



Source Calibration for CYGNO_04



Number of events	Frequency	Frequency per unit area
1.5 million events	$\approx 557 \text{ Hz}$	$\approx 0.24 \text{ Hz/cm}^2$
1 M events	$\approx 561 \text{ Hz}$	$\approx 0.24 \text{ Hz/cm}^2$

Source position: (25, 57.5, 0) cm

The simulation was conducted for varying numbers of events to validate the interaction rate. The results for 1.5 million and 1 million events, as presented above, confirm a frequency of approximately 560 Hz.

The next objective is to reduce the frequency to the tens of hertz range (by adjusting the position of source and sizes of the PMMA window and holes in the copper shield, as recommended in the last simulation meeting.

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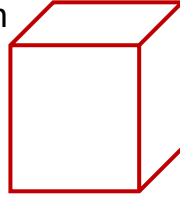
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CYGNO
Experiment

The inner copper shield (with 14 holes) within the rest of the geometry.

4.5mm

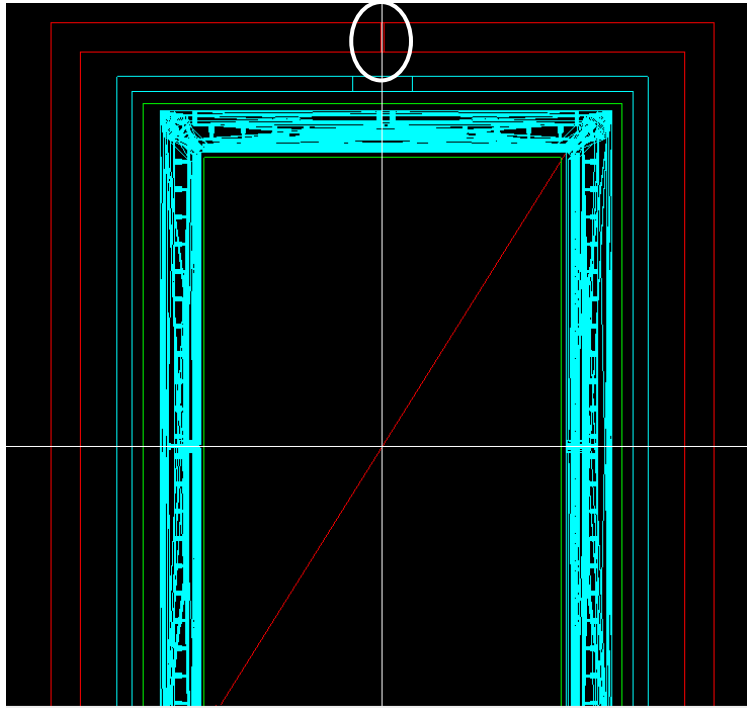


4.5mm

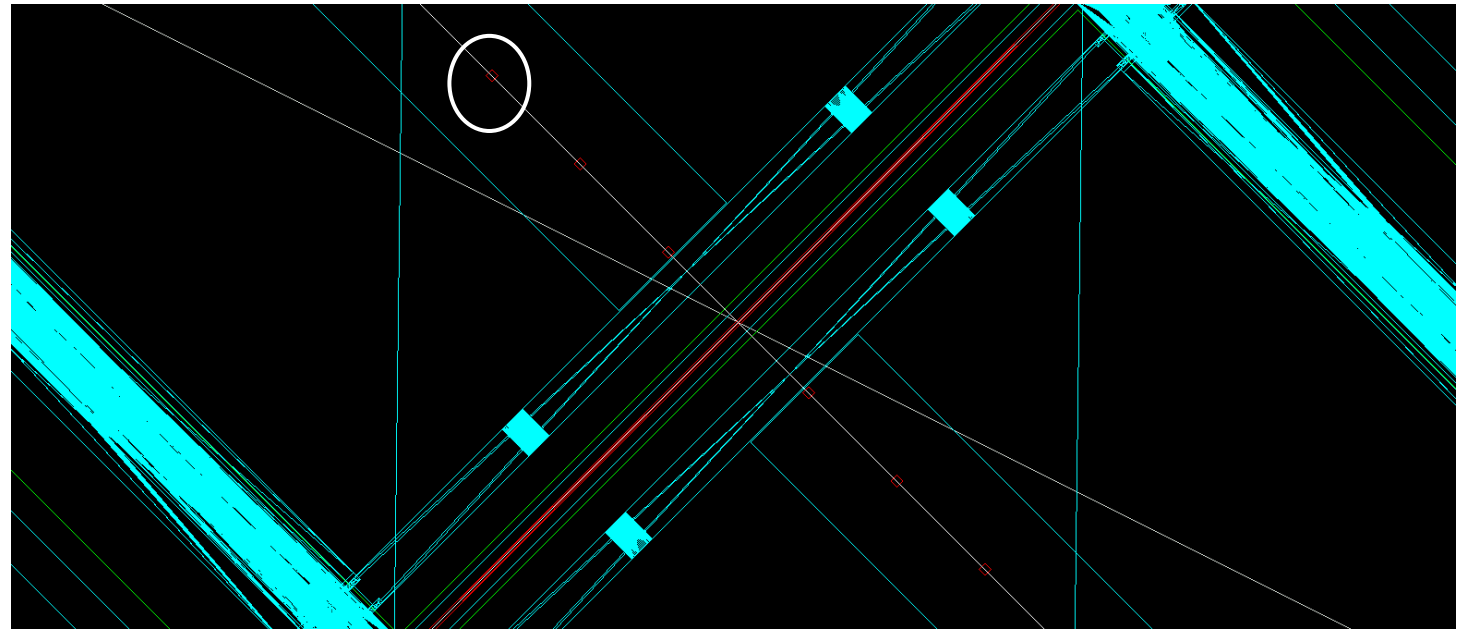
40 mm same as cu thickness

Hole size along z axis is reduced to 4.5 mm from 14.5 mm

Distance between two consecutive holes is 65.5 mm



Front view



Top view



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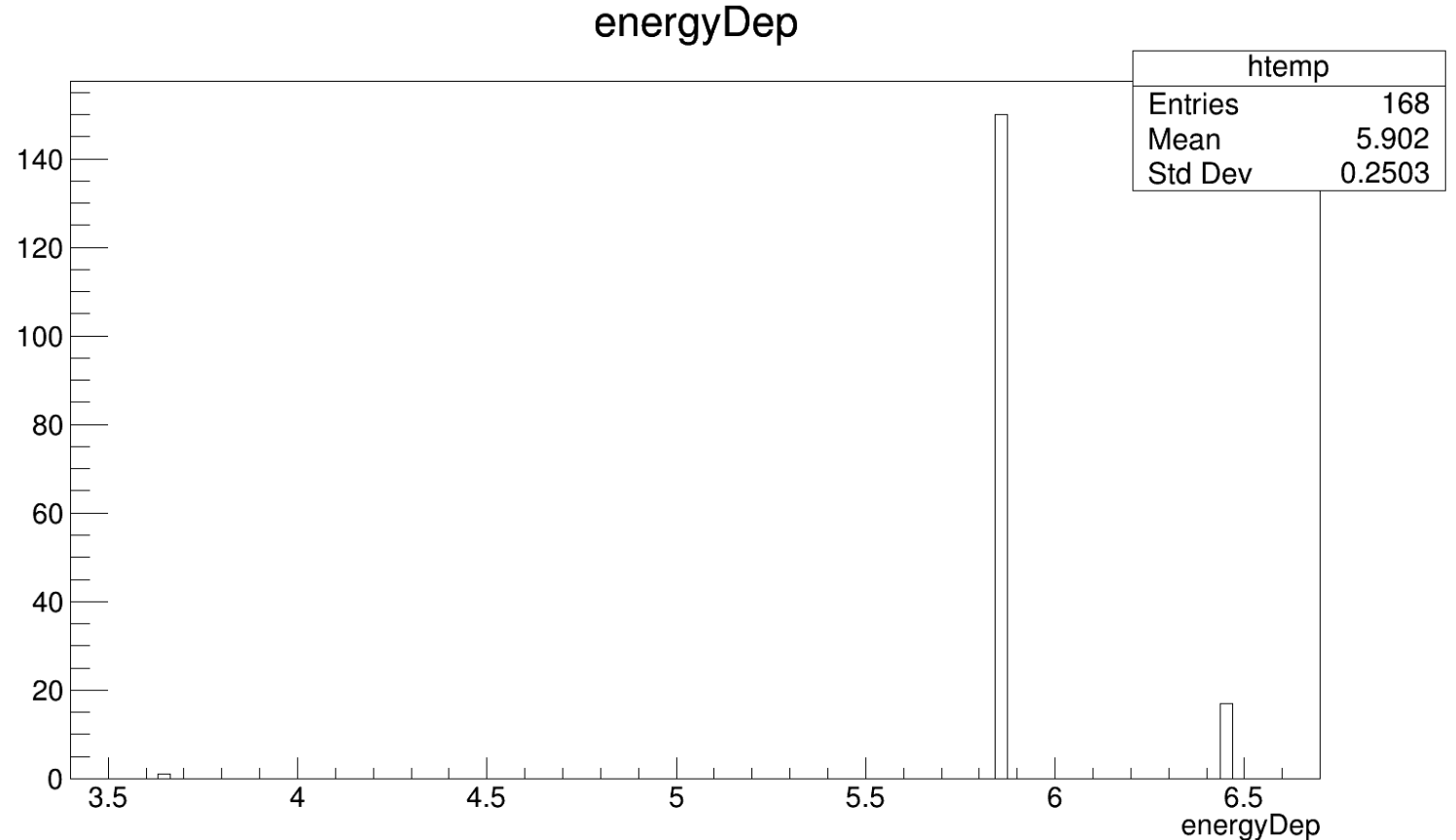
Total Events: 1.5 million
Number of entries: 168

