

# First Internship Results

Lorenzo Restrepo

# Pre-Fit raw output

	<b>event</b>	<b>success</b>	<b>t</b>	<b>x</b>	<b>y</b>	<b>z</b>	<b>goodness</b>
0	0	True	-157.860846	416.511151	1074.219364	902.193036	-120.448553
1	1	True	-220.333346	-22.793884	378.454132	-239.080827	-4.999150
2	2	True	-142.753225	85.766400	0.477390	-7.322286	-846.442743
3	3	True	-141.415583	107.805655	2.753646	-17.064924	-842.775985
4	4	True	-209.218784	-33.699373	-105.303321	4.984660	-4.000066
...	...	...	...	...	...	...	...
95	95	True	-211.316702	0.061192	0.036225	0.001519	-1.000000
96	96	False	-142.086217	82.645483	2.291232	6.742762	-837.866585
97	97	True	-213.288143	77.860539	2.752638	-111.492628	-4.000000
98	98	False	-142.341946	97.586649	0.553517	-18.265578	-890.235360
99	99	True	-219.394705	14.654689	-60.648210	28.546740	-4.000005

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Indicates if the minimization converged

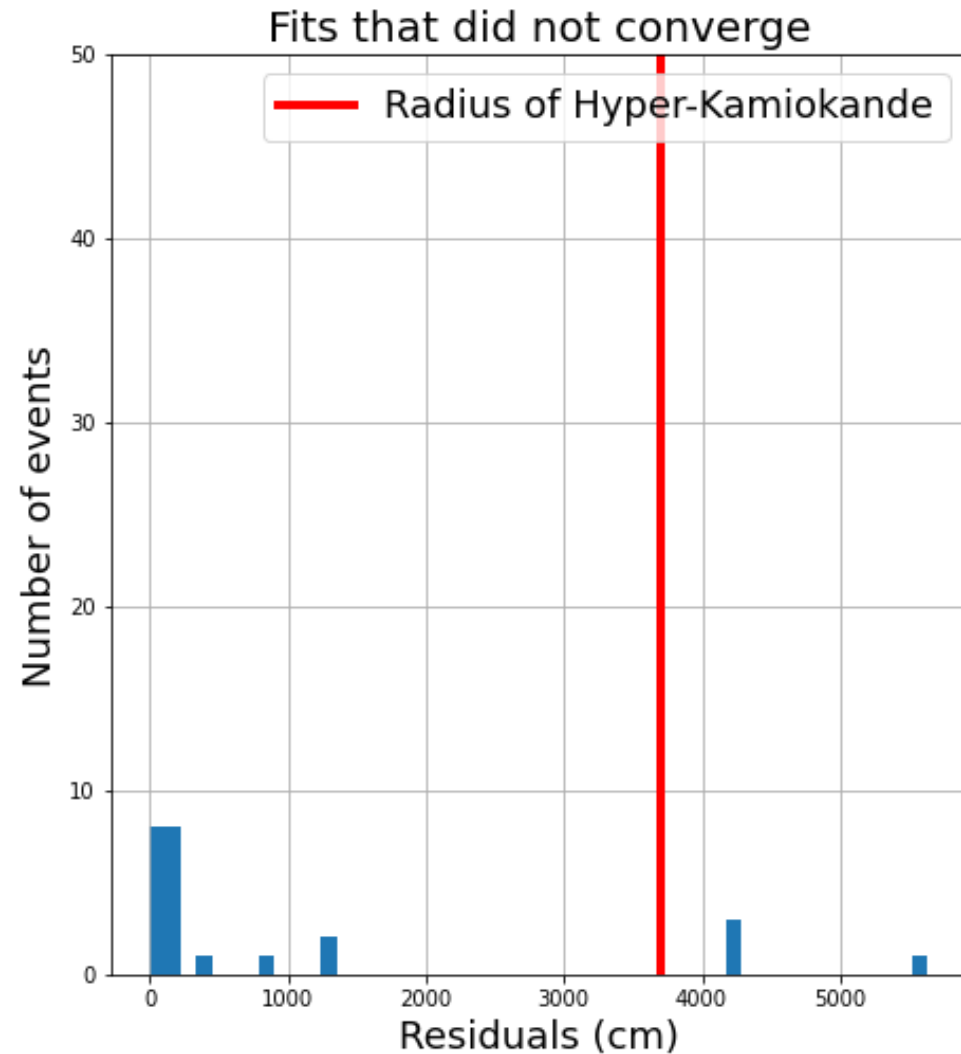
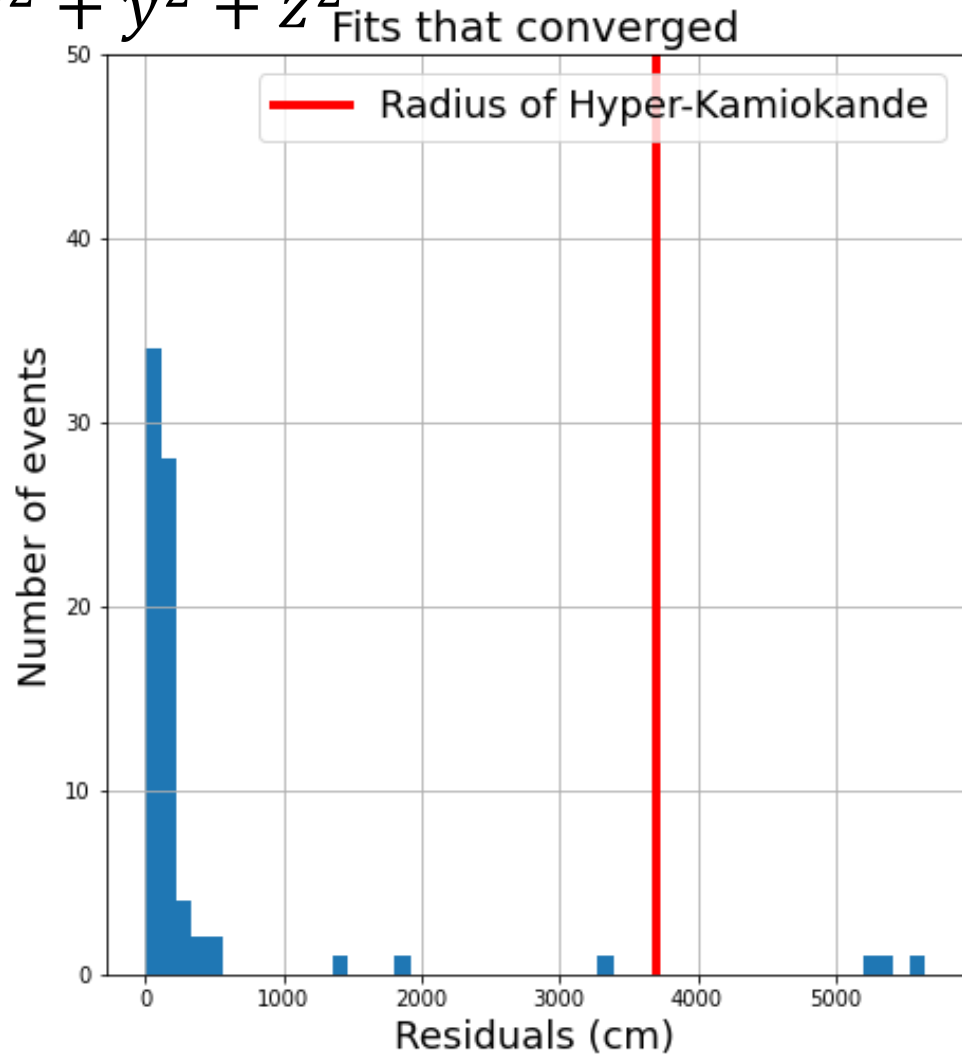
$$G(\mathbf{x}, t) \equiv \sum_i^{\text{hit}} \exp(-(T_{\text{res}}^i / \sigma)^2 / 2)$$
$$T_{\text{res}}^i \equiv t_i - t - |\mathbf{R}_{\text{PMT}}^i - \mathbf{x}| / c_n$$

