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ORNL/FTR--3576

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# ORNL

# FOREIGN TRIP REPORT

ORNL/FTR-3576

Date: April 6, 1990

Subject: Team Report of Foreign Travel of A. W. Trivelpiece, B. R. Appleton, H. R. Brashear, T. A. Gabriel, M. J. Rennich, and F. Plasil

To: A. W. Trivelpiece

From: Bill R. Appleton, Associate Director for Physical Sciences and Advanced Materials

Purpose: The purpose of this trip was to initiate the process of preparing an Expression of Interest (EOI) letter or proposal to the Department of Energy for the L* detector as one of the systems proposed for use on the Superconducting Super Collider (SSC) for high energy physics measurements. The L* collaboration involves scientists from many countries and the Moscow meeting was the first of several that will define the roles and responsibilities appropriate for the various participants. The final meeting will be hosted by Oak Ridge National Laboratory (ORNL) on April 26-28, 1990. We also attended a meeting at CERN prior to the Moscow meeting to discuss the magnet system proposed for L* and to hear of the latest physics measurements from the L3 detector located on the LEP accelerator at CERN.

| | | | | |
|---|---|---|---|---|
| Sites Visited: | 2/22-23/90 | CERN | Geneva | Prof. S. C. C. Ting |
| | 2/25-27/90 | Kurchatov | Moscow | Participants |



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Abstract: The ORNL group and Professor William Bugg from the University of Tennessee, Knoxville (UTK) had very productive discussions with the other members of the L3 collaboration at CERN and heard the latest measurements from the L3 detector. We also participated in a meeting involving some of the key collaborators of the L* project to discuss the design and construction constraints of the magnets that might be proposed for L*. Representatives from the DOE Office of High Energy Physics and the SSC project also attended these meetings as well as all the meetings held in Moscow.

The workshops in Moscow were hosted by the Kurchatov Institute of Atomic Energy. They were organized into a series of focused sessions dealing with technical aspects of the various detector components followed by group meetings to develop consensus and an integrated design. Participants included scientists from many countries including three DOE National Laboratories, namely ORNL, Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). In addition, there were a series of meetings between Professor S. C. C. Ting, who will head the L* project, representatives from the USSR, the DOE and SSC representatives, and representatives from the three DOE Laboratories to clarify responsibilities for future work, funding issues, and to facilitate the close interactions that will be required in the future.

The meetings and workshops were very successful. Many issues were resolved and a clear plan was established to complete the EOI letter in time for the proposal deadline of May 25, 1990.

**COVER SHEET**
**FOR TRIP REPORTS SUBMITTED TO THE**
**OFFICE OF ENERGY RESEARCH**

| | |
|---|---|
| Destination and Dates for Trip Report Being Submitted: | Geneva, Switzerland<br>February 21-24, 1990<br><br>Moscow, USSR<br>February 25-27, 1990 |
| Name of Traveler: | Bill R. Appleton |
| Joint Trip Report: | Yes |
| Names of Other Travelers: | H. R. Brashear, T. A. Gabriel,<br>F. Plasil, M. J. Rennich and<br>A. W. Trivelpiece |

# REPORT OF FOREIGN TRAVEL

**CERN, Geneva, Switzerland**
**February 22-24, 1990**

**Moscow, USSR**
**February 25-27, 1990**

## 1. Introduction

In now appears that Oak Ridge National Laboratory (ORNL) will play a role in building components for some of the detector systems proposed for the Superconducting Super Collider (SSC), and participate in the exciting physics opportunities the SSC will offer once completed. We have received requests from the Southern Association for High Energy Physics (SAHEP) to to make (ORNL) facilities and expertise available to them to assist their member universities in the South and Southeast to participate in building SSC detector components. We have also been asked by L* to collaborate in building some of the critical components for the L* detector and serving as a major U.S. base of operations for integrating the many L* components. In response to these requests we have established the Oak Ridge Detector Center (ORDC) to serve as an interface with these collaborators.

The ORDC has already hosted a number of workshops and planning meetings for SAHEP and L*, and has entered into component R&D work with some of the SAHEP universities funded by the SSC Project. ORNL has recently joined the L3 collaboration at CERN and is joining with University of Tennessee at Knoxville (UTK) to add at least two high energy physicists through joint appointments to enhance our involvement in L3 and L*.

Following the Moscow meeting there will be additional L* meetings and workshops at CERN March 8-10, in Rome March 28-30, in Los Alamos April 2-3, at Massachusetts Institute of Technology (MIT) April 16-18, and the final wrap-up meeting at ORNL April 26-28, 1990. These meeting will culminate in an Expression Of Interest (EOI) proposal to Department of Energy (DOE) for the L* detector system. L* addresses some of the most interesting measurements possible with the SSC and appears to have a high probability of being funded.

