Single Event Transients (SET) in linear devices - NASA/GSFC studies

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Background

- SET studies started in 1999 with the objective to define a low cost conservative test methodology.
  - study on 139 voltage comparators from two vendors (NSC, Intersil) and LM124 operational amplifier from NSC under many operational conditions.
  - The results showed that the worst case test condition is specific for each device (2001NSREC paper).
- More data was collected to understand the effect of bias conditions and support Vanderbilt modeling effort.
- Lessons learned during testing have been used to define testing guidelines.
- Laser studies were performed.

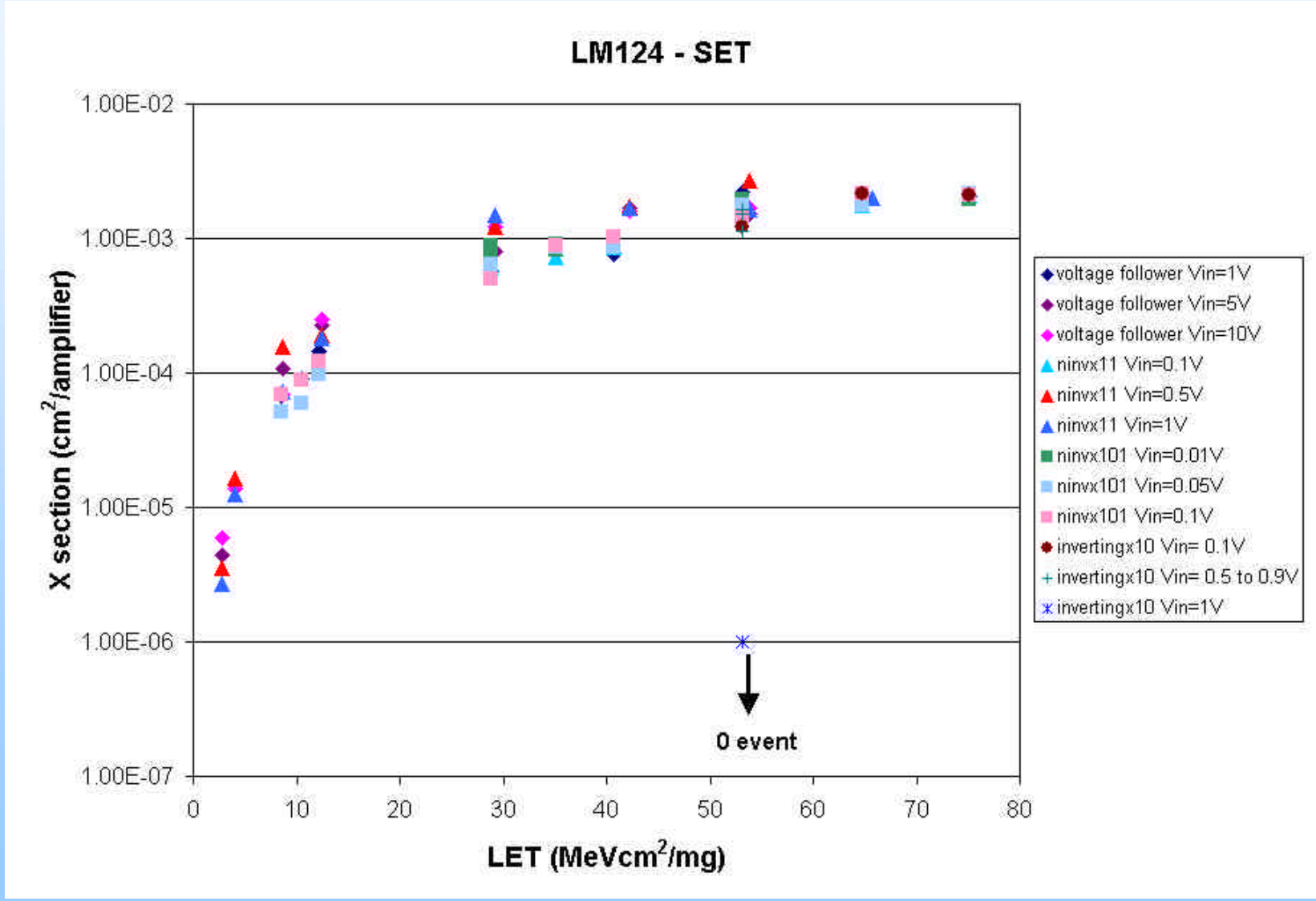
Objectives of NASA-GSFC SET studies

- Collect SET data on common linear devices used in NASA missions.
- Issue of NASA guidelines for SET testing of linear devices.
- Collect broad beam and laser test data in support of Vanderbilt modeling effort.
- Evaluate the laser tool for Radiation Hardness Assurance of linear devices

