

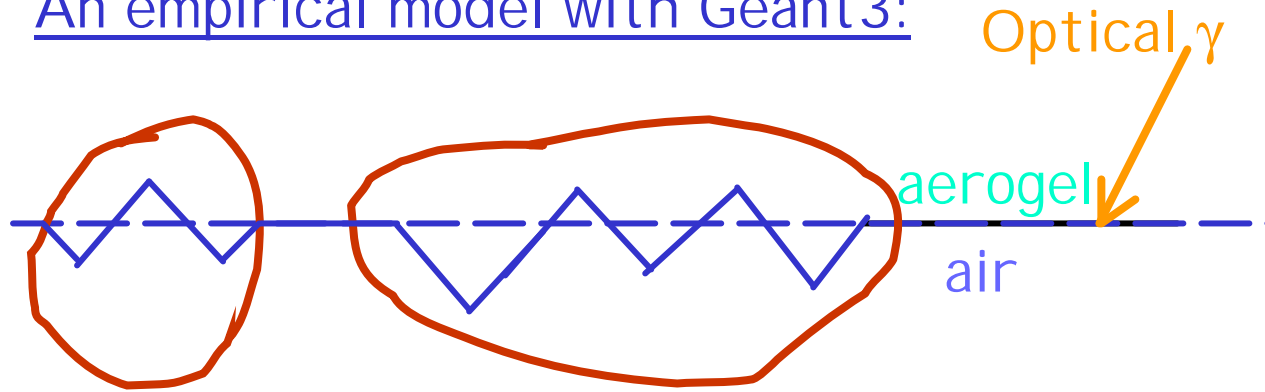
# Aerogel surface description and its implementation in Geant4

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# Photon scattering in the radiator surface

An empirical model with Geant3:



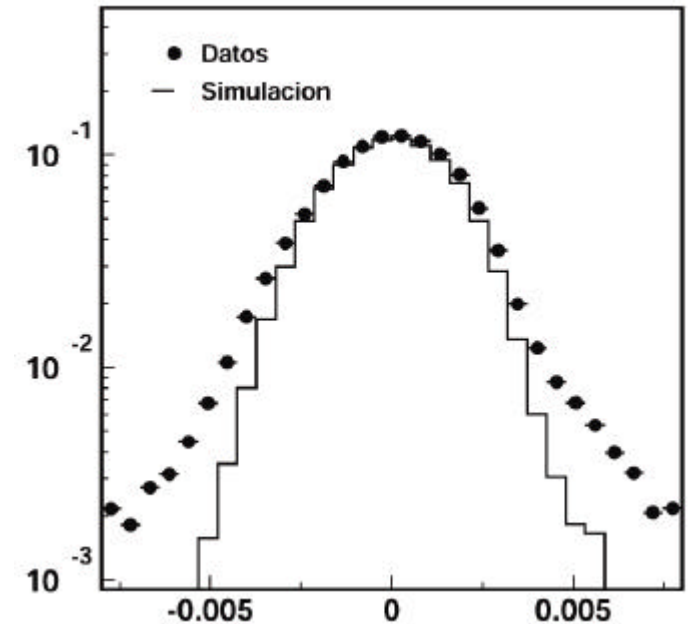
for  $P < P(\text{scattering.})$ :

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

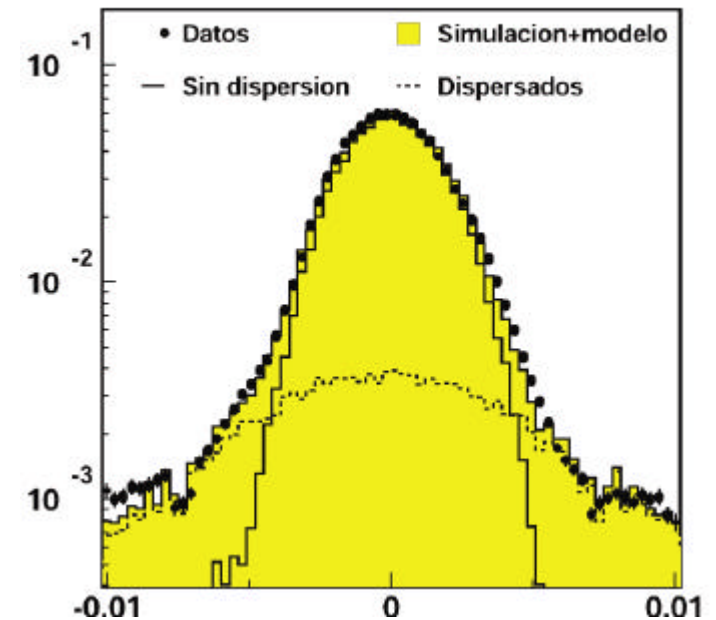
Fit to data:

