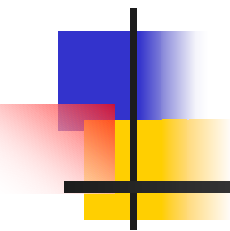


# Electronic Simulation Work at Victoria and TRIUMF



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- Victoria: Erica Muzzerall, Dr. Richard Keeler
- TRIUMF: Dr. Chris Oram

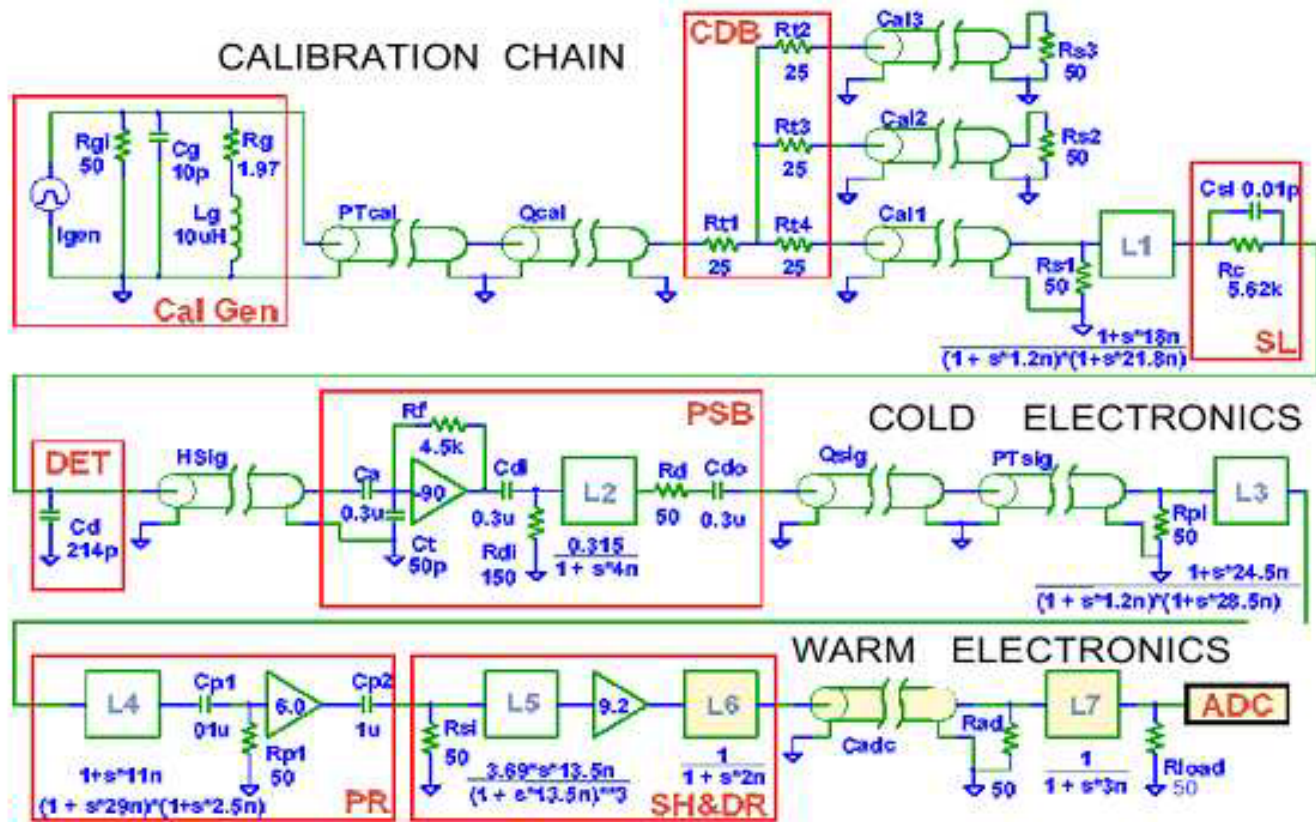


# Outline

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- Catch up on test beam simulation
  - NIM paper, Leonid
- Examine non-ideal signal source
- Conclusion

