

Haskell-Java-JikesRVM/ImageJ Nano-Bio Informatics Framework based Cryo-Electron Microscopy/TEM/SEM Image Processing in the Context of Haskell Image Processing Libraries & HDF5 Image Format – A Simple Communication on Applications of Meta-circular Research Virtual Machine(RVM) & JTransformer-Prolog Development Tool.

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Abstract :

Current R&D project was the development of a software platform designed to be an advanced research testbed for the prototyping of Haskell based novel technologies in Cryo-EM Methodologies. Focused upon software architecture concepts and frameworks involving Haskell image processing libraries. Cryo-EM is an important tool to probe nano-bio systems. A number of hi-tech firms are implementing BIG-DATA analysis using Haskell especially in the domains of Pharma, Bio-informatics etc. Hence current research paper is one of the pioneering attempts made by the author to encourage advanced data analysis in the Cryo-EM domain to probe important aspects of nano-bio applications.

Keywords : Cryo-EM Imaging, Haskell, Haskell Imaging libraries, JVM/RVM, JikesRVM, ImageJ.

I. Introduction :

I had an opportunity to read the following article on Haskell and the story is very much promising and interesting.

“In Praise of Haskell - By Aaron Contorer, October 29, 2013.

An elegant, reliable, easy-to-maintain, high-level, parallel-friendly, native language. What's not to like? *"I've noticed several times when someone says 'X really changed the way I think about programming,' frequently X=Haskell."* — Andrew Binstock, editor-in-chief, *Dr. Dobb's Journal*.”

Author of this paper is very much inspired by the above mentioned article in Dr.Dobb's Journal – a really nice writeup on Haskell Language.Hence the author presents an inspiring communication to encourage other researchers in this demanding and challenging domain of Cryo-EM image Processing applications.

II. Informatics and Computing Design Algorithms :

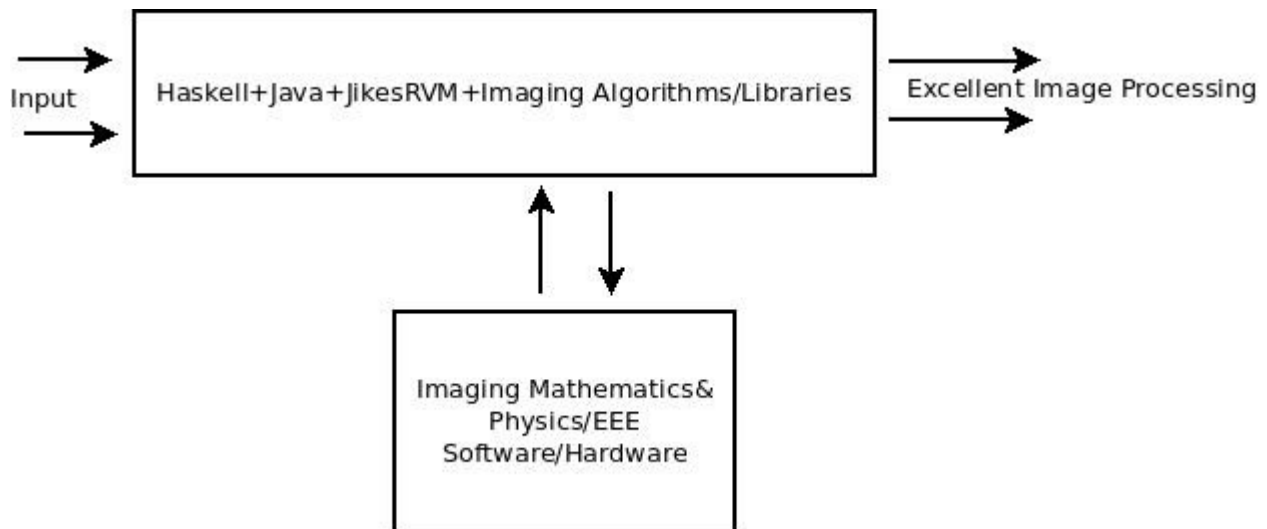


Figure I – Overall idea of this simple communication.