Reconstructed vertex position

# Residuals histograms (100

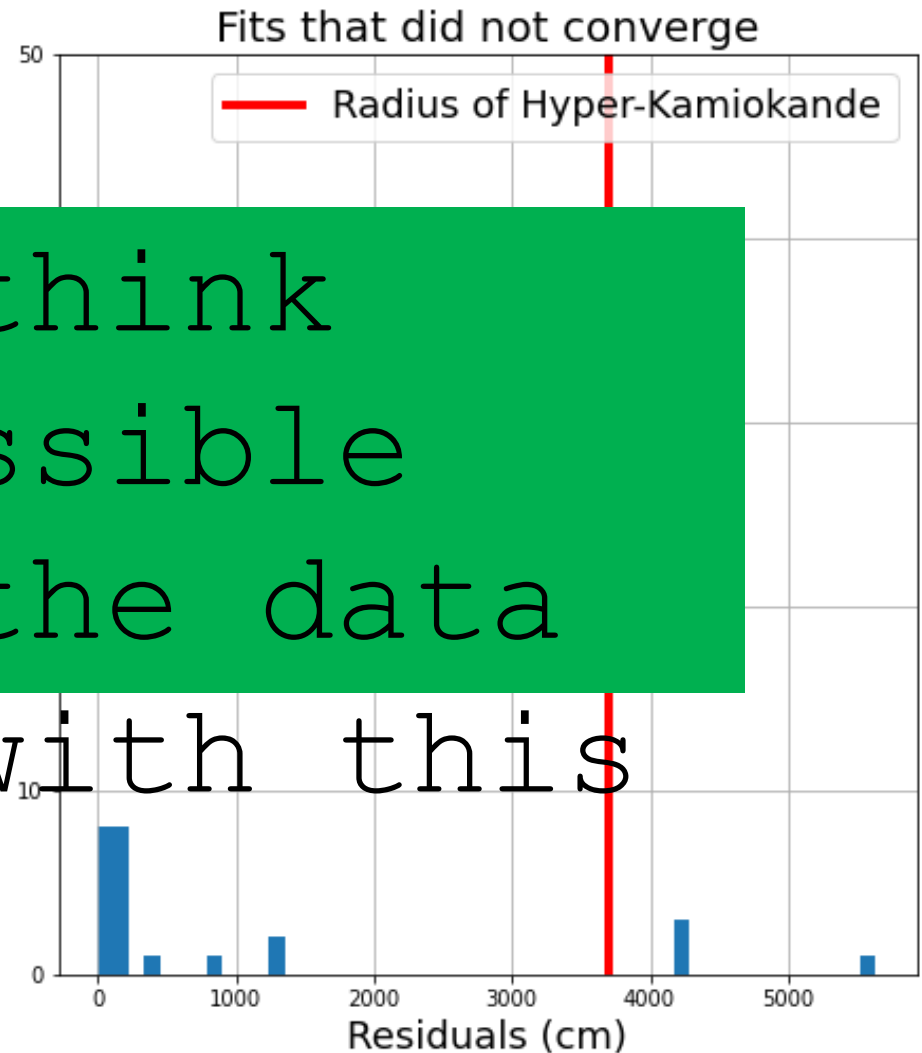
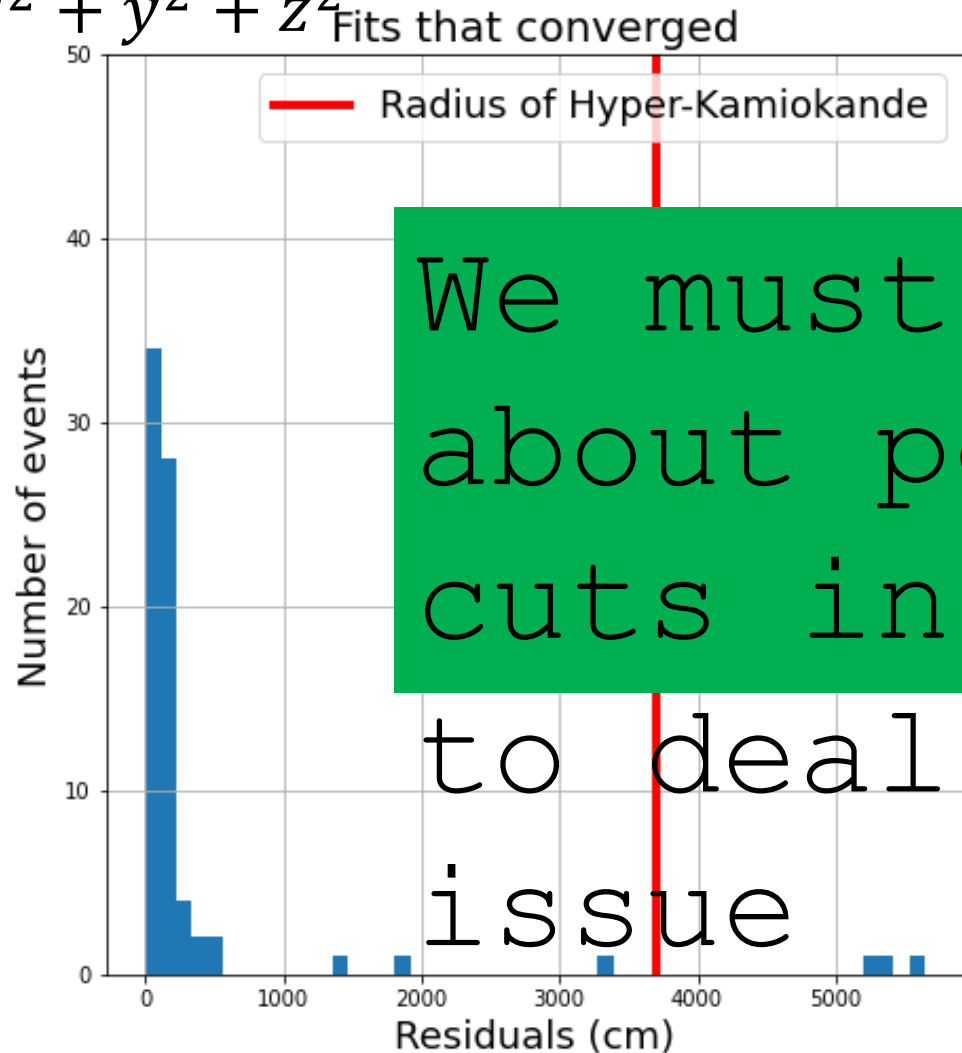
events)

