

# Build your Own Homodyne

Beam Instrumentation System Simulator - Drawing Board

Beam: Revolution Period (Trev): 5  $\mu$ s  
Revolution Frequency: 200 kHz  
RF Bucket Length: 100 ns  
Harmonic Number: 50

Simulator Status: Step: 200 ns  
Length: 2 \* (Trev)  
Points per RF Bucket: 500  
Total Steps: 50 k

Simulation Parameters: Points per No. of: 100 2

Simulation Data:  Save Simula...  Suppress W... Simulation

Operation Mode: Normal Mode

Undo - Redo: **Undo** **Redo**

Beam Instrumentation System Simulator - Drawing Board

Circuit: Save Load Clear Board

Circuit Drawing: Block Sub-System Place Wire Place Probe

Simulate Actions: Simulate Viewer Parametric S... Discard Simulation Data

Extra: Units - Scales Expert View Save As Picture

# Homodyne Experiment – the Beam/BPM signal

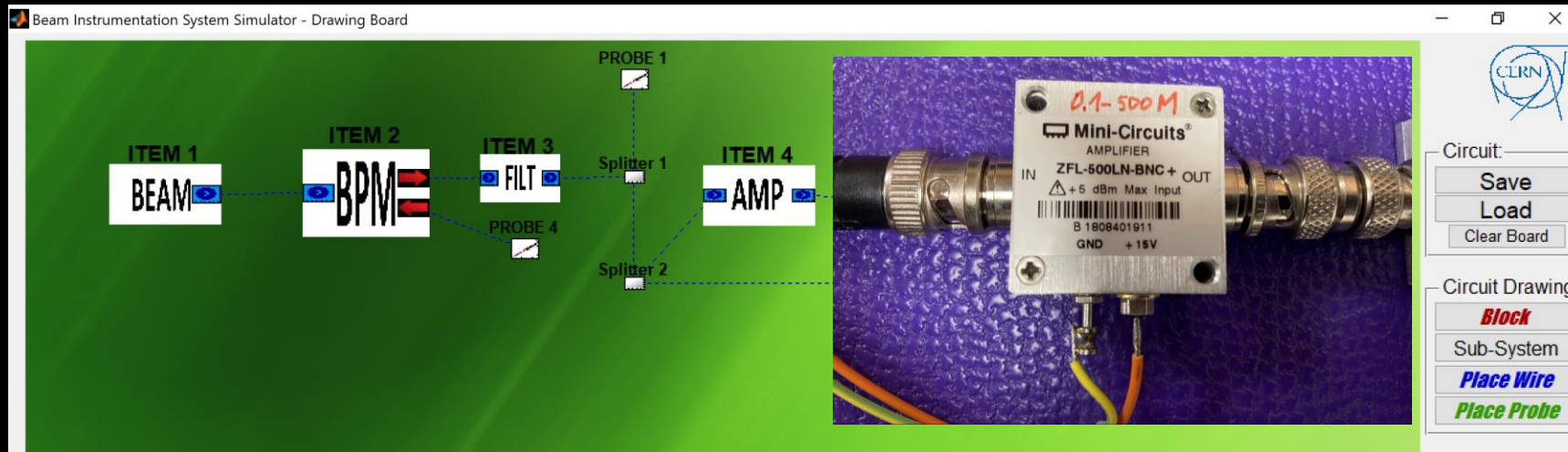
- The Generator will mimick the Beam and single port output of a BPM (CH1 and CH2 giving the same output)
- Have a look at this by connecting CH 2 of the generator to CH 4 of the oscilloscope

# Homodyne Experiment – the Bandpass Filter

The screenshot displays the Beam Instrumentation System Simulator (BIS) interface. The main window shows a circuit diagram with three items: ITEM 1 (BEAM), ITEM 2 (BPM), and ITEM 3 (FILT). A 'FilterDialog' window is open, showing filter properties: Filter Type: Band - Pass, Hardware Type: RC, Order: 1. The 'Frequencies' section shows Parameter Type: absolute, F High: 13.5 MHz, Cut-off Freq: 7.5 MHz, PassBand Ripple: 0.5 dB. Two plots are visible: Magnitude (dB) vs Frequency (log scale) and Angle vs Frequency (log scale). The bottom status bar shows simulation parameters like Beam, Simulator Status, Simulation Parameters, and Simulation Data.

