

RF wavelength, 23 cm, is nine times longer than that of the higher-frequency copper alternative. That makes for larger accelerating cavities less sensitive to small misalignments, seismic ground motion, and the disruptive effects of wake fields on the bunches of beam particles. The copper scheme would require a large number of devices, called SLEDs, to boost accelerating power by temporally compressing the RF pulses coming out of the klystron tubes. A downside of the superconducting scheme's longer wavelength is that it requires much larger damping rings—that is, storage rings in which synchrotron radiation reduces the phase-space spread of the beams.

A superconducting linac will consume less electric power and require far fewer klystrons than its warm alternative. The klystrons in the warm scheme would also have to be quite close to the accelerating cavities, thus necessitating a second tunnel running alongside the beam tunnel. The superconducting scheme has the option of conveying the RF power to the underground beam tunnel from klystron buildings every few kilometers on the surface. For reasons of safety and access, however, the second tunnel remains under consideration.

An important consideration for the ITRP was that industrialization of the superconducting linac's major components is already under way. That's partly because the German government last year approved the construction of the 1.4-km XFEL coherent x-ray light source at DESY (see *PHYSICS TODAY*, April 2003, page 35). The XFEL will have essentially the same superconducting accelerating structure as the TESLA design. "Aside from the XFEL," says Barish, "the early involvement of industry in large-scale scientific proposals is more common in Germany than in the US." Overall, the ITRP report concludes, "The main linac and RF systems [of the superconducting technology] are of comparatively lower risk."

Early next year, the steering committee for the International Linear Collider (ILC), as it will now be called, hopes to appoint a director for the project and set up design and testing teams in Europe, Asia, and the Americas. A site-independent conceptual design should be completed by 2006—after which, work on the detailed engineering design is scheduled to begin, probably even before a site has been chosen.

After final approval by the relevant governments, digging and component manufacturing could begin as early as 2009. By then, first results from the

Large Hadron Collider at CERN will have revealed first glimpses of the terra incognita into which both accelerators are to make their complementary forays. For governments not completely convinced by the theoretical

arguments that important new physics is bound to show up at LHC and ILC energies, disappointing early LHC results would provide what has been called a last-minute off-ramp.

Bertram Schwarzschild

Japan Funds New Cosmic-Ray Detector in Utah

The new Telescope Array (TA) in Utah will combine fluorescence and scintillation detection methods used in earlier experiments to resolve a discrepancy in the observed rates of ultrahigh-energy cosmic rays. "Looking with both methods simultaneously should settle this," says the University of Utah's Pierre Sokolsky, a spokesman for the US-Japan collaboration. "If there's no cutoff in the energy, there will be quite a lot of excitement. If there is, then we have some understanding. It's been a burning question in cosmic-ray physics for 30 years." (See Sokolsky's article in *PHYSICS TODAY*, January 1998, page 31.)

Ground was broken in late August for the first of TA's three fluorescence detectors. Fluorescence from atmospheric nitrogen relaxing to the ground state is used to reconstruct the energy and directional origin of incident cosmic rays as a function of atmospheric depth.

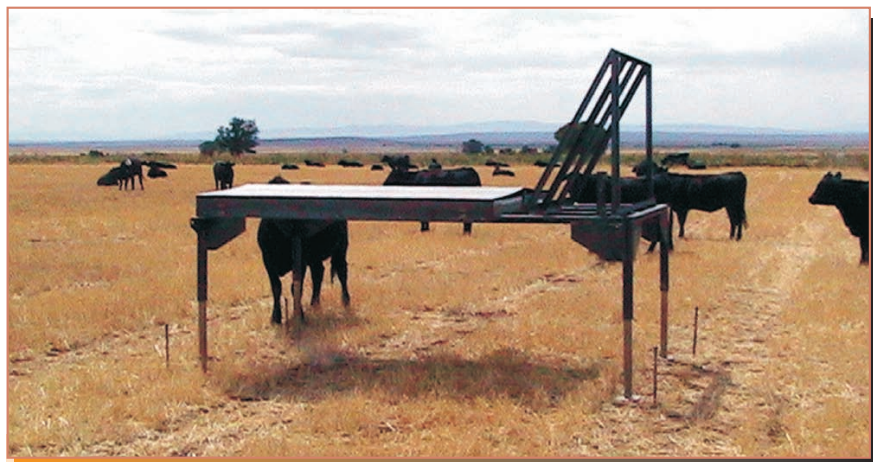
In addition to the fluorescence detectors, which are scheduled to be up and running next year, TA will have 576 scintillation detectors spaced at three-quarter-mile intervals. The scintillators record charged particles produced by cosmic-ray showers and are similar to those used in Japan's now defunct AGASA experiment. The fluorescence detectors are based on the High Resolution Fly's Eye (HiRes), located on the US Army's

Dugway Proving Ground, about 90 km north of TA.

TA is designed to record cosmic rays with energies of 3×10^{18} eV and higher. Over times normalized for the experiments' sizes, AGASA scientists recorded 12 events above 10^{20} eV, whereas HiRes spotted only 2. "This is statistics of small numbers, so the overall discrepancy is nothing to talk about. Yet if it's true, these 12 events would tell us something is wrong with our understanding of how the physics works," says Utah physicist Kai Martens. "In any case, we don't know the sources [of the highest-energy particles]."

