

The AMS RICH aerogel tiles characterization

- Status report -

M. Brinet, M. Loth, Y. Sallaz-Damaz, R. Pereira (Lisboa)
M. Buénerd, L. Derome, M. Marton, J.P. Scordilis
E. Belmont, H. Leon Vargas, A. Ortiz Velasquez (UNAM)



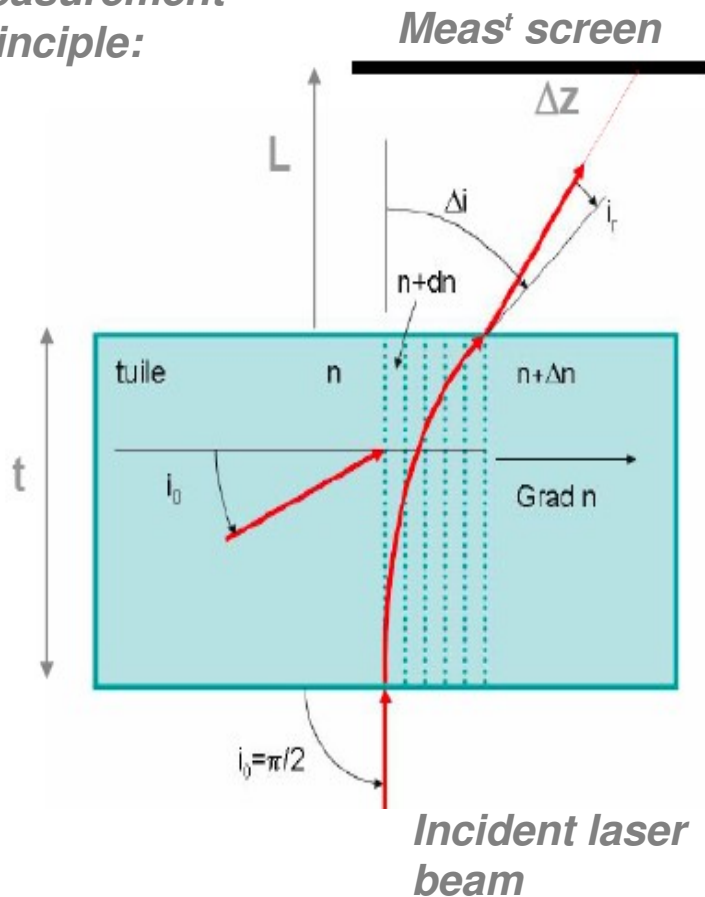
Contents

- " Method of refractive index determination and measurement procedure
- " Illustrative results
- " What next ?

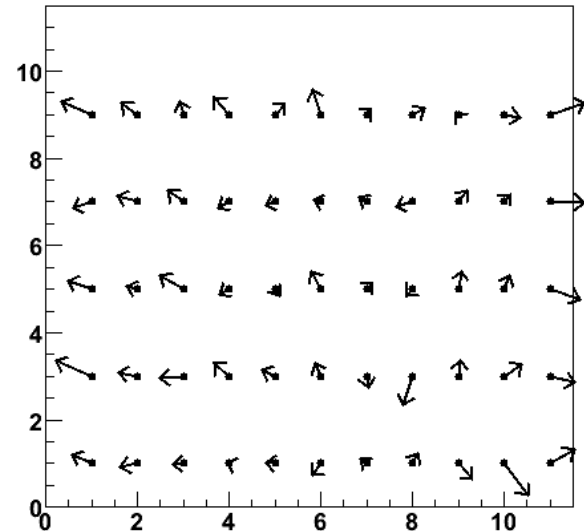
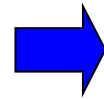
Gradient measurement method for refractive index determination (I)

I. Measurement of laser deviation (parallel sides) :

Measurement principle:

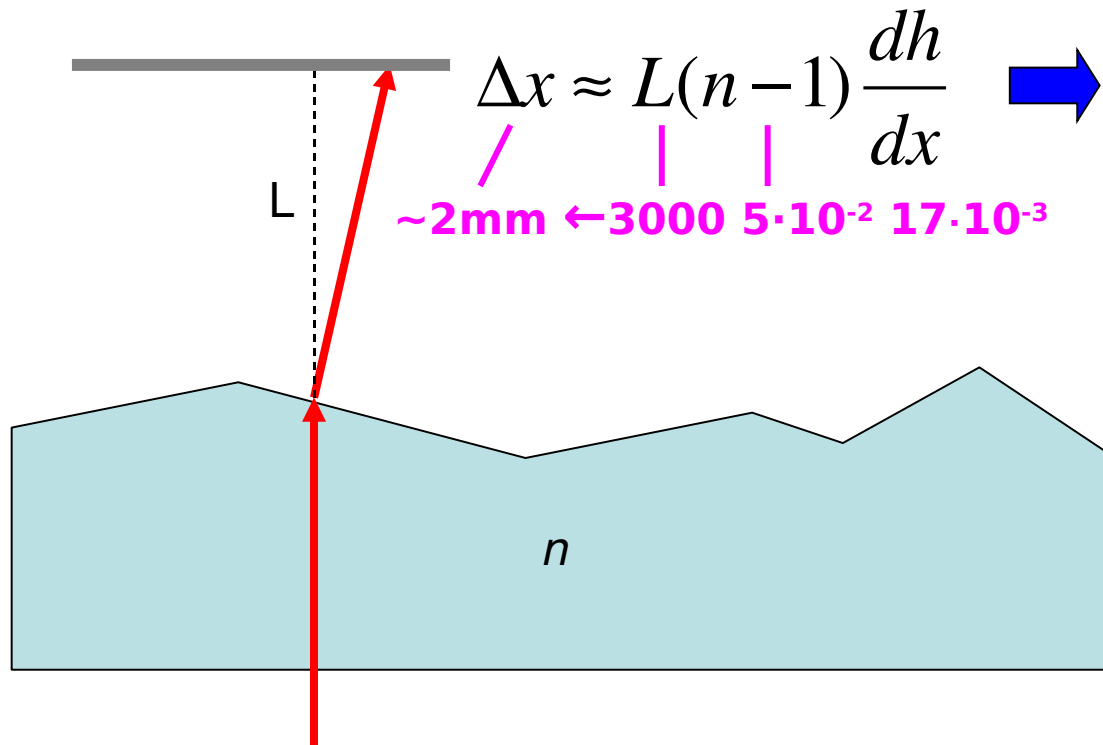


For $\frac{dn}{dz} = 10^{-4} / \text{mm}$ across a 25 mm thick tile, the laser beam deviation is ~ 7 mm for $L \approx 3$ m.



But, other source of deflection:

Surface defects also bend the incident beam :



Full mapping of **thickness** for all tiles, for corrections

□□ background on the $dn \sim 10^{-4}$ scale for the observed surface defects

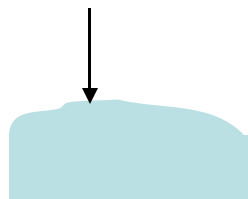
Method

- Perform thickness mapping & density measurement \Rightarrow mean index $\langle n \rangle$
- Perform laser scan \Rightarrow index gradient map
- Apply refraction (surface) corrections
- Index map generation

Method of refractive index determination (cont')

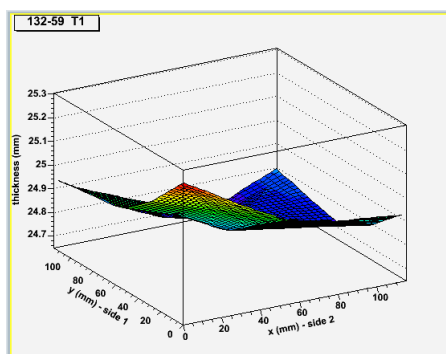
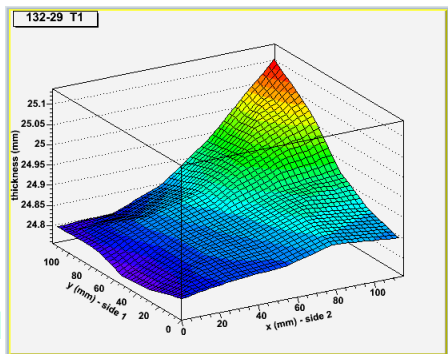
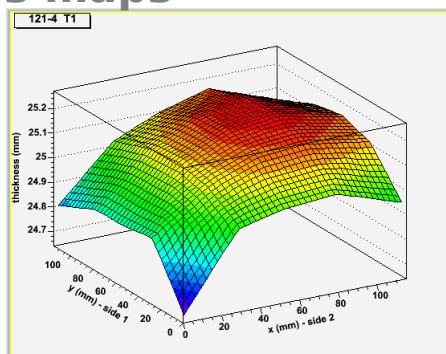
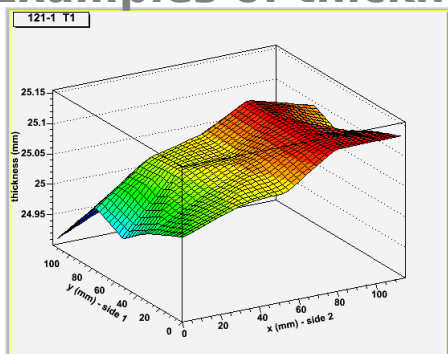
III. Estimation of tile thickness :

Measurement using a
com|



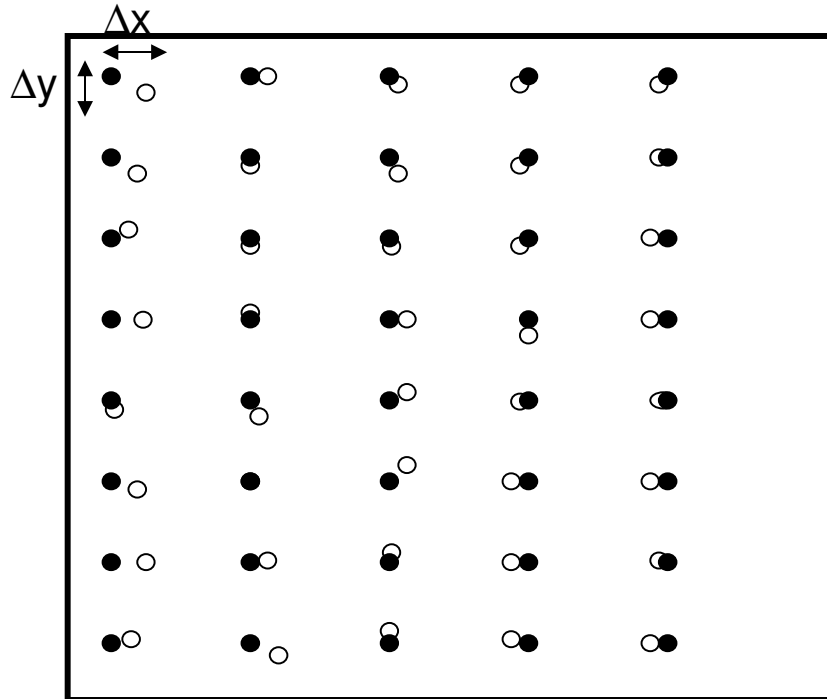
Optical surface on top, and assuming flat bottom surface (confirmed).

