



Air Force Research Laboratory



Computing Worst Case Transients in AE9/AP9

Feb 2017

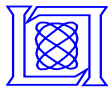
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Outline



- AE9/AP9 Monte Carlo scenarios allow calculation of worst case transients via “accumulators”*
- How should this work in the AE9/AP9 application?

- *v1.35 has a beta version of this, but we don't think it's what you want



Some Assumptions



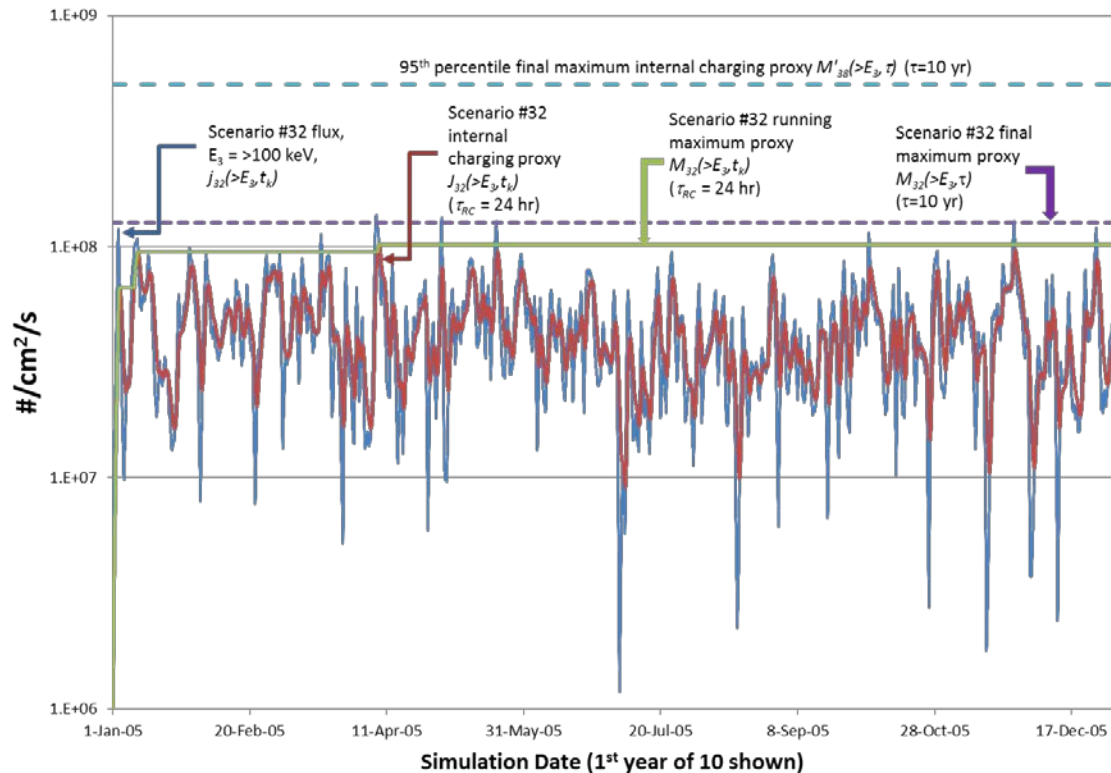
- For proton Single Event Effects, a worst case boxcar average flux is needed
- For electron internal charging, a worst case exponential average flux is needed: mimics decay of RC circuit
- It is better to do the statistics on integral energy channels because that approximates the response of parts behind shielding



Example



AE9 Monte Carlo Internal Charging Simulation



- The model generates one integral flux scenario (dark blue)
- The application averages that flux with a running 24-hour window (red)
- The application keeps track of the worst case 24-hour average since launch (green)
- This leads to the worst case at the end of the 10-year mission (purple)
- The final values from multiple scenarios are used to determine the “worst case 24 hour average flux after 10 years at the 95% confidence level” (light blue)



Our Current Plan



- Compute two kinds of running averages:
 - Boxcar: all times in trailing window weighted equally
 - Exponential: older times are weighted less with an exponential time constant (mimics RC circuit decay)
- The running average updates at every time step
- Multiple types and timescales can be generated in a single run
- The model will output the worst-case-so-far at user-specified checkpoints (every day, every year, etc)
- Running averages can be run on differential flux, integral flux, or dose rate



Questions For Audience



- What are the typical use cases?
 - Integral proton flux with boxcar average over 1 minute?
Instantaneous (no averaging)?
 - Integral electrons flux with exponential averages at 6 hours, 1 day, 30 days, 6 months?
 - What about Dose Rate or kernel effects?
- What are we missing?



V1.35.001 Accumulators



Five accumulator modes available in Ae9Ap9

- *Cumulative* (default) – values reported at each input time
- *Interval* – values reported at the specified interval duration
- *Full* – values reported only at the very end
- *Boxcar** – running average of fluxes over the specified interval, reported at the specified increment
- *Exponential Average** – exponential average fluxes reported at the specified interval duration

* designated as '*experimental*'



V1.35.001 Accumulators