Aerogel      P(scattering)       $s_a$  (mrad)

Mats. 1.05	$0.20 \pm 0.02$	$25 \pm 3$
Mats. 1.03	$0.28 \pm 0.02$	$24 \pm 2$
Mats. 1.03 n	$0.33 \pm 0.02$	$20 \pm 3$
Nov. 1.03	$0.15 \pm 0.01$	$24 \pm 1$
Nov. 1.04	$0.21 \pm 0.01$	$25 \pm 4$



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



# Measurement of the aerogel surface

A more precise description of the photon scattering in aerogel

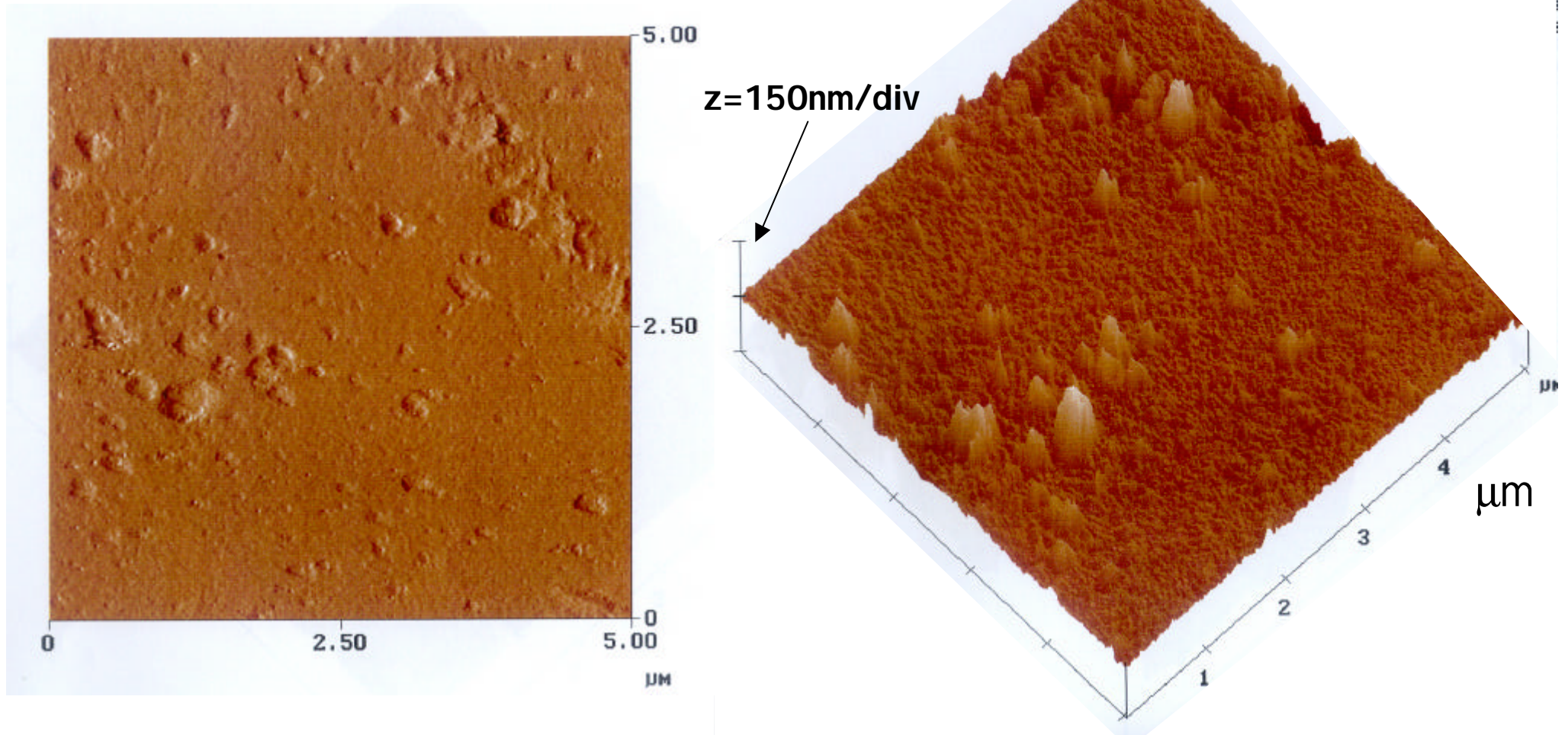
## Atomic Force Microscopy:

- 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

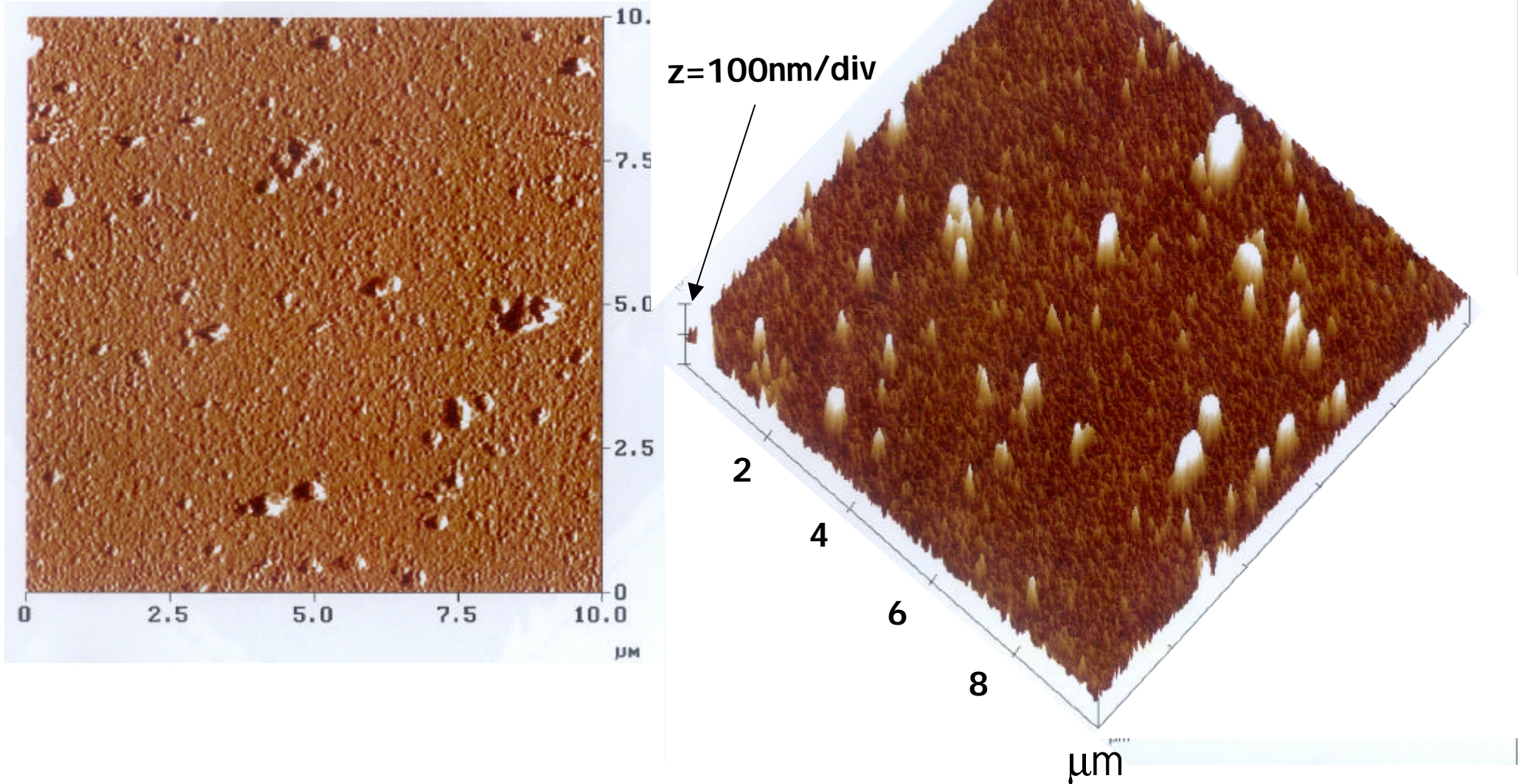
Aerogel:  $n=1.03$  (Matsushita)