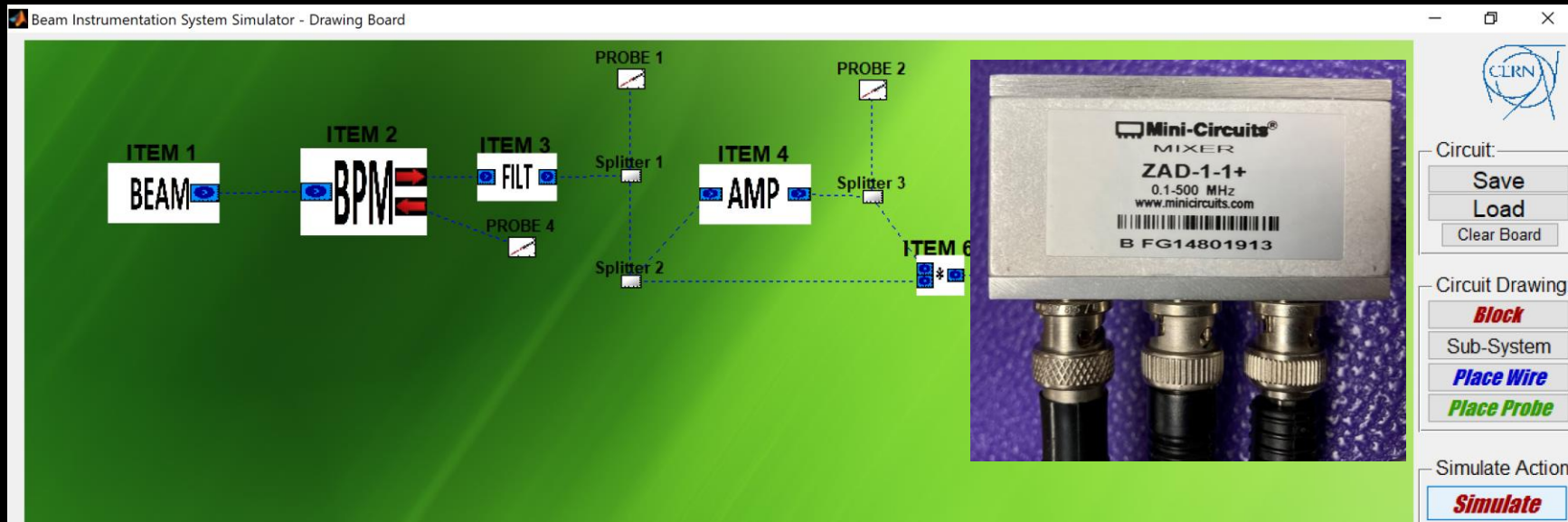
- The ringing bandpass filter is centred on the repetition frequency of the beam
- Have a look at this by connecting the filter to the generator and to CH1 of the oscilloscope

# Homodyne Experiment – the Amplifier



- Create your square mixing frequency by adding the amplifier which is driven into saturation
- To view both the amplifier input and the amplifier output, connect a splitter to the filter out put with one branch going directly to CH1 of the oscilloscope and one branch going to the amplifier
- The output of the amplifier can then be connected to CH2 of the oscilloscope

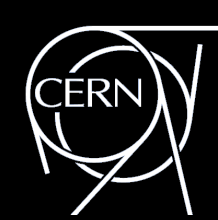
# Homodyne Experiment – the Mixer



- Now split the output from the amplifier (keep viewing on CH2) and add the mixer
  - L = Local Oscillator (your square wave input) : R = RF (your signal input) : I = Intermediate frequency (your output)
- View the output from the mixer on CH3 of the oscilloscope

# Homodyne Experiment – the Low Pass Filter

- Finally add the Low Pass filter before CH3 on the oscilloscope



# Homodyne Experiment – the Full Circuit

Beam Instrumentation System Simulator - Drawing Board

ITEM 1 BEAM

ITEM 2 BPM

ITEM 3 FILT

ITEM 4 AMP

ITEM 6

ITEM 5 FILT

PROBE 1

PROBE 2

PROBE 3

PROBE 4

Splitter 1

Splitter 2

Splitter 3

Beam Instrumentation System Simulator - Drawing Board

Circuit:

Save

Load

Clear Board

Circuit Drawing:

Block

Sub-System

Place Wire

Place Probe

Simulate Actions:

Simulate

Viewer

Parametric S...

Simulation Data

Extra:

Units - Scales

Expert View

Save As Picture

Undo - Redo

Undo

Redo

Beam:

Revolution Period (Trev): 5 us

Revolution Frequency: 200 kHz

RF Bucket Length: 100 ns

Harmonic Number: 50

Simulation Status:

Step: 200 ns

Length: 2 \* (Trev)

Points per RF Bucket: 500

Total Steps: 50 k

Simulation Parameters:

Points per No. of: 100, 2

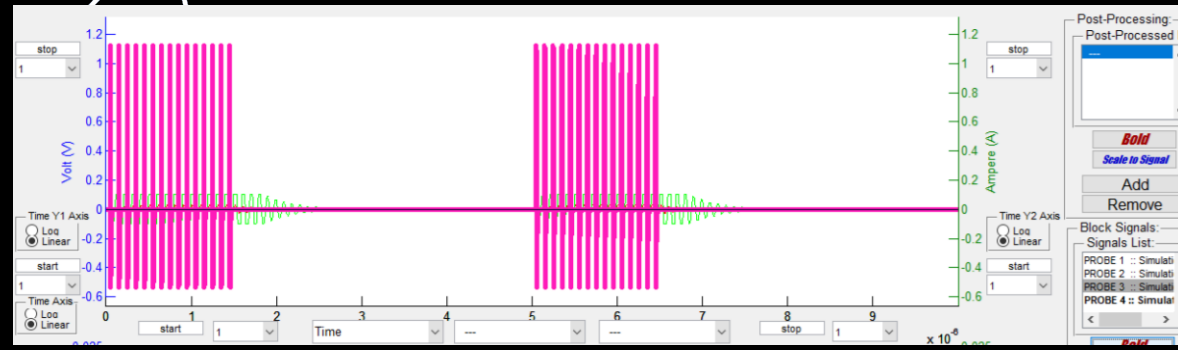
Simulation Data:

Save Simula... Suppress W...

