SOFTWARE NEED ASSESSMENT

OptimumG - Optimum Tire for the 2020 Formula Student season

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version 0.1 -April 14, 2019

Contents

1 Introduction

1.1 The EPSA organization at the École Centrale de Lyon

The École Centrale de Lyon (ECL) is one of the oldest engineering schools of France, It is locate in the city of Lyon, center France. The Écurie Piston Sport Auto (EPSA) is a spin-off organization composed for the most part of ECL students and alumni. The history of EPSA started with the competition of the Société des Ingénieurs de l'Automobile (SIA) at which several teams of the organization participated. Today EPSA is one of the five Formula Student (FS) teams in France.

As engineering students at ECL we follow engineering fundamental classes during the first two years which give us a general view of the engineering process on the industrial level. On the end of the second year and during all of the third year we choose where and how to specialize. In order to prepare us for such a specialization choice, during the first two years the school lets us develop an engineering project all over the year for an equivalent workload of 4 hours per week. The formula student project represents as of today the biggest of the school projects.

During Mars and April 2019 some of the members of the team attended for the first time the two OptimumG seminars in Nevers, France.

1.2 State of the art understanding of tire models at EPSA

brief description of GTE's work.

Brief description of the preliminary models work-flow for the suspension department : LAS points, Mecamaster load cases, where to use tire models ?

1.3 This document's goal

After the two seminars held by OptimumG at Nevers in April 2019 we understood the need fo using tire models during the preliminary design phases. Our team as FS team has access to the Tire Test Consortium (TTC) raw data for the different tire models available to the competition. As of today the few hundreds lines of Matlab and Python code that we wrote in order to fit Pacejka Models to some old TTC data do not suffice in giving us the tire properties needed during preliminary design. Having a software such as OptimumTire on our side would surely make a great difference.

to present the kind of feedback OptimumG can get from a collaboration with us
to state how this feedback can be strained to OtimumG's special requests

1.4 Structure of the present document

By following the four tutorial proposed on the OptimumG website and by searching for the questions we posed ourselves in the official documentation (documents [6] and [5]), we eventually noted down

1. some of the difficulties we encountered,
2. some graphical features of the software UI that we think might me improved
3. some presentation aspects related to the fore-mentioned documents that we think might be structured differently

In the following two sections we redacted a short description of those notes. We state here and for the rest of the document that the OptimumTire software was tested on a up to date Windows 10 environment.

Figure 1: tested software version

2 First impressions on the Optimum-Tire documentation

2.1 Tutorials

In the tutorial [1] there is no sample data to utilize to follow the tutorial. We happened to have de TTC datas for the FS but... could be a plus to parallel download some raw data to practice the tutorial.

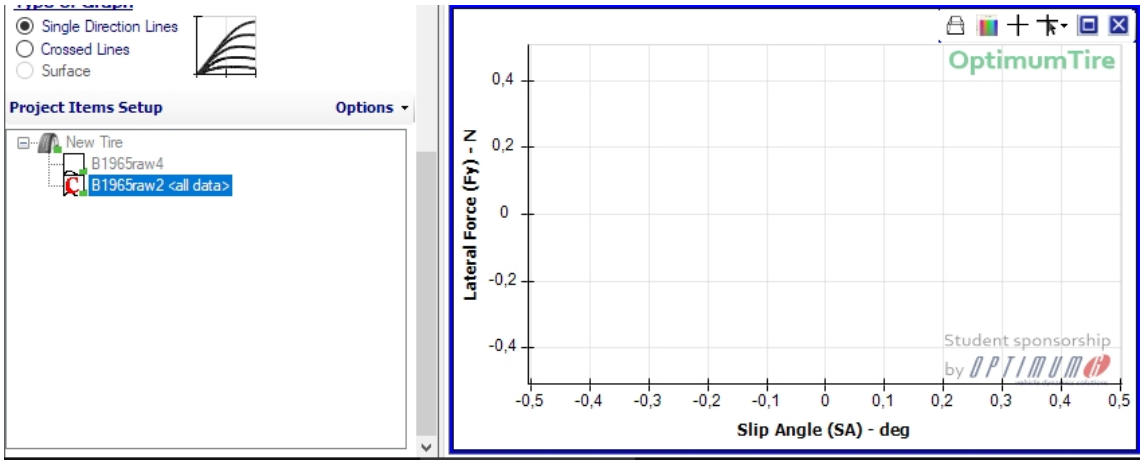
In the tutorial [2] we found some difficulties in understanding the collapse tool and visualizing the collapsed data. Once understood the tool works very well but at the beginning it was not clear what tolerance meant. Words like *step-size* or *step-difference* might represent a valid alternative form our point of view.

