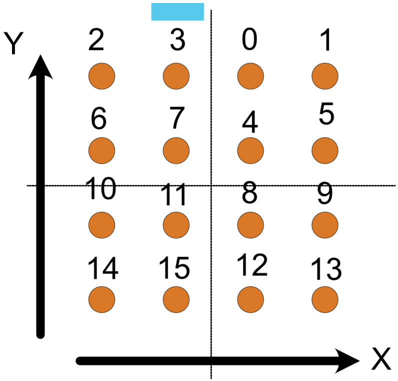
Cofee break

27/09/24

Reminder: Conventions

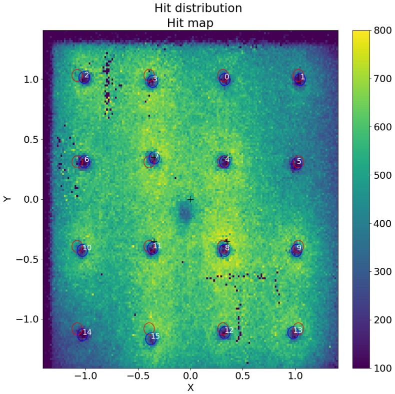


- X-Y convention derived from the drift chambers
- Propagated to the Xm-Ym variables
- Blue square is the drift chamber blind zone

Fibre position

Determining the actual fibre position

- Use the V2 processing (use 2 drift chamber/3)
- Finding the minimum of the mean hit value (blue circle) with an iterative procedure starting with an approximate position (red)



Results (cm) :

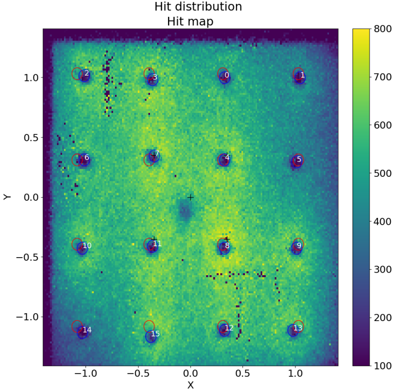
Fiber	0	1	2	3	4	5	6	7
X	0.33	1.05	-1.01	-0.36	0.33	1.01	-1.01	-0.34
Y	1.0	1.0	1.01	0.98	0.31	0.29	0.31	0.34

Fiber	8	9	10	11	12	13	14	15
X	0.33	1.01	-1.03	-0.36	0.33	0.98	-1.03	-0.38
Y	-0.43	-0.43	-0.43	-0.41	-1.11	-1.11	-1.13	-1.17

Fibre position

Determining the actual fibre position

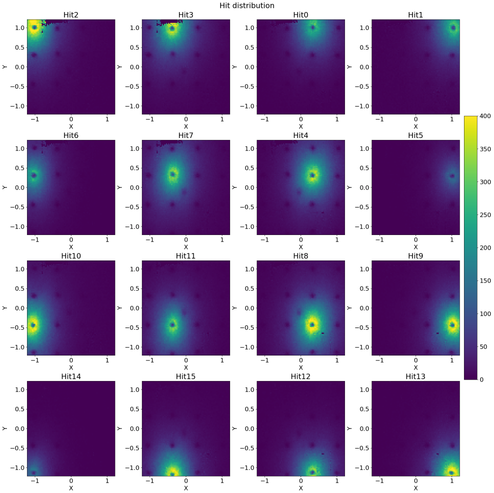
- The position method resolution is 160 μ m
- Difference in x of the fibre position are consistent (less < 200μm) within resolution
- Differences in y are larger up to 600 μm
- No clear pattern indicating a misalignment of the GRAiNITA with respect to the beam nor a beam divergence (indeed no systematic effect observed but localized misalignment)
- Can we check the actual position of the fibre on Troll 1?



