Sound System Calibration

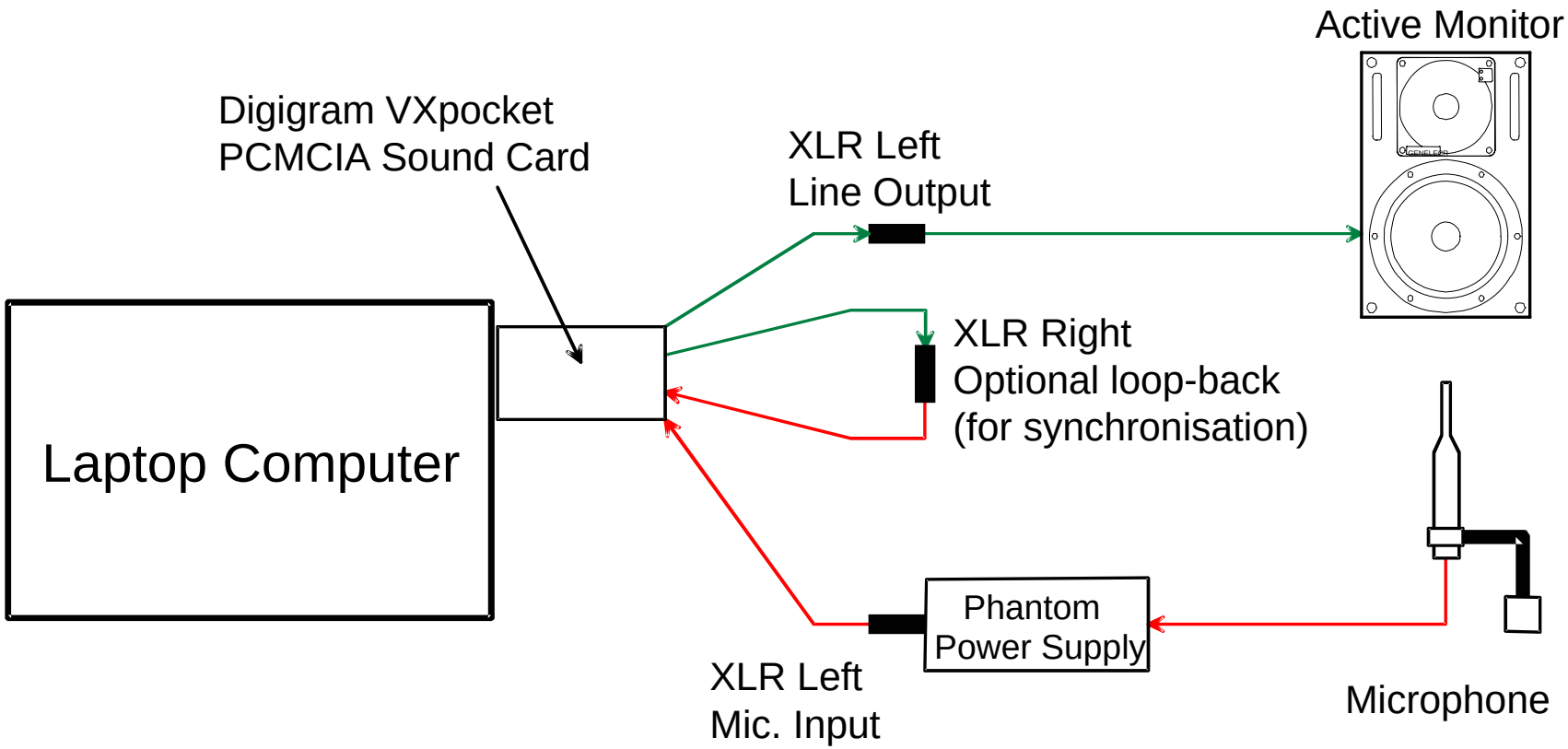
Example - Performing
Monitor Calibration
in Studios

Introduction

- Setting up the measuring equipment
- Ambient sound levels
- The effect of reflections
- Impulse and Frequency Responses
- Acoustical problems in rooms
- Reflection diagnosis & causes of reflections
- Tone controls on different monitors
- Calibration standard
- Practical calibration of monitors
- Subjective evaluation

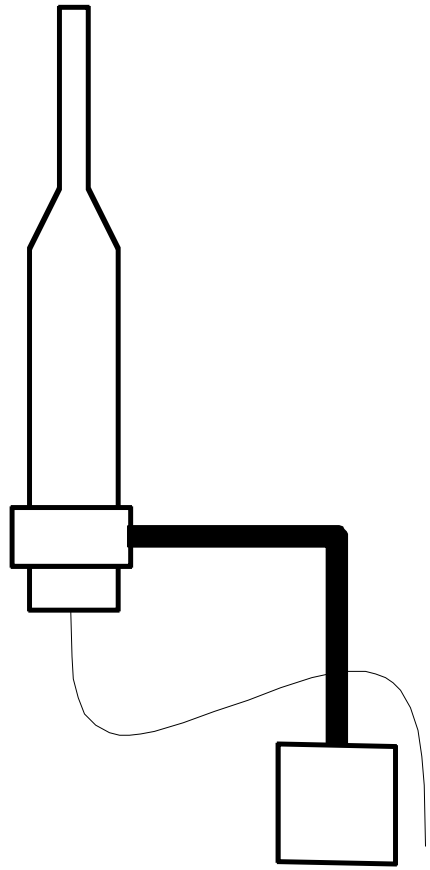
Connecting the Measuring System

- example of equipment.



