

Novel $\text{Al}_2\text{O}_3:\text{C},\text{Mg}$
Fluorescent Nuclear Track Detectors
for Passive Neutron Dosimetry

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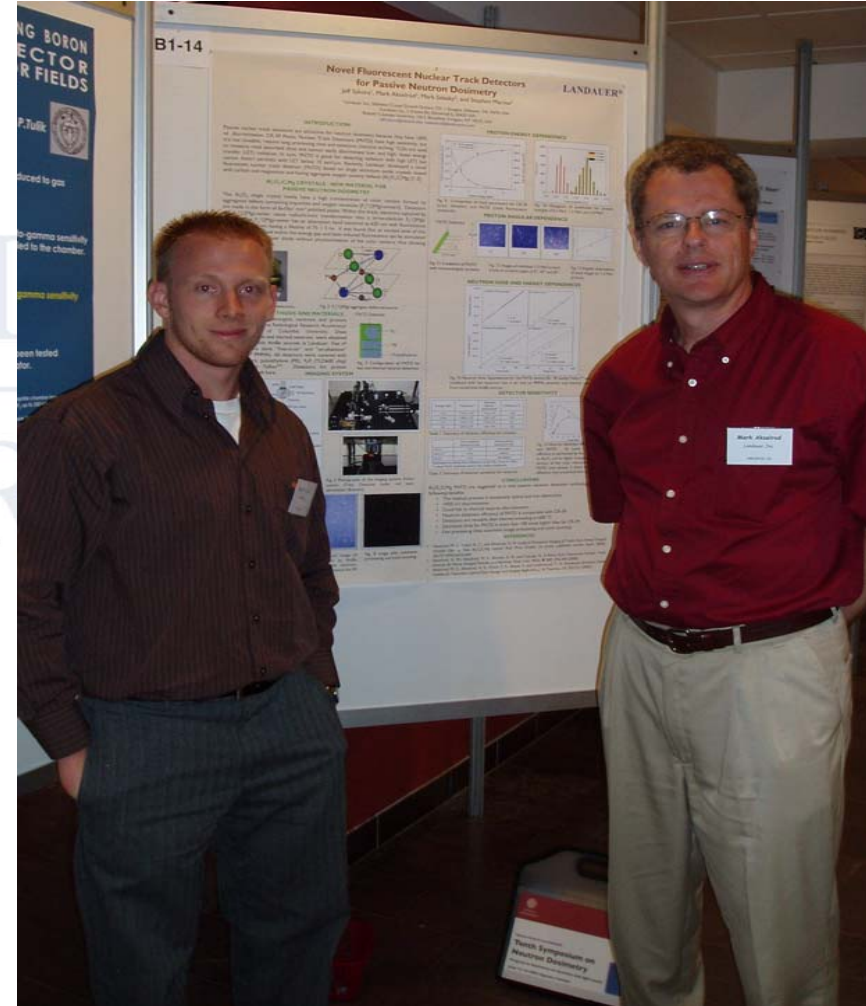
Acknowledgements

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Current passive neutron dosemeter drawbacks

- CR-39:
 - Long processing times
 - Chemical etching
 - Not reusable
- TLD
 - Photon response
 - Not re-readable

