Heavy Ion Effects in PWM's of the type UCC1806 and UC1825

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Heavy ion tests of 2 types Pulse Width Modulators (PWM),

1/ UCC1806 DC: 0146

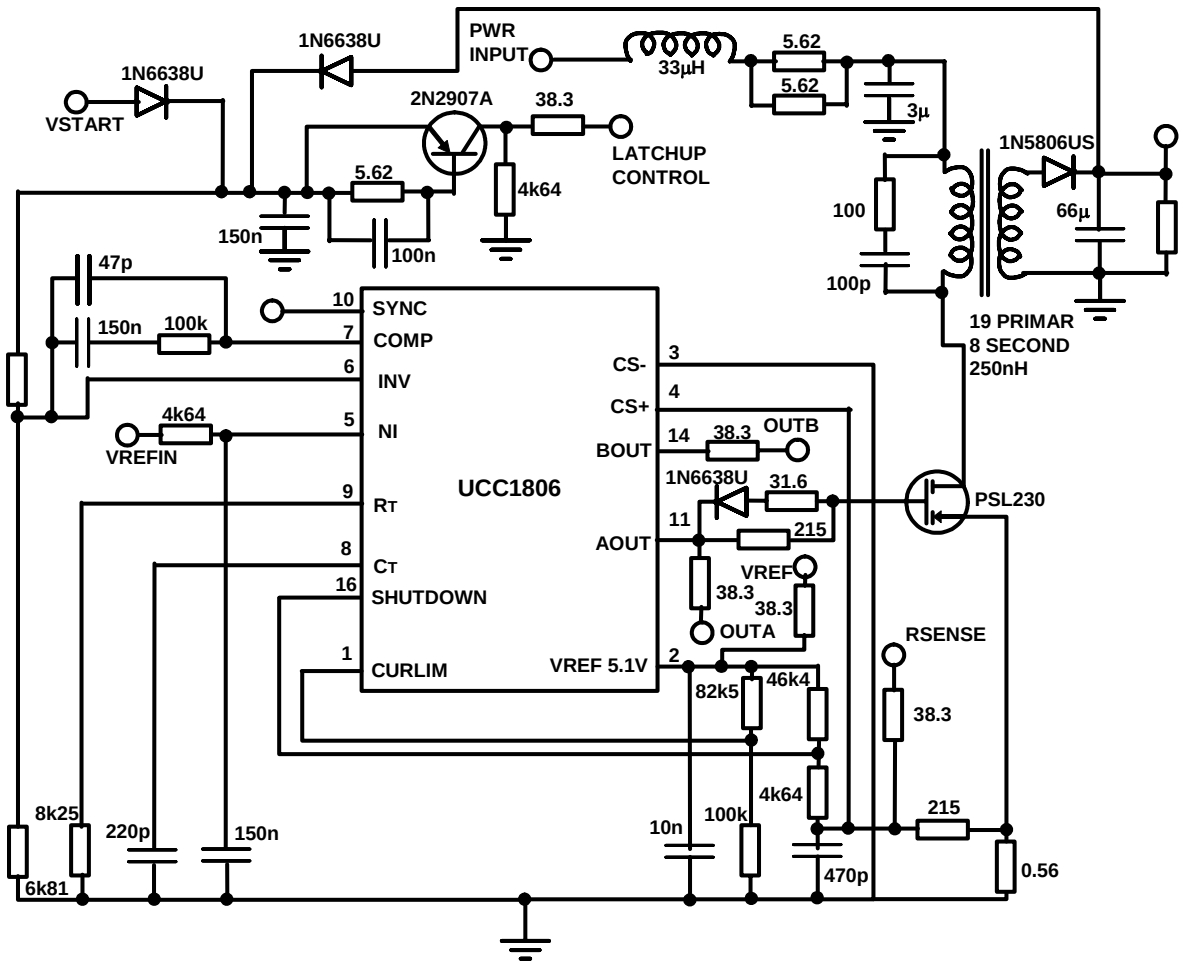
2/ UC1825. DC: 0313

Both are from Texas Instrument. The dices come from stock and are manufactured by Unitrode at Merrimac.

Heavy ions used in the present investigation at CYClotrone at Louvain la Neuve

Element	Energy MeV	Range µm	LET value MeV·cm^2/mg
22 Ne7+	235	199	3.3
40 Ar12+	372	119	10.1
78 Kr25+	756	92	32.4

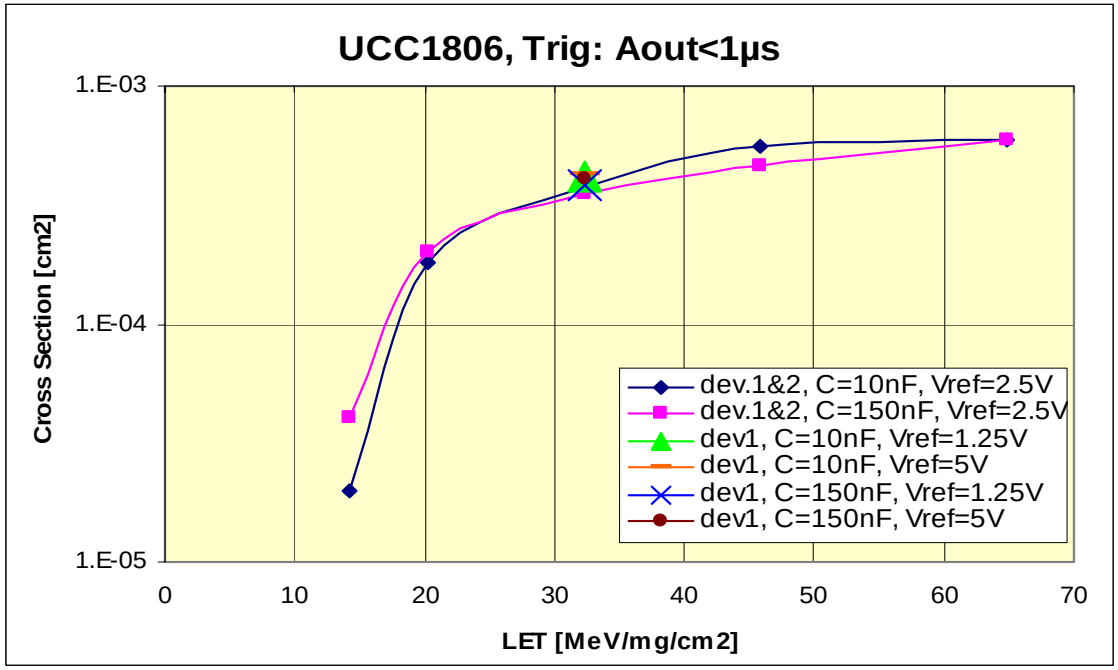
Test Setup for UCC1806



Measured signals and trigger condtions

Signal	Trig condition
Aout	Pulse width<1µs
Bout	no trig
EA	neg. slope at 1.36V
CL	neg.slope at 2.80V
Vref-out	neg. slope at 0.59V
Rsence	no trig

