Calorimeter Upgrade Meeting

Analog Electronics
COTS design

14/oct/2011

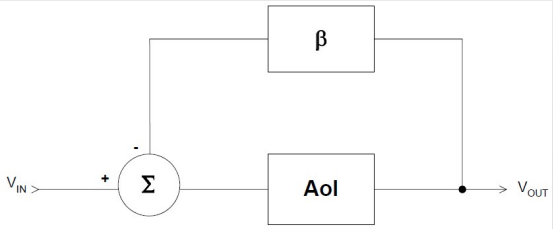
COTS status

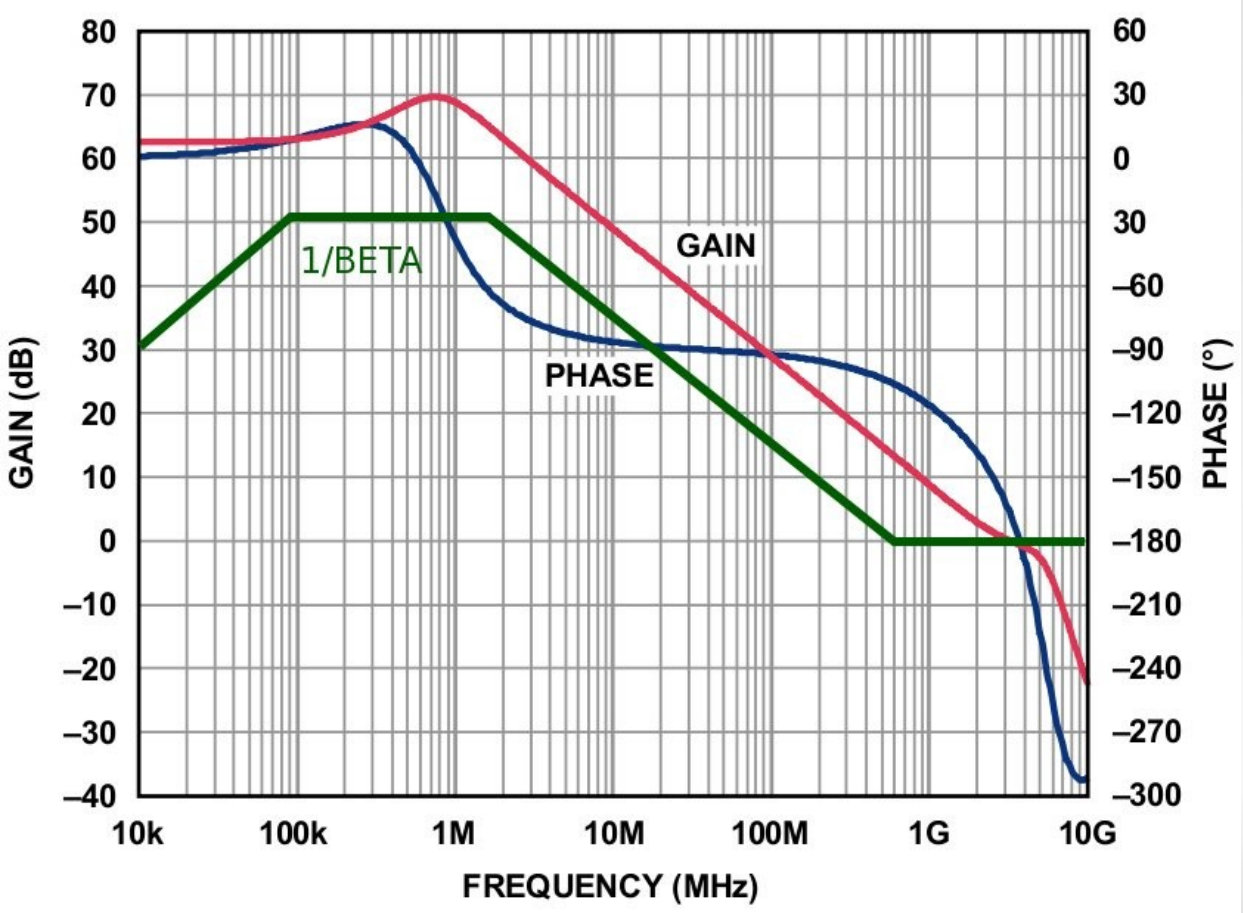
- Integrator Oscillations
- Measurements
  - Input Stage
  - Clipping Stage
  - Integrating Stage
- Conclusions/Ideas

Integrator Oscillations

Integrator Oscillations

- $A_{OL} \cdot \beta \neq -1 \rightarrow A_{OL} \neq -1/\beta$
- ADA4930
- Calculate 1/β with all parasitic effects
- Nearly No Phase Margin

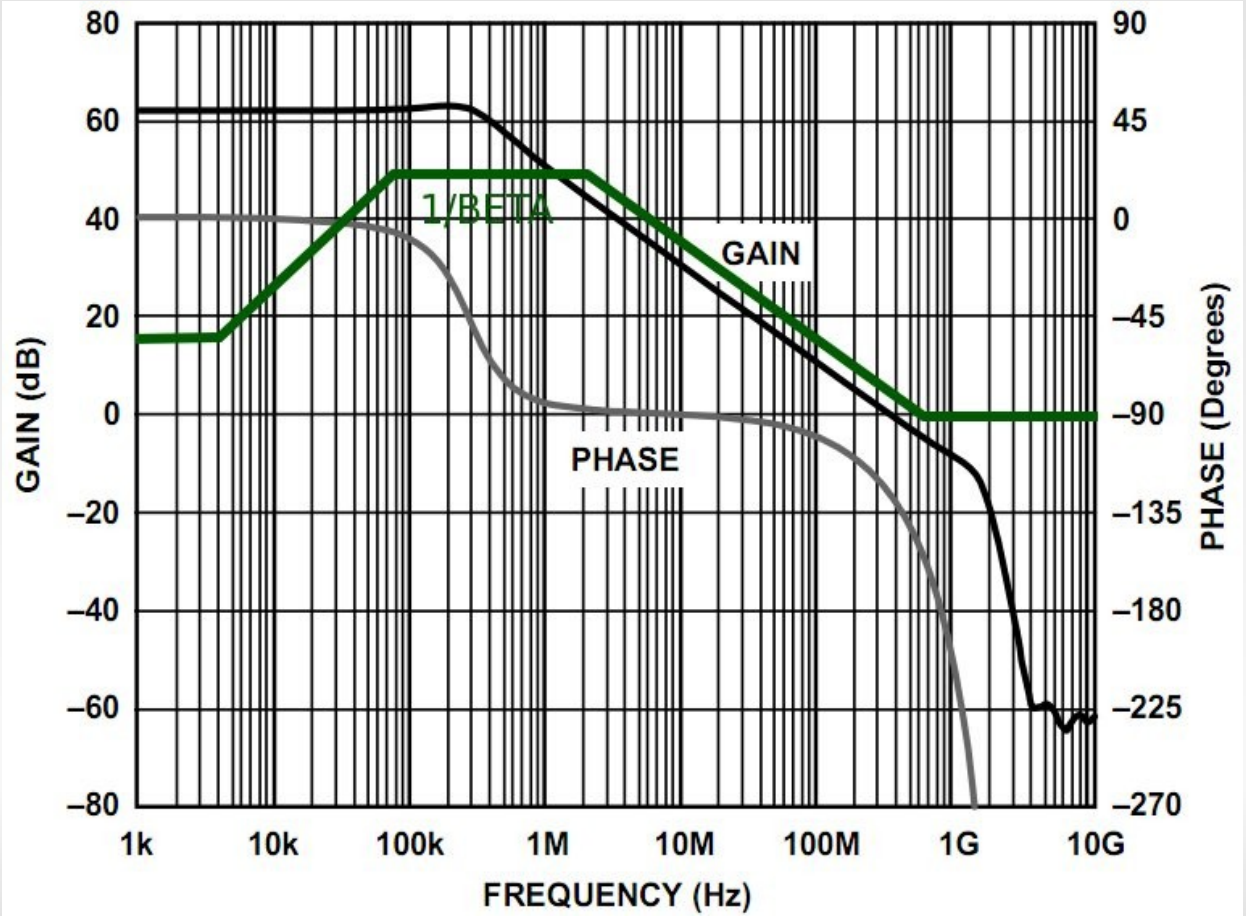




Integrator Oscillations

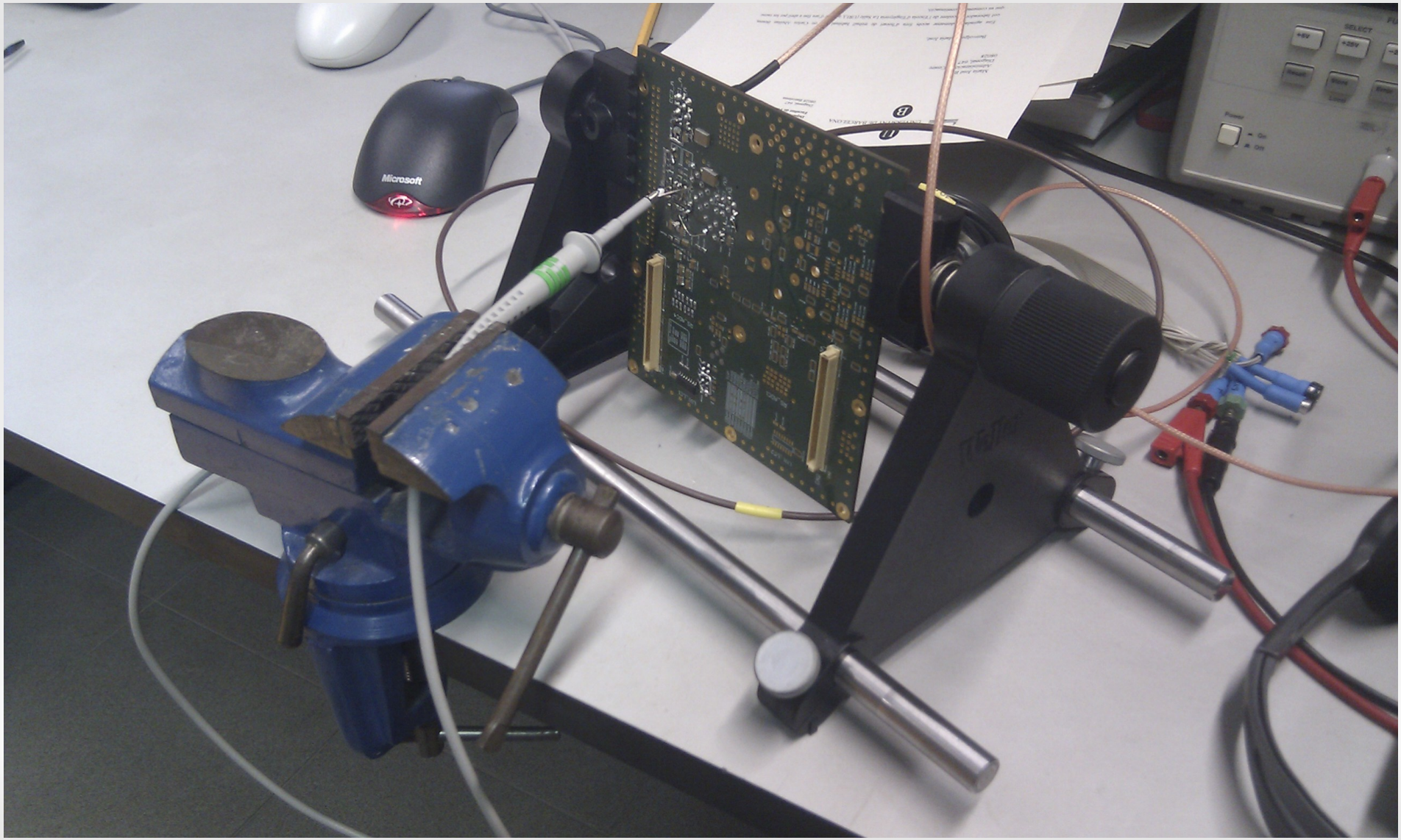
Chage for other model looking for stability...

