

# Cooling Analyses of HV-MAPS detector for the Compton Polarimeter in Hall A of JLab

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The Measurement Of a Lepton-Lepton Electroweak Reaction (MOLLER) experiment aims to explore new dynamics beyond the Standard Model. The experiment is placed in Hall A at the Thomas Jefferson National Accelerator Facility (JLab) in Newport News, Virginia, USA. The measurements are acquired by the scattering of longitudinally polarized electrons off unpolarized electrons in a liquid hydrogen target. MOLLER will utilize High Voltage-Monolithic Active Pixel Sensors (HV-MAPS) in the Hall A's Compton polarimeter to monitor the polarization of the incoming beam from the Continuous Electron Beam Acceleration Facility (CEBAF). The HV-MAPS based electron detector contains a quad-planar geometry and each plane incorporates three HV-MAPS chips attached. Compton polarimeter utilizes this detector assembly placed inside the vacuum to detect the Compton scattered electrons. The chips generate heat during operation, and thus require an effective cooling system in vacuum. The temperature measurement of the HV-MAPS is useful to understand the thermal properties of the pixel detector and cooling needs. This present study reviews the efforts towards the cooling strategies, structure modification, and thermal simulations to achieve an in-vacuum operation. Further, the prototyping and successful testing of the electron detector's cooling system (using a test version of HV-MAPS chips with equivalent heat load) in a local laboratory was performed, and computational fluid dynamics studies are compared with the collected data.

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