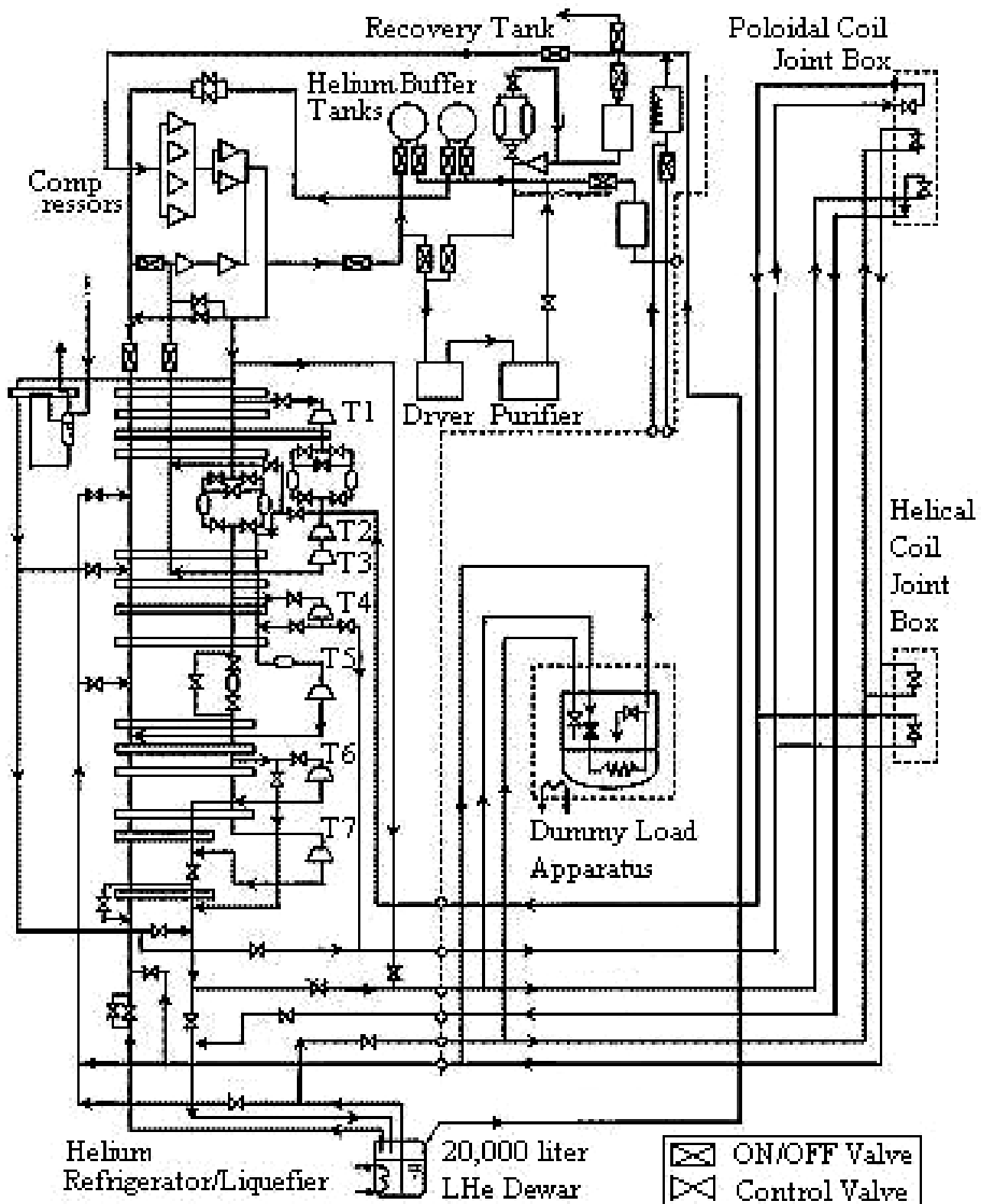


## CRYOGENIC ENGINEERING CENTRE

### Invitation for UG/PG Projects on Steady State and Dynamic Simulation of Helium Liquefaction Plants

	Questions	Answers
1	<i>What is helium?</i>	Helium is a rare and inert gas with molecular weight of 4. It is the last gas in the periodic table that was liquefied in 1908.
2.	<i>What is so great about helium liquefaction or helium liquefiers?</i>	It is the only gas which, in its liquid state, can produce a temperature below 15 K ( minus 258 degree C) down to millikelvin. Many phenomena such as superconductivity and superfluidity are observed in this temperature range. Facility such as Particle Accelerators or Fusion reactors need very large magnetic fields that can only be produced by superconducting magnets cooled by large helium liquefiers having cooling capacity of tens of kilowatts. Very small helium refrigerators used for electronic cooling may need a few milliwatts of cooling. Thus liquefiers or refrigerators have a very wide range of size and capacity.
3.	<i>Why simulation is required?</i>	A helium plant can have many possible combinations of compressors, heat exchangers, turbines etc. for maximizing or minimizing various objective functions such as cost, space, weight, reliability, flexibility etc. Simulation is the only way to evolve such custom-made designs.
4.	<i>Why not simulate it on commercially available simulation software?</i>	<b>We are already doing it.</b> In fact, we have a sponsored-research project from NFP (National Fusion Project) whose mandate is to adapt commercially available softwares such as <b>ASPEN HYSIS and CHEMCAD for helium plant simulation. 2 Ph. D. scholars, 1 M Tech and 1 B Tech (Mechanical) students are working for it.</b>
5.	<i>Then, why are you trying to develop your own software?</i>	The commercial Software is general purpose software suitable for all kinds of chemical plants. It requires a lot of adaptation starting from fluid properties to heat exchanger, turbine or compressor characteristics. In many cases customization is severely restricted. So, we are feeling that if we try to write our own code, it may be a good idea.