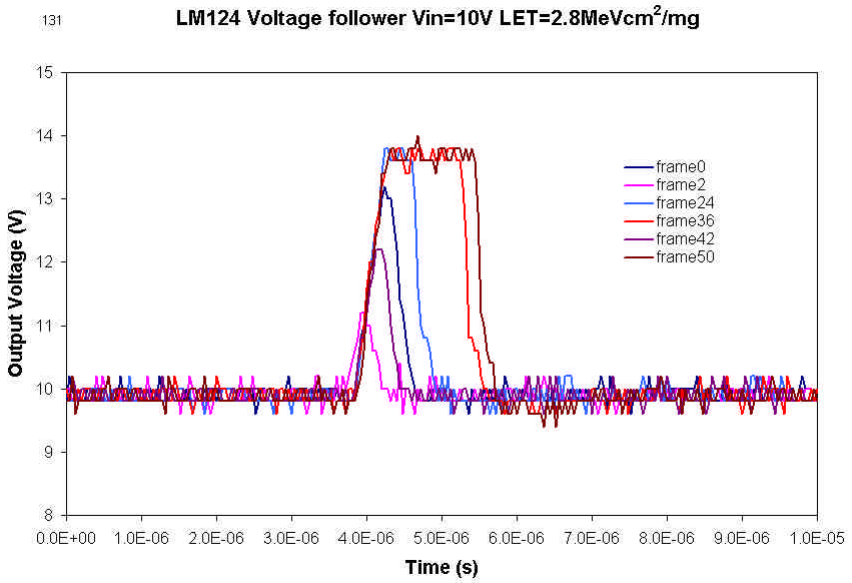
2002/2003 activities

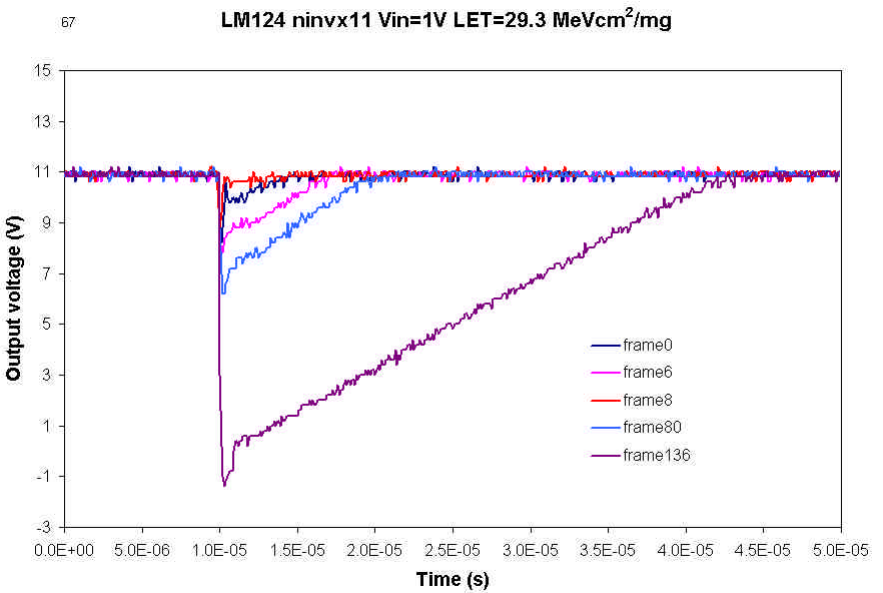
- Broad beam testing
  - LM124, LMC6484, LT1128
  - Project testing: OP293, MAX494, SG1525,…
  - OP27, LM6144 (NAVSEA CRANE)
- Laser testing at NRL
  - LM124, LMC6484, OP27
    - LM124 paper submitted to RADECS
  - LM6144, OP293, SG1525,…
- Issue of SET test guidelines

