3G sensitivities and how to look at them ….

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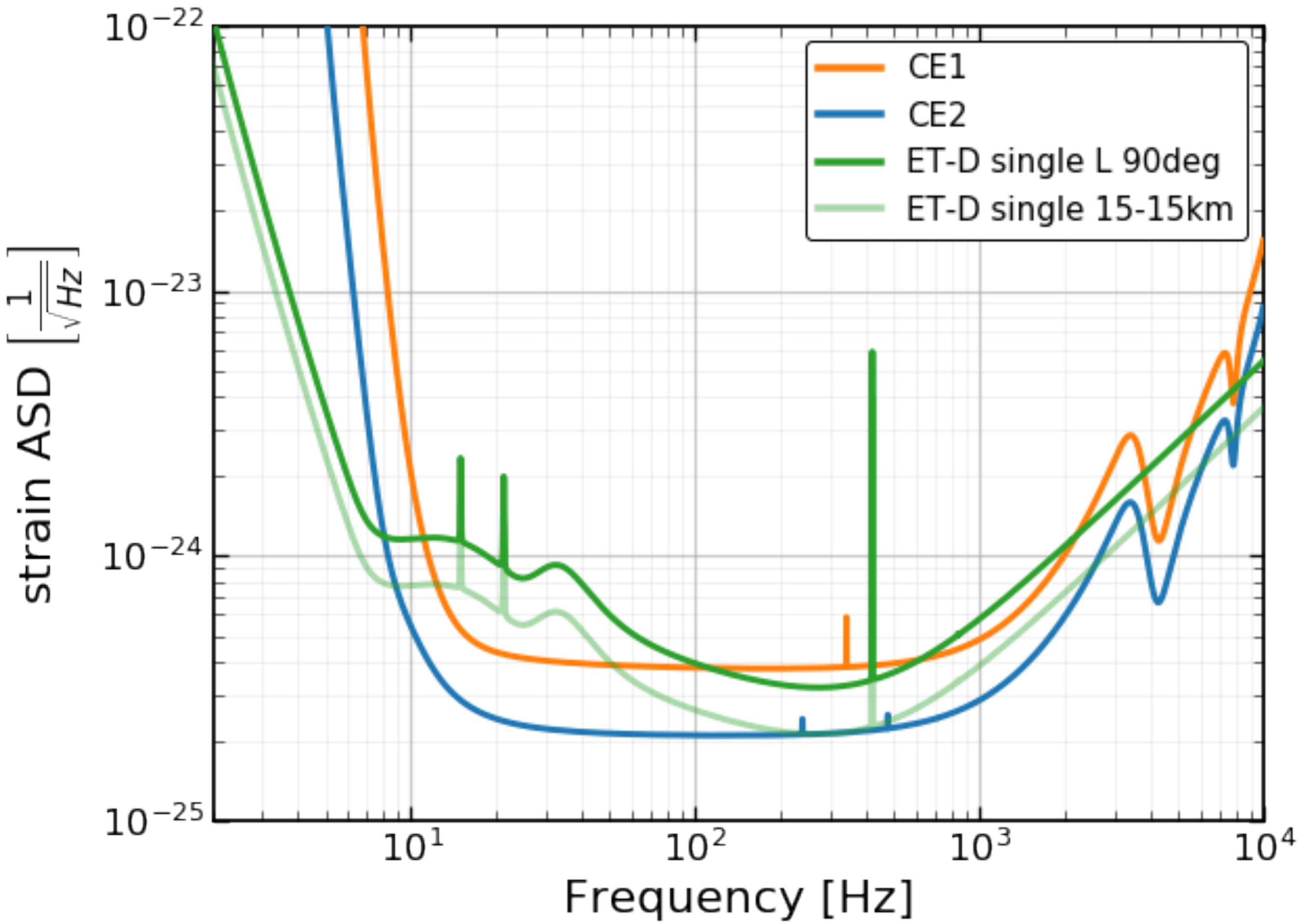
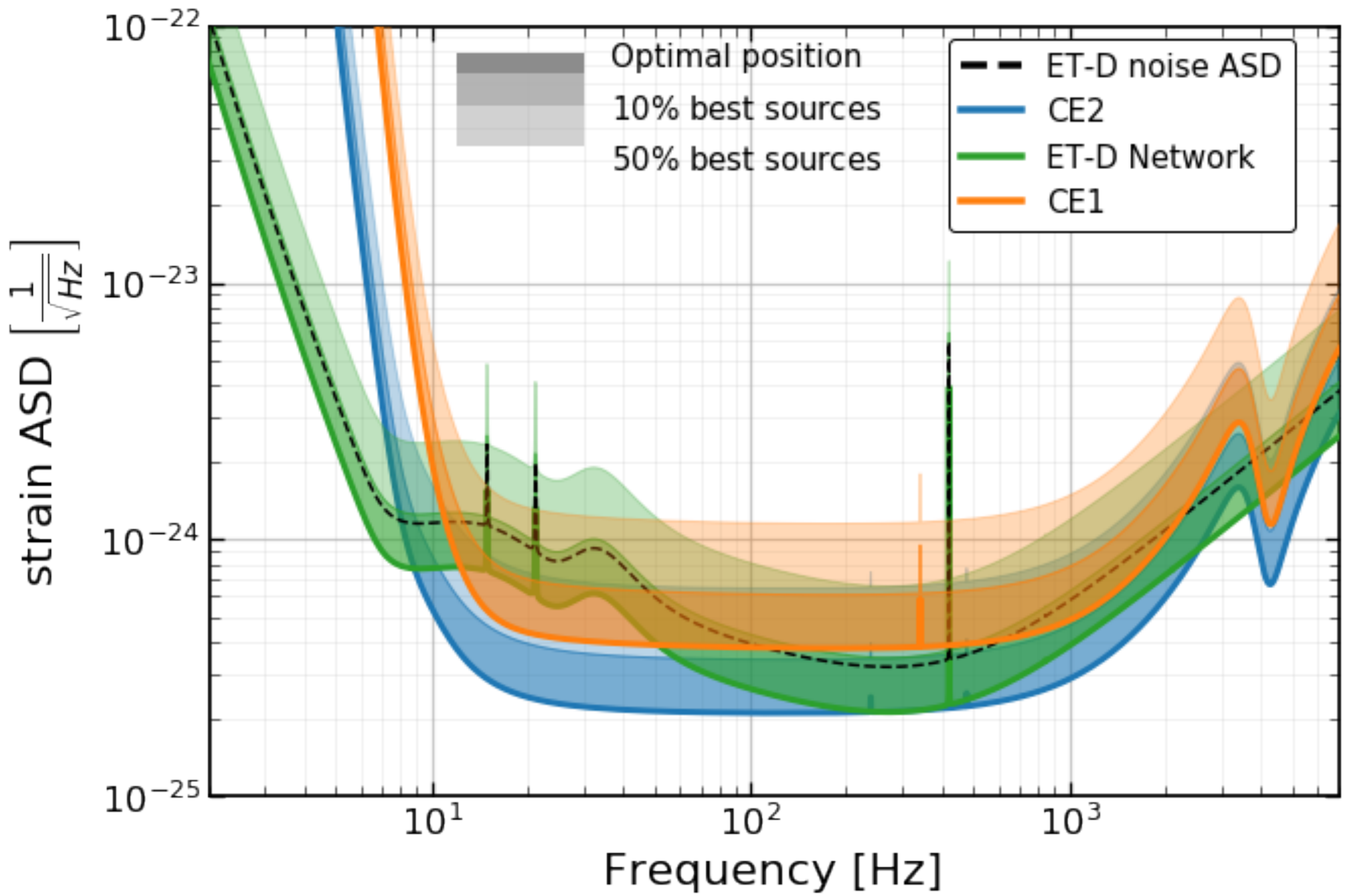
Detector Strain Sensitivities Used



