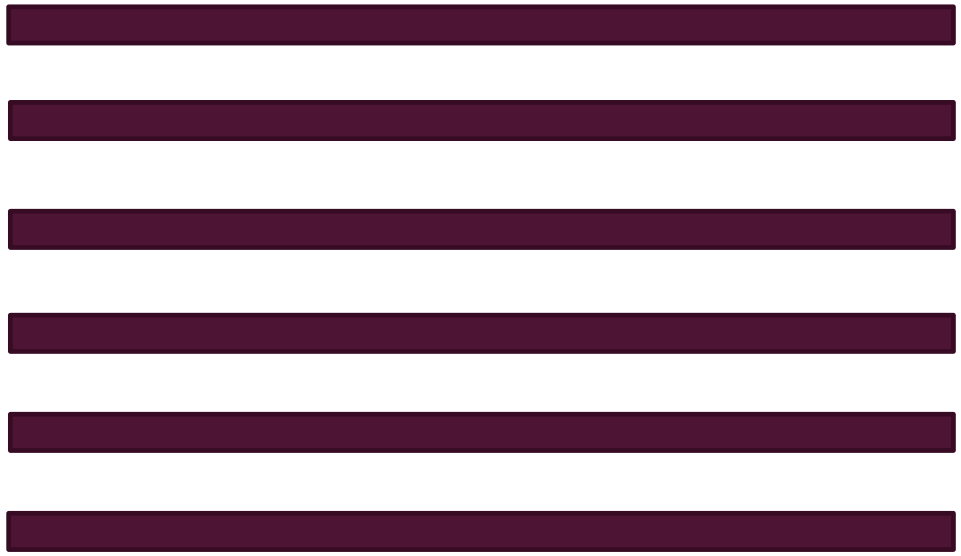
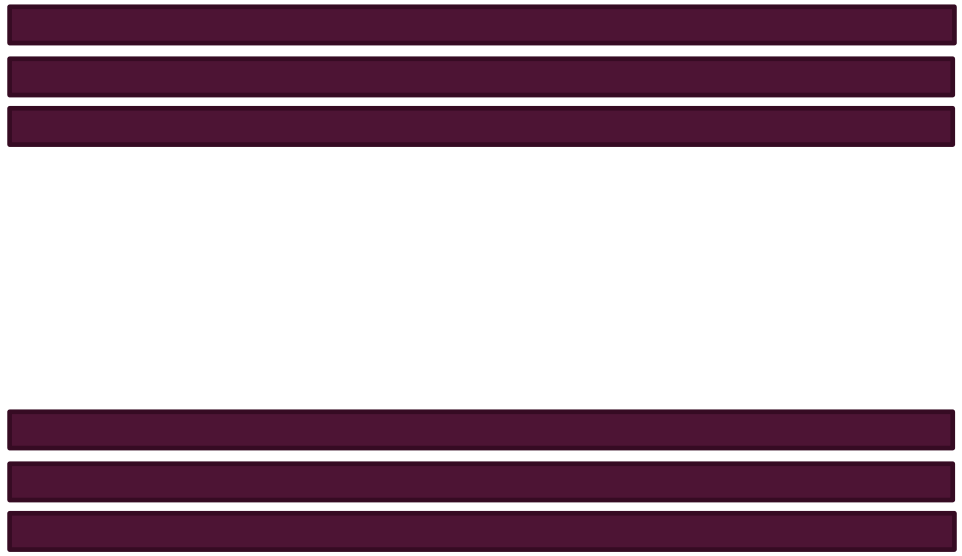
CONFIGURATION OF TRACKING PLANES