Examples of thickness maps



Method for refractive index determination (cont')

IV. After thickness correction, integration of the gradient maps:



- For each point, the Δx and Δy deviations are measured.

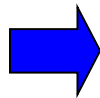
- Due to the experimental errors, the gradients are not exact derivatives.

- To construct the index map, we form :

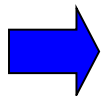
$$\chi^2 = \sum_{i < n_{\text{points}}} \sum_{j < n_{\text{neighbours}_i}} (n_i - \tilde{n}_i^j)^2$$

where \tilde{n}_i^j is the index at the i^{th} position computed from the 4 closest neighbors j :

$$\frac{dn}{dx} \cong \frac{n\Delta x}{Lt}$$



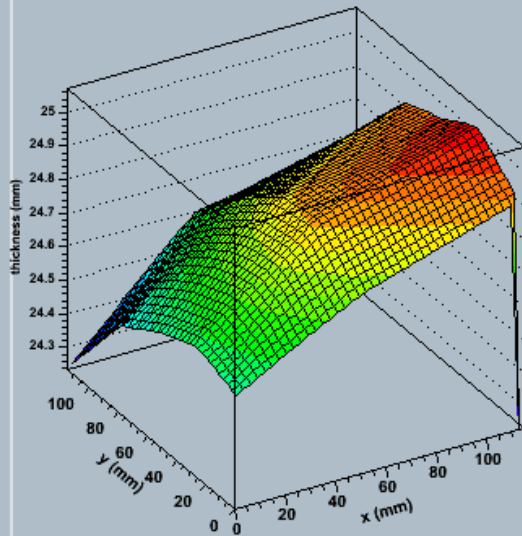
$$\tilde{n}_i^j = n_j + \frac{\Delta x_j}{L} \frac{(x_i - x_j)}{t} + \frac{\Delta y_j}{L} \frac{(y_i - y_j)}{t}$$



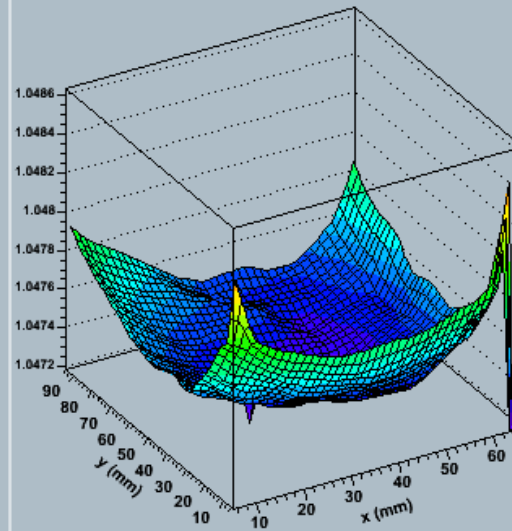
Find the $\{n_i\}$ to minimize the χ^2 function (Minuit or relaxation method)

Some results:

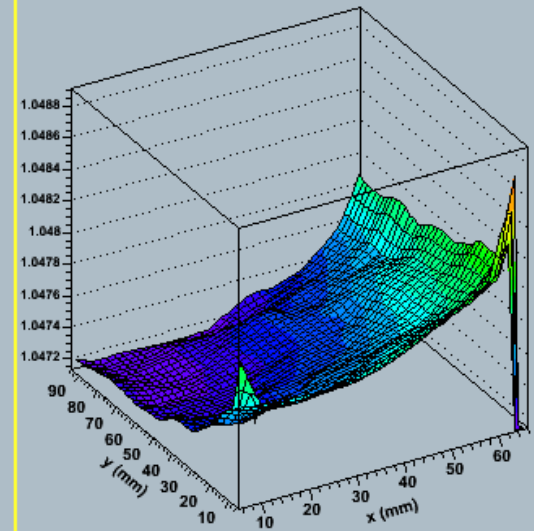
121-5 T2 : thickness



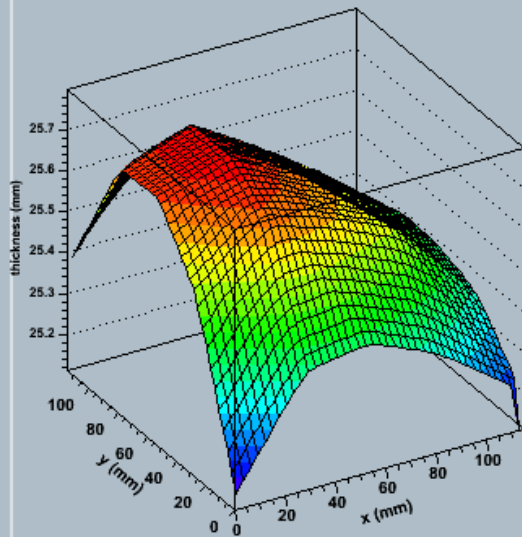
Refractive index (corrected)