# Leonid's HEC Chain



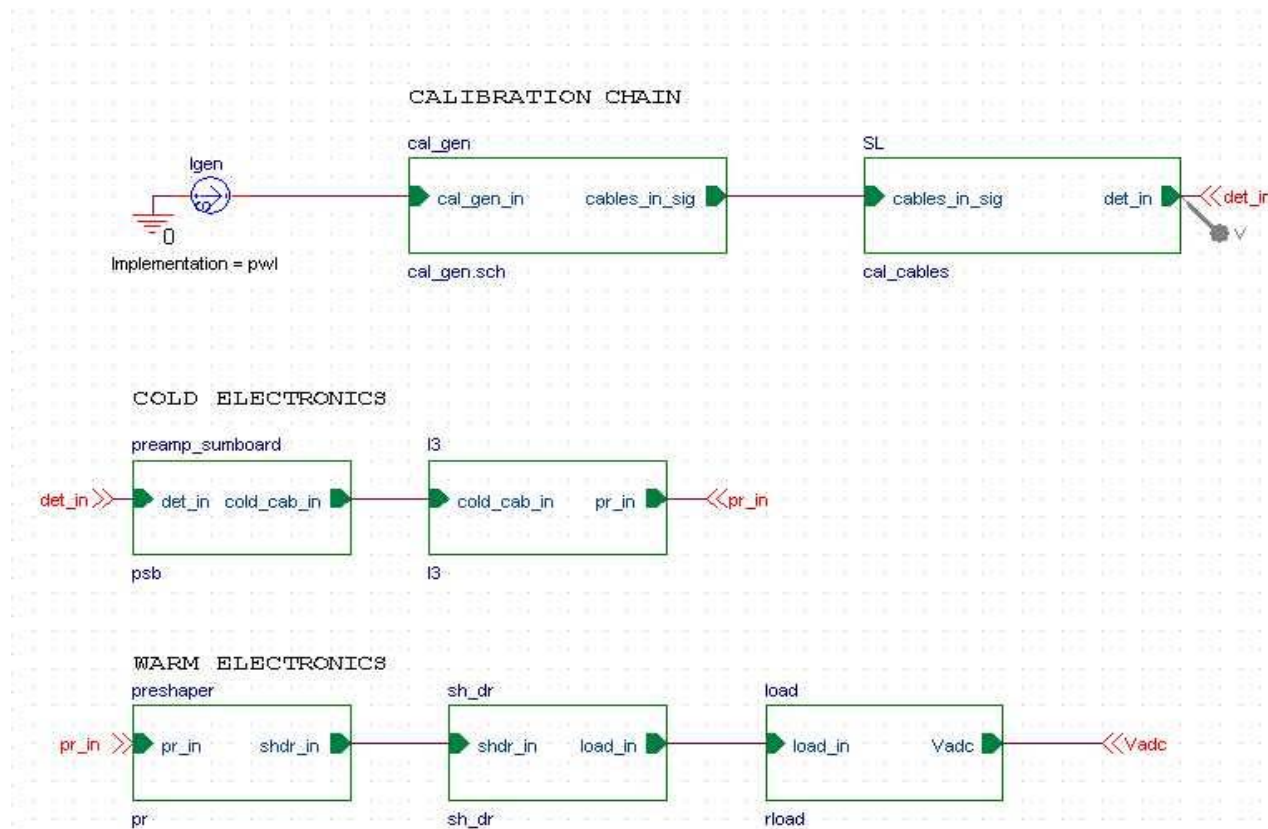


# PSPICE Simulations

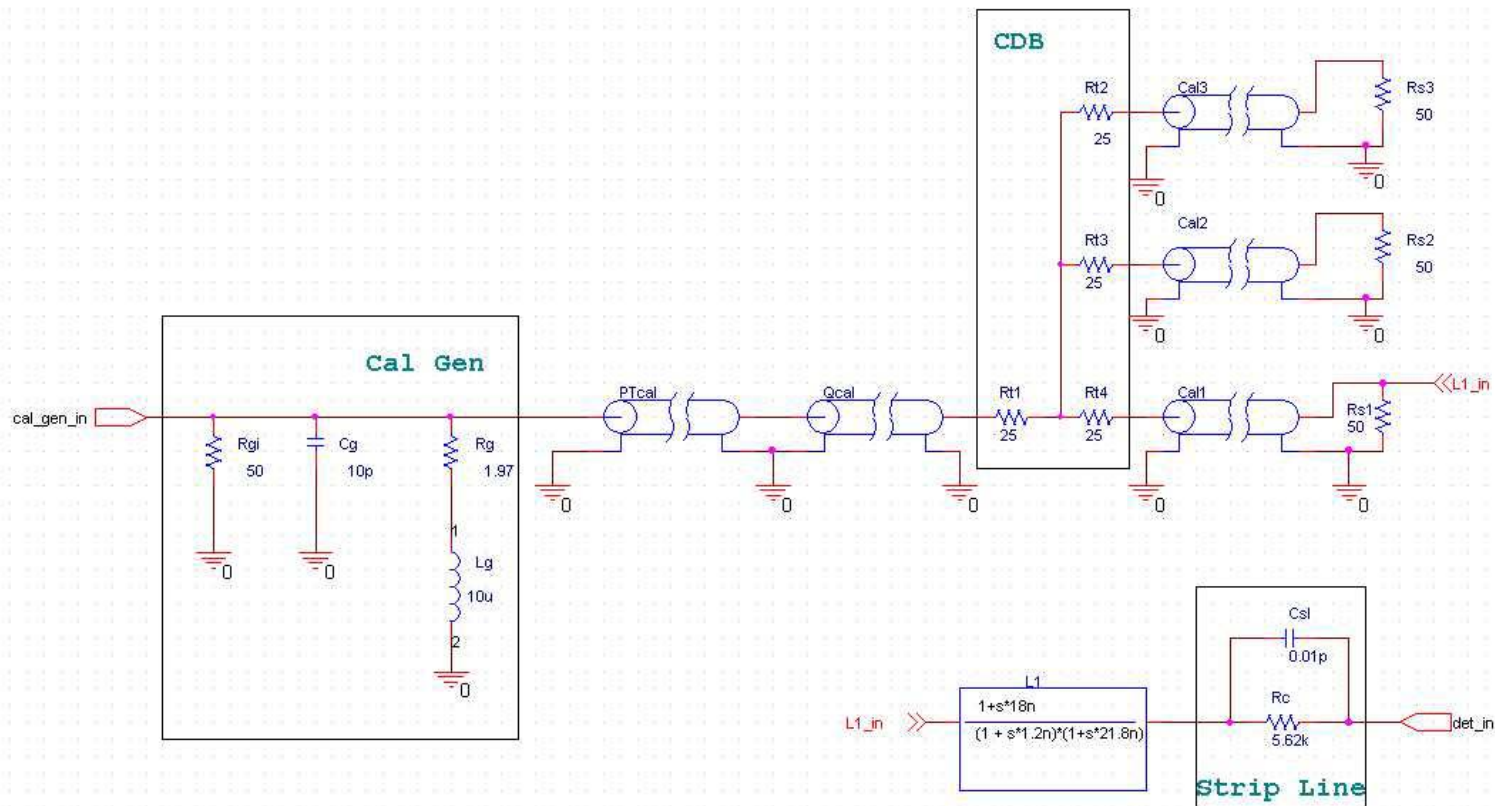
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- Cadence PCB Series Software
- PSpice version 9.2
- Can create schematics for analog or mixed signal designs, PCB layout
- PSpice can simulate analog designs
  - PSpice libraries contain over 11,000 parts
  - can download PSpice models directly from manufacturer's web sites

