*OSB **Div9**: Scientific potential of different detector configurations, and common tools*

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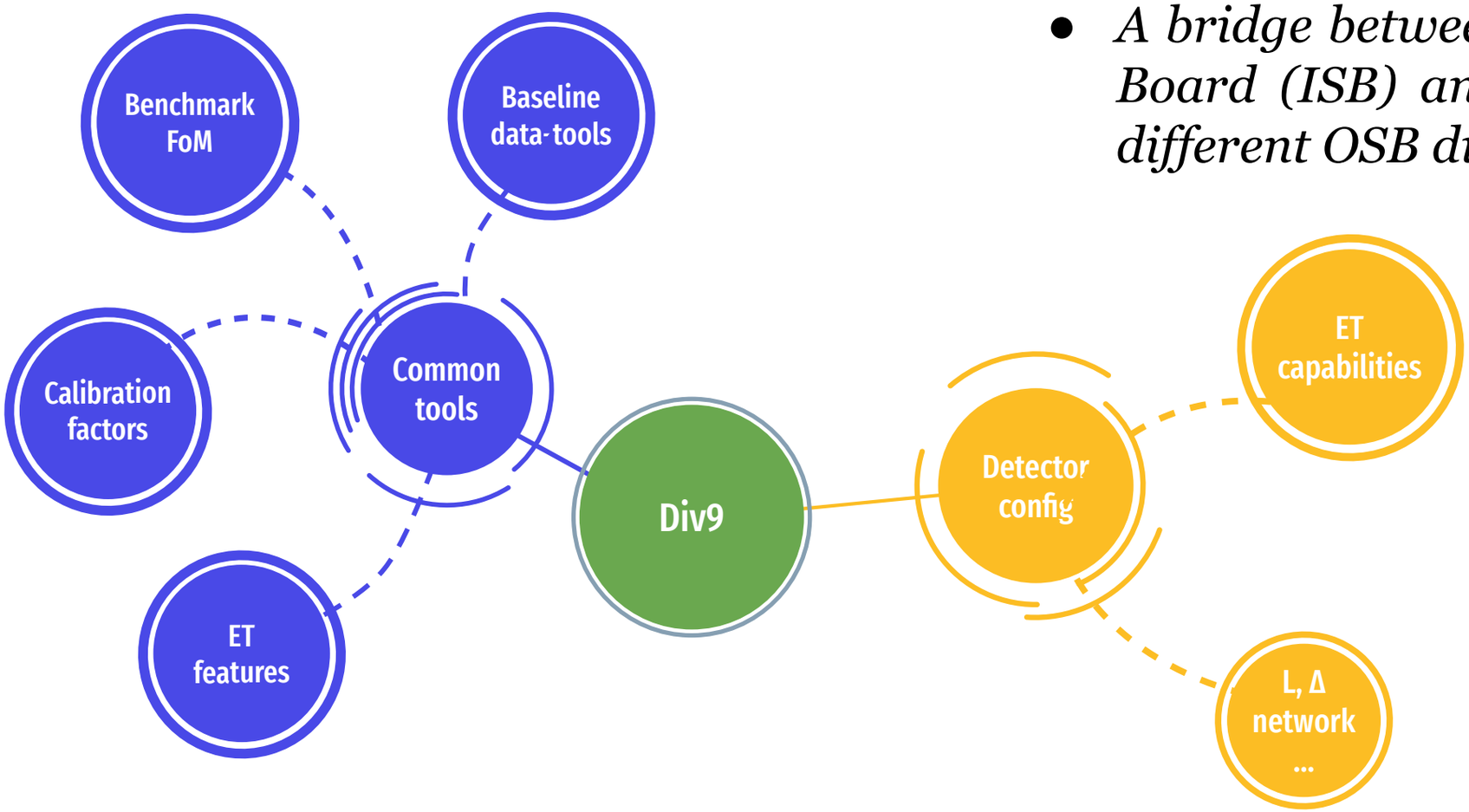
http://mail.ego-gw.it/mailman/listinfo/et-osb-tools

What this division is about



- *A bridge between the Instrument Science Board (ISB) and the OSB, and between different OSB divisions*

- *Software tools developed within division 9 have produced results which are applicable to almost all over OSB divisions*
  - *potential for overlap in material for ET Blue Book*

- *Decide to focus on source parameter estimates, mostly from CoBA study*

Outline of Blue Book contribution

1. *Introduction*

2. *Brief overview of software tools with links*

3. *Sky localisation and distance performance (Ulyana Dupletsa)*
   eg. Table 3 from CoBA; horizon distance (Francesco); Early warning; Redshift distribution (Niccolo)

4. *Intrinsic parameter inference (Francesco Iacovelli)*
   eg. Eccentricities, source mass uncertainties…

5. *Null stream (Boris Goncharov)*

In sections 3, 4 and 5, we will present the work in the context of 2L vs 1 triangle.