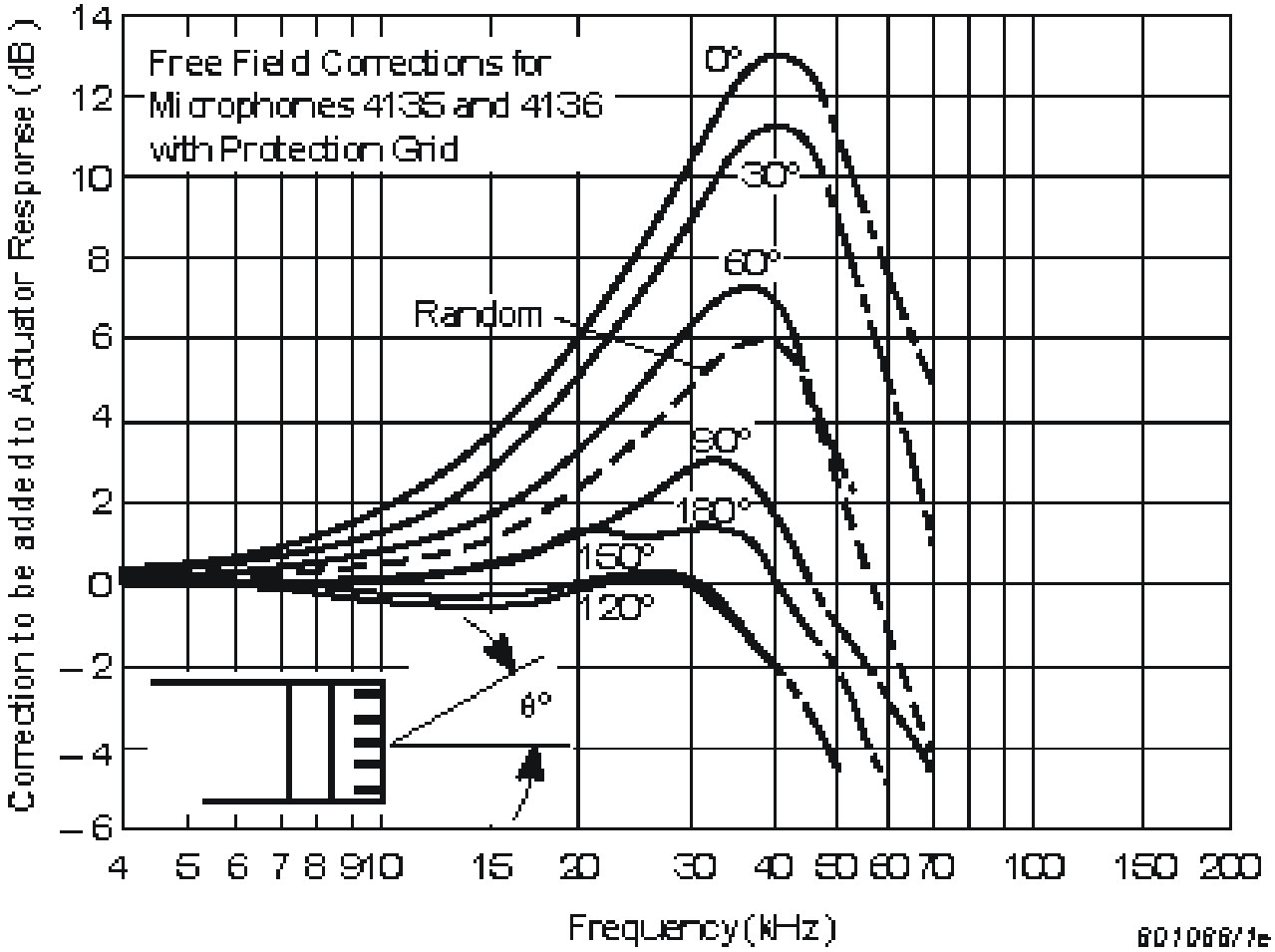
Positioning the Microphone

- At the listening position
- At average ear height (1.4m)
- Vertically NOT horizontally
- On a good microphone stand



