SHIFTS

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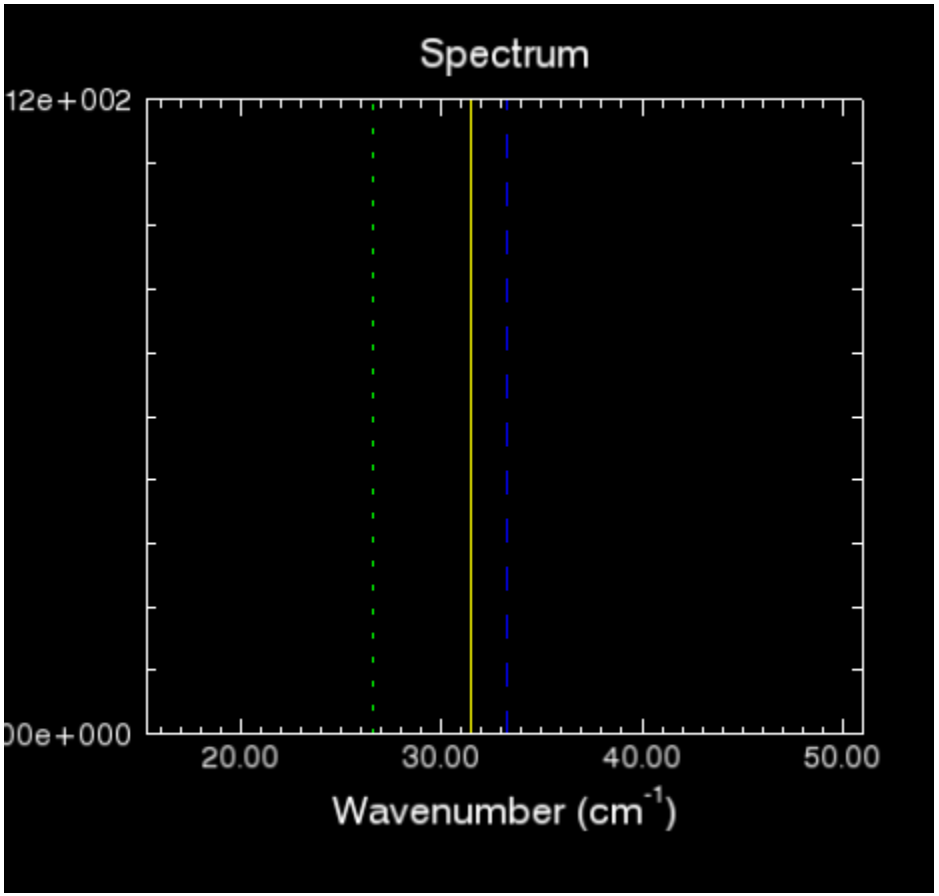
Shifts Test Module

Shifts Test Module

- The shifts_test program **(new name: shifts_test_ideal_instrument)** verifies the basic ability of shifts to generate a interferogram from a given input. This allows future modifications to be easily checked.
- A simulation with no noise settings and ideal components is run and compared to the theoretical result.
- The theoretical result is generated by reading in the settings used in the simulation and using these to calculate the appropriate interferogram