# Atomic Force Microscopy

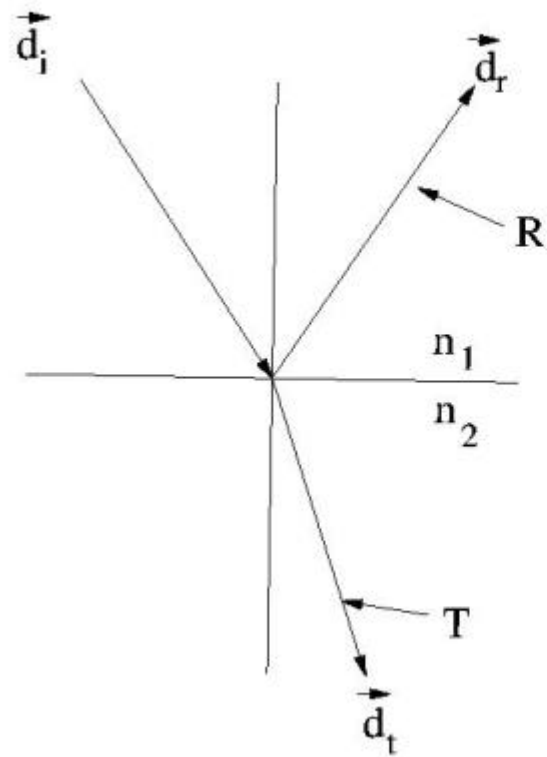
## Preliminary results

Aerogel:  $n=1.05$  (Matsushita)

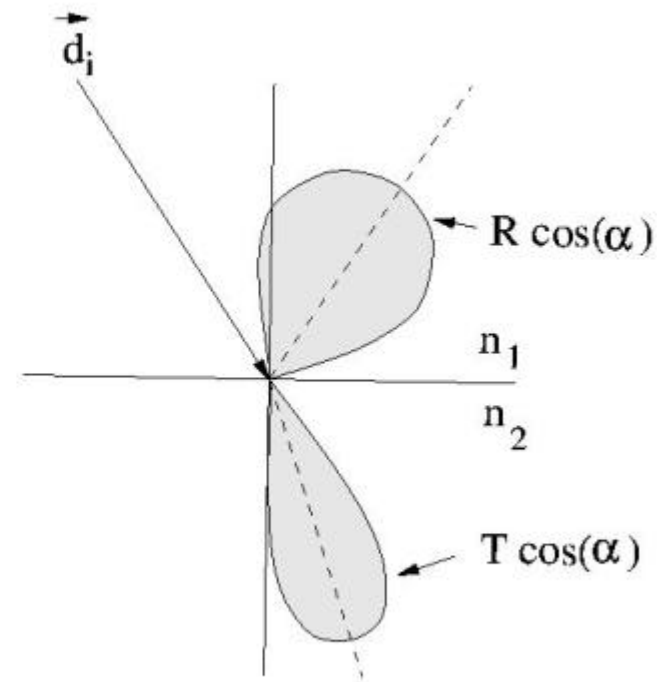


# Model implemented in Geant3

Can the glisur model describe photon scattering in aerogel ?



