

Beam Instabilities Workshop
Grenoble 13-15th March 2000

DaΦne Longitudinal Feedback
Status Report

Alessandro Drago

DaΦne LFB Collaboration

INFN-LNF

R. Boni
O. Coiro
A. Drago
A. Gallo
O. Giacinti
A. Ghigo
F. Marcellini
D. Pellegrini
M. Serio

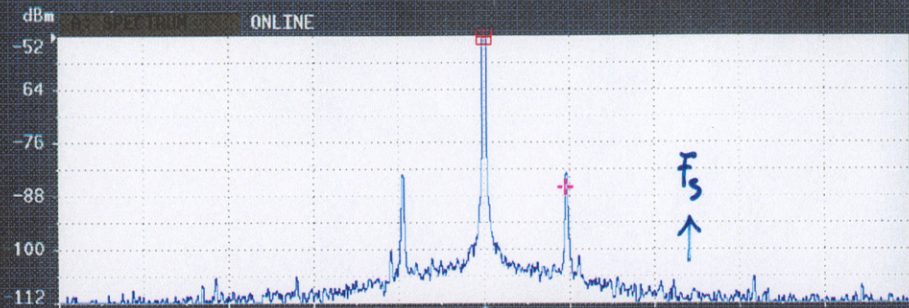
SLAC

J. D. Fox
S. Prabhakar
D. Teytelman
A. Young

LBNL

G. Stover

DAFNE Main Ring



368.20058 MHz 368.32558 MHz
 Time : 912.9564000 Sec Delta: 0.00000000 Sec
 Marker: 368.2749550 MHz -85.8866 dBm Delta: 11.7968750 KHz -58.1069 dB
 frac(MRKR/f_rev) = 0.0039 (@ f_RF = 368263080 Hz) Fri Sep 17 21:36:22 1999
 cf= 137*f_rev

```

hp3507s >> e
Enter RF value : .26
RF = 368260000
hp3507s >> e
Enter RF value : .26308
RF = 368263080
hp3507s >> [0
hp3587s >> *
cf=368263080
stop= 306059
new center freq=371331439
hp3587s >>
    
```

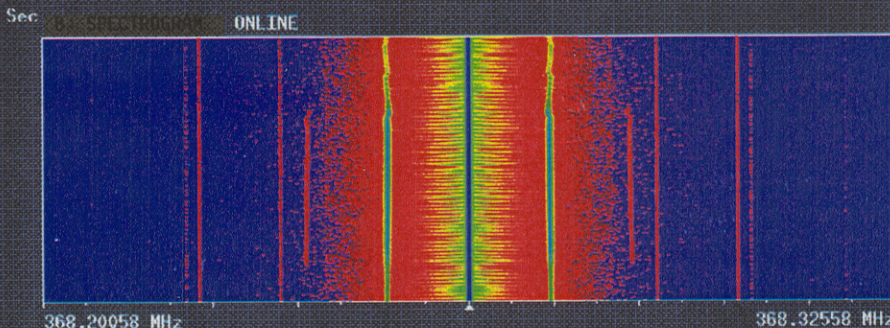
e+ ring
 24 bunches
 (1 every 4)

