

POLYPHASE ANALYSIS FILTER BANK DOWN- CONVERTS UNEQUAL CHANNEL BANDWIDTHS WITH ARBITRARY CENTER FREQUENCIES DESIGN I

Elettra Venosa

Seconda Università degli Studi di Napoli

elettra.venosa@unina2.it

Xiaofei Chen and fred harris

San Diego State University

chenxiaofei_sdsu@yahoo.com, fred.harris@sdsu.edu



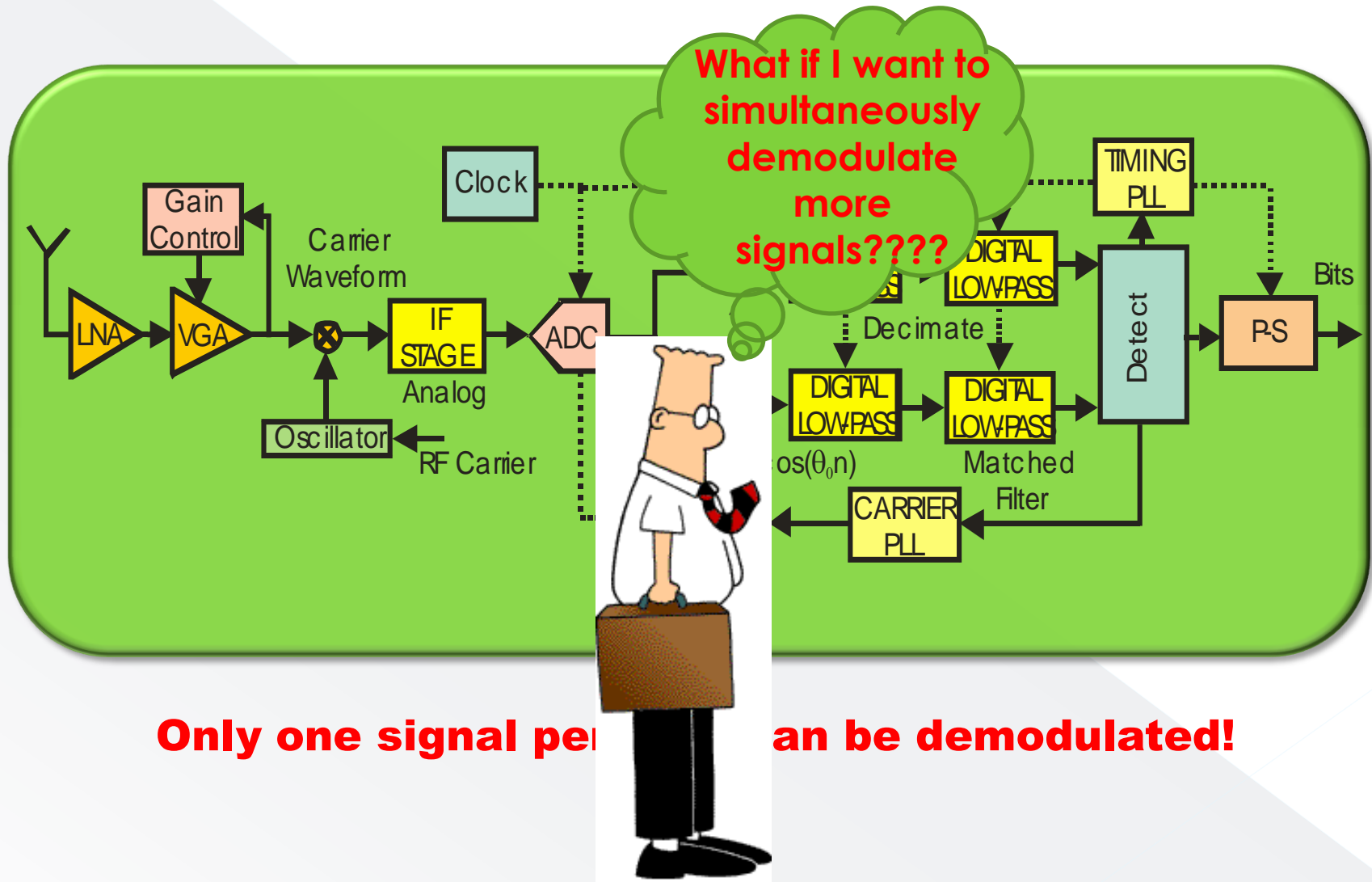
**SAN DIEGO STATE
UNIVERSITY**

College of Engineering

SDR'10

Wireless Innovation Conference
and Product Exposition

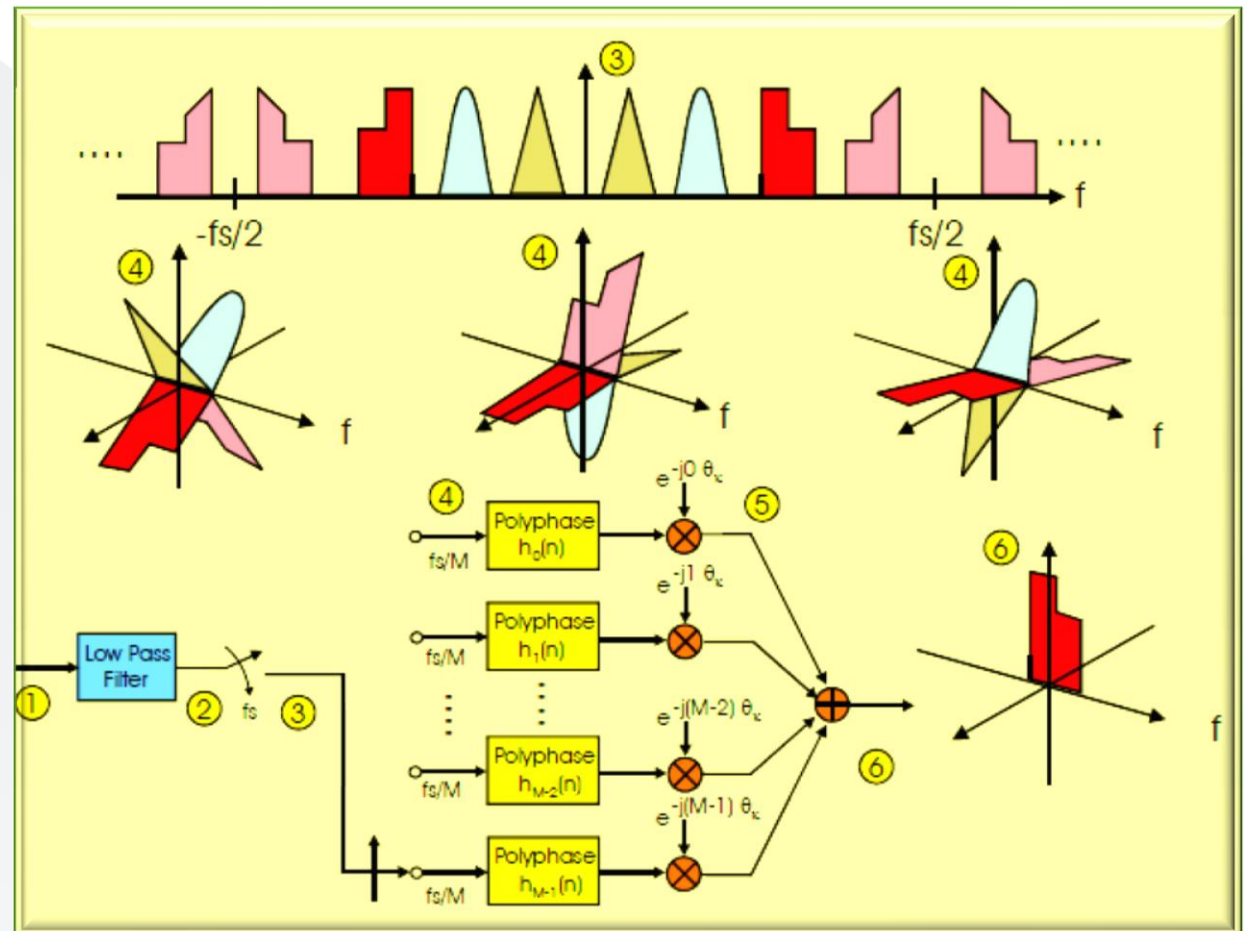
Background



Only one signal per channel can be demodulated!

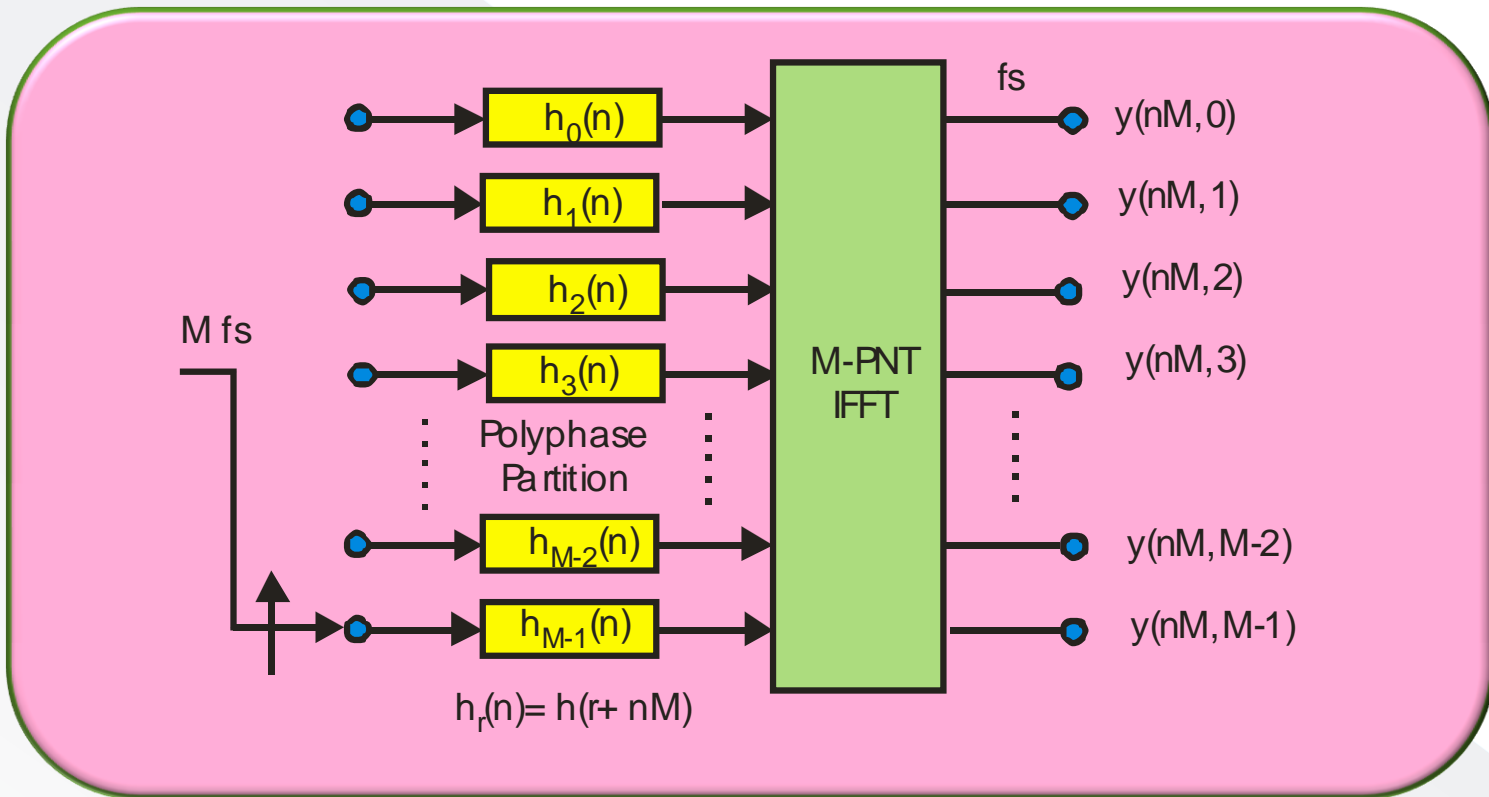
What is the Down Converter Channelizer?

