



53-970609-CLN-02

**TO: DISTRIBUTION**  
**FROM: C NEUMEYER**  
**SUBJECT: COMPARISON OF SIMULATION CODE WITH CDX-U**  
**MEASUREMENTS**

*References:*

[1] 53-970609-CLN-01, "Simulation of NSTX Plasma Initiation"

*Introduction*

This memo presents a comparison of simulation code output with measurements taken on CDX-U. The code and its application to NSTX are described in reference [1].

Agreement between simulation and measurements is found to be quite good.

*Input Data*

Three data files were provided by W. Choe as follows...

eddy.dat - this file contains the coil and passive structure geometry

0429970358PM.CDX - this file contains the coil current (amp-turn) waveforms for the sample pulse (16 currents x 3062 points,  $\Delta t = 80 \mu\text{S}$ )

Vloop.dat - this file contains the measured (at  $r = 0.08 \text{ m}$ ,  $z=0$ ) loop voltage versus time (2499 points,  $\Delta t = 10 \mu\text{S}$ )

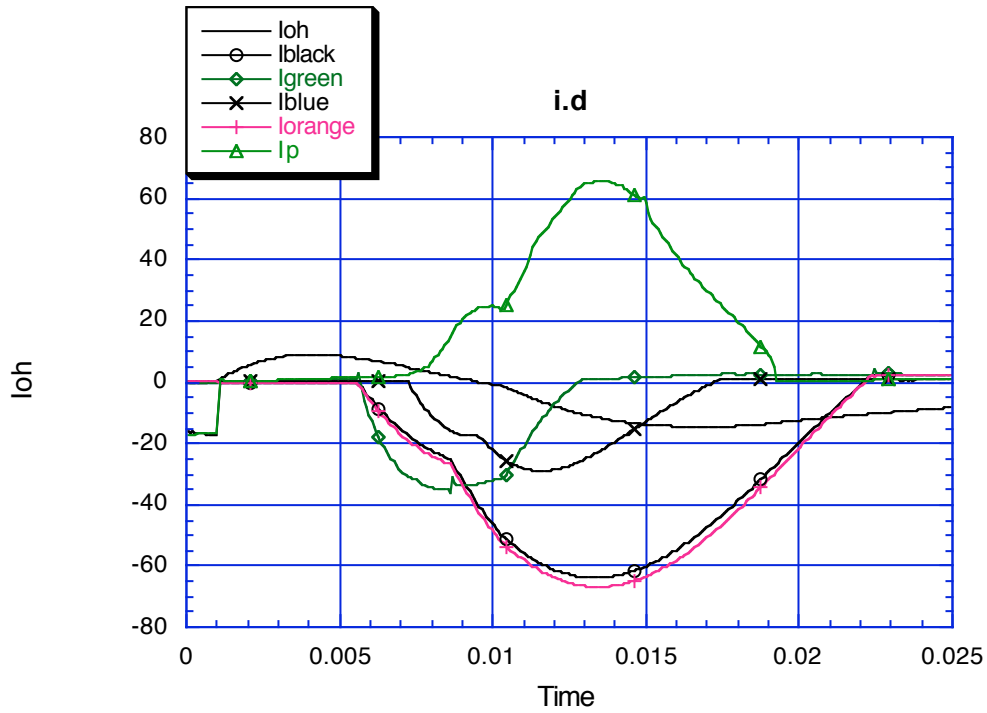
*Processing of Input Data*

File of currents was scaled to amps/turn using the following factors...

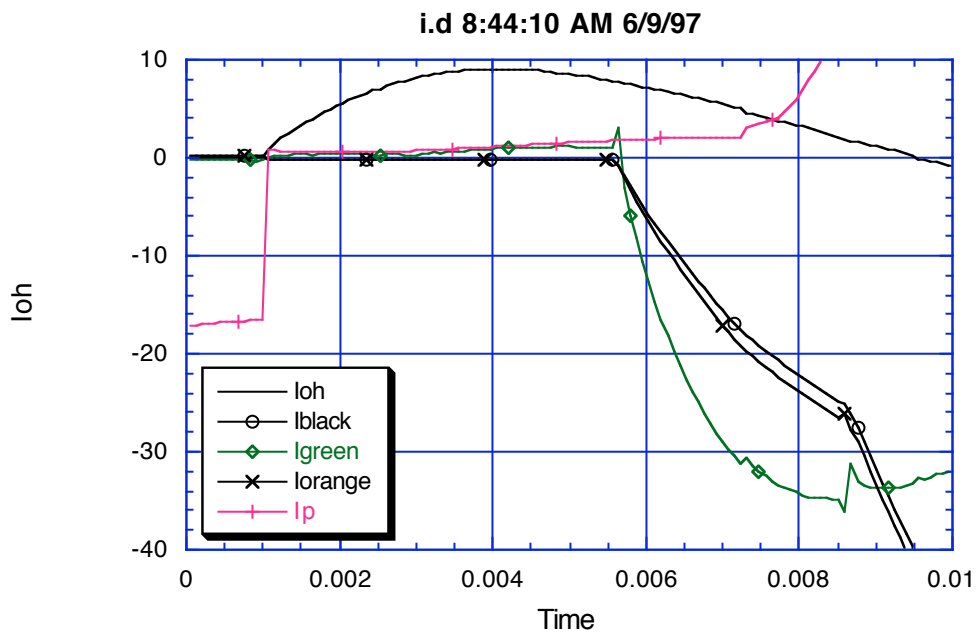
```
channel=[1 2 3 4 5 6 7 8]  
factor =[1., 12., -24.5, 18., -28., -35., 19., -40.]
```