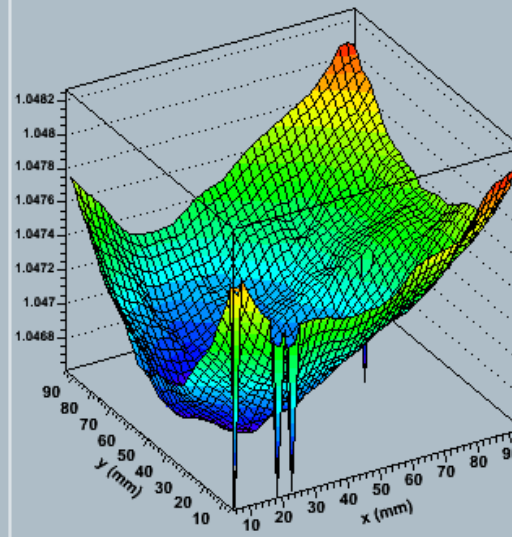
Refractive index (uncorrected)



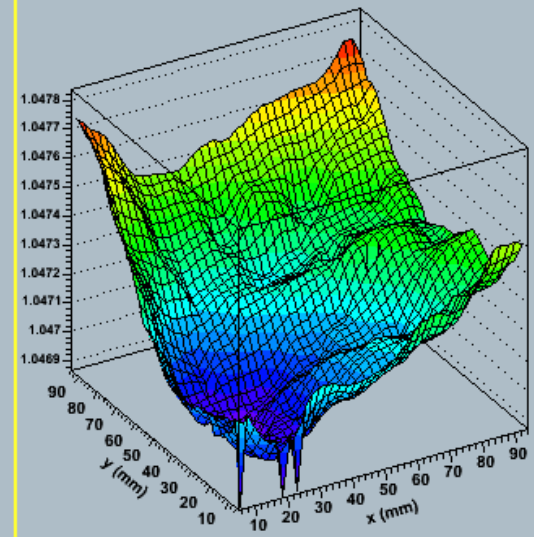
121-7 T1 : thickness



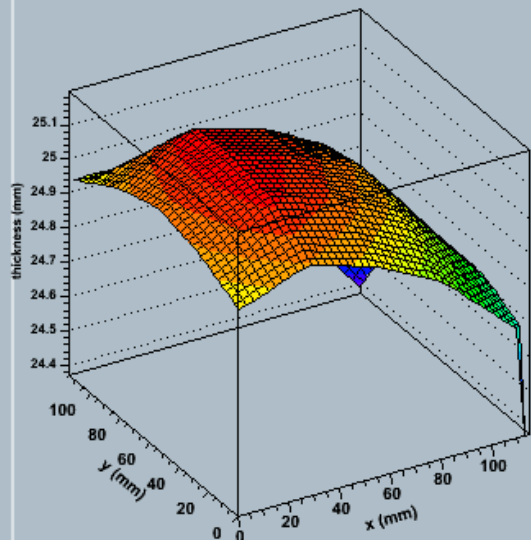
Refractive index (corrected)



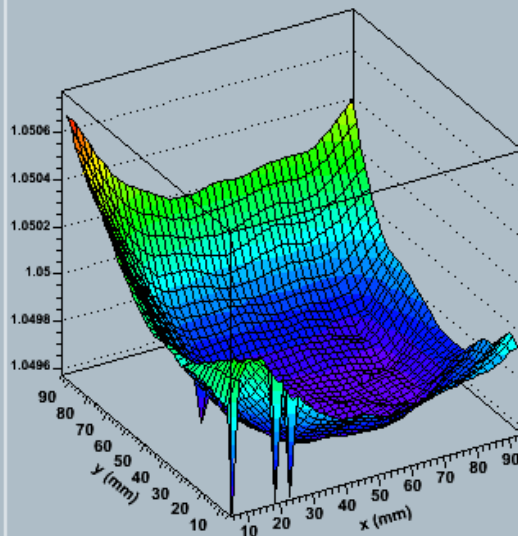
Refractive index (uncorrected)



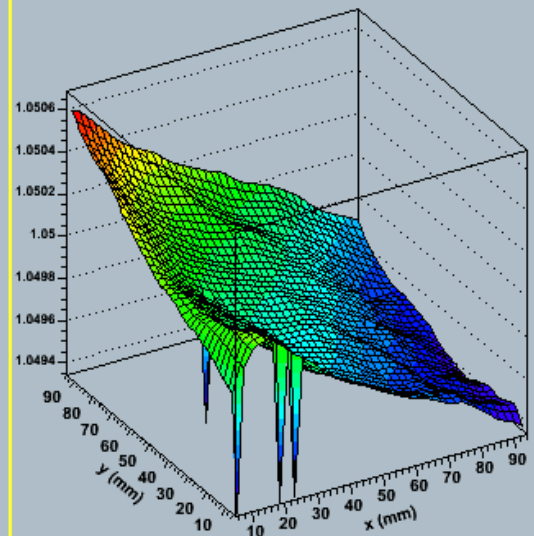
126-77 T1 : thickness



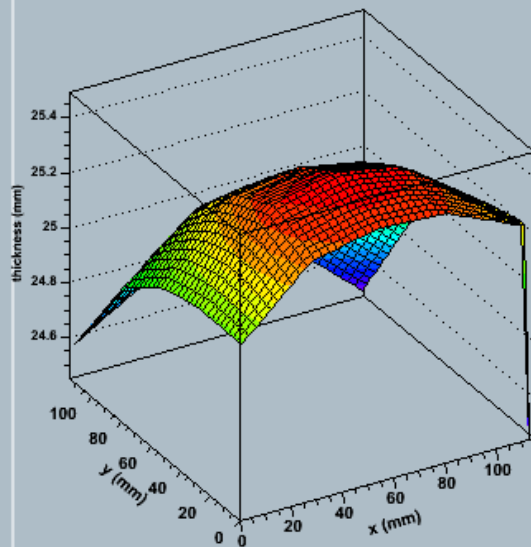
Refractive index (corrected)