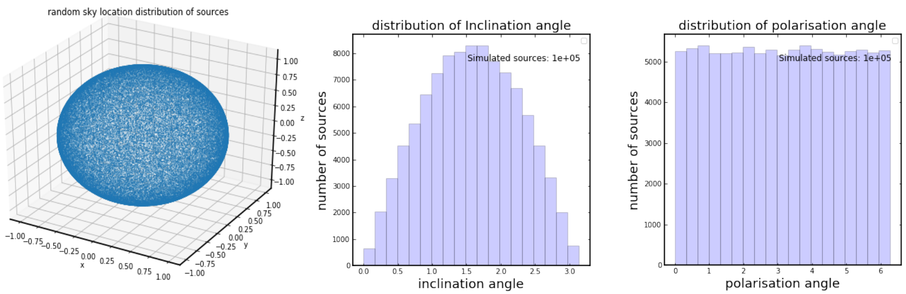
- CE1: room temperature, fused silica CE (~2030?), as described in decadal submission of LIGO lab (https://arxiv.org/abs/1903.04615)
- CE2: cryogenic, silicon CE (~2040?), as described in the decadal submission of LIGO lab. (https://arxiv.org/abs/1903.04615)
- ET-D curve as published in http://iopscience.iop.org/0264-9381/28/9/094013/. Refers to a single detector of 10km armlength and opening angle of 90 degree.
- ET-D for a single 15km L-shaped detector with 90 degree opening angle (divided ET-D by 1.5, which is oversimplified and gives too good sensitivity at high frequencies)

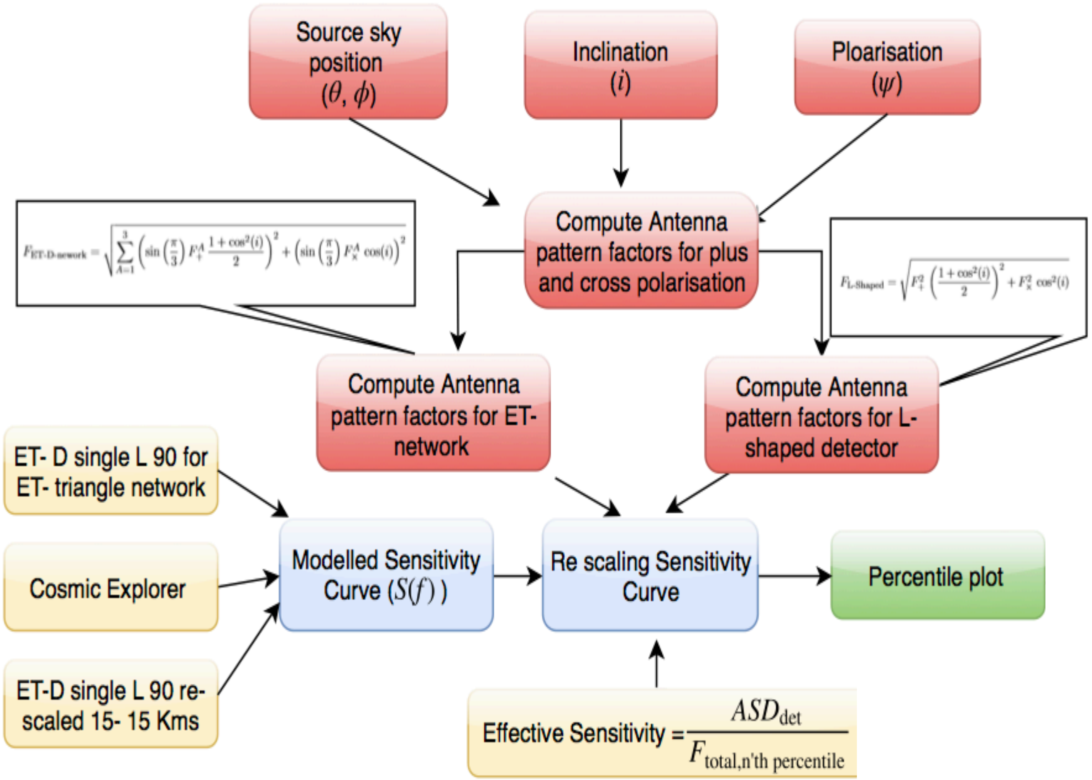
Effective Strain Sensitivities

Plot ala E.Hall. In the 3G –Metric paper



Effective Strain Sensitivity Calculation





Effective Strain Sensitivities

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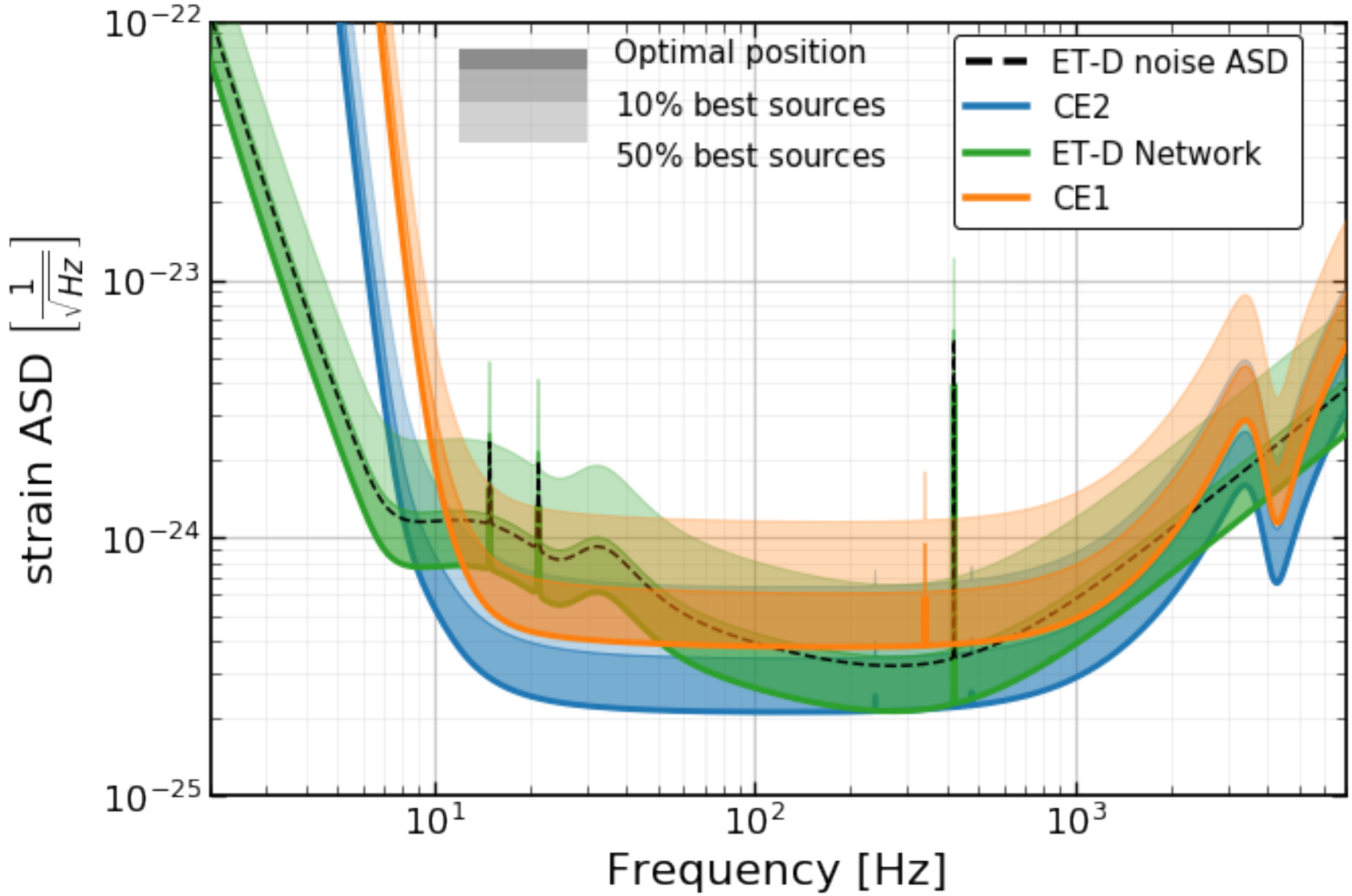

