ONERA/DESP GEANT 4 SPACE ENVIRONMENT TOOLKITS

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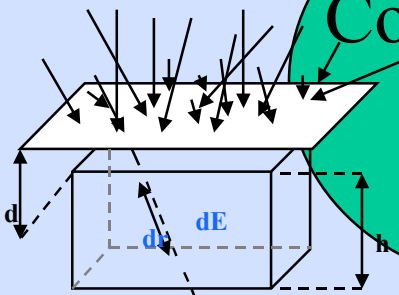
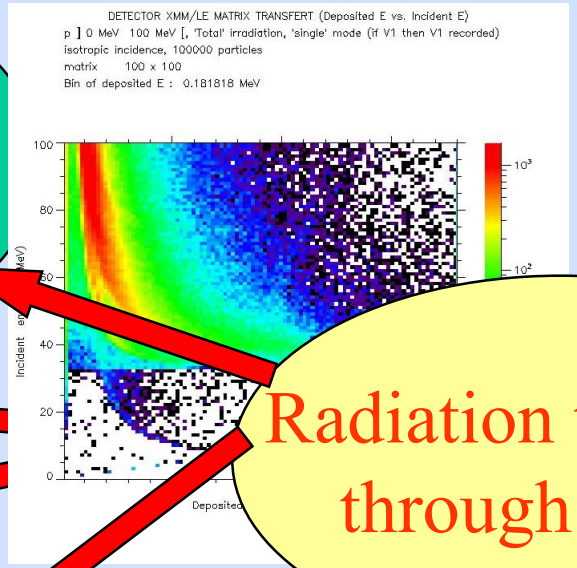
Environment
detector analysis

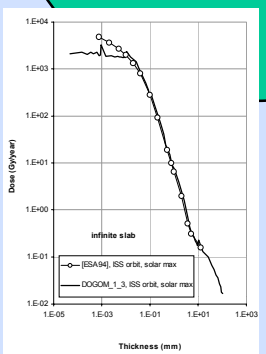
Components
SEU
Dose
displacement





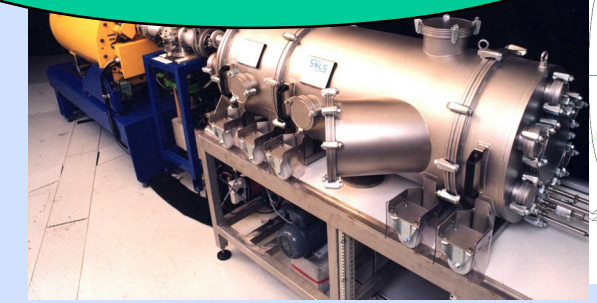
Radiation transport through matter

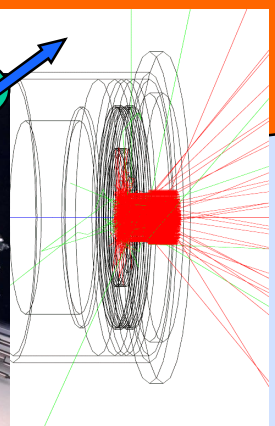
Material
Dose
displacement



Experimental facilities

Spacecraft charging





DESP INTEREST

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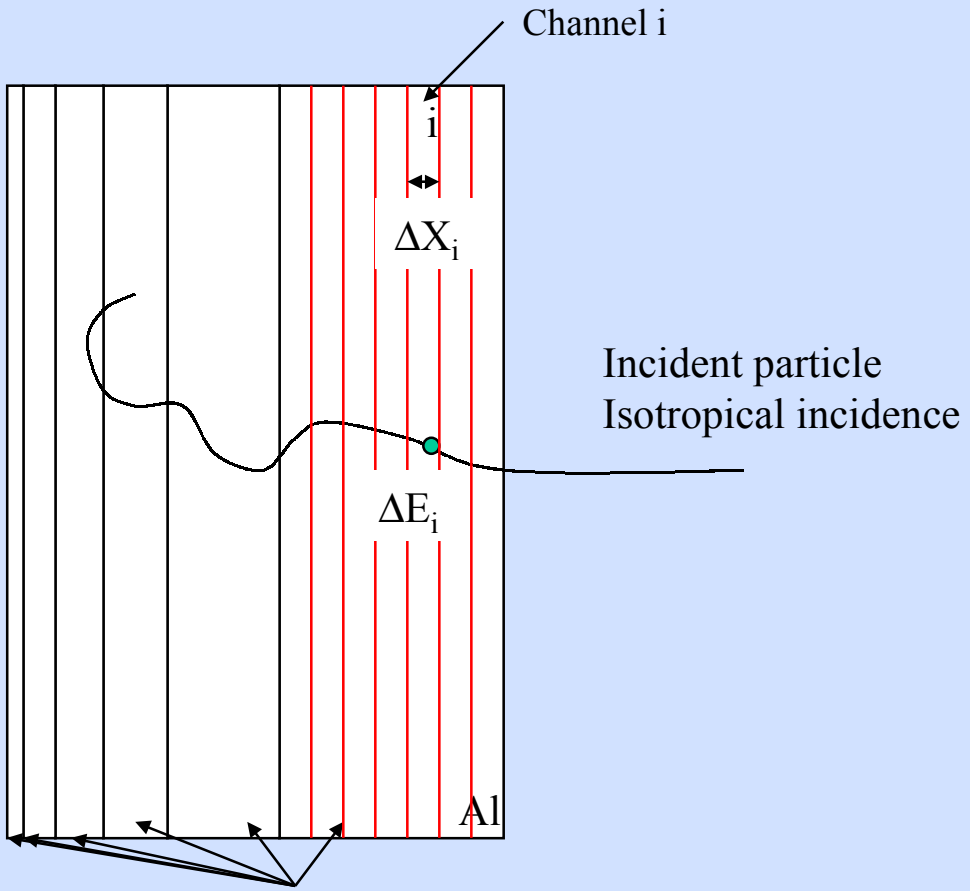
Dose calculation

$$Dose_i = 1{,}6 \cdot 10^{-09} \frac{\Delta E, i}{\Delta x, i} \cdot \frac{1}{\rho}$$