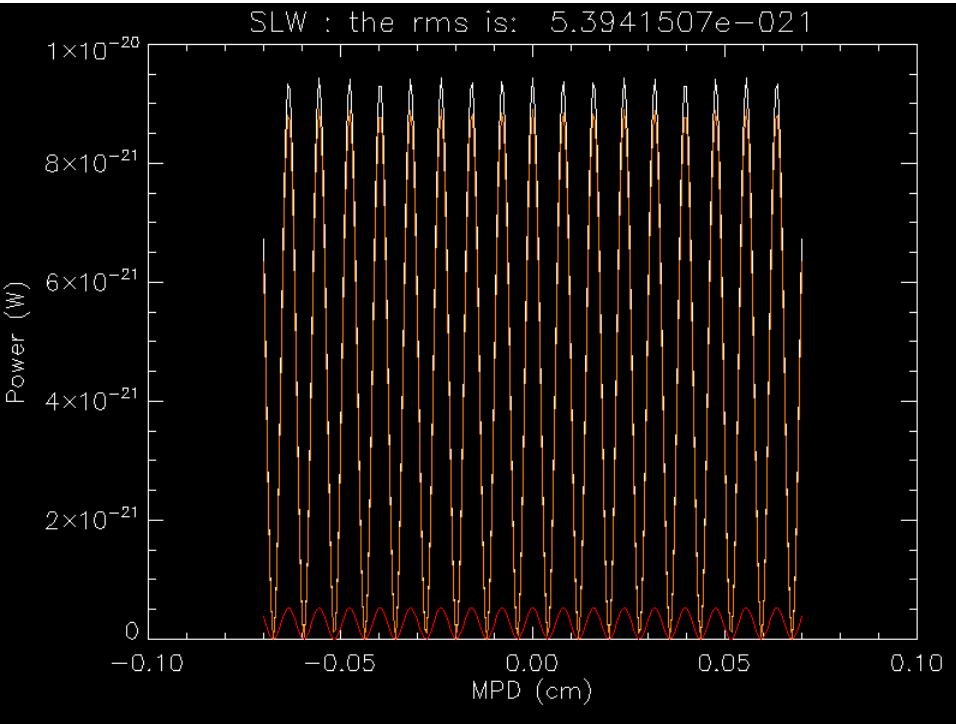
Shifts Test Module

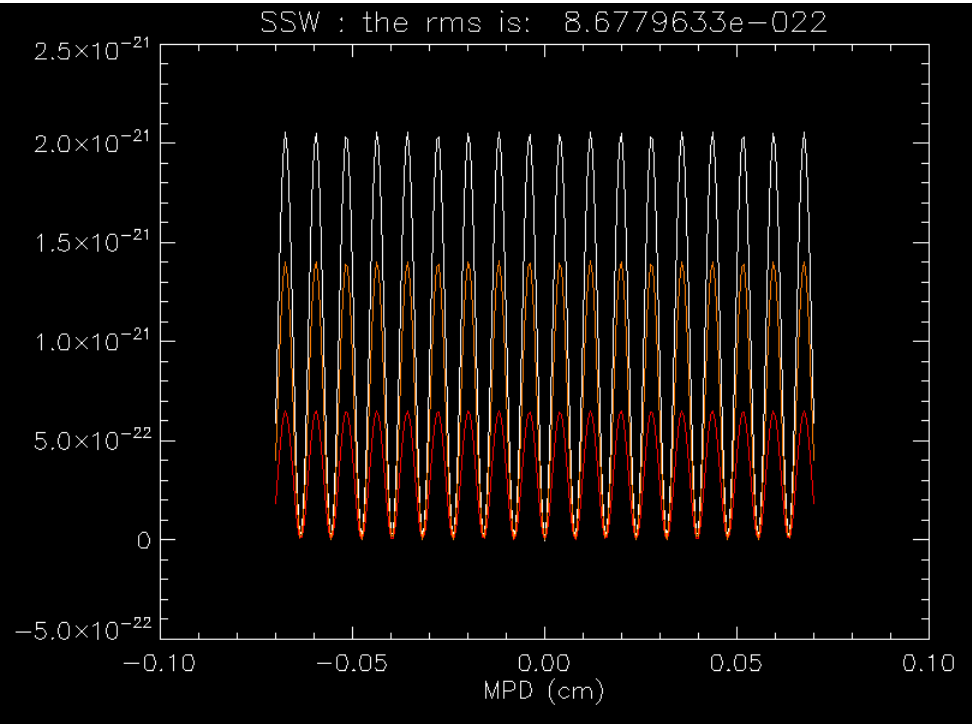
- The input consists of a spike place in the overlap of the SSW and SLW bands
- This was chosen as it will generate a simple sine wave as an interferogram