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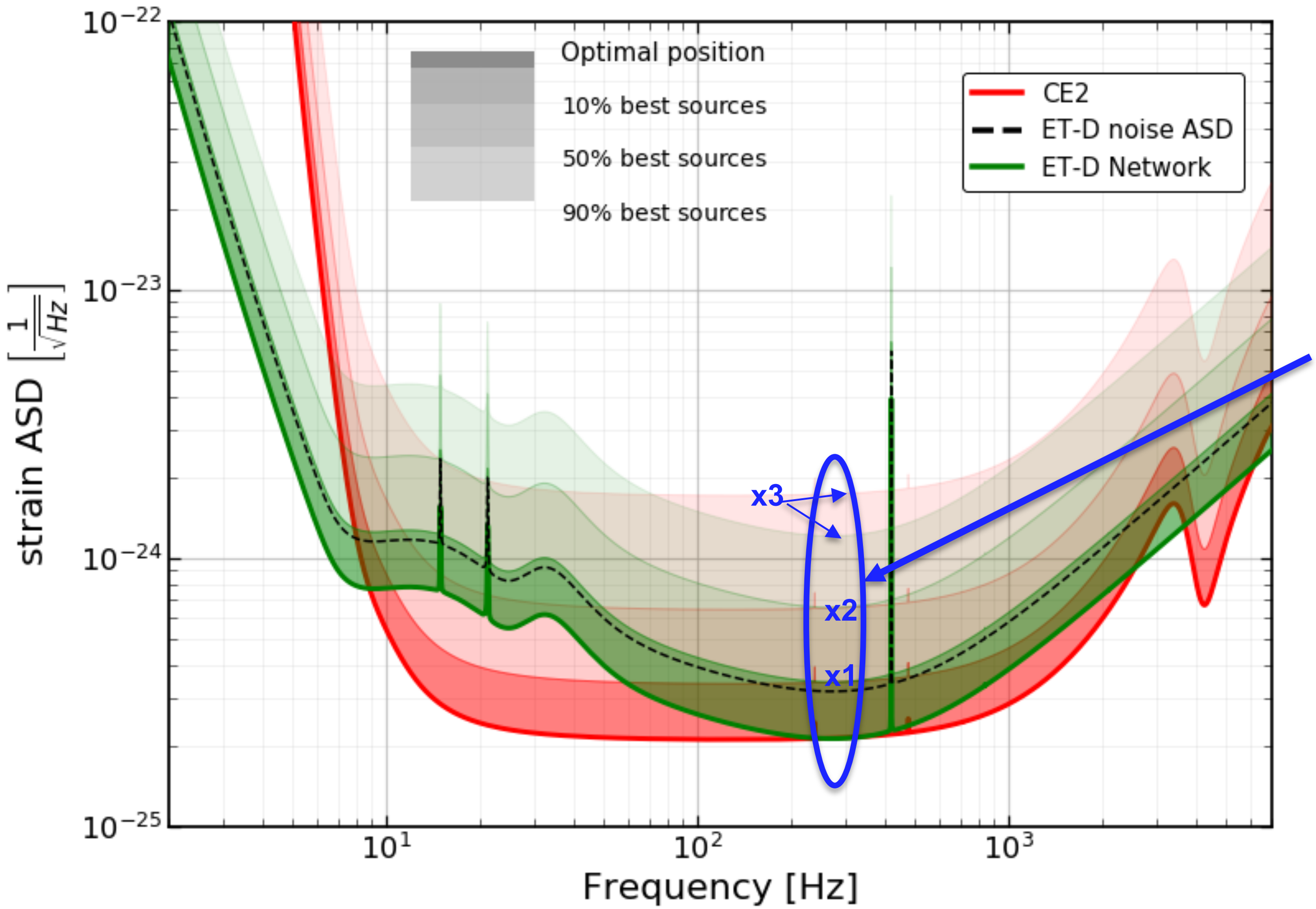
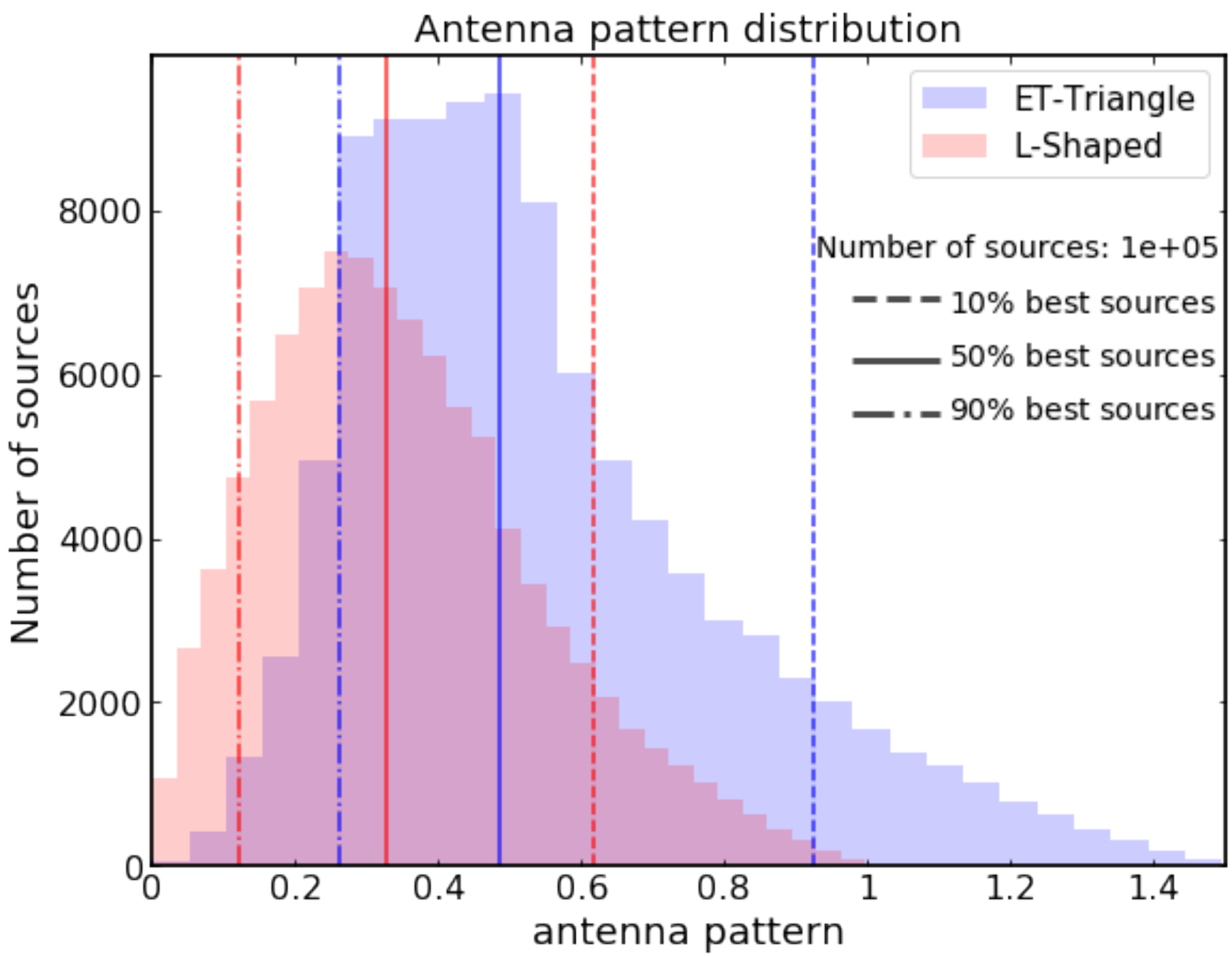
Effective Strain Sensitivities



