How to optimize the sky coverage of the CHIME telescope for the detection of FRBs? The Canadian Hydrogen Intensity Mapping Experiment (CHIME) is a radio telescope located in British Columbia, Canada. Thanks to its large field of view, and broad detection frequency band, it currently holds the record for Fast Radio Burst (FRB) detection with 535 published bursts. FRBs are electromagnetic radio waves of unknown, distant origins. In order to solve their mystery, it is crucial to collect more data for better studies. To detect them, CHIME tiles its field of view with 1024 beams, yielding independent searchable data streams focused on particular sky locations. Acting like pixels, these 1024 beams are distributed in 4 rows (East-West) of 256 focal points (North-South). Each beam's focal location is within a ±60° range on the North-South axis, and has a fixed East-West inclination. In this project, we study this East-West angle for detecting a maximum of FRBs.

The way the beam covers the sky is intuitively closely related to the resulting observations, i.e. the detected FRBs. We study this relation through the East-West inclination of the beams, by running simulations with artificially generated FRB signals. The CHIME collaboration has designed a simulation framework using collected signals to randomly create credible FRBs. We use this tool to test the detection patterns for different configurations of the formed beams (the studied East-West beam spacings range between 0° and 2°). We run these simulations for 100 different beam spacings, and using 100 different FRB populations (randomly drawn from observed parameters). We average the number of detected FRBs at each beam spacing over all populations (shown on figure 1). Our results are two folds, the current beam spacing coincides with the observed optimal beam spacing in our simulations, and the detection count standard deviation remains close to the mean, indicating similar patterns across different FRB populations.

We conclude that the current configuration of the beam model is optimal for the detection of FRB originating from populations fitting characteristics observed so far. Further exploration with different FRB population characteristics would clarify the generality of our results. This project was made possible thanks to the support and guidance of Dr. Cherry Ng, and Dr. Paul Scholz, as well as the SURP committee.

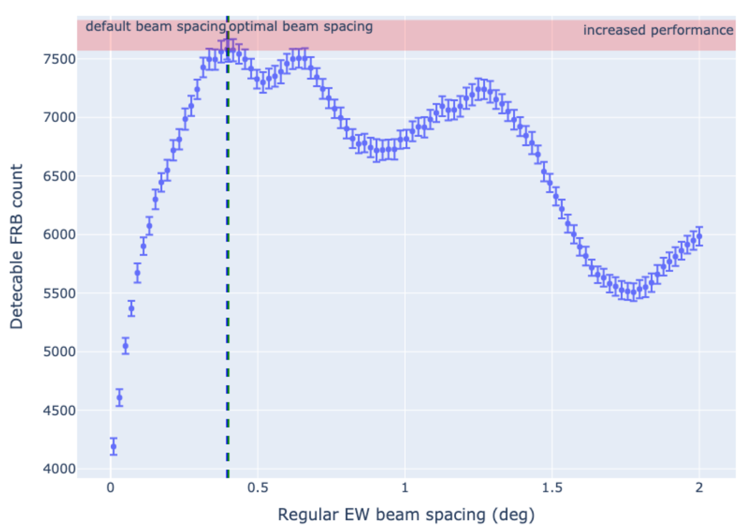

Figure 1: Detectable FRB count per beam spacing averaged over sampled FRB populations. The represented errors display the standard deviation on the number of detections across FRB populations.