Let start from
the
beginning.....



What is the Down Converter Channelizer?

.....and then generalize

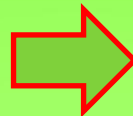


What can we do with a Down Converter Channelizer?

What

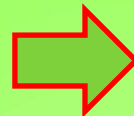
How

❑ Sample rate change



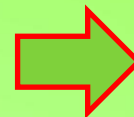
input commutator

❑ Bandwidth reduction



M-partitioned filter weights

❑ Nyquist zone selection

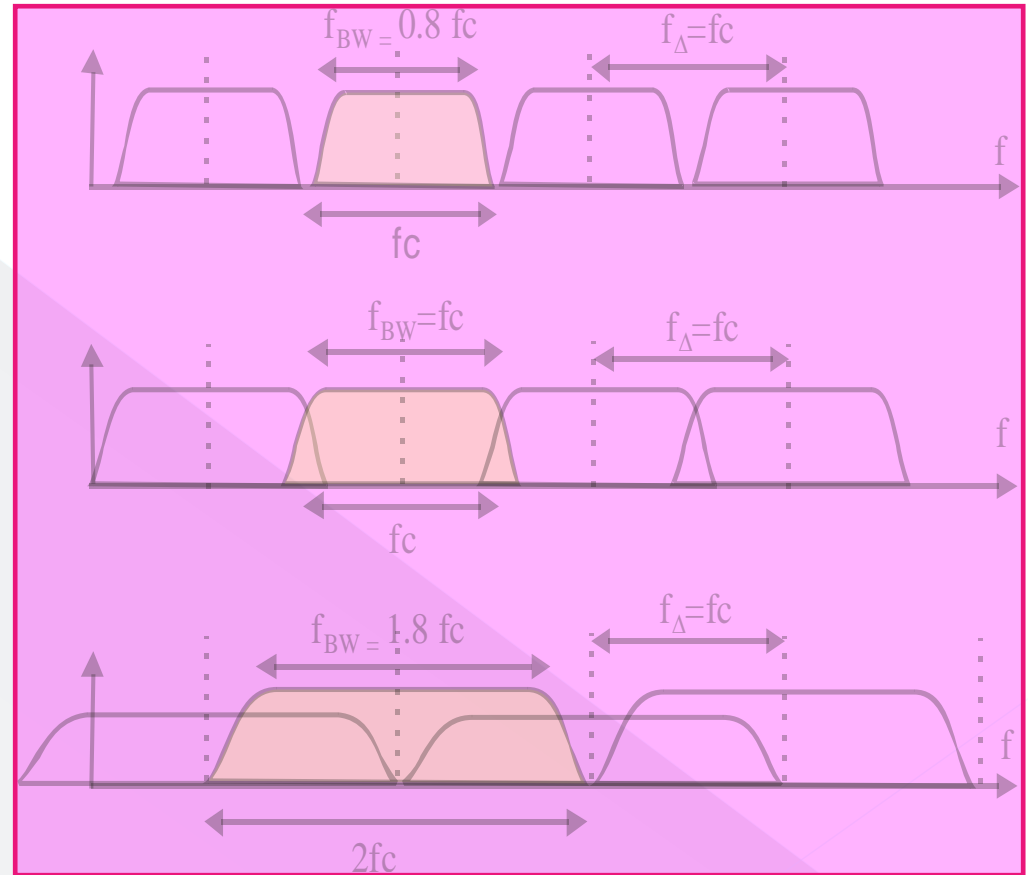


IFFT

Three Important Parameters

- Channel Spacing
- Channel Bandwidth
- Sampling Frequency

**We can
independently
choose all of them
based on the
application!**



Square-Root Nyquist Filter

-3dB at the nominal band edge



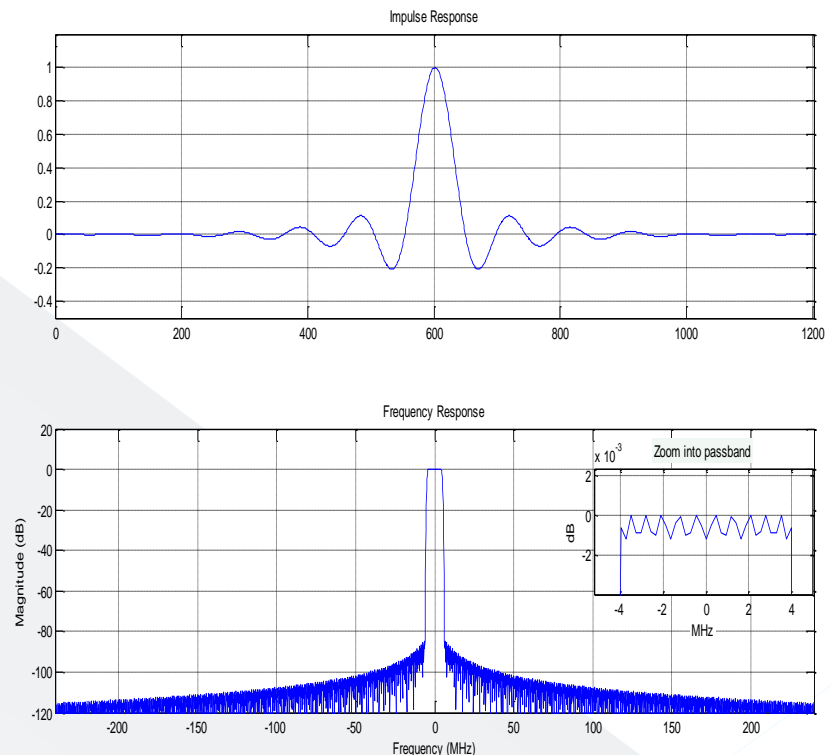
The signals can be placed in the channel's overlapping transition bandwidths....

there is no more way to lose energy during the processing!