Times of the voltage and current files were adjusted so that the plasma initiation event begins at  $t=0.001$  seconds in each case.

The current waveforms are shown in the following figure...



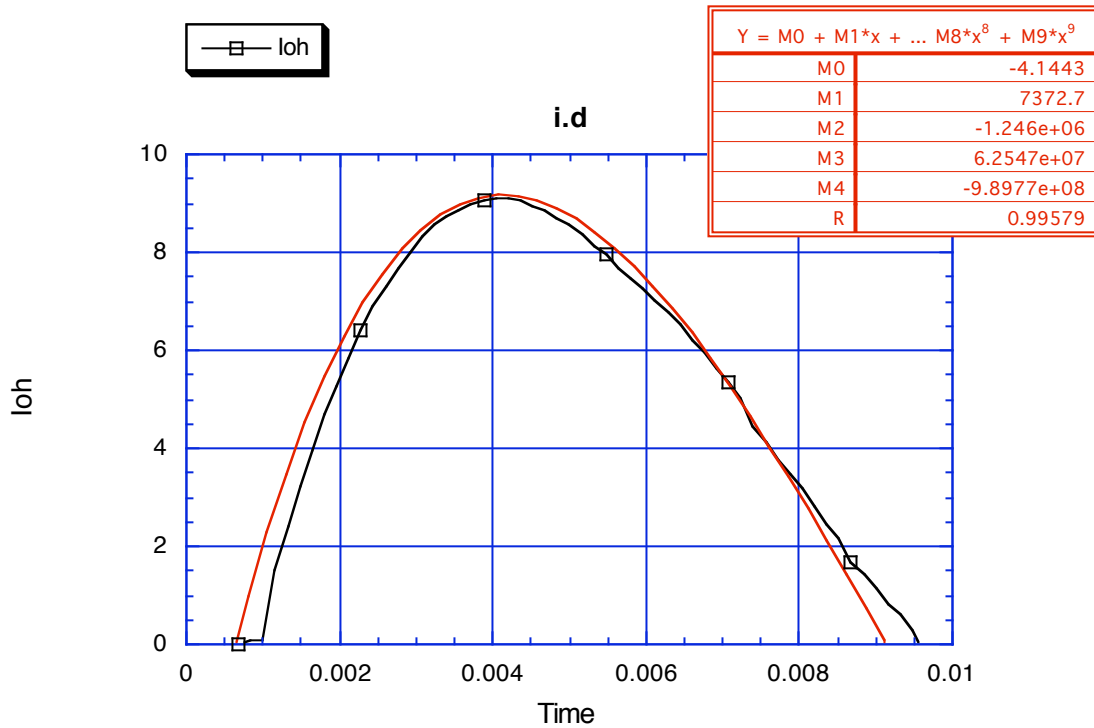
A zoom of the first 10 mS is shown in the following...