6.	<i>Will this student project be a part of the NFP project?</i>	<b>No.</b> <b>It is not within the mandate of the NFP project to develop our own code.</b> We want to do it on our own interest. However, we can always get some money from the project to spend.
7.	<i>Will it be one single project?</i>	No. <b>We intend to divide it into 3 parts.</b> Student 1 will write the main structure of the program. Student 2 will write the programs on Plate-fin heat exchanger. Student 3 will write programs on compressor and turbine and also compare the results with those from ASPEN HYSIS.
8.	<i>Will these projects be a B Tech or Dual Degree projects? If so, what would be the possible titles?</i>	Why not? HOD or Student advisors may be approached for formalizing them. Titles: <b>1. Development of Steady State and Dynamic Simulation Program with user interface for a kilowatt class helium liquefier.</b> <b>2. Development of Steady State and Dynamic Simulation Program with user interface for a multi-stream plate-fin heat exchanger.</b> <b>3. Development of programs with user interface for components of a helium liquefier (except heat exchanger) and comparison of entire simulation results with those from commercial software.</b>
9.	<i>Who are eligible?</i>	<b>3<sup>rd</sup> year students of B Tech and Dual Degree of Mechanical and Chemical.</b>
10.	<i>Is softcopy of this announcement available</i>	<b>Yes.</b> URL is <a href="http://www.iitkgp.ac.in/departments/home.php?deptcode=CR">http://www.iitkgp.ac.in/departments/home.php?deptcode=CR</a> . Look at the bottom of the page under “Announcement”
11.	<i>What kind of facility is available</i>	<b>5 high end Dell desktops, 3 HP workstations, 3 other desktops, licences of ASPEN ONE, ANSYS and Property Package for Helium upto 1 K and Metal property data.</b>
12.	<i>Who are contact persons?</i>	<b>Prof. Kanchan Chowdhury (9434010442); chowdhury.kanchan@gmail.com Dr. Parthasarathi Ghosh (9932584162); partha_s2000@yahoo.com</b>



Schematic Diagram of a Typical Large-scale Helium Liquefier for Nuclear Fusion Reactor