I. HOMOGENISATION OF THE FIBRES RESPONSES

Introduction

- Use muon data (V3 processing)



Hit Map for each fibre

Cuts

Run 60 (Muons)

Events

Cuts (for fibre i):

eventType	4 (beam event)
hitTot = $\sum$hit[i]Cor	< 2000 and > 0

Track

mean distance to track < 250 μm :

diffTrack2 =1

Track has been reconstructed :

muonDZ >0

Geometrical

Track in a 1.3x1.3 cm square :

xM and yM > -1.3 and < 1.3

Distance definitions

dist2 =
$\sqrt{(xM - x[i])^2 + (yM - y[i])^2}$

dx = $xM - x[i]$

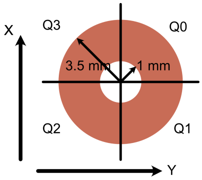
dy = $yM - y[i]$

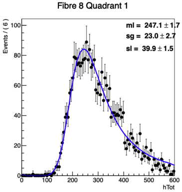
Quarters

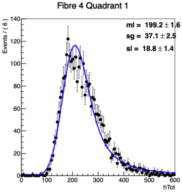
dist2	> 1 mm and <3.5 mm
Q0	dx>0 and dy>0
Q1	dx<0 and dy>0
Q2	dx>0 and dy<0
Q3	dx<0 and dy<0

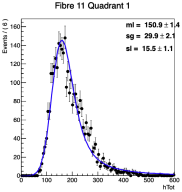
Quarters definition

- Compute the MPV value of the PE/track around each fibre
- Use quarters in order to avoid potential border effects (1 quarter used in the corner, 2 for side and 4 for center fibres)
- Fit the fibre distribution for a Landau convoluted with a Gaussian
- Equalise the Landau MPVs used as the fibre response estimator
- Build corrective factor from the average value of individual responses







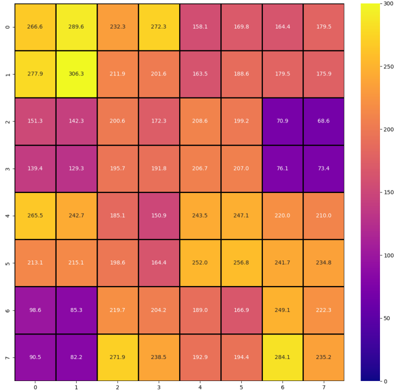


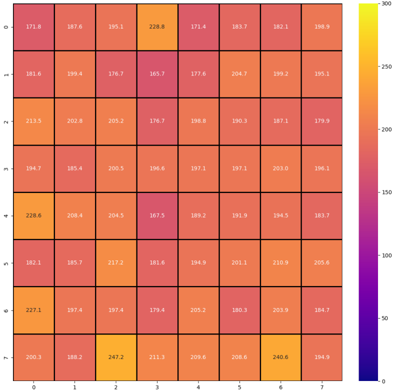
Results

Coefficients :

$$hit[i]_{\text{corrected}} = \frac{hit[i]}{coeff[i]}$$

Map of each quadrants (4/fibres) of hit[i]Cor (not htot!):





Before applying the coefficients After applying the coefficients

Can be enabled/disabled in the processing.

II. Border effects

Cuts

Run 60 (Muons)

Events

Cuts (for fibre *i*):

eventType	4 (beam event)
hitTot = $\sum$hit$[i]$Cor	$<$ 2000 and $>$ 0

Track

mean distance to track < 250 μm :

diffTrack2 =1

Track has been reconstructed :

muonDZ >0

Geometrical

Track in a 1.3x1.3 cm square :

xM and yM > -1.3 and < 1.3

Distance definitions

dist2 = $\sqrt{(xM - x[i])^2 + (yM - y[i])^2}$

dist3a = $abs(xM - x[i])$

dist3b = $abs(yM - y[i])$

Round quarters

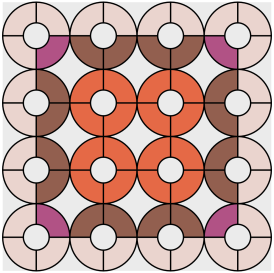
dist2> 1 mm and dist2<3.5 mm

Square quarters

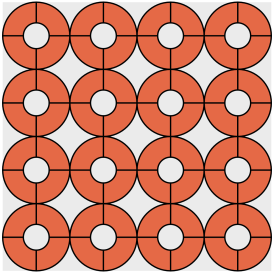
dist2 > 1 mm and dist3a < 3.5 mm and dist3a < 3.5 mm

