# RTM LO-Generation (uLOG).

## Feasibility Study and First Measurement Results

U. Mavric (i-Tech)
M. Zukocinski, M. Hoffmann, F. Ludwig (DESY)
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HELMHOLTZ GEMEINSCHAFT

DESY

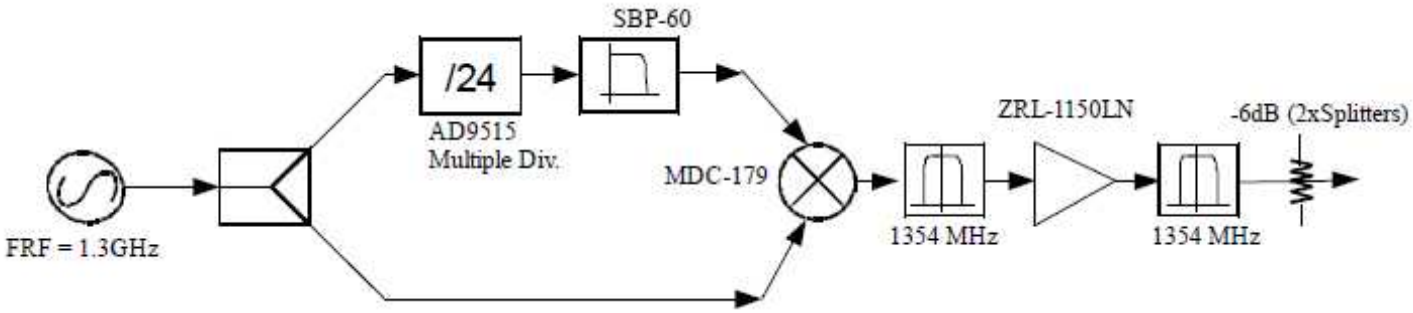
# Outline.

- Low residual phase noise LO generation (Intro)
- 1313 MHz vs. 1354 MHz (Measurements)
- Technological issues with 1313 MHz
- Proposed schematic for 1313 MHz

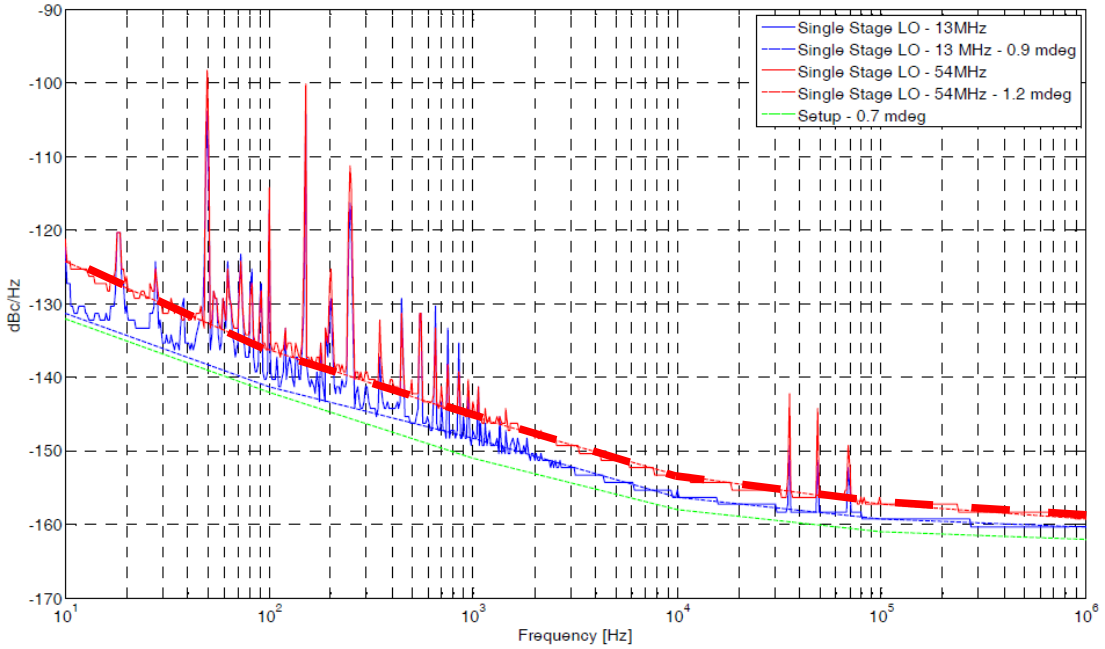
# Low Residual Phase Noise LO Generation (Intro).

