



SAFARI

# The SAFARI FDM Crosstalk-04

## The impact of cryogenic looms

### *Summary:*

The impact of looms is modelled by mutual inductances and leakage capacitances.

1. In LC Filters it changes the frequency spacing
2. It worsen the cross talk by increasing the leakage current in order of 5 dB

SRON

Amin Aminaei, January 2020

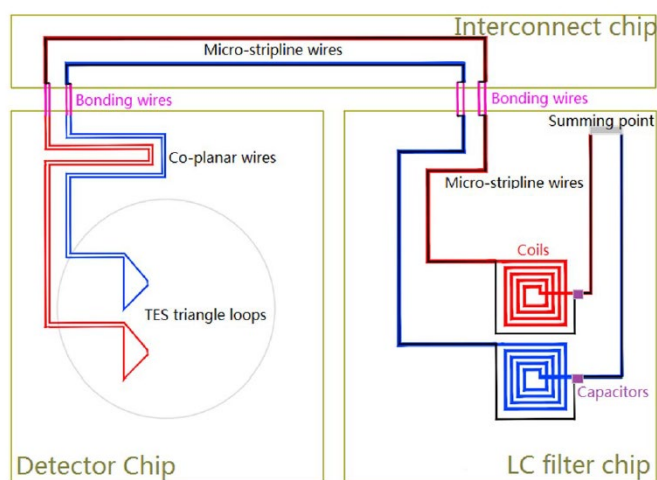


Fig. 4. Schematic layout of two neighbouring channels from SRON's 160 pixel FDM setup as shown in Fig. 1. Note it is out of scale for the illustration.