Material split in 6 volumes
where the step lenght is adjusted

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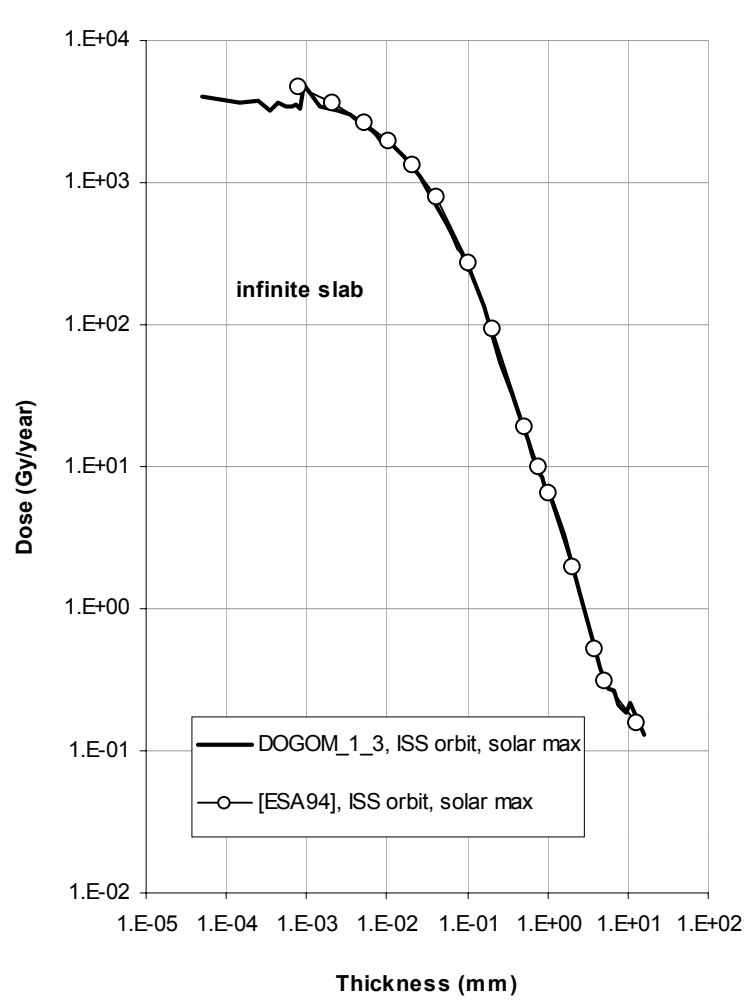
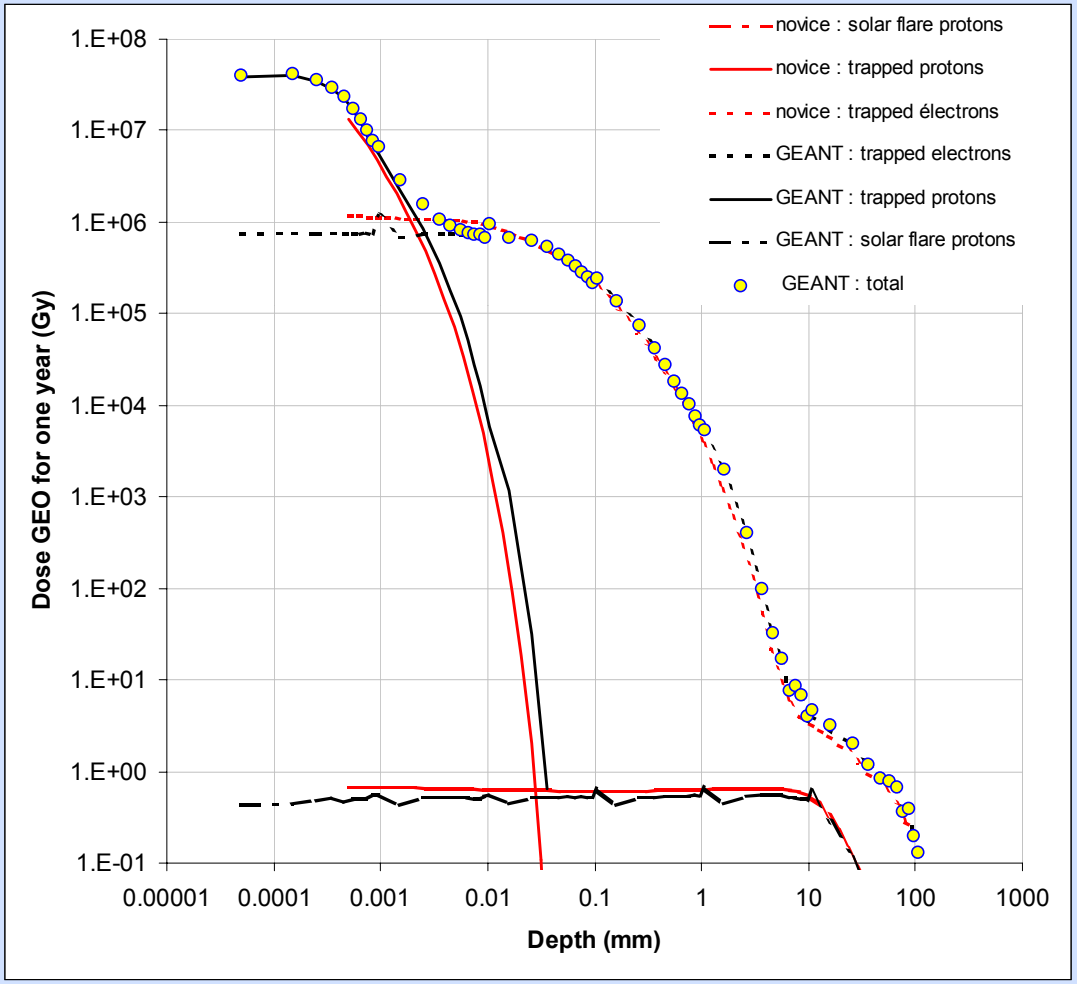
Dose calculation





