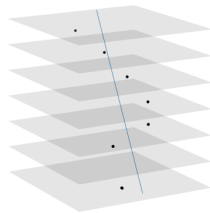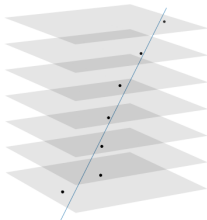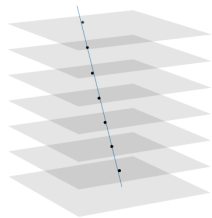# Status report - Thursday

χ^2-Distribution and Track Analysis
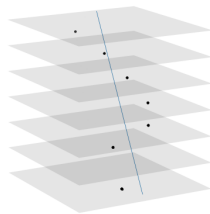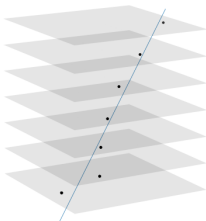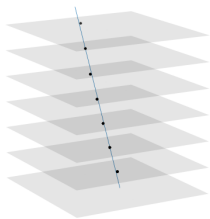
Maurice Donner

July 30, 2020

Tracking

Implemented a 3D-Fitting algorithm in python:

Using numpy's Singular value decomposition `np.linalg.svd`

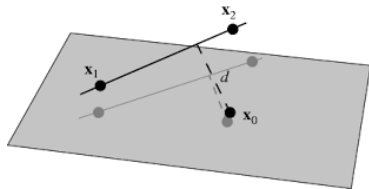# Tracking

Implemented a 3D-Fitting algorithm in python:

Using numpy's Singular value decomposition `np.linalg.svd`
$\rightarrow$ Now interested in χ^2 (goodness of fit)

$$d^2 = \frac{|x_1 - x_0|^2 \, |x_2 - x_1|^2 - [(x_1 - x_0) \cdot (x_2 - x_1)]^2}{|x_2 - x_1|^2}$$

Goodness of Fit

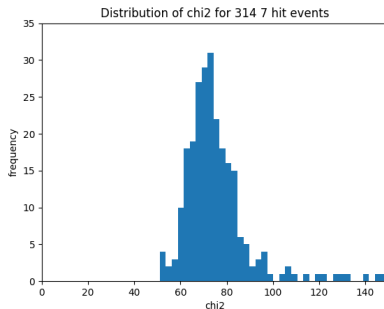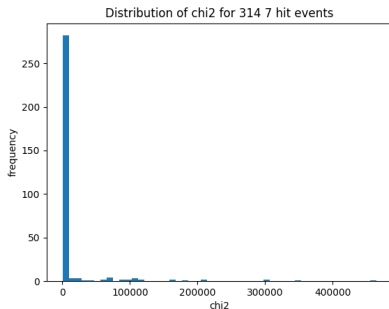$$\chi^2 = \sum_{i=0}^{6} \frac{\left(x_{i,\text{hit}} - x_{i,\text{track}}\right)^2}{\sigma_{i,\text{hit}}} \qquad \text{i = index of plane}$$

Goodness of Fit

$$\chi^2 = \sum_{i=0}^{6} \frac{\left(x_{i,\text{hit}} - x_{i,\text{track}}\right)^2}{\sigma_{i,\text{hit}}} \qquad \text{i = index of plane}$$

First look of χ^2:

Goodness of Fit

$$\chi^2 = \sum_{i=0}^{6} \frac{\left(x_{i,\text{hit}} - x_{i,\text{track}}\right)^2}{\sigma_{i,\text{hit}}} \qquad \text{i = index of plane}$$

First look of χ^2:
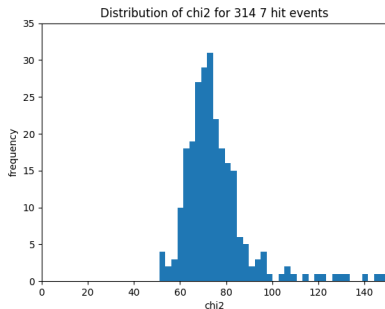
- Most of the hits are 1 or 2 pixel ($\sigma = 0.5$)
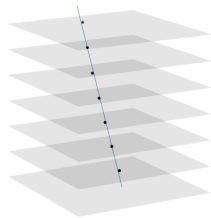- Assume same deviation for all planes

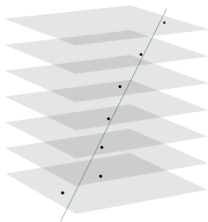$\chi^2 = 100 \rightarrow \sqrt{100/6 \cdot 0.5} < 3$ Pixel (90μm)

Goodness of Fit

$$\chi^2 = \sum_{i=0}^{6} \frac{\left(x_{i,\text{hit}} - x_{i,\text{track}}\right)^2}{\sigma_{i,\text{hit}}} \qquad i = \text{index of plane}$$
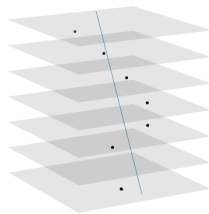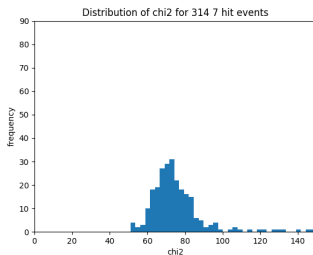
Second look of χ^2:

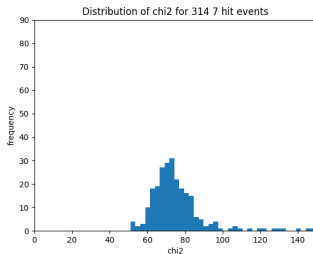$\chi^2 = 1459$ $\chi^2 = 112000$ $\chi^2 = 290252$

Taking a closer look at 5+ Events

Taking a closer look at 5+ Events
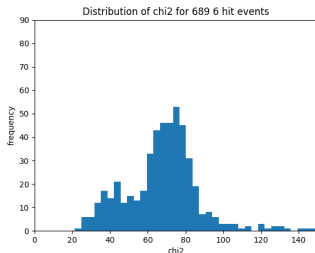
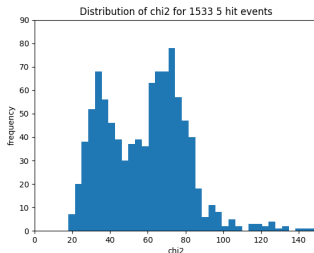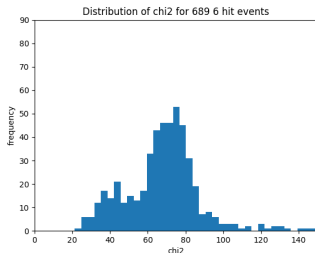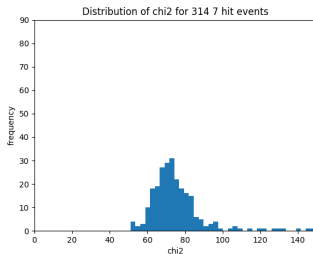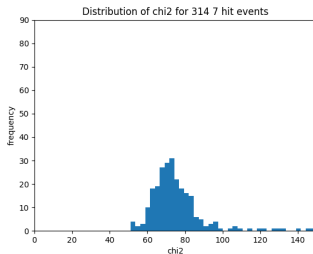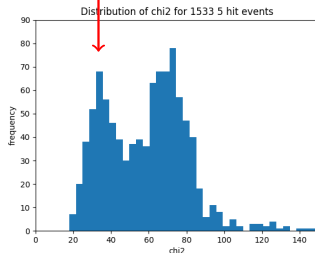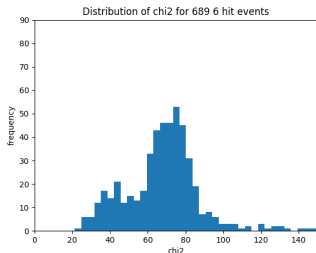# Taking a closer look at 5+ Events

Taking a closer look at 5+ Events

Where does this come from?

Second peak in χ^2-Distribution - What's going on?

Suspicion

One or more planes is misaligned more than the others, resulting in a 'higher' Fit-Accuracy for tracks, where that plane is missing

- To verify, look at tracks that have a specific χ^2 Value

Second peak in χ^2-Distribution - What's going on?

Suspicion

One or more planes is misaligned more than the others, resulting in a 'higher' Fit-Accuracy for tracks, where that plane is missing

- To verify, look at tracks that have a specific χ^2 Value

No hits on Plane 0 and 1

Second peak in χ^2-Distribution - What's going on?

Suspicion

One or more planes is misaligned more than the others, resulting in a 'higher' Fit-Accuracy for tracks, where that plane is missing
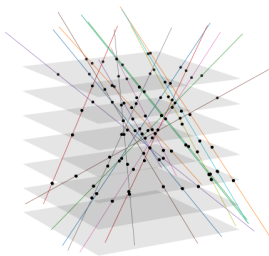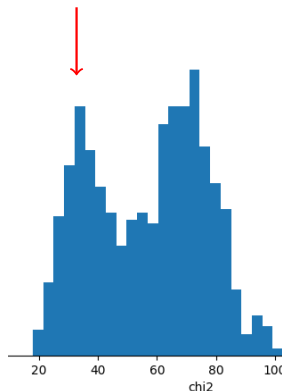
- To verify, look at tracks that have a specific χ^2 Value

No hits on Plane 5 and 6

Second peak in χ^2-Distribution - What's going on?

Suspicion

One or more planes is misaligned more than the others, resulting in a 'higher' Fit-Accuracy for tracks, where that plane is missing

- To verify, look at tracks that have a specific χ^2 Value
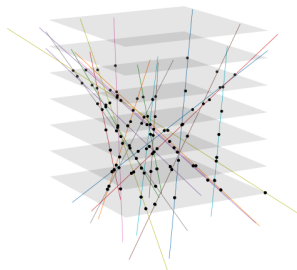

Need better alignment...

No hits on Plane 5 and 6