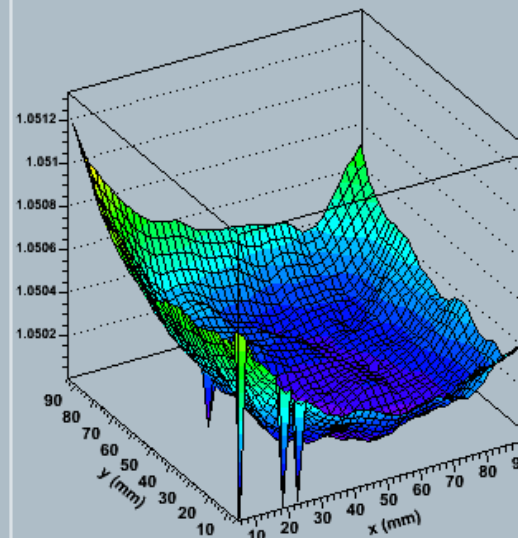
Refractive index (uncorrected)



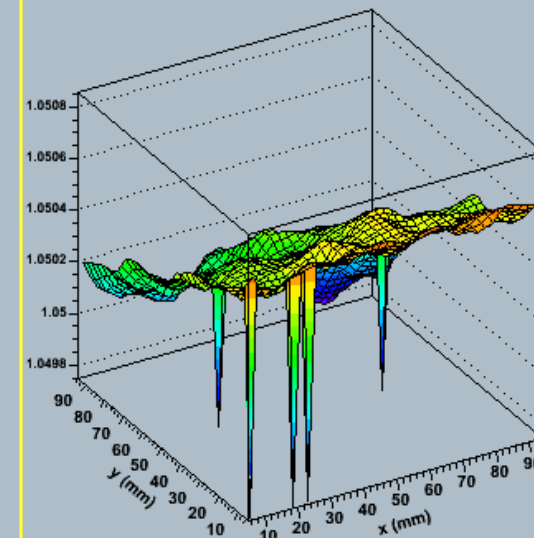
124-31 T1 : thickness



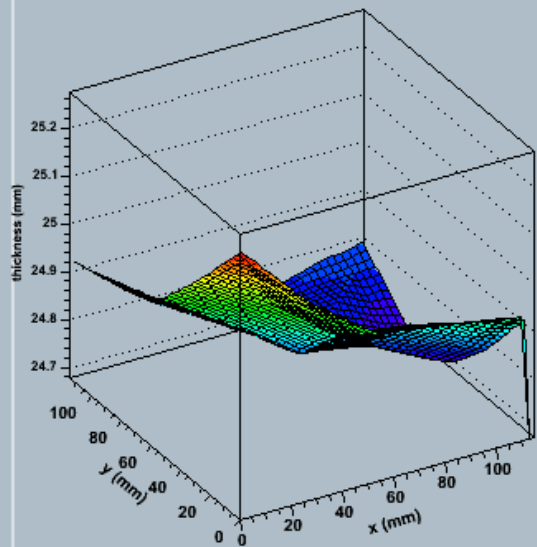
Refractive index (corrected)



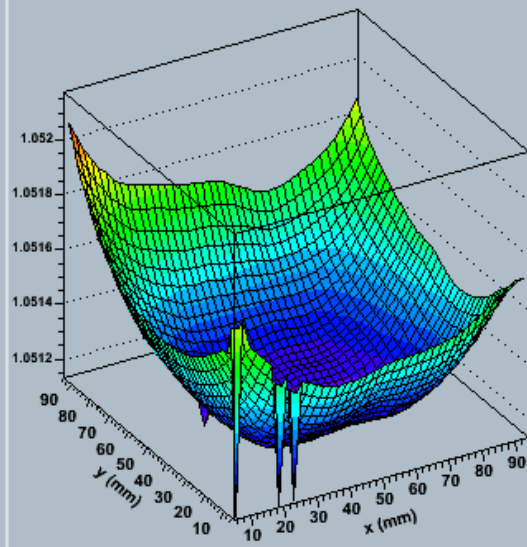
Refractive index (uncorrected)



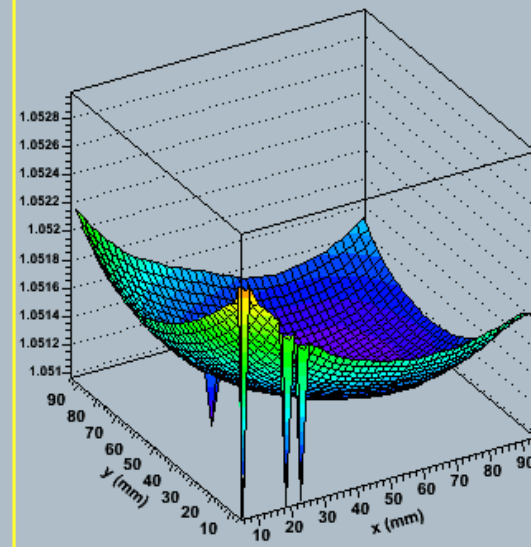
132-59 T1 : thickness



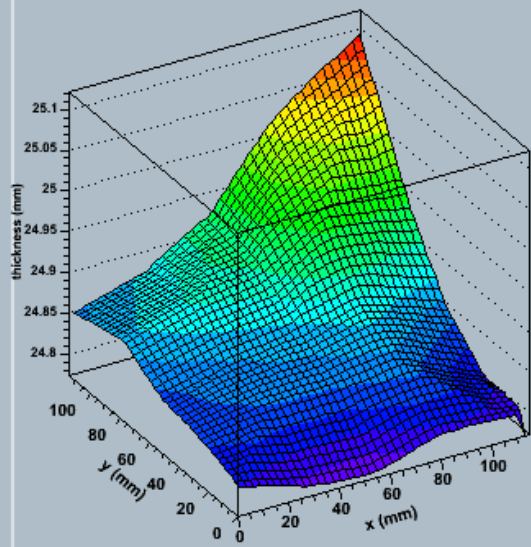
Refractive index (corrected)



