NAL PROPOSAL No. 154

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Test of Proportional Wire Chambers in Hybrid Systems

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Yale University - National Accelerator Laboratory

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Agreement

This is an agreement between the National Accelerator Laboratory and Professor I. Pless of MIT representing the experimenters to provide selected instrumentation for the beam to the 30-inch bubble chamber, and to use the hybrid chamber for an experiment. This document contains an enumeration of the major items needed for the proper execution of Experiment No. 154 as expressed in the proposal for the experiment, subsequent correspondence, and the draft agreement. This agreement covers phases I and II of the experiment and is outlined in Appendix I.

A. Manpower

1. The experimenters committed to this experiment are: D. G. Fong, A. M. Shapiro, M. Widgoff, Brown University; G. Ascoli, B. Eisenstein, L. Eisenstein, J. D. Hansen, U. Kruse, R. Sard, Univ. of Illinois; R. A. Burnstein, C. Fu, H. A. Rubin, D. V. Petersen, Ill. Inst. of Tech; E. D. Alyea, K. F. Galloway, H. J. Martin, J. E. Mott, R. E. Mercer, Indiana University; A. Pevsner, C. Chien, D. Denegri, R. A. Zdanis, Johns Hopkins Univ; B. T. Feld, B. Haber, R. Hulsizer, V. Kistiakowsky, I. A. Pless, C. Pilcher, J. Wolfson, R. K. Yamamoto, Mass. Inst. of Tech; R. J. Plano, T. L. Watts, P. Yamin, A. Sheng, D. Pandoulas, E. Brucker, E. L. Koller, S. Taylor, Rutgers Univ. - Stevens Institute; W. Bugg, H. Cohn, E. Hart, George Condo, Univ. of Tennessee, - Oak Ridge; H. Kraybill, H. Taft, T. Ludlam, W. Barletta, D. Bogert, Yale University - NAL.

2. In addition the university groups expect to involve 3 other physicists, 4 engineers, and 12 technicians during various phases of the experiment.

3. The following major responsibilities were assumed by the individual Universities:

   a. Upstream magnet system monitoring.

      Johns Hopkins - I.I.T.

   b. Tagging of π^+ and protons.

      Johns Hopkins - I.I.T.

   c. Bubble chamber data box and magnet field read-out.

      I.I.T.

   d. Scintillation telescope, coincidence and master gate.

      Brown Univ.

   e. Upstream proportional chambers and amplifier electronics.

      Univ. of Illinois - M.I.T. - Yale Univ.

   f. Upstream shift registers and electronics.

      Yale Univ. - M.I.T.

   g. Upstream proportional chamber wire - read-out system.

      M.I.T. - Yale Univ. - Rutgers - Brown Univ.

   h. Downstream proportional chambers and electronics.

      M.I.T. - Yale - Rutgers - Brown - Univ. of Tenn.

   i. Proportional chamber station facilities.

      Univ. of Indiana - N.A.L.

   j. Computer, CAMAC crate, branch driver.

      Rutgers

   k. Software.

      Rutgers - Yale

4. R. K. Yamamoto was chosen to be Project Manager to coordinate all interface problems and monitor the overall progress of the program.

5. The scientific spokesman for this experiment is I. Pless.

6. The presently assigned NAL liaison physicist is W. Fowler

B. Beam and Equipment

1. The instrumentation and experiment will be done using the beam (N3) to the 30-inch bubble chamber located in the Neutrino Laboratory area.

2. The beam will be equipped with appropriate quadrupoles, bending magnets, collimators, and with additional instrumentation as described herein.