Definition

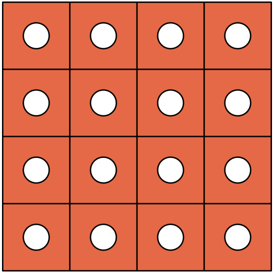
3 geometries studied :



Geometry 1: Round shapes, without borders

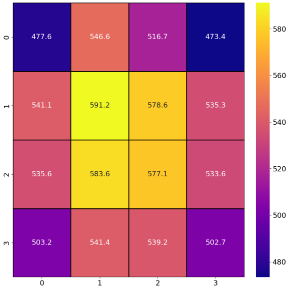


Geometry 2: Round shapes

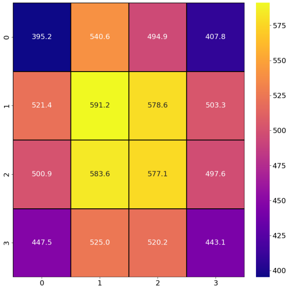


Geometry 3: Square shapes

Results 1/3



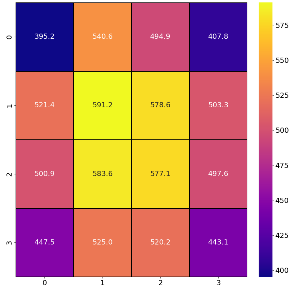
Geometry 1



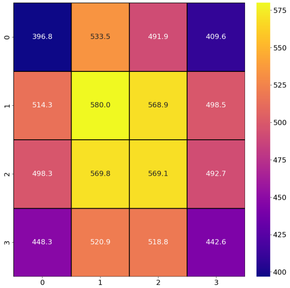
Geometry 2

- Geometry 1 : The one used in uniformization of fibres, now look at the sum of the fibres.
- We clearly see that the corner and borders regions are less luminous than the central ones, likely border effect
- With geometry 2/3 we can scrutinize the border effect with more granularity
- When comparing within a region the innermost to the outermost we also see a decrease of the light yield, effect up to 20 %

Results 2/3



Geometry 2



Geometry 3

- Geometry 3 : embodies the full volume but the center of the fibre
- Effect is expectedly stronger
- We build estimators of the border effect amplitude by comparing the corners, central and borders respectively
- Uncertainties are estimated by taking the min to max of the variation for the 4 corners, the 8 borders and 4 central

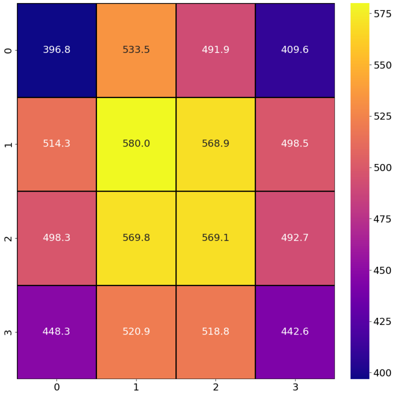
Results 3/3

Average values :

- Center: $\mathrm{Ce} = 571.9 \pm 5.6$ PE
- Corner: $\mathrm{Co} = 424.3 \pm 25.7$ PE
- Borders: $\mathrm{Bo} = 508.6 \pm 20.8$ PE

Some estimators :