Self Explanatory Graphical Illustration

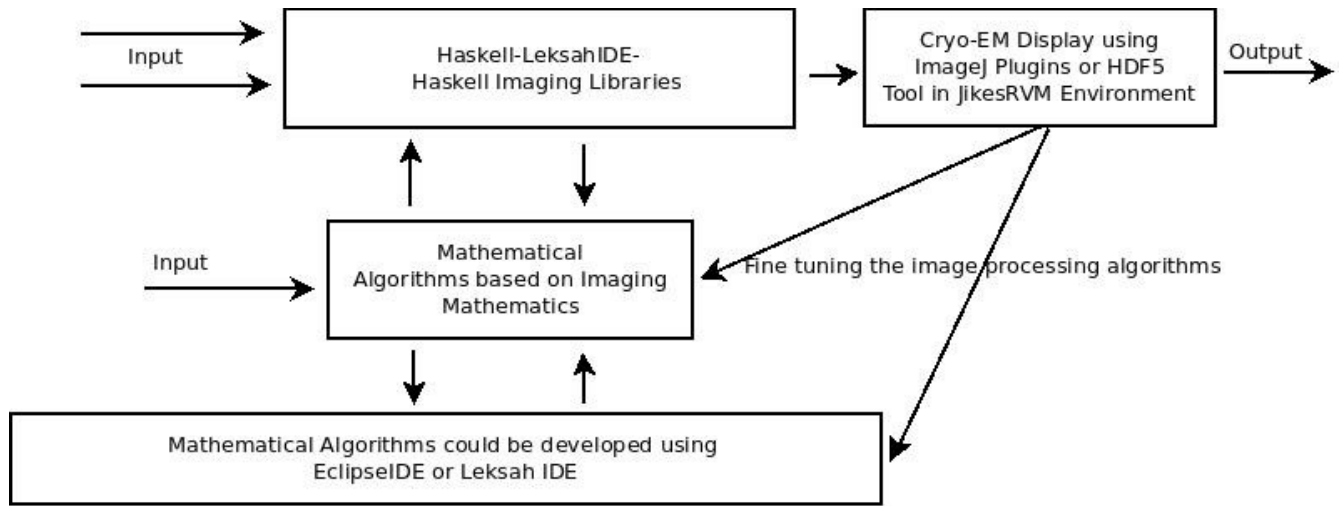
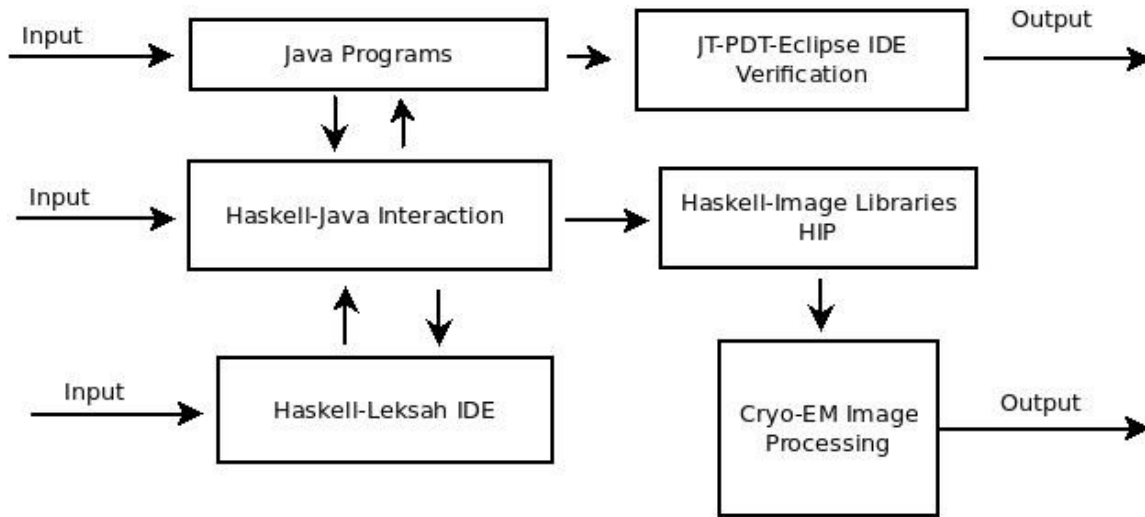
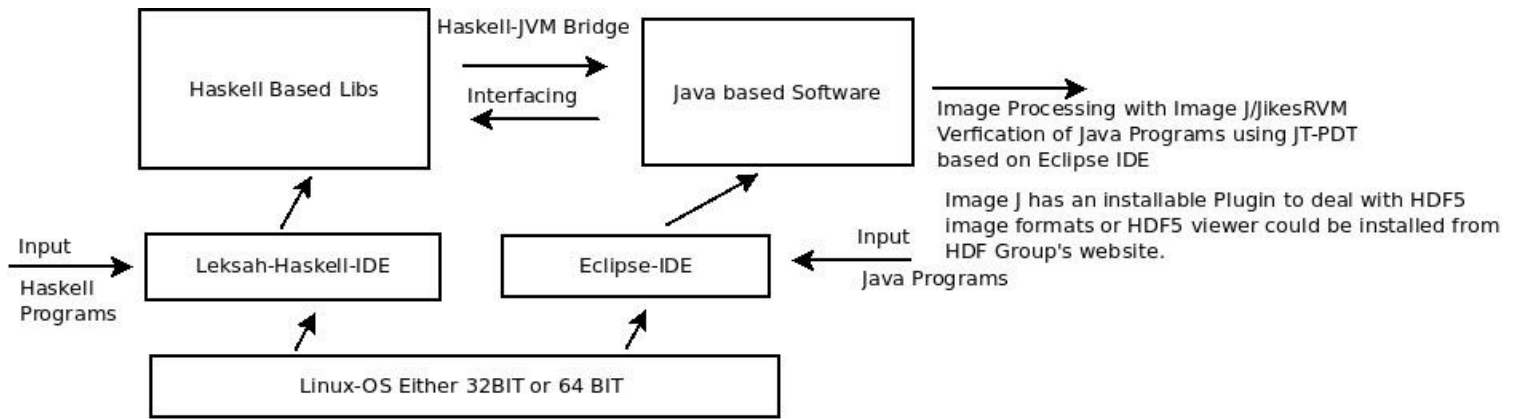