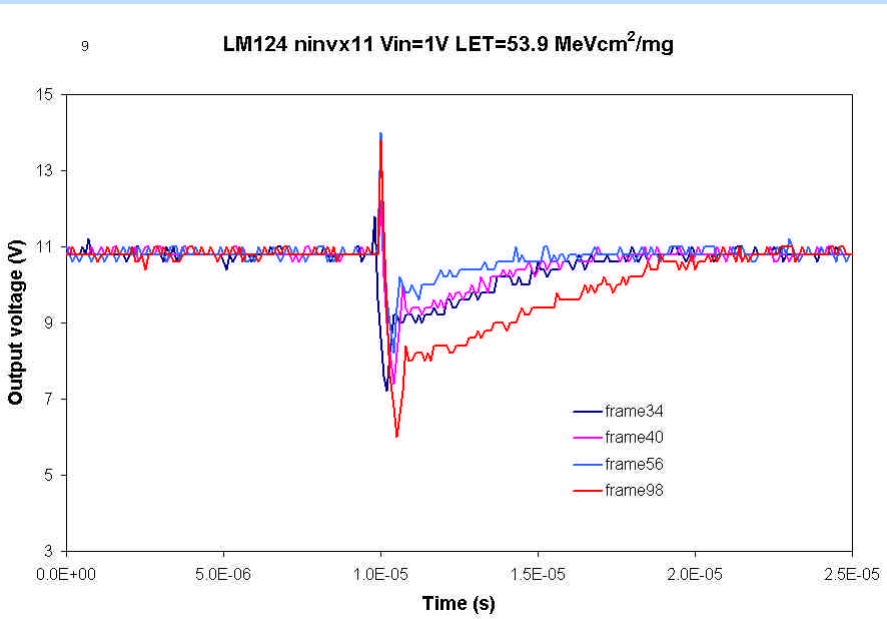
Results – LM124

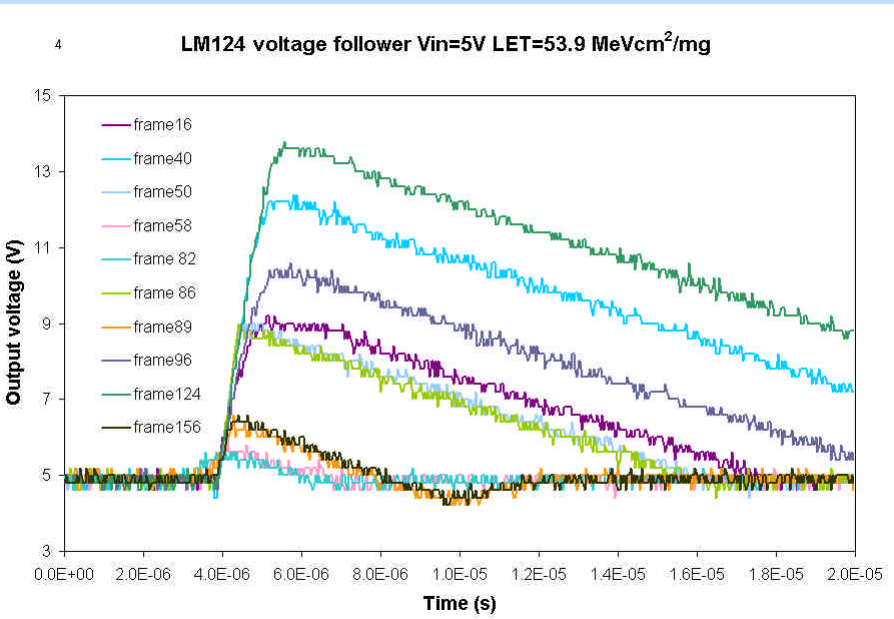


Results – LM124

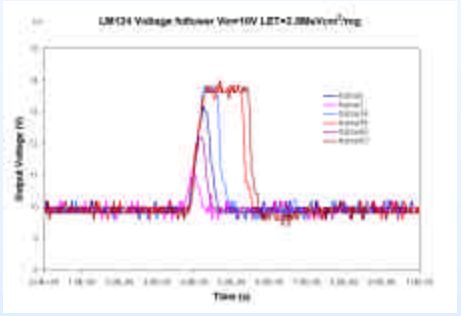


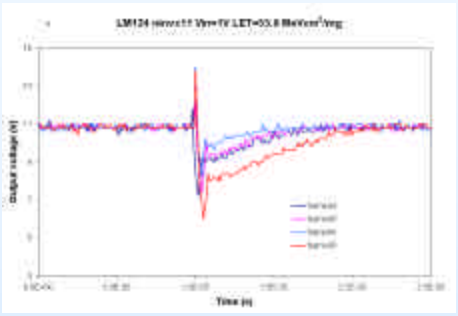


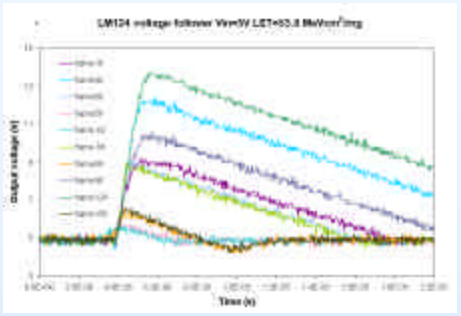


