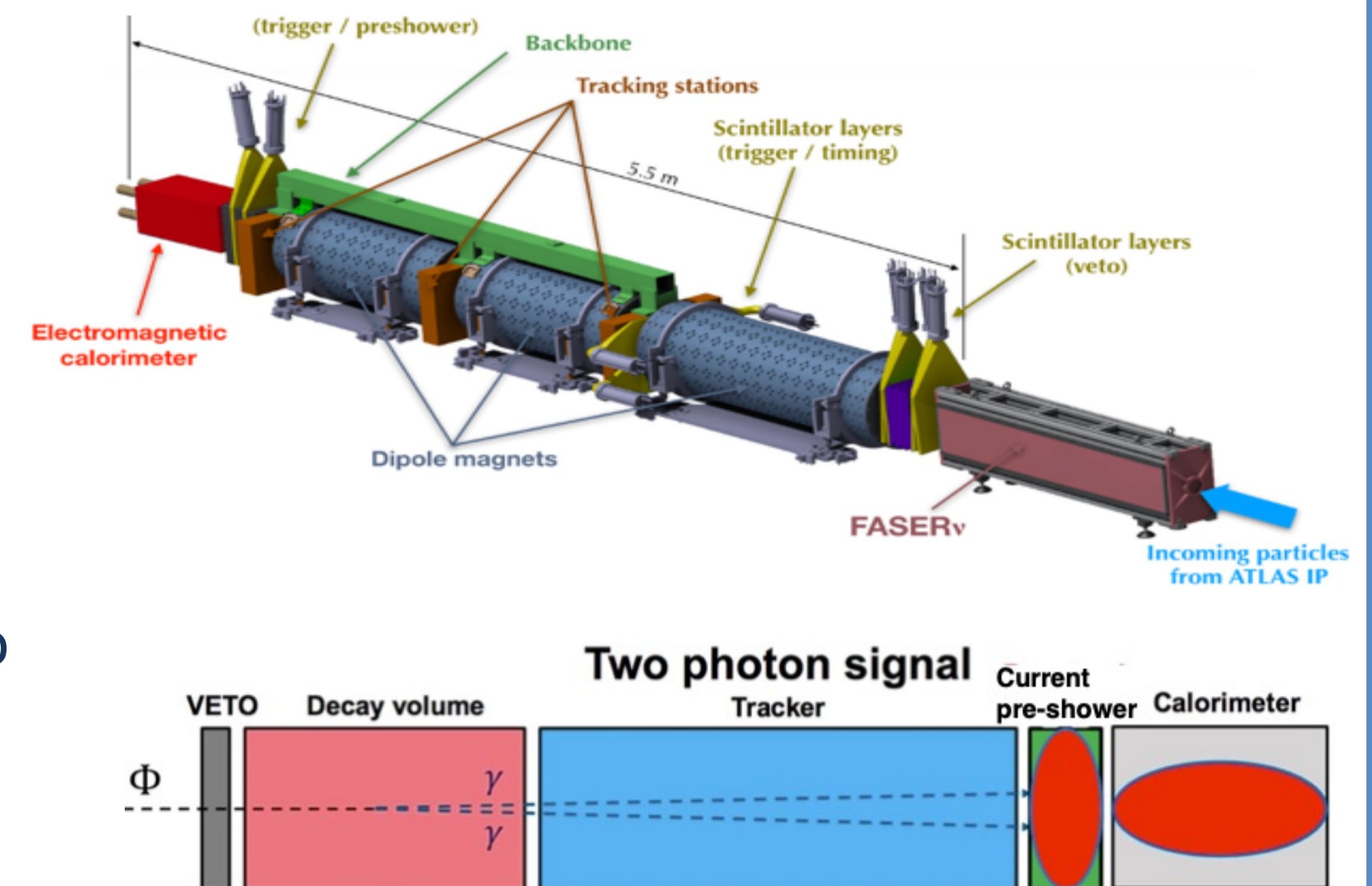


Faser Experiment

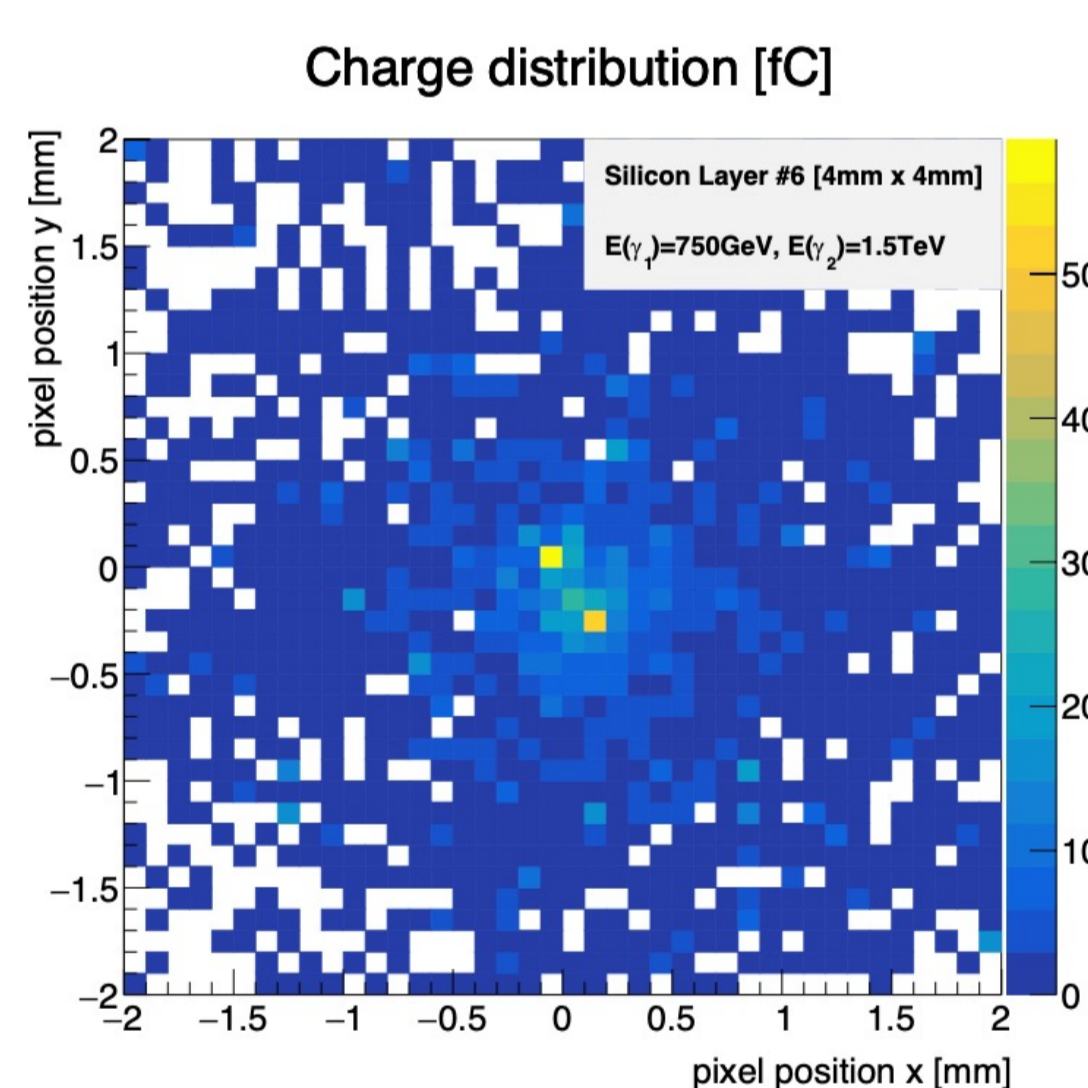
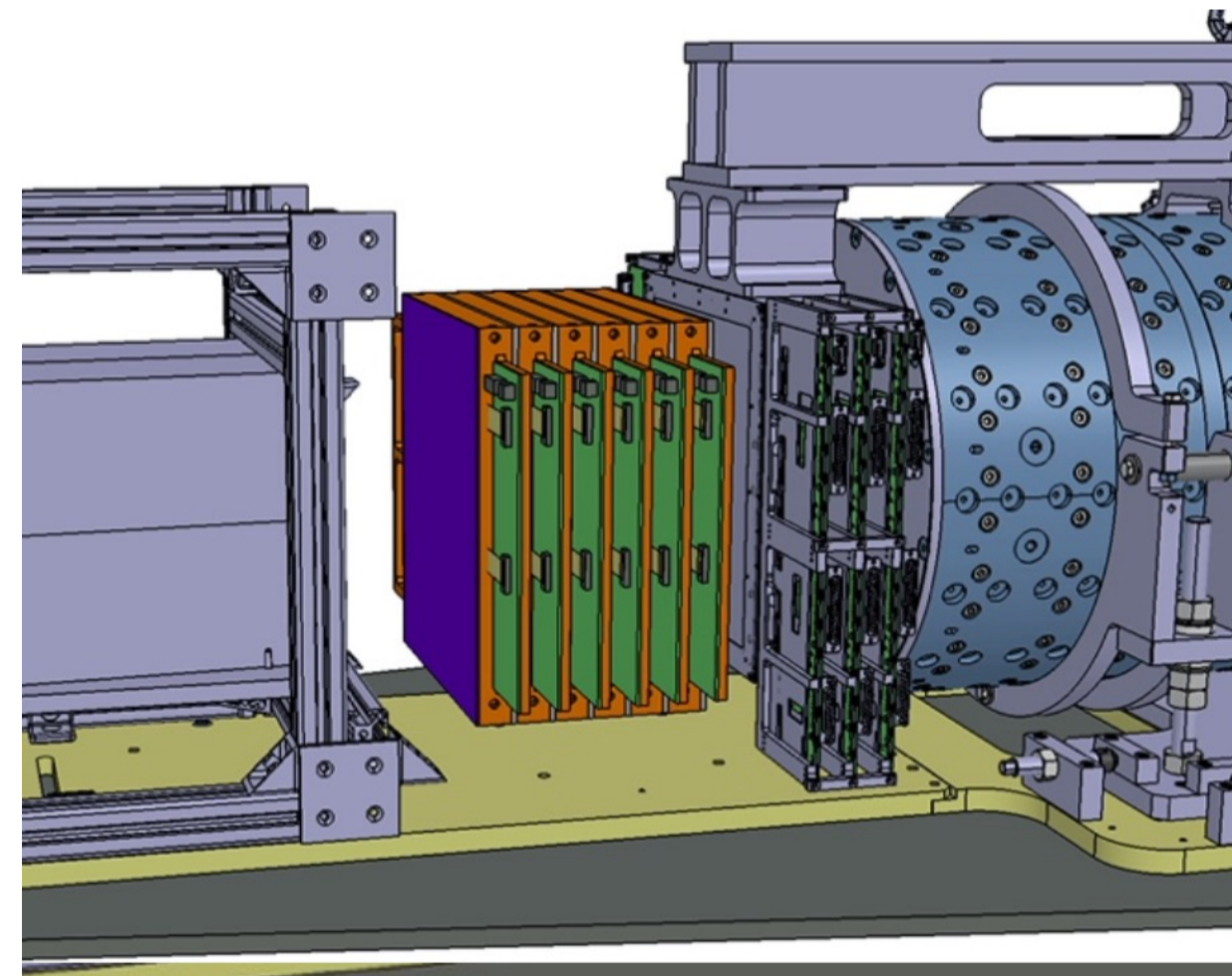
- The ForwArD Search ExpeRiment (FASER) at the LHC is precisely aligned with the collision axis in ATLAS, 480 m away from the collision point.
- Its design is optimized for the search of Long Lived Particles (LLPs) decaying into two charged leptons, like dark photons. Those particles are advocated to be the portal between the SM and a still undiscovered hidden sector.
- Goal of this research is to enable the measurement of LLPs decaying into two photons, such as axion-like particles (ALP) or CP-odd scalars, extending the discovery potential of the experiment.



