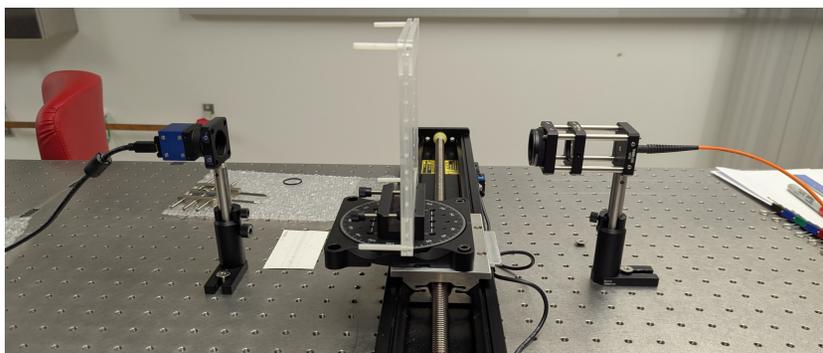
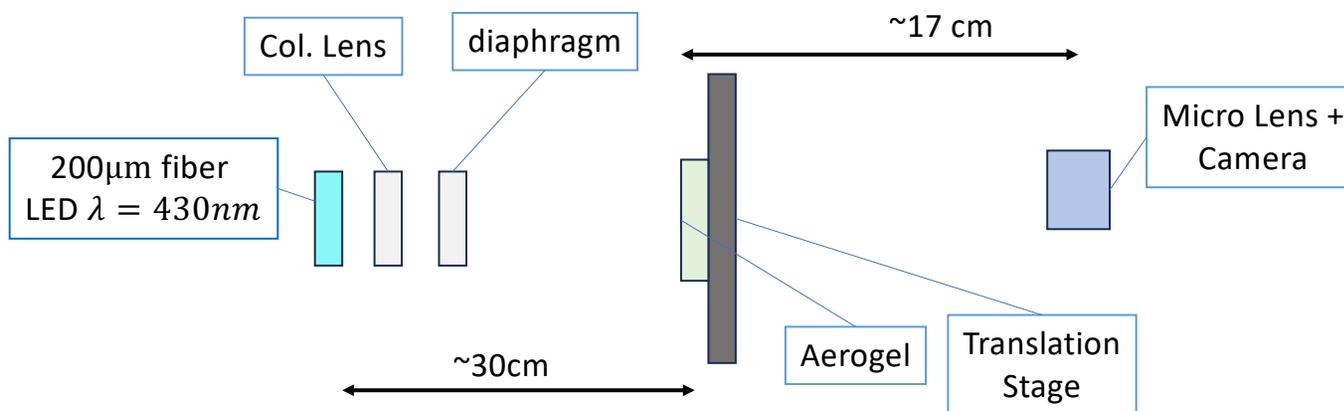


# ePIC pfRICH Aerogel Microlens Update

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Matt Posik  
Temple University

# Microlens Setup



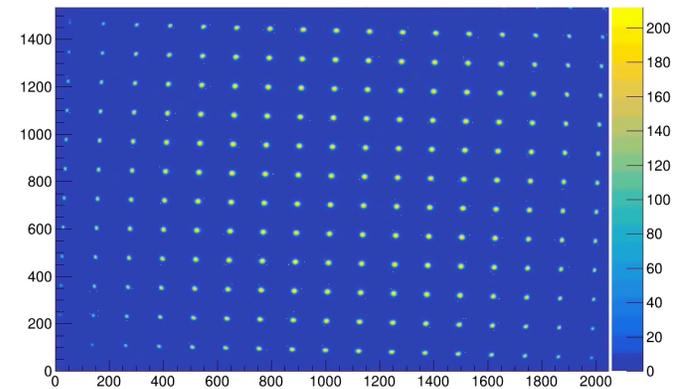
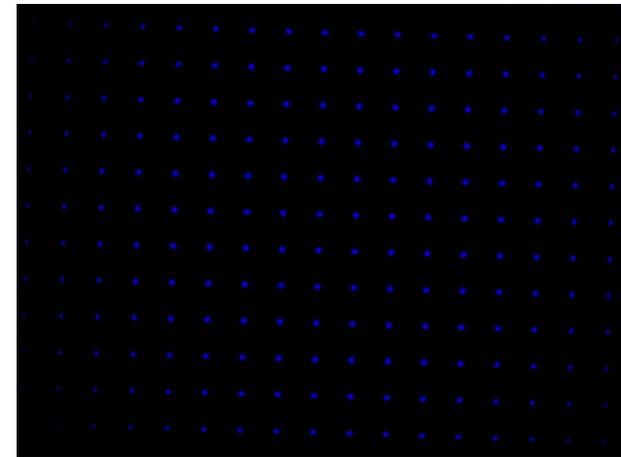
Location from Aerogel [cm]	Approx. Beam Spot Diameter [mm]
0	3
17	~3-3.5mm

