SEE Evaluation of Pulse Width Modulators UC2843 and UC2845 from ST Microelectronics

ESA contract 11407/95/NL COO 11
RUAG Report No D-P-RAD-01220-RSE
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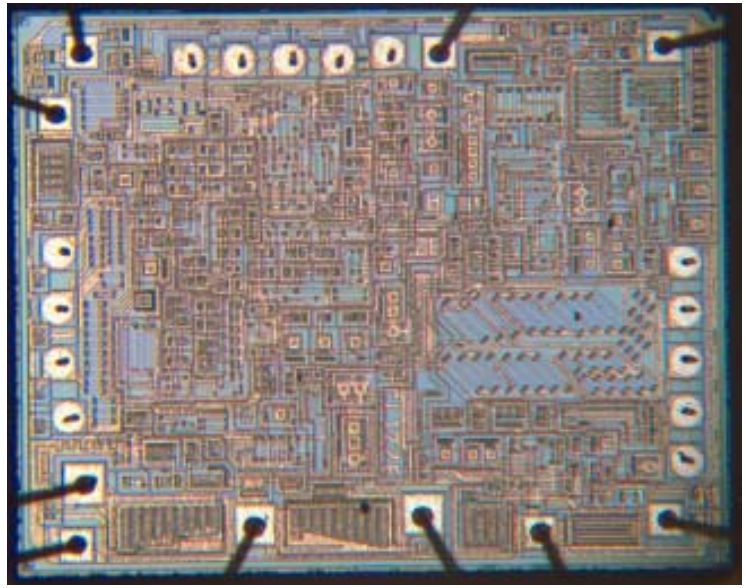
UC2843 & UC2845 Samples SGS Thomson Microelectronics

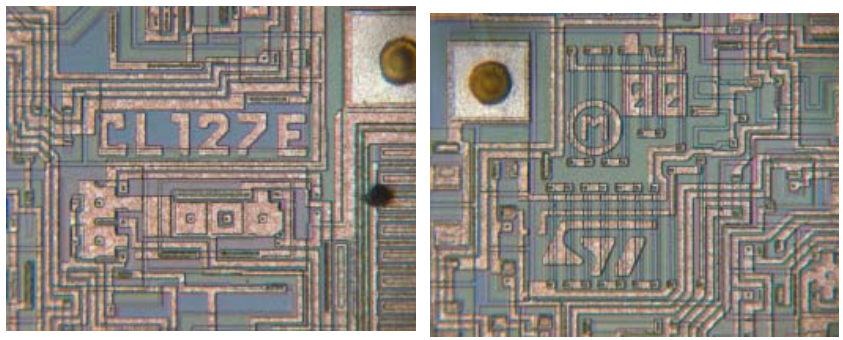


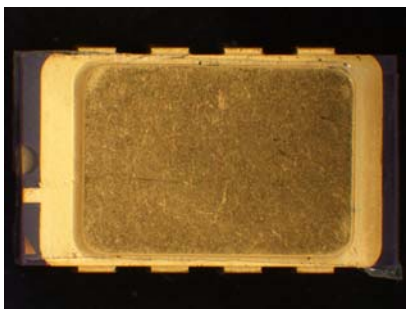
- Fixed frequency current mode Pulse Width Modulator (PWM)

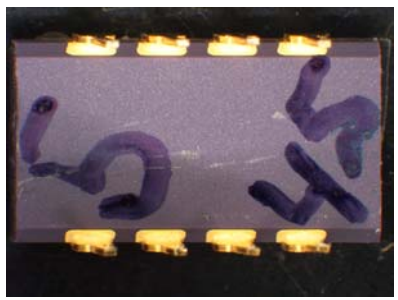
- UC2843/2854 are drop-in replacement to Texas Instrument UC1843/UC1845, data sheets almost identical (**UC2843** can operate to **duty cycles** approaching **100%,** while **UC2845** operate in the range zero to **< 50%** by addition of an internal toggle flip flop which blanks the output off every other clock cycle.)

