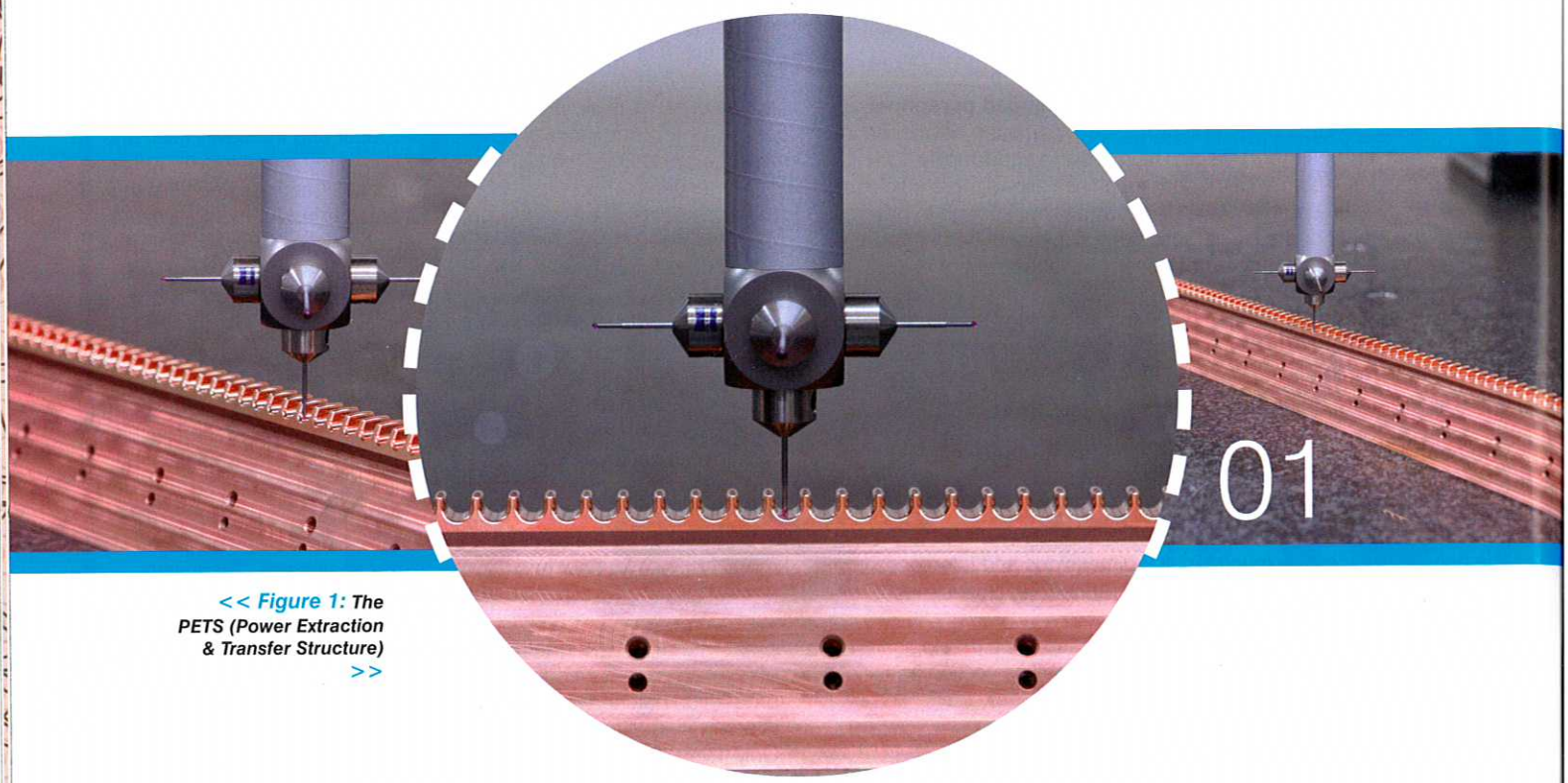

<< Figure 1: ***The PETS (Power Extraction & Transfer Structure)*** *>>*

KERN and CERN
– an Exciting Double Act

With its 10,000 users — staff, researchers, colleagues from other institutes etc., the European Organisation for Nuclear Research CERN, which is headquartered in the canton of Geneva, Switzerland, is the largest research centre for particle physics in the world. At CERN, wide-ranging fundamental physics research activities are carried out with the help of a series of accelerators, including the LHC (Large Hadron Collider).