3. NAL will provide:

a.	The secondary beam, bubble chamber and beam enclosures	-
b.	Enclosure for detectors	2K
c.	Basic instrumentation for tuning and controlling the beam including Cerenkov counters	30K
d.	Weatherproof signal cable conduits or above ground cable trays (construction cost)	10K
e.	Computer maintenance contract (operating cost)	5K
	Total NAL	$47K

4. The experimenters will provide:

a.	Proportional wire planes with 2" radius active area	14.6K
b.	PDP-9 computer - existing, value	(76.0K)
c.	Upstream systems and interfaces	23.3K
d.	Cables, power supplies, etc.	13.0K
e.	Proportional wire planes with 6" radius active area for downstream system	19.4K
f.	Downstream Systems and interfaces	10.0K
g.	Cables, power supplies for downstream system	15.0K
	New equipment	95.3K
	Existing value	(76.0K)
	Experimenters Total	$171.3K

C. Other Considerations

1. It is recognized that the experiment is in three phases.

   I. Fabrication, instrumentation and operation of the upstream detectors.

   II. Testing out of the downstream detectors taking 20,000 pictures - (~6 beam tracks per picture). This should provide one enough data to give $d\sigma/dt$ for ~1,000 elastic events, and a momentum distribution for charged particles. This test will be done in such a way so as to minimize interruption and interference to the scheduled operation of the bubble chamber and auxiliary detectors.

   III. Taking a full exposure with the hybrid chamber system. A later proposal will be made for phase III when the performance of phase II is demonstrated.

2. The particles and their energies will be determined later, depending on the proposal of Smith, et al., (2B).

3. NAL will arrange that certain locations downstream from the 30-inch chamber are available for installation of proportional chambers at a later date.

4. The PDP-9 Computer (processor, 8K Memory, Teletype, Two Tape Units and Display) is the property of Rutgers University. Rutgers University agrees to lend this equipment to NAL for this experiment and for six months beyond the end of the experiment.

   At the end of this loan period NAL has the option either to return the computer to Rutgers University or to compensate Rutgers University in a mutually agreeable manner. During the loan period, NAL will keep the

computer under a Digital Equipment Corporation Maintenance Contract.

5. Experimenters estimate that the installation of the beam elements will take one month. Testing of the system will require two months with a beam duration greater than 60 μ sec considering possible interruption in scheduled operations.

5. The testing will not interfere with bubble chamber operations or use of the chamber.

D. Funding

1. NAL funds are available in FY 72 for the items in category B.3.

2. Each university will approach its funding agency (AEC, NSF) for an incremental increase of at least $15,000. This will provide a base of $120,000 or greater to fund this experiment. R. Plano was chosen to be the treasurer to monitor the university funds.

E. Experimental Planning Milestones (tentative)

1.	Prototype upstream detectors	1 July 1971
2.	Install Porta-camp	1 Nov 1971
3.	Start installation of upstream detectors	1 Dec 1971
4.	Acceptance by NAL of the upstream detector facility	1 Mar 1972
5.	Start of installation of downstream system - to be arranged by NAL, assuming that experiment 2I has accomplished initial running	1 April 1972
6.	Test of downstream system (Phase II)	1 May 1972

This Agreement is mutually acceptable to both the experimenters and NAL. Circumstances and needs will change as the design of the experiment, and the plans for the experimental program develop. This Agreement will be amended when necessary. The tentative dates will be confirmed later.

James R. Sanford 11/18/71

James R. Sanford (Date)
National Accelerator Laboratory

Irwin A. Pless 11/23/71

I. Pless (Date)
Massachusetts Institute of Technology

Appendix I

In Phase I the experimenters will design, construct and bring into operation a complete upstream proportional chamber system. This system will tag incident beam particles as to type by correlating the Cerenkov signals furnished by NAL with the proper incoming particle. In addition, the system will measure the position of the incident particle which passed through the momentum slit. The system will contain three proportional wire chambers (3 planes each) which will provide data suitable for defining the incident beam both as to position and angle. The experimenters will furnish the computer, magnetic tape units, programs, and all necessary readout and interface hardware. When the system is installed, debugged, documented and completely functional, it will be turned over to NAL to be operated as a general facility.

Phase II of the experiment consists of an exposure of about 20,000 30-inch bubble chamber pictures (~6 beam tracks per picture) correlated with data from a set of proportional wire chambers downstream from the chamber. The experimenters expect to demonstrate the utility of the proportional chamber spectrometer by attempting to analyze every event. They will do this before requesting a major exposure.