

# Overview of GstLAL Likelihood and Background calculation in the ER5 release

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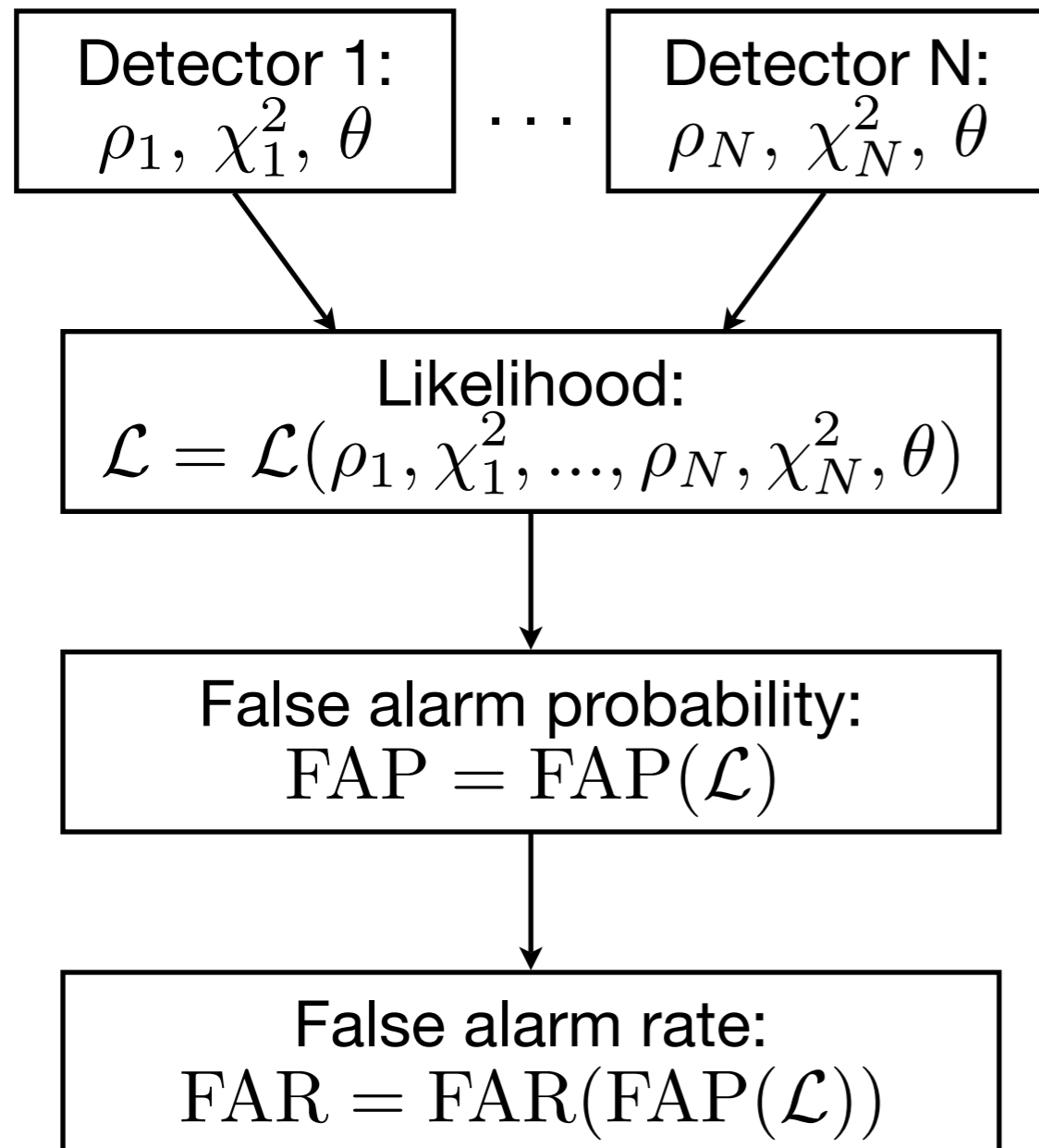
# Barebones GstLAL Algorithm

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- The detection statistics are:
  - Signal-to-noise ratio ( $\rho$ )
  - Chi-squared ( $\chi^2$ )
- Single detector trigger threshold:  $\rho = 4$
- Triggers grouped together as coincident or non-coincident
  - Coincident triggers - candidate signals
  - Non-coincident triggers - background

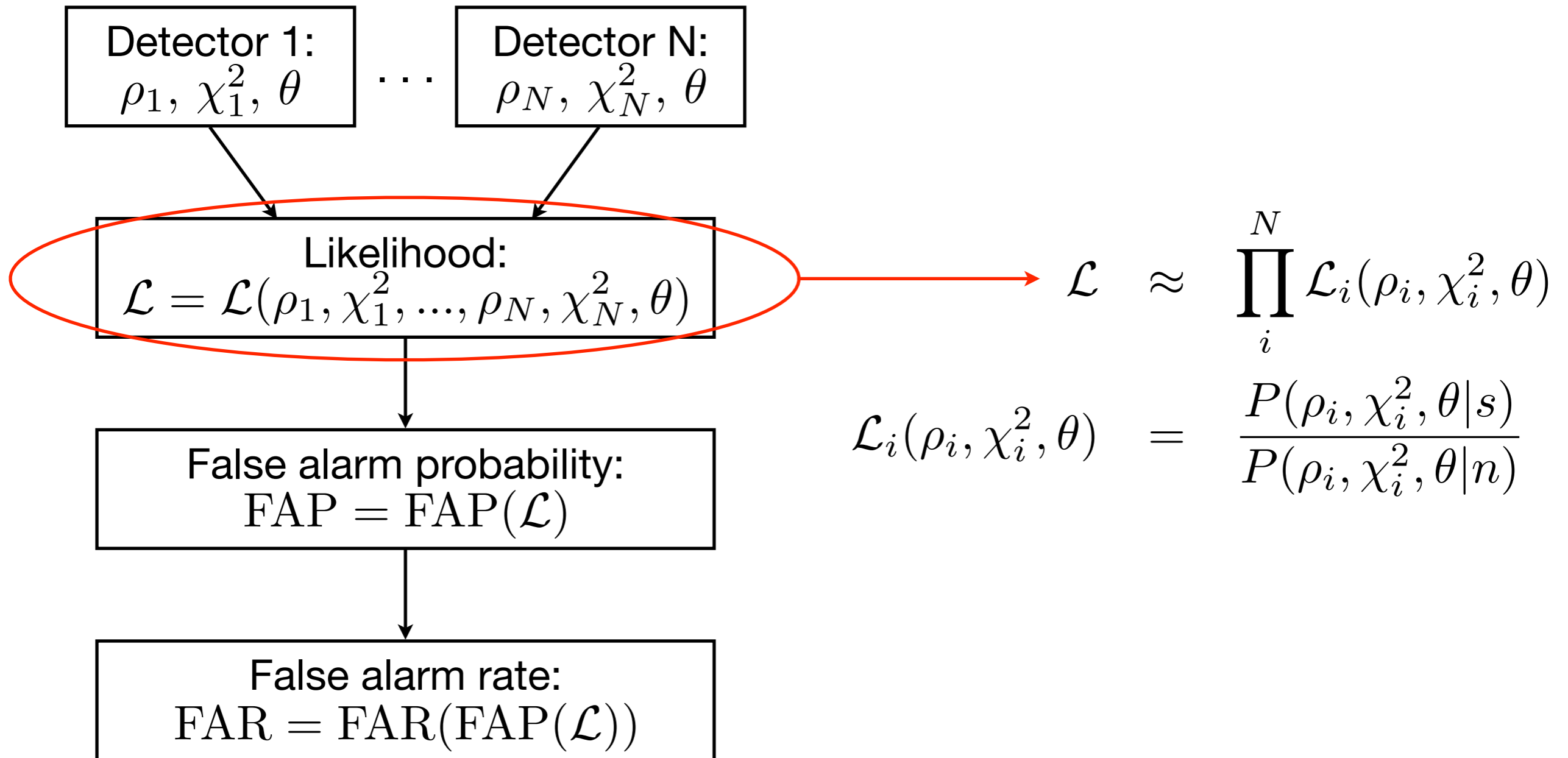
# For a trigger coincident in N detectors...

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# Single-detector Likelihood: Gaussian Noise Ex.

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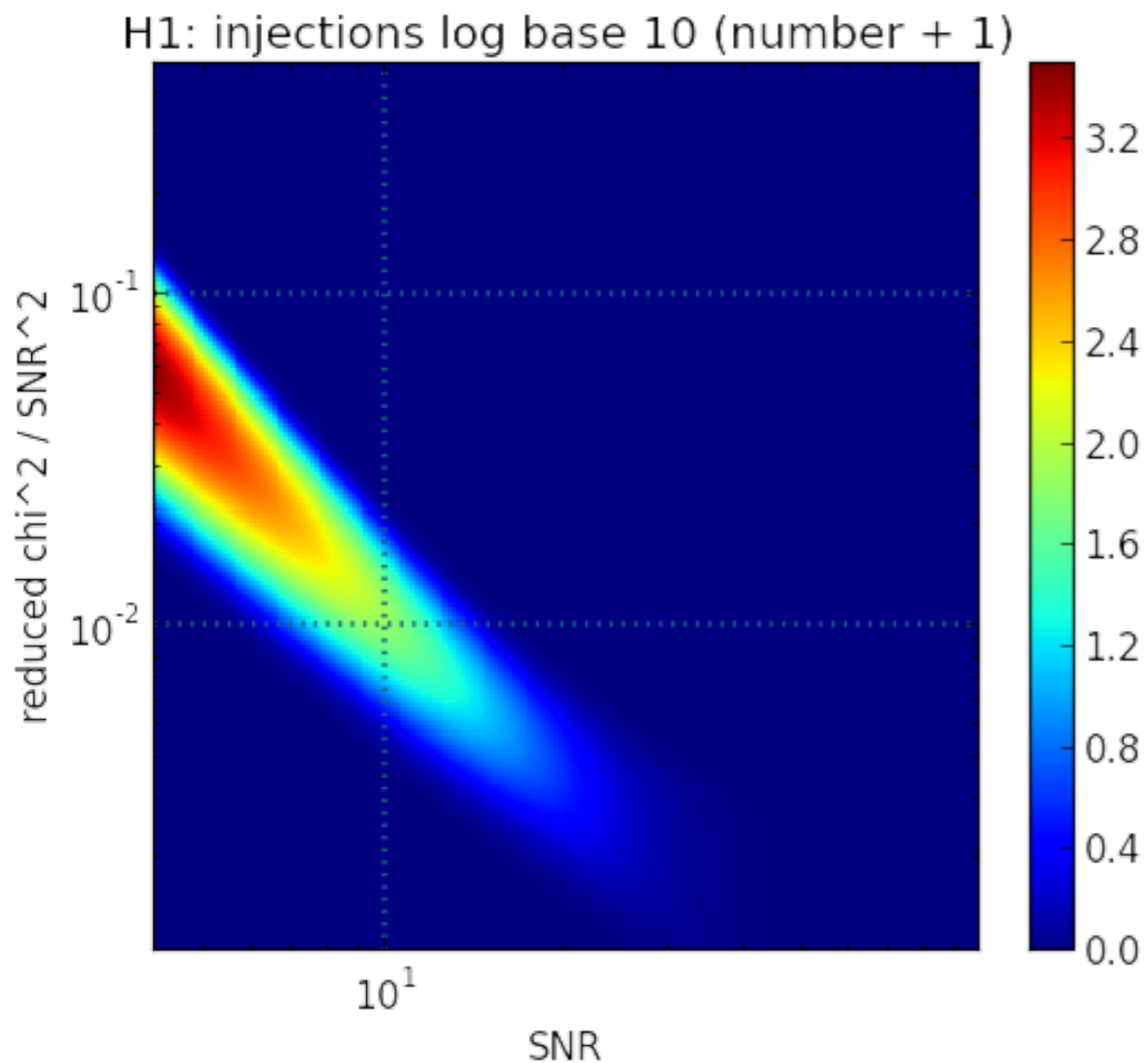
$$\mathcal{L}_{H1} = P(\rho_{H1}, \chi_{H1}^2, \theta | s) / P(\rho_{H1}, \chi_{H1}^2, \theta | n)$$