Results from UCC1806



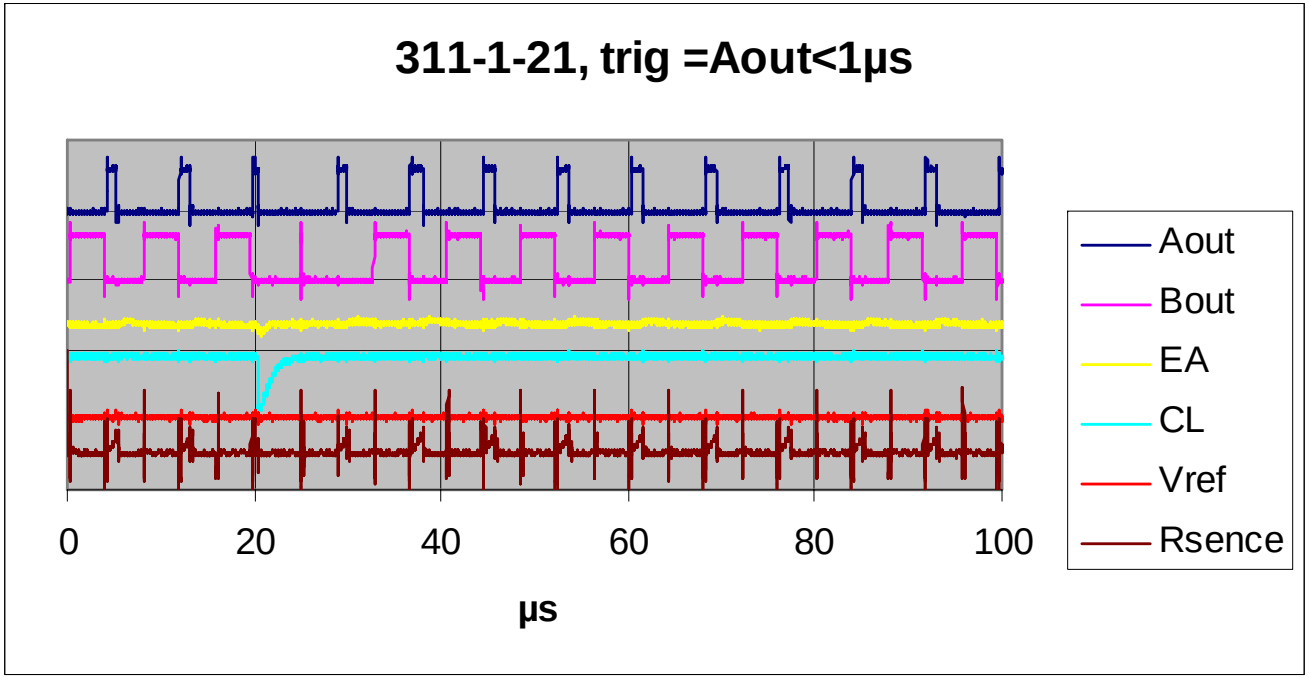
Comparative tests at a LET=32.4MeV/mg/cm2 for different Vref in and different capacitances on Vref out at

C	Vref=1.25V	Vref=2.50V	Vref=5.00V
10nF	4.20E-04	4.10E-04	4.30E-04
150nF	3.80E-04	3.55E-04	4.10E-04

