MDL has continued pushing detector technology further by developing arrays with approximately 10X the quantity of pixels in either Herschel or Planck. While the SPIRE and Planck detectors were partially assembled by hand, the new detector arrays and antenna structures are entirely made by microlithographic processes. Each pixel in the detector array is capable of measuring both linear polarizations simultaneously using a phased array of slot antennas. The power coupled by the slot antenna is guided by low-loss superconducting striplines to so-called voltage-biased superconducting transition-edge sensor bolometers, or TES bolometers for short. The TES arrays are read out with a multiplexed SQUID array made by NIST.

In 2010, the first of these arrays was fielded on the BICEP2 telescope, led at Caltech by Jamie Bock and led at Harvard by Professor John Kovac. Anthony Turner and Tony Bonetti of MDL spent several months developing engineering-grade arrays and testing with the warm electronics and cryogenic telescope. After development, science-grade arrays were tested and packed for shipping. The field campaign started in late November 2009. Members of the team hand-carried the detectors to the South Pole via New Zealand and re-integrated them in the telescope. First light was measured in February 2010.