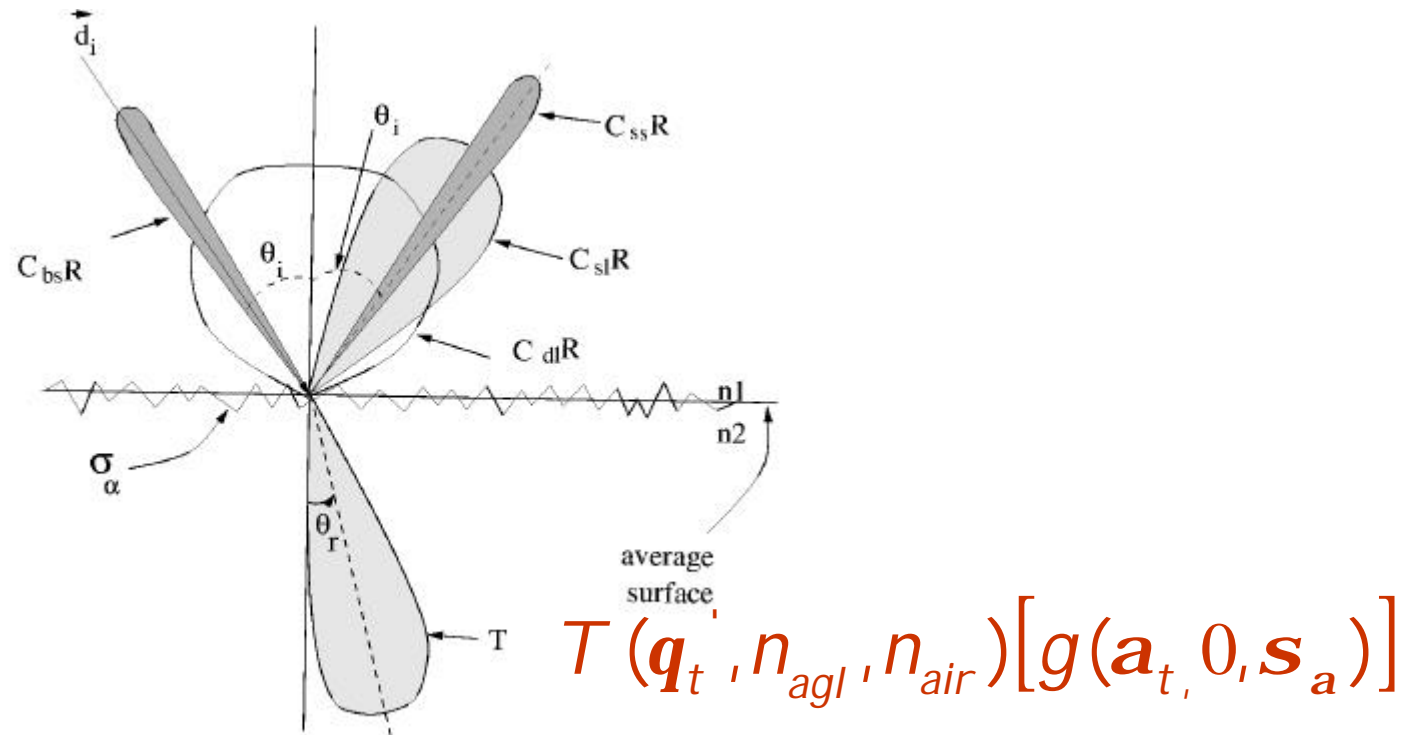
polished



ground

# Rich radiator studies with Geant4

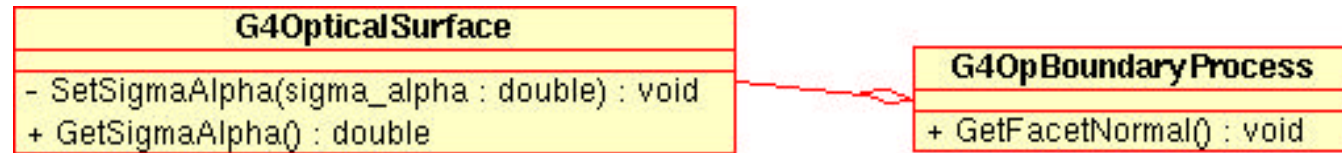
Can the unified model describe photon scattering in aerogel ?