# Single-detector Likelihood: Gaussian Noise Ex.

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analytic expression

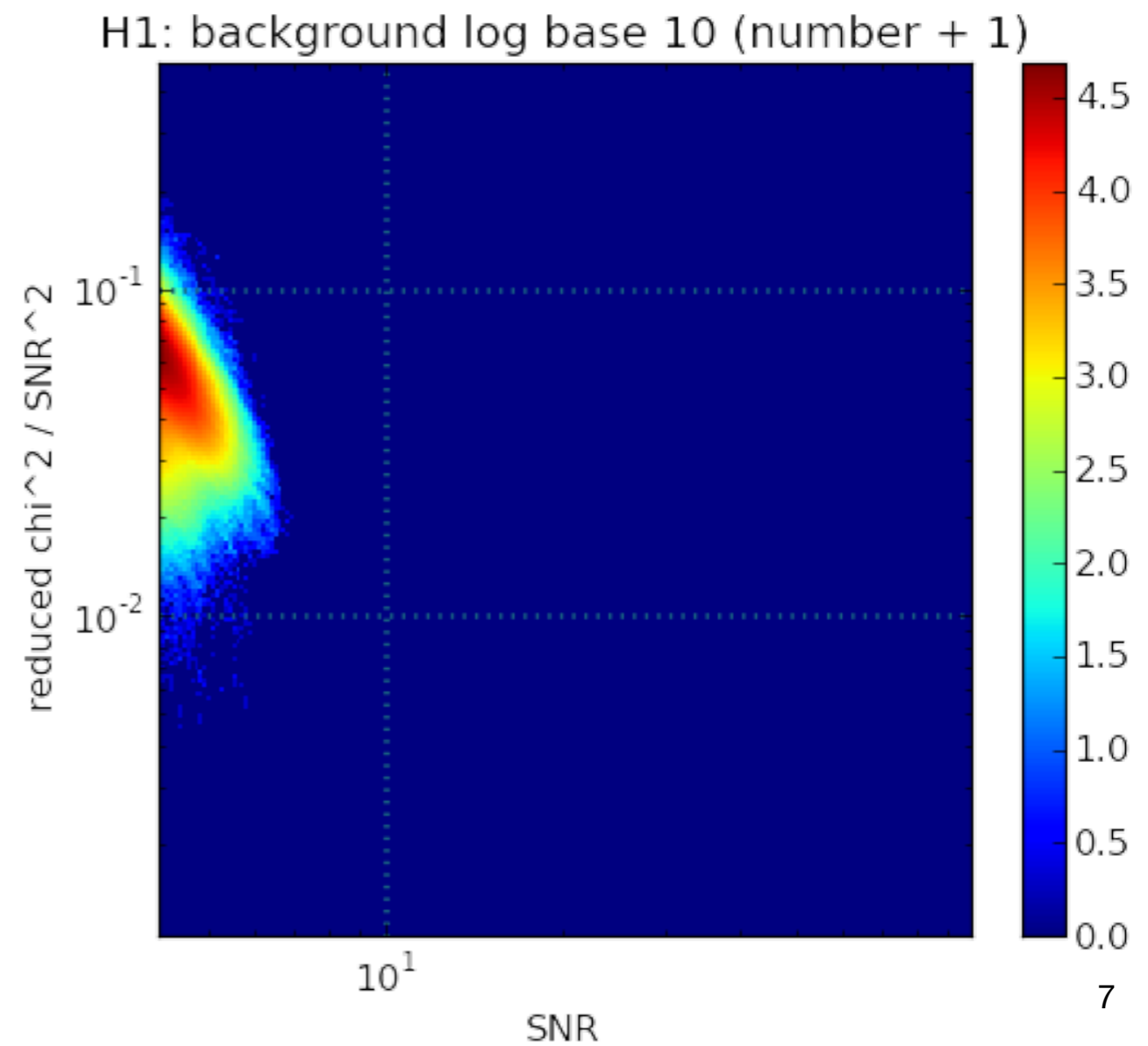
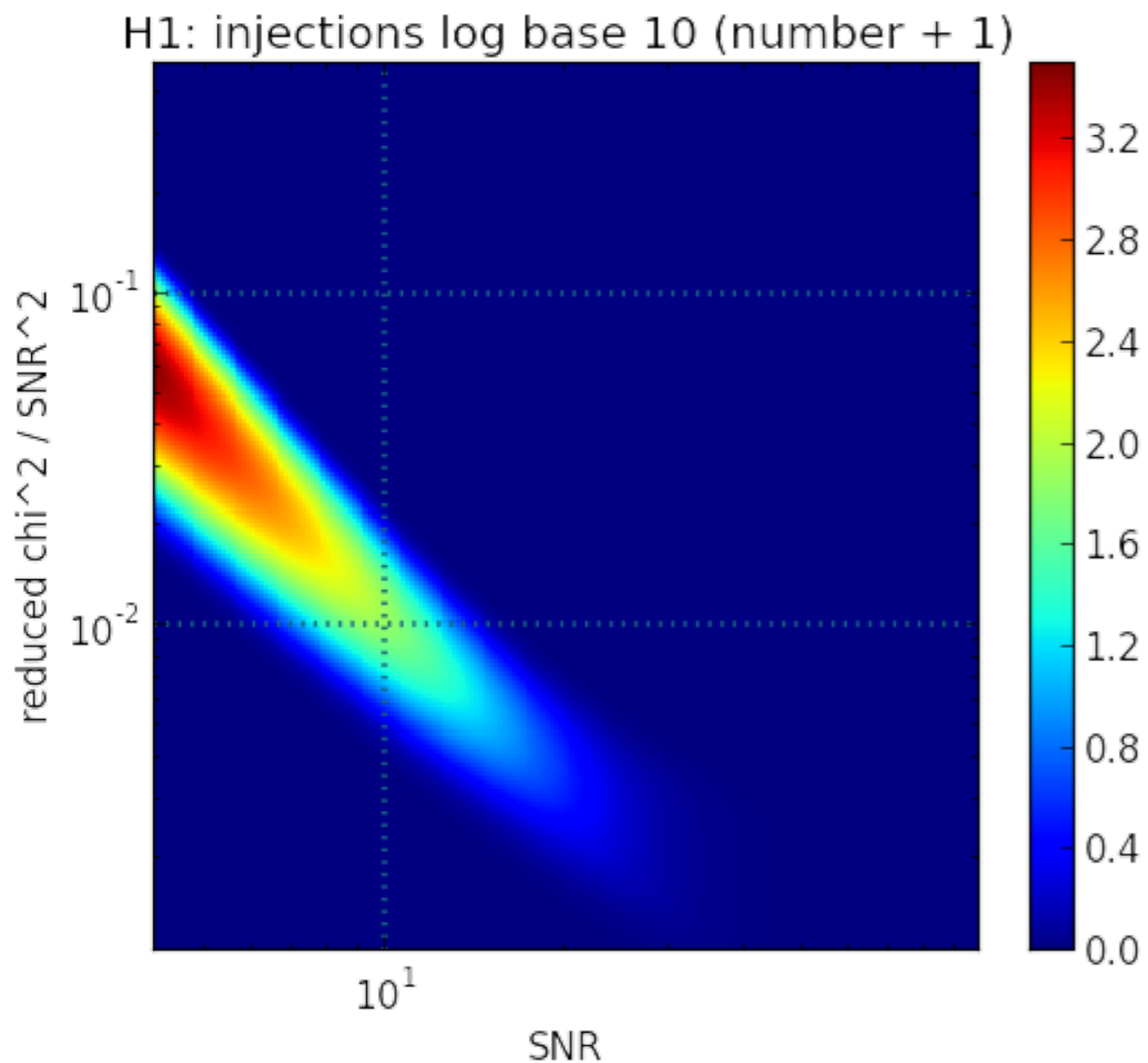


