HEIDELBERG UNIVERSITY HOSPITAL

HIT Heidelberg Ion-Beam Therapy Centre

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

UK HD

Improvements on the RF KO-Exciter setup at HIT

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

APPROACH:
- New methods for the spectum generation (Rπ-PSK, Dual FM, AWGN, etc.)
- Extended frequency spectrum (Single Mode, Multi mode)

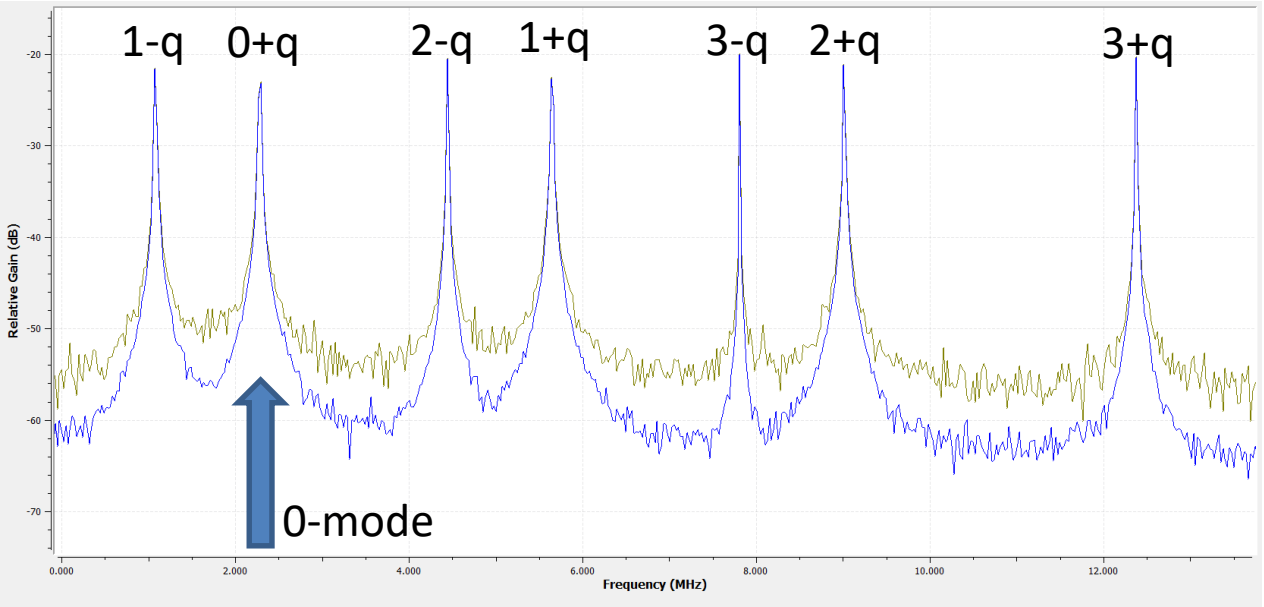
Christopher Cortés, a master student from the Technical University of Darmstadt, just started working on this topics at HIT.
So we are sure, we will see some interesting results at the end of this year.