TABLE I

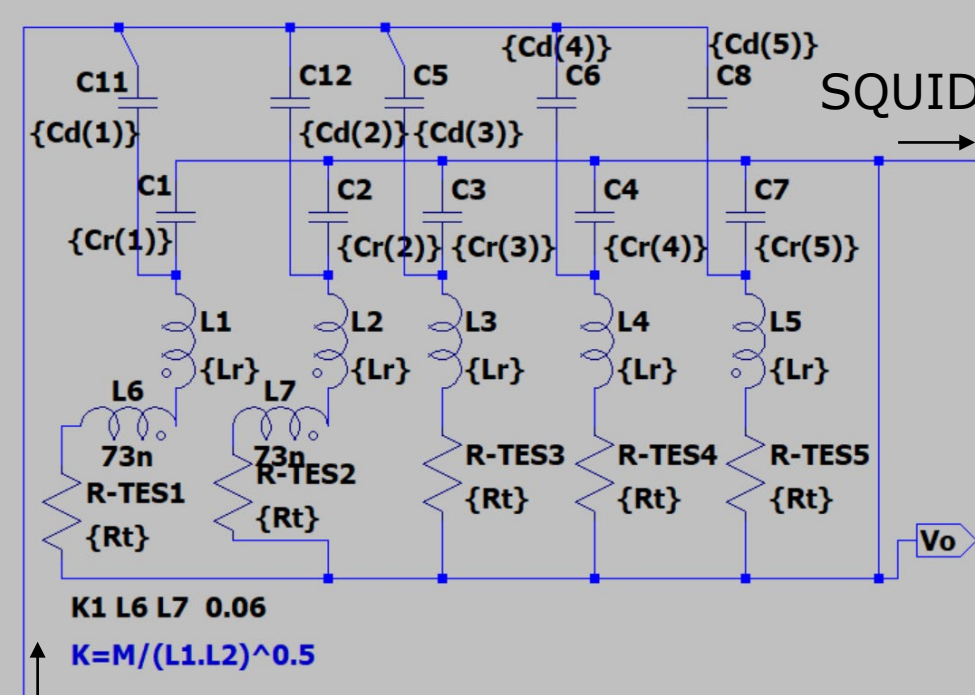
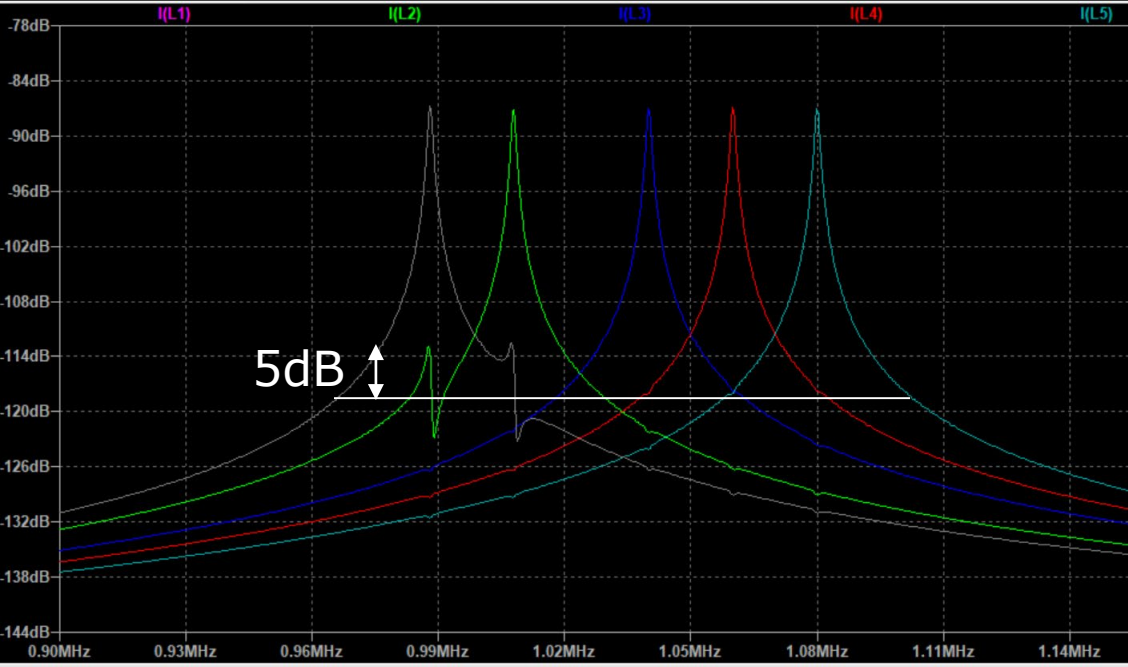
LIST OF SELF-INDUCTANCE OF THE WIRES FROM EACH SECTION, THEIR CONTRIBUTION IN %, AND THE TOTAL SELF-INDUCTANCE. THE DEFINITION OF EACH SECTION IS GIVEN BY FIG. 4

Sections	Self-inductance (nH)	Percentage
TES triangle loop	2.06	0.1%
Co-planar wires	29.94	1.5%
Bonding wires	4.48	0.2%
Coil inductors	1960.00	97.6%
Micro-striplines	12.03	0.6%
Total	2008.51	100 %

