inclusive DIS off deuterium and hydrogen

Conditions:

- ❑ 11 GeV electron beam
- ❑ 10 cm long Liquid deuterium and hydrogen targets
- ❑ Hall C SHMS for electron detection
- ❑ Hall C HMS for charged pion detection
- ❑ 22 days of beam time



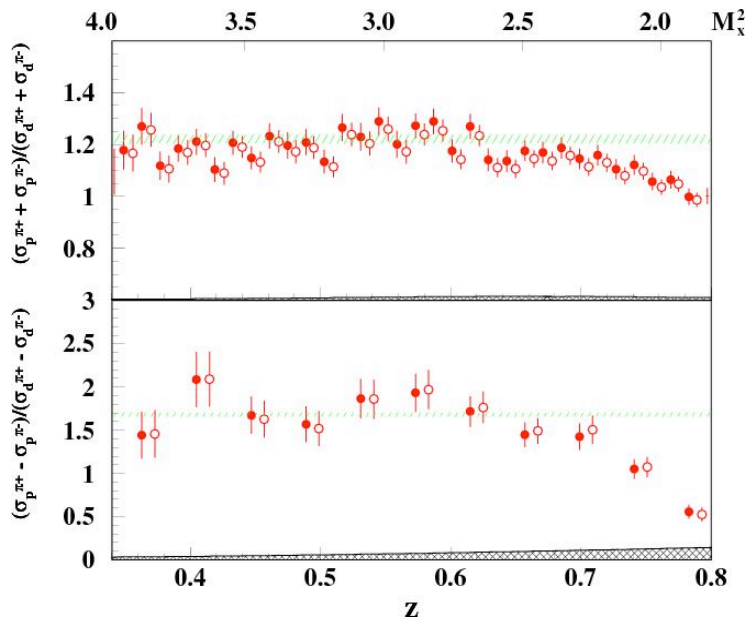
Primary goal: measure charged pion **ratios** to extract Charge Symmetry Violating (CSV) quark distributions → $\delta d - \delta u$ where $\delta d = d^p - u^n$ and $\delta u = u^p - d^n$

Additional physics: Semi-inclusive cross sections at 1.5-3% precision, ^2H and ^1H for factorization tests

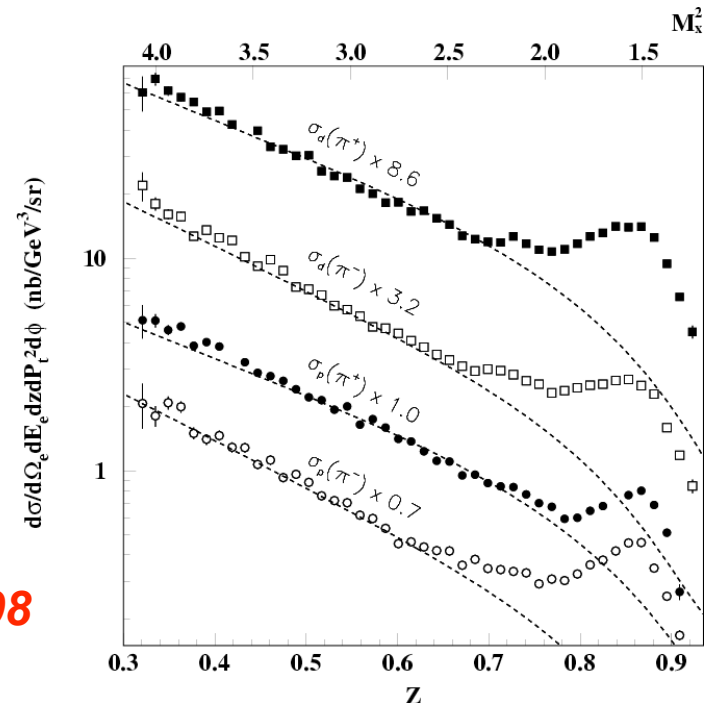
E12-09-002: Why run early?