$V_{RF} = 100 \text{ KV}$

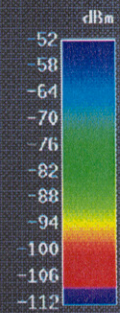
FEEDBACK ON

$f_{sync} \approx 24 \text{ KHz}$

$I_b \approx 200 \text{ mA}$

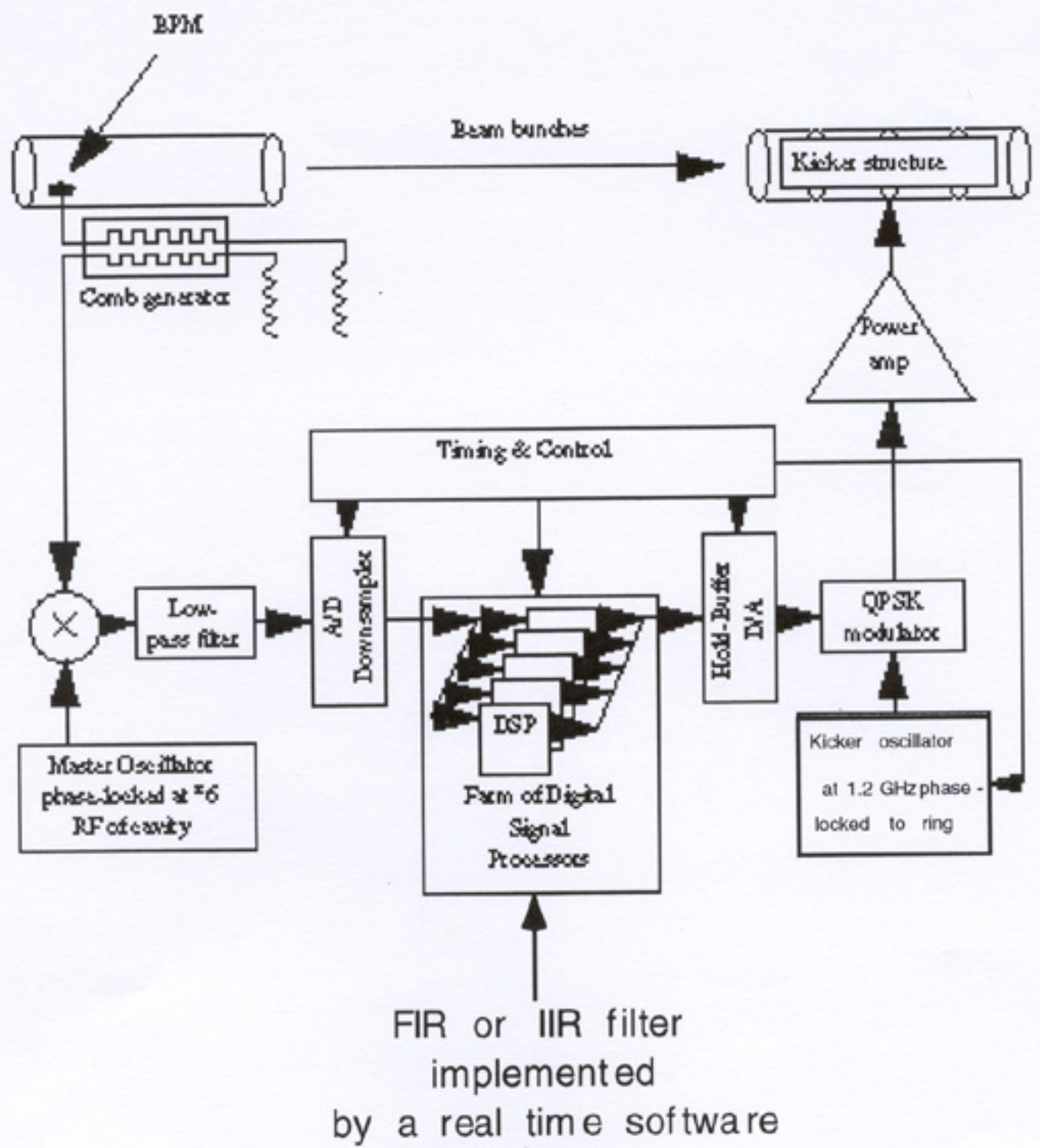


368.20058 MHz 368.32558 MHz
 frac(MRKR/f_rev) = 0.0039 (@ f_RF = 368263080 Hz) Fri Sep 17 21:36:22 1999
 cf= 137*f_rev



>>>> DATA HEADER START <<<<					
Range : -20 dBm	Span : 125.0000 KHz	Trg Mode : FREERUN	Amplitude : OFF	Histogram Bins: 201	
Window : FLATTOP	Center : 368.2631 MHz	Trg Level : 0%	Spectrum : ON	Start Voltage : -1.00 V	
Ground : SINGLE IN/DI	Reference : 10.24000 MHz	Trg Mag lvl: 24 dBFS	Time [Real] : ON	Stop Voltage : -1.00 V	
Coupling: DC	Bandwidth : FULL	Trg Slope : POSITIVE	Time [Imag] : ON	Overlap : 0%	
Avg Mode: RMS	Zoom : ON	Trg Delay : 0 SMPL	Analog Filter : IN	Data Width : 32 bit	
Averages: 16	Resolution: 78.12500 Hz	Exp Factor : 10			