## 2. CERN Meeting, Geneve Switzerland, February 23, 1990

The first event at the CERN meeting was an overview of recent physics results from the L3 detector located on the LEP accelerator at CERN. This overview was presented by the L3 staff. A copy of the agenda is shown below.

L3 PHYSICS RESULTS
Presented to

Academician S. Belyaev, Deputy Director
Kurchatov Institute of Atomic Energy
Prof. N. Chernoplekov, I.A.E.

Prof. A. Menth, Director Paul Scherrer Institut (PSI) Villigen

Dr. Thomas Dombeck U.S. (D.O.E.)
Dr. John 0'Fallon, U.S. (D.O.E.)

Dr. Alvin W. Trivelpiece, Director Oak Ridge National Laboratory
Dr. Bill R. Appleton, Associate Director, ORNL

Dr. Bruce Tarter, Deputy Director, Lawrence Livermore National Laboratory
Dr. Harold Britt, Head Physics Department, L.L.N.L.

Dr. John Holzrichter
Assistant Director, L.L.N.L. for Institutional Research and Development Projects

& Visitors

Friday, February 23, 1990 in Prof. Ting's Office : 32/4B03

| | | |
|---|---|---|
| 13:00 - 13:10 | Welcome & Introduction | S. C. C. Ting |
| 13:10 - 13:30 | Study of QED at large angles | Ian Brock |
| 13:30 - 13:50 | Study of number of neutrinos | J. Branson |
| 13:50 - 14:10 | Study of muon pairs | B. Wyslouch |
| 14:10 - 14:20 | Coffee / Tea | |
| 14:20 - 14:40 | Study of Electron Pairs | K. Read |
| 14:40 - 15:00 | Study of tau pairs | P. Duinker |
| 15:00 - 15:20 | Study of inclusive muons | G. Herten |
| 15:20 - 15:40 | Study of inclusive photons | B. Clare |
| 15:40 - 16:00 | Search for new particles | P. McBride |
| 16:00 - 16:40 | Monte-Carlo programing and Computer | H. Newman |
| 16:40 - 17:00 | Next year's research plans | S.C.C. Ting |

There were a number of extremely interesting results from the L3 measurements made possible by the very high resolution of the L3 detector.

In addition to the overview of physics measurements, there was a meeting at CERN preliminary to the Moscow meeting to discuss potential magnet design concepts for the proposed L* detector. Although both warm and superconducting magnet concepts are still being considered for L*, the discussions at CERN concentrated on the superconducting concept that is being proposed by the USSR. The discussions were highly technical and concentrated on magnet configurations that could give the necessary field uniformity and accommodate the other detector components. These discussions continued in Moscow.

**3. Moscow Workshops, Moscow, USSR, February 25-27, 1990.**

The workshops in Moscow were again very technical and intense. The schedule for the workshops is attached. ( See attachment 1) The L* will consist of several massive detector components nested around the SSC beam of colliding protons and surrounded by the magnets. The various individual components must be built to high precision with close tolerances, but ultimately integrated into a single interacting system. Consequently, design decisions arrived at in the individual component working groups often required iterative changes when considered as part of the whole detector. This process will continue to be refined in the upcoming workshops until the final designs are reconciled for the EOI proposal. Because of this, it is more useful to discuss general conclusions from the workshops than technical details.

The tentative decision was made to pursue a superconducting magnet design with a second superconducting shield as the primary design. The USSR was assigned responsibility for the design and construction of the system. A warm, nonsuperconducting magnet was the backup technology. (NOTE: As a result of the March 8-10 meeting in CERN it now appears that a warm magnet design will be proposed in the EOI because of the complexity that has evolved in designing the superconducting magnets).

The main responsibility assumed by ORNL was for the hadron calorimeters. The calorimeters consist of a central large calorimeter and a smaller forward calorimeter. Two designs will be included in the EOI, one with a separate electromagnet (EM) section, which will be the primary choice for inclusion in the EOI, and a secondary design without the EM section. The primary hadronic calorimeter will contain Pb/Fe absorbing material and Si sampling material. The separate EM option will feature $BaF_2$. ORNL and UTK will have the major responsibility for the hadronic calorimeters in collaboration with the USSR. ORNL, UTK and the University of Mississippi will also be responsible for the necessary simulation calculations. ORNL will have

overall engineering design responsibility for the hadron calorimeters and Aachen will handle the forward calorimeters. It appears that LANL and Boston University will handle the central tracking detectors. The muon chambers will involve a number of laboratories with CERN and MIT playing the lead roles.

**4. Moscow Meetings, Moscow, USSR, February 25-27, 1990.**

In addition to the workshops a number of very cordial and productive meetings were held which included various representatives, academicians and dignitaries from the USSR, Professor Ting, representatives from the DOE Laboratories, and representatives from DOE and SSC. Those involved in these meetings and their affiliations were as follows:

1. L*.

   In addition to Professor S. C. C. Ting from MIT, Prof. Hans Hofer of CERN represented L3.

