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ORNL/FTR--3590

DE90 010110

Received by OSTI

MAY 07 1990

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FOREIGN TRIP REPORT

ORNL/FTR-3590

DATE: April 19, 1990

SUBJECT: Report of Foreign Travel of Martin L. Bauer, Group Leader, Instrumentation and Controls Division

TO: Alvin W. Trivelpiece

FROM: Martin Bauer

Purpose: To attend a planning meeting on the SSC L-Star detector collaboration to discuss the design of the data triggering and analysis system.

Sites
Visited: 3/29-31/1990 University of Rome Prof. Bruno Borgia
Rome, Italy

ABSTRACT

Collaborators on the L-Star detector system met to discuss the design of a data triggering and acquisition system and to assign responsibilities for writing the expression of interest (EOI) for the SSC Laboratory. In addition, areas for future work were delineated.

The trip was successful in that ORNL was assigned responsibility for writing half of the trigger and data acquisition chapter for the EOI. We also enhanced our position as designers of the front-end electronics for all detector subsystems for the L-Star detector. The traveler presented an informal review of ORNL efforts in application-specific electronics and computing architectures.

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Introduction

As part of the effort to establish the Detector R&D Center at Oak Ridge National Laboratory as a collaborator in the L-Star detector for the SSC, staff member Martin Bauer attended a collaboration meeting at the University of Rome March 29-31, 1990. The purpose of the meeting was to discuss and assign responsibilities for the design and for writing the tracking and data acquisition portions of the expression of interest (EOI) to the SSC Laboratory for the L-Star detector. The meeting was composed largely of those who had been responsible for the trigger system for the L3 collaboration at CERN.

Professor Bruno Borgia of the University of Rome, who has overall responsibility for this effort, organized the meeting in Rome. The discussion centered around designs for the trigger and data acquisition system that could work in the SSC environment, which is a challenge compared to any existing systems.

Technical Discussions

The first two days were spent largely on technical presentations by various persons and discussions of the system needs for triggering and data acquisition at the L-Star detector (see agenda, Appendix B, and list of participants, Appendix C). On the third day, responsibilities were assigned for writing the expression of interest sections on triggering and data acquisition.

Some of the conclusions reached in Rome were that radical new approaches on the front-end electronics are needed to implement schemes involving the transmission of data out of the system. The calorimeter lends itself to easier solution because the tower structure allows one to run all signals toward the outside of the unit. The worst case will be the central tracking region, which will have high radiation fields and very tight spaces.

Because of intensive discussions during trigger talks about the non-availability of muon chamber signals for significant periods of time, the muon chamber signals *cannot* be treated as in the past. With low occupancy, beam crossing times of 16 ns, drift times of 1.1 ms, and wire-to-wire variations of tens to hundreds of nanoseconds, there will be little to no apparent correlation between *hits* and any particular beam crossing. Tying a hit to a particular event will involve extensive deconvolution using central tracking and calorimeter data and massive track reconstruction. Therefore, from a front-end point of view, it may make sense just to time-tag events and send them all to an "unscrambler." This may imply that, in the event of a "keeper," one keeps all time/hit information from that event-zero for 0 to 1.1 ms.

Optical transmission of clock and trigger information using fiber optics is feasible but will require radiation-hard photodiodes and lots of power for fast preamplifiers.

Assignment of Areas of Responsibility

Writing:

1. Introduction and general considerations (Bruno Borgia)
2. First-level trigger (M. L. Bauer, F. Cesaroni)
3. Second-level trigger (M. L. Bauer, F. Cesaroni)
4. Digital conversion (M. L. Bauer, Helmut Vogel)
5. Third-level trigger (Franco Marzano)
6. Data Acquisition (Rome)

Drafting and Graphics: Oak Ridge

Dates:	Ver 0	4/10	Fax to Rome
	Ver 1	4/17	
	Ver 1.1	4/20	Fax to Rome for Bruno

Accomplishments and Conclusions

The Rome segment of the trip would have been a total waste of time if not for the fact that we now have major visibility in the area of electronics, trigger, and data acquisition. There were far too few people in Rome and there was an absence of physicists from the modeling side of the house. We could not answer any of the basic questions about how the triggers should be set up to capture the physics of interest. As it was, the architecture set at the Moscow meeting was modified slightly. Open questions were left as to how well such a trigger system will function under SSC conditions.

Some of those answers were provided in Santa Fe by the modeling performed at Boston University and Caltech. Though the modeling was aimed at how to separate out the physics of interest, it was not strictly oriented toward how to implement trigger decisions.

Responsibility for preparation of the EOI will be shared by ORNL and Rome. We will be responsible for the sections on front-end electronics, first- and second-level trigger, and data conversion systems.

From a programmatic point of view, and for future work, ORNL will have responsibility for the detector front-end electronics architecture and, jointly with Rome, responsibility for all other parts of the data trigger and acquisition system. The proposed system will certainly challenge presently available electronics and will need much development effort over the next several years.

APPENDIX A

Itinerary

3/27-28/90	Travel from Oak Ridge, Tennessee to Rome, Italy, via plane
3/29-31/90	Meeting of collaborators at the University of Rome
4/1/90	Travel from Rome, Italy, to Sante Fe, New Mexico, via plane
4/2-4/90	Collaboration meeting in Sante Fe
4/5/90	Return to Oak Ridge, Tennessee

APPENDIX B

Workshop on L* trigger for LHC/SSC University of Rome March 29-31, 1990

Agenda

Thursday, March 29

- 14.30 Introduction
- 14.40 R. Santonico: "RP Counters, performance and development"
- 16.00 M. L. Bauer: "Electronic Systems Development at Oak Ridge"
- 17.30 Overview of data acquisition and trigger systems
- 20.30 *dinner at Restaurant "Cesarina"*

Friday, March 30

- 0.9.00 Parameters of the data acquisition system: granularity, clustering, rate, time response
- Prompt or first-level trigger
- 13.15 *Lunch*
- 14.30 Second-level trigger
- Farm/Event builder
- Data transfer, optical fibers
- Expert systems
- Simulation and tools for simulation

Saturday, March 31

- 09.00 Summary, conclusions, and assignment of work
- 12.00 End of workshop

APPENDIX C

Participants

Rome: B. Borgia
F. Cesaroni
M. C. Ferrer
E. Longo
L. Luminari
F. Marzano
G. Mirabelli
G. Pascale
E. Petrolo
R. Santonico

ORNL: M. L. Bauer
F. Plasil

Carnegie-Mellon: H. Vogel

ICTP, Rome: Z. Gao

LeCroy: J. R. Brooks
G. Burgada

Napoli: M. G. Aliggi

ETH Zurich: H. Rykaczewski

CAEN: F. Catarsi

APPENDIX D

Bibliography

H. Rykaczewski et al., "R&D Programme in Switzerland for Future Detectors," from a talk given at the 1990 International Industrial Symposium on the Super Collider, Miami Beach, March 16-19, 1990.

DISTRIBUTION

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