2. Overview of software tools

The main tools used by div9 studies will be briefly described here, with links to respective git repositories

1. *GWBench*

2. *GWFast*

3. *GWFish*

4. *TiDoFM*

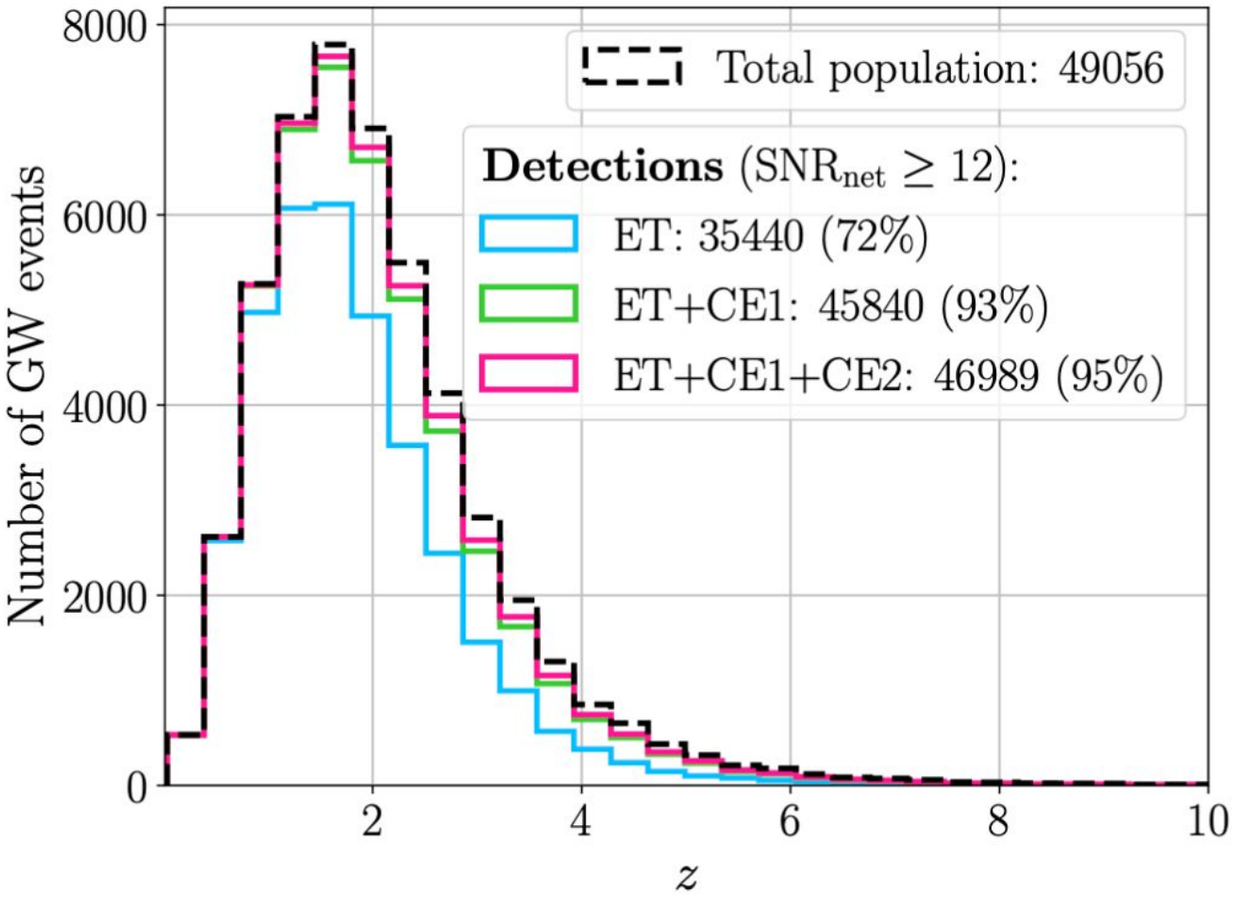
3. Sky localisation, distance, redshift

In this section, we present localisation and distance uncertainty estimates for different detector comparisons, without commenting on science impact which, we expect, will be presented in other divisions (Also include localisation for BBHs)