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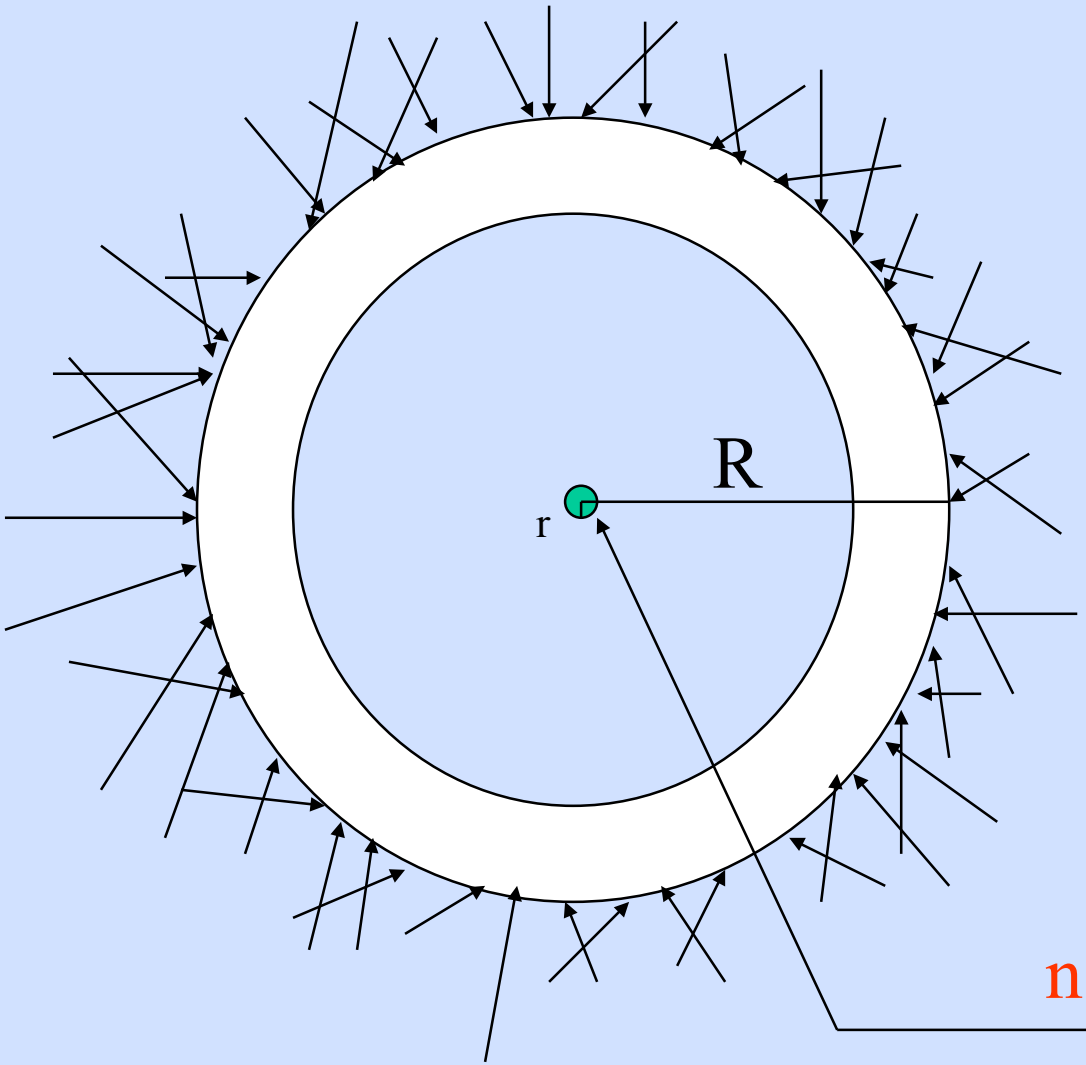
Limit of GEANT 4 for dose calculation



The number of incident particle that impinge a little sphere at the center of the shielding (**n**), is very small compared to the number of simulated incident particle **N**.

$$n \sim N.\ r^2 / R^2$$

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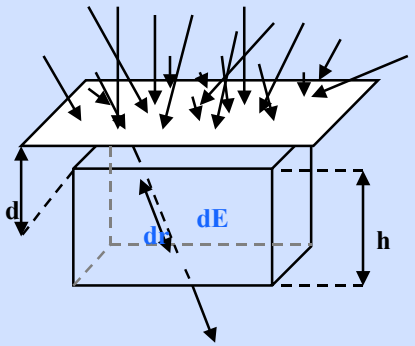
GEANT 4 : SEU calculation



Effective LET : $LET_{eff} = dE/h$

$$N = \int_{LET_{Min}}^{LET_{Max}} \frac{d\phi}{dLET}\Bigg)_{eff} (LET) \cdot \sigma_{ion}(LET) \cdot dLET$$

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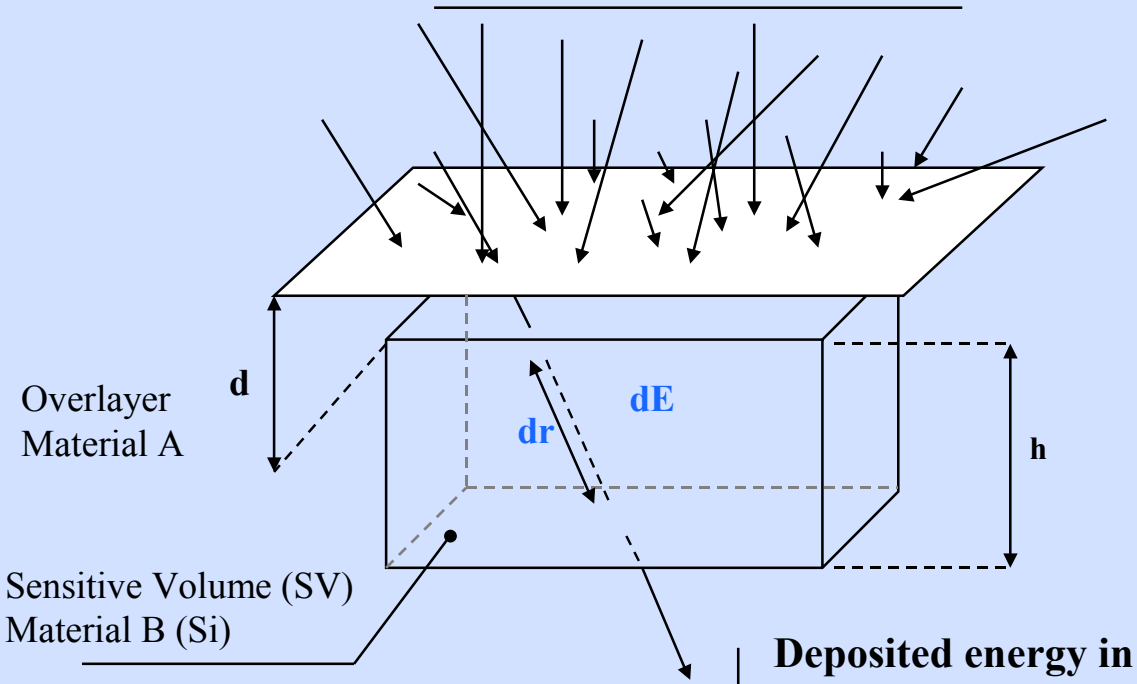
GEANT 4 : SEU calculation

