

Deep Cleaning for Gravitational Wave Data

Non-linear noise regression with neural networks

Tri Nguyen ⁽¹⁾ Erik Katsavounidis ⁽¹⁾ Michael Coughlin ⁽²⁾ Rich Ormiston ⁽³⁾ et al.

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¹ Massachusetts Institute of Technology

² California Institute of Technology

³ University of Minnesota - Twin Cities



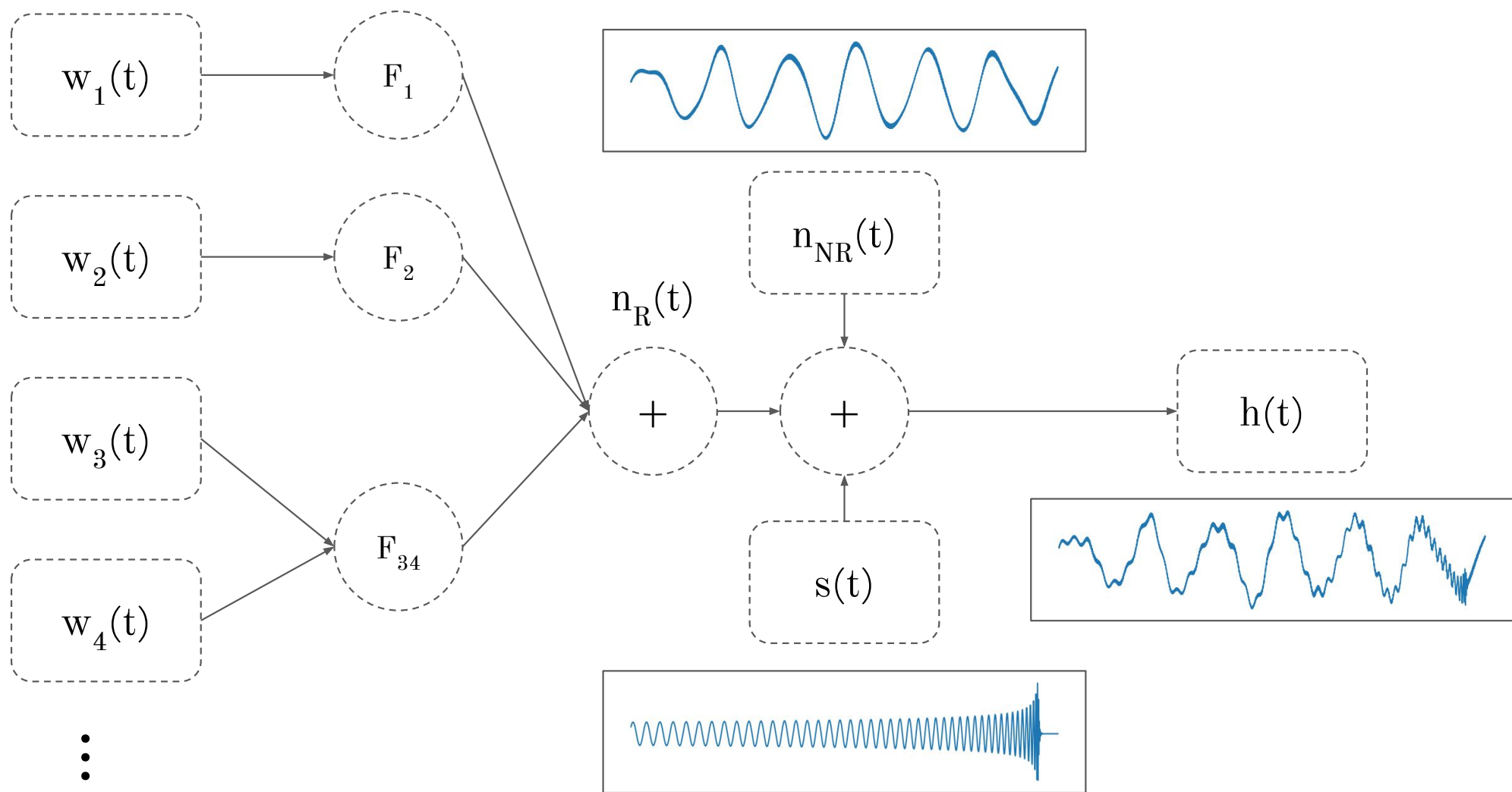
GW strain: $\mathbf{h}(t) = s(t) + n_{NR}(t) + n_R(t)$ ***bold** =
DATA

