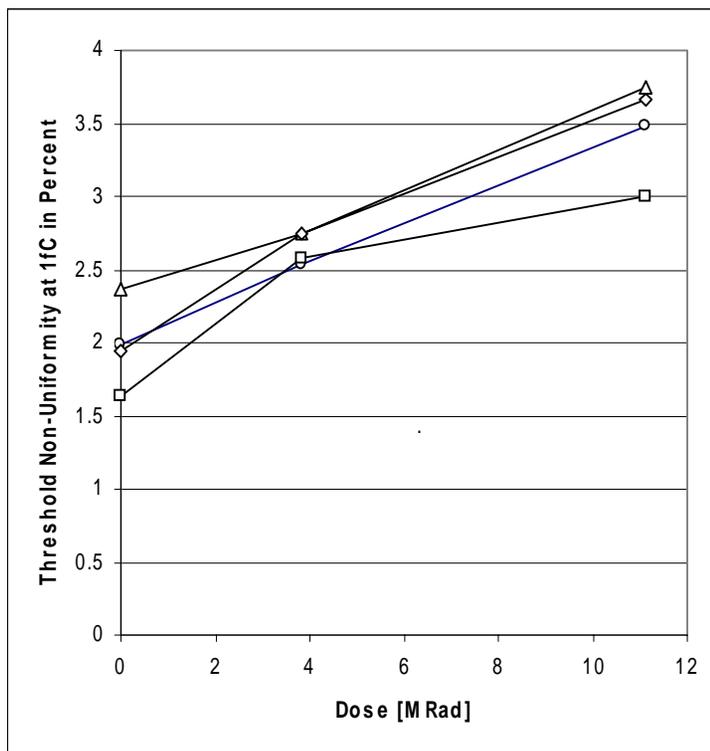


# ABC/CAFE-P and ABCD2T Irradiation

- Samples: 1 Hybrid with 4 ABC/CAFE-P pairs  
1 Hybrid with 4 ABCD2T's
- 2 Runs:

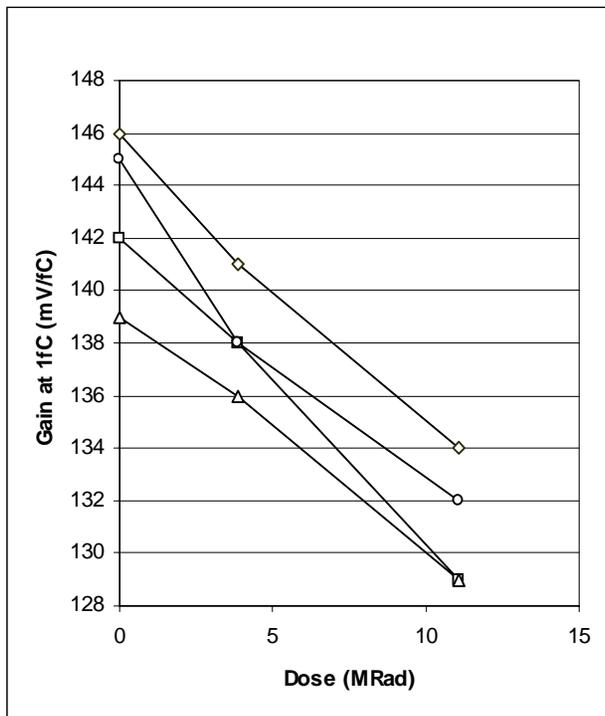
After First	Fluence	2.23e13 p/cm <sup>2</sup>
	Dose	3.83 MRad
	Rate	~ 1.1e10 p/(cm <sup>2</sup> min)
After 2nd (prel.)	Fluence	6.67e13 p/cm <sup>2</sup>
	Dose	11.1 MRad
	Rate	~ 1.1e10 p/(cm <sup>2</sup> min)
- Hybrid Temperature: around 8-13 degrees during irradiation