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analytic expression

histogram non-coincident triggers

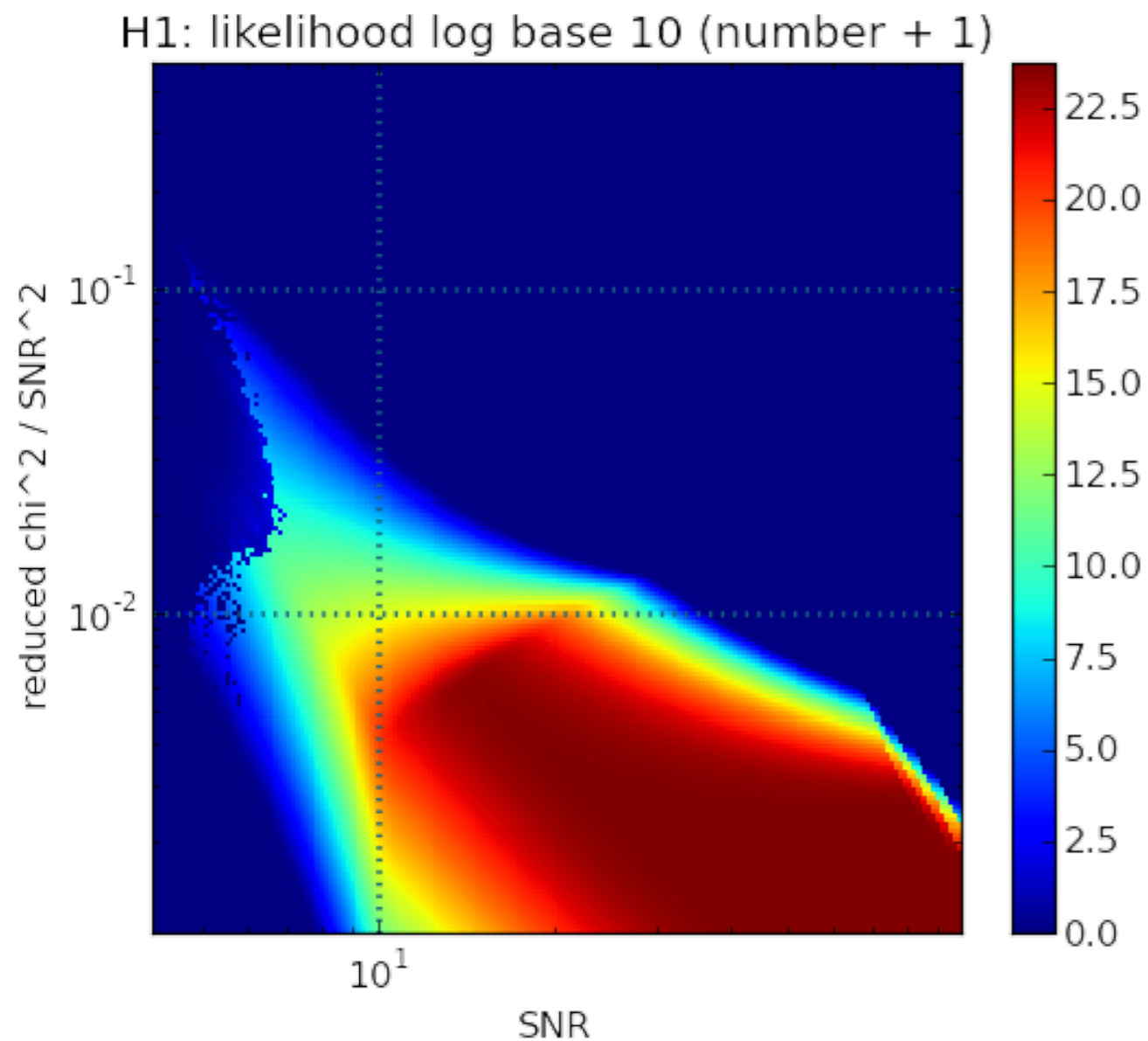


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raw histograms



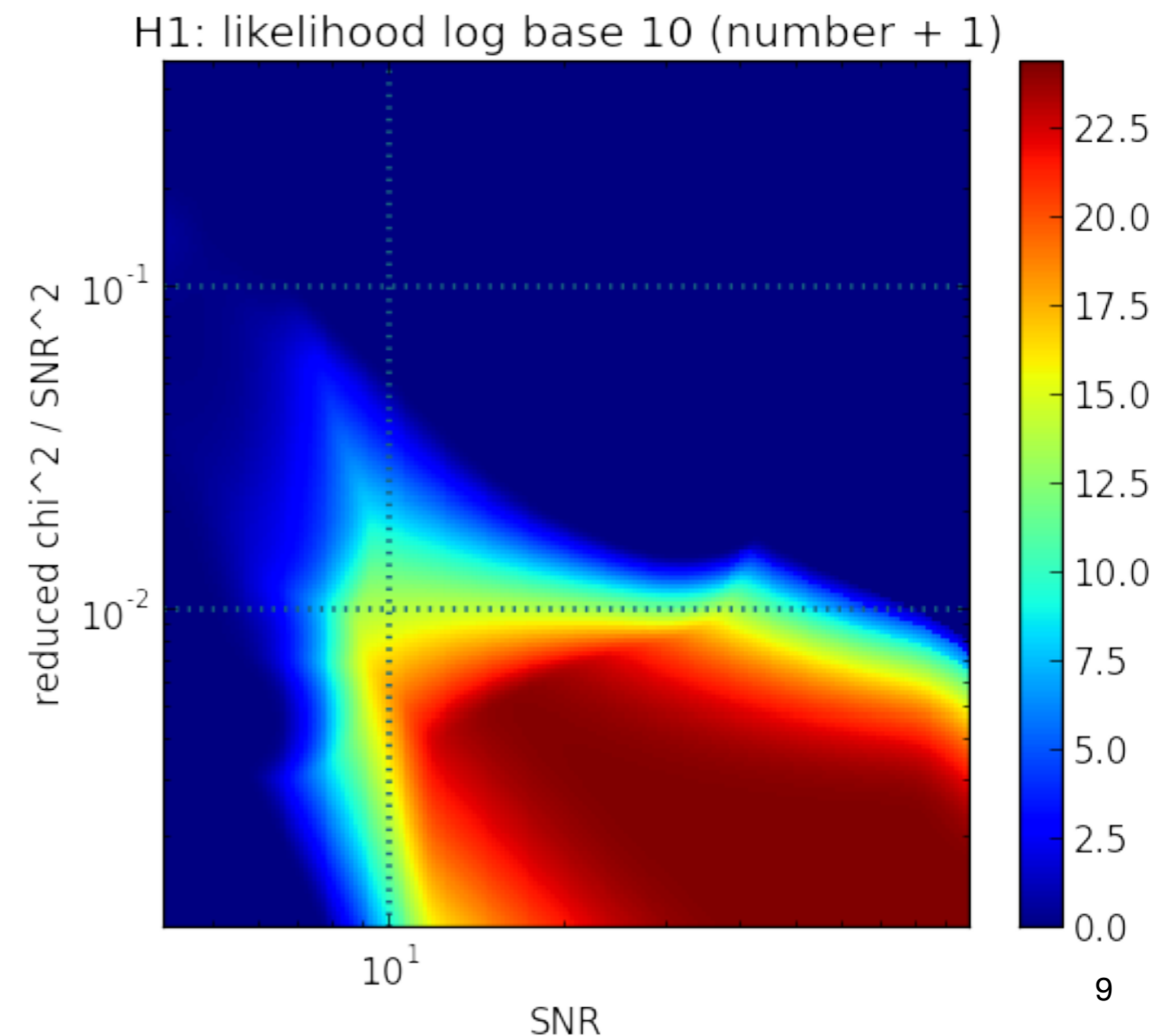
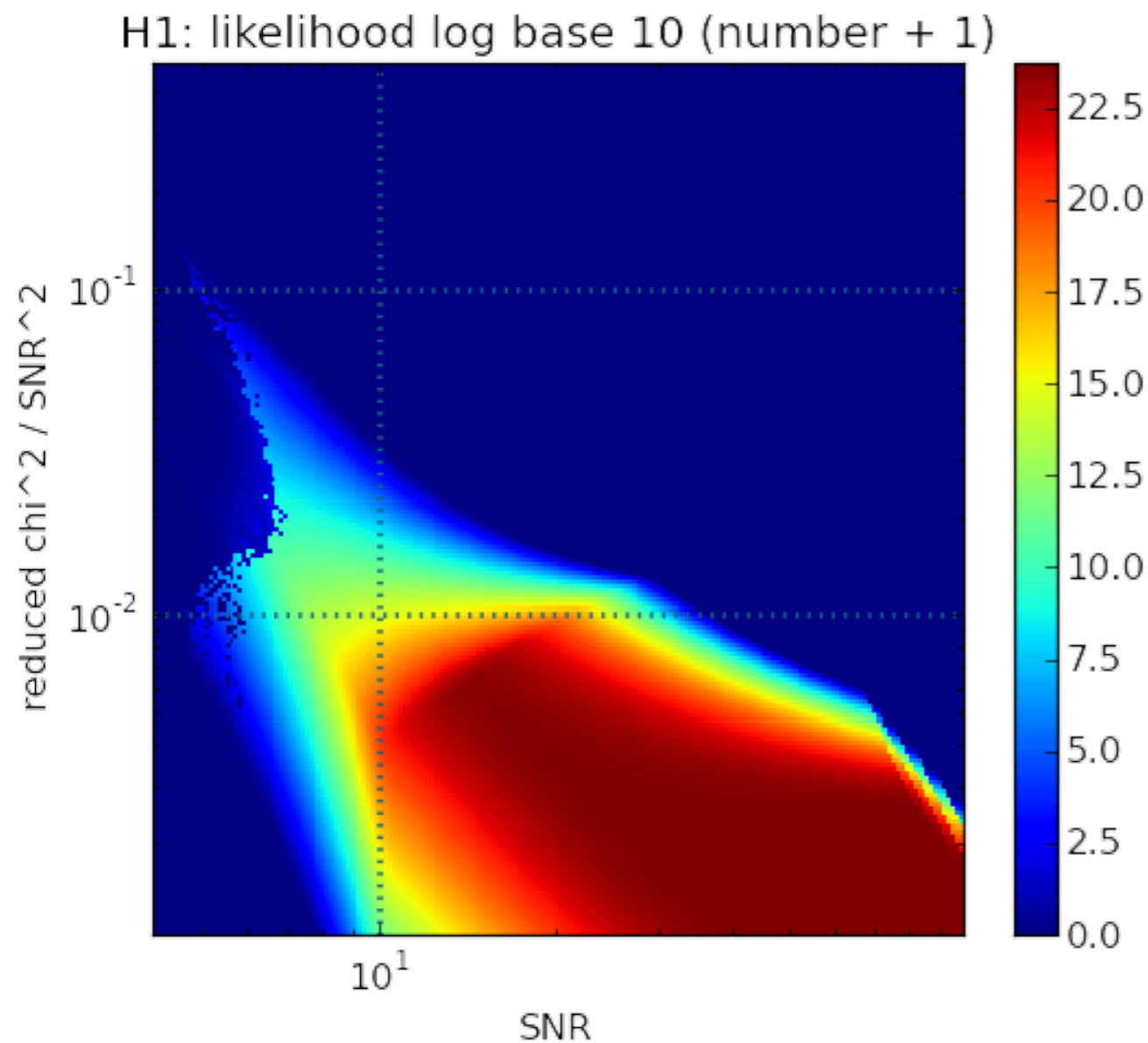


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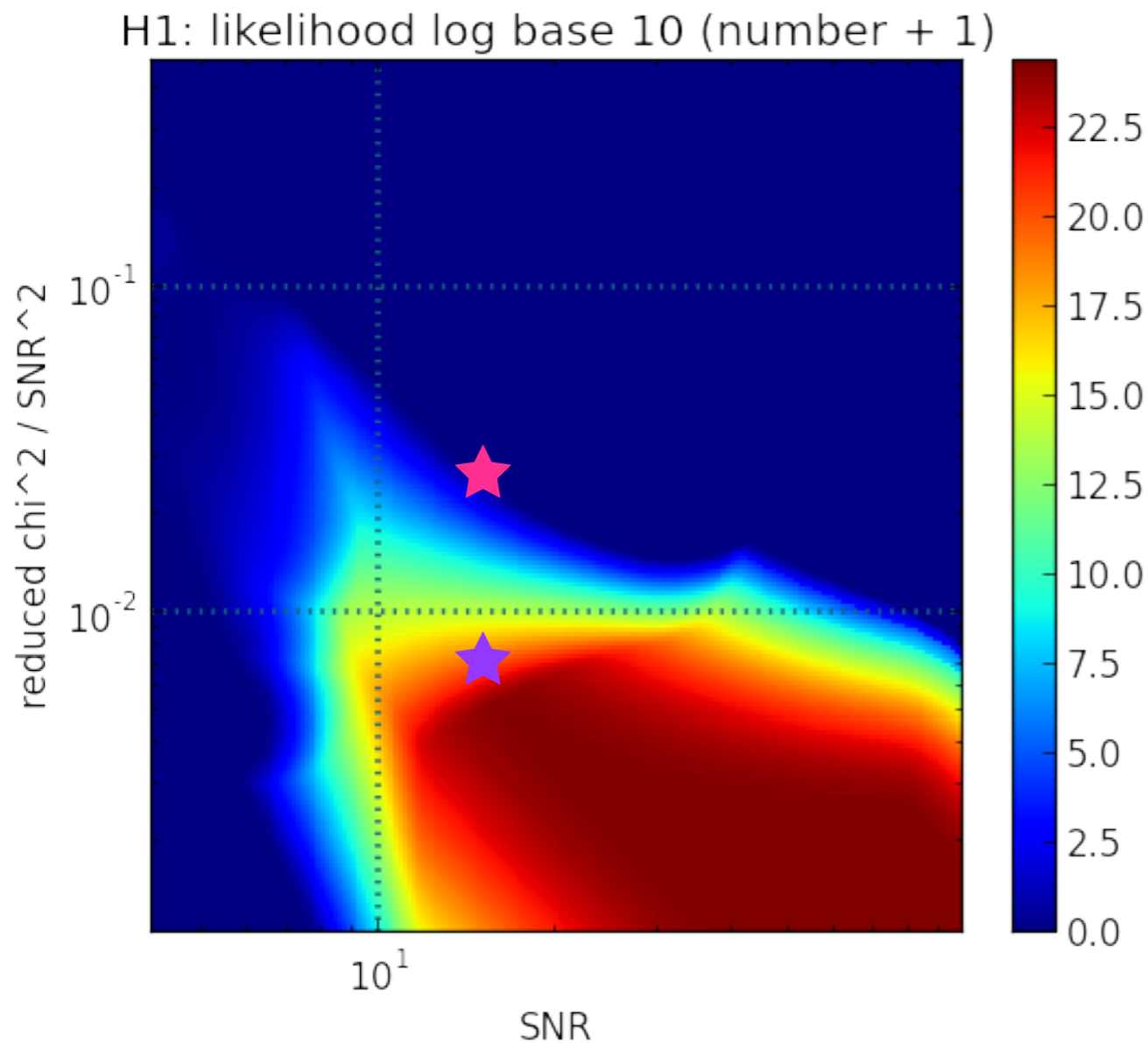
PDF estimates