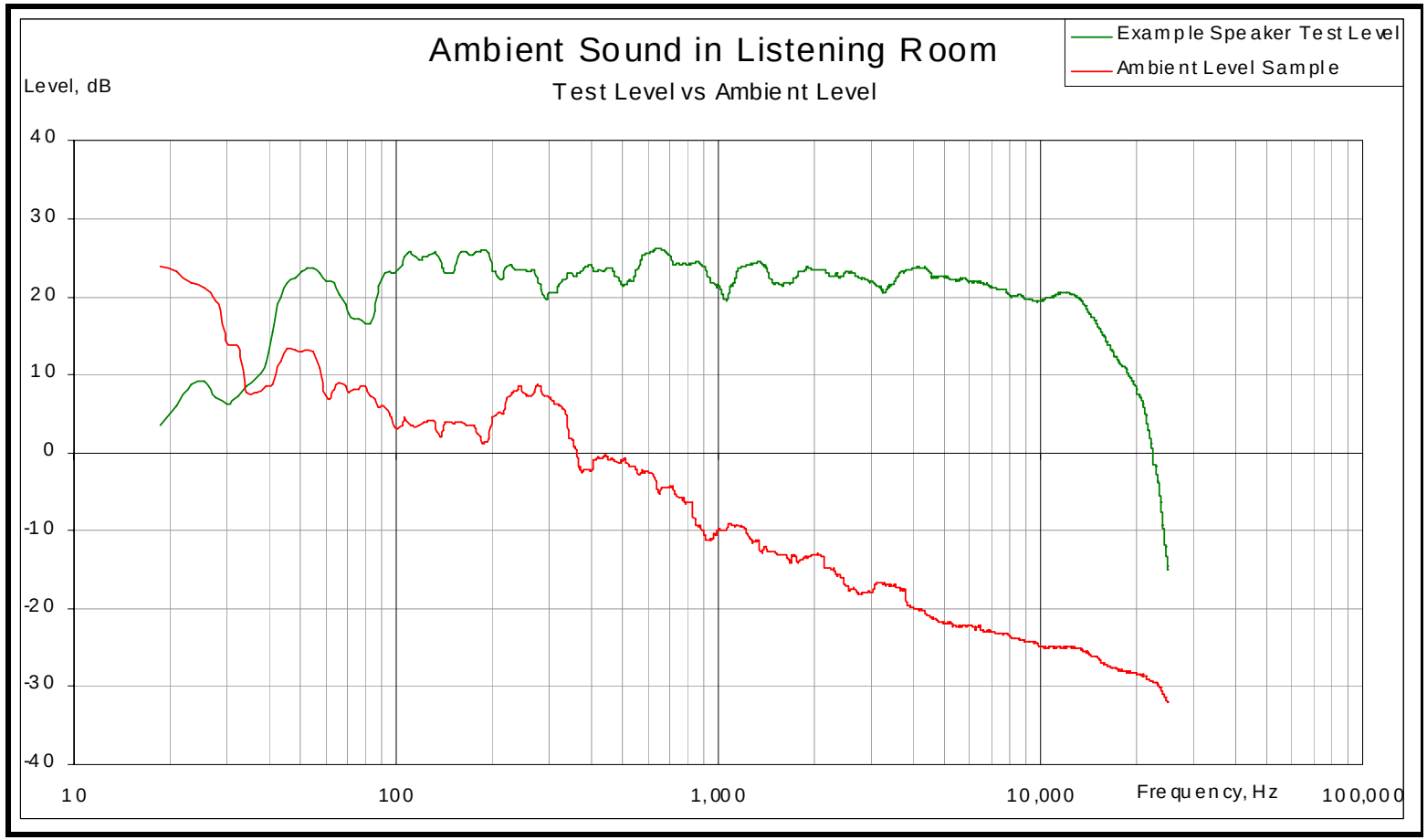
Morset Sound Development

Why is the microphone angled at 90º