□ 48 samples per symbol

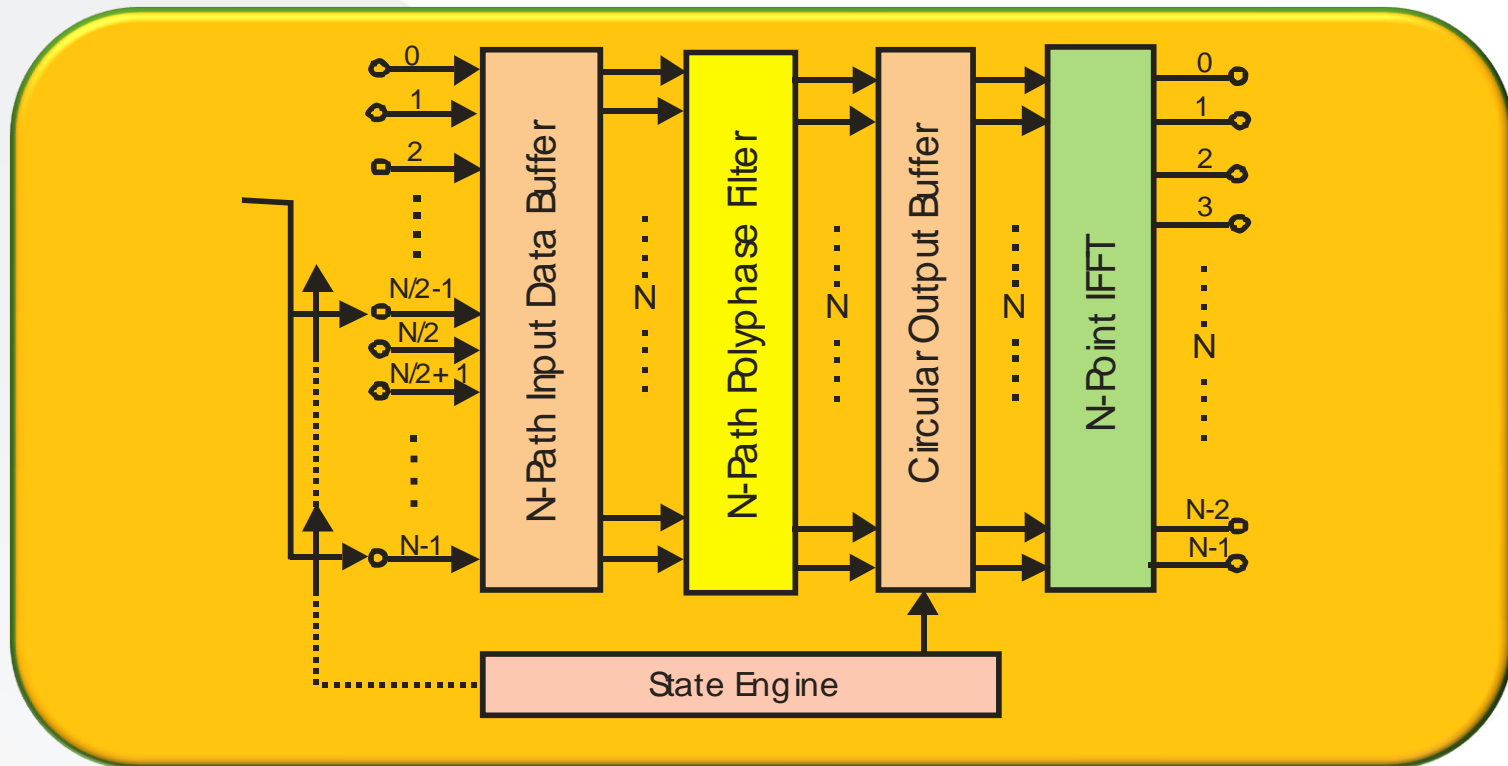
□ 1200 taps long

□ -80dB stop band attenuation



M-to-2 Channelizer Down Converter - Analysis

