▶ move at or close to the speed of light, a detector cannot record a full movie of their motion.)

From this mess, the LHC's computers reconstruct tens of thousands of tracks in real time, before moving on to the next snapshot. "The name of the game is connecting the dots," says Jean-Roch Vlimant, a physicist at the California Institute of Technology in Pasadena who is a member of the collaboration that operates the CMS detector at the LHC.

After future planned upgrades, each snapshot will be expected to include particle debris from 200 proton collisions. Physicists currently use pattern-recognition algorithms to reconstruct the particles' tracks. Although these techniques would be able to work out the paths even after the upgrades, "the problem is, they are too slow", says Cécile Germain, a computer scientist at the University of Paris South in Orsay. Without major investment in new detector technologies, LHC physicists estimate, the collision rates will exceed the current capabilities by at least a factor of ten.

Researchers suspect that machine-learning algorithms could reconstruct the tracks more quickly. To help find the best solution, Vlimant and other LHC physicists teamed up with computer scientists, including Germain, to launch the TrackML challenge. For the next 3 months, data scientists will be able to download 400 gigabytes of simulated particle-collision data — the pixels produced by an idealized detector — and train their algorithms to reconstruct the tracks.

Participants will be evaluated on the accuracy with which they do this. The top three performers will receive cash prizes of US$12,000, $8,000 and $5,000.

PRIZE APPEAL

Such competitions have a long tradition in data science, and many young researchers take part to build up their CVs. "Getting well ranked in challenges is extremely important," says Germain. In a similar competition in 2014, teams competed to 'discover' the Higgs boson in a set of simulated data (the LHC discovered the Higgs, long predicted by theory, in 2012).

TrackML is "incomparably more difficult", says Germain. She thinks the winning technique might end up resembling those used by the program AlphaGo, which made history in 2016 when it beat a human champion at the complex game of Go. In particular, the methods might use reinforcement learning, in which an algorithm learns by trial and error on the basis of 'rewards' that it receives after each attempt.

Vlimant and other physicists are also beginning to consider more untested technologies, such as quantum computing. "It's not clear where we're going," says Vlimant, "but it looks like we have a good path." ∎

Grizzly bears in the greater Yellowstone ecosystem could be targeted by hunters as early as September.

CONSERVATION

Hunting proposal might threaten bears

Biologists argue that the plan could endanger grizzlies in iconic ecosystem that includes Yellowstone National Park.

BY GIORGIA GUGLIELMI

On 23 May, Wyoming officials will vote on whether to allow the hunting of up to 24 grizzly bears around Yellowstone National Park this September. The proposal has reignited controversy over whether or not this population has recovered from decades of hunting and habitat destruction — an issue central to the US government's decision to take the bears in the greater Yellowstone ecosystem off the endangered-species list in 2017.

Seventy-three scientists sent a letter to Wyoming Governor Matt Mead on 25 April, asking him to halt the hunt until independent experts can review data on the size of the grizzly (*Ursos arctos horribilis*) population in this area. They are concerned that government tallies overestimate the number of bears in this region, which spans roughly 80,000 square kilometres and is one of the largest continuous wilderness areas in the contiguous United States.

Critics challenge the federal government's methods of assessing whether the grizzly population is large enough to face a hunting season. The estimates might be too high because of several factors, says David Mattson, a wildlife researcher in Livingston, Montana, who retired from the US Geological Survey (USGS) in 2013. These include increased monitoring efforts in the past 30 years and better visibility of bears to aerial surveys because of shifts in where they look for food.

Wildlife scientist Frank van Manen, who leads the USGS Interagency Grizzly Bear Study Team (IGBST) in Bozeman, Montana, disagrees with critics of the government estimates. The IGBST collects population data using a range of methods, including aerial surveys and tagging bears, van Manen says, and the numbers from each method agree. The current population estimate of 718 bears is "extremely conservative", he says.

The Wyoming Game and Fish Department proposed the hunt in February on the basis of those population assessments, and gave the public until 30 April to comment on draft regulations. Under the proposal, hunters could kill up to 12 bears in the monitored region surrounding Yellowstone National Park, and a further 12 bears outside that area (but still in the greater Yellowstone ecosystem).