AUDREY KVAM

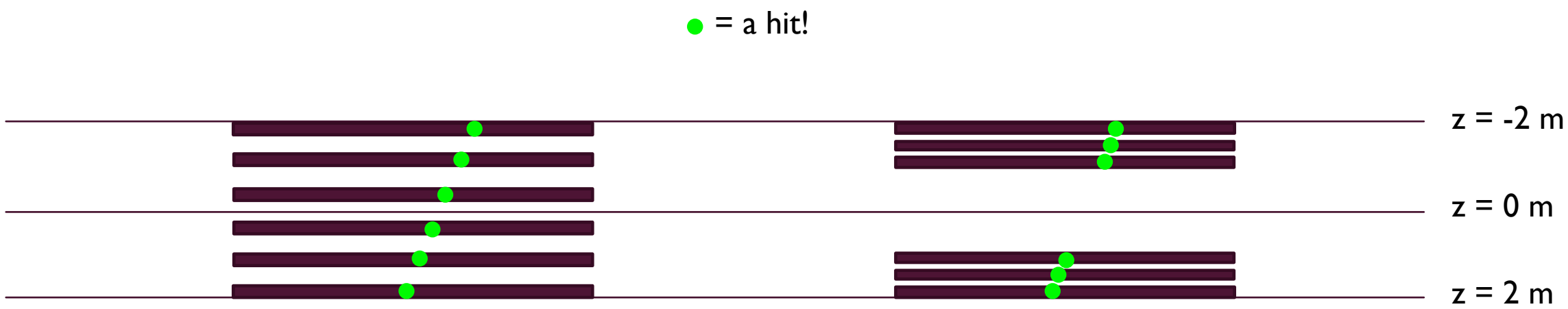
2 options under consideration, is one preferable over the other?



Equally spaced layers

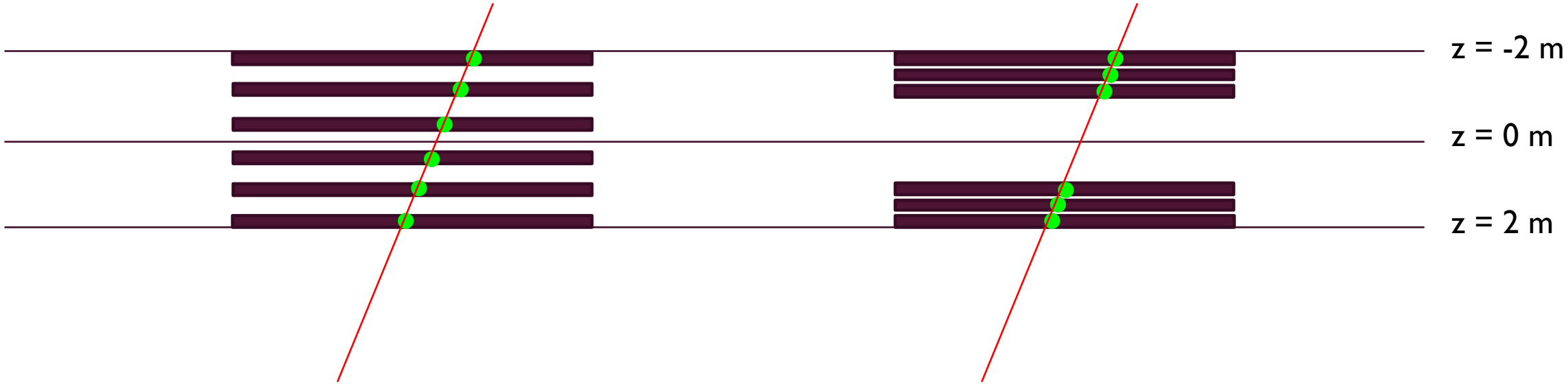


2 “super-layers” formed from unequal spacing



In order to test only the effect of the spacing, I assume both configurations have 6 layers and are distributed from -2m to 2m. For unequal spacing, RPCs are at $z = \{-2, -1.8, -1.6, 1.6, 1.8, 2\}$