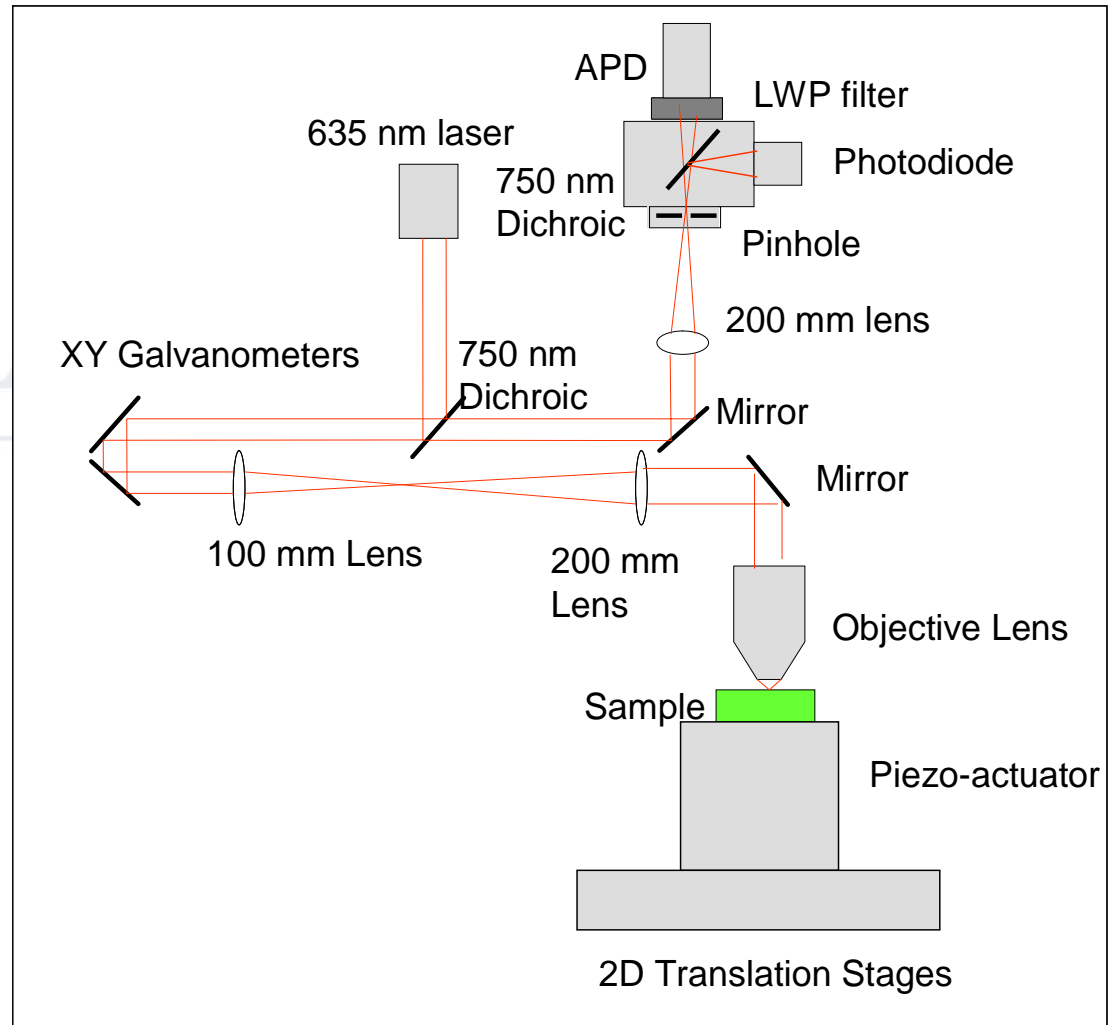
$\text{Al}_2\text{O}_3:\text{C},\text{Mg}$ - a new material.



