

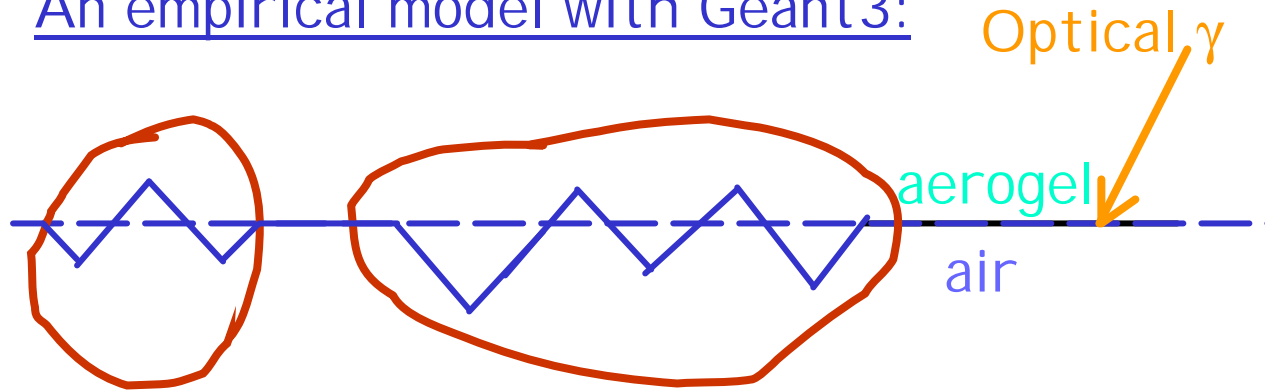
Aerogel surface description and its implementation in Geant4

Patrícia Gonçalves, LIP - Lisboa



Photon scattering in the radiator surface

An empirical model with Geant3:



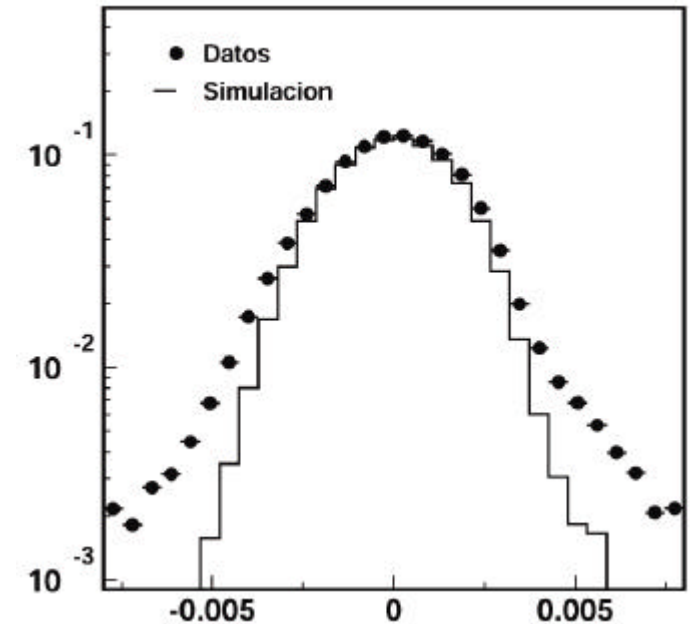
for $P < P(\text{scattering.})$:

$$p(\mathbf{a})d\mathbf{a} \approx \exp\left(-\frac{\sin^2 \mathbf{a}}{2s_a^2}\right)d(\sin^2 \mathbf{a})$$