- ADA4932
  - First Order Calculation OK!!
  - Real Life Measure OK too (later shown)
  - No more oscillations



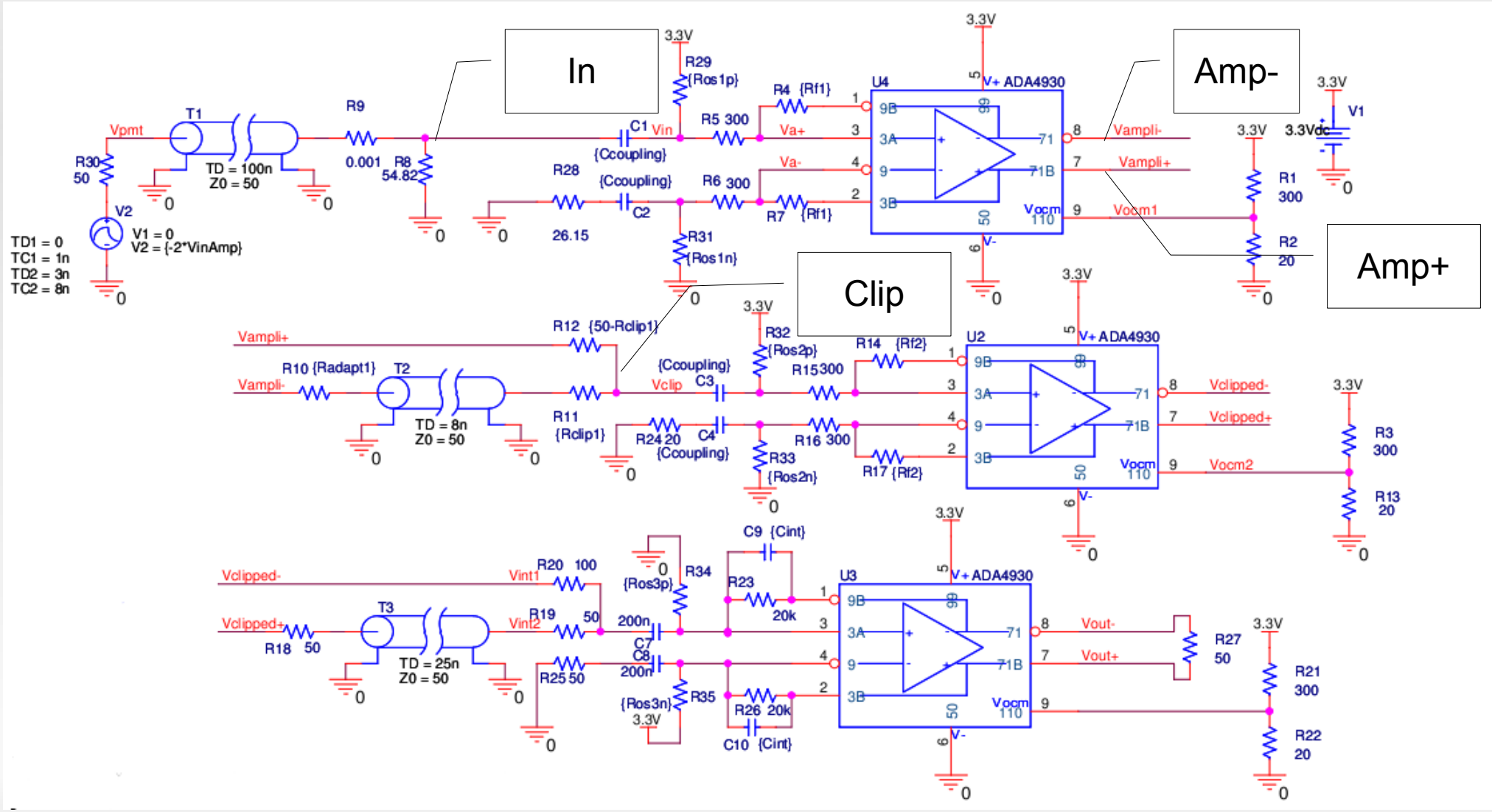
Measurements

- No oscillations → Continue work → Measurements



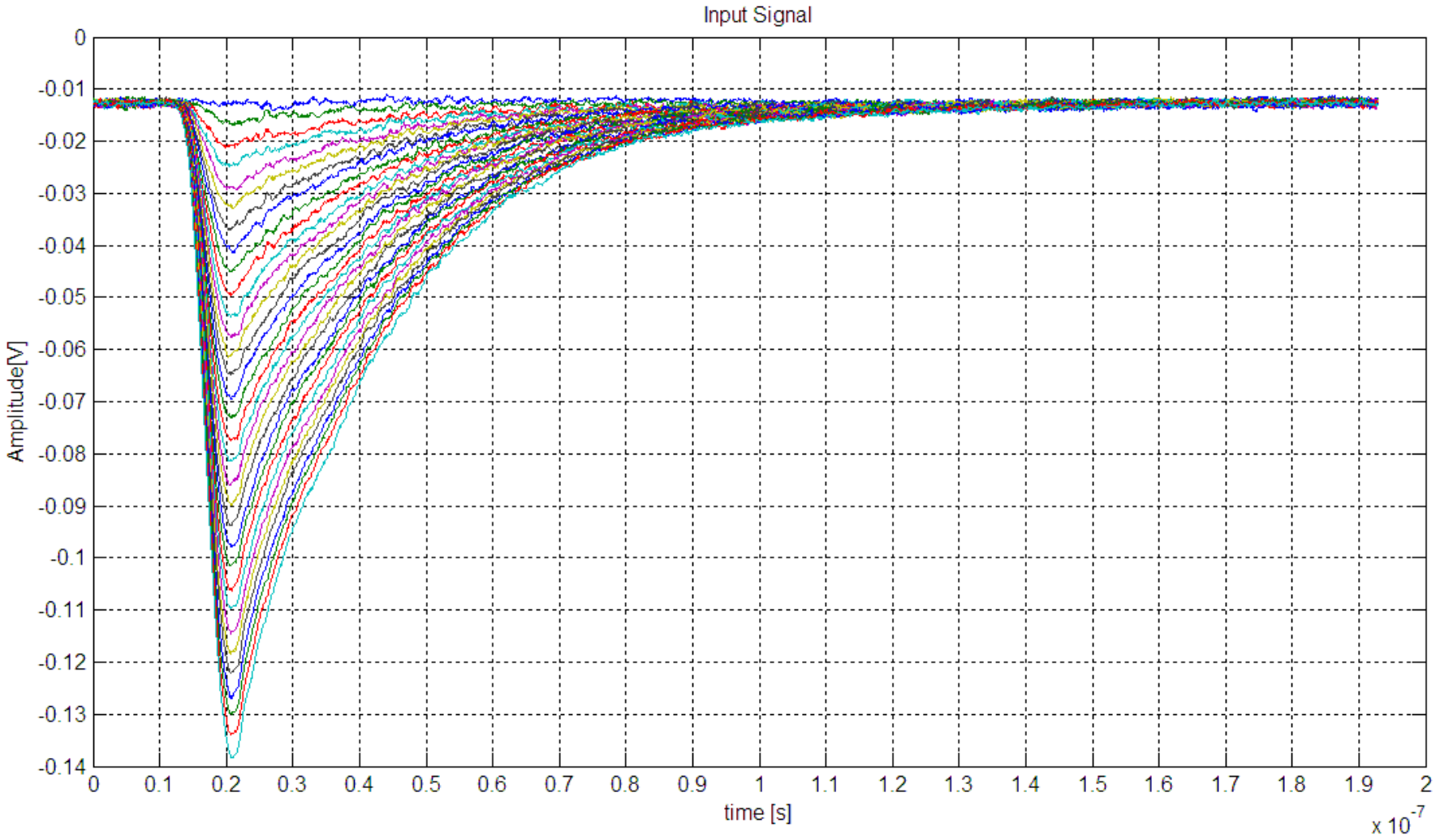
Measurements INPUT STAGE

- Input Stage Measurements



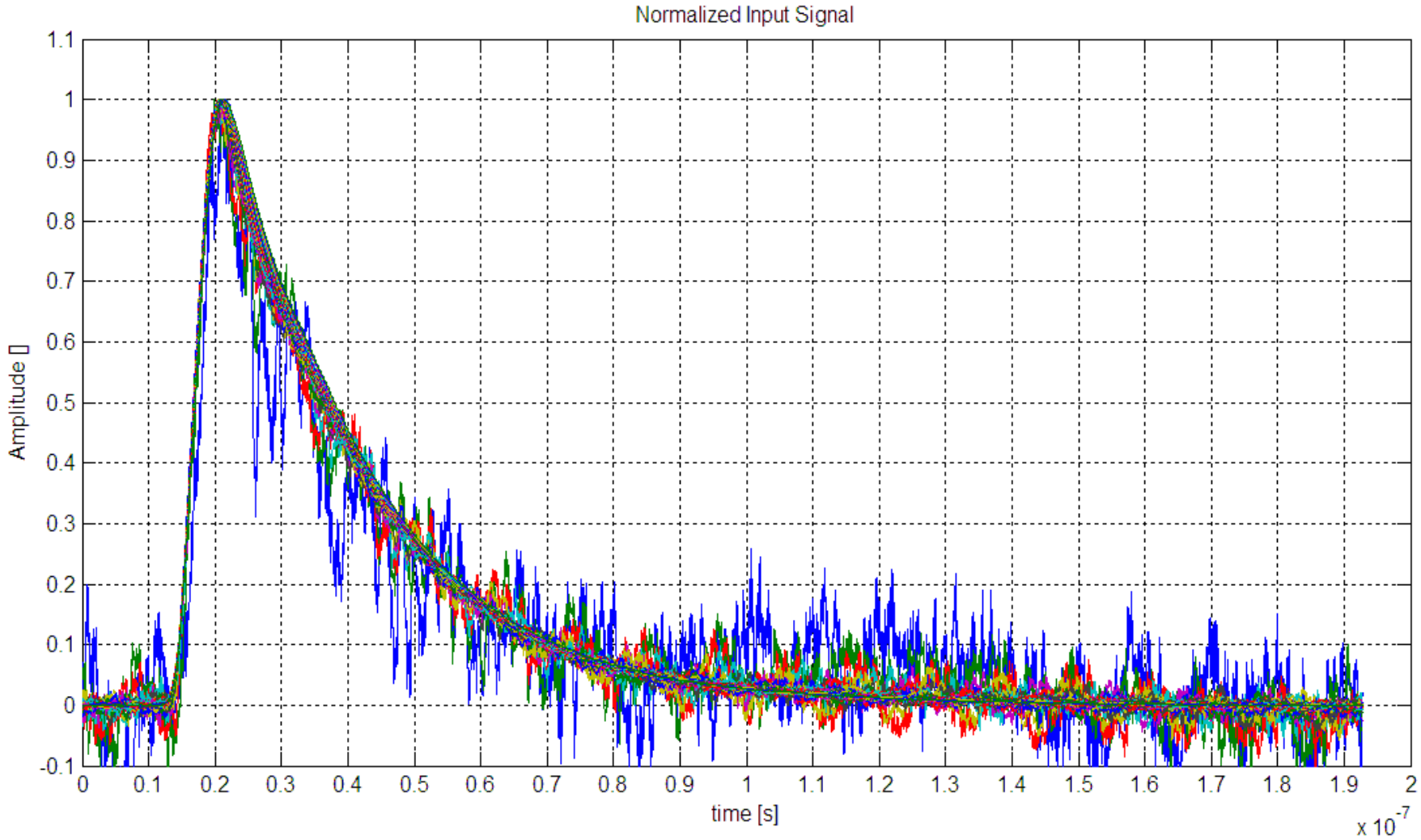
Measurements INPUT STAGE

- Input RAW DATA



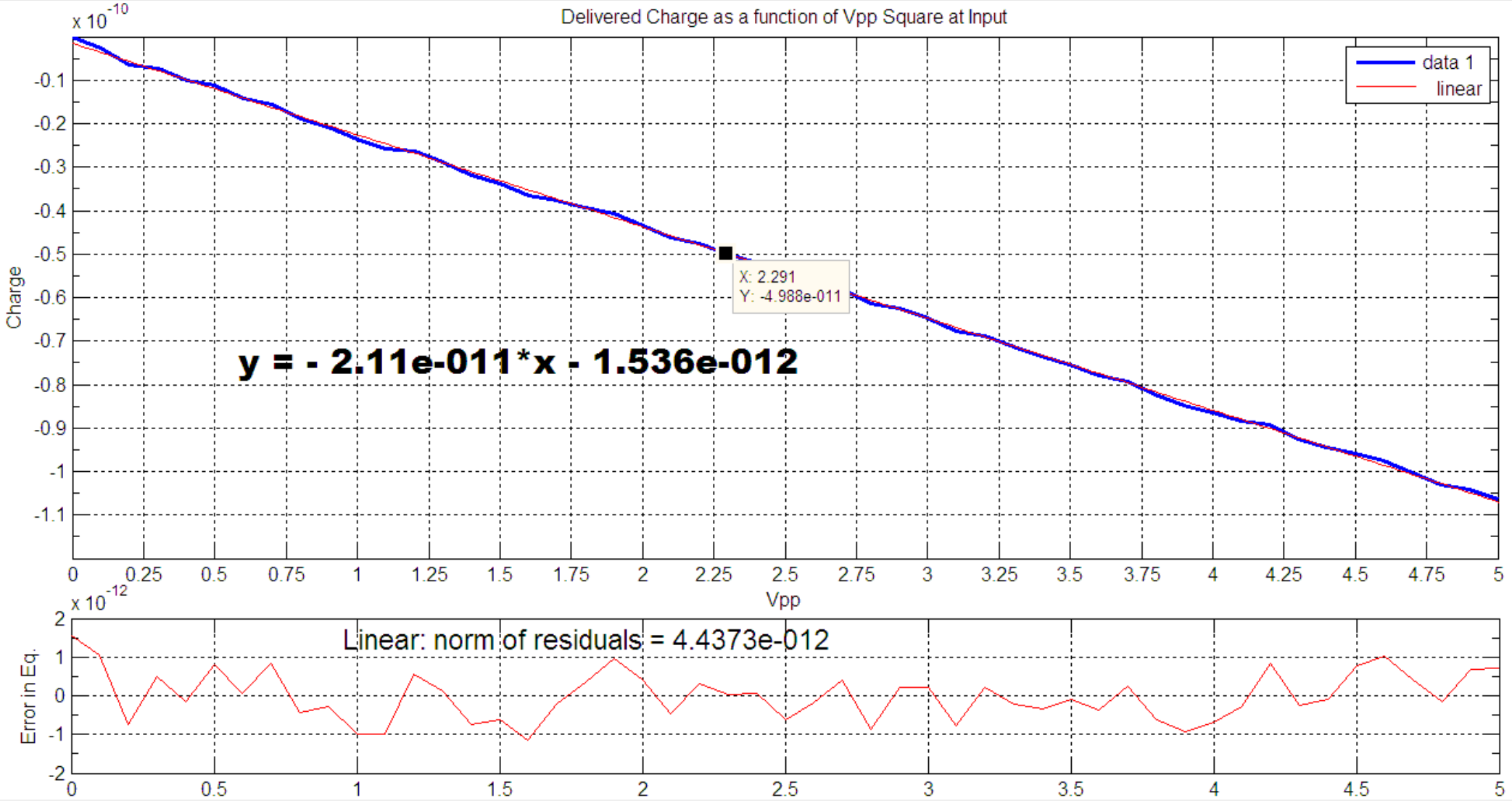
Measurements INPUT STAGE

- Input Normalized (SHAPE)



