Title of Experiment: ELECTRON-PHOTON ELASTIC SCATTERING

Spokesman: (1.) John Litt (2.) R. Taylor

Experimenters: (Name) Gp. or Institution Name Gp. or Institution
W. K. H. Panofsky SLAC Gp A J. I. Friedman MIT
D. Coward SLAC Gp A H. W. Kendall MIT
K. De Stebleker SLAC Gp A L. Van Speybroeck MIT
J. Litt SLAC Gp A C. Peck CIT
L. W. Mo SLAC Gp A J. Pine CIT
R. E. Taylor SLAC Gp A

Students: Name Gp. or Institution
MIT Graduate Student will be assigned to this experiment.

Summary of Experiment:
The 8 Bev/c spectrometer will be used to obtain the energy spectrum of electrons elastically scattered from a liquid H₂ target. At each of several values of q² between 2(KeV/c)² and 16 (KeV/c)² measurements are taken at five different angles, allowing good separation of form factors G_p and G_q for all but the highest momentum transfers. Accuracy aimed for is limited but the experiment should give considerably improved data over that available now at the lower q² and of course new information at the higher transfer. No serious background troubles are expected.

SLAC Equipment Required for Experiment:
8 Bev/c spectrometer installation, energy calibration better than 1% "A" counting house including 30 Computer.
Up to 200 Tons of steel and concrete shielding.
$ Beam monitor
Liquid H₂, fill and vent systems

Major Items of Equipment to be Furnished by the Group:

Detection system up to computer interface
H₂ target
Computer software

Date Available

Aug. 66
Aug. 66
Jul.-Sept. 66

Beam Requirements:
Electron beam in end station "A". ESY calibration to better than ½.
Stability of 1%.
Energy: Variable, up to maximum
Energy Spread: Variable, ± 1.3 for small fraction of running time up to ± 25%.
Current: Variable, majority of running at 2 x 10¹² electrons/sec.
Spot Size: 3 ms vert. x 1 cm horiz. (including instability).
Halo < 10⁻³ central density
Angular Divergence: Less than 30⁻⁴ in horizontal plane (implies 10⁻³ stability for pulsed magnet in split beam operation).
6. Estimated Time Required: 75 hours - to debug data system, check backgrounds, test target with high beam, etc.
275 hours - data collection, including set up time for changes in angle and/or energy.

Debug time is more useful if run consists of several small parts. Once equipment is collecting data, solid time is preferable, but not essential.

7. Data Analysis: The data analysis is not expected to be very time consuming or difficult. We expect that most of the analysis will be done using the Sis 9300 computer, or campus computers. We would expect to complete the experimental analysis within 3-6 months or the completion of running.
# Experimental Summary

## 2. Experiments:

### a. Spokesmen (1.) L. W. Ho (2.) R. E. Taylor

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<th>Experimenter</th>
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<tr>
<td>W. K. M. Panofsky</td>
<td>SLAC-GP A</td>
<td>J. I. Friedman</td>
<td>MIT</td>
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<tr>
<td>D. Coward</td>
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<td>W. D. Hobbeler</td>
<td>SLAC-GP A</td>
<td>L. Van Speybroeck</td>
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<td>L. W. Ho</td>
<td>SLAC-GP A</td>
<td>J. Fine</td>
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### b. Students

M.T. Graduate Student will be assigned to this experiment.

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## 3. Summary of Experiment

The 20-BeV/c spectrometer will be used to measure the momentum spectrum of electrons inelastically scattered from a liquid hydrogen target. A search will be made for new nucleon isobars up to the maximum energy available. In addition, the q²-dependence of the form factor at each p-p, p-Γ vertex will be measured from q² ~ 0.02(BeV/c)² to ~ 1.6(BeV/q)². To separate the inelastic longitudinal and transverse form factors, measurements will be made at several angles for the same q².

