





Design and preliminary characterizations of traveling wave parametric amplifiers for DARTWARS (19)



QUTE

-62.0



M. Borghesi on behalf of DARTWARS collaboration



DARTWARS (Detector Array Readout with Traveling Wave AmplifieRS) is a three years project that aims to develop high-performing innovative traveling wave parametric amplifiers (TWPAs) for low temperature detectors and qubit readout. The practical development follows two different promising approaches, one based on the Josephson junctions (TWJPA) and the other one based on the kinetic inductance of a high-resistivity superconductor (KITWPA). The technical goal is to achieve a gain value around 20 dB, comparable to the currently used semiconductors low temperature amplifiers (HEMT), with a high saturation power (around -50 dBm), and a quantum limited or nearly quantum limited noise. These features will lead to the readout of large arrays of detectors or qubits with no noise degradation.

Travelling wave amplification, in a nutshell



TWJPA fabrication progress



KITWPA fabrication progress

Process for production of NbTiN films set up @ FBK

high kinetic inductance L_K $L_K = \frac{\hbar}{1.76\pi k_B T_c} R_n$

wide range of L_K can be achieved!

• NbTiN patterned into KIDs to characterize the L_K and its non-linearity (I_*)



cosputtering Nb/Ti + N_2 (+ Ar) flow



Meander artificial line target amplification ~ 8 dB @ 3-6 GHz

• First prototype KITWPA over summer!

Kinetic Inductance Detector (KID)