Incident ions with isotropical incidence
(Lambertian distribution)



Deposited energy in SV	**:**	**dE**
Range in SV	**:**	**dr**
Average LET	**:**	**<LET> = dE/dr**
LET	**:**	**Lim dE/dr**
		dr → 0
Effective LET	**:**	**LET_{eff} = dE/h**

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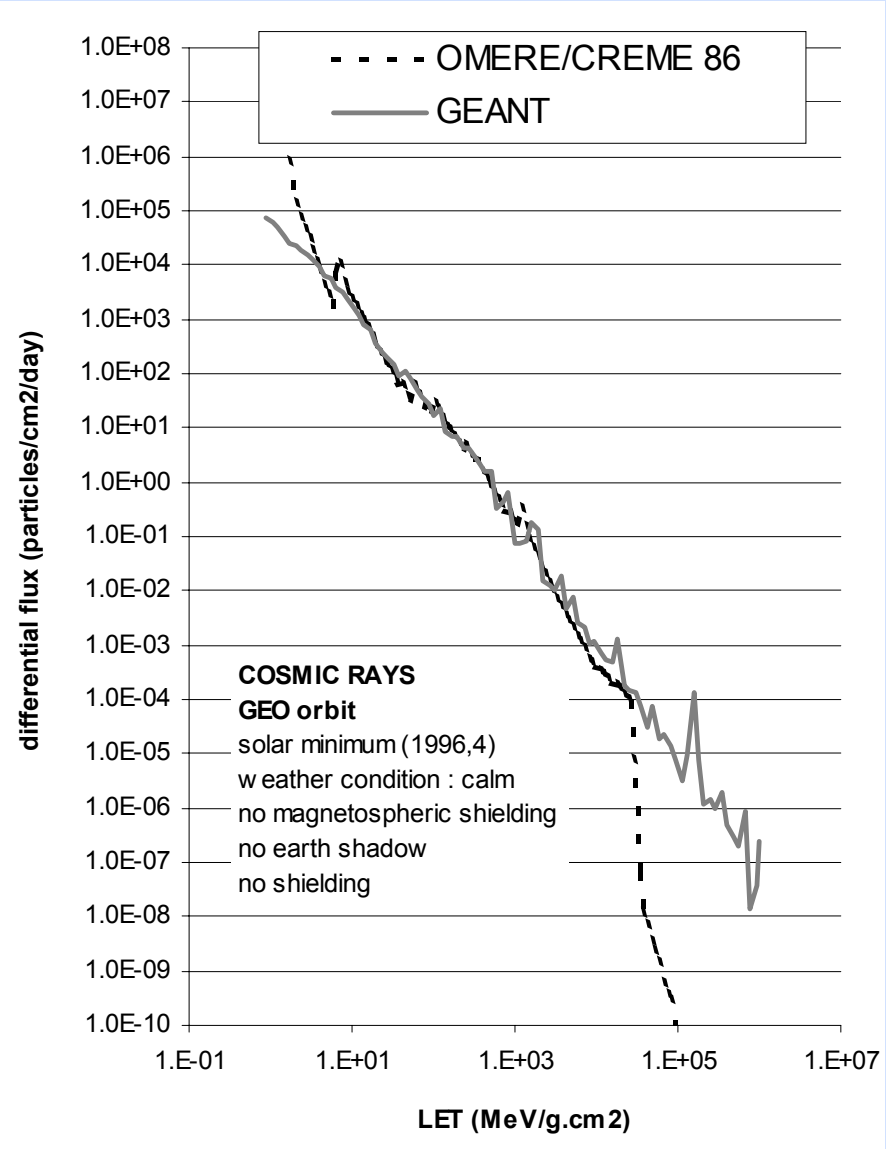
GEANT 4 : SEU calculation, effective LET spectrum