Note, that the 10% line and the 50% line by chance are nearly identical factors above the horizon for a L and full triangle (see x1, x2). This is suprising, but we will explain later.

However, for the sources which are less favoured by the antenna pattern of the an L-shaped detector (see 90% lines, i.e. x3) the spread is larger for the L than for the triangle.

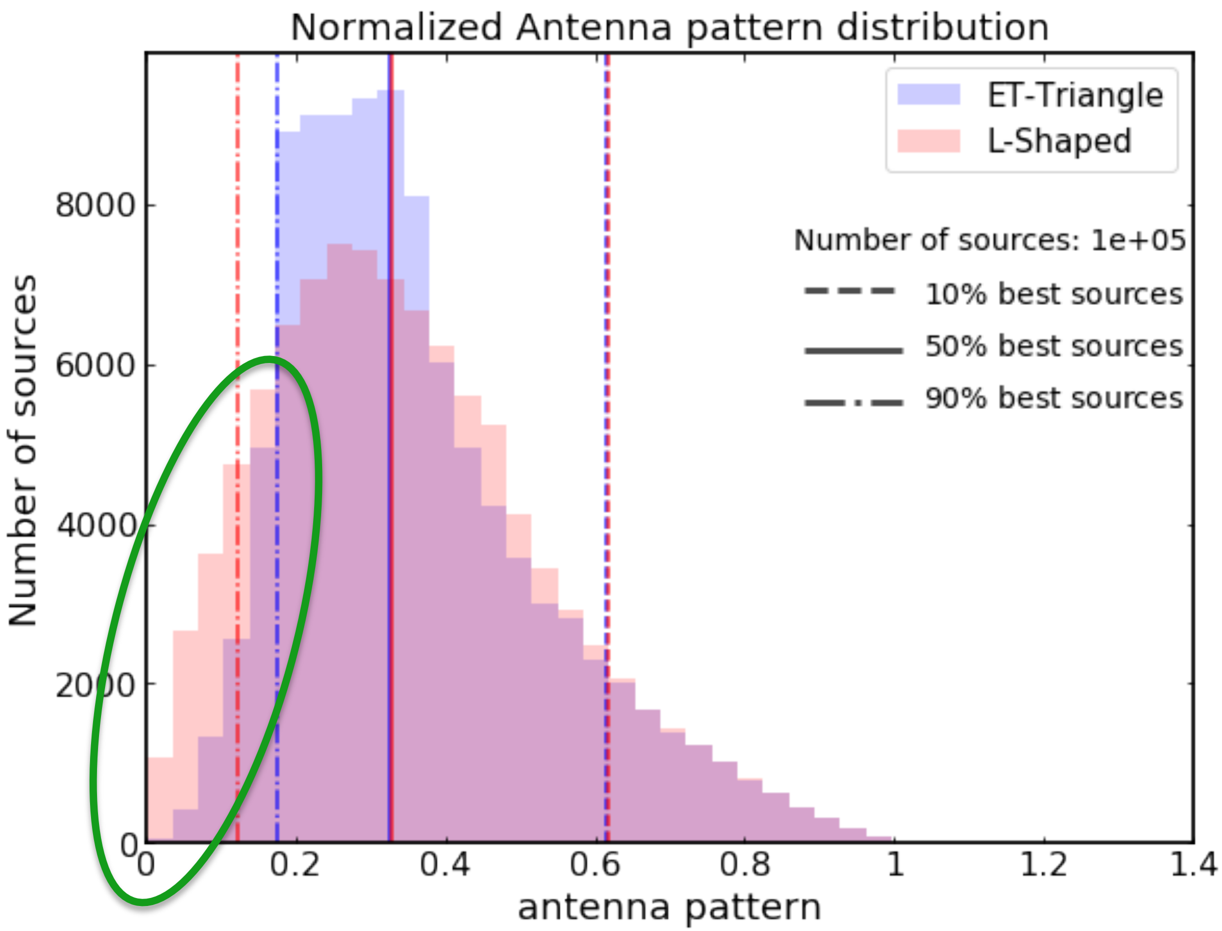
Effective Strain Sensitivities



Note:
Maximum value for antenna patterns
L-Shaped: 1

ET-Triangle: 1.5
i.e. three L added coherently, then corrected by sin(60deg)