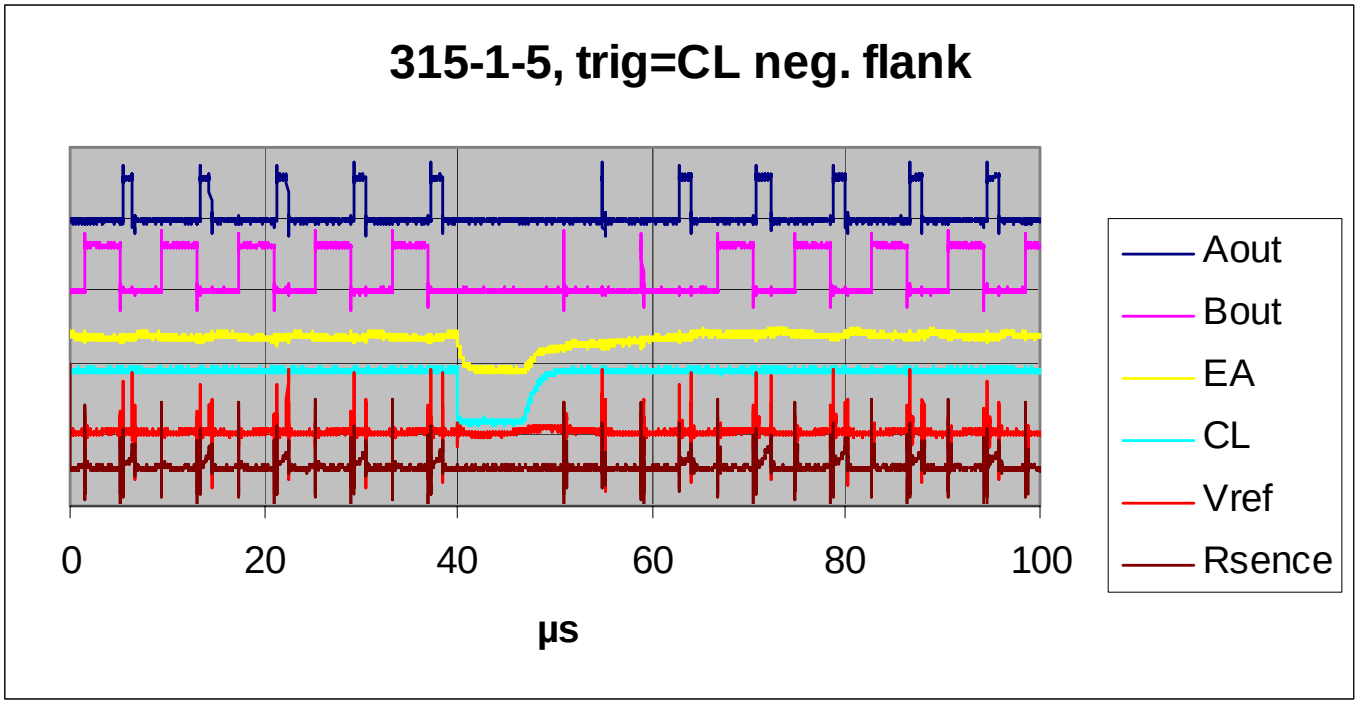
The Cross Section values given in cm^2

→ **No significant differences**

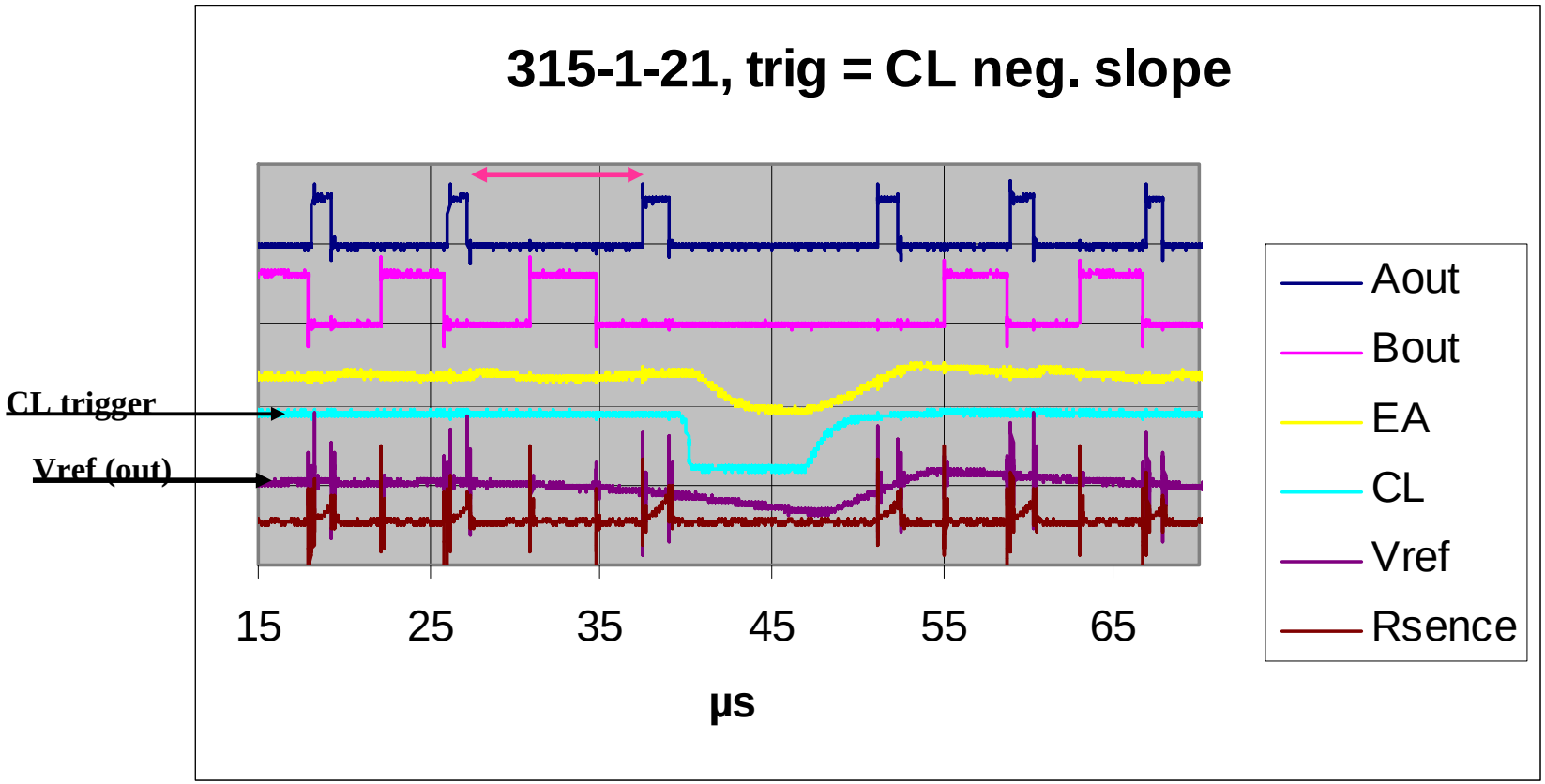
Oscilloscope picture indicating that one of the latches in the UVLO is hit by an ion. The CL signal show a short response time.



