# The Supercam 8-pixel integrated focal plane unit

C. Groppi[1], D. Golish[2], C. Walker[2], B. Love[2], C. Kulesa[2], S. Weinreb[3], J. Kooi[3], A. Lichtenberger[4]
*(1) Arizona State University, PO Box 871404, Tempe, AZ, 85287, USA*
*(2) University of Arizona, 933 N. Cherry Ave. Tucson, AZ, 85721, USA*
*(3) California Institute of Technology, 1200 Colorado Blvd., Pasadena, CA 91125, USA*
*(4) University of Virginia, 351 McCormick Road, Charlottesville, VA 22904, USA*
* Contact: cgroppi@asu.edu, phone 1-480-965-6436

*Abstract*— **The SuperCam 64 beam focal plane is constructed from eight linear array modules with eight pixels each. Each pixel consists of a sensitive, single ended SIS mixer optimized for operation from 320-380 GHz, with measured noise temperatures of ~75K. The array mixers utilize SIS devices fabricated on Silicon-On-Insulator (SOI) substrates, with beam lead supports and electrical contacts. The 1x8 mixer subarrays are constructed from tellurium copper using the splitblock technique. Stainless steel guide pins and screws are used to ensure proper alignment and good contact between parts. A diagonal feedhorn extension block is bolted to the front of the mixer array assembly, extending the diagonal horns to 11mm aperture size. This eliminates the need for dielectric lenses and their associated manufacturing and alignment difficulties. The waveguide environment is designed around full height rectangular waveguide, with a fixed quarter wave backshort. IF outputs from the SIS devices are bonded directly to the input matching networks of low-noise, InP MMIC amplifier modules located in the array mixers. The IF center frequency of the array is 5 GHz. The MMIC chip is contained in an 11mm x 11mm amplifier module that contains integrated bias tees for the SIS device and the amplifier chip. The module achieves noise temperature of ~5 K and delivers 32 dB of gain while consuming only 8 mW of power. Several tests have been performed with these modules to ensure oscillation free operation, low noise, high stability, and no heating effects on the SIS device. Modules have been integrated into both single pixel and 1x8 array mixers, and have shown performance as good or better than expected with connectorized amplifiers. No heating effects are visible, although care must be taken to avoid oscillation due to feedback. Short lengths of semi-rigid cable inside each mixer block ensure that the output from the LNA cannot radiate into the mixer block cavity, preventing oscillations. We present the design, fabrication and measured performance of the Supercam 1x8 FPU modules, along with the design and performance of the integrated LNA modules and SIS devices.**