- Die STM specific,
- Samples delivered by ESA, 8-pin DIL

UC2845 Die

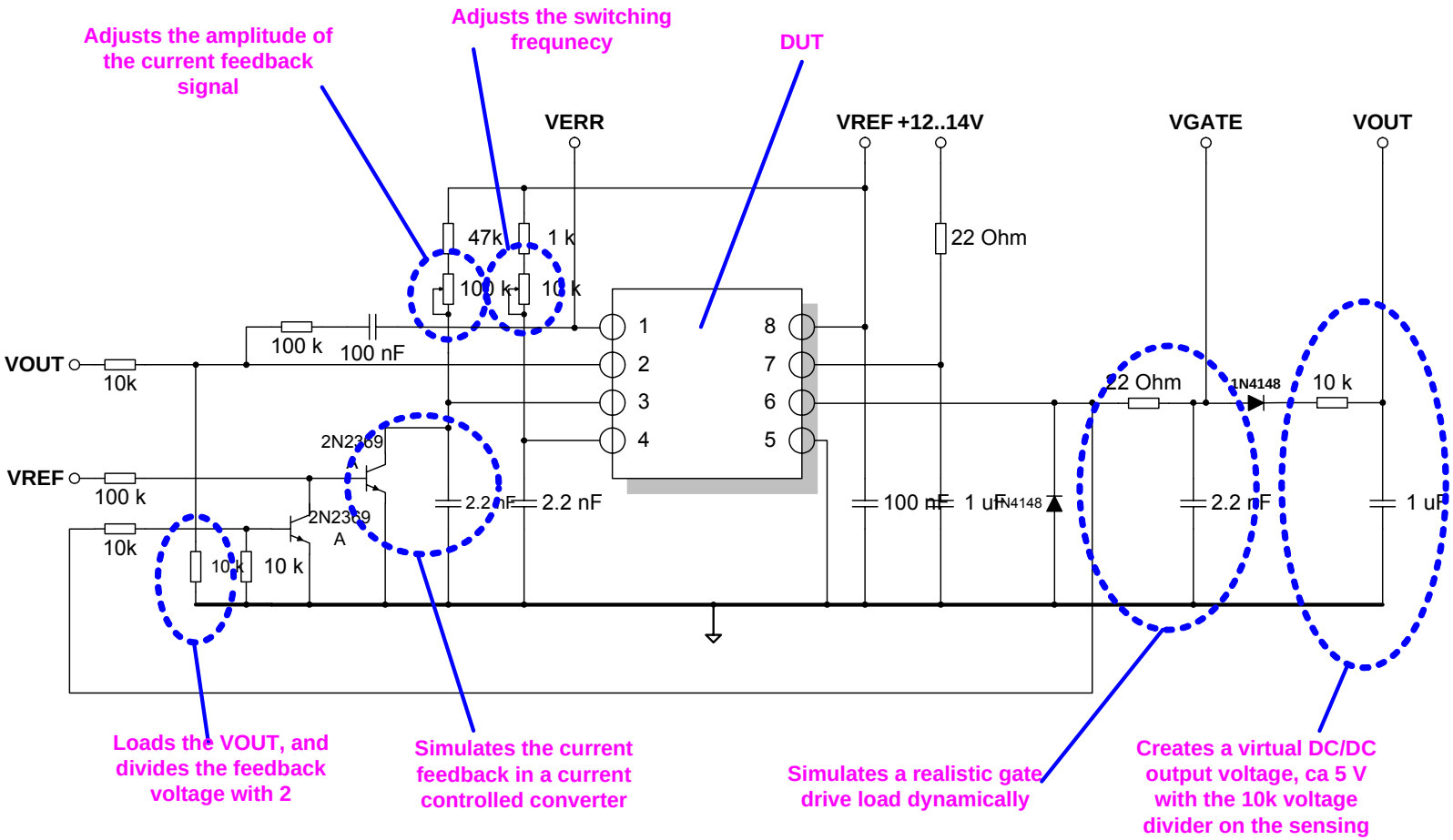






Bias Schematic for Tests

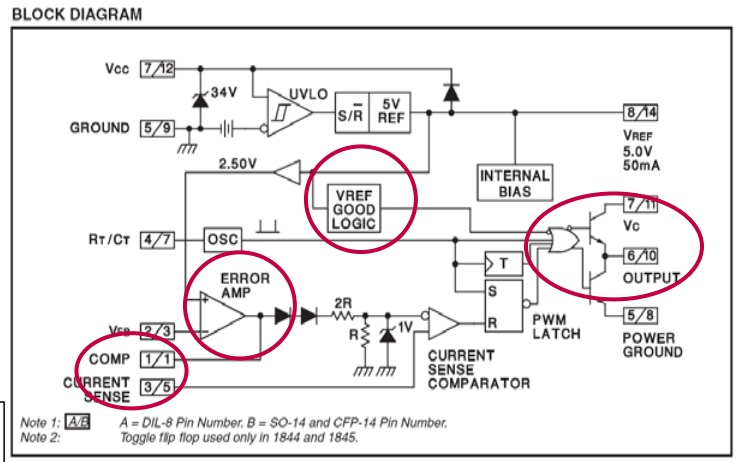
- Results specific for the following bias circuit

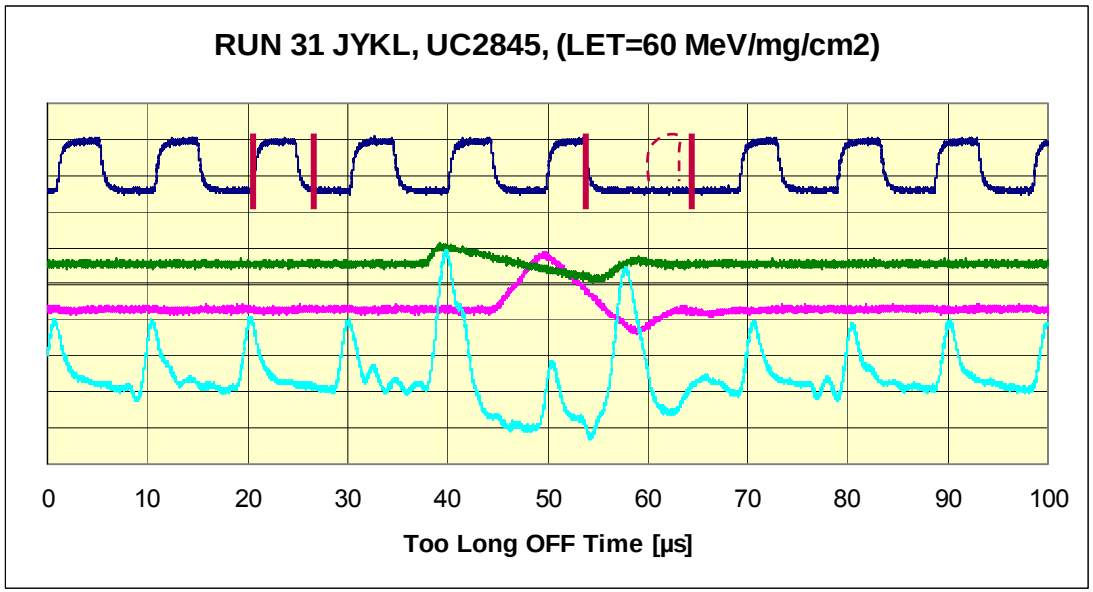


Monitored Signals During Irradiation

Trigger Conditions

Output OFF time >12µs
Output ON time > 5µs
Vref Nominal value ± 0.3 V





- Output (Vgate)
- Reference (Vref)
- Error Amplifier (EA)
- Current Sense (CS)

