



Investigating data quality metrics for stochastic GW detection

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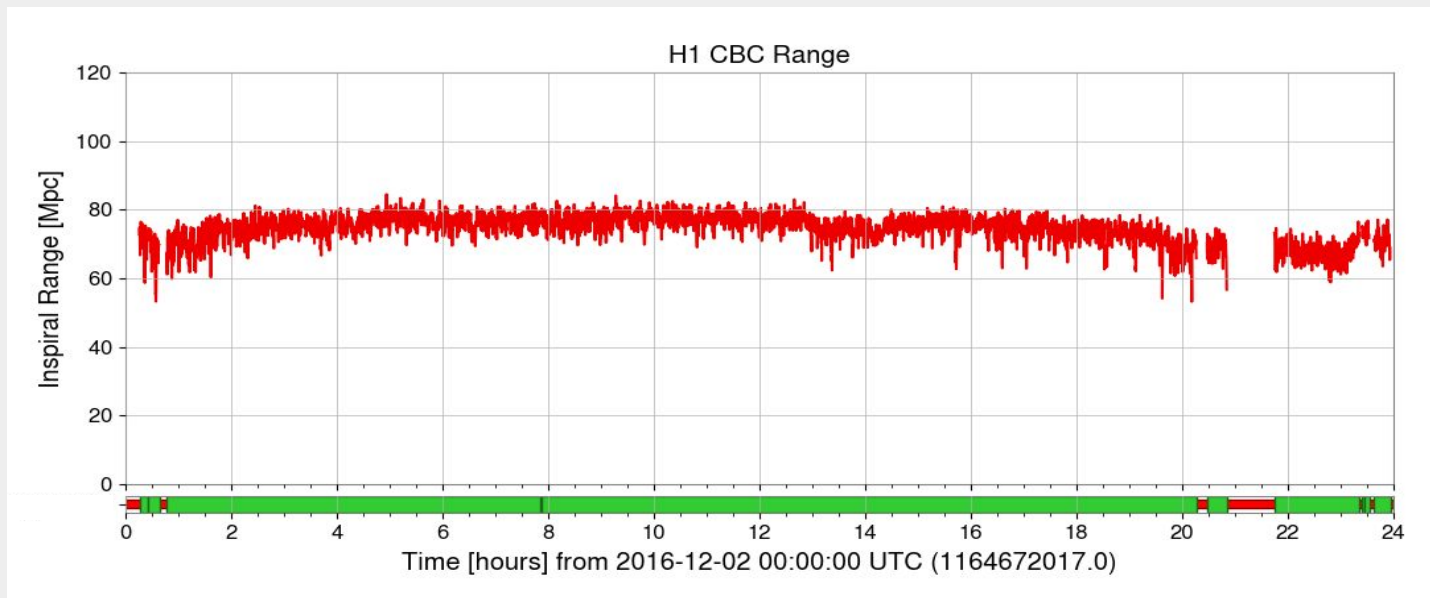


Outline

1. Background
2. StochCharMon
3. Stochastic Detector Sensitivity
4. Final Deliverable

CBC Range

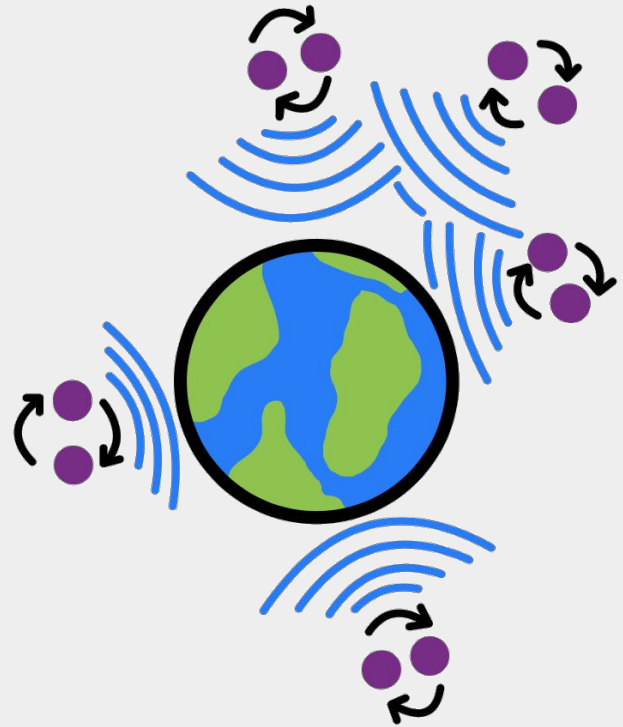
- Compact Binary Coalescence Inspiral Range
- Detector sensitivity



