

---

# SNEMO: a new model for Type Ia Supernovae

---

Clare Saunders  
LSST-France, 18.01.2018



---

# Why is a new model needed?

---

- ❖ Current models very simple
  - ❖ Don't capture diversity of Type Ia population
  - ❖ Potential for systematic biases



---

# A New Model

---

- ❖ Trained on data from the Nearby Supernova Factory
- ❖ Series of spectral time series templates that can be added together to fit observed spectra or photometry.
- ❖ Method combines Gaussian Processes with Expectation Maximization Factor Analysis (variant on PCA)



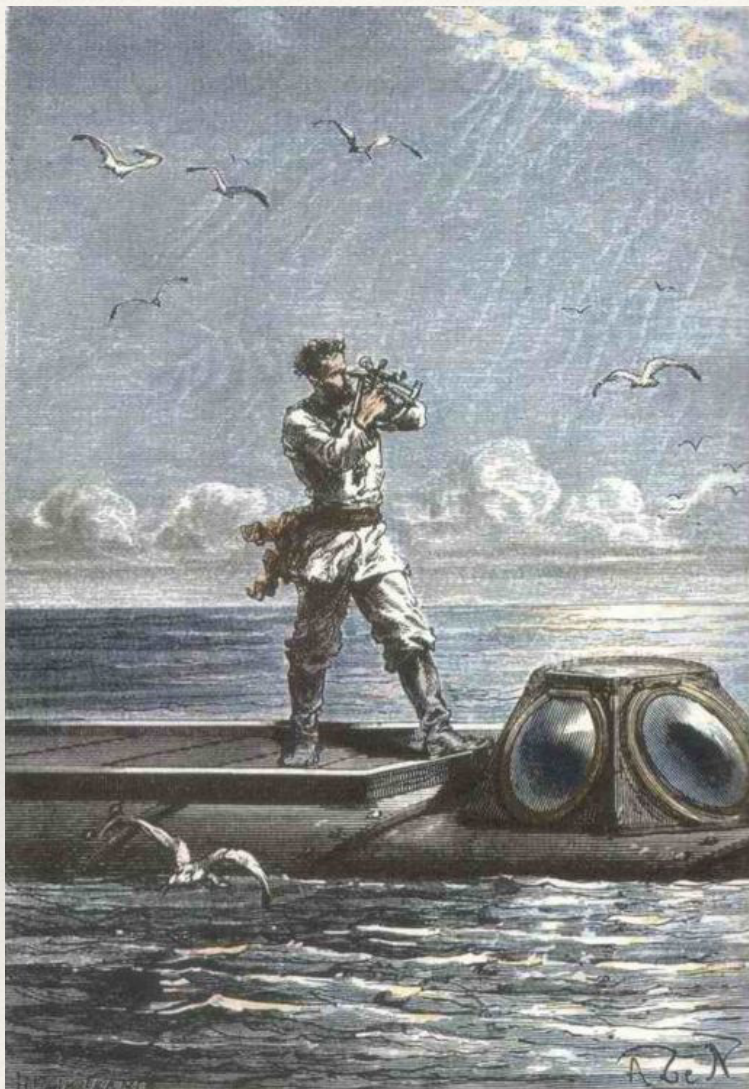


---

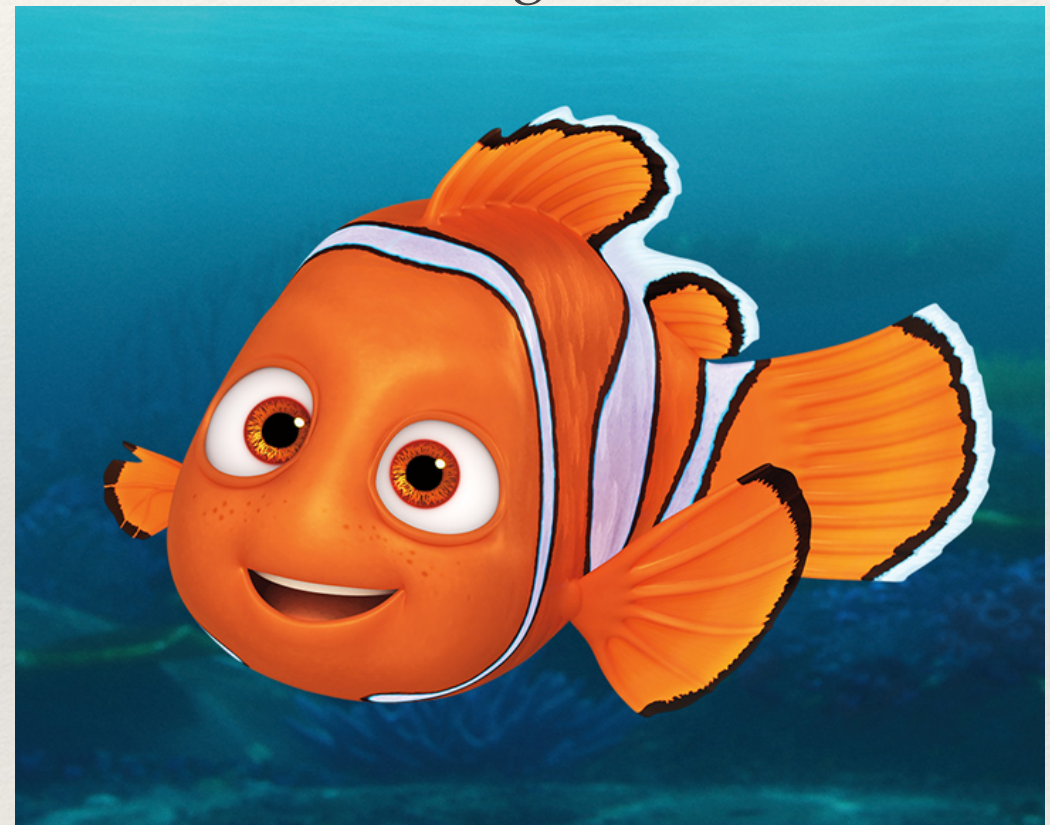
# SNEMO = type Ia SuperNova Empirical MOdel