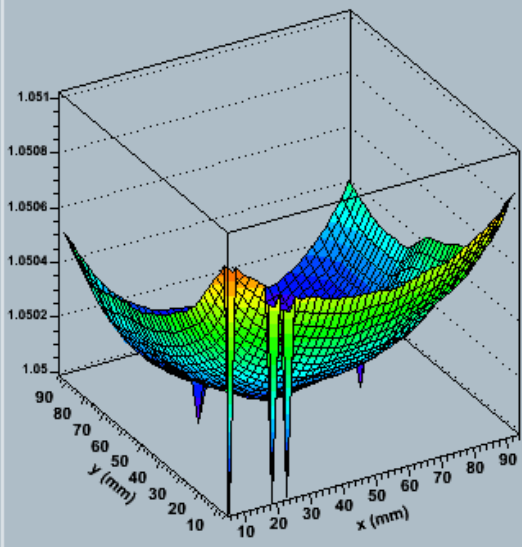
Refractive index (uncorrected)



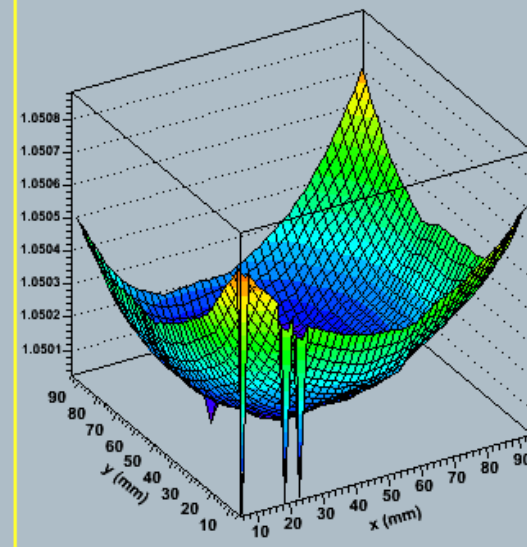
132-29 T1 : thickness



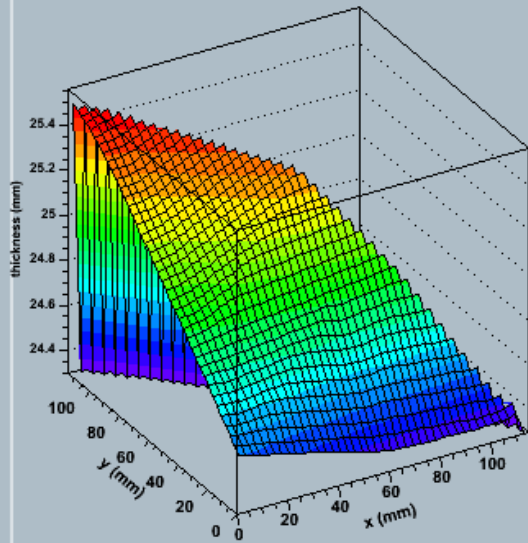
Refractive index (corrected)



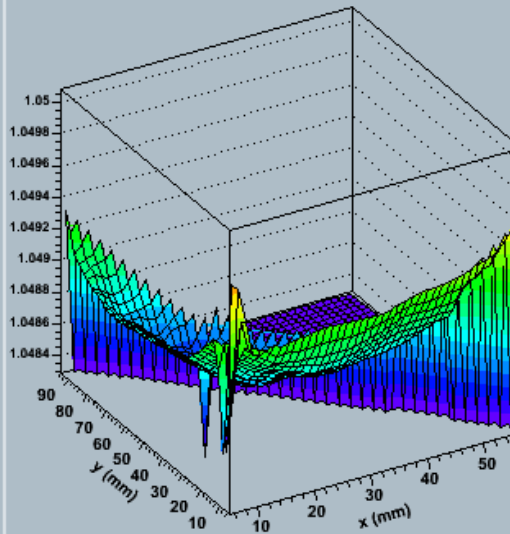
Refractive index (uncorrected)



