HIGH-ENERGY PHYSICS

Video Conferencing Lets Physicists Go Head to Head

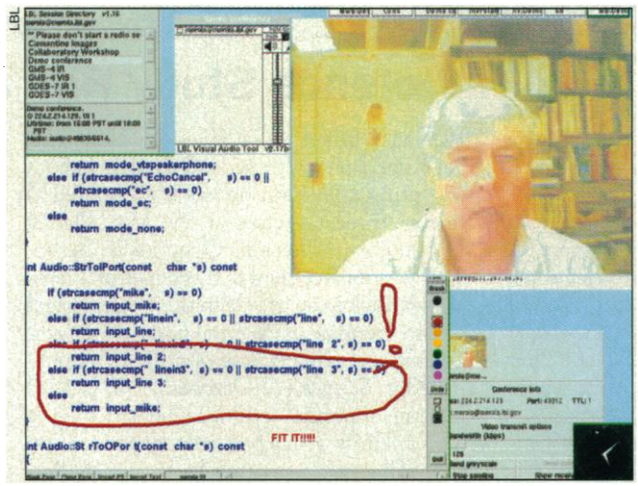
How do you collaborate intensively on a physics experiment a continent away? You video conference. That, at least, is how Larry Price, director of the high-energy physics division of Argonne National Laboratory, thinks U.S. physicists would stay in touch with experiments planned for CERN's Large Hadron Collider—through "virtual meetings" in which physicists on opposite sides of the Atlantic would share transparencies, draw on whiteboards, and quarrel with speakers. Even though funding for a U.S. role in the LHC is uncertain, Price has already proposed that the newly formed U.S.-LHC Collaborators' Group provide a video conferencing link with CERN. "It will be difficult to carry on these collaborations without this technology," he explains.

Video conferencing may conjure up the dated futurism of the short-lived picture phones of days of yore. But improvements in high-speed data networks and the increasingly extended nature of high-energy physics collaborations are making the technology part of day-to-day reality for physicists—one that has already affected the structure of collaborations and relations between advisers and students. "Ultimately," Price says, "I think its impact will be comparable to [that of] computer networking."

Much of the impetus came in the late 1980s from Stu Loken, director of the Information and Computing Sciences Division of Lawrence Berkeley Laboratory (LBL). Loken thought video conferencing might prove a valuable tool for high-energy physics collaborations, which involve many researchers in widely separated locations. Video conferencing had been restricted to television studios and wealthy corporations because it required expensive dedicated lines. But Loken saw an opportunity to apply it to physics in January 1990, when the Department of Energy upgraded the bandwidth of ESnet, a nationwide computer network serving the research needs of DOE's energy research community. The upgrade gave ESnet enough capacity to handle the 378 kilobits per second required by existing video equipment.

Loken set up a link between LBL and colleagues at Fermi National Accelerator Laboratory, the hub of two large top-quark searches, D0 and CDF, that drew on hundreds of collaborators at outside laboratories. The system was rudimentary. Each conference room was equipped with a monitor and a camera that took in a table with no clear view of any one person; the image was transmitted to the monitor at the other end of the link. A separate camera and a monitor were used for presentation material. The setup was not much different in principle from the ones used for years to link TV studios, notes Loken, but "instead of a single talking head in a studio, you were taking in a round-table discussion with lots of people talking and many overhead presentations."

Still, he concedes, "it was slow to catch on." But once the Superconducting Super Collider (SSC) laboratory in Waxahachie, Texas, had been added to the network, the system expanded rapidly. Today, it is called the Energy Research Video Network (ERVN) and links 17 sites around the globe, including national laboratories, universities heavily involved in physics (Caltech, Harvard, MIT, University of Michigan), and foreign laboratories (KEK in Japan, INFN in Italy, Saclay in France). Price's proposal would make CERN the next node in ERVN.



Face-off. Screen display in workstation-based video conferencing, with audio, video, and whiteboard.

This network saw heavy use during the planning of the SSC, notes physicist Don Reeder of the University of Wisconsin. He and his colleagues in one of the SSC's detector groups became "hooked" on video conferencing and began using it for 3 to 4 hours a week. "It's great for presentations," Reeder says, "better than just faxing visual materials, because you get explanation and amplification of the documents." And the technology also eased collaboration with detector group members in Japan and Italy. Since the demise of the SSC, Reeder has been using the Wisconsin video conferencing facilities only about once every 2 weeks, but colleagues in other physics collaborations, such as those being organized for Brookhaven's Relativistic Heavy Ion Collider, have filled the gap. "It's definitely a growth industry," Reeder says. "As people become aware of its utility, it'll be more frequently used."

The result of this growth, Loken believes, will be "very dramatic changes in the way scientists collaborate." One change, he says, will be to open projects to input from poorer institutions and countries whose voices might not be heard otherwise. He adds that video conferencing has already affected relations between faculty supervisors and graduate students working at distant facilities. As any adviser knows, students tend to drift, and video conferencing makes close supervision possible without pulling the student back to campus and interrupting work.

A few hurdles, however, are still slowing the spread of the technology. Cost is one. "The expense has come down," Price says, "but it's still not cheap"—the cost of barebones hardware for a CERN node will be $40,000—"and that's making things go slowly." Another is psychological. Reeder notes that while the existing conference-room–based scheme works well for formal presentations, "when it's a free, brainstorming discussion that pops around from one person to another, it works much less well. The pictures are kind of jerky, and it's difficult to see who's speaking."

Informal discussions may go more smoothly with a new, workstation-based technology for video conferencing. In these systems, camera and monitor are installed at the user's desk, with both the audio and video packets going through the Internet rather than across hardwired lines. Such a system will make it possible to join and leave a video conference during the normal flow of work and to analyze data together with colleagues at remote workstations. But workstation-based technology is "not coming easily," says Ari Ollikainen, networking technology analyst at the National Energy Research Supercomputer Center at Lawrence Livermore National Laboratory. The technology has not been standardized, he says, and international data links don't have the needed capacity.

Price, Loken, and others doubt that these drawbacks will reverse high-energy physicists' addiction to video links. And Price thinks that, as the Internet did, video conferencing will soon spread beyond science. "Video conferencing is going to become a part of daily life in the next 5 years."

–Robert P. Crease