## 4. SLAC Equipment Required for Experiment:

- **20-BeV/c spectrometer installation, energy calibration better than 1%**
- **A** counting house, including SIR 9000 computer
- **Up to 400 tons of steel and concrete shielding**
- **1% beam monitor**
- **Liquid hydrogen filling and ventilation systems**

### Major Items of Equipment to be Furnished by the Group:

- Detection system up to computer interface: Date Available: Aug. 66
- Liquid Hydrogen target: Aug. 66
- Computer Software (Radiative correction program): Jul. ~ Dec. 66

## 5. Beam Requirements

- **Electron beam in Station A.** ESY calibration to better than 0.5% stability of 0.1%.
- **Energy:** Variable, up to maximum
- **Energy Spread:** ± 0.15% 
- **Current:** Variable, majority of running at 2 x 10¹³ electrons/sec.
- **Spot Size:** 0.5 cm (vert.) x 1 cm (horiz.) (including instability)
- **Mol. < 10⁻⁵ central density
- **Angular Divergence:** For some particular angles we require ~ 10⁻⁴ in horizontal plane (angles ~ 10⁻³ stability for pulsed magnet in split beam operation)
- **Target Structure:** Flat top, maximum length
- **Damp:** Beam dump east
- **Repitition Rate:** High enough to provide the required current 2 x 10¹³ electrons/sec.
6. Time Required:

- 50 Hours - System checking, background measurement, etc.
- 200 Hours - Data collection, including set up time for changes in angle and/or energy

7. Data Analysis:

The data analysis is quite complicated because of the necessity of subtracting radiative tails and other backgrounds. We expect that most of the analysis will be done using the SDS 9300 computer and a campus computer. We would expect to complete the experimental analysis within 6 to 9 months upon completion of running.
1. Title of Experiment: COMPARISON OF POSITION-PHOTON AND ELECTRON-PHOTON ELASTIC SCATTERING

2. a. Spokesmen (1.) H. DeStaebler (2.) J. Pine

b. Experimenter: (Name) Op. or Institution Name Op. or Inst.

W. K. H. Panofsky SLAC - Op A J. J. Friedman MIT
R. Coward SLAC - Op A H. W. Kendall MIT
H. DeStaebler SLAC - Op A L. Van Speybroeck MIT
J. Litt SLAC - Op A
L. V. 96 SLAC - Op A C. Peck CIT
R. E. Taylor SLAC - Op A J. Pine CIT

3. Summary of Experiment

The 8.6-BeV/c spectrometer will be used to obtain the momentum spectrum of positrons (and electrons) elastically scattered from a liquid hydrogen target. About ten cross section measurements (to about 2% accuracy) will be made for a range of angles at q^2 values less than 4(BeV/c)^2. A comparison of the cross sections for e^-p and e'^-p scattering will provide information which is sensitive to about a two percent two-photon exchange effect. Further measurements will be made up to q^2 values of ~12(BeV/c)^2 but with decreasing accuracy.

4. a. SLAC Equipment Required for Experiment:

8-BeV/c spectrometer installation, Energy calibration better than 1% "A" Counting House including SDS 9300 Computer.
Up to 200 tons of steel and concrete shielding.
18 Beam monitor
Liquid He, fill and vent systems

b. Major Items of Equipment to be Furnished by the Group:

Detection system up to computer interface Date Available

Hb target Aug. 66
Computer software Jul.-Sept. 66

5. Beam Requirements

Electron or positron beam in end station "A". E0Y calibration to better than 1/2%. Stability of 1%.
Energy: Variable up to ~12 BeV positrons
Energy Spread: Generally ± 0.5%, but ± 0.2% will be needed for some runs.
Current: The intensity of the electron beam is to be approximately matched to that of the positron beam. The current will be variable up to the positron beam design intensity (~ 300A), but for the majority of the runs about 10% will be sufficient.
Spot Size: 0.5 cm vertical x 1.5 cm horizontal (including instability)
Halo < $10^{-2}$ central density
Angular Divergence: ~ $10^{-2}$ in horizontal plane (implies $10^{-3}$ stability for pulsed magnet in split beam operation)

Time Structure: Flat top, maximum length
Dump: Beam dump last
Some runs are low energy, requiring quadrupole focussing to transport beam to dump.

Rep. Rate: Small fraction of running time requires high repetition rate. Majority of run does not require high rep. rate, but high rep. rate may be necessary to provide current.

6. Estimated Time Required:

20 hours - with the electron beam at 60 cycles/sec and low intensity to debug data system, to check backgrounds, etc.

200 hours - Data collection time

De-bug time is more useful if run consists of several small parts. Once equipment is collecting data, solid time is preferable, but not essential.

7. Data Analysis:

The data analysis is not expected to be very time consuming or difficult. We expect most of the analysis will be done using the SIR 930 computer, or campus computers. We would expect to complete the experimental analysis within 3-6 months of the completion of running.