---

Captain Nemo



Finding Nemo

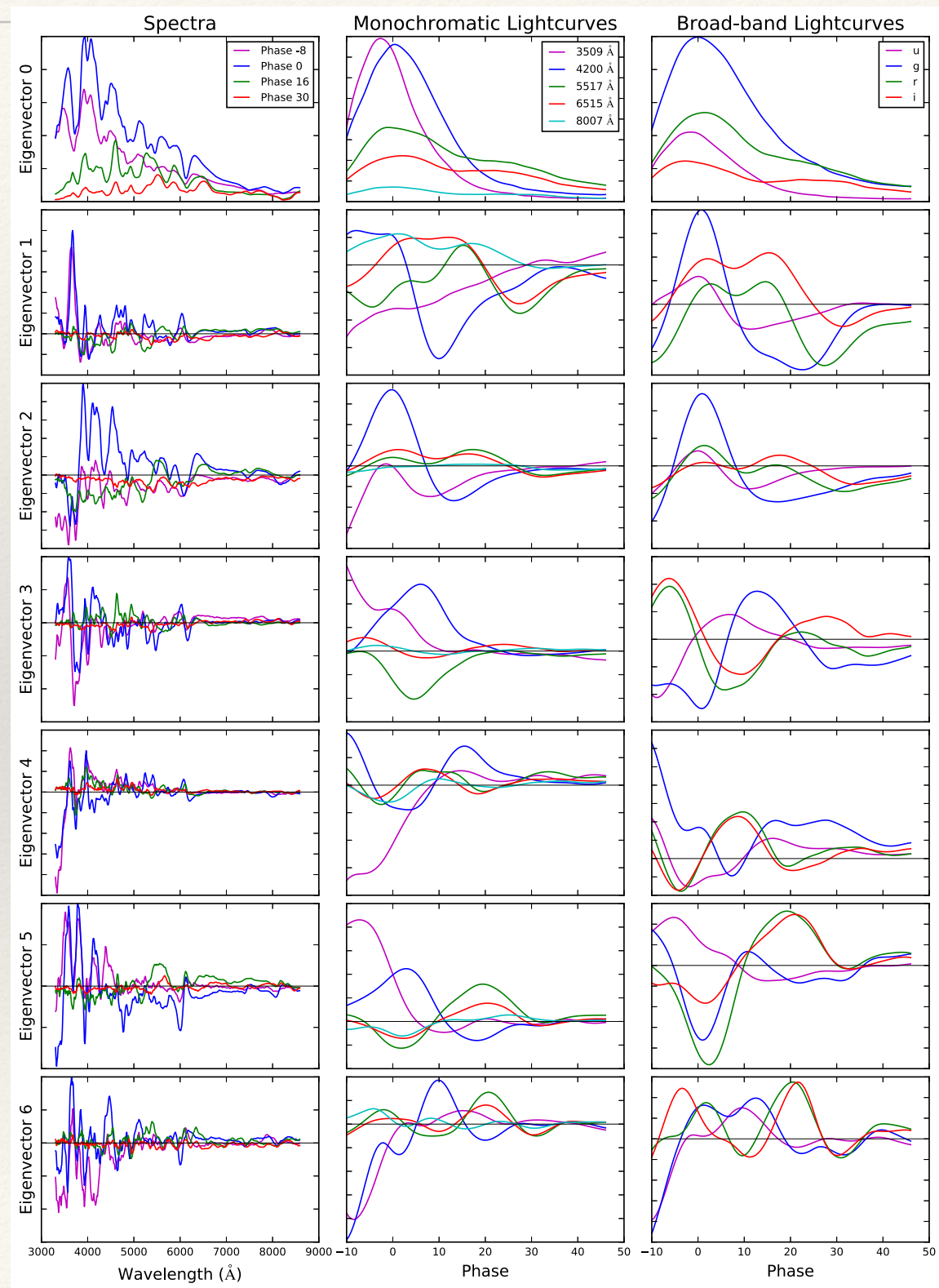




- ❖ **SNEMO2**: 2 component model for comparison with SALT2, MLCS2k2
- ❖ **SNEMO7**: 7 component model chosen for standardizing supernova magnitudes
- ❖ **SMEMO15**: 15 component model for maximizing the amount of SNIa variability captured by the model.