# Analysis Overview



1. Pixel value fraction cut =  $p_c/p_{max}$
2. Cluster amplitude cut
  - Looser amplitude cut applied to aerogel clusters
3. Cluster RMS cut
  - No RMS cut applied to aerogel image
4. Match reference and aerogel clusters
5. Compute displacement of aerogel clusters to reference clusters
6. Global fit to displacement, rotation, pitch, and cluster resolution
7. Determine wave front slopes, refractive index gradient, and change in refractive index

Reference Image (no aerogel in path)

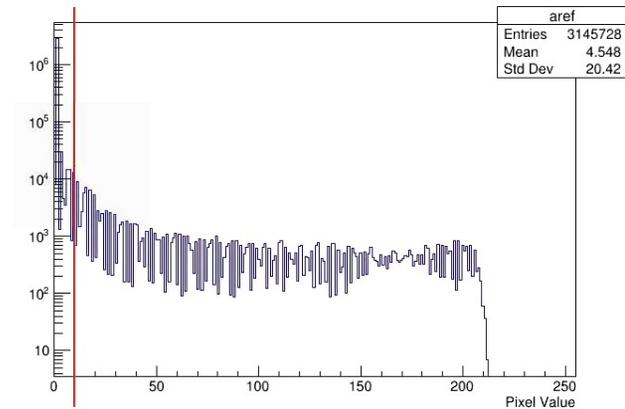


# Found Clusters



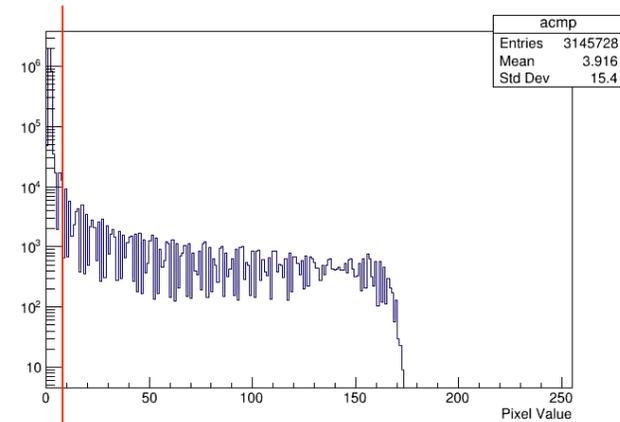
## Reference Image

- Dynamic pixel threshold (0.05 of max=212) = 10
- 148401 used pixel(s)
- 265 cluster(s)



## Aerogel Image

- Dynamic pixel threshold (0.05 of max=173) = 8
- 139253 used pixel(s)
- 284 cluster(s)

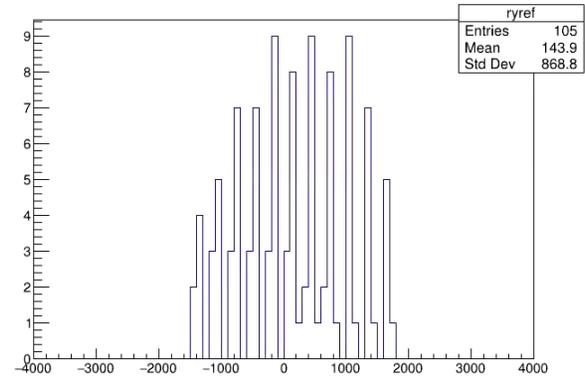
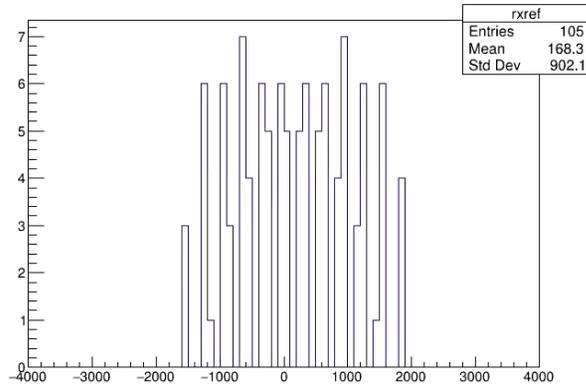