Oscilloscope picture with trigger conditions shown as red bars

Heavy Ions

Heavy ions used at RADEF Jyväskylä

Ion	Energy [MeV]	LET^{SRIM} @surface [MeV/mg/cm2]	$Range^{SRIM}$ [microns]
$^{20}Ne^{+6}$	186	3.6	146
$^{40}Ar^{+12}$	372	10.1	118
$^{56}Fe^{+15}$	523	18.5	97
$^{82}Kr^{+22}$	768	32.1	94
$^{131}Xe^{+35}$	1217	60.0	89

Heavy ions used at Louvain la Neuve in Belgium

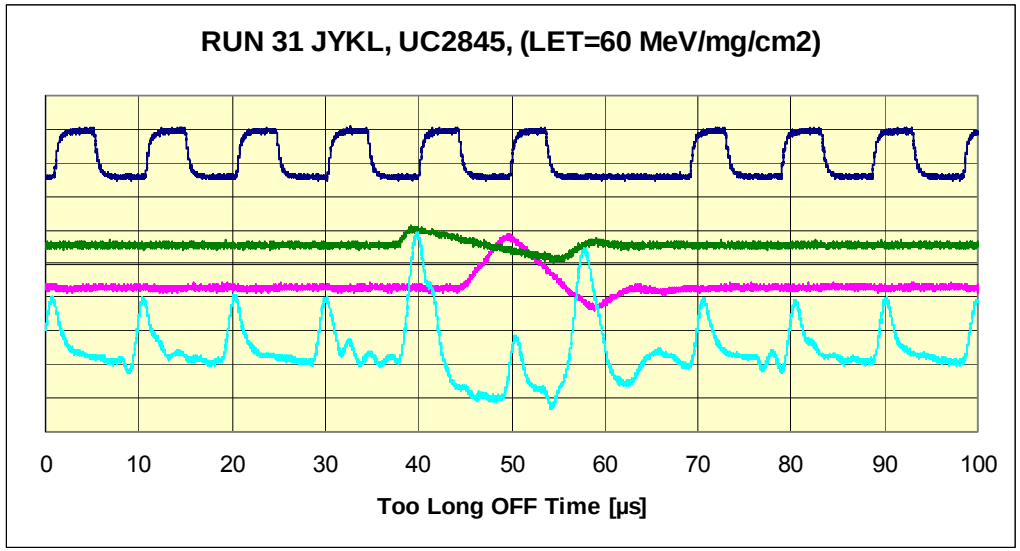
Ion	Energy [MeV]	LET^{SRIM} @surface [MeV/mg/cm2]	$Range^{SRIM}$ [microns]
$^{82}Kr^{+17}$	316	34	43
$^{131}Xe^{+26}$	459	60	43