- The residual phase noise of the LO generation can not be minimized by means of standard LLRF feedbacks.
- The processing gain of the vector sum of N probe signals leads to a 10*log10(N) increase in SNR of the measurement (assuming that noises of signals are uncorrelated).
- This imposes more strict demands on the allowed additive phase noise of the receivers (i.e. LO generation).

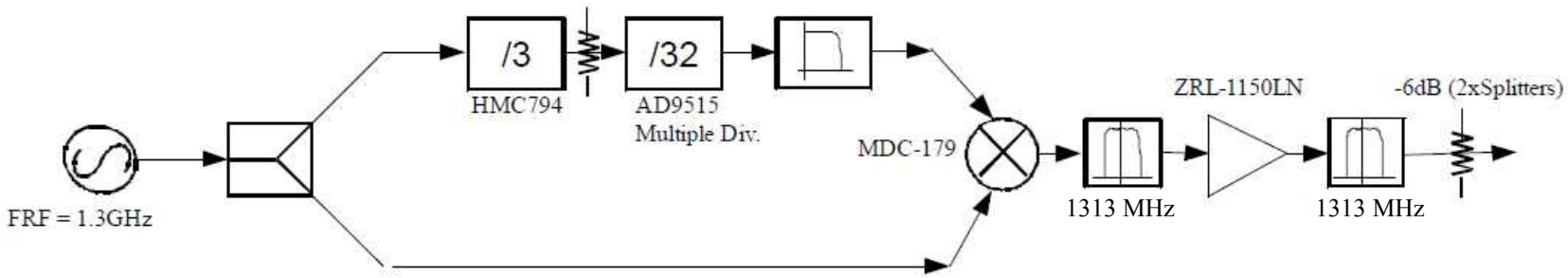
# Single Stage, 1354MHz (Measurements).

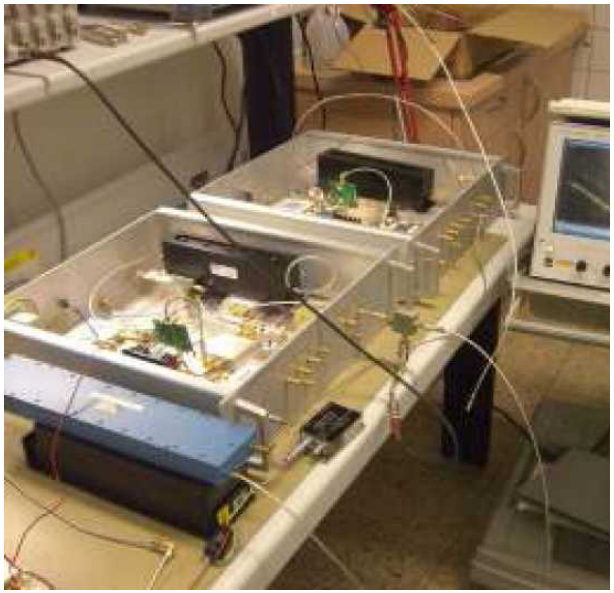



1.2 mdeg (2.5fs) [10 Hz – 1 MHz]