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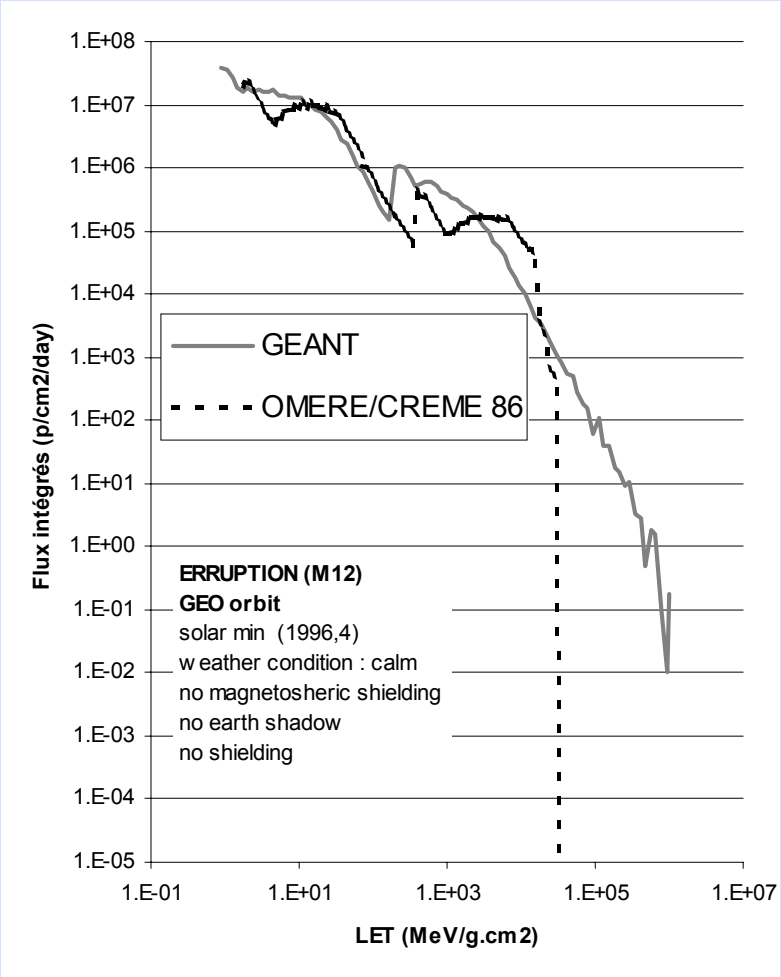
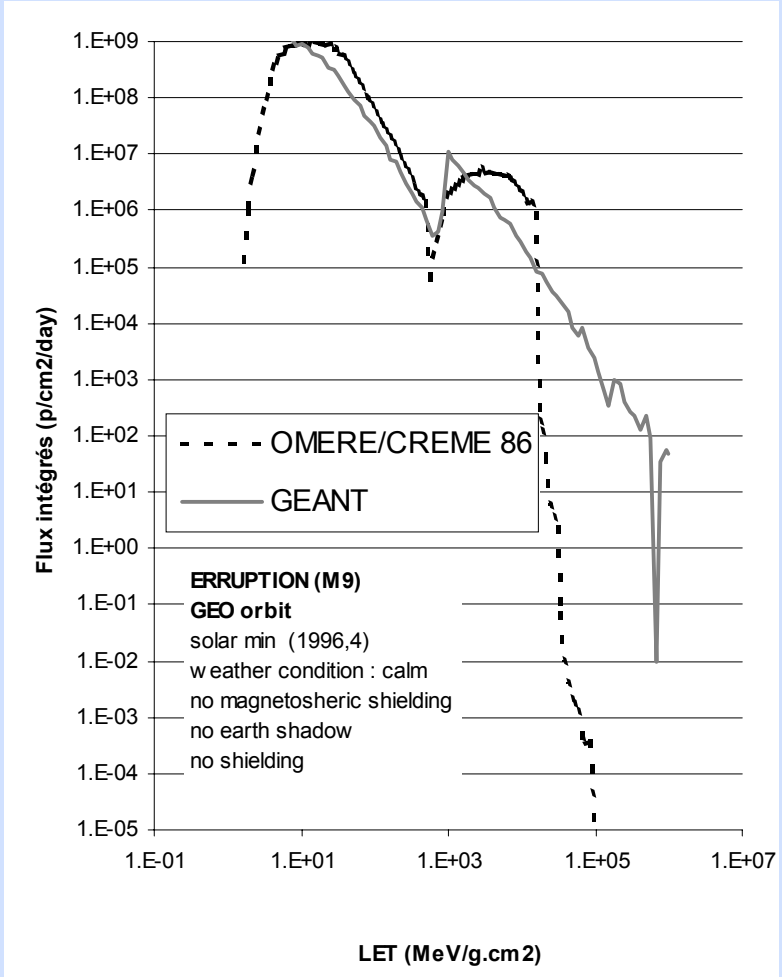
GEANT 4 : SEU calculation, effective LET spectrum





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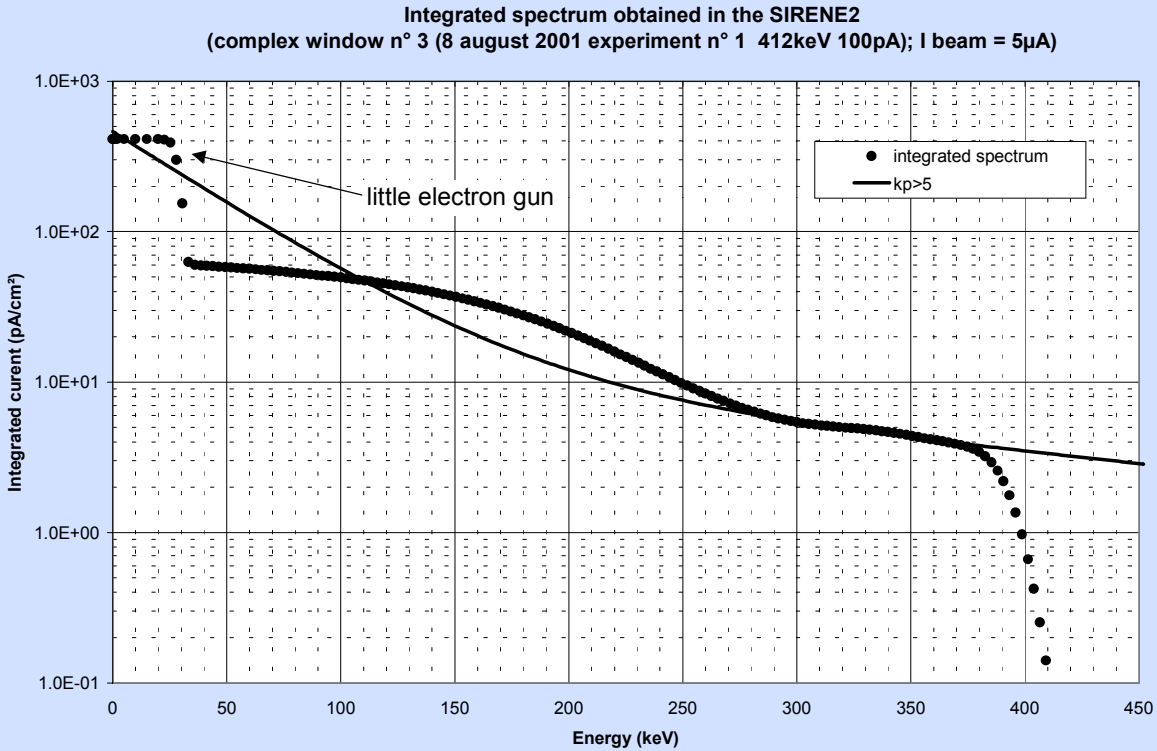
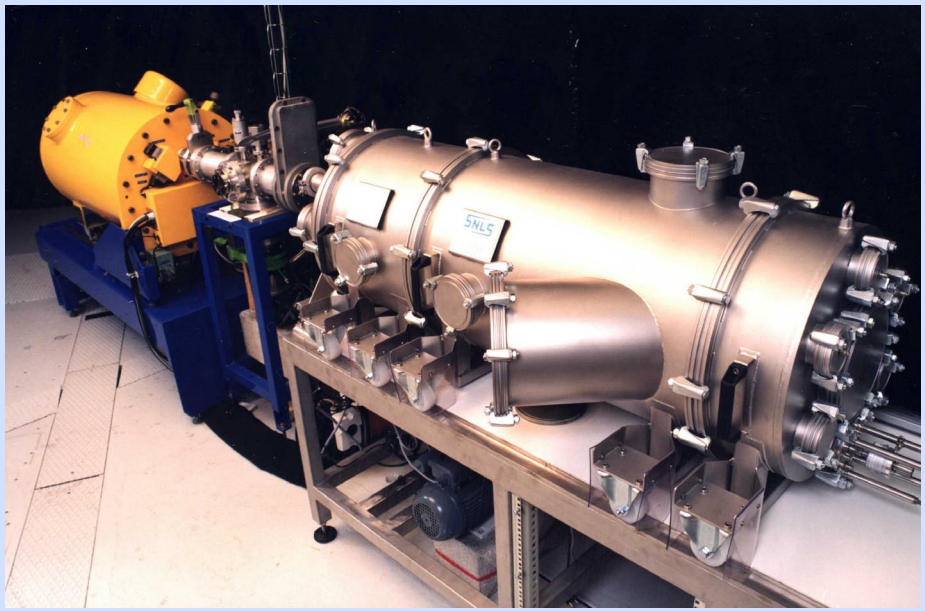
GEANT 4 : Experimental facilities