Typical SET in UC2843 /2845

Too Long OFF Time

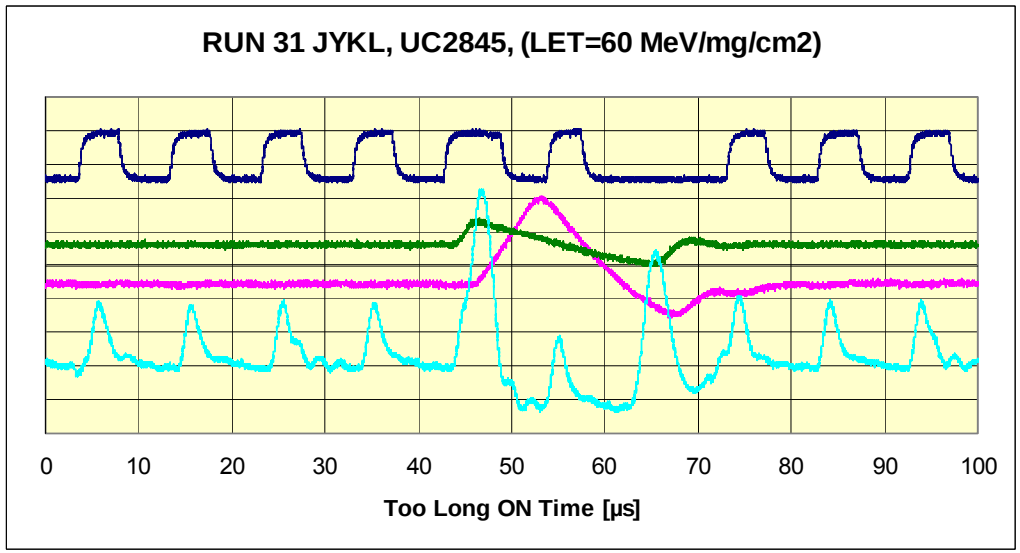
Majority of SET =
Loss of 1 pulse

Trigger on Output

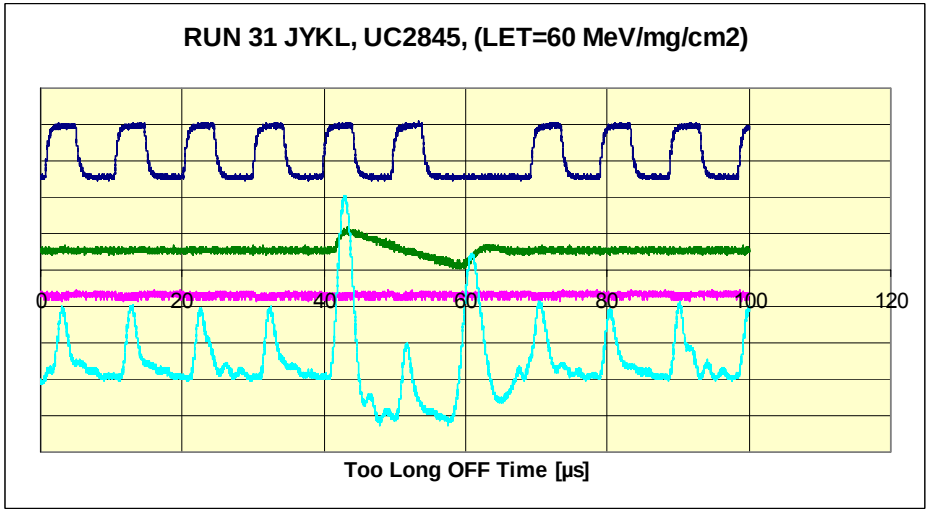


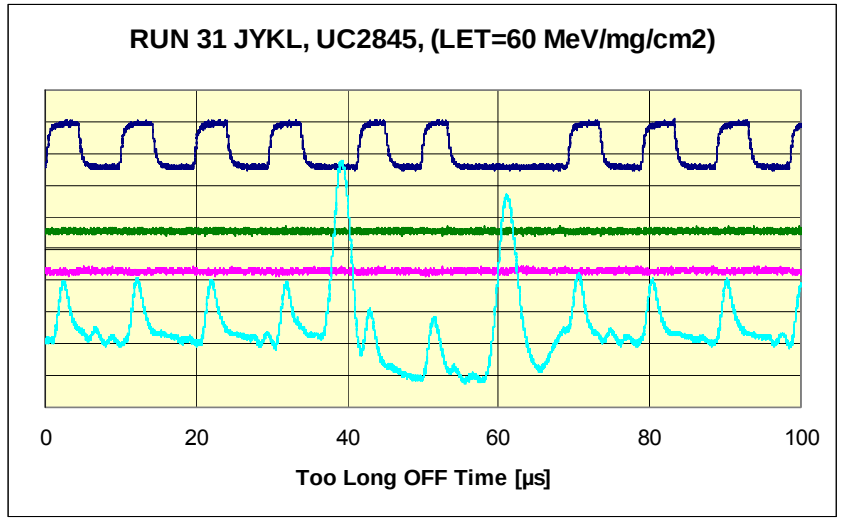
Too Long ON Time

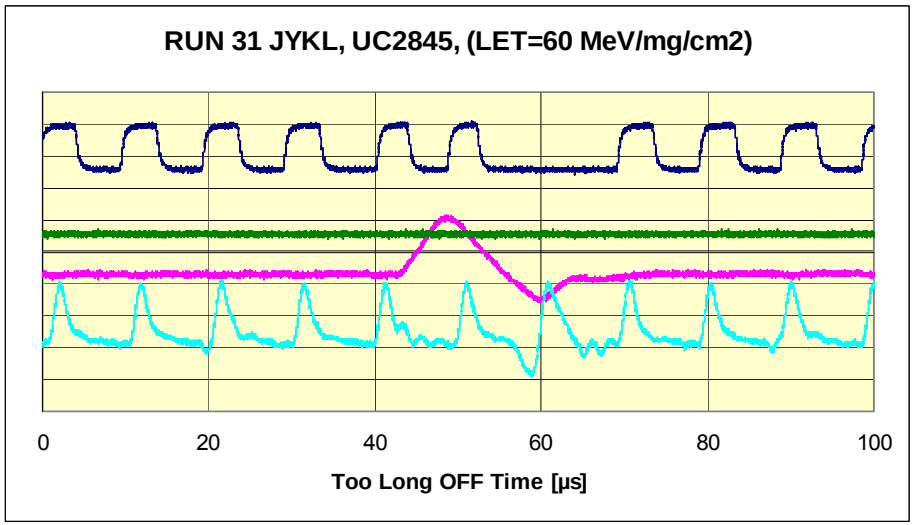
