PHYSICS DEPARTMENT SUMMER PROGRAM FOR UNDERGRADUATE STUDENTS

Drasko Jovanovich

Every summer, the Fermilab Physics Department assumes a "rejuvenated look." The main cause of that rejuvenation is the presence of some 25 undergraduates, freshman to senior, from colleges and universities throughout the United States, as well as an occassional foreign student.

Some time in March, a large stack of applications for summer jobs at Fermilab are examined. There are usually more than 500 applicants. Many local kids know of Fermilab, and apply for a variety of summer jobs, outdoor and indoor. Of these 500 or so applications, about 150-200 are from physics, computer science, math, and engineering majors who are seeking a summer expereience closely related to their field of study. The vast majority of these applicants are excellent, and it is a painful process indeed to narrow the list down to the 25 students who are allowed into the Physics Department Summer Program by the department's budget constraints and the realities of available supervisory personnel.

Every incoming undergraduate is assigned to either a technician or one of our Fermilab research assistants (post-docs) on a one-to-one basis. The Summer Program student then becomes the "right-hand-person"to his or her mentor, and experiences all the work which a young Ph.D. must do to make an experiment a success. Sometimes this involves downright repetitive mechanical work, like manufacturing hundreds of plastic scintillators and light pipes for calorimeters. Sometimes it is wire-chamber manufacturing, sometimes programming. The student's assignment is based on individual interviews, and the goal is to match aptitudes and expectations.

The work these Summer Program students do is important. A great deal of work is accomplished during their brief, 10-week stay. But even more important is their interaction with Fermilab. Students are encouraged to go to all lectures and colloquia given on site. There are also special tutorials every Friday at 9 a.m. These sessions give the Summer Program students a chance to interact with physicists in an informal but learning-intensive situation.

It is a pleasure to watch a double metamorphisis take place each summer: the cautious, somewhat timid youngsters who begin each Summer Physics Program soon become "pro junior" particle physicists. Questions are asked and answers demanded; reasons are expected. "What is gauge field?" "What is Higgs?" The tutors sweat and toil to explain.

The other transformation occurs among the technicians and R.A.'s who have taken on the responsibility for these students. At the begining of each summer, it is the heavy investment of the

professional's time which brings the student up to a state of usefullness. By the time summer draws to a close, it is the students who have often become irreplacable. "Who will finish this Monte Carlo?" "Who will check that trigger electronics?" Many times, after students have gone back to their colleges and universities, requisitions appear seeking replacements for the Summer Program students, without which the experiment will surely "fail" for lack of help!

Upon departure, every student is asked to write a one-page summary of his or her experience in the Summer Physics Program in order to aid the Physics Department in planning future programs. With much gratitude to all our students for their thoughtful comments, we present two such letters:

Dear Drasko,

I am writing this letter to tell you about my experience at Fermilab, as you requested. I want you to know first of all that my job turned out much better than I had expected, and in fact was better than I had hoped. Credit should go to Mike Sokoloff. He showed great concern; he was available at all times; he was very knowledgeable; and he gave me projects that were at the right level for a summer job. In sum, I can say that I feel very lucky that you assigned me to work for him.

I learned a great deal this summer. I had never been to a physics institution outside of Harvard, so it was interesting to see the different ideas and emphases of the physicists at Fermilab. I also learned a fair amount of particle physics. The things that I do not understand yet are serving as motivation--I really feel re-energized to go back to the classroom and learn more physics. I also am now much more certain about my career future--I definitely want to be a high-energy theorist.

As fas as what I did on my job this summer, the most important physics result is summarized in my memo, "A Test of the OZI Rule." The idea was similar to that in a paper that you had co-authored about the photoproduction of ϕ particles. (I believe it was Ackerloff, et al. sometime around 1978.) Basically, I had a large sample of ϕ particles, and the OZI rule predicts that each ϕ particle produced by quark pairs bubbling out of the vacuum will be accompanied by two extra strange particles. I looked for this extra strangeness by searching for kaons, but I only found about $.45 \pm .25$ kaons per ϕ event. Mike will have a copy of this memo if you are interested. I also produced a couple of other memos describing my analysis of data tapes from E-516. Finally, I successfully fused Milind Purohit's event-generation Monte Carlo program from E-691 with the old tracking and reconstruction Monte

Carlo from E-516. Other people will want to do this in the future, so my notes should be useful.

I think that your summer student program is very worthwhile, and I urge you to continue it. I am sorry that I have no criticisms to help you improve the program, but I really cannot think of any.

Yours truly,
Jonathan Yedidia

P.S. After I gave you that problem about the statistical mechanics of hydrogen atoms in free space, I found it in a book called **Surprises in Theoretical Physics** by Peierels. He gives essentially the explanation that I gave you, and the exposition is very clear. It is in the chapter on statistical mechanics, under "ionization." You were right that the effect is important for astrophysics.

Dear Drasko,

As a summer intern in ten weeks time, I came to grow fond and familiar with my experimental group composed of ten or so senior members, grave and dependable; a number of young and industrious postdocs; a bunch of graduate students, working and worrisome; and a handful of fleeting summer students, professing ignorance and being obliging.

I found myself involved in an experiment which seemed of seriousness and important consequence; an inquest in need of long-term planning, testing, changing; an overriding presence in the mind presiding over the vicissitude of night and day.

Specifically, E-705 aims at detecting excited chi states and direct photons from the interaction between a $\pi^{\pm}$, p, $\bar{p}$ beam, and a beryllium target. My first task was to generate a list of wire connections to be made on the electronics portion of the cluster finder. The signal from each block of the 425 lead-glass block array is compared to the signal from its neighbor blocks. When the signal is larger than its neighbors, a hit is said to have occurred, and the energies from that cluster is summed to determine the energy of the particle which hit the glass.

My second project was to read through a Monte Carlo program which generated the background noise of the experiment. Subsequently, I was to use the information gathered from the Monte Carlo and say how often two or more photons from a π^0 background decay hit the same block of the lead-glass array, and to make up a relevant histogram and scatter plot. When two photons hit the same block, the detector will not distinguish the two photons separate from one another and a misleading energy will be read.

My recommendation to a student at Fermilab in your program is that he or she become involved and feel himself or herself to be a component of the large social network here, to be in a family which does not hold in common nationality, culture, geographic area, school alliance, age, and experience, but who come together with one goal--to do, understand, and discover physics.

I did not like very much to leave and would have liked to be a more lasting or serious member of the experiment. It is to your doing that I was given this introduction to an aspect of certain physicist's lives. My gratefulness.

Sincerely,

Mary Dung