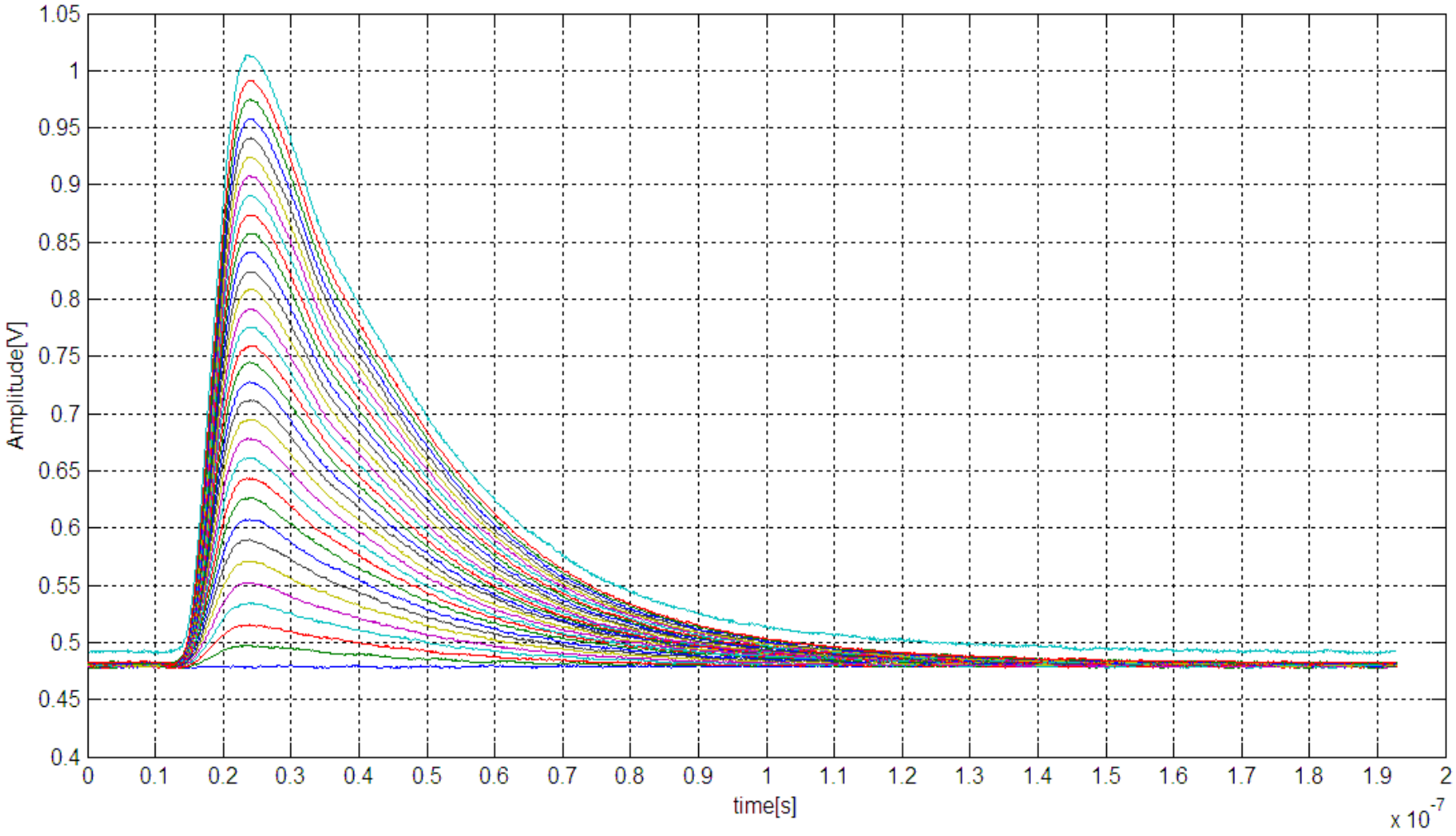
Measurements INPUT STAGE

- Input Linearity



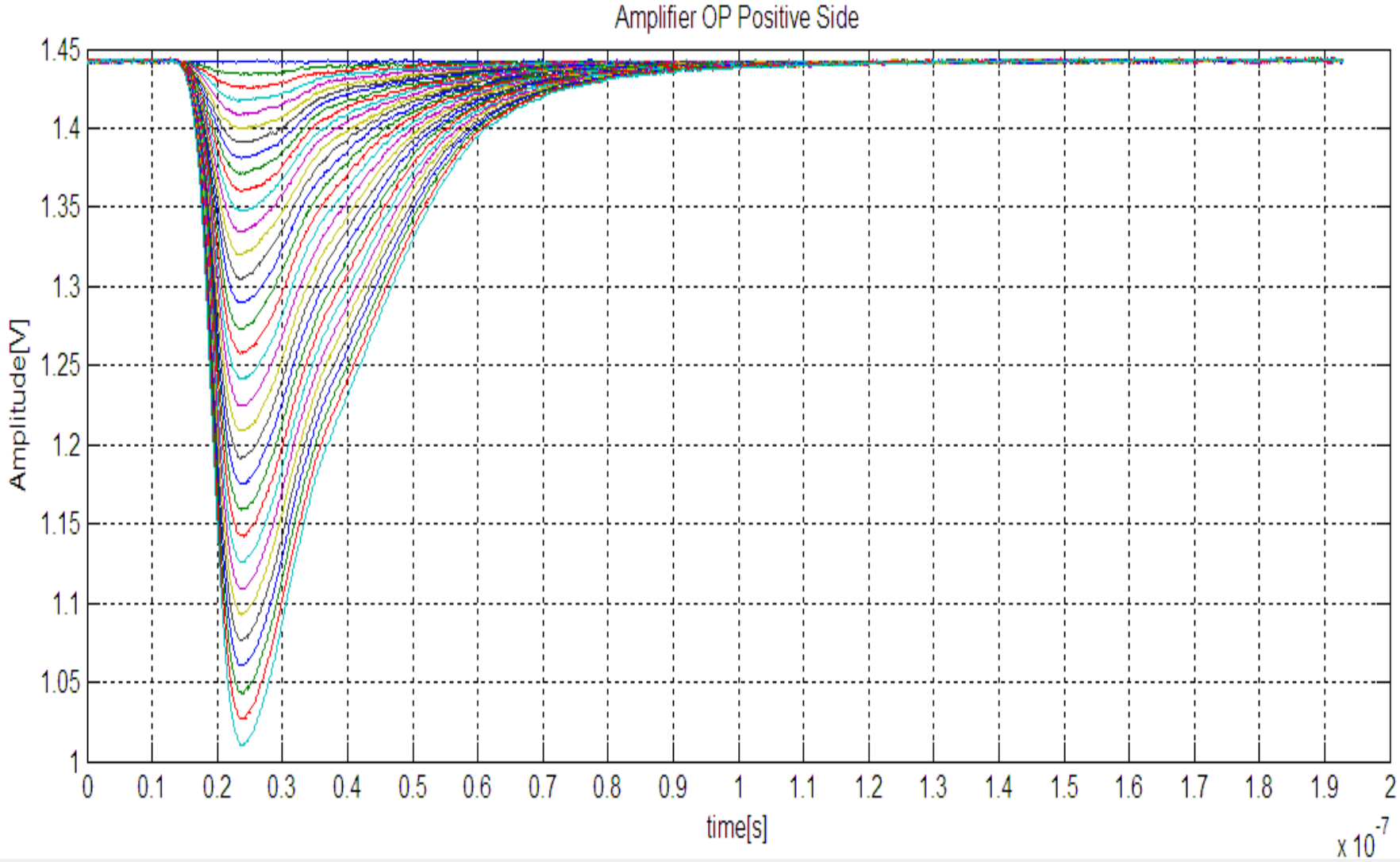
Measurements INPUT STAGE

- AMP- RAW DATA



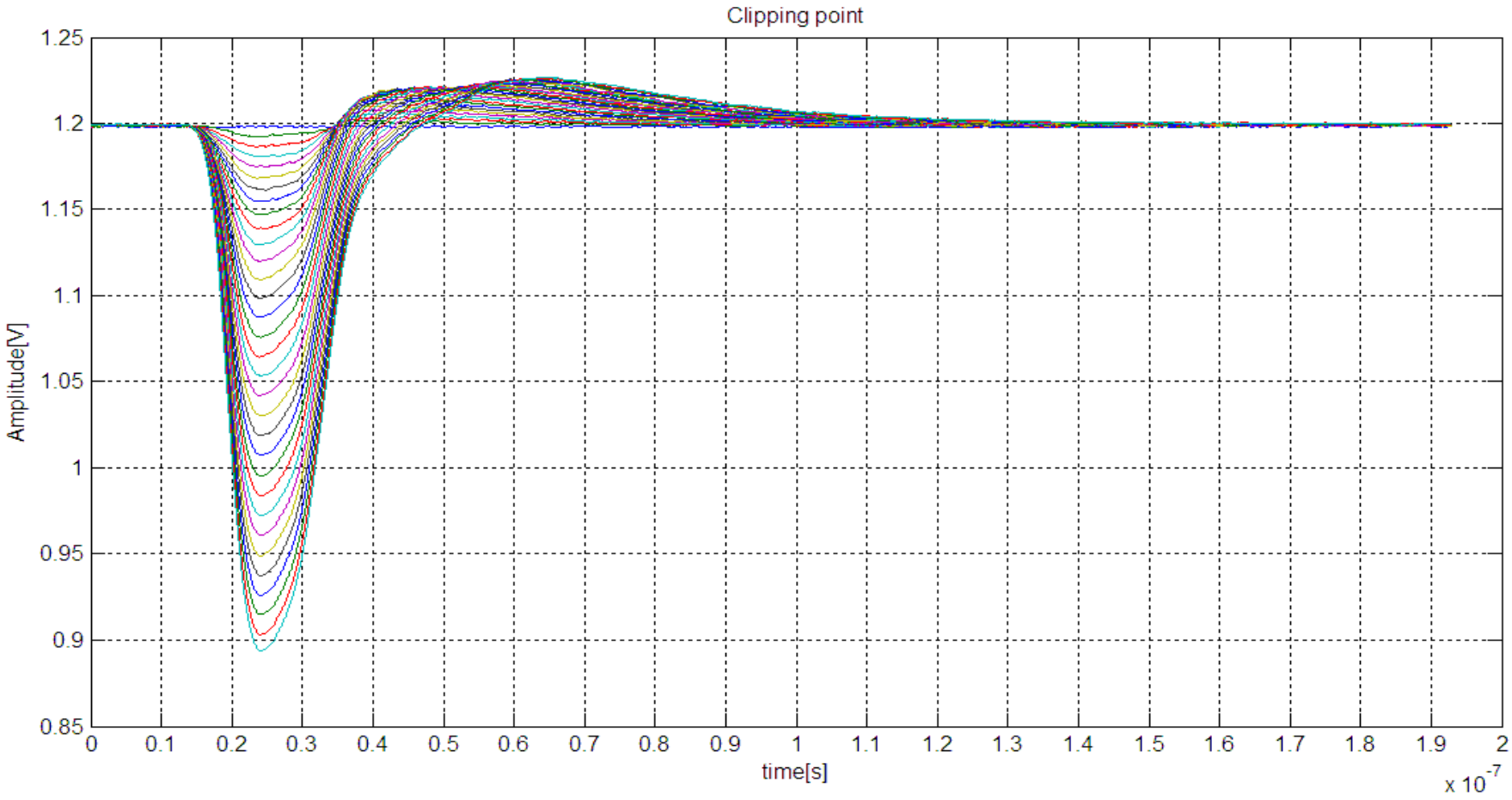
Measurements INPUT STAGE

- AMP+ RAW DATA



Measurements INPUT STAGE

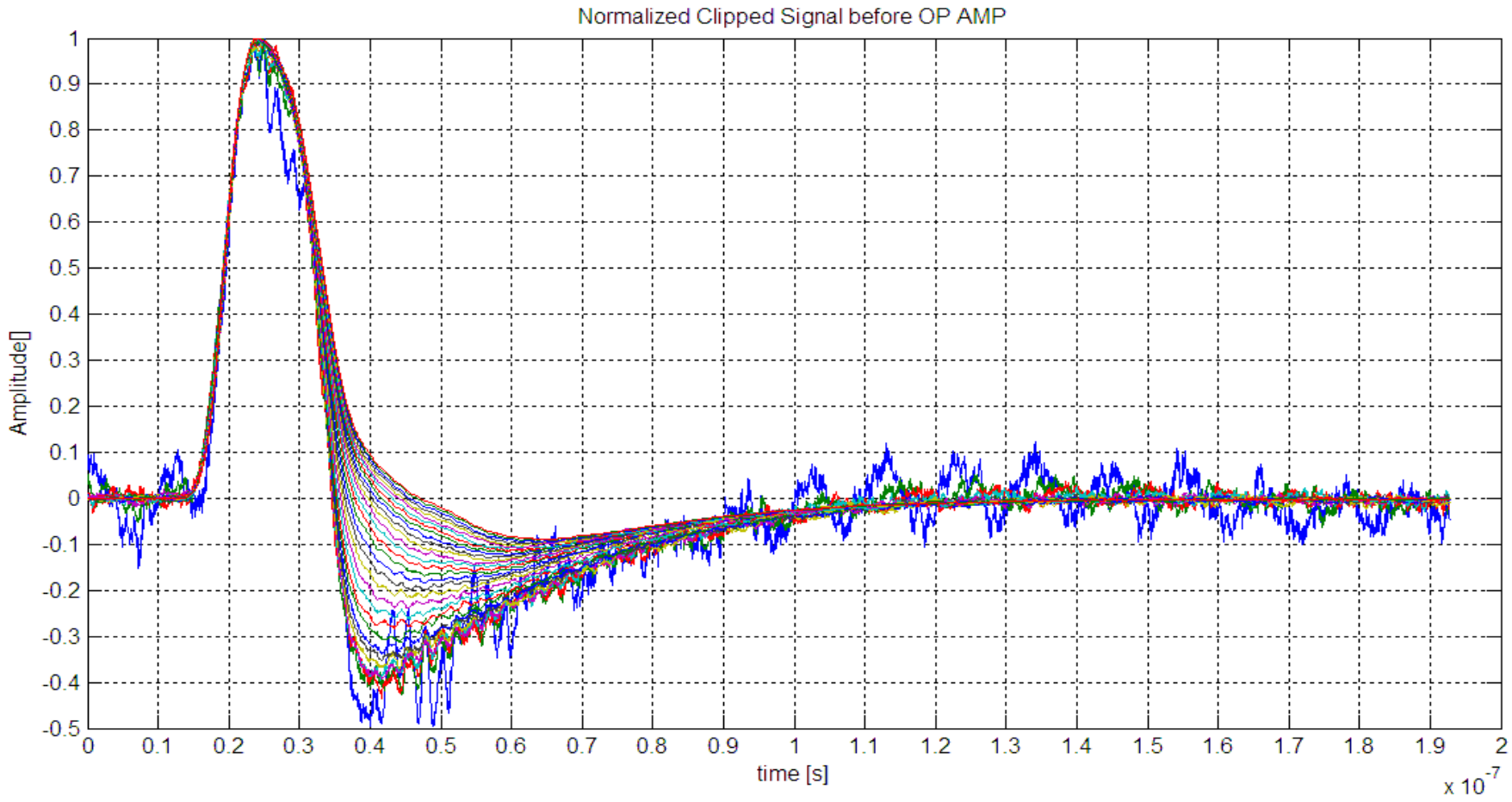
- CLIP RAW DATA



- ¿? Why Undershoot? (RC=50*200n=1us)