Figure II. Implementation Schema



[a]

Self Explanatory Graphical Illustration



[b]

Figure III [a] & [b] Implementation Schema

Self Explanatory Graphical Illustration

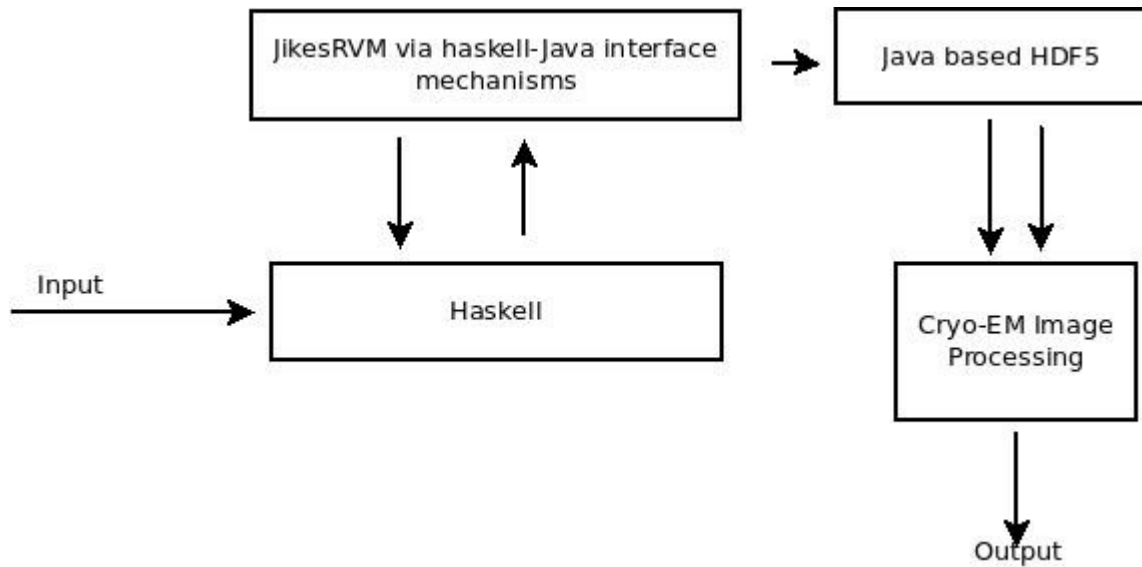
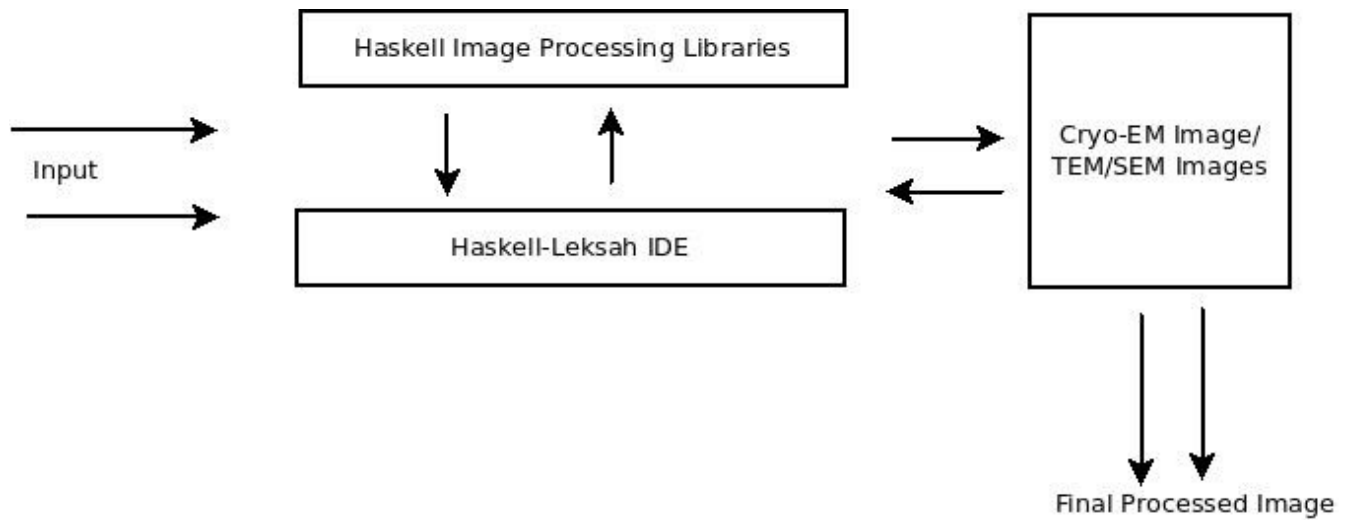
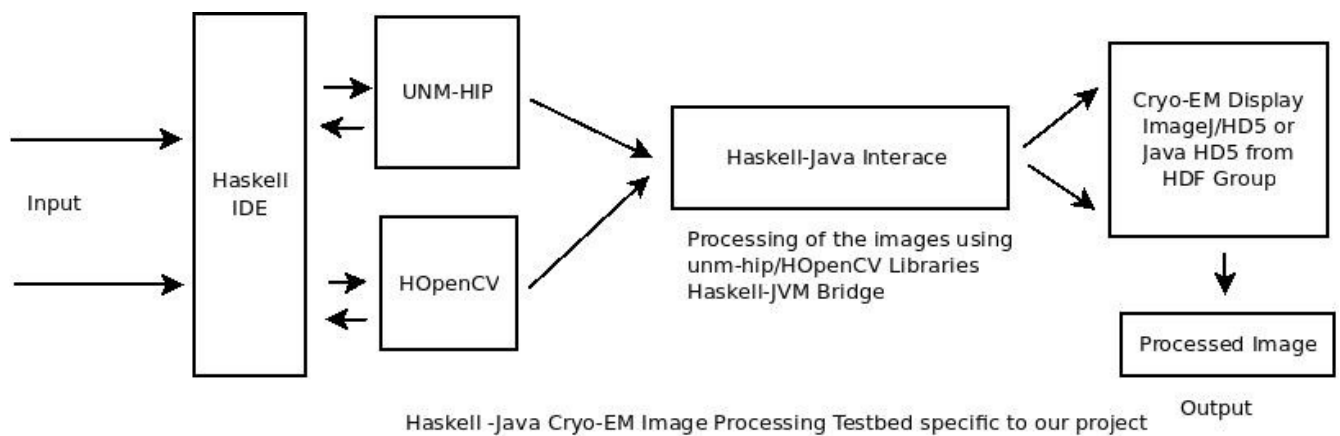


Figure IV. Implementation Schema

Self Explanatory Graphical Illustration



[a]



[b]