The TA team needs permission from the federal Bureau of Land Management to place the scintillators on government land. Another hurdle is money. Japan has committed \$12 million, but the University of Utah and other US partners are still trying to rustle up an additional \$6 million. TA is being built in Utah because it's high, dry, and dark. Japan is too humid and crowded for the experiment, says TA spokesperson Masaki Fukushima, a physicist at the University of Tokyo's Institute for Cosmic Ray Research.

Scientifically, TA overlaps with the much larger Pierre Auger Observatory. Also a hybrid, Auger couples fluorescence detection with an array of water



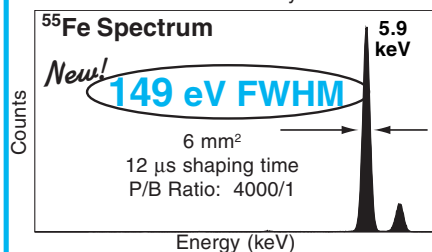
Solar-powered scintillators for the Telescope Array will sit on platforms scattered around the central Utah desert.

TIMOTHY ARNOLD

X-Ray and Gamma Ray Detectors

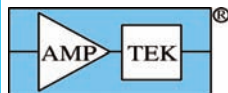
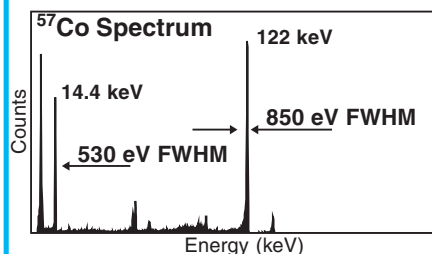
XR-100CR

With Si-PIN for X-Ray Detection



XR-100T-CdTe

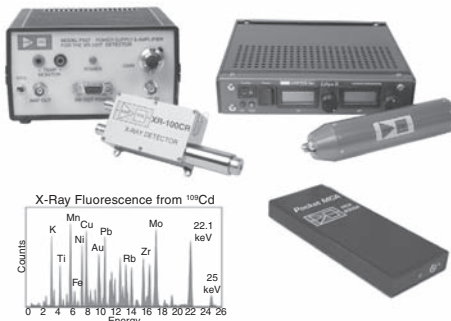
With Cadmium Telluride (CdTe)
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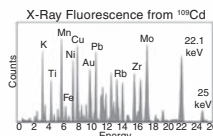
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tanks that record Čerenkov radiation caused by passing muons. Auger's Southern Hemisphere facility is getting started in Argentina; Utah and Colorado are the prime candidates for Auger North. "Auger really aims at the highest-energy events—it requires the largest possible area—and their global understanding," says Auger spokesman Johannes Blümer of Karlsruhe University in Germany. The distribution of matter and sources of ultrahigh-energy cosmic rays are found to be different in the two celestial hemispheres, he adds.

Although Blümer says he sees no "threat to Auger North by TA," some particle astrophysicists worry that, with budgets tight, the new experiment could make it more difficult to secure funding for Auger North. But Sokolsky, who is a member of both projects, says TA "is a windfall for the US. Would people really rather not have the \$12 million from Japan?" TA has narrower goals than Auger, he says. "If we work this right, we can use TA to help Auger." Adds Martens, "The hope for Utah really is that we get Auger North here. Then we will combine three techniques and have a higher density of counters on the ground."

Toni Feder

Business Leaders Urged to Heed Global Warming Science

The greenhouse effect "is real and intensifying," according to a stark "executive action report" issued by the Conference Board, a New York-based nonprofit, nonpartisan business organization that does economic research for major corporations and other businesses. Based on a June 2004 conference on climate change, held by the American Association for the Advancement of Science (AAAS), the report notes that while controversy exists about the exact causes of global warming, "there is widespread consensus that climate change is occurring." The document sums up the views of scientists at the conference by saying that "the trajectory is set" for a warmer planet, and it warns the business community to expect increasing pressure to deal with the issue.

"This was designed to be a back-grounder for our members and business people generally," said the report's author, Charles Bennett, a geographer and a senior research associate with the Conference Board.

"We wanted to provide our members a synopsis of the science as 10 leading American scientists see it."

The report discusses the scientific evidence for sea levels rising, glaciers melting, and spring arriving earlier in the Northern Hemisphere. "The participating scientists . . . believe that human activity is now contributing to warming . . . especially through greenhouse gases that result from human activity," the document says. Warming can't be avoided, "but the trajectory can be jiggled and potential risks associated with warming can be mitigated." The report advises businesses that "governments and markets are likely to act on their perception of the science. Increasingly, this perception is swinging toward a belief that climate change is an urgent priority." The document also says that "corporate boards will be increasingly expected to evaluate potential risks associated with climate change," and that "the global economy will become less carbon-intensive over time."

Bennett cited the arguments of global warming skeptics, particularly the concern about the lack of precision of the global circulation computer models used to simulate and project