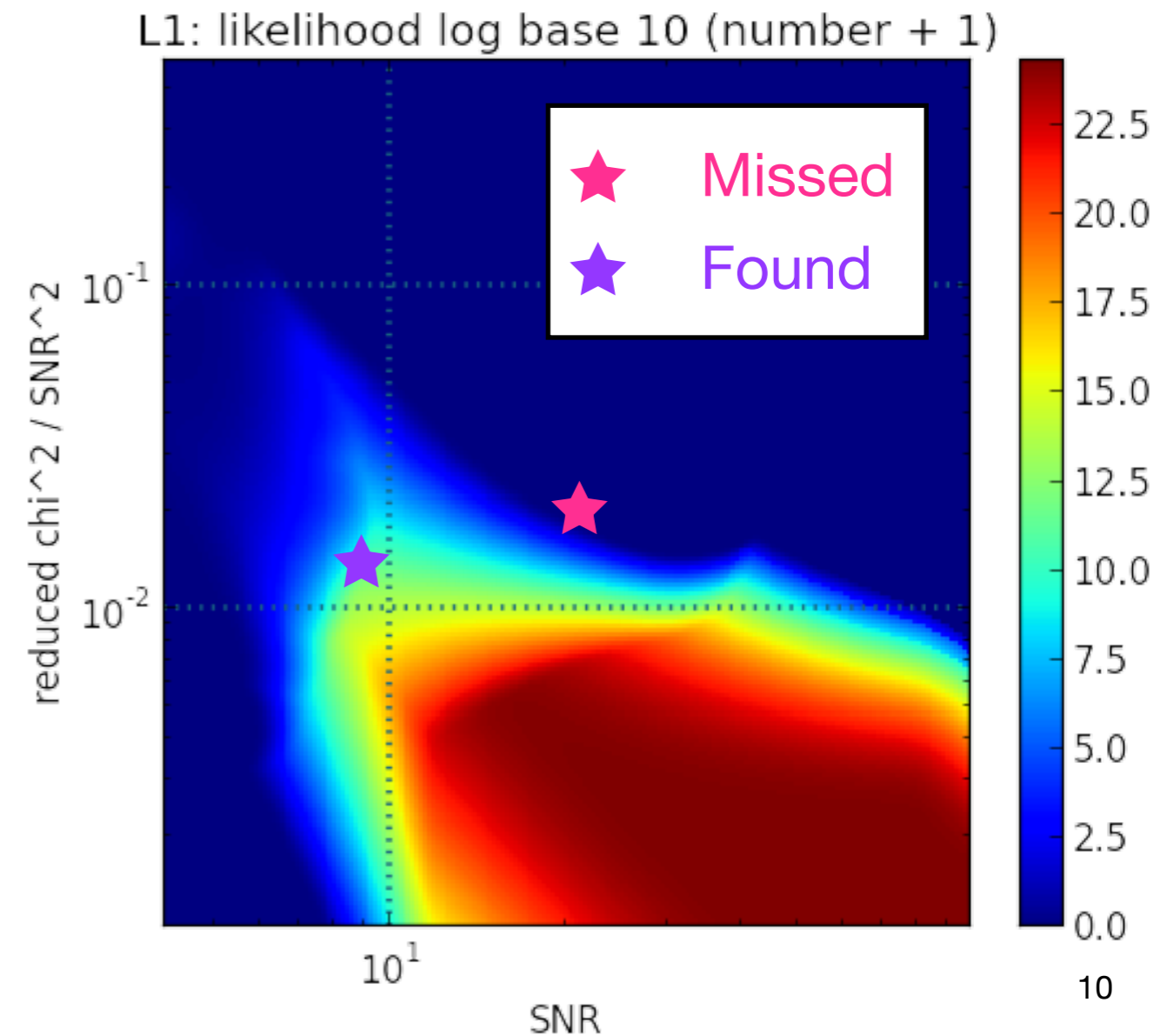
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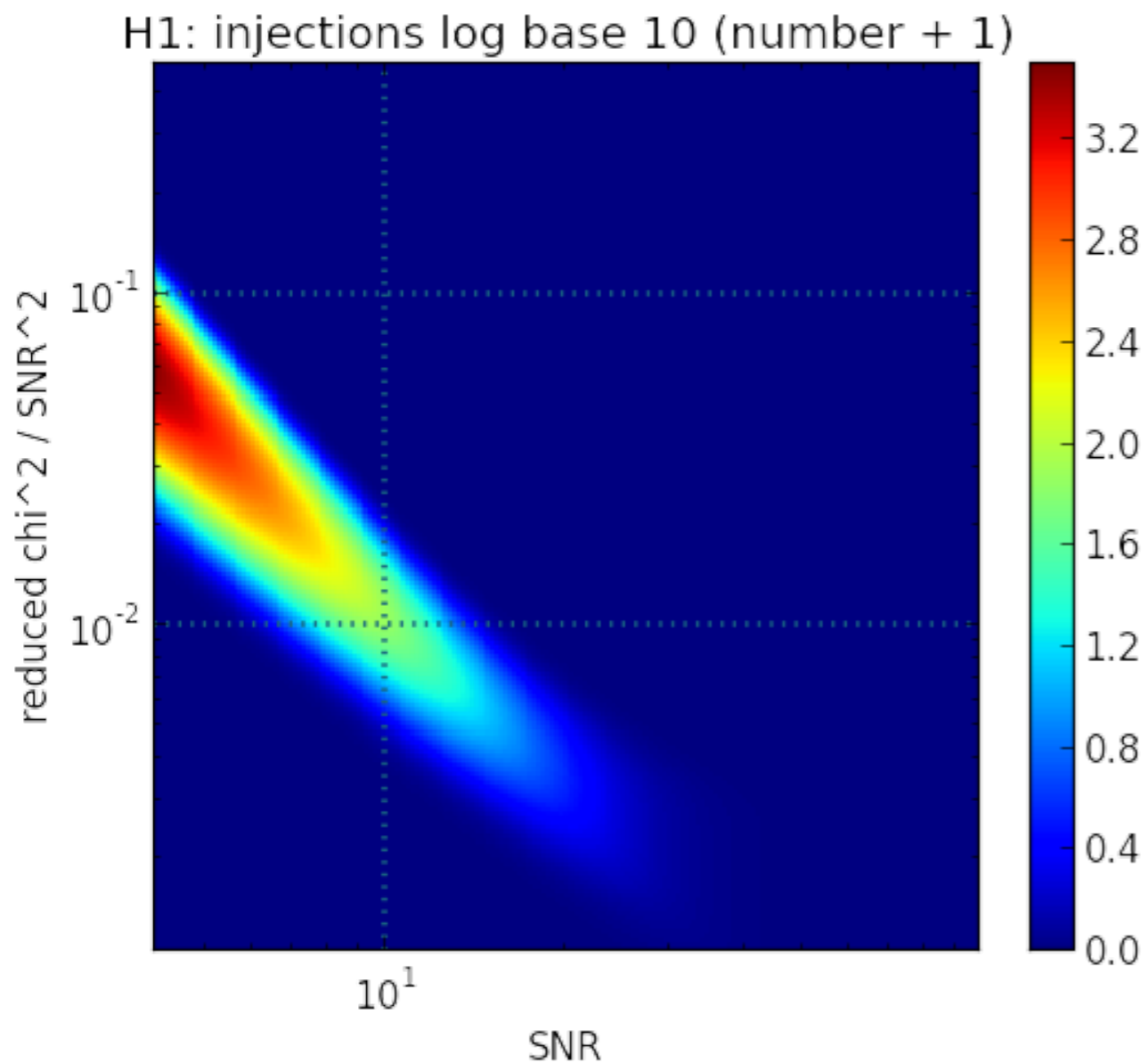