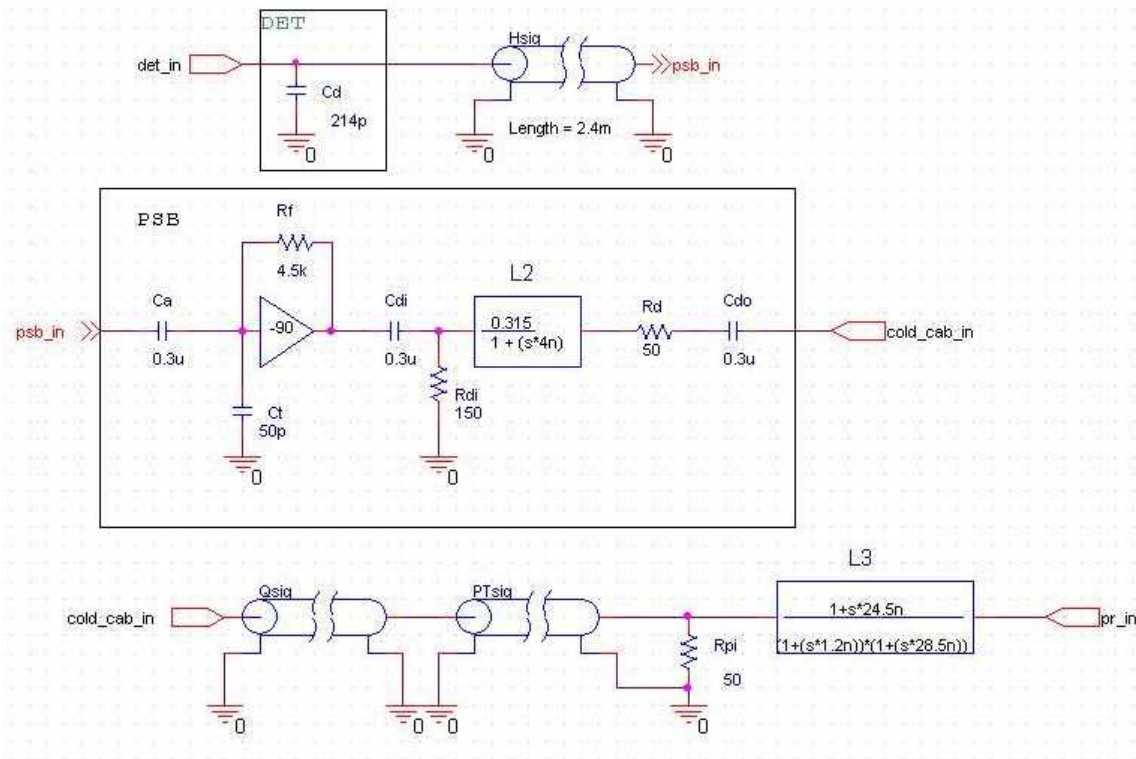
# HEC Electronics Chain



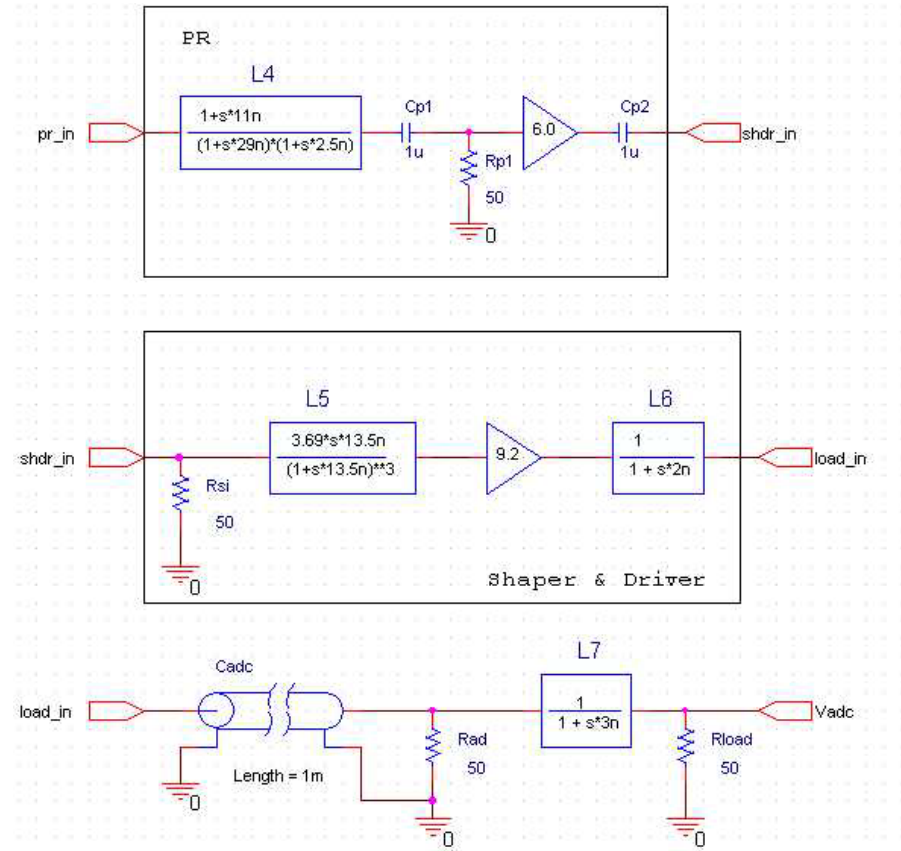
# Calibration Chain



# Cold Electronics

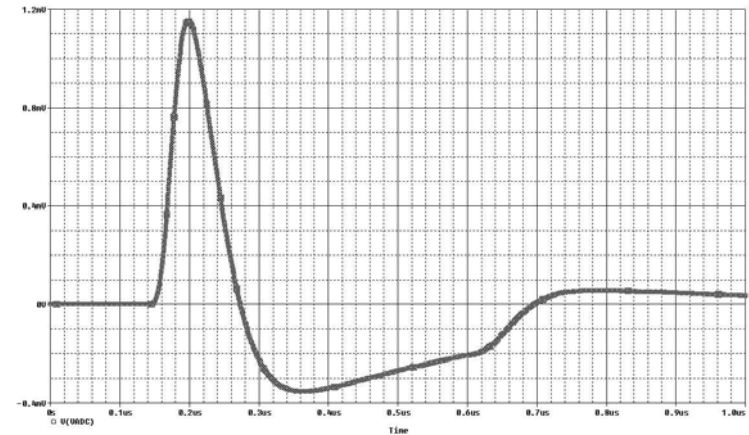
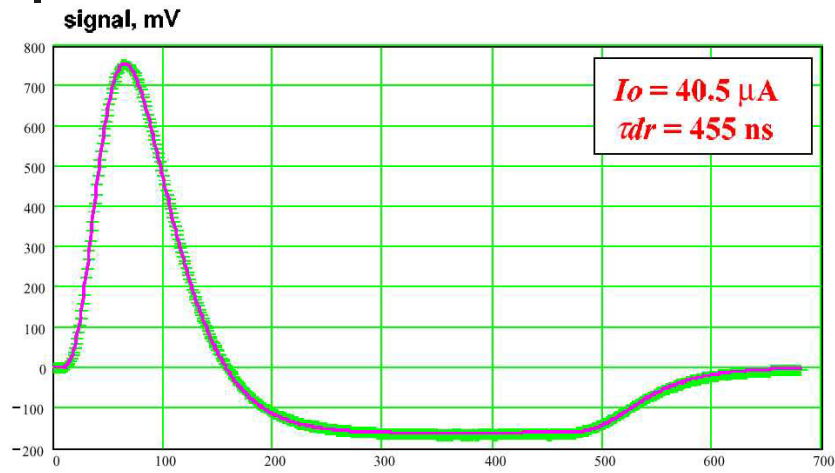