Shifts Test Module

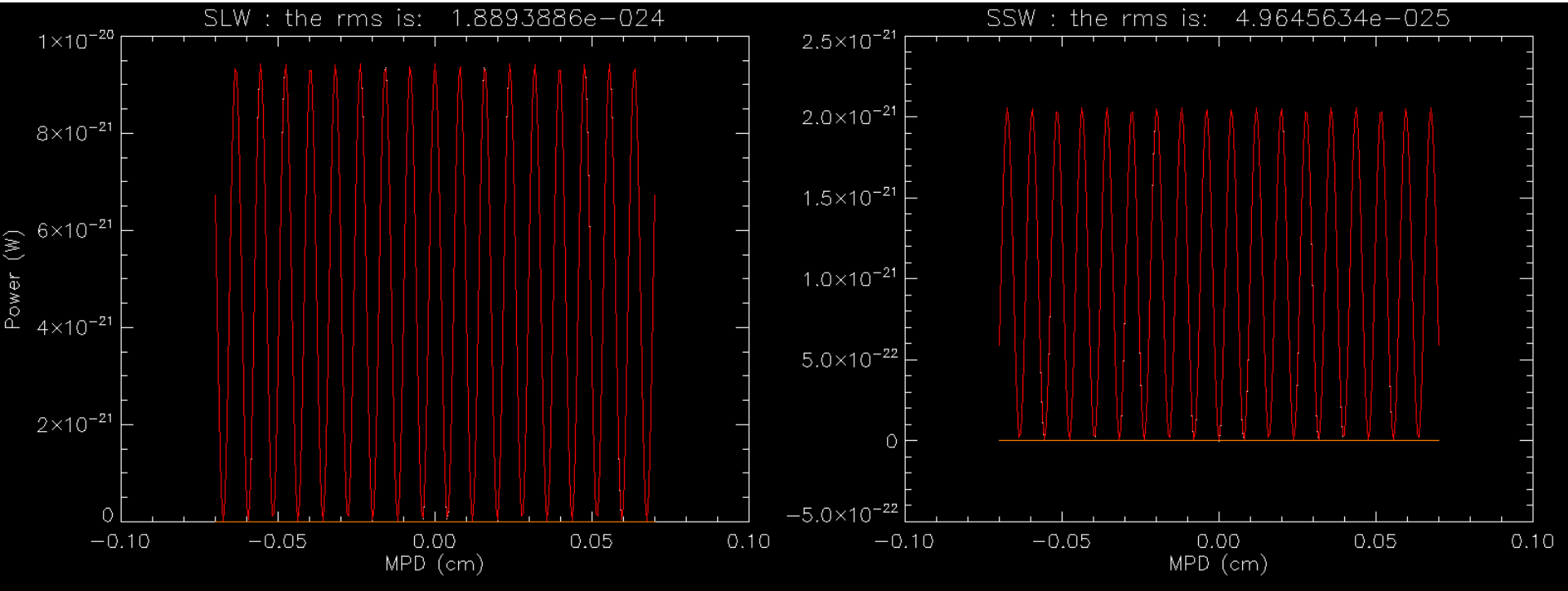
- A change in the efficiency settings in SHIFTS will create a difference between the theoretical and produced sine waves.





Shifts Test Module

- When SHIFTS is working correctly the resulting sine waves should agree to within a reasonable error.



Cosmic Ray Simulation in SHIFTS

Cosmic Ray Simulation

- A cosmic ray module was added to SHIFTS in order to simulate the impact of random hits by high energy particles (cosmic rays) on the SPIRE instrument
- The impacts were assumed to occur as a instantaneous deposition of energy on to the bolometer detectors.
- SHIFTS has two settings used in the simulation of these effects:
  - Average rate of impact
  - Power law exponent

Cosmic Ray Simulation

- The rate set by the user, N, is taken to be the average rate of impacts over time.
- The actual number of hits on a given pixel for a given run is calculated as a Poisson distribution with an expected value of N
- Each impact is assigned a time based on a set of uniformly distributed random numbers

Cosmic Ray Simulation

- The power of an impact is calculated from the formula:

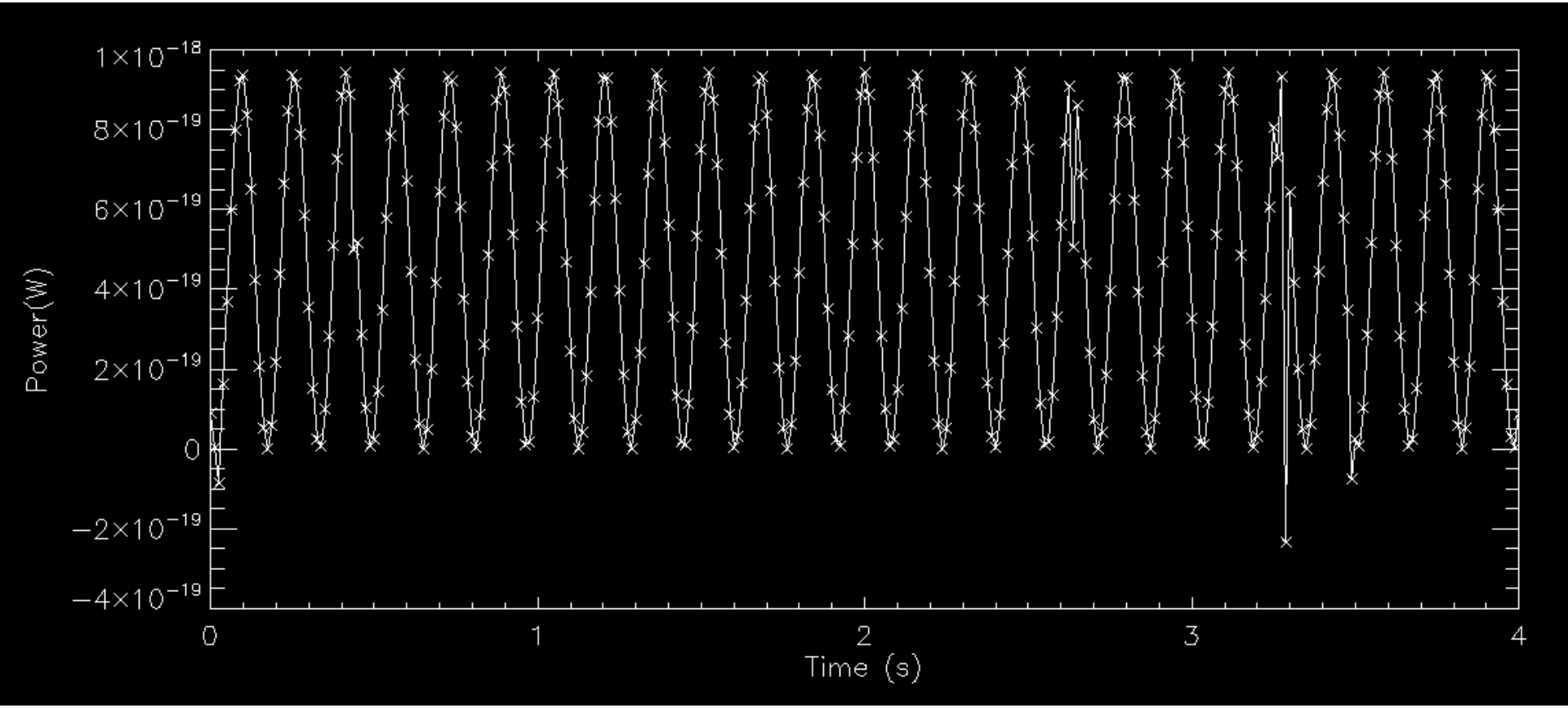
$$A=A_0*(R^{(-1/M)})$$

Where A_0 is the photon noise at the given point, R is a randomly generated number, and M is a user specified parameter.

- The amplitude A is then subtracted to the interferogram at the previously determined time.

Testing of Cosmic Ray Module

- The first test done was simply to verify the presence of glitches on an interferogram

