I-DESIGN perspective of FAIR in-kind contribution:

Challenges and opportunities

for

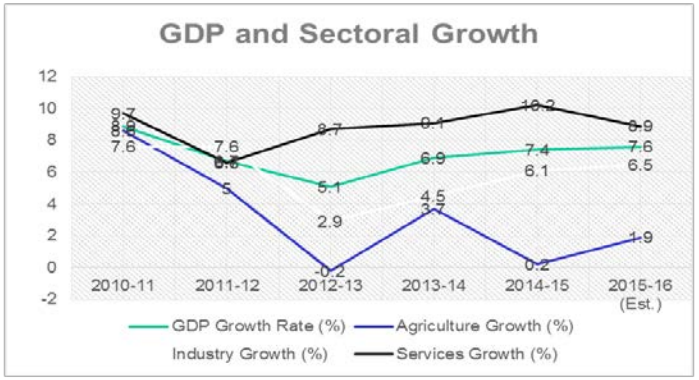
Indian industries

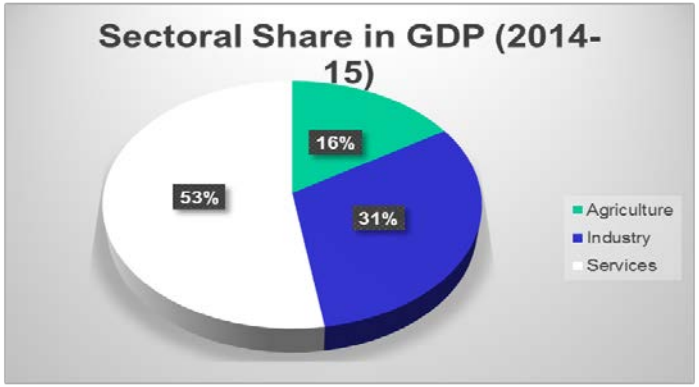
Indian Economy – Some Facts

- Seventh largest in the world by nominal GDP
- 3100 Technology start-ups in 2014-15
- Fourth largest Start-up Hub in the World
- Major exporter of IT services
    - USD 73.1 Billion in 2014-15
- One of the largest Automotive industry – 23.37 Million vehicles produced in 2014-15
- A large Retail Market – USD 600 Billion in 2015
- Fastest growing E-commerce market
- Young and Large English speaking population

Indian Economy – Some Statistics

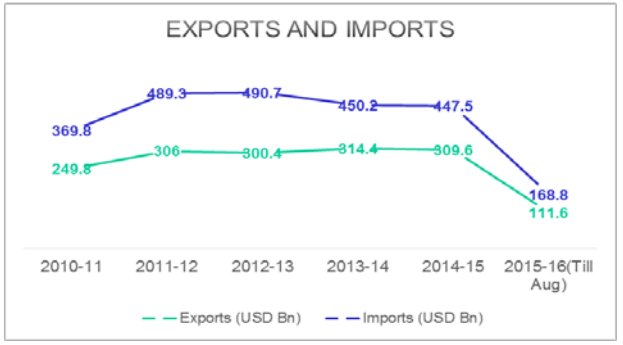
- Nominal GDP as of October 2015- USD 2.382 Tl
- GDP growth- Average 7 %
- Sectoral growth
  - Agriculture 16 %
  - Industry 31 %
  - Services 53 %
- Inflation (as off Sept 2015) 3.66%
- Labour force502.3 Mn (2014 est.)
  - Agricultural 49%
  - Industry 20%
  - Services 21%

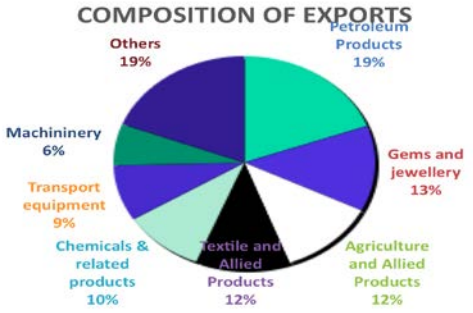


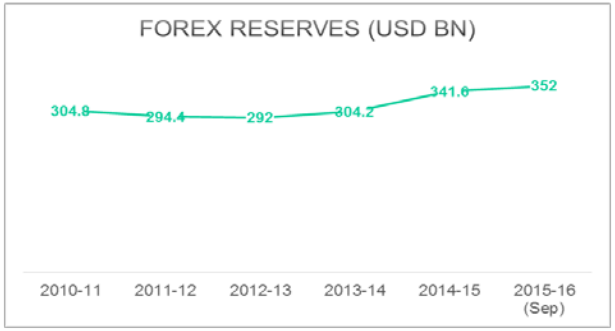


Indian Economy – Foreign Trade

- India is a net importer perennially
- Major export items are petroleum products, Gems and Jewellery, Textile products, Chemical products etc.
- Steady forex reserve





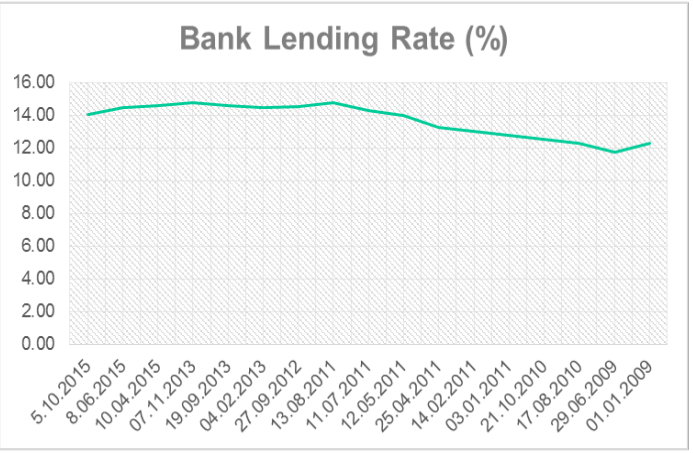


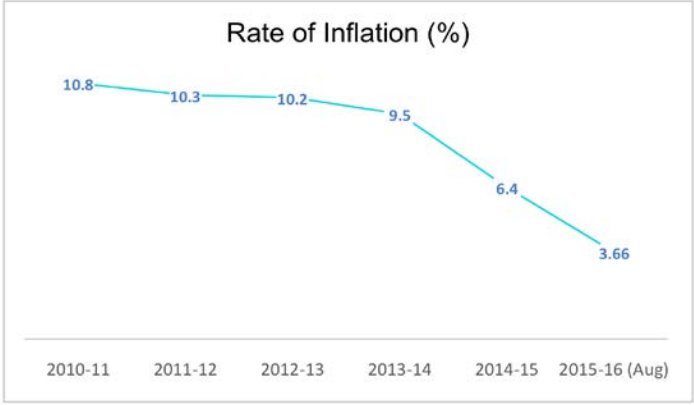
Indian Industries - opportunities

- Large domestic market – demand for all kind of products and services
- Abundant availability of natural resources like minerals, water, land etc.
- Availability of large pool of technical and scientific manpower – Large no of technical universities
- Adequate infrastructure – Rail, Road, Port & Air connectivity
- Pro-industry Government policies – since liberalization in 1992
- Reasonably low labour cost
- PPP – Public Private Partnership in major projects
- Entrepreneurial attitude of young technocrats/ engineers

Indian Industries - Challenges

- Outside dependence on latest manufacturing technologies and processes
- High interest cost of borrowed capital
- High fluctuation in inflation index
- Low labour productivity
- Complex tax structures





I-DESIGN !

I-DESIGN Engineering Solutions Ltd.

I-DESIGN at a glance

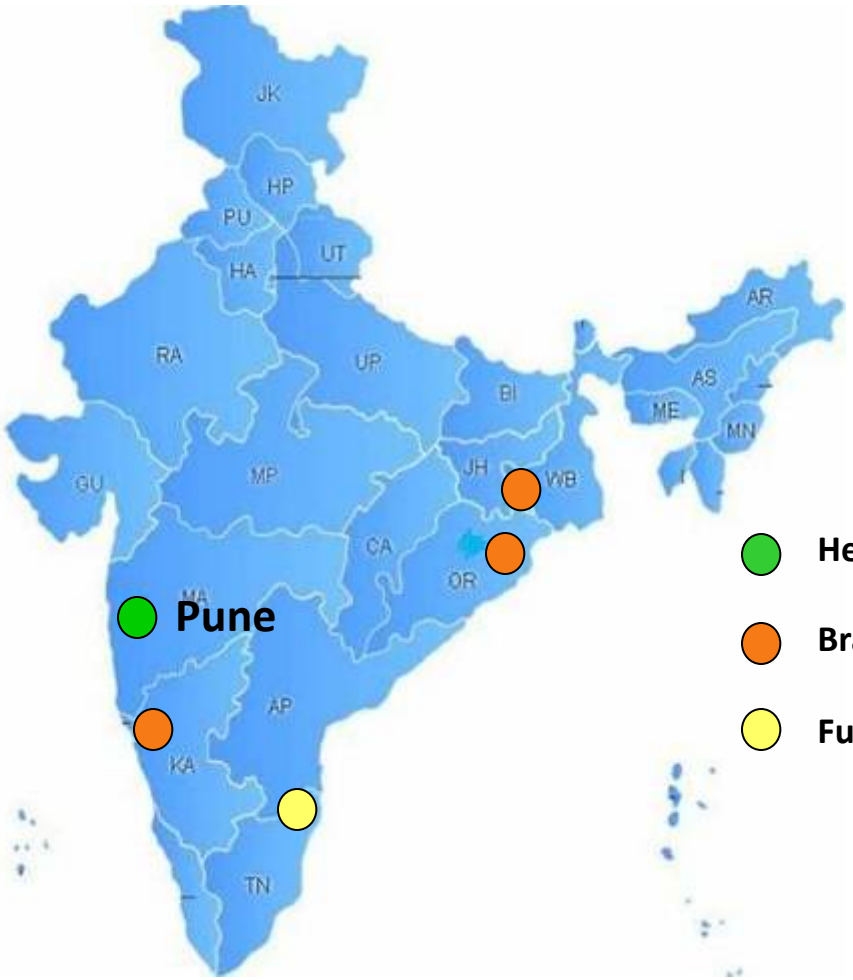
- I-DESIGN was an integral part of RSB transmissions as R&D division of the company.
- Started as a separate entity in 2002 to cater to R&D needs of RSB and other automotive customers.
- In year 2009 diversified its service portfolio to vacuum and cryogenic and special equipment manufacturing.
- Capable of Product designing from scratch , mathematical modeling with CAE and CFD , Instrumentation and control engineering , Prototype building, manufacturing engineering , Product Testing etc.
- Total 2500 man years of experience with 150 Engineers and scientists and 50 technicians.
- Divisions of I-DESIGN:
  - Automotive Engineering Division (AED)
  - Special Equipment Division (SED)
  - Vacuum and Cryogenics Division (VCD)
  - Blue Bastion Laboratory (BBL)

I-DESIGN

Infrastructure

- Design facility occupies about 15,000 sq. ft., Product validation facility spread over 50,000 sq. ft, special equipment manufacturing facility is spread over 20,000 sq. ft. area
- Facility for Vacuum and Cryogenic spread over 16000 sq. ft. area. Out of which UHV chamber manufacturing facility consists of
    - Class 10,000 clean room,
    - Automated welding machines
    - Full fledged dimensional inspection and vacuum testing facility
    - DM water plant, Ultra sound cleaning and baking facility
- Dedicated Tool Room and assembly area.
- Real Time electronic Data Acquisition facility

Location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JH
WB
CA
OR
Pune
AP
KA
TN
Headquarter
Branch Office
Future Expansion

I-DESIGN

Certifications

RSB

CERTIFICATE

UL DQS Inc.

I - Design Engineering Solutions Ltd.

ISO 9001 : 2008

ISO 9001:2008

CERTIFICATE OF AUTHORIZATION

The American Society of Mechanical Engineers

COMPANY:

I-Design Engineering Solutions Limited
Pune Trade Centre, GAT No. 233/1, Ubale Nagar
Pune Nagar Road
Wagholi
Pune Maharashtra 412207
India

SCOPE:

Manufacture of pressure vessels at the above location and field sites controlled by the above location (This authorization does not cover impregnated graphite)

AUTHORIZED: February 16, 2011
EXPIRES: February 16, 2014
CERTIFICATE NUMBER: 46,401

Vice President
Conformity Assessment

Director, Accreditation and Certification

U-Stamp

THE NATIONAL BOARD
OF
BOILER & PRESSURE VESSEL INSPECTORS

Certificate of Authorization

This is to certify that

I-DESIGN ENGINEERING SOLUTIONS LIMITED
PUNE TRADE CENTRE,
GAT NO. 233/1, UBALE NAGAR
PUNE NAGAR ROAD
WAGHOLI, PUNE, MAHARASHTRA, 412207
INDIA

is authorized to apply the "NB" mark and register boilers, pressure vessels, or other pressure retaining items with the National Board in accordance with its provisions.
The scope of Authorization is limited to items manufactured in accordance with:

ASME Stamp(s): U

ISSUE DATE: March 17, 2011
EXPIRATION DATE: February 16, 2014

Executive Director

NB

THE NATIONAL BOARD
OF
BOILER & PRESSURE VESSEL INSPECTORS

Certificate of Authorization

This is to certify that

I-DESIGN ENGINEERING SOLUTIONS LIMITED
PUNE TRADE CENTRE,
GAT NO 233/1, UBALE NAGAR,
PUNE NAGAR ROAD
WAGHOLI, PUNE, MAHARASHTRA, 412207
INDIA

is authorized to use the "R" STAMP in accordance with the provisions of the National Board.

