Doelan v.1.0.1

Project Documentation

École Normale Supérieure Microarray Platform

23 September 2005

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1.1 What is Doelan ?

Welcome to Doelan

Get Doelan 1.0.1

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- System Requirements
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- QuickStart tutorial

Doelan is an automated tool to check the quality of produced DNA microarrays. This software is based on the execution of TestSuites on quality control data to validate batches of chips. The reports generated by Doelan will help microarray platforms in their quality approach such as ISO 9001 certification. Doelan application is written with Java programming language, works with a plug-in system that allows everyone to add is own validation test and is distributed under the GNU General Public License .

Production of glass slide microarrays requires the spotting of a large number of probes. In this process, many factors can influence the success of the spotting (i.e. blocked spotting pin, glass slides...); so controlling the quality of the spotting process is a required step before to distribute chips to the user. Up to now, it was quite difficult for the quality control manager to check if the spotting of chips was good or bad: many different parameters as spot diameters, heterogeneous spots or absent spots had to be manually considered to reach a decision. In addition, it is a very subjective step, so that the opinion about a batch may differ between two quality control managers. Using manually defined criterias for microarray quality, Doelan allows an automated expertise of the quality of a batch of slides and makes automatically the decision of validation or rejection of the batch.

The principle of Doelan is based on TestSuites. A TestSuite is a set of tests, which are dedicated to a specific features (for example spot diameter). The microarray designer creates the TestSuites and sets the parameters (i.e. minimal and maximal values, thresholds...) of each test to validate a chip. Several TestSuites can be created according to the type of validation experiment chosen as sybergreen, universal RNA hybridisation or a "real" experiment. The fail of one of the tests leads to the fail of the TestSuite, and consequently to the rejection of all the batch of chips. Doelan is bundled with many tests. These tests can deal with various features of the chips such as spot diameter, spot flags, spot heterogeneity, saturated pixels of the spots... In addition to this standard tests, the Doelan plug-in system with Java programming allows one to set up new kind of test to fulfil specific needs.

1.2 Screenshots

Screenshots

This is some screenshots of Doelan on several operating systems:

1.3 License

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```
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1.4 People behind Doelan

People behind Doelan

Doelan is developed by the bioinformatic team of the microarray platform at the École Normale Supérieure:

Name	Work
Claude Jacq	Transcriptome platform head responsible
Stéphane Le Crom	Bioinformatic responsible and Doelan testing
Laurent Jourdren	Doelan design and coding

Special thanks to:

Name	Work
Corinne Blugeon, Fanny Coulpier, Frédéric Devaux and Véronique Tanty	For Doelan testing
Charles Hébert	For the new logo

Contact

Who can you contact if you have any question:

You can also visits our microarray platform website .

1.5 How to cite Doelan

How to cite Doelan

Doelan: a solution for quality control monitoring of microarray production

Laurent Jourdren and Stéphane Le Crom
Bioinformatics Advance Access published on September 22, 2005. doi:10.1093/bioinformatics/bti686
[Abstract] [Accepted Manuscript]

2.1 Downloading

Download Doelan latest version

Doelan is distributed in several formats for your convenience.

- `.tar.gz` archive (5.4 MiB)
- `.zip` archive (5.9 MiB)

Doelan is distributed under the General Public License .

System Requirements

Component	Comment
Java Runtime Environment	1.4 or above (Dolean might run under Java 5.0 but no test has been realized).
Memory	No minimum requirement. The necessary amount of memory needed by Doelan depends on size of the files to be tested. Currently with GPR and GAL files greater than 20,000 lines, Doelan doesn't need to modify the memory allocation pool size (default is 64 MiB) with the **-Xmx** option of the JVM.
Disk Space	No minimum requirement. Approximately 11 MiB will be used by Doelan.
Operating System	No minimum requirement. Tested on Windows XP, Debian testing and Mac OS X.

2.2 Installing

Standalone installation

The installation of Doelan on all platform is quite similar and very easy. You don't need to be the administrator or the root user of your system to install Doelan.

The only tool you need to have is a zip extractor. A zip extract tool is included on Windows XP, Linux and Mac OS.

If you are a user of Windows prior to XP, you can download **7-Zip** (7-Zip is a free software) at the following location http://www.7-zip.org/ .

- Download Doelan on our website
- Unzip the archive where you want install the software
- Doelan is ready to run.

Installation for Genepix integration

To configure Genepix integration of Genepix, you need to allow the Doelan applet in Genepix to read and write on your filesystem and set the path to the doelan report page in Genepix.

Modify Doelan Applet security permissions

To allow a normal execution of Doelan in Genepix, you need to modify the security permissions for the applet. Edit the `{JAVA_HOME}/lib/security/java.policy` and add the following lines:

```
// Doelan permissions
grant codebase "{PATH_TO_DOELAN}/lib/*" {
  permission java.lang.RuntimePermission "*";
  permission java.io.FilePermission "<<ALL FILES>>", "read";
  permission java.io.FilePermission "<<ALL FILES>>", "write";
  permission java.util.PropertyPermission "*", "read";

};
```

`{JAVA_HOME}i` is the path to your java installation and `{PATH_TO_DOELAN}` is the path to Doelan on your filesystem.

Add the link to the doelan report page in Genepix

To have an access to Doelan in the report tab of Genepix, you must modify the index of the genepix report file: `C:\Axon\Scripts\GenePixPro5\Default.htm`

and add the following line in **Analysis Reports** section:

```
<li>
  <a href="{PATH_TO_DOELAN}\genepix-applet.html">
  Doelan Quality Report</a>.
</li>
```

2.3 Release Notes

Release History

Version	Date	Description
1.0.1	2005-09-19	
1.0	2005-07-18	
1.0-rc9	2005-04-15	
1.0-rc8	2005-04-15	
1.0-rc7	2005-04-11	
1.0-rc6		

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Release 1.0.1 - 2005-09-19

Type	Changes	By
➕	Add information about empty spot in the report.	jourdren
🔨	Fix bug with empty spot in the arrayplot.	jourdren
🔨	Fix bug with scrollbar in html documentation widget.	jourdren
➕	An array description can be added in the report.	jourdren
🔨	Fix bug with custom empty identifiers.	jourdren
🔨	In minimal intensity test, the channel to test can be set.	jourdren