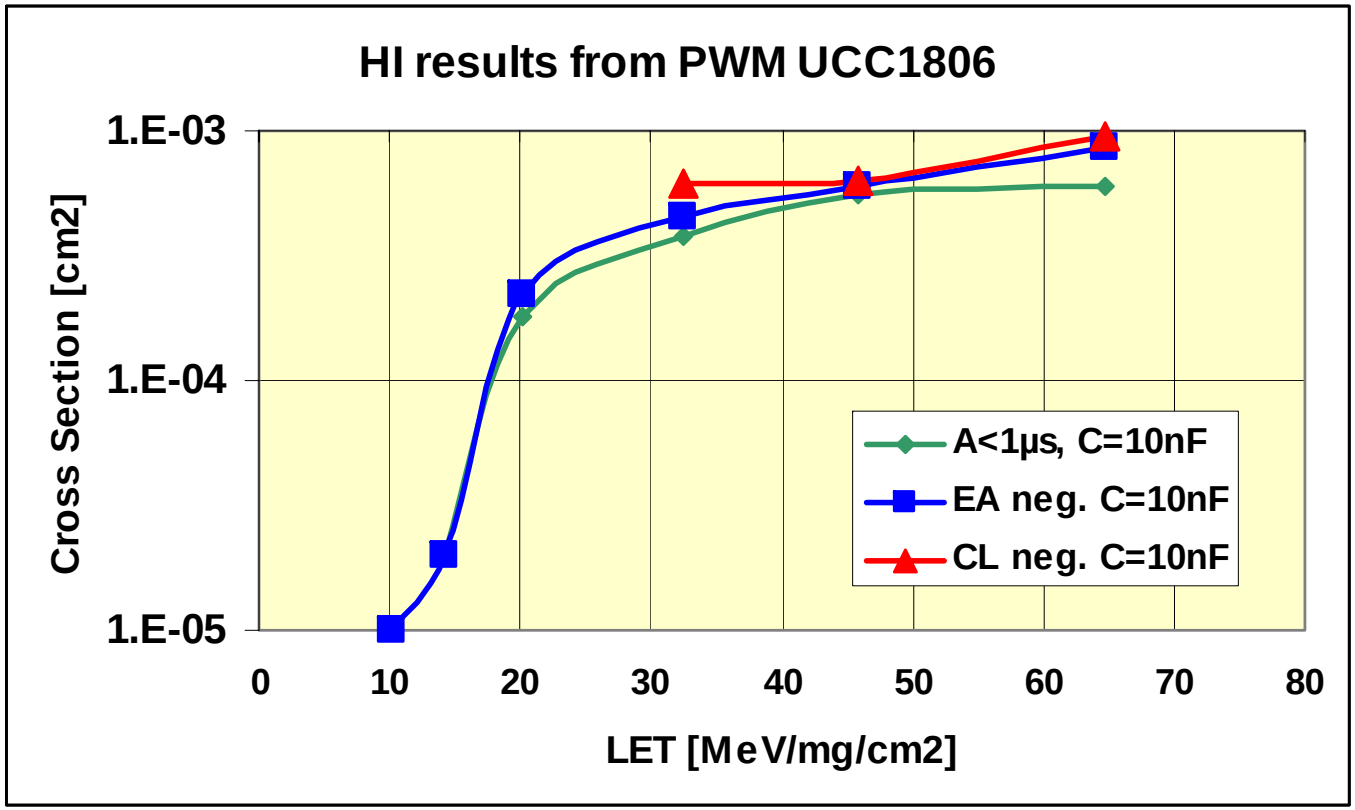
Typical picture of an error generated in some of the OP-amplifiers controlling the UVLO where almost all signals are affected.



Oscilloscope picture of measured parameters when negative slope on the CL signal was triggering the oscilloscopes. The Vref starts to decrease at about 10µs before the CL close down the PWM and at the same time the Aout pulse period is shifted.