Configuration	$\Delta\Omega_{90\%}$	All orientation BNSs			BNSs with $\Theta_v < 15°$		
	[deg^2]	30 min	10 min	1 min	30 min	10 min	1 min
Δ10km	10	0	1	5	0	0	0
	100	10	39	113	2	8	20
	1000	85	293	819	10	34	132
	All detected	905	4343	23597	81	393	2312
Δ15km	10	1	5	11	0	1	1
	100	41	109	281	6	14	36
	1000	279	806	2007	33	102	295
	All detected	2489	11303	48127	221	1009	4024
2L 15 km misaligned	10	0	1	8	0	0	0
	100	20	54	169	2	7	26
	1000	194	565	1399	23	73	199
	All detected	2172	9598	39499	198	863	3432
2L 20 km misaligned	10	2	4	15	1	1	2
	100	39	118	288	7	19	47
	1000	403	1040	2427	47	128	346
	All detected	4125	17294	56611	363	1588	4377

3. Sky localisation, distance, redshift

Redshift distribution of detected events by different networks (arXiv:2303.10693)



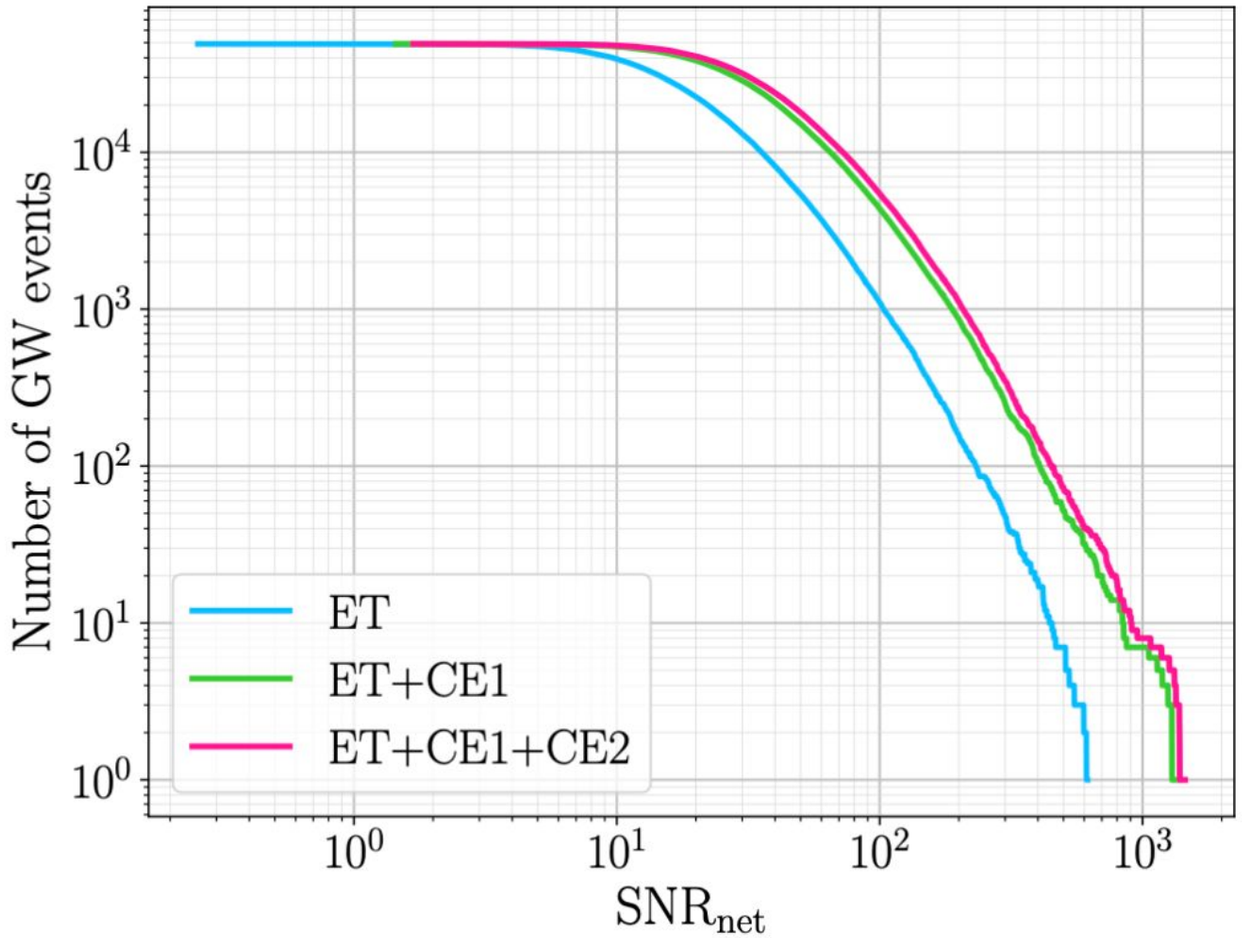
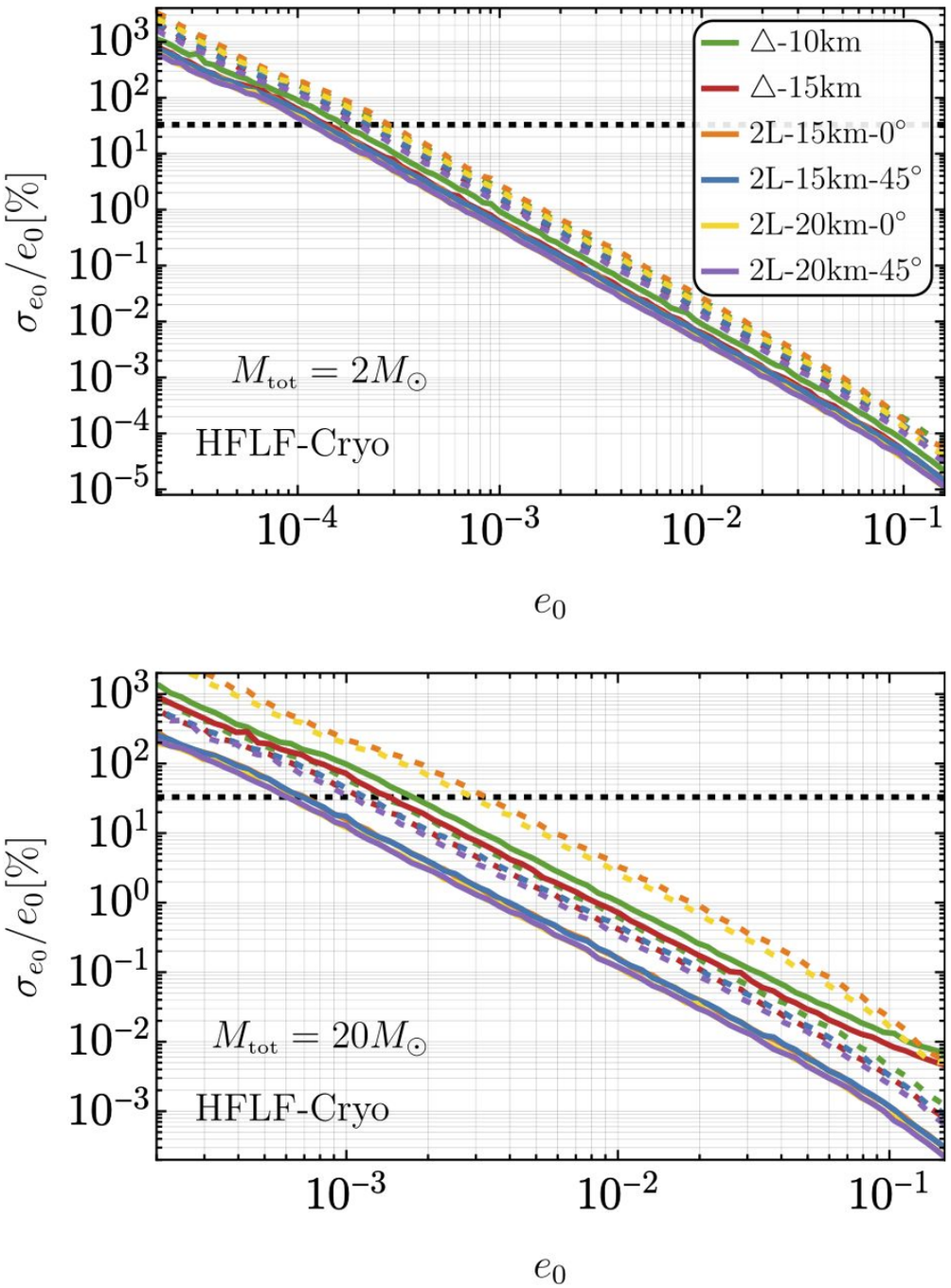
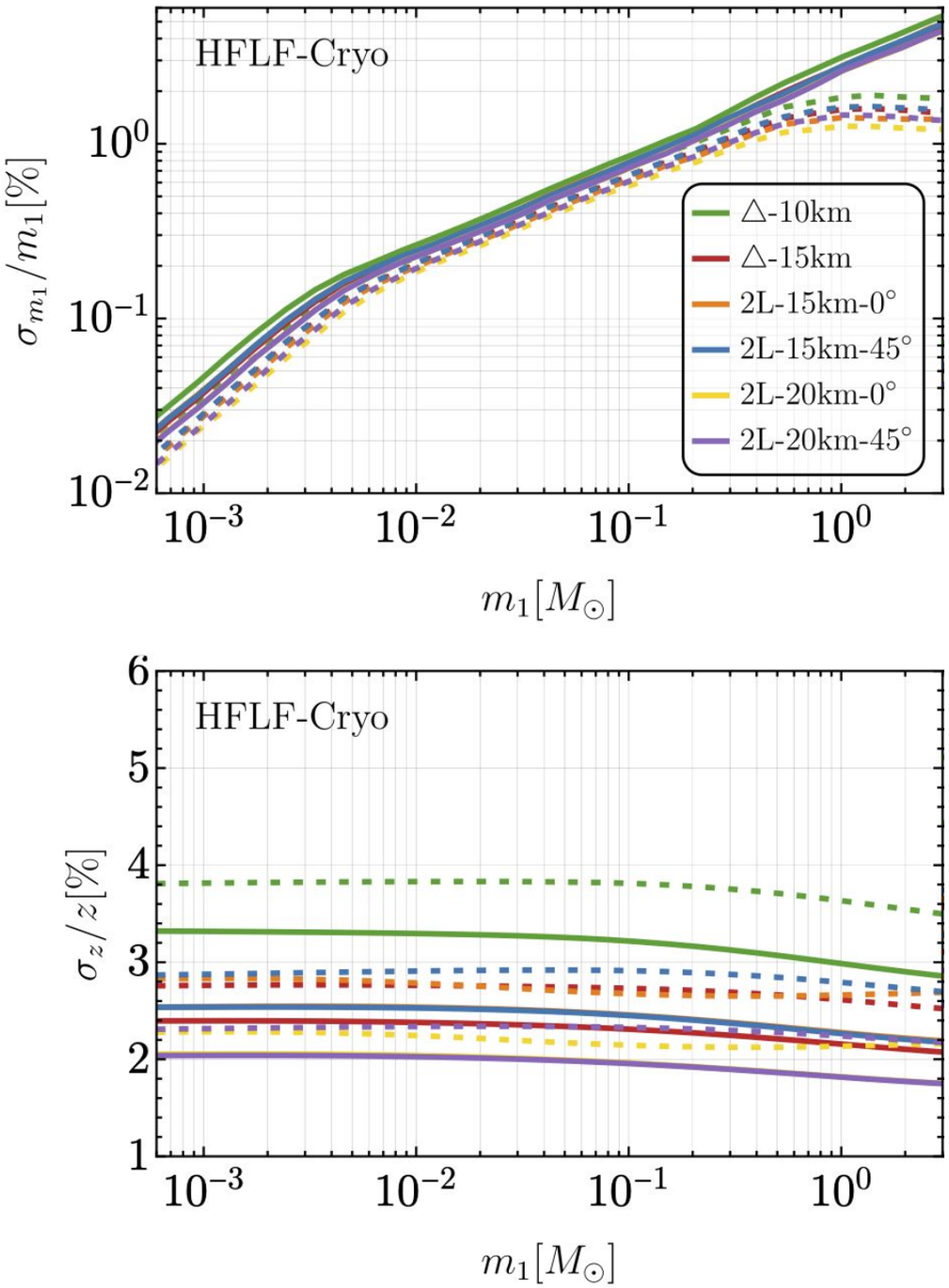