Release 1.0 - 2005-07-18

Type	Changes	By
🔨	Fix bug with logarithmic axis.	jourdren

Release 1.0-rc9 - 2005-04-15

Type	Changes	By
➕	Use a Pluggable Look And Feel from JGoodies looks under *nix.	jourdren
➕	Add information pages (about test and documentation of a test) in contextual menu.	jourdren
➕	New test: GenericTest, generic test for a column of GPR.	jourdren
➕	New test: GlobalMaxBadFeaturesRemovedTest, count the maximal bad spots removed in a TestSuite	jourdren
🔄	In the output gal file, now, don't remove line but change the the identifier of the line and add in the description field the reason of the reject of the spot.	jourdren
🔄	The arrayplot now show in white, feature which fail to one or more tests but doesn't be removed.	jourdren
🔄	Reorganize the file hierachy of the application. Ready for online update of doelan when available.	jourdren
➕	User can set the identifiers of the empty spots.	jourdren
🔄	Test identifiers are now in the same order in the TestSuite tab and this the report.	jourdren
🔨	Bad result for spot heterogenity.	jourdren
🔄	Now use JFreechart to draw plot.	jourdren

Release 1.0-rc8 - 2005-04-15

Type	Changes	By
🔨	Fix bug for saving and printing report.	jourdren
➕	Add a framework for global tests.	jourdren
➕	New Global test: Count all the bad spots in a TestSuite.	jourdren
➕	Report tab: Show the manufactuer, the name and the revision of the array (informations from GAL file).	jourdren
➕	Report tab: Add a line in summary section of the report which show the final result of the TestSuite. :-)	jourdren
👉	Use now romde 0.6-CVS.	jourdren
👉	Majors changes in romde workflow organization. Now an algorithm before generating the report runs all the globals. Add useful methods to get romde data object from Romde platform container.	jourdren

Release 1.0-rc7 - 2005-04-11

Type	Changes	By
🔨	Fix huge memory usage by BioAssay Objects in Romde.	jourdren
👉	ArrayPlot use margin with.	jourdren
👉	Update maven configuration files.	jourdren
🔨	Fix Graphics plots.	jourdren

Release 1.0-rc6 -

Type	Changes	By
➕	Initial realease in CVS.	jourdren
➕	New Graph : Array visualisation.	jourdren

Type	Changes	By
🔨	Safari problem.	jourdren
🔨	Windows sample plugin compilation script now works.	jourdren
➕	Make a sample plugin : windows batch.	jourdren
🖐	Make a logo and an icon.	jourdren
➕	Modifier le script d'integration à Genepix pour qu'il affiche un message d'erreur quand il n'est pas executé dans Genepix.	jourdren
🔨	Change the name of the launcher.	jourdren
➕	New Graph : Distribution graph.	jourdren
➕	New test: Spot size.	jourdren
➕	New test: Empty spot.	jourdren
➕	New test: Heterogenous spot.	jourdren
➕	New result output : HTML report.	jourdren
➕	GUI : Save result array list button.	jourdren
➕	GUI : Save report button.	jourdren
➕	New array list output : GAL File.	jourdren
🔨	Change the background of the graph : lighter color	jourdren
➕	Show the TestSuite name in TestSuite tab and report tab	jourdren
➕	Show the units of the thresholds.	jourdren
➕	Show the threshold on the graphs.	jourdren

Type	Changes	By
➕	New test: Valid spotting.	jourdren
✍	Polish Report tab	jourdren
➕	GUI : Print report button.	jourdren
🔨	Clear TestSuite and result tab when start a workflow.	jourdren
➕	Make a sample plugin (jar + source in docs).	jourdren
➕	Add a progress bar.	jourdren

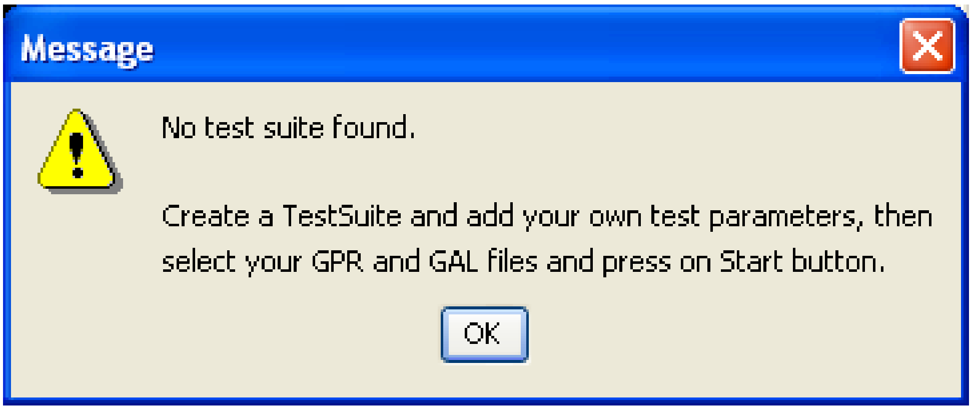
3.1 QuickStart tutorial

What is a TestSuite?

A TestSuite is a collection of tests which are apply on chip to validate it.

How to create a TestSuite

When you launch Doelan for the first time, a message notify you that you need to first create a TestSuite.

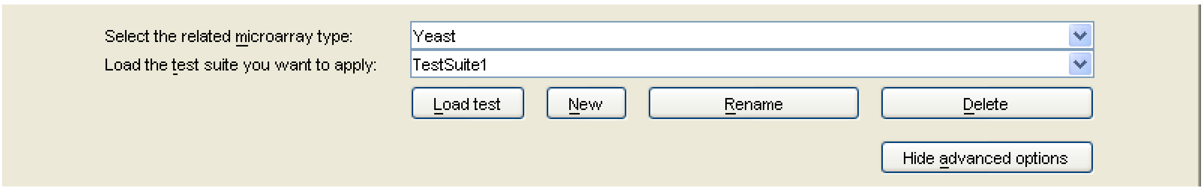


Message

No test suite found.

Create a TestSuite and add your own test parameters, then select your GPR and GAL files and press on Start button.

Each TestSuite is link to a chip type, so you need to create a chip type before creating a TestSuite. To create a chip type or TestSuite: on the main tab click on the **New** button, if this button is hidden, you can show this button and other optionals buttons by pressing on the **Show advanced options**. Now a dialog box appears, select the type element which you want to create (Chip type or TestSuite), set a name and validate with **OK** button. If there is no chip type created, you cannot create a TestSuite, you must create a chip type before a TestSuite.