# CAFE-P Threshold Spread at 1 fC



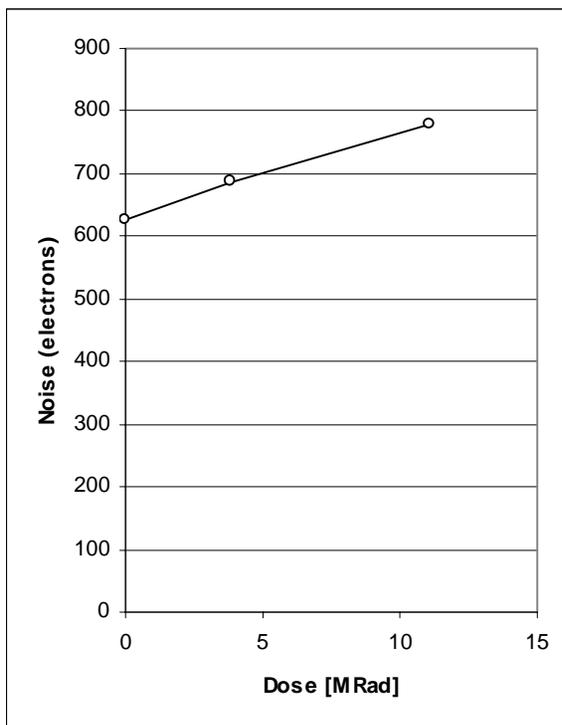
- From Treshold Scans
- Four lines show threshold spread on the four CAFE-P's as determined from a gaussian fit to the threshold distribution
- Ipreamp = 218 uA
- All channels included (0 bad channels)
- Vcal Scan yields slightly better results on average

# CAFE-P Gain at 1fC



- From Treshold Scans
- Four lines show gain in mV/fC on the four CAFE-P's as determined from a gaussian fit to the gain distribution
- $I_{\text{preamp}} = 218 \text{ uA}$
- All channels included (0 bad channels)

# CAFE-P Noise



- From Treshold Scans
- Average on all 4 chips
- Result is sigma of a gaussian fit to the noise distribution of all channels
- $I_{\text{preamp}} = 218 \text{ uA}$
- All channels included

## SEE in ABC

- Test: Run one 37kWords testvector which writes data to the mask register, shifts it through the pipeline/fifo and activates the readout controller. Test vector runs 50% of time, other 50% is used for comparison to simulation results (done on VME board).
- Test vector is run until readout disagrees with simulation data. Then the readout data is transferred to PC and analyzed.
- Tested at 40MHz and VDD=4.0 V
- Single ABC/CAFE-P pair on test board

# SEE in ABC

- How to be sure that we see SEE and not effects of an imperfect readout system?
  - Test for errors in ABC readout and readout system by running TV for .5 10e6 times with beam off. 0 Errors.
  - Test for SEU on support card by running TV .5 10e6 times in situ when beam is on but replacing ABC chip with loopback wires. 0 Errors.
- Result: 32 SEE spotted in total. Thereof
  - 27 times just a bit flip in the pipeline or the readout buffer
  - 4 times readout controller/data compression logic shows errors in the data format which would lead to the loss of one event at most.
  - 1 event not understood.
- Takes 1.45 10e10 p/cm<sup>2</sup> on average for 1 SEU with 55 MeV Protons

## ABC/CAFE-P Summary

- ABC and CAFE-P still working at nominal pre-rad conditions after a fluence of  $6.67 \times 10^{13}$  p/cm<sup>2</sup> 55 MeV Protons at a dose rate of  $\sim 1.1 \times 10^{10}$  p/(cm<sup>2</sup> min). The samples were cooled.
- Some important parameters (timewalk !) yet to be measured.
- Threshold spread within specifications before and after irradiation.
- Takes  $\sim 1.45 \times 10^{10}$  p/cm<sup>2</sup> on average for 1 SEU with 55 MeV Protons

# ABCD2T

- 2 ABCD2T chips digitally not functional any more after the first run: (Fluence =  $2.23 \times 10^{13}$  p/cm<sup>2</sup>, Dose = 3.83 MRad, Rate ~  $1.1 \times 10^{10}$  p/(cm<sup>2</sup> min)).

Following failure characteristics: S1 does not receive token from M0 and stays in a loop where it sends senseless data.

S3 gets a token with too small amplitude (40mV) from S2 and does not respond to that.

- After second run (Fluence= $6.67 \times 10^{13}$  p/cm<sup>2</sup> , Dose =11.1 MRad), none of the 2 remaining ABCD2T's work digitally any more at 40MHz/4.0V. Need to go to 4.5 V or 38 MHz to read them out. Not even clk/2 works at nominal conditions.

# ABCD2T

- [http://www-physics.lbl.gov/~pberna/rad\\_88](http://www-physics.lbl.gov/~pberna/rad_88)
- No pre-rad uniformity data available
- Caution: Measurements done at low shaper current (15.6 uA) and therefore at low gain -> measured threshold spread numbers expected to be larger than necessary