Trigger on Output

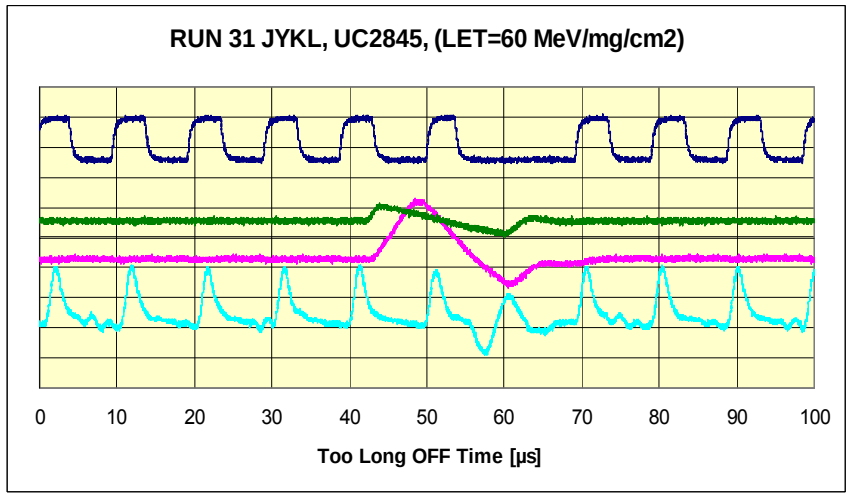


Trigger on Output



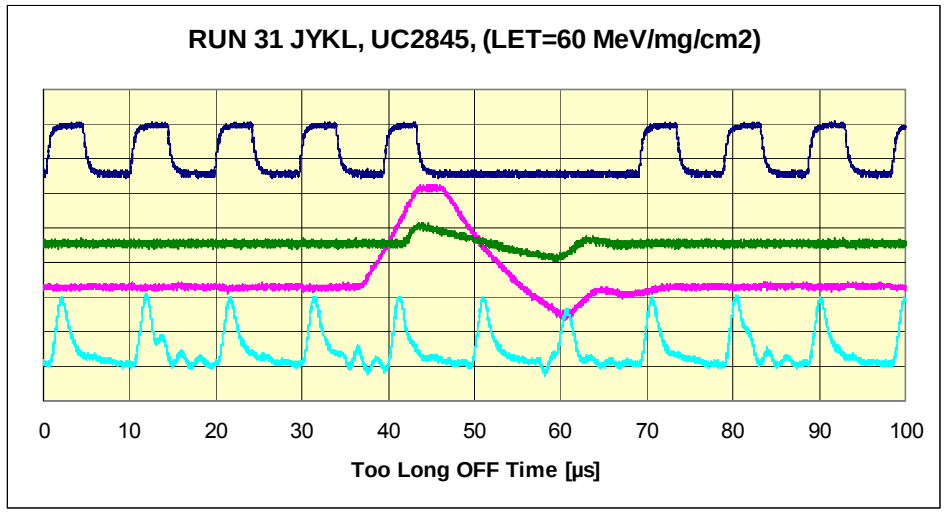






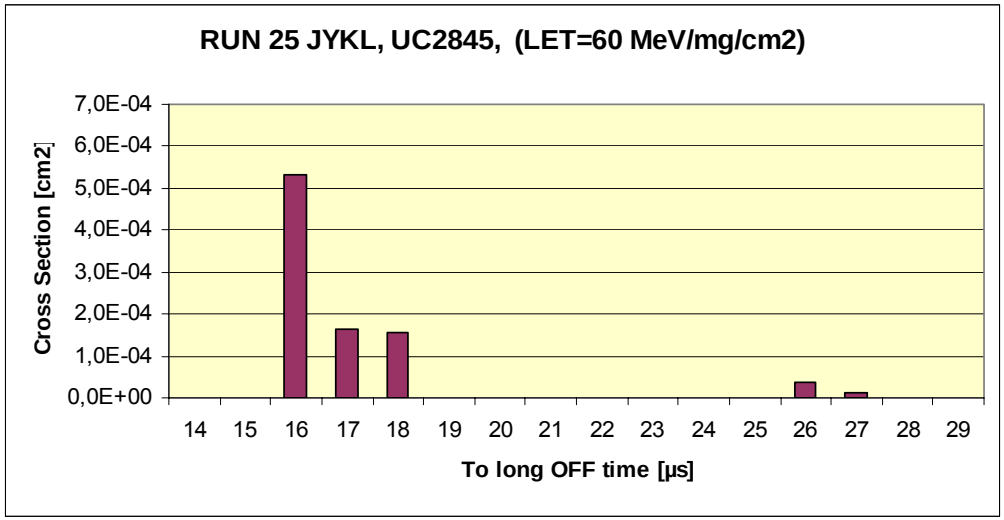
Worst case SET @ 100kHz

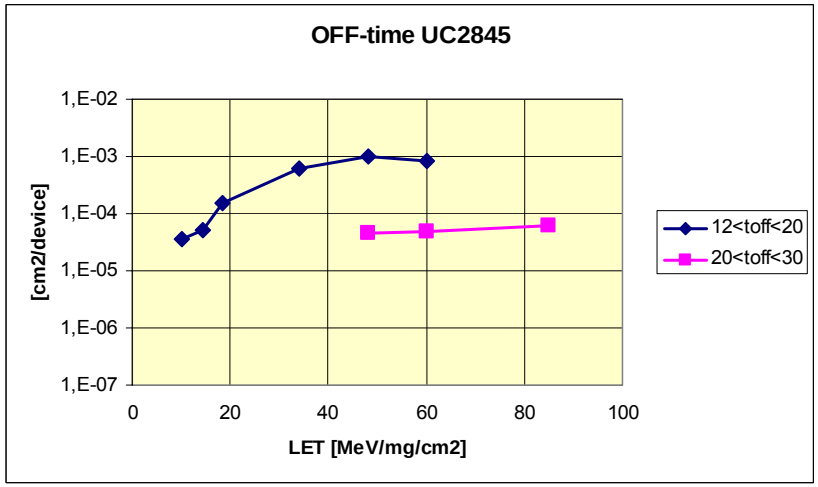
Frequent Worst case OFF Time SET;
loss of 2 pulses,
UC2843 similar