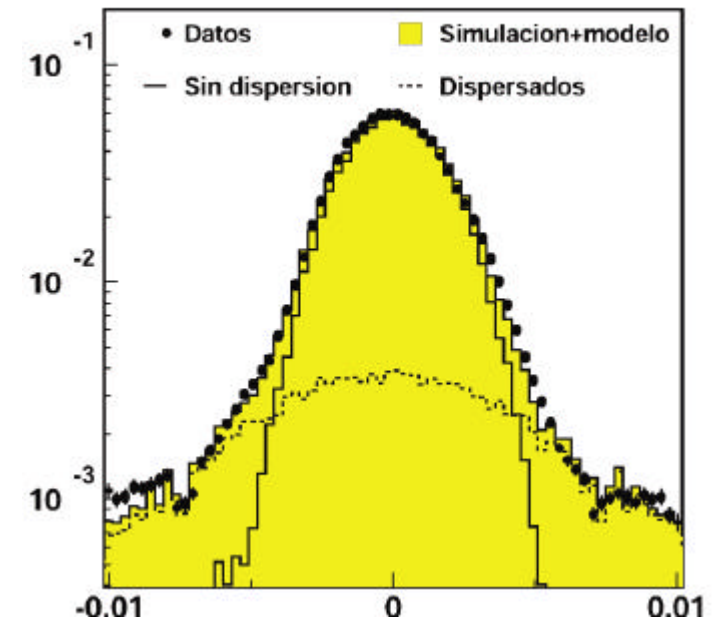
Fit to data:

| Aerogel | $P(\text{scattering})$ | s_a (mrad) |
|---------|------------------------|--------------|
|---------|------------------------|--------------|

| | | |
|--------------|-----------------|------------|
| Mats. 1.05 | 0.20 ± 0.02 | 25 ± 3 |
| Mats. 1.03 | 0.28 ± 0.02 | 24 ± 2 |
| Mats. 1.03 n | 0.33 ± 0.02 | 20 ± 3 |
| Nov. 1.03 | 0.15 ± 0.01 | 24 ± 1 |
| Nov. 1.04 | 0.21 ± 0.01 | 25 ± 4 |



$b_{\text{rec.}} - b_{\text{exp.}}$



Measurement of the aerogel surface

A more precise description of the photon scattering in aerogel

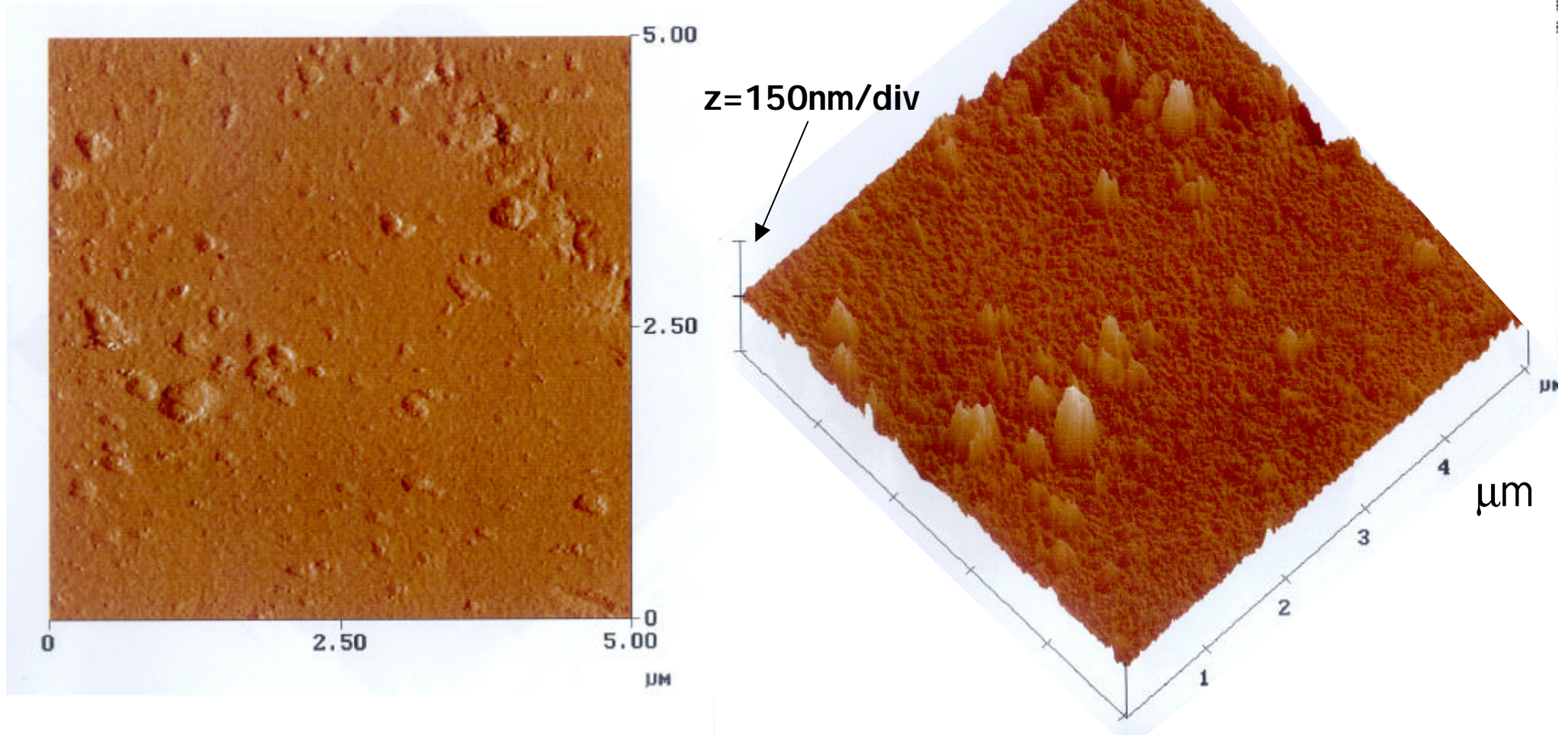
Atomic Force Microscopy:

- Study of the surface of different aerogel types :
from different manufacturers /with different refractive indices.
- Contribute for the choice of the aerogel type to be used in the AMS
RI CH flight configuration ?
- Obtain aerogel surface mappings and/or estimate effective parameters
for the surface.

Atomic Force Microscopy

Preliminary results

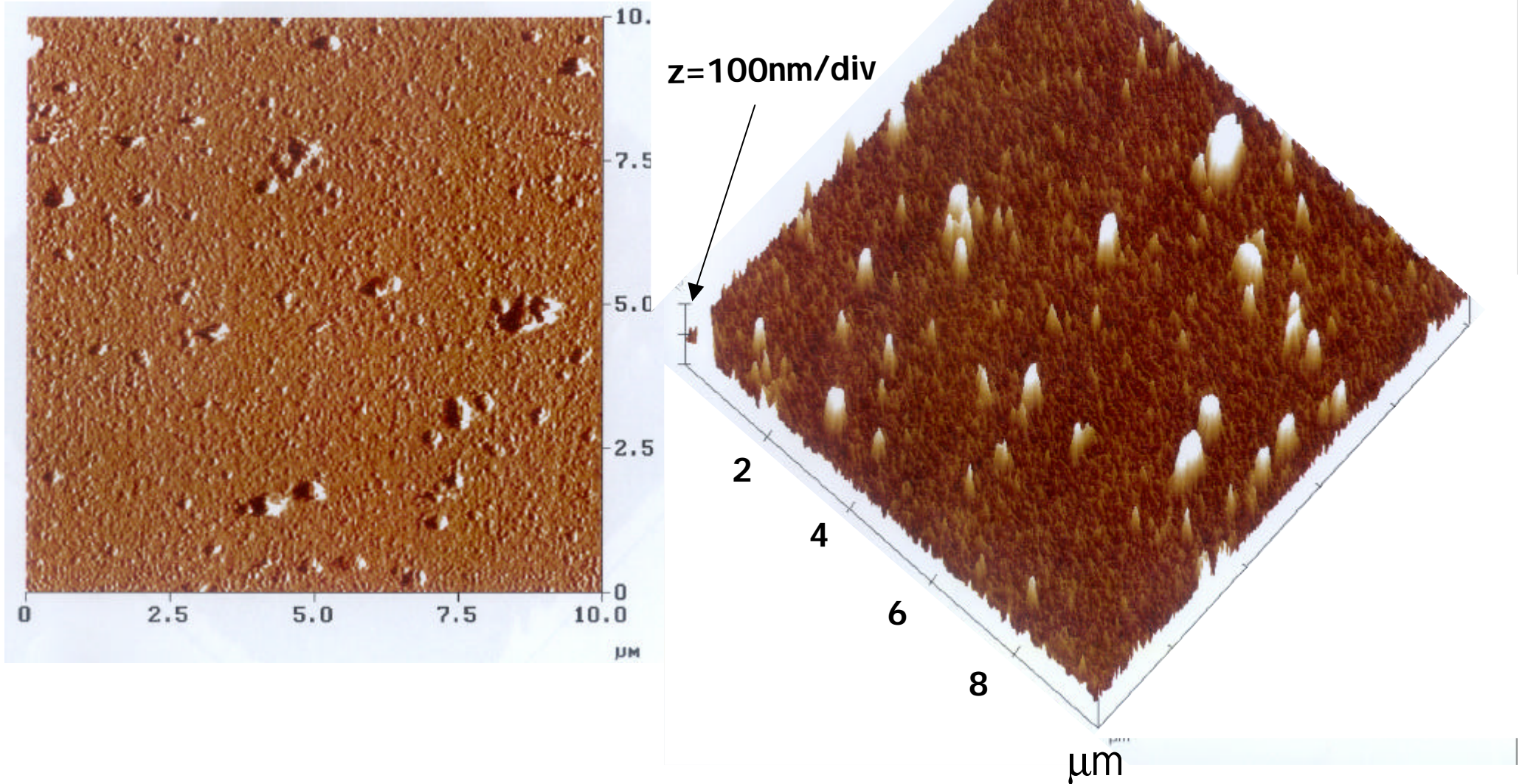
Aerogel: $n=1.03$ (Matsushita)



