# *Segmentation Geometry and Optimization (2)*
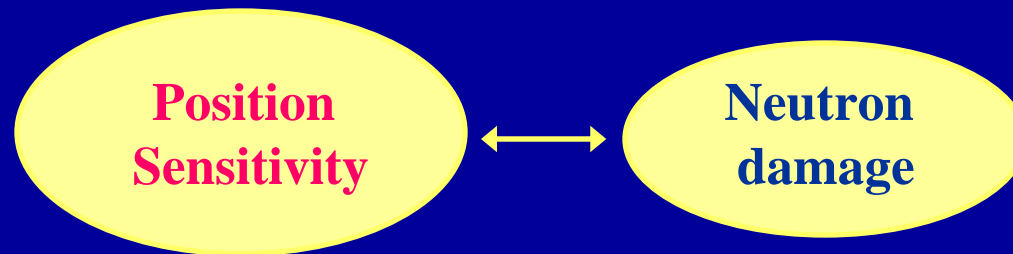
## GRETINA Detector Working Group Meeting
### ORNL, March 19-20, 2004

Martina Descovich

BERKELEY LAB

# Neutron Damage

❖ Is the position sensitivity affected by neutron damage?

**Position Sensitivity** ⟷ **Neutron damage**

- Signal generation program was modified to include neutron damage effects, through the **trapping length λ**.
- Only neutron damage effect on holes is considered.
- $\chi^2$ between pulse shape at the same position was calculated as a function of λ.
