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EXPERIMENTAL HALLS WORKSHOP SUMMARY*

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I. INTRODUCTION

On May 26 and 27 approximately 50 people met for an informal workshop on plans for experimental halls for ISABELLE. A schedule for the workshop, which was followed with minor modifications, is included as Appendix I. The morning of the 26th was spent in presenting plans as they exist in the May 1976 version of the ISABELLE proposal. The remainder of the 26th and the first part of the 27th were spent in discussions of four general topics by separate working groups:

1. Pros and cons of open areas as compared with enclosed halls.
2. Experimental hall needs of ep, $\bar{p}p$, and other options.
3. Hall for the lepton detector.
4. Hall for the hadron spectrometer.

Many participants spent some time with more than one group, so the workshop developed in a fluid and informal way.

The latter part of the afternoon of the 27th was devoted to an overall summary. Pier Oddone explained the planning for experimental halls at PEP, Mike Kreisler summarized the discussions on the hall for the lepton detector, Satoshi Ozaki those on the hadron spectrometer, Dave Ayres those on open areas, and Lee Pondrom those on options.

The general organization of the workshop was the responsibility of Alan Thorndike, and the following notes have been prepared by him, based largely on the final afternoon session, with thanks to those who presented summaries at it.

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*V. Agoritsas, J. Alspector, D. Ayres, H. Brown, A. Carroll, R. Chasman, C.Y. Chien, Y. Cho, S.U. Chung, E.D. Courant, R. Drucker, A. Etkin, A. Fainberg, T. Ferbel, H. Foelsche, K. Foley, W. Frisken, H. Gordon, H. Hahn, J. Humphrey, S. Jacobs, M. Kreisler, T. Kycia, R. Lanou, Y.Y. Lee, S. Lindenbaum, D. Lowenstein, H. McChesney, K. McDonald, P. Mohn, M. Month, S. Ozaki, L. Pondrom, A. Prodell, N. Samios, J. Sandweiss, J. Sanford, J. Skelly, J. Spiro, A. Stevens, L. Sulak, W. Walker, C. Wang, E. Willen, R. Wilson, M. Witherell, P. Yamin.

DISCLAIMER

II. PROS AND CONS OF OPEN AREAS

The main reason for interest in having open areas with movable concrete block shielding at some insertions is the flexibility to make substantial changes in arrangements there after ISABELLE has been in operation for some time. This could be used to take care of needs that one could not anticipate before the machine had been in use. In addition, such areas would be likely to be available initially for small experiments (of the "nook and cranny" variety), which would be valuable. Open areas probably could be completed in a shorter time than an enclosed building, and this could be valuable in permitting use at an early time for access to the tunnel and other purposes involved in assembling and installing magnets and other components of ISABELLE.

The cost of open areas would be lower than that of enclosed buildings by perhaps 50 percent so long as the concrete block shielding could be obtained from the AGS inventory at no charge. If all shielding had to be purchased new, the open area approach would be considerably more expensive than for enclosed buildings. A minimal shield around the beam pipe would require about 5000 tons of shielding, while an enclosure big enough to accommodate a modest experiment would need 10 000 tons or more. The present AGS inventory is 84 000 tons. It seemed reasonable to assume that when ISABELLE is running there would be some reduction in scope of the AGS research program and that some fraction of the shielding could be used at ISABELLE. Such a condition would make open areas attractive from a cost standpoint. At the present time, however, all AGS shielding is in use and no surplus is envisioned. One would be reluctant to reduce the AGS research program just to provide shielding for ISABELLE areas, even though ISABELLE research will have a very high priority when the machine begins operation. Clearly plans for ISABELLE must fit into an overall plan for high-energy physics at Brookhaven (and elsewhere). One possibility is given in the report of the scenario group of the Insertion Workshops.[1] At the workshop it was assumed that up to 30 000 tons of shielding might be available.

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1. A.M. Thorndike, these Proc.