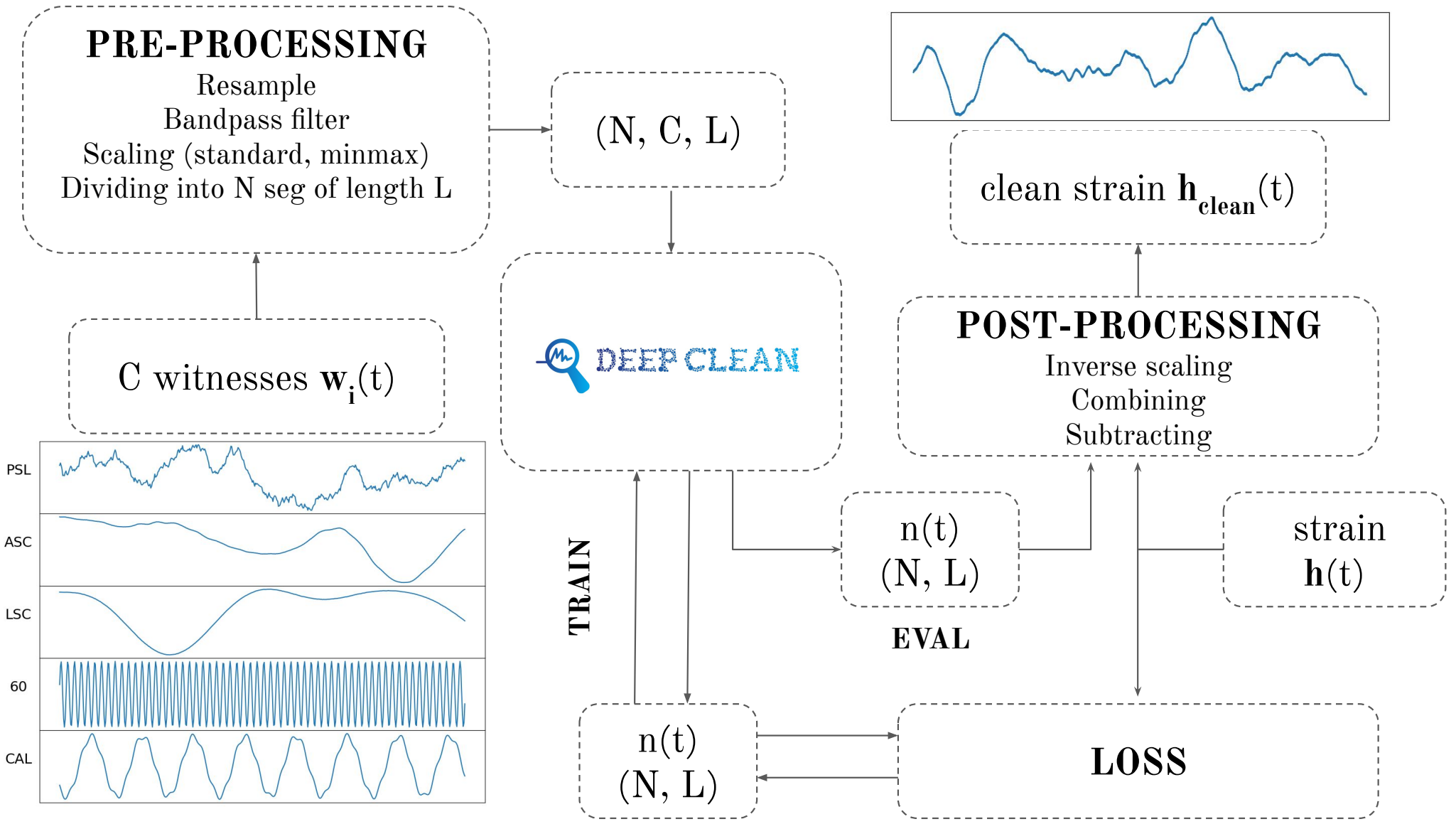
← GW signal
↙ Non-removable noise (e.g. shot noise, thermal noise)
↘ Removable (target) noise (e.g. magnetic noise, power line)