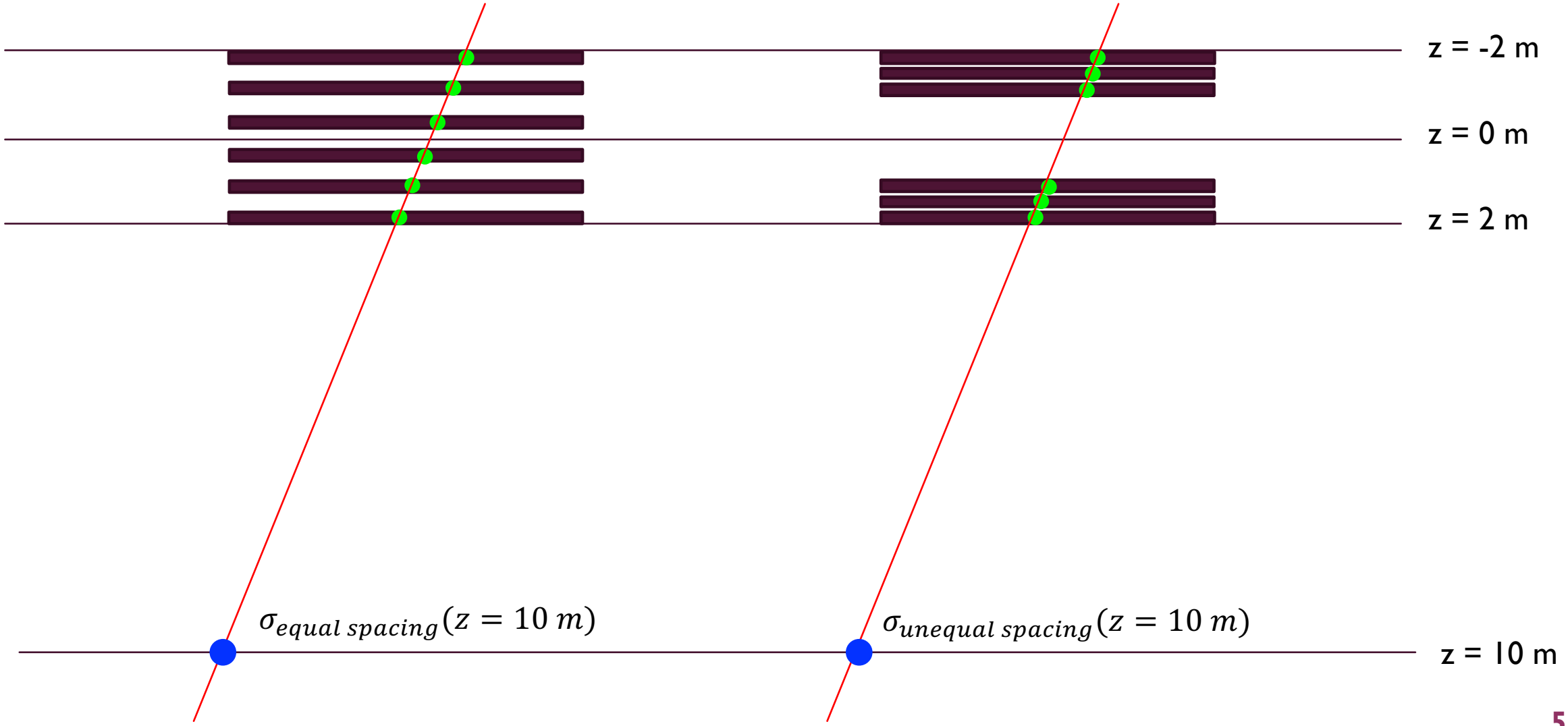
A hit in any layer gives us a coordinate (x_i, z_i) where z is known from the detector geometry and x is measured with an uncertainty of σ (uncertainty is the same for all layers)