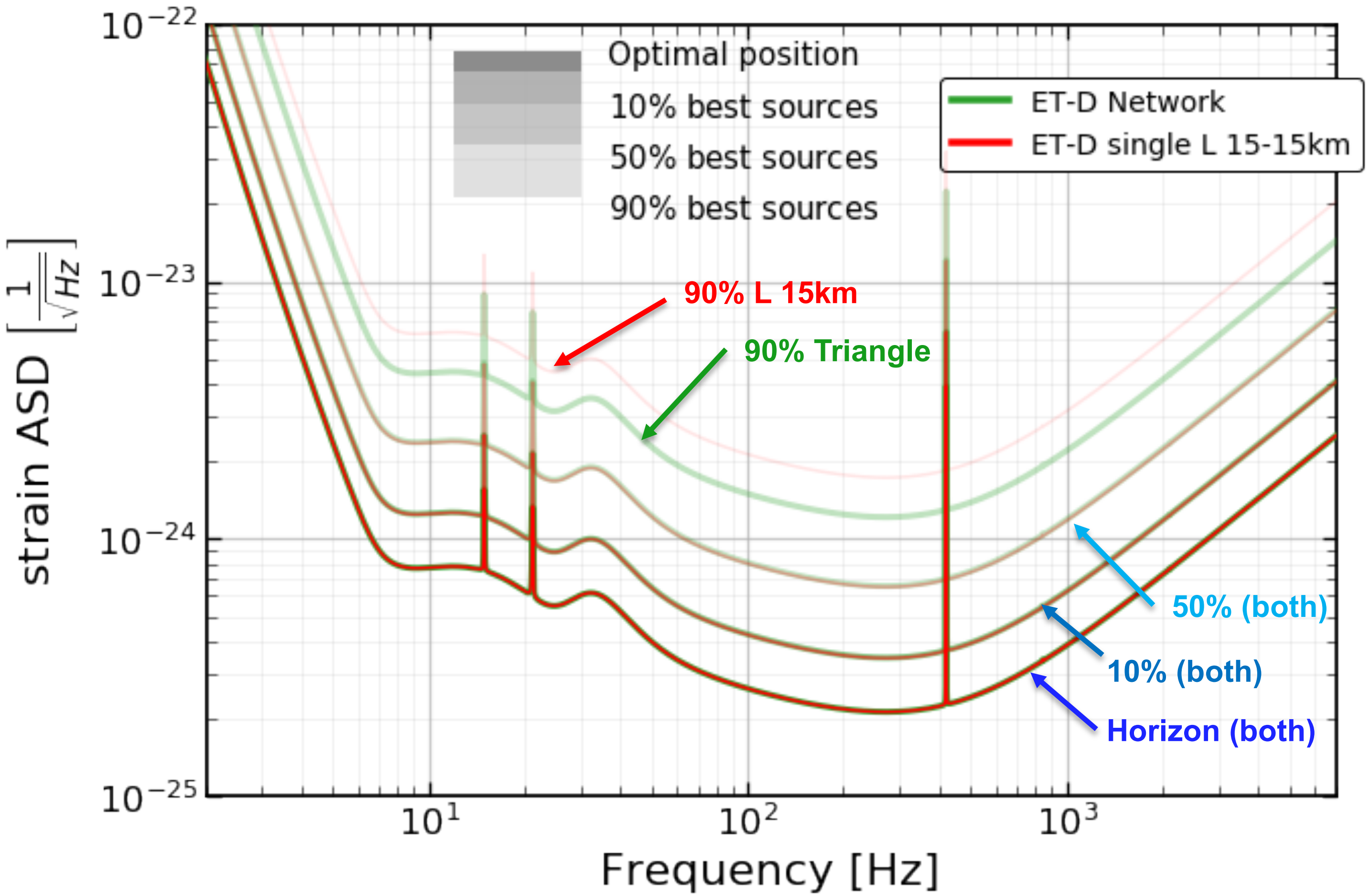
Effective Strain Sensitivities



Note:
While the absolute scaling factor for the total antenna pattern are the same, ET boosts the ”blind sources”.

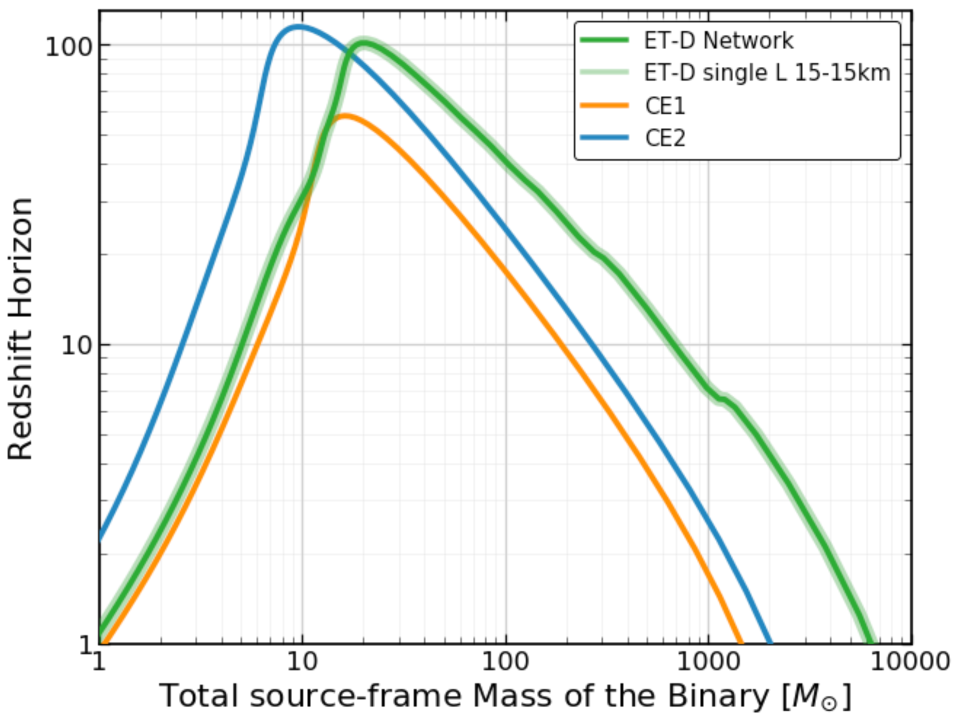
The difference in the number of low tail sources is **8.6%** of the total.

