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SSCL-SR-1156
SSC-E010001

Dr. R.F. Schwitters, Director
SSC
2550 Becklemead Avenue
Suite 260
Dallas, TX 75237

May 4, 1990

SSC-E010001

Dear Roy:

This letter is an Expression of Interest in an SSC experiment which would measure
Inclusive spin-spin effects and cross sections near 20 TeV.

The experiment would use spin-polarized colliding proton beams which would be accelerated to about 20 TeV by using Siberian Snakes to overcome the many depolarizing resonances in the various SSC rings. The inclusive events would be detected by a quadrupole focusing high luminosity spectrometer similar to the 55 m long spectrometer now being constructed for our NEPTUN-A experiment in Russia. NEPTUN-A is scheduled to run at UNK starting in 1992 as a 400 GeV fixed-target elastic and inclusive experiment and then later as a 3 TeV fixed-target elastic and inclusive experiment. It might also later run as a 3 TeV on 3 TeV inclusive collider experiment. The experience gained at UNK might be valuable in the early running at the SSC.

Our high energy spin physics group is quite experienced with such inclusive experiments. We made perhaps the world's first inclusive measurement in 1967 by studying $p + p \rightarrow x^\pm + \text{anything}$ at 12 GeV at the ZGS.¹ Our group then made the first inclusive measurements at the ISR in 1971² and confirmed Feynman-Yang scaling.

Indeed the inclusive spectrometer that we would propose to use at the SSC would be quite similar in general concept to the 45 m long inclusive spectrometer used at the ISR and the 55 m long elastic/inclusive spectrometer that we plan to use at UNK.³ Notice that we do not propose to measure elastic scattering at SSC since it may be quite difficult to clearly identify elastic collisions at 20 TeV on 20 TeV.

You may recall that last year we exchanged letters about leaving space in the SSC lattice for Siberian Snakes. Adding Siberian Snakes to the SSC would certainly be a non-trivial task. However, our studies of Siberian Snakes at IUCF continue to produce promising results. Moreover, I believe that many distinguished members of the world accelerator community would find this task both challenging and intellectually exciting. If SSC responds positively to this Expression of Interest, our group would probably be able to take an active role in helping to develop a polarized beam capability at SSC as we did at the ZGS⁴, the AGS⁵, and the IUCF Cooler Ring⁶. We believe that other experimental teams at the SSC might also benefit considerably from polarization capability.

Our preliminary plan is to develop a spectrometer somewhat similar to our UNK spectrometer. It might be about 80 m long with conventional 2 T steering magnets and with quadrupoles to focus a solid angle of about $\Delta\theta = 30$ mrad by $\Delta\phi' \equiv \Delta\phi \sin\theta = 100$ mrad into a size of about 30 cm x 30 cm at 80 m. This focusing and steering would allow small detectors and small aperture magnets and thus reduce the cost considerably. We would concentrate on detecting relatively slow secondary particles in the angular range of perhaps 20 to 90° and in the momentum range of about 1 to 20 GeV/c. This range would allow us to use familiar and reliable detection techniques to study inclusive cross-sections at P_{\perp} values of almost 20 GeV/c. A preliminary drawing of the proposed SSC spectrometer is shown in Fig. 1.

This spectrometer would limit our $x_{\text{Feynman}} = P_t/P_{\text{cm}}$ range to about 0.001 but allow a significant P_{\perp} range. Since essentially nothing is known about spin-spin effects in 20 TeV p-p inclusive cross-sections, it seems prudent to make the early exploratory measurements using an inexpensive and reliable technique. If exciting results are obtained, we might later propose to upgrade the spectrometer perhaps by using higher field magnets; or perhaps some other group might extend them using a larger detector.

Notice that this simple and inexpensive spectrometer would also allow us to measure unpolarized inclusive cross sections just as we did when the ISR first operated. It might be valuable to have such a simple and flexible spectrometer during the early operation of the SSC.