Real-time equivalent for 1.5 million decays:
 $1.5 \times 10^6 / 1.5 \times 10^6 \approx 1$ second

Interaction frequency:
168 interactions in sec = 168 Hz

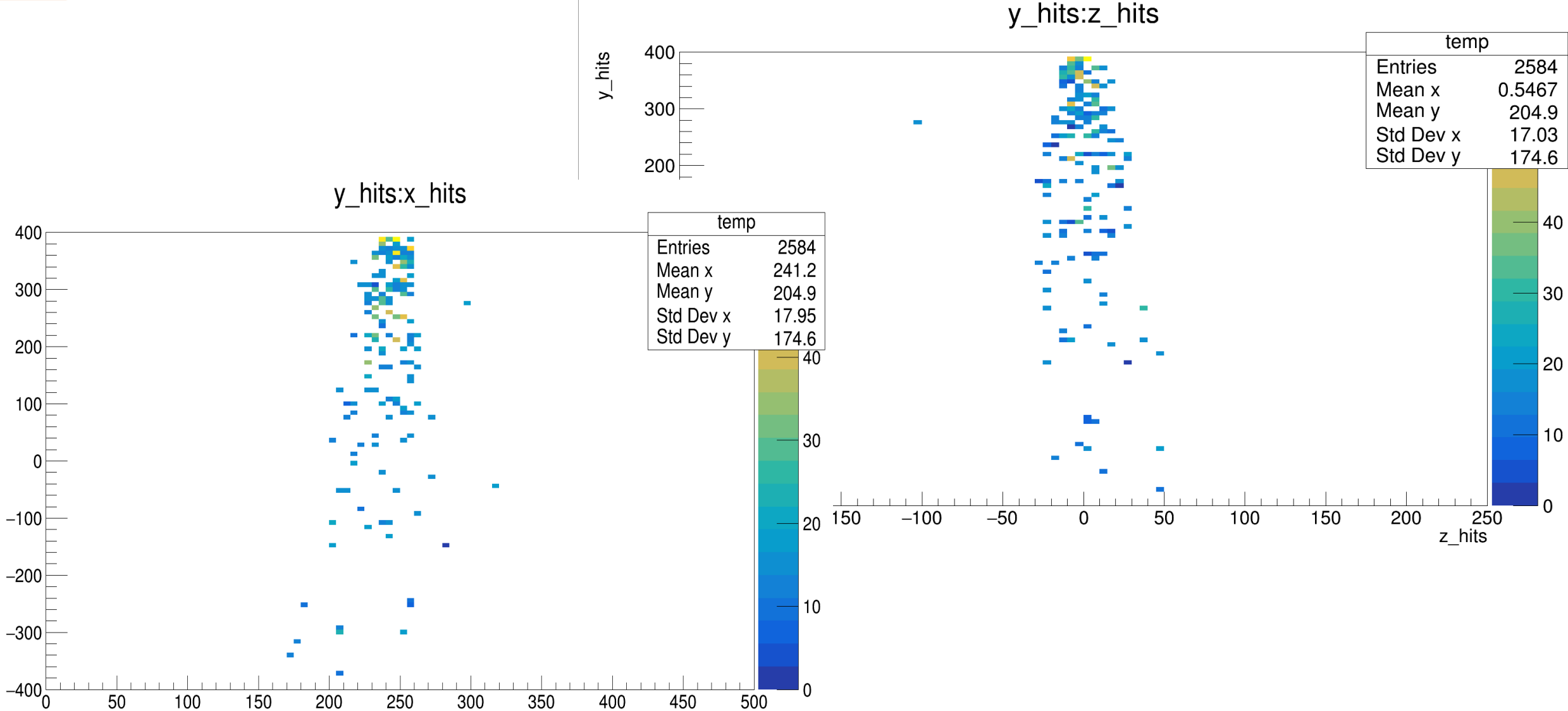
Area of PMMA window = $8 \times 40.2 = 321.6 \text{ cm}^2$
For 168 Hz over 321.6 cm^2 , the rate per unit area is:
 $168 \text{ Hz} / 321.6 \text{ cm}^2 \approx 0.52 \text{ Hz/cm}^2$