FIG. 2. Left: Redshift distributions of the total and detected population for different networks in one year of observation (full duty cycle), colors as in legend. Right: Number of detected GW events left above a given SNR_{net}, colors as in legend.

4. Intrinsic CBC parameter inference

- *eg. Eccentricities (Fig 51 from CoBA), source mass & redshift (Fig 50)*





Example results

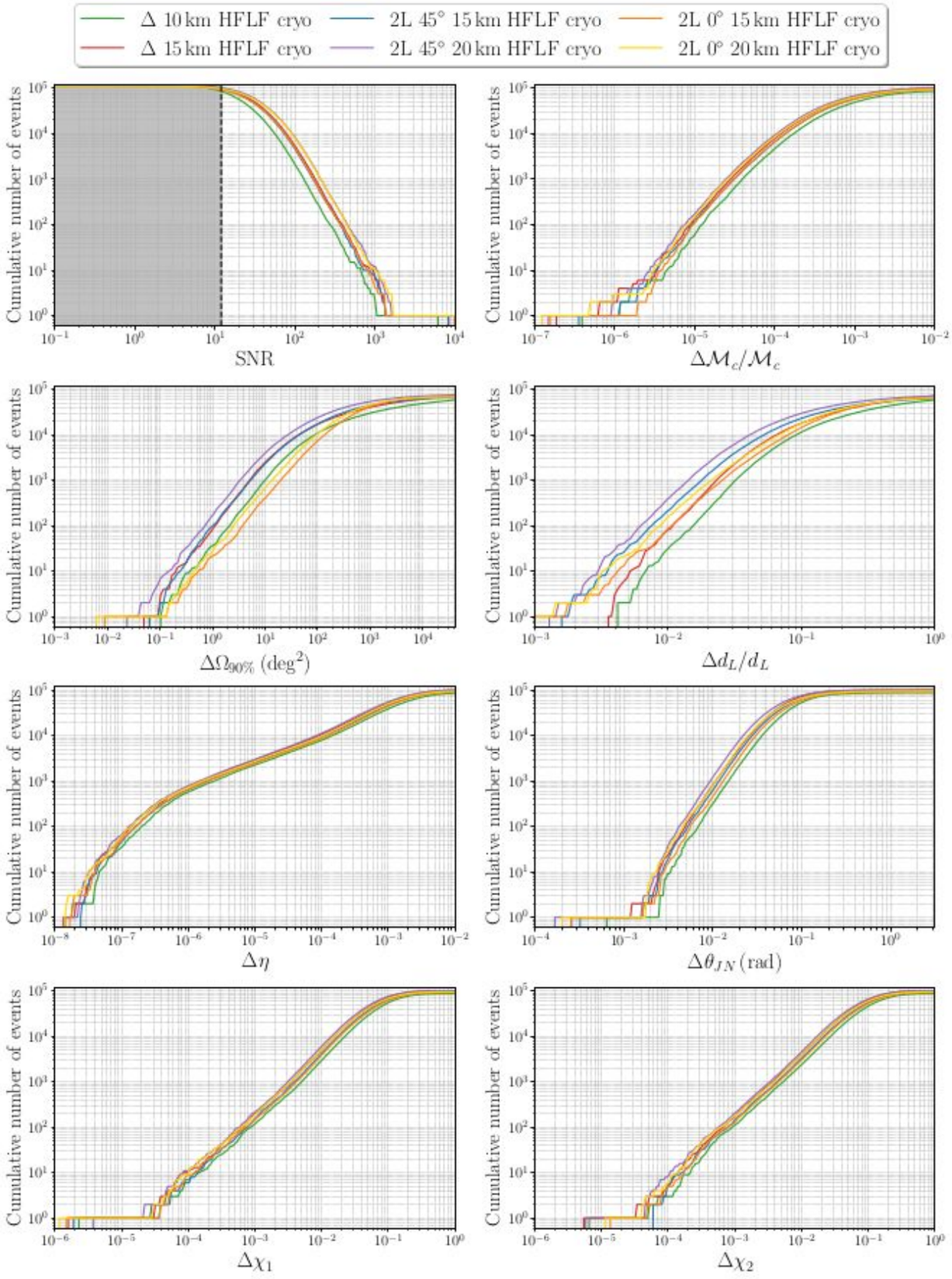


Figure 4: Cumulative distributions of the number of detections per year, for the SNRs and for the error on the parameters, for BBH signals, for the six considered geometries, all with their best ASD, including xylophone configuration and cryogenic LF instrument.

