Contents

Chapter 1

CONCLUSION

At the time of publication, production efforts of a new rhodotron type electron accelerator are currently continuing in KAHVELab. Present bottleneck is the fabrication of the cavity.

1.1 Future Work

Regarding the cavity manufacturing process, it is in the concluding stages. The sheet bars and the flanges of the upper and the lower parts have been produced and are being welded and getting ready for heat treatment. After the heat treatment operation, the supporting toroidal sheets will be removed and the inside surface will be polished before cyanide copper plating.

As far as the magnets concerned, it was decided to be kept on hold in the early stages of the project, due to the disagreement on energy gain amount between the calculations of *J. POTTIER* [?] and the simulation results from *CST Studio Suite* & *Rhodotron Simulation*. The software is planned to be used in magnet design and beam optimizations in KAHVELab after the initial tests are completed.

Rhodotron Simulation, which has been the main focus of this thesis, is ready and waiting to be tested with the cavity that is being manufactured; several improvements and new feature implementations are underway in the mean time. They include the following;

- Electric and magnetic field import
- Field generator module to directly produce field files from specified cavity
- Synchrotron radiation calculations to determine radiation and energy loss
- $\mathbf{e^-}$ - $\mathbf{e^-}$ interactions
- Redesign of the GUI
- 3D render in GUI
- Refactoring of the $\mathbf{e^-}$ - **EM** interaction and logging to improve performance
- Refactoring of the GUI Render Frame to improve render speed
- Refactoring the magnet class to introduce field leaks
- Extention of analysis tools in Analyze Frame
- L_{out} sweep in Sweep Frame

After the cavity manufacturing is concluded, energy gain predictions of this software will be tested on this cavity. Complementary bending magnet design will be the first challange of *Rhodotron Simulation*, which will provide tremendous testing and improvement opportunuties.

1.2 Discussion

In conclusion, a new computational $\mathbf{e^-}$ - **EM** interaction simulation and analysis tool that focuses on designing and improving *Rhodotron-type* accelerators has been successfully developed; a *Rhodotron-type* accelerator with an operating frequency of 107.5 MHz and a target energy of $1 - 5$ MeV has been designed and is currently being manufactured.

The software features a robust GUI that is capable of rendering and analyzing simulation results. Leap-frog and Runge-Kutta numerical methods have been implemented for initial speed and accuracy tests. The real-world performance and accuracy of this new tool, on the other hand, cannot be tested before the cavity production is completed and the performance is compared with the predictions of the tool; however, the capabilities it presents, coupled with the analogous results obtained from other extensively utilized simulation tools, lead to the inference that it holds promise.