Resubmission of Preliminary report

Development of a C^{++} based user-interface for a plasma simulation tool

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25 November 2016

Declaration of academic integrity

I confirm that I have read and understood the University's Academic Integrity Policy.

I confirm that I have acted honestly, ethically and professionally in conduct leading to assessment for the programme of study.

I confirm that I have not copied material from another source nor committed plagiarism nor fabricated, falsified or embellished data when completing the attached piece of work. I confirm that I have not copied material from another source, nor colluded with any other student in the preparation and production of this work.

SIGNATURE.....Junming Zhang.....
DATE .....25/11/2016.....

Abstract

An existing microplasmas simulation tool which developed by the technological plasma team will generate considerable output data in various formats. Therefore, a user-friendly interface is needed by relevant researchers and industry users.

The aim of this report is to describe the preliminary development procedures of this user-friendly interface and this report includes six parts which are project description, methodology, project plan, project rationale with the relevance of industry, literature review and the working results in the first three weeks.

The future work of this project will perform according to the project plan in continuing research.

Contents

1. Introduction

This preliminary report will be divided into six main parts.

First is the project description. The overview, aims and objectives of this project will be mentioned, and then it will describe the general ways about how to realize these purposes.

The second part is the methodology include the explanation of the specific tools and technological processes.

The third part is project plan with Gantt chart. This project is combined with large amount of specific tasks with duty cycle and then these tasks will be used to generate the Gantt chart for managing the procedure of project.

After that is the part of project rationale and industrial relevance. The evaluation of this project and the research interests of project supervisor will be used to analysis this project and the relationship with industry.

Next is the literature review. The relevant research results of other people will be displayed as the reference list.

The final part is the achievement. Preliminary research results of this project in the first three weeks will be introduced.

2. Project Description

2.1 Problem statements

A simulation tool for microplasmas which named Plasimo has been developed by the Technological Plasma Group. A large amount of output files will be generated through the model simulation of plasma.

This project uses the Plasimo 5.0 developer version and the Micro Discharge 2D (md2d) model of plasma. The running process of this simulated tool is shown in Figure 1.

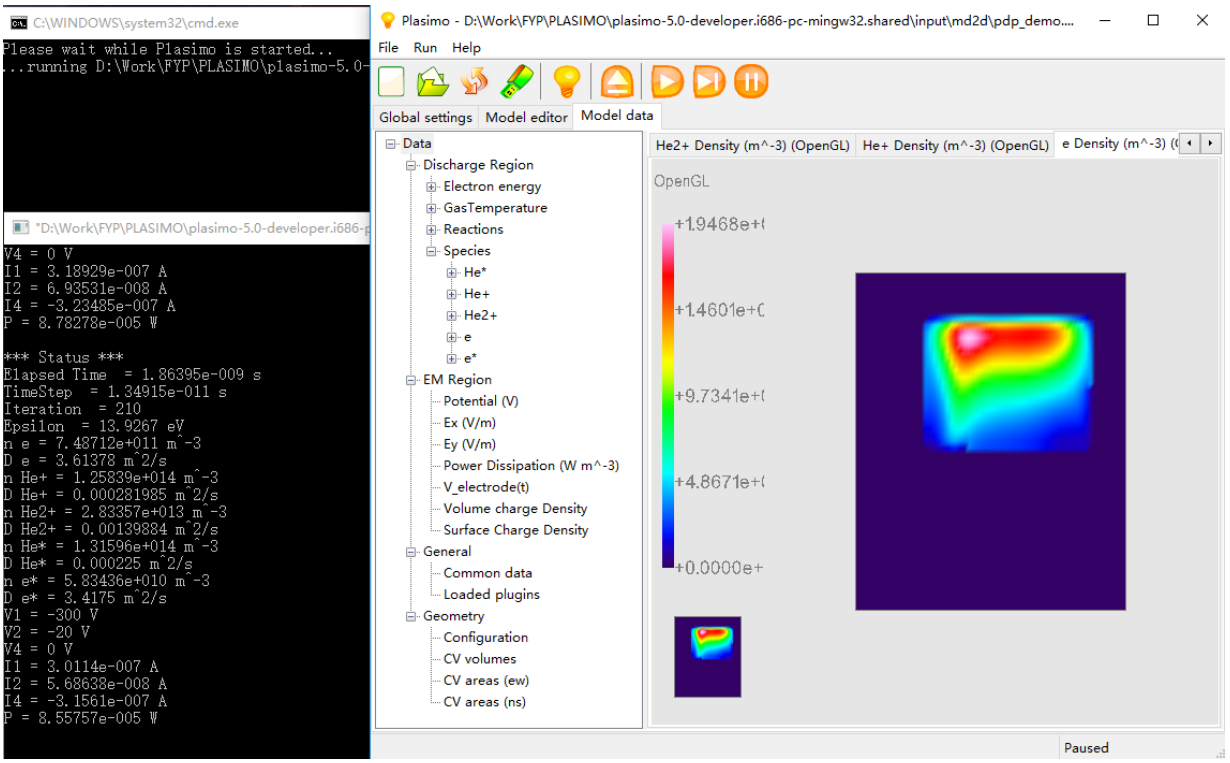


Figure 1. Running process of Plasimo 5.0 with md2d model

It will generate a large amount of output files as text after finished the simulated process and the output formats will show in Figure 2.