sources :
- Van de Graaff accelerator (400 keV)
- electron gun (35 keV)

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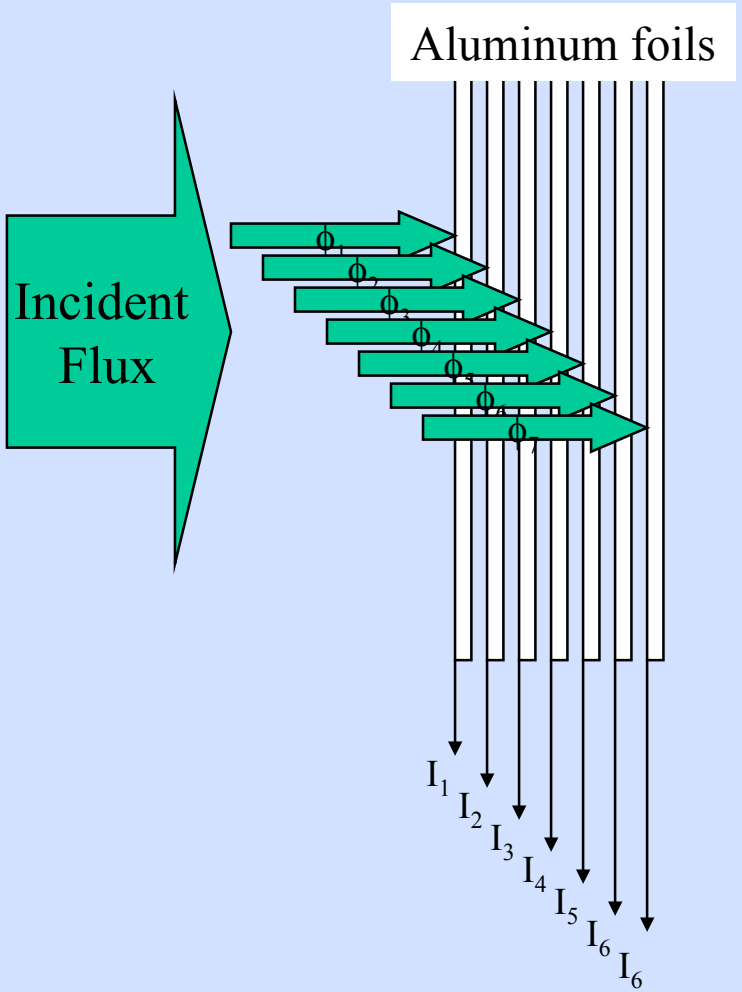
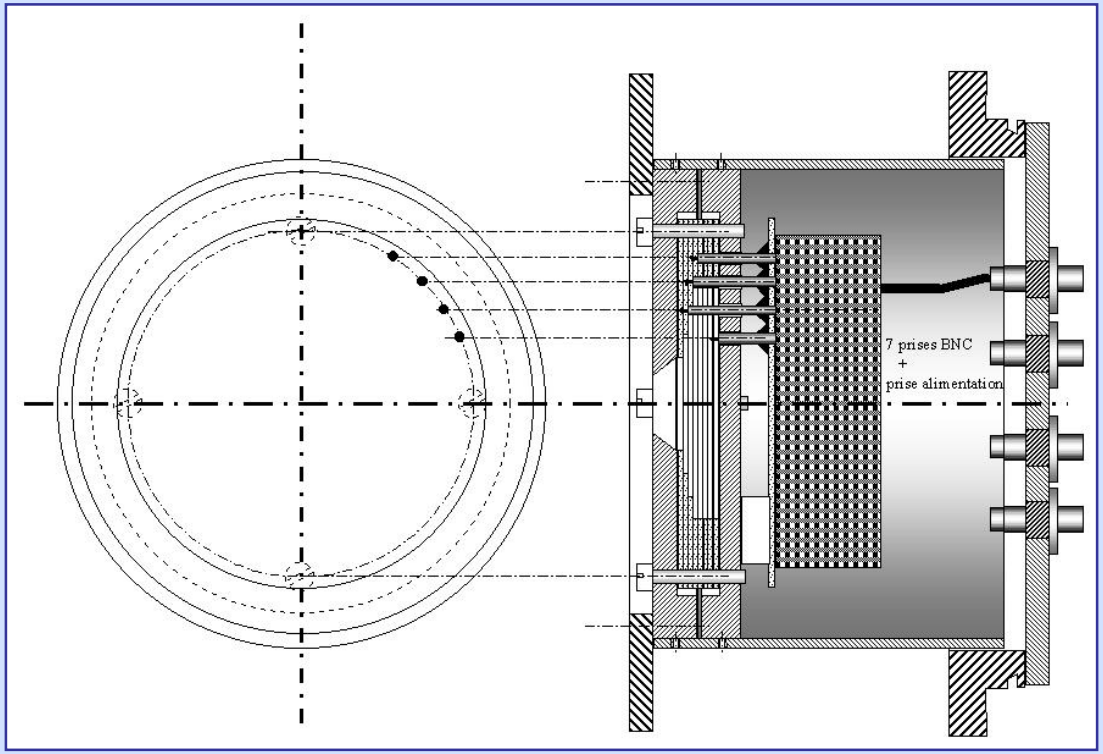
GEANT 4 : Experimental facilities