Longitudinal Bunch-by-bunch Feedback Block Diagram



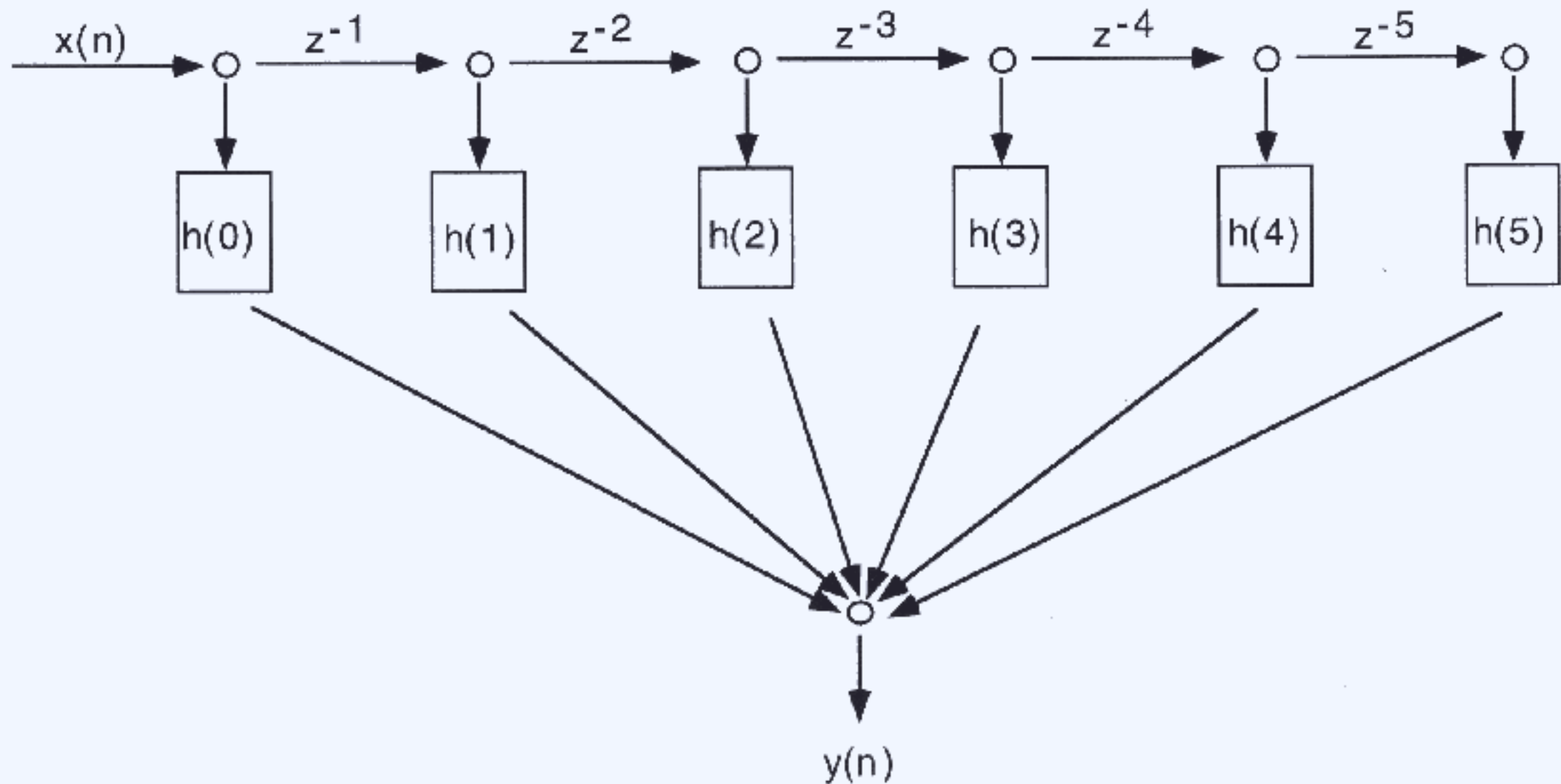
F.I.R (Finite Impulse Response) filter

$$y(n) = \sum_i x(n-i) * h_i$$

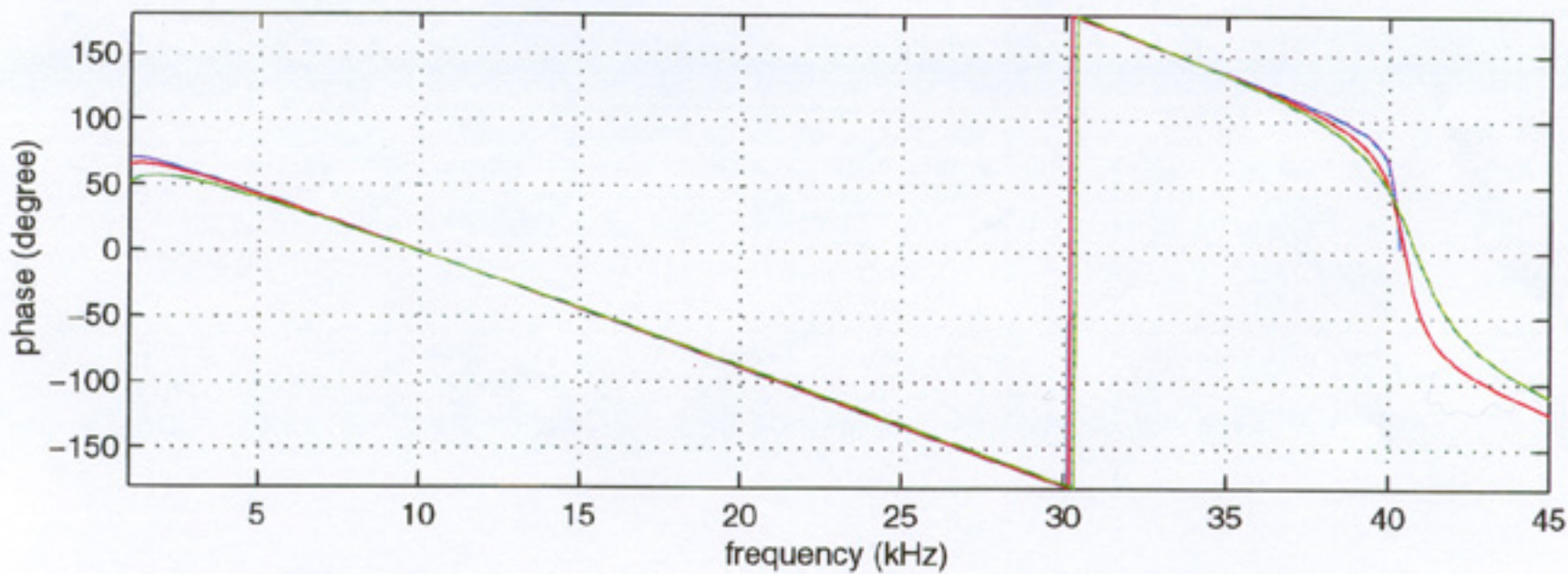