- Prefit residuals =  $\sqrt{(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2} = \sqrt{x^2 + y^2 + z^2}$



# Residuals histograms (100 events)

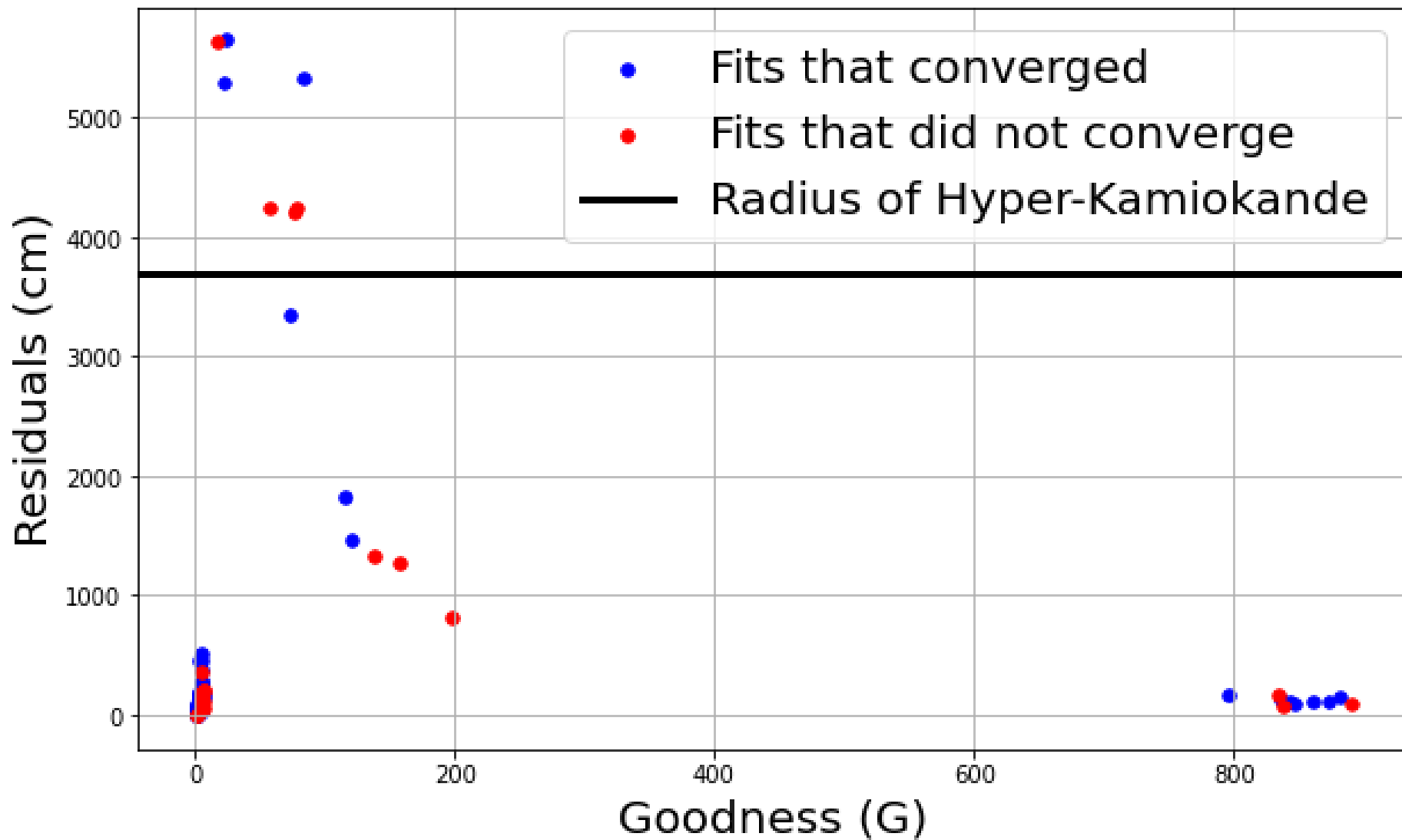
- Prefit residuals =  $\sqrt{(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2} = \sqrt{x^2 + y^2 + z^2}$



