Resonant Quadrupole Monitor

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Resonant BPM

- M. Kesselman et al - PAC 2001
- Stub-tuned 1/4 wave resonator
- Simulated in Spice
- frequency ~ 240MHz (8.5xRF)
- Q_{loaded} ~ 100 optimal coupling
- In-tunnel hybrid for Σ and Δ
- Resonate difference mode - not sum mode signal at revolution line
- Moveable - minimize difference mode signal at revolution line
- Resonate above coherent spectrum

Basic Method - Quadrupole Oscillations

Incoherent tune shift in x plane is related to measured quadrupole frequency by:

$Q_2 = 2Q_0 - (1.5-0.5a_x/(a_x+a_y))\delta Q_{inc}$

Where

Q_2 = measured quadrupole frequency

Q_0 = coherent tune

δQ_{inc} = incoherent tune shift

a_x = horizontal beam dimension

a_y = vertical beam dimension

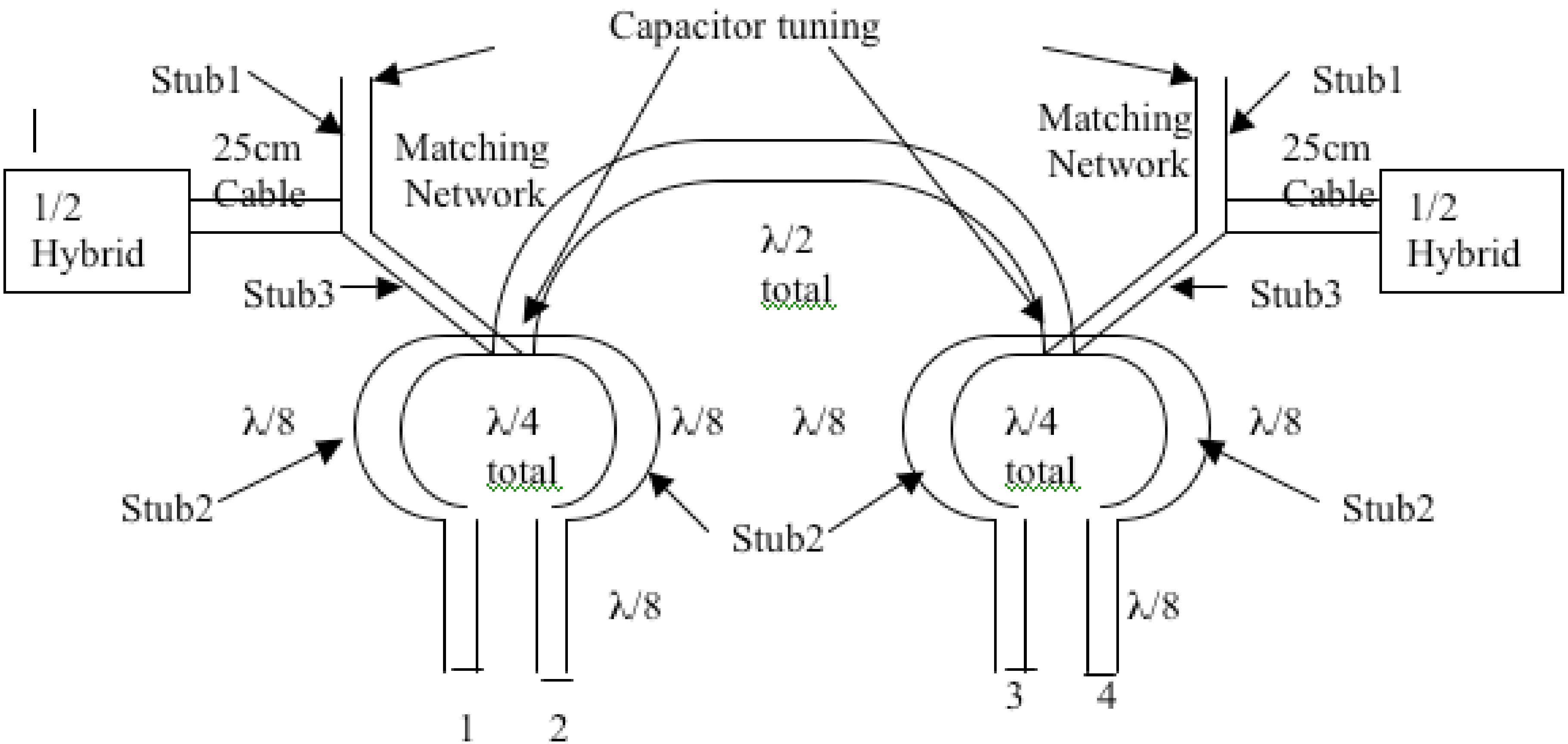
Delivers a number - rms incoherent tune spread.