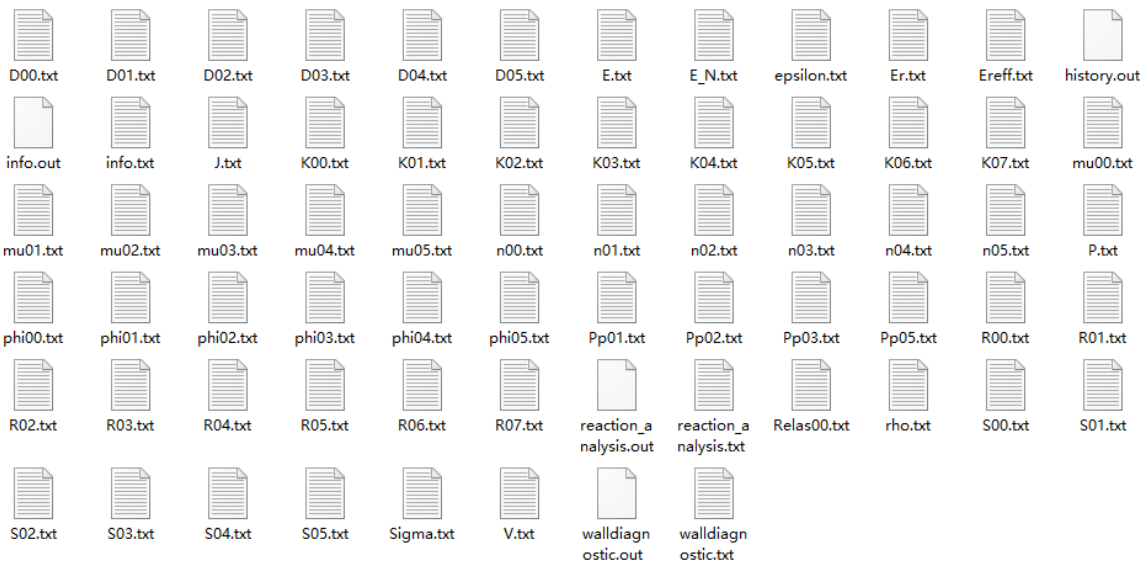


Figure 2. Output files of md2d model simulation

Lots of simulated information are stored in these files detailedly. The explanation of each file is shown in Table 1[1].

n00.txt	electron energy density [J m^{-3}]
phi00.txt	electron energy flux density [W m^{-2}]
S00.txt	electron energy source [W m^{-3}]
D00.txt	electron energy diffusion coefficient [W m^{2}]
mu00.txt	electron energy mobility coefficient [J m2 V^{-1} s^{-1}]
Relas00.txt	rate of electron energy loss from elastic collisions [W m^{-3}]
epsilon.txt	mean electron energy [J]
n01.txt	density for species 1 [m^{-3}]
S01.txt	source for species 1 [m^{-3} s^{-1}]
D01.txt	diffusion for species 1 [m^{2} s^{-1}]
mu01.txt	mobility for species 1 [m^{2} V^{-1} s^{-1}]
phi01.txt	flux for species 1 [m^{-2} s^{-1}]
R00.txt	reaction rate for reaction 1 [m^{-3} s^{-1}]
K00.txt	reaction rate coefficient for reaction 1 [m^{3} s^{-1}]
Pp01.txt	power dissipation for species 1 [W m^{-3}]
P.txt	dissipated power density [W m^{-3}]
J.txt	current density [C s^{-1} m^{-3}]
V.txt	potential [V]
E.txt	electric field [V m^{-1}]
Er.txt	reduced electric field E/p [V m^{-1} Pa^{-1}]
E_N.txt	reduced electric field E/N [V m^{2}]
rho.txt	volume charge density [C m^{-3}]
sigma.txt	surface charge density [C m^{-2}]
info.txt	the averaged values written with the user-specified frequency
info.out	the averaged values
history.out	gives the calculated variables as a function of time

Table 1. The explanation of each simulated output file from plasimo user guide

For plasma model md2d, it needs the simulation for a long time to run the md2d model in the plasimo. In addition, there are total 68 files with 32.9 MB data and different files represent different data of plasma as shown in Table 1. Moreover, it contains a number of useless data. Hence, researchers and industry users will be complicated to read these data.

2.2 Project overview

According to the problem statements, a user-friendly interface is needed to develop. Therefore, the aim of this project is to develop a practical C^{++} based user-interface to help researchers and industry users to obtain significant output data effectively.

This project can be divided into two main objectives:

- The first is research of plasma to select useful data from various output data because the significant data is needed to pick at the beginning to reduce the workload of programming. Hence, the initial phase of this project will include background reading and plasma discharges researching.
- Second and the key aspect of this project is developing a widely accessible user-interface to help researchers and industry users. The ability to develop an interface by using C^{++} based tools should be trained.

In order to finish this project within 20 weeks, it needs developer working through combined research work with programming skill. Meanwhile, the report and presentation of this project should be prepared and then it will discuss more detail about how to realize this project in the Methodology part.

3. Methodology

3.1 Tools

3.1.1 C++ based software developing tools

The requirements of this project is under C++ developing environment. There are three main tools will be used to build this user-interface.

3.1.1.1 Microsoft Visual Studio Community 2013

Visual Studio is the most popular integrated development environment on Windows. It will be used for the major developing tool in this project.

3.1.1.2 Qt 5.7.0

Qt is a framework of cross-platform C++ graphical user interface (GUI) application development. It contains the fundamental technology of GUI which is used to render the interface [2].

3.1.1.3 openGL

Open Graphics Library (OpenGL) is the most widely 2D and 3D Application Program Interface (API). It could be applied in lots of platforms such as Window, Linux and MacOS.

3.2 Software Development Process

3.2.1 Software requirements

This program is used to display required data by processing considerable text files and it should be used to select significant data of plasma to researchers and industry users.