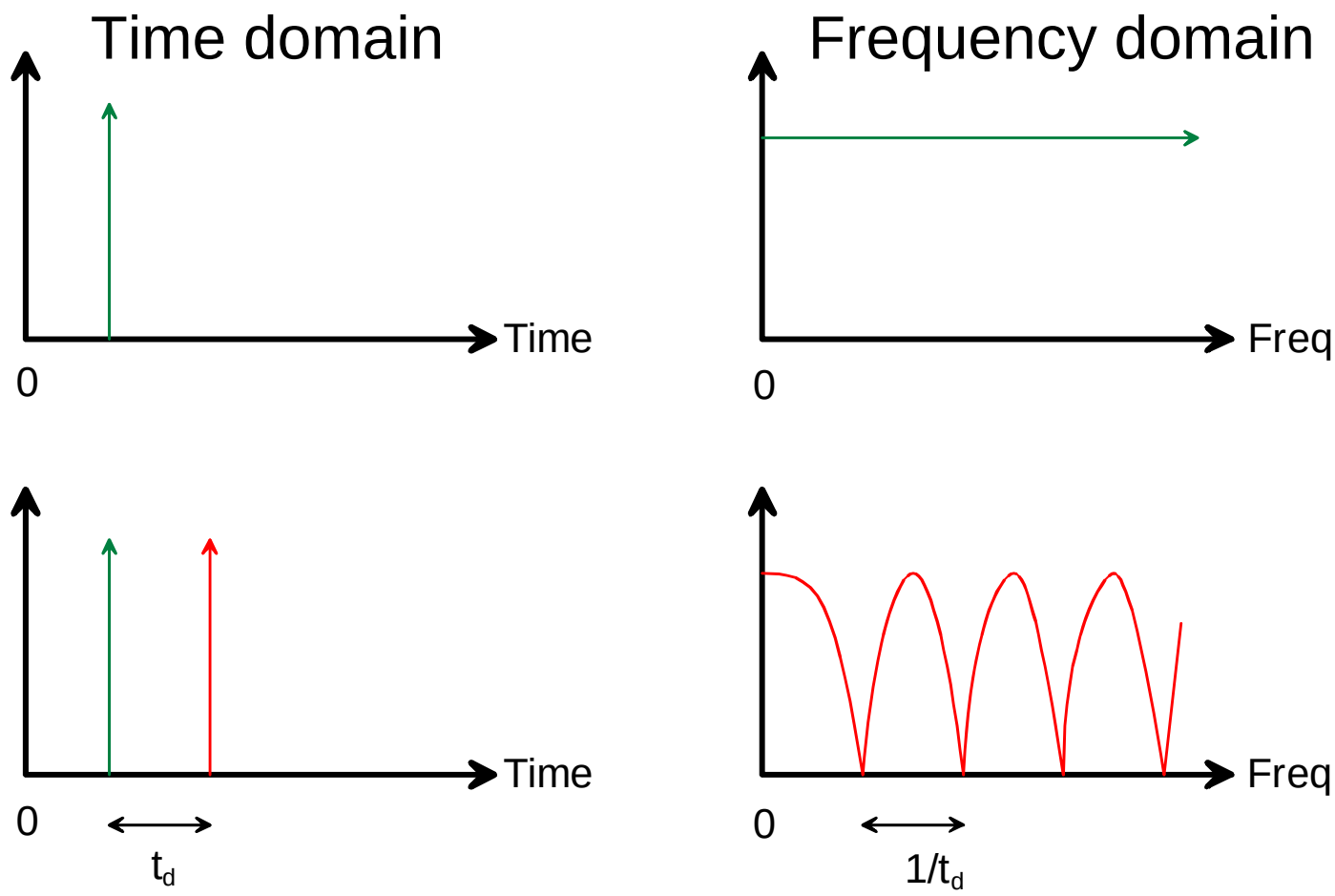


Ambient Sound Level

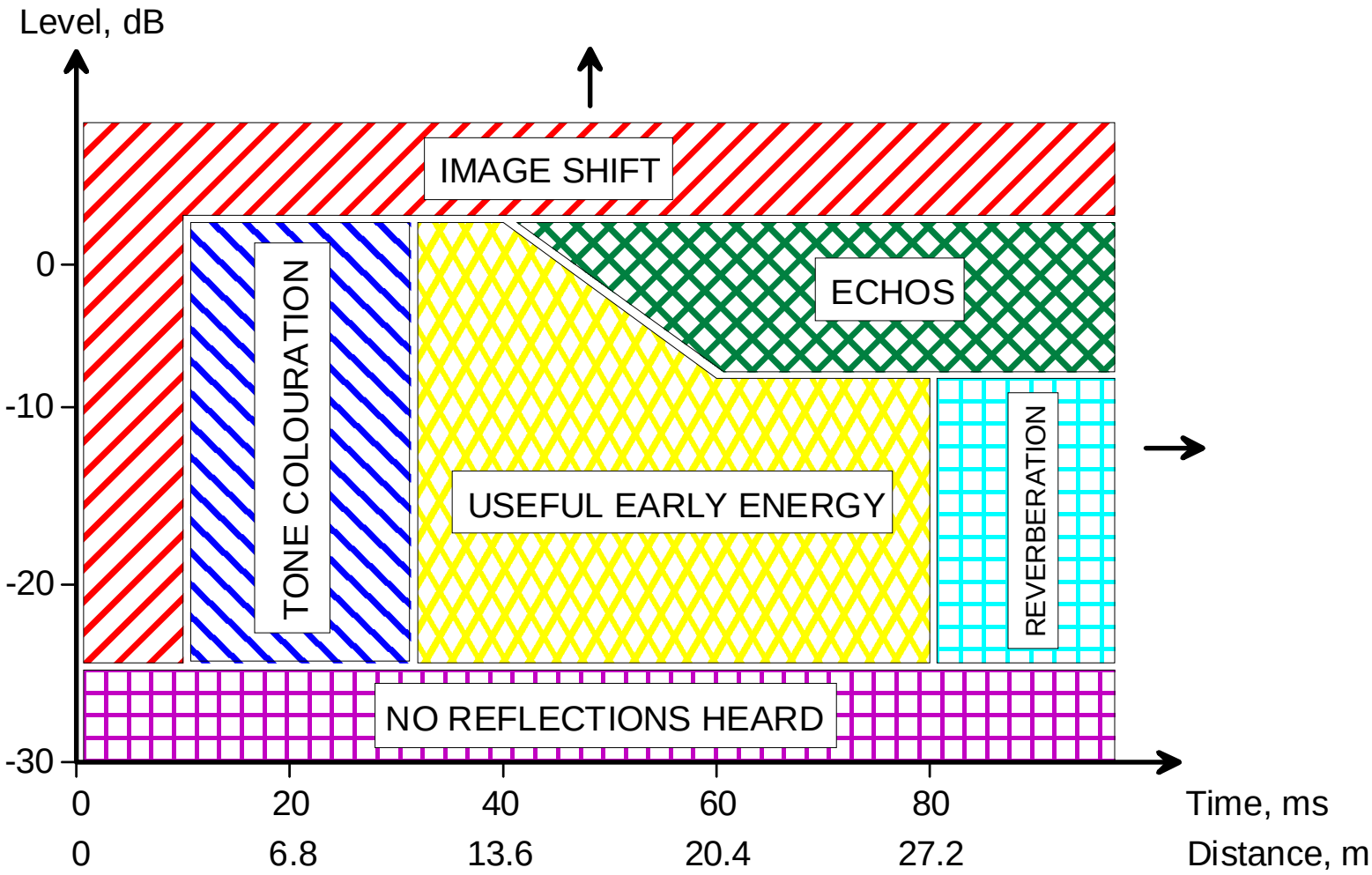
(Signal-to-Noise Ratio)