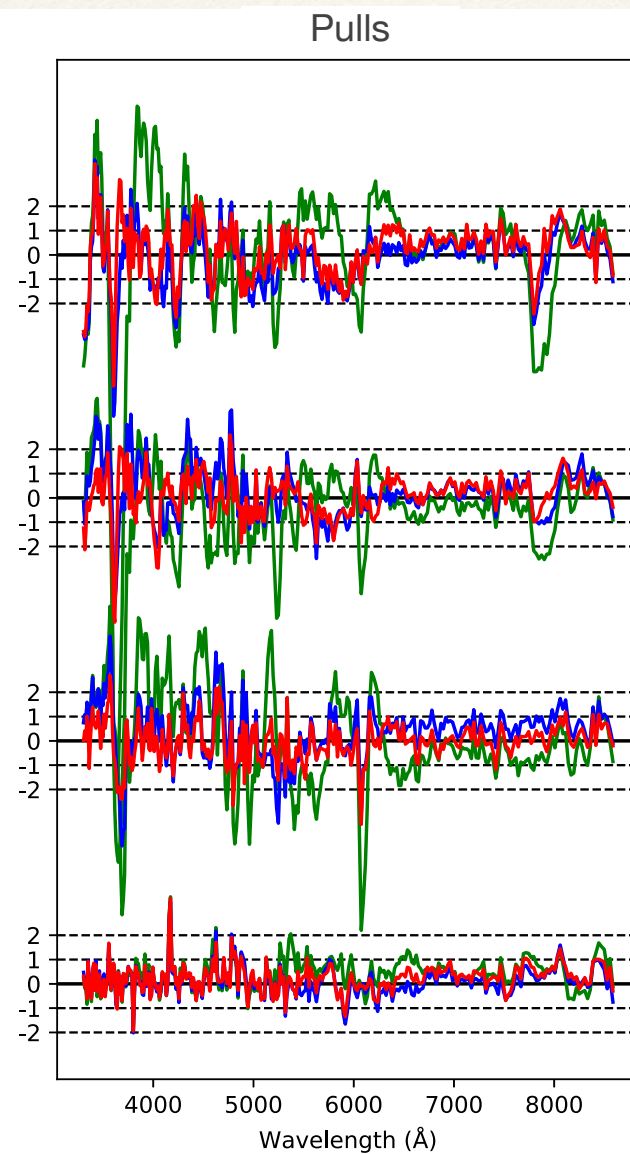
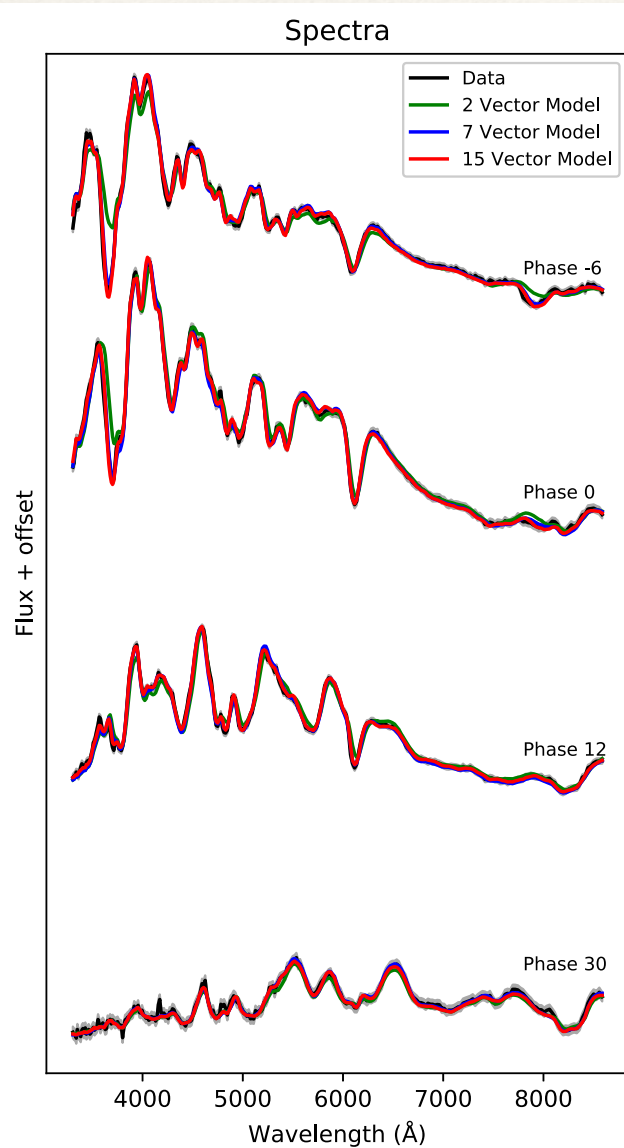
# SMEMO7 Model Components