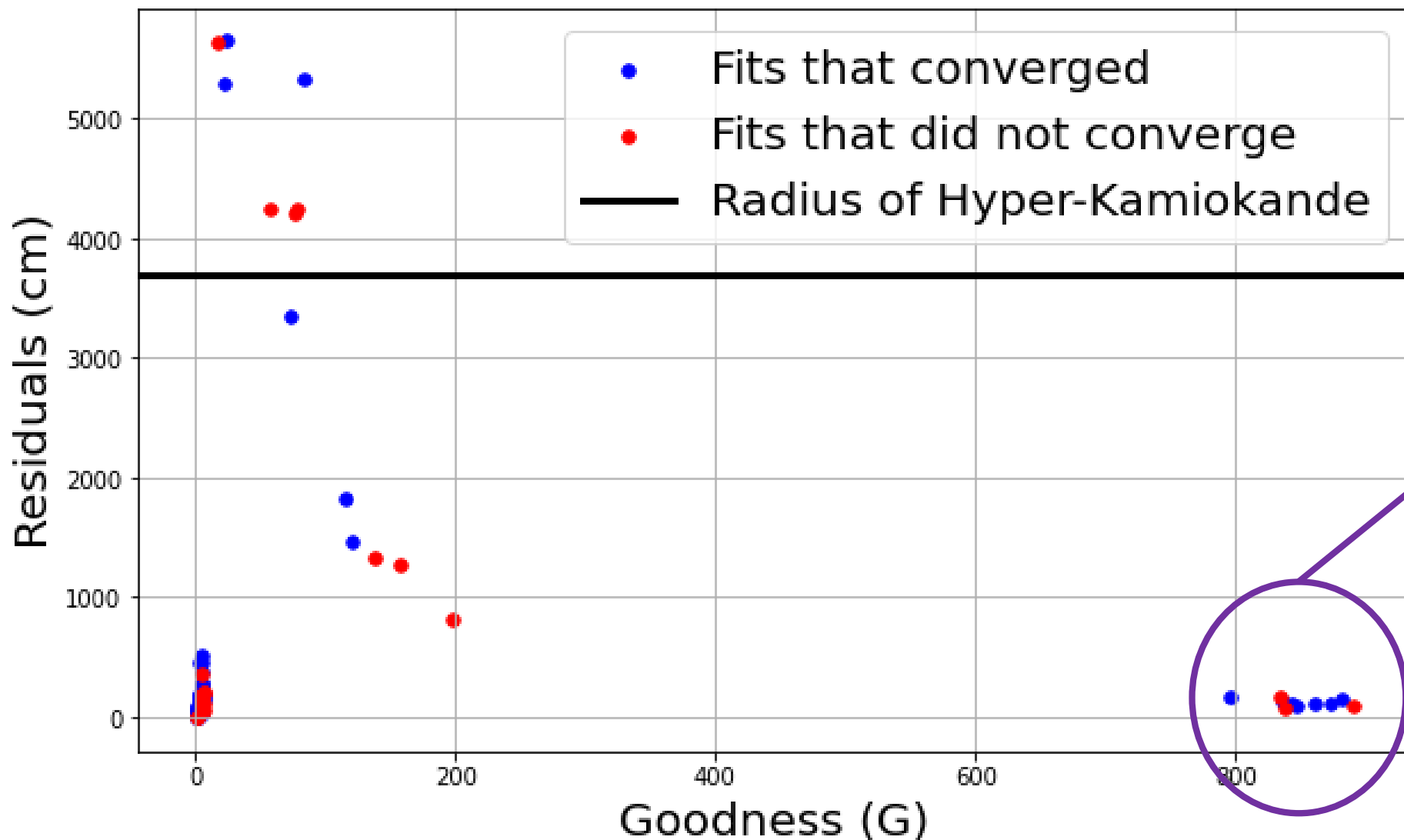
We must think about possible cuts in the data