# Warm Electronics





# HEC Chain Output



Left: fig 8 from HEC Note 109

Right: our PSpice output

# Non Ideal Signal Source

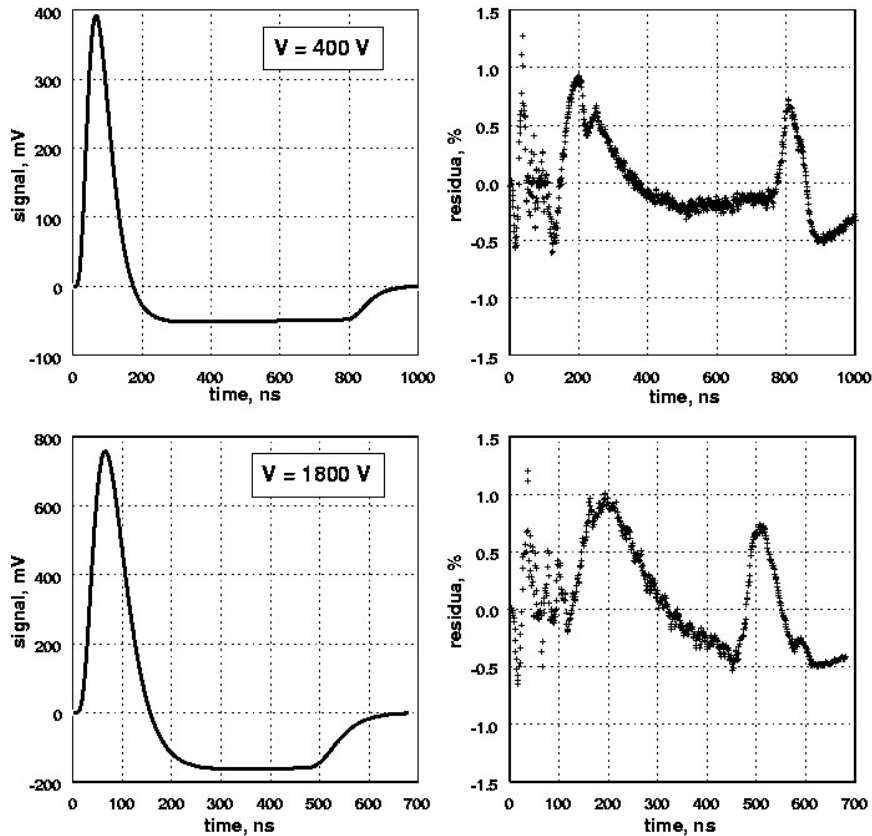


Fig 19, NIM paper

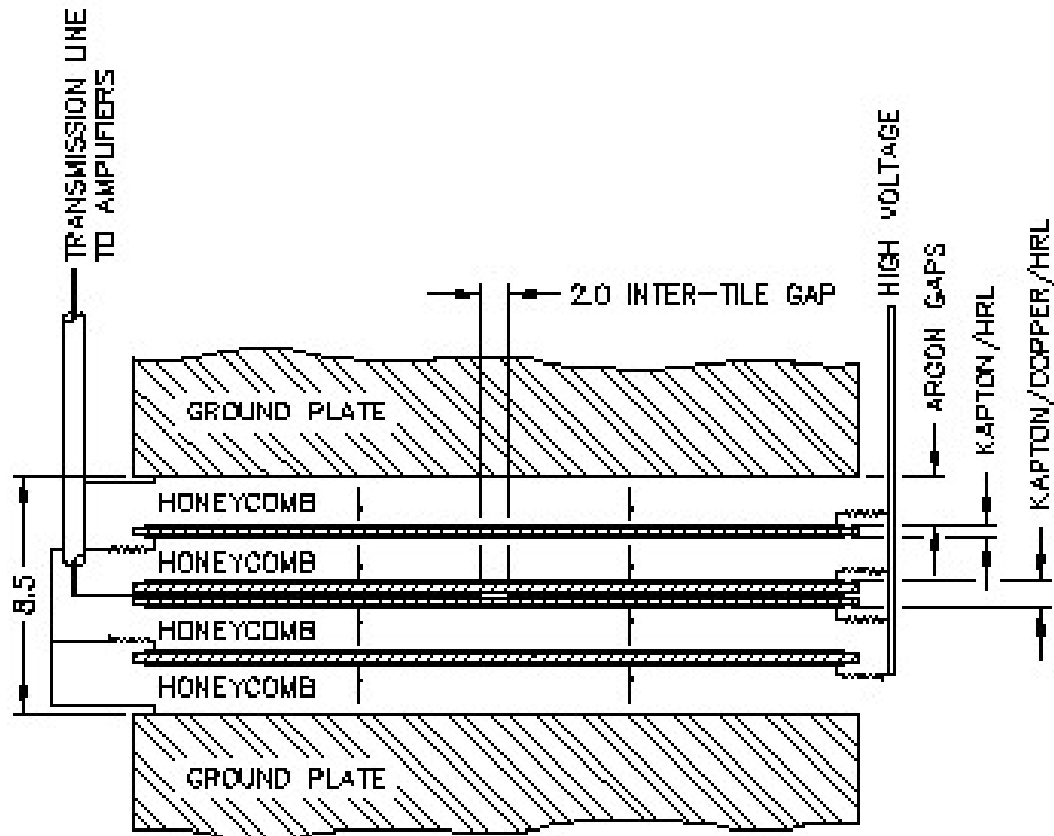


# Hypothesis:

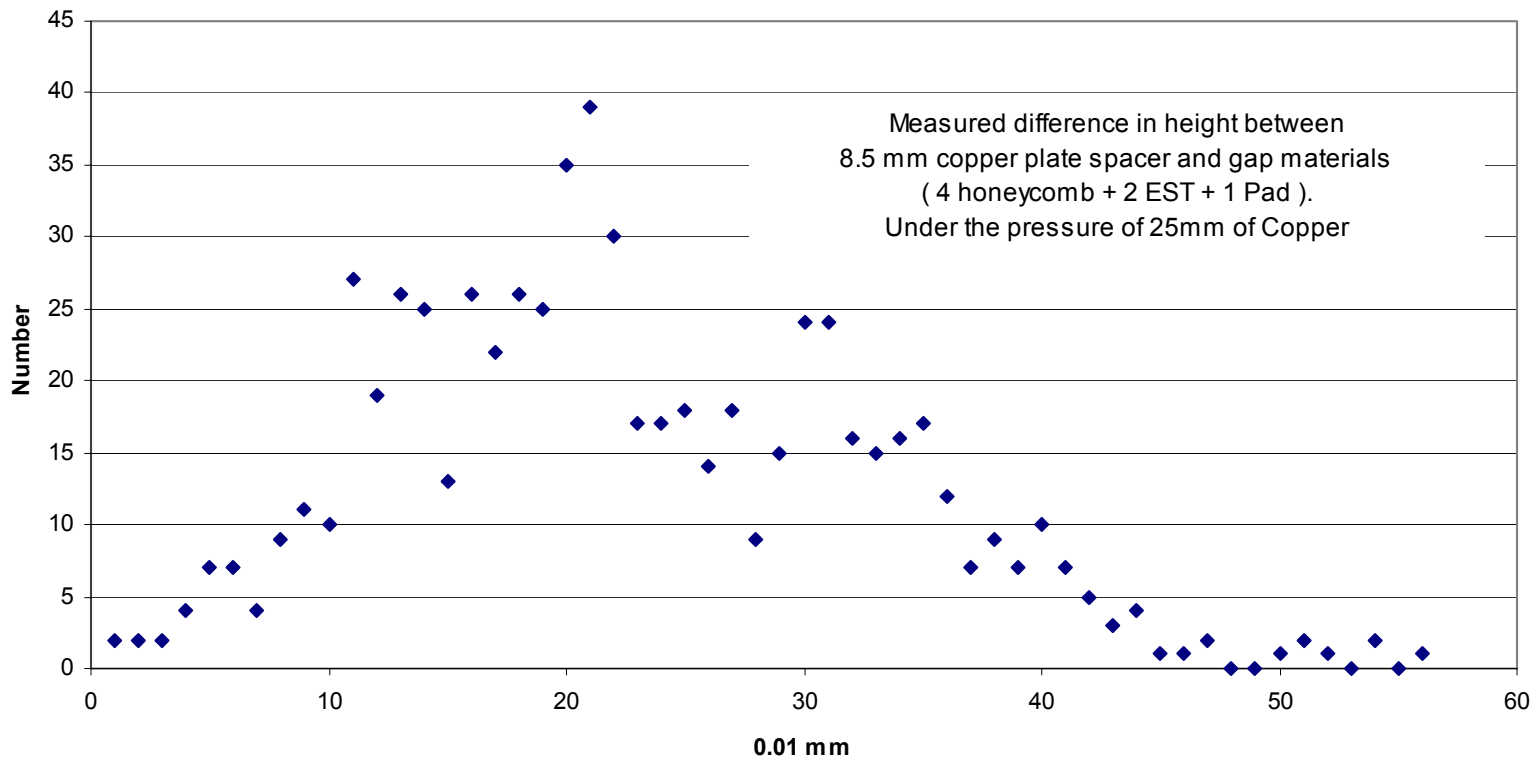
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- Why these residuals?
- Consider 2 possible sources:
  - Unequal Liquid Argon gaps in EST
  - Uncertainty in the gap capacitances
- Future: Investigate cross talk