- Since the effective position sensitivity is of the order of 1 mm $\chi^2$ was renormalized, so that $\chi^2 = 1$ corresponds to a position sensitivity of 1 mm.
- Neutron damage becomes an important factor if $\chi^2 > 1$.
- Position sensitivity is calculated as $1/\chi$ and is compared to energy resolution
- The analysis concerns A3.
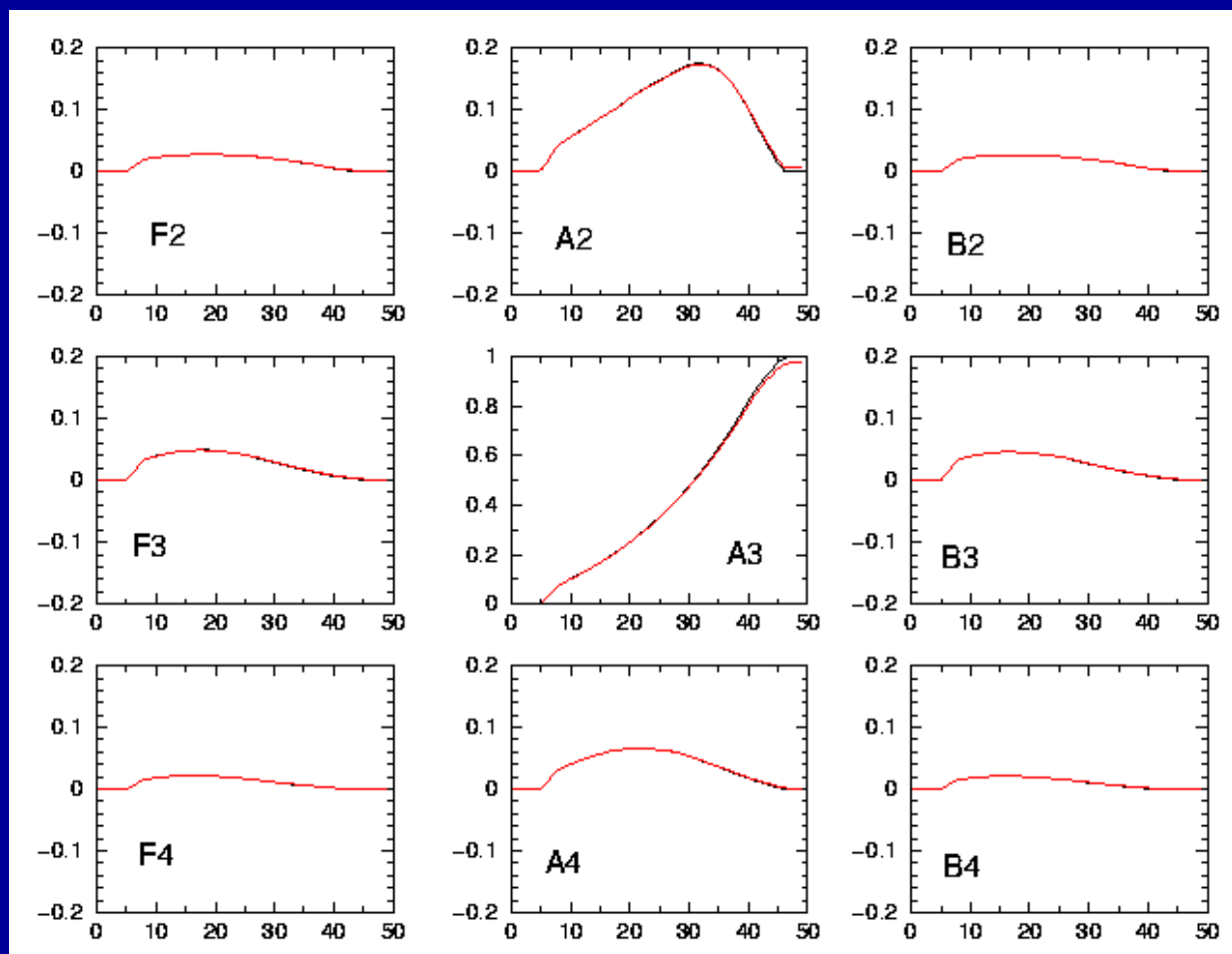
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# Calculated Pulse Shapes
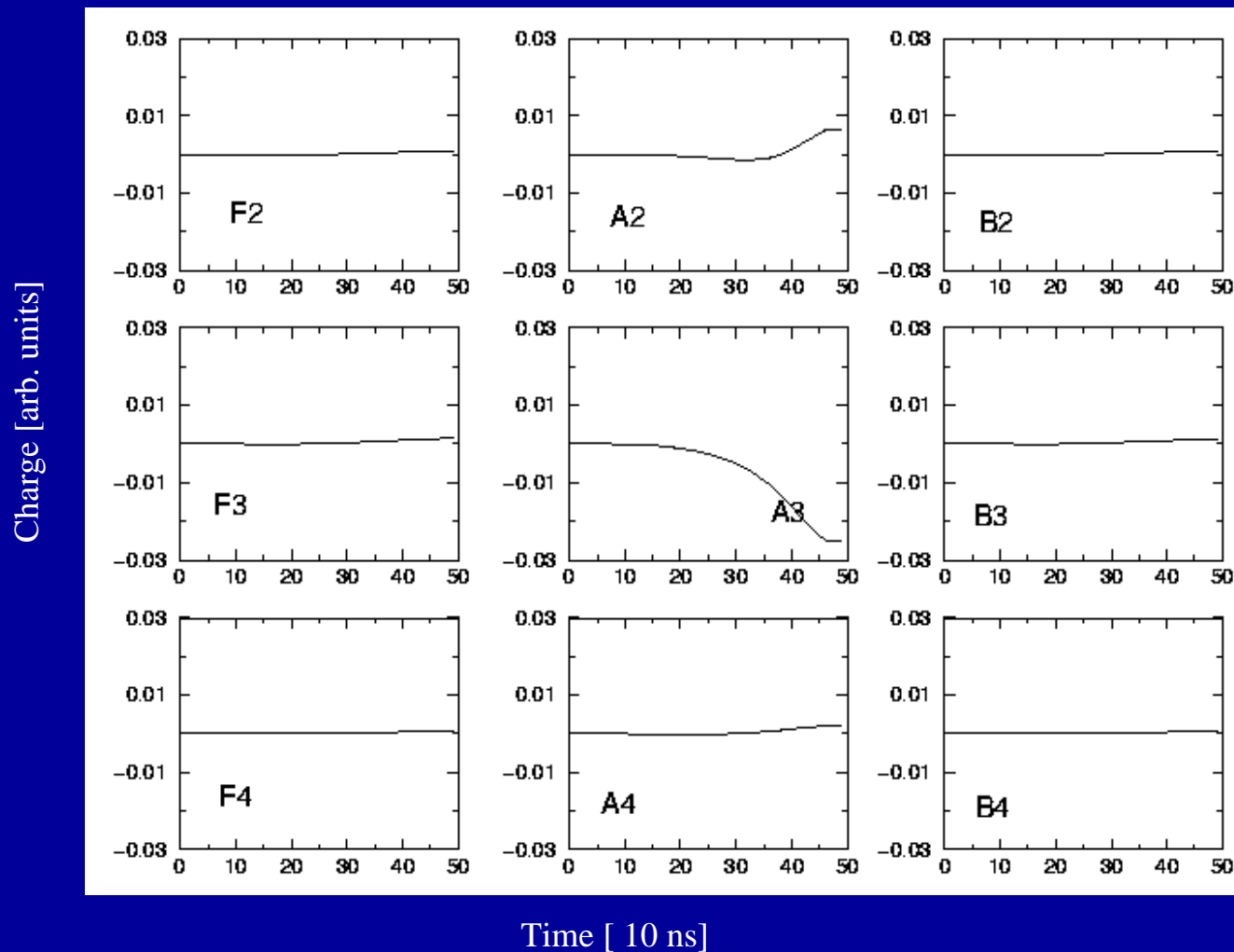