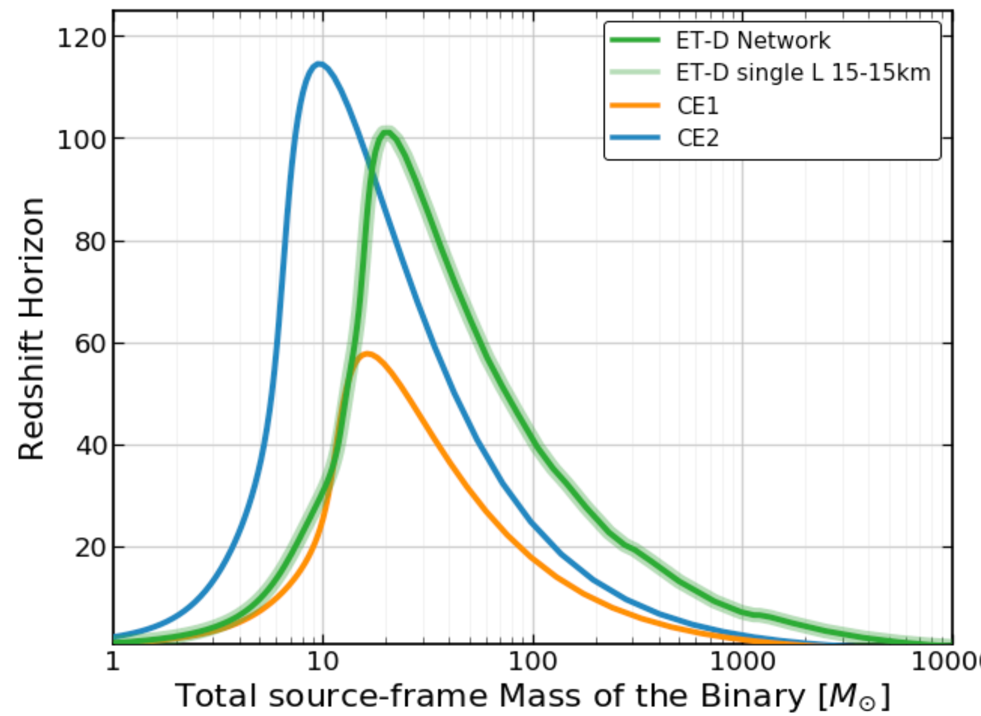
Effective Strain Sensitivities



Compact Binary Horizons

Equal Mass No Spinning CBC in Plank2015 Cosmology

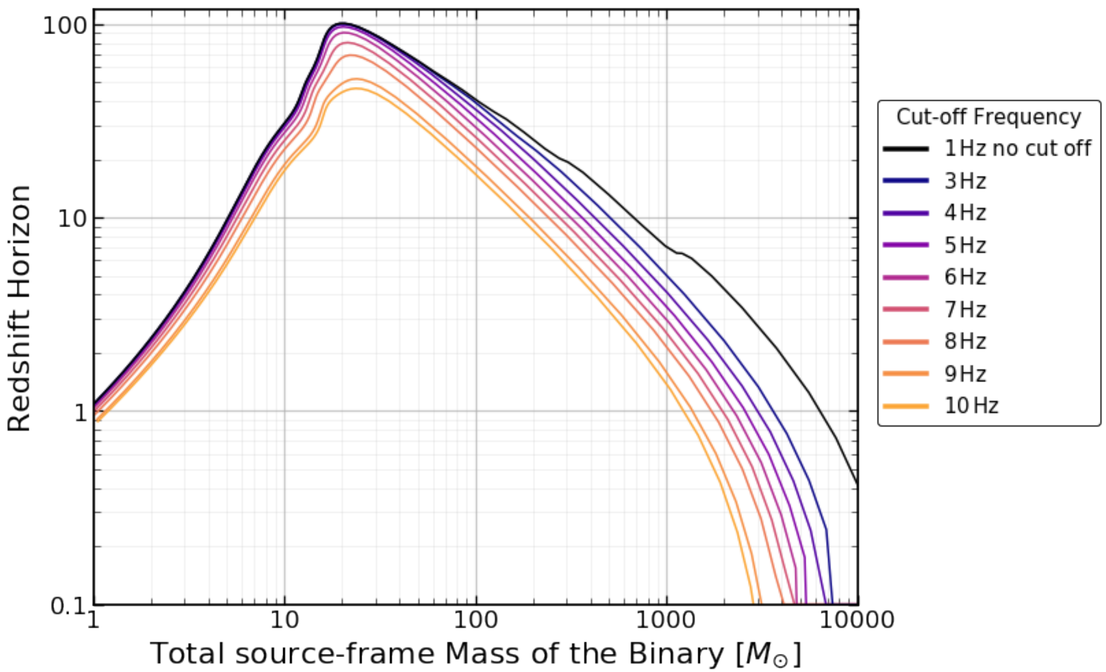


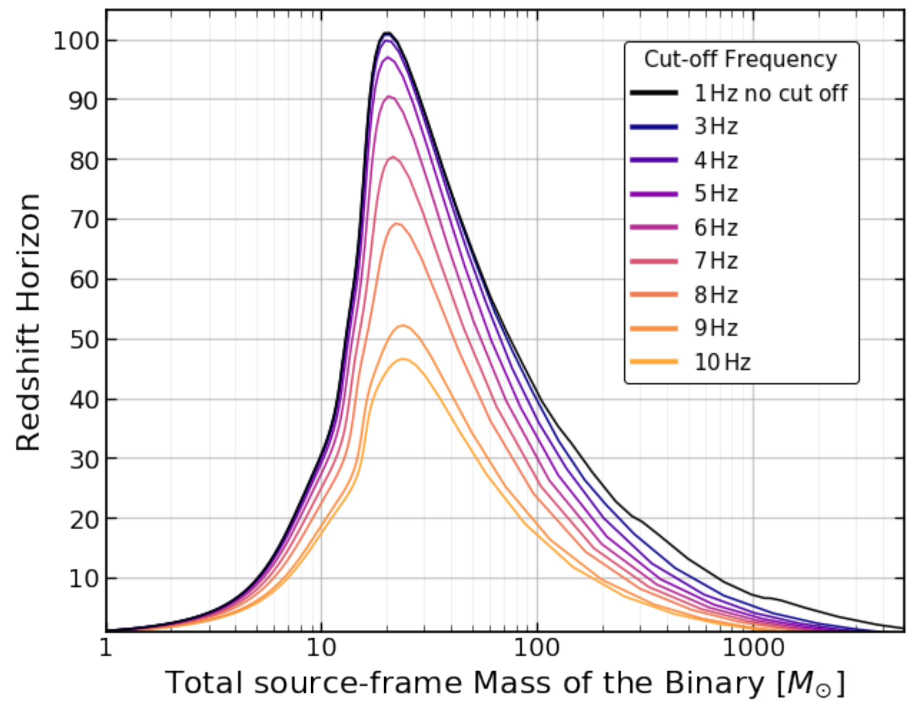


Note: for the horizon the ET-D network (3x 10km detector with 60 deg opening angle) is identical to a single 15km ET-D with 90 deg angle. However, the absolute number of sources will be different for the single L detector because of less homogenous antenna pattern.