The participants in this experiment would certainly include our University of Michigan high energy spin physics group which presently consists of:

R. Baiod	Postdoctoral Fellow
J. A. Bywater	Design Engineer
E. D. Courant	Professor
D. G. Crabb	Associate Research Scientist
J. E. Goodwin	Postdoctoral Fellow
W. A. Kaufman	Postdoctoral Fellow
A. D. Krisch	Professor [Spokesman]
A. M. T. Lin	Senior Research Associate
D. C. Peaslee	Research Scientist
R. A. Phelps	Research Investigator
R. S. Raymond	Senior Research Associate
T. Roser	Assistant Professor
D. P. Stewart	Graduate Student
J. A. Stewart	Graduate Student
B. S. Van Guilder	Graduate Student
B. Vuaridel	Postdoctoral Fellow
V. K. Wong	Professor

Probably the team would include significant participation from our NEPTUN-A collaborators at IHEP, Protvino and JINR, Dubna. The team might also include a few of our long term collaborators from various institutions including Brookhaven, Saudi Arabia, Texas A & M, TRIUMF, and ETH Zurich and perhaps some new collaborators. I hope that our total SSC collaboration would be no larger than 30 to 40 physicists.

Based on our experience with the NEPTUN-A spectrometer, we estimate that the total cost of our spectrometer would be about \$10 Million in FY 1990 Dollars. This would include: about \$5 Million for conventional construction of the cave including water and power, about \$3 Million for the magnets, power supplies, and stands for the spectrometer, and about \$2 Million for detectors. This estimate does not include the normal operating budget for our group which we expect would continue at about its present level mostly from the Research Branch of DoE.

Based on the 1985 Ann Arbor Workshop on Polarized Protons at the SSC [AIP Conf. Proc. 145, Editors A. D. Krisch, A. M. T. Lin, and O. Chamberlain] I would estimate that the total cost of obtaining polarization capability at the SSC would be \$30 Million to \$40 Million in FY 1990 Dollars. This would include Siberian Snakes, polarized ion sources, RFQ's, polarimeters, correction magnets, and other associated hardware. However this cost estimate must be qualified in two ways:

1. Since obtaining polarization capability will require some modifications to the collider facilities, these modifications must be carefully reviewed by the SSC accelerator physics staff to assure that they conform to SSC standards.
2. Since polarized beams might be used by other experiments, it is not clear if this cost should be fully assigned to our EOI.

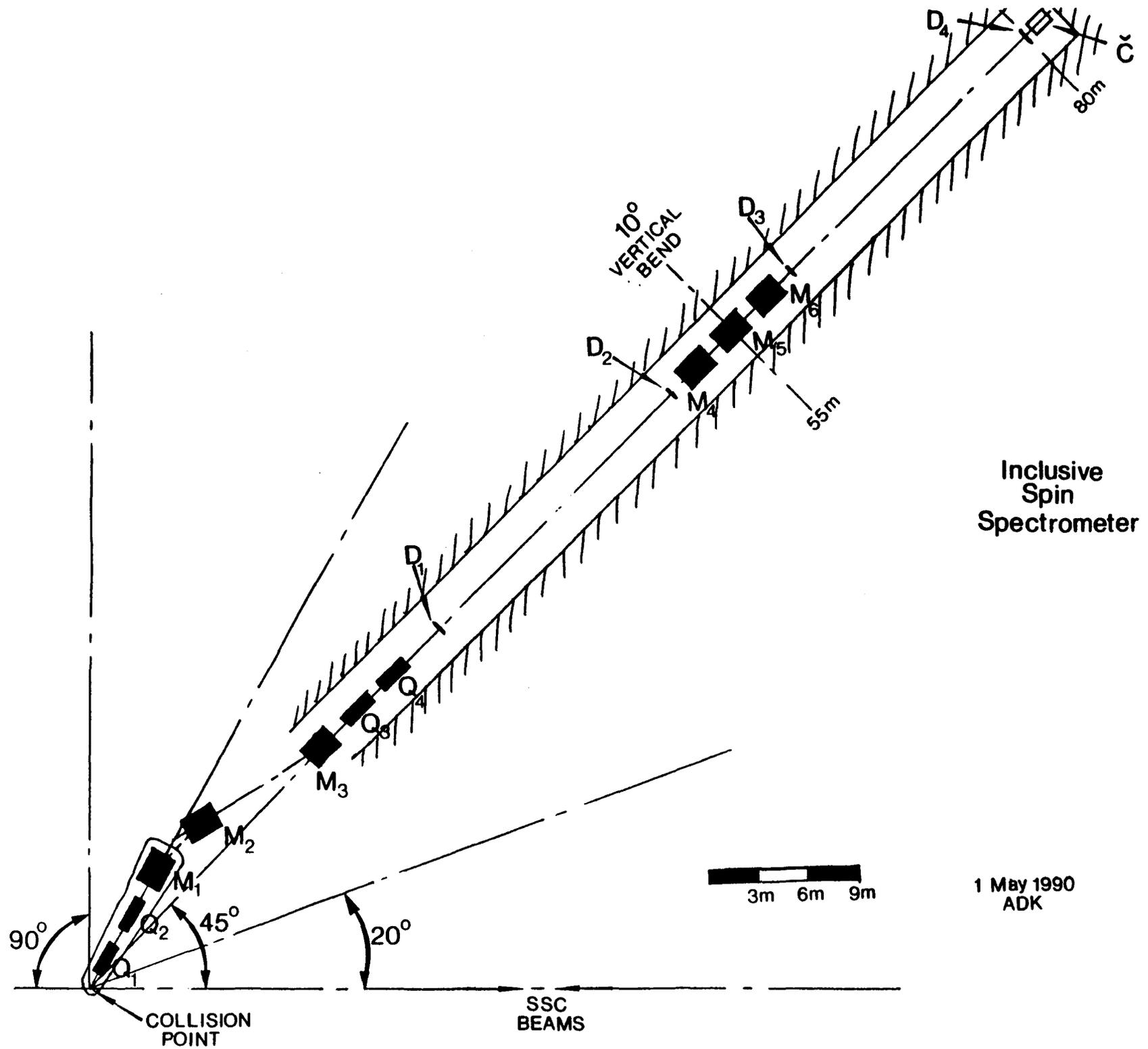
We would be pleased to provide any further information that might be helpful to you and the PAC in evaluating this EOI.