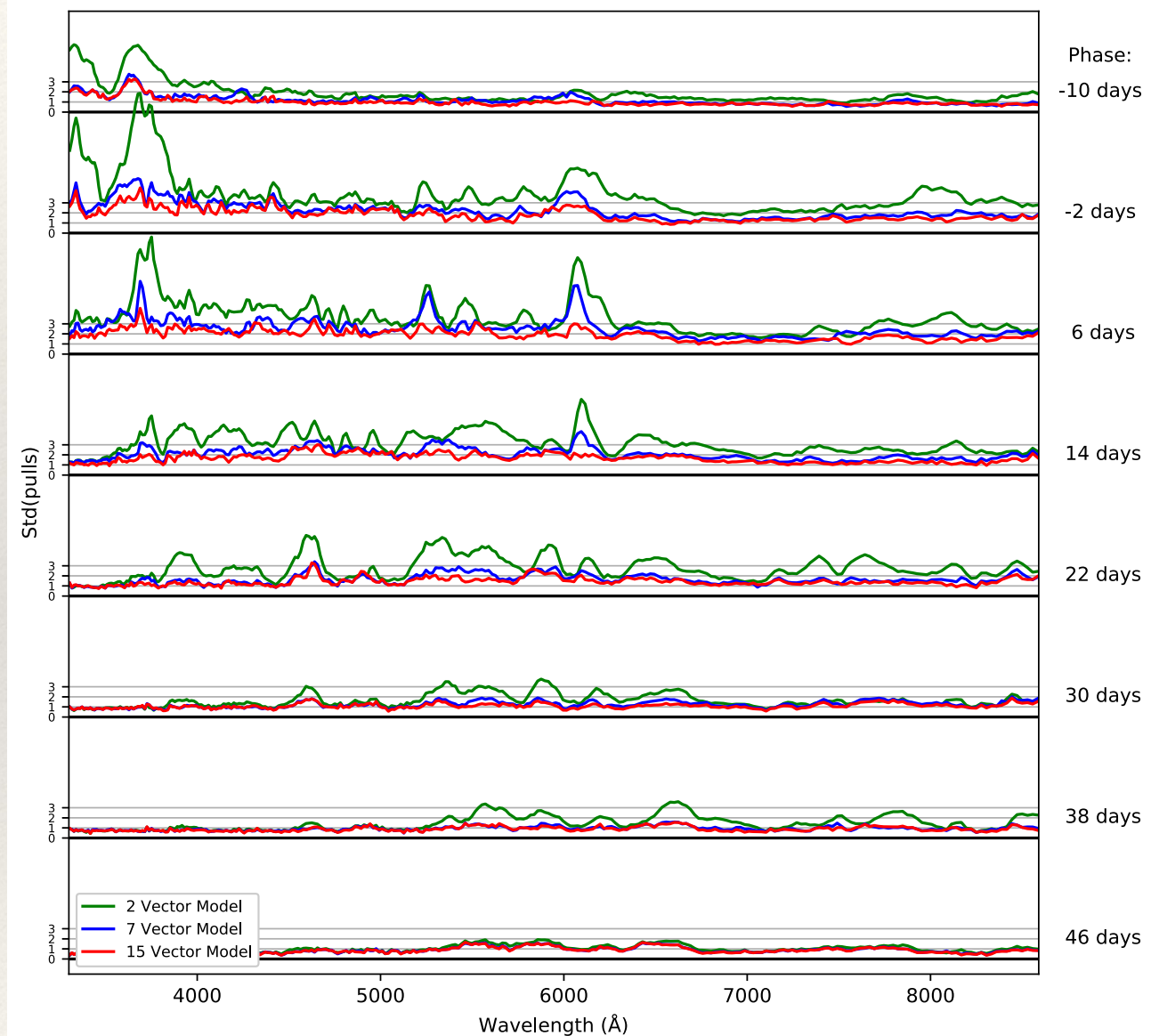


# Performance on Test Data

## One Out-of-Sample SN