In addition, Quadrupole BTF possible with this system.

Dynamic Range Problem

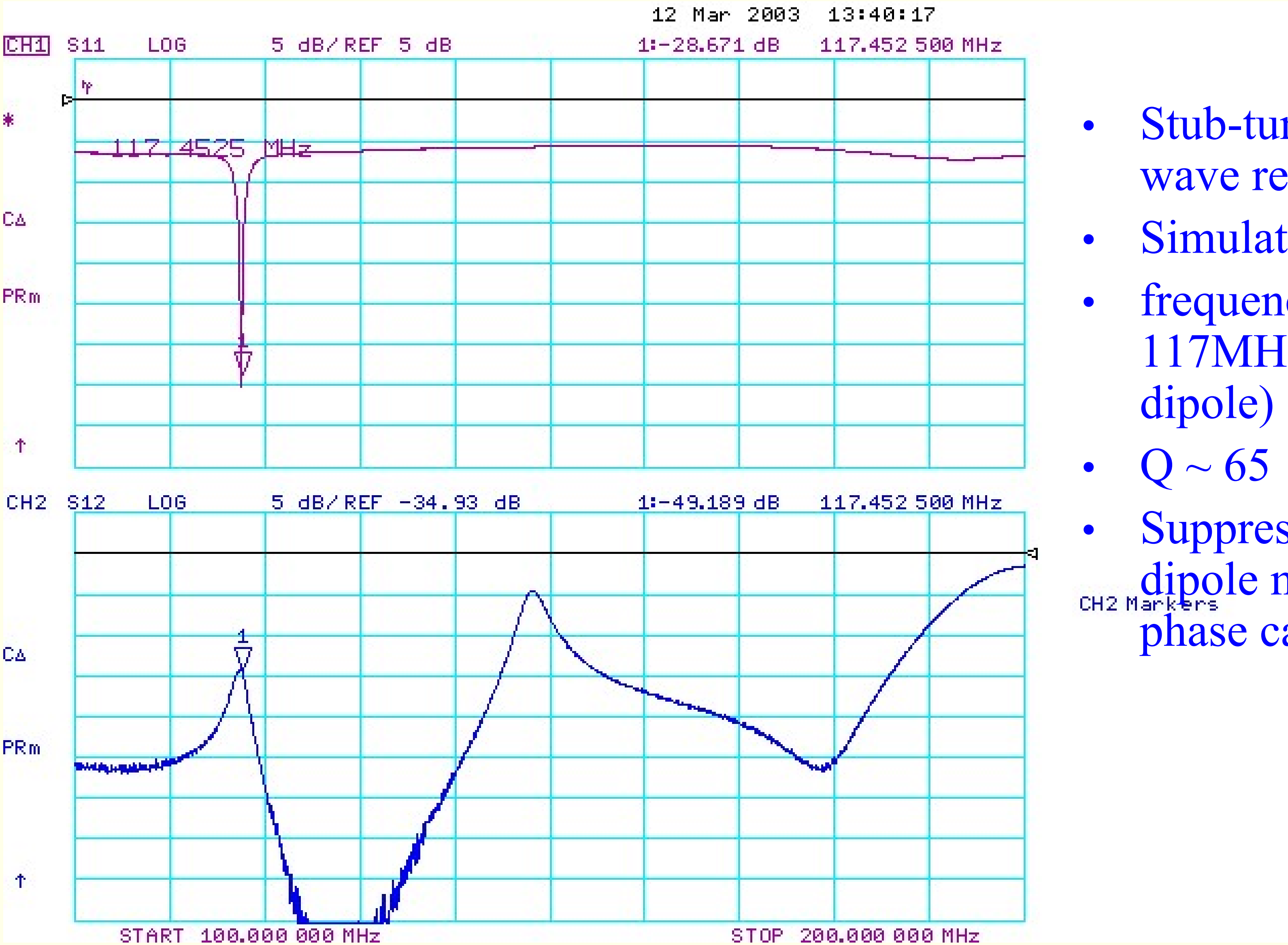
- Dynamic range problem - need to see the Quadrupole mode signal in the presence of sum and difference mode signals. The approach is
  - Excite the beam in quadrupole mode only, above the coherent spectrum to minimize sum and difference mode signals
  - Use a resonant kicker to minimize amplifier power requirement
  - Use a resonant pickup to enhance sensitivity to quadrupole mode
  - Use phase cancellation to minimize response to dipole
  - Filter, filter, filter
- SNS Ring beam is large compared to aperture - this is a big help

Resonant Quadrupole Plumbing



General Tuning Scheme

Quadrupole mode resonance



- Stub-tuned 1/8 wave resonator
- Simulated in Spice
- frequency ~ 117MHz (~ .5 x dipole)
- Q ~ 65
- Suppression of dipole mode via phase cancellation

Instability Data