Select the related microarray type: Yeast

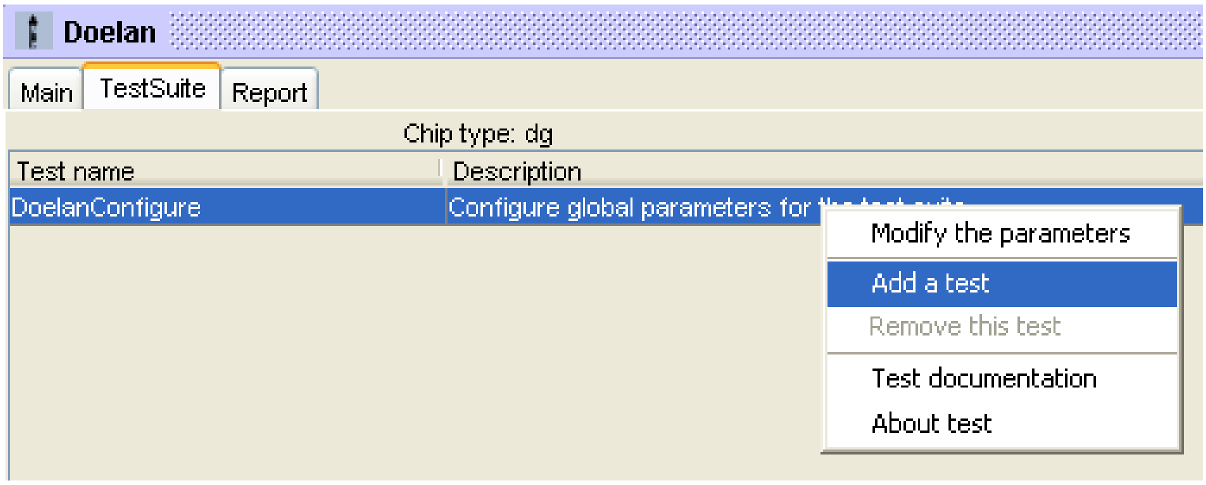
Load the test suite you want to apply: TestSuite1

Of course with doelan, in addition to create chip type and TestSuite, you can rename and remove this elements.

Edit a TestSuite

To edit a TestSuite, you must load it first. Loading a TestSuite is performed by a click on the **Load** button or by a click on **Start** button.

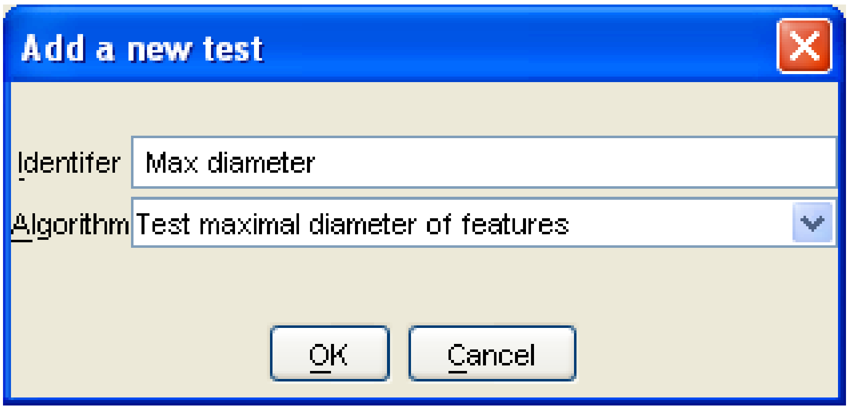
If you want to show and modify the elements of a TestSuite, you must go to the **TestSuite** tab of the application. In a recently created Testuite only one element compose the TestSuite. This element is not really a TestSuite but an element to set global parameters of the TestSuite.



Chip type: dg

Test name	Description
DoelanConfigure	Configure global parameters for the test suite

To add a new element, right click (or double click) on an existing element, select **add** and a dialog box appears with the list of all availlable tests. Select one and define an identifier for this test in your TestSuite. This test identifier must be unique.

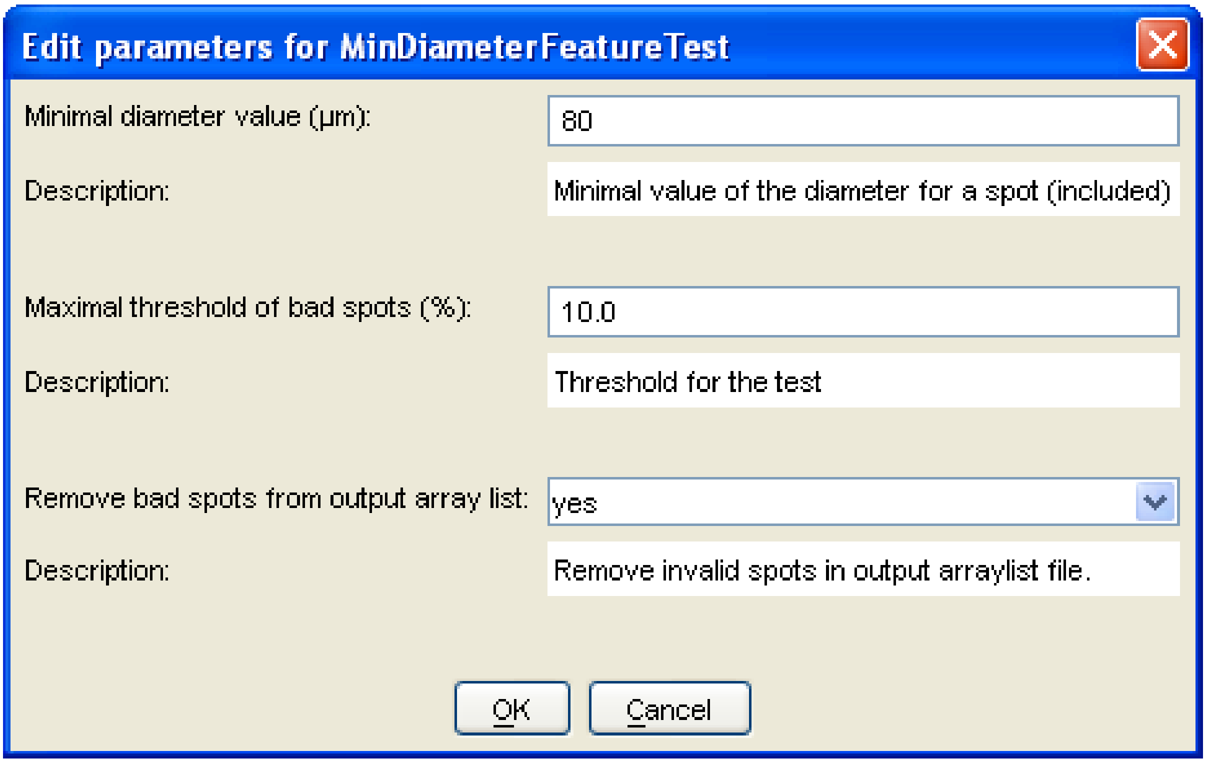


Identifer: Max diameter

Algorithm: Test maximal diameter of features

There are two kinds of tests in Doelan: global and unit tests. The unit tests provides statistics about chip data while global test provides informations about a set of unit tests results. You can only add one type of global test in a TestSuite.

