**Chiron Major Changes:**

1. **General Software Update**

The old version of the software was last updated in 2012. Harris Geospatial Solutions has created new procedures, deprecated some others, and updated IDL’s version to version 8.8 since then. The present software accounts for deprecated procedures and is fully compatible with IDL version 8.8.

1. **From Linux to Windows**

The software was initially written in Linux. We have updated all the pertinent procedures to be Windows compatible by changing general expressions, handling of paths, and substituting Linux for Windows commands

1. **Tracking Code Changes**

All software updates have been stores, dated, and tracked throughout the use of a Version Control System software, GIT. This allows for easy distribution of the software and the reference to the previous source code.

1. **Full spectral range of CHIRON**

The full spectral range of CHIRON is achieved by extracting the extra 14 blue orders for a total of 74 orders. The full spectrum ranges from 408 [nm] to 880 [nm].

1. **New logic for order tracing**

The old software presented various difficulties to trace the orders. These difficulties were prominent in the red orders for the slicer mode. The problem is due to the proximity of order profiles in the cross-dispersion direction. The old algorithm simply discards these orders or traces them wrongly. The present solution is optimizing the order tracing solution by running two algorithms in parallel (a greedy algorithm and gaussian based algorithm).

1. **Master Bias and Master Flat**

The old software combines the calibration images (e.g., master flat and master bias) by staking them together and finding the median of each stack. With the objective to acquire a better signal noise ratio the present software allows for finding the average of the stacks while taking care of outliers.

1. **Combining stellar files**

The present software allows the user to set an option to combine all stellar files of a given night (either by the median or the average) or reduce each stellar file individually.

1. **Cosmic Ray Removal**

For nights with more than 3 bias, flats, and stellar images there is new algorithm that gets rid of the cosmic rays by finding all outliers and using a technique named “Sigma clipping”

1. **Implementation of LaCosmic**

The old software presented many challenges when removing cosmic rays for an individual exposure, up to the point of taking bright emission lines as cosmic rays according to Professor Walter from Stony University. The cosmic ray removal procedure has been substituted for LaCosmic, an algorithm based on Laplacian Edge Detection.

1. **Wavelength Calibration**

The wavelength solution has been extended to work with 74 orders. We found a shift in the dispersion direction of the image which causes unexpected results when finding the wavelength solution. The present software automatically identifies those cases and compensates for such pixel shift.

1. **New Flat options**

The following new options and uses for dealing with the master flat and flattening of the spectra have been implemented.

1. The master flat was NOT normalized before been calculated. Spectra is not flattened.
2. The master flat was NOT normalized before been calculated. Spectra is flattened AFTER extraction.
3. The master flat was NOT normalized before been calculated. Spectra is flattened BEFORE extraction. By default, order is extraction is reduced by 4 pixels for slicer mode.
4. The master flat WAS normalized before been calculated. Spectra is flattened AFTER extraction.
5. The master flat WAS normalized before been calculated. Spectra is flattened BEFORE extraction. By default, order is extraction is reduced by 4 pixels for slicer mode.