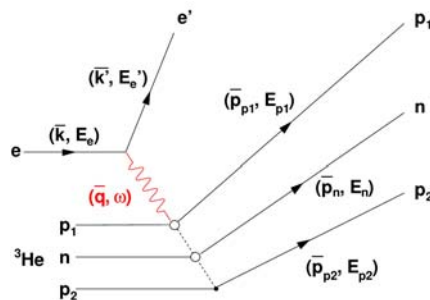


# Three-body forces & other nuclear dynamics studied in $^3\text{He}(e, e'pp)n$ reactions

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Dave Ireland  
(University of Glasgow)



CAA proposal, CLAS Collaboration meeting, Nov. 2005

## Motivation

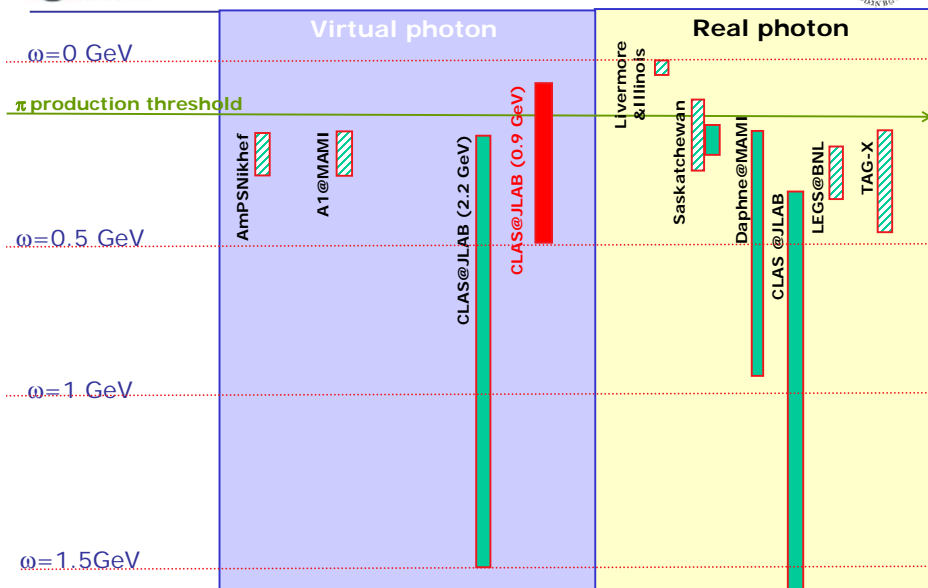
- Analyse e2b data taken at low electron beam energy  
→ get significant yield with energy transfers ( $\omega$ ) below  $\pi$  production threshold and moderate momentum transfer ( $q$ )

1) Test recent “exact” theories of  $^3\text{He}$  electrodisintegration (e.g Faddeev)

2) Test the diagrammatic approaches (e.g. Laget model) in new kinematic regimes

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## $^3\text{He}$ disintegration measurements