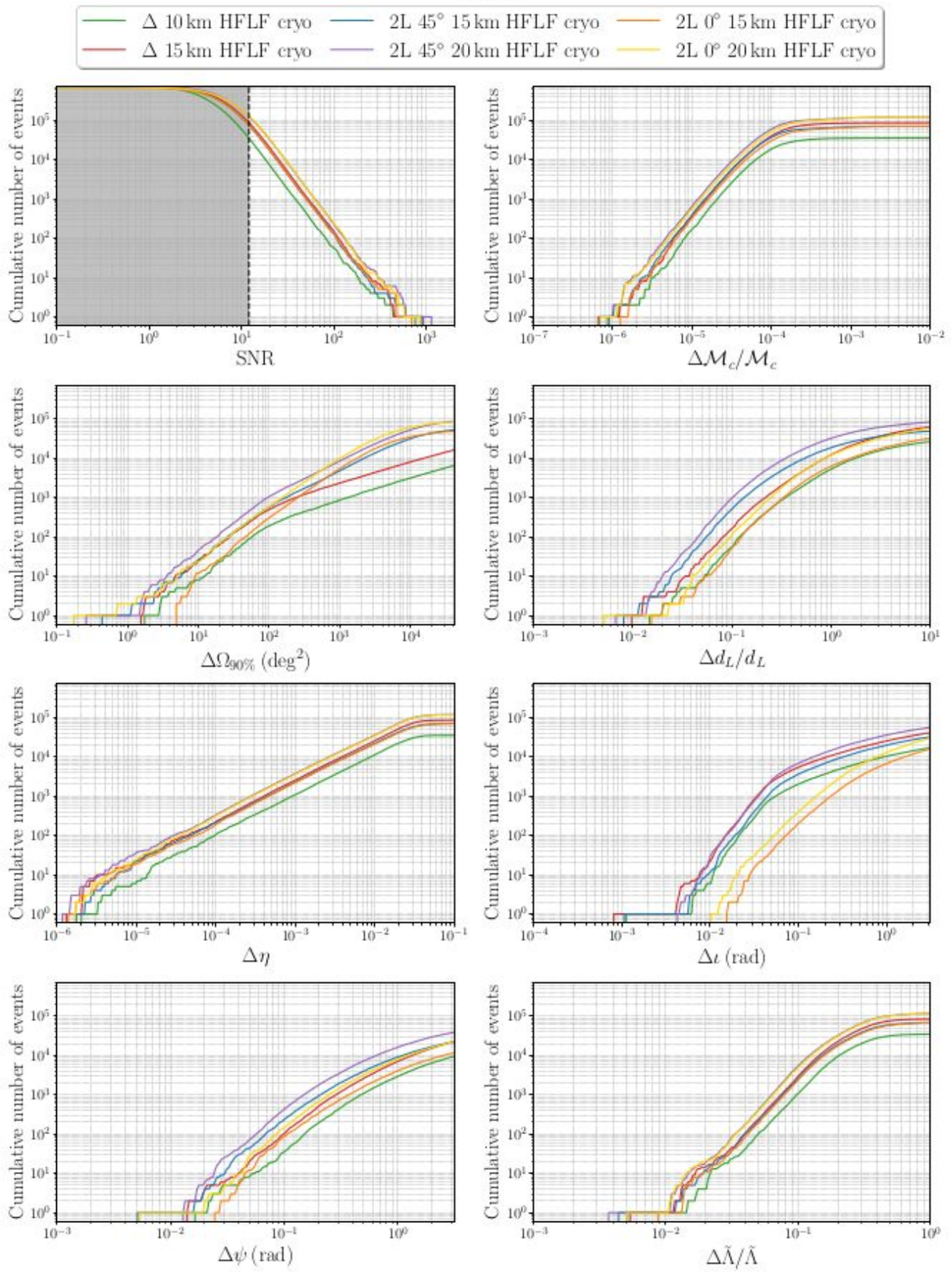


Figure 10: Cumulative distributions of the number of detections per year, for the SNRs and for the error on the parameters, for BNS signals, for the six considered geometries, all with their best ASD, including xylophone configuration and cryogenic LF instrument.