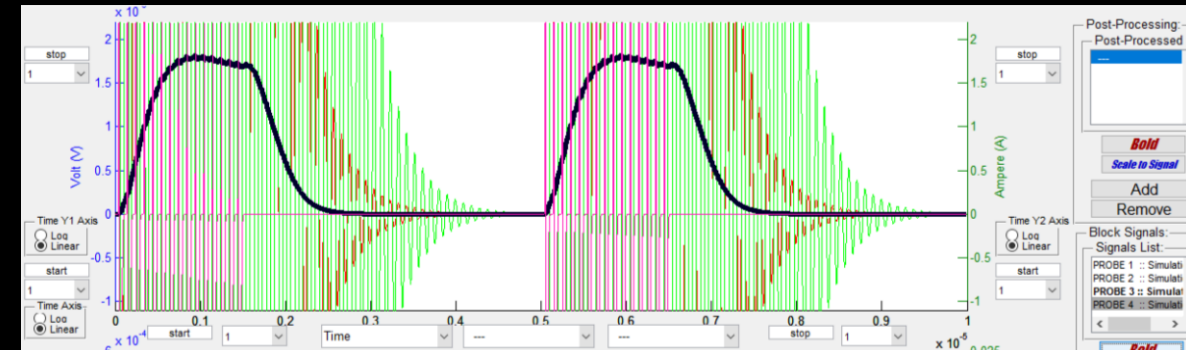
Operation Mode: Normal Mode



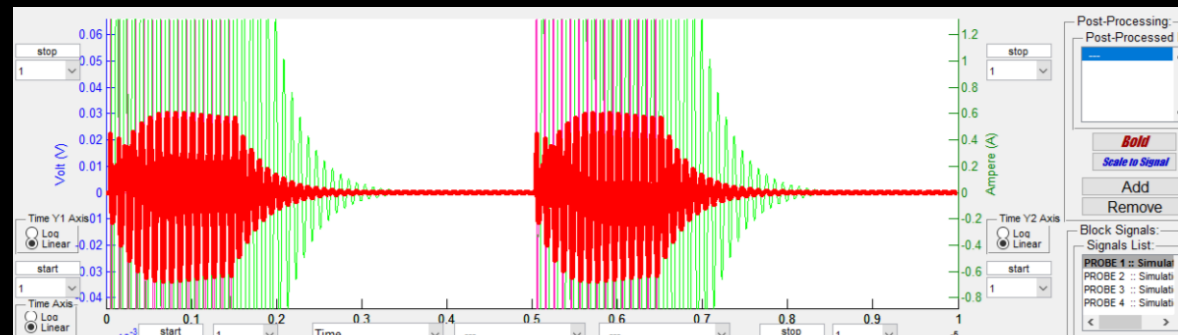
# Homodyne Experiment – the Results



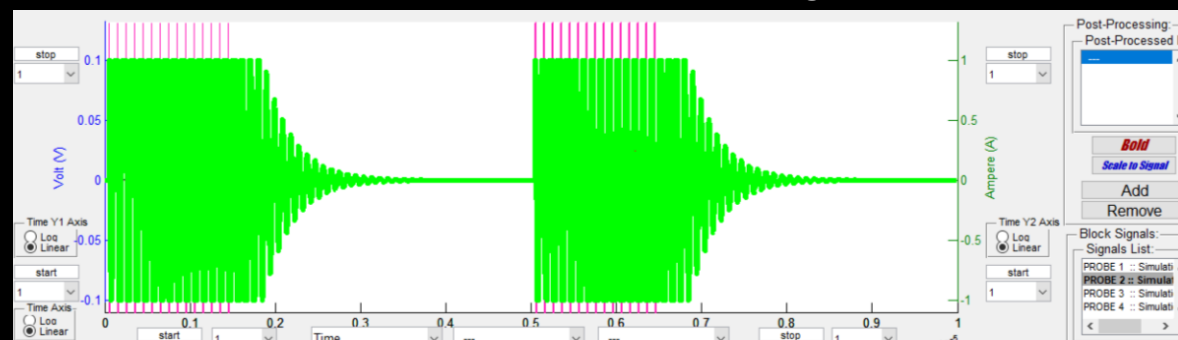
CH4 – BPM output signal



CH3 – Low Pass Filter Output



CH1 – Bandpass Filter output signal



CH2 – Amplifier output signal