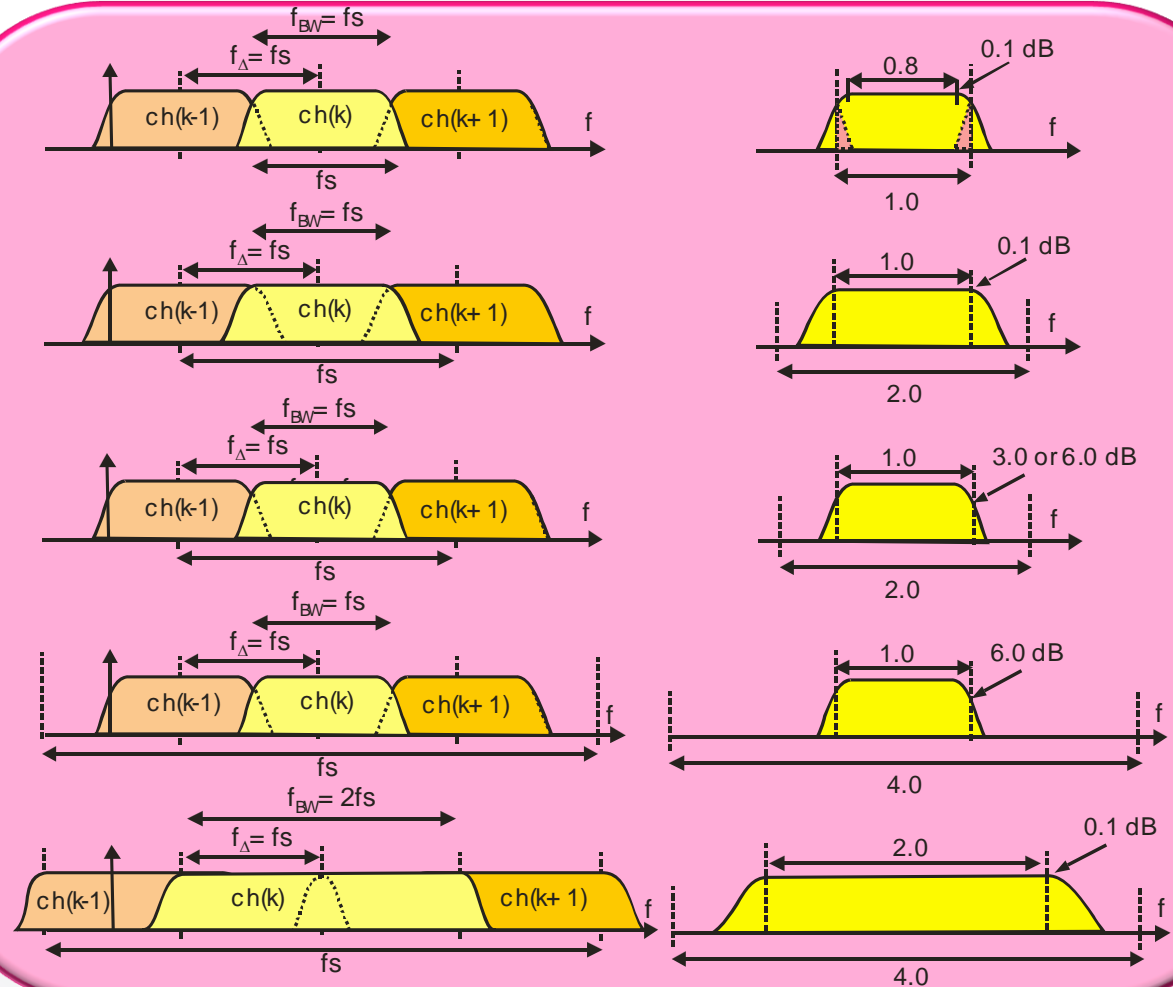
We need some modifications to achieve better results



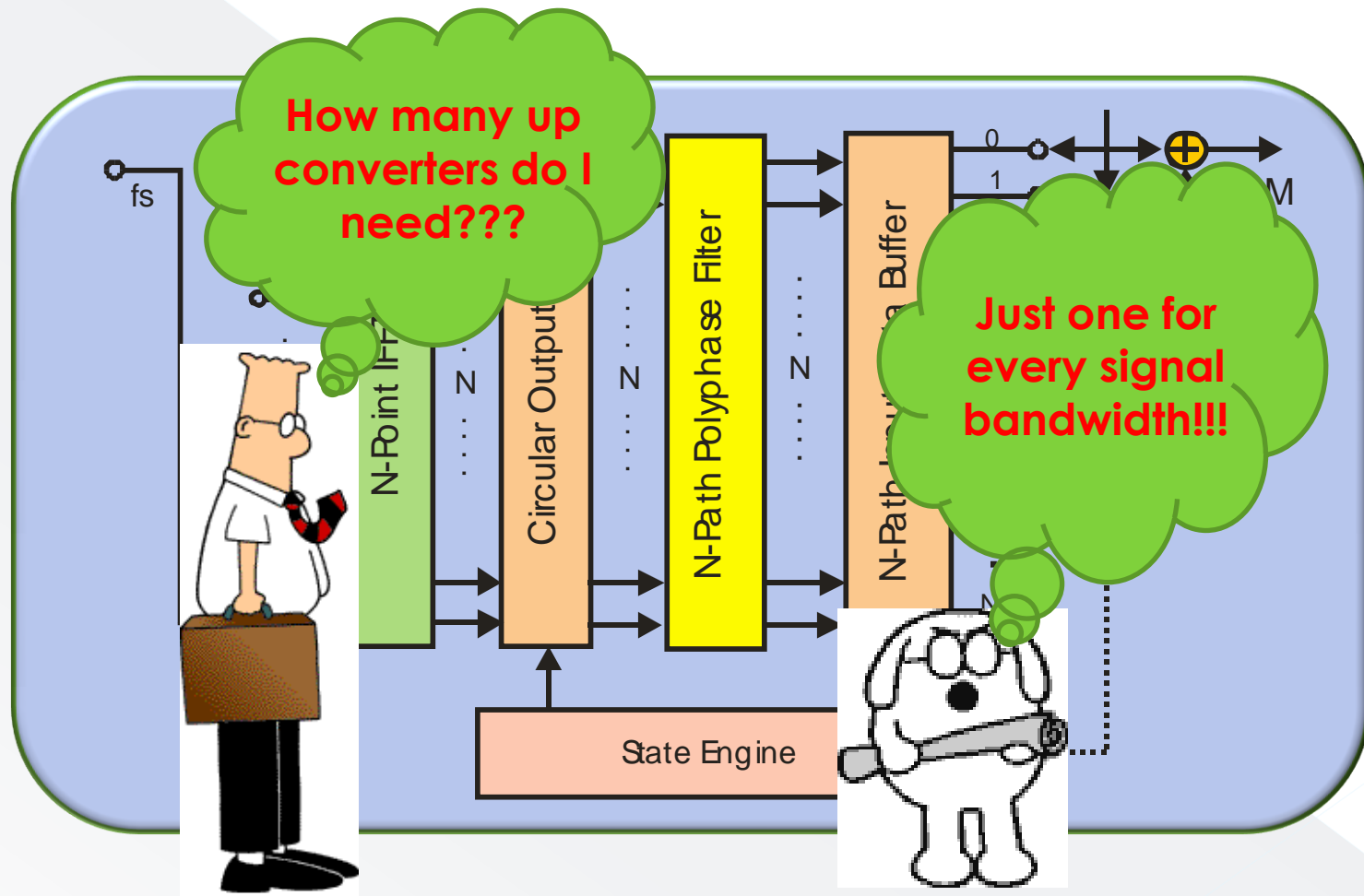
NO MORE SPECTRAL FOLDING.....