↑
Higher CBC range
=
Better

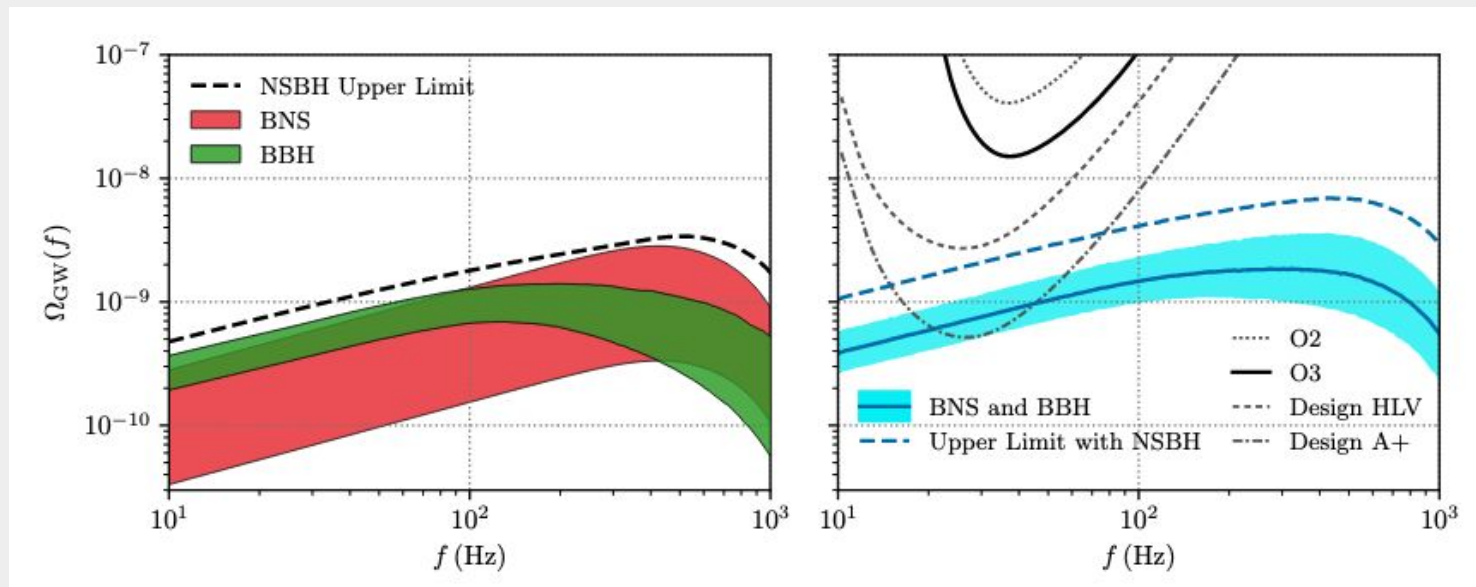
Stochastic Gravitational Wave Background

- Weak signals from a collection of sources
- Informative
- SGWB = not close
- Not yet detected



Energy Density (Ω)

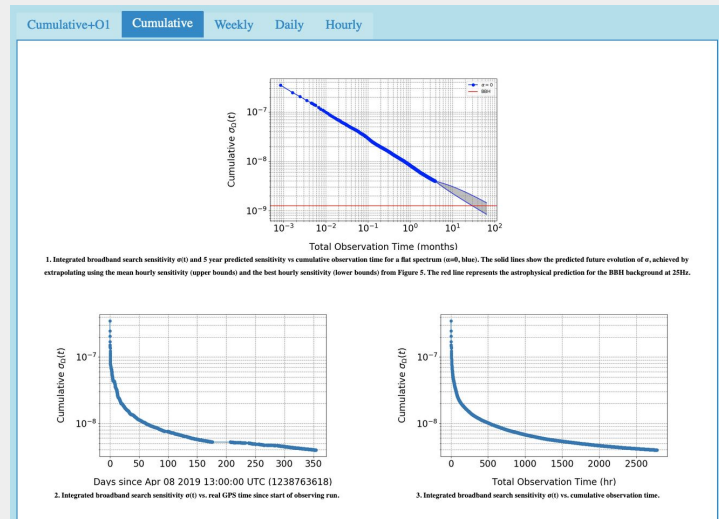
- GWB energy density predictions
- SGWB energy density $\rightarrow \sim 7 \cdot 10^{-6}$