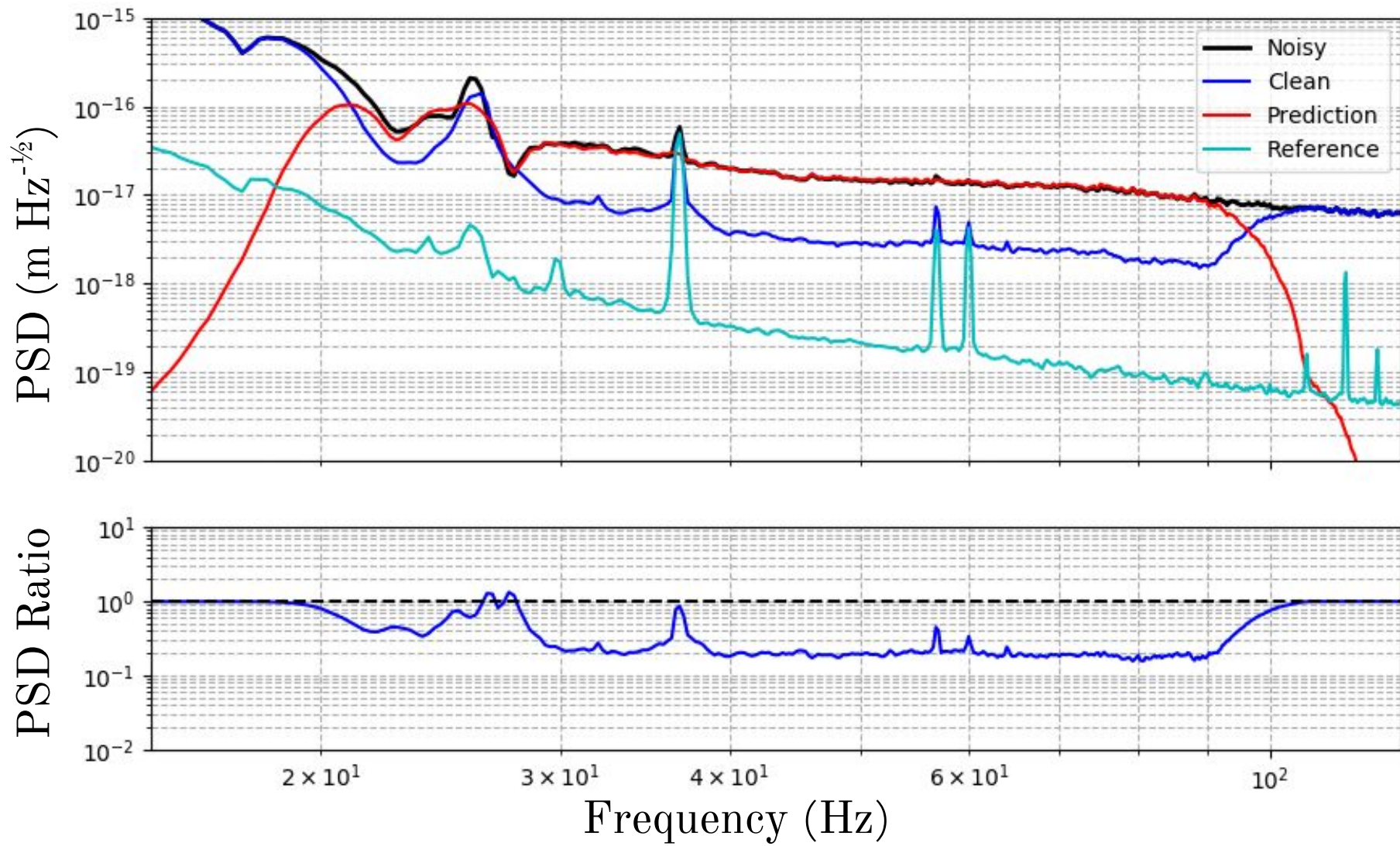
N witness channels: $n_R(t) = F\{\mathbf{w}_1(t), \mathbf{w}_2(t), \dots, \mathbf{w}_N(t)\}$