Understand semi-inclusive reaction mechanism at 11 GeV

- Large part of JLab 12 GeV program focused on extracting various quark distributions using semi-inclusive DIS
- Factorization, independent fragmentation is often assumed/presumed to be valid
- E12-09-002 (and E12-09-017) will provide precise cross sections and charged pion ratios useful for testing factorization
- Early run, quick analysis will provide guidepost for SIDIS experiments in Hall A and Hall B



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PAC 37 Report

*“[T]he cross sections are such basic tests of the understanding of SIDIS at 11 GeV kinematics that they will play a critical role in establishing the entire SIDIS program of studying the partonic structure of the nucleon. In particular they complement the CLAS12 measurements in areas where the precision of spectrometer experiments is essential – in this case, precise control of the relative acceptance and efficiency for different particle charges. **The PAC strongly recommends that these measurements occur in the early years of 12 GeV operation.**”*

E12-09-002: Why run early?

Technically straightforward

- Single beam energy – no LT separation so not very sensitive to point-to-point systematic uncertainties
- Standard equipment and cryo-targets
- Precision required on ratios → cross sections only need modest precision (by Hall C standards)

Most challenging aspects of experiment in HMS

- High singles rates in HMS → approaching 1 MHz
- Need good control of high-rate tracking and pion ID

already accomplished during 6 GeV running

E12-09-002 and SHMS

SHMS requirements modest

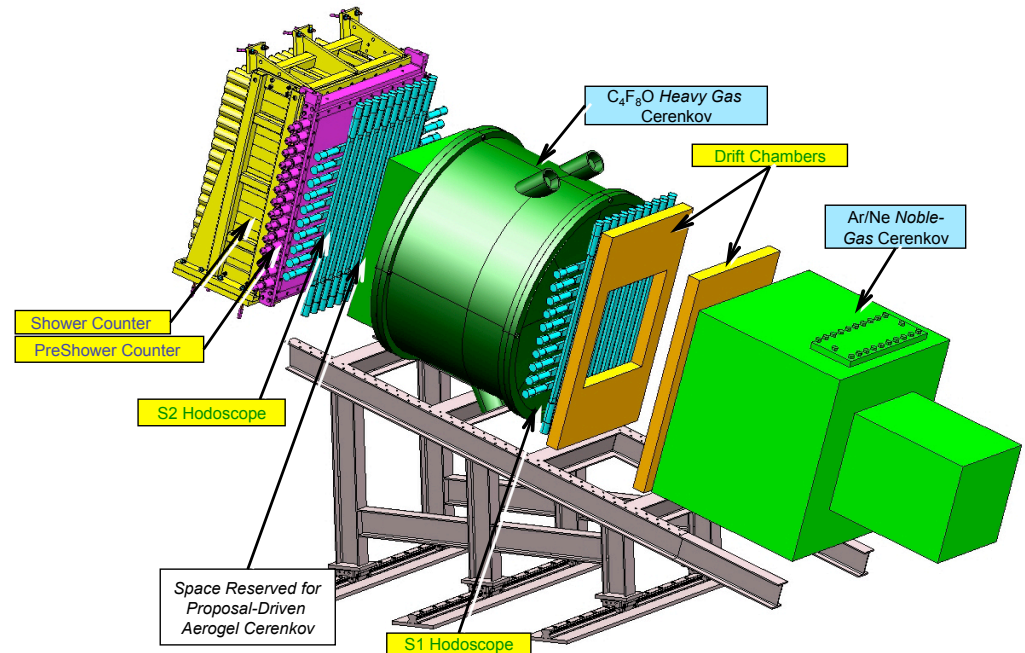
Used as the electron arm

→ just need to reject pions

Low singles rates, < 50 kHz

π/e ratio favorable

→ expect at worst 1:1



Production kinematic settings will be in the DIS regime

→ Inclusive cross section well-known

→ Smoothly varying without a great deal of structure

→ *Excellent for testing/verifying our understanding of the SHMS acceptance*

E12-09-002

- We propose E12-09-002 as an “early” experiment (1st 5)
 - Need SHMS functioning well enough to extract reasonably precise cross sections, but not at L-T separation levels of precision
- Spokespersons contributions
 - K. Hafidi (ANL): SHMS optics design and commissioning
 - D. Dutta (Miss. State): Help design and commission collimators and sieve slits for SHMS → GEM forward tracker, part of NSF/MRI for aerogel
 - D. Gaskell (JLab): Hall C polarimetry at 12 GeV, SHMS in SIMC maintenance
- Spokespeople, collaboration have extensive experience running in Hall C, good track record of successfully completing experiments, commissioning new equipment
 - We welcome the participation of any Hall C User