Charge [arb. units]

Time [ 10 ns]

Pulse shapes corresponding to the same interaction position in segment A3

No neutron
$\lambda = 100$ cm

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# Calculated Pulse Shapes



Charge [arb. units]

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No neutron
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# Neutron Damage Results

❖ From the plot of $\chi^2$, the critical trapping length is estimated to be: $(\lambda_{max}) = 16$ cm

Neutron damage has more effect on energy resolution than on position resolution

The detectors will be annealed before the position resolution will be affected.
The annealing process should not change the pulse shape characteristic (although it has not been experimentally proved)
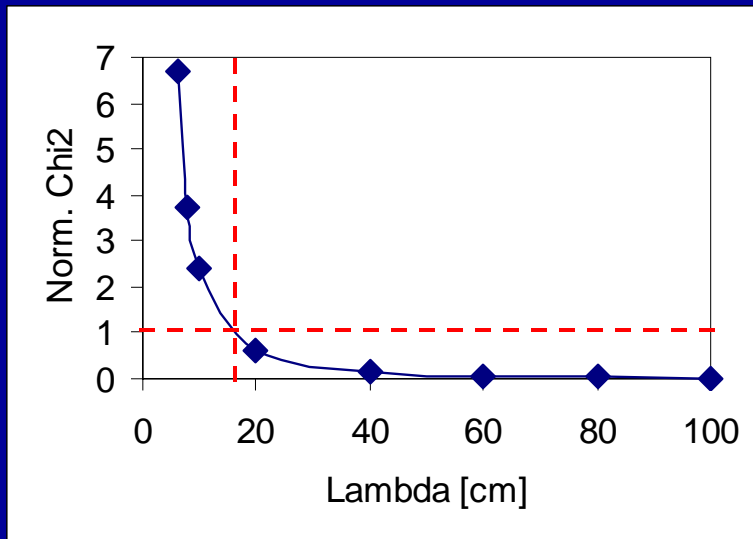


| $\lambda$ [cm] | $\Delta E$ [keV] | S [mm] |
|---|---|---|
| 6 | 27.4 | 0.4 |
| 8 | 21.7 | 0.5 |
| 10 | 16.4 | 0.6 |
| 20 | 10.3 | 1.3 |
| 40 | 5.9 | 2.6 |
| 60 | 4.9 | 3.9 |
| 80 | 4.3 | 5.2 |
| 100 | 3.9 | 6.5 |

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# Conclusions

Neutron damage does not represent a problem for position determination

… BUT we need to verify the stability of pulse shape after annealing.

# Acknowledgements

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