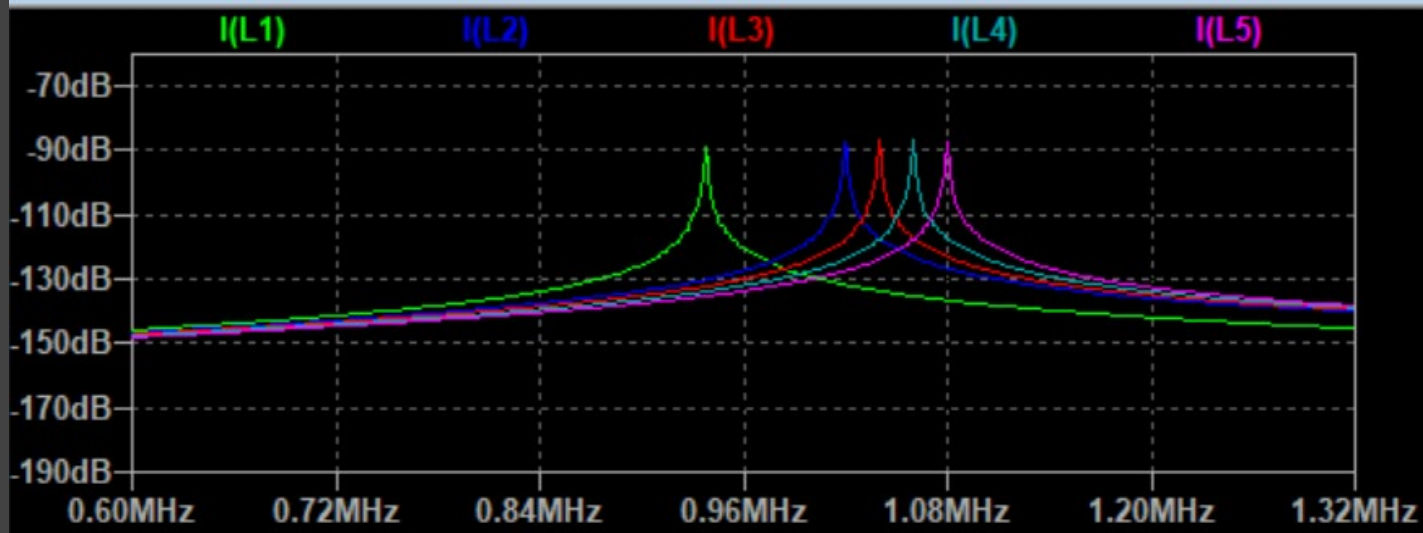
TABLE II

LIST OF MUTUAL INDUCTANCE OF THE WIRES FROM EACH SECTION, THEIR CONTRIBUTION IN %, AND THE TOTAL MUTUAL INDUCTANCE. THE DEFINITION OF EACH SECTION IS GIVEN BY FIG. 4

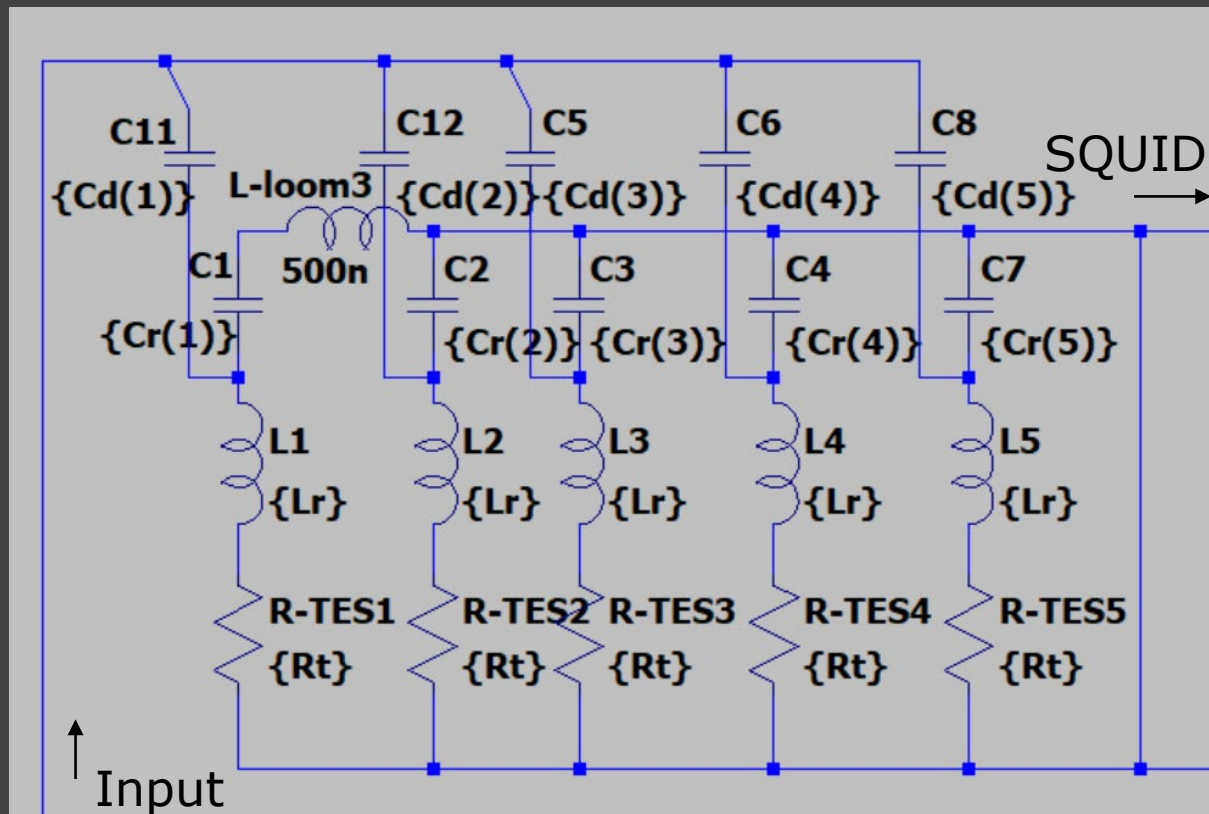
Sections	Mutual inductance (nH)	Percentage
TES triangle loop	0.01	0.4%
Co-planar wires	1.70	59.4%
Bonding wires	0.22	7.7%
Coil inductors	0.89	31.1%
Micro-striplines	0.04	1.4%
Total	2.86	100 %