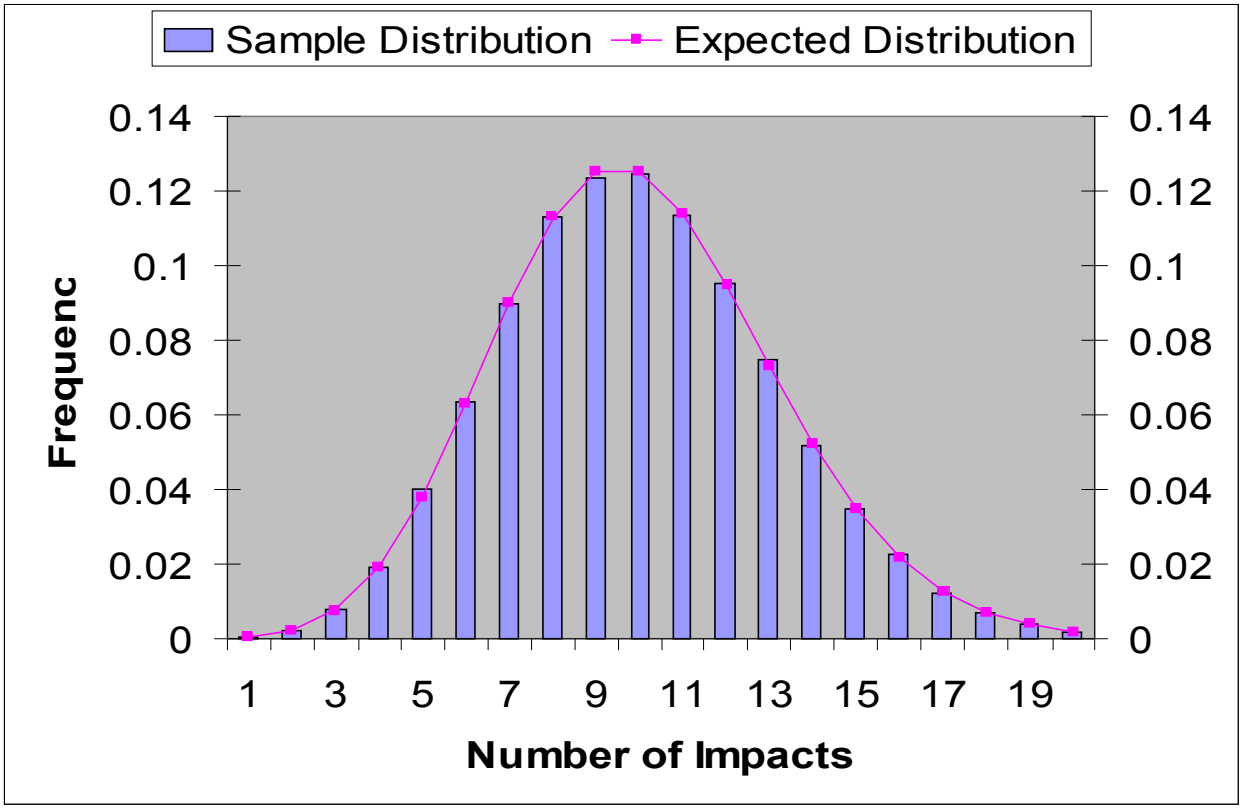


Rate of 200 impacts/minute M=2,Input spike of height 1E6 JY

Testing of Cosmic Ray Module

- The next test was to verify that the number of impacts is following the proper Poisson distribution.
- A set of 50,000 simulations were made with the appropriate settings so that the time for each run was 9.998s, with an impact rate of 60 impacts per minute.
- This should yield an mean of 9.998 impacts with a distribution that follows the related Poisson

Testing of Cosmic Ray Module



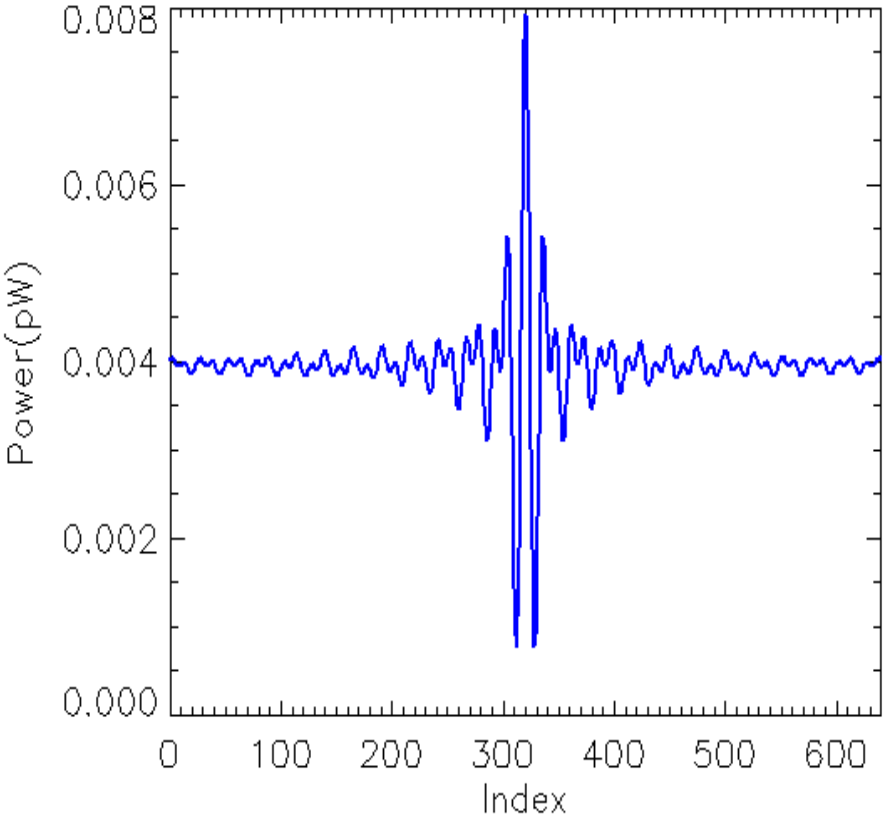
- The mean of the results is 9.997 with a standard deviation of 3.156.
- Calculating a 95% confidence interval using a t-distribution yields an interval of +/- 0.0277.
- 9.998 falls within this range and so we confirm that the number of impacts is being calculated correctly