Atomic Force Microscopy

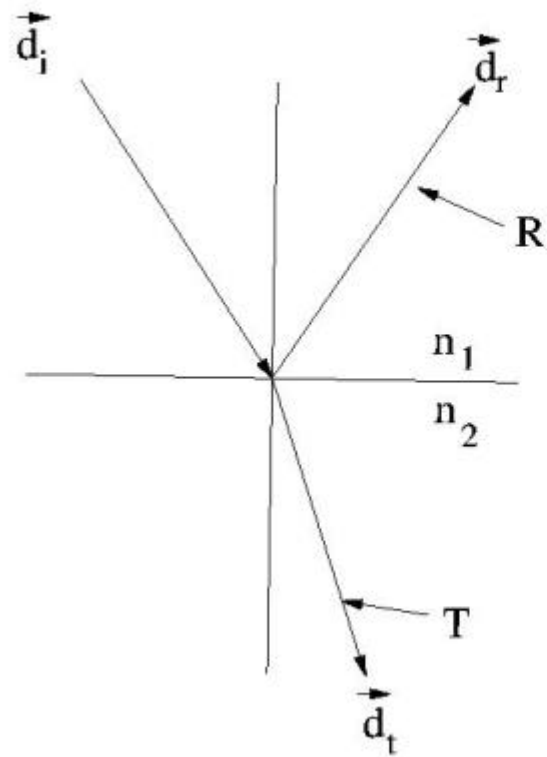
Preliminary results

Aerogel: $n=1.05$ (Matsushita)

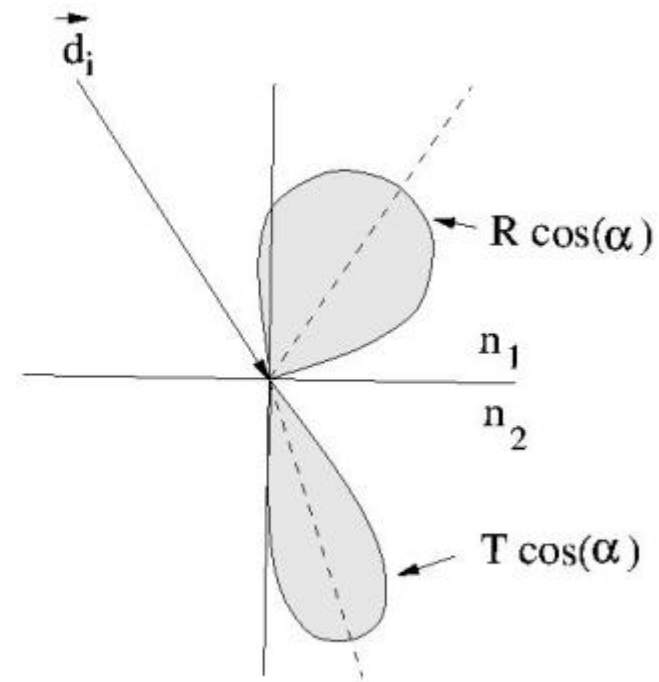


Model implemented in Geant3

Can the glisur model describe photon scattering in aerogel ?



