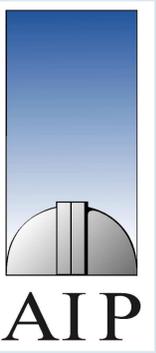




Sky Subtraction for the MUSE Data Reduction Pipeline



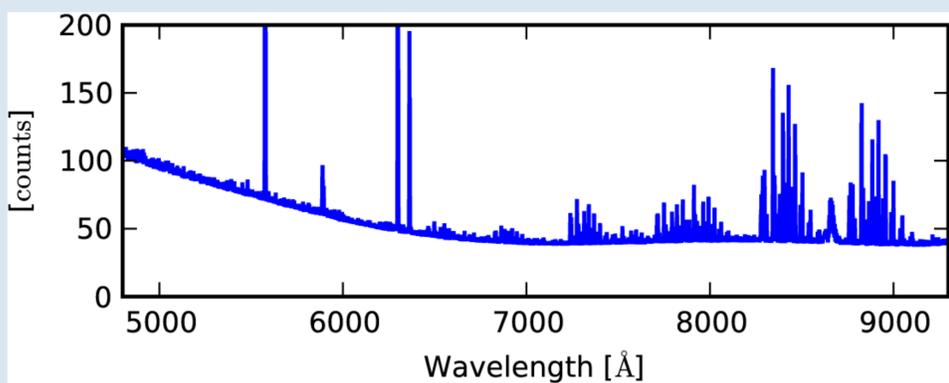
Ole Streicher, Peter M. Weilbacher, Aurélien Jarno & the MUSE Team

Abstract

The sky subtraction is an important step in the reduction of astronomical data since the sky emission is one of the main noise sources for astronomical observations. In this poster we present our methodology for sky subtraction on MUSE data. MUSE is a 2nd generation integral-field spectrograph in development for the VLT consisting of 24 integral field units (IFU). Our method is based on the parametrized simulation of the emission processes and the instrument response. In most cases, this method does not require a separate sky exposure. Our approach is described and illustrated using simulated data.

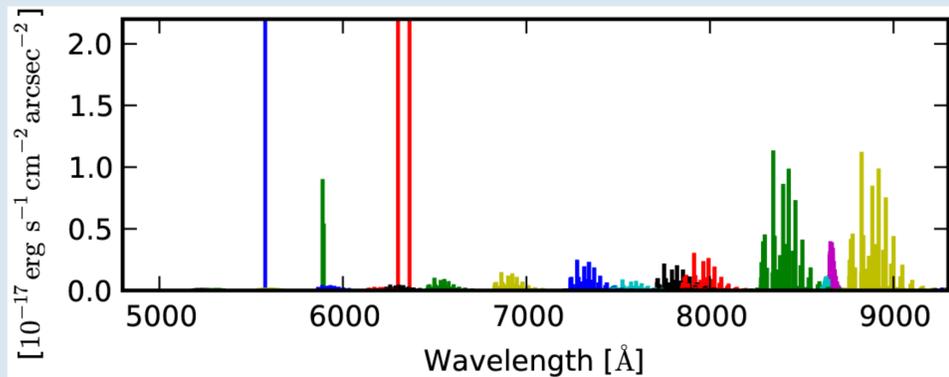
1 Sky parameter determination

1.1 Selection of sky regions in the exposure



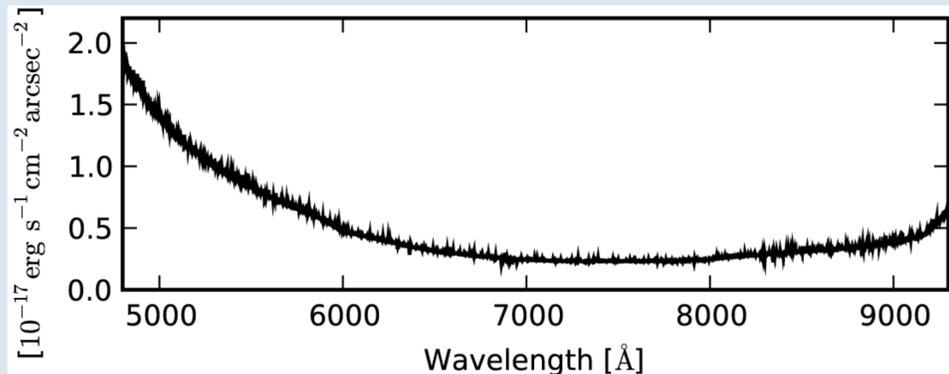
The sky regions are selected by choosing the areas with the lowest integrated flux. The selected regions are combined into one spectrum with a fixed bin width. The figure shows a sky spectrum for simulated data.