# Connection between LC Filters

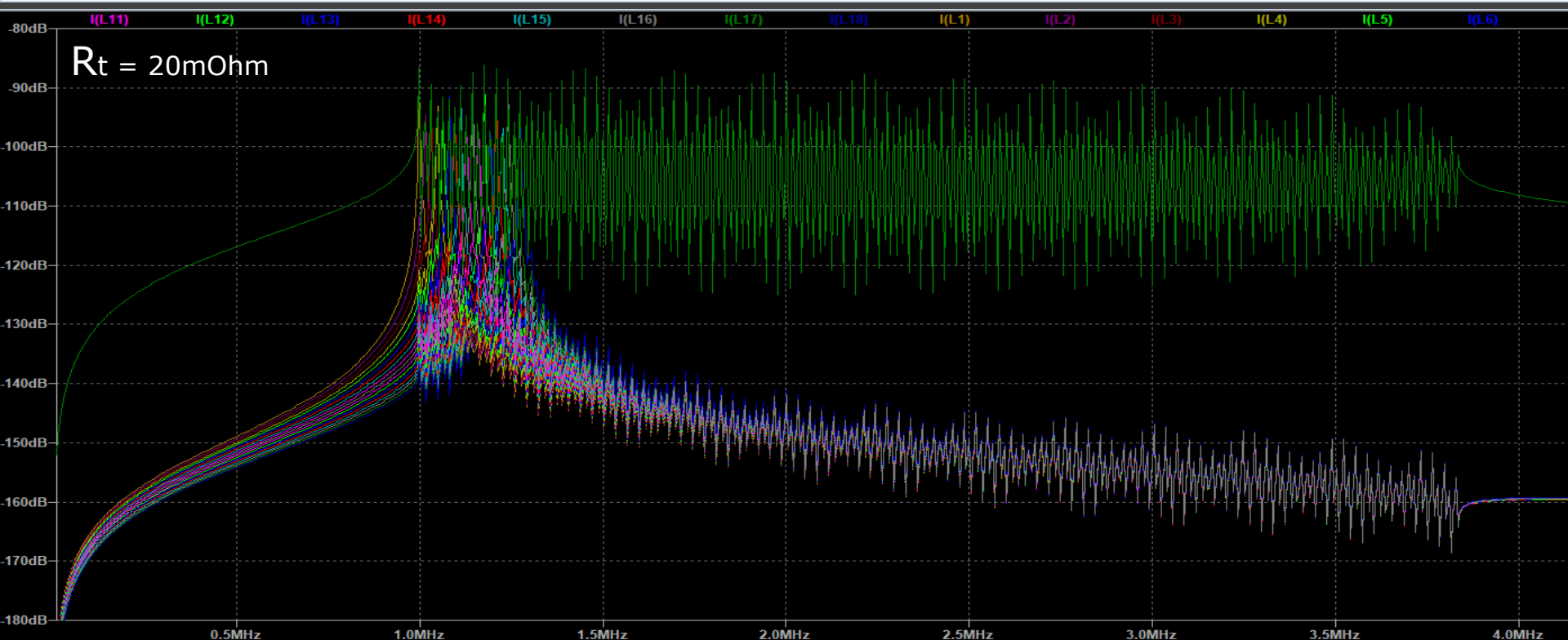
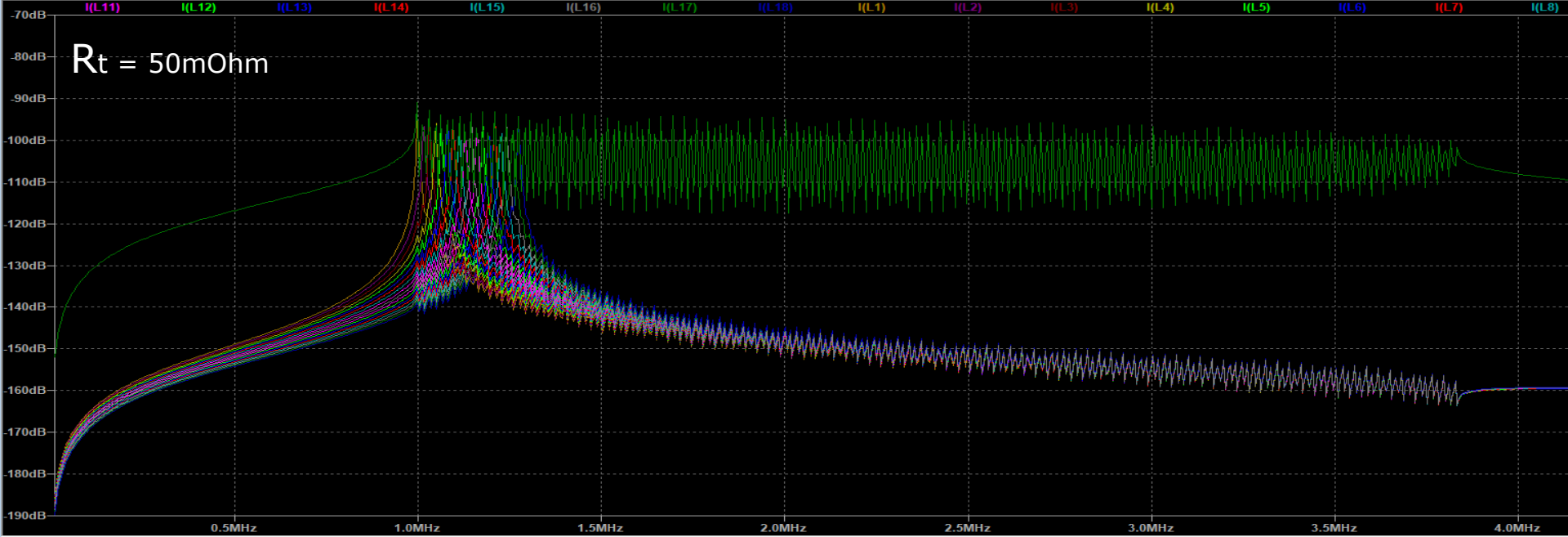


Any parasitic inductance  
between LC filters causes  
a change in  
frequency spacing



# Sawtooth Feature, $R_t$

- $R_t$  nominal value 40mOhm
- To see the extreme cases,  $R_t$  is set to 20mOhm-50mOhm
- By increasing  $R_t$ , the sawtooth feature in  $I_L$  ( and  $R_t$  ) decreases
- Codes: Resonators-176pix-CrossTalk-test-M (Simulation)



# References:

- Truong, T. K., Twisted-pair transmission line distributed parameters
- X. Yan et al., Modeling Inductances of Wiring for a TES Array Read by FDM, IEEE Transactions on Applied Superconductivity, Vol. 25, No. 3, 2015.