CBC Horizons for ET with different low frequency cut-off frequencies

Equal Mass No Spinning CBC in Plank2015 Cosmology





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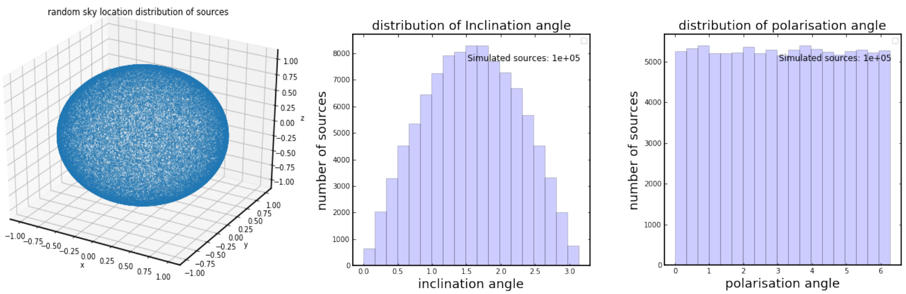
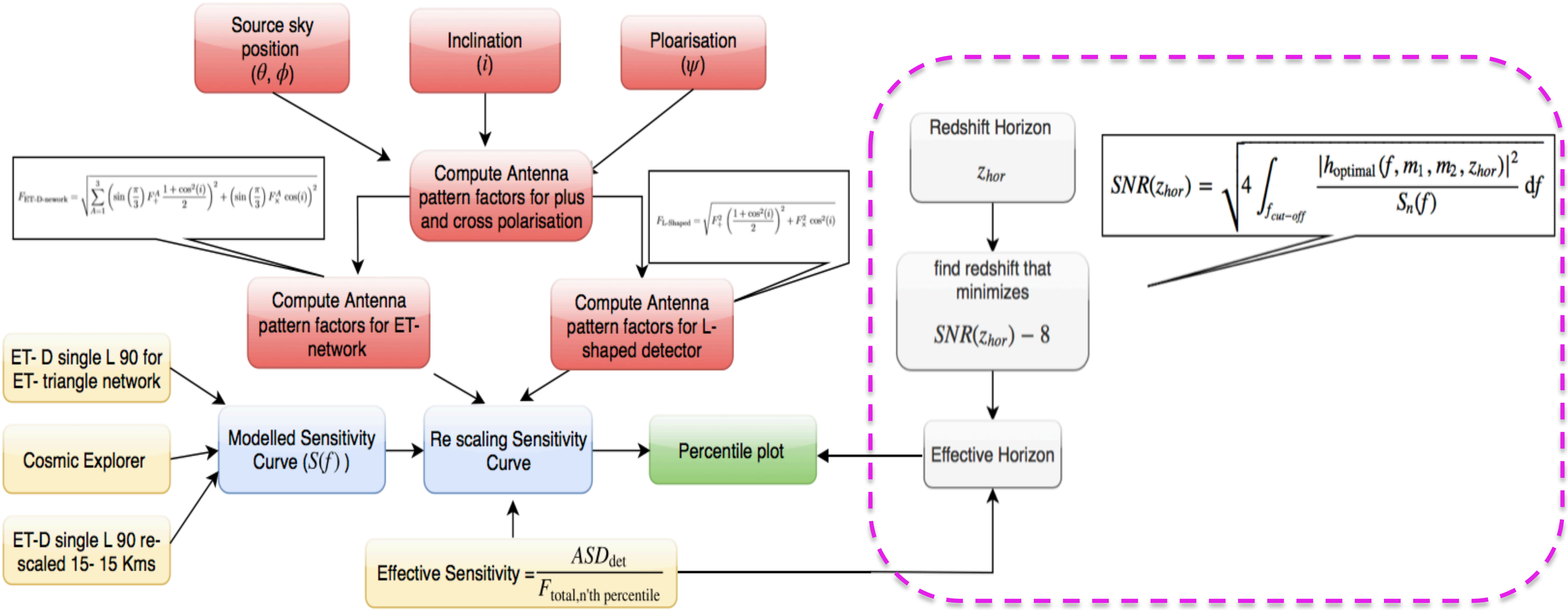
Effective Redshift Horizon Calculation