R. Abbott et al. 2021

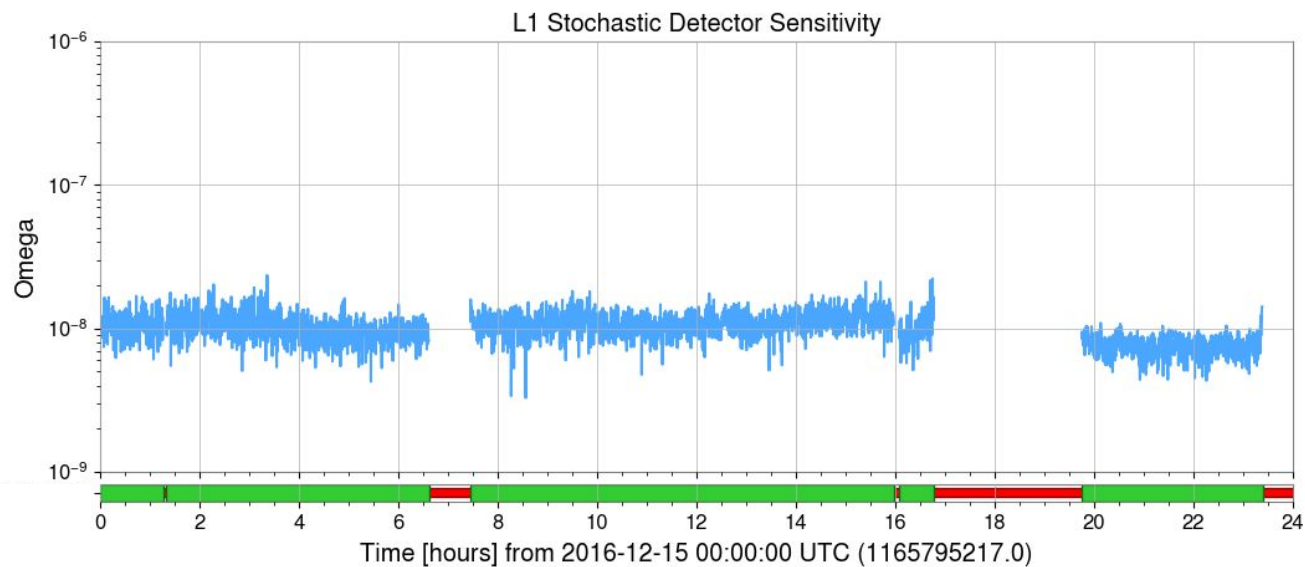
Stochmon → StochCharMon

- Low latency stochastic data monitoring pipeline
- Update and integrate
- SGWB detection
- Current Summary Page



