

## Defining THz detector with nanometric accuracy.

**Background:** The most sensitive detector for heterodyne receivers below 1THz is the Superconductor-Insulator-Superconductor (SIS) junctions. The mixing properties of such detector are largely determined by the dimensions of the junctions, which therefore require a nanometric control of its lateral dimensions as well as an accuracy of the thickness of the insulating tunnel barrier at the ångström level.

Since the production of such diodes involves, several photolithographic lithographic steps and subsequent dry etching using plasmas, the actual size of fabricated junction differs from the nominal (designed) size used mixer simulations and hence results in so called “de-tuned” mixers, i.e. mixers not sensitive to the right incoming THz signal.

**Thesis project:** With this thesis, we propose for one or two students to investigate the influence of the different processing steps on the difference between the actual (produced) and designed size of SIS junctions. This shall be practically done by studying and even modifying the current technological process steps for producing different junctions and develop simple measurement methods to accurately determine the size of the junctions

The master thesis is divided in to five different stages:

- Literature survey
- Selection of the best methods for the accurate measurements of the junction size
- Component design and microfabrication
- Measurements of the actual size of junctions
- Study of the influence of the different process steps on the junction size.

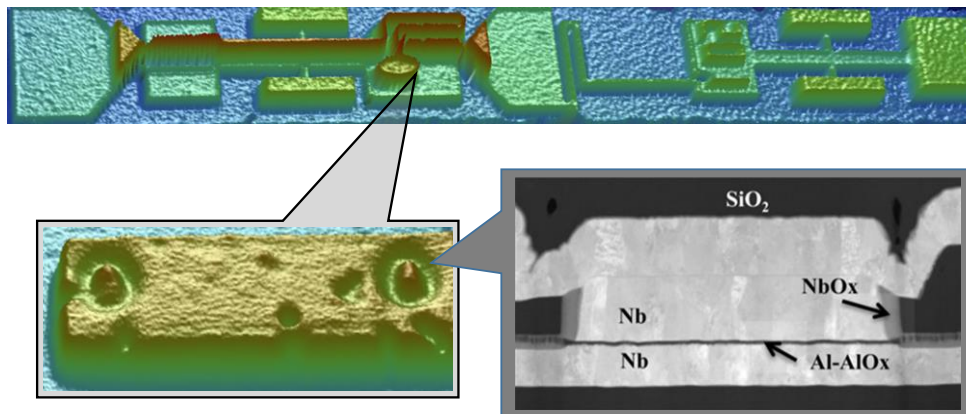


Figure 1 SIS junctions in superconducting tunnelling device

### Prerequisites

Course in electromagnetics

Interest and/or courses in microfabrication techniques.

Course in Superconductivity, low temperature physics, or THz electronics are not required, but good to have

### Supervisors

Alexey Pavolotsky, [alexey.pavolotsky@chalmers.se](mailto:alexey.pavolotsky@chalmers.se), 031-7721833

Victor Belitsky, [victor.belitsky@chalmers.se](mailto:victor.belitsky@chalmers.se), 031-7721893

Vincent Desmaris, [Vincent.desmaris@chalmers.se](mailto:Vincent.desmaris@chalmers.se), 031-7721846