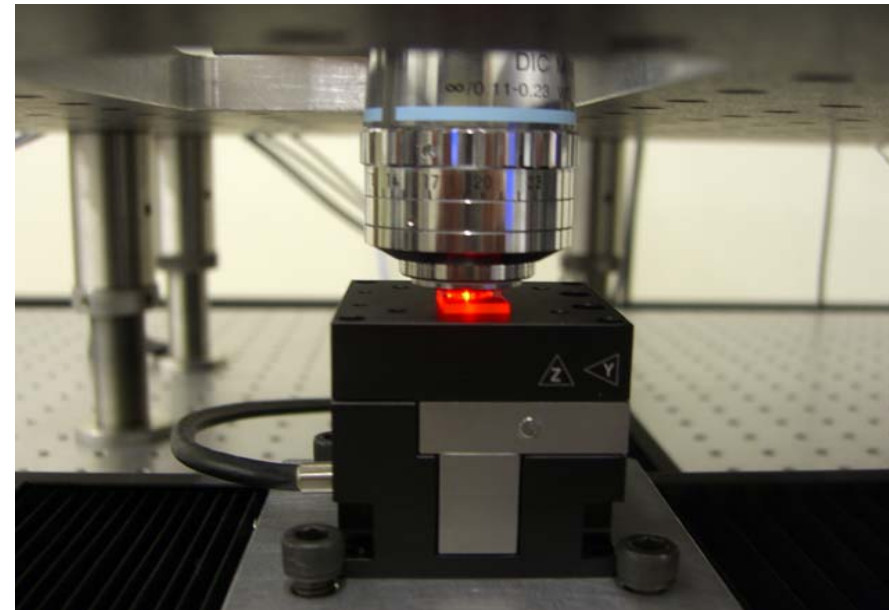
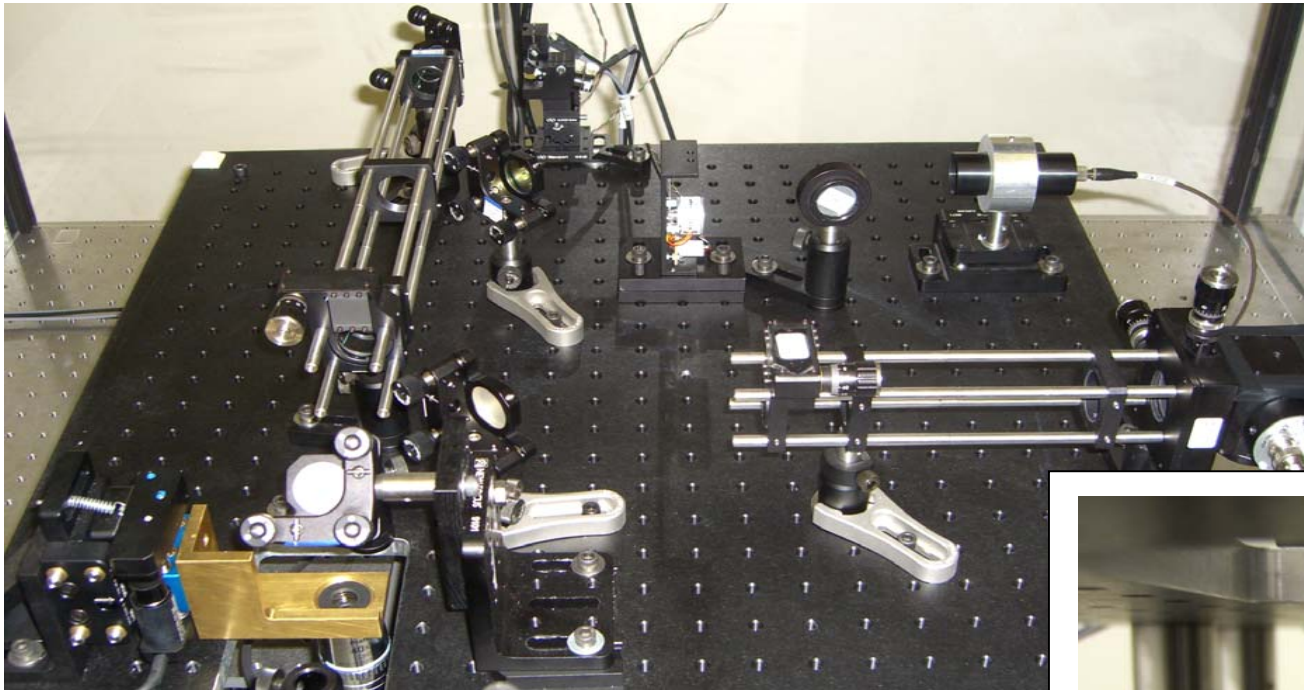
- High concentration of colour centres
- Detectors in the form of $6 \times 10 \times 1 \text{ mm}^3$ polished plates