# Used Clusters



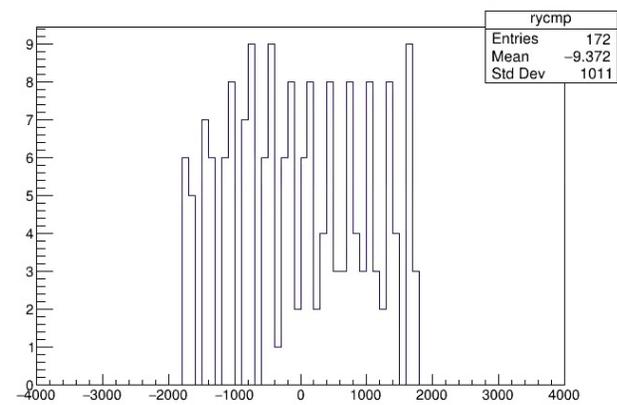
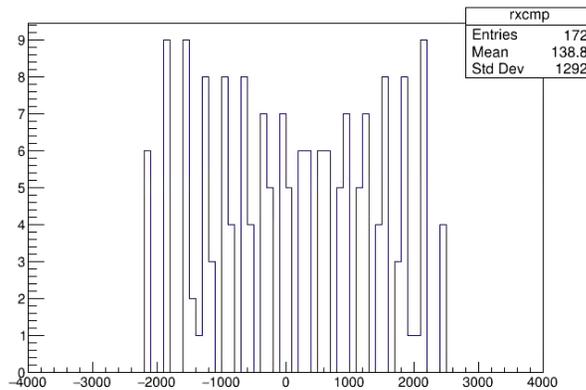
## Reference Image