# Single-detector Likelihood: Recolored Noise Ex.

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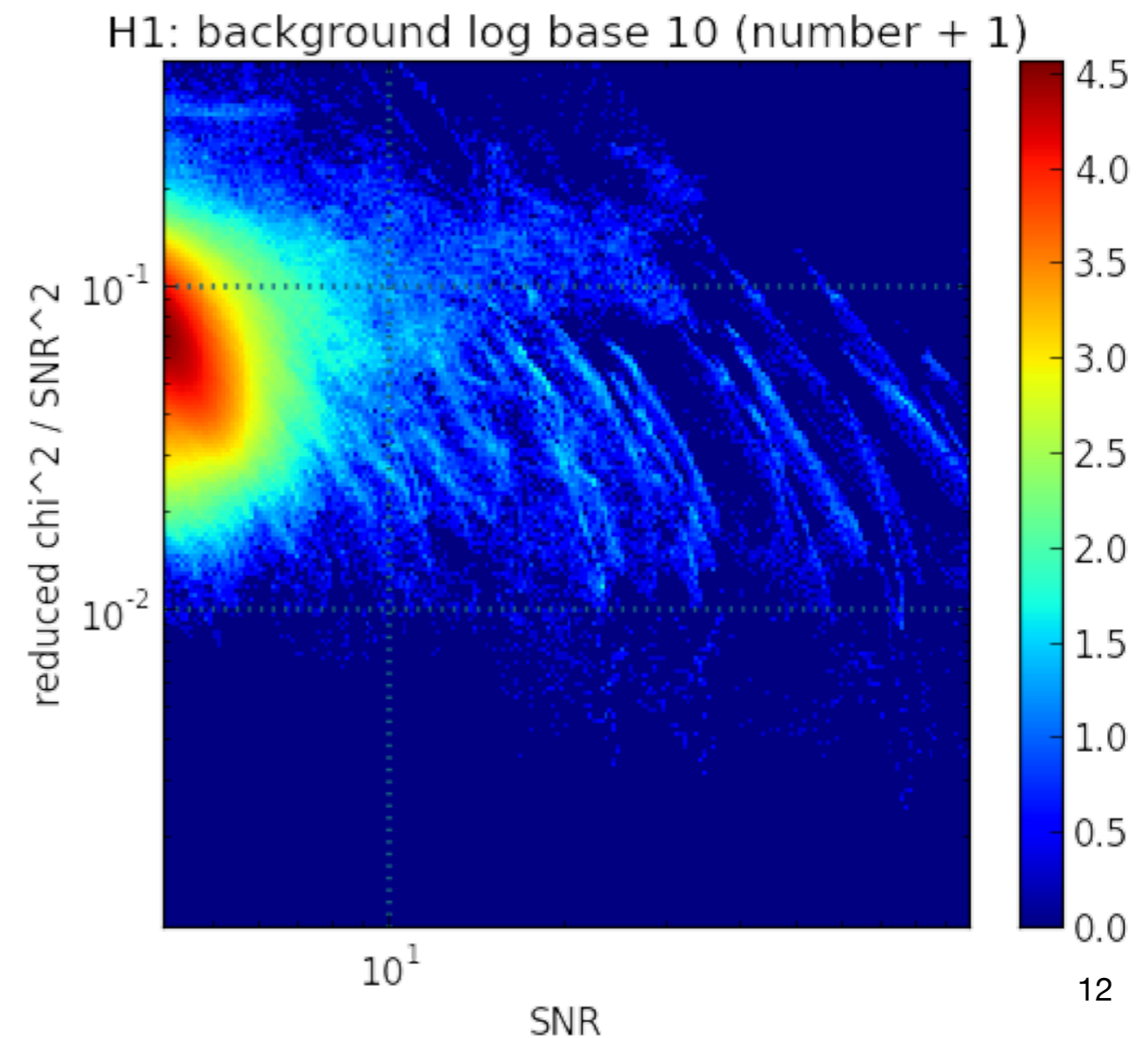
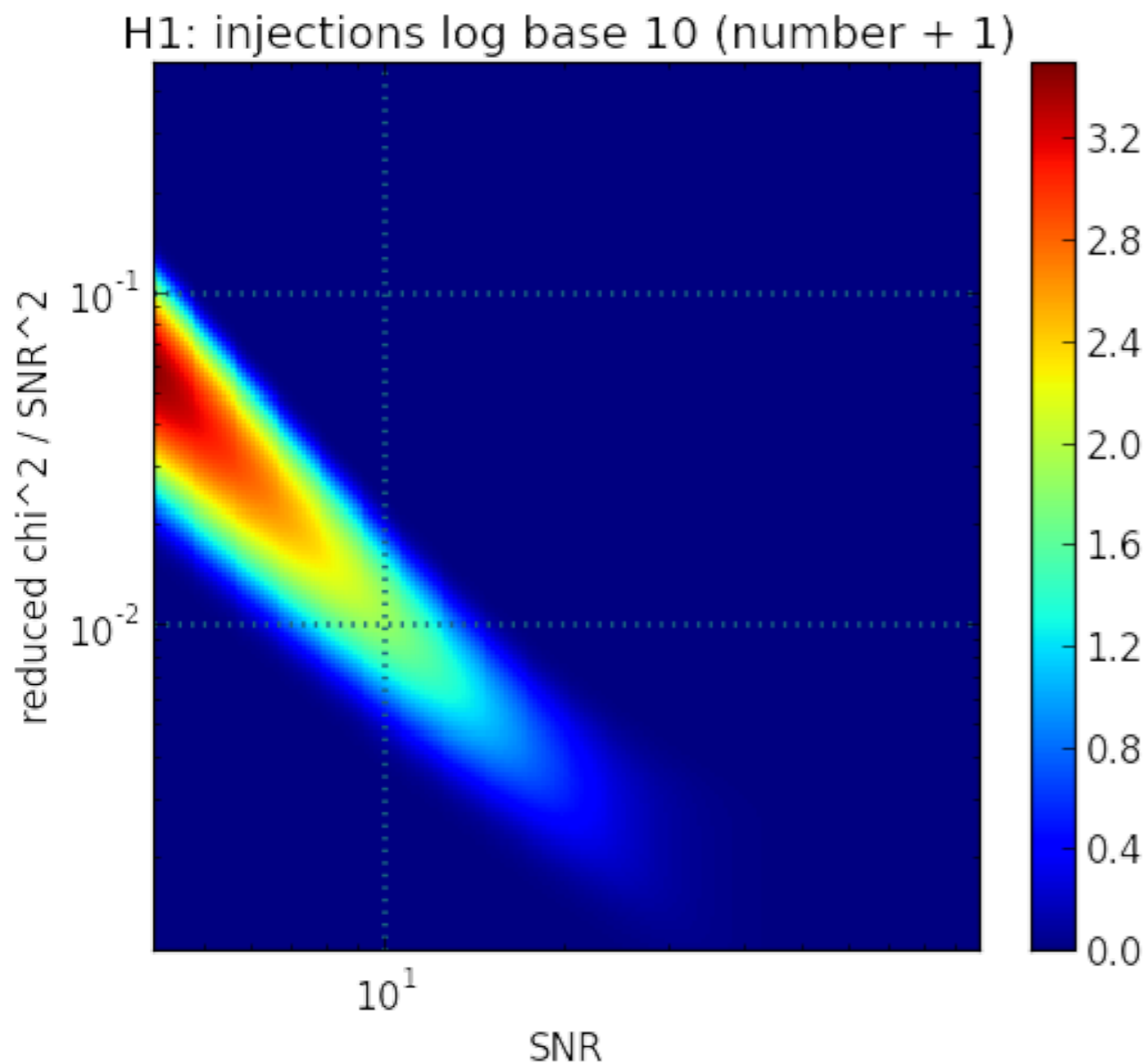


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histogram non-coincident triggers

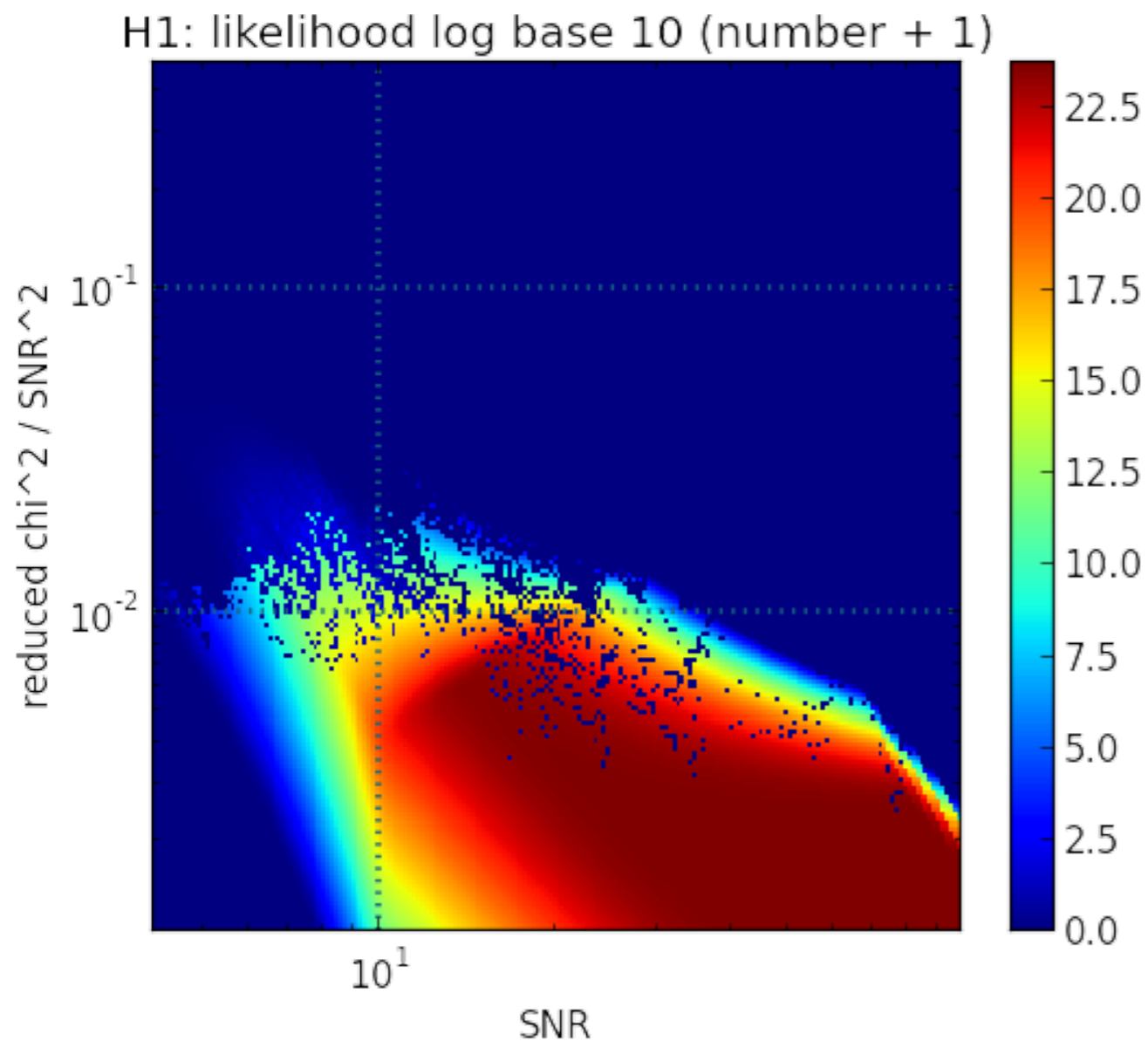


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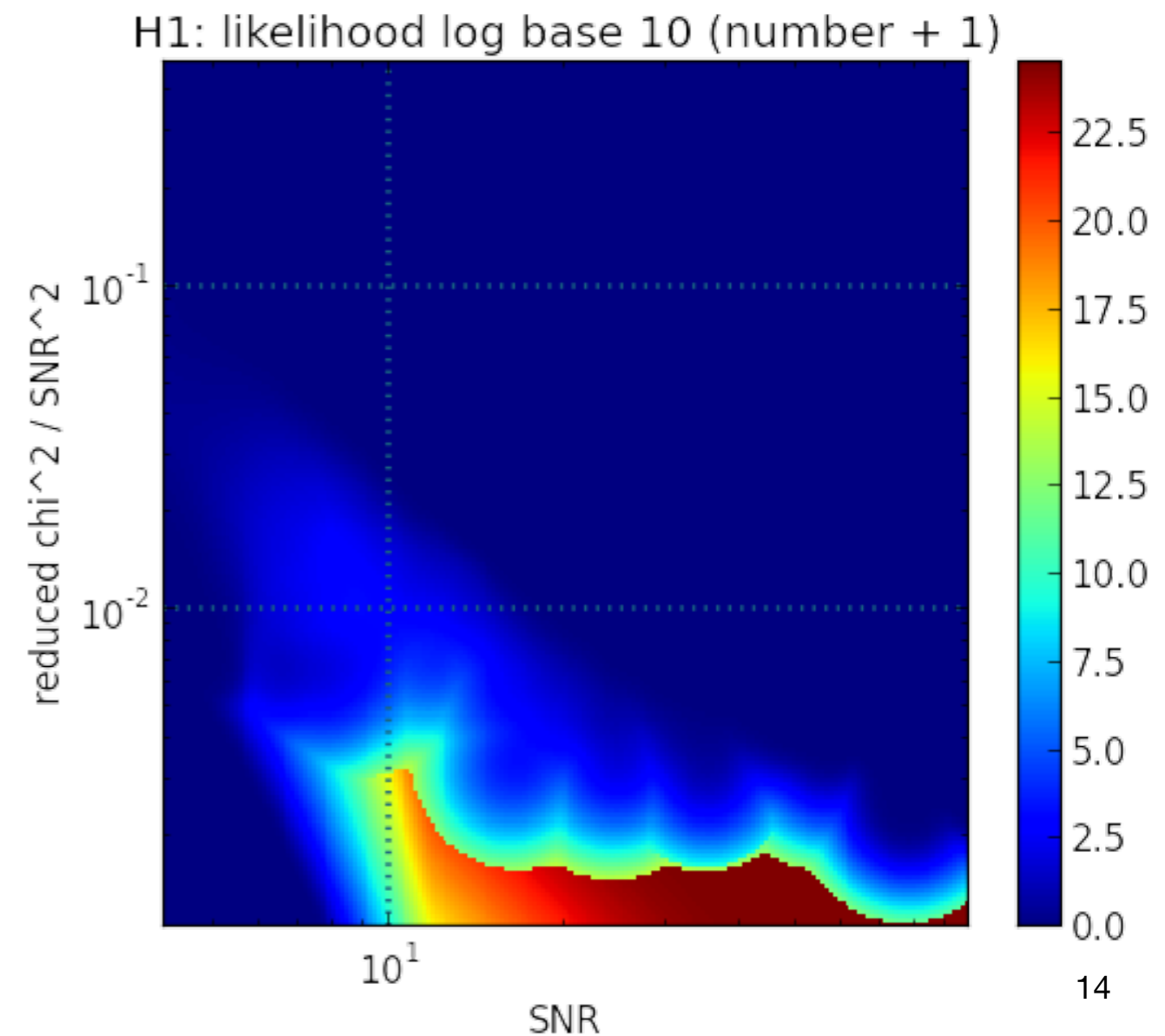
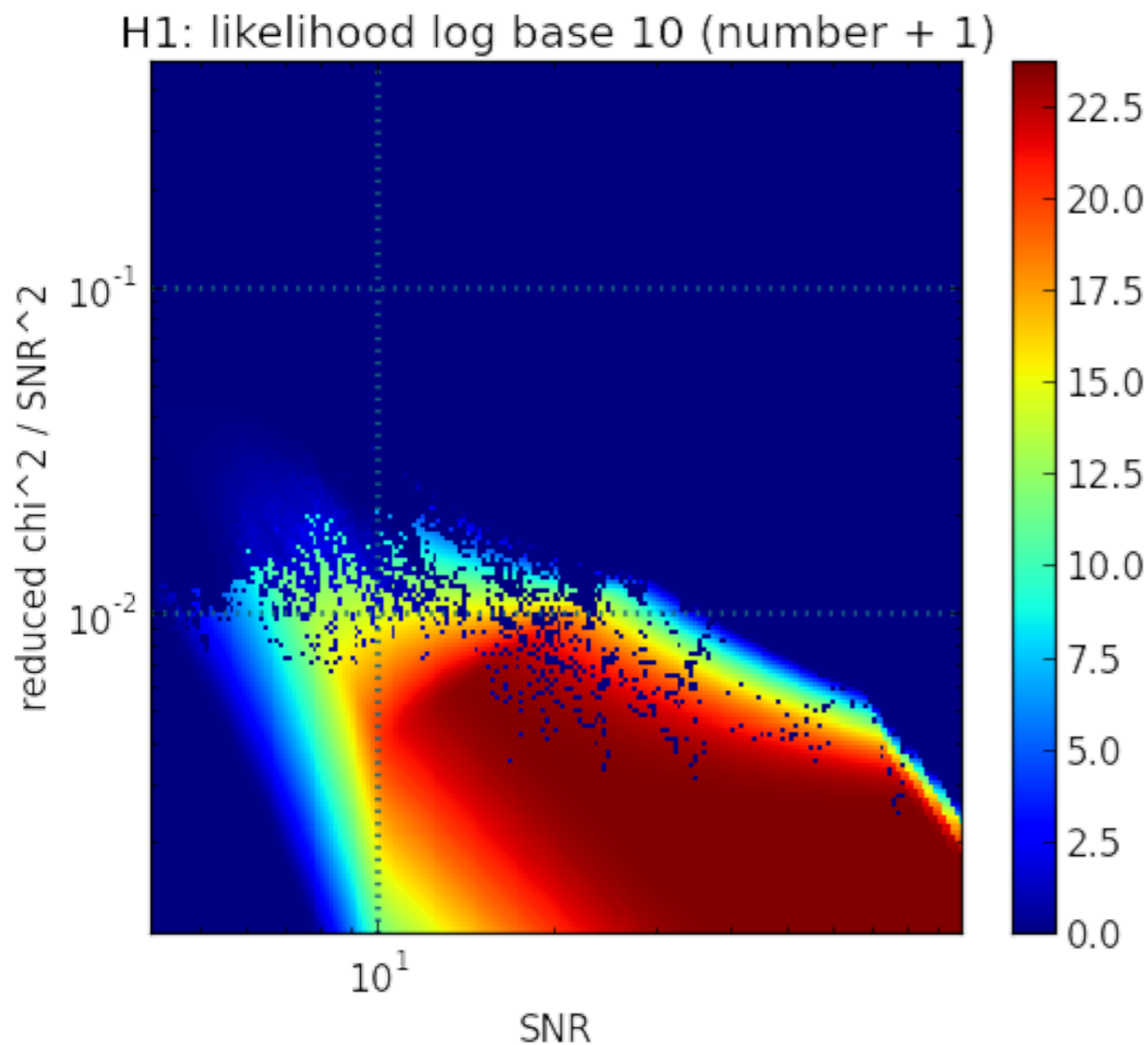