Measurements INPUT STAGE

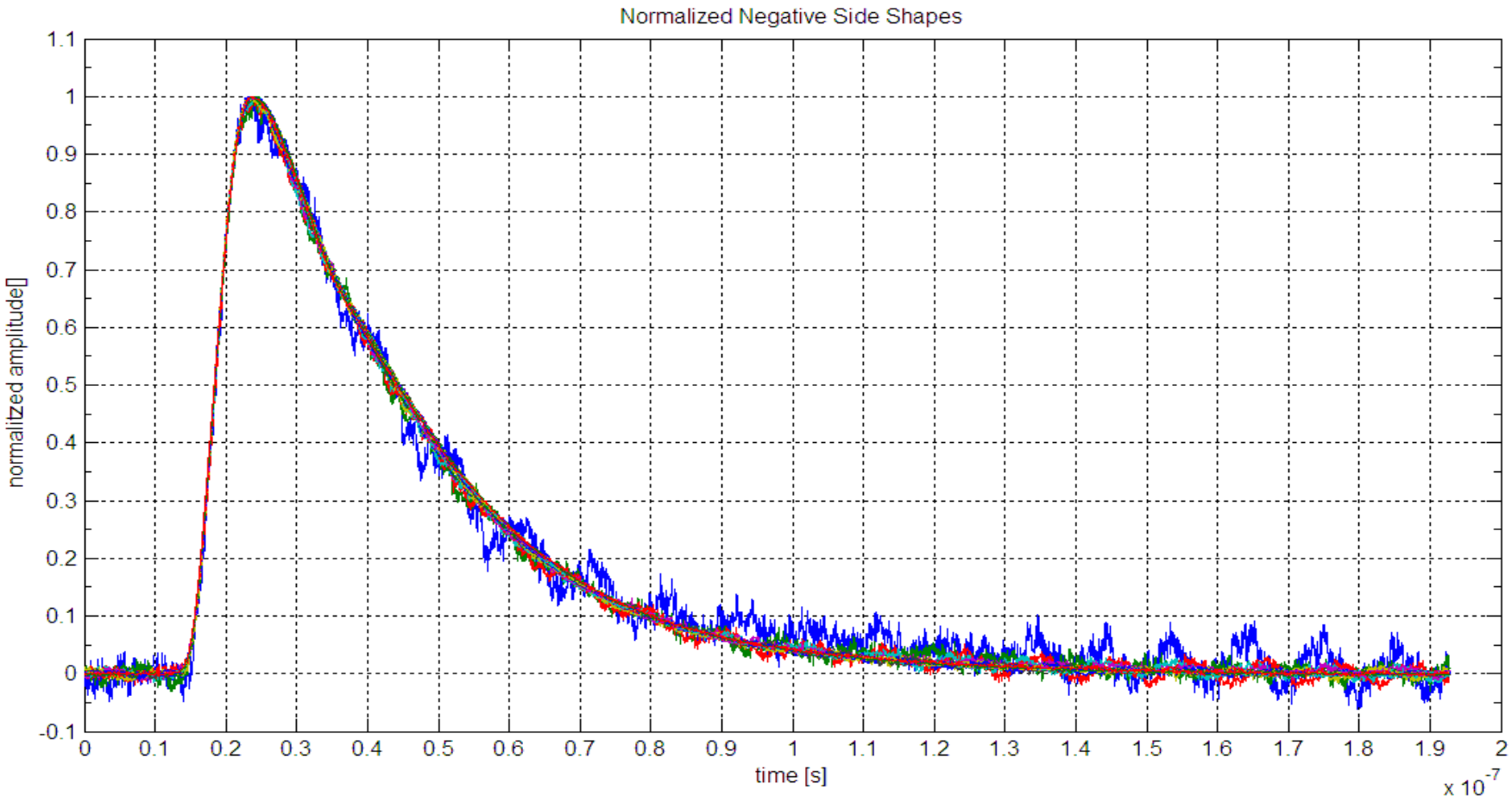
- CLIP Normalized (SHAPE)



- Undershoot increases when amplitude decreases → ¿?
- Let's have a closer look to AMP+ and AMP- at 0.4E-7s

Measurements INPUT STAGE

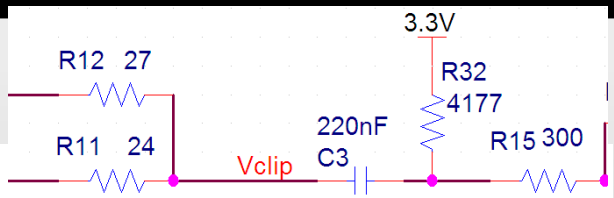
- AMP- Normalized (SHAPE)

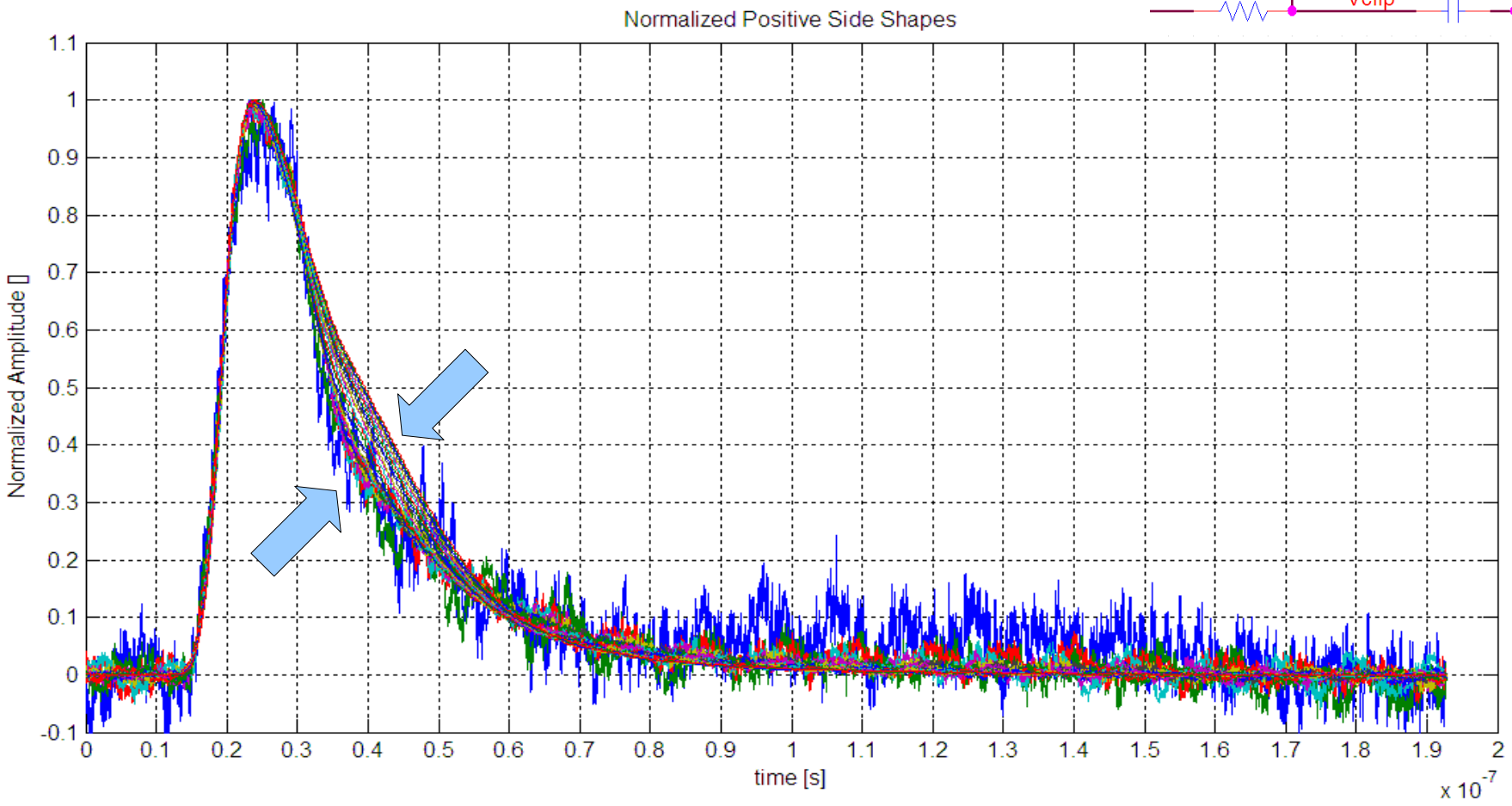


- Looks good

Measurements INPUT STAGE

- AMP+ Normalized (SHAPE)

