

Challenges in the High Frequency Region

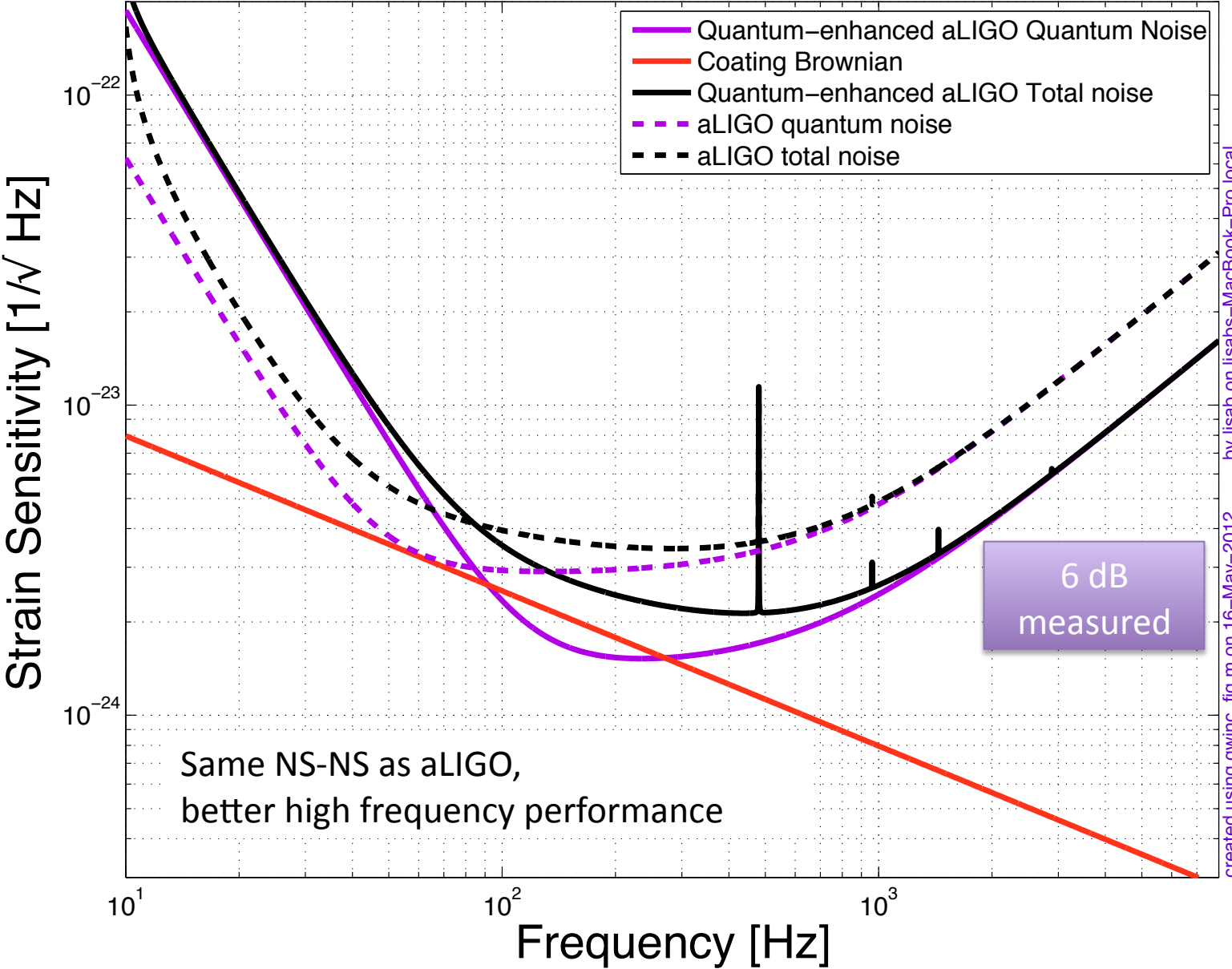
- Squeezing -

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LIGO-G1200571