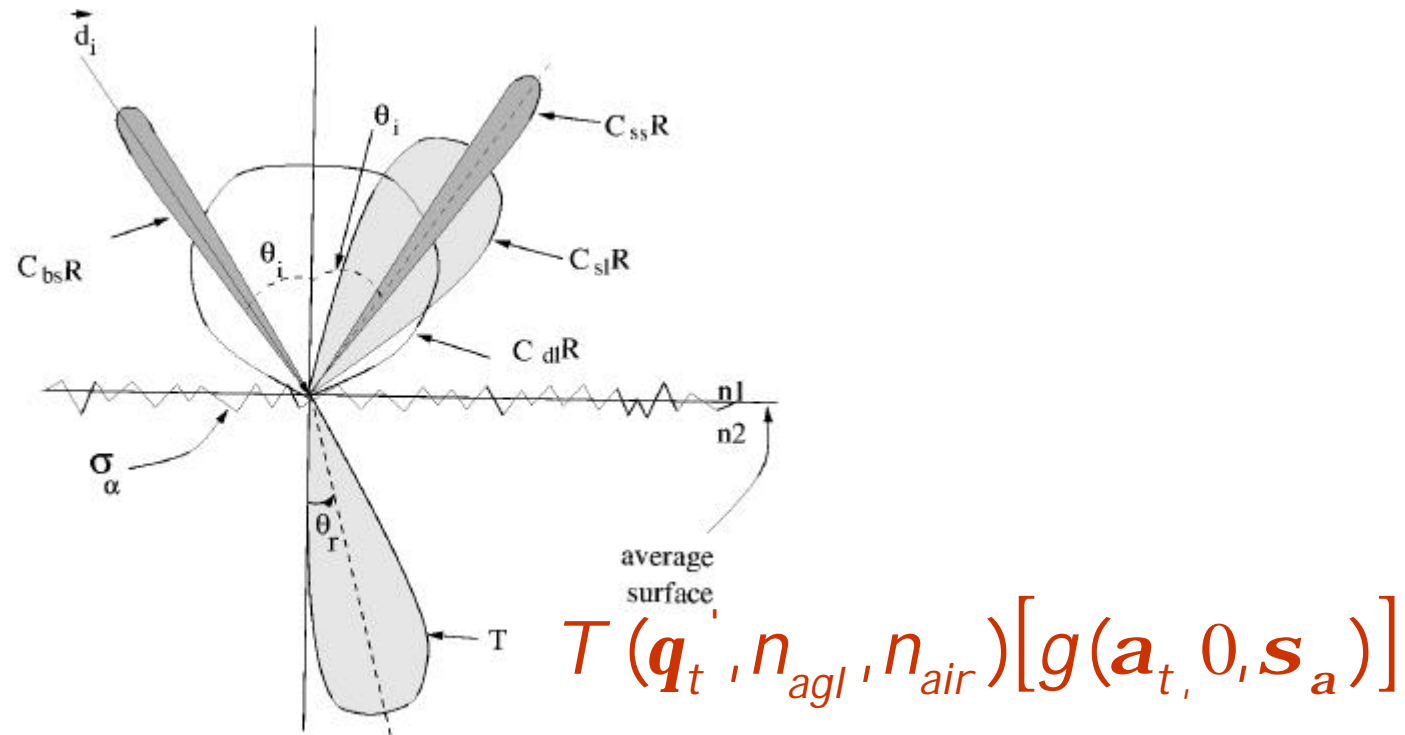
polished



ground

Rich radiator studies with Geant4

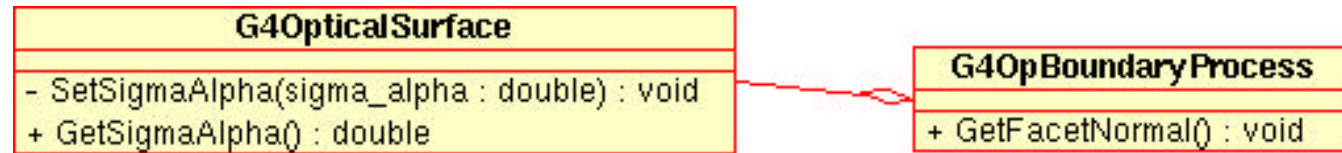
Can the unified model describe photon scattering in aerogel ?