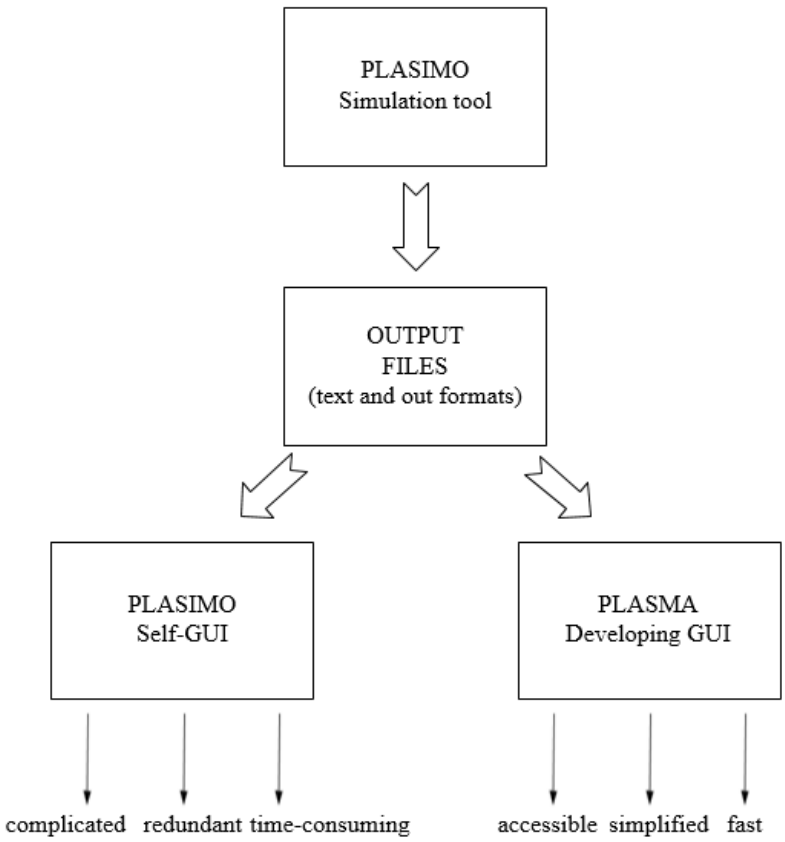


Figure 3. The general analysis of this project

According to characters analysing of this GUI in Plasimo, it could find that it is complicated because new users are difficult to use this software without a handbook. At the same time, redundant output data will be generated through the simulated process, researchers and users cannot find useful data directly. For m2de model, it spends 10 minutes to complete simulated process. Moreover, there still has other models of plasma are more time-consuming.

In order to solve these problems, the requirement of software is developing an accessible, simplified and fast GUI to provide useful data to users. The analysis process is shown in Figure 3 and the design process of this project will follow this analysis.

3.2.2 Design

The characters of accessible, simplified and fast will be considered as the key points of the design process to realize requirements of this software,

3.2.2.1 User-interface building

In order to develop an accessible user-interface, it should obey the Eight Golden Rules of Interface design [3].

- Strive for consistency
- Cater to universal usability
- Offer informative feedback
- Design dialogs to yield closure
- Prevent errors
- Permit easy reversal of actions
- Support internal locus of control
- Reduce short-term memory load

In addition, interfaces researching of different software especially research-based software are significant. Therefore, it needs to spend more time in comparing advantages and disadvantages of various interfaces in the future research.

3.2.2.2 3D graphical display function

For technology users, the output simulated data of plasma should be displayed intuitively. Therefore, a 3D graphical model could be treated as a simplified and intuitionistic way to research plasma and then users could observe the changing process of this particular plasma model.

3.2.2.3 Rapid loading text files function

An Excellent response time of a software should be considered as an important standard. Numerous output files will be generated by md2d plasma simulation and other models of plasmas may spend longer time to obtain results. In addition, there are 68 output files of one simulated plasma. Hence, the rapid text files loading function is needed to research and develop a fast interface.

4. Project Plan

4.1 FYP

4.1.1) Preparatory Work

4.1.1.1) Obtain plasma simulation tool and relevant reading materials

4.1.2) Research Work

4.1.2.1) Weekly background reading for plasma discharges.

4.1.2.2) Investigating significant data in numerous output file.

4.1.2.3) Investigating Interface of learning, researching and factory software.

4.1.2.4) Literature review.

4.1.2.4) Learning of related software include C^{++} based visual studio, openGL and Qt.

4.1.3) Developing Work

4.1.3.1) Write software requirements

4.1.3.1.1) Software specifications

4.1.3.1.2) Software analysis

4.1.3.2) Design

4.1.3.2.1) Rapid loading text files function developing.

4.1.3.2.2) 3D graphical model displayed function developing.

4.1.3.2.3) Intuitive user-interface developing.

4.1.3.3) Testing and improving

4.1.3.3.1) Program test and debug.

4.1.3.3.2) Development methodology.

4.1.4) Report Work

4.1.4.1) Writing project specification report form.

4.1.4.2) Writing Preliminary report.

4.1.4.3) Weekly virtual log book.

4.1.4.4) Preparing presentation.

4.1.4.5) Creating poster.

4.1.4.6) Writing a final report.

The complete project plan will show in Appendix 2 with the Gantt chart.

5. Project Rationale and Industrial Relevance

In this project, the main areas are computer science and physics, which are both significant branches of human scientific and technological development. In addition, the relationship between these two areas and EEE are not similar. Therefore, this is a challenging opportunity to test the learning ability of new areas as an EEE undergraduate.

For the future development, this project will create a greater contribution because there are many applications on the plasma.
For example, biomedicine is an important application of microplasmas. The plasma needle could be used to generate reactive species such as excited molecules, radicals and ions [4]. In this case, the properties of the plasma needle can be displayed and investigated from simulation tool which is shown in Figure 4.

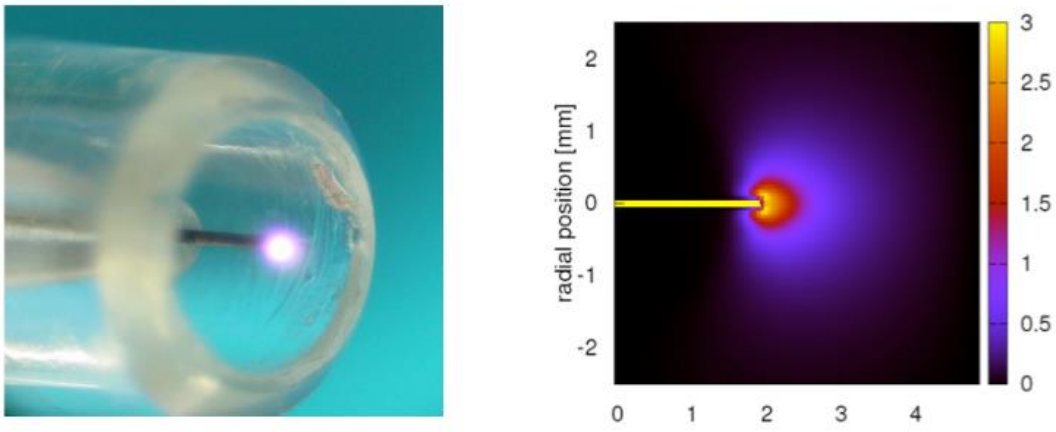


Figure 4. Simulation of the plasma needle

Source: Numerical description of discharge characteristics of the plasma needle

6. Literature Review

At the preliminary stage, three literatures which related to this project have been found through the university library database. Two of them are related to web-based user interface and the remaining one is related to software interface developing of plasma.