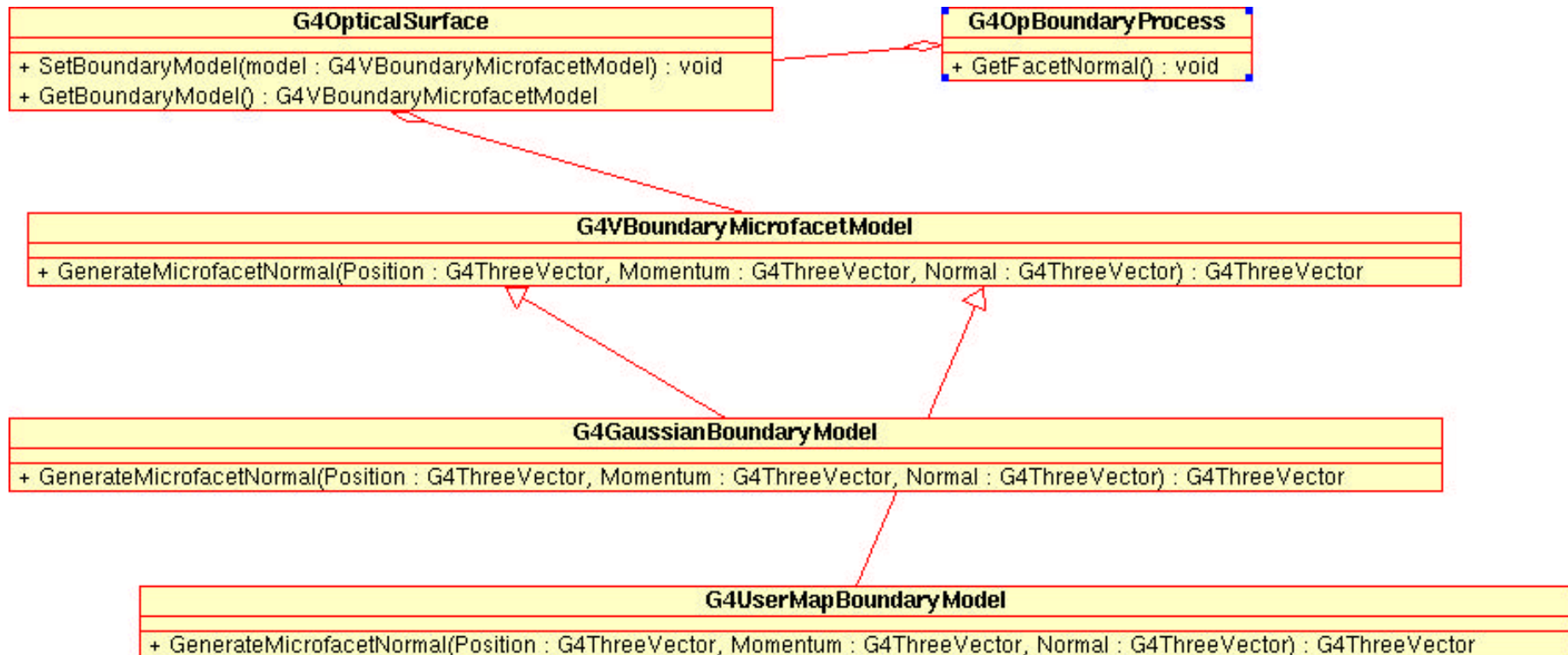
In the unified and in the glisur model the direction of the transmitted photons is only parameterised by a Gaussian distribution of resolution  $\sigma_\alpha$  ( $\alpha$  is the difference between the average surface normal and the microfacet slope).