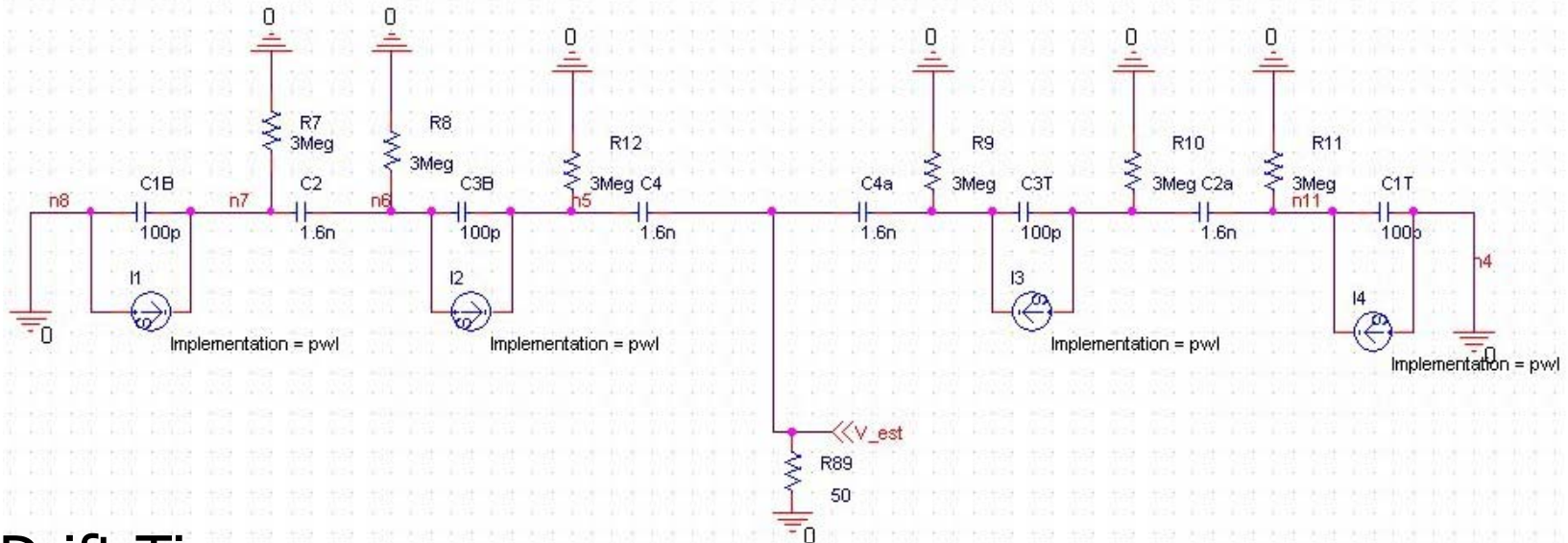
# EST Drawing



# Gap Tolerance



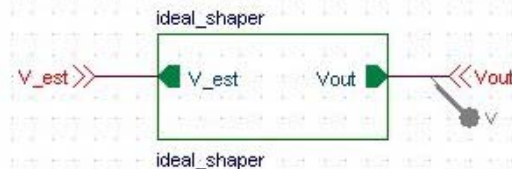
# Model EST



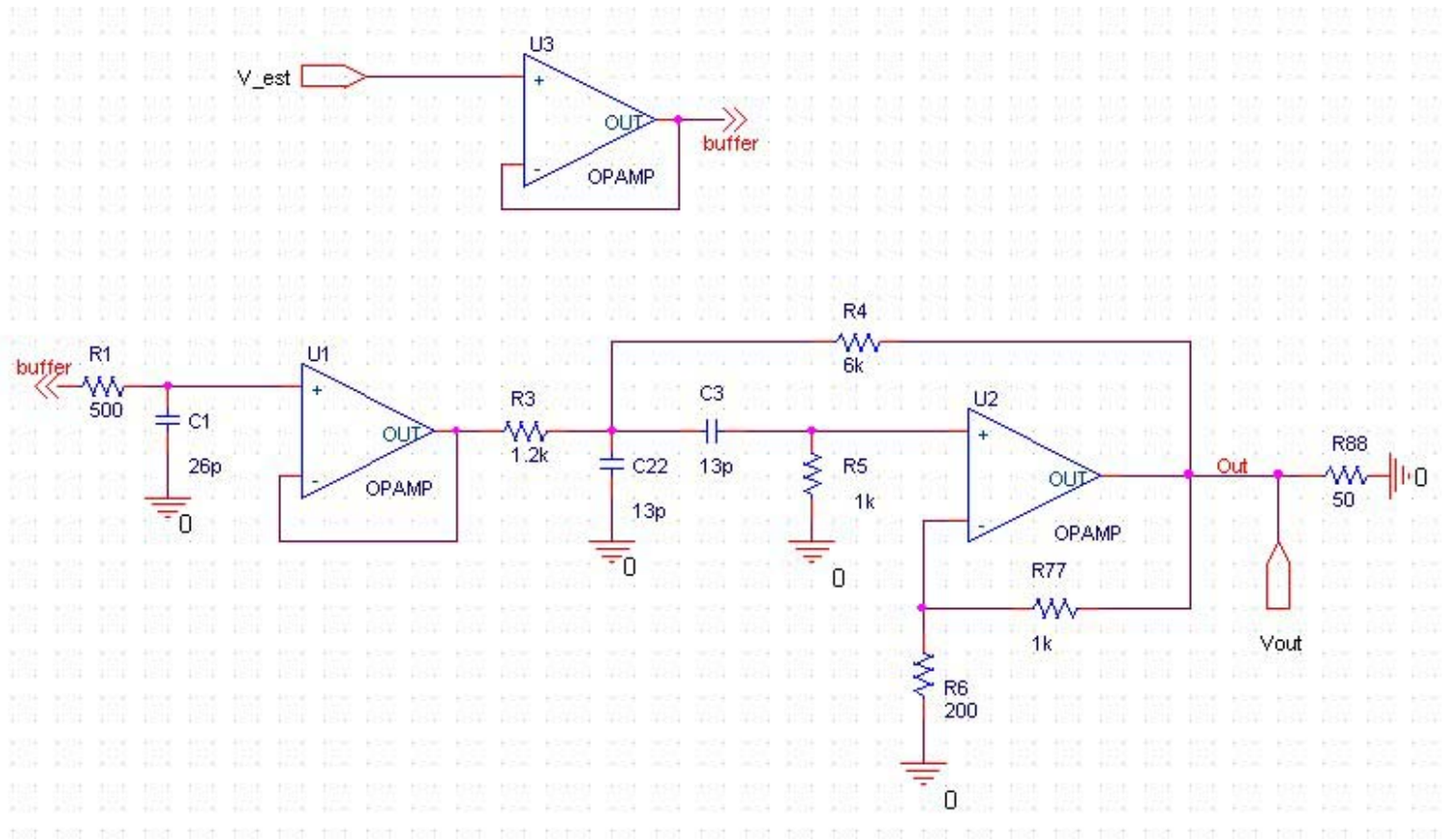