Best regards,



A.D. Krisch
Professor of Physics

1. L. G. Ratner et al., Phys. Rev. Lett. 18, 1218 (1967).
2. L. G. Ratner et al., Phys. Rev. Lett. 27, 68 (1971).
3. Experiment NEPTUN-A, in Proc. of Workshop "Physics at UNK", 152 (March 1989), Published by IHEP, Protvino, Ed. A. M. Zaitsev (1989).
4. T. Khoe et al., Part. Accel. 6, 213 (1975).
5. F. Z. Khiari et al., Phys. Rev. D39, 45 (1989).
6. A. D. Krisch et al., Phys. Rev. Lett. 63, 1137 (1989).



Inclusive Spin Spectrometer

1 May 1990 ADK

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FROM: _____ Professor A. D. Krisch _____

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Professor R.F. Schwitters, Director
SSC
2550 Becklemead Avenue
Suite 260
Dallas, TX 75237

May 24, 1990

Dear Roy:

Enclosed find a copy of a letter by V. L. Solovianov of the Institute of High Energy Physics at Protvino, USSR indicating that 10 Russian physicists from his group and the group of S. B. Nurushev have agreed to join our Inclusive Spin Spectrometer EOI. Please include this letter with our EOI.

Best regards,

A.D. Krisch
Professor of Physics

Enc.
ADK/dw



ИНСТИТУТ ФИЗИКИ ВЫСОКИХ ЭНЕРГИЙ

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Prof. A. D. Krisch
University of Michigan
Ann Arbor,
Michigan 48109-1120

May 21, 1990

Dear Alan:

I would like to inform you that the some of the IHEP participants in the NEPTUN-A experiment have agreed to join the Michigan EOI for an Inclusive Spin Spectrometer using polarized proton beams at the SSC.

The present IHEP participants are S. B. Nurushev and V. L. Solovianov and their colleagues: V. A. Kachanov, V. Yu. Khodyrev, V. V. Mochalov, D. I. Patalakha, A. F. Prudkoglyad, V. V. Rykalin, M. N. Ukhanov and A. N. Vasiliev.

We would be pleased to provide any further information that might be helpful to you to prepare a detailed project with possible contribution from our side.

Best regards,


V. L. Solovianov

Spokesman NEPTUN