- 105 used clusters



## Aerogel Image

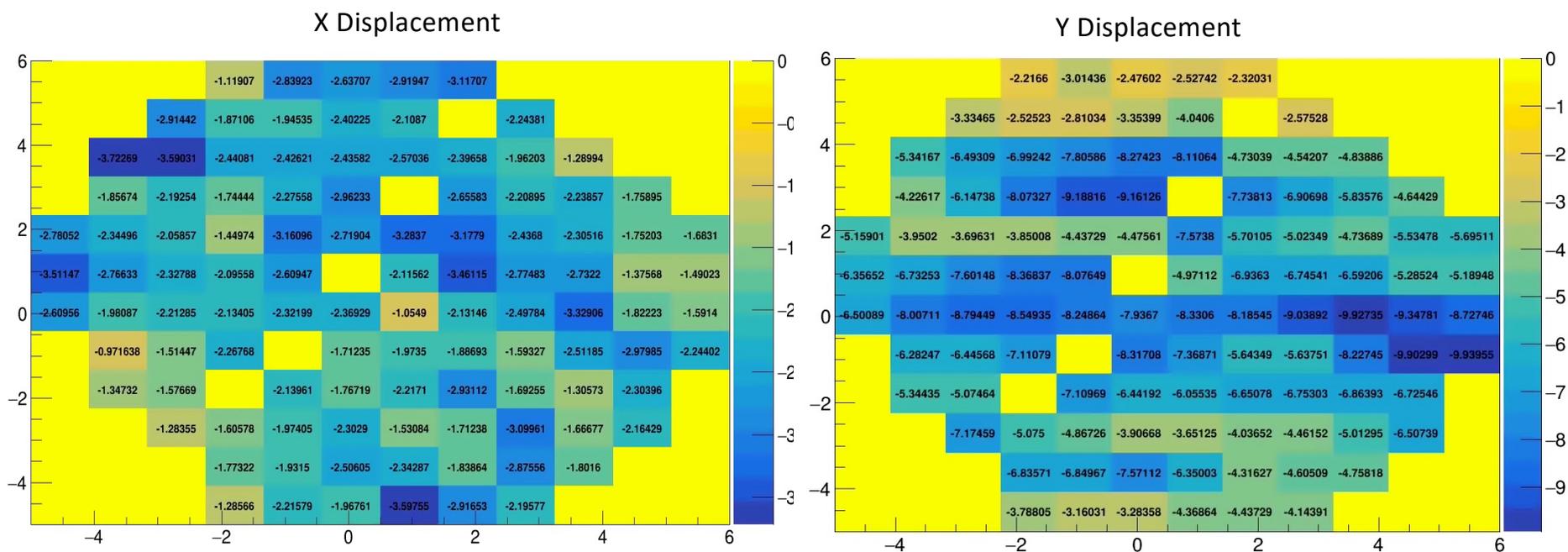
- 172 used clusters



# Displacements



Fit results: DX=9.248 DY=14.097 FI=-1.813 PT=293.788  
XY-resolution estimate per cluster is 83.30 [um] (ndf = 206)



## Refractive Index Gradient



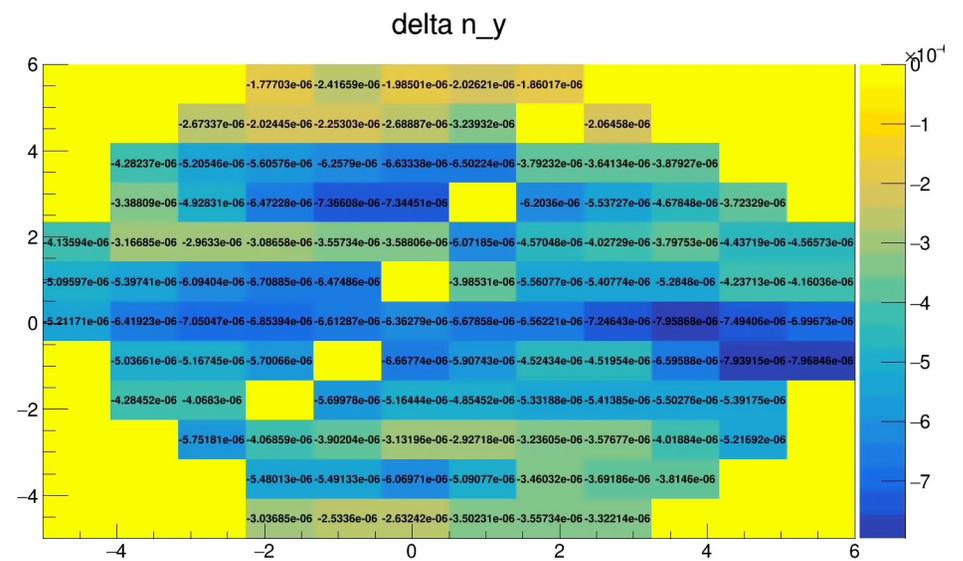
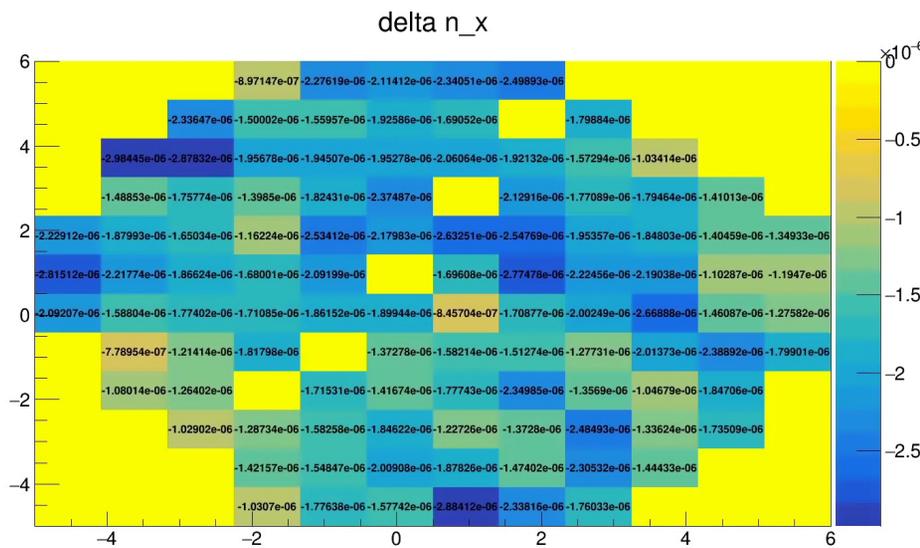
- Optical path difference:  $W(x, y) = \int_0^t [n(x, y, z) - n_0] dz, t = 25.1 \text{ mm}$  (aerogel thickness)
- Assume small angles and no aerogel z structure (depth structure):  
$$W(x, y) = [n(x, y) - n_0]t$$
- Wave front slopes:  $\frac{\partial W}{\partial x} = \frac{dx}{f}, \frac{\partial W}{\partial y} = \frac{dy}{f}, f = 14.2 \text{ mm}$  (microlens focal length)
- Refractive index gradient:  $\frac{\partial n}{\partial x} = \frac{dx}{ft}, \frac{\partial n}{\partial y} = \frac{dy}{ft}$
- $\Delta n_{x,y} = \sum_i \left( \frac{\partial n}{\partial x,y} \right)_i p, p = \text{microlens pitch, sums over clusters}$