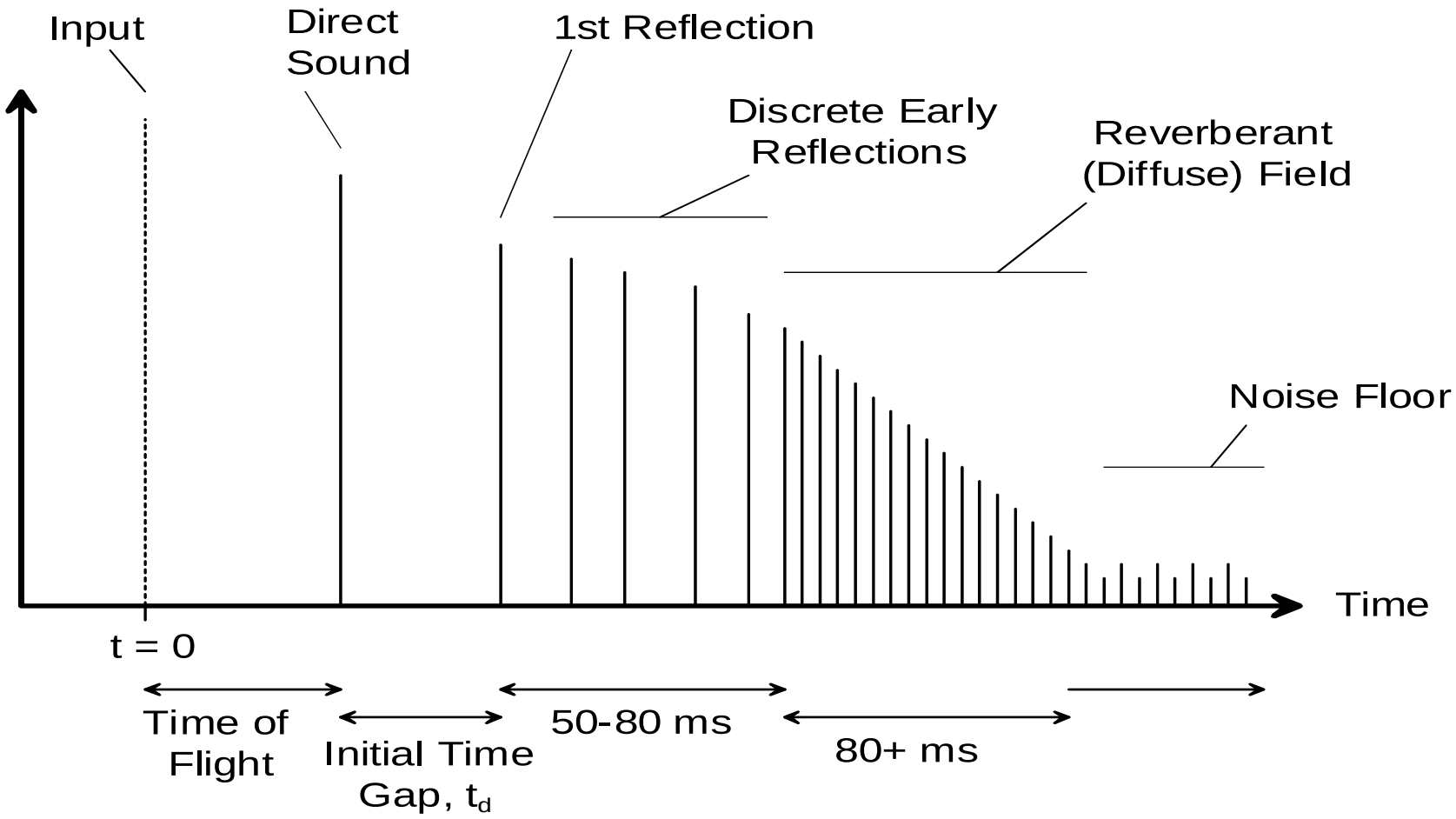
The Effects of Reflections



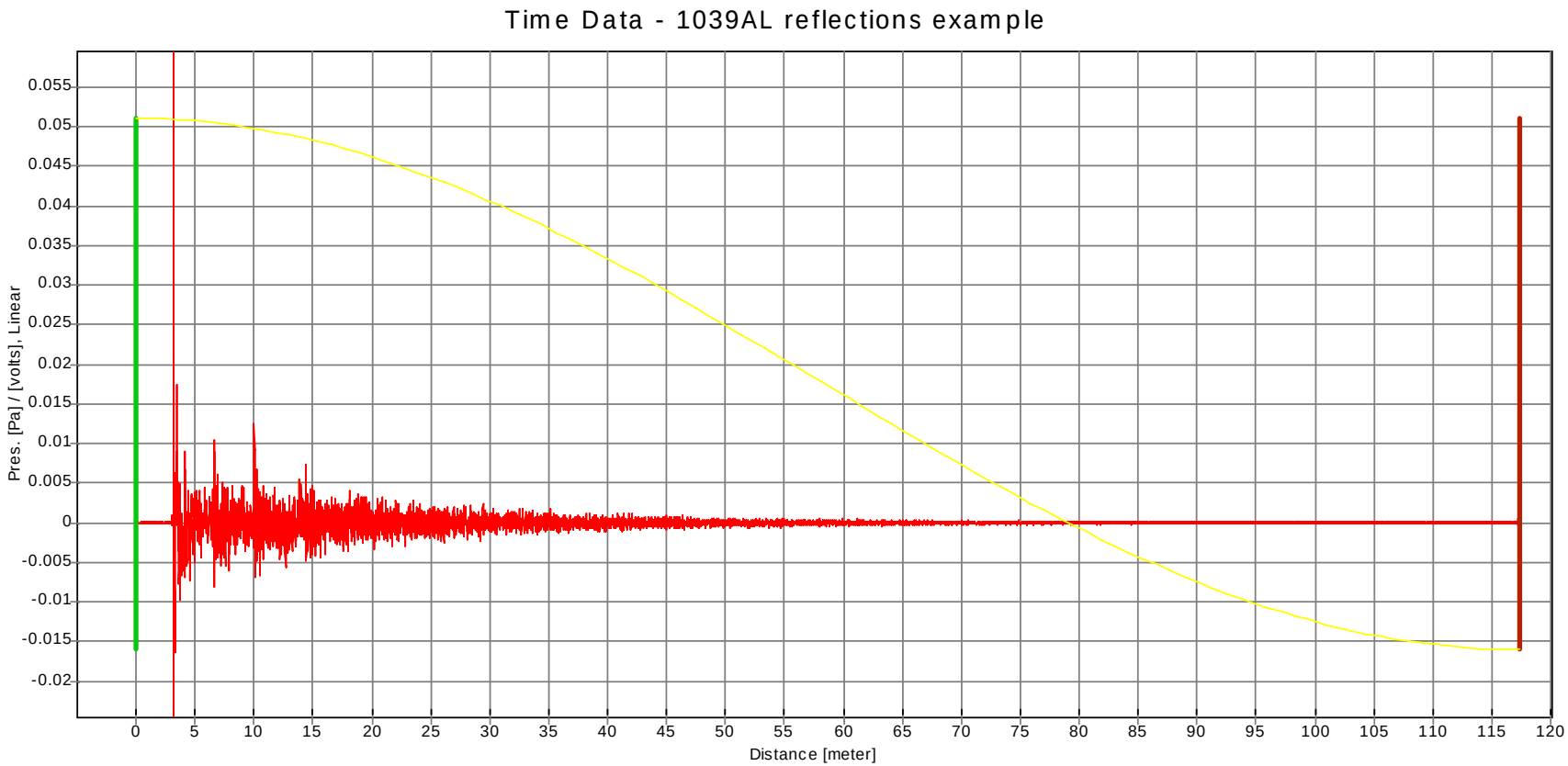
Subjective Perception of Reflections



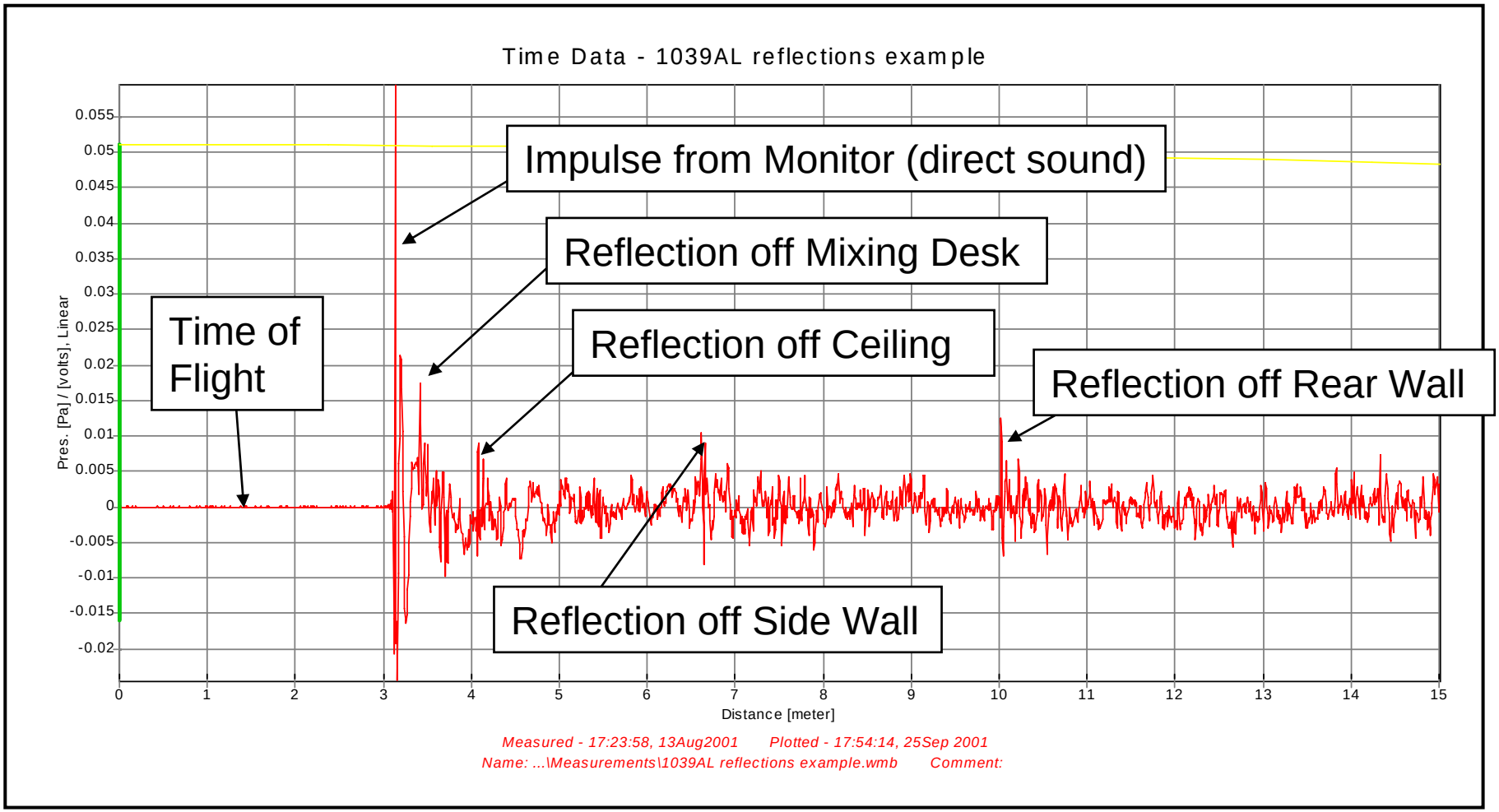
Room Impulse Response



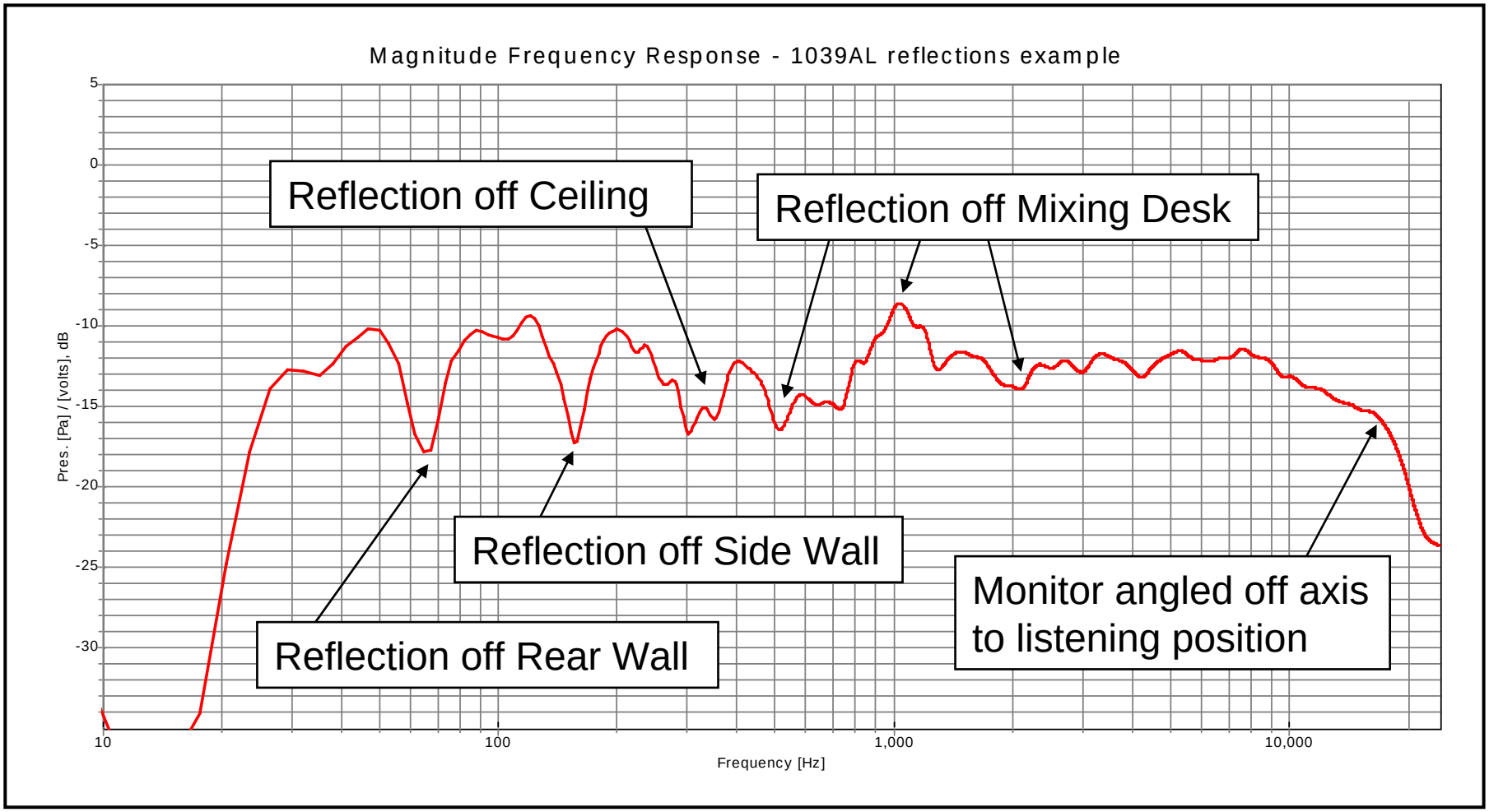
Typical Studio Impulse Response



First 15m (44ms) of the Impulse Response



Reflections in the Frequency Domain



Typical Acoustical Problems

Front Wall and Floor

- Front wall should have no discontinuities (the front glass window, doors, etc. should all be flush)
- When less than 1.2m from the floor, floors reflections can dominate
- Bass trapping can be implimented in the front wall but beware of the ¼ wavelength cancellation with the hard wall behind the monitors
- Main monitors are usually mounted with a vertical angle of about 15º - 20º