Figure V [a] & [b] Implementation Schema

Self Explanatory Graphical Illustration

III. Image Processing Analysis & Discussion :

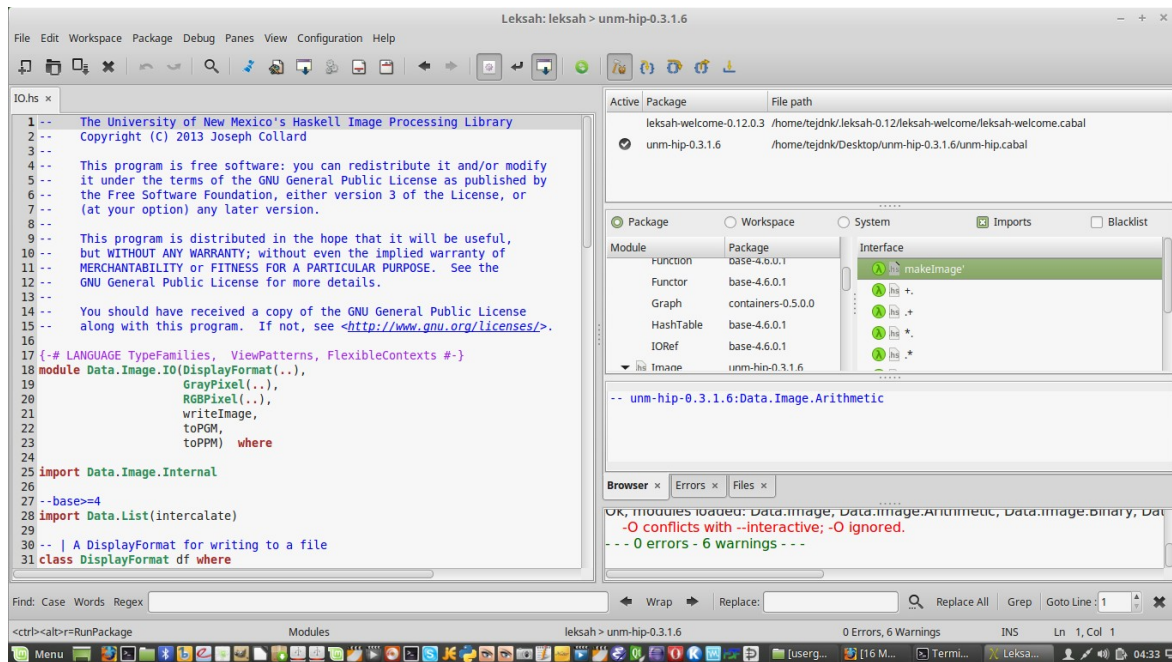


Figure VI. Explanation using screen shot from Lekash IDE/UNM-HIP Lib Testing setup.