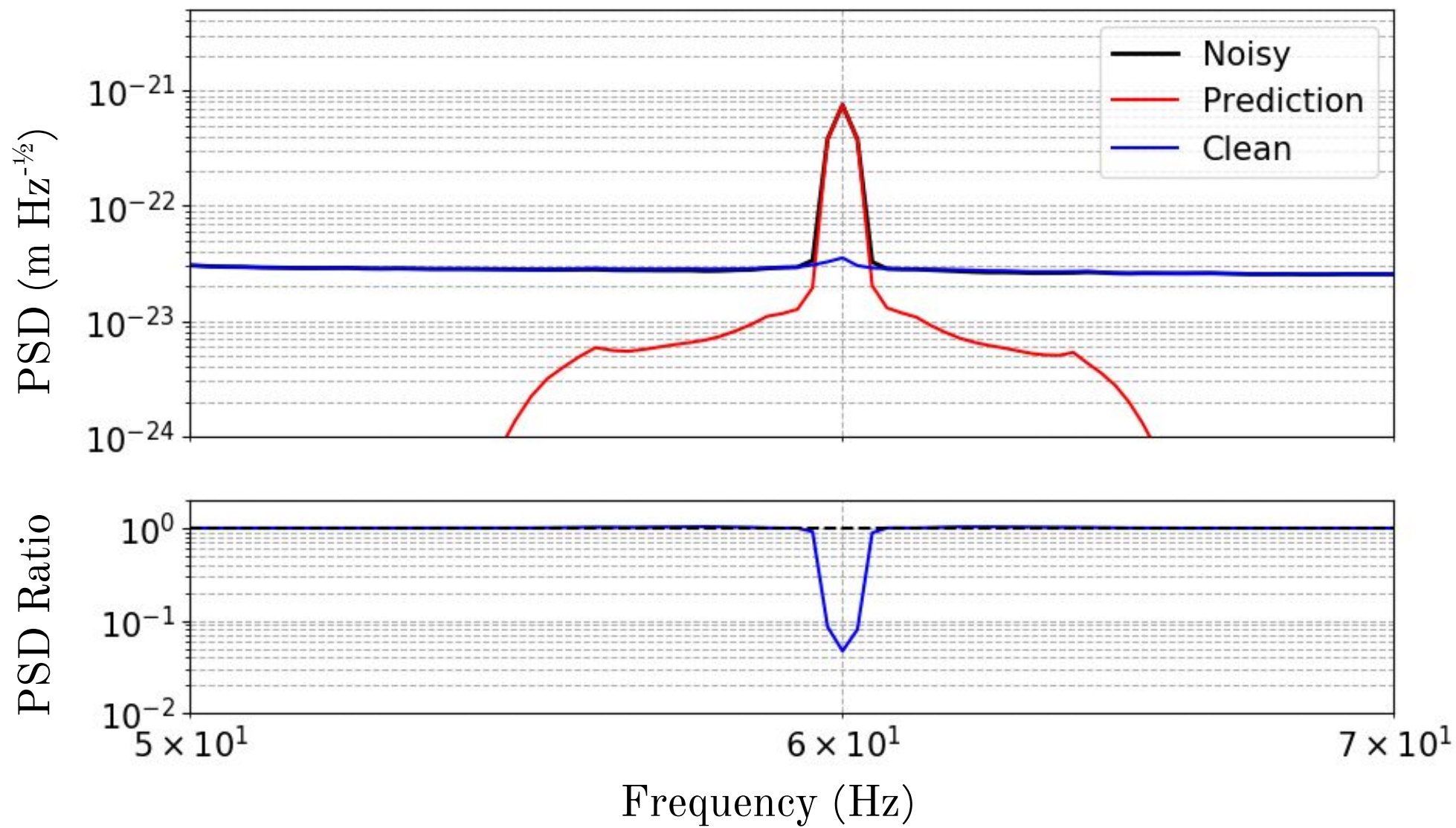
Find: $\hat{F} = \operatorname{argmin}_F \mathcal{L}[\mathbf{h}(t), F\{\mathbf{w}_i(t)\}] \quad i = 1, \dots, N$

$$\mathcal{L}[h(t), n(t)] = \frac{1}{f_2 - f_1} \int_{f_1}^{f_2} df \left(\frac{S_{rr}(f)}{S_{hh}(f)} \right)^\alpha; \quad r(t) = h(t) - n(t)$$









Future work

- Current difficulties:
 - which channels?
 - non-stationary
- Injection study:
 - parameter estimation
 - matched filter
- Low-latency subtraction
 - online learning?

