



PROTEAS SOLAR POLYGENERATION PRESENTATION OF SYSTEM'S TECHNOLOGY AND COMPONENTS

HELIOTRON INSTITUTE

SOLAR ENERGY RESEARCH & DEVELOPMENT STUDIES

NOVEMBER 2015

HELIOTRON INSTITUTE

- Heliotron Energy S.A., consisting of a group of skilled scientists led by M-Eng NTUA Mr. Alexandros Papadopoulos, having 45 years' experience in the field, was founded in 1999 aiming to the study, the promotion and the application of Green Energy.

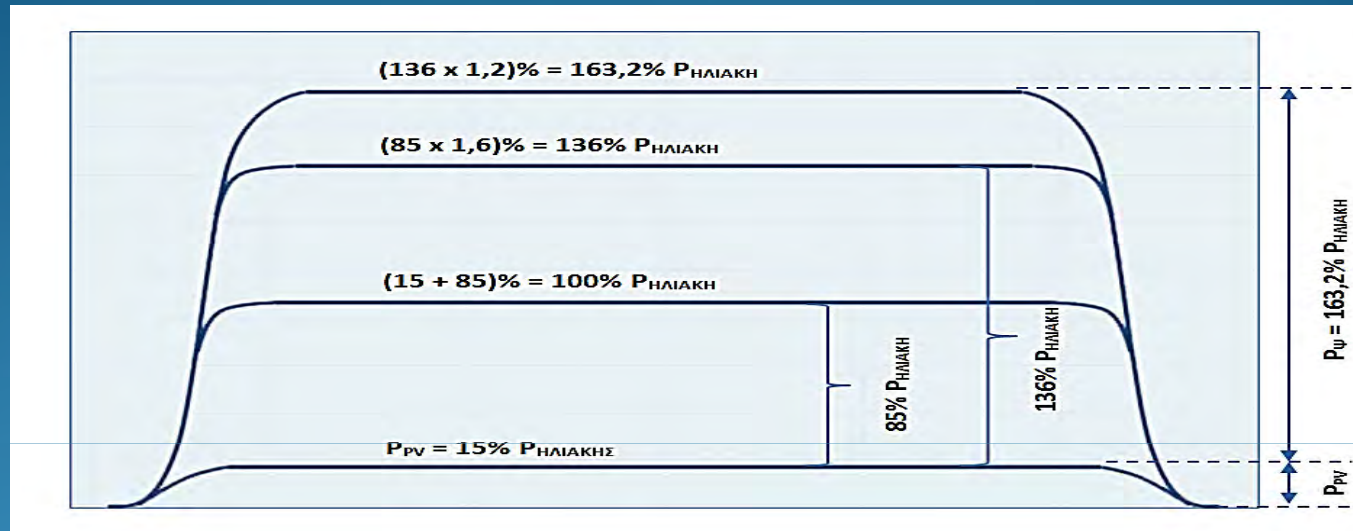
- The founder of the company, Mr. Alexandros Papadopoulos has invented and integrated the advanced solar polygeneration system PROTEAS in Research & Development Programs, a system which produces simultaneously electric, thermal and cooling energy as well as hot water..

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PROTEAS – BRIEF HISTORY

- PROTEAS is invented, patented and joined in Research & Development programs by Alexandros Christos Papadopoulos, Mechanical – Electrical Engineer of NTUA.
- PROTEAS won the First Prize of Technology of the Industrial Property Organization in 2004. PROTEAS also won the Second Prize in the Competition of the European Union ETRERA 2020 PRIZE.
- PROTEAS was developed within the framework of one European and two National R & D Programs totaling 4,6 Million Euros.
- PROTEAS has been patented in China, India, USA, Australia and in selected European countries as well.
- A new National Program under the NSRF amounting to three million euros was presented in July 2011 (11SYN_7_1500 of GSRT) in collaboration with the NTUA, the TUC, the IOBE and three reputable Industrial Companies, has been positively evaluated and has been signed for implementation in 2013.
- The aim of the Program under the NSRF is the final configuration, the certification and the implementation of a pilot production line for PROTEAS units.