The new Pre-shower

- Requirement: detect and discriminate two photon with $O(1)$ TeV energy and 200 μm separation.
- Composed by six $1X_0$ tungsten layers, each followed by a $20 \times 20 \text{ cm}^2$ plane of monolithic silicon pixel detectors in SiGe BiCMOS technology.
- It will measure ultra-collimated EM showers to identify their charge centroid.
- Install and commissioning of the pre-shower detector at the end of 2023 and data during the last year of the LHC Run 3 period.

CAD drawing of the W-Si high-resolution pre-shower, placed between the last silicon tracking station and the EM calorimeter.

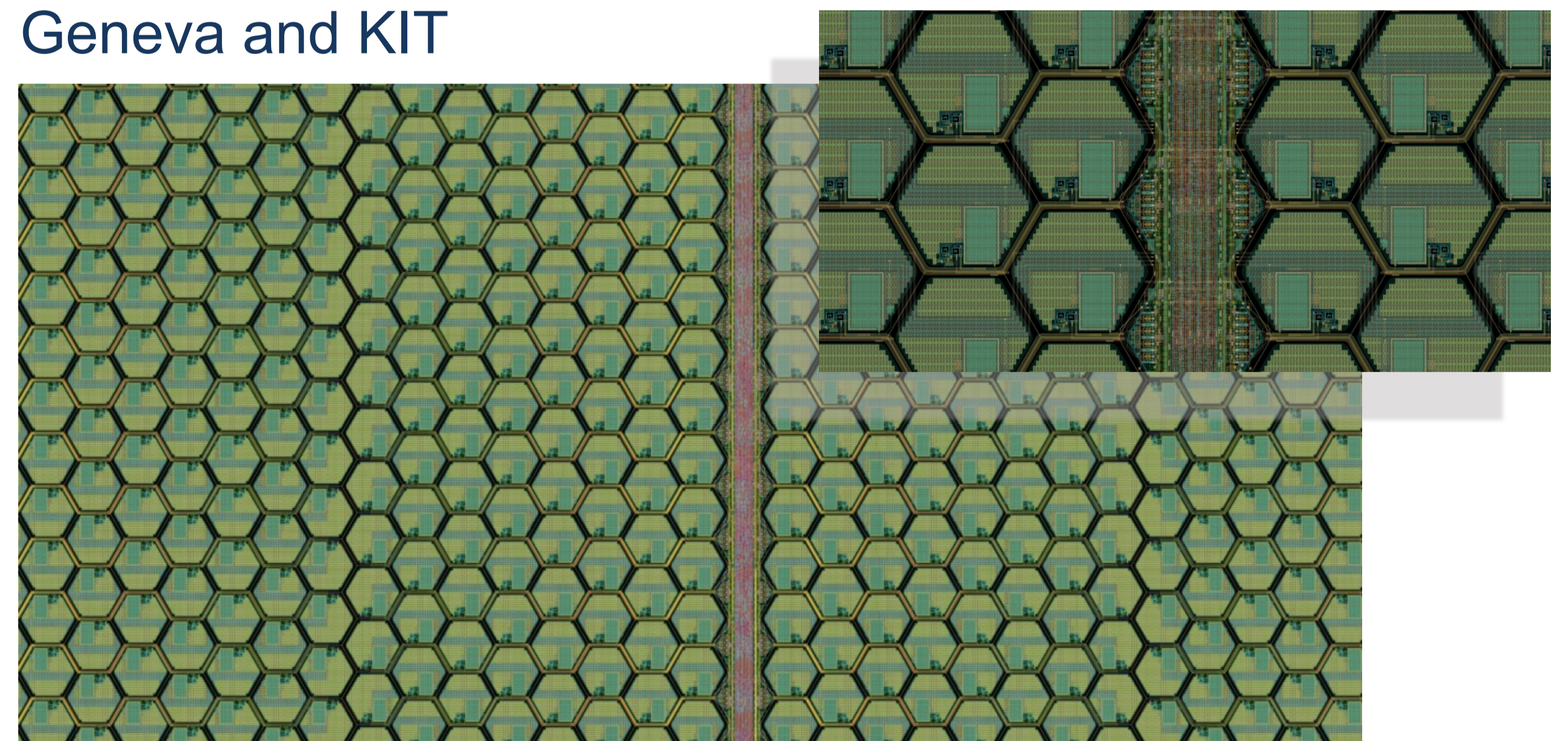


Charge deposition in fC in each of the $100 \times 100 \mu\text{m}^2$ area pixels of the 6th silicon layer for two photons of energy 750 and 1500 GeV.