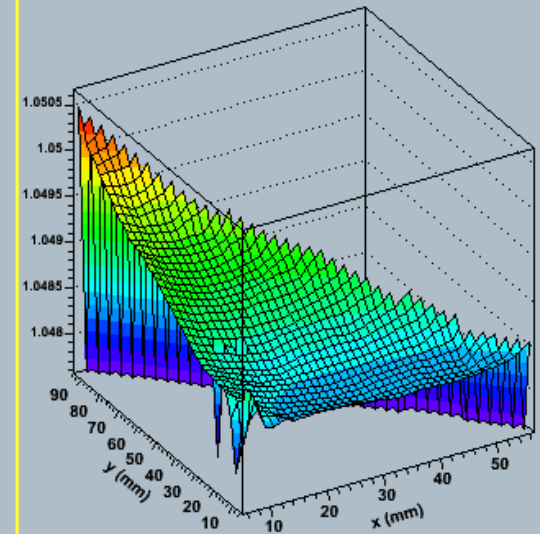
135-19 T3L : thickness



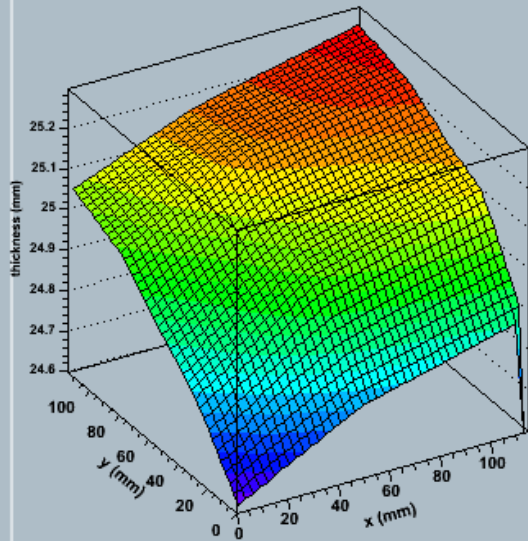
Refractive index (corrected)



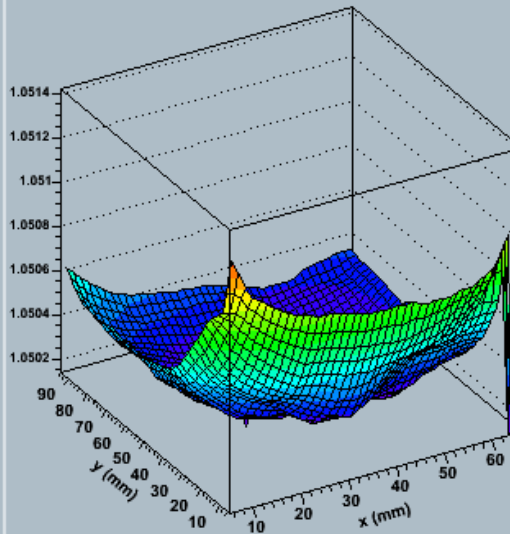
Refractive index (uncorrected)