to deal with this issue

# Residuals vs Pre-Fit Goodness

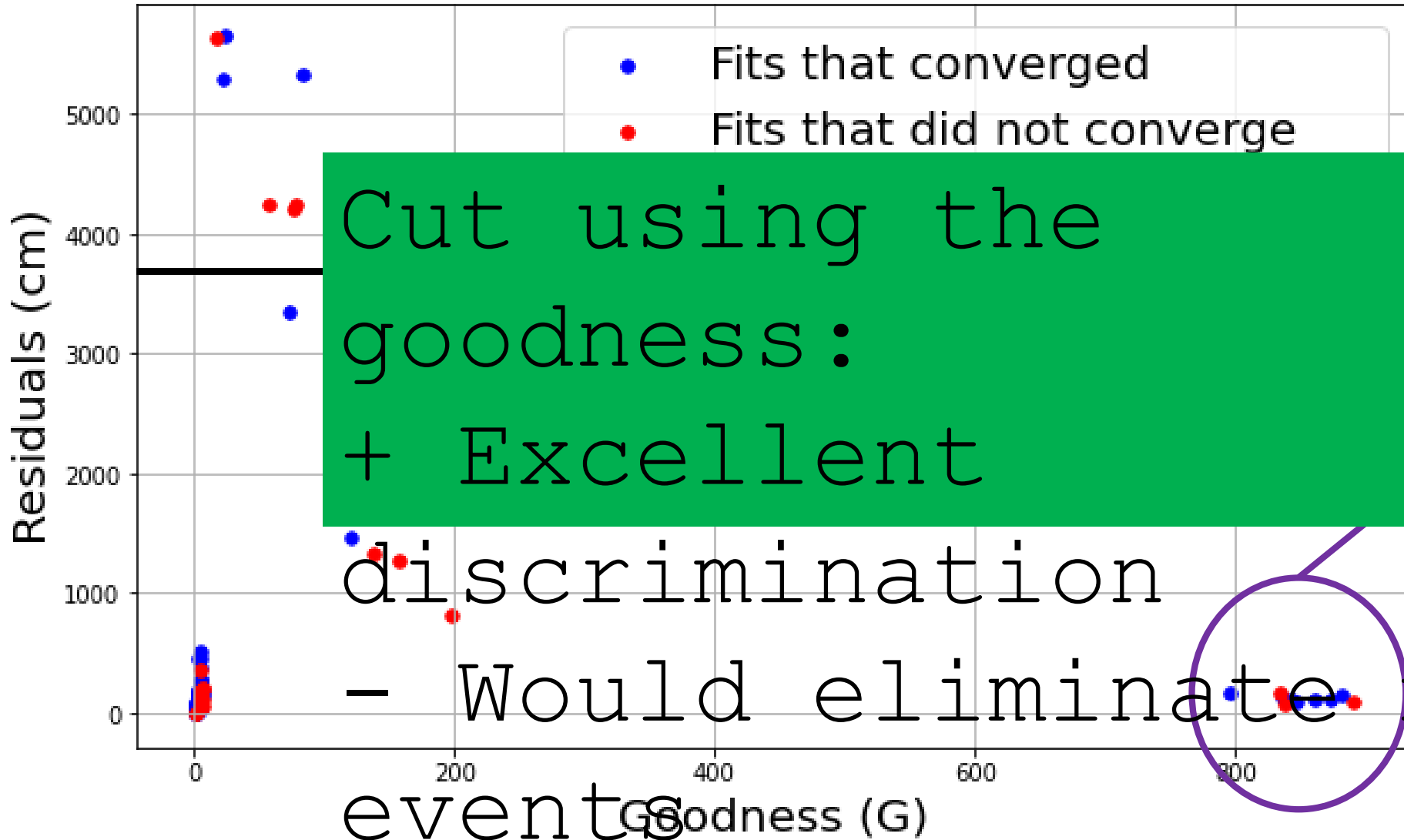


# Residuals vs Pre-Fit Goodness



This is probably the only sample in which the minimization worked as it should

# Residuals vs Pre-Fit Goodness



Cut using the goodness: + Excellent discrimination

- Would eliminate most events

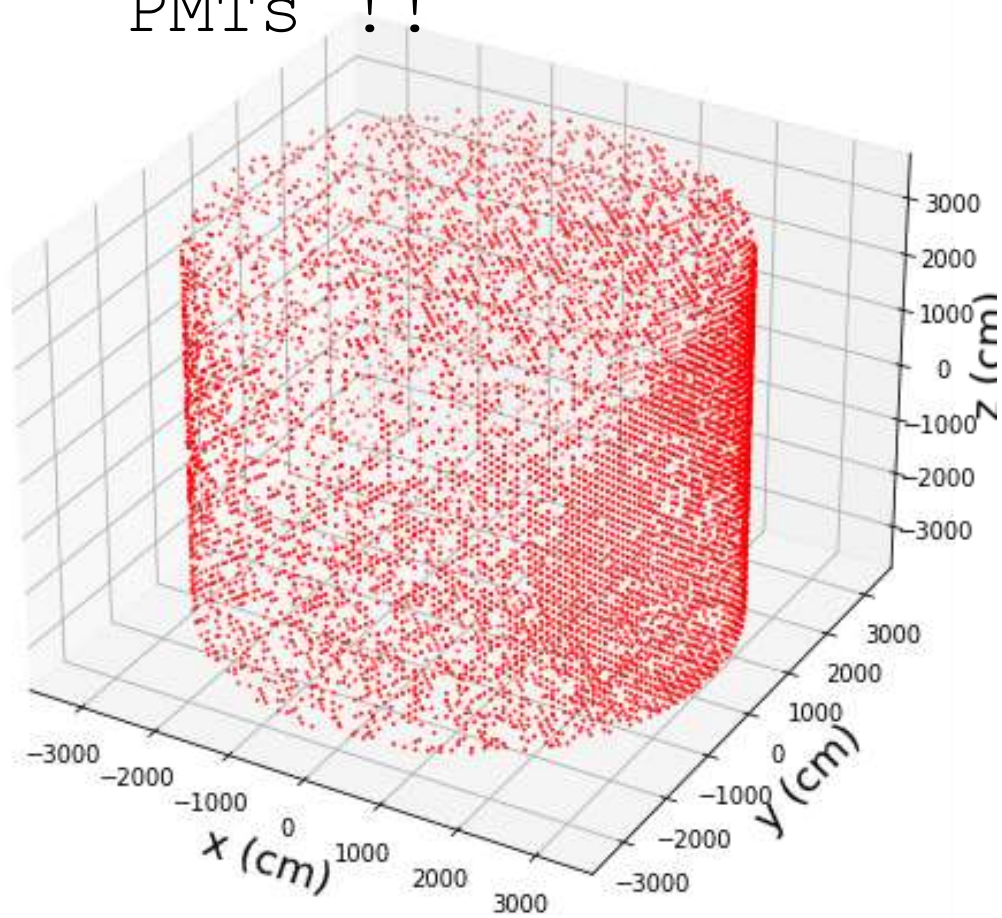
is probably the sample in which the minimization worked as it should



# Hit display

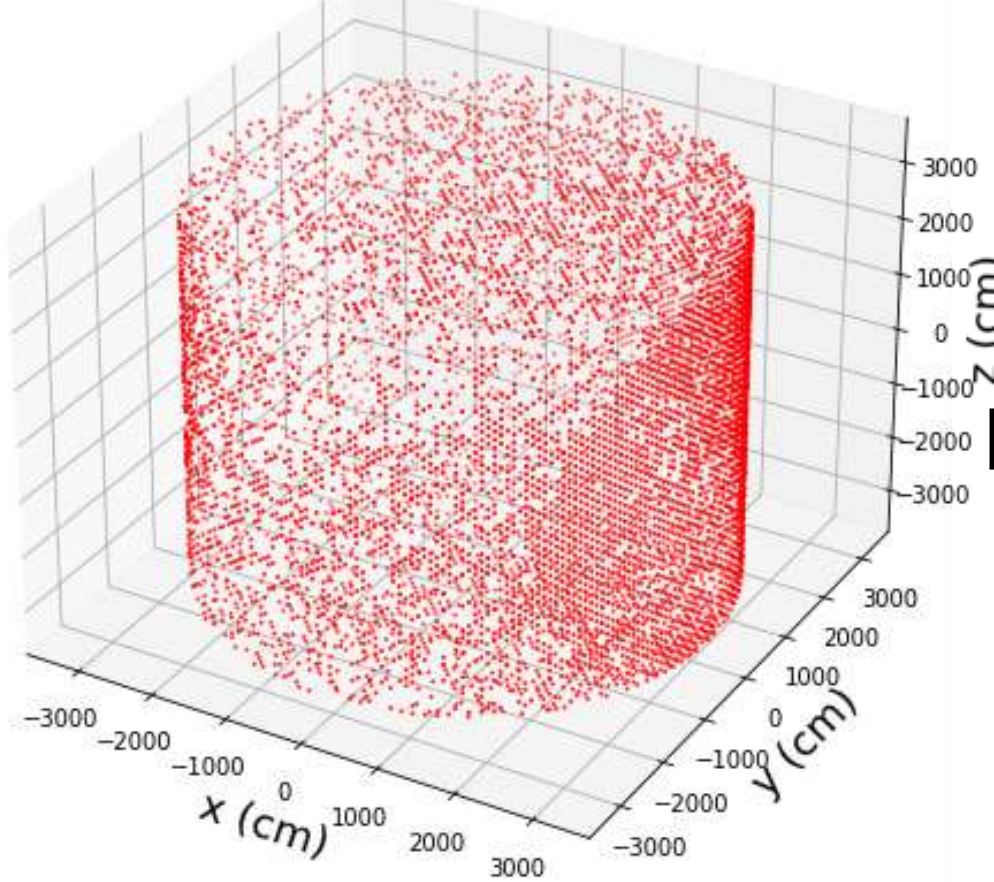
Raw hit ~ 7,000

PMTs !!