The scope of Authorization is limited as follows:

METALLIC REPAIRS AND/OR ALTERATIONS AT THIS ABOVE LOCATION AND EXTENDED FOR FIELD REPAIRS AND/OR ALTERATIONS CONTROLLED BY THIS LOCATION

CERTIFICATE NUMBER:
ISSUE DATE: MARCH 11, 2011
EXPIRATION DATE: FEBRUARY 16, 2014

Executive Director

R-Stamp

Collaborating Institutions

I-DESIGN has collaborated with several prestigious Institutions of India and Abroad for technical assistance

IIT Mumbai

IIT Kharagpur

IMMT Bhubneshwar

NIT Rourkela

IISc Bangalore

Colorado School of Mines, US

I-DESIGN

Software capability

Detailing (2D modeling)

3D Modeling/ Assembly

Thermal Analysis
Welding study

Structural Analysis

Fatigue Analysis

Computational Fluid Dynamics

PLC Programming

Load data analysis

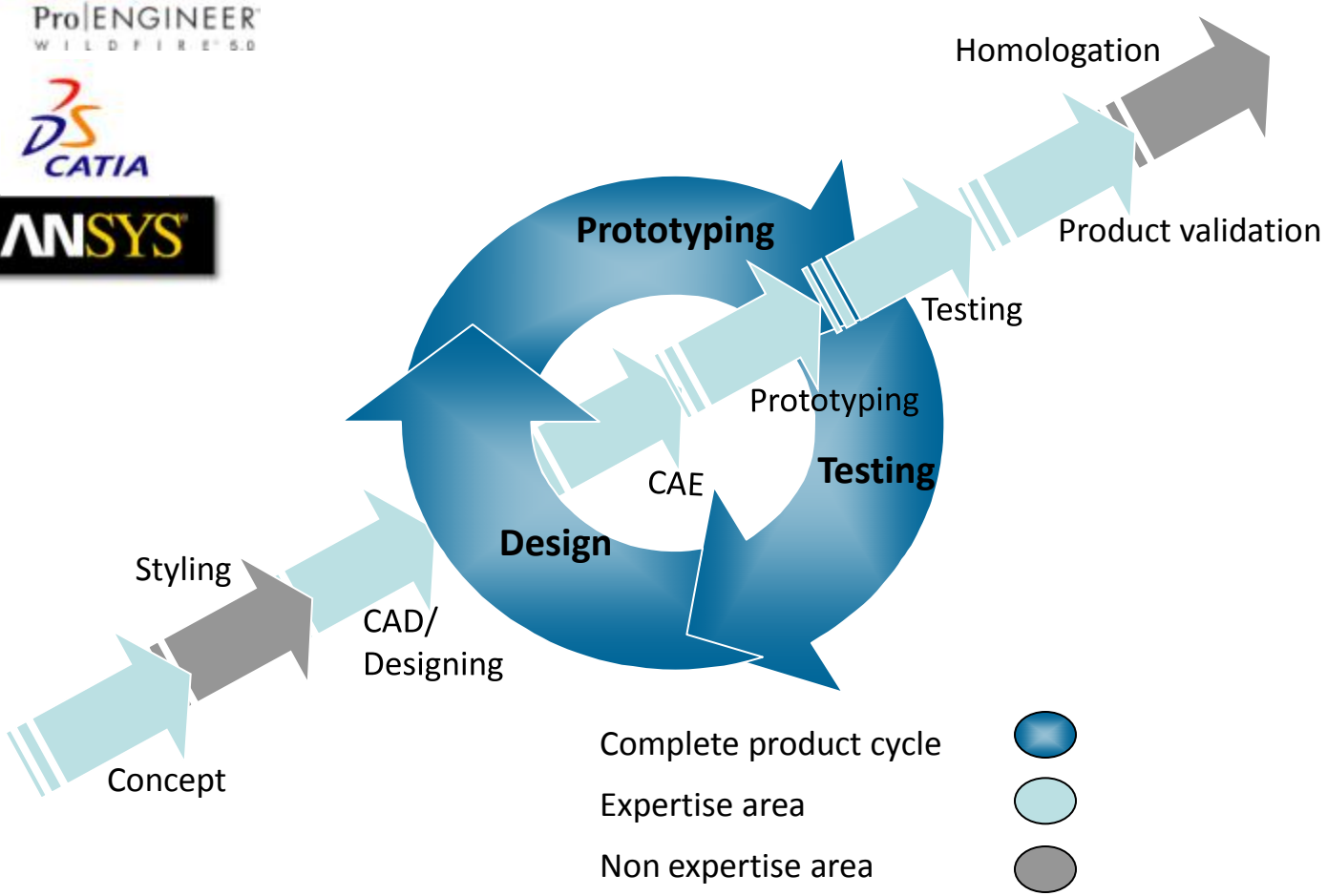
Product Life cycle management

AutoCAD

Pro|ENGINEER WILDFIRE 5.0

CATIA

ANSYS



Milestones

- **2002** : Beginning of I-DESIGN Engineering Solutions at Pune as a separate company
- **2004:** I-DESIGN Established at Jamshedpur, Jharkhand
- **2007**: Formed dedicated testing area for Tata Motors, Pune
- **2008:** Got ISO 9001:2000 Certified
- **2009**: Got into listed vendors list of DRDO for its development Projects.
- **2009**: Associated with IPR for its various product development programme and Study
- **2010:** I-DESIGN Opens a new Office at Bhubaneswar
- **2011:** Got U-Stamp Certification from ASME
- **2011**: Got R-Stamp Certification from National board of boiler & Pressure Vessel.
- **2013**: Bagged EBMF project from NFC
- **2014**: Bagged PMF project from NFC
- **2015**: Started Blue Bastion laboratory for advance technology development.
- **2015: Nominated by Govt. of India for supply of UHV chamber to FAIR**

I-DESIGN

Projects in Vacuum and Cryogenics field.

Typical projects in Vacuum and Cryogenics field.

- Manufacturing of Ultra High Vacuum components.
- Design and Development of Thermal / Radiation shields.
- Thermo-vac chambers for space lab application.
- Vacuum chambers and cryostats for SC magnets
- Super conductor cables in close conduit
- Hydrogen Pallet extruders and injectors.
- Computational Fluid Dynamics analysis of cryo systems
- Design and Development of cryo pumps.
- Development of adhesives for fixing micro porous carbon on the cryo pump panels.
- Development of micro porous carbon of different surface area and types
- Pumping speed of different gases at low temperature.
- Design and development of electron beam guns.

Welding Facilities at I-DESIGN

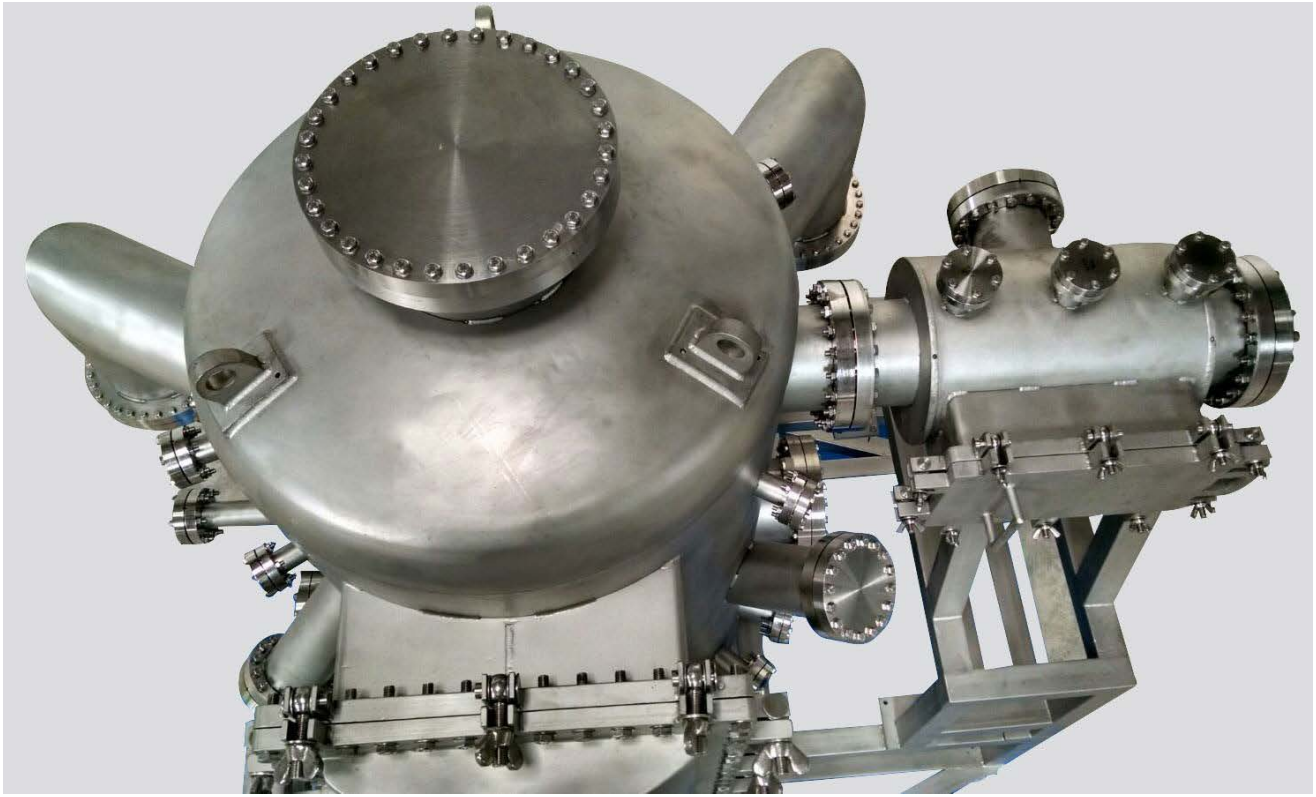
Seam Welding station

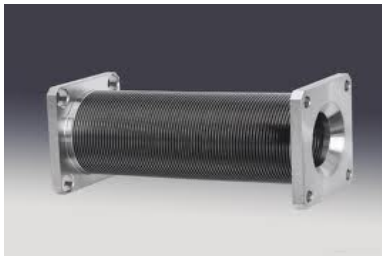
Spot welding station

CO2 welding station

TIG welding station

Vacuum chamber and components





Design of Thermal shield

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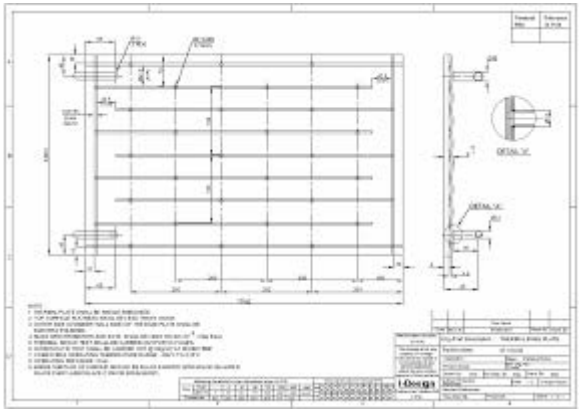
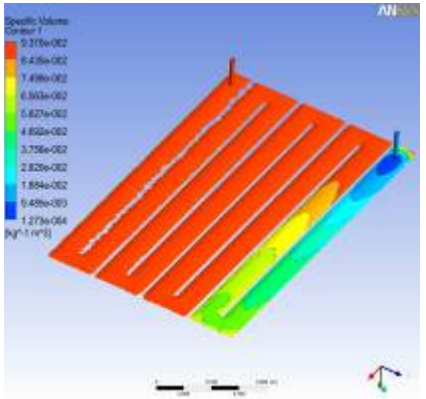
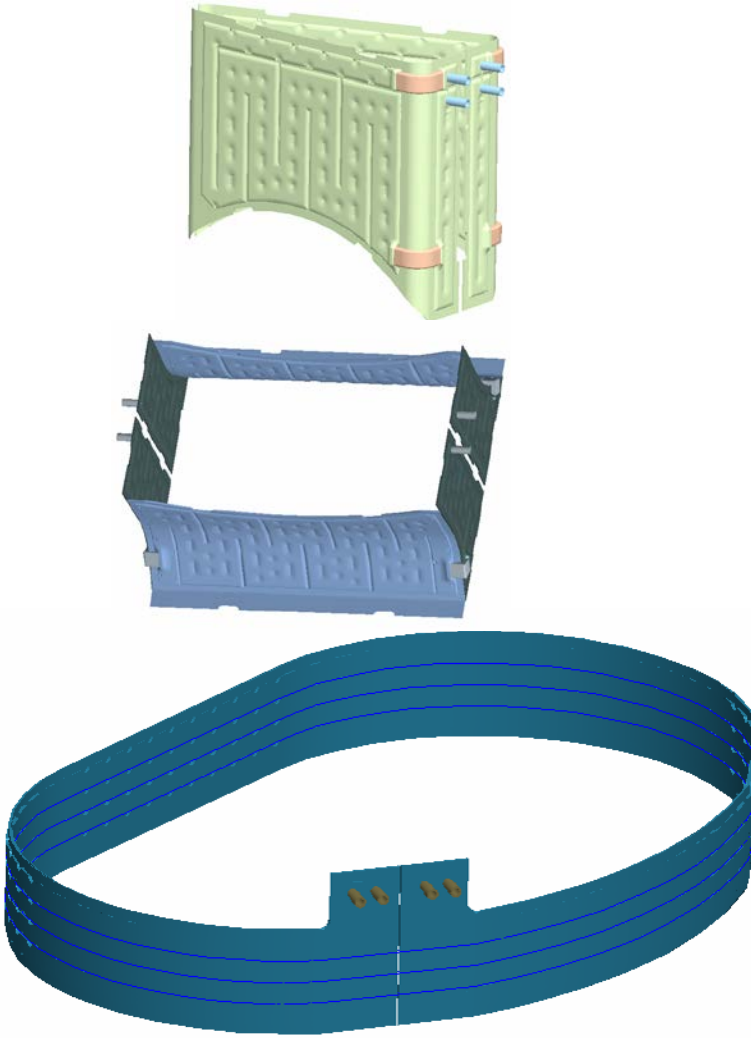
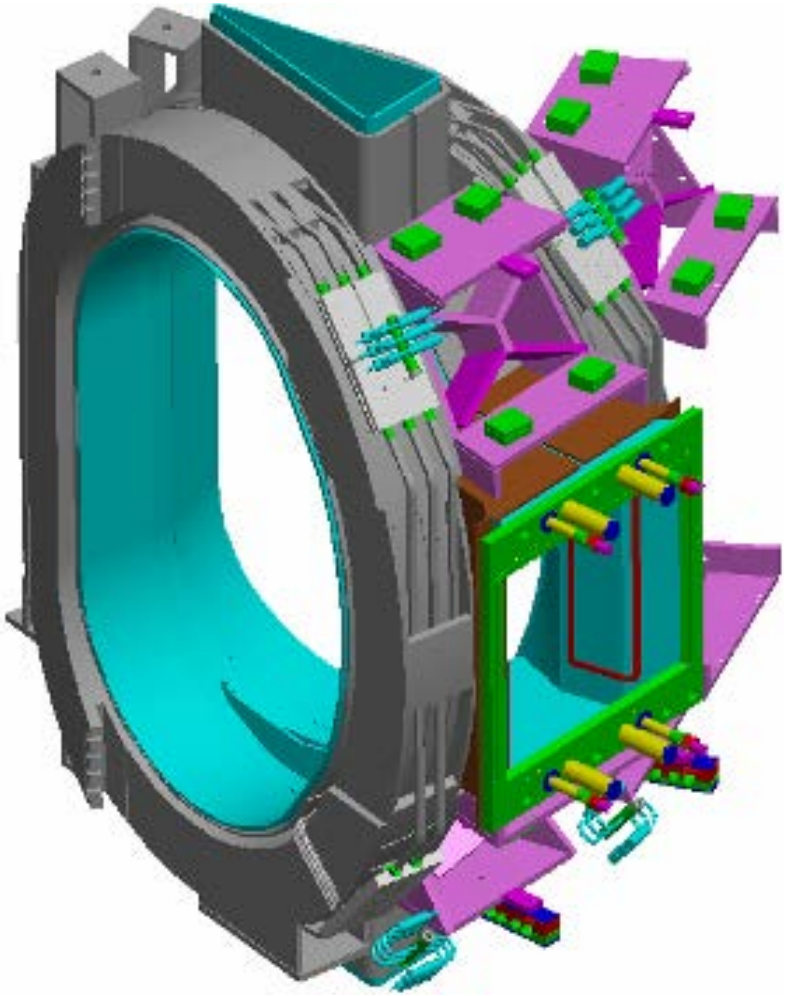




