# CERN's Antimatter Factory unveils revolutionary photon detector



At CERN’s Antimatter Factory, a groundbreaking development in antimatter detection has emerged, spearheaded by the AEgIS collaboration. Under the leadership of Professor Christoph Hugenschmidt from the Technical University of Munich (TUM), the researchers have introduced OPHANIM, a revolutionary optical photon and antimatter imager. This device uniquely combines everyday mobile phone technology with advanced scientific imaging capabilities.

The OPHANIM detector is constructed from an array of sixty repurposed 64-megapixel sensors typically found in smartphones, collectively forming a 3.84-gigapixel system. Its primary function is to observe the annihilation of antiprotons—one of the rarest phenomena in nature—where these particles collide with matter and dissipate energy in an explosive manner. By employing these modified camera sensors, the AEgIS team is effectively harnessing consumer technology for high-level scientific experimentation.

Francesco Guatieri, Principal Investigator at TUM, highlighted the necessity of high spatial resolution for the AEgIS project, stating, “For AEgIS to work, we need a detector with incredibly high spatial resolution, and mobile camera sensors have pixels smaller than 1 micrometre.” The innovative approach required significant micro-engineering to strip away the initial layers of the sensors that typically facilitate smartphone functionalities. Guatieri elaborated, “We had to strip away the first layers of the sensors, which are made to deal with the advanced integrated electronics of mobile phones,” thus enabling the sensors to capture the light patterns associated with annihilation events directly.

The outcome of these modifications not only retains the original performance of the sensors but enhances it significantly. For instance, the OPHANIM detector presents a 35-fold improvement in real-time resolution compared to traditional methods. Guatieri pointed out the advantages of their new solution, commenting on the historical reliance on photographic plates, which lacked real-time capabilities. “Our solution… combines photographic-plate-level resolution, real-time diagnostics, self-calibration and a good particle collection surface, all in one device,” he added.

The capabilities of OPHANIM enable researchers to observe annihilation events with an extraordinary real-time resolution of approximately 0.6 micrometres. This level of precision allows scientists to differentiate between various particles generated during these annihilation processes.

Dr. Ruggero Caravita, AEgIS spokesperson, described the significance of this technological innovation, saying, "This is a game-changing technology for the observation of the tiny shifts due to gravity in an antihydrogen beam travelling horizontally, and it can also find broader applications in experiments where high position resolution is crucial or to develop high-resolution trackers." He further noted the implications of OPHANIM for future research, asserting, “This extraordinary resolution enables us also to distinguish between different annihilation fragments, paving the way for new research on low-energy antiparticle annihilation in materials.”

The utilisation of smartphone technology in scientific applications through the OPHANIM detector underscores an exciting intersection between consumer technology and cutting-edge research. This development not only holds promise for advancements in antimatter research but also provides a cost-effective model that could benefit a multitude of experiments requiring high-resolution tracking capabilities.

Source: [Noah Wire Services](https://www.noahwire.com)

## References

* <https://www.techradar.com/pro/scientists-plan-3-84-gigapixels-virtual-sensor-made-of-60-smartphone-cameras-to-detect-elusive-antiproton-annihilation-events> - This article supports the claim about the development of OPHANIM and its use of repurposed smartphone camera sensors for detecting antiproton annihilation at CERN. It highlights the innovative approach and the resulting high spatial resolution.
* <https://www.all-about-industries.com/high-precision-detector-cern-innovation-tu-munich-a-c74c35dacb9b3e253d61bd0017efd81c/> - This source corroborates the use of modified smartphone sensors for the OPHANIM detector, emphasizing the high spatial precision required for detecting antimatter reactions and the collaboration between TUM and CERN.
* <https://www.tum.de/en/news-and-events/all-news/press-releases/details/photo-sensor-from-smartphones-helps-with-antimatter-research-at-cern> - This press release from the Technical University of Munich supports the claims about using photo sensors from smartphones for antimatter research at CERN, focusing on the AEgIS experiment's goals and the OPHANIM detector's capabilities.
* <https://www.science.org/doi/10.1126/sciadv.ads1176> - This publication details the real-time antiproton annihilation vertexing with sub-micron resolution using the OPHANIM detector, supporting the technological advancements achieved by the TUM researchers in antimatter detection.
* <https://www.frm2.tum.de/en/frm2/home/> - This webpage provides background information on the FRM II research reactor at the Technical University of Munich, which was involved in the development and optimization of the OPHANIM detector for antimatter research.