6.1 The web-based user interface for EAST plasma control system

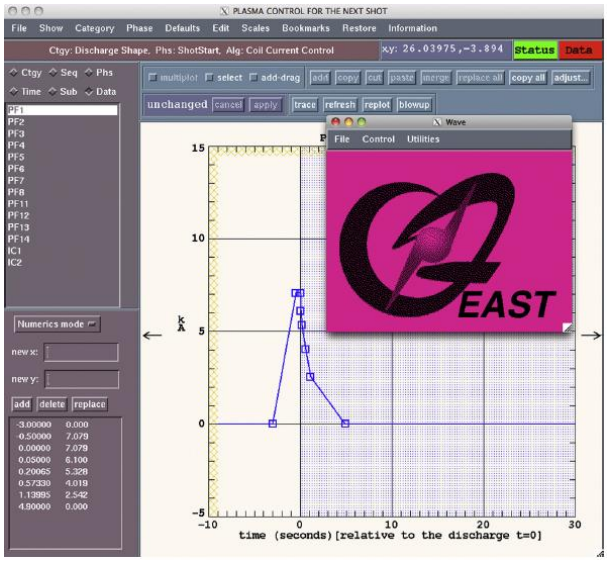


Figure 5. The IDL user interface of EAST

The report of this system illustrates the clear design process of the GUI and it provides an idea to this project about design a software interface of plasma. In this report, the excellent workflow was built to express the process of the whole system and the ideas of function. However, this interface still has some disadvantage need to be improved and avoided in this project such as the completed interface is not as adequate quality as their design process because the narrow space cannot display too many data.

6.2 Web interface for plasma analysis codes

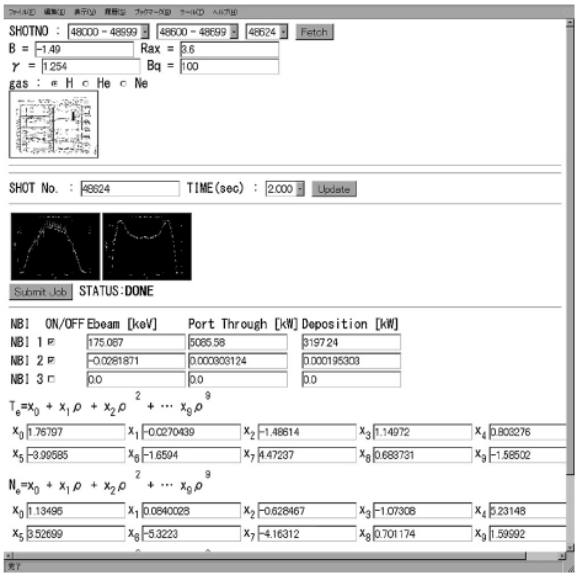


Figure 6. The Web interface for FIT code

This interface could display the data of plasma into formulas and line charts. Therefore, it compensates the disadvantage of EAST plasma control system. The Web-based interface is developed by JavaScript, but the concept of the GUI design process is worth to study.

6.3 User control interface for W7-X plasma operation

This report describes the detailed design process of GUI and it could support convenient interface to control the operation of plasma. At the beginning of this report, it describes how to reduce the workload of users through optimizing the procedures of software. Therefore, investigating the requirements of users is an important step to develop a great GUI.

6.4 Literature reviews appendix

- R.R. Zhang, B.J. Xiao, Q.P. Yuan, F. Yang, Y. Zhang, R.D. Johnson, B.G. Penaflor, " The web-based user interface for EAST plasma control system", *J. Appl. Phys.* February 2014, DOI: 10.1016/j.fusengdes.2014.02.070

- M. Emoto, S. Murakami, M. Yoshida, H. Funaba and Y. Nagayama., " Web interface for plasma analysis codes", *J. Appl. Phys.* vol. 83, no.2-3, pp. 453-457, April 2008, DOI: 10.1016/j.fusengdes.2007.10.008

- S. Anett, L. Heike, S. Jörg, " User control interface for W7-X plasma operation", *J. Appl. Phys.* 2007, DOI: 10.1016/j.fusengdes.2007.05.052

7. Results

Plasma is a new area of the EEE student. This project contains two main parts which are deep learning about plasma and user-interface developing.
At the preliminary stage, researching basic properties of plasma and developing specific function are two main results.

7.1 Preliminary research of plasma

7.1.1 Plasma and Micro Discharge 2D(md2d) model

7.1.1.1 Plasma definition

Plasma is the fourth fundamental states of matter. It is part of ionized gas which consists of electrons, ions, free radicals, neutral ions and photons.
The general type of plasma will be applied to this project which is shown in Figure 7.