In the tutorial [3]

2.2 Optimum-Tire Product Specification

2.3 Optimum-Tire help File

During the tutorial [1] we happened to have a question about tire temperatures. When importing from a TTC data file we had three temperatures (inner, center and outer) and we could not associate these temperatures to the temperatures available in the importing window (temp 1,2,3,4 and 5). By searching the word *temperature* in the help file (document [6]) we did not find any match. We would like to suggest a revision of this aspect



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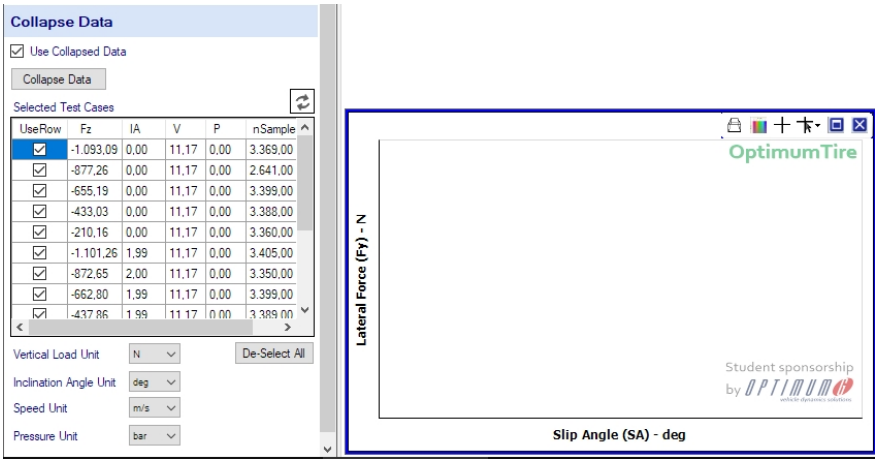
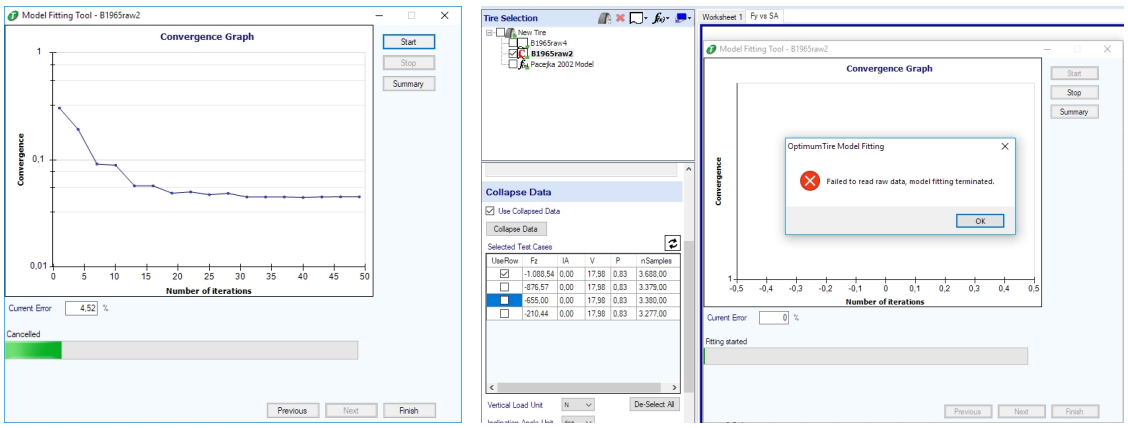


(b)

Figure 2: troubles after collapse tool



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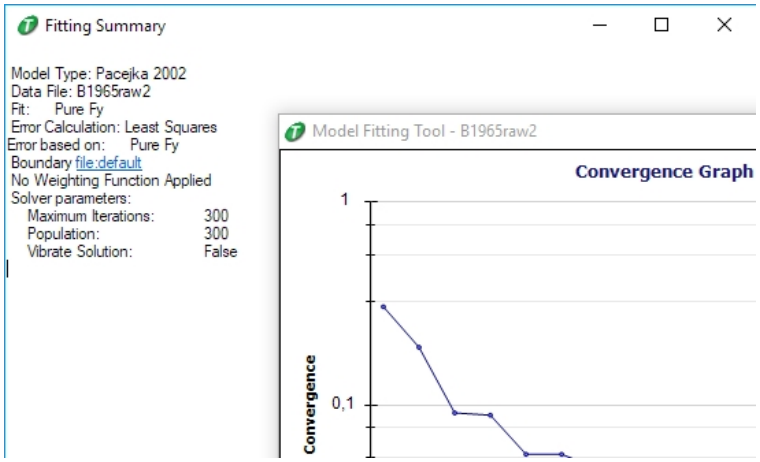

