built, and are presently undergoing testing. Results of testing and performance are presented.

*We thank the Fermilab staff and the technical staffs of the participating institutions for their vital contributions. This work was supported by the U.S. Department of Energy and National Science Foundation: the Italian Istituto Nazionale di Fisica Nucleare; the Ministry of Education, Sciences and Culture of Japan; the Natural Sciences and Engineering Research Council of Canada; the National Sciences Council of the Republic of China; and the A. P. Sloan Foundation.

16:00

SB09 11 Fiber Optic Data Acquisition System for the CDF Silicon Vertex Detector Upgrade MAXWELL CHERTOK, *Texas A&M University* CDF COLLABORATION,* As part of the comprehensive CDF detector upgrade, the silicon vertex detector from Run I is being completely redesigned and improved. More than 670,000 channels of data will be read out by a new data acquisition system that includes a two-component fiber optic system. The data will be available fast enough to be used for triggering on displaced vertices within 20 microseconds.

*We thank the Fermilab staff and the technical staffs of the participating institutions for their vital contributions. This work was supported by the U.S. Department of Energy and National Science Foundation: the Italian Istituto Nazionale di Fisica Nucleare; the Ministry of Education, Sciences and Culture of Japan; the Natural Sciences and Engineering Research Council of Canada; the National Sciences Council of the Republic of China; and the A. P. Sloan Foundation.

16:12

SB09 12 Large PC-Based Level 3 Trigger at CDF, Fermilab KONSTANTIN ANIKEEV, *Massachusetts Institute of Technology* CDF COLLABORATION,* Baseline Level-3 trigger processing at the CDF experiment at Fermilab is specified to process events at a rate of about 300 Hz with an average event size of 150 KB. It is further desirable that Level-3 system will be able to operate up to peak loads of 1000 Hz and 250 KB, which corresponds to the Level-2 limits. Level-3 trigger performs reconstruction and filtering tasks requiring in excess of 45,000 MIPS of CPU power. We present a distributed, scalable architecture using commodity Linux PC's for the event processing. PC's are also used for event distribution throughout and collection from the Level-3 processors via multiple Fast Ethernets. We report on studies conducted at CDF with a medium-size prototype (as opposed to the small-scale prototype that we were using earlier). This architecture is also a possible candidate for the CMS experiment at LHC.

*We thank the Fermilab staff and the technical staffs of the participating institutions for their vital contributions. This work was supported by the U.S. Department of Energy and National Science Foundation: the Italian Istituto Nazionale di Fisica Nucleare; the Ministry of Education, Sciences and Culture of Japan; the Natural Sciences and Engineering Research Council of Canada; the National Sciences Council of the Republic of China; and the A. P. Sloan Foundation.

SESSION SB10: ACCELERATOR PHYSICS AND ITS APPLICATIONS II

Wednesday afternoon, 24 March 1999
Room 217E GWCC at 14:00
Ming Xie, Lawrence Berkeley National Laboratory, presiding

14:00

SB10 1 Scientific Opportunities using Infrared Synchrotron Radiation* G.P. WILLIAMS, *Brookhaven National Laboratory* G.L. CARR, *Brookhaven National Laboratory* NATIONAL SYNCHROTRON LIGHT SOURCE TEAM, Infrared synchrotron radiation is a white source, some 1000 times brighter than 2000K black-body sources, polarized, and pulsed on the nanosecond time-scale. All synchrotrons and storage rings emit IR light, but this spectral region has been one of the last to be exploited for research. For the past 10 years, however, we have developed programs at the National Synchrotron Light Source, Brookhaven National Laboratory, which now embrace physics, chemistry, biology, geology, as well as the multidisciplinary arenas of materials science, surface science medical and environmental sciences. In this talk we will review the properties of synchrotron radiation in the infrared region and present a selection of applications to demonstrate its superior capability as a scientific research tool.

*Funded by the Dept. of Energy under Contract DE-AC02-98CH10886

14:12

SB10 2 Synchrotron Radiation of Crystallized Beams REINHOLD BLUMEL, *Wesleyan University* HAREL PRIMACK, *Freiburg University* We study the modifications of synchrotron radiation of charges in a storage ring as they are cooled. The pair correlation lengths between the charges are manifest in the synchrotron radiation and coherence effects exist for wavelengths longer than the coherence lengths between the charges. Therefore the synchrotron radiation can be used as a diagnostic tool to determine the state (gas, liquid, crystal) of the charged plasma in the storage ring. We show also that the total power of the synchrotron radiation is enormously reduced for crystallized beams. This opens the possibility of accelerating particles to ultra-relativistic energies using small–sized cyclic accelerators.

14:24

SB10 3 Diagnostic Criterion for Beam Crystallization REINHOLD BLUMEL, *Wesleyan University* HAREL PRIMACK, *Freiburg University* With the help of laser cooling, longitudinally cold heavy-ion beams were recently obtained in various storage rings. Theoretical computations indicate that cold beams in a storage ring may exhibit a transition to a crystalline state. Because of the near-relativistic velocities of the particles in a storage ring, direct imaging is currently not possible in order to prove the presence of a crystalline beam. Therefore indirect diagnostic methods are called for. We propose the following criterion: Absence of heating following reduction of the cooling power. This criterion is motivated by a hysteresis effect first observed in crystallization experiments with the Paul trap. The criterion is based on the structure of the classical phase space of the heavy-ion beam. The criterion is generally applicable and does not depend on the details of the storage ring. The validity and applicability of the criterion is confirmed with the help of detailed numerical simulations.