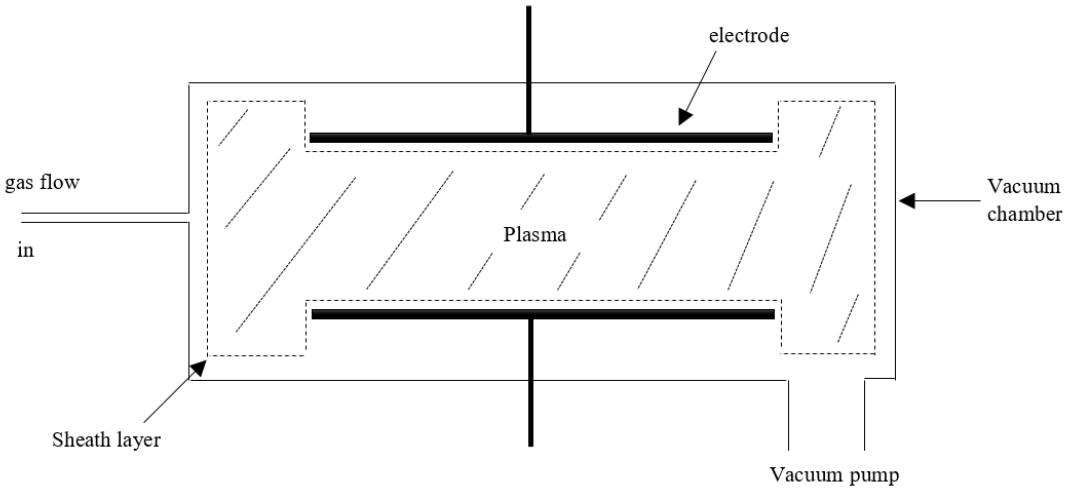


Figure 7. The general type of a plasma image

According to Figure 5, it could be observed that the general type of plasma has a vacuum chamber, pump, a gas flow system and electrodes.

In addition, the plasma has various significant features, which are:

- Sheath layer
- Different types of particles
- Reactions in the plasma
- Power input and loss of the plasma
- Gas flow into and out of the chamber.

A large amount of output files was generated through the Plasimo simulation tool and the explanation of each output file is shown in Table 1. It describes 24 properties of plasma. However, the most basic plasma properties are:

- Gas density and pressure
- Neutral particle density
- Electron density
- Electron energy and electron temperature
- Ion density
- Plasma potential

- Ionization ratio

7.1.1.2 md2d model definition

Micro Discharge 2D (md2d) is the target model in this project. It is a time-dependent model and the function of it is solving particle transport problem in conjunction [5].

7.2 Preliminary developing of software

7.2.1 Rapid loading text files function

There are 68 text files with 32.9 MB data of simulated md2d model. Moreover, other models of plasma may generate more data. Hence, the stable and fast text load command should be chosen to improve the response speed of this software

After searching on the internet, it can be found that there are four commands to load the text file in C++ environment.

In order to test these commands, it needs to generate a text file with 10000000 random numbers first, and the different loading commands will be used to test the loading time of this files.

Scanf is a normal loading command in C++.

```
#include <ctime>
#include <iostream>
int main()
{
    int start = clock();
    printf("%.3lf\n", double(clock() - start) / CLOCKS_PER_SEC);
    const int MAXN = 10000000;

    int numbers[MAXN];
    void scanf_read();
    {
        freopen("data.txt", "r", stdin);
        for (int i = 0; i<MAXN; i++)
            scanf("%d", &numbers[i]);
    }
```

Figure 8. Code of testing scanf command

cin is the most common loading command in C++.

```cpp
#include <ctime>
#include <iostream>

const int MAXN = 10000000;

int numbers[MAXN];

void cin_read()
{
    freopen("data.txt", "r", stdin);
    for (int i = 0; i<MAXN; i++)
        std::cin >> numbers[i];
}
```

Figure 9. Code of testing cin command

Fread command is used to load all data into one string

```cpp
#include <ctime>
#include <iostream>

const int MAXN = 10000000;
const int MAXS = 60 * 1024 * 1024;

int numbers[MAXN];
char buf[MAXS];

void analyse(char *buf, int len = MAXS)
{
    int i;
    numbers[i = 0] = 0;
    for (char *p = buf; *p && p - buf<len; p++)
        if (*p == ' ')
            numbers[++i] = 0;
        else
            numbers[i] = numbers[i] * 10 + *p - '0';
}

void fread_analyse()
{
    freopen("data.txt", "rb", stdin);
    int len = fread(buf, 1, MAXS, stdin);
    buf[len] = '\0';
    analyse(buf, len);
}
```

Figure 10. Code of testing fread command

Visual Studio 2013 command	Time (s)
scanf	3.8
cin	21.6
fread	0.42

Table 2. Testing results of loading command.

According to the analysis of these result, it could find that command fread has the fastest rate to load files. Thus this command will be used firstly to loading data.

However, this is only the preliminary test of this function. All tests focused on one text file, but there are 68 text files of the simulated output. Therefore, the rapid loading text files function still needs further development.

8. Conclusion

In general, this preliminary report is the initial guide of the Final Year Project which is the development of a C^{++} based user-interface for a plasma simulation tool. It has been divided into six parts include the project description, methodology, relevant plan, project rationale, literature review and the result. The aim and objective are developing a user-friendly interface to help researchers and industry users to investigate plasma effectively.

The ability to formulate a project plan and preliminary work are trained through this process. After complete this report, the understanding of the project will increase, so that it will provide convenience to the future development. However, it is still the beginning of this FYP, the details about interface design and corresponding programming still need more time to develop.

References List

[1] The Plasimo Team. (2014 April) IEEE Citation Reference [online]. Available: https://plasimo.phys.tue.nl/generated-docs/plasimo-5.0.0/misc-docs/user_guide.pdf (accessed 14th October 2016)

[2] D. Molkentin, "*The Book of Qt 4: The Art of Building Qt Applications*". San Francisco, USA: No Starch Press, 2007, ISBN-13 978-1593271473

[3] B. Shneiderman. (2010) IEEE Citation Reference [online]. Available: https://www.cs.umd.edu/users/ben/goldenrules.html (accessed 14th October 2016)

[4] W.J.M. Brok, M.D. Bowden, J. van Dijk, J.J.A.M. van der Mullen and G.M.W. Kroesen., " Numerical description of discharge characteristics of the plasma needle", *J. Appl. Phys.* vol. 98, 2005, DOI: 10.1063/1.1944218

[5] The Plasimo Team. IEEE Citation Reference [online]. Available: https://plasimo.phys.tue.nl/physics/md2d/index.html (accessed 14th October 2016)

Appendices

Appendix 1. The specification report form

UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

Project Specification Form 2016-2017
*Final Year BEng (***ELEC340***) and Year 3 MEng (***ELEC440***)*

Student Name: Junming Zhang Module: ELEC340

Supervisor: Mark Bowden Student ID No: 201138928

Project Title: Development of a C++ based user-interface for a plasma simulation tool

Project Specification

A. Project Description and Methodology:
(Overall view of the project with proposed route to realization i.e. what are the project aims and objectives and how you are going to do it?)