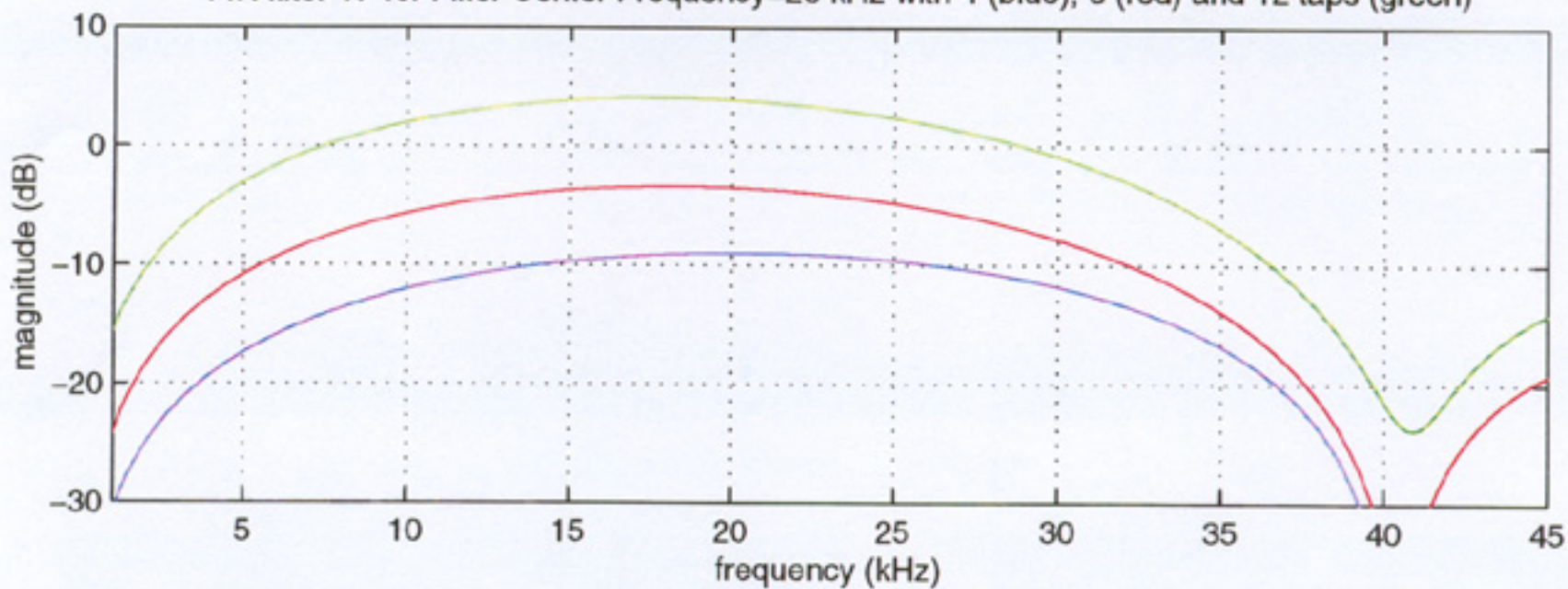
$$h_i = \text{gain} * \sin(2\pi i Q_s / D_s \text{ Factor} + \Delta\phi)$$

$$[h_i = \text{gain} * \sin(2\pi i f_{\text{synch}} / f_{\text{samp}} + \Delta\phi)]$$