# Revisiting the class G4OpBoundaryProcess

## STANDARD

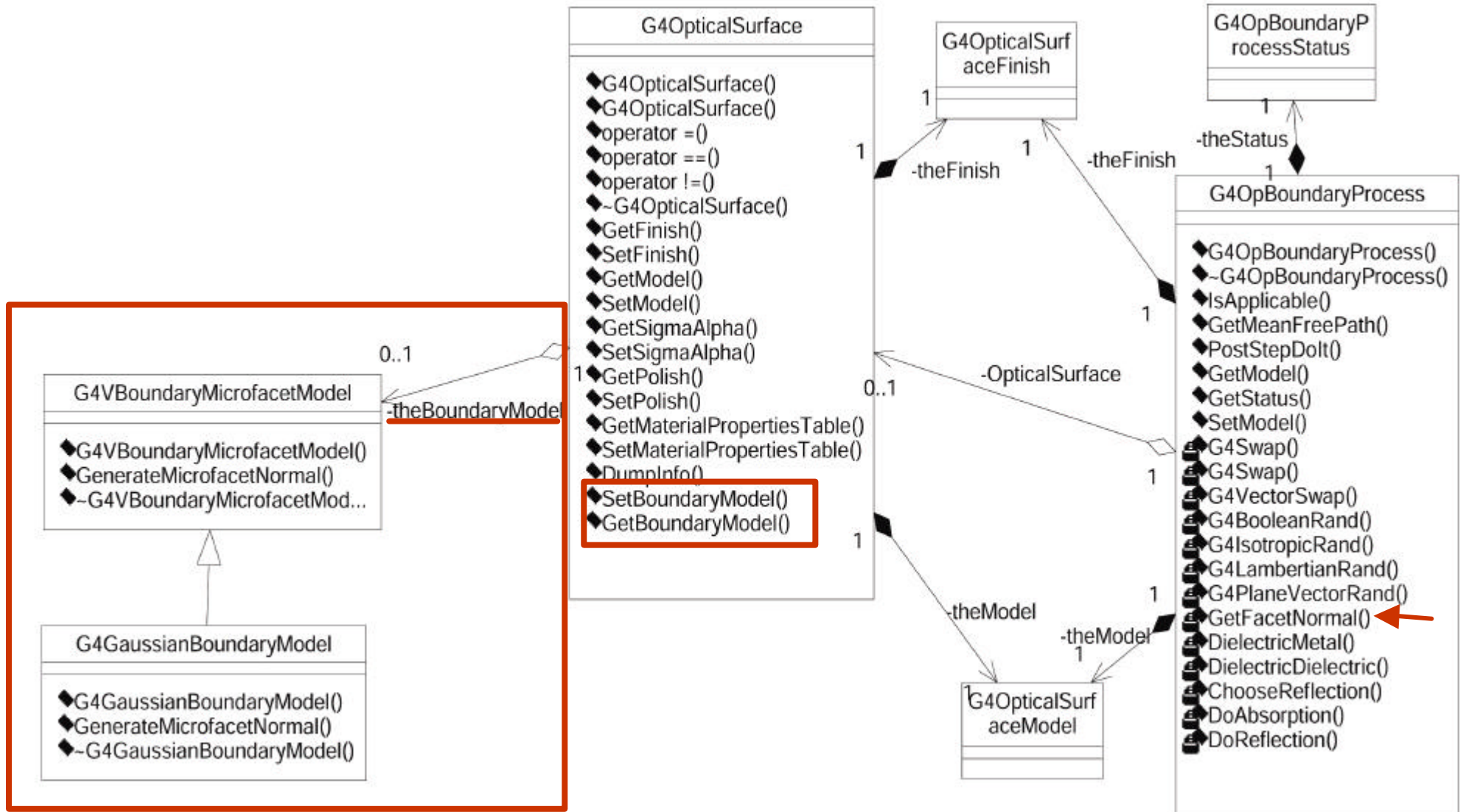


## NEW





# 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.