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# Further developments of the KO-Exciter setup at HIT

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Kick-off Meeting for I.FAST-REX REsonant eXtraction improvement  
8./9. February 2021



# Improvements on the RF KO-Exciter setup at HIT

## GOAL:

Reduce the micro spill structure  $r(\Delta t) = c_{max}/c_{mean}$ ,  $\Delta t = 1 \text{ ms}$  [1] to improve the beam quality for our application.

## APPROACH:

- New methods for the spectrum generation (R $\pi$ -PSK, Dual FM, AWGN, etc.)
- Extended frequency spectrum (Single Mode, Multi mode)

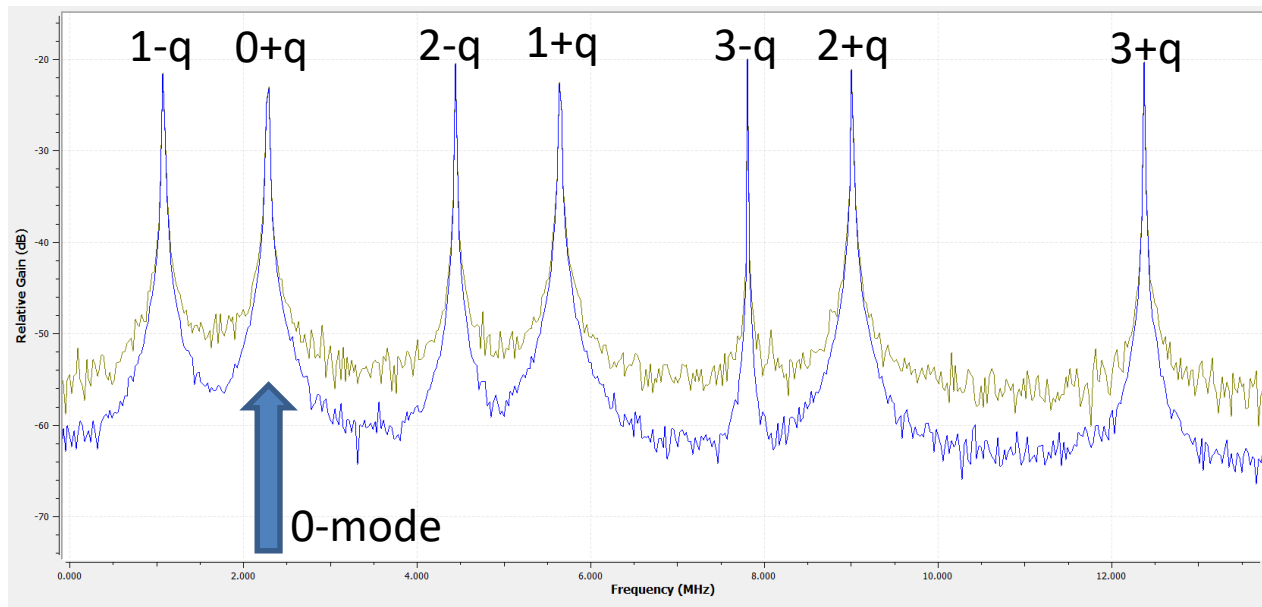
Christopher Cortés, a master student from the Technical University of Darmstadt, just started working on this topics at HIT.

So we are sure, we will see some interesting results at the end of this year.

# Frequency spectrum of side band excitation

C12 E255:  $f_{rev} = 3.36599$  MHz,  $q_{frac} = 0.6785$

$$f_{\beta} = f_{rev} \cdot (n \pm q_{frac}), n = 0, 1, 2, 3$$



$\sim(n \pm q)$	f [MHz]
1 - 2/3	1.0822
0 + 2/3	2.2838
2 - 2/3	2.8695
1 + 2/3	5.6498
3 - 2/3	7.8141
2 + 2/3	9.0158
3 + 2/3	12.3818