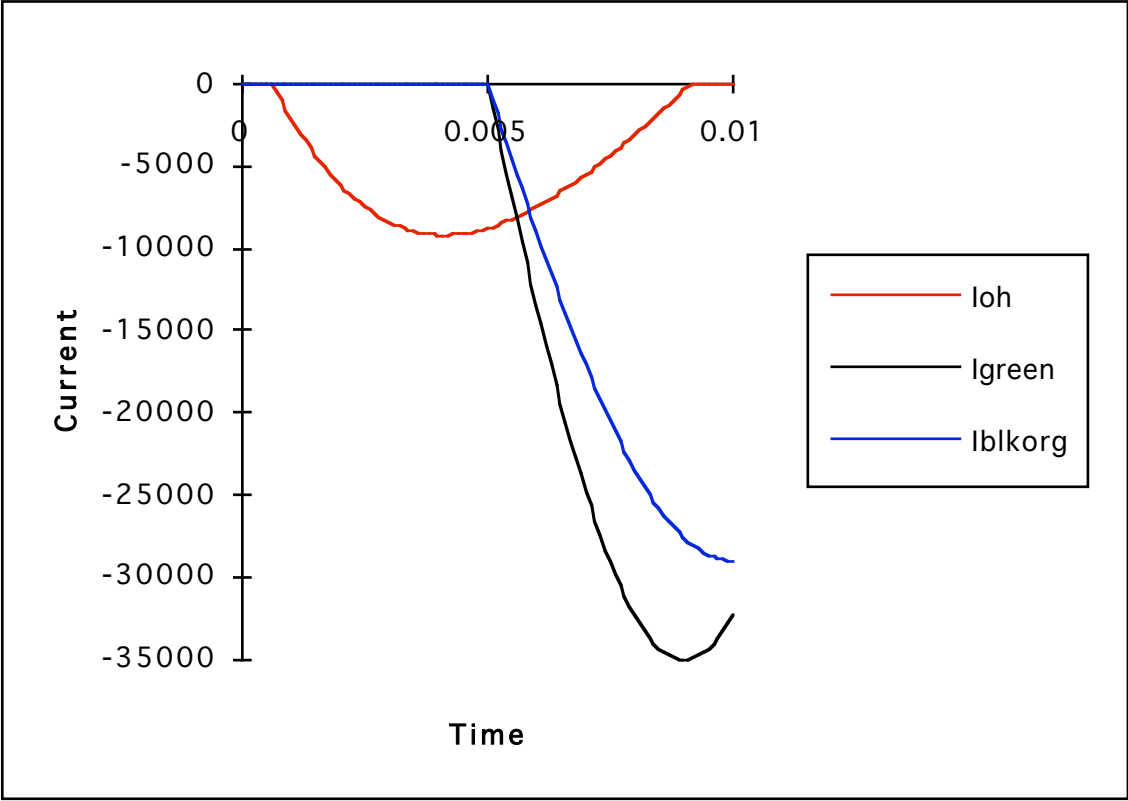
The negative plasma current measurement prior to 1mS is assumed to be an instrumentation anomaly (probably integrator drift which is reset at  $t = 1\text{mS}$ ), so it is ignored. It is noted that the plasma current begins at  $t = 7.25\text{ mS}$  (small

measurement prior to that time assumed to be integrator drift), so that vacuum conditions only exist prior to this time.

A curve fit to the OH current waveform over the interval of interest was made as follows...

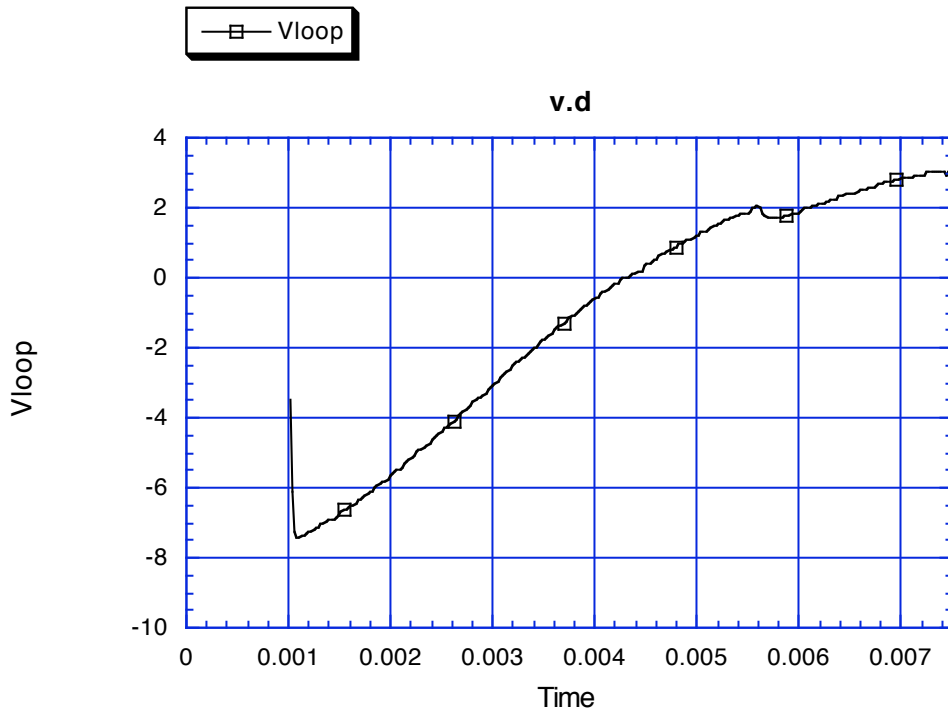


An Excel spreadsheet was used to generate linear breakpoint files to use as driving currents for the simulation to approximate the measurements. A total of 76 points was used to cover a 7.5 mS interval. The OH current trace was inverted to correct the polarity. Waveforms resulting were as follows...