Design and Development of 80K and 4K Panels



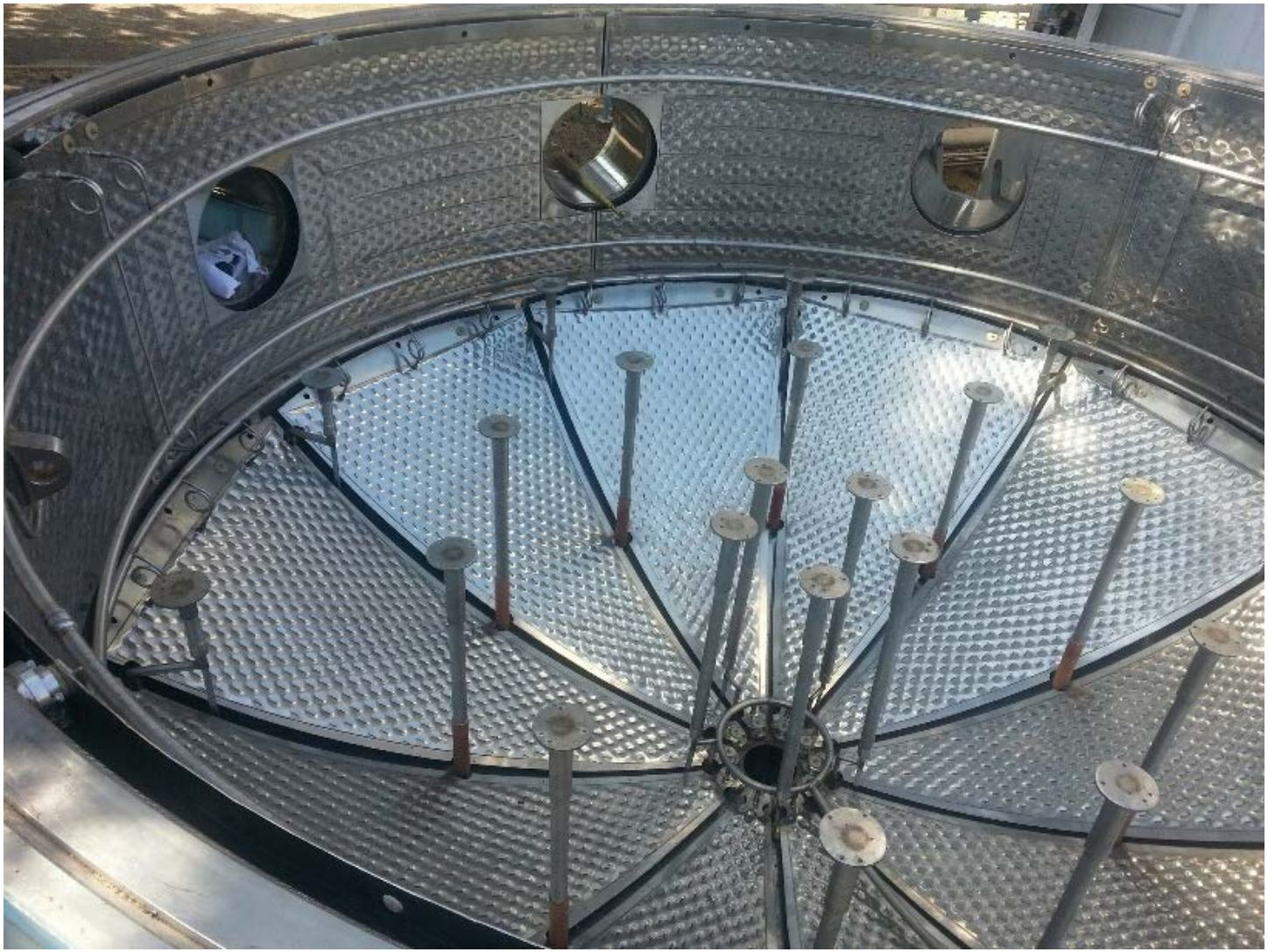


Types of Thermal shields

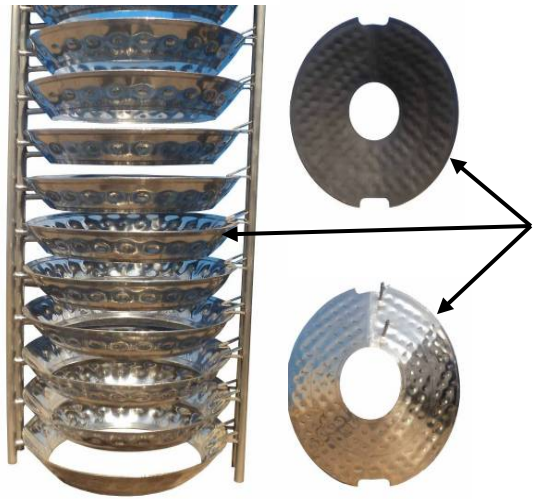
- Single embossed panel
- Double embossed panel
- Charcoal coated panel
- Coated panels (Aeroglaze /Al_2O_3)
- Panels to suit cooling up to 4 K
- Different shapes (Radiation/ thermal/ Active cooling Shields)
- Low out gassing and low leak panels (upto 1x 10^{-10} mbar L/s)

Material of → Stainless steel → Aluminium → Copper

Large scale integration of thermal shields



Cryo pumping study

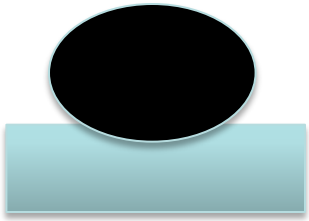


I-DESIGN

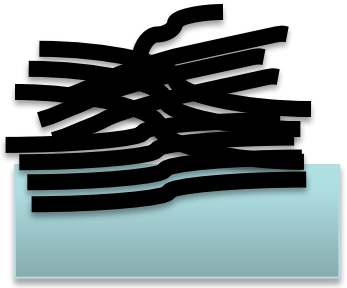
Development of Activated Carbons for Cryo-pumping

RSB

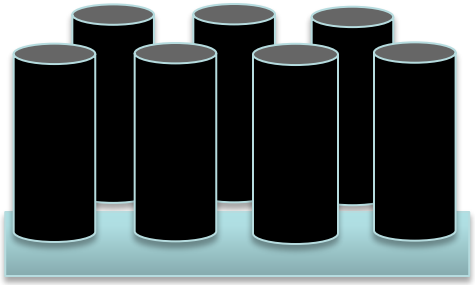
Granule 800m^2/g



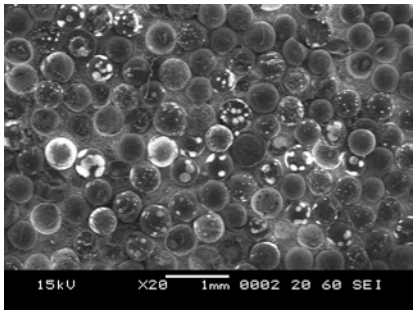
Globule 1400m^2/g

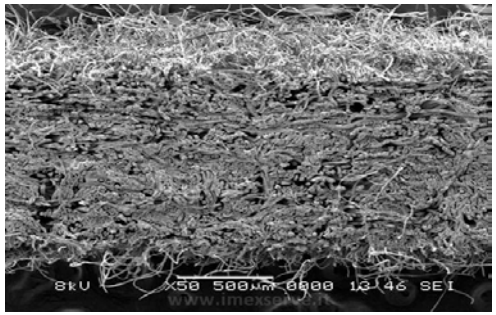


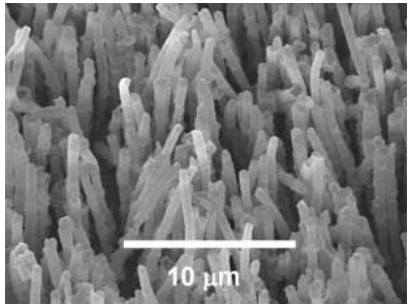
Fibers 1300m^2/g



Micro fiber 2000m^2/g



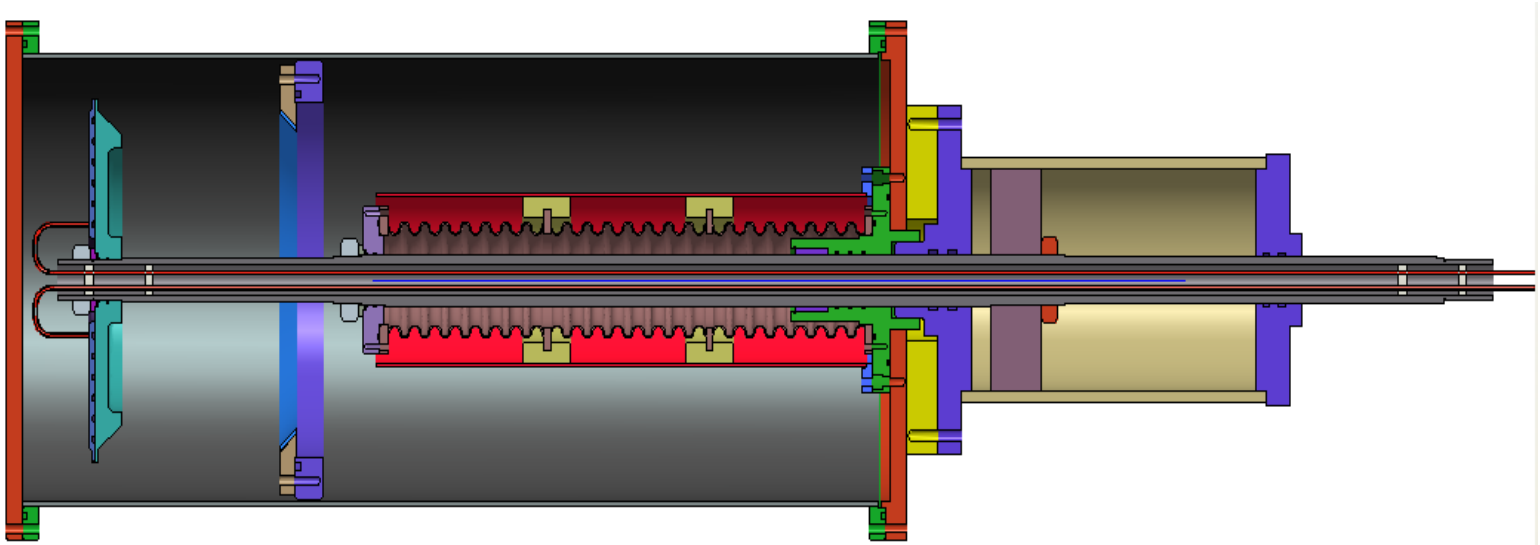


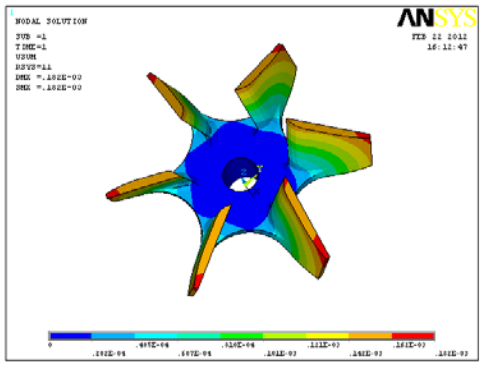


I-DESIGN is now working on development

of Activated Charcoal nano fibers 3000m^2/g

with increased thermal conductivity

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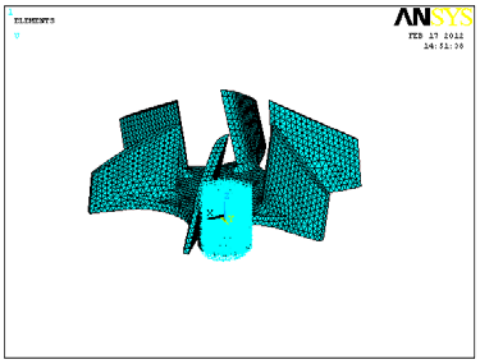
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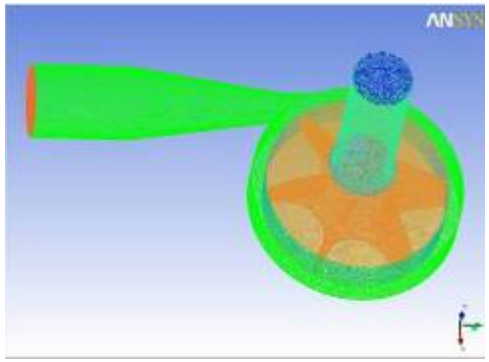
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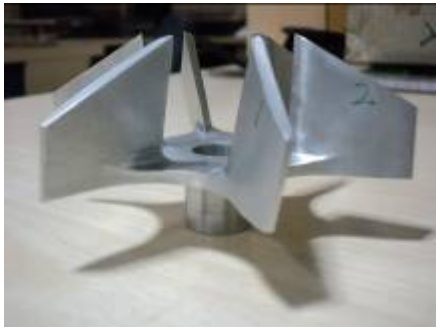