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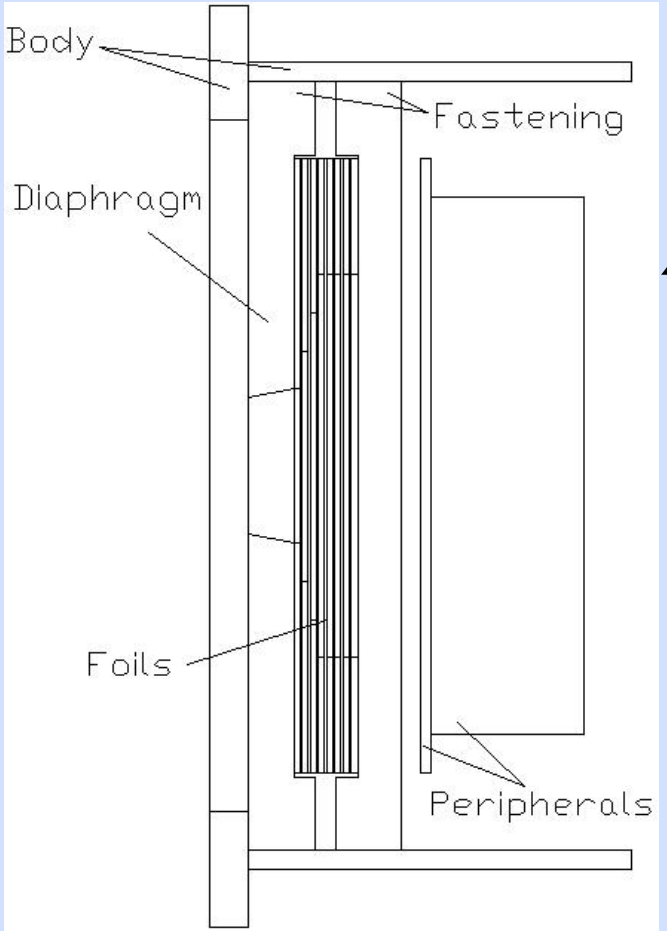
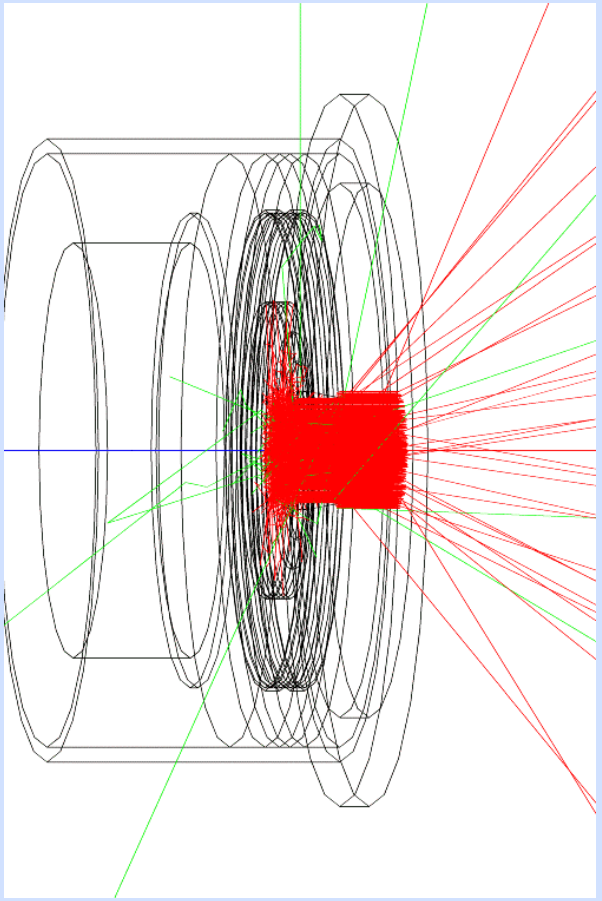
GEANT 4 : Experimental facilities

Detector simulation



construction

View of the irradiation of the detector with DAWN



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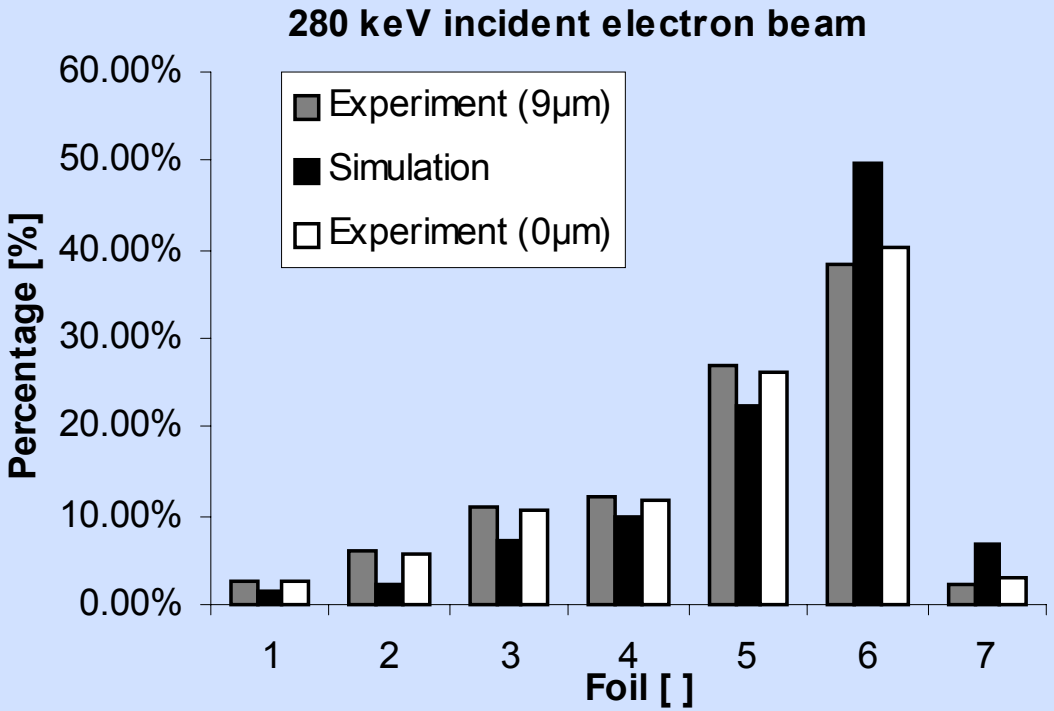
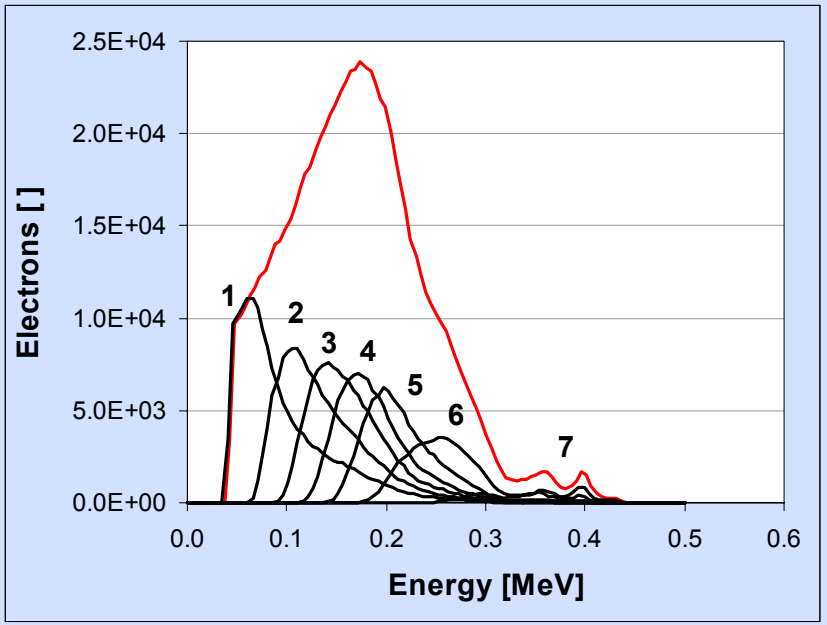
GEANT 4 : Experimental facilities