Stochastic Detector Sensitivity

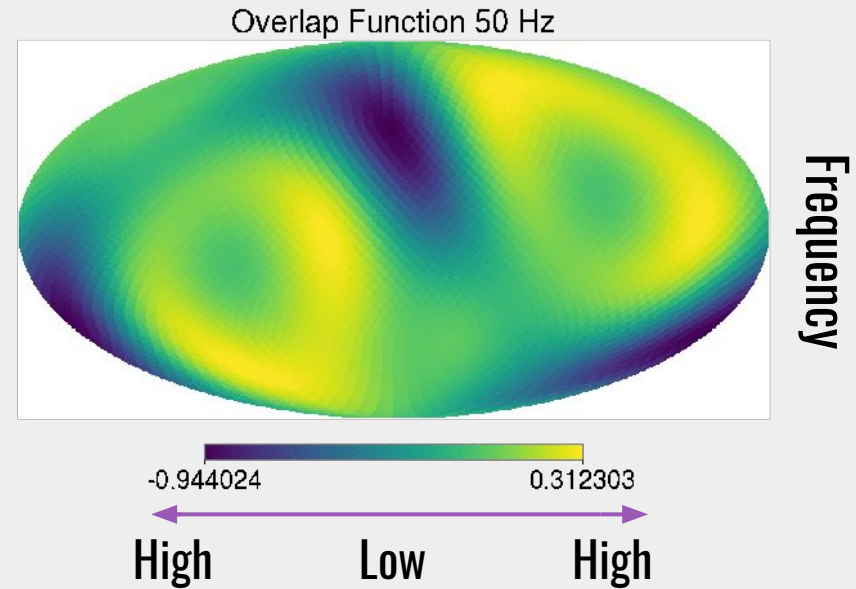
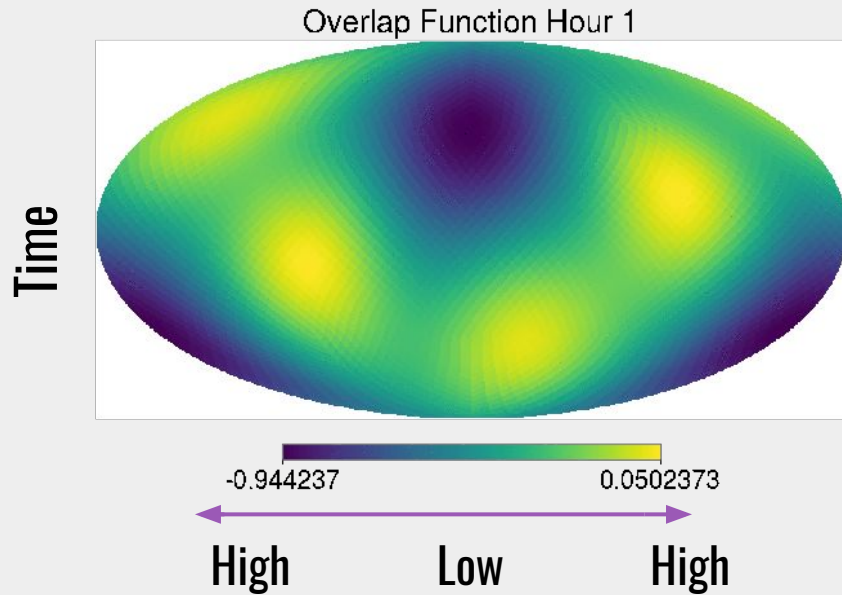
- SDS
- Sensitivity of a singular detector