To be useful for doing experiments the space in an open area must be protected against rain and snow and there must be some way to get equipment in and out and to move it around. In these respects it will be less efficient than the enclosed buildings with permanent crane coverage that are included in the present design.

Taking these pros and cons into account, the working group was in general agreement that very serious consideration should be given to providing two open areas instead of the Little Hadron and Little Lepton halls. Several other suggestions were made:

1. Provide road access to both sides of areas if possible.
2. Make dimensions about 40 m by 60 m, with beam height at least 3 m, and 4 m if practical.
3. East and Southeast insertions seem to be the best locations for open areas.
4. Provide a wider tunnel for 20 - 30 m adjacent to the open areas if the cost is not excessive.
5. Shielding block enclosures should be designed for several experiments from the 1975 summer study with real shielding block dimensions to check feasibility.
6. Probably some blocks for the roof about 15 m long should be made.

Two arrangements were discussed. In the first the concrete block enclosure would be large enough to house a small crane, perhaps rolling on wheels like the Travellift, to handle pieces of experimental equipment. In the second the concrete block enclosure would be of minimum size, and an external crane would remove the shielding when access was required. This would probably be in a simple building, like EEBA, but much smaller in size. There was no agreement as to which arrangement was preferable.

III. NEEDS OF $\bar{p}p$, ep AND OTHER OPTIONS

A. $\bar{p}p$ Option:

The experimental equipment for $\bar{p}p$ interactions would be the same as that for pp, or much like it, in many cases. The $\bar{p}p$ option has bending magnets to reduce the crossing angle to 3 mrad which reduce the free space at the intersections to about ± 13 m instead of ± 20 m. The lepton detector would fit between, but some arrangements would have to be modified, or the larger crossing angle and lower luminosity accepted. In the case of the hadron spectrometer described in the 1975 Summer Study those magnets interfere with the "E-magnet" location. In general, however, experimental halls suitable for pp are also suitable for $\bar{p}p$.

B. ep Option:

In experiments involving ep interactions the aim will generally be to extend the range in Q^2 and s to higher values than have previously been possible. This means an ability to observe electrons at large angles, and over a large range of angles and momenta. Secondary nucleons will tend to be at angles close to the incident proton beam. This would seem to imply a hall with wide central part and beam arms, resembling that for the hadron spectrometer. In the 2-day workshop, however, detailed designs with dimensions were not prepared.

To make it easy to switch electron ring operation on and off, it is envisaged that the electrons would cross the protons at some intersections but not at all of them. The electrons might pass straight through the insertion above or below the proton crossing (about 90 cm away), but this would interfere with most experiments that might be installed and would usually not be possible. The electron ring can have a "bulge" which allows it to pass far enough outside the pp crossing to go around the experimental equipment installed there. This horizontal distance could be as much as 6 meters. The present experimental hall designs do not provide space for this bulge, which would begin to depart from the proton beam lines about 75 m away from the crossing point. They should be designed so that a bulge can be added when and where it is necessary to do so. Deciding which intersections should have "bulges" is a complex topic which was discussed at some length, but without a firm conclusion.

Perhaps it will be possible to use one proton ring for electrons, somehow, in the end. That would be the simplest solution with respect to experimental halls. Various ideas for doing so were discussed, but it was not clear whether they would really work, or would produce an adequate electron energy. It seemed good to pursue any such possibilities, though that subject is clearly outside the scope of the workshop.

IV. LEPTON DETECTOR HALL

A. Conclusions on Building:

The enclosed building with poured concrete walls is satisfactory, and a construction schedule with main magnet pieces installed before completion of walls and roof would probably work best.[2] A 40-ton crane would be adequate, permitting calorimeter modules of 30 - 40 tons, with hook at least 20 ft above the beam line. The dimensions of the building should be increased to a length of 150 ft and width of 80 ft to provide adequate working space and room for detectors along the beam line. Heat and humidity control similar to EEBA would be adequate. Ventilation and other provision for combustible gases are required.