Typical Acoustical Problems

Console, Equipment and Furniture

- First order reflection off the mixing console surface creates a dip around 1 – 3kHz. Vertical positioning of 2-way is necessary in all cases
- The ¼ wavelength cancellation with the hard wall behind the monitors is often a problem with near-field monitors
- Meter bridge, large tables, computer monitors and racks all create ripples and comb filtering in the mid band
- Computer monitors should be tilted and mounted into the furniture. Flat screens are acoustically better
- Open furniture is acoustically more transparent

Typical Acoustical Problems

The Ceiling and the Side Walls

- Hard reflective ceilings close to the monitors create strong reflections. Bumps and dips can be seen around 3 – 5kHz
- Ceiling construction close to the monitors should not induce first order reflections

- Various design philosophies exist for side wall construction but symmetrical treatment is essential

Typical Acoustical Problems

Control Room Layout Recommendation

- No control room design should have parallel walls
- No control room should be installed in a ’shoe box’ type rectangular room. Standing waves will be hard to control
- All equipment in the room should be placed in a symmetrical layout arrangement
- Enough (thick) damping material should be built in the trapping to handle very low frequency absorption

Typical Causes of Cancellations in Studios

• 3kHz – 5kHz	Compression ceiling
• 1kHz – 3kHz	Mixing console
• 250 Hz – 1kHz	Furniture, etc
• 70 Hz – 250Hz	Floor
• Under 200Hz	Rear wall of studio?
	Side walls of studio?
	Wall behind monitor?