Area of sensitive vol = xz plane = $47 \times 48.4 = 2274.8 \text{ cm}^2$
For 168 Hz over an area of 2274.8 cm^2 , the rate per unit area is:
 $168 \text{ Hz} / 2274.8 \text{ cm}^2 \approx 0.073 \text{ Hz/cm}^2$



The histogram shows a strong peak at $\sim 5.9 \text{ keV}$ (mean $\sim 5.91 \text{ keV}$, std. dev. $\sim 0.308 \text{ keV}$), which is the characteristic X-ray from Fe55.

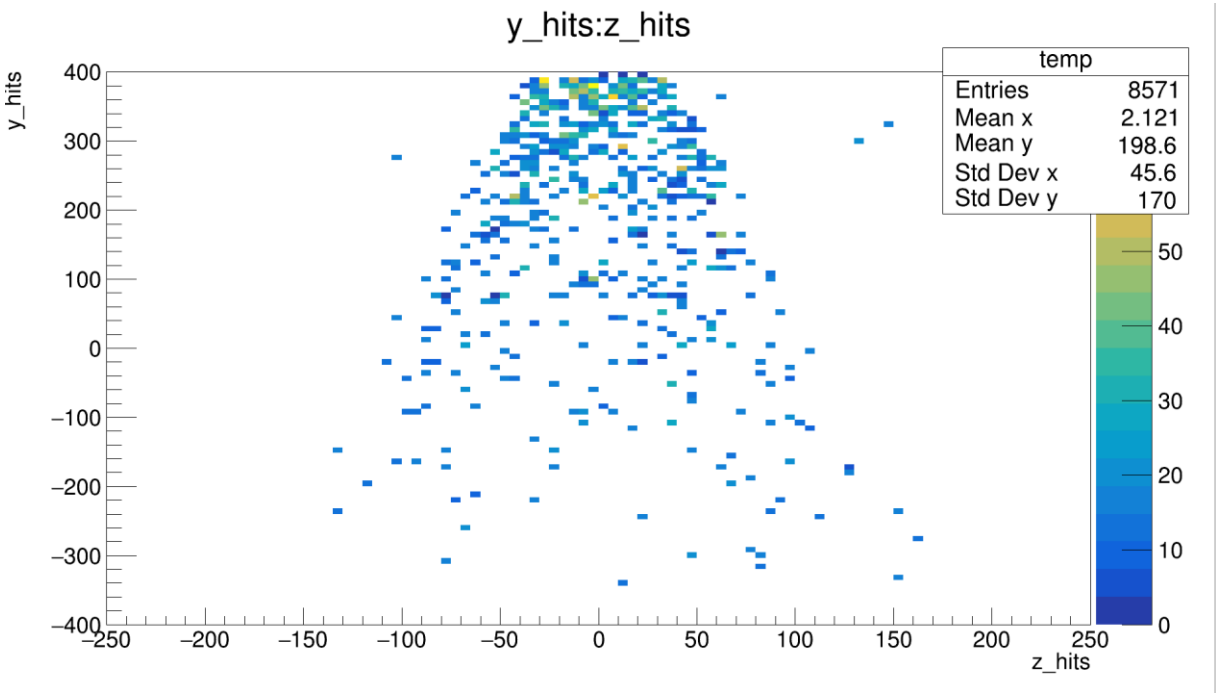
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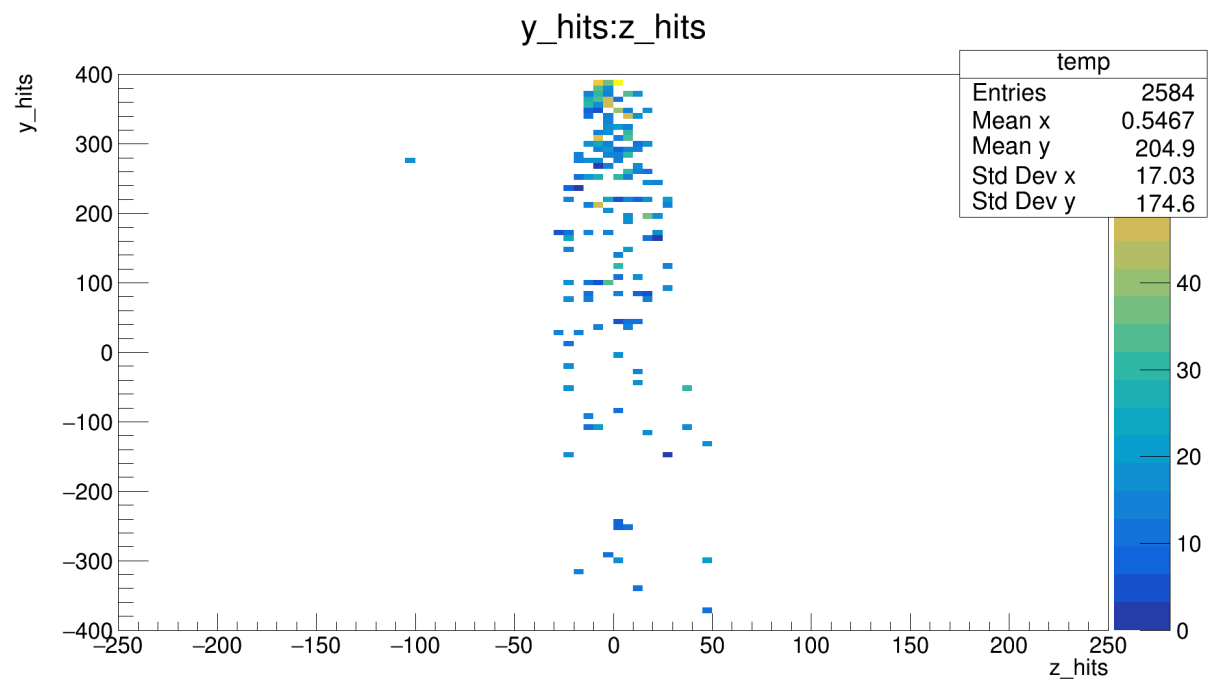
Source Calibration for CYGNO_04