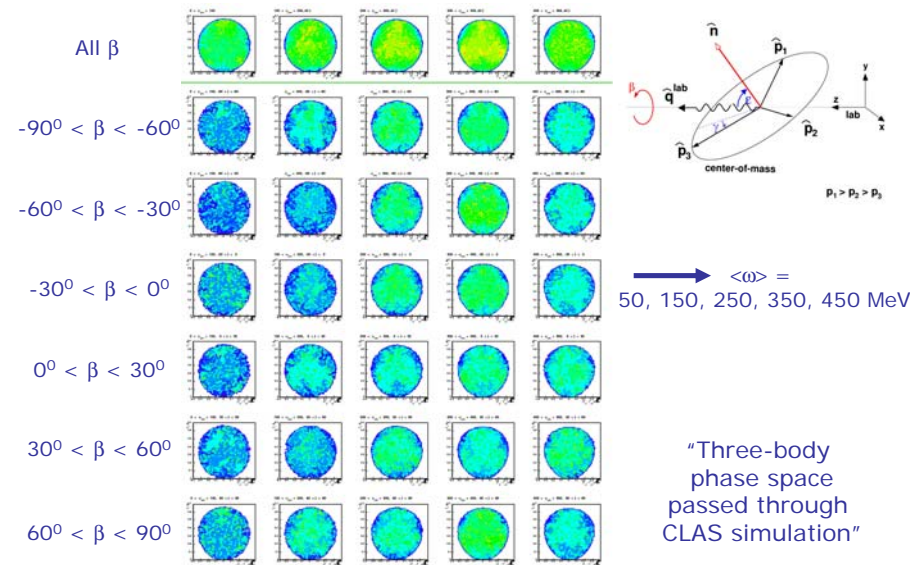
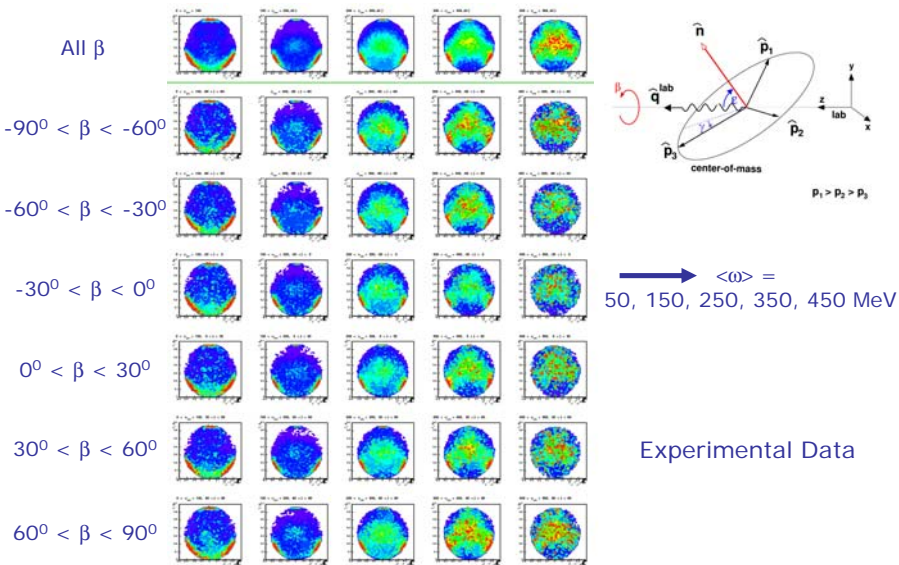
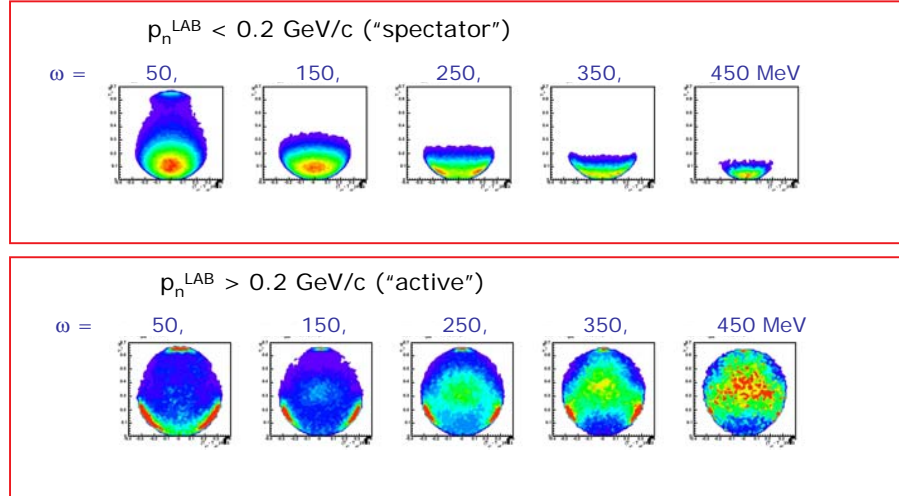
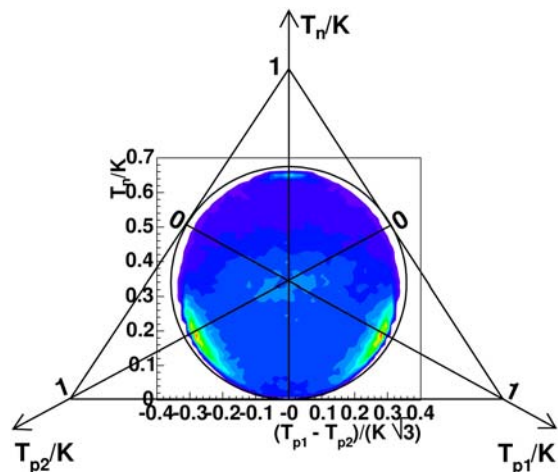
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## Experimental Details