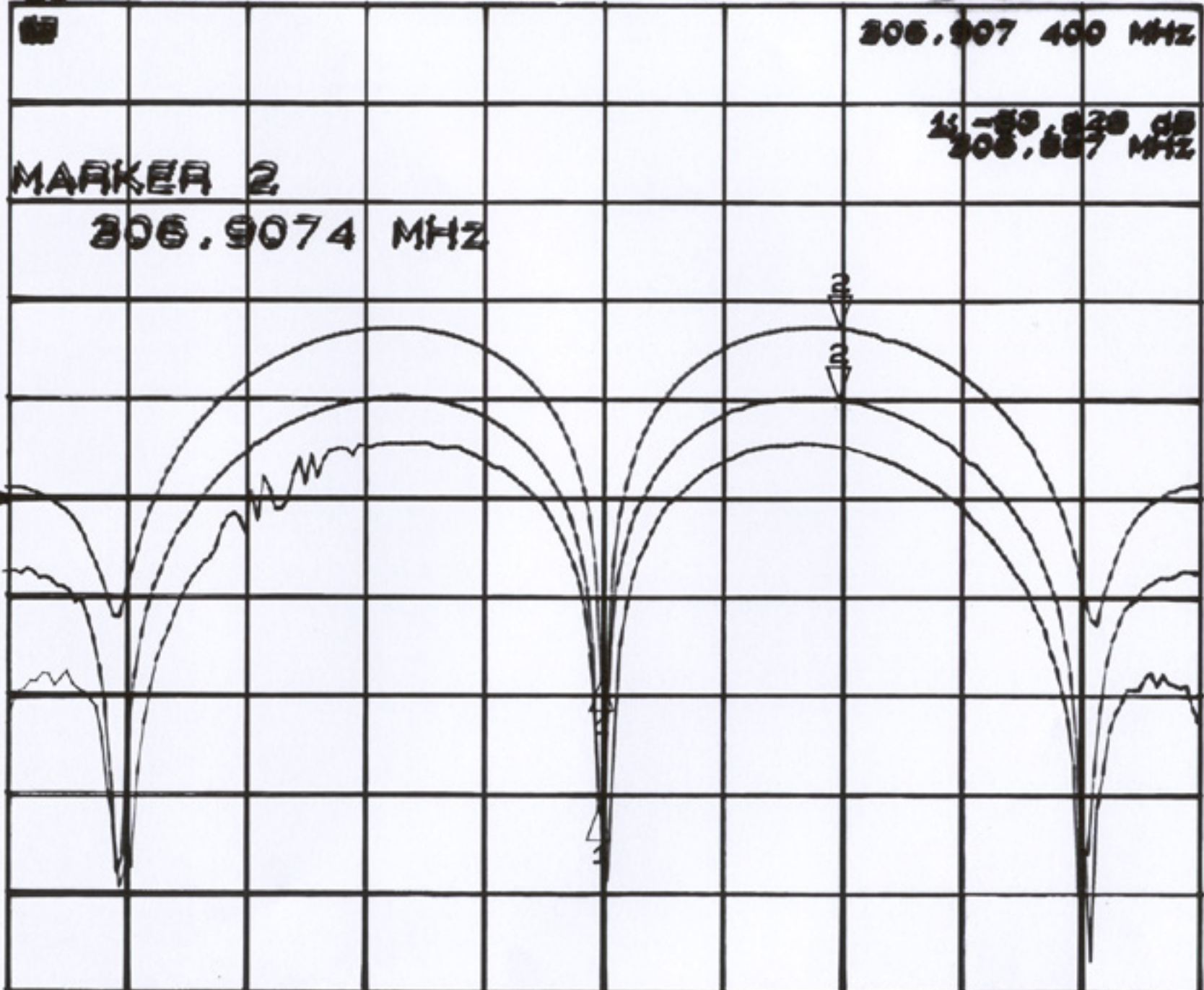
Direct Form Implementation



FIR filter TF for Filter Center Frequency=20 kHz with 4 (blue), 6 (red) and 12 taps (green)