GWADW2012 – Round Table

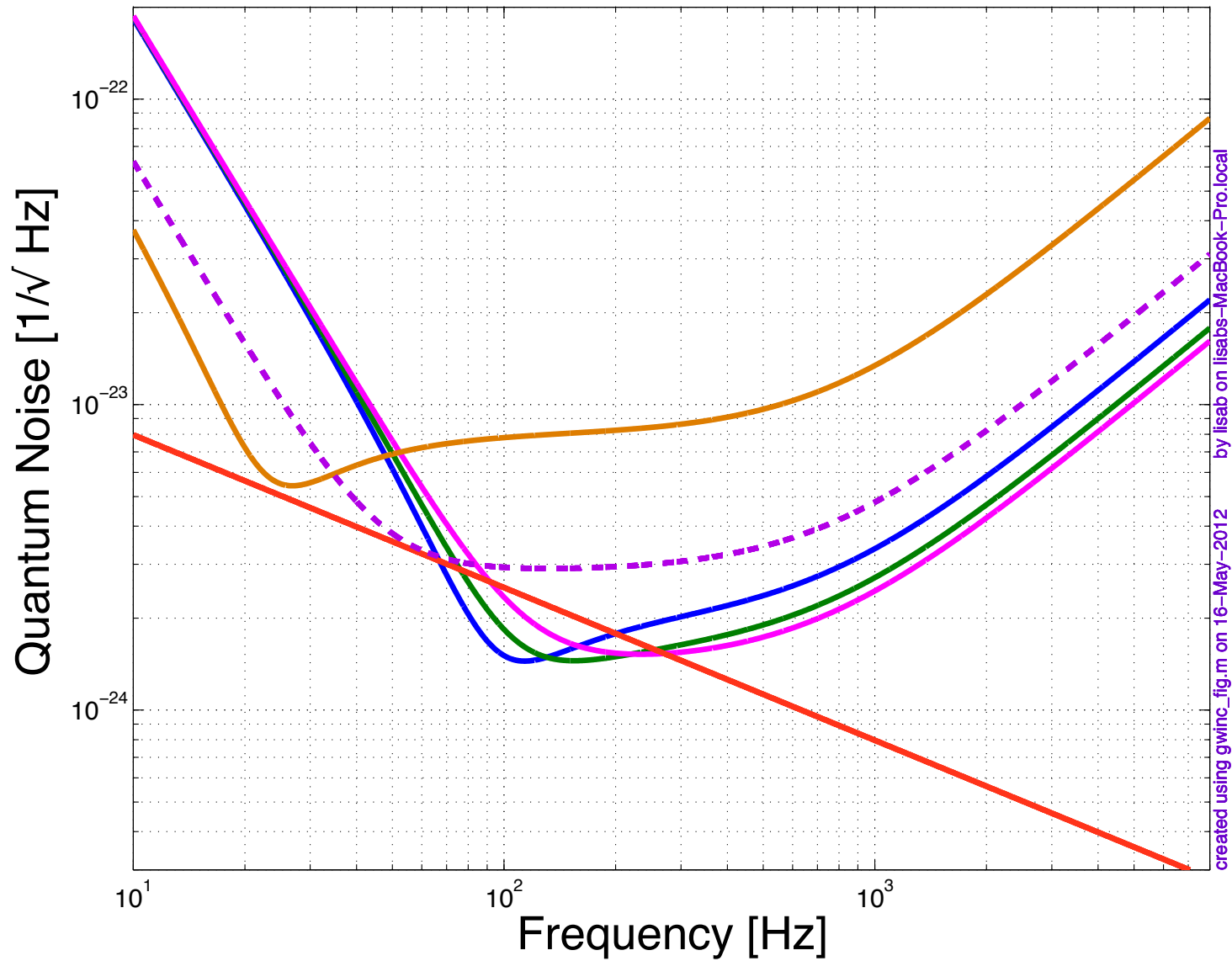
Quantum-Enhanced Advanced LIGO



created using gwinc_fig.m on 