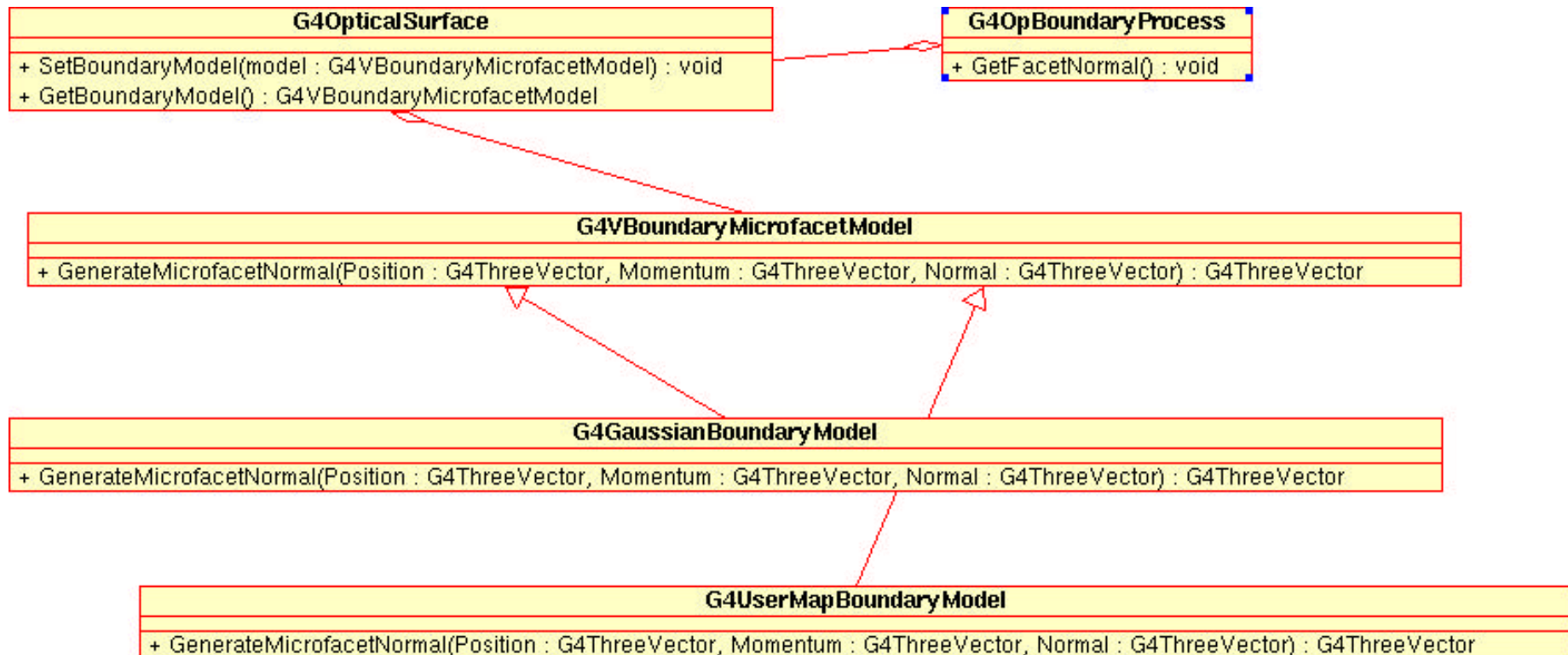
In the unified and in the glisur model the direction of the transmitted photons is only parameterised by a Gaussian distribution of resolution σ_α (α is the difference between the average surface normal and the microfacet slope).