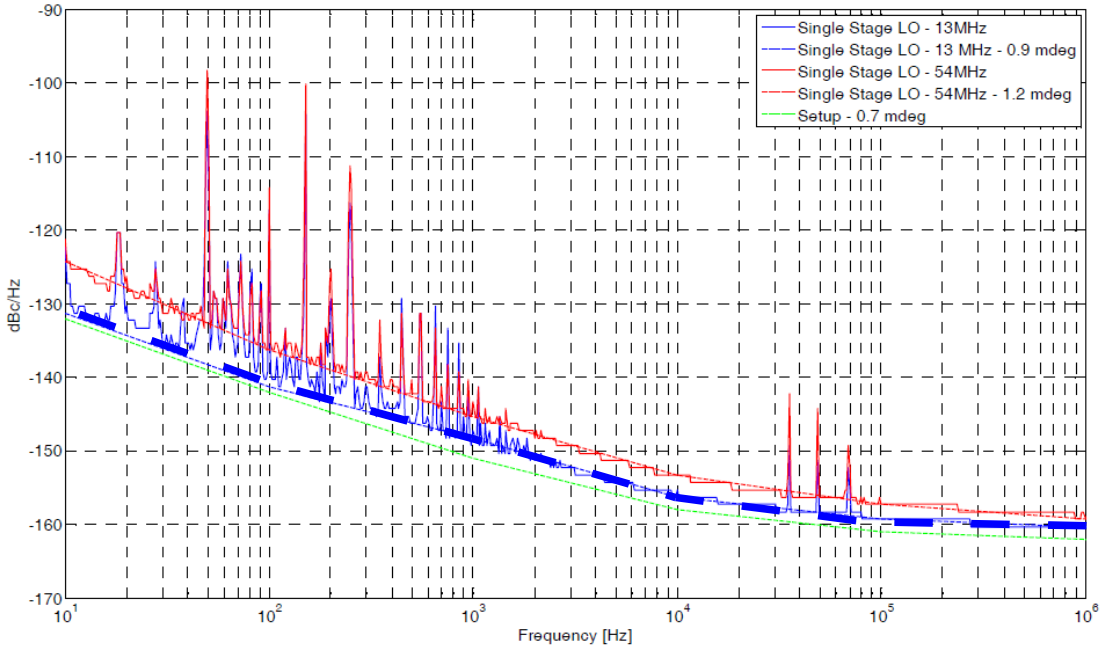


# Single Stage, 1313 MHz (Measurements).

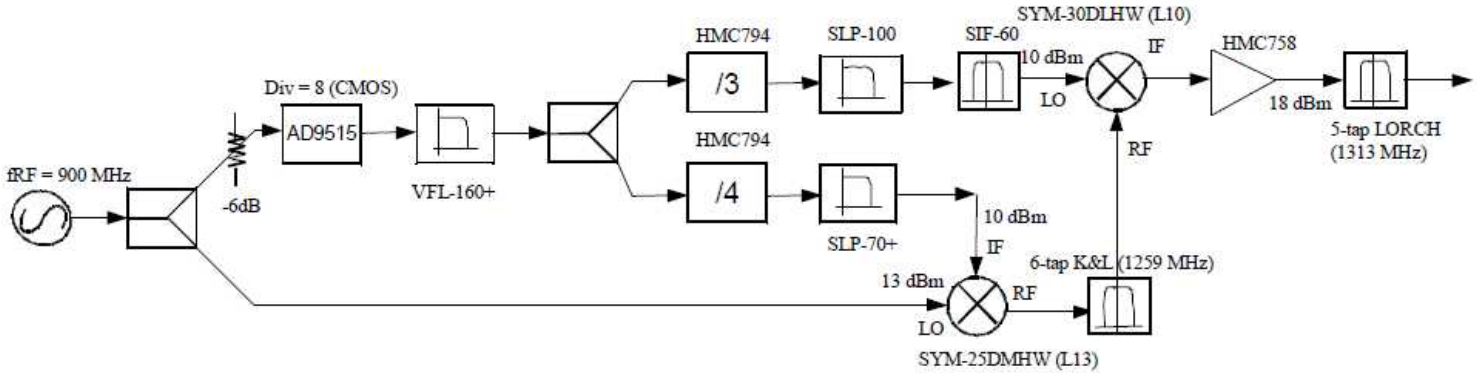


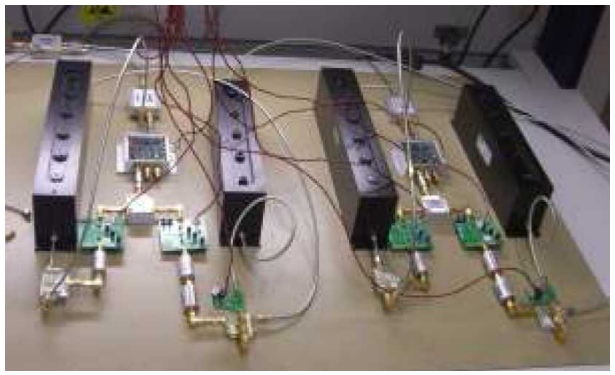
0.9 mdeg (1.9fs) [10 Hz – 1 MHz]