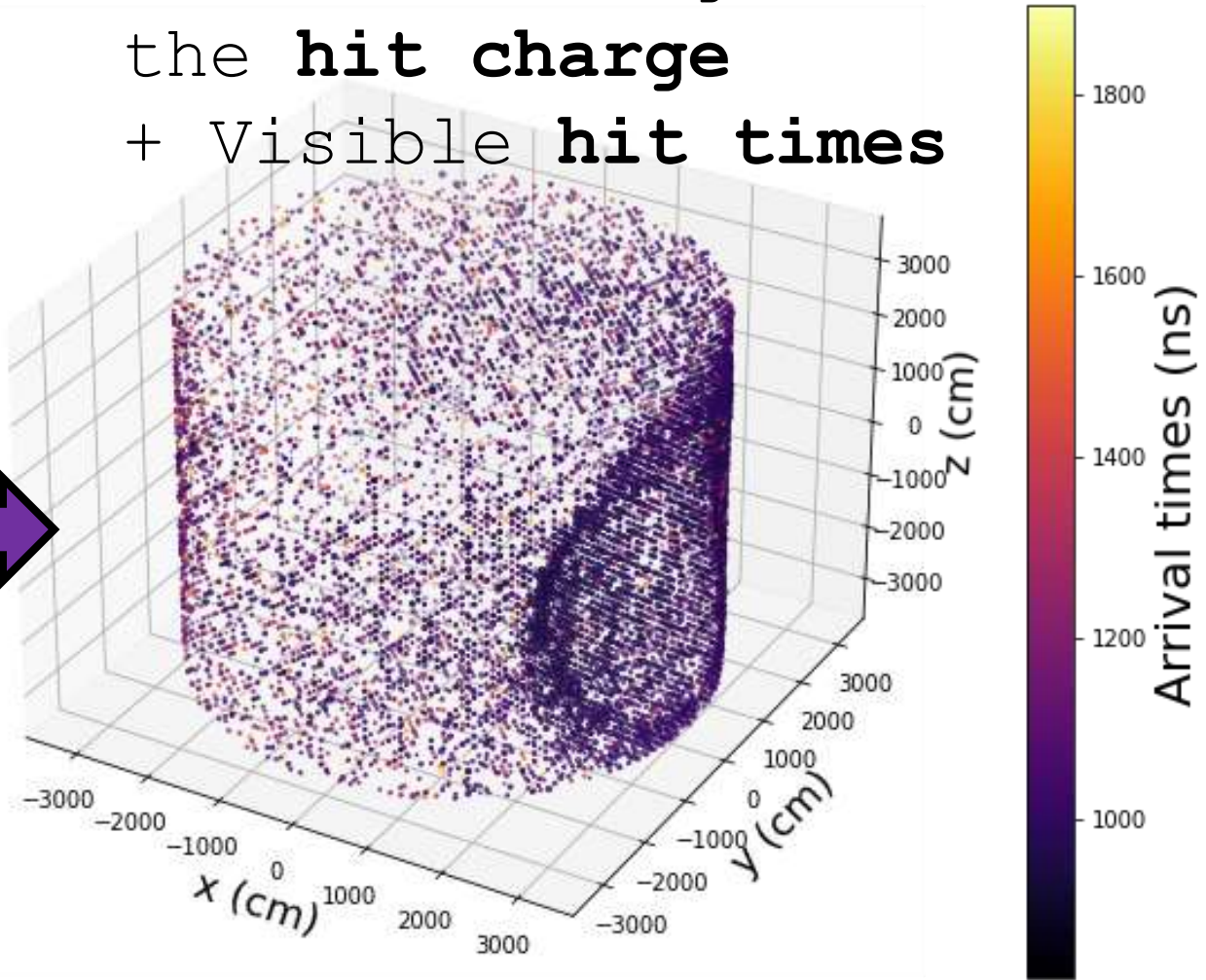


# Hit display

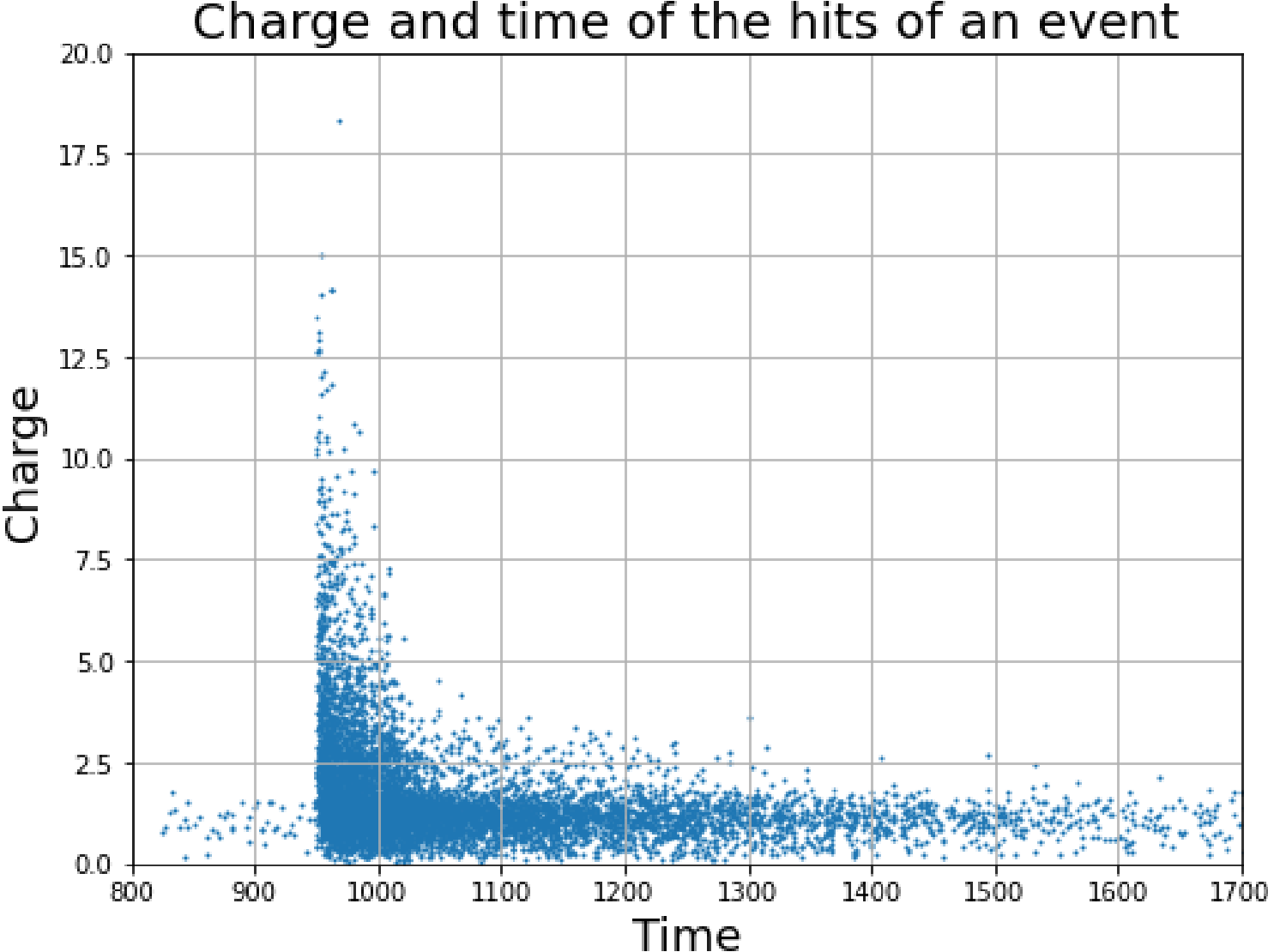
Raw hit ~ 7,000  
PMTs !!