M-to-2 Channelizer Down Converter - Analysis

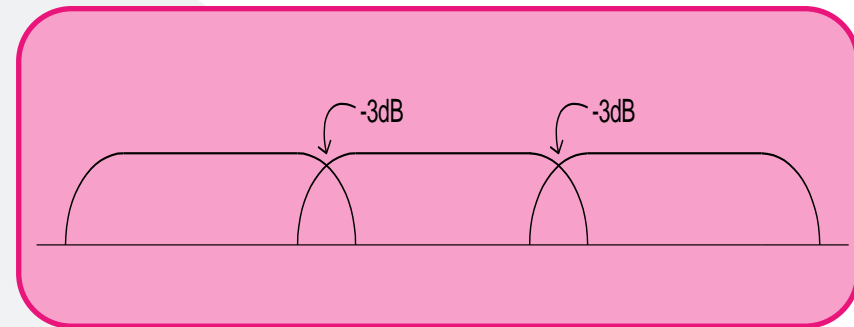
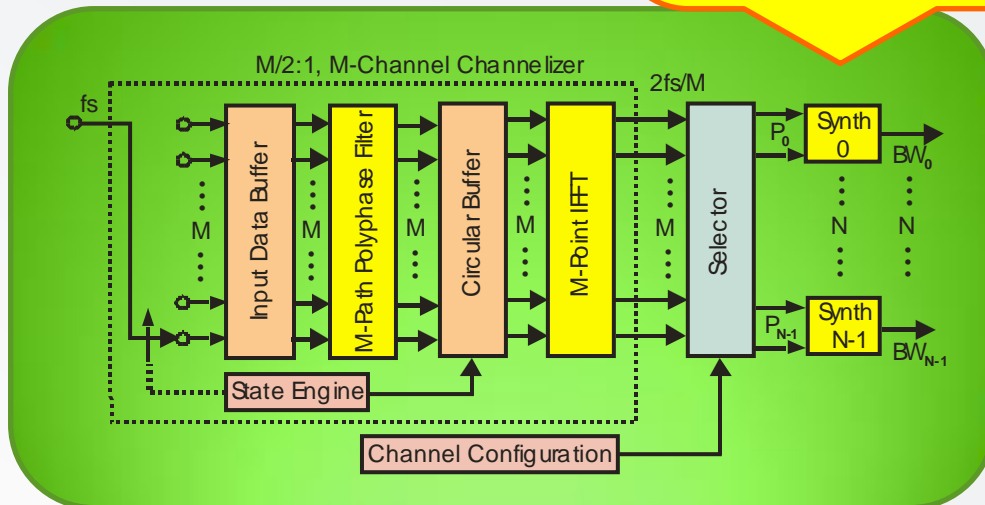
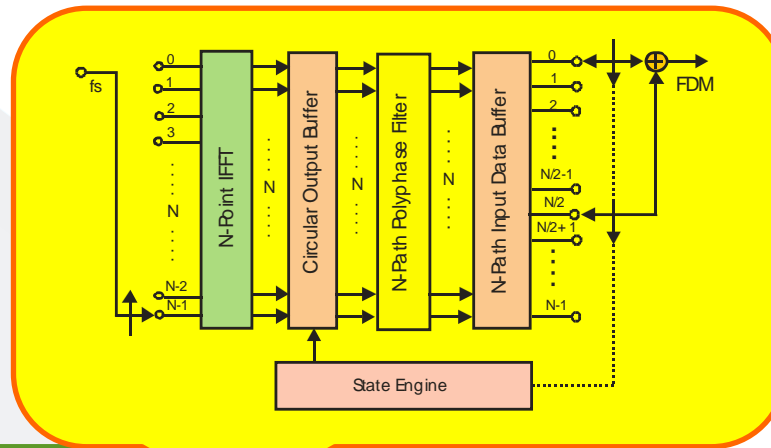
No more spectral folding???