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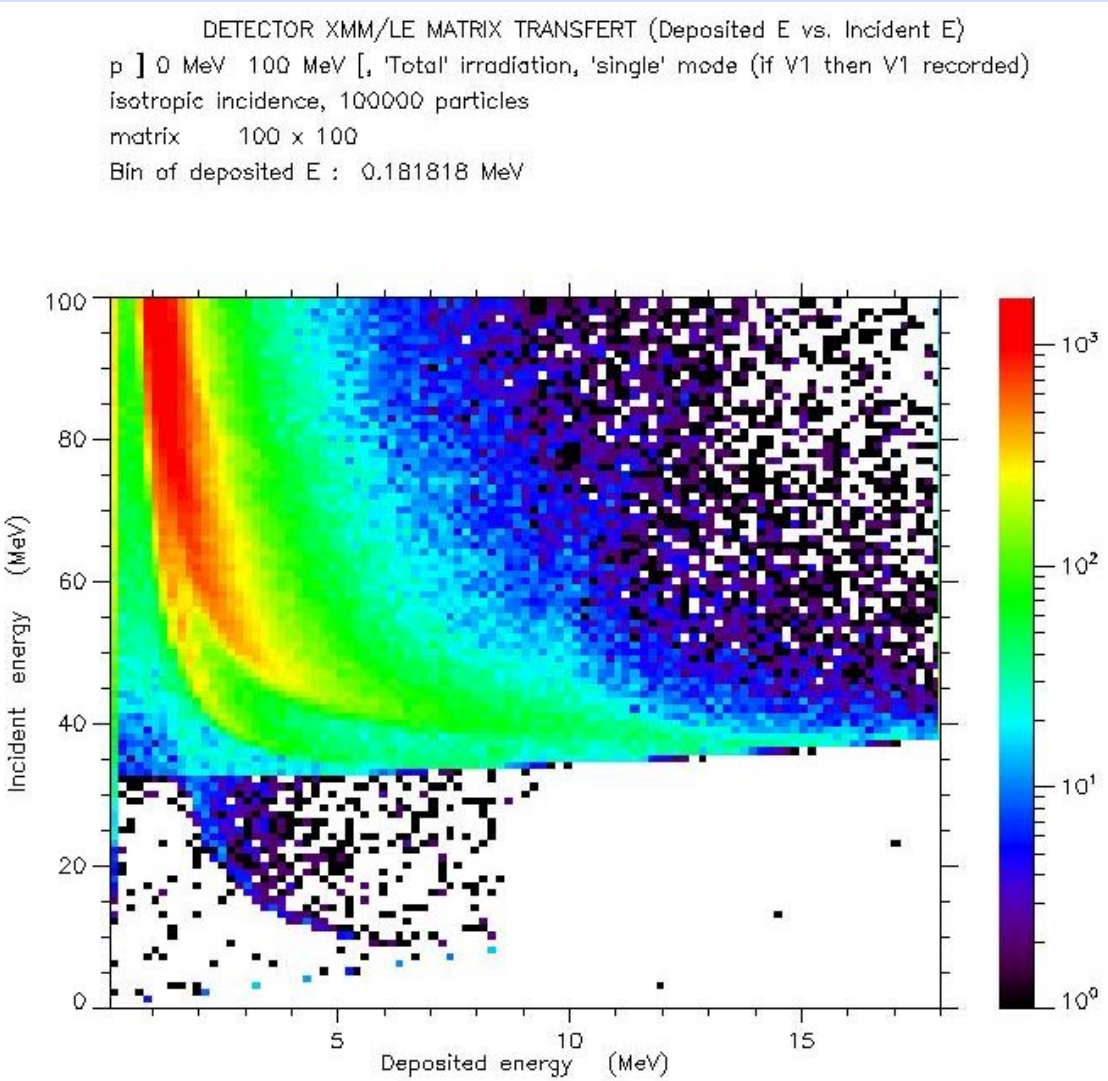
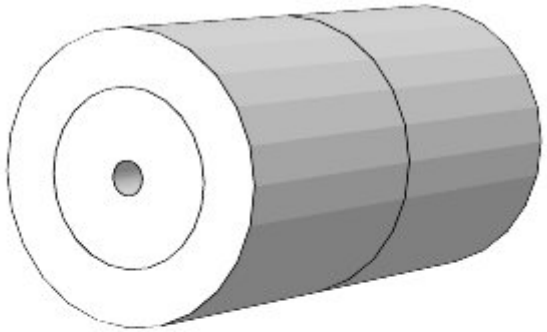
GEANT 4 applications

Usefull to get the response of a detector





XMM/ERMD

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CONCLUSION

Interesting tool :

- **For radiation monitor analysis**
- **Analysis of experimental facilities**
- **SEU calculation**

Limited for dose calculation