## Drift Times:

400 V: 905 ns

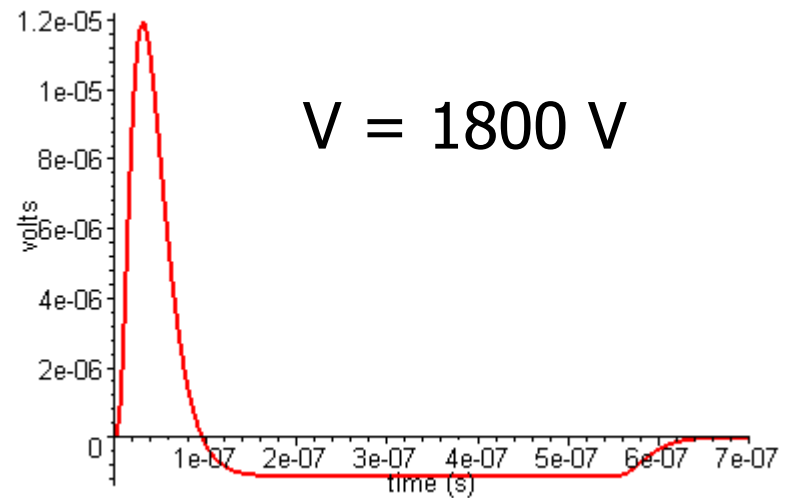
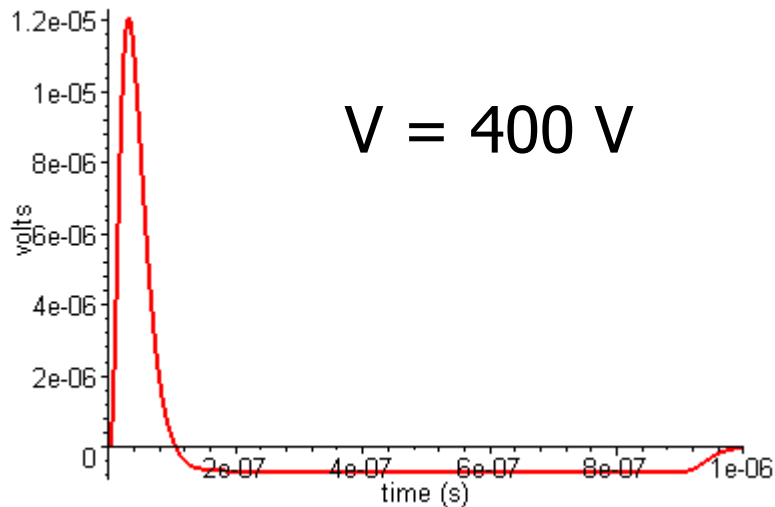
1800 V: 548 ns