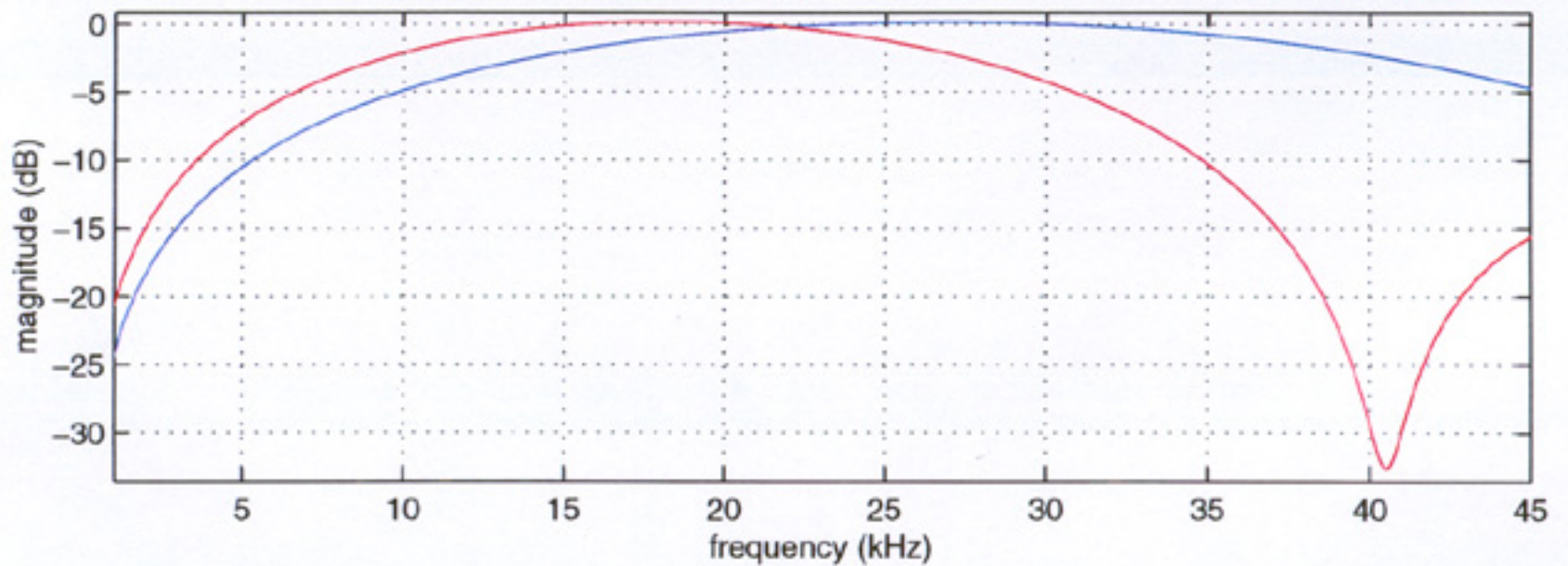


CH1 S21 100 MAG 10 dB/ REF -20 dB 2: -2.45982 dB

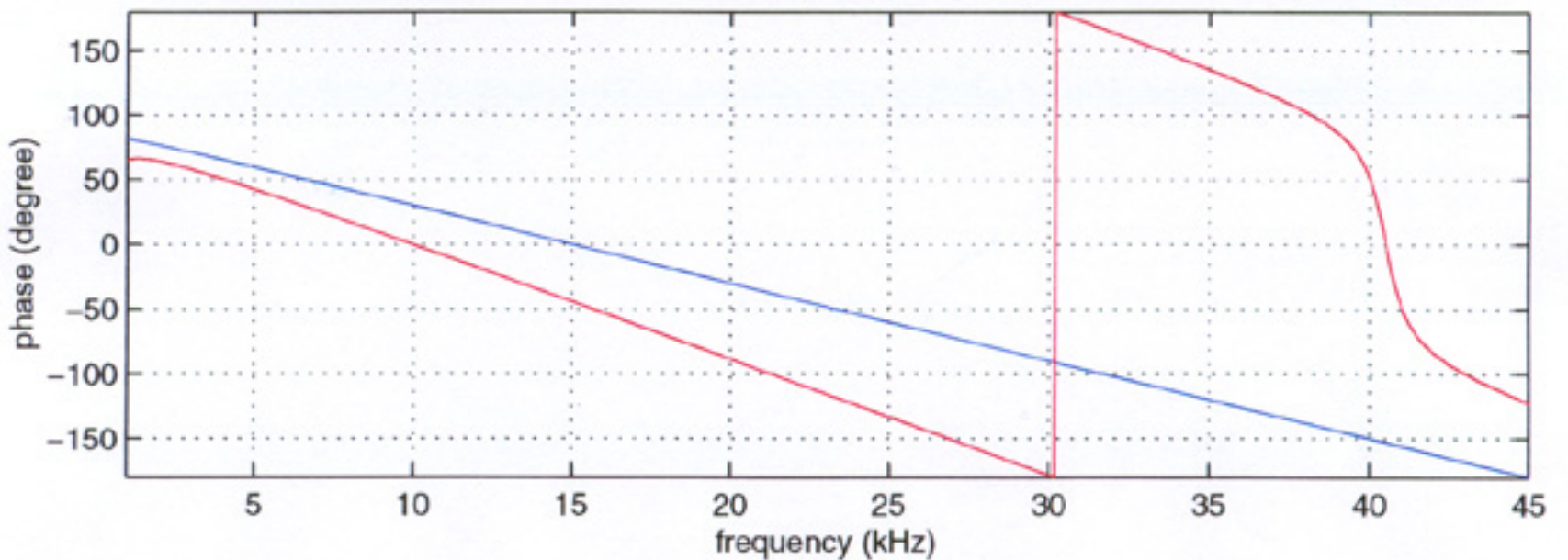


CENTER 306.887 400 MHz SPAN .100 000 MHz

FIR filter transfer function for Filter Center Frequency=20 kHz (in red) and 30 KHz (in blue), 6 taps