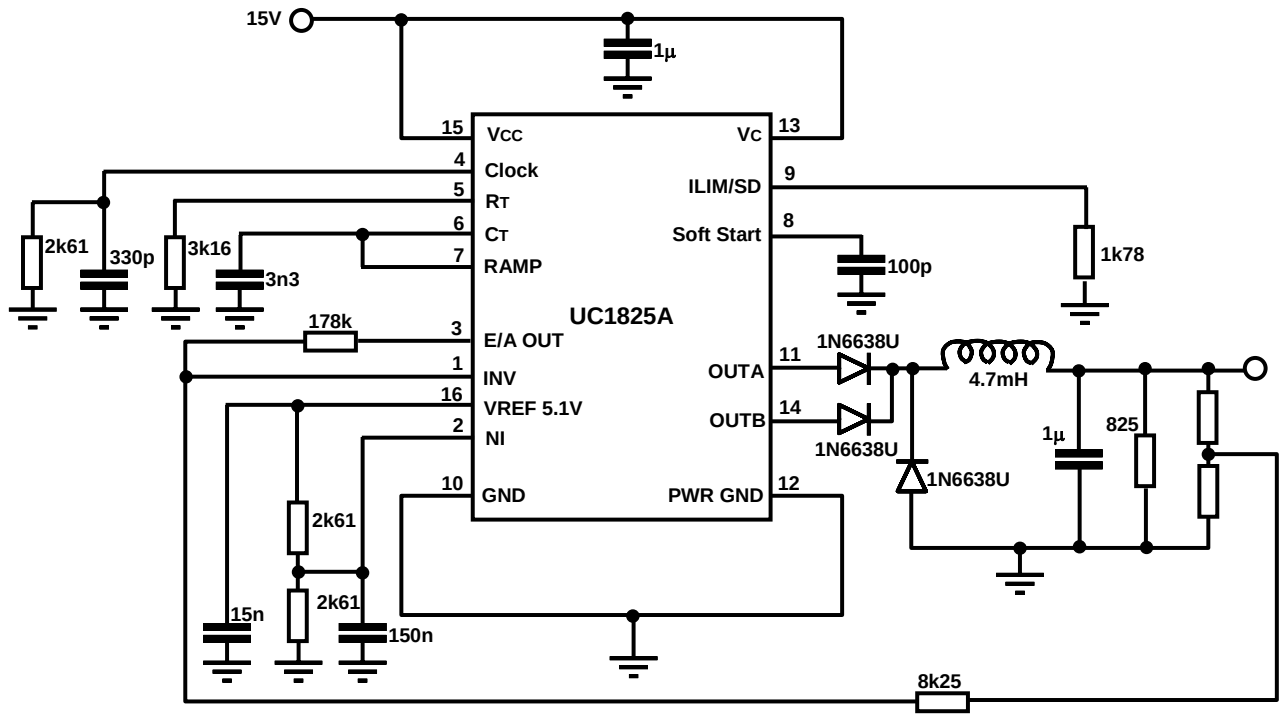


Cross Section vs LET



The above diagram indicate that an ion hit somewhere will influence all signals

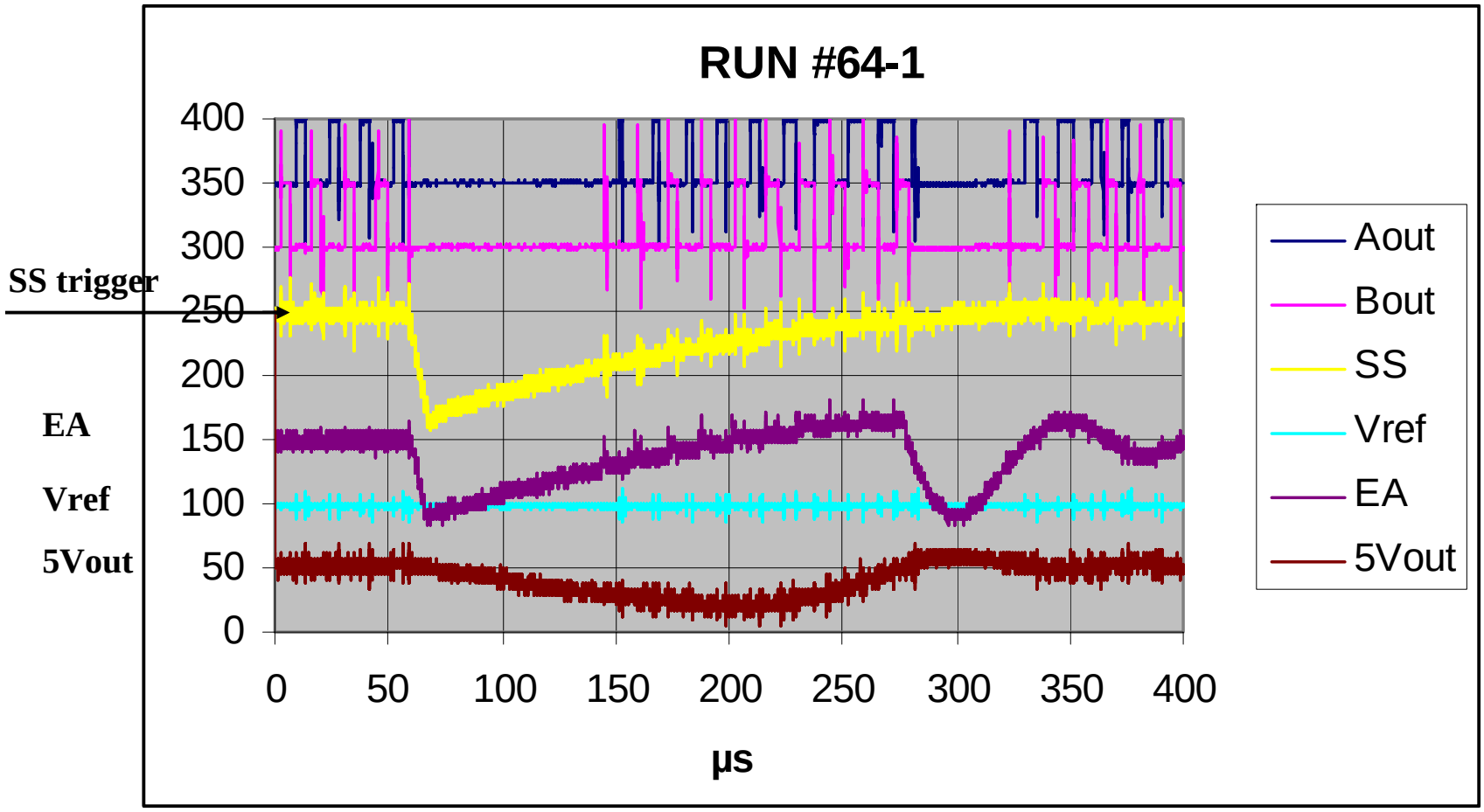
Test setup for UC1825



Signal	Trig condition
Aout	Pulse width<3µs
Bout	no trig
SS	neg. slope at 2.60V
EA	neg.slope at 2.00V
Vref-out	neg. slope at 2.80V
5V out	no trig