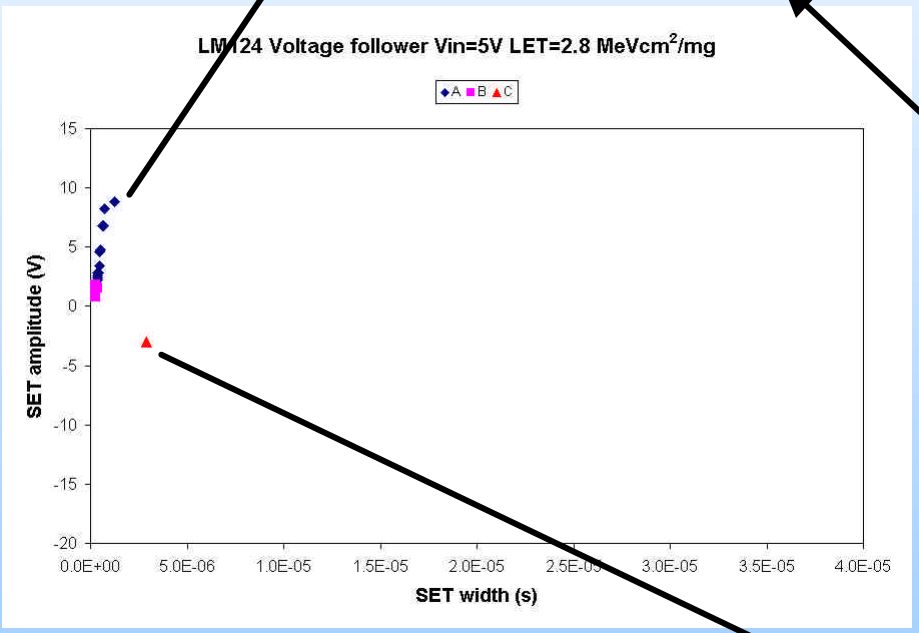


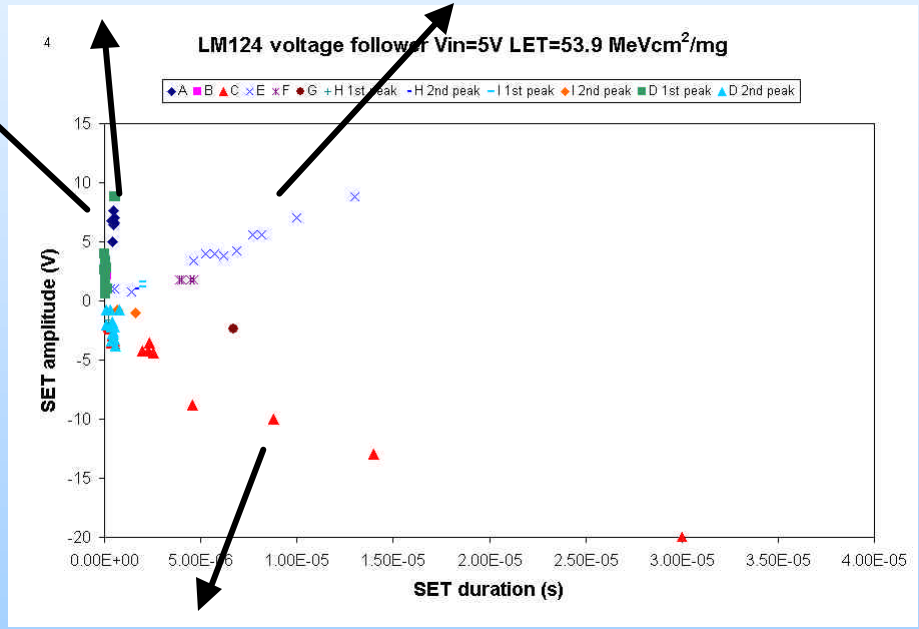
Results – LM124

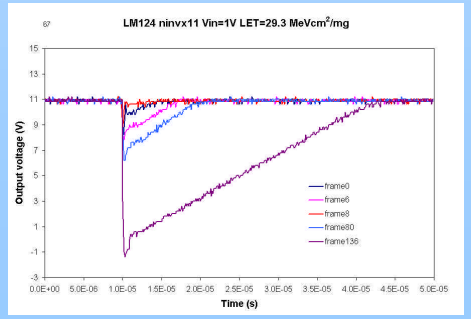




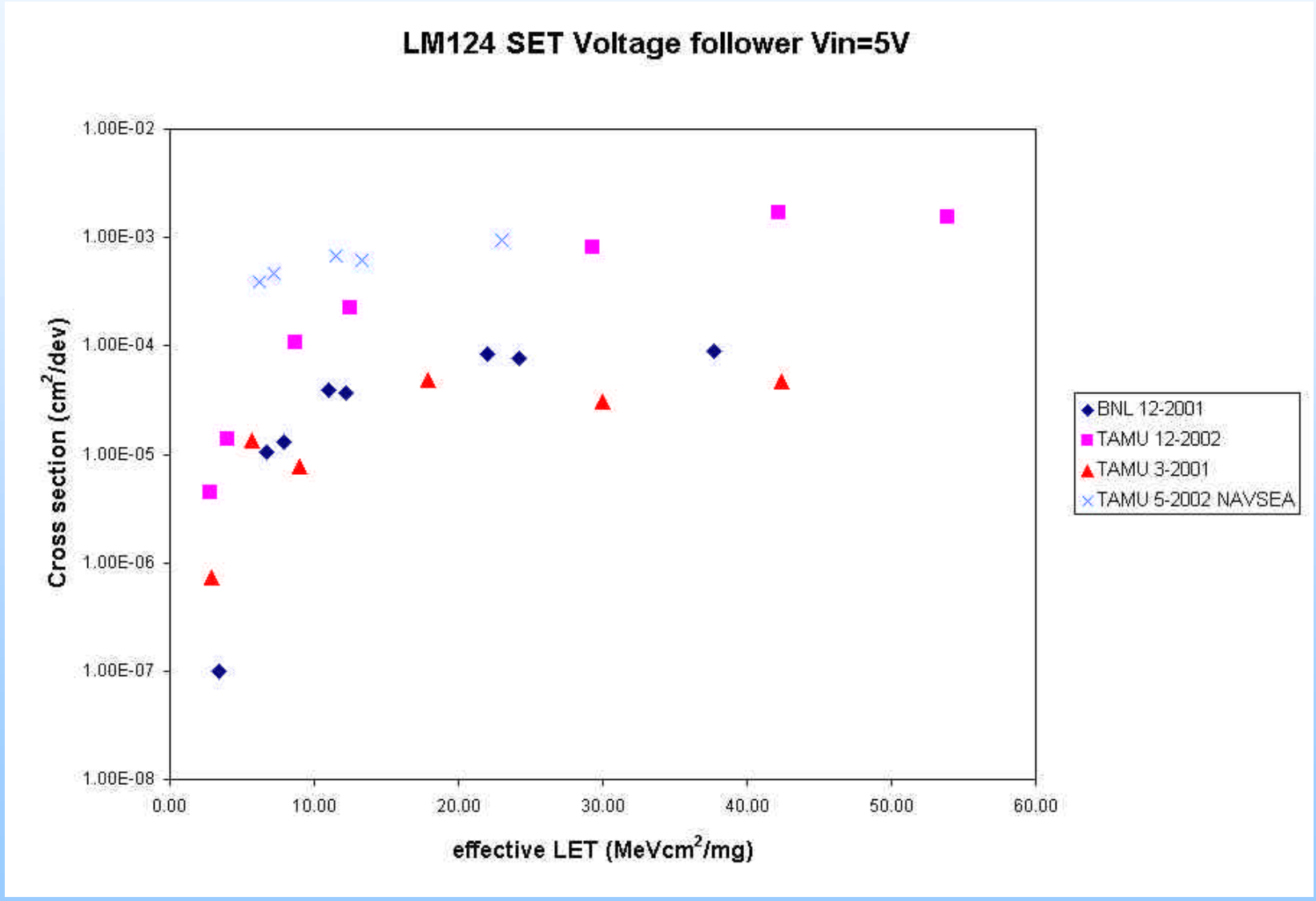




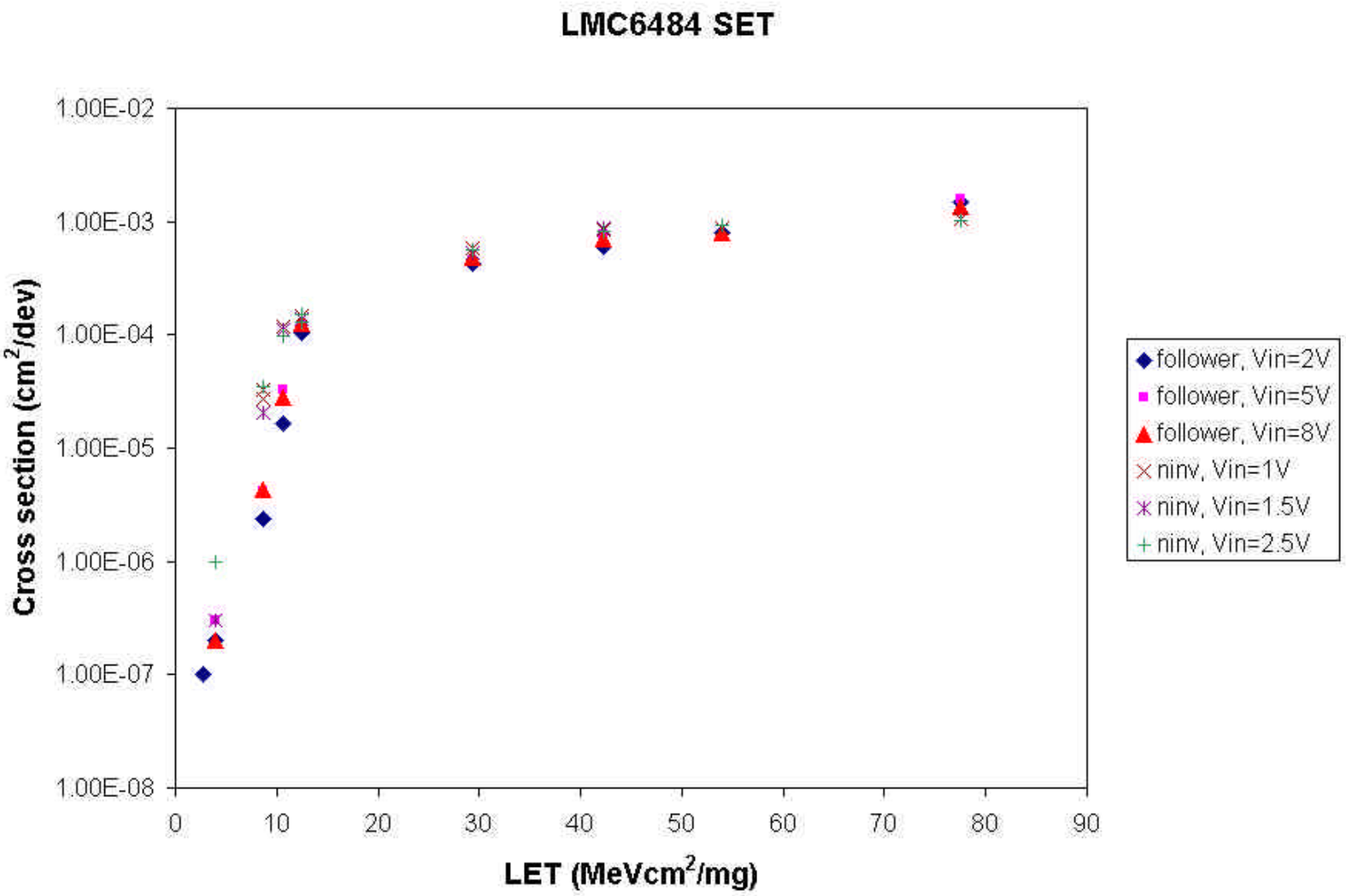