Imaging system

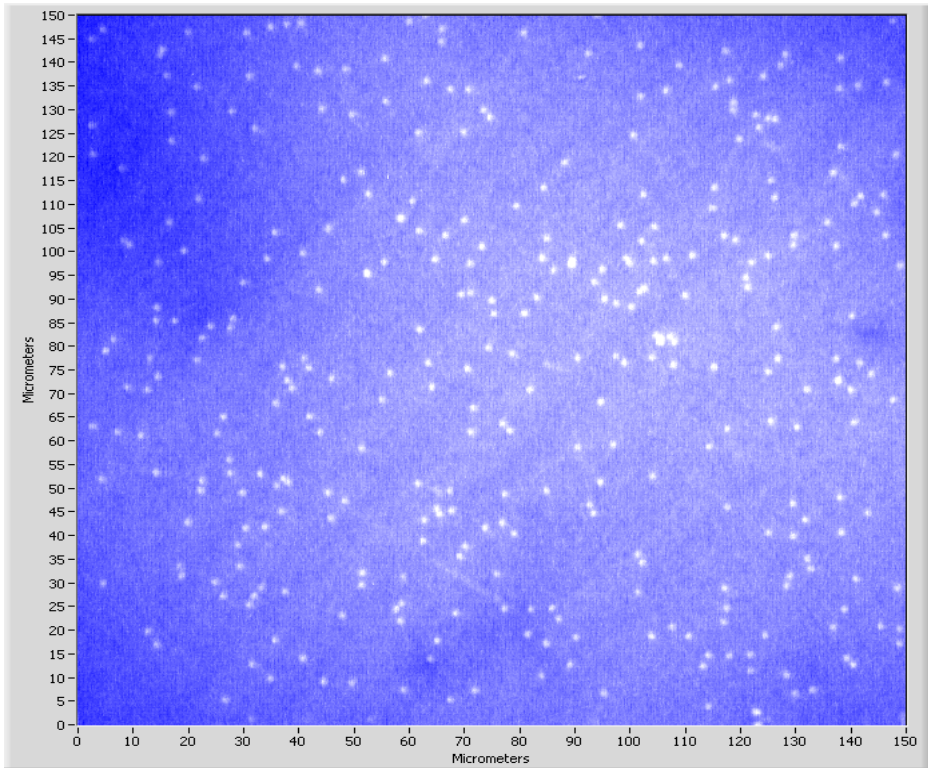
- Confocal laser scanning microscope
- Fast scanning and non-destructive readout