Revisiting the class G4OpBoundaryProcess

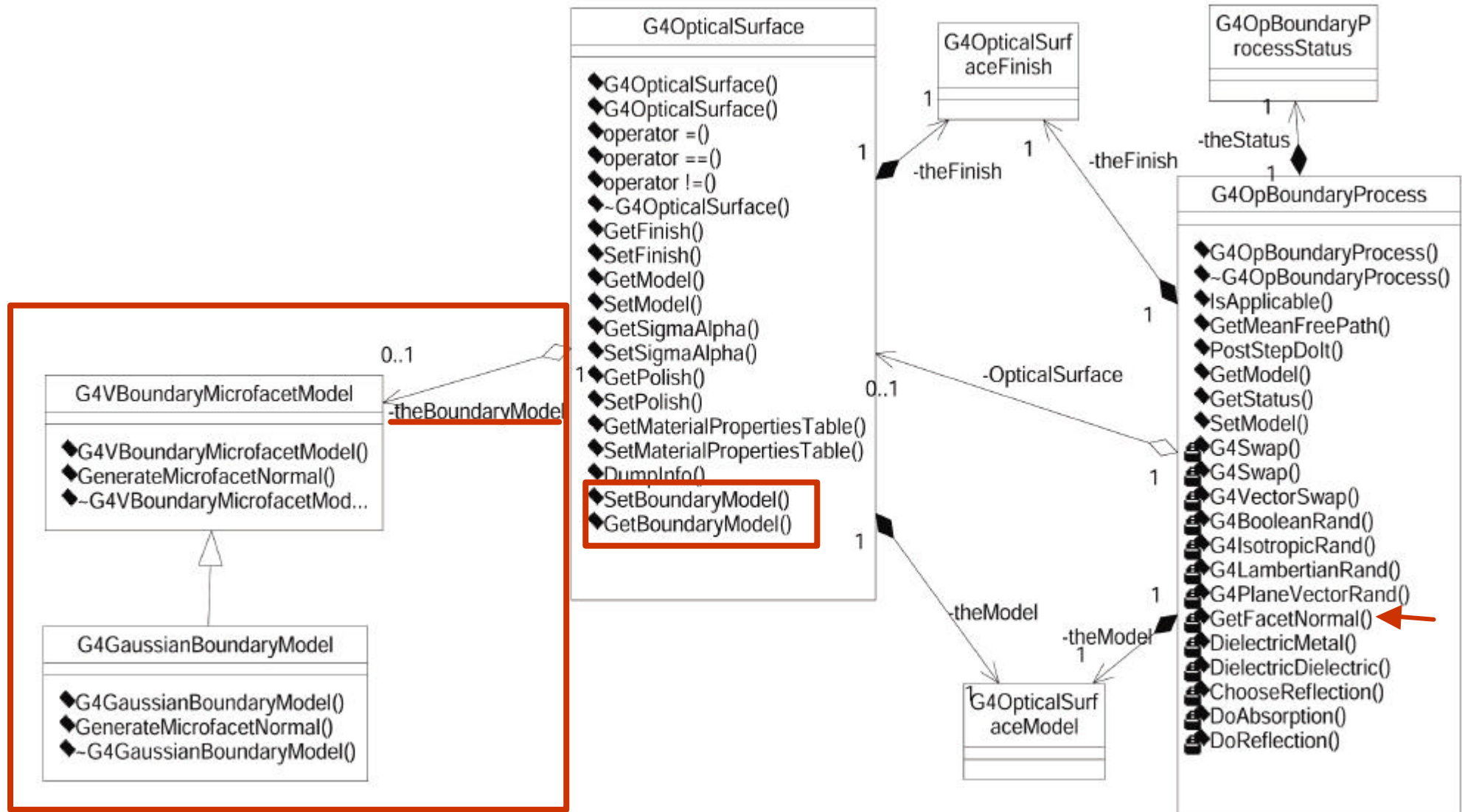
STANDARD



NEW



Present implementation with interface class



Outlook

- The detailed description of photon scattering in aerogel is fundamental to understand the performance of the AMS RICH detector, both in what concerns the charge and the velocity reconstruction.
- Given the characteristics of the aerogel surfaces the Unified model, in its present implementation, does not describe accurately the direction of the Cerenkov photons after leaving the radiator.
- An interface class `G4VBoundaryMicrofacetModel` was implemented in Geant4 enabling the choice of different surface description frameworks.
 - > AFM preliminary measurements compatible with parameters fitted from data for Geant3.
 - > The implementation of surface mappings as a concrete class is underway.