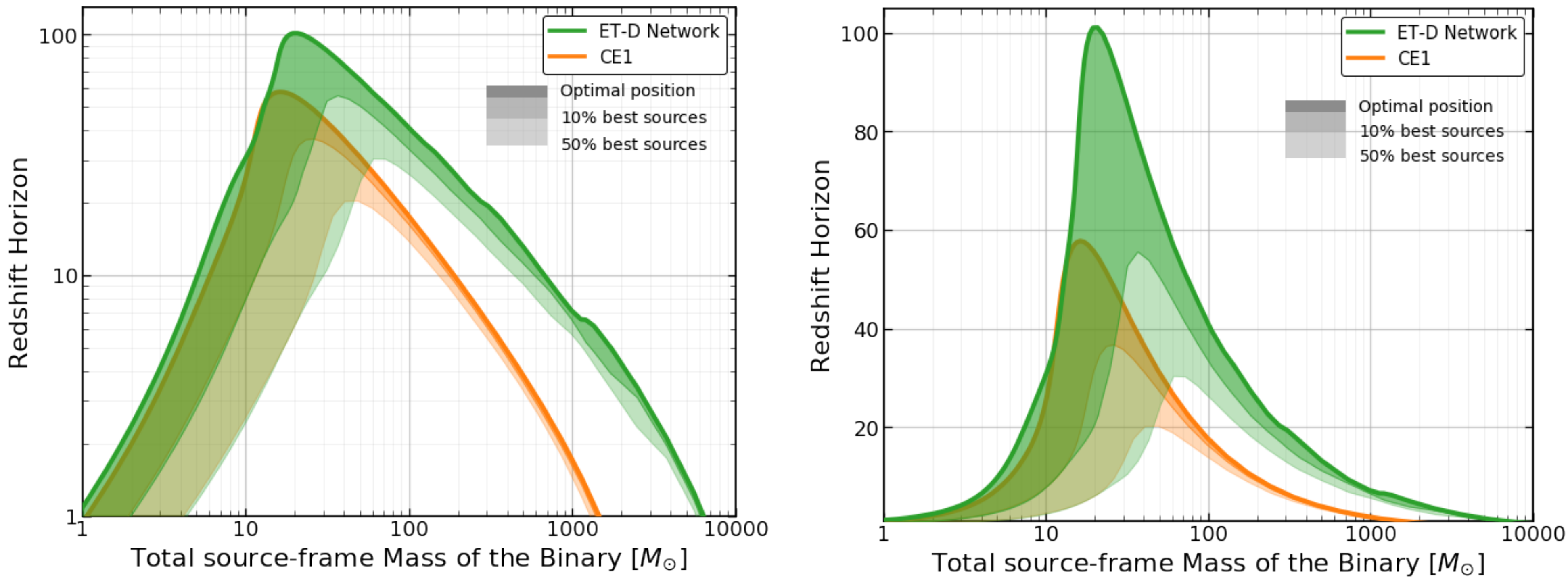




CBC-ranges

Plot ala J. Miller and E.Hall

Equal Mass No Spinning CBC in Plank2015 Cosmology



CBC-ranges

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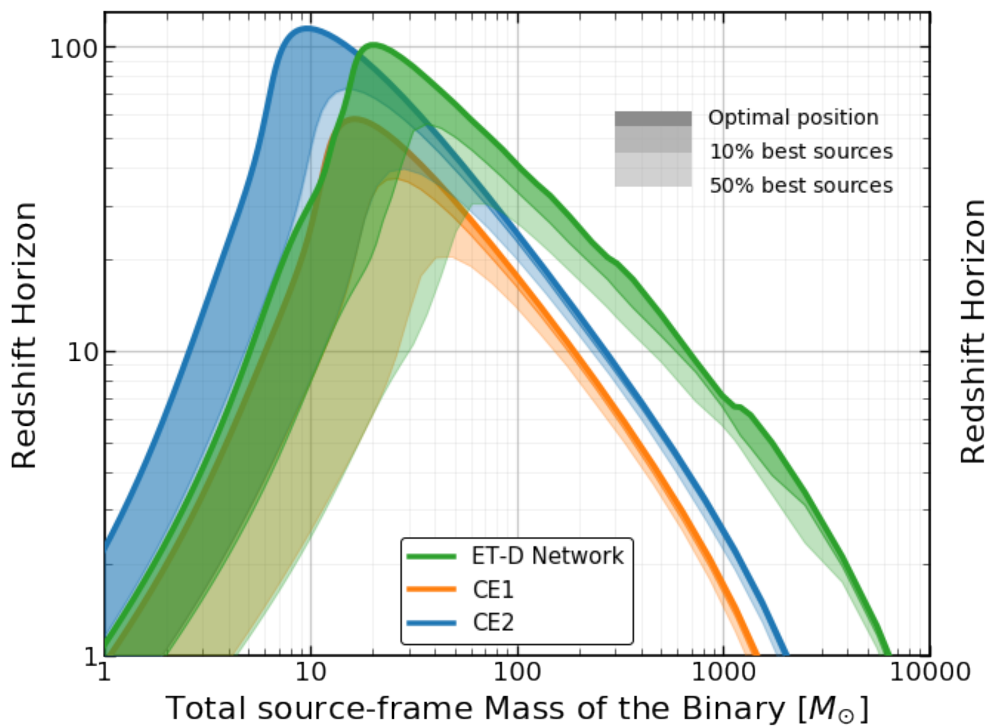
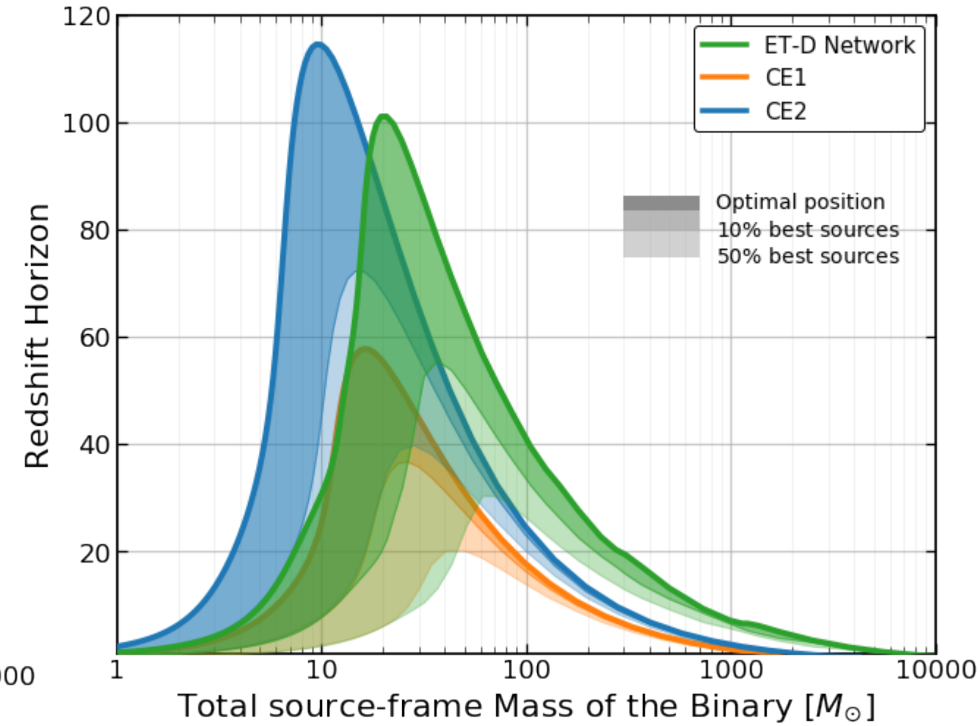
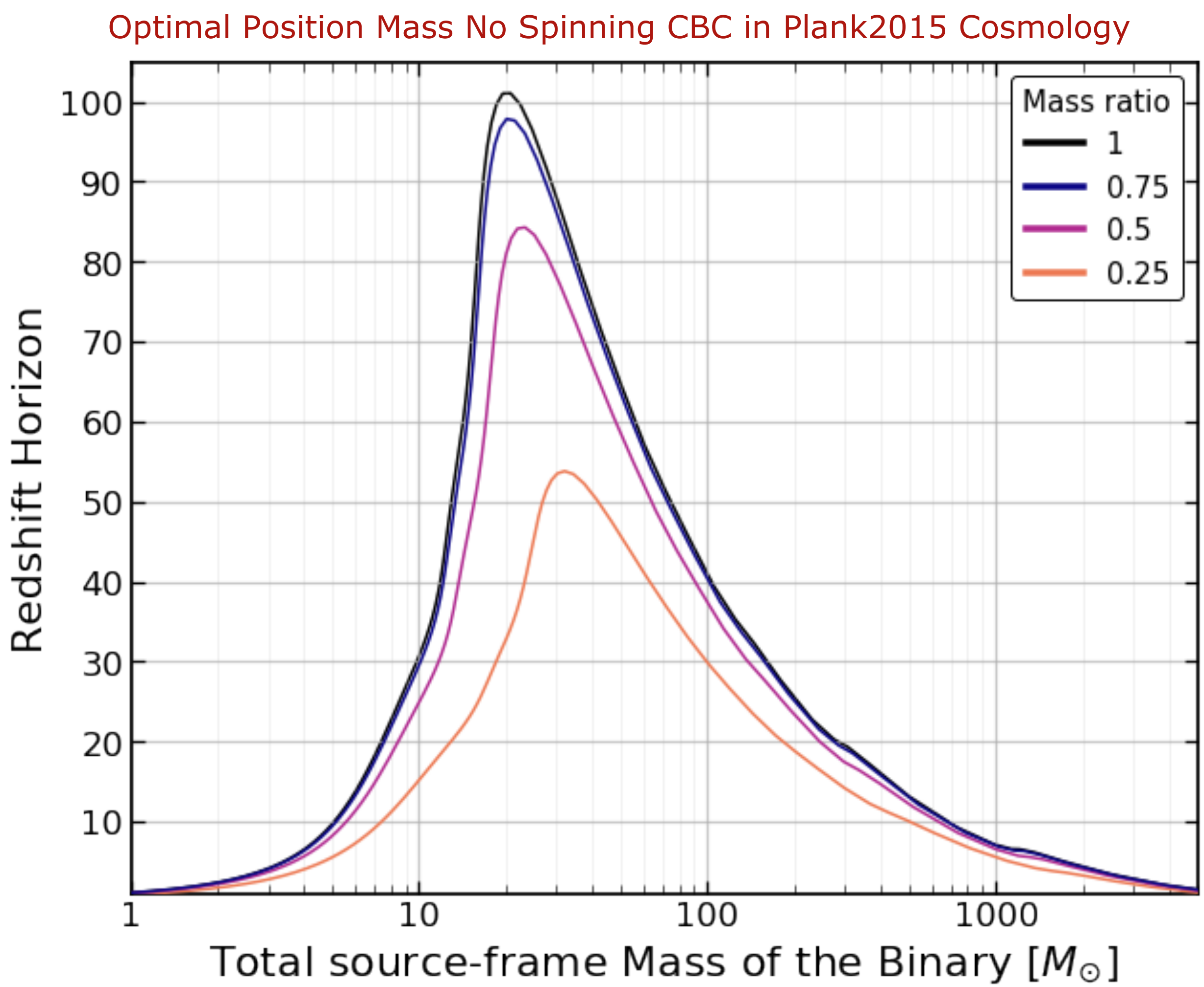
Equal Mass No Spinning CBC in Plank2015 Cosmology





Un-equal mass CBC Horizon



Summary

- Started an effort to being able to evaluate various sensitivity options for various figures of merit. Built on efforts from Evan Hall at MIT.
- Compared effective sensitivities of ET-D triangular, CE1, CE2, and a simplified ET 15km L detector. Horizons and best sources are very comparable. Only for worst ~50% of sources there is a significant difference.
- Horizon and percentiles do not give good indication of absolute number of detectable sources.
- Also show the effect of low-frequency sensitivity on redshift horizon in particular in the seed black hole mass range.
- We plan to extend this effort to different figures of merit. Happy to hear any input on what figures of merit you would like to see **(please get in contact!)**
- We hope this will be useful service work for ESFRI roadmap application and similar documents ….

Thank you for your attention!