$\Delta n$



$(\Delta n_x)_i$ ,  $\Delta n_x = -0.00019$

$(\Delta n_y)_i$ ,  $\Delta n_y = -0.00050$



- Full width of the aerogel was scanned yesterday with 3mm and 1mm beam spot
- Image analysis in process

## Additional Material

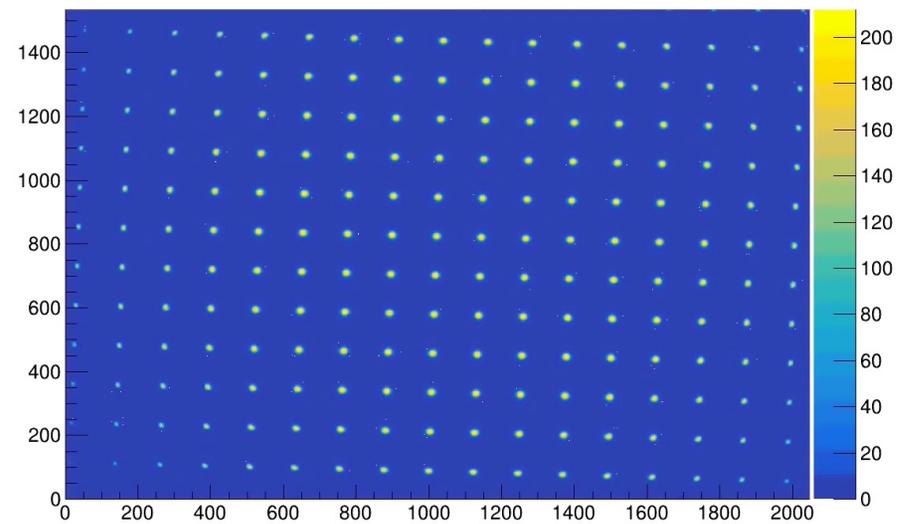
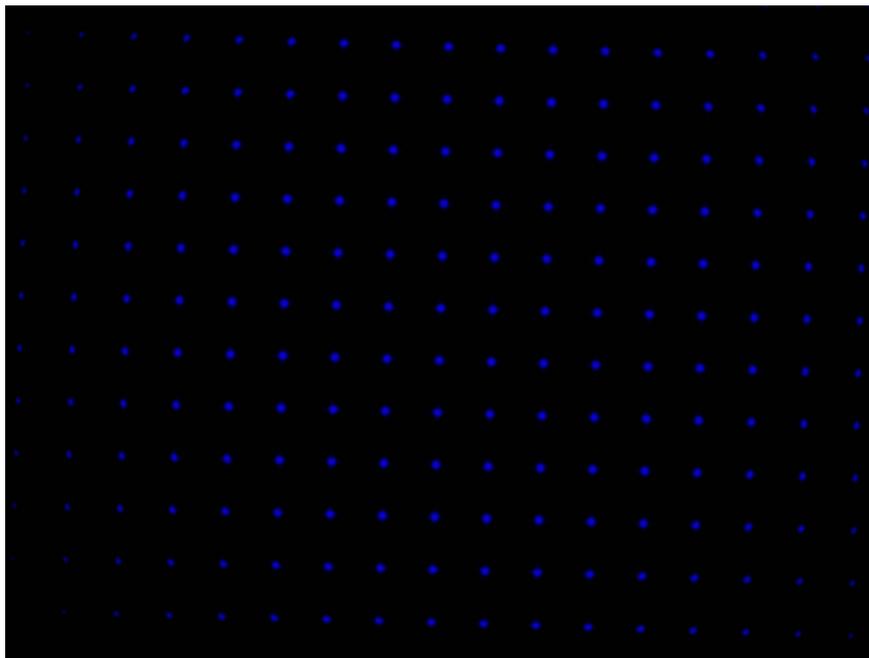
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# Images: Reference