The Monolithic pixels in SiGe BiCMOS

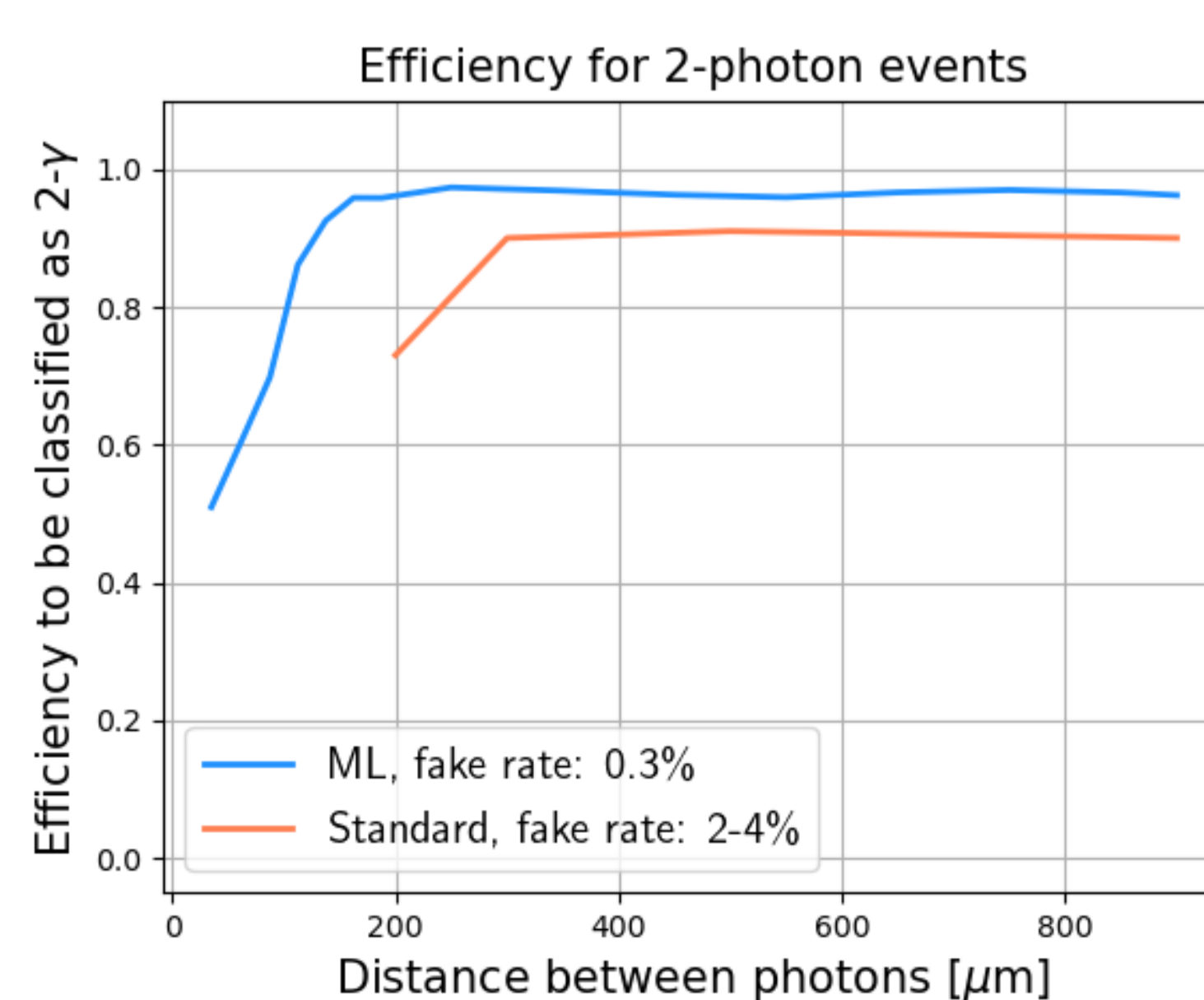
Description:

- Monolithic ASIC in **130nm SiGe BiCMOS** from IHP microelectronics.
- The ASICs will have hexagonal pixels of 65 μm side and an active area $23.5 \times 15.0 \text{ mm}^2$.
- Local analog memories are used to store the charge.
- Ultra fast readout with no digital memory on-chip to minimize the dead area.
- Cluster time resolution of 200 ps.
- Power consumption below 150 mW/cm^2 .
- Design in collaboration between CERN, University of Geneva and KIT



Simulation Results

- The reach plot shows that the new module will extend the physics program of FASER in a region not explored by other experiments.
- Simulations show that the resolution of the new pre-shower provides a discovery potential close to the one achievable with an ideal photon discrimination.



Discovery potential for ALPs of the FASER detector instrumented with the proposed pre-shower.

