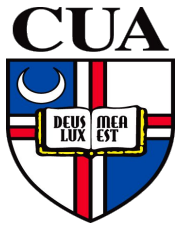
Quick first look at KaonLT experiment data

Richard Trotta, Tanja Horn, Garth Huber, Pete Markowitz,
Stephen Kay, Vijay Kumar, Vladimir Berdnikov, Mireille Muhoza,
Nathan Heinrich,
and the KaonLT collaboration

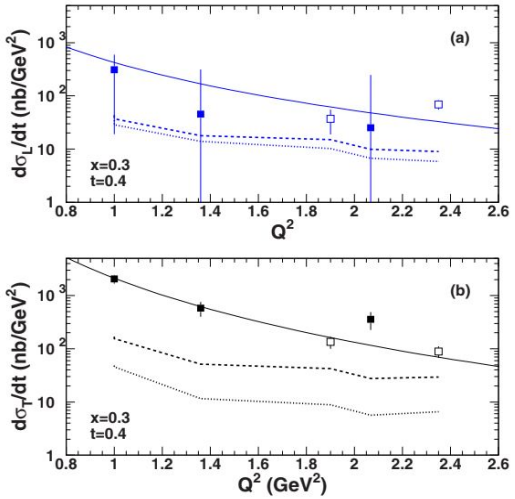


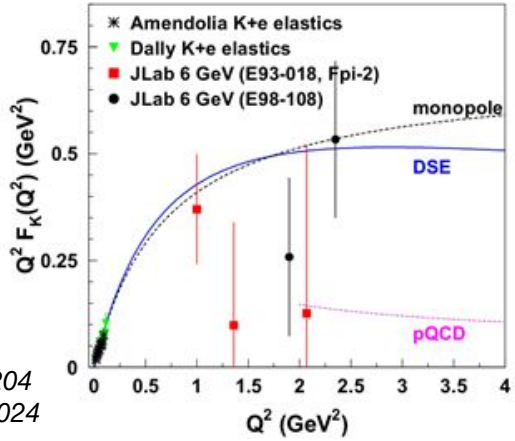
Jefferson Lab

Review E12-09-011 (KaonLT) Goals

- Q^2 dependence will allow studying the scaling behavior of the separated cross sections
  - First cross section data for Q^2 scaling tests with kaons
  - Highest Q^2 for L/T separated kaon electroproduction cross section
  - First separated kaon cross section measurement above W=2.2 GeV

- t-dependence allows for detailed studies of the reaction mechanism
  - Contributes to understanding of the non-pole contributions, which should reduce the model dependence
  - Bonus: if warranted by data, extract the kaon form factor



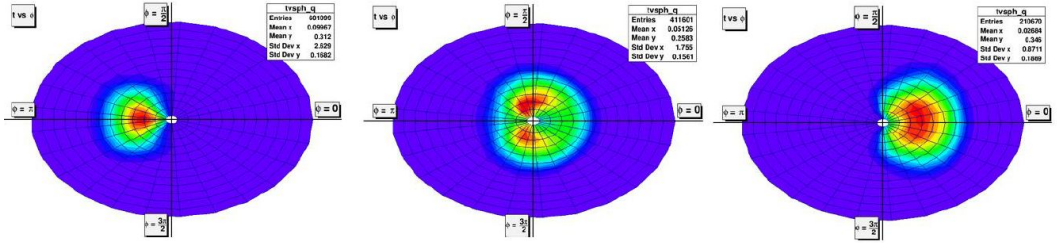


*M. Carmignotto et al., PhysRevC **97**(2018)025204*
F. Gao et al., Phys. Rev. D 96 (2017) no. 3, 034024