16-May-2012 by lisab on lisabs-MacBook-Pro.local

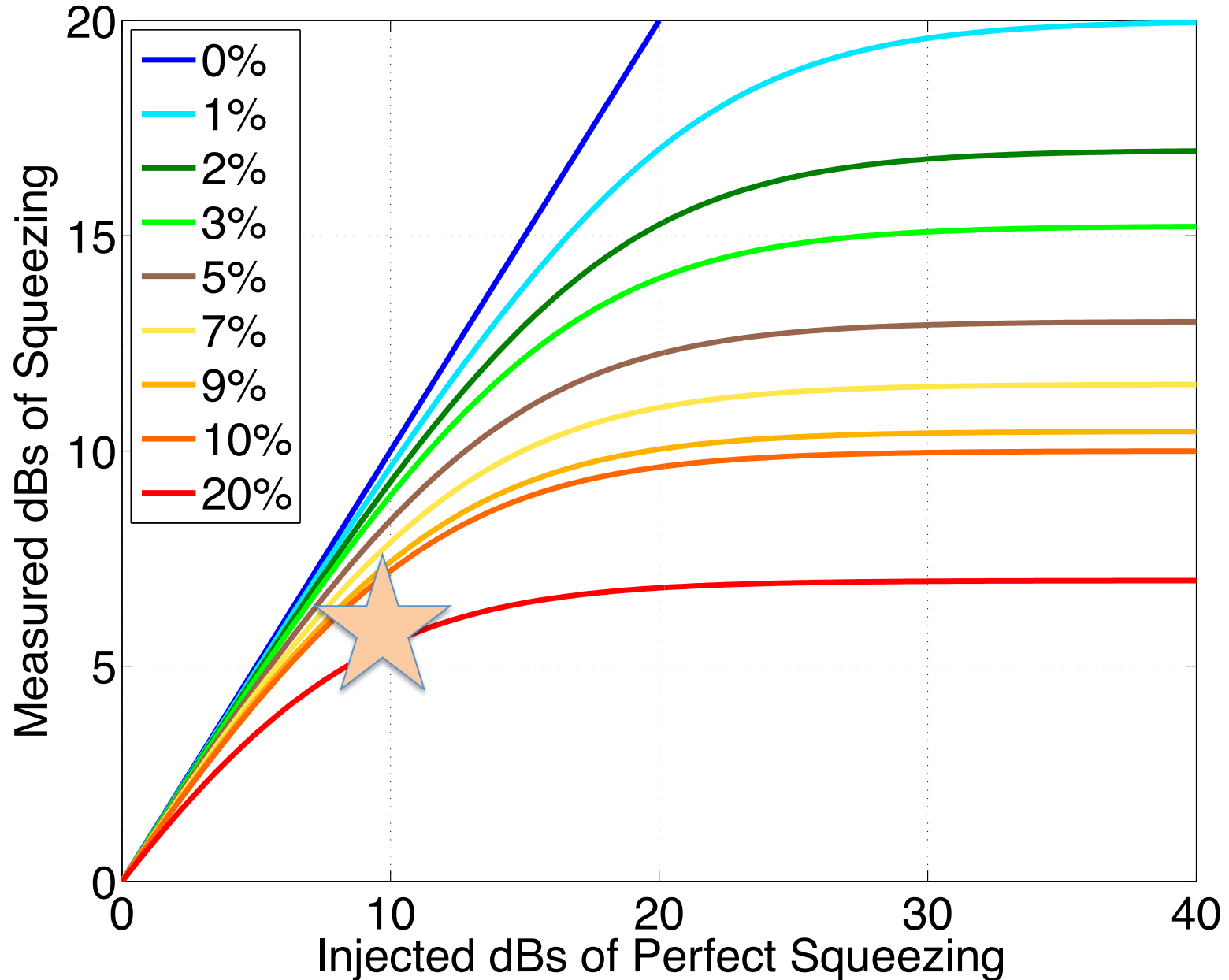
Still with frequency independent squeezing (no filter cavities)