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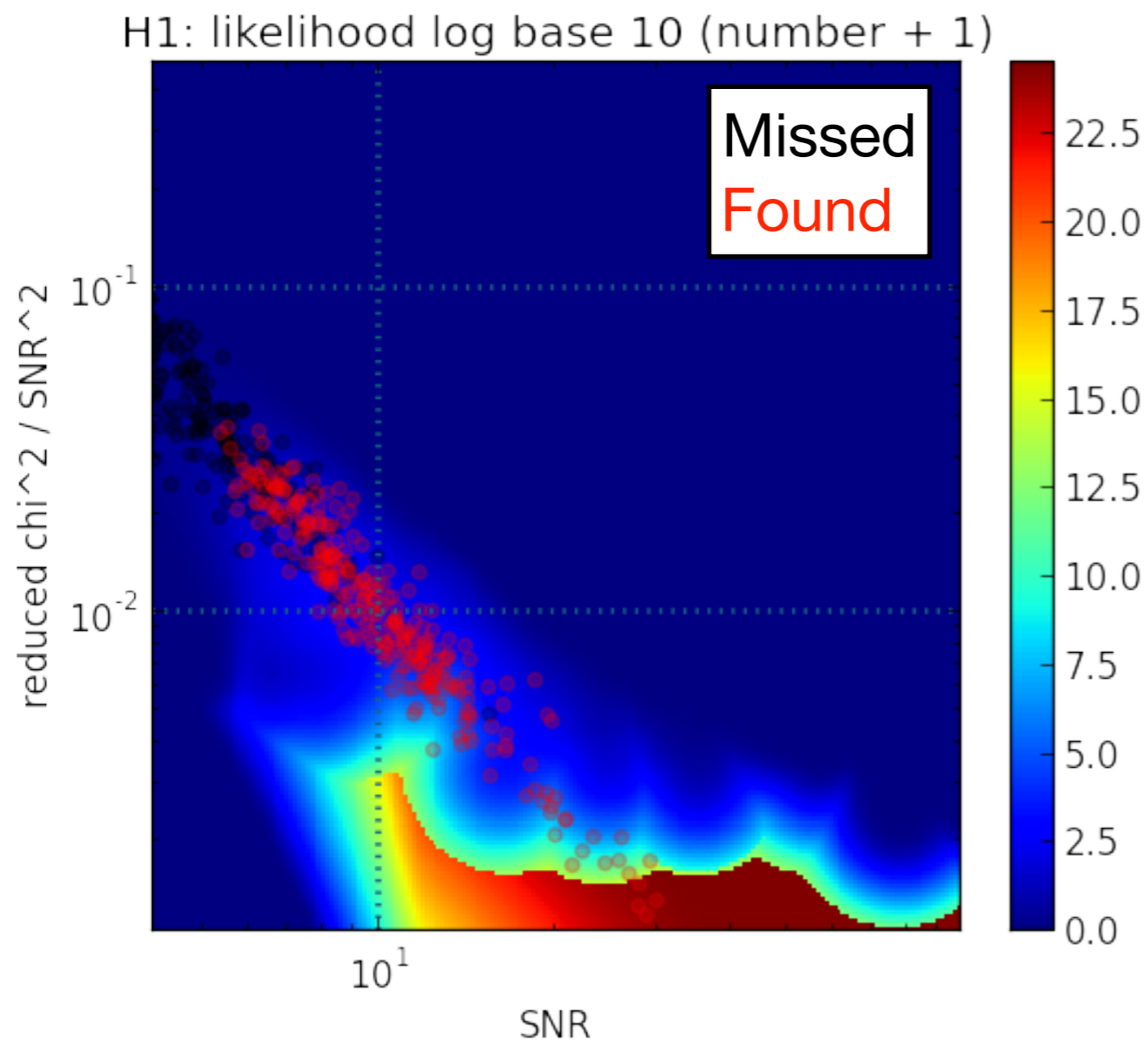
PDF estimates



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PDF estimates - 50:50

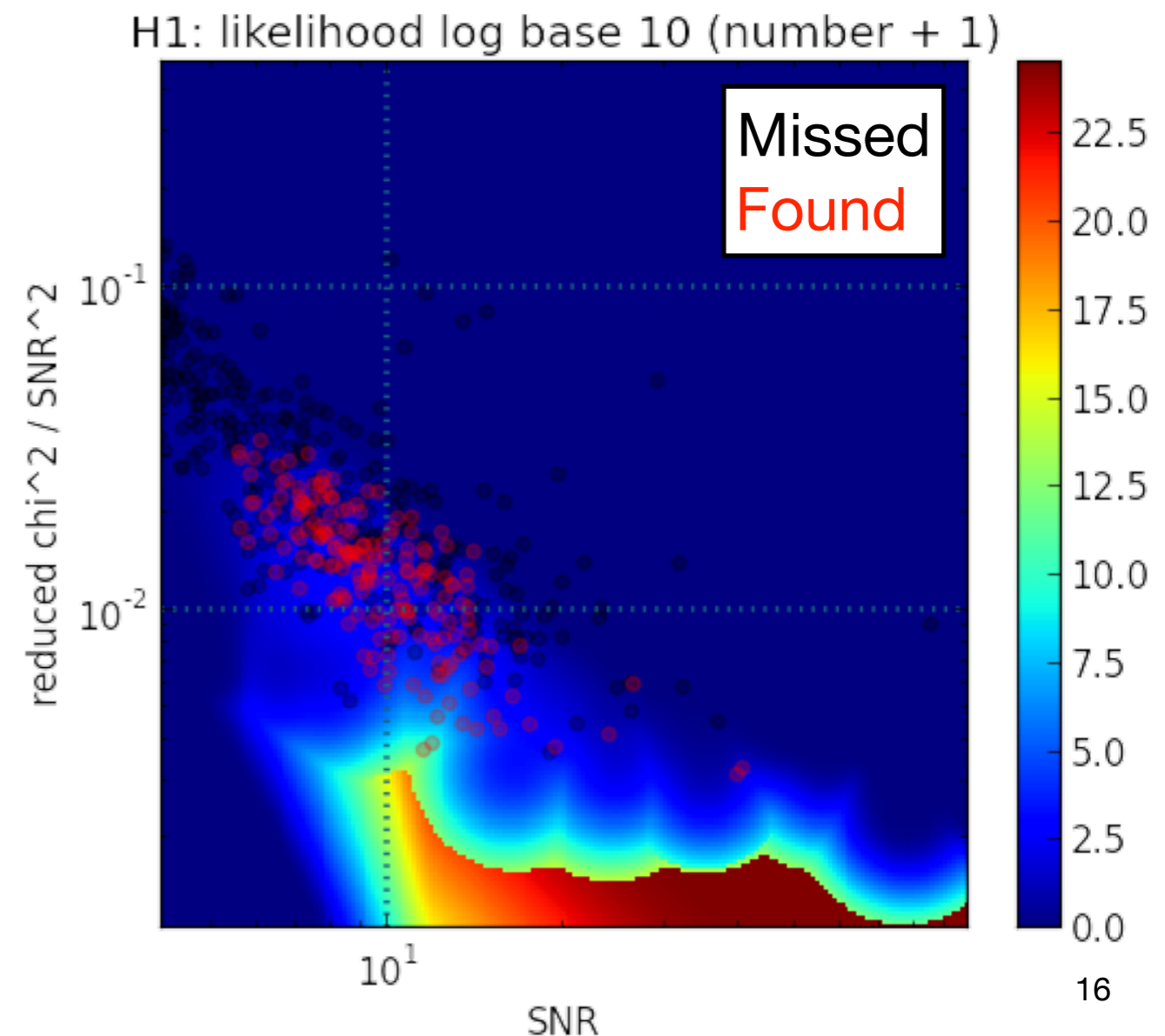
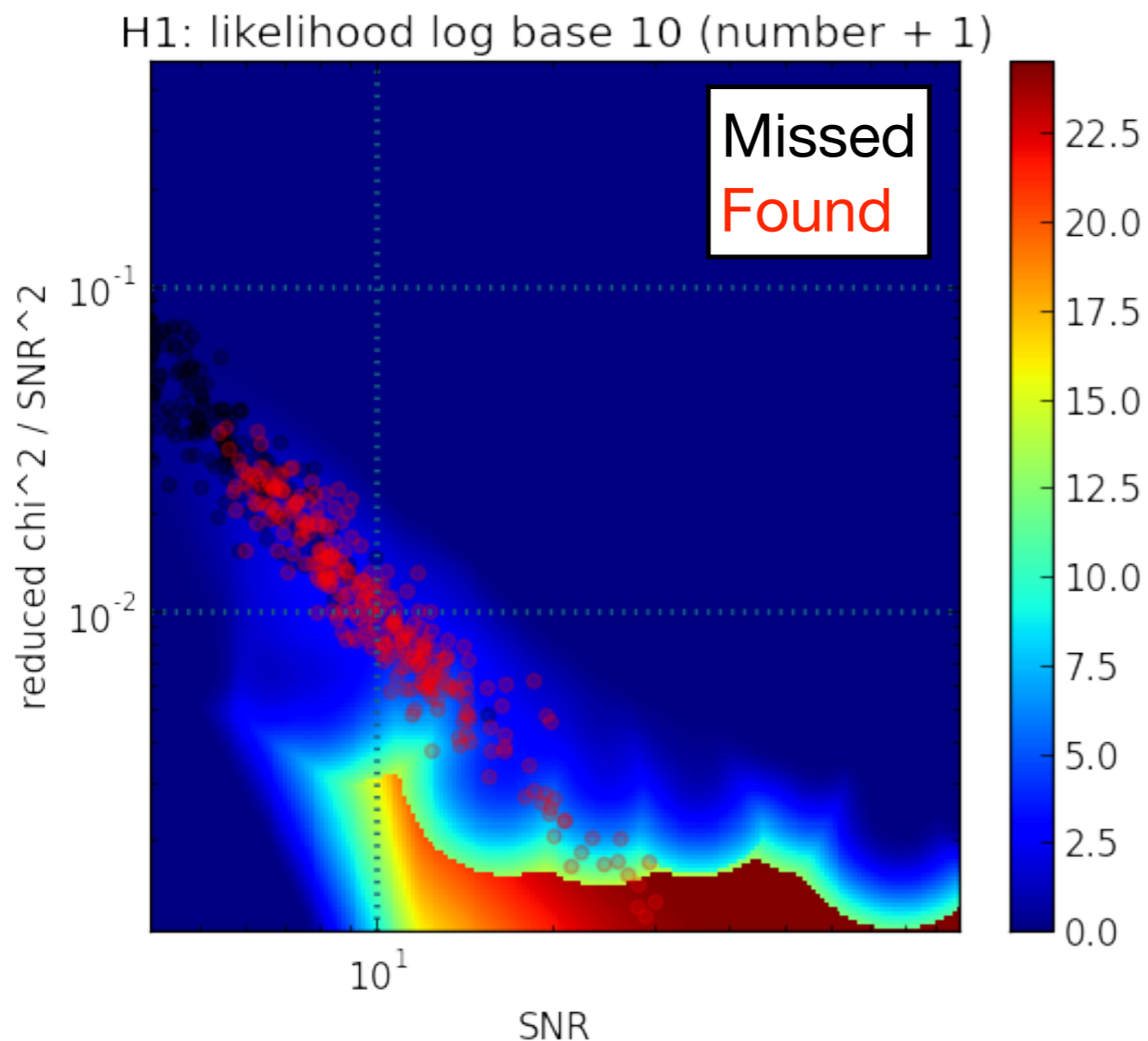