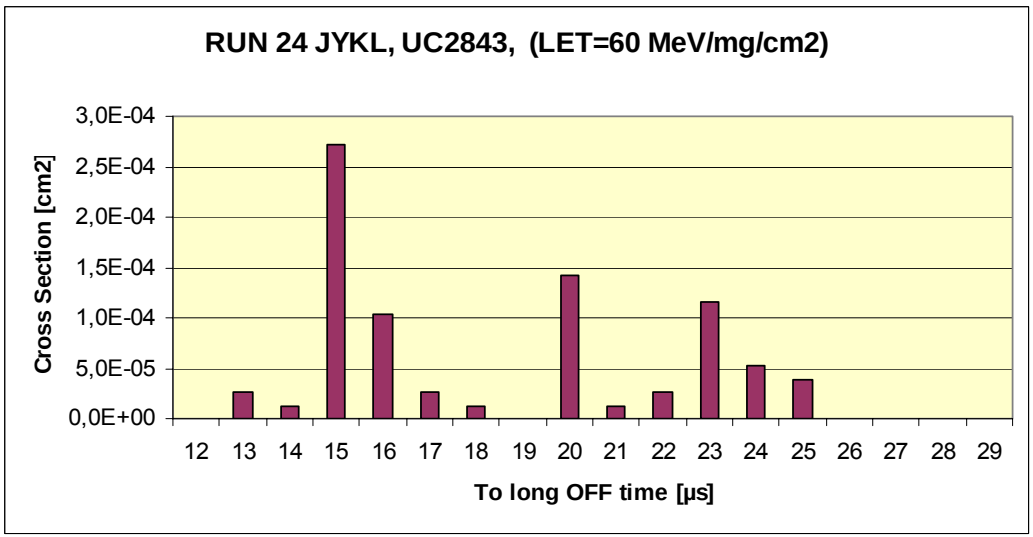


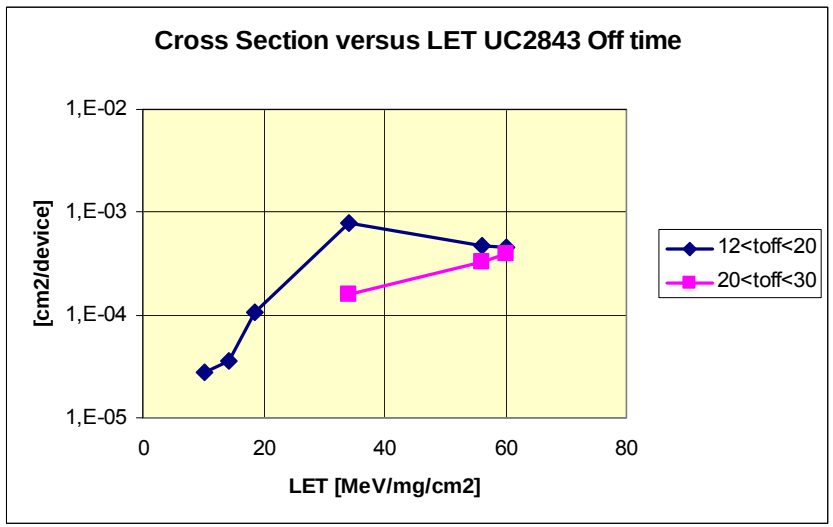
Worst SET Observed = 3 lost pulses: 1 event in 8e+7 Xe-ions/cm2