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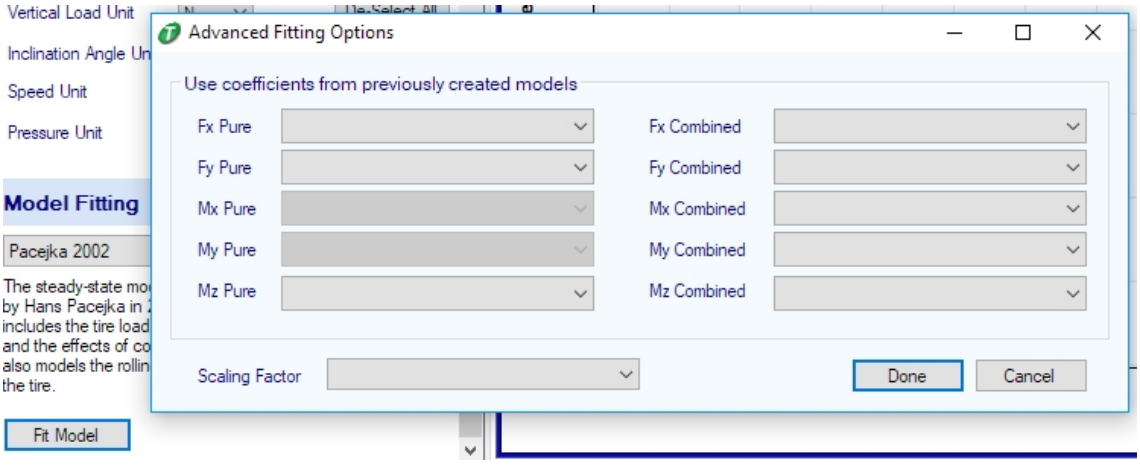


(d)

Figure 3: model fit tool screen-shots

3 First impressions on the Optimum-Tire user interface

3.1 Some thoughts after the tutorial experience

During tutorial [**?**] when importing raw data the software interface asks the user a `.csv` file. TTC gives data using the `.dat` format, which is a text file like the first one. The point being that the UI could updated to ask a data file without specifying the format since the SW itself asks for the data separator character before importing.

During tutorial [2] using the collapse tool we found the method of entering the tolerances values a little repetitive. The sw prompts the user with some text fields in a first window and only later allows to visualize the curves on a second window which must be closed in order to enter back the values on the first window. We think it might be quicker to allow the user to plot the curves and enter the tolerances values in the same window.

3.2 Some more general thoughts

We would like to suggest some mouse feature that we think should be standardized between scientific software. We would like to address in particular to the mouse behaviour over plot visualization figures. We found the middle button zoom feature and the absence to a direct click-to-pan tool a little odd. From our point of view, over a plot figure, left click and drag should zoom, middle button click should allow to pan and in order to move along the vertical (horizontal) axis the scroll wheel (with `shift` respectively) should be used.

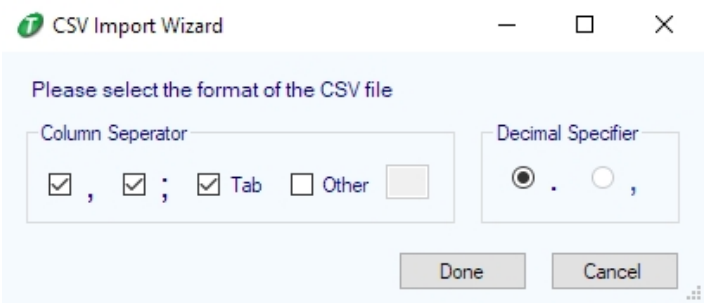
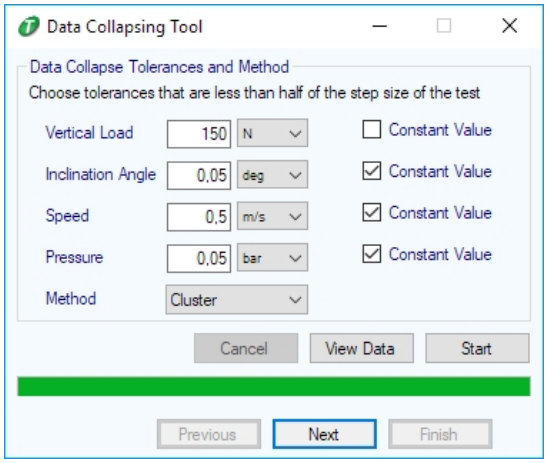