In a TestSuite you can customize all the parameters of the tests. To do so, right click (or double click) on the test which you want to set the parameters and select **Modify the parameters**.



Minimal diameter value (µm): 80

Description: Minimal value of the diameter for a spot (included)

Maximal threshold of bad spots (%): 10.0

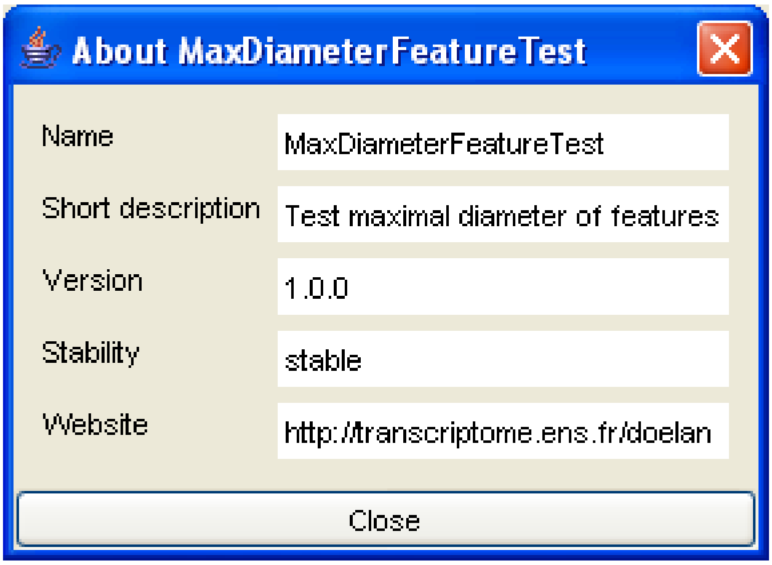
Description: Threshold for the test

Remove bad spots from output array list: yes

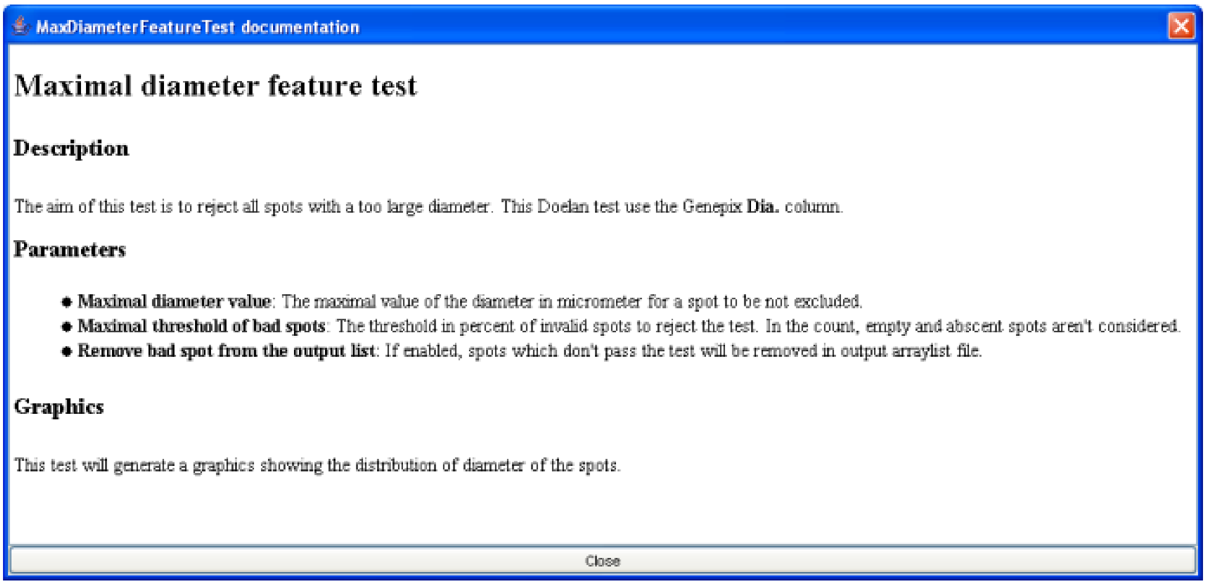
Description: Remove invalid spots in output arraylist file.

Go to the available tests page for more information about test parameters. You can also, of course remove a test in a TestSuite with the **Remove test** option in the contextual menu.

You can show additional information about the test with the **About test** and **Test documentation**.



Name	MaxDiameterFeatureTest
Short description	Test maximal diameter of features
Version	1.0.0
Stability	stable
Website	http://transcriptome.ens.fr/doelan



Maximal diameter feature test

Description

The aim of this test is to reject all spots with a too large diameter. This Doelan test use the Genepix **Dia.** column.

Parameters

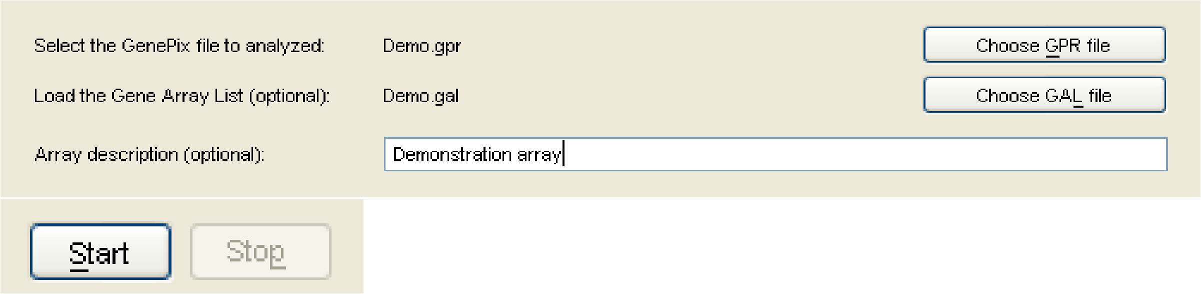
- **Maximal diameter value**: The maximal value of the diameter in micrometer for a spot to be not excluded.
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

Graphics

This test will generate a graphics showing the distribution of diameter of the spots.

Launching a TestSuite

To start a TestSuite: in the main tab, select a GPR file and a GAL file, add a comment about the array (optional), select a TestSuite and click on the **Start** button.