# Experimental Setup

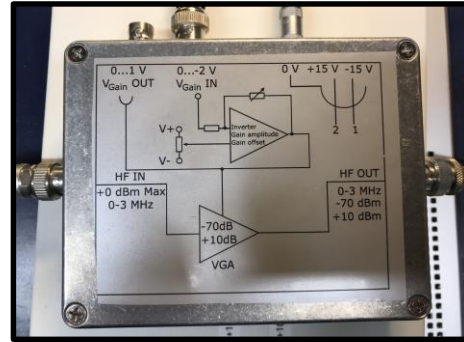
signal generation



Universal Software Radio  
N210

f: 0 - 30 MHz  
P: < +7 dBm

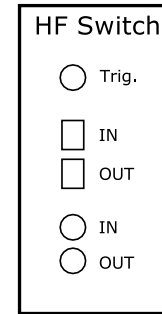
amplitude modulation



Log. variable gain amplifier  
LMH6502

f: 0 - 130 MHz  
A: -60 dB to +10 dB

RF switch



RF switch  
SW-239

f: 0 – 2 GHz  
Att: 60 dB  
Trise: 2 ns

PA +  
KO Exciter

# GNU Radio and USRP

**Options**  
 Title: KO\_EXCITS\_algenerator  
 Authors: E. Feldmeier  
 Output Language: Python  
 Generate Options: QT GUI  
 Realtime Scheduling: On

**Variable**  
 Id: samp\_rate  
 Value: 10M

**Import**  
 Import: math

**QT GUI Range**  
 Id: f0  
 Label: f0  
 Default Value: 2.28046M  
 Start: 0  
 Stop: 2.5M  
 Step: 1

**QT GUI Range**  
 Id: bw  
 Label: bw  
 Default Value: 20k  
 Start: 2k  
 Stop: 1M  
 Step: 1

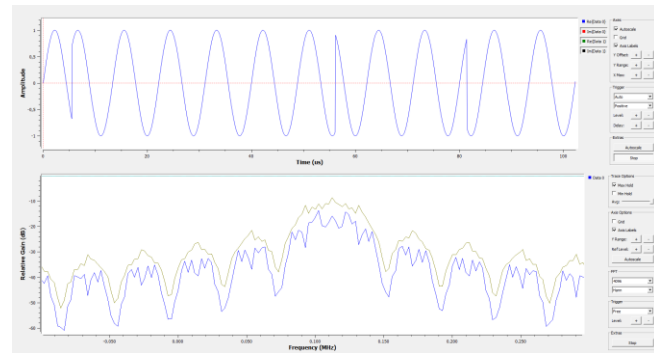
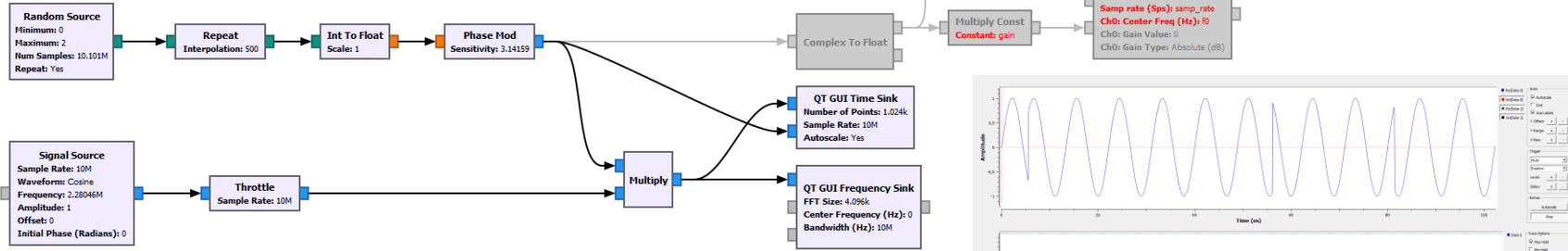
**QT GUI Range**  
 Id: gain  
 Label: gain  
 Default Value: 300m  
 Start: 0  
 Stop: 1  
 Step: 10m

Die Verwendung dieser Anwendung ist unter folgender Lizenz mit Namensnennung möglich:

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# „Wishlist“ for modified „new“ KO Extraction

Amplifier actual	Amplifier new
0.1 - 5 MHz	0.1 - 15 MHz
P = 400 W, U = 200 Vp	P = 1 kW?, U = 632 Vp?
LLRF actual	LLRF new
Spektrum: R $\pi$ -PSK, Single Mode 0.1 – 5 MHz, +10 dBm	To be defined: R $\pi$ -PSK, Dual FM, AWGN, other Single mode, Multi mode 0.1 - 15 MHz, +10 dBm
KO Exciter, Trafo, Attenuator actual	KO Exciter, Trafo, Attenuator new
0.1 - 5 MHz, P = 500 W @ 50 Ohm	0.1 - 15 MHz, P = 1 kW? @ 50 Ohm