4. Intrinsic CBC parameter inference

- *Detection & inference horizons (arXiv:2303.16323)*

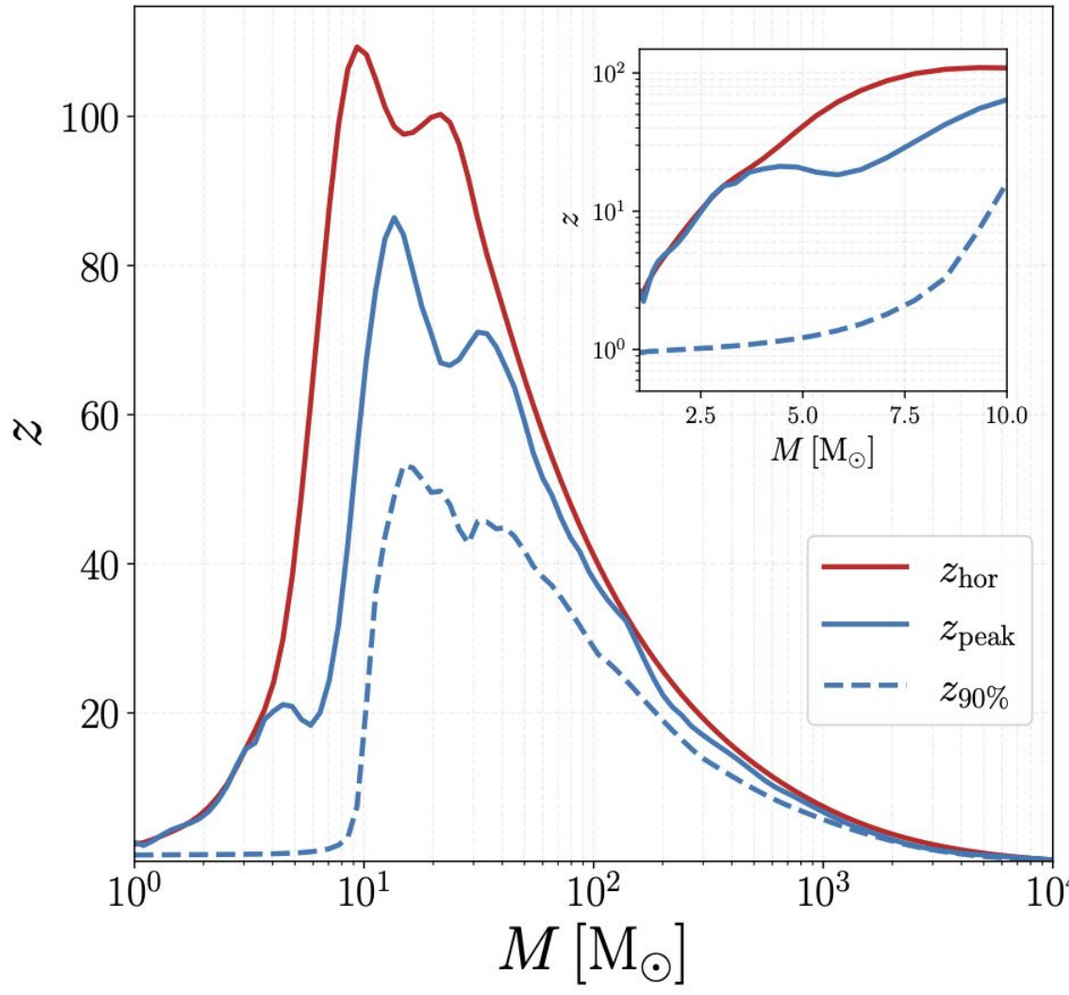


FIG. 4. Detection and inference horizons for a 3G detector network made of a triangular ET and two L-shaped CE instruments. The red curve indicates the larger redshift at which a source of a given mass M is detectable, z_{hor}, the solid blue curve indicates the true value of the redshift z_{peak} that provides the most stringent constraint, and the dashed blue curves indicates the corresponding lower bound $z_{90\%}$ on the redshift itself.

5. Null stream

- *Brief description null-stream*
- *Summarise comparison of 2L & triangle from CoBA*