2-to-M Up Converter Channelizer - Synthesis

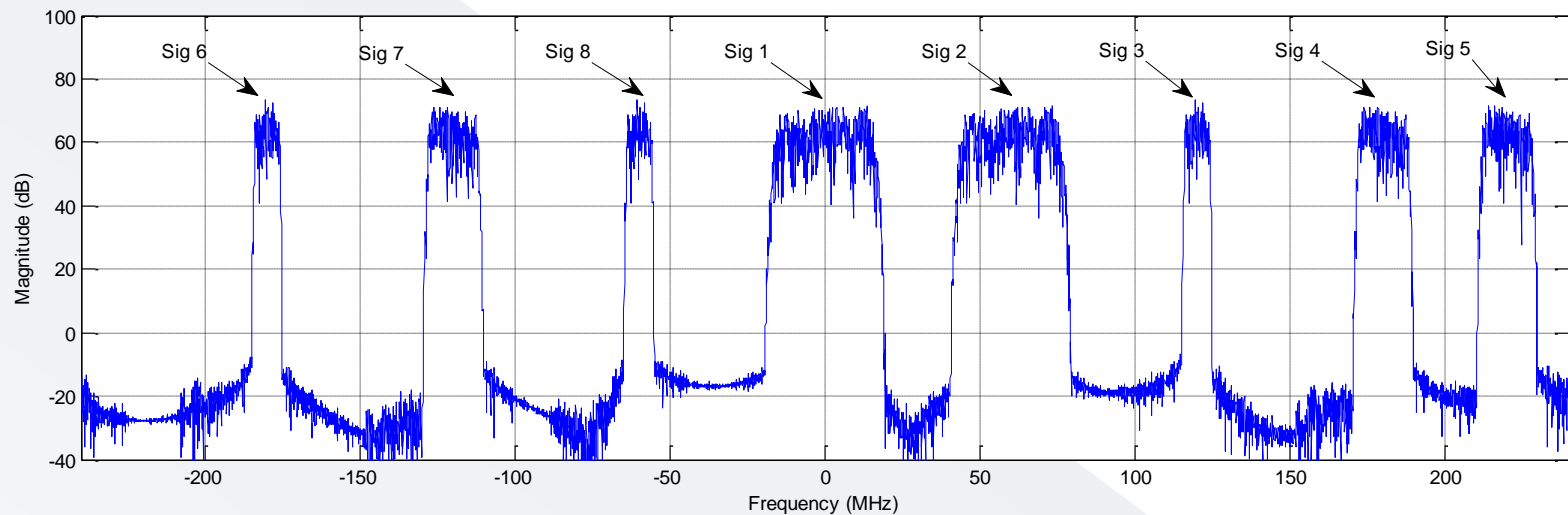


Analysis + Synthesis + SQRT Nyquist Filters



Does it work?

Let us show the proof....