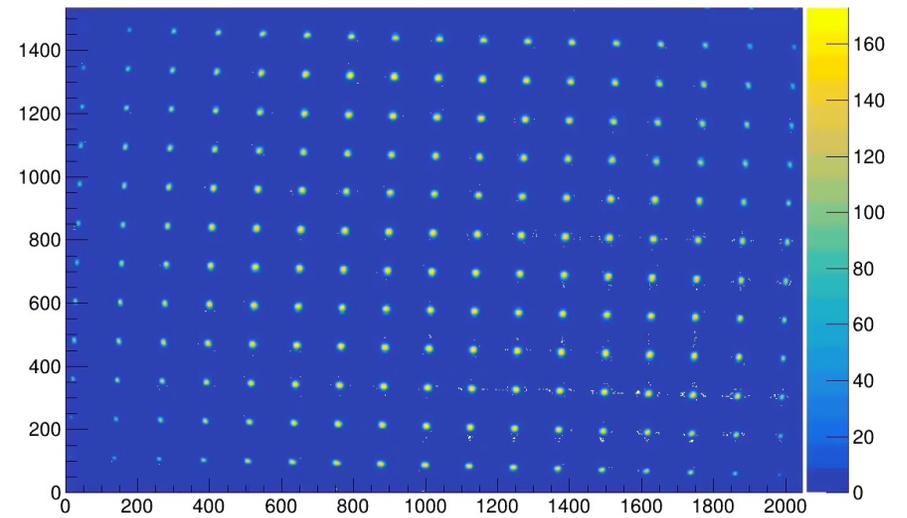
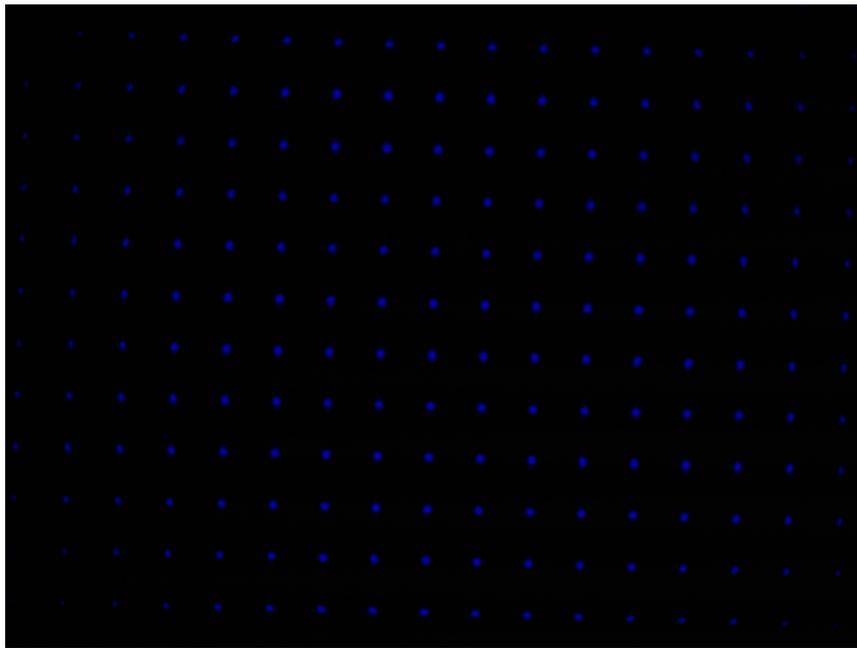