One of CERN's very interesting research projects is the study of a new accelerator concept, the CLIC (Compact Linear Collider), an electron-positron machine 48.3 km long and with a centre-of-mass energy of up to 3 TeV.

The new concept comprises a linear two-beam accelerator in which the counter-rotating beams interact at a designated collision point in the centre of the machine.

And this is where KERN Micro- und Feinwerktechnik comes into the picture. One of the key components for this project is a part manufactured by KERN: the PETS (Power Extraction and Transfer Structure), an 800 mm long copper rod made of highly conductive, oxygen-free copper with a high-precision, toothed comb profile. Eight of these copper rods (PETS) running parallel to one another are installed in an octagonal arrangement. An electron beam is then passed through this arrangement at the speed of light and some of the beam energy is extracted in the form of high-frequency microwaves. This power is then used for the acceleration process as such in a second parallel accelerator, with the copper surfaces being exposed to huge electromagnetic fields in the process.

Although CERN's requirements were extremely exacting, this was not a major issue for KERN. As the production of the high-frequency field is directly dependent on the structure of the part, form and volume tolerances of only ± 20 µm were admissible for all reference faces. A particular challenge here was to control the temperature of the part during the entire production process. As copper has a very high heat expansion coefficient, a temperature change of just one degree Kelvin would extend the length of this component by 10 µm. This is why the ambient temperature of 20°C had to be strictly maintained during the entire production process. Despite ideal climate control in the production facility's measuring lab, the parts could only be measured between 3 and 4 am, because during the day there are too many people in the lab to allow accurate control of the ambient temperature and therefore guarantee the specified temperature.

<< << Figure 2: The KERN Pyramid Nano milling machine >>

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To achieve all of this KERN can bring on its star performer — the KERN Pyramid Nano. Faced with this kind of challenge, the machine's key innovations come to the fore, i.e. its completely hydrostatic guides and drives. These run on a constantly controlled 15 μm thick hydraulic oil cushion. The KERN Pyramid Nano is one of the very few milling machines in the world on which the workpiece is not moved by mechanical components. Positioning accuracy is only possible if the friction is equivalent to zero — as is the case with the KERN Pyramid Nano.

The final machining of these CERN components lasts around 16 hours. During this time there are constant vibrations from the surrounding area due to the rail traffic running along directly beside the production hall. However, this does not affect the precision of the KERN Pyramid Nano and not even the slightest vibration can be detected in the machine.

After a two-year period of intensive development work, KERN was able to supply the first 'test part' to CERN. It was received enthusiastically by CERN and KERN was then awarded a follow-on order. "We are very appreciative of how KERN handled this challenging job systematically and professionally and are more than happy with the result," said Said Atieh, engineer at CERN responsible for the fabrication of the high-precision parts for the CLIC project.

<< Precision and quality are the very essence of the KERN brand. >>

"Our collaboration with KERN showed us that a midsized enterprise with a dedicated and enthusiastic workforce really can make a significant contribution to high-level scientific research and thus help us to make our vision reality," said Dr. Steffen Döbert, project manager for the PETS programme.

Precision and quality are the very essence of the KERN brand. Having succeeded in producing the precision and surface quality demanded by CERN, and having done so at a reasonable unit cost, KERN has now been welcomed on board by CERN. KERN is very proud to be producing components for the best known and most successful nuclear research facility in the world.

A fine example of how closely industry and research interact and provide mutual support. Because it is not just that CERN is benefitting from the knowhow of KERN engineers, for "KERN too has learned a huge amount from CERN," explained Oliver Fischer, plant manager for contract manufacturing at KERN.

KERN and CERN, two names that are perfectly matched, not just on account of their spelling similarities.