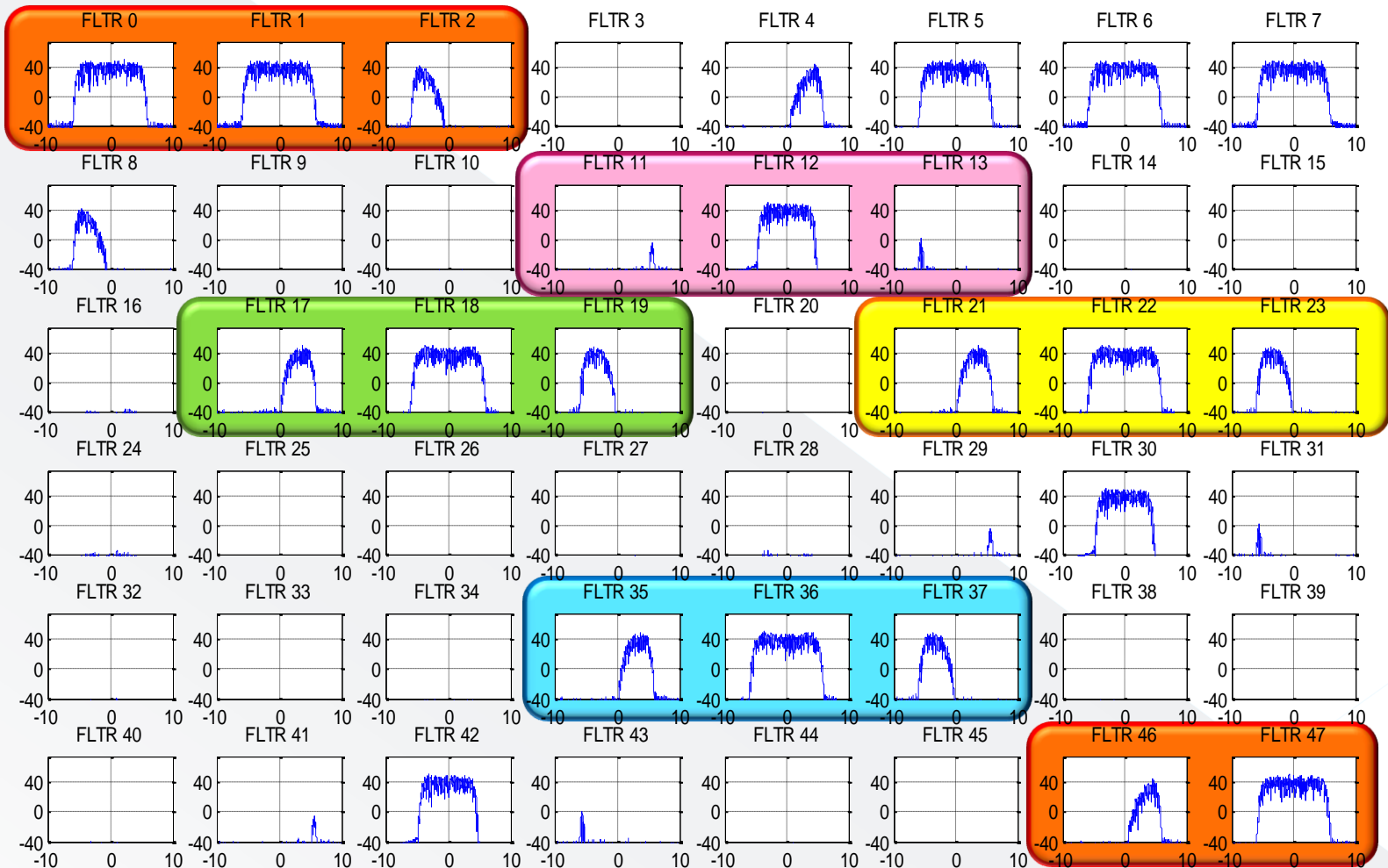
Signal 6,8,3: 7.5×1.25 MHz

Signals 7,4,5: 15×1.25 MHz

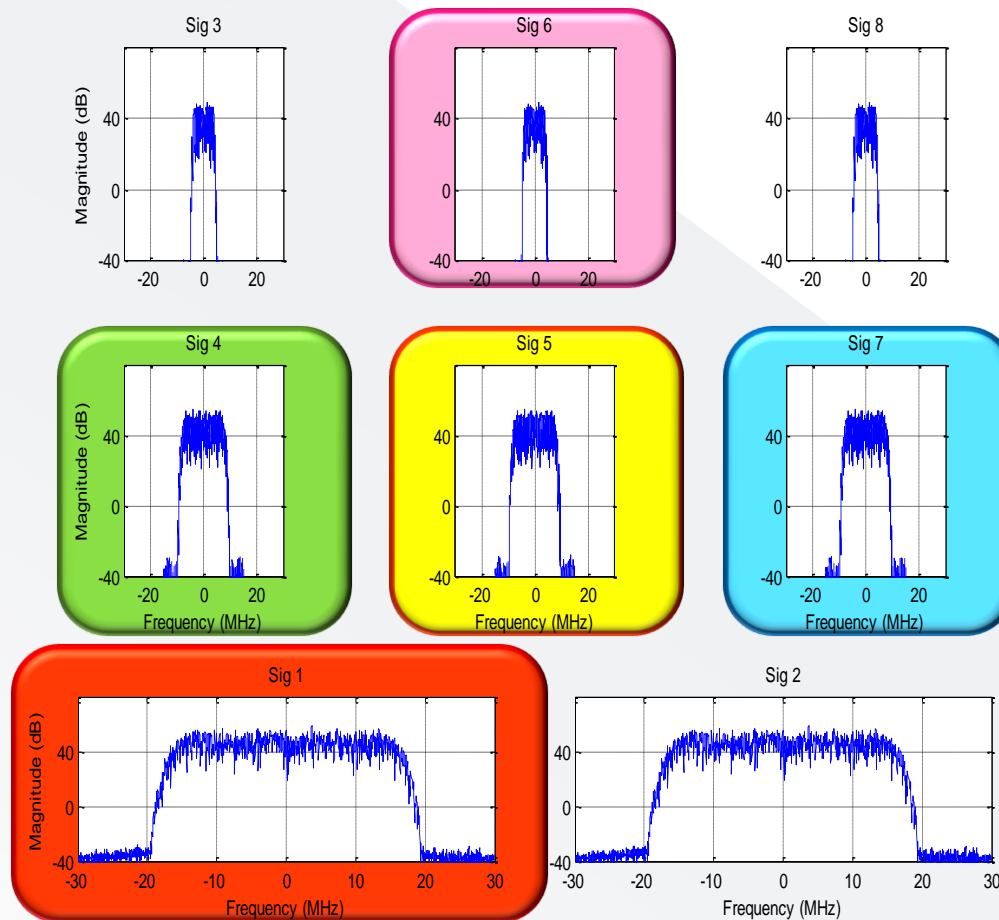
Signals 1,2: 30×1.25 MHz

shaped by SQRT-Nyquist filters with 25% excess bandwidth

Analysis Channelizer Outputs

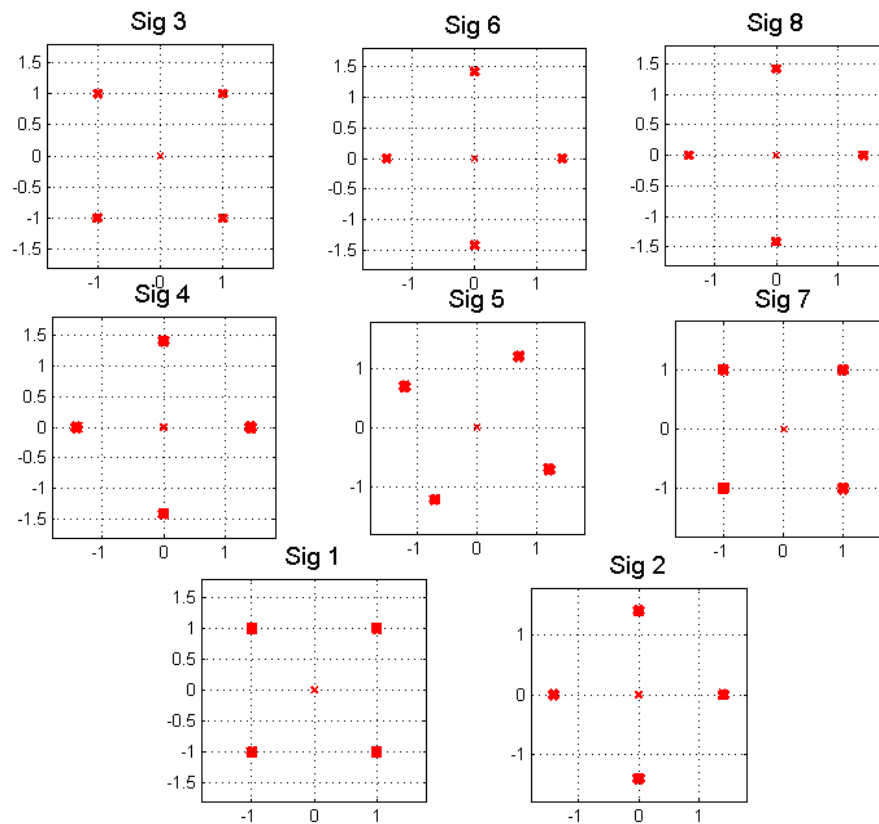


Synthesis Channelizer Output - Spectra -



The IFFT size of every synthesizer can be the smallest possible to give us at least two samples per symbol

Synthesis Channelizer Output - Constellations -



Conclusion

we presented a novel analysis channelizer to simultaneously down convert multiple signals with arbitrary bandwidths and randomly located center frequencies

**What can we do
with it???**



**A software
defined
radio
receiver???**



We are now Open For Questions!

Thanks
for your
attention