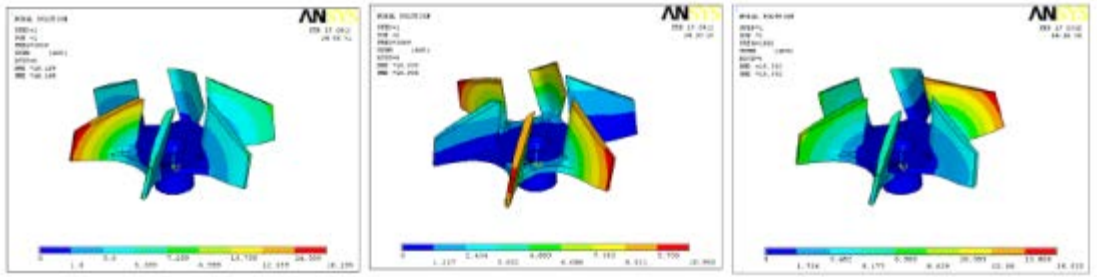
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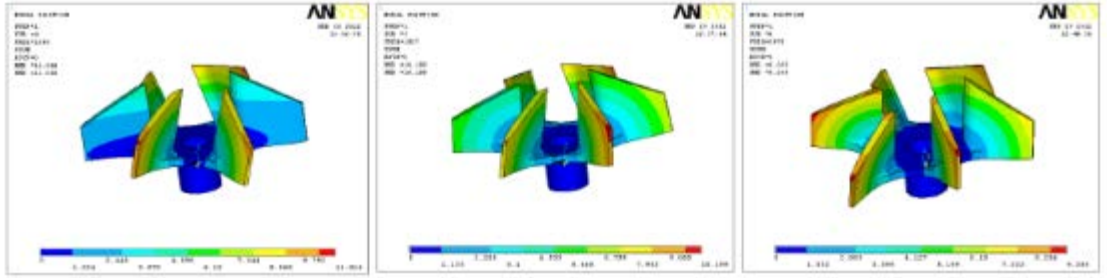
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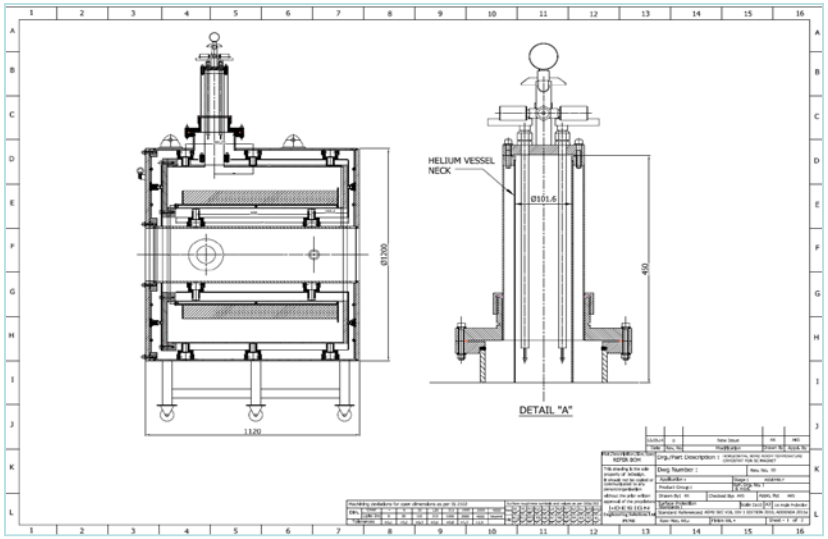
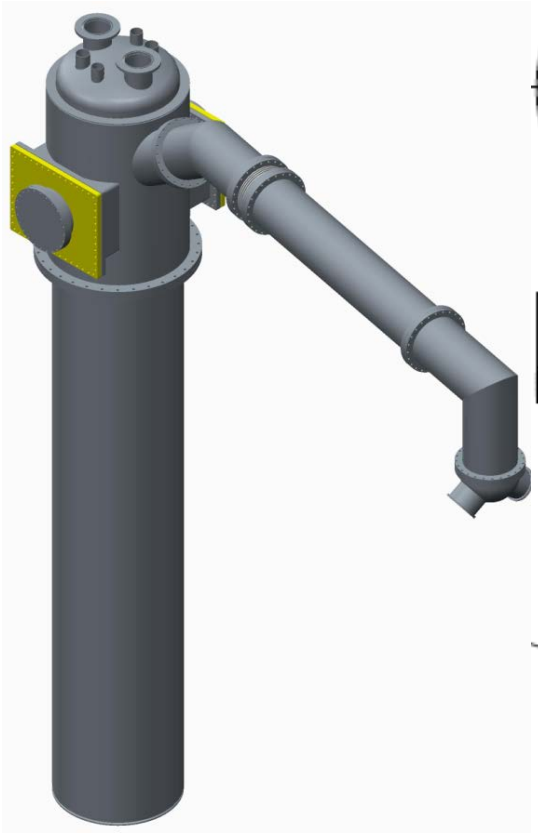
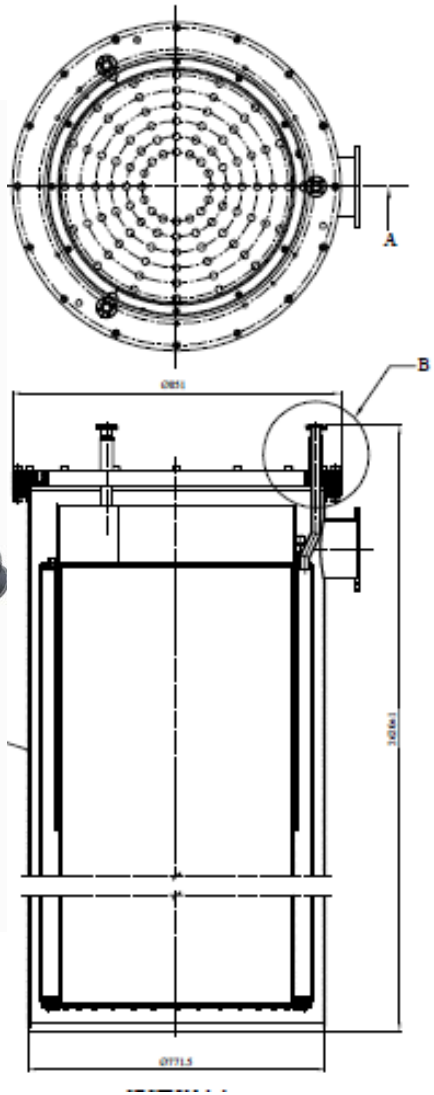
I-DESIGN

Design and Manufacturing of LHe Cryostat





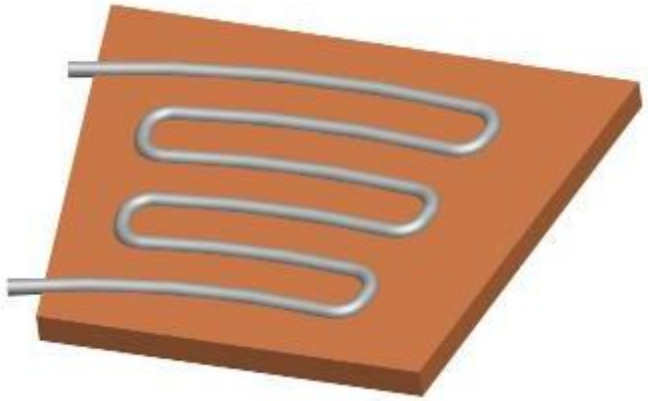


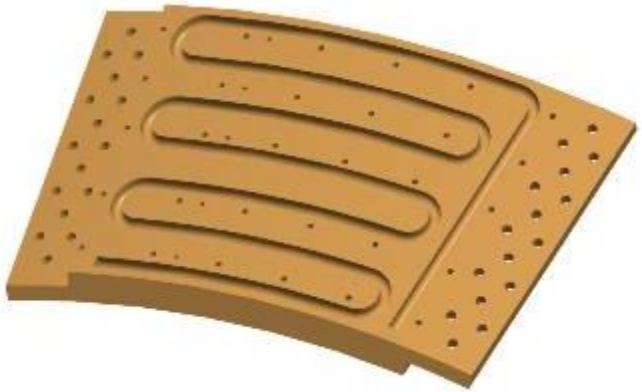
BARC, VECC

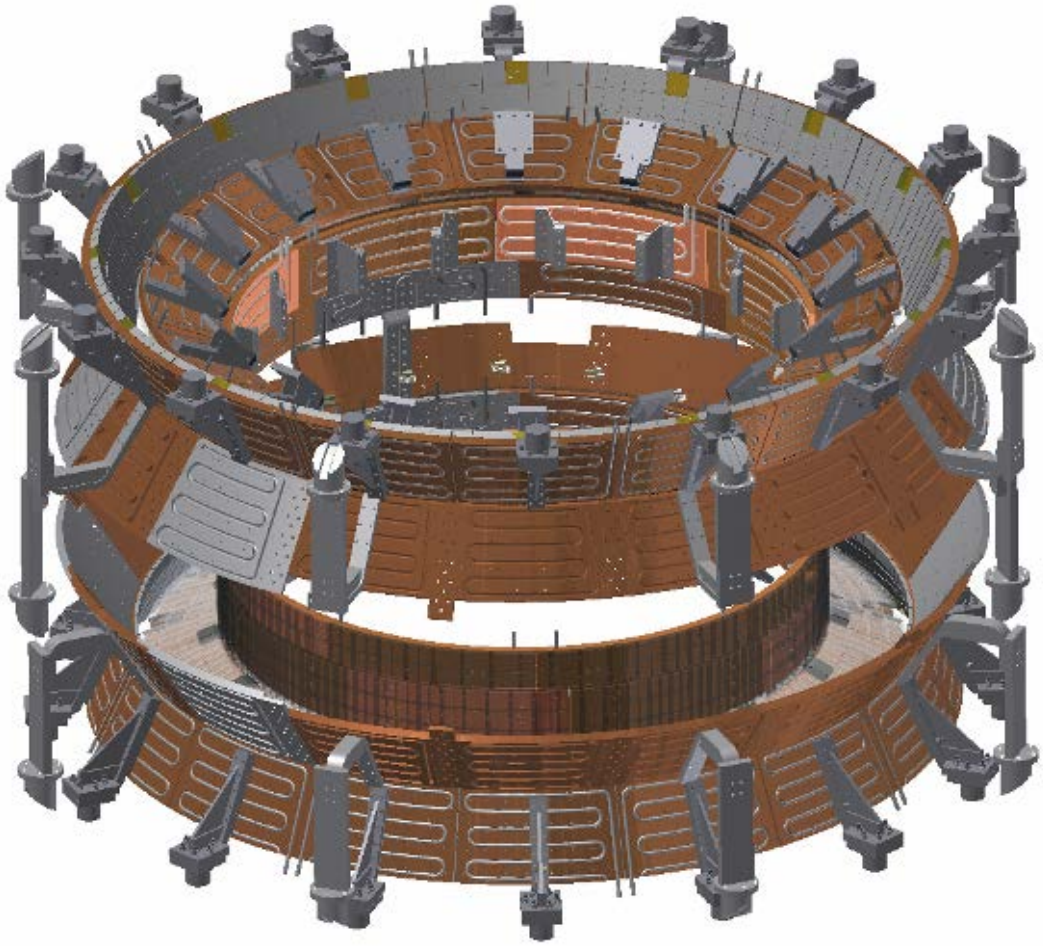
CICC integration work at IPR

Continued…..

CICC integration work at IPR







Plasma Facing Components after integration in Tokomak

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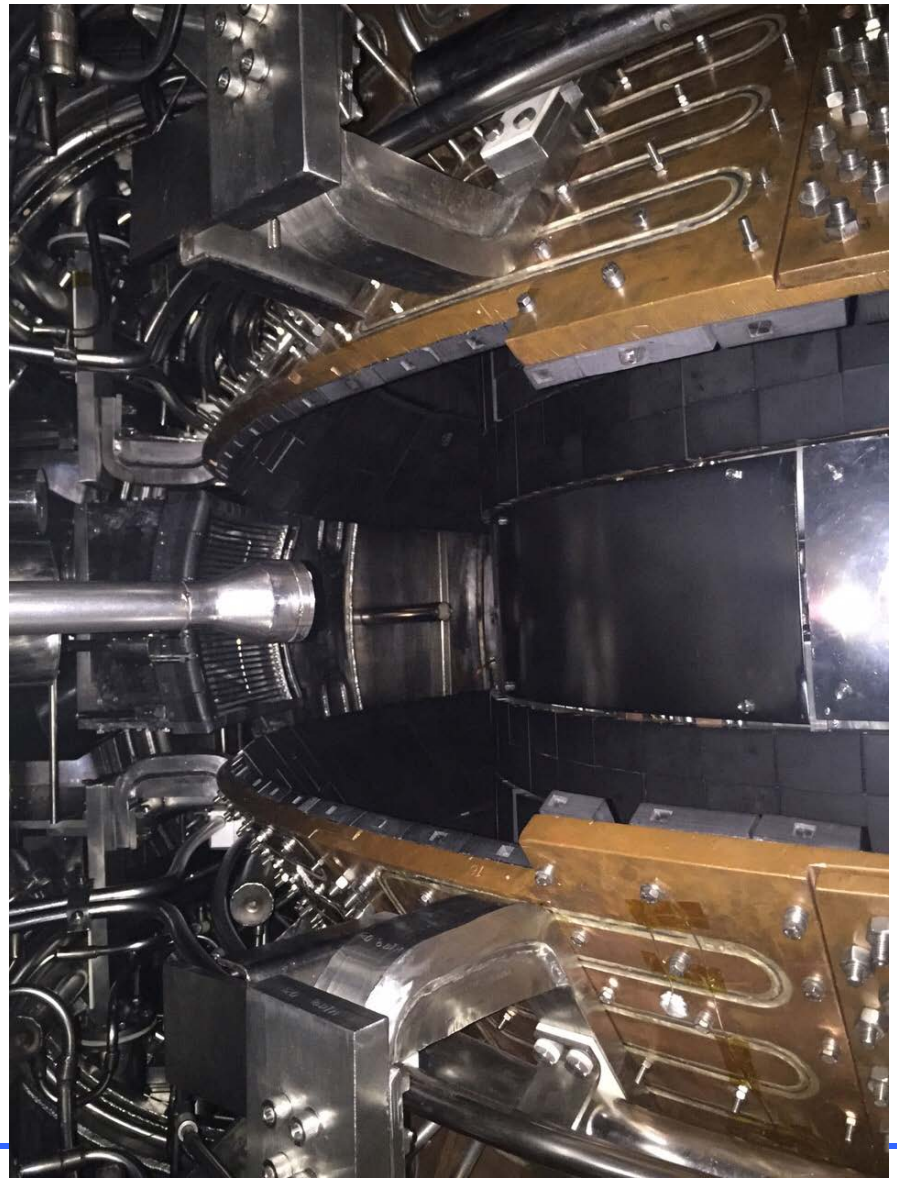