1.2 Fit of common emission line parameters



The emission lines are grouped by the molecule (OH, [O I], Na I, O₂) and upper transitional level, shown as different colors in the figure. Within each group, the emission flux ratio is fixed.

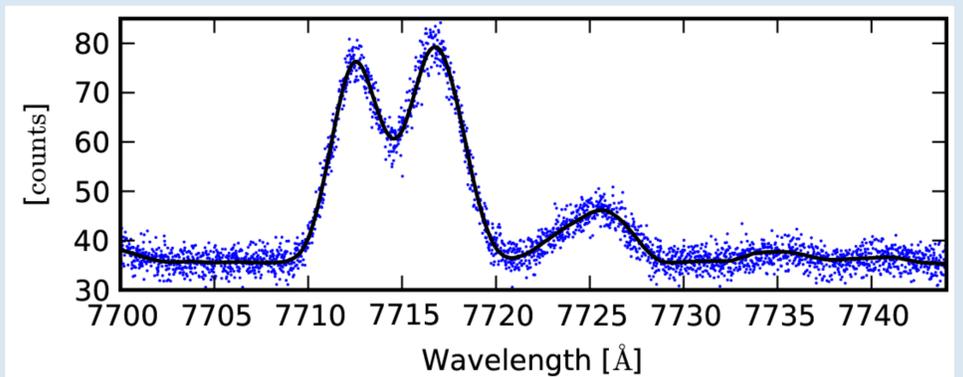
1.3 Determination of sky background



For the sky background, the residuals of the sky spectrum after subtraction of the sky lines is used. If the original image does not contain sky regions, the background from a sky exposure may be used instead.

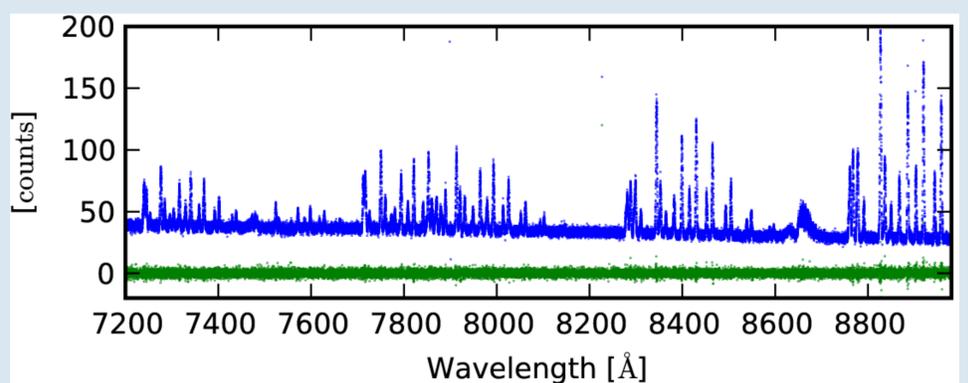
2 Detector simulation and sky subtraction

An accurate description of the instrument parameters and their variations across the instrument (24 IFUs, 48 slices per IFU) is essential to avoid artefacts in the final image. For each slice, an individual fit of the wavelength dependent shape of the line spread function (LSF) and width is done.



The figure shows the modelled LSF (black line) compared to the input data (simulation, blue dots) for one slice. Finally, the slice-dependent sky emission line fit and the continuous sky background are used to reconstruct the sky spectrum and subtract it from the original data.

3 First results with simulated data



The figure shows the residuals after the sky subtraction for one slice (green dots) compared to the original (simulated) data.

The used model describes well the data from the Instrument Numerical Model (INM). The resulting spectrum has almost no remaining flux coming above the statistical limit from the night sky emission. However, the method strongly depends on the correct description of the detector parameters (LSF, throughput), so further tests with real exposures have to be done.