Measured signals and trigger condtions

Results from UC1825

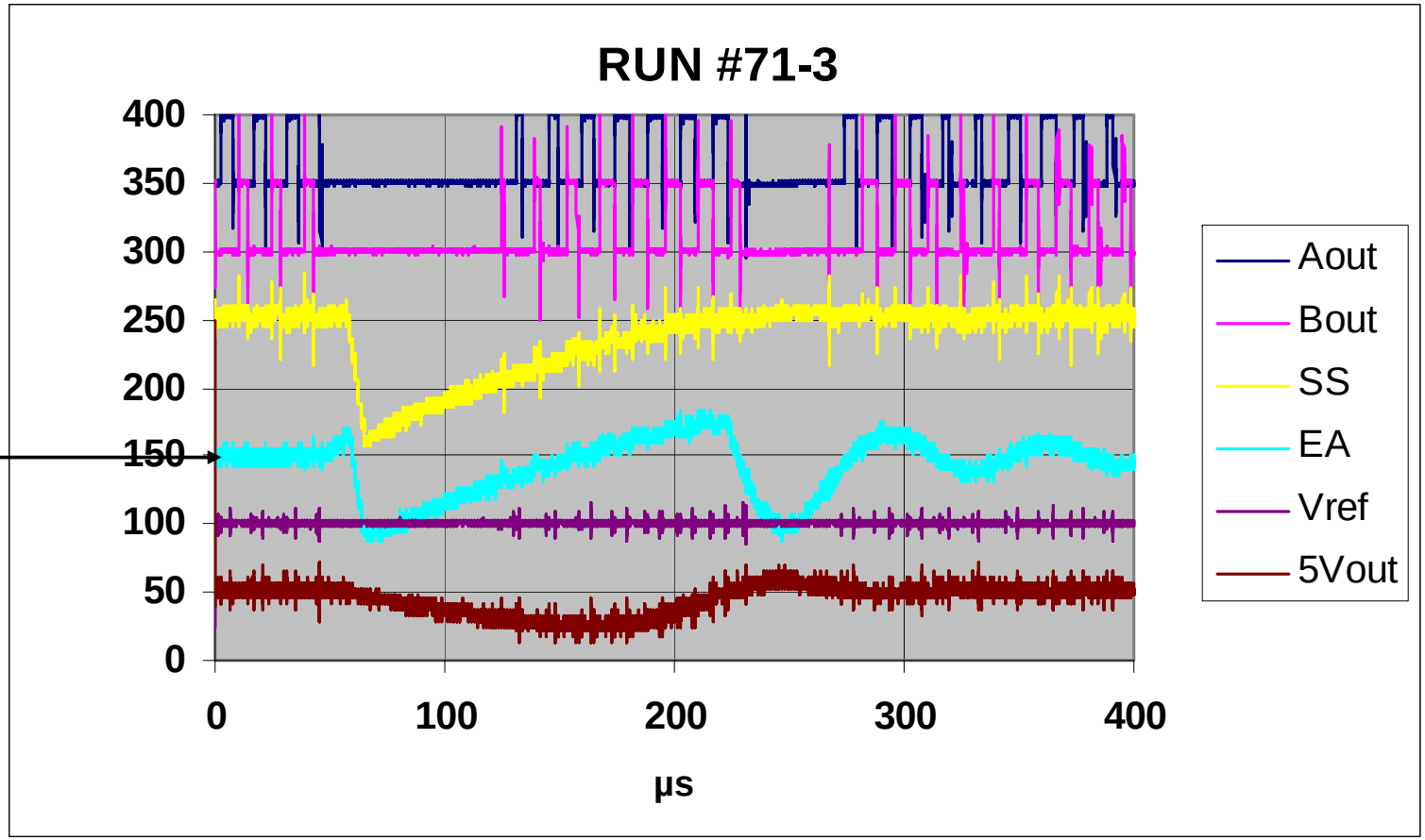


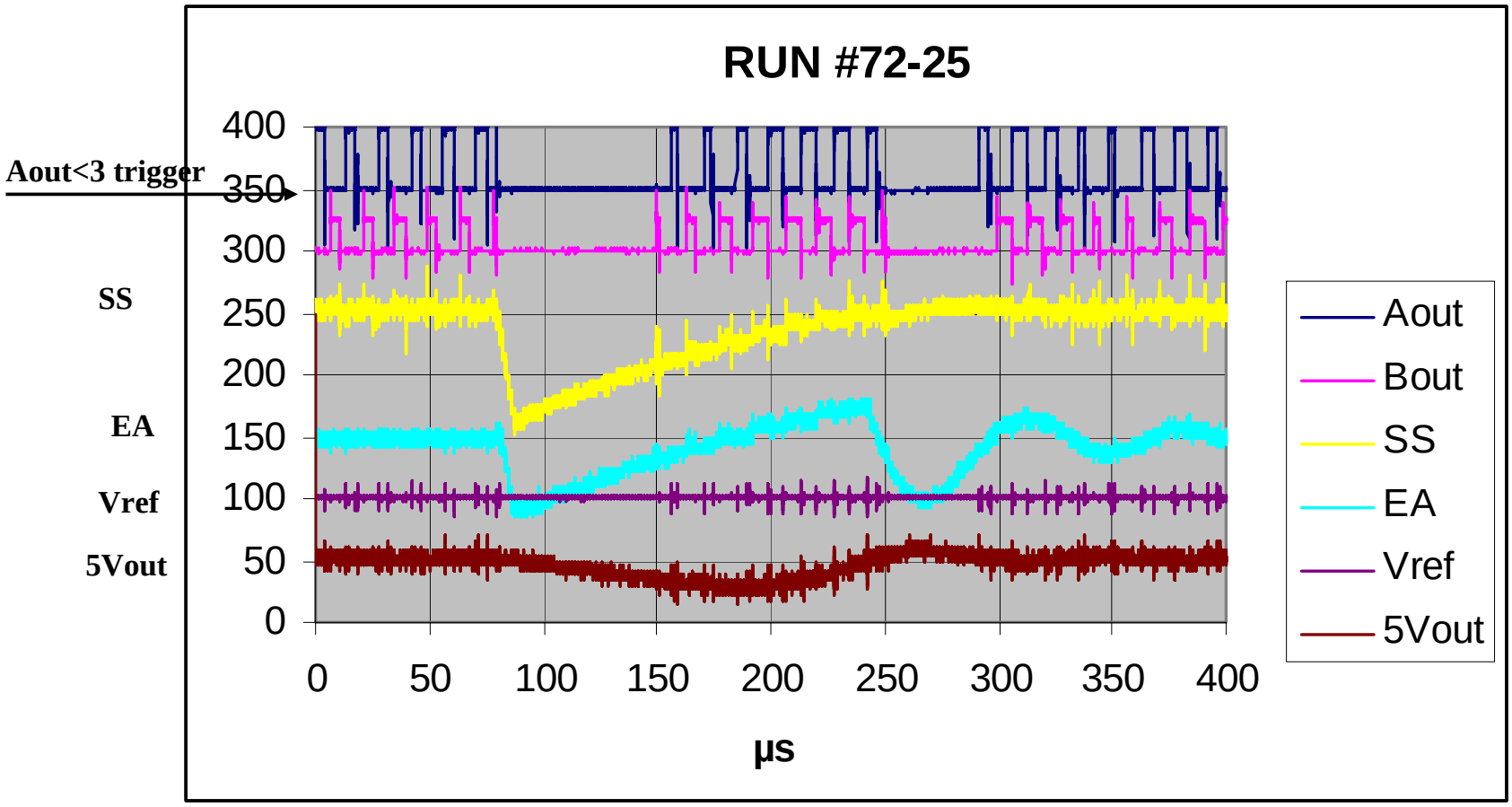
SS

EA trigger

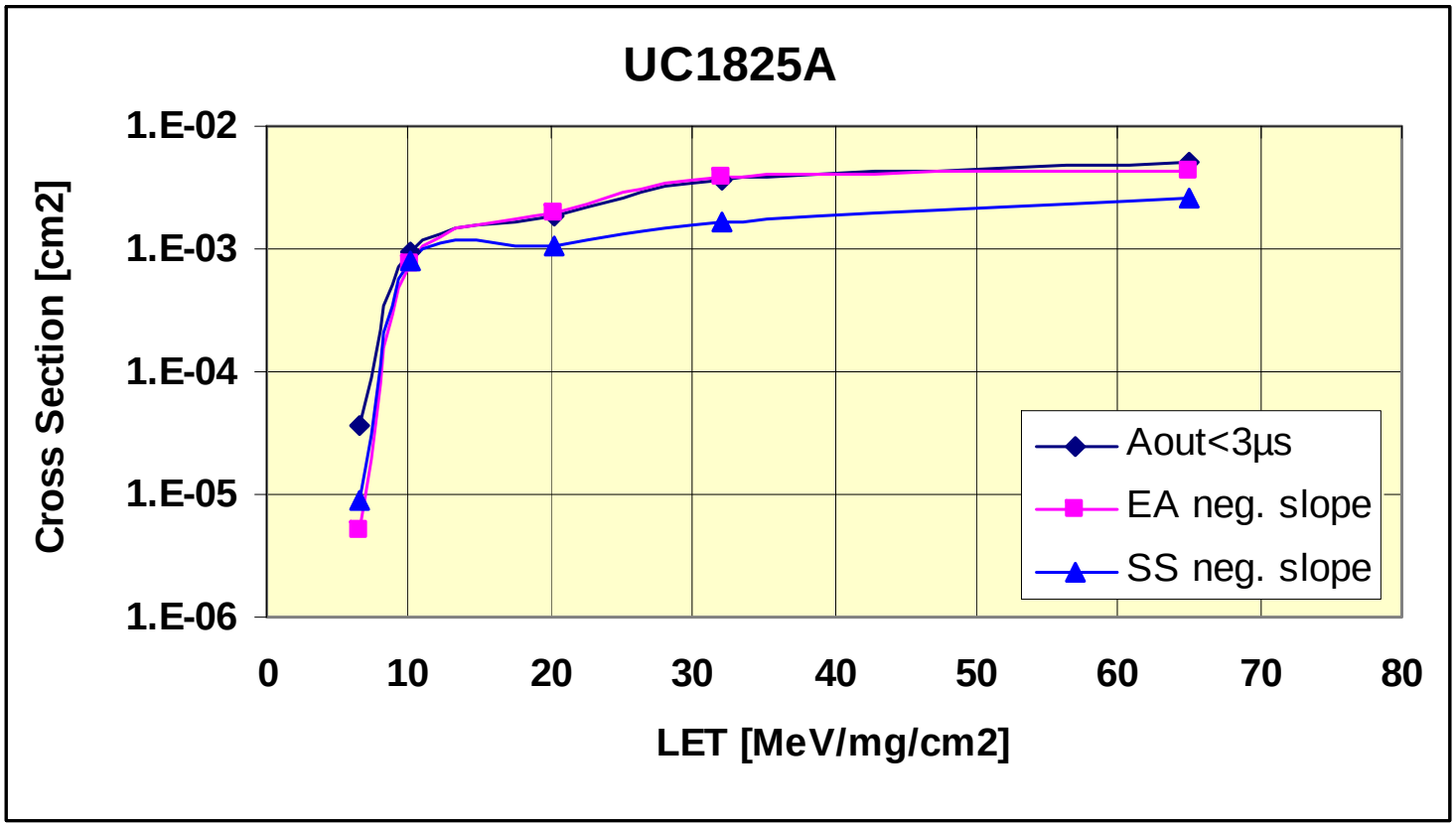
Vref

5Vout




RUN #72-25
Aout<3 trigger
SS
EA
Vref
5Vout
400
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
µs
Aout
Bout
SS
EA
Vref
5Vout

Cross Section vs. LET for UC1825

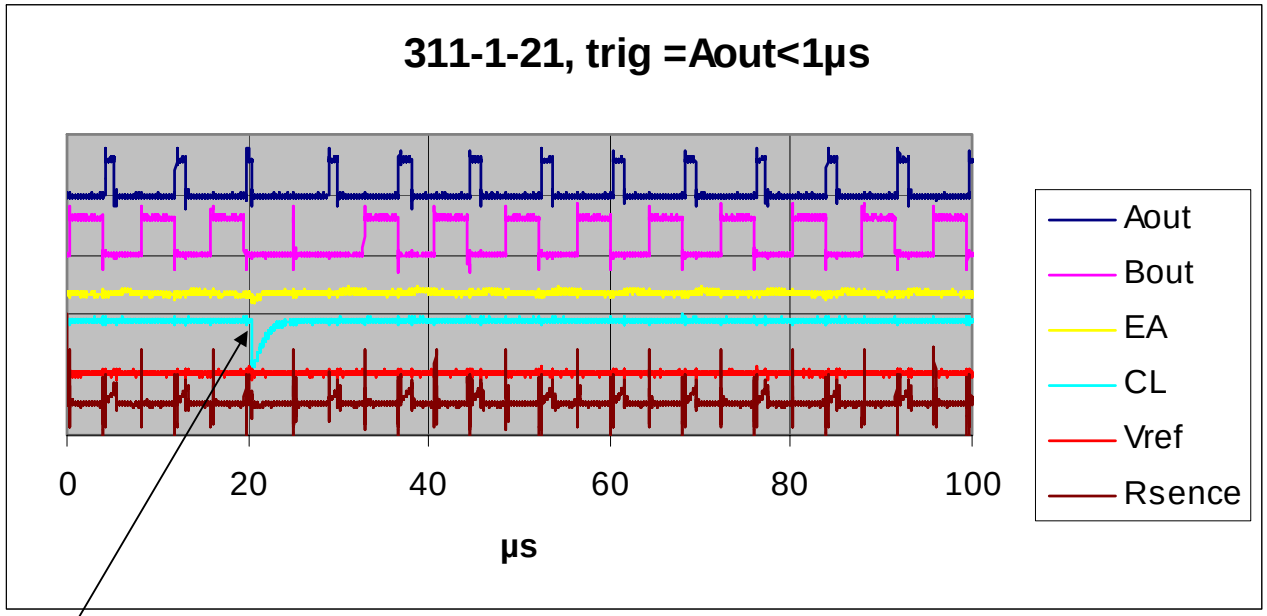


Trigg on Aout<3µs and EA negative slope show identical cross sections
A slightly lower cross section was measured when trigger was set on the SS

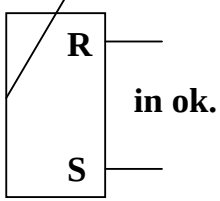
Conclusions

- No Single Event Latch-up (SEL) or hard errors were observed for UCC1806 or UC1825
- The cross section for UCC1806 has here been shown to be about 10 times higher than what has been reported earlier. Here a LET threshold value of about 20MeV/mg/cm^2
- The LET threshold value for UC1825 is about 10Mev/mg/cm^2
- The differences in results from earlier tests with UCC1806, can certainly depend on the test setup used