Hole size	Frequency for 1.5 million events (approx.)	Frequency for 1 million events (approx.)
4.5 mm x 40 mm x 14.5 mm	557 Hz	561 Hz
4.5 mm x 40 mm x 4.5 mm	168 Hz	170 Hz



4.5 mm x 40 mm x 14.5 mm

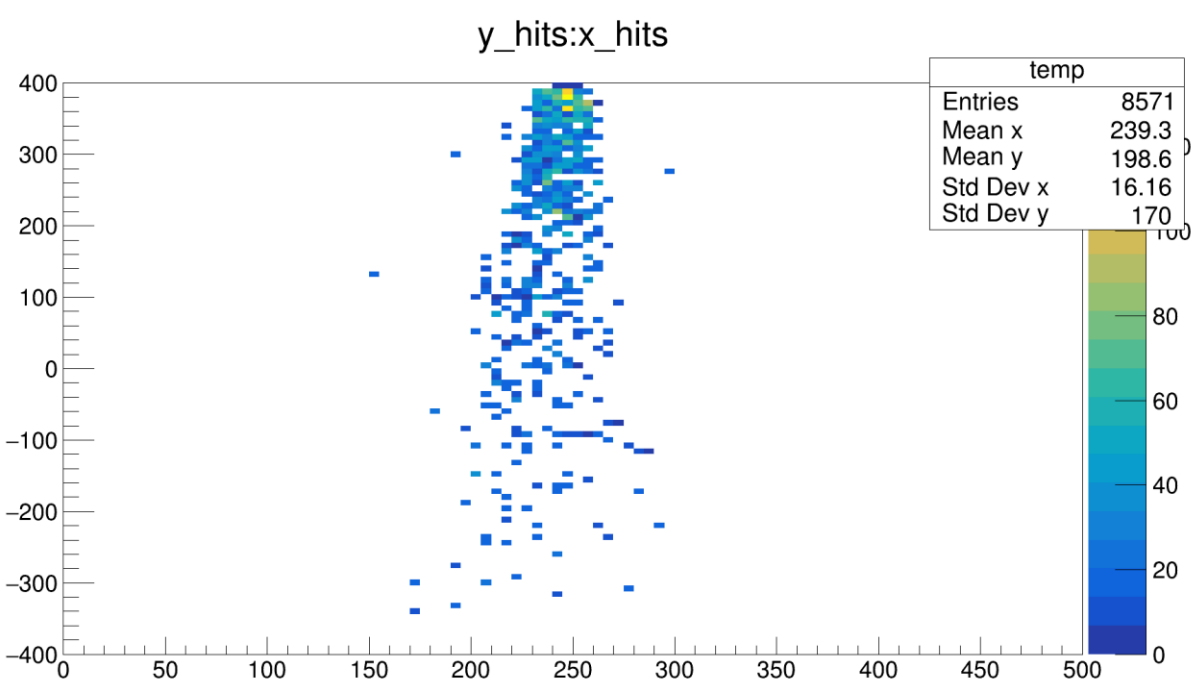


4.5 mm x 40 mm x 4.5 mm

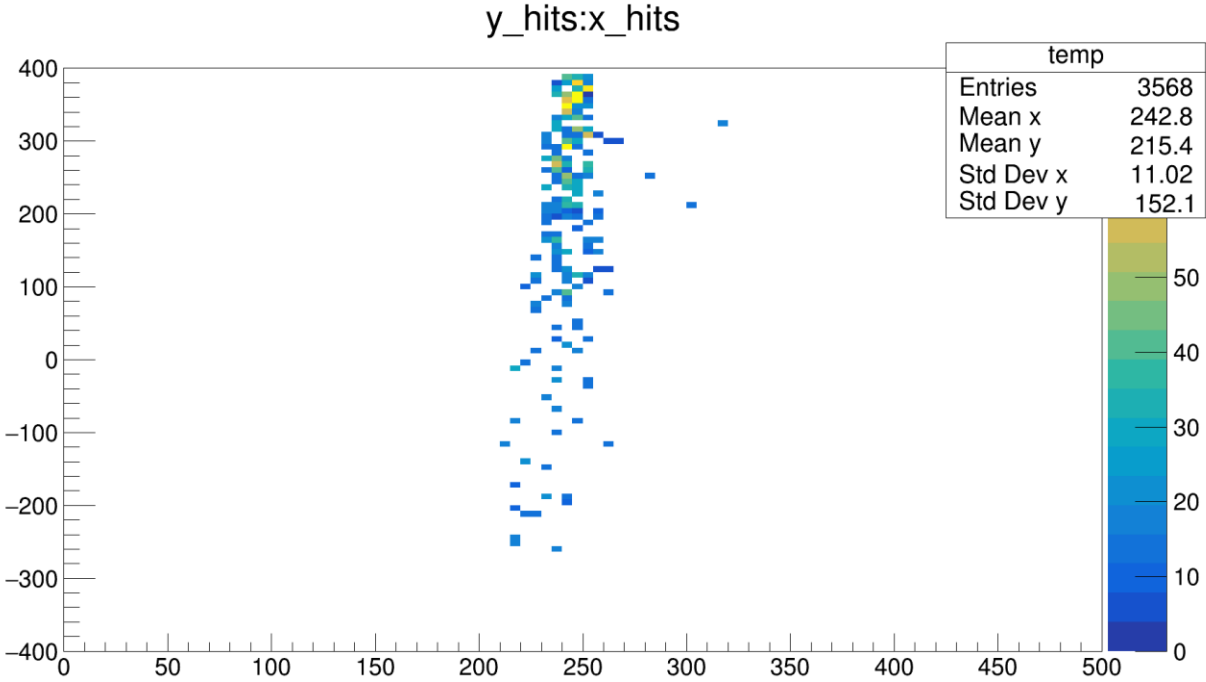
Source Calibration for CYGNO_04



Hole size	Frequency for 1.5 million events (approx.)	Frequency for 1 million events (approx.)
4.5 mm x 40 mm x 14.5 mm	557 Hz	561 Hz
4.5 mm x 40 mm x 4.5 mm	168 Hz	170 Hz
2.5 mm x 40 mm x 14.5 mm	238 Hz	234 Hz



4.5 mm x 40 mm x 14.5 mm



2.5 mm x 40 mm x 14.5 mm