Other facilities at I-DESIGN

Vacuum Furnace

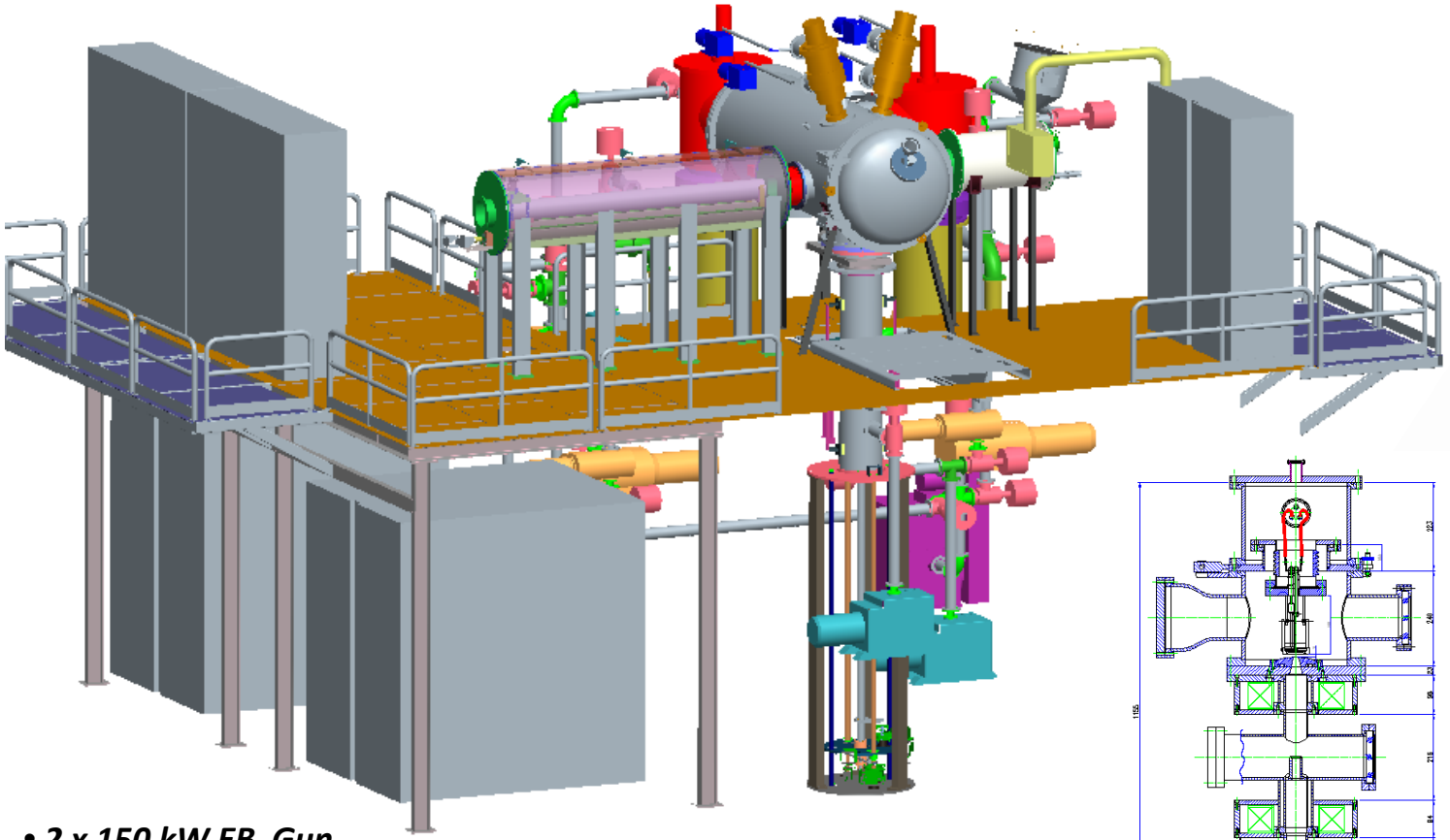
Mass Spectrometer Leak Detector

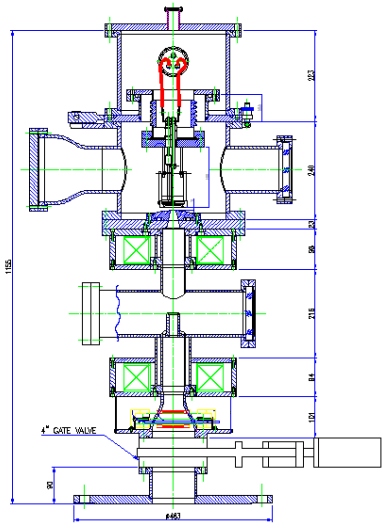
Activities at Special equipment division (SED)

I-DESIGN

Electron beam melting furnace design

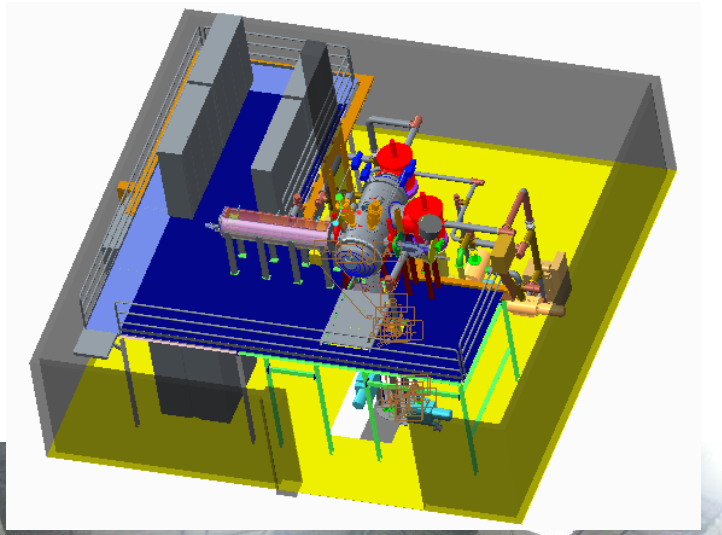
Continued…..

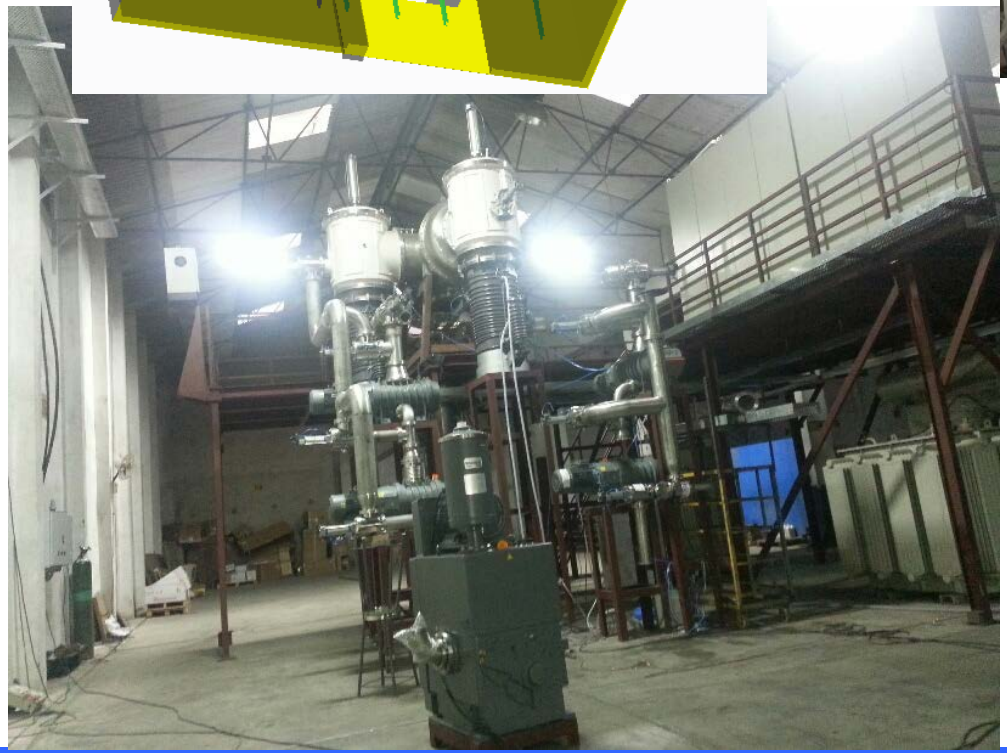




- *2 x 150 kW EB Gun*
- *Ultimate vacuum up to 1 x 10^{-5} mbar*
- *1 ton capacity ingot retraction*
- *Twin feeder (Bar & chunklet)*
- *Continuous operation up to 48 hrs*

Manufacturing of EBM Furnace





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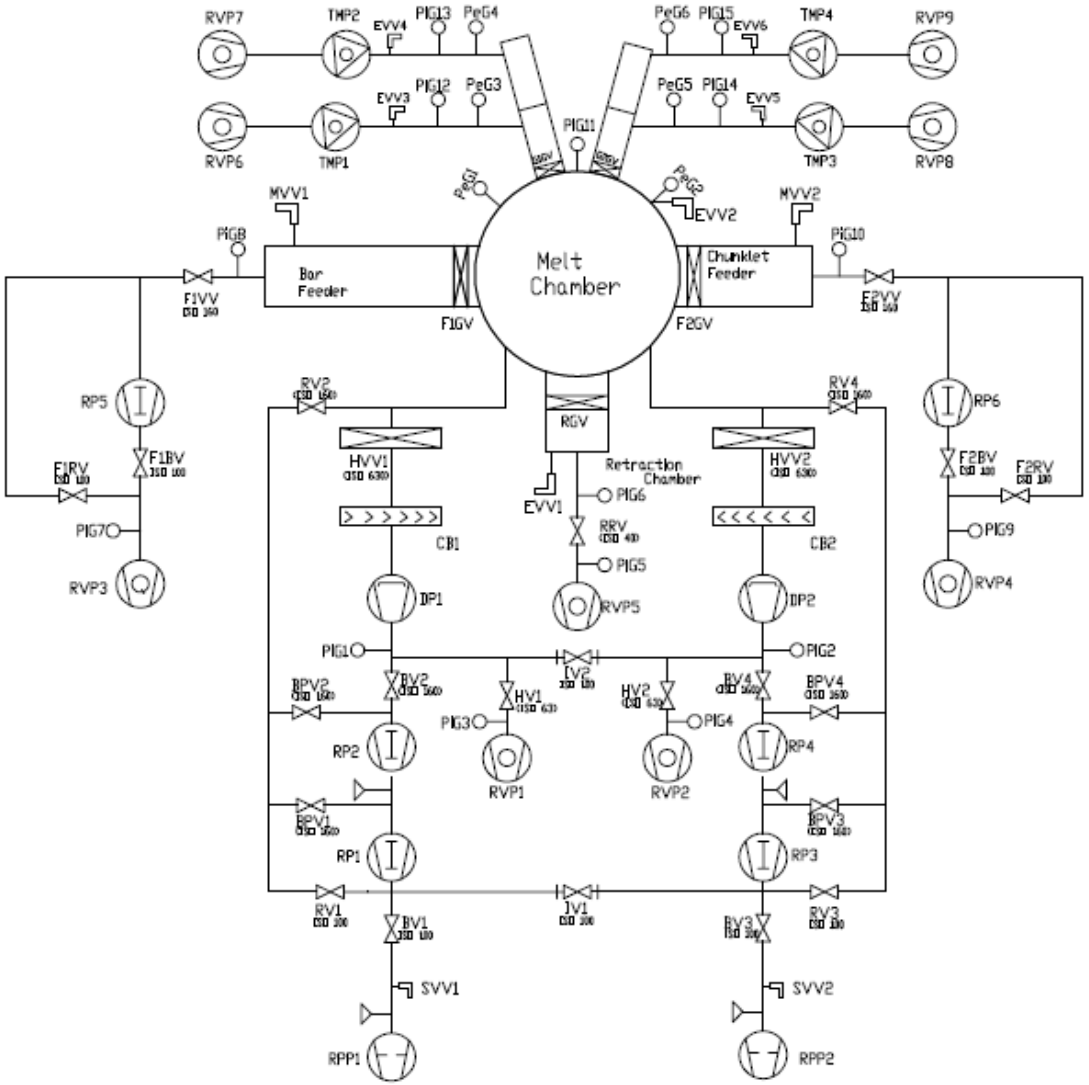
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EVV4
PIG13
PeG4
PeG6
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EVV6
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RVP9
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EVV3
PIG12
PeG3
PeG5
PIG14
EVV5
TMP3
RVP8
PIG11
PeG1
PeG2
EVV2
MVV1
MVV2
PIG8
PIG10
Bar Feeder
Melt Chamber
Chunklet Feeder
F1VV
F2VV
F1GV
F2GV
RV2
RV4
RGV
RP5
RP6
HVV1
HVV2
F1BV
F2BV
F1RV
F2RV
Retraction Chamber
EVV1
PIG6
RRV
PIG7
PIG5
PIG9
CB1
CB2
RVP3
RVP5
RVP4
DP1
DP2
PIG1
PIG2
BPV2
BV2
IV2
HV1
HV2
BV4
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RP2
RP4
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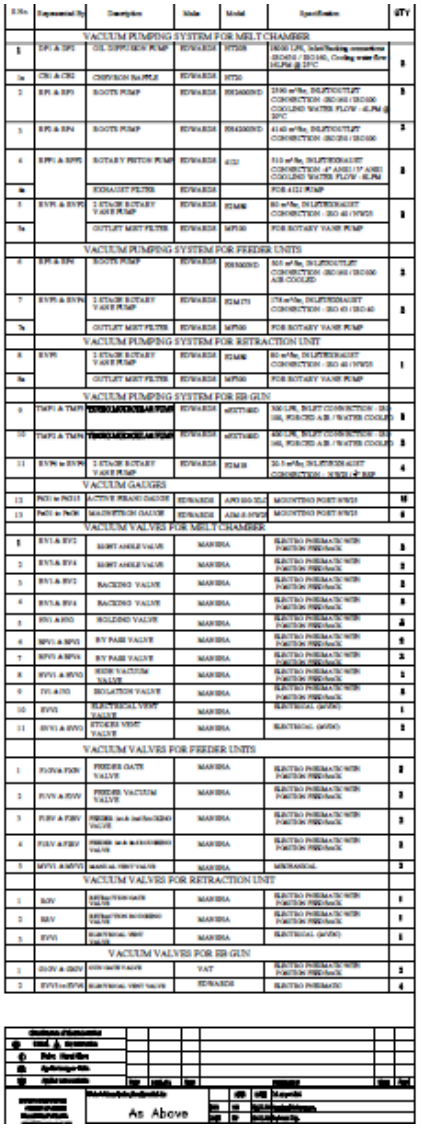
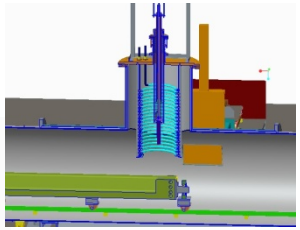
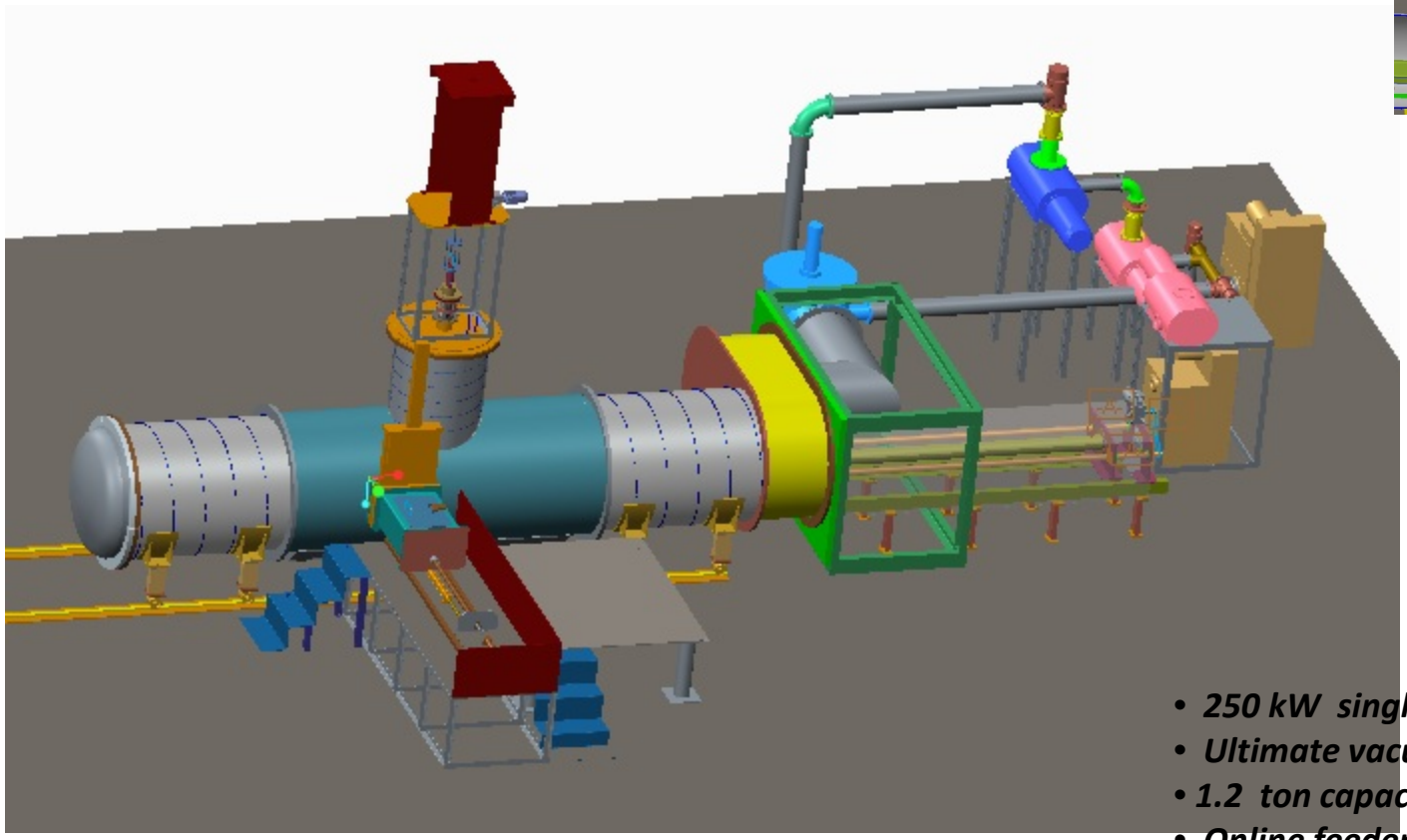
RPP1
RPP2