Histogram and Cross Section OFF time

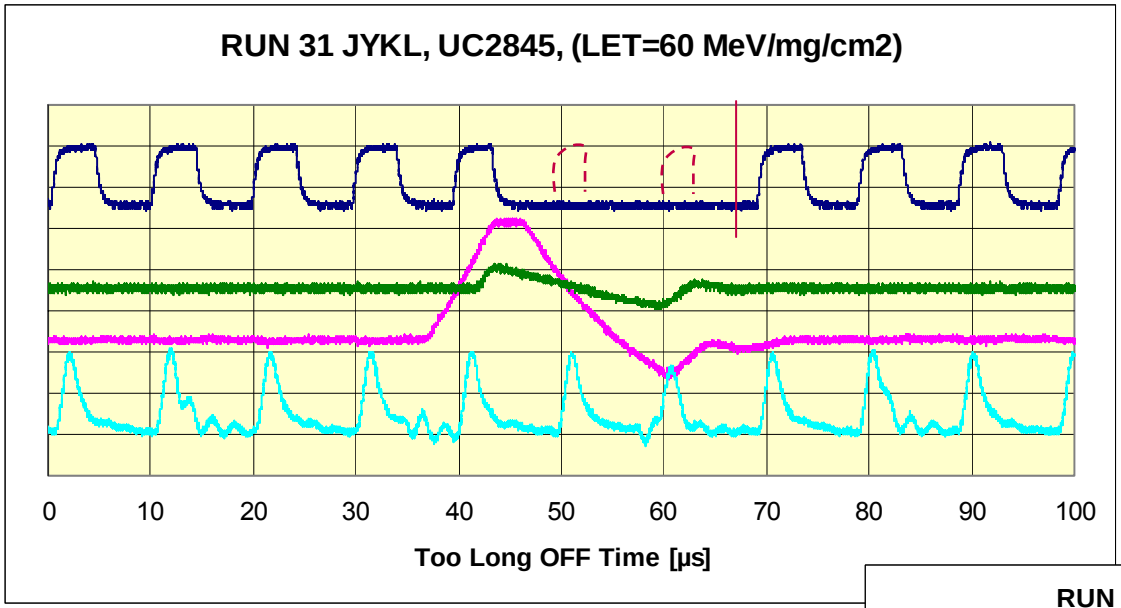






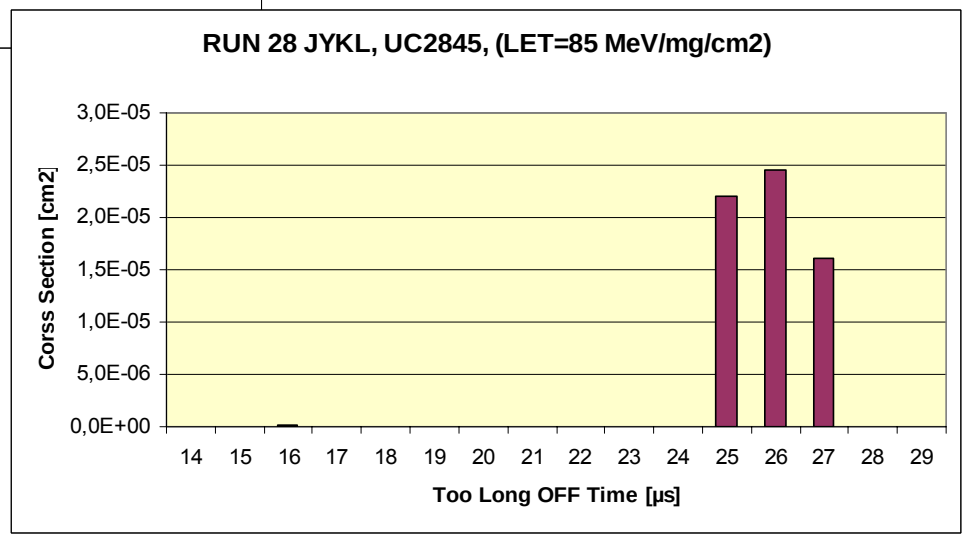


Cross section 2 lost pulses@100kHz



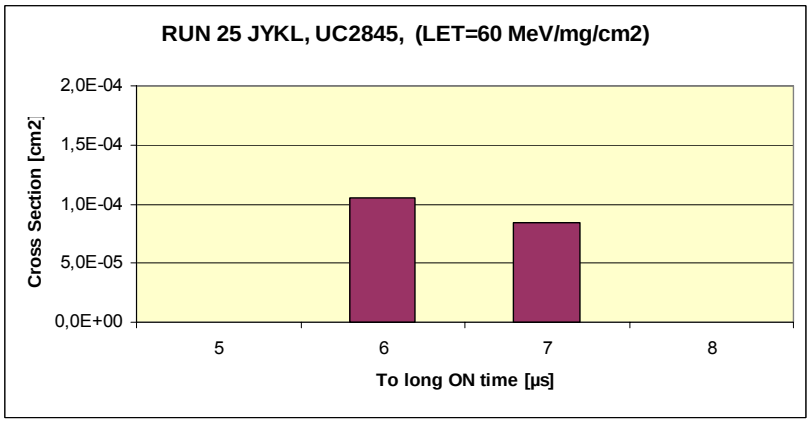
- OFF time trigger cond > 22µs

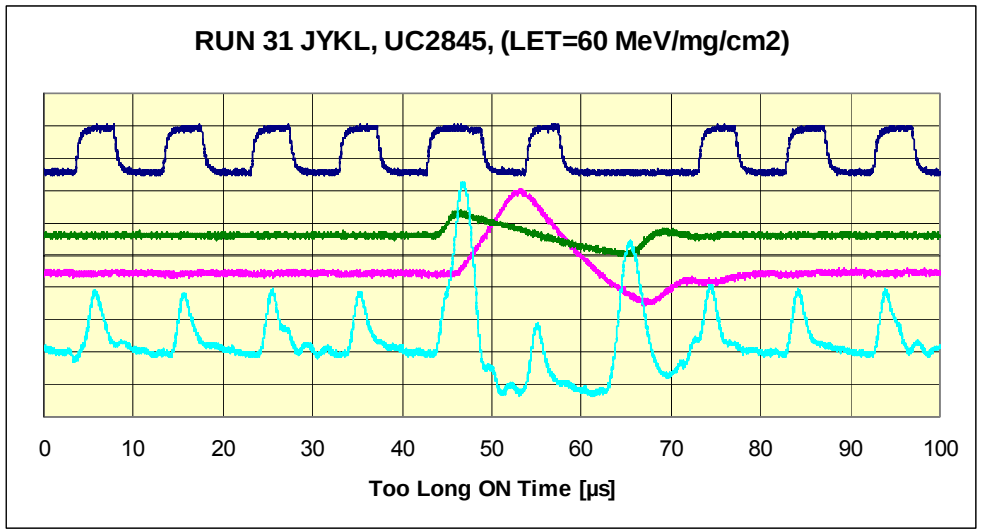
- 10% of all SET
(data based on 1e+7 ions)



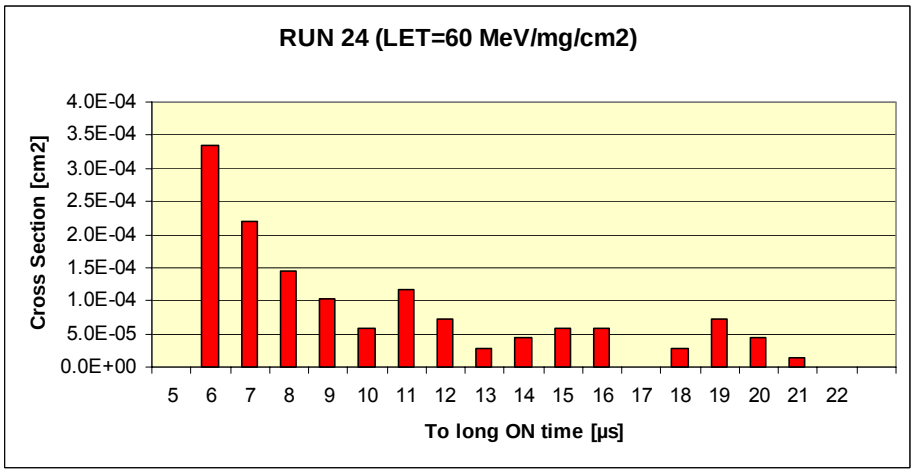
Histogram and Cross Section ON time UC2845

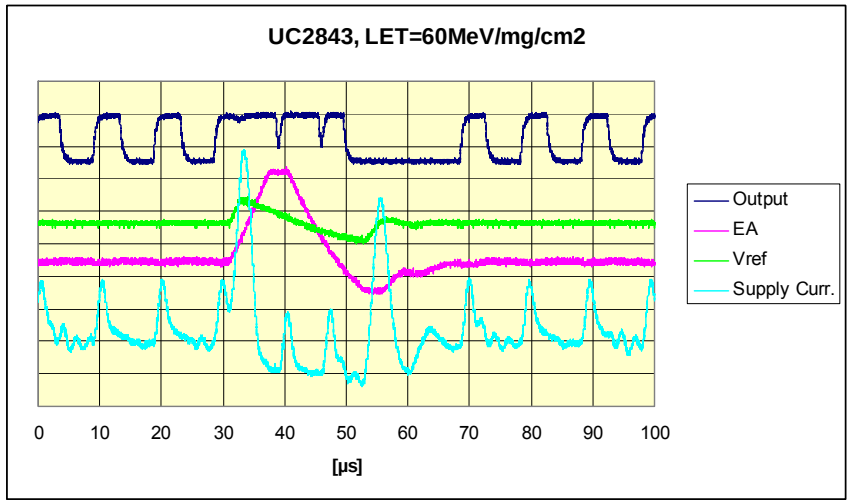
- Too long ON time often followed by too long OFF time