On the plot:  
+ Rescaling of the  
dots according to  
the **hit charge**  
+ Visible **hit times**

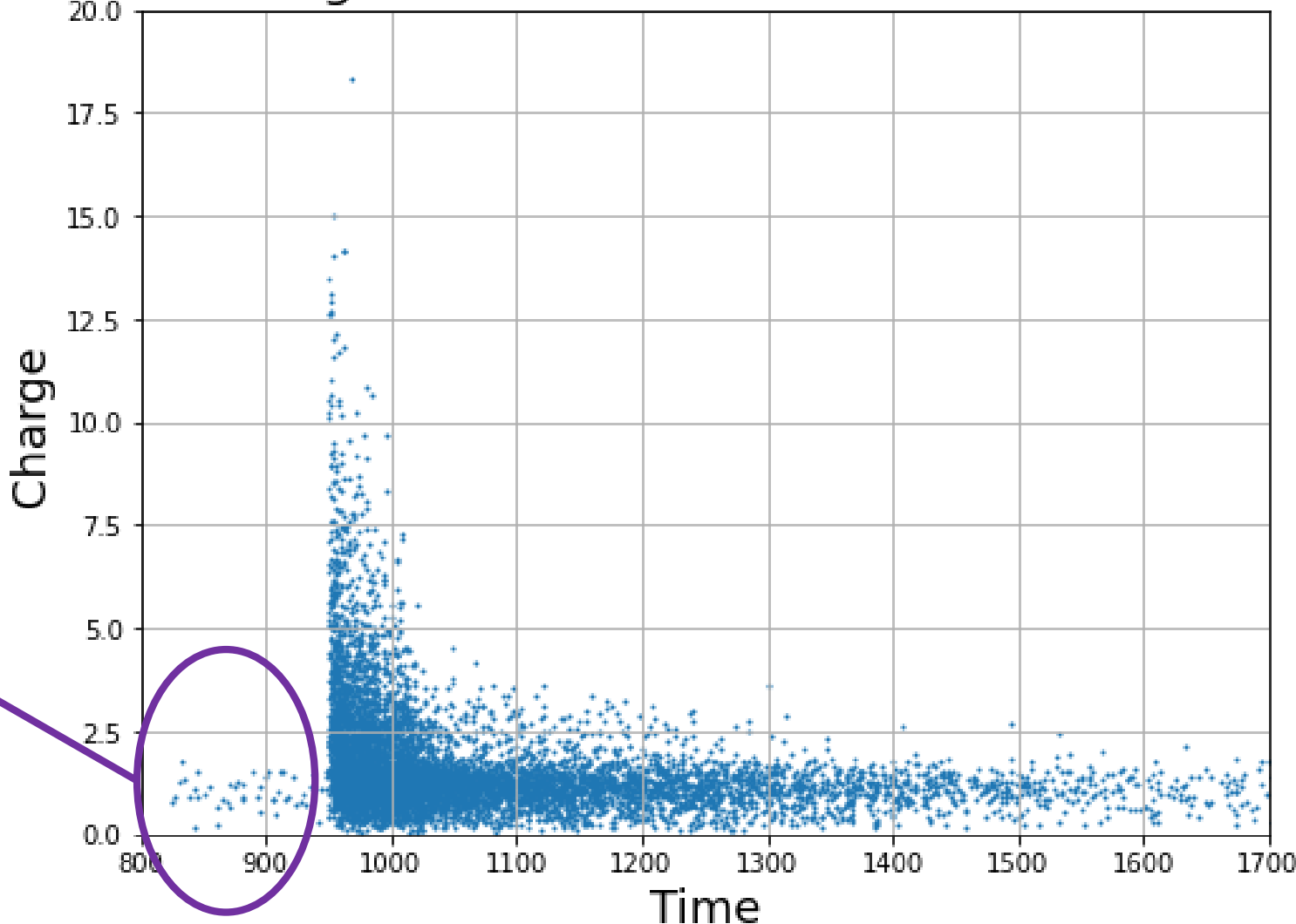


# Charge and time cut



# Charge and time cut

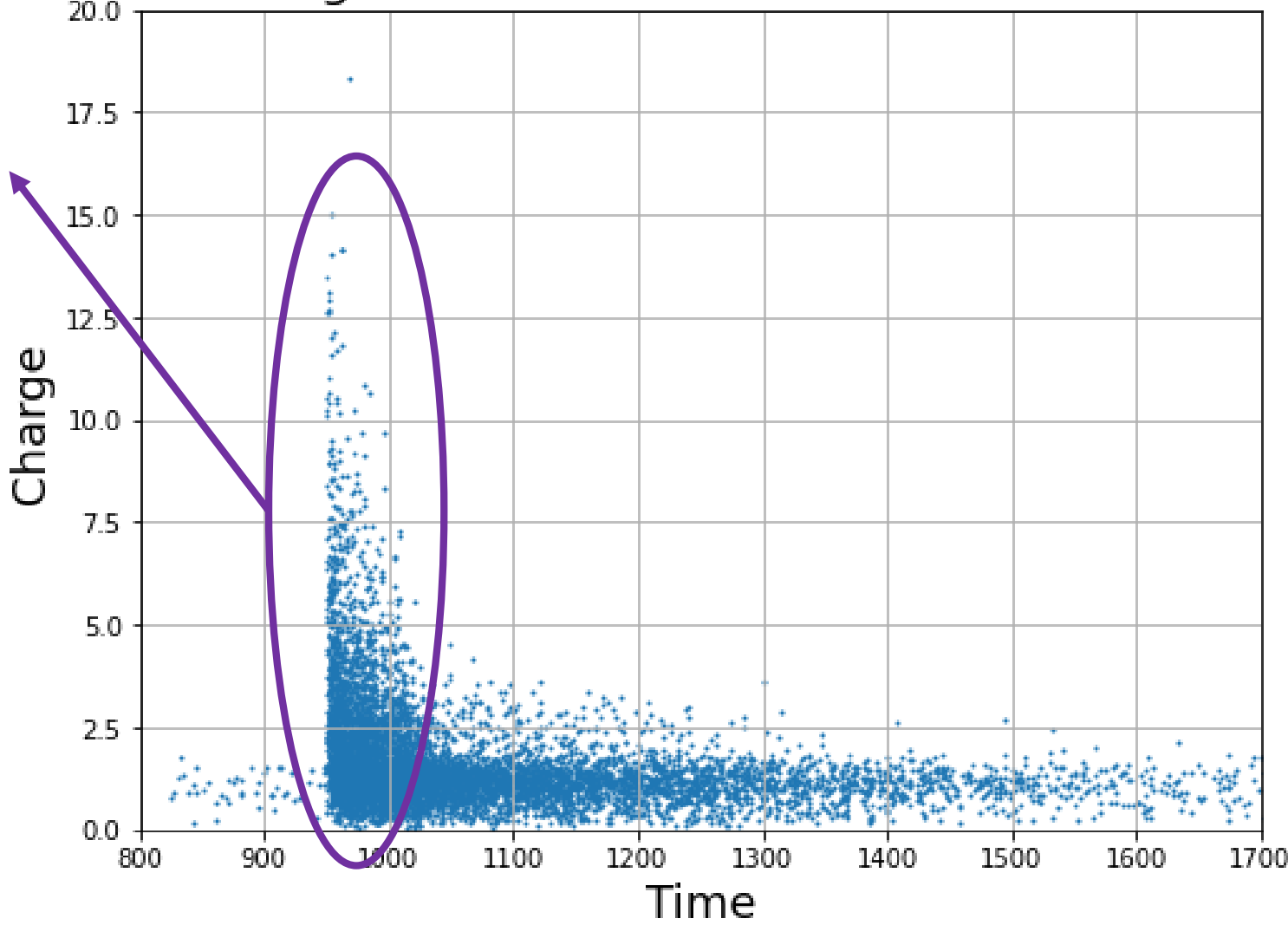