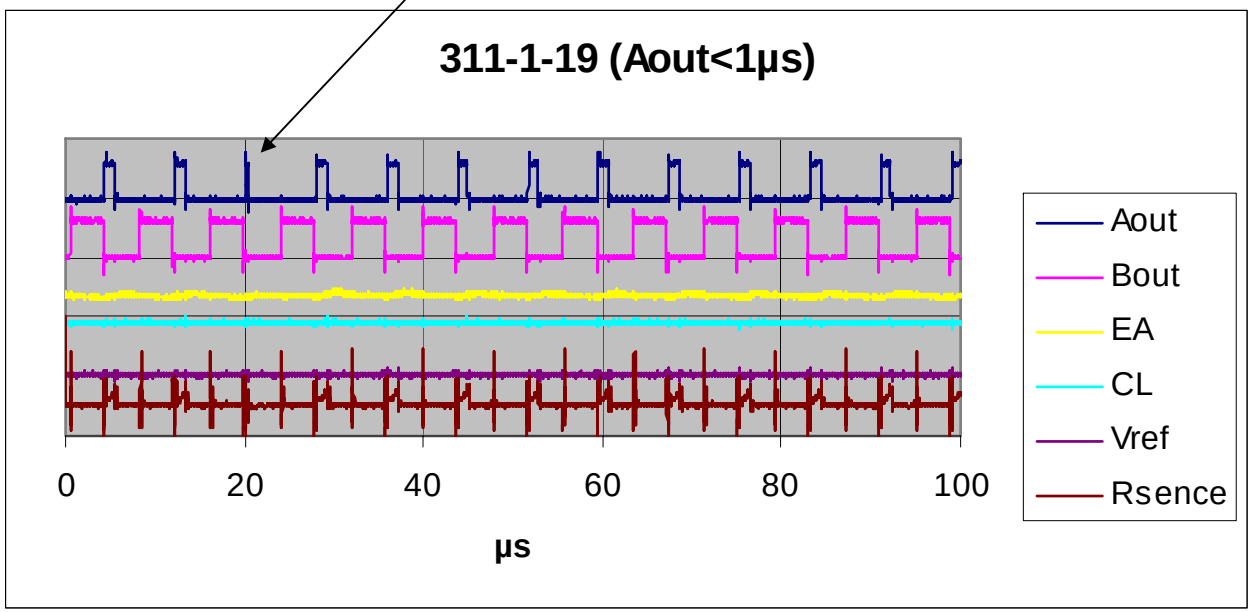
FINISH

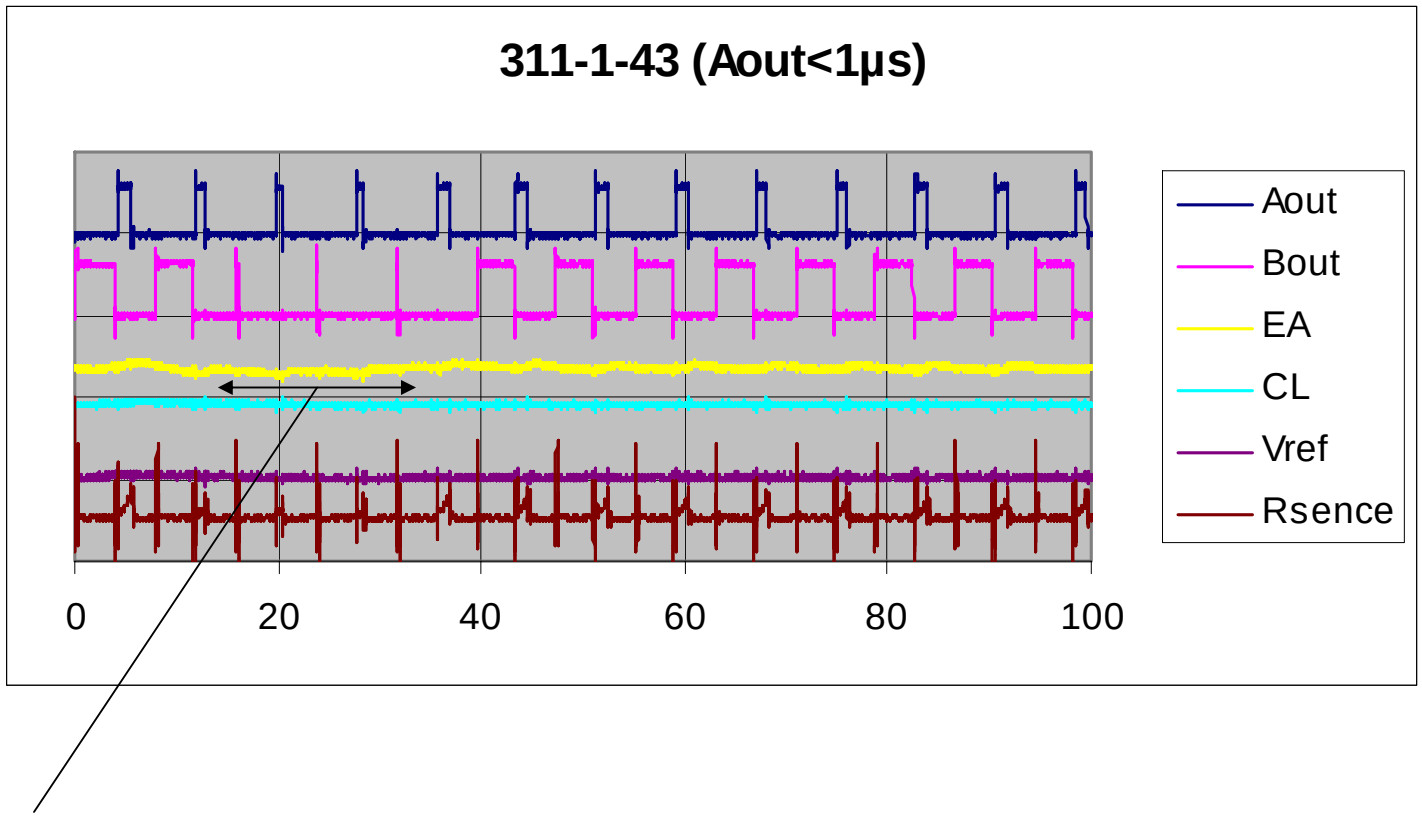


Current Limit latch



assumed to be only in the ”out-latch”





Assumed to be an error in the Error Amplifier