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PDF estimates - 50:50

PDF estimates - 150:150





# Sources

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- <http://journals.aps.org/prd/abstract/10.1103/PhysRevD.88.024025> (or <http://arxiv.org/pdf/1209.0718v1.pdf>)

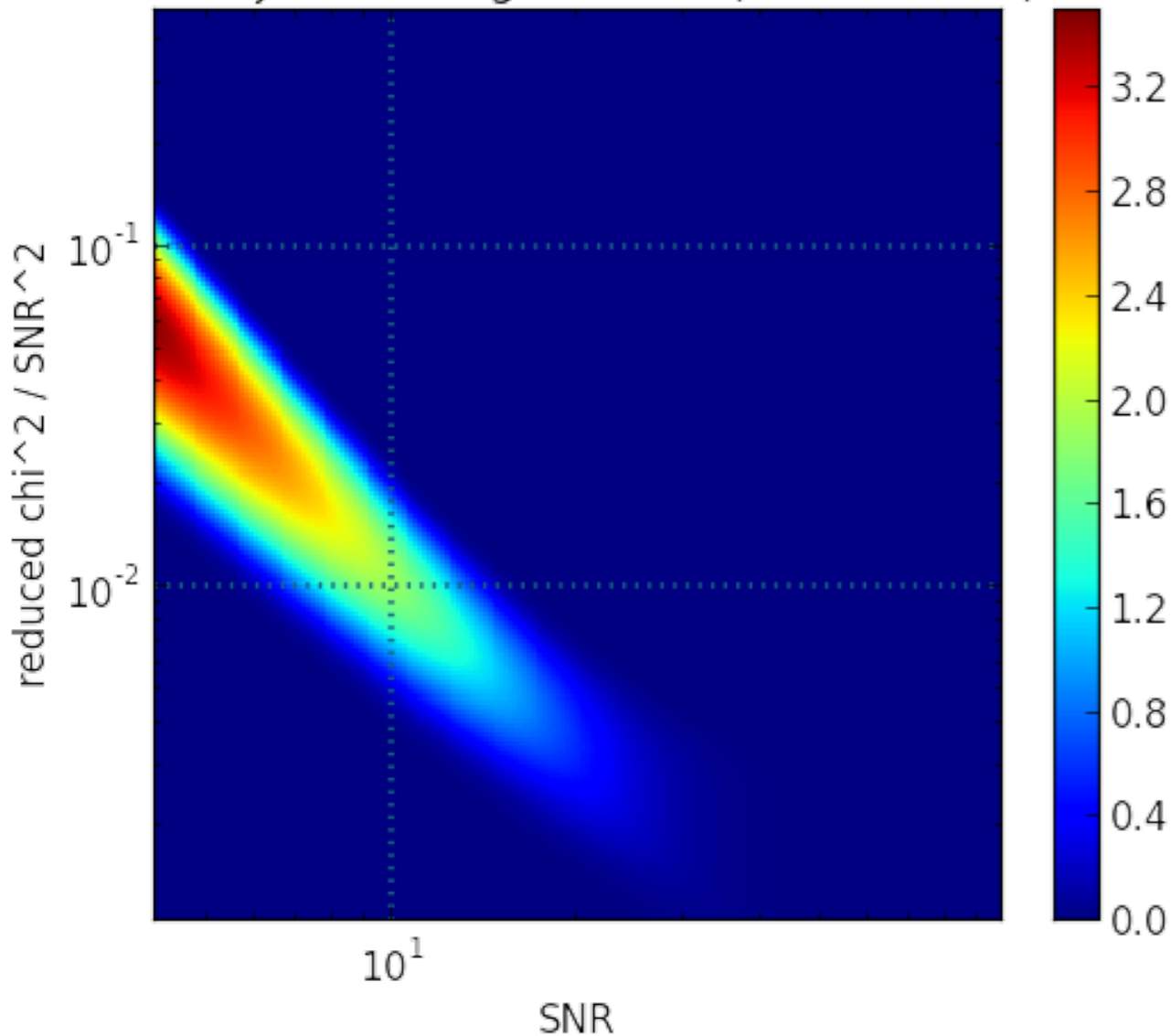
# Bonus Slides

# Adjusting the numerator

$$P(\rho_{\text{H1}}, \chi_{\text{H1}}^2, \theta | s)$$

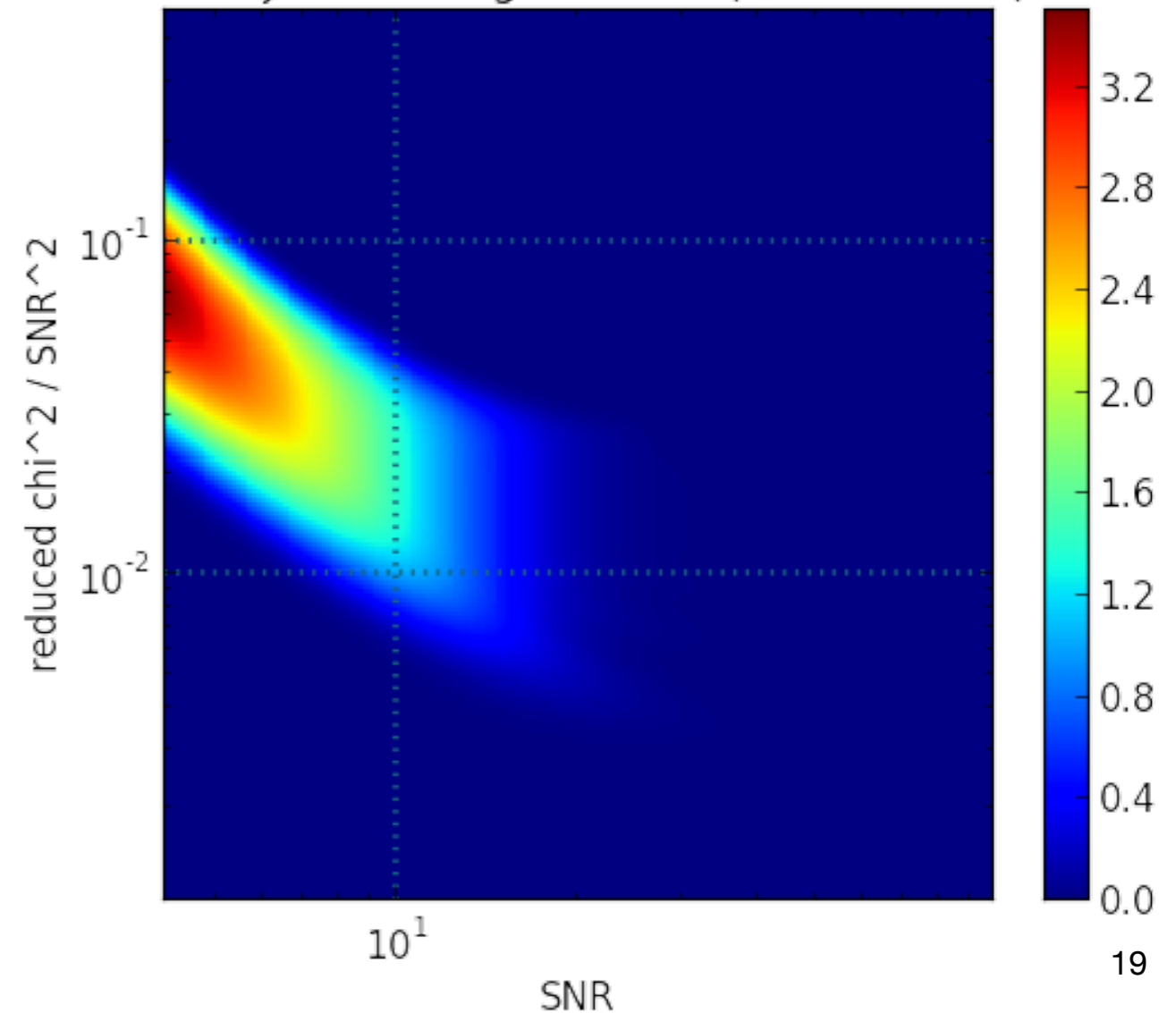
raw histograms

H1: injections log base 10 (number + 1)



raw histograms (adjusted)