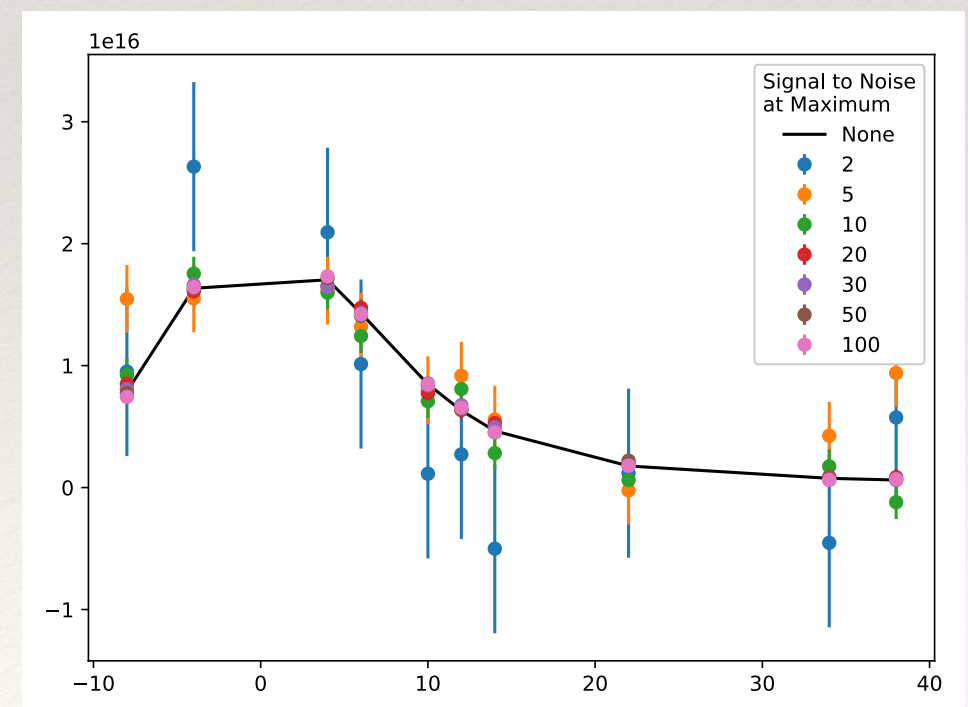
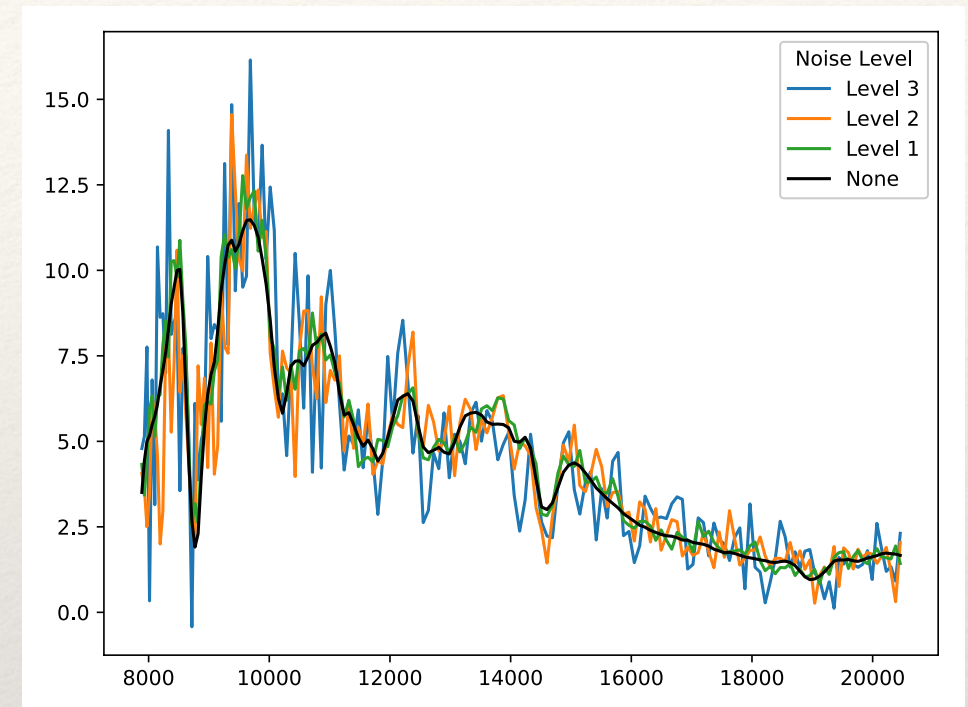
## Std Deviation of Pulls for All Out-of-Sample SNe





