SED Sherpa

Project Test Plan

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1 Goal

This document describes the details of how the Spectral Energy Distribution (SED) Sherpa models will be tested through its life cycle for requirements to be implemented in Year 1 of the project.

2 References

- Sherpa Modeling Package
- SED Sherpa derived requirements
- SED PDD
- Main SED testing page. Contains links to other SED project test plans.

3 Project Description

The SED Sherpa models are a component of the SED project. It is a sub-project which will provide a number of models for doing statistical fitting and scientific analysis of SED data produced by other SED components, and which conform to the SED data model standard. The host environment for doing this analysis is the Sherpa package.

4 Test Environment, Tools and Execution Considerations

This component utilizes Sherpa, a 3rd party package, for executing the statistical fitting of the SED models.

The scope of testing for this software shall encompass acceptance and functional testing of the models to verify their utility and adherence to project requirements. Documentation of these models is part of this project, however, no testing of Sherpa code, or review of general Sherpa documentation is in scope for this test plan.

Many test cases are indicated as manual, however these may be executed within the CfA test environment as designated by CfA staff, and reported to QA&T test team. Test code will be made available in a manner agreeable to both PD and QA&T staff at the time of testing (check in to SVN repository).

5 Additional Information

To faciliate reporting of tests, all reporting must map test results back to test cases specified in this test plan. A list of a SED models which will be implemented and tested in this test plan include the following:

Test Model ID	Description
AbsorptionEdge?	Absorption edge function
AccretionDisk?	Accretion disk continuum function
AGaussian	Absorbed Gaussian
ALorentz	Absorbed Lorentz function
AVoigt	Absorbed Voigt (Gaussian core, Lorentz wings)
BlackBody?	Blackbody continuum emission
Bremsstrahlung	Bremsstrahlung continuum emission
BrokenPowerlaw?	Broken power law (break between two different indices)
CCM	CCM extinction curve
FM	Extinction curve for UV spectra below 3200A
Gaussian	Emission Gaussian function
LMC	LMC extinction curve
Log_absorption	Log absorption function
Log_emission	Log emission function
Lorentz	Emission Lorentz function
Polynomial	Polynomial continnum function
Powerlaw	Power law continuum
Recombination	Optically thin recombination continuum
Seaton	Seaton's interstellar extinction function
SMC	SMC extinction function
SM	Galactic interstellar extinction function
TGaussian	Absorption Gaussian function expressed in optical depth
Voigt	Emission Voigt function
XGal	Extragalactic extinction function

Furthermore, a grid of the test data (or a document pointing to the same) needs to be described here.

6 Test Cases

6.1 Acceptance Tests

TestCase0 : Artifact Completeness

Requirement Identifier: **???**
Procedure: Manual inspection of project artifacts.

The system shall be checked for deliverable artifact completeness as specified by Requirements **???**. Model documentation will be checked for completeness, and comprehensibility and Iris will be checked to ensure that all models are exposed and available to a user.

TestCase1 : Scientific Suitability and User Experience

Requirement Identifier: **???**
Procedure: Manual execution of models on test SED data

The SED models shall be checked by users external to the SED project for suitability for scientific research. In the context of this test case, it means that the parameters available to a user of the models are suitable for doing scientific fitting of spectral (SED) data. This review should occur by loading each model in Iris environment and checking the parameters may indeed be used in fitting.

6.2 Functional Tests

TestCase2 : Fitting of spectral models to a SED and estimation of integrated quantities

Requirement Identifier: SED.an.4 and derived requirements
Procedure: Automated test using CfA test framework

The user can fit **aggregate** SEDs with analytical and tabular functions as source models by identifying the parameter values which give the optimum value of the fit statistic. A list of SED models is included in the Addtional information section above. A list of estimation of the variance for chi-squared fitting includes:

Variance estimator
based on the data
modeled value
an input array of measured error values

The last case is required to utilized for all sub-test cases.

TestCase2.1 : SED Spectral Model Library and Fitting of aggregate SED with spectral models

Requirement Identifier: SED.an.4.1, SED.an.4.7, SED.an.4.3, SED.an.4.4
Procedure: Automated test using CfA test framework

The user can fit an aggregate SEDs and return the best-fit parameter values and the reduced statistic value (chi-squared statistic). Furthermore, the user can estimate the confidence levels for the fit parameters at a user-defined standard-deviation. This test case shall check running each of the SED models against a set of test data and verify the result (fitted parameters of the models, as well as their errors) are as expected.

Per requirement SED.an.4.3, this test case should include tests which specify the range of spectral coordinates to be considered which can be either the whole range or multiple disjoint intervals of spectral coordinates. Per requirement SED.an.4.4, these test cases should be constructed so that at least one test will encorporate the use of Sherpa model algrebra to do a model fit. Finally, this test shall also check that Sherpa can convert the units of measure of the SED for both spectral and flux coordinates.

TestCase2.2 : SED Spectral model library

Requirement Identifier: SED.an.4.3
Procedure: Automated test using CfA test framework

The user has access to spectral models in a library of commonly used functions that are defined either analytically or empirically. This test case shall exercise Sherpa to check that each of the indicated models (see *Additional information section above*) have indeed been loaded, and when executed with test SED data (see *Additional information section above*) and take the appropriate input and produce the expected output. Finally, this test shall also check that Sherpa can convert the units of measure of the SED for both spectral and flux coordinates.

TestCase2.3 : SED Goodness of fit estimation

Requirement Identifier: SED.an.4.6
Procedure: Automated test using CfA test framework

The user can estimate the goodness-of-fit of the model and specify among a small number of reference fit statistics of his choosing. (for example, χ2 statistics and some of the specific statistics derived by the maximum likelihood principle).

Please list of other goodness-of-fit estimators implemented, or point to documentation with this list

7 Schedule

Activity	Task	Dependencies	Responsible party	Start Date	End Date	Comments
Functional Tests	execution	Model List and SED data specified for testing	SED Service PD Team	April 2011	Jul 2011	Verify deliverables during beta test 1,2 and at delivery
Acceptance Test	execution	Passed prior testing	QA&T team	April 2011	Jul 2011	Have acceptance testers interact with SED models and data to report suitability for scientific research