VACUUM PUMPING SYSTEM FOR MELT CHAMBER
VACUUM PUMPING SYSTEM FOR FEEDER UNITS
VACUUM PUMPING SYSTEM FOR RETRACTION UNIT
VACUUM PUMPING SYSTEM FOR EB GUN
VACUUM GAUGES
VACUUM VALVES FOR MELT CHAMBER
VACUUM VALVES FOR FEEDER UNITS
VACUUM VALVES FOR RETRACTION UNIT
VACUUM VALVES FOR EB GUN
As Above

Design and Manufacturing of Plasma Melt Furnace

Continued…..





- ***250 kW single plasma gun***
- ***Ultimate vacuum up to 1 x 10^{-5} mbar***
- ***1.2 ton capacity Cu Hearth***
- ***Online feeder unit***
- ***Continuous operation up to 48 hrs***

Gear box Test Rig for Synchronizer

FUDP test rig

Submarine seal test rig

Drive axle test rig

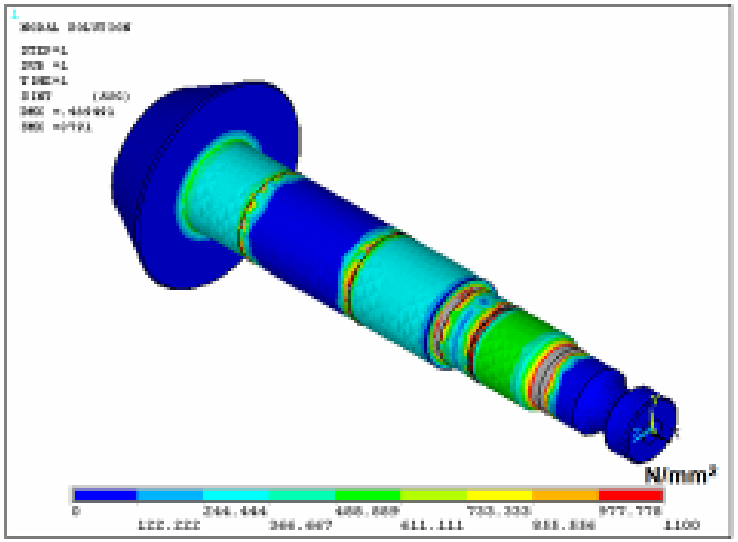
Steering System test rig

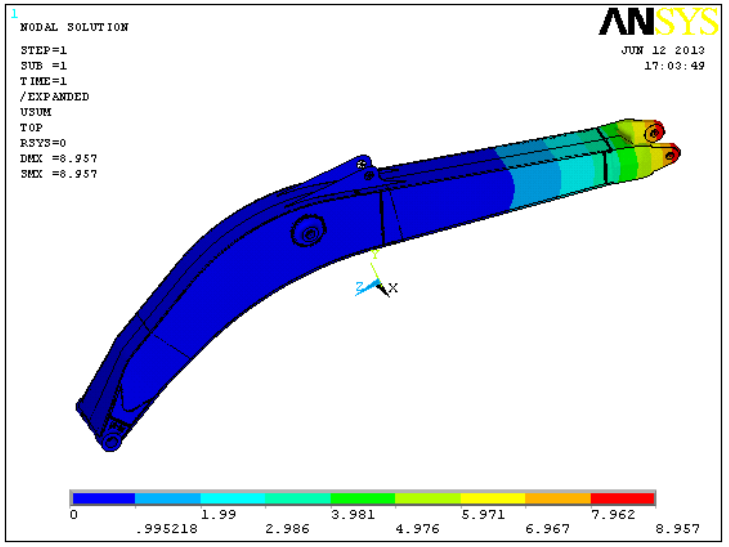
Plasma melting furnace

Instrumentation Capabilities

- Design and Integration of Electronic Control System for Test Rigs.
- Programming on various brands of PLC including Allen Bradley, Messung .
- Development of SCADA programs.
- Data acquisition by using hardware from National Instruments and Advantech.
- Data acquisition hardware includes NI Compact Field Point , COMPACT RIO, PCI 6221,USB 9215, Advantech PCI 1716.
- Programming on National Instruments Lab VIEW for latest versions 8.5, 8.2, 8.0, 7.1, Report Generation Toolkit, PID Toolkit, Application Building.
- Field testing & data acquisition using 32 channel recorder.

CAE projects


N/mm²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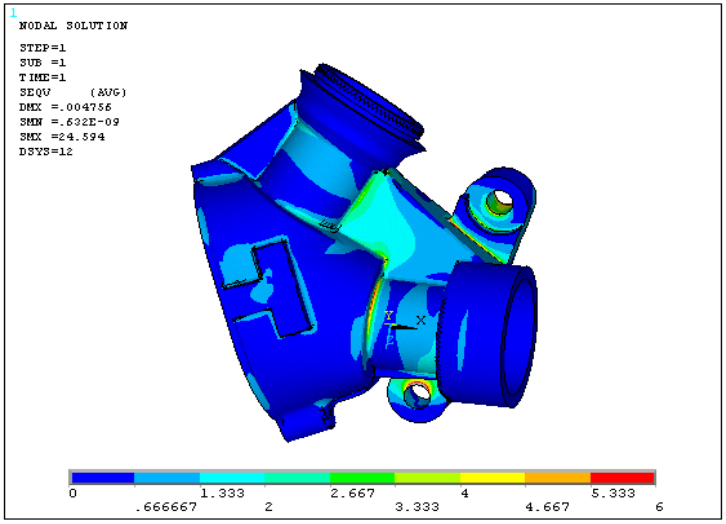
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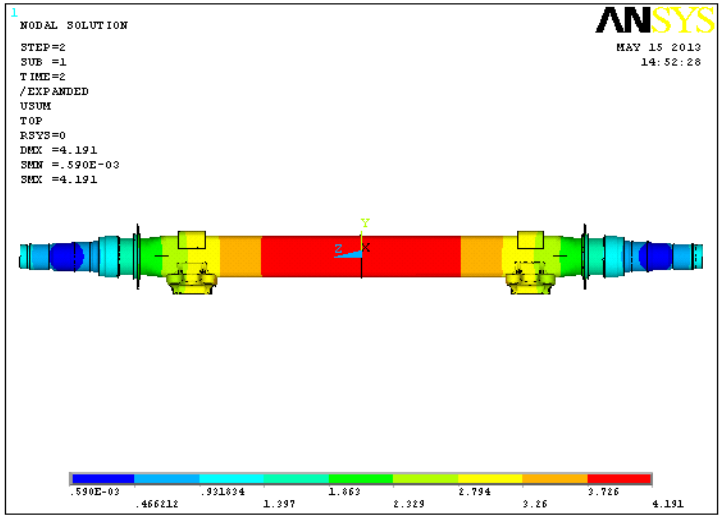
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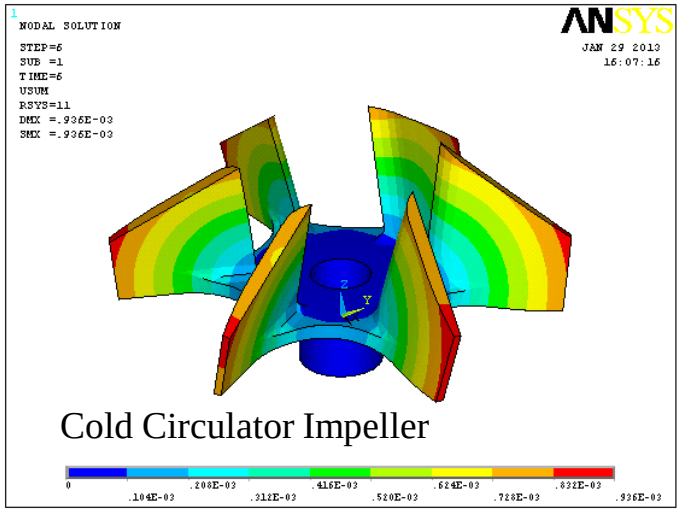
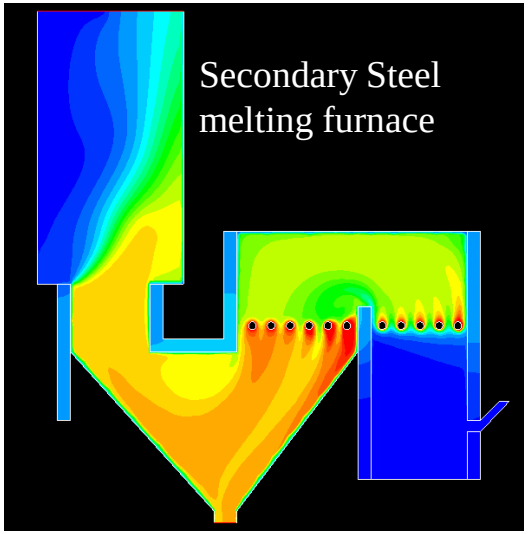
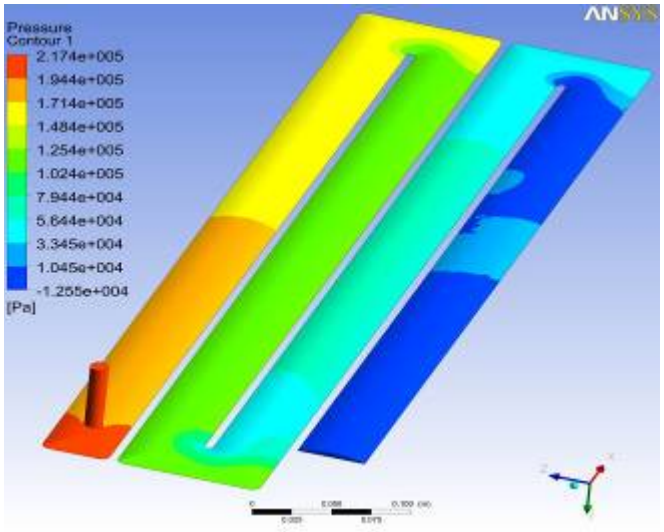
I-DESIGN

Computational Fluid Dynamics (CFD)

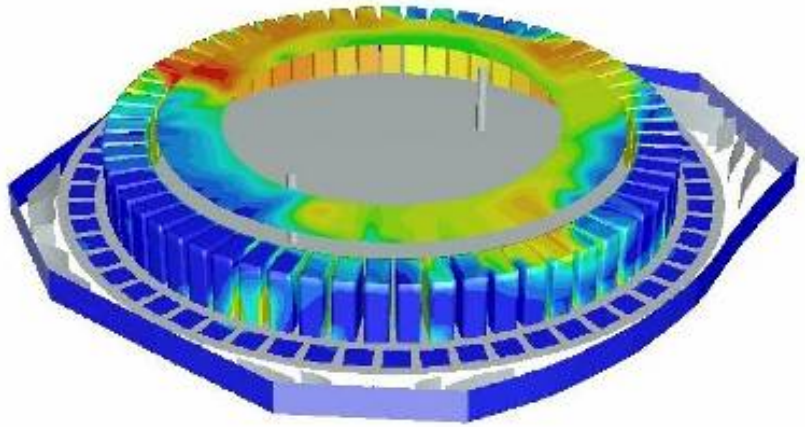


Cold Circulator Impeller





Cryogenics radiation shield

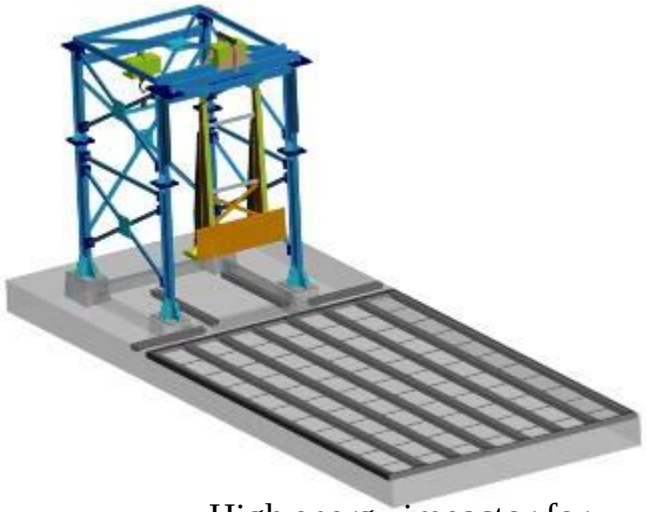


Football Stadium

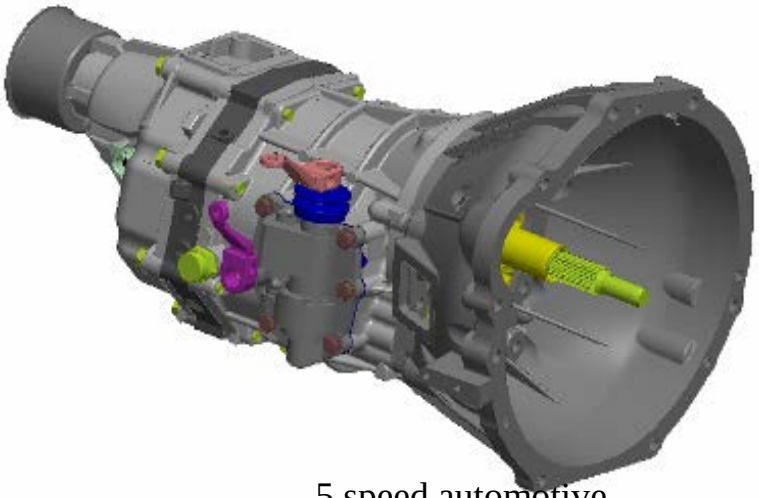
Activities at Automotive Engineering Division (AED)