# Ideal Shaper

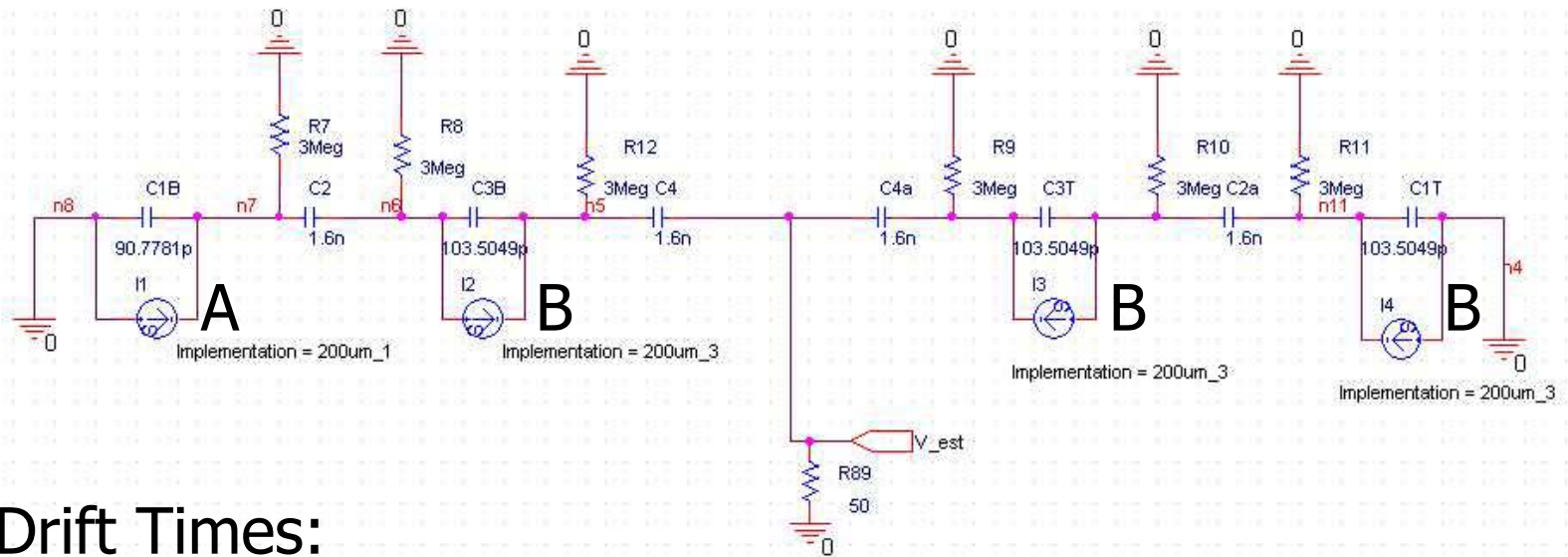


# Output from Perfect EST



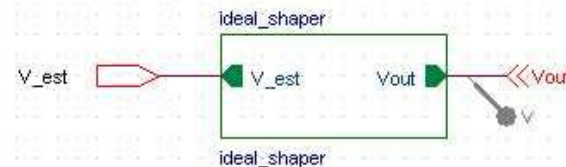


# Modified Model EST

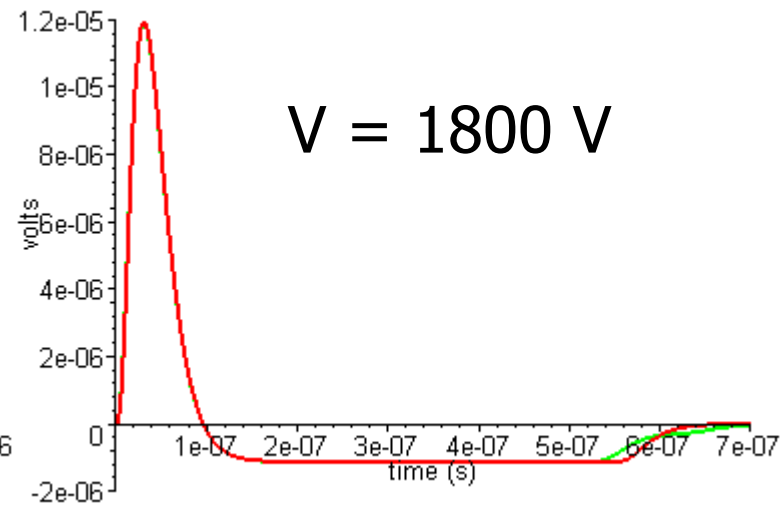
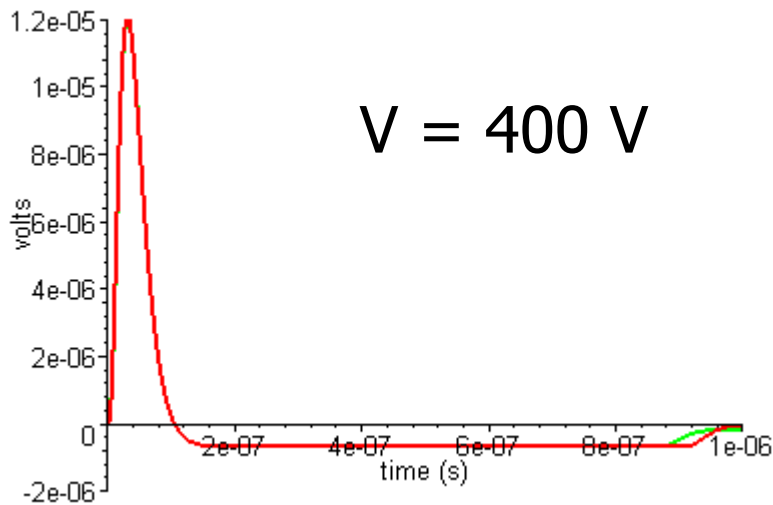


Drift Times:

	A	B
400 V	1029 ns	864 ns
1800 V	624 ns	524 ns



# Output from Modified Model EST



red: ideal EST    green: modified EST

Gap change = 0.2 mm



# Procedure

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- Gap change was adjusted to approximate peak height at end of NIM residual spectra
  - 400 V : 0.055 mm
  - 1800 V: 0.076 mm
- The capacitance of ideal circuit was altered to approximate distortions at the beginning of NIM residual spectra
  - Ideal capacitance changed from 100 pf to 99 pf