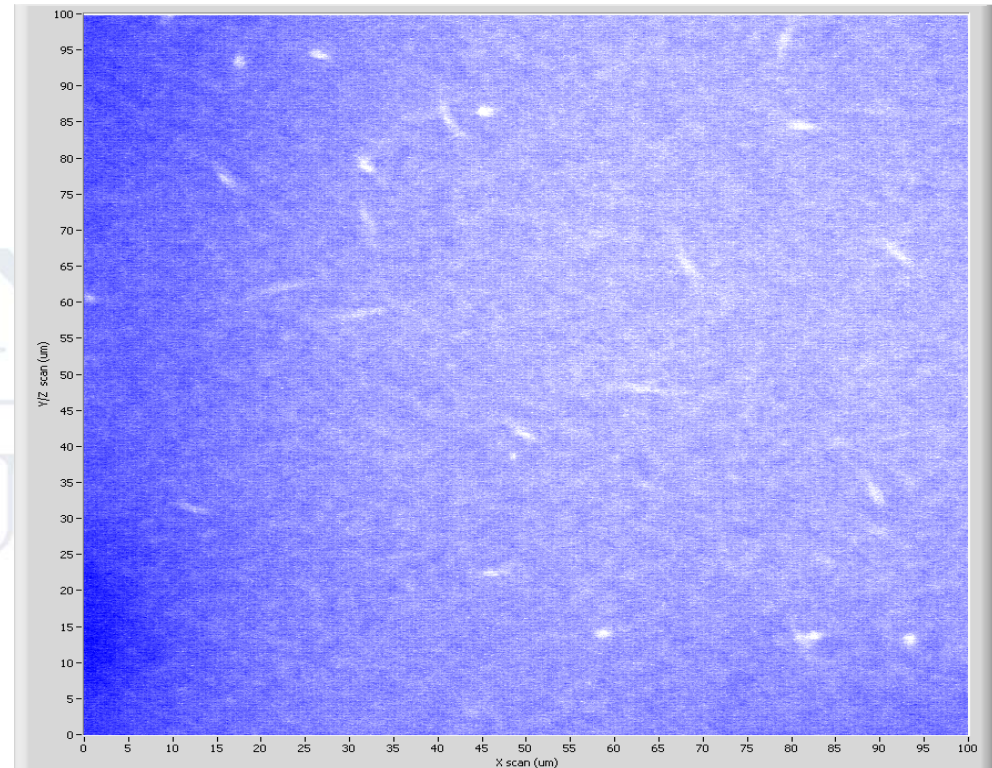
Imaging system



Images

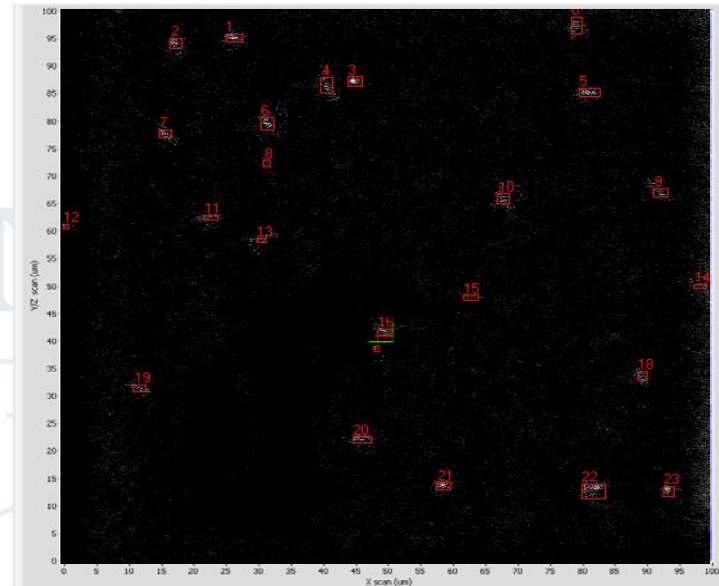
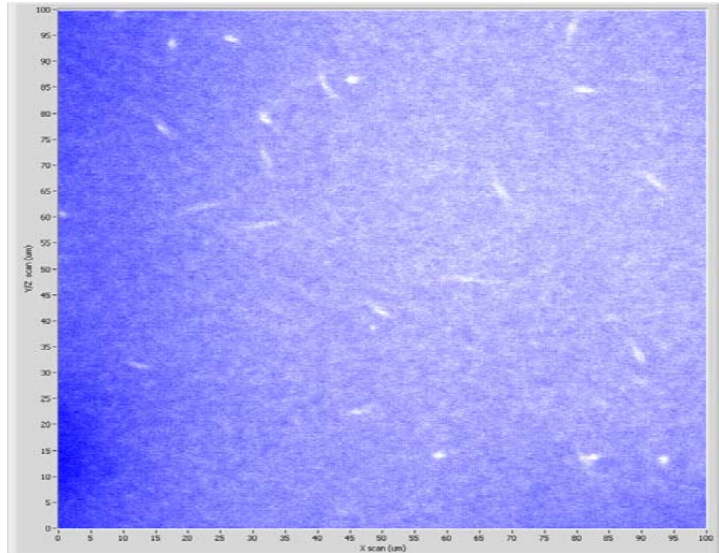