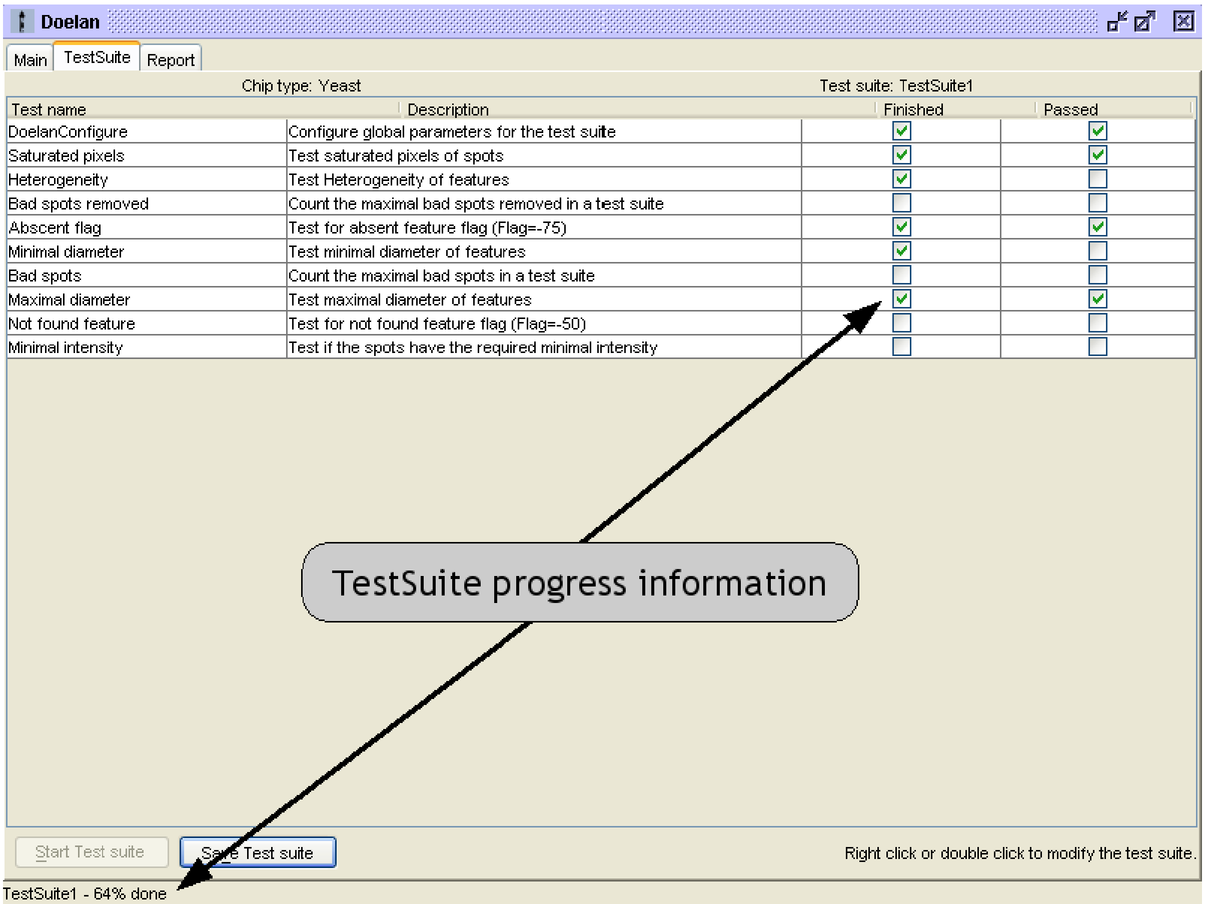


Select the GenePix file to analyzed: Demo.gpr

Load the Gene Array List (optional): Demo.gal

Array description (optional): Demonstration array

In the status bar and in the TestSuite tab, you can follow the progress of the executed TestSuite. At the end of the execution of a TestSuite a detailled report is avaivable in the report tab.



Chip type: Yeast

Test suite: TestSuite1

Test name	Description	Finished	Passed
DoelanConfigure	Configure global parameters for the test suite	☑	☑
Saturated pixels	Test saturated pixels of spots	☑	☑
Heterogeneity	Test Heterogeneity of features	☑	□
Bad spots removed	Count the maximal bad spots removed in a test suite	□	□
Absent flag	Test for absent feature flag (Flag=-75)	☑	☑
Minimal diameter	Test minimal diameter of features	☑	□
Bad spots	Count the maximal bad spots in a test suite	□	□
Maximal diameter	Test maximal diameter of features	☑	☑
Not found feature	Test for not found feature flag (Flag=-50)	□	□
Minimal intensity	Test if the spots have the required minimal intensity	□	□

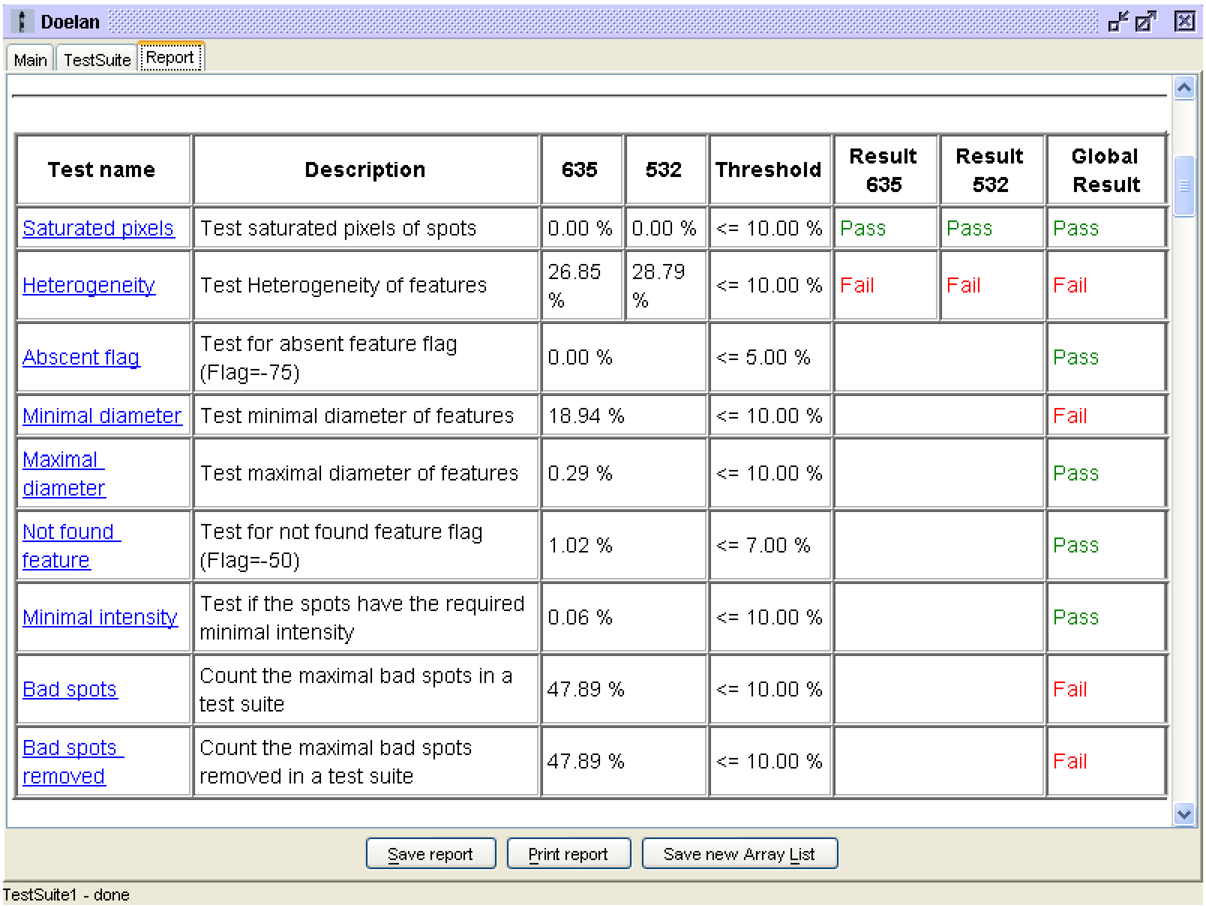
Right click or double click to modify the test suite.