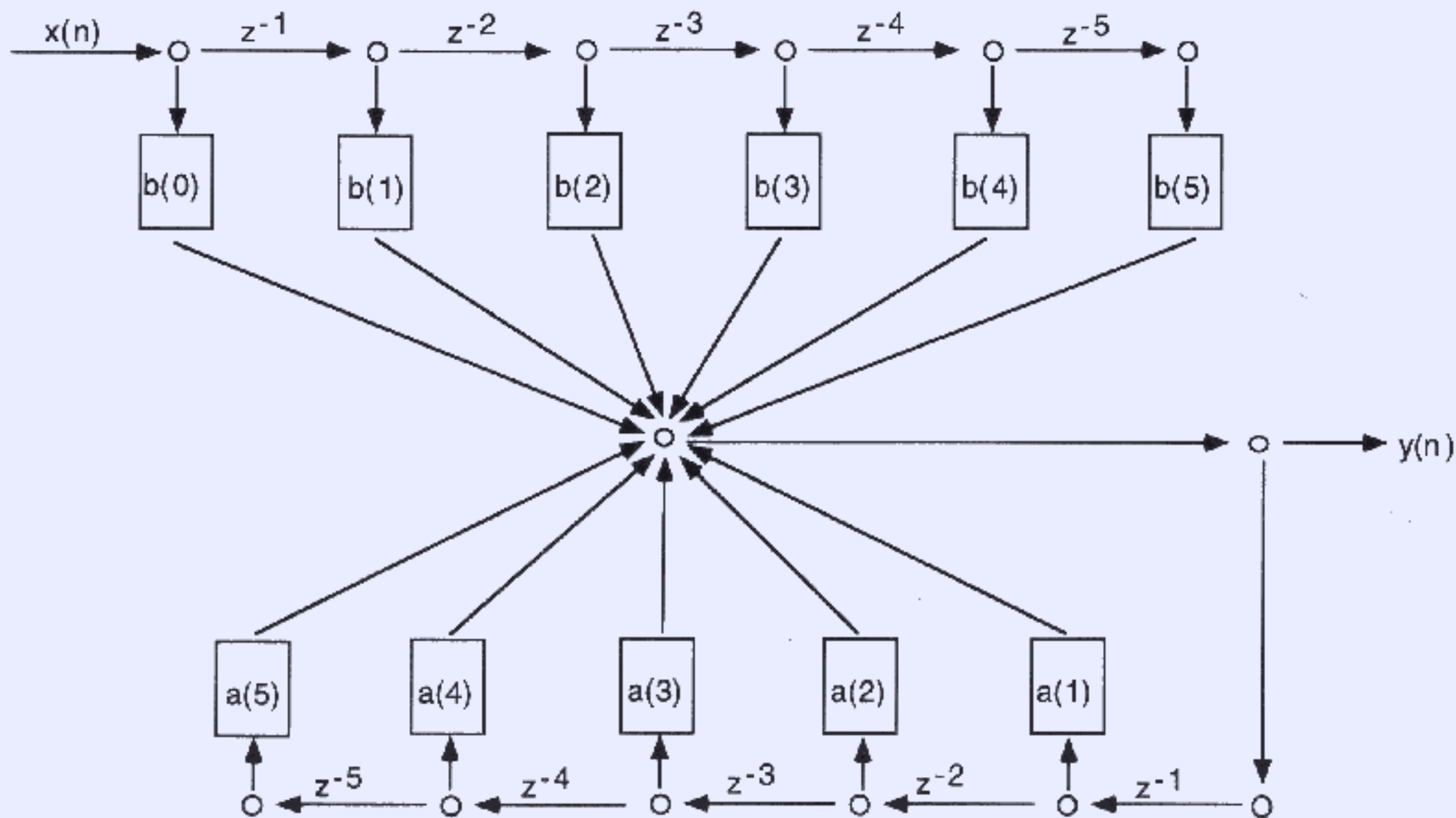
FIR filter transfer function for Filter Center Frequency=20 kHz (in red) and 30 KHz (in blue), 6 taps