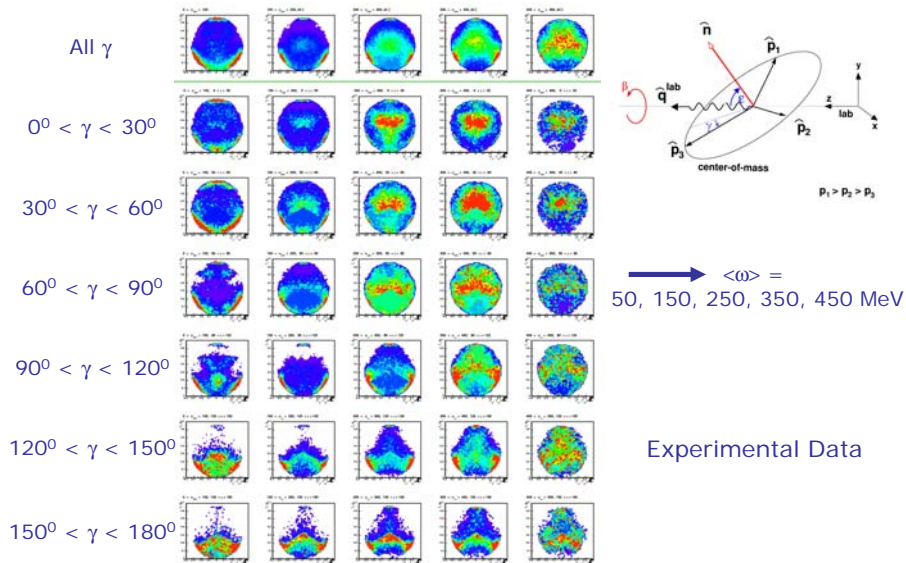
- Run: e2b (June 2002)
- Beam energy: 0.982 GeV
- No. of triggers: 1042 M
- Events with 2 protons: 18.4 M
- $^3\text{He}(e, e'pp)n$  passing all cuts: 1.5 M
- Events with  $\omega < m_\pi$ : ~0.75 M

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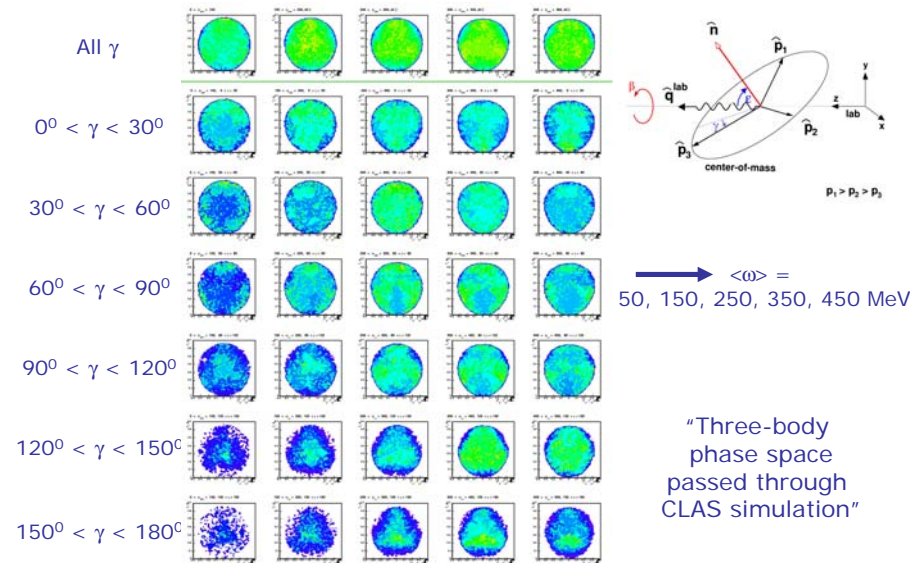