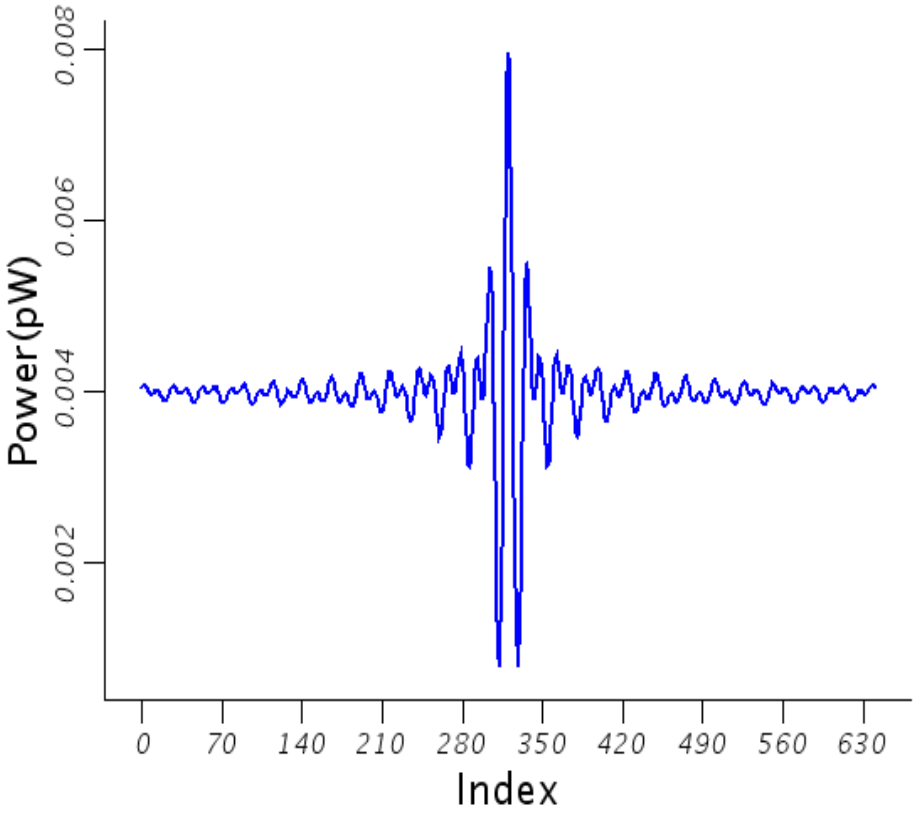
SHIFTS/HCSS Bridge

- SHIFTS outputs both an IDL .sav file and a set of FITS file containing the data from the simulation
- In order to use the data in the HCSS data processing it must be read in and stored into the proper arrays.
- This was done by creating three new classes which take the input from the fits file and process it.

SHIFTS/HCSS Bridge

- Comparison of data in IDL and HCSS
- Interferogram comes through the process intact





SHIFTS/HCSS Bridge

- The product of the three classes are then further processed within the normal HCSS pipeline.
- This returns an Interferogram Data Product which has the scans separated.
- Once this step is complete all of the other HCSS deglitching, phase correction, FT methods can be run on the data