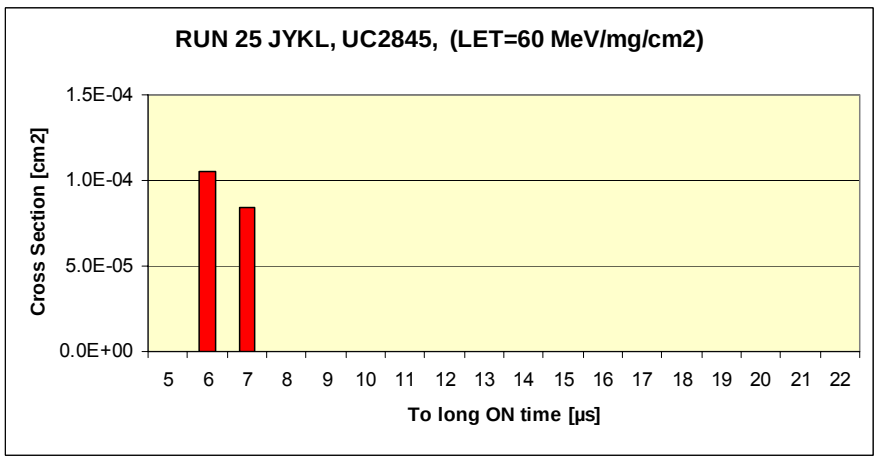


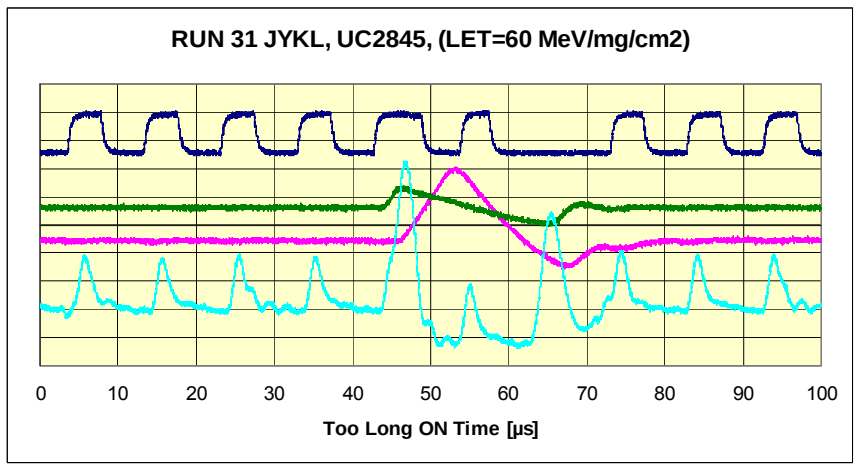
ON-time; change of Duty cycle, UC2843



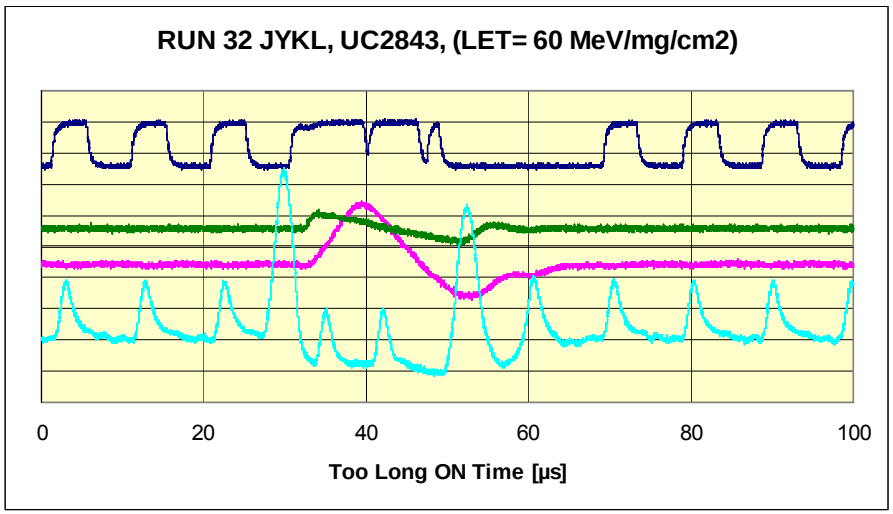


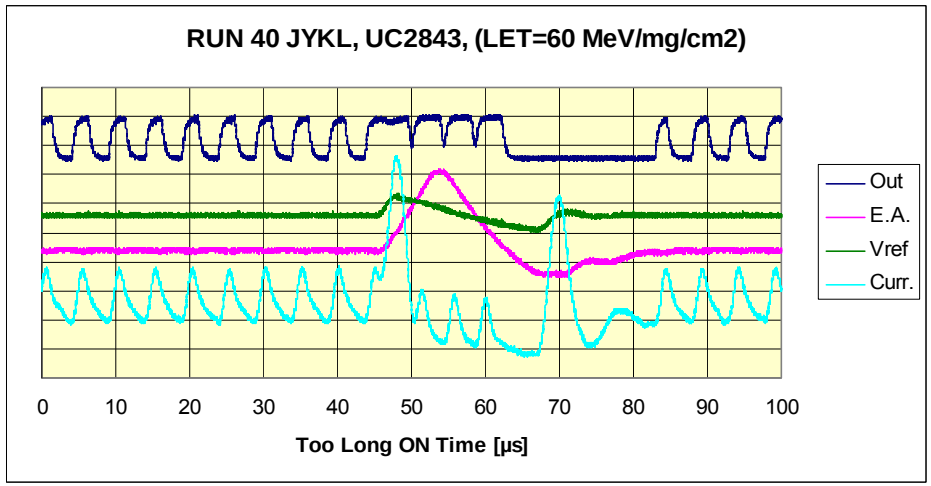
Low Flux Measurements ~ 1e+2 ions/ cm2





Wores Case SET's 200 kHz





Operation @100 kHz

Operation @200 kHz

Too long ON or OFF time independent of frequency

Conclusion UC2843/UC2845

- No Latch-Up up to 80 MeV/mg/cm2
- Very good SET Behaviour
  - UC2845@100kHz, $\sigma_{(2\ lost\ pulses)}$ = 7e-5 cm2
  - UC2843@100kHz, $\sigma_{(2\ lost\ pulses)}$ = 5e-4 cm2

Thank You