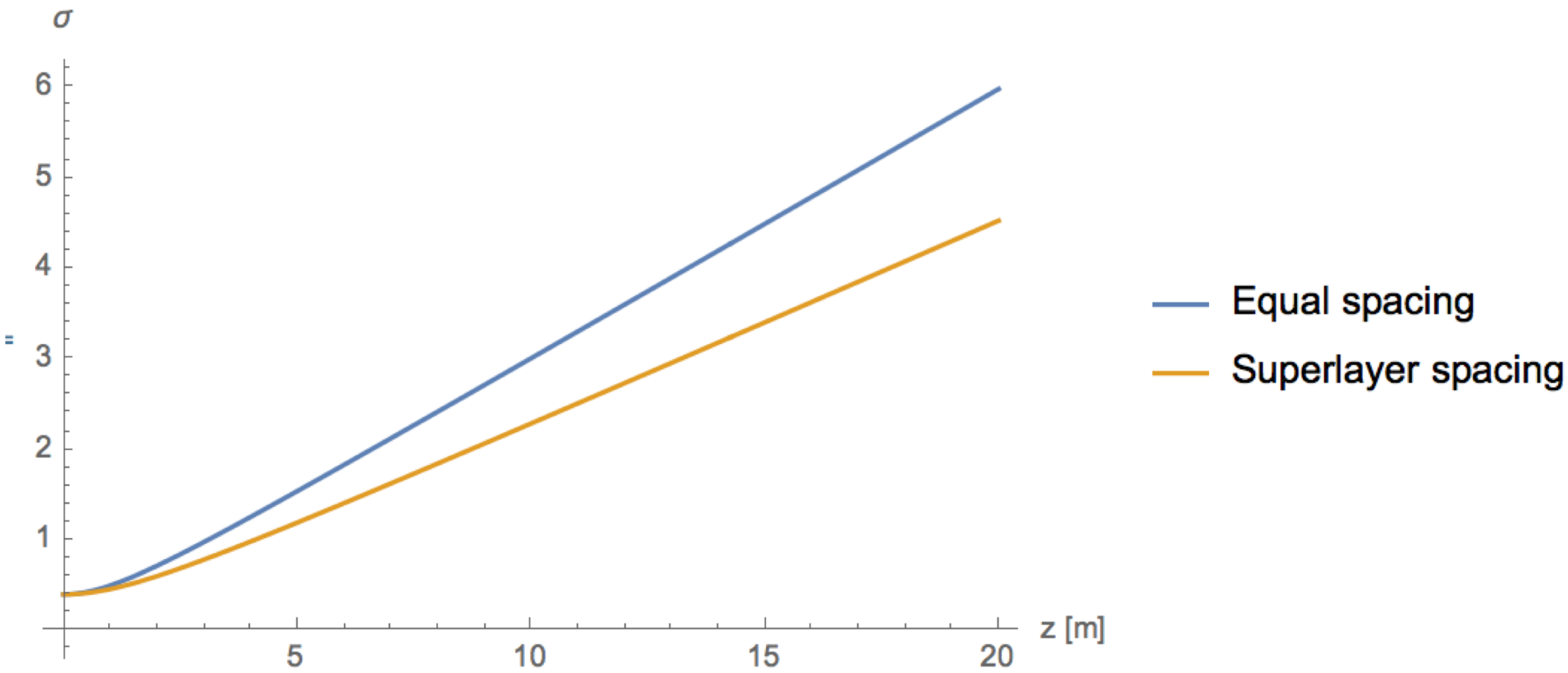
Use χ^2 minimization to find linear track $x = x_0 + x'z$

$$\begin{pmatrix} x_o \\ x' \end{pmatrix} = \frac{1}{\left(\sum_i \frac{1}{\sigma_i^2}\right)\left(\sum_i \frac{z_i^2}{\sigma_i^2}\right)} \begin{bmatrix} \sum_i \frac{z_i^2}{\sigma_i^2} & 0 \\ 0 & \sum_i \frac{1}{\sigma_i^2} \end{bmatrix} \begin{pmatrix} \sum_i \frac{x_i}{\sigma_i^2} \\ \sum_i \frac{z_i x_i}{\sigma_i^2} \end{pmatrix}$$

https://indico.cern.ch/event/578560/contributions/2343779/attachments/1359985/2057719/Telescope.pdf



How do $\sigma_{equal\ spacing}$ and $\sigma_{unequal\ spacing}$ compare?


σ
6
5
4
3
2
1
5
10
15
20
z [m]
Equal spacing
Superlayer spacing

$z\ [m]$	σ_{equal}	$\sigma_{unequal}$
0	0.41	0.41
1	0.51	0.47
2	0.72	0.61
5	0.55	1.20
10	3.02	2.30
15	4.50	3.41
20	5.99	4.54

$$= \frac{1}{\sqrt{6}} = \frac{1}{\sqrt{(\text{number of layers})}}$$