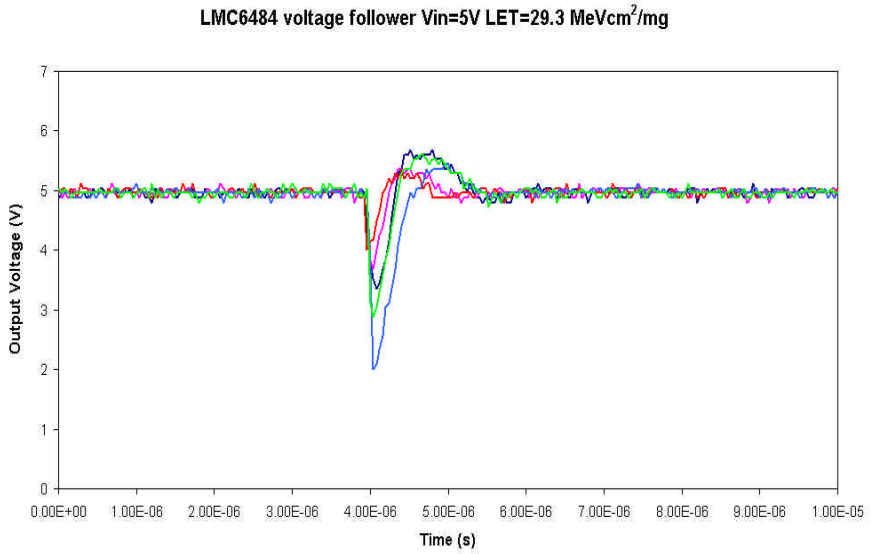
Results – LM124

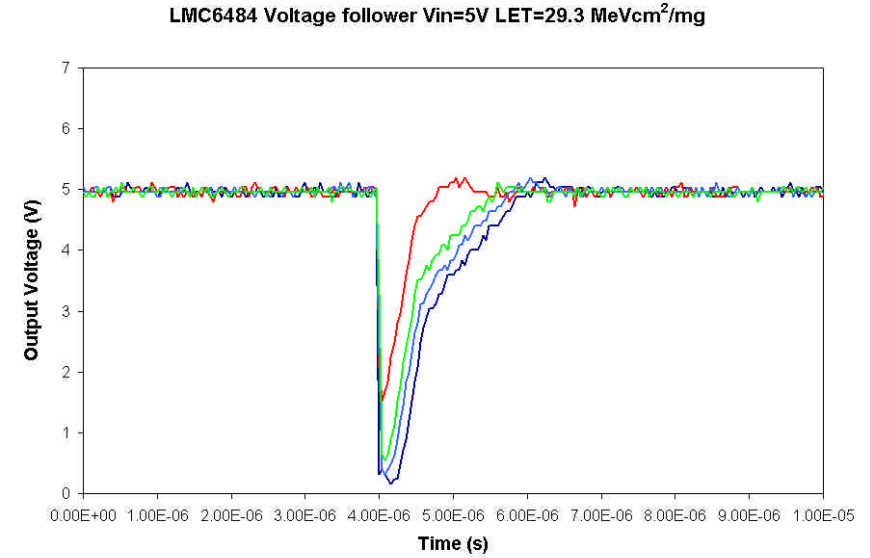


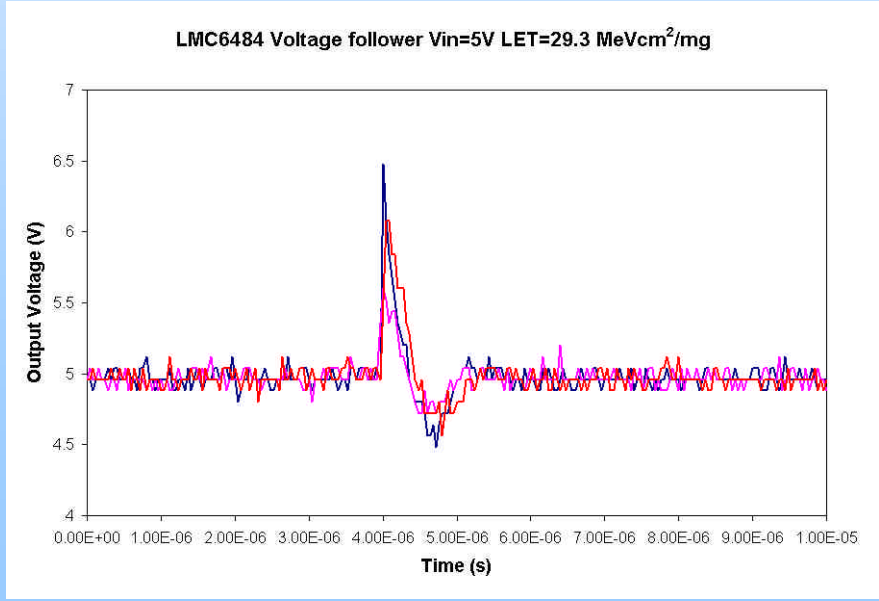
Results – LMC 6484

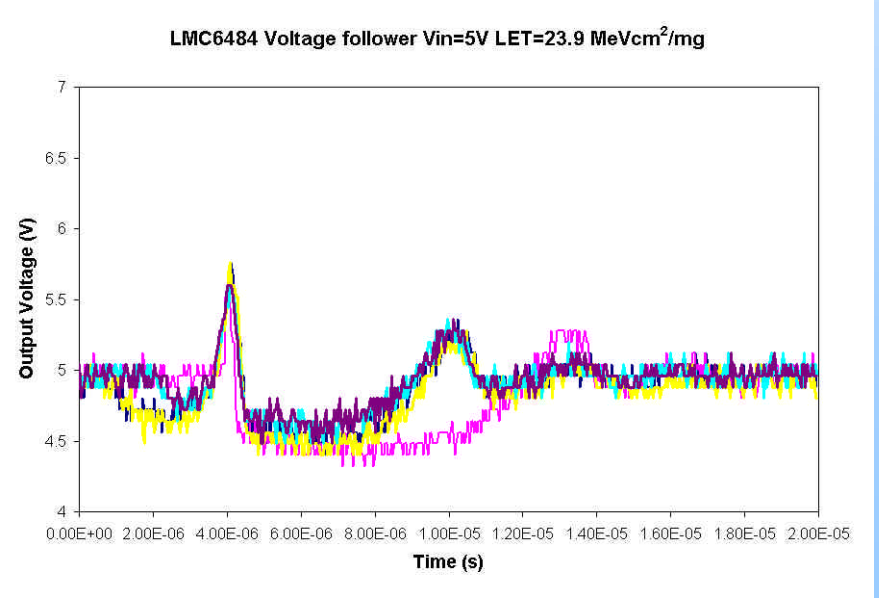


Results – LMC 6484