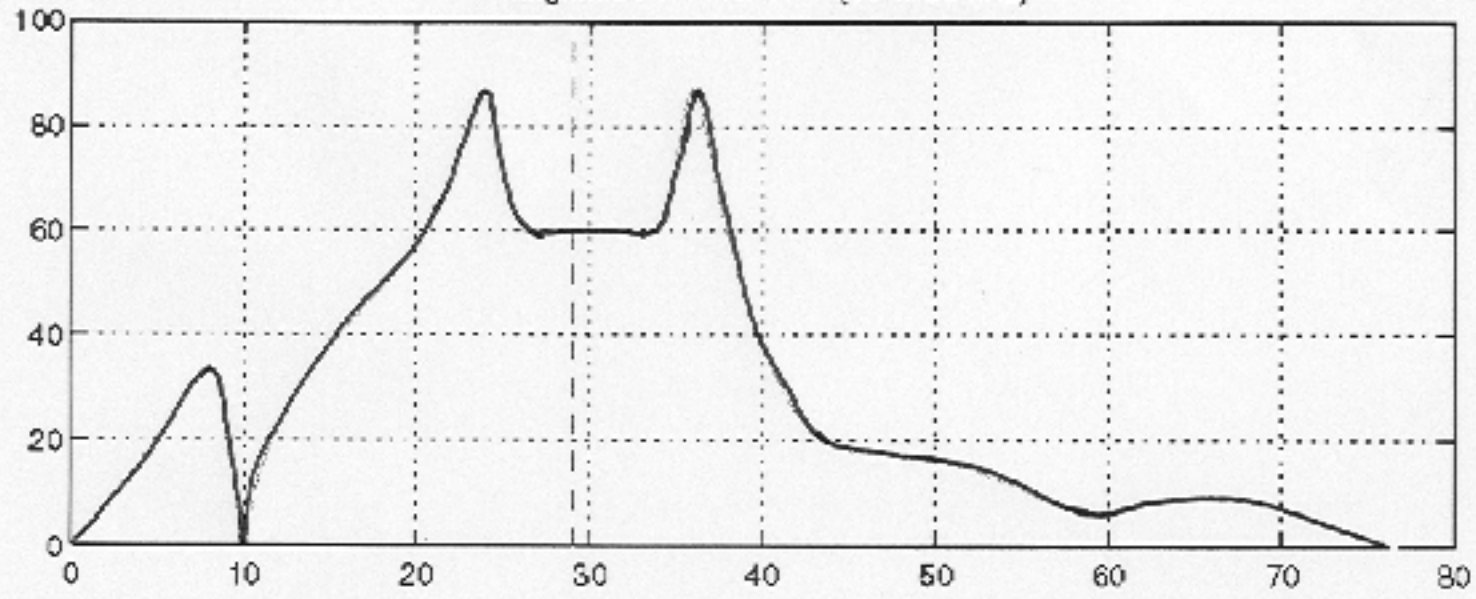
IIR (Infinite Impulse Response) filter

$$y(n] = \sum_{i=0}^N x(n-i) * b_i + \sum_{j=1}^M y(n-j) * a_j$$

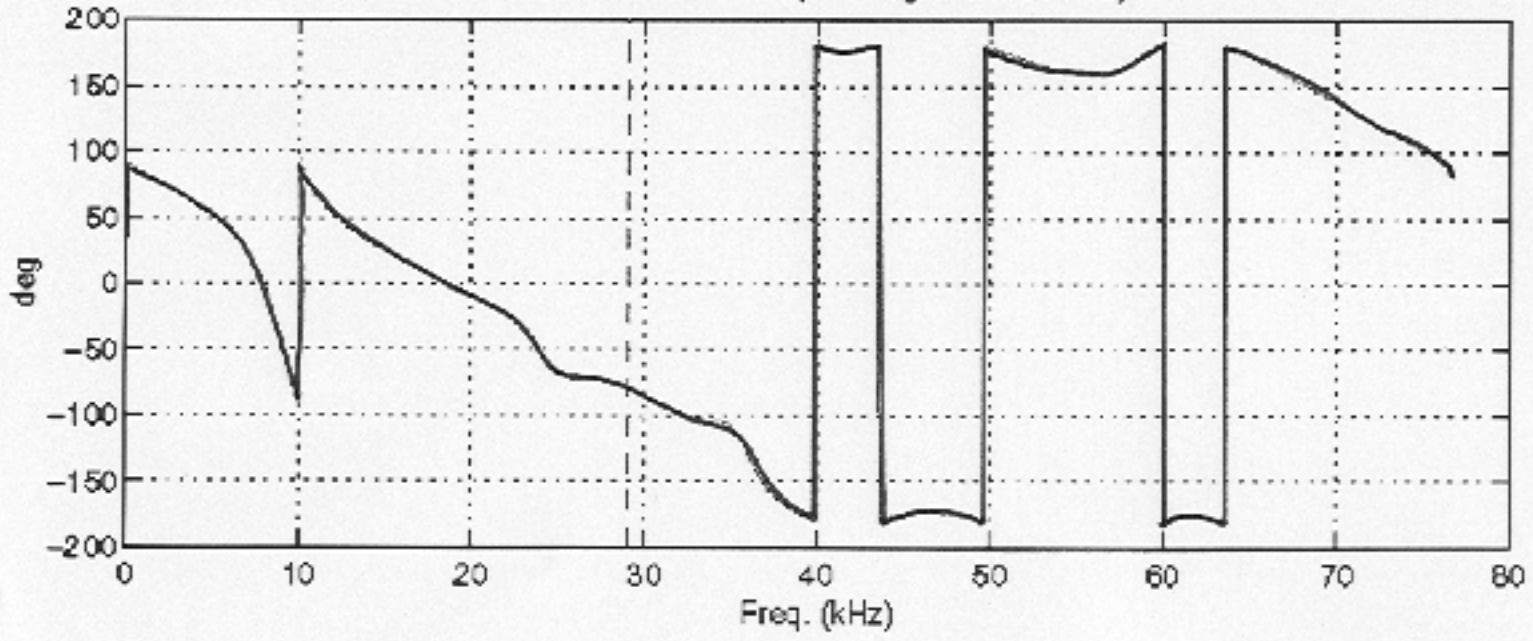
Direct Form I Implementation



Magnitude of Filter TF (60 at 29 kHz)



Phase of Filter TF (-80 degrees at 29 kHz)



Example of IR filter

by
D. Teitelman