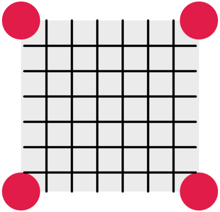
- $\frac{\mathrm{Ce}-\mathrm{Co}}{\mathrm{Co}} = 0.347 \pm 0.095$
- $\frac{\mathrm{Ce}-\mathrm{Bo}}{\mathrm{Bo}} = 0.124 \pm 0.057$
- $\frac{\mathrm{Bo}-\mathrm{Co}}{\mathrm{Co}} = 0.198 \pm 0.121$



Geometry 3

III. UNIFORMITY MAP

Geometry



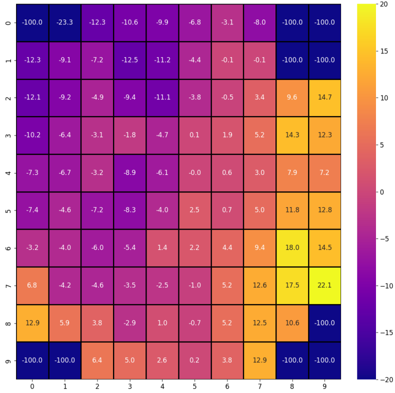
4Sq definition

4Sq 0	4Sq 1	4Sq 2
4Sq 3	4Sq 4	4Sq 5
4Sq 6	4Sq 7	4Sq 8

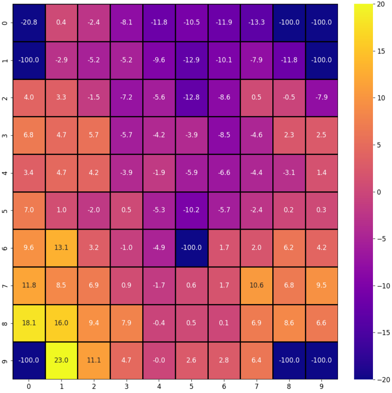
4Sq position

- Space in a 4-fibre square (4Sq) cut in 49x1 mm^2 squares
- Landau x Gaussian fit in each
- 9 (4Sq) can be built
- MPV map can be produced for each
- Fit error in the 1-2% range, can rise to 4% in the corners
- Mean value of each map took as a reference
- Fit with $\chi^2 > 1.1$ are discarded