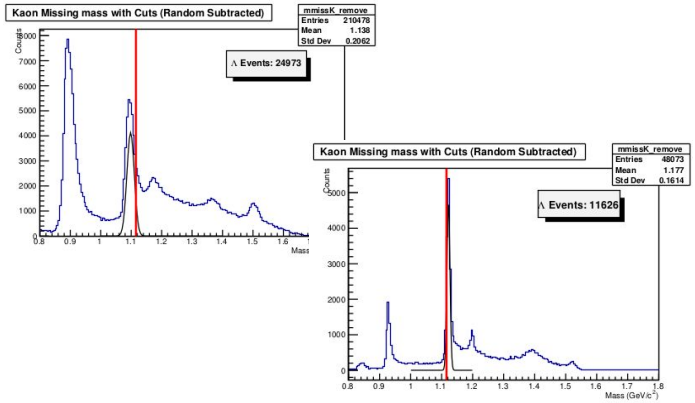
L/T Separation Example

$$2\pi\frac{d^2\sigma}{dtd\phi} = \varepsilon\frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\varepsilon(\varepsilon+1)}\frac{d\sigma_{LT}}{dt}\cos\phi + \varepsilon\frac{d\sigma_{TT}}{dt}\cos 2\phi$$

Setting	Low ε data	High ε data
Q^2=0.50 W=2.40	✓	✓
Q^2=2.1 W=2.95	✗→✓	✓
Q^2=3.0 W=2.32	✗→✓	✓
Q^2=3.0 W=3.14	✗→✓	✓
Q^2=4.4 W=2.74	✗→✓	✓
Q^2=5.5 W=3.02	✗→✓	✓



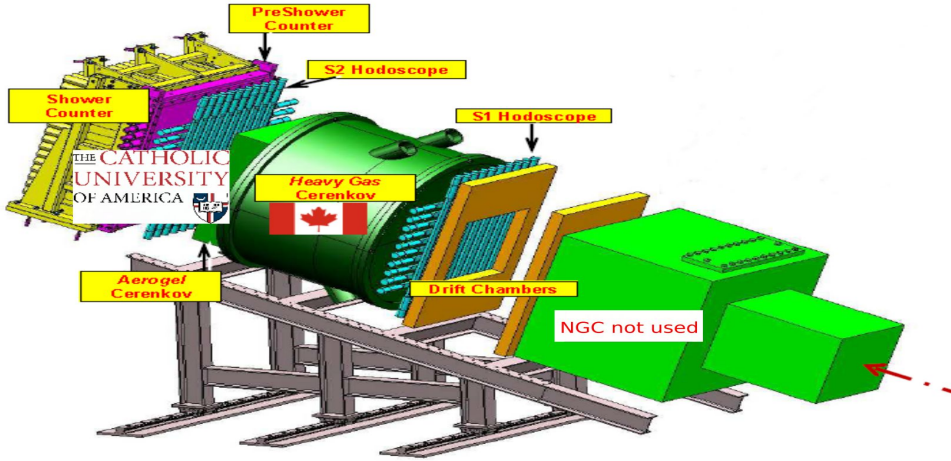
- σ_L is isolated using the Rosenbluth separation technique
- Measure the cross section at two beam energies and fixed W, Q^2, -t
- Three SHMS angles for azimuthal (ϕ) coverage to determine the interference terms (LT, TT)



Plots by R. Ambrose, S. Kay, R. Trotta

Experimental Details

- Hall C: k_e=3.8, 4.9, 6.4, 8.5, 10.6 GeV
- SHMS for kaon detection :
  - angles, 6 – 30 deg
  - momenta, 2.7 – 6.8 GeV/c
- HMS for electron detection :
  - angles,10.7 – 31.7 deg
  - momenta, 0.86 – 5.1 GeV/c
- Particle identification:
  - Dedicated Aerogel Cherenkov detector for kaon/proton separation
    - Four refractive indices to cover the dynamic range required by experiments
  - Heavy gas Cherenkov detector for kaon/pion separation