I-DESIGN

I-DESIGN developed products

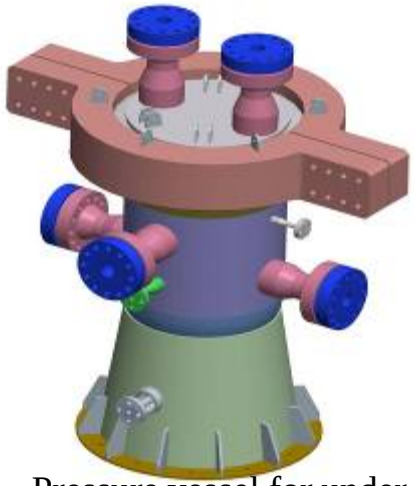


High energy impactor for trucks

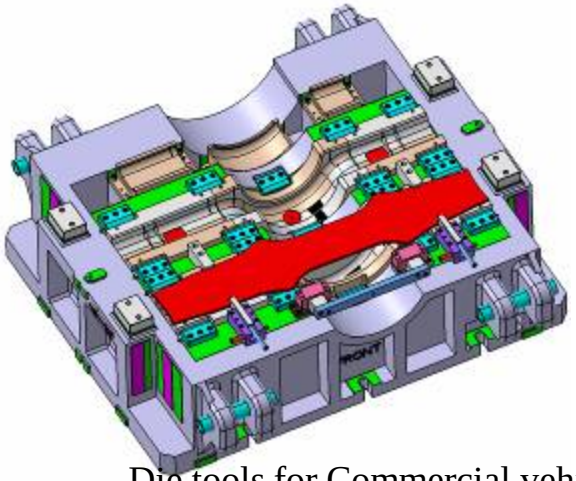


5 speed automotive transmission

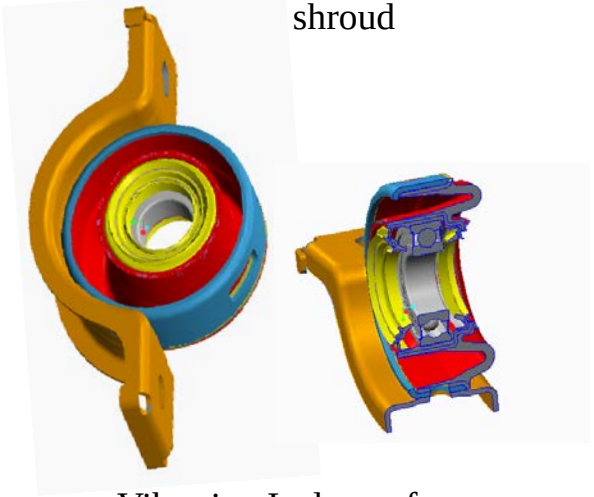
Thermo-vac chamber shroud



Pressure vessel for under sea system testing



Die tools for Commercial vehicle Driven axles



Vibration Isolators for drive shafts

I-DESIGN

Some Examples of Product Development

Continuous Variable Transmission Drive

Product Designing, Development & Validation for noise reduction in the Tractor

Design, Development & validation has been done by I-DESIGN

Trailers

I-DESIGN

Testing facilities at I-DESIGN, Dighi

RSB

Testing Facilities at I-DESIGN

Structural dynamics laboratory

Glimpses of testing facility

Control mechanism environmental test set-up

Gear box efficiency test set-up

Gear Box endurance test set-up

Axle beam test set-up

I-DESIGN

Glimpses of testing facility

RSB

Continued…..

Synchrocone test set-up

Drive shaft test set-up

Hub Bearing test set-up

Oil Seal test set-up

Glimpses of testing facility

Continued…..

Rock Shaft Test System

Propeller shaft Test System

Hub Bearing Test System

Transmission Test System

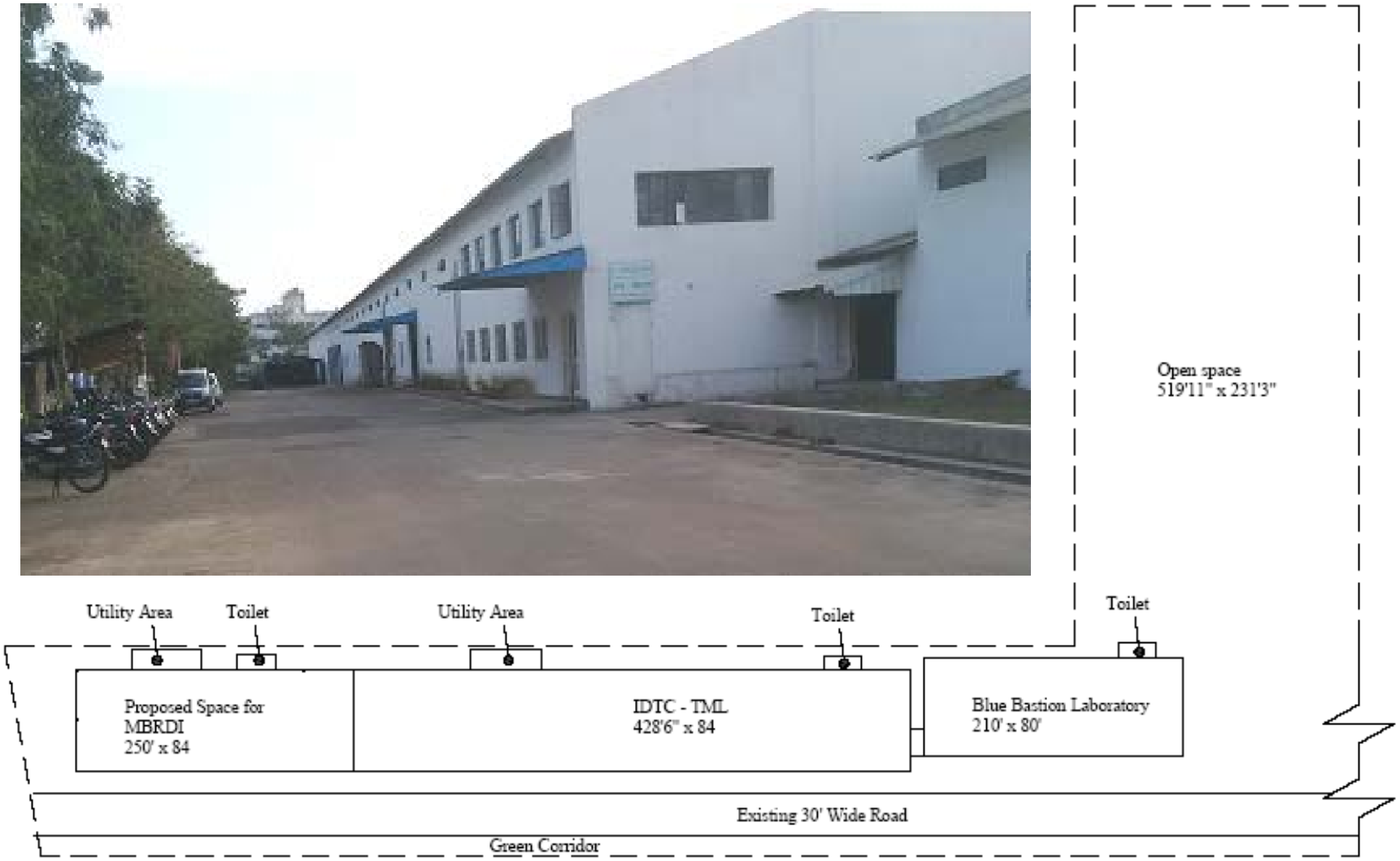
Steering Test System

Brake Test System

Activities at Blue Bastion Laboratory (BBL)

I-DESIGN

Layout of I-DESIGN, Dighi premise



I-DESIGN

Blue Bastion laboratory , I-DESIGN

Lab space for superconductivity , ultra high vacuum and cryogenics

I-DESIGN

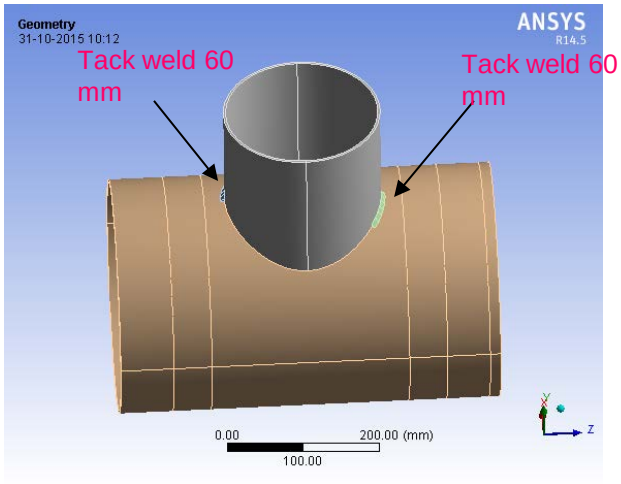
FAIR team visit to I-DESIGN

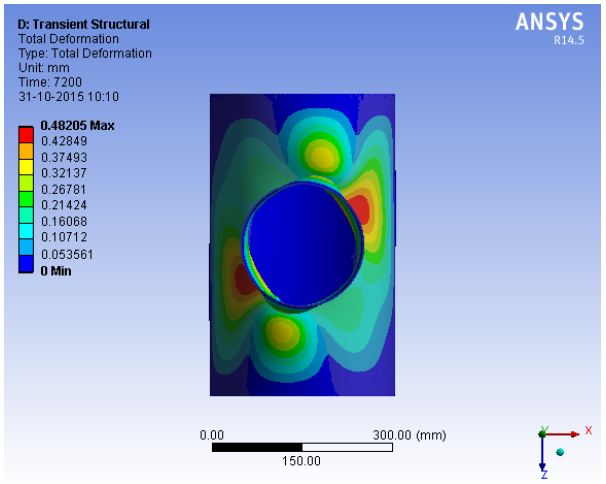
RSB

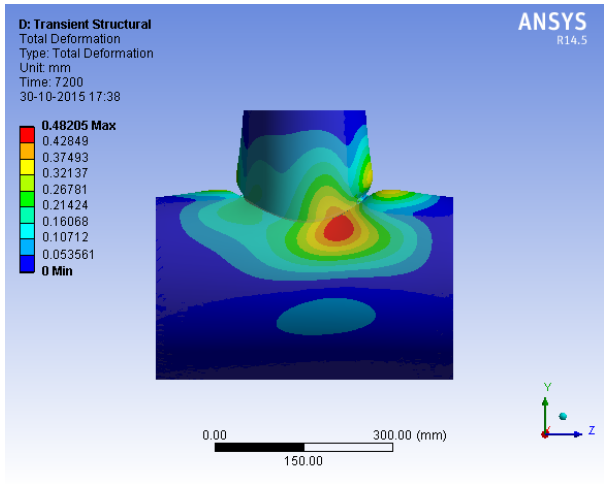
Assessment by FAIR and INDIAN team on 19th January, 2015

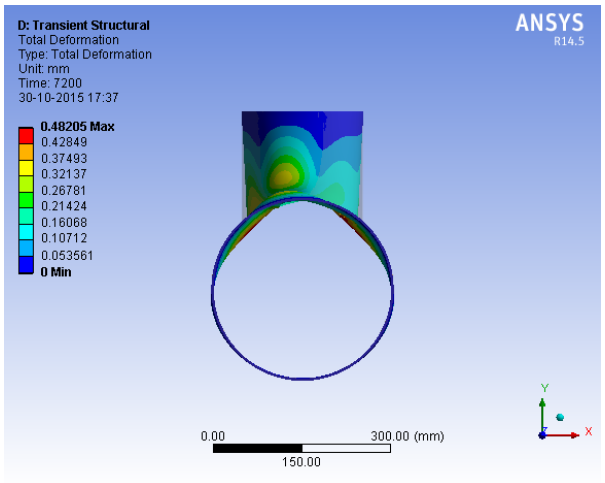
Axial tack (60 mm) welding without side weld (Three faces fixed)

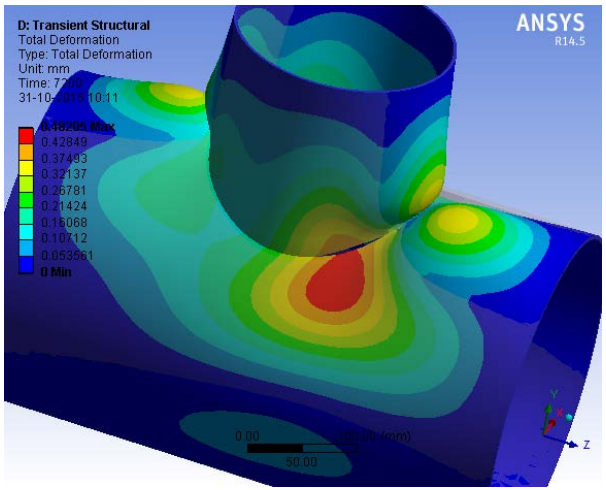
I-DESIGN



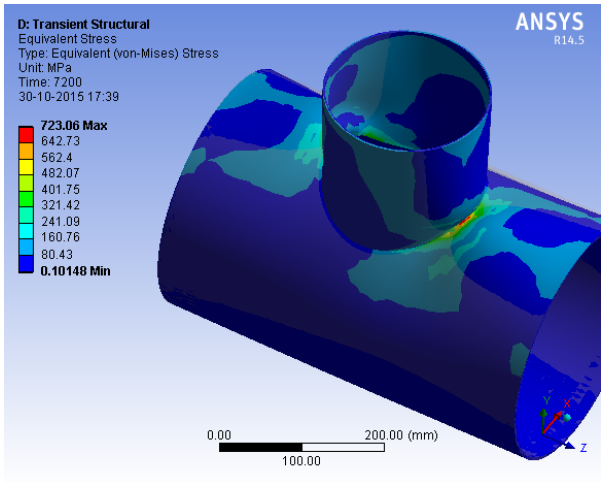








60X Zoom

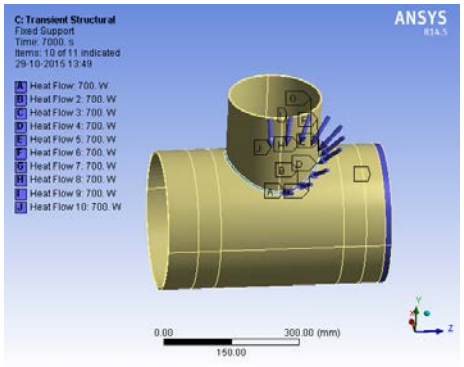


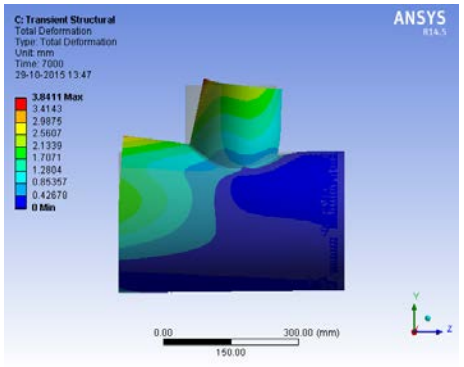
R. Stress after cooling

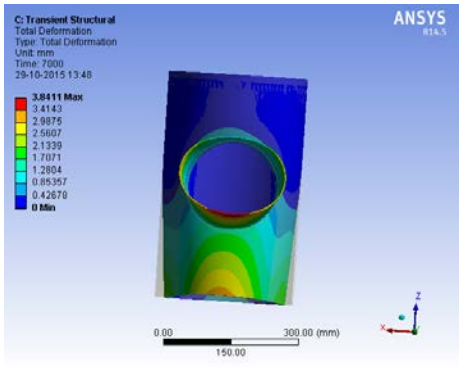
Barrel – Nozzle fusion welding outside (180°) One face fixed