This project develops a practical C++ based user-interface to help researchers and industry users obtain the output of plasma simulation effectively.

The existing simulation tool of plasma will generate large amounts of output data in various formats. Thus, the main objectives of this project contain research of plasma to select numerous output data and deep learning of C++developing tool to build the user-interface. Specifically, it requires leaning of C++ based tools which contain Visual Studio (C++ fundamental), Qt (develop GUI) and OpenGL (build 3D graphics).

In order to achieve them within 20 weeks, background reading and research for plasma discharges should be the first objective, at the meanwhile, the skill of C++ developing tools should be practiced. Next, the developing of this software should be proceeded. Finally, the report and presentation of this project should be prepared.

B. Project Tasks and Milestones: (indicate the tasks and milestones that should be achieved and their expected dates e.g. understanding of theory, designs of circuits, construction of circuits, software specifications, working demonstrations etc.)

Tasks: (a task is a package of work that should be completed during a particular time period)

Preparatory Work Week 1 ~ Week 2
- Obtaining plasma simulation tool and relevant reading materials.

Research Work Week 3 ~ Week 15
-Weekly background reading for plasma discharges.
- Investigating and selecting significant data in numerous output files from plasma simulation tool.
- Investigating and comparing different interface of learning, researching and factory software.

Developing work Week 4 ~ Week 15
- Learning of corresponding C^{++} based software include openGL, visual studio and Qt.

- 3D graphical model display function developing.
- Write relevant report.

- Rapid loading text function developing.
- Write relevant report.

- Intuitive user-interface developing and combine all functions together.
- Write relevant report

-Software testing and optimization.

Report working Week 1 ~ Week 20
- Project specification report form writing.
- Preliminary report writing.
- Preparation for first presentation
- Creating poster.
- Preparation for bench inspection.
- Final report writing.
- Weekly virtual log book

Milestones: (an objective that should be achieved by a particular date e.g. the completion of a task)
Semester 1
Week 3 Completion of preparatory work, project specification and preliminary report writing. **Week 11** Completion of first presentation preparation. Completion of rapid loading text function and 3D graphical model display function developing as necessary elements of user-interface.
Semester 2
Week 15 Completion of user-interface developing and whole system testing. Completion of virtual log book. **Week 20** Completion of poster, bench inspection presentation and final report writing.

C. Project Deliverables: (Indicate what should be completed at the end of the project e.g. this list should indicate what will be presented / demonstrated at the final bench inspections)

- The completed software of plasma simulation user-interface with detailed software handbook. - The poster with significant achievements of this project. - The software demonstration and presentation. - The main functions will be displayed and introduced with the software and codes. - The final report and relevant documents of this project.

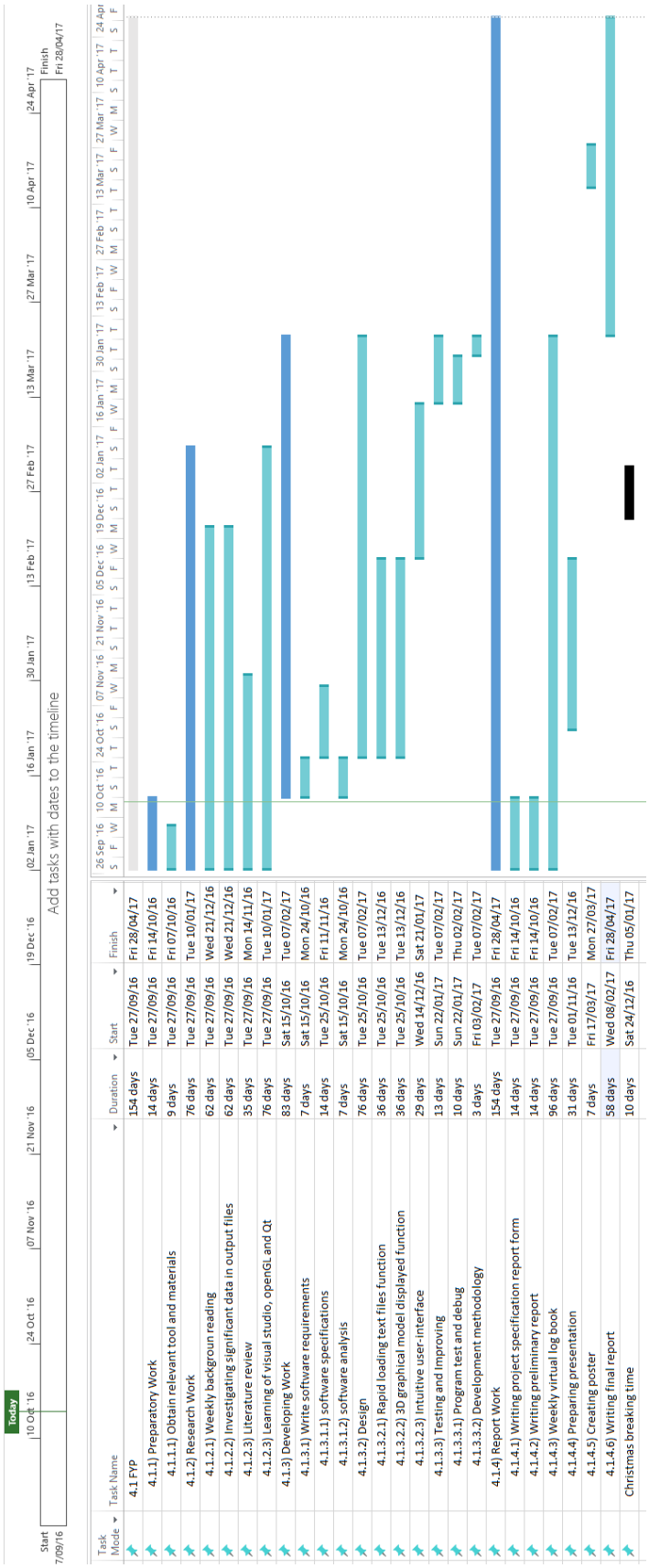
D. A section on Project Rationale and Industrial Relevance must be included in the preliminary report (deadline midnight Friday 14th October 2016). This should explain how and why the project was devised, e.g. it may be a project sponsored by a company or linked to a research project.