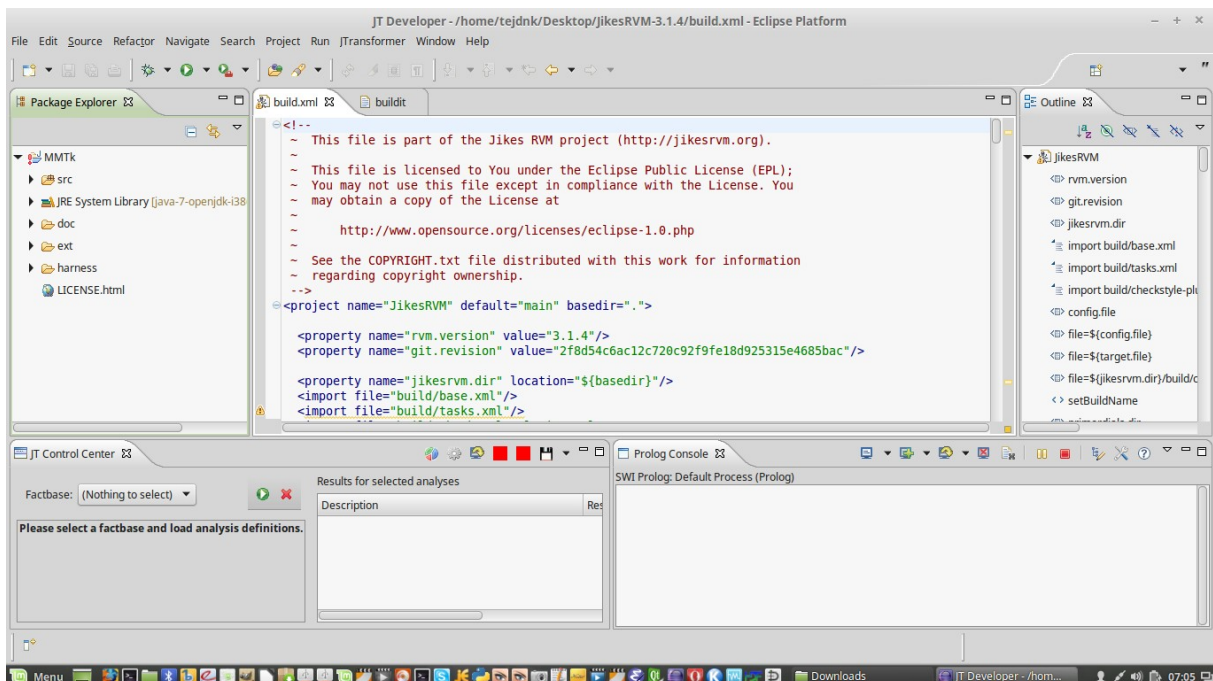


Figure VII. Explanation using screenshot of JikesRVM/JT-PDT/Eclipse IDE setup for testing and analysis .

It is important to understand that, for the purposes of this simple communication, Cryo-EM/TEM/SEM are treated as important EM mechanisms that ensure solutions within the domain of Image Processing. Our objective is to mainly focus and improve the performance through the exploitation of advantages by using “Haskell-Java-JikesRVM/ImageJ/HDF5/JT-Prolog”, informatics system or frame work. Programs implemented with the above depicted figures/algorithms typically incur an uplift in the image processing performance when compared with existing schemes, due to the overheads of process management.

The scheme works by considering all possible combinations of evaluation forced by the challenging situations of the Cryo-EM/TEM/SEM definitions, and identifying which image processing mechanisms always cause errors when they are undefined. The scheme can also “partly rectify” a definition or a n existing defective mechanisms that cannot be run in a single thread, reducing the number of concurrent processes required to implement different schema. The schemes presented here bear some similarity to the process of strictness analysis, but they have three significant advantages in the context of EM Image Processing Frame works :

- Is much simpler than strictness analysis based on the above mentioned algorithms as criteria ;
- Naturally handles imaging patterns with nested conditions for Cryo-EM/TEM/SEM applications;
- Can optimize some definitions that cannot be fully understood.

Please Note : that the optimization scheme/s is/are independent of any particular implementation of EM Image Processing Framework, and that they are likely to play an important role in any future implementation of challenges in Electron Microscopy domains like Cryo-EM/TEM/SEM.

The communication makes the following contributions:

- To present formal methods in implementing novel designs in EM domains.
- To describe the implementation of frameworks that execute each of its mechanisms by using concurrent Haskell threads.
- To evaluate the performance of the implementation using a small suite of benchmark programs like UNM-HIP Library & HOpenCV Library to probe important challenges we could face for example in Cryo-EM domain.(there are other Haskell based image processing libraries as well)

It is useful to know about OpenCV from - <http://opencv.org/>

Please refer to all the Figures [I- VII] for your information and analysis, Additional Information and Refs[1-9] to understand the communication presented. All the algorithms/figures/methods presented are approximate in nature and the implementation could vary to a certain extent. Please check.

IV. Conclusion :

In this communication, the author has demonstrated the feasibility of a possible prototyping solution to process a simple set of Cryo-EM Images using Haskell-JVM-ImageJ Java Platform. To rapidly prototype and process Cryo-EM images with different mathematical imaging algorithms, we do need an excellent testbed. So, Haskell-Java Informatics Platform was an obvious choice. Author's intention is to simply highlight the importance of Haskell-JNI-JVM-ImageJ System as testbed for Cryo-EM informatics using Java-Haskell interaction concepts.

V. Acknowledgement/s:

Special thanks to all those who have made this possible. The author declares no conflict of interest and no competing financial interest/s. This short note or technical communication is for non-profit academic research work. Sincere thanks to my mentors involved in Cryo-EM/TEM/SEM Imaging domains. This communication was written using open source software technologies in all aspects. Scientific & Mathematical Software used are also open source products.

VI. Additional Information :

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