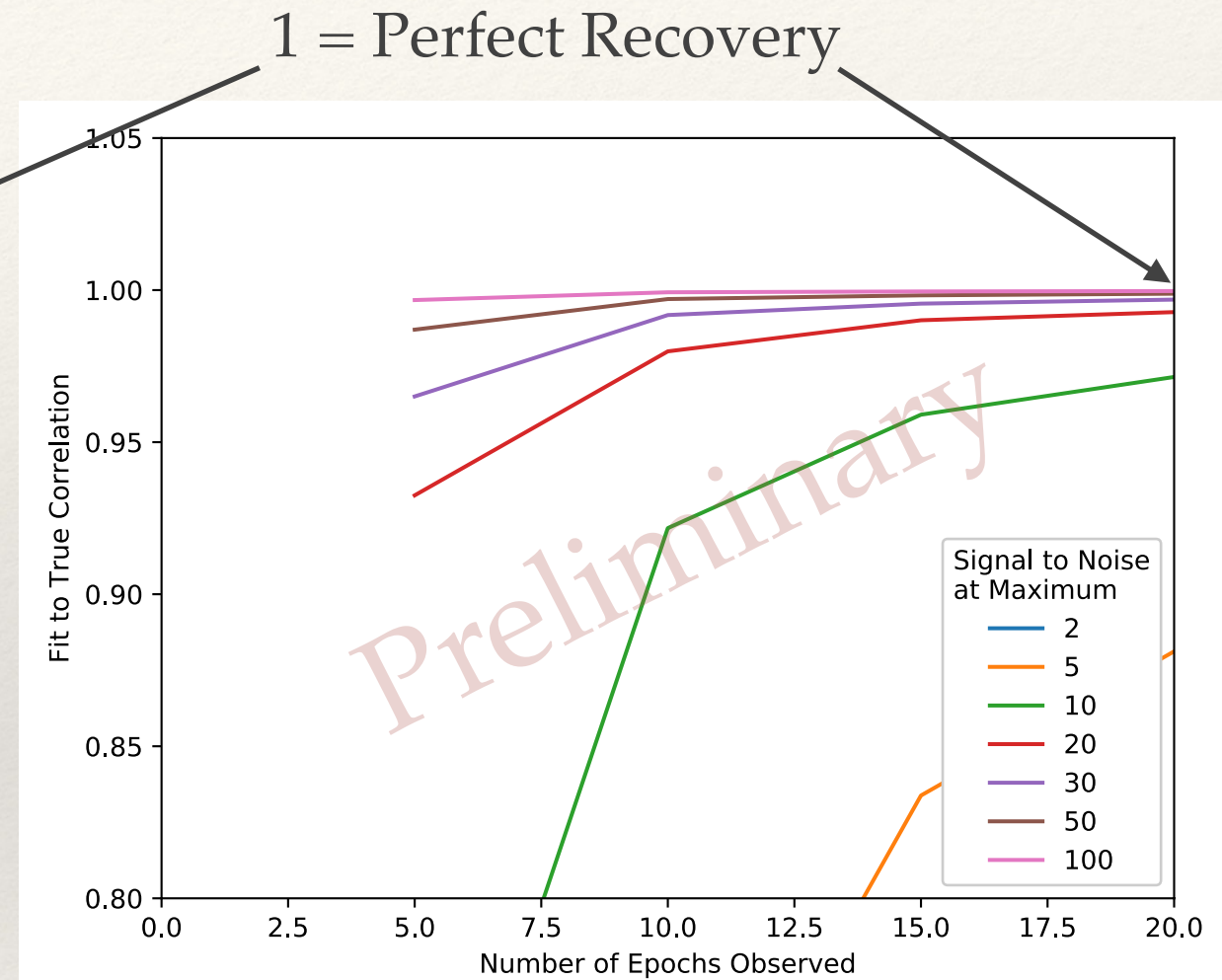
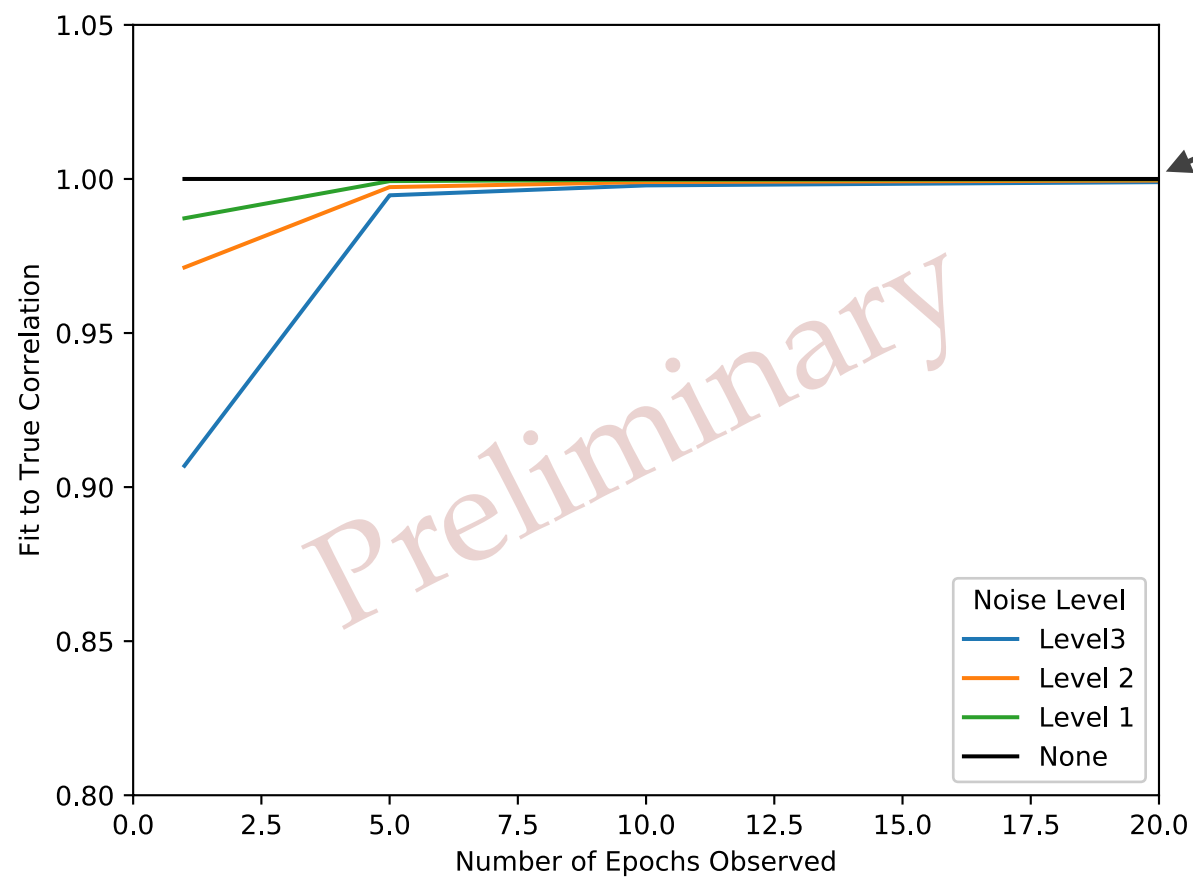
# Simulating Performance on Real Data

- ❖ Use model and realistic parameter distributions to sample data.
- ❖ Add noise, do synthetic photometry.
- ❖ Fit this and compare the fit model parameters to the simulated parameters.





# Compare Fit Model to 'True' Model



Metric should be converted to see effect on fit vs. true standardized magnitude.



- ❖ LSST filters and PhoSim data can be added to simulations.
- ❖ Tests on real data to come.
- ❖ Paper is being finalized.