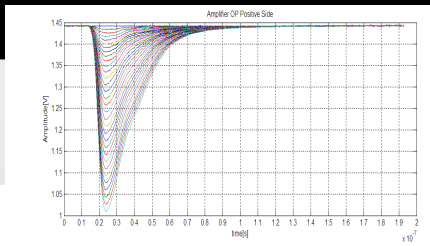


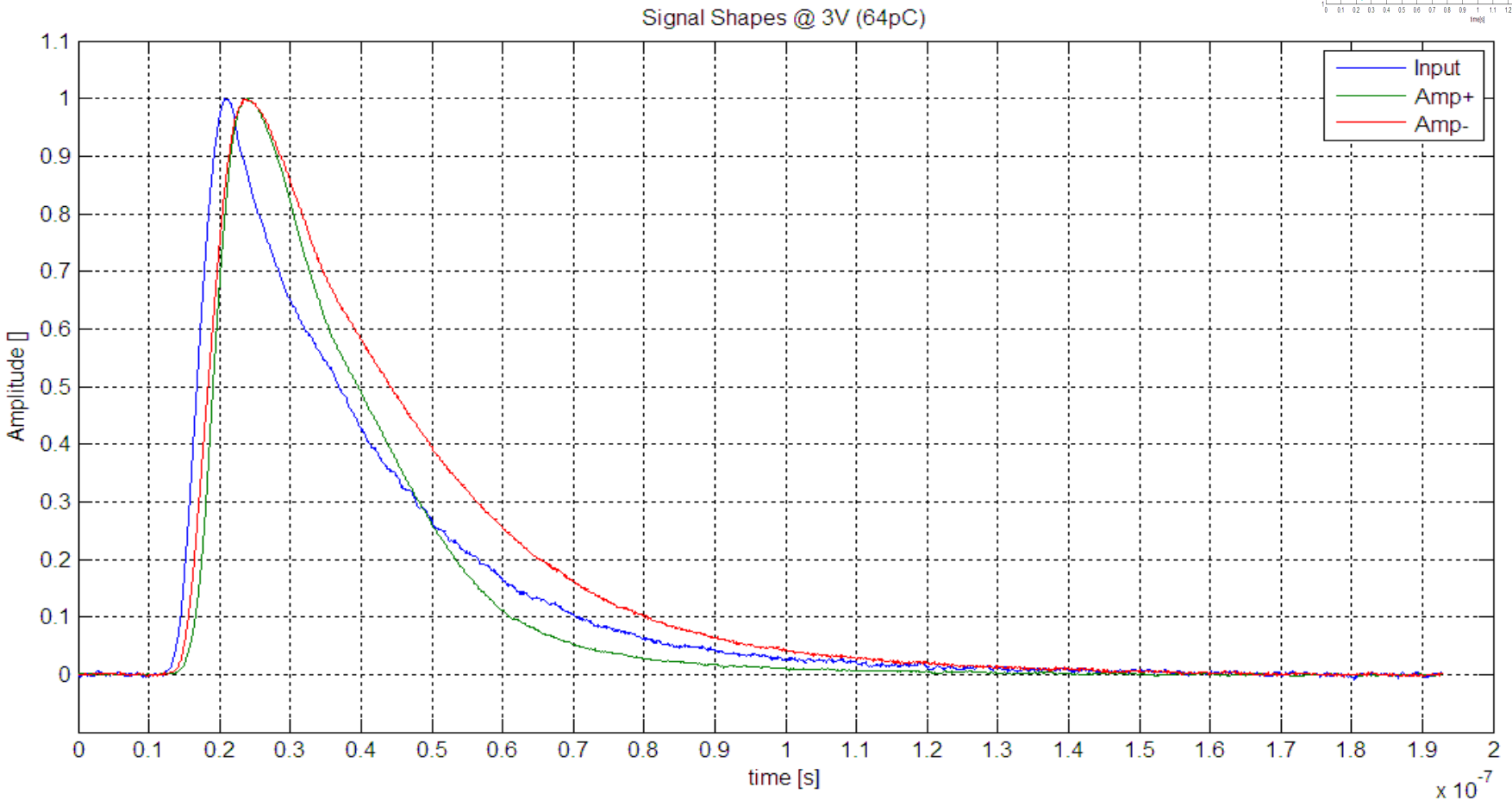


- Variations at 0.4E-7s depending on amplitude
- Maybe because of RC differences?

Measurements INPUT STAGE

- IN, AMP+, AMP- Normalized (SHAPE)

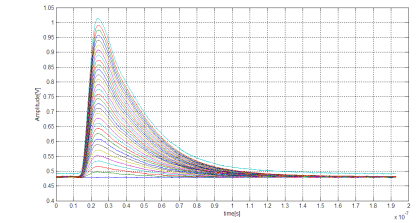


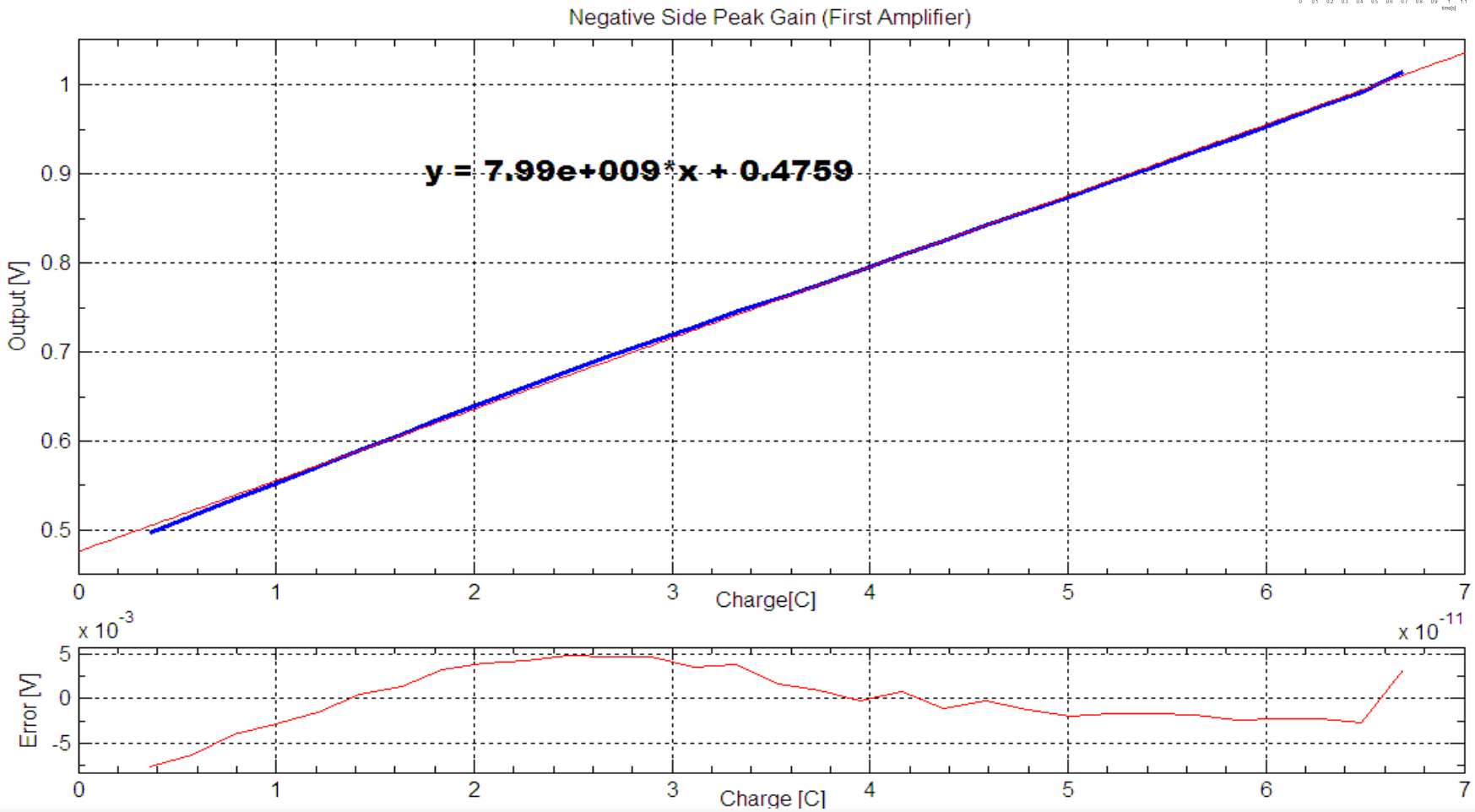


- Different shapes of AMP+ and AMP-
- Ideal (Simulated) clipping with these shapes → measured result

Measurements INPUT STAGE

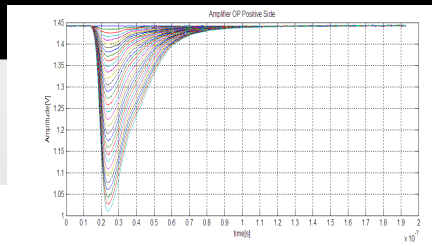
- AMP- Transfer Function MAX_Out(Charge_in)



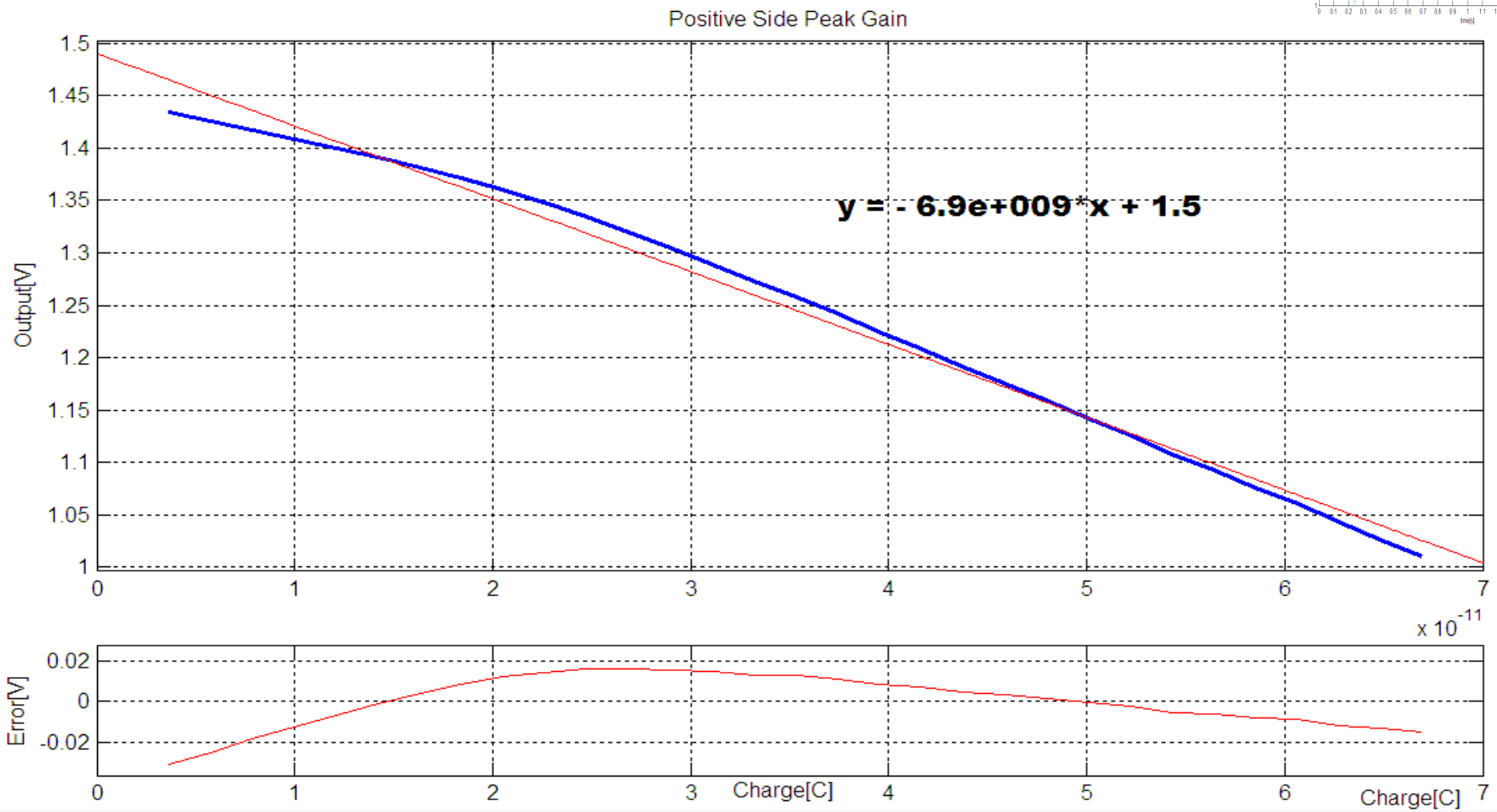


- Looks good, althoug 0.4759 is a bit low
- Error about 5E-3/5E-1*100=1% (Compatible with IN precision)