Figure 4: the `.csv` import window



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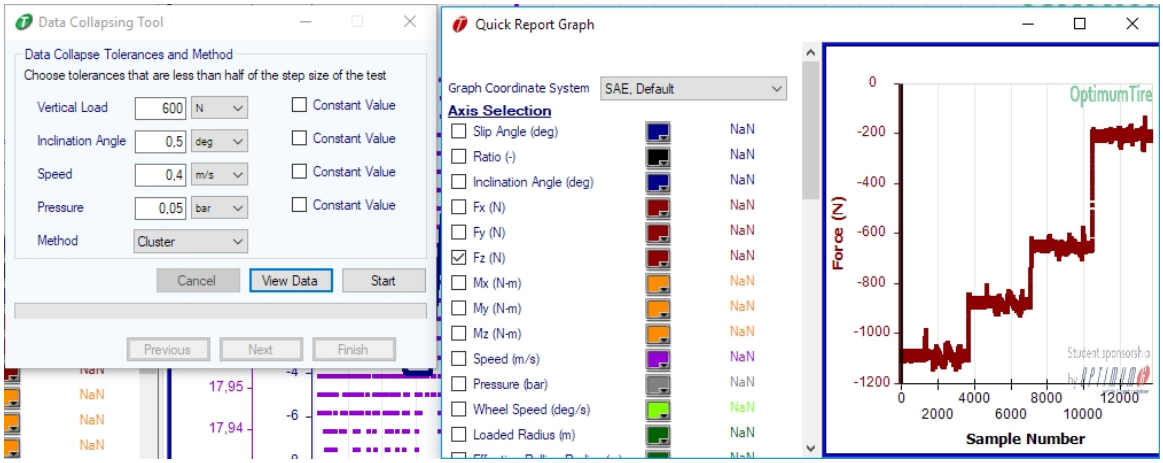

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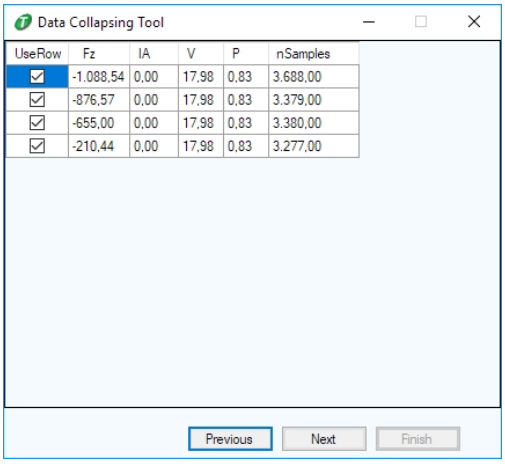

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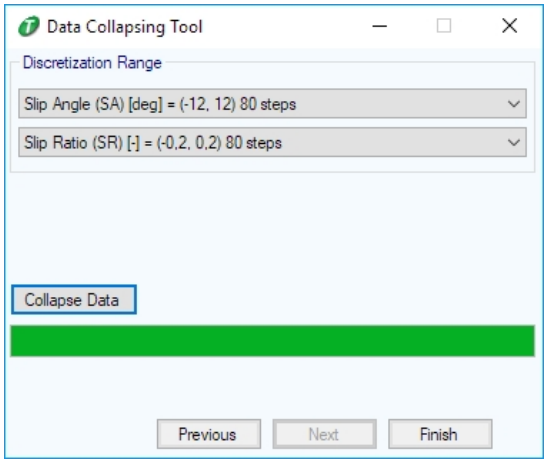

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Figure 5: collapse tool screen-shots