Charge and time of the hits of an event



Dark  
Noise

# Charge and time cut

Charge and time of the hits of an event

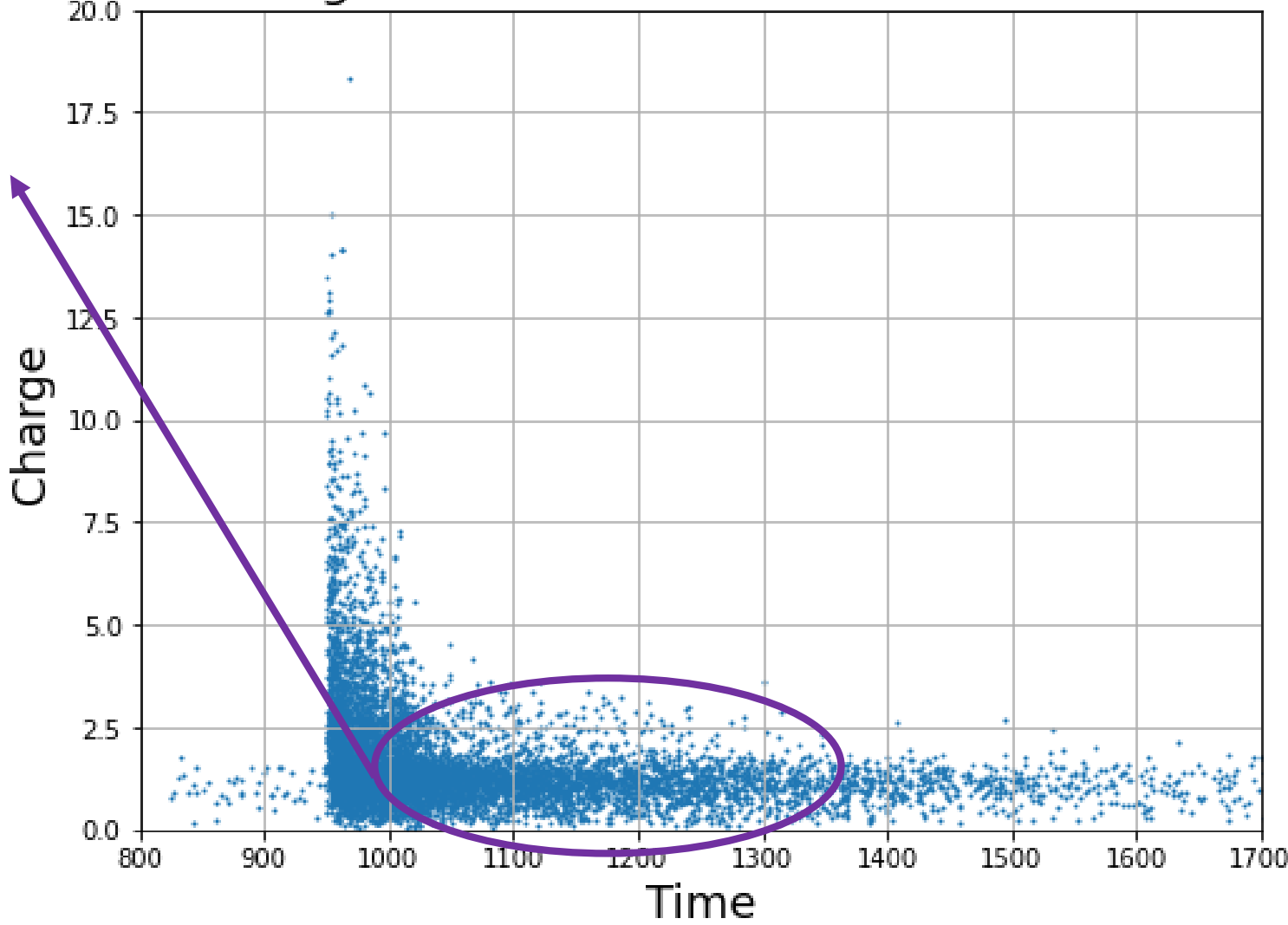


Direct  
light



# Charge and time cut

Charge and time of the hits of an event



Scattered  
light ??