Diagnosis of the Causes of Reflections

- Move the microphone about 30-40 cm in one direction at a time
  - Left / Right … side wall reflections
  - Up / Down … floor / ceiling reflections
  - Forwards / Backwards … rear wall reflection
- No change indicates *monitor* rear wall reflection
- Dip moves down indicates longer path length
- Dip moves up indicates shorter path length

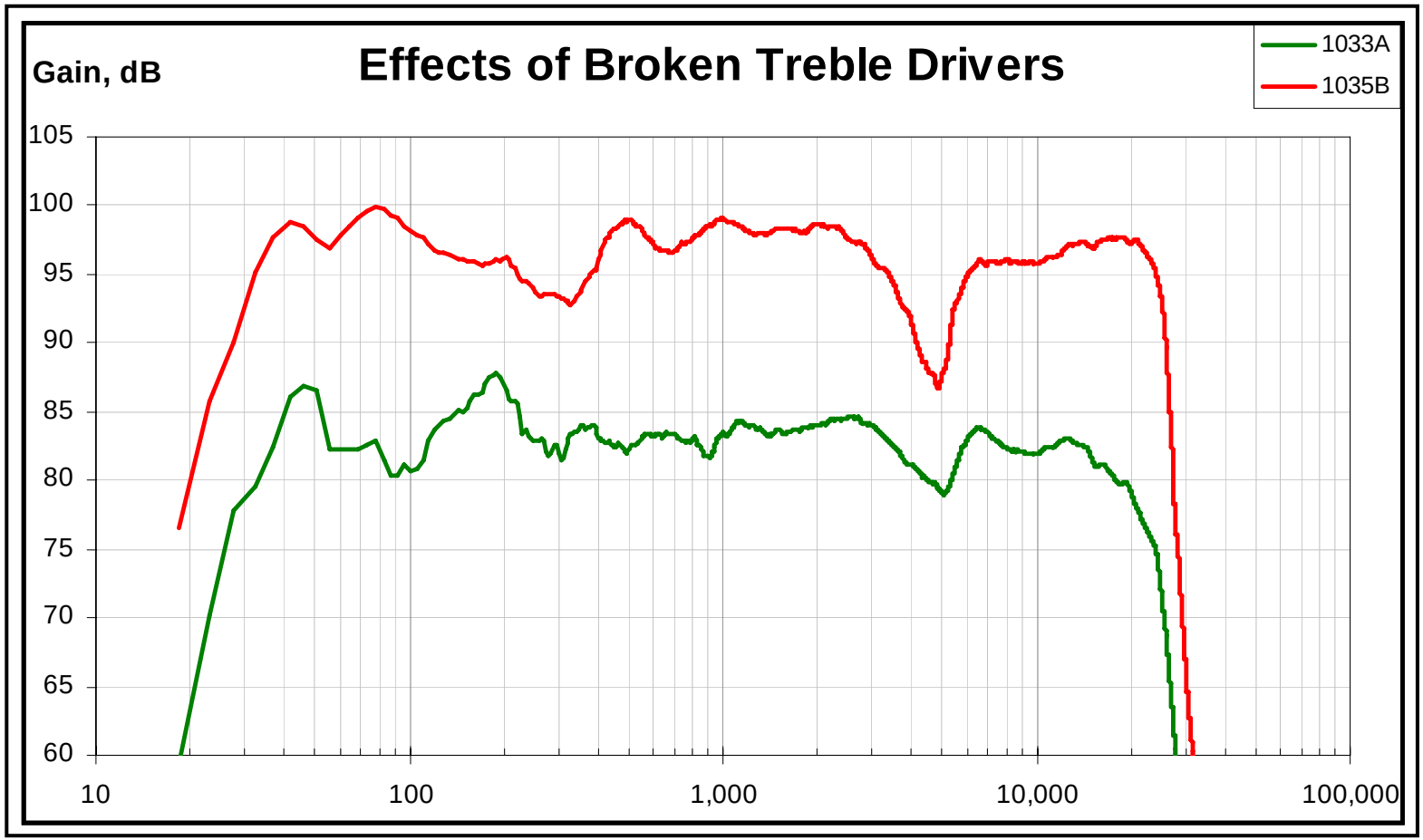
Calibration Standard

- High quality monitor design tolerance is **+/-2.5dB** over the whole pass band when measured in anechoic conditions
- This **can** also be achieved in a good studio with well controlled acoustics
- The calibration target is to fit the whole bandwidth of the frequency response **within a 5dB window**
- WinMLS lets you overlay a 5dB guideline

Calibration Standard

- WinMLS system gives you about 80% of the information about the calibration
- The listening process (about 20%) lets you check for colouration, harshness, unfocused imaging, tonal changes etc
- The monitor balance has to be right at the mix position where the engineer does most of his/her work

Broken Tweeters



Subjective Evaluation of Calibration

- Use a large variety of source materials:
  - Orchestral, Big Band, Female vocal, rock, etc.
- Listen for the following:
  - Smooth bass with no obvious bumps or holes
  - Bass content should not mask vocals & guitars
  - No upper midrange hardness at high SPL
  - Midrange & HF in balance

Calibrations Session Summary

- Remove the obvious causes of reflections to get a better response with less ripple
  - Move the monitors around in the room
  - Move equipment around in the room
  - Recommend appropriate acoustic treatment (maybe?)
- Move the microphone to find the source of reflections
- Tone controls are for acoustical loading correction and do not solve the problems of poor acoustical design
- Reflections **CANNOT** be equalised out using tone controls
- The calibration standard is +/- 2.5dB

Conclusions

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