Uniformity maps 1 out of 5

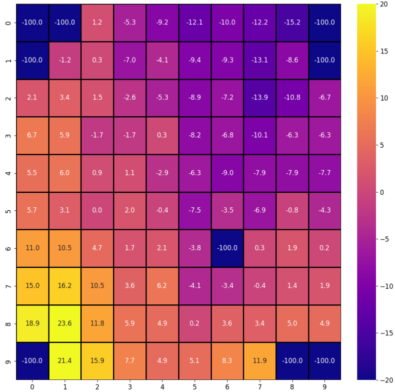


4Sq 0

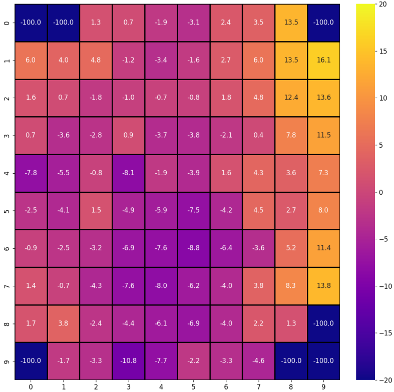


4Sq 1

Uniformity maps 2 out of 5

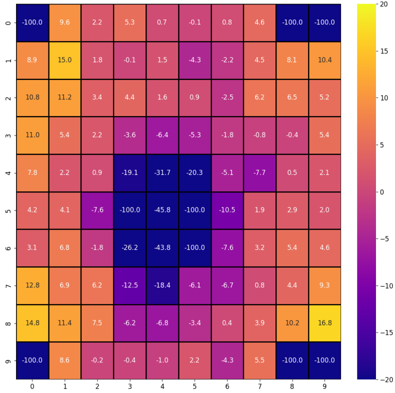


4Sq 2

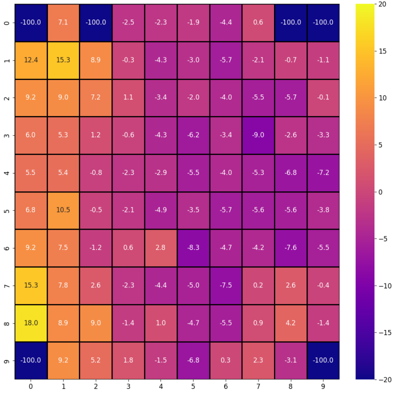


4Sq 3

Uniformity maps 3 out of 5

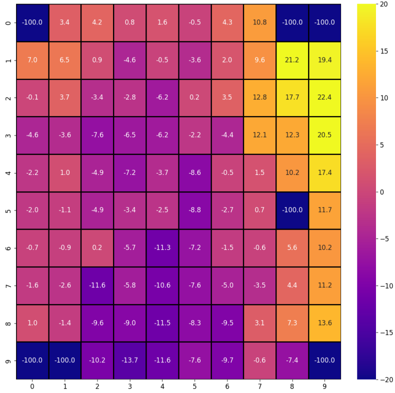


4Sq 4

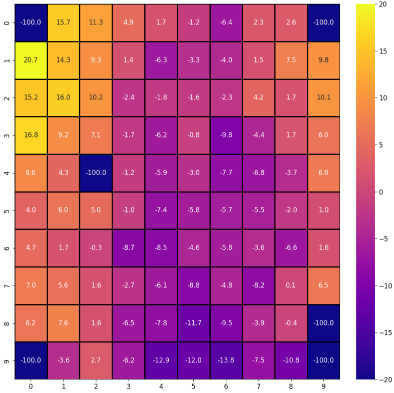


4Sq 5

Uniformity maps 4 out of 5

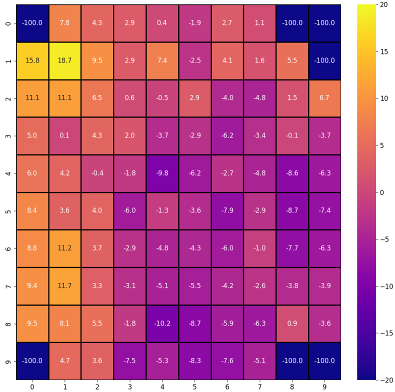


4Sq 6



4Sq 7

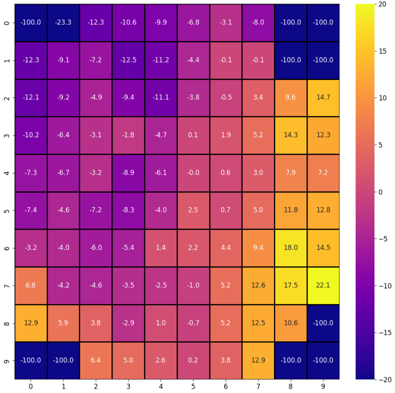
Uniformity maps 5 out of 5



4Sq 8

Interpretation

- The 9 maps are showing departure from uniformity consistently
- Border effect that are likely the explanation
- Maximum of the order of 35 % (in the corners)
- Select region which we think are not plagued by border effect

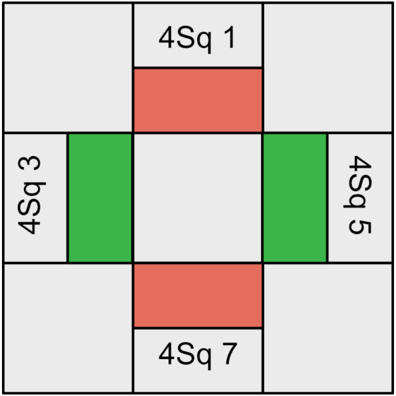


4Sq 0 (corner)