↓
Lower SDS
=
Better

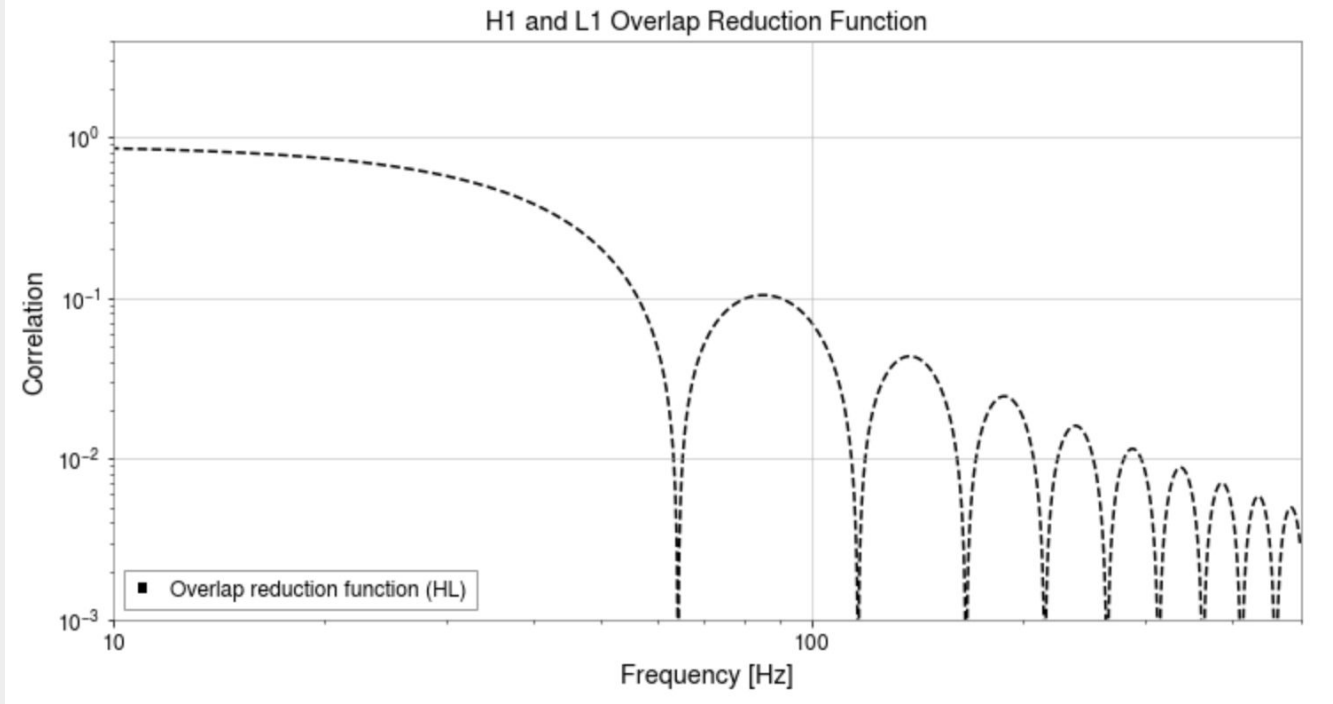
Stochastic Overlap Function

- Detector polarization response function (+ and x)
- Sensitivity of a pair of detectors



Overlap Reduction Function

- Frequency dependent correlation between a pair of detectors

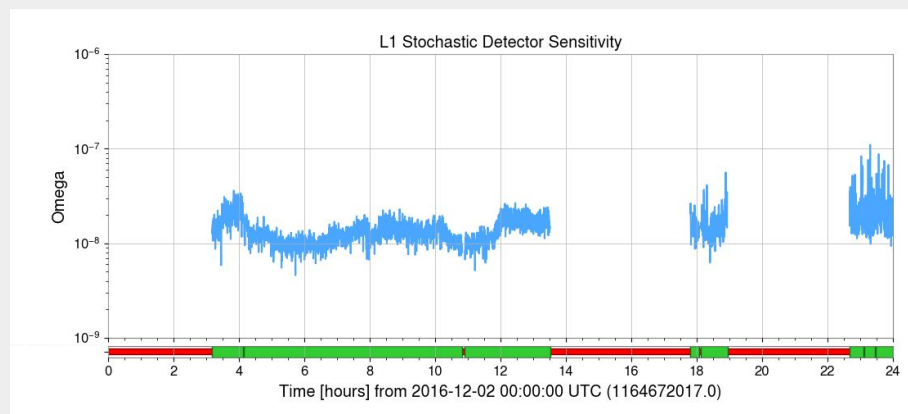
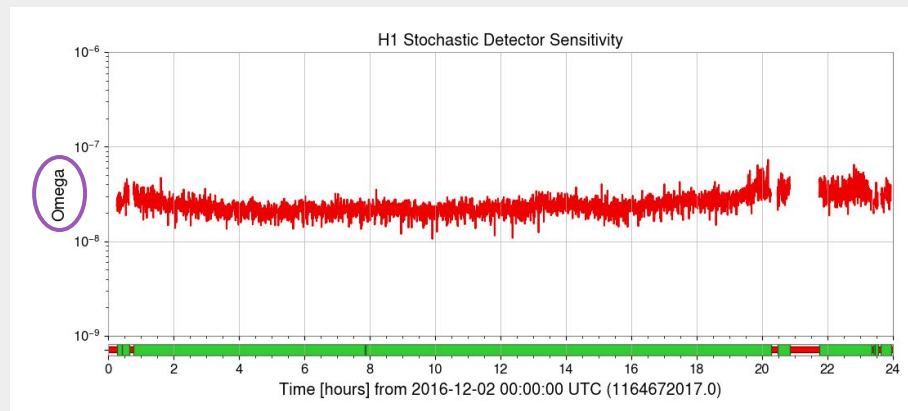