PROTEAS – MULTIPLE AMPLIFICATION OF SOLAR ENERGY

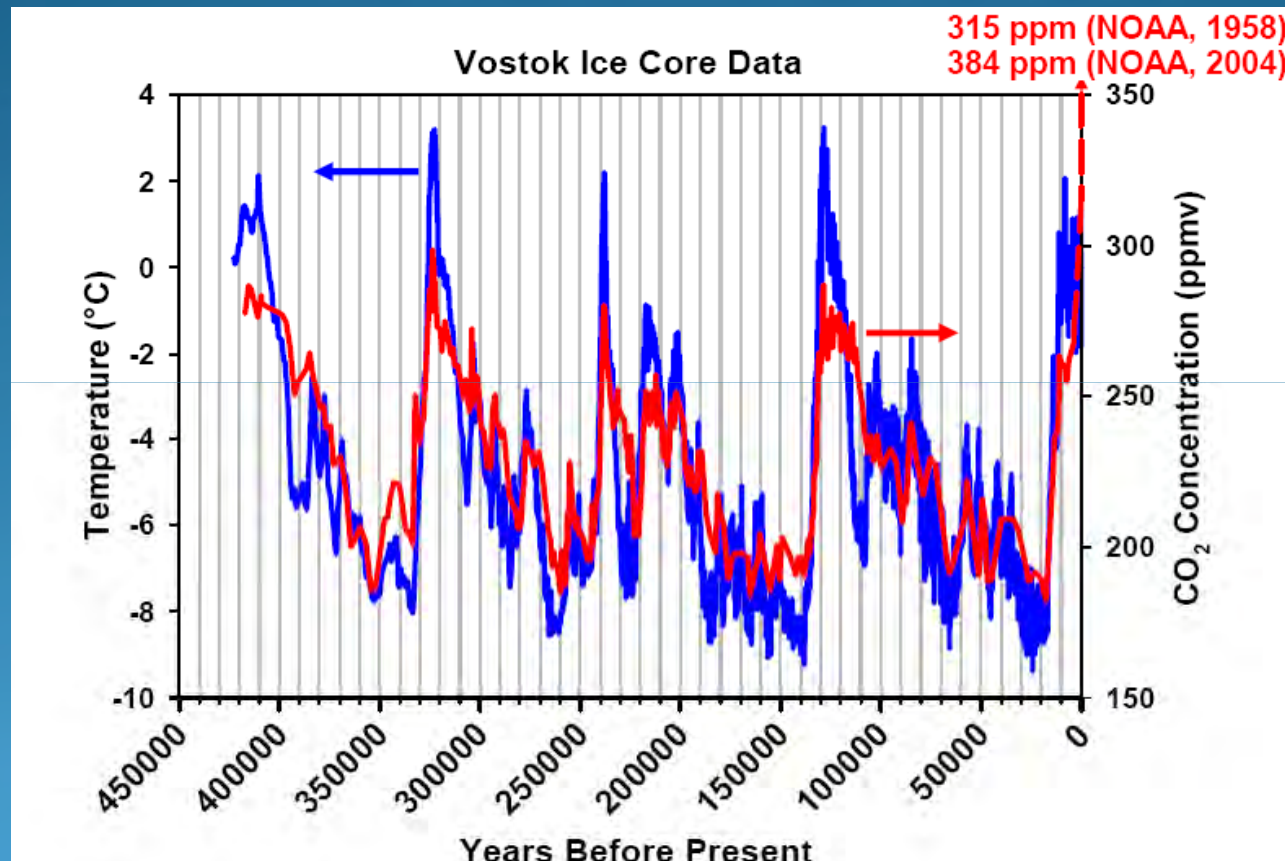


- PROTEAS, using VMJ cells, utilizes 15% of the incoming solar energy in order to produce electricity
- The innovative technology of the system allows it to multiply the wasted thermal energy reaching to a high of 163,2% and turning it into cooling energy.
- The produced cooling energy converted into equivalent electric energy leads to multiple amplification of the solar energy from PROTEAS, which produces 5 times equivalent shearing peak force compared to its nominal electric power.
- During the conversion process, besides cooling power, the system produces thermal power at lower temperatures, whilst attaching a considerable part of the heat absorbed by the building to various uses.

PROLIFERATION OF THE INCOMING AND UTILIZED SOLAR RADIATION

- In conventional PV systems wherein $\eta=15\%$, the remaining 85% of the solar radiation is rejected to the environment as heat.
- In PROTEAS wherein $\eta=15\%$, the remaining 85% of the unutilized solar radiation not only is not rejected to the environment as heat but also it is enhanced to 163,2%, it gets converted to cooling energy A/C and it is used for the building's air conditioning.
- At the same time, it is converted to hot water and a significant part of the rejected heat removed from the building is converted to air conditioning using the heat pump.

Climate Change Diagram of last 450.000 Years



Antarctic Ice Core Data allows for Temperature and CO₂ Profiles Mapping of past hundreds of thousand years

Warning Facts

Oceans Cooling Stream Velocity is reduced from 6.0 to 4.8 Miles/Hour. Climate Change is here! Too Late ? Why build-up of floating fresh water in Arctic as big as Lake Victoria could spell trouble for Britain and not only



Consequences of the Haline Stream Interruption



“The Day After Tomorrow”, just a movie scenario, for now
Based on a study as above financed by the American Army