[1] P. Forck, Slow Extraction Workshop 2016, Darmstadt

Frequency spectrum of side band excitation

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

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



~(n +/- 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

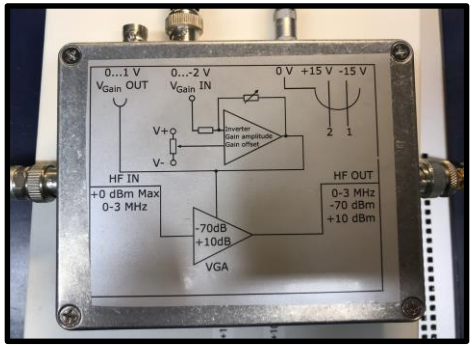
signal generation

Universal Software Radio N210

f: 0 - 30 MHz

P: < +7 dBm

amplitude modulation

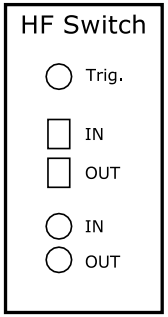


Log. variable gain amplifier LMH6502

f: 0 - 130 MHz

A: -60 dB to +10 dB

RF switch



RF switch SW-239

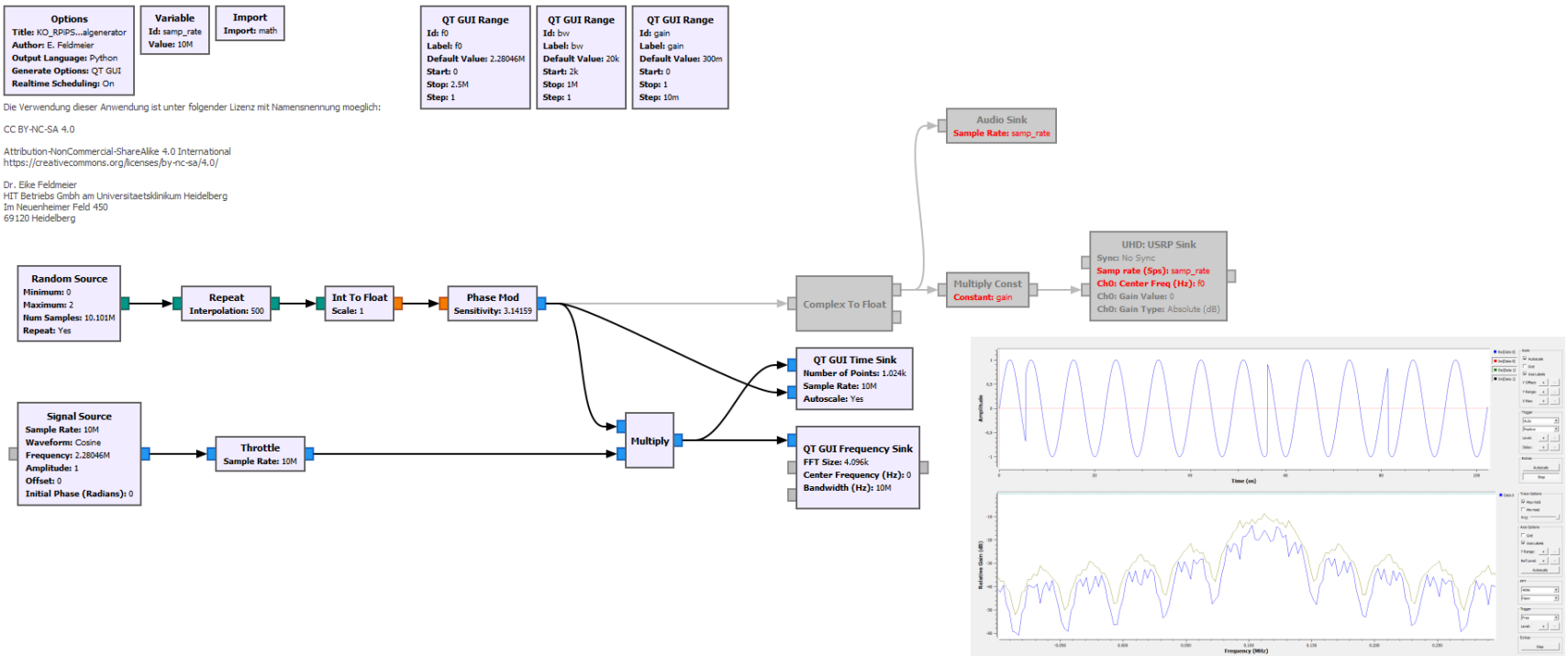
f: 0 – 2 GHz

Att: 60 dB

Trise: 2 ns

PA +
KO Exciter

GNU Radio and USRP



„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: Rπ-PSK, Single Mode 0.1 – 5 MHz, +10 dBm	To be defined: Rπ-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