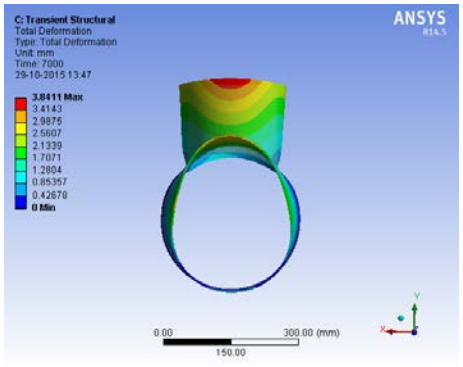
I-DESIGN

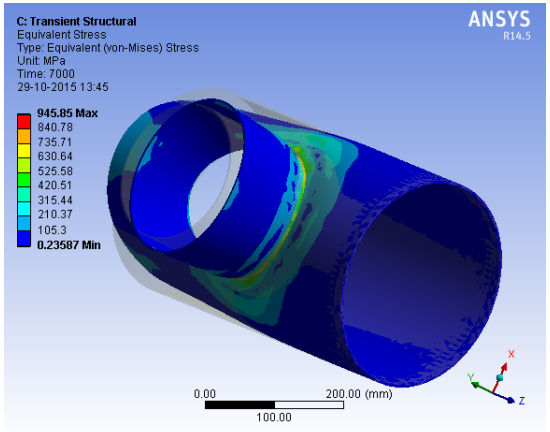
RSB

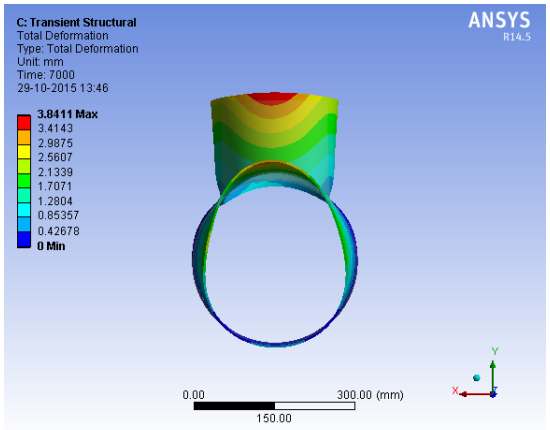










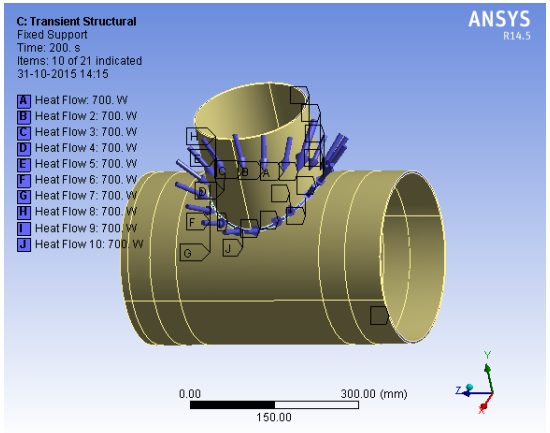


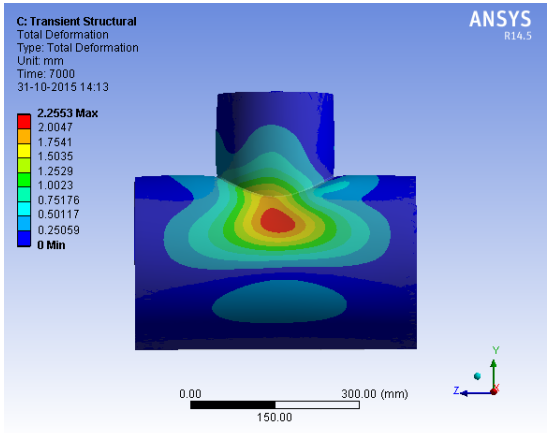
R. Stress after cooling

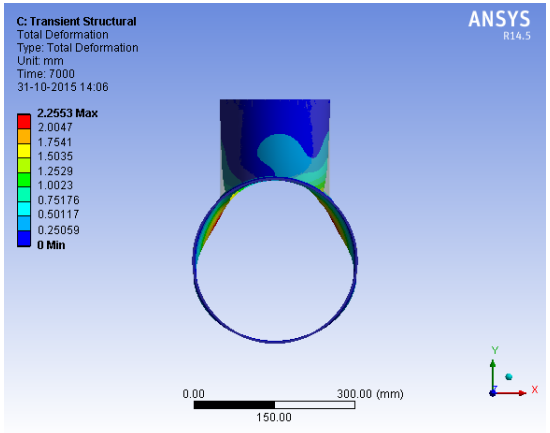
Date: 28/10/15

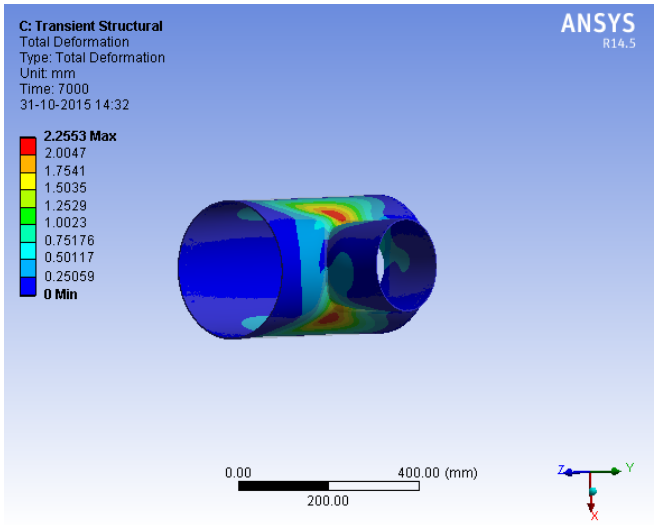
Barrel – Nozzle fusion welding outside (360°) three end faces fixed

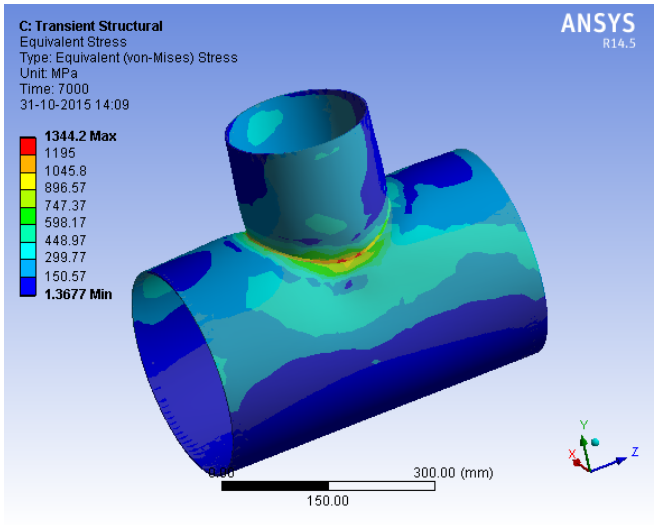
I-DESIGN











R. Stress after cooling

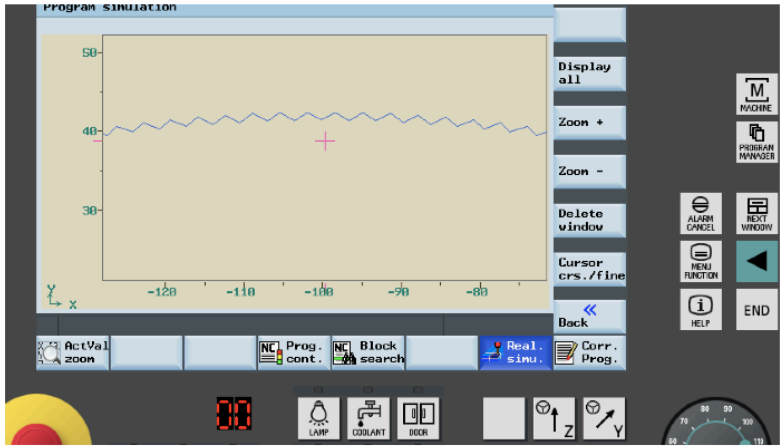
Date: 28/10/15

I-DESIGN

Automated welding trials at I-DESIGN

RSB

Modified Zigzag Profiled Program:

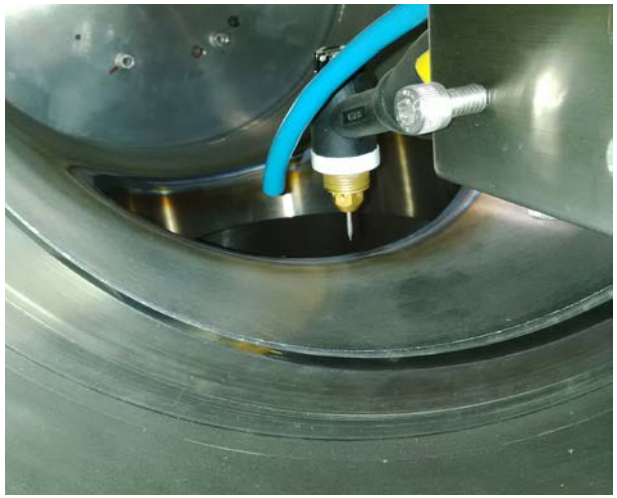


1st Trial with out nozzle: (Wave pitch=1.7 mm, wave amplitude 0.5

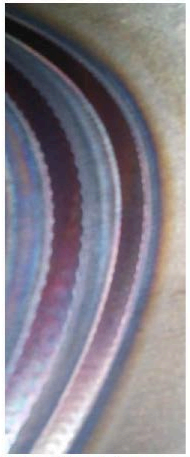
At 90 Amp

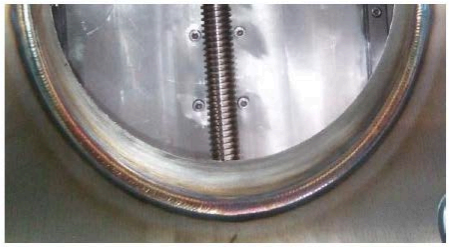
At 100 Amp

At 110 Amp



2st Trial: (Wave pitch=0.8mm, wave amplitude 0.5





With Nozzle trial

Without Nozzle (Comparative between 1st and 2nd trial)

I-DESIGN	Internal Testing		Rev No: 02 Date: 31-Oct-2014
Process Id	Process Description	Fixtures/ Equipments/ Methods	Control Parameters/ CTQ's
IT-10	Mounting of chamber Assembly on the test fixture	Manual loading on Fixture	Use of hand gloves, No hand touching, Use of SS tools
IT-20	Fitting of blank flanges & gate valves	Blank flanges & gate valves	Use of hand gloves, No hand touching, Use of SS tools
IT-30	Fitting of dry pumps, dry MSLD, RGA & Ion gauges	MSLD, RGA, TMP, Scroll pump, Ion gauge, Pirani gauge, gate valves	Use of hand gloves, No hand touching, Use of SS tools
IT-35	Local Leak Detection	MSLD equipment	Max Leak rate 1X 10^-10 mbar l/s

I-DESIGN	CF Flange - 150		Rev No: 03 Date: 17-Jan-2015
Process Id	Process Description	Fixtures/ Equipments/ Methods	Control Parameters/ CTQ's
F-10	Procurement of SS 316 LN round bars	Refer. Technical Guideline 2.6e (1.4429)	Chemical composition, Inclusion rating, Mechanical properties, Magnetic properties, Intergranular Corrosion. Labelling of material.
F-20	Billet cutting	Use of mechanical saw/ Shearing	Labelling of material.
F-30	Forging of blanks	Use of RSB Group's forging facility with new dies	Checks for Dimensional & Multi-dimensional grain flow. Labelling of material.

	I-DESIGN	ROUTE CARD for UHV CHAMBER MANUFACTURING		Card No.	
				Page	_____of _____

A. Part Details:

1) Part No:		2) Part Description:		
3) Drawing No:		4) Revision No:		
5) Child Parts used:	6) Description	7) Part No./Drawing. No	8) Rev No.	9) Route Card No (If applicable)

B. Incoming Material Control

Process ID:

Reviewer/ Executer details

	Doc/Record	Ref No	Rev no.	Name	Date	Signature
D.1	WI for GRN Preparation					
D.2	WI for Supplier TC Verification				____No Fill___	
D.3	WI for GIN Preparation					
R.1	Goods receipt note No: (GRN)					
R.2	Good Inspection note No: (GNN)					
R.3	Stores Location ID					
		TC No	TC Date			
R.4	Supplier test certificates					

Advantages: In-Kind Contribution

- Country Advantages:
  - Involvement of country's scientific community in project design, manufacturing, testing and erection
  - Development of manufacturing capability and infrastructure for frontier technologies
  - No Forex outflow

- Industry Advantages:
  - Participation with large International scientific projects
  - Learning thru' interactions with scientific community (both domestic and international)
  - Opportunity to move up in the technology value chain
  - Help upgrade quality systems and practices

Challenges

- Sourcing of materials for tubes – Non-standard sizes and small quantities
- Special grade material for CF Flanges - SS316LN thru' ESR process and MDF route – Sourcing due to small quantity requirements
- High welding distortion in tubes – Due to small thickness and multi nozzle configuration and full penetration welding of end cover from out side
- Maintaining specified Geometrical tolerances after welding

THANK YOU

I-DESIGN Engineering Solutions Limited.

Pune Trade Centre, 2337 / 1, Ubale Nagar, Nagar Road, Wagholi, PUNE # 412207. Maharashtra, INDIA.

Ph # + 91 20 65611559 / 60. Fax # + 91 20 66032995. URL: WWW.idesign.co.in