Region location

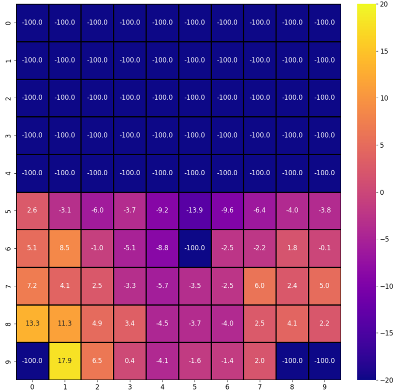
Selection :

- Avoid the clear fibre and minimize the border effects
- Choice of the half blocs located at the vicinity of the center 4Sq 4.

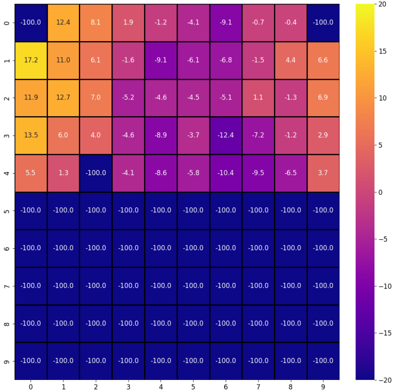


Position of the selected blocs

Uniformity maps 1 out of 2

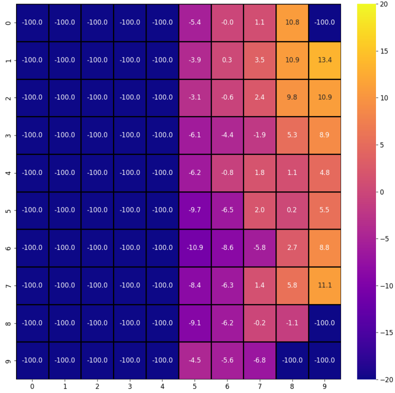


4Sq 1

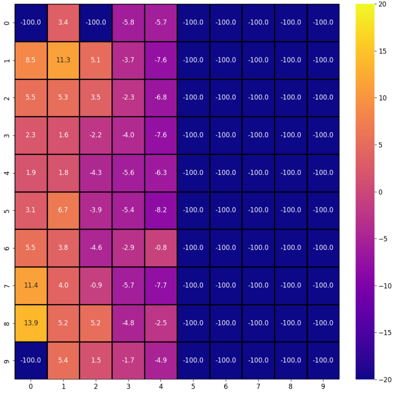


4Sq 7

Uniformity maps 2 out of 2



4Sq 3

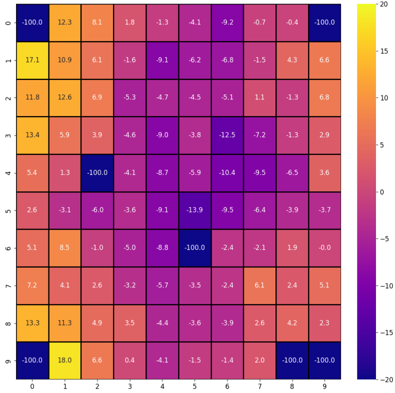


4Sq 5

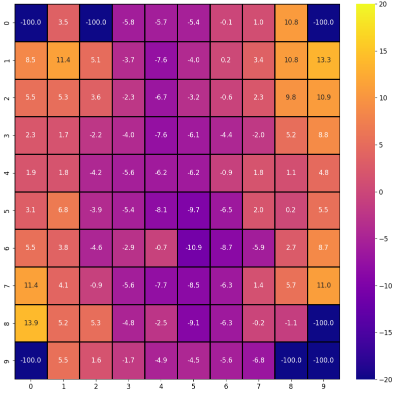
Proposal

- Is there a way to present this result in a unique way to input into Denys simulation.
- Our proposal : merge the previous plot

Final result



4Sq 1-7



4Sq 3-5