Mattson and the other researchers who wrote to the governor about the hunt listed several concerns in their letter. Some of the bear's food, such as cutthroat trout (*Oncorhynchus clarkii*), will probably become even scarcer in the future as a result of environmental changes, they say. This would push the animals to hunt livestock or look for food near

houses, increasing their run-ins with people, says Mattson. If the number of bears killed as a result of these conflicts increases, this would further shrink the population.

Even if the current population estimates are accurate, removing 24 animals through hunting could have detrimental effects, says Andrea Santarsiere, an attorney at the Center for Biological Diversity who is based in Victor, Idaho. In 2017, 56 bears died in the IGBST monitoring area as a result of natural causes or conflicts with people. "If the same

amount dies this year, we could be looking at up to 80 bears removed from the population," Santarsiere says.

Killing females might pose even higher risks to the survival of these grizzlies, she says. The Wyoming proposal would allow the killing of up to two females in the IGBST monitoring area, but it doesn't cap how many females hunters can take outside this region. Females can carry up to four cubs at a time, Santarsiere says, "so killing one female could equal removing five bears from the population".

Van Manen says the hunting proposal won't pose a risk to the bear population. Only two hunters at a time would be allowed in the monitoring area, and the hunts would stop as soon as two females had been killed, he says.

Wyoming officials seem intent on allowing the hunt, says Louisa Willcox, a wildlife activist based in Livingston, Montana, who has been in contact with Wyoming's wildlife department. "It's extremely unlikely that the scientists' comments will make them pause." ∎

FUNDING

Wellcome Trust vows to pull grants from harassers

UK charity launches policy to force institutions to report bullying or sexual misconduct.

BY HOLLY ELSE

One of the world's largest research-funding charities is cracking down on harassment and bullying. Scientists who have been sanctioned by their institutions could lose out on funding from the Wellcome Trust, under rules announced on 3 May.

It is the first major UK research funder to institute such a policy; the US National Science Foundation introduced similar rules earlier this year.

Wellcome's policy will come into force for new and existing grant applications on 1 June. It will apply to anyone already associated with a grant, including those whose projects are already under way. It gives Wellcome, a biomedical-research charity in London, the right to withhold funding from a researcher or to bar them from applying for future grants.

The policy also means that sanctions can be levied against institutions that fail to disclose details of such misconduct, do not investigate allegations in a timely and fair manner, or take inappropriate action. In extreme circumstances, sanctions could include suspending funding from an entire organization.

"Bullying and harassment are just plain wrong," says Alyson Fox, director of grants at the charity. These behaviours are harmful, and therefore affect the research that Wellcome funds, she adds. The policy "will give organizations notice that we are taking this extremely seriously".

The Wellcome Trust funded more than 900 grants, worth a total of more than £1 billion (US$1.4 billion), in 2017.

Under the new guidelines, Wellcome will require organizations that receive its grants to have clear policies that outline standards of acceptable behaviour by staff and procedures for responding to allegations of harassment and bullying.

The policy defines bullying as a misuse of power that can make people feel vulnerable, upset, humiliated, undermined or threatened. It says harassment is unwanted physical, verbal or non-verbal conduct that has the purpose or effect of violating someone else's dignity, or creating an intimidating, hostile, degrading, humiliating or offensive environment for them.

Six types of sanction can be applied to grant holders and Wellcome advisory committee members whose employers have investigated

and upheld an allegation of bullying or harassment. They include removing researchers from grants, and banning them from supervising Wellcome-funded PhD students or submitting future grant applications.

Institutions that do not abide by the policy risk being temporarily barred from applying for Wellcome grants. In extreme cases, they will have existing funded suspended.
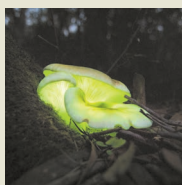
Emma Chapman, an astrophysicist at Imperial College London and a member of the 1752 group, which lobbies against sexual misconduct in higher education, calls the harassment policy an "excellent step forward". However, she worries that it could lead universities to settle complaints informally to hide problems. The requirement to report only upheld allegations is understandable, Chapman adds, but it risks missing researchers who resign before an investigation is completed.

Philip Maini, a biological mathematician at the University of Oxford, UK, also questions how effective the policy will be. "If an institution has someone bringing in huge amounts of overhead and publishing in *Nature* and *Science*," Maini says, "are they really going to take action against them if they are a bully? I think not." ∎