## Variation with $\gamma$



## Variation with $\gamma$



## Obtaining theoretical comparisons

### "Exact" Faddeev calculations :

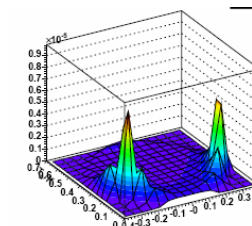
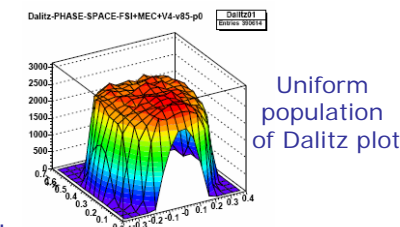
- Obtained computer code for Krakow/Bochum Faddeev calculations
- Implemented a phase space sampling procedure to allow theory to be filtered through CLAS acceptance  
→ preliminary results

### Diagrammatic approach :

- Laget is preparing calculations from events generated within the CLAS acceptance for the e2b data.
- Calculations based on complete diagrammatic expansion in the future (Gross)?

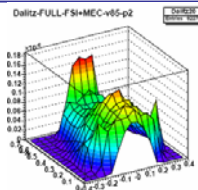
## Preliminary sampling of calculations

- Three-body phase space generator to produce events sampling the full phase space
- Apply minimum energy threshold (no fiducial cuts yet – but soon!)
- For each event apply a weight proportional to the cross section for that kinematics (calculated by e.g. Faddeev)

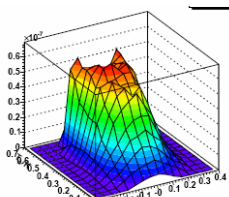
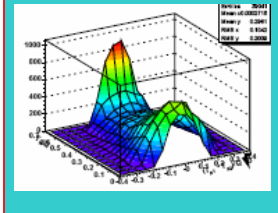


"Spectator" neutron  
 $P_n < 0.2 \text{ GeV}/c$   
 $\omega_{cm} = 0.1 \text{ GeV}$   
 $q = 0.5 \text{ GeV}/c$

1B+MEC

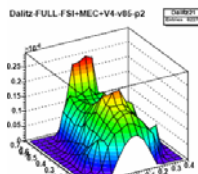


Experimental data  
 $\omega_{cm} = 0.1 \pm 0.025 \text{ GeV}$   
 $q = 0.5 \pm 0.05 \text{ GeV}/c$

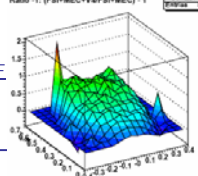


Plane wave calculation  
 (No FSI)

1B+MEC  
 + 3NF



$\frac{1B+MEC+3NF}{1B+MEC}$

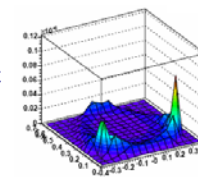


3NFs predicted to give noticeable effects

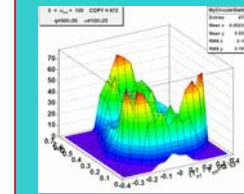
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"Active" neutron  
 $P_n > 0.2 \text{ GeV}/c$   
 $\omega_{cm} = 0.1 \text{ GeV}$   
 $q = 0.5 \text{ GeV}/c$

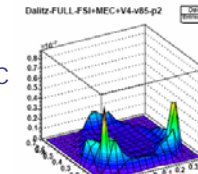
1B+MEC



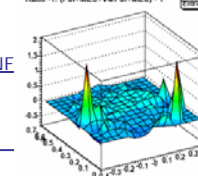
Experimental data  
 $\omega_{cm} = 0.1 \pm 0.02 \text{ GeV}$   
 $q = 0.5 \pm 0.05 \text{ GeV}/c$



1B+MEC  
 + 3NF



$\frac{1B+MEC+3NF}{1B+MEC}$



3NFs predicted to give noticeable effects

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## Summary

- Present Status
  - Analysis of  ${}^3\text{He}(e,e'pp)$  ~complete
  - Setup a procedure to compare Faddeev calculations (Gloeckle/Golak) with data
  - CLAS analysis note ~complete
- To Do
  - Radiative corrections to experimental data
  - Faddeev: Improve statistical sample and add fiducial cuts.
  - Also compare with other "exact"  ${}^3\text{He}$  electrodisintegration calculations based on different framework (Deltuva/Sauer)
  - Laget (/Gross?): Comparison with diagrammatic calculations at higher  $\omega$

More plots on <http://nuclear.gla.ac.uk/~protopop/work/3bf/>