H1: injections log base 10 (number + 1)



# Adjusting the numerator

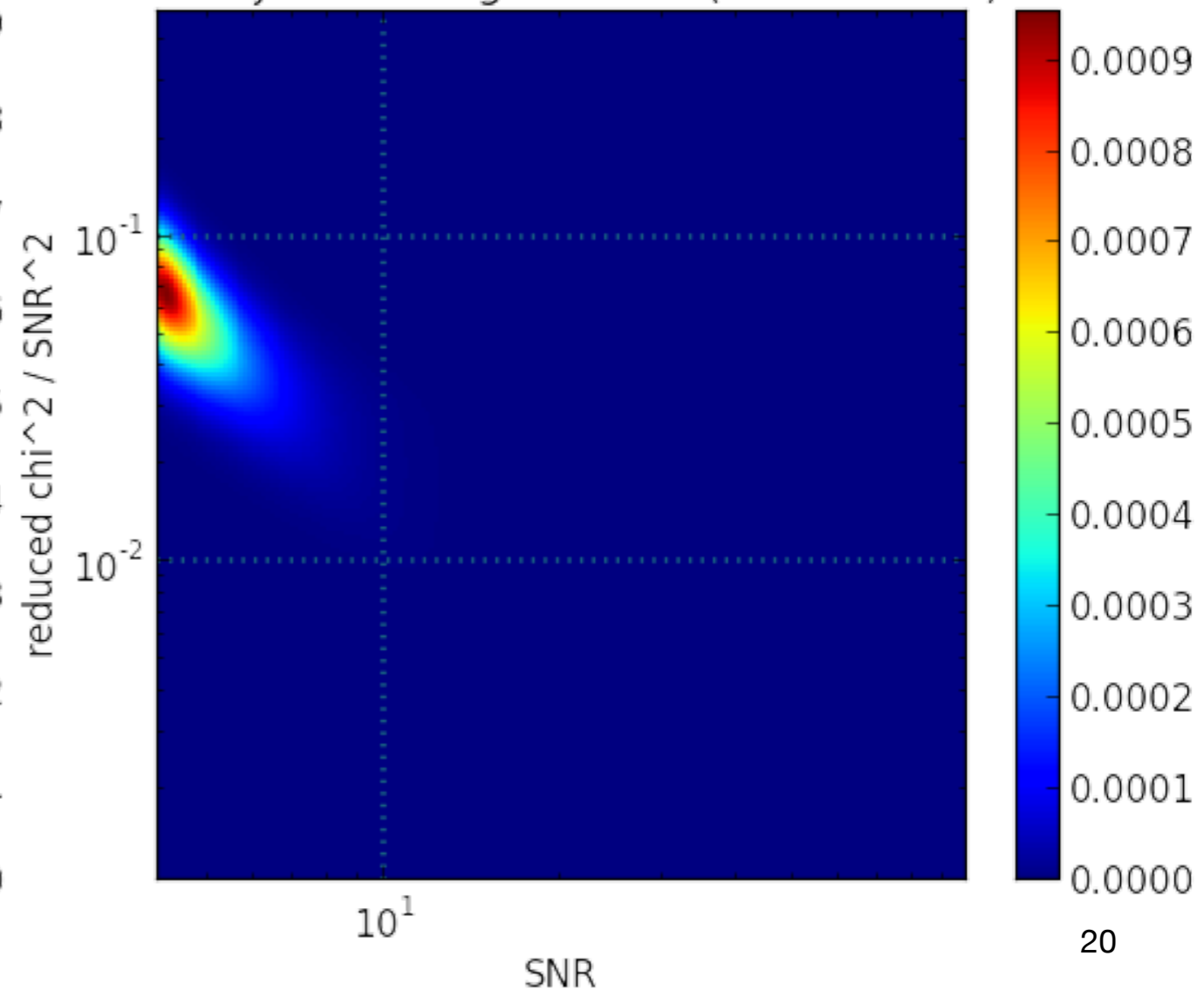
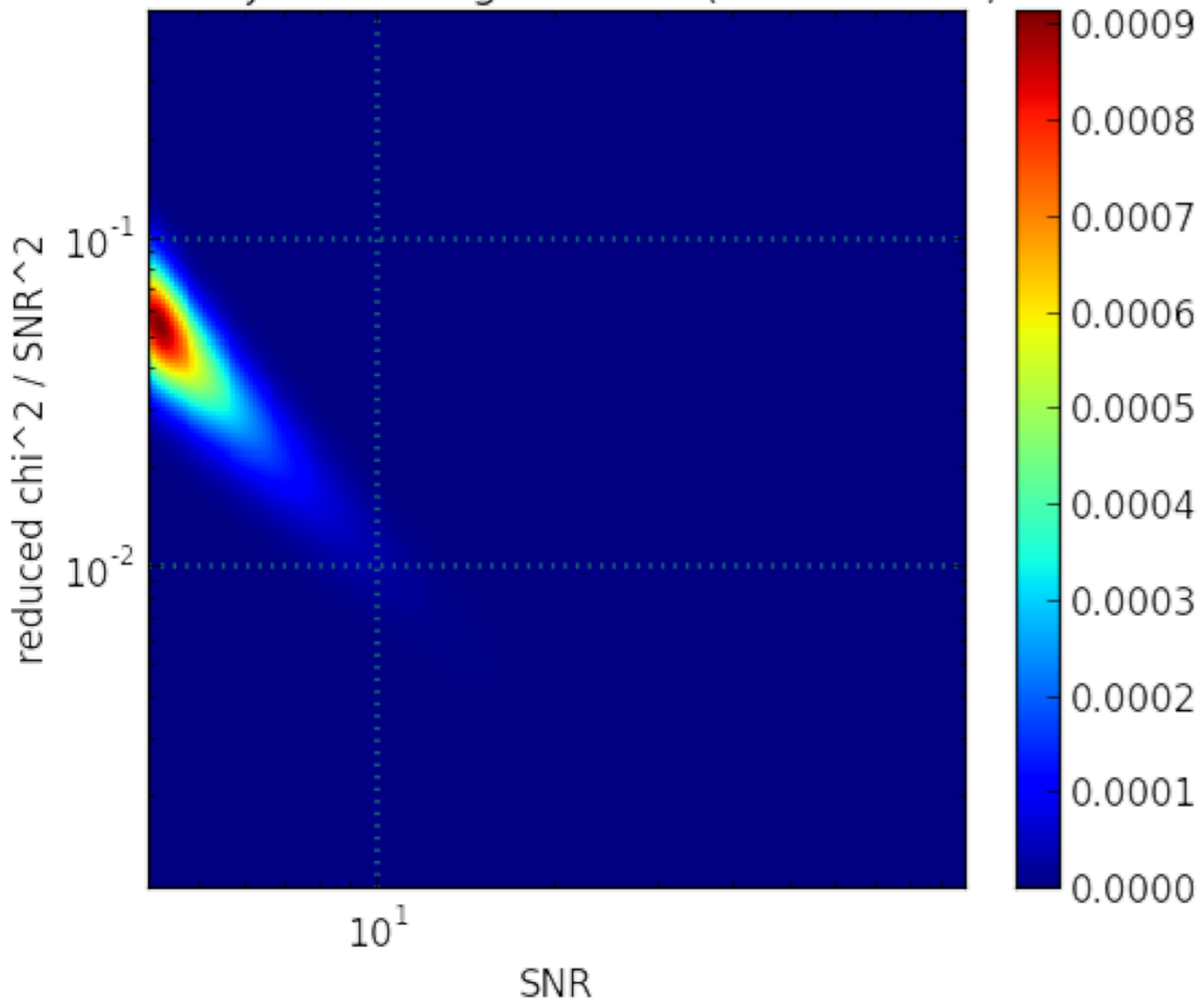
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PDF estimates

PDF estimates (adjusted)

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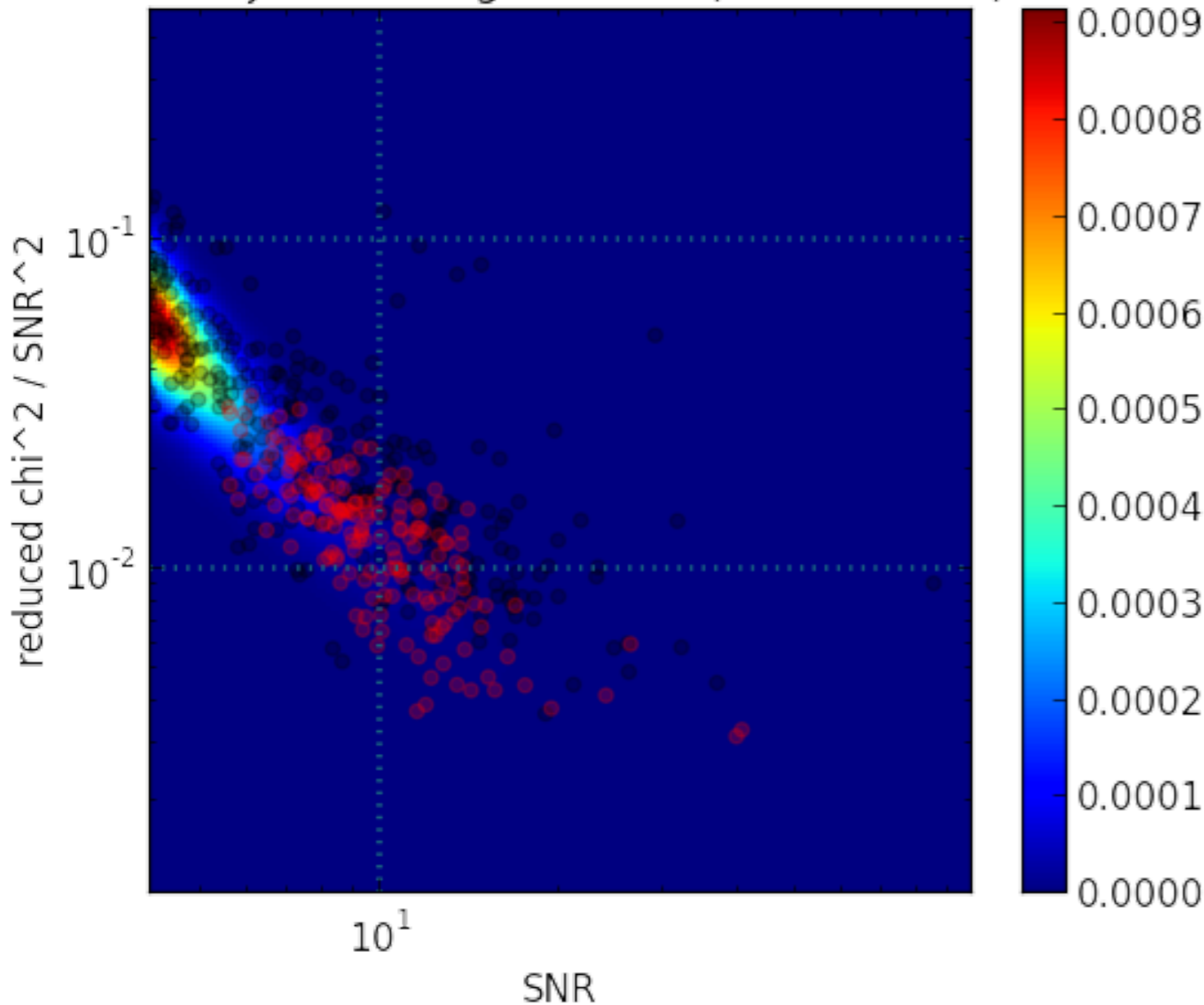


# Adjusting the numerator

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PDF estimates - 150:150

H1: injections log base 10 (number + 1)



PDF estimates - 150:150 (adjusted)

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