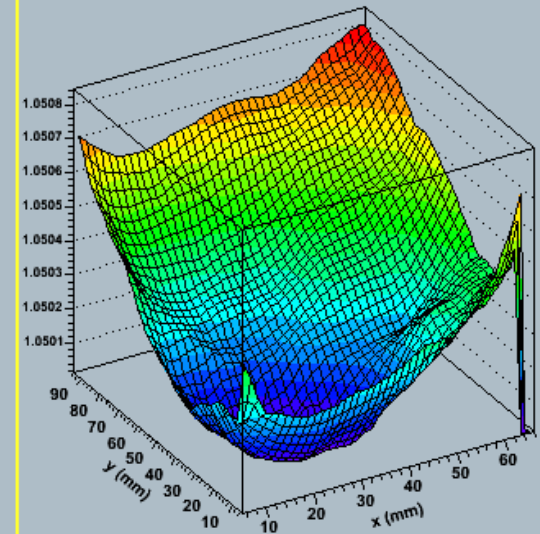
135-18 T2 : thickness

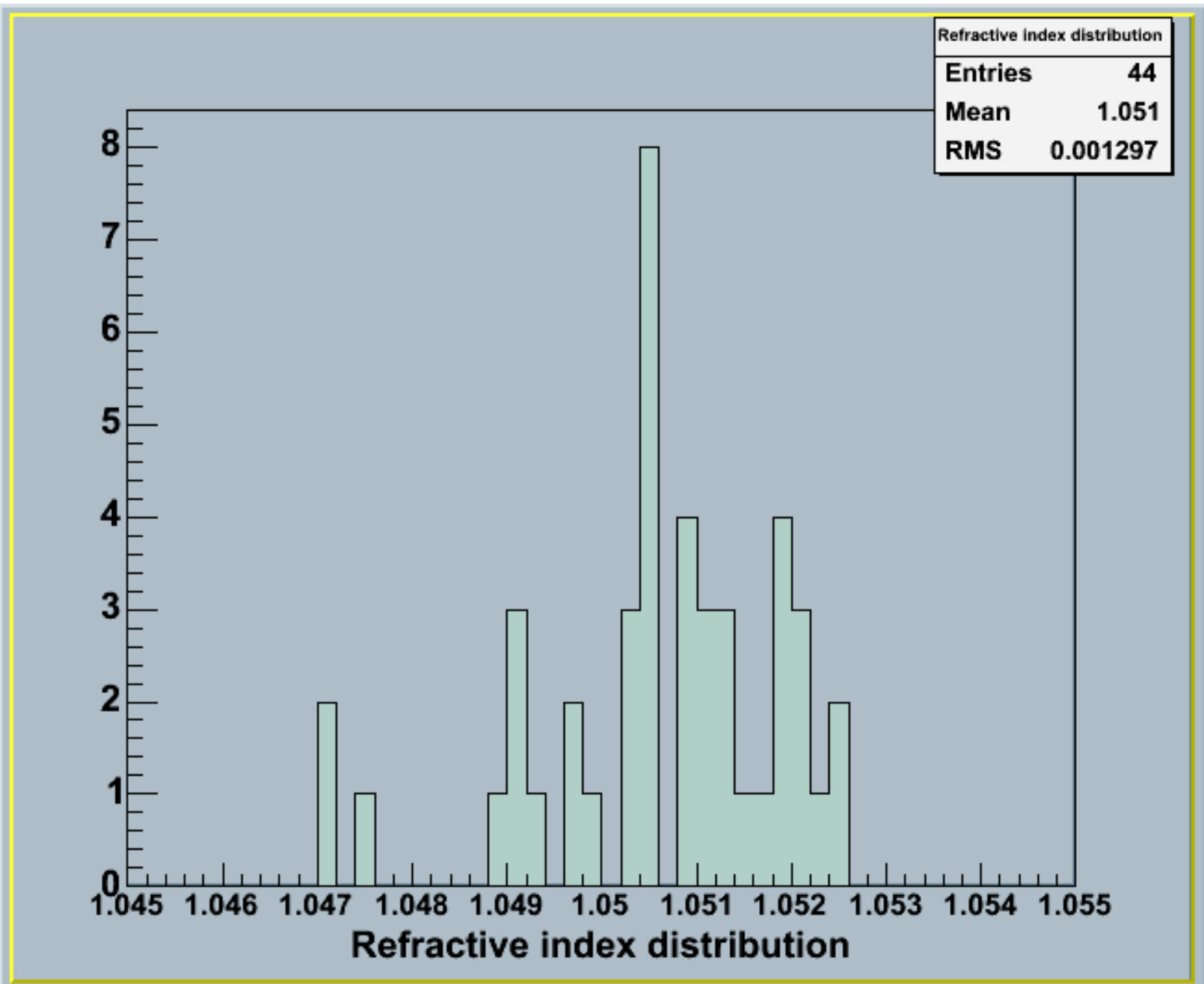


Refractive index (corrected)

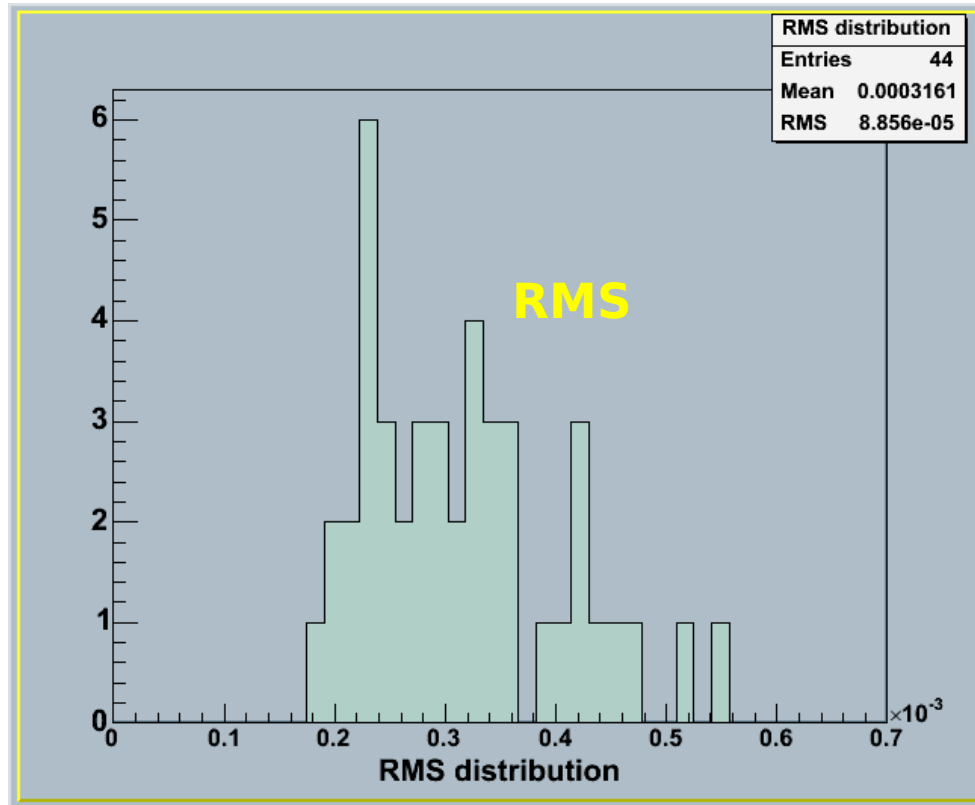


Refractive index (uncorrected)





n dispersion in tiles



Current situation

- " 44 tiles tested and analyzed.
 - 8 waiting to be retested^(*).
 - 8 rejected and recently replaced by Novosibirsk, to be tested.
 - & 26 in Madrid (How many of them survived ?)
- " In summary: around 140 tiles still to be processed (when delivery of new prod completed)
- " Results available for simulation (txt files of geometry and refractive index)

(*) one of the measurements (metrology, laser, mass) missing

New production status

- OK for ordering through CERN
- OK for delivery at CERN. The IN2P3 logistics will then take care of the transfer to Grenoble.
- Order being processed, nothing signed yet.
- Delivery : Last tiles before August, 45 tiles available now.
- Bill=81k\$, breakdown: 81/4 k\$ for Bologna/Grenoble/Madrid; 81/8 k\$ for Mexico/UMD.

Summer camp @ LPSC ?

- ~ 140 tiles to be processed:
full metrology + n mapping.
- About 1-2 months for a team of 2 people
- Campaign extending over June-August ?
- Already registered:
 - Ernesto Belmont + 1 Mexico student (3w-1month)
 - Fernando (part time on August) ?
- Who else would join ?



But, what policy in the context ?

- AMS is back to the no-shuttle available scenario.
- Question: Is it wise to order 100 tiles for a flight that might take place in more than 4-5 years from now, if ever ?
- Should we hold the order until the AMS situation is cleared up ?
- Let's talk about it !