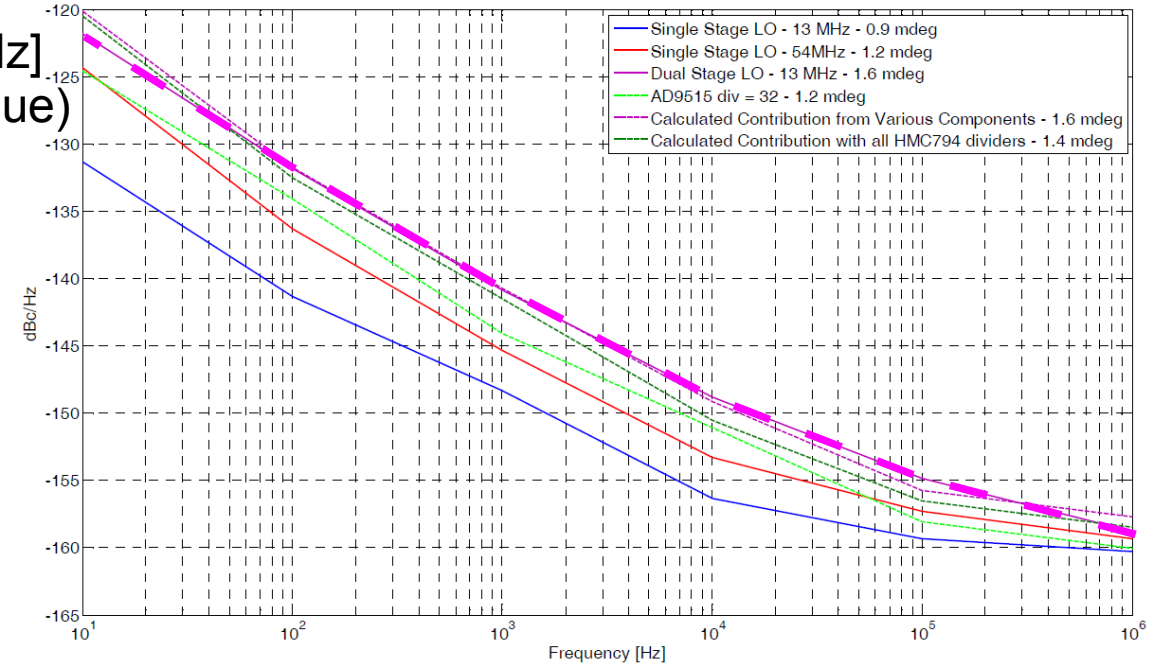


# Dual Stage, 1313 MHz (Measurements).




1.6 mdeg (3.4fs) [10 Hz – 1 MHz]
(simulation shows the same value)

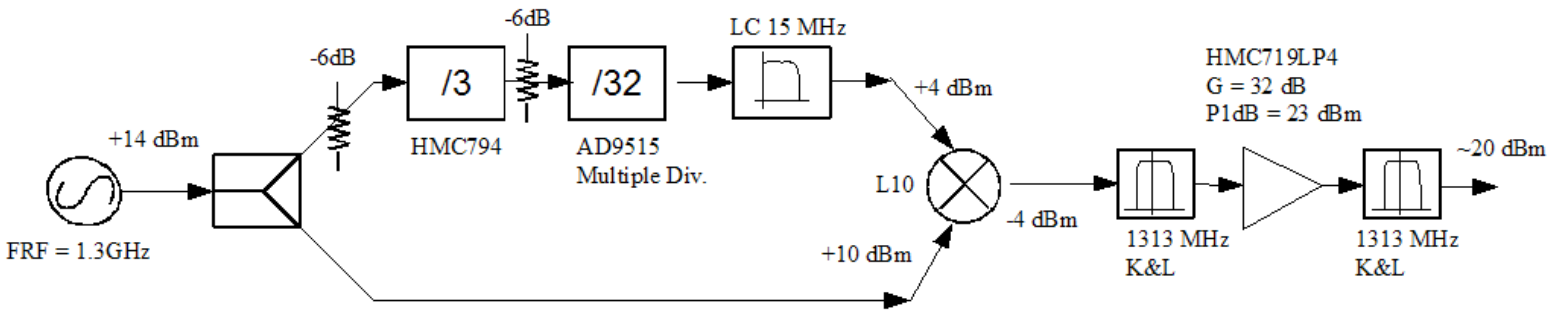




# Technological Issues of Single Stage.

- Output filter (to suppress 1300 MHz and 1326 MHz):
  - Cavity Filters (e.g. K&L, -50dBc @1300 MHz, IL=4dB, BW=3MHz, 10cm x 8cm x 3cm)
  - SAW Filters (-5dBc @ 1300 MHz best case)
  - Ceramic filters (standard solution with quarter-wave of half-wave stubs is not appropriate)

# Proposed Schematic.




- The level 10 mixer needs to be defined
  - LO-RF isolation, IF-RF isolation
  - 10 dBm LO power
  - Bandwidth, insertion loss
  - Residual phase noise
- Splitter 1:2 needs to be defined
  - Isolation at 1.3 GHz
  - Insertion loss at 1.3 GHz

# Summary.

- Single stage LO generation adds less phase noise (app. two times).
- Proven by simulation and measurements
- Main technological challenge of single stage are:
  - Output filtering of LO signal
  - Amplification of the signal driving the LO and the output LO signal.
- A schematic of the single stage LO generation was proposed.