Quantum noise shaped by squeezed angle

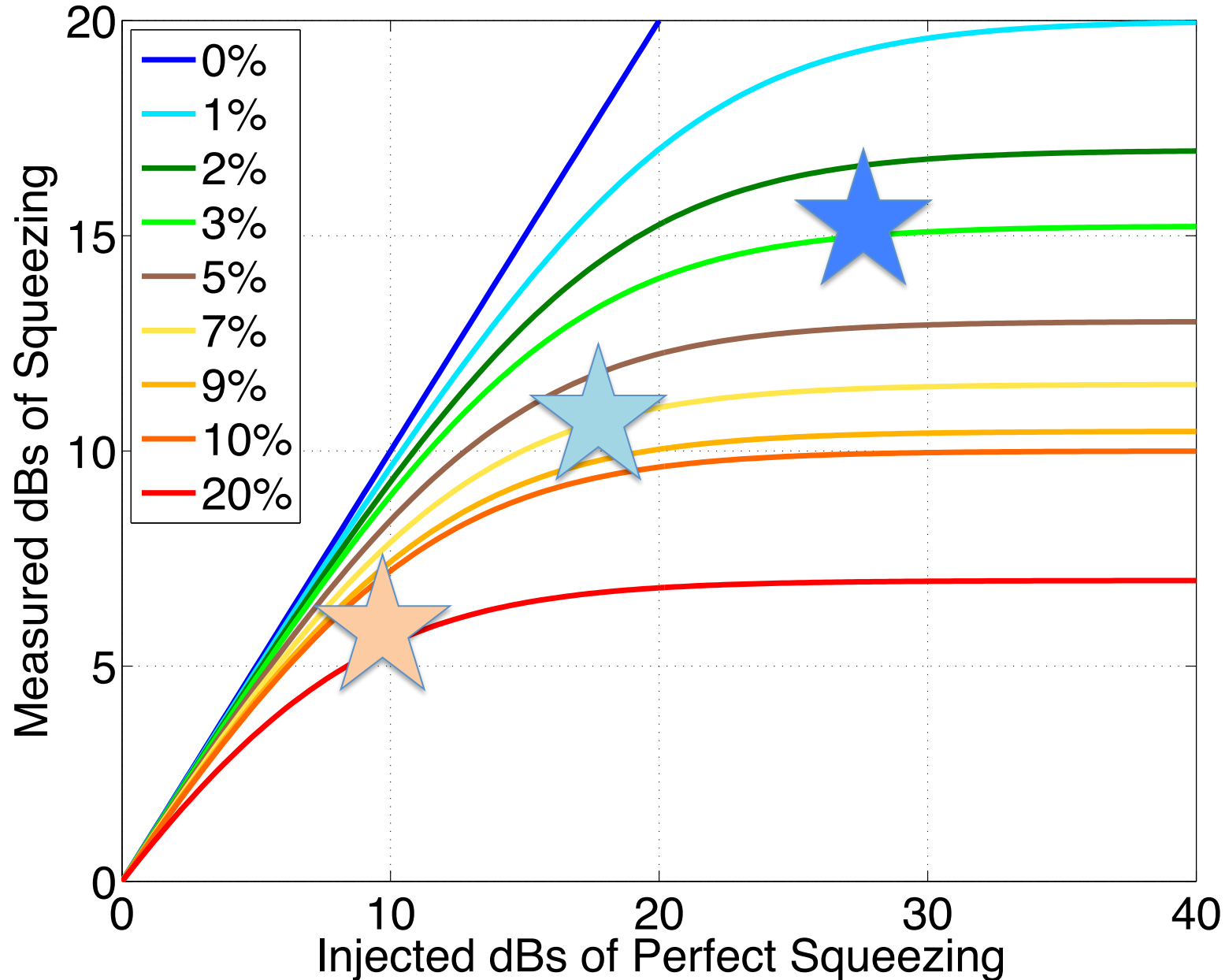


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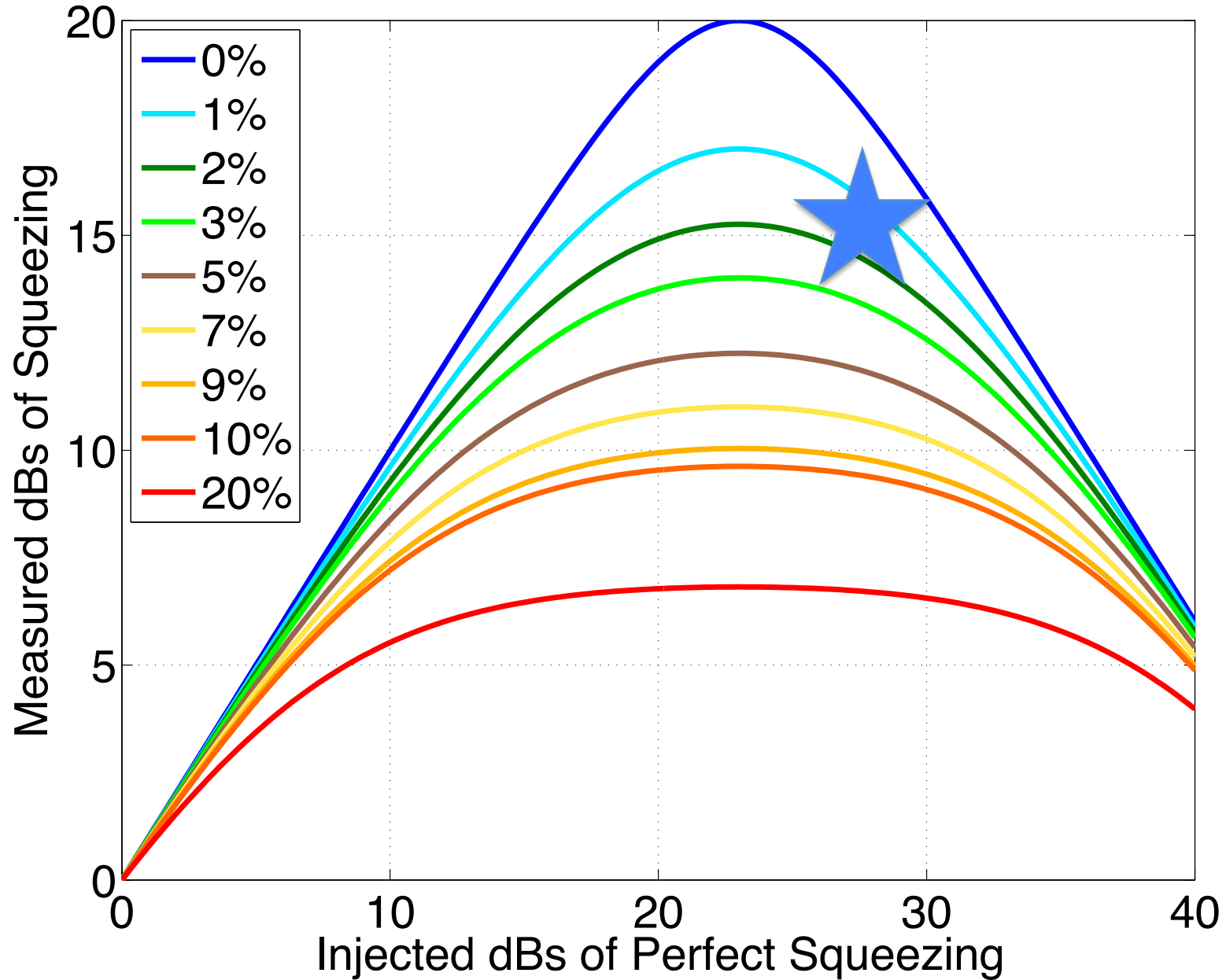
Total losses in the squeezed beam with 0 mrad phase noise



Total losses in the squeezed beam with 0 mrad phase noise



Total losses in the squeezed beam with 5 mrad phase noise



The Message

- ✧ We know how to get ready for aLIGO (6 dB)
 - ✧ Auto-alignment, better sqz angle sensing, mode matching, OPO temperature control, high OMC transmission,...
- ✧ 10 dB is really hard, 15 dB is a dream, unless
 - ✧ Think 0 losses, 0 phase noise
 - ✧ If you have 10 things which have 0.5% losses each, total losses are $\gg 2\%$

The Quantum Future (1 dB/year)



Long term stability (alignment, OPO temperature, sqz phase,..)
macroscopic losses



1-2% losses in Faradays, >98% mode matching, OMC > 99%

Filter cavity to mitigate additional quantum noise at low frequency



Everything <<1% losses (Faradays, OPO, OMC, IFO, ..)
Filter cavities to beat radiation pressure noise



...or some new idea!