B. Further Comments on Design:

Various electron detector and hadron calorimeter modules have to be inserted into the main magnet and removed from it, probably sliding on rails. Scaffolding and walkways will be needed for people to work from, and space is needed for future "end caps" to detect particles emitted near the beam directions. The dimensions above provide room for these components in addition to the basic magnet structure.

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2. These conclusions were modified to some degree in the Lepton Detector Workshop held subsequently. See M. Sakitt, these Proc.

Consideration should be given to placing a counting room right at the side of the magnet with sufficient shielding provided that it can be occupied when the proton beams are circulating. The main experimental living space would be in trailers or temporary buildings erected on the external pad as envisaged in the present experimental hall plans.

V. HADRON SPECTROMETER HALL

The enclosed building with poured concrete walls is satisfactory, but there would be an advantage to having heavy concrete shielding between the hall and fast electronics room to make cables as short as possible. If this wall could be movable blocks or at least easy to penetrate for beam lines or modifications it would be valuable. The distance from floor to beam line in the beam arms should be adequate for the "D" and "E" magnets and detectors that go in them, which may require an increase from present plans. There may be advantages to having beam lines off-center in the hall, and location at a different insertion (now at the West insertion) may be preferable.

While the fast electronics room (for trigger circuitry) can be about 16 ft x 40 ft, a larger control room for data acquisition electronics and computers will also be needed, about 40 ft x 50 ft in size. It should be close to the hall since several thousand cables are anticipated, probably set into the sand shielding with a retaining wall.

Magnets are planned to be superconducting. Power supplies are small, but there will need to be space for compressors and gas-handling equipment to provide refrigeration. Experimental magnets would be off during injection and acceleration, and then turned on at a controlled rate so as not to disturb the circulating beams. Some additional service building space may be needed for those magnet-support functions.

It would be desirable to schedule the construction of the hadron spectrometer so that major magnet components could be put in place before construction of ISABELLE is completed. Present spectrometer designs may not be final, however. During the two days there was an active discussion of the merits of different types of central spectrometers. The summary of the Hadron Spectrometer Workshop, held in July provides further information on hadron spectrometer needs.[3]

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3. D.H. White, these Proc.

APPENDIX I

ISABELLE EXPERIMENTAL HALLS WORKSHOP

May 26 - 27, 1976

This workshop will provide an opportunity for discussion of topics such as: a) improved experimental flexibility through inclusion of open areas, b) the experimental area needs of experiments using ep, $\bar{p}p$, and other options, and c) the needs of large multipurpose detectors in terms of space, support facilities, installation schedules, etc. The workshop is open to all those interested in attending. There will be a general HEDG meeting on the 28th.

Space for participants will be available in the "Blue Building" (923) east of the AGS office building. The tentative schedule for the workshop is the following:

Wednesday, May 26

9:00	ISABELLE Status	Sanford
9:15	Site Plan and Halls in Proposal and Open Area Alternative	Mohn
9:45	Shielding Constraints	Thorndike
10:00	Coffee	
10:15	ep, $\bar{p}p$, and Other Options	Chasman
10:45	Lepton Detector	Michael
11:00	Hadron Spectrometer	Foley
11:15	General Discussion: a) Pros and cons of open areas b) Needs of ep, $\bar{p}p$, and other options c) Needs of large detectors d) Any other topics	
12:30	Lunch	
1:30	Formation of working groups, and group discussions	
3:30	Walk around ISABELLE location	
6:00	Dinner	
7:30	Working group activity	

Thursday, May 27

8:30 Continued Working group activity

Informal visits to magnet R&D area

4:00 General session to identify:

a) Any conclusions reached

b) Specific questions for further study

6:00 Cocktails and Dinner - Berkner Hall

Friday, May 28

HEDG Meeting