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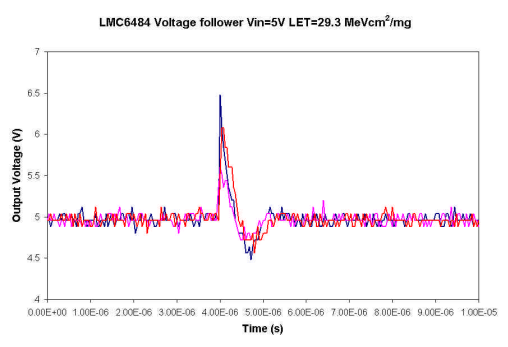
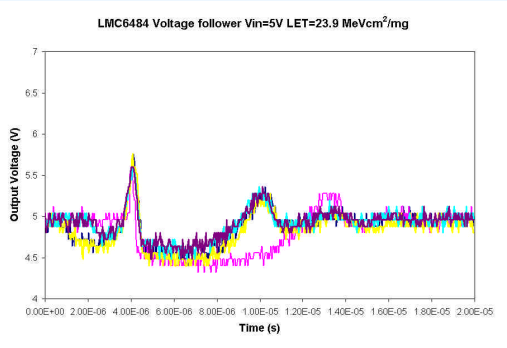
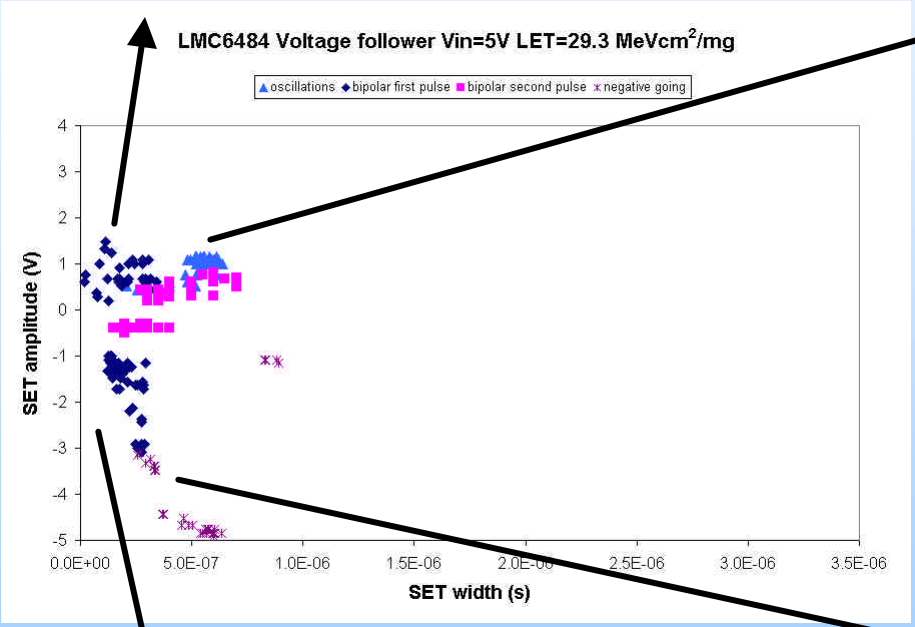
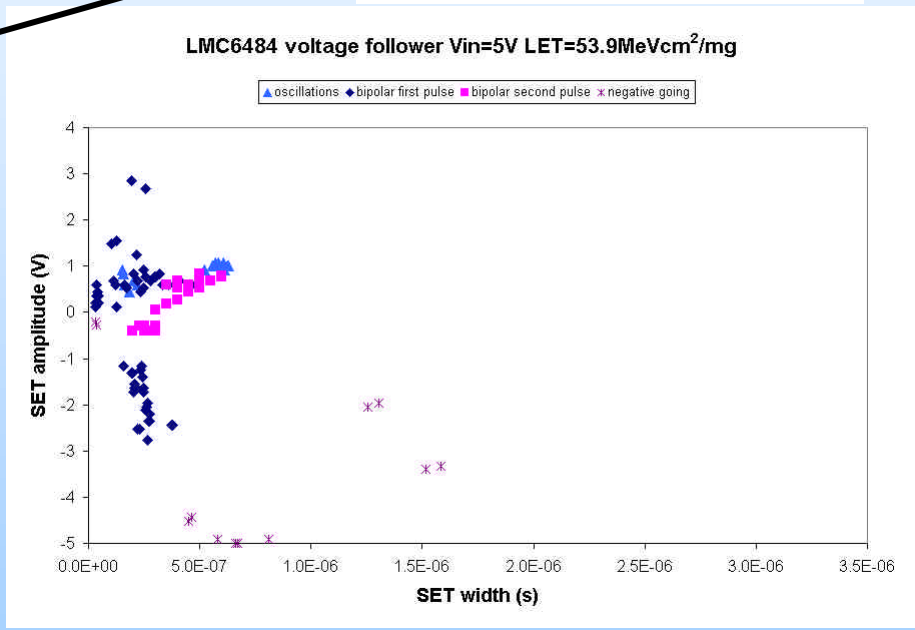
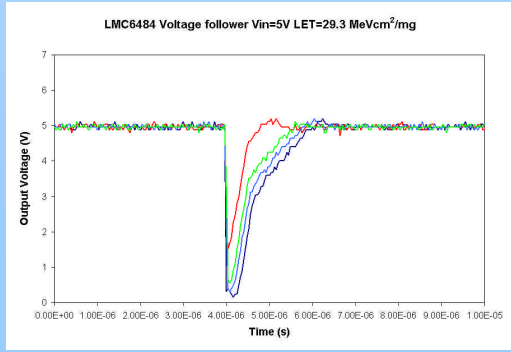


