Concept Design of a Dual-Polarization Sideband-Separating Multi-Pixel SIS Receiver

Wenlei Shan[1*,2], GonzalezAlvaro[1], Matthias Kroug[1], Takafumi Kojima[1], Yasunori Fujii[1], Shinichiro Asayama[1], Takashi Noguchi[1]

[1]*National Astronomical Observatory of Japan*, Mitaka, Tokyo, 181-8588, Japan,*
[2]*Purple Mountain Observatory, Nanjing,JiangSu, 210008, China*
* Contact: wenlei.shan@nao.ac.jp

ALMA is a unique facility not only because it combines high sensitivity and high angular resolution, but also because it is sensitive to the cold gas in the universe that radiates mainly in mm/sub-mm frequencies, which has not been fully explored. The weak point of ALMA is its narrow field of view (FOV) with a typical value of one arc minute. The proposed multi-pixel SIS receiver is aimed to extend the FOV of ALMA by an order of magnitude. The frontend of the receiver is an integrated type. This assembly concept will largely reduce the use of electrical and mechanical interconnections, and thus brings about robustness and reliability of the multi-pixel frontend. In this design, two linear polarizations are received in a sideband-separating (2SB) manner. Both the orthomode transducers and the quadrature hybrids are implemented with planar circuits in order to reduce the difficulty in the machining of metallic waveguides. Low power-consumption MMIC cryogenic amplifiers are considered to be integrated into the frontend module. Radio-over-fiber technique is designed to transmit tens of IF channels out of the receiver cryostat with little thermal leakage. Challenges also come from the multi-pixel optical design and the increase in computing cost. They will be also discussed.