Student Signature: Junming Zhang Date: 11/10/2016

Supervisor's Signature: Date: 11/10/2016

By signing this form, the supervisor and student are confirming that the project is of a sufficiently demanding nature that it is suitable for the individual project component of an accredited engineering degree and that a student, who is capable of producing a first class performance, will be able to demonstrate his/her capabilities in this project.

Appendix 2. A Gantt chart preferable produced by MS project



Task Mode	Task Name	Duration	Start	Finish
	4.1 FYP	154 days	Tue 27/09/16	Fri 28/04/17
	4.1.1) Preparatory Work	14 days	Tue 27/09/16	Fri 14/10/16
	4.1.1.1) Obtain relevant tool and materials	9 days	Tue 27/09/16	Fri 07/10/16
	4.1.2) Research Work	76 days	Tue 27/09/16	Tue 10/01/17
	4.1.2.1) Weekly backgroun reading	62 days	Tue 27/09/16	Wed 21/12/16
	4.1.2.2) Investigating significant data in output files	62 days	Tue 27/09/16	Wed 21/12/16
	4.1.2.3) Literature review	35 days	Tue 27/09/16	Mon 14/11/16
	4.1.2.3) Learning of visual studio, openGL and Qt	76 days	Tue 27/09/16	Tue 10/01/17
	4.1.3) Developing Work	83 days	Sat 15/10/16	Tue 07/02/17
	4.1.3.1) Write software requirements	7 days	Sat 15/10/16	Mon 24/10/16
	4.1.3.1.1) software specifications	14 days	Tue 25/10/16	Fri 11/11/16
	4.1.3.1.2) software analysis	7 days	Sat 15/10/16	Mon 24/10/16
	4.1.3.2) Design	76 days	Tue 25/10/16	Tue 07/02/17
	4.1.3.2.1) Rapid loading text files function	36 days	Tue 25/10/16	Tue 13/12/16
	4.1.3.2.2) 3D graphical model displayed function	36 days	Tue 25/10/16	Tue 13/12/16
	4.1.3.2.3) Intuitive user-interface	29 days	Wed 14/12/16	Sat 21/01/17
	4.1.3.3) Testing and Improving	13 days	Sun 22/01/17	Tue 07/02/17
	4.1.3.3.1) Program test and debug	10 days	Sun 22/01/17	Thu 02/02/17
	4.1.3.3.2) Development methodology	3 days	Fri 03/02/17	Tue 07/02/17
	4.1.4) Report Work	154 days	Tue 27/09/16	Fri 28/04/17
	4.1.4.1) Writing project specification report form	14 days	Tue 27/09/16	Fri 14/10/16
	4.1.4.2) Writing preliminary report	14 days	Tue 27/09/16	Fri 14/10/16
	4.1.4.3) Weekly virtual log book	96 days	Tue 27/09/16	Tue 07/02/17
	4.1.4.4) Preparing presentation	31 days	Tue 01/11/16	Tue 13/12/16
	4.1.4.5) Creating poster	7 days	Fri 17/03/17	Mon 27/03/17
	4.1.4.6) Writing final report	58 days	Wed 08/02/17	Fri 28/04/17
	Christmas breaking time	10 days	Sat 24/12/16	Thu 05/01/17

Appendix 3. The risk assessment form

UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

YEAR 3 BENG/MENG Project Safety Risk Assessment 2015/16

The Management of Health and Safety at Work Regulations require that a risk assessment is carried out before work starts. For guidance on risk assessment see Safety Circular SC42/3.

STUDENT NAME: Junming ZHANG ID No: 201138928

LOCATION WHERE WORK IS TO BE UNDERTAKEN: Computer lab. SUPERVISOR Mark Bowdler

TITLE OF PROJECT: Development of a C++ - based user- interface for a plasma simulation tool

Description of Work Undertaken

Familiar with the properties and background of gas discharge. Using PLASIMO which is the plasma simulation software to obtain a series of output data. Then using C++ software to develop a user-friendly interface to pick up the significant output data and display them to user intuitively.

Main hazards of the work/project *(Consider: people who can be affected, equipment used, materials handled and environment hazards)*	**Controls required** *(Consider: appropriate physical, procedural and behavioural controls).*
- standards of prolonged Komputer use.	- standard controls for computer use - regular break. - appropriate workspace

Page 1 of 2

All boxes must be ticked in the following section to indicate either YES or NO.			
	NO	**YES**	**If you have ticked YES please follow the hyperlinks in the attached document, complete and return supplementary paperwork and/or implement and adhere to the guidance given.**
Will work require the lifting of weights (heavier than 15kg)	✓		SC44-5 Manual Handling
Use lasers of any kind?	✓		Laser Risk assessment Laser Local rules Laser Registration form Read CoP & AURPO
Use gas cylinders or compressed gas?	✓		Gas Cylinder safety
Use Chemicals?	✓		COSHH SCR18 – COSHH assessment
Use voltages over 30V DC/AC	✓		Electrical Safety Electricity at work
Use Power tools or rotating motors and machines	✓		SCR15-4 PUWER
Use Cryogenic Liquids/gases	✓		Cryogenic liquids and solids
Use Vacuum Systems and pressurised vessels	✓		Vacuum Systems and Pressure vessels
Use Radiation (UV, x-rays, microwaves)	✓		Control of artificial optical radiation at work Radiation safety code of practice Local rules – UV Code of Practice – UV Microwave registration

LEVEL of Supervision?	**A** = Work May not be started without direct supervision
	B = Work may not start without Supervisor advice or approval
	C = No specific extra supervision requirements
Other relevant specific assessments (Local rules) none.	
I can confirm that Hazards identified and precautions specified are appropriate for the task :- Academic supervisor Signature M Ford Date 5/5/2016 Student Signature Junming Zhang	

- **A new assessment must be completed whenever there is a change that affects safety**

A copy of this assessment must be dated and signed by the student and supervisor. Please scan this form and submit online on VITAL within one week of selecting the project with your supervisor. Also submit the paper copy to the Student Support Office. If you fail to return the form within one week, your project may be reallocated to another student.