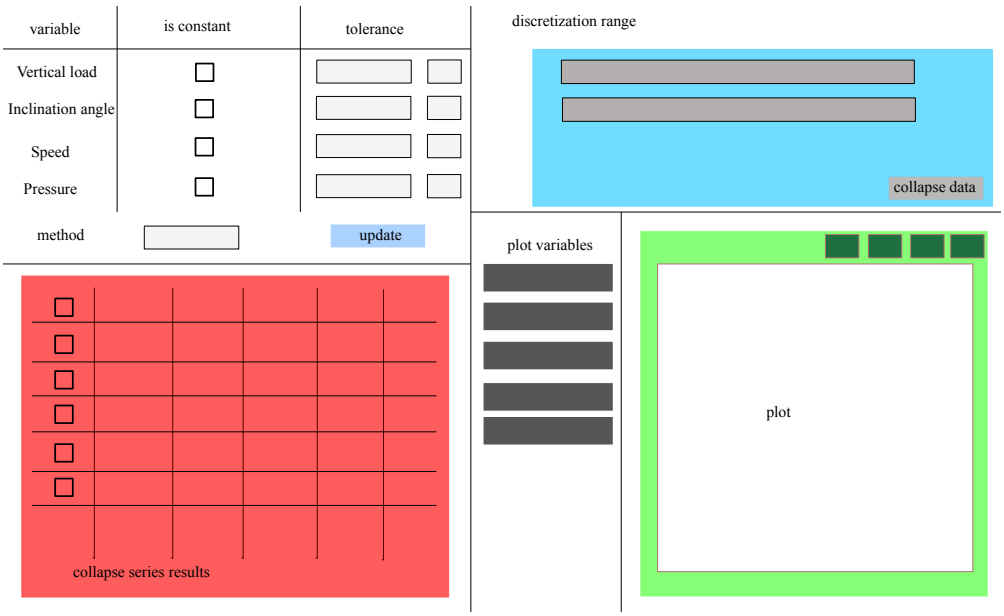
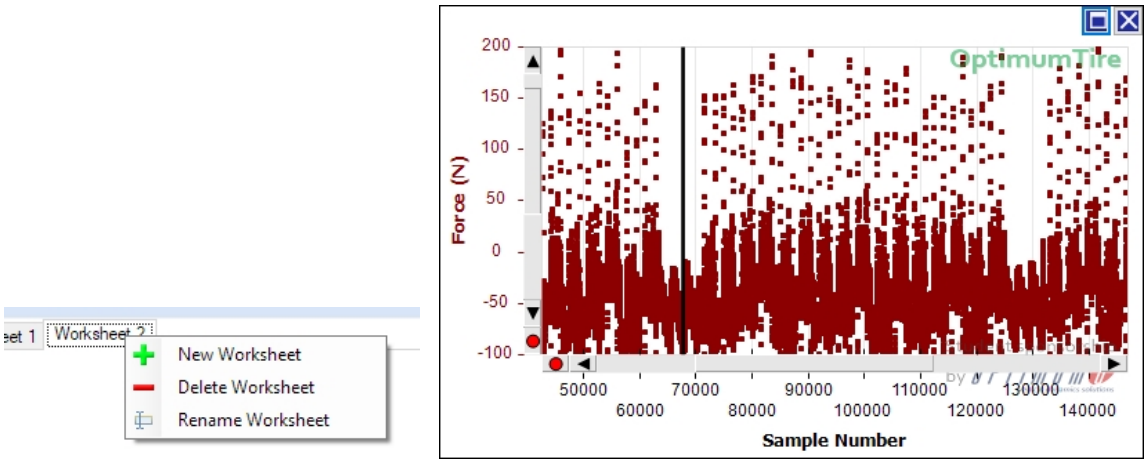


Figure 6: A possible layout for the collapse tool



(a) (b)

Figure 7: more general user interface thoughts

4 References

[1] Tutorial part 1: Importing Data, OptimumG®website, OptimumTire Tutorials (last retrieved: April 14, 2019)

[2] Tutorial part 2: Data Pre-processing, OptimumG®website, OptimumTire Tutorials (last retrieved: April 14, 2019)

[3] Tutorial part 3: Fitting a Model (Cornering), OptimumG®website, OptimumTire Tutorials (last retrieved: April 14, 2019)

[4] Tutorial part 1: Fitting a Model (Combined), OptimumG®website, OptimumTire Tutorials (last retrieved: April 14, 2019)

[5] OptimumTire Product Specification, OptimumG®website, OptimumTire Documentation (last retrieved: April 14, 2019)

[6] OtimumTire Help File, OptimumG®website, OptimumTire Documentation (last retrieved: April 14, 2019)