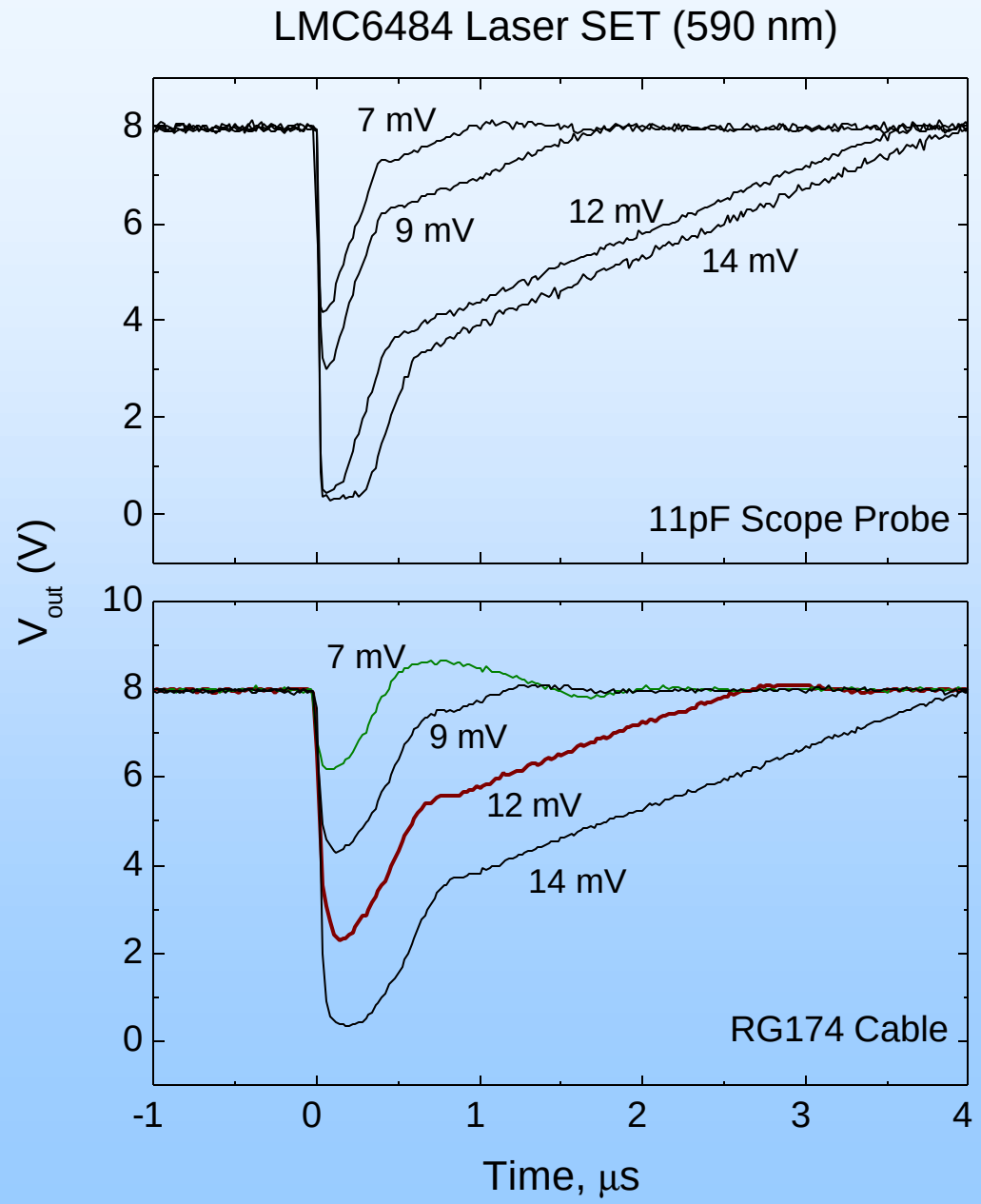






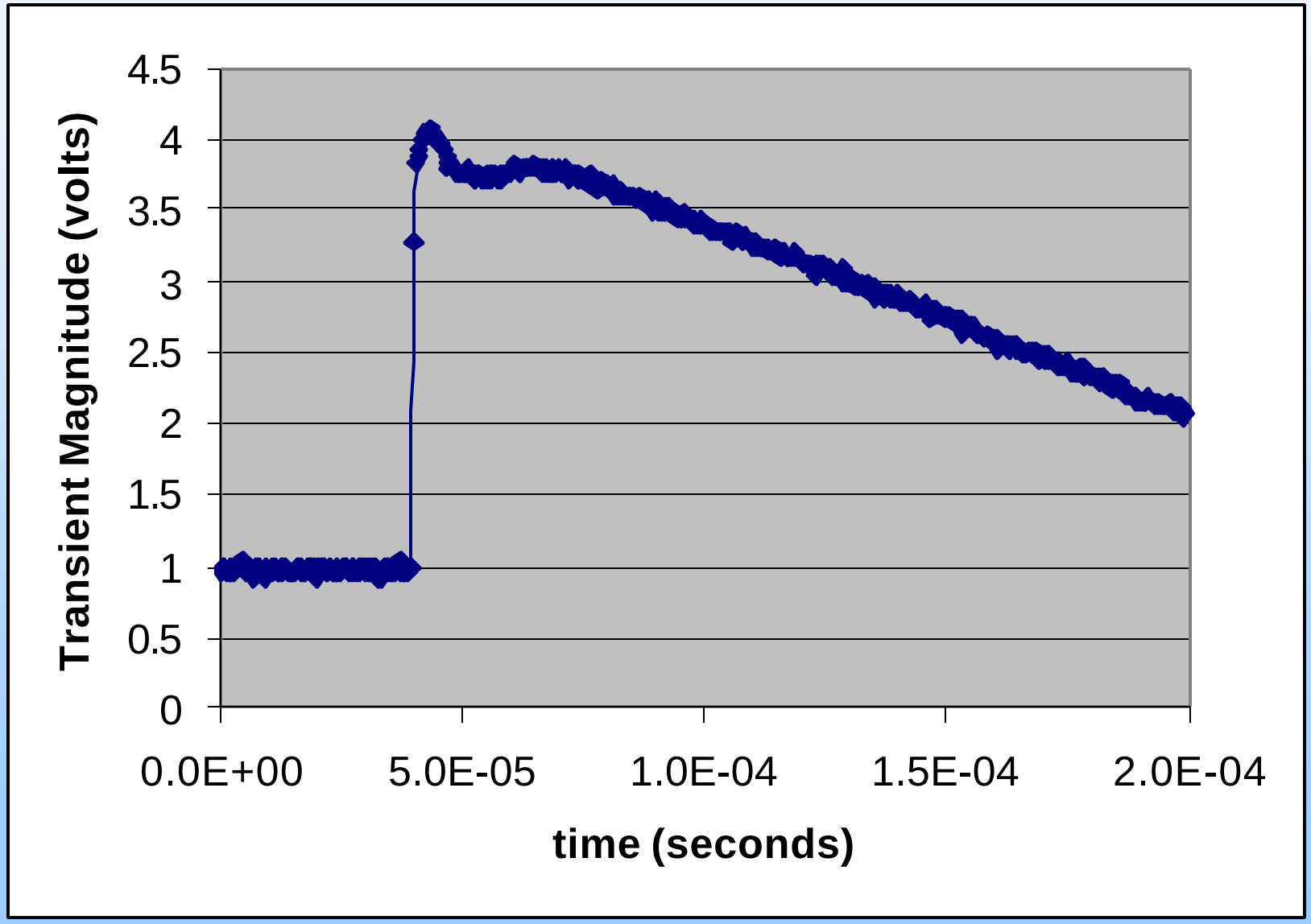


Results – LMC 6484



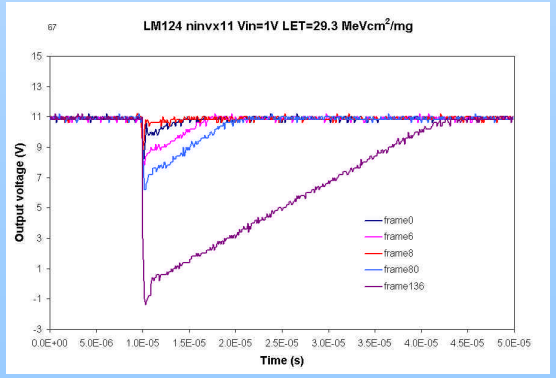
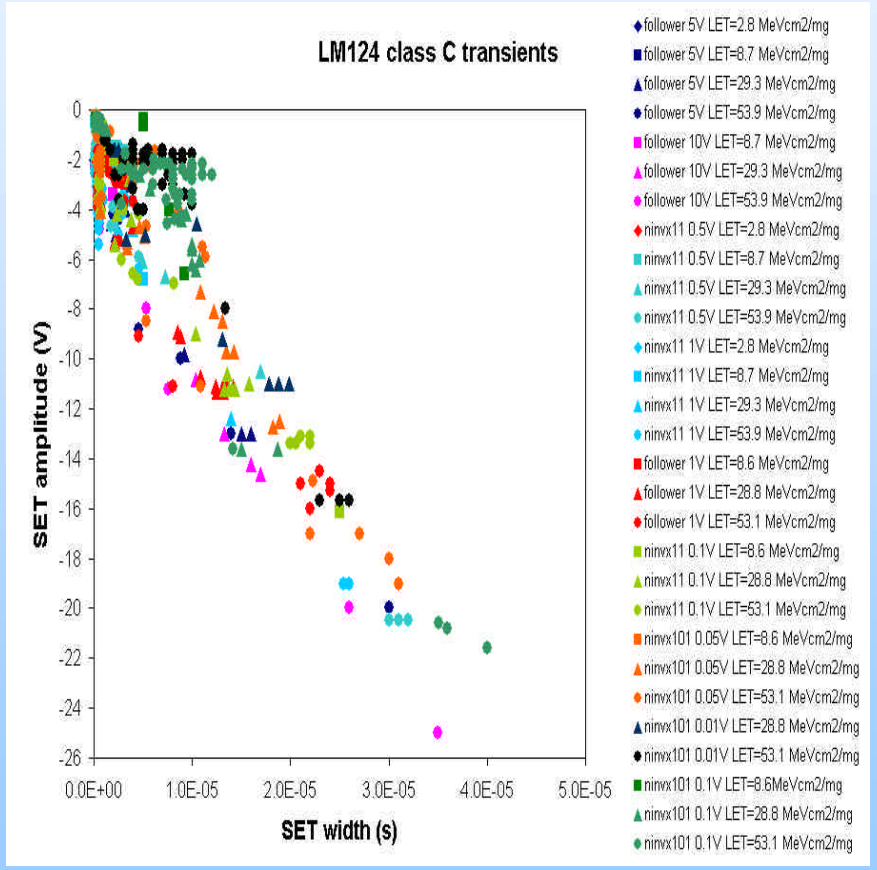
10/09/02 Data

Results – OP293



Lessons learned

- Different bias conditions and applications give different responses. It is often difficult to define the worst-case condition based on a limited set of bias conditions
  - Test in the application condition
  - Laser testing
  - Modeling
- SET characteristics are significantly affected by test set-up conditions and irradiation conditions. -> see testing guidelines
- A detailed data analysis is very important to assess the impact in applications.
- Flight experiments would be very useful

Future work

- provide more accurate transient characteristics data to designers -> SET design book