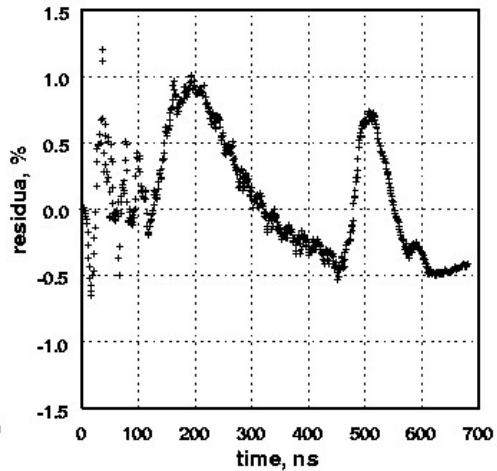
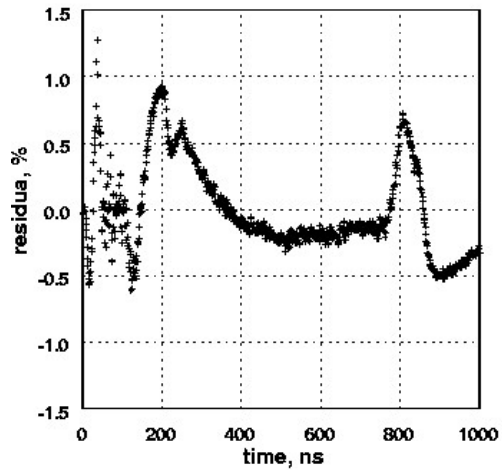
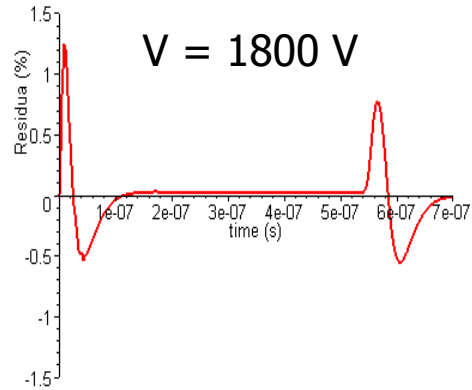
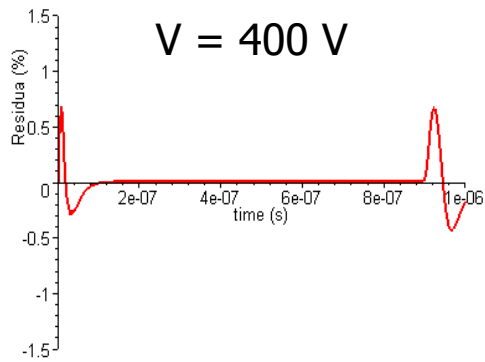


# Procedure

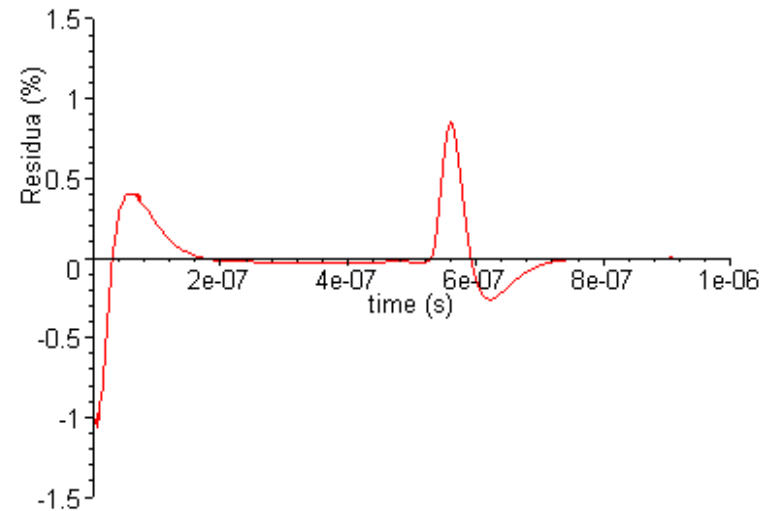
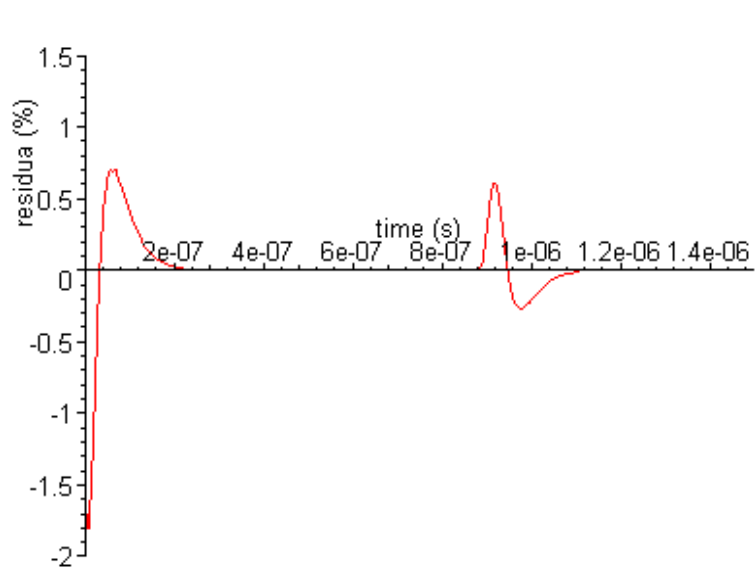
400 V	1800 V			$\Delta g$
				400 V   1800V
C = 97.3 pf T <sub>d</sub> = 939.0 ns	C = 96.3 pf T <sub>d</sub> = 576.6 ns	} Gap 1	g + $\Delta g$	0.055 mm   0.076 mm
C = 100.9 pf T <sub>d</sub> = 893.9 ns	C = 101.3 pf T <sub>d</sub> = 538.8 ns			} Gap 2
C = 100.9 pf T <sub>d</sub> = 893.9 ns	C = 101.3 pf T <sub>d</sub> = 538.8 ns	} Gap 3	g - $\Delta g/3$	
C = 100.9 pf T <sub>d</sub> = 893.9 ns	C = 101.3 pf T <sub>d</sub> = 538.8 ns			} Gap 4

T<sub>d</sub> takes into account E-field change

# Results



# Results – realistic shaper





# Conclusion

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- The investigated effects are a plausible source of the observed residuals between the data and the nominal model.
- Future: Investigate cross talk