Stochastic Detector Sensitivity

- Similar to CBC range calculation
- ORF \rightarrow pair of detectors
- PSD \rightarrow single detector
- Same α as CBC range

$$\propto \int \frac{(ORF)(f^{\alpha-3})}{(PSD)} df$$

For CBC: $\alpha = \frac{2}{3}$

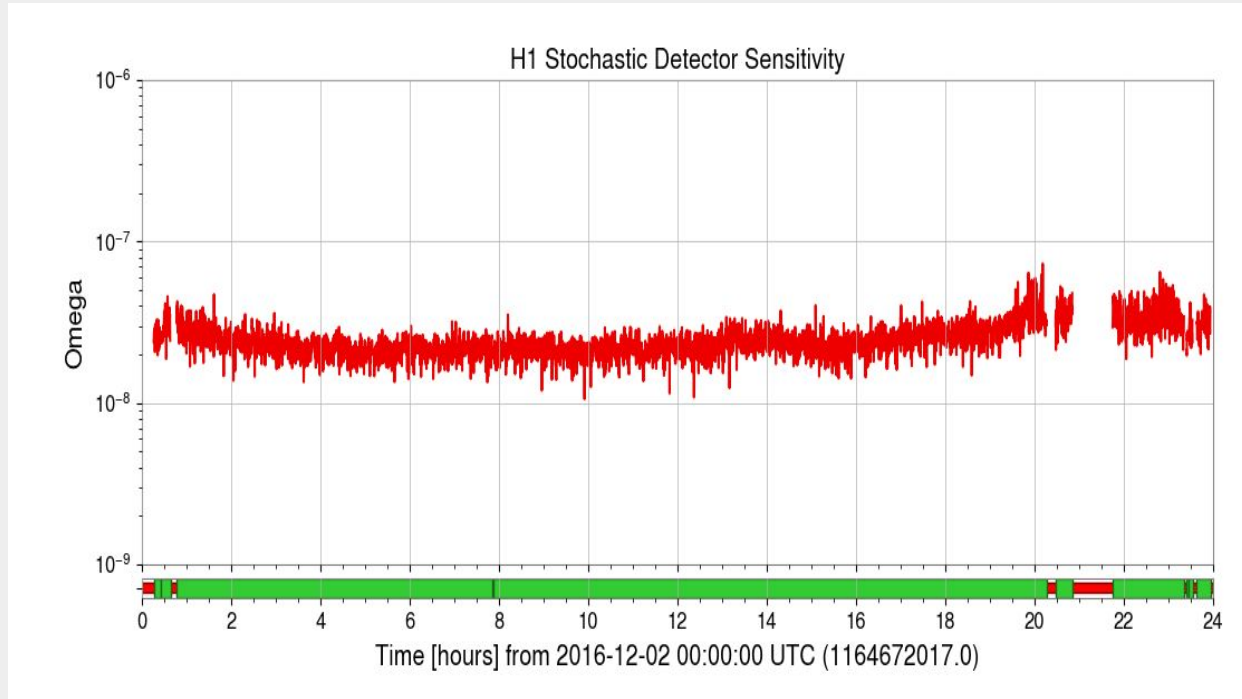


The Constant

- Re-normalize the fractional energy density
- Obtain the constant from energy density equation