Reference



# Images: Aerogel

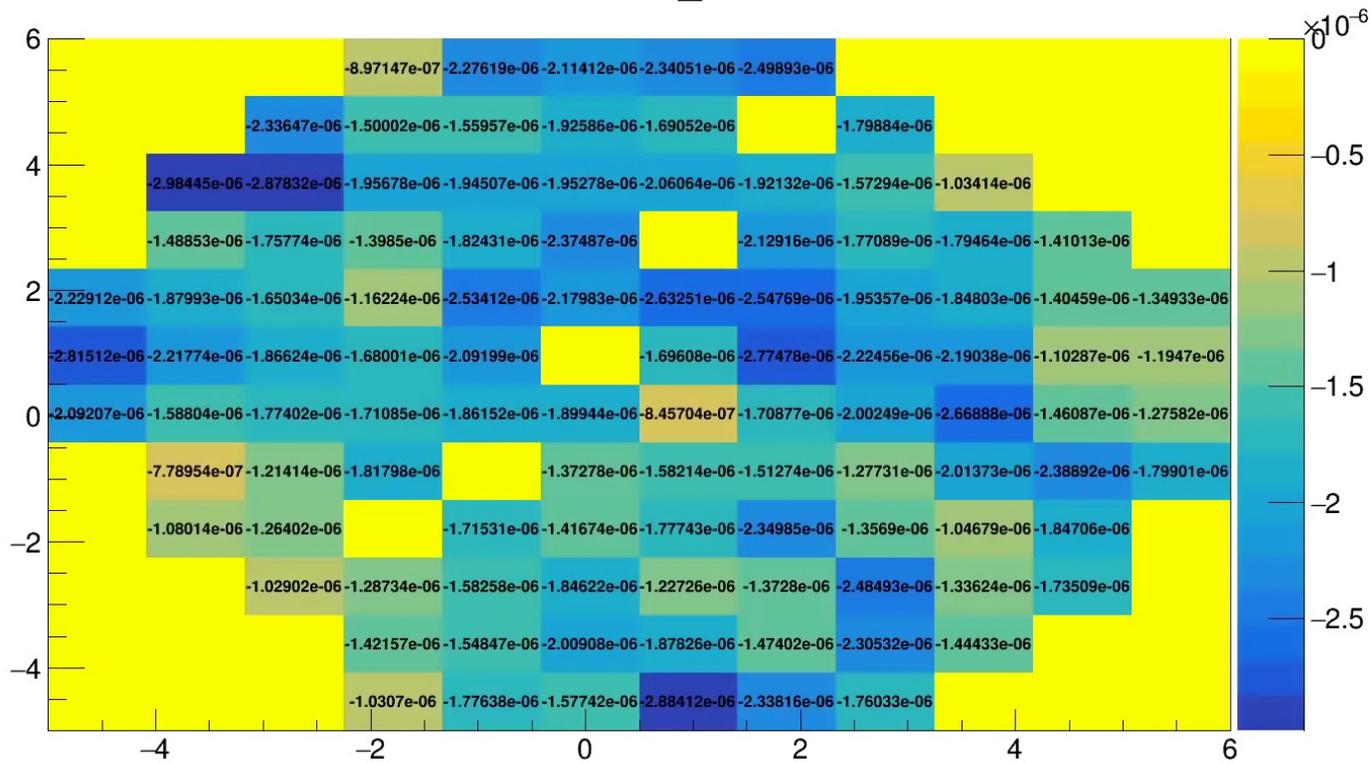
Aerogel



$\Delta n_x$



$(\Delta n_x)_i, \quad \Delta n_x = -0.00019$   
delta n\_x



$\Delta n_y$ 
 $(\Delta n_y)_i, \quad \Delta n_y = -0.00050$   
 delta n\_y