Measurements INPUT STAGE

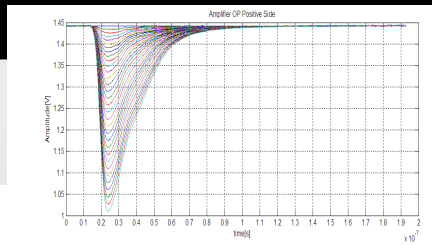


- AMP+ Transfer Function MAX_Out(Charge_in)

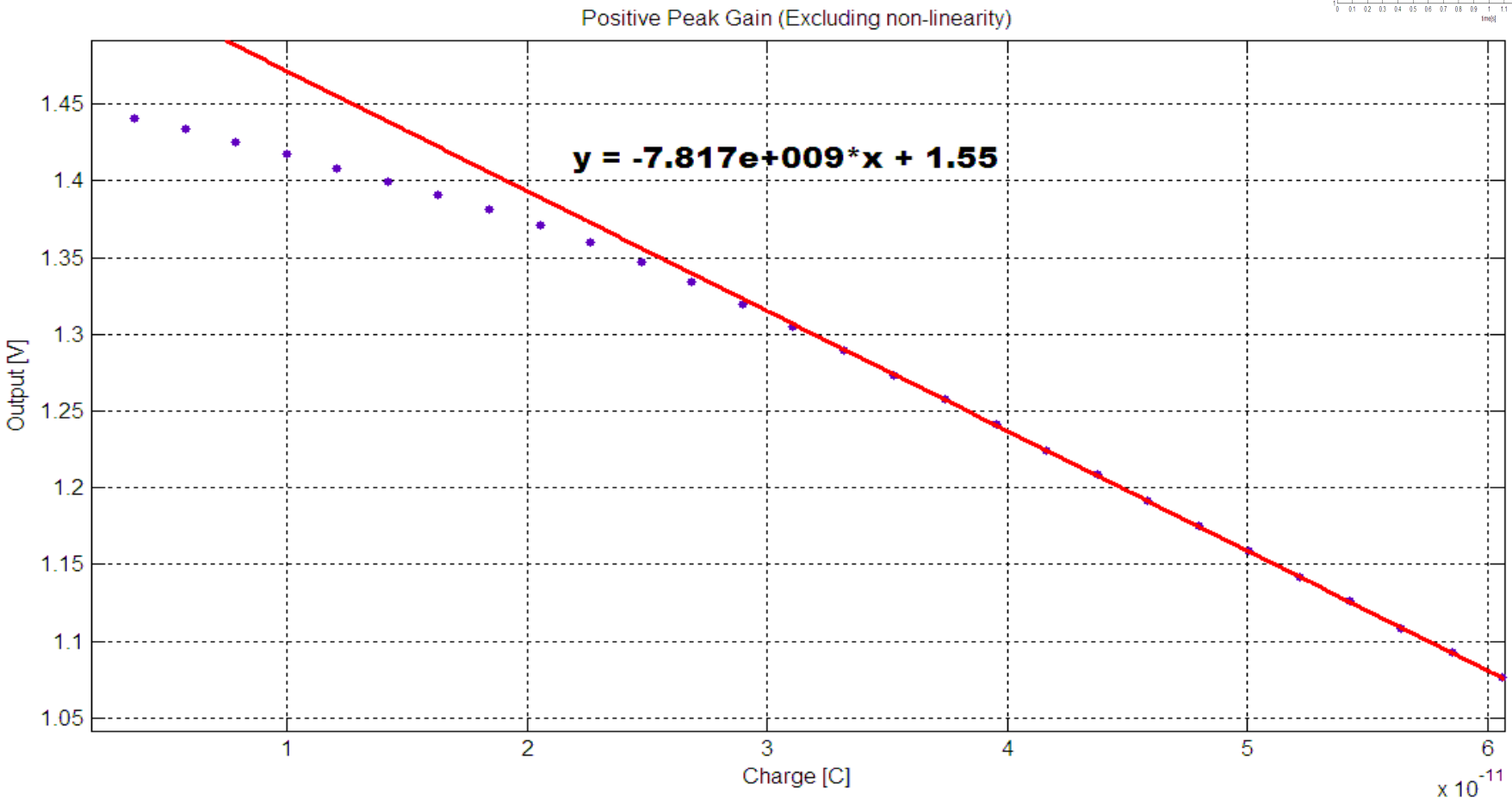


- Linearity wrong
- Linear regression useless (need to exclude conflictive zone)

Measurements INPUT STAGE



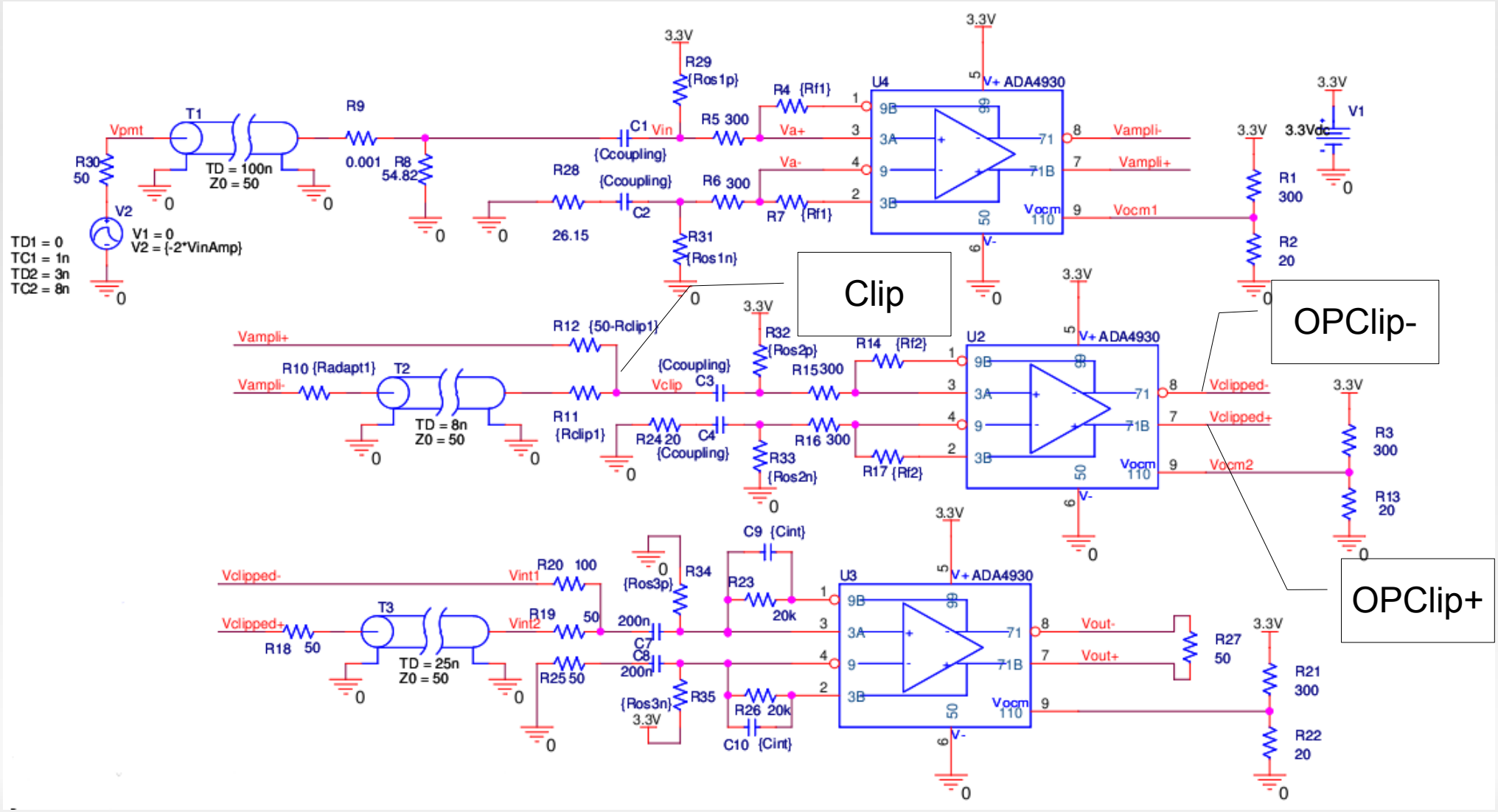
- AMP+ Transfer Function MAX_Out(Charge_in)



- It would like to have a 1.55V at 0 input → too high! (Max=1.45)
- Related to different shapes? Two different errors?