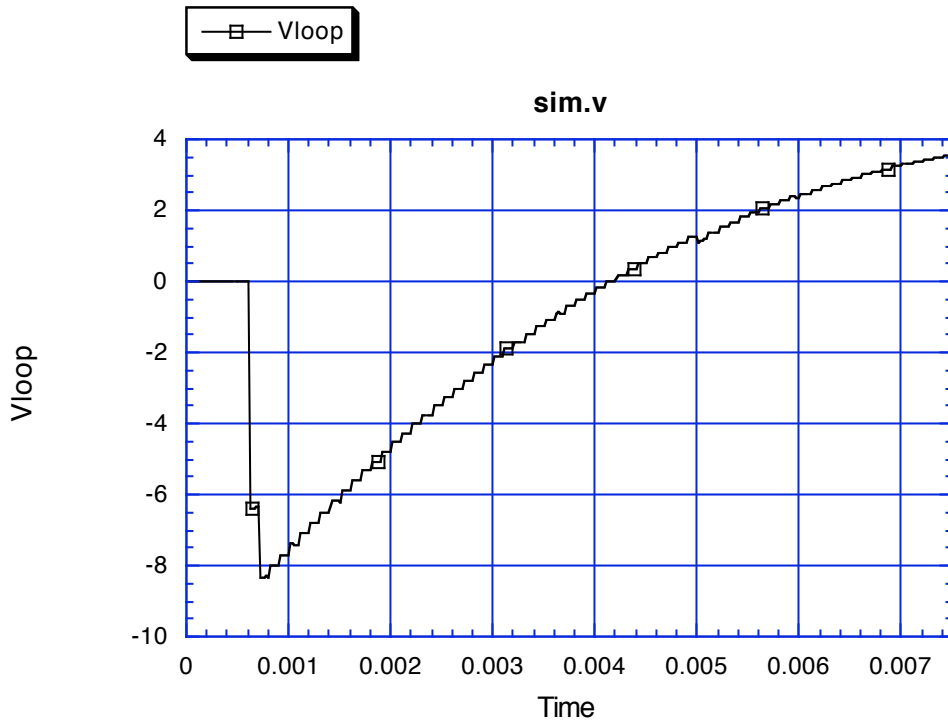


### Comparison of Simulation Results to Measurement

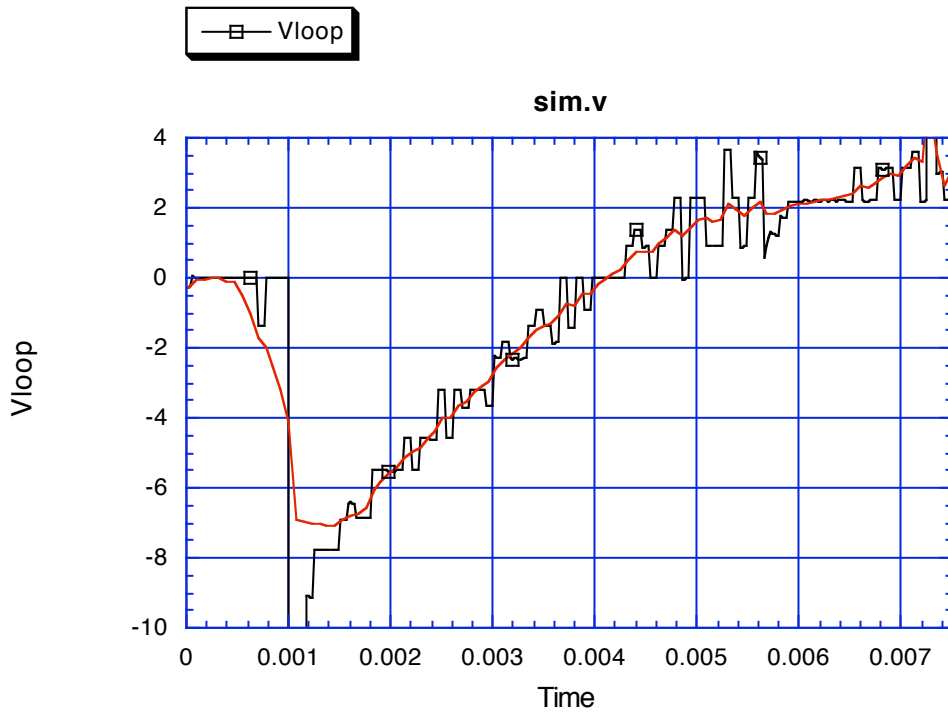
Loop voltage measurement over the interval of interest is as follows...



Simulation result using the Excel generated 76 point waveforms for OH, green, black, and orange circuits is as follows...



Simulation result using the actual measured current data file as an input is as follows, along with a smoothed average...



The discretization and noise associated with the current measurements cause the significant fluctuation in the simulated voltage signal.

cc:

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R Hatcher  
S Kaye  
M Ono  
M Peng

NSTX File