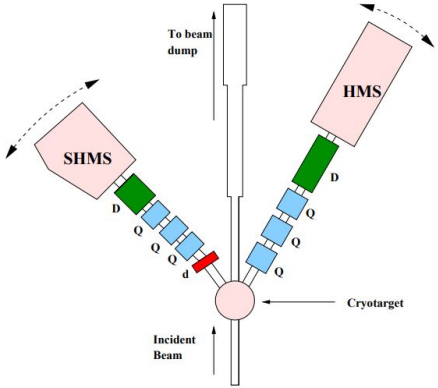


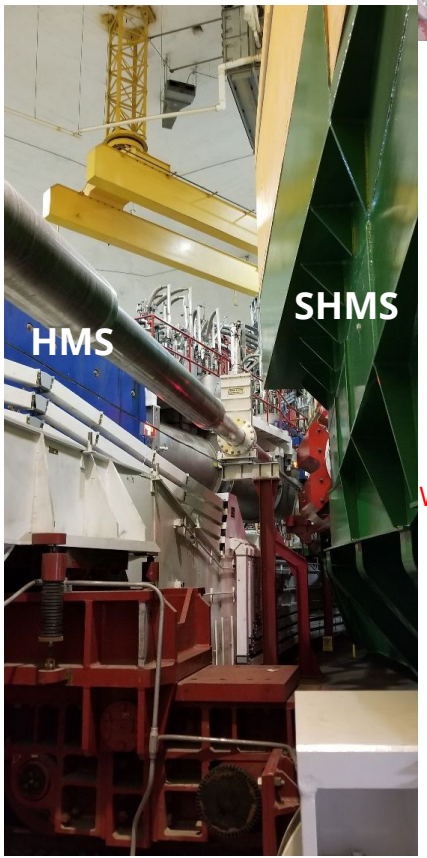
n	π_{thr} (GeV/c)	K_{thr} (GeV/c)	P_{thr} (GeV/c)
1.030	0.57	2.00	3.80
1.020	0.67	2.46	4.67
1.015	0.81	2.84	5.40
1.011	0.94	3.32	6.31

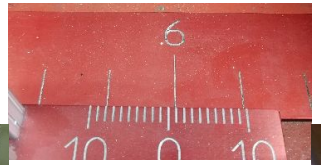
SHMS small angle operation

- Some issues with opening and small angle settings at beginning of run
  - SHMS at 6.01°
  - HMS at 12.7°

[12/17/18]



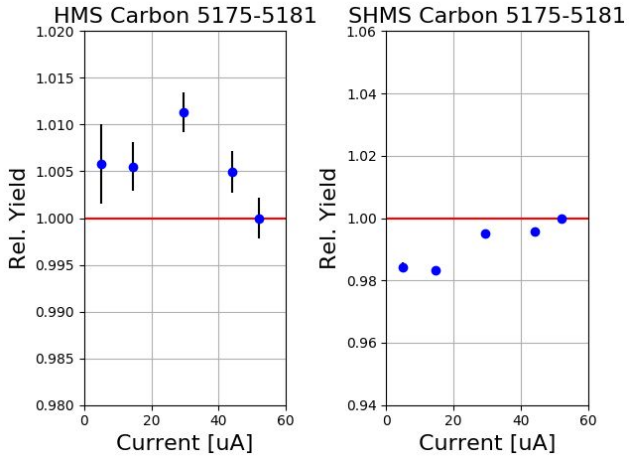




Work of many people …

Analysis Phases

1. Calibrations ← Current Phase
   - Calorimeter, aerogel, HG cer, HMS cer, DC, hodo
   - Assure we are replaying to optimize our physics settings
2. Efficiencies and offsets
   - Luminosity and elastics
3. First iteration of cross section
   - Bring everything together
4. Fine tune
   - Fine tune values to minimize systematics
5. Repeat previous step
   - Repeat until acceptable cross sections are reached
6. Possible attempt at form factor extraction
   - Fit the data to a model and iterate



Come by on Friday, June 28th at 3:30 pm for a more detailed talk!

Coffee Break		
F113, Cebaf Center		15:10 - 15:30
Update/First results on KaonLT	*Richard TROTTA*	
F113, Cebaf Center		15:30 - 15:50