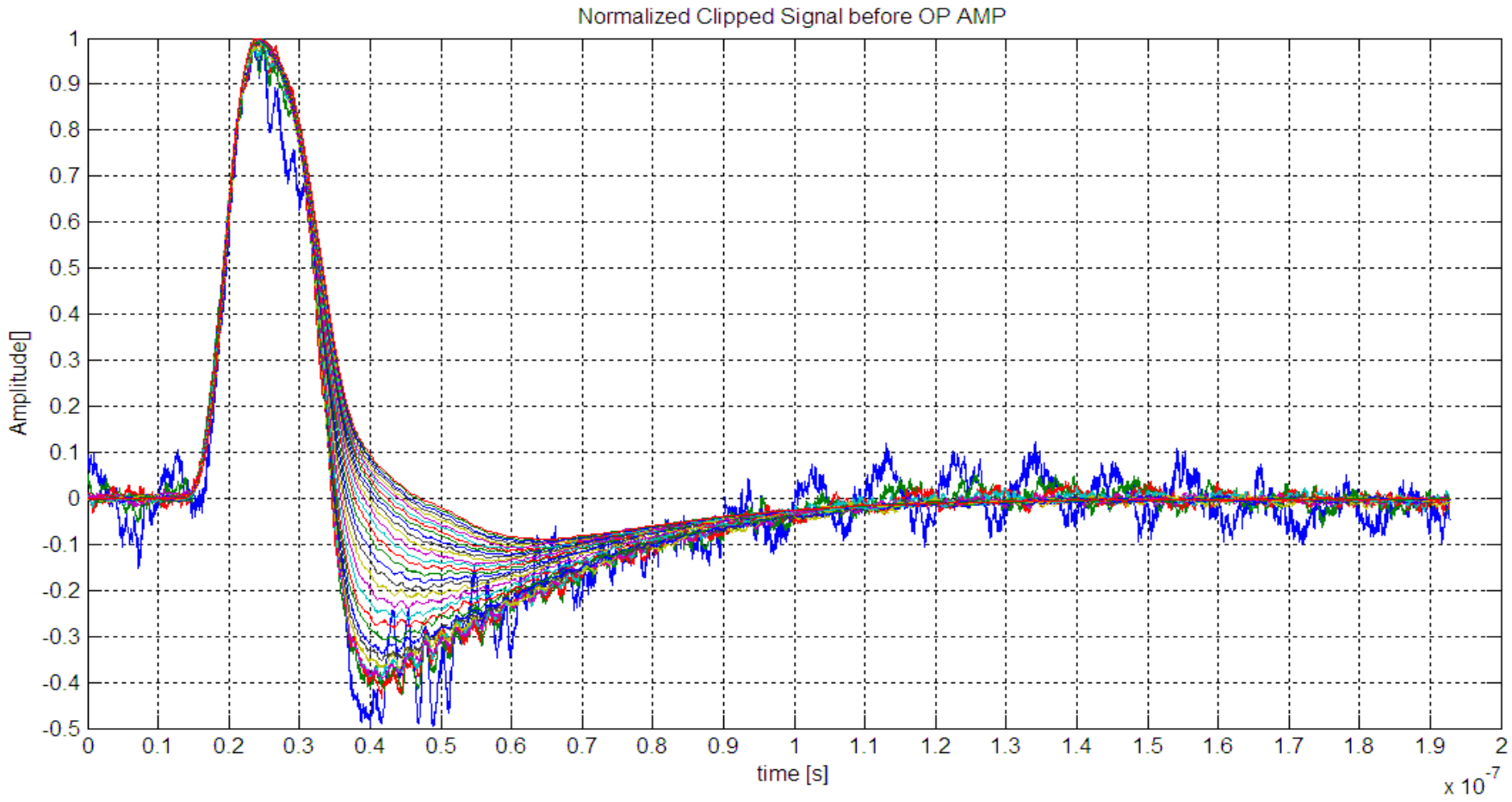
Measurements CLIPPING STAGE

- Input Stage Measurements



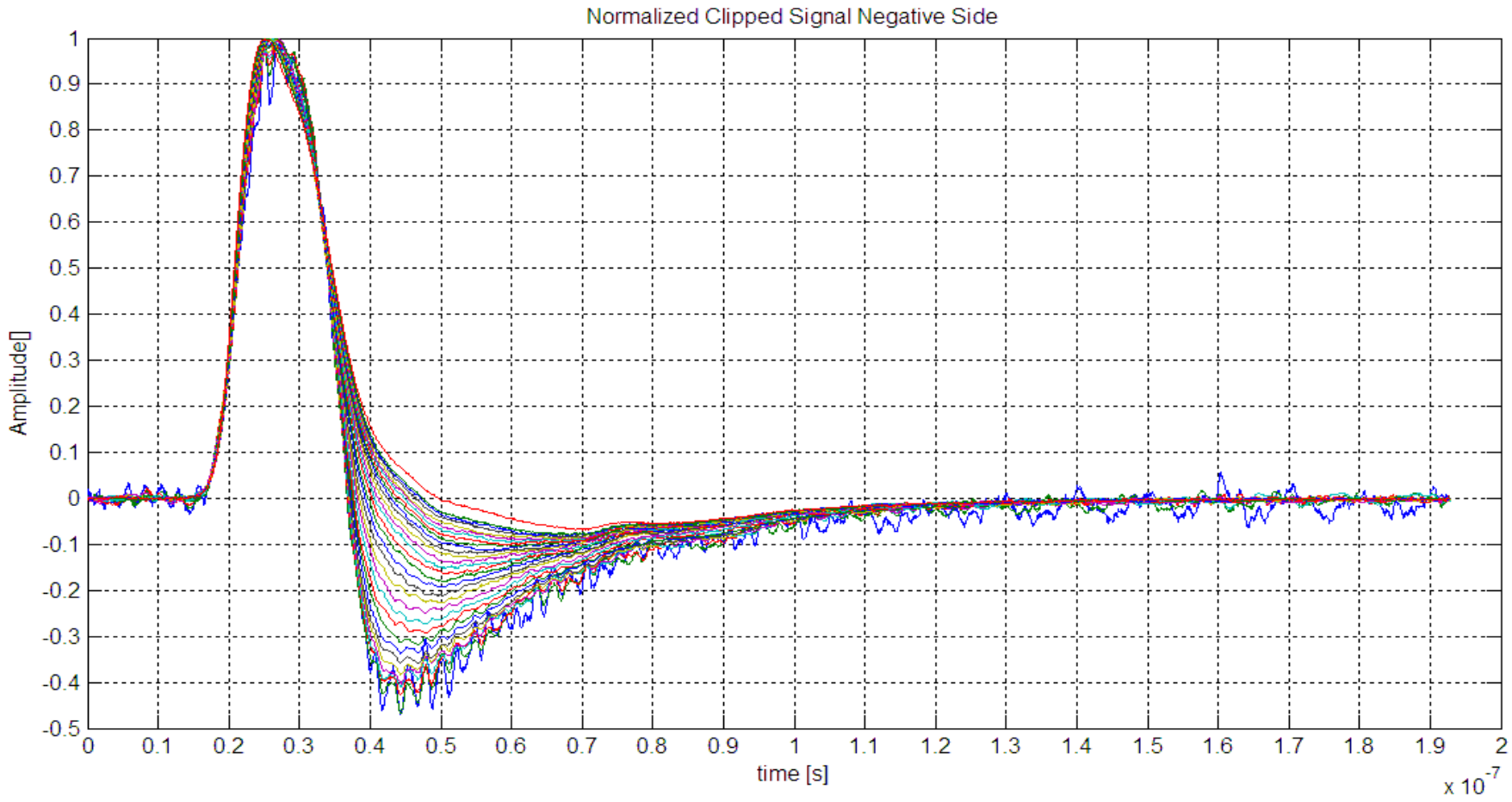
Measurements CLIPPING STAGE

- Clip Signal Normalized (SHAPE) ← RECALLING



Measurements CLIPPING STAGE

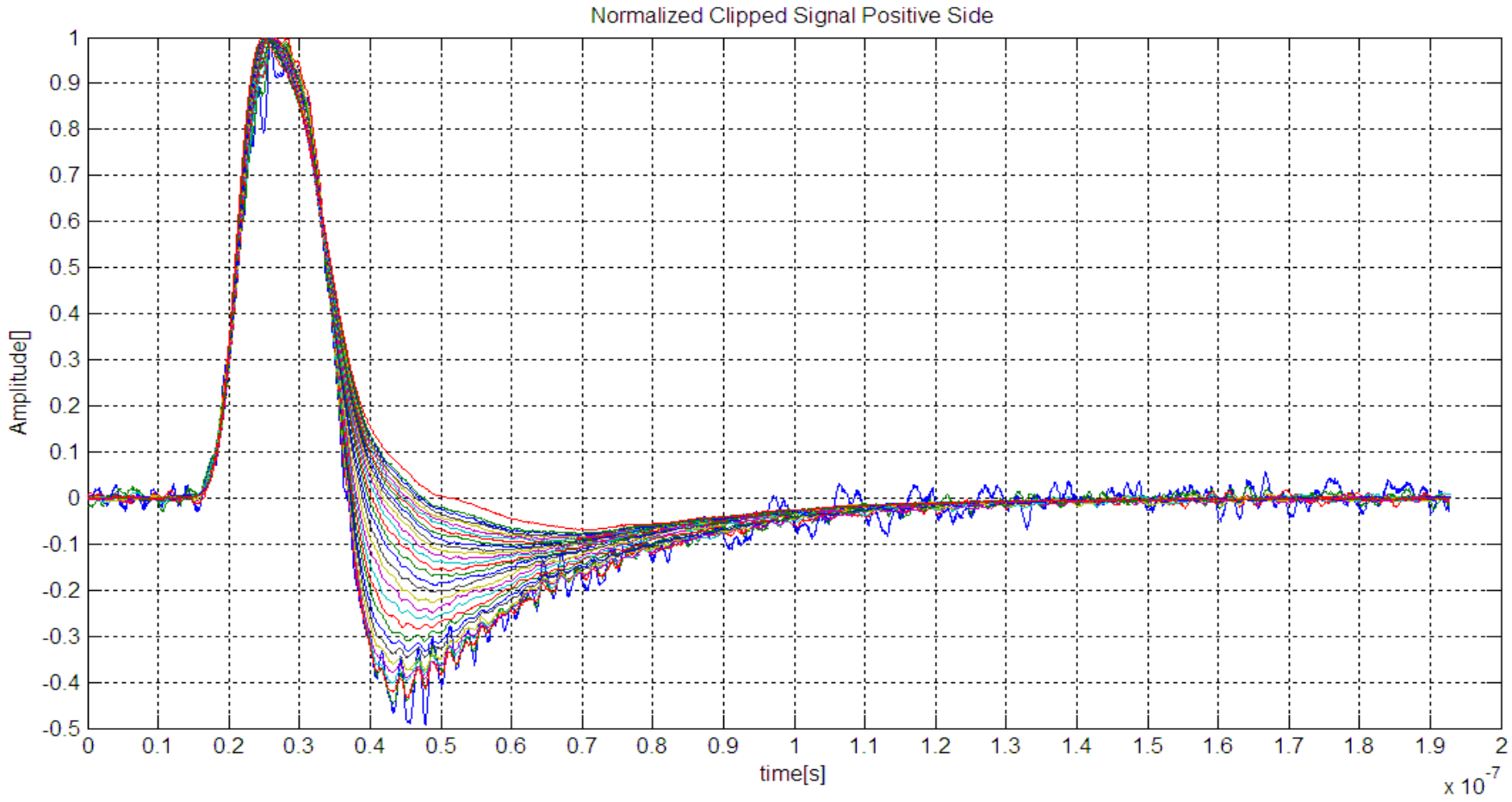
- OPClip- Normalized (SHAPE)



- Same Shape approx
- Linear to the eye

Measurements CLIPPING STAGE

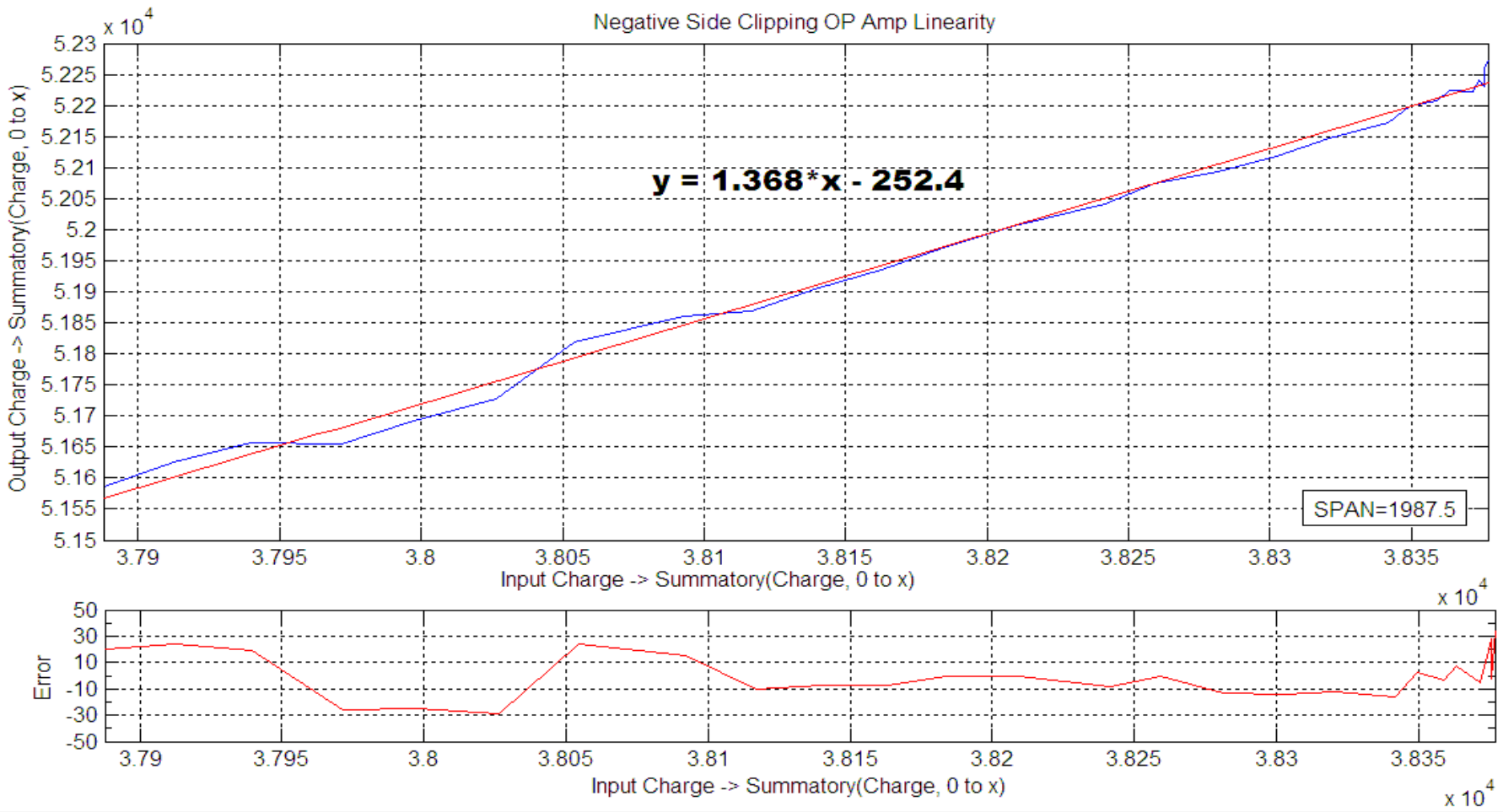
- OPClip+ Normalized (SHAPE)