Tracks of proton produced by
accelerator



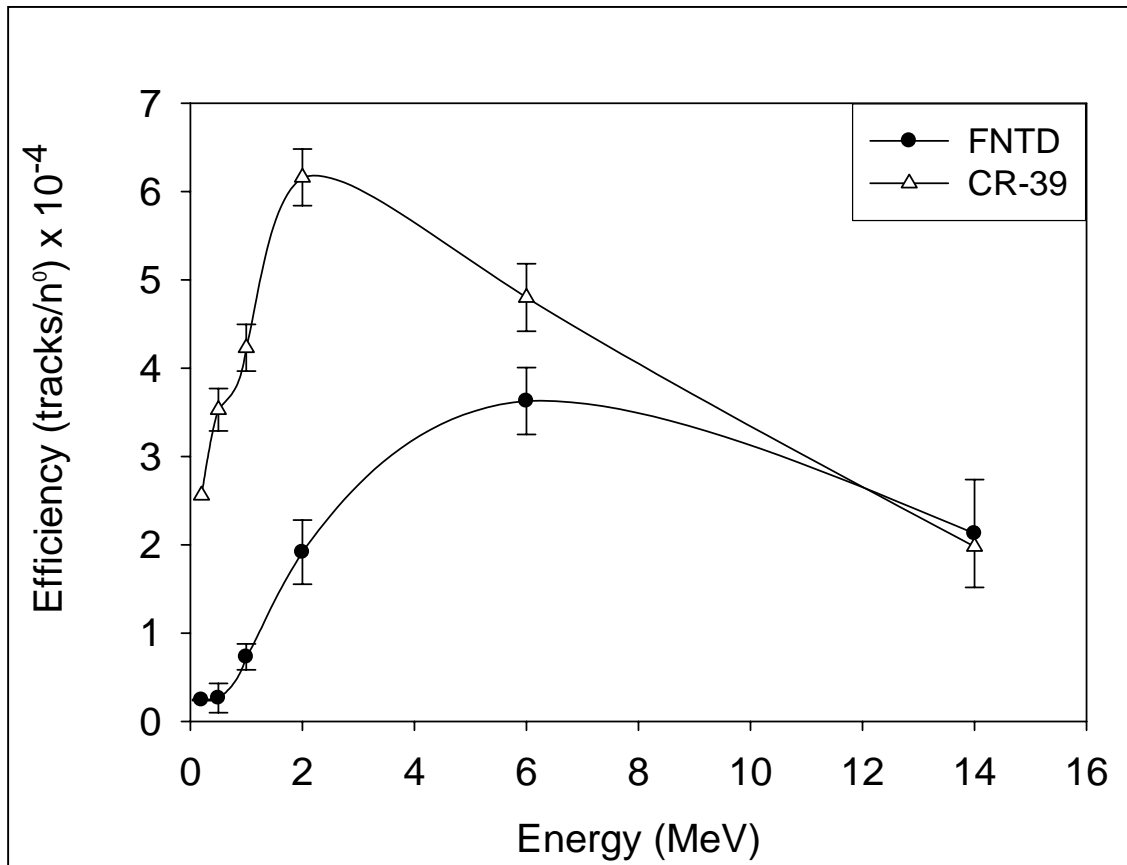
Tracks of recoil protons produced in
PE converter during fast neutron
irradiations

Automatic track analysis



- Eliminates background noise and uses pattern matching to count tracks

Neutron energy dependence



Tracks mm⁻² mSv⁻¹

- AmBe - 21.4
- Thermal - 6464.9

Neutron dose dependence

- Fast neutron sensitivity at least 2 x that of CR-39
- 100% neutron to gamma discrimination
- Saturation dose 100 x higher than for CR-39

Advantages

- Readout process is fast and automatic
- Rereadable and reusable
- No chemical etching
- Re-readable
- Reusable

Conclusions

- Excellent dosimetry properties
- Ongoing research and development
- Further information:
 - A novel Al_2O_3 fluorescent nuclear track detector for heavy charge particles and neutrons G M Akselrod, MS Akselrod, ER Beton and N Yasuda. NIM(B) pp 295 – 306 (2006).
 - Confocal fluorescent imaging of tracks from heavy charged particles utilising new $\text{Al}_2\text{O}_3:\text{C},\text{Mg}$ crystals. MS Akselrod, C Yoder and GM Akselrod. Radiation Protection Dosimetry To be published.