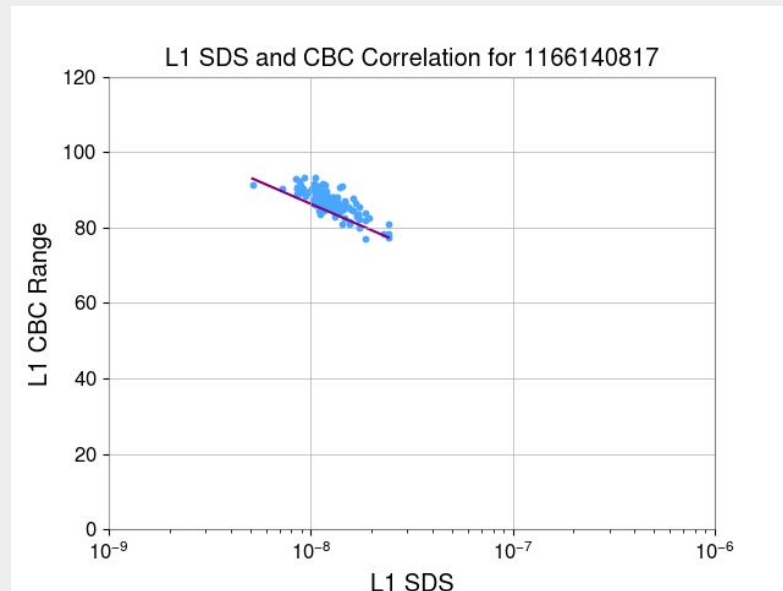
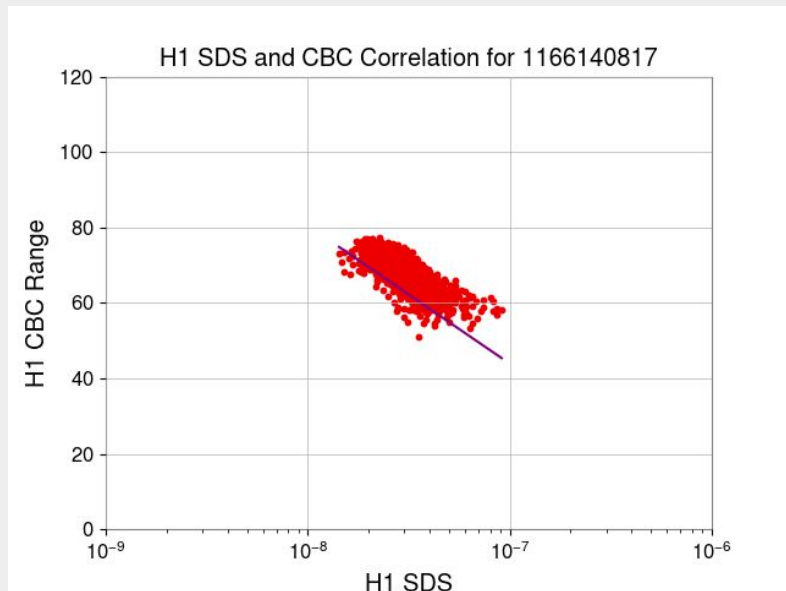
$$\Omega_0 = \frac{\rho}{T^{1/2}} f_0^{2/3} \left(\frac{2\pi^2}{3H_0} \right) \left(\int \left(\frac{(ORF)(f^{\alpha-3})}{PSD} \right)^2 df \right)^{-1/2}$$

The Constant



Correlation

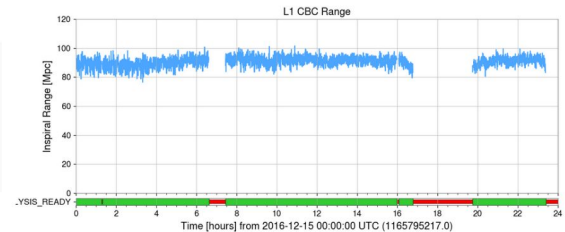
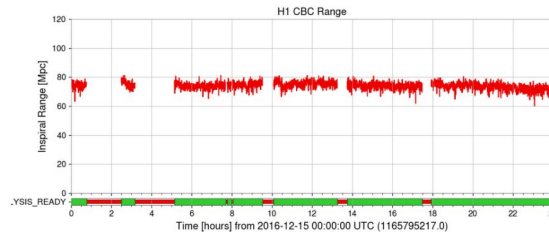
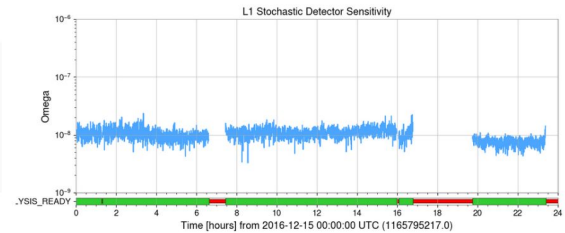
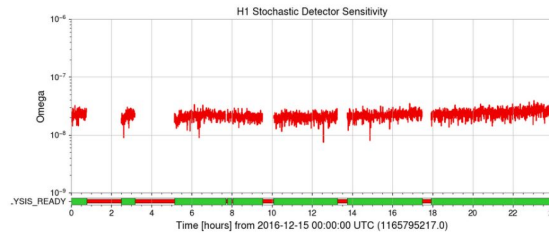
- Strong correlation (expected)
- CBC range is a fairly accurate measure of stochastic sensitivity but SDS is still valuable



- Summary page

Network ◀ December 15 2016 ▶ Summary H1 Summary L1 Summary

Summary



Future of StochCharMon

- Continue updating and integrating
- 04
- Detect the SGWB



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**Thank
you.**