DSE WORKSTATION AND USER RISK ASSESSMENT

NB – if self-assessing, please remember to return your completed form to your DSC who will check and authorise it. Users of laptops and similar devices do not need to complete this form. They should follow the guidance in the relevant generic risk assessment.

Department: Electrical and Electronic Eng	**Assessment date:** 05 / 10 / 2016
Individual: Junming Zhang	**Date of Birth/staff No.:** 01 / 06 / 1994

NB – Section A: texts in bold italics are minimum requirements. Other issues are best practice.

SECTION A – WORKSTATION ASSESSMENT	YES	NO	N/A
Are screen characters appropriate (i.e. clear, of suitable size and stable)?	✓		
Have the monitor brightness/contrast controls been explained?	✓		
Is the screen fully adjustable (i.e. is height adjustable and can swivel/tilt)?	✓		
Is the screen free from reflective glare that may cause discomfort?	✓		
Is the screen size the most suitable for the workstation?	✓		
Is the screen in front of the operator so that twisting is minimised?	✓		
Is the top of the screen at about eye level?	✓		
Is there good colour contrast between screen characters and the background?	✓		
Is the keyboard tiltable and separate from the screen?	✓		
Is there sufficient space in front of the keyboard to rest hands/arms?	✓		
Is the mouse, trackball, etc suitable for the task?	✓		
Is it positioned correctly near to the keyboard?	✓		
Is the desk large enough to allow flexibility in positioning of equipment?	✓		
Is the area under the desk free from obstruction and/or clutter?	✓		
If a document holder is used is it stable and set at the right height?	✓		
Is it possible to arrange the equipment to find a comfortable position?	✓		
Is the work chair stable and does it have five feet?	✓		
Is the chair adjustable in height?	✓		
Is the chair back adjustable in height and tilt?	✓		
Has the individual been shown how to use the controls?	✓		
Where required, is the footrest suitable for the task?	✓		
Can the user change position and move around when seated at the workstation?	✓		
Has excessive contrast between the screen and background been reduced?	✓		
Is the workstation layout positioned correctly to reduce glare problems?	✓		
Are windows fitted with suitable blinds to reduce glare problems?	✓		
Is the general workstation environment suitable for the task?	✓		
Is the software used suitable for the task?	✓		
SECTION B – USER ASSESSMENT			
Is the individual a User i.e. uses the DSE for significant periods on a regular basis?	✓		
Have any bodily aches or pains been experienced when using DSE?		✓	
Does the User have specific problems/impairments that make DSE work difficult? *(NB - this does not refer to a medical diagnosis but rather to a loss of function, or a symptom such as pain, aches, stiffness, or a perception such as "eye strain")*		✓	
Is there control over the speed of DSE work?	✓		
Are other tasks and/or short breaks taken at least every hour?	✓		
Has the individual been informed about DSE risks?	✓		
Has the individual been trained in how to use the software?	✓		
Has the individual been informed about eye/eyesight tests?	✓		
Are problems associated with DSE work reported to the DSC?			✓

Copies to User and Departmental file

SECTION C -ADDITIONAL COMMENTS

Workstation assessment based on PC in EEE 3rd Floor computer laboratory.

RECOMMENDATIONS	Responsible person	Timescale
Recommendations should address any issues identified in Parts A, B or C of this form		

Assessors name (print) MARK BOWDEN Signature M Bowden

Date for review 05 / 10 / 2016

Copies to User and Departmental file

Appendix 4. Ethical approval questionnaire

UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

Ethical Approval Questionnaire 2016-2017

Final Year BEng (ELEC340) and Year 3 MEng (ELEC440)

Student Name: Junming Zhang Module: ELEC340 / ~~ELEC440~~ (delete one)

Supervisor: Mark Bowden Student ID No: 201138928

Project Title: Development of a C++ - based user - interface for plasma simulation tool

Formal ethical approval must be obtained for all research projects *'involving research on human subjects or human tissues or databases of personal information to be carried out by University staff or students on University premises, or at any location, where there is no other acceptable provision for ethical consideration'*. Final year projects (ELEC340) and year 3 MEng projects (ELEC440) involving human participation must be undertaken in a way that safeguards the dignity, rights, health, safety, and privacy of those involved.

It should be noted that this policy covers **all** research methodologies including such activities as informal interviews, accessing personal files in an archive, or on-line data gathering. The requirement to obtain ethical review applies with equal force to projects undertaken by undergraduate students. For these projects, it is the responsibility of the supervisor to ensure that the ethical issues of the research are fully assessed and that formal ethical approval is obtained before the project commences.

Does your project involve any human participants (including situations where you are a participant as well as the investigator)?	~~YES~~	(NO)
Does your project involve any human tissues (including your own)?	~~YES~~	(NO)
Does your project involve any databases of personal information (including your own personal information)?	~~YES~~	(NO)
Does your project involve experiments using animals?	~~YES~~	(NO)

Delete either YES or NO on each line above

If any of the answers given above are YES then you, along with your project supervisor, must investigate the requirement to apply for ethical approval. Details of how to apply for ethical approval can be found at www.liv.ac.uk/intranet/research-support-office/research-ethics/ (for human participation) and at https://www.liv.ac.uk/research-integrity/biomedical-research/ (for use of animals).

Student Signature: Junming Zhang Date: 05/05/2016

Supervisor's Signature: MBowden Date: 5/5/2016