- Same Shape approx
- Linear to the eye NEED A BETTER WAY TO MEASURE

Measurements CLIPPING STAGE

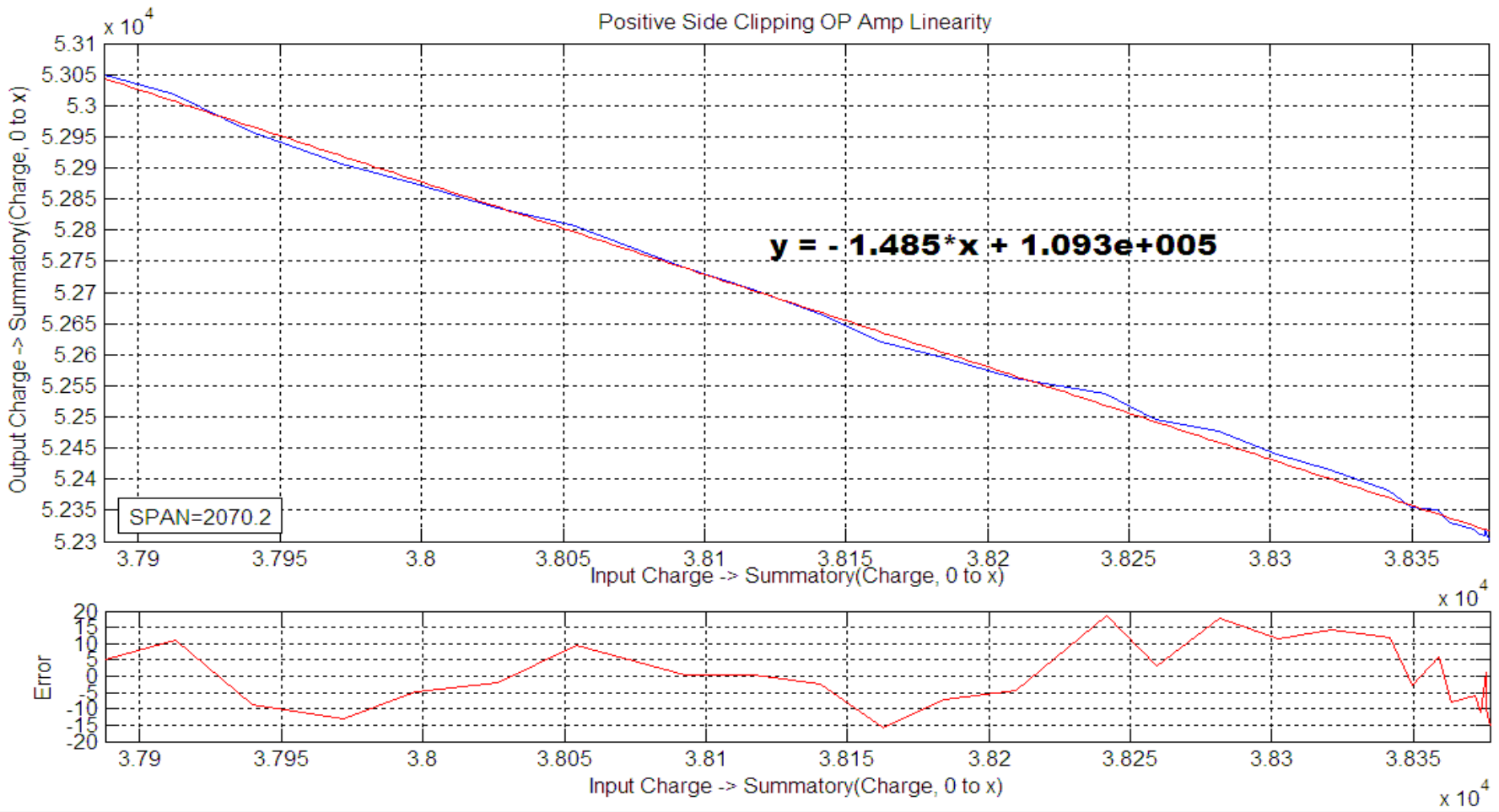
- OPClip- Gain



- Reasonable Linearity taking noise into account

Measurements CLIPPING STAGE

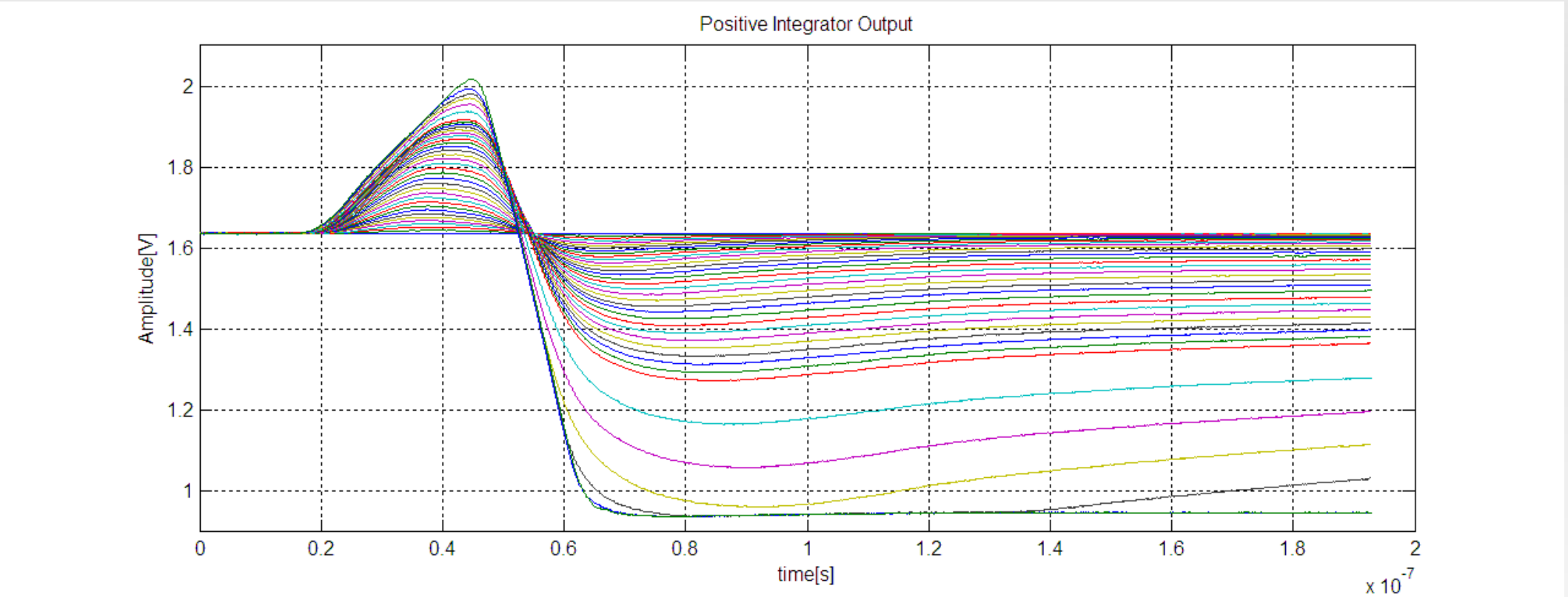
- OPClip+ Gain



- Reasonable Linearity taking noise into account
- But different gain? 1.368 vs. 1.485?

Measurements INT. STAGE

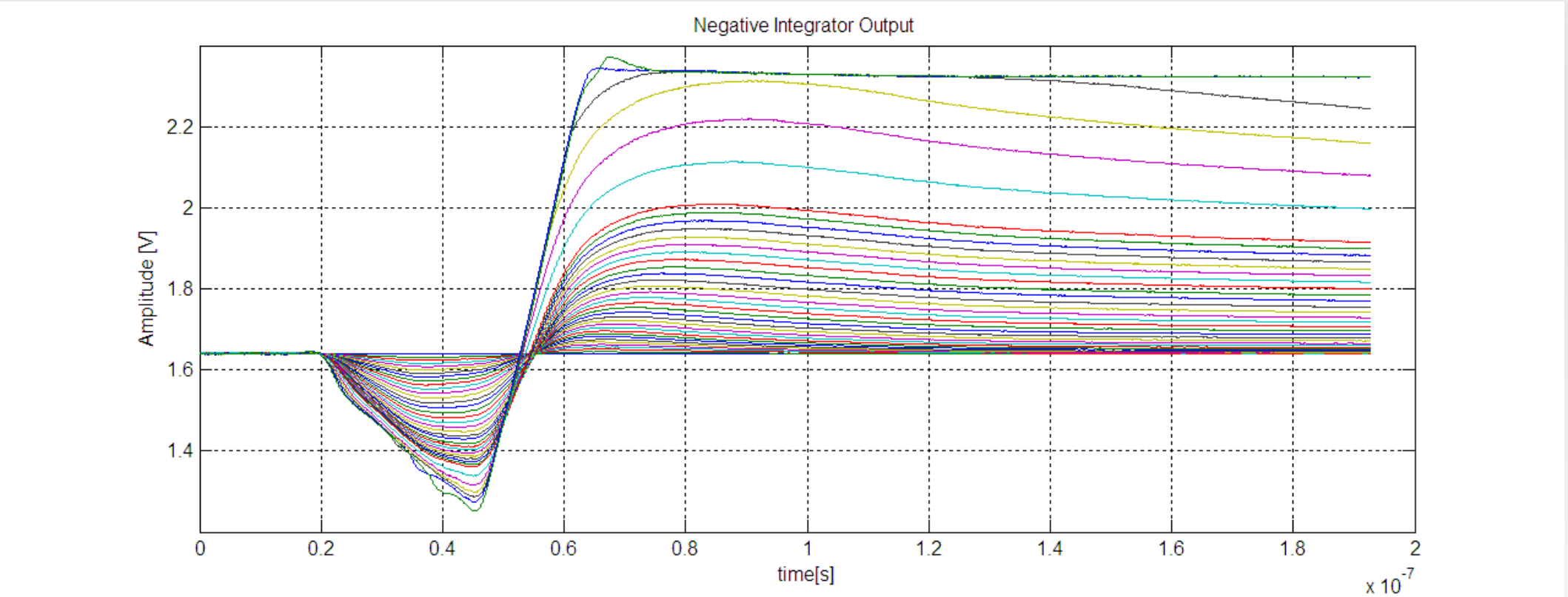
- Integrator Positive Output



- Need to understand why

Measurements INT. STAGE

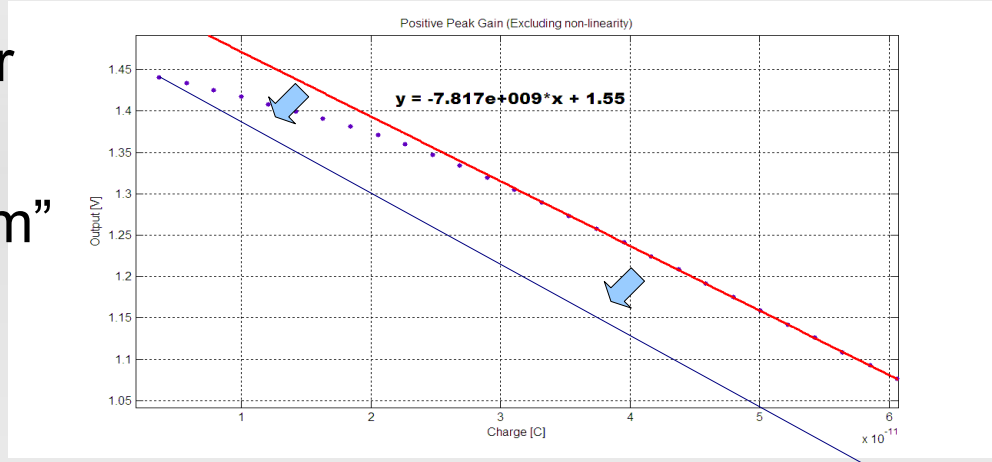
- Integrator Negative Output

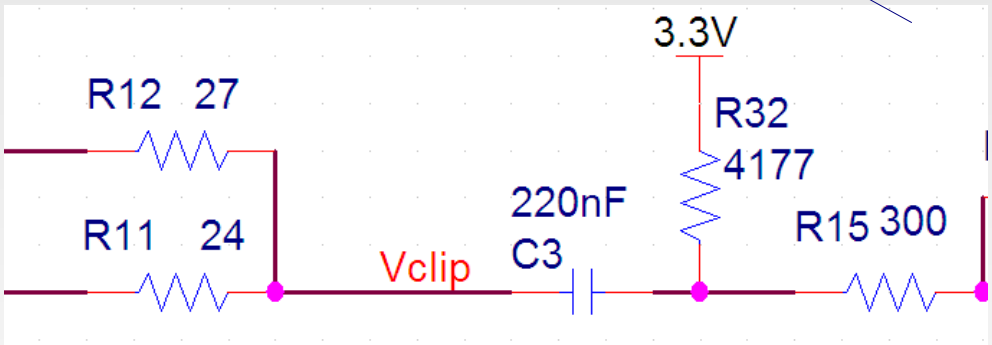


- Need to understand why

Conclusions/Ideas

- INPUT STAGE:
  - Need to tune input to have lower offset
  - Need to understand ”RC problem”
- Will offset solve it all?
  - Test and see
- If not:
  - Cut DC path between outputs
  - Reduce capacitor
  - Increase next stage impedance





Conclusions/Ideas

- CLIPPING STAGE:
  - Performs reasonably from linearity point of view
- INTEGRATING STAGE:
  - Oscillation solved
  - Integrator Output not understood
    - Need to simulate with captured data
      - (Numerical Integration)
- GENERAL:
  - Need to use a more precise source
  - Perform noise tests with ADC
  - Possibly change the ADA4930 with ADA4932 → Bipolar supply with no offsets. +3V and -3V → much more dynamic range