2. DOE National Laboratories

   Dr. Alvin W. Trivelpiece, Director, ORNL
   Dr. Bill R. Appleton, Associate Director, ORNL
   Dr. Bruce Tarter, Associate Director, LLNL
   Dr. Fred Morse, Associate Director, LANL
   Dr. Harold Britt, Head Physics Dept., LANL

3. Department of Energy

   Dr. John O'Fallon, Division of High Energy Physics, OER
   Dr. Thomas Dombeck, Superconducting Super Collider, OER

4. USSR

   His Excellency Vitali Konovalov, Minister of Atomic Energy and Industry
   First Deputy Minister Boris V. Nikipelov, Ministry of Atomic Energy and Industry of the USSR
   Academician Evgueni Velikhov, Vice President of the Soviet Academy of Sciences and Science Advisor to the General Secretary of the Communist Party.
   Academician S. T. Belyaev, Deputy Director Kurchatov Institute of Atomic Energy (IAE)
   Prof. N.A. Chernoplekov, IAE
   V.G. Shevchenko, Deputy Director of ITEP

Working meetings were hosted by His Excellency Vitali Konovalov and Academician Velikhov to discuss USSR/L* cooperation and industry involvement, and by S. T. Belyaev of Kurchatov and V. G. Shevchenko of the

Institute for Theoretical and Experimental Physics to discuss the cooperations with their respective institutes. Informal social gatherings were hosted by S. T. Belyaev and N. A. Chernoplekov.

ATTACHMENT 1

# L*/SSC/LHC MEETING IN MOSCOW

at

Kurchatov Institute of Atomic Energy

25-27 February, 1990

## MEETING AGENDA

### Sunday, February 25, 1990 (at IAE)

| | |
|---|---|
| 10.00 - 10.30 | Welcome to IAE - S. T. Belyaev (IAE) |
| 10.30 - 11.00 | L* description - S. C. C. Ting (MIT) |
| 11.00 - 11.30 | Introduction of Institute of Atomic Energy - S. T. Belyaev |
| 11.30 - 12.00 | Introduction of Los Alamos National Laboratory - Dr. Fred Morse |
| 12.30 - 13.00 | Introduction of Oak Ridge National Laboratory - Dr. Bill R. Appleton |
| 13.00 - 13.30 | Introduction of Lawrence Livermore National Laboratory - Dr. Bruce Tarter |
| 13.30 - 14.30 | Lunch |
| 14.30 - 15.00 | Introduction of Superconducting Super Collider - Dr. Tom Dombeck (SSC/DOE) |
| 15.00 - 15.30 | Views on United States High Energy Physics - Dr. John O'Fallon (DOE) |
| 15.30 - 16.00 | Views of USSR Ministry of Atomic Energy and Industry on High Energy Physics |
| 16.30 - 19.30 | Individual group meetings:<br>- Magnet group<br>- Hadron calorimeter group<br>- Muon chamber group<br>- Vertex chamber group<br>- Electronics<br>- Computation<br>- Estimated finances |
| 19.30 - 20.30 | Dinner |

Monday, February 26, 1990

Uzkoe Hotel and ITEP

| | | |
|---|---|---|
| 9.00 - 19.30 | continued individual group meetings | |
| | - Magnet group | Uzkoe Hotel |
| | - Hadron calorimeter group | ITEP |
| | - Muon chamber group | Uzkoe hotel |
| | - Vertex chamber group | Uzkoe hotel |
| | - Electronics | Uzkoe hotel |
| | - Computation | ITEP |
| | - Estimated finances | Uzkoe hotel |
| 13.00 - 14.00 | Lunch | |
| 19.30 - 20.30 | Dinner | |

Tuesday, February 27, 1990

Uzkoe Hotel

| | |
|---|---|
| 09.00 - 13.00 | Report of individual group meeting<br>- Magnet group<br>- Hadron calorimeter group<br>- Muon chamber group<br>- Vertex chamber group<br>- Electronics<br>- Computation<br>- Estimated finances |
| 13.00 - 14.30 | Lunch |
| 14.30 - 19.00 | Writing up of individual group meeting reports |
| 19.00 - 20.00 | Conclusions |
| 20.00 - 22.00 | Farewell party |

# APPENDIX

Itinerary

| | |
|---|---|
| 2/21/90 | Depart for Geneva, Switzerland |
| 2/22/90 | Arrive Geneva |
| 2/22-24/90 | CERN, Geneva |
| 2/24/90 | Depart for Moscow, USSR |
| 2/24-28/90 | Kurchatov Institute of Atomic Energy, Moscow |
| 2/28/90 | Depart for USA |
| 3/1/90 | Return to Oak Ridge of all travelers |

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18. J. B. Ball
19. F. E. Bertrand

20-22. H. R. Brashear

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