

A tunnel for (module) dummies

The XFEL mock-up tunnel helps scientists practice for the real thing

It feels like the real accelerator tunnel, but it's only building 71 at DESY in Hamburg. It's basically a tube made of concrete, 51 metres long and 5.20 metres in diameter. One accelerator module hangs from the top of the tube, water pipes, cable trays and ventilation ducts are installed and other accelerator parts stand around on the tunnel floor. All these are dummies, some even made of wood, but they are life-size dummies in building 71: the [European XFEL](#) mock-up tunnel.

Construction for the European X-Ray Free-Electron Laser is supposed to start next year, so up to now it exists only virtually. Most of the plans and thoughts are digitalised and saved in a computer. But a real hardware model of this 3.4-kilometre-long facility with a total of about 6 kilometres of "tunnels" would be helpful to practise the installation of modules, cables and supply lines. So researchers from DESY designed this mock-up tunnel, which was then built within a year. "Two years ago it was our concern to build up a model made of sheets of tin to have the real dimensions to test the installation of the acceleration modules," Norbert Meyners, leader work packet 33 (tunnel installation), explains. Then other research groups also wanted to test installing other tunnel items and soon the XFEL team noticed that an even more detailed model was necessary. "Now with this tube the situation is really like it would be at the XFEL tunnel," Meyners says.



Almost like the real thing: the mock-up tunnel for the European XFEL. By the way, the klystron and transformer are made of wood. Photo: DESY



DESY has built a tunnel above ground to test XFEL linac installations. Photo: DESY

The mock-up tunnel isn't only good for testing and practice the installation of the tunnel items. The researchers also think about how to arrange the working space for servicing the machine, ways of transport and safety regulations. So the mock-up tunnel is split into two parts: The first 41 metres simulate a part of the 2.1-kilometre-long accelerator part; and the following 10 metres are supposed to be for the undulator part of the XFEL, where the high-intensity X-ray laser flashes will come into being in future.

In the accelerator sector DESY staff will practice the installation of the accelerator modules. One module is about 12 metres long. Two dummies are foreseen in the mock-up. The remaining space is left for a so-called string connection box and for a mock-up of a bunch compressor section. A dummy module has a weight of three tons, which is almost the half of a real module. While the other machine parts - like water distribution, klystron or pulse transformer - will be placed at the floor of the tunnel, the modules will be hanging from the ceiling. "The first test module we fixed the Egyptian way with hoists, because the tunnel vehicle wasn't finished yet, to perform vibration measurements to check the design of the module suspensions," says Meyners. But soon with the special vehicle of XFEL tunnel they want to fix the second module — with its lifting platform this will be much more accurate and reliable. And finally they can test the connection by welding together the two modules.

But before then further tests will be done on how to equip the tunnel with the vehicle. This is important because there is not much space in the tunnel. The passage for the vehicle is 1.80 metres wide, the vehicle itself 1.40 metres. And if you want to fix a module with a diameter of about one metre and the waveguides for the cavities alongside of the modules, it could become tight. "It is a question of centimetres in some places," Meyners says.

Start of construction for the real XFEL tunnel is planned for next year. For ILC scientists the XFEL is something like the test facility for the ILC because the acceleration modules use the TESLA technology. And even if both machines are not reality yet, the XFEL mock-up tunnel conveys a feeling, how the future XFEL tunnel will be like.

-- Jan Dreyling-Eschweiler, DESY



Watch a video of the automated tunnel vehicle. [Download video](#)