TestSuite1 - 64% done

Giving an array list file (GAL file) is optional but there are two benefits to do so: First, in the report tab you can see an image which represents the locations on the microarray of spots which pass the tests. And secondly, you can save an output array list without rejected spots.

Report

After launching a TestSuite, Doelan generates a four parts report. The first part shows general informations about the TestSuite used such as the current date or the name of the TestSuite. The second part summaries all the results of the TestSuite. The next part shows detailed informations about all tests with parameters values, the result, a comment and sometimes one or more graph to visualize the results. If an array list file was selected, the last part of the report and represents the locations on the microarray of spots which pass the tests (in green) and which does not (in red).



Test name	Description	635	532	Threshold	Result 635	Result 532	Global Result
Saturated pixels	Test saturated pixels of spots	0.00 %	0.00 %	<= 10.00 %	Pass	Pass	Pass
Heterogeneity	Test Heterogeneity of features	26.85 %	28.79 %	<= 10.00 %	Fail	Fail	Fail
Abscent flag	Test for absent feature flag (Flag=-75)	0.00 %		<= 5.00 %			Pass
Minimal diameter	Test minimal diameter of features	18.94 %		<= 10.00 %			Fail
Maximal diameter	Test maximal diameter of features	0.29 %		<= 10.00 %			Pass
Not found feature	Test for not found feature flag (Flag=-50)	1.02 %		<= 7.00 %			Pass
Minimal intensity	Test if the spots have the required minimal intensity	0.06 %		<= 10.00 %			Pass
Bad spots	Count the maximal bad spots in a test suite	47.89 %		<= 10.00 %			Fail
Bad spots removed	Count the maximal bad spots removed in a test suite	47.89 %		<= 10.00 %			Fail

TestSuite1 - done

Save results

The report can be saved in HTML format or can be printed. If an array list data was selected, the creation of a new array list file without all the rejected spots is allowed. The identifiers of all this spots will be set to a new "empty" identifier and the description field will notify the origin of the rejection. Warning, if this new identifier is in the list of "empty" identifiers, rejected spots in the repport map will be considered as abscent (dotted circle) and not as rejected (red filled circle).

3.2 Available tests

Test in Doelan

Doelan is bundled with many tests. However, you can add your own test to Doelan thanks to the Doelan plugin system. The writing a plugin page learns you how to do this.

Built-in Test in Doelan

The Doelan builtins tests can play with various features of the chips such spots diameter, spots flags, spots heterogeneity, saturated pixels of the spots...

Here is the list of the built-in tests, click on a test to display documentation on parameters:

- **Unit tests**

Test name	Description
DoelanConfigure	Configure global parameters for the TestSuite
BadFeature	Test for bad feature flag (Genepic flag=-100)
AbsentFeature	Test for absent feature flag (Genepix flag=-75)
NotFoundFeature	Test for not found feature flag (Genepix flag=-50)
HeterogeneousFeature	Test for heterogeneous spots
SaturatedPixels	Test for saturated spots
MinimalIntensity	Test for minimal spot intensity
MaxDiameterFeature	Test maximal diameter of spots
MinDiameterFeature	Test minimal diameter of spots
GenericTest	Generic test to test any column of a GPR file

- **Global tests**

Test name	Description
GlobalMaxBadFeatures	Global test to count rejected spots
GlobalMaxBadFeaturesRemoved	Global test to count removed spots from output file

- **Special**

Test name	Description
DoelanConfigure	Configure global parameters for the TestSuite

3.2.1 DoelanConfigure

DoelanConfigure Element

Description

This element is not a test but an element used to set several global parameters for the TestSuite.

Parameters

- The list of the "empty" identifiers. That is to say, all the identifiers of the spot that Doelan may consider as empty spots.
- Column for empty identifiers. This can be the identifier or the description field.
- The new identifier for the spots which are rejected in the output file. Warning, if this identifier is "empty", rejected spots in the repport map will be considered as abscent (dotted circle) and not as rejected (red filled circle).

3.2.2 BadFeature

Bad feature test

Description

The aim of this test is to count and reject all spots with a flag set at -100. This Doelan test use the **Flag** column of the GPR.

Parameters

- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

3.2.3 AbsentFeature

Absent feature test

Description

The aim of this test is to count and reject all spots with a flag set at -75. This Doelan test use the **Flag** column of the GPR.

Parameters

- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

3.2.4 NotFoundFeature

Not found feature test

Description

The aim of this test is to count and reject all spots with a flag set at -50. This Doelan test use the **Flag** column of the GPR.

Parameters

- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

3.2.5 MaxBadFeatures

Global maximum bad features test

Description

The aim of this global test is to count the number spotd which are rejected by all the unit tests. In this test all rejected spots are counted, not only the removed spots.

Parameters

- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test.

3.2.6 MaxBadFeaturesRemoved

Global maximum bad features removed test

Description

The aim of this global test is to count the number spotd which are rejected by all the unit tests. In this test only all removed spots are counted.

Parameters

- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test.

3.2.7 HeterogeneousFeature

Heterogeneity feature test

Description

The aim of this test is to reject all spots which are too Heterogeneous. This Doelan test use the standard deviation of the green foreground (Genepix **F635 SD** column) and the standard deviation of the red foreground (Genepix **F532 SD** column).

Parameters

- **Maximal value of standard deviation**: The maximal value of the standard deviation for a spot to be not rejected.
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

Graphics

This test will generate two graphics (one for each color) showing the distribution of the standard deviation of the intensities of the spots.

3.2.8 SaturatedPixels

Saturated pixels feature test

Description

The aim of this test is to reject all spots with too many saturated pixels. This Doelan test use the percent of 635 foreground intensity (Genepix **F635 % Sat.** column) and the percent of 635 foreground intensity (Genepix **F532 % Sat.** column).

Parameters

- **Threshold maximum of saturated pixels**: The maximal value in the percent of saturated pixels for a spot to be not excluded.
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

3.2.9 MinimalIntensity

Minimal Intensity feature test

Description

The aim of this test is to reject all spots with a too low intensity. This Doelan test use the 635 foreground intensity (Genepix **F635 Median** column) and the 532 foreground intensity (Genepix **F532 Median** column).

Parameters

- **Minimal spot intensity**: The mininum value of the intensity in each color for a spot to be not excluded.
- **Channel to test**: The channel(s) to test (red, green or both).
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

Graphics

This test will generate two graphics (one for each color) showing the distribution of intensities of the spots.

3.2.10 MaxDiameterFeature

Maximal diameter feature test

Description

The aim of this test is to reject all spots with a too large diameter. This Doelan test use the Genepix **Dia.** column.

Parameters

- **Maximal diameter value**: The maximal value of the diameter in micrometer for a spot to be not excluded.
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

Graphics

This test will generate a graphics showing the distribution of diameter of the spots.

3.2.11 MinDiameterFeature

Minimal diameter feature test

The aim of this test is to reject all spots with a too small diameter. This Doelan test use the Genepix **Dia.** column of the GPR.

Parameters

- **Minimal diameter value**: The minimal value of the diameter in micrometer for a spot to be not excluded.
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

Graphics

This test will generate a graphics showing the distribution of diameter of the spots.

3.2.12 Generic

Generic feature test

Description

This test is a versatile test. You can use it to test one of the columns which compose an GPR file.

Parameters

- **Column name**: The name of the column to be tested. The name must be the same as in a GPR file.
- **Test**: The type of the test (lesser than, equals, greater than...).
- **Test value**: A value to be tested against all the values of the selected column.
- **Maximal threshold of bad spots**: The threshold in percent of invalid spots to reject the test. In the count, empty and abscent spots aren't considered.
- **Remove bad spot from the output list**: If enabled, spots which don't pass the test will be removed in output arraylist file.

3.3 Writing your own test

Writing your own test

This section how to writing a simple plugin. In this example, we will create a test which filter spots with flag value at notfound. There is only one requirement to produce a functional plugin: it must contains one or more (a plugin can have more than one test) class witch extends `QualityUnitTest()` and implements the `Module()` interface.

The `Module()` interface force the developer to describe the module he want to add to doelan.

The abstract `QualityUnitTest()` impose you to set the parameters (name, type and default value) of test and wrinting a `test()` witch do the job.

The end of this section show you the annoted code of a test filtering spots with flag value at notfound. You'll find the source of this plugin and scripts to build it in the doc/plugin directory of doelan.

```
// Import Unit test class
import fr.ens.transcriptome.doelan.algorithms.QualityUnitTest;

// Import Result test classes
import fr.ens.transcriptome.doelan.data.QualityUnitTestResult;
import fr.ens.transcriptome.doelan.data.QualityUnitTestResult.SummaryResult;

// Import Module management classes
import fr.ens.transcriptome.nividic.platform.module.AboutModule;
import fr.ens.transcriptome.nividic.platform.module.Module;
import fr.ens.transcriptome.nividic.platform.module.ModuleDescription;
import fr.ens.transcriptome.nividic.platform.PlatformException;

// Import of the classes for handling bioassays
import fr.ens.transcriptome.nividic.om.BioAssay;
import fr.ens.transcriptome.nividic.om.SpotIterator;

// Import of the classes for handling parameters in a module
import fr.ens.transcriptome.nividic.util.parameter.FixedParameters;
import fr.ens.transcriptome.nividic.util.parameter.Parameter;
import fr.ens.transcriptome.nividic.util.parameter.ParameterBuilder;
import fr.ens.transcriptome.nividic.util.parameter.ParameterException;
import fr.ens.transcriptome.nividic.util.parameter.Parameters;

/**
 * Plugin Sample Test.
 * This class define a test based on not found spot flags.
 * @author Laurent Jourdren
 */
public class PluginSampleTest extends QualityUnitTest implements Module {

  /**
   * Get the description of the module.
   * The aboutModule() method allow to describe the test for the
   * user in the doelan interface.
   * @return The description of the module
   */
  public AboutModule aboutModule() {

    ModuleDescription md = null;
    try {
      md = new ModuleDescription("PluginSampleTest",
          "Plugin sample Test : Test not found spot flag for BioAssay");
    } catch (RomdePlatformException e) {
      getLogger().error("Unable to create the module description");
    }
    return md;
  }

  /**
   * Set the parameters of the element.
   * The defineParameters() method allow to describe the type,
   * the defaults values and the range of all parameters of the test.
   * If the user enter enter in Doelan an out of range parameter, the
   * message will tell him that parameter is wrong.
   * @return The defaults parameters to set.
   */
  protected Parameters defineParameters() {

    try {

      final Parameter threshold = new ParameterBuilder().withName("Threshold")
          .withType(Parameter.DATATYPE_DOUBLE).withDescription(
              "Threshold for the test").withGreaterThanValue(0)
              .withDefaultValue("0.10").getParameter();
      final Parameter filterFlags = new ParameterBuilder().withName(
              "Filter flags").withType(Parameter.DATATYPE_BOOLEAN)
              .withDescription(
              "Filter invalid features in output arraylist file")
              .withDefaultValue("false").getParameter();

      final FixedParameters params = new FixedParameters();
      params.addParameter(threshold);
      params.addParameter(filterFlags);

      return params;

    } catch (ParameterException e) {
      System.err.println(e);
    }

    return null;
  }

  /**
   * Test the quality of the bioassay.
   * @param bioassay BioAssay to test
   * @param arrayList The array list
   * @param parameters parameters of the test
   * The test() method is the main function of the test. There, the test will be
executed.
   * @return A QualityObjectResultTest Object
   * @throws PlatformException if an error occurs while executing
   * the test.
   */
```

```
public QualityUnitTestResult test(final BioAssay bioassay,
    final BioAssay arrayList, final Parameters parameters)
    throws PlatformException {

  QualityUnitTestResult result = null;

  try {

    final boolean[] results = new boolean[bioassay.size()];
    final int[] flags = bioassay.getFlags();

    // Get the user parameters values
    final double threshold = parameters.getParameter("Threshold")
                             .getDoubleValue();
    final boolean filterFlags = parameters.getParameter("Filter flags")
                                .getBooleanValue();

    int countNotFound = 0;
    int countRealSpot = 0;

    // Iterate over the bioassay to test all the flags of the spots
    SpotIterator si = bioassay.iterator();

    while (si.hasNext()) {
      si.next();

      if (si.isEmpty() || si.isFlagAbscent())
        continue;

      // If the flag of spot is not found, the spot if set to false in
      // the results array and will not be in the output gal file
      if (si.getFlag() == BioAssay.FLAG_NOT_FOUND)
        countNotFound++;
      else
        results[si.getIndex()] = true;

      countRealSpot++;
    }


    final double ratio = ((double) countNotFound) / ((double) countRealSpot);

    // Set the result information in the result variable
    result = new QualityUnitTestResult(bioassay, this);
    result.setMessage("Not found flag features : " + countNotFound + " / "
        + countRealSpot + " max : " + (countRealSpot * threshold));

    result.setGlobalResultType(true);
    if (filterFlags) result.setNewFlags(results);

    SummaryResult rac = result.getResultAllChannels();
    rac.setPercent(true);
    rac.setThresholdEqualityType("<=");
    rac.setUnit("%");
    rac.setThreshold(threshold);
    rac.setValue(ratio);
    rac.setPass(ratio <= threshold);

  } catch (ParameterException e) {
    throw new PlatformException("Error while creating parameters ("
        + this.getClass().getName() + ") : " + e.getMessage());
  }
```

```
    // Return the result
    return result;
  }

  //
  // Constructor
  //

  /**
   * Public constructor.
   * @throws PlatformException If the name or the version of the element
   *         is null.
   */
  public PluginSampleTest() throws PlatformException {
    // MUST BE EMPTY
  }
}
```

Compliation and installation of plugins

This section presents you the process of building a functionnal plugin after writing the source code. All the next steps are very common, you can easily script it (with ant, unix or Windows shell). In the next chapter you'll find two scripts (one for *nix and one for Windows) to automate the building of a simple plugin. Wrinting an Ant script will be useful if you consider to develop a large plugin.

- In your source directory compile your plugin. You can use a makefile like Ant to automate the compilation of your sources.
- Pack the generated *.class* file in a *.jar* file.
- Copy your *.jar* in the Doelan *plugins* directory.
- Restart Doelan.
- Now, You can use your own test in the application.

Building the plugin sample

This an script for building the *.jar* file of the plugin under *nix. Don't forget to replace *PATH_TO_DOELAN* by the valid path to Doelan on your filesystem in the script.

```
#!/bin/sh

DIRLIB=$PATH_TO_DOELAN/lib

for LIB in `ls $DIRLIB`
do
  CLASSPATH=$DIRLIB/$LIB:$CLASSPATH
done

rm *.class *.jar
javac -classpath $CLASSPATH *.java
jar cf testplugin.jar *.class
```

This is the same script for Windows. It's a batch file, save into a text file and rename it with the *.bat* extension. Be careful under Windows, with the *CLASSPATH* and *PATH* environement variable, sometimes they are not set. See your Java documentation for more information.

```
del *.class
del *.jar
javac -classpath %CLASSPATH% *.java
jar cf testplugin.jar *.class
```

3.4 PDF documentation

4.1 Get the source

Download Doelan source

Doelan source is distributed in several formats for your convenience.

- `.tar.gz` archive (1.5 MiB)
- `.zip` archive (1.7 MiB)

Doelan is distributed under the General Public License .

Compilation

You'll find more information about how compile Doelan in the compiling section .

4.2 Compiling

How to compile Doelan

To build Doelan, you need a Java 2 Standard Edition SDK greater or equals to 1.4.x and Maven 1.x.

First set your current directory to the base directory of **Doelan**. The next commands works whatever your operating system and the "`$`" character represent the command line prompt. Then, you can show all availlable commands of **Maven** with:

```
$ maven -g
```

To build build binary distribution:

```
$ maven dist-bin
```

To build build source distribution:

```
$ maven dist-src
```

To build build both source and binary distribution:

```
$ maven dist
```

To clean the build directories:

```
$ maven clean
```

4.3 Known bugs

Known Bugs for Doelan 1.0

- Remove freezing actions from applet mode. It is a Genepix Bug. Actualy, Axon doesn't support embeded java applets in Genepix.
- Graphics in Doelan are not antialiased. Due to a bug in Sun Java Virtual Machine, antialiasing isn't turn on. If you enable it, a fatal error sometimes occurs.

Submit a Doelan bug

You can submit a bug by sending a sending a mail to the doelan list .

4.4 Futur improvements

Futur improvements

- Load TestSuites from different source (not only filesystem, i.e. website, database) using the plugin system.
- Create several plugins for the export of the report (not only an html file, i.e. xml file, database).
- Create a new test: Test if signal/background ratio is lower than 15%
- Create a new test: Test if signal/background ratio is greater than 2 SD

4.5 Contribute to Doelan

How can I contribute to Doelan?

Doelan is a free software project. Everybody is encouraged to contribute to Doelan. There are lots of ways in which you can help to continue Doelan:

- Testing new versions
- Submitting bug reports to the mailling list
- Send your TestSuites (with comments) to the developer to publish it on the website
- Programming new Doelan plugins

There are several places to look for more information if you want to get involved in the development. The first step is to subscribe to the mailing list. You will soon see something that can be improved or added.

How do I commit a bug report?

There is actualy no automatic bug tracking system available like Bugzilla for Doelan. So, to report a bug, you must send your report on the mailing-list .

Publish TestTuites and plugins on Doelan website

We can post on the mailing-lists your TestSuite suggestions for publication on website. For the pluggins, please contact the developer without sending your plugin in attachment.

5.1 Additional TestSuites

Additional TestSuites

In this section you will find soon, samples TestSuites for Doelan with description. You can also publish your own TestSuite on Doelan website by send your creation on the mail lists .

5.2 Additional Test Plug-ins

Additional Plugins

In this section you will find soon, test plugins for Doelan. You also publish your own plugins on Doelan website by send your creation on the mail lists .

5.3 Mailing list

Mailing Lists

These are the mailing lists that have been established for this project. For each list, there is a subscribe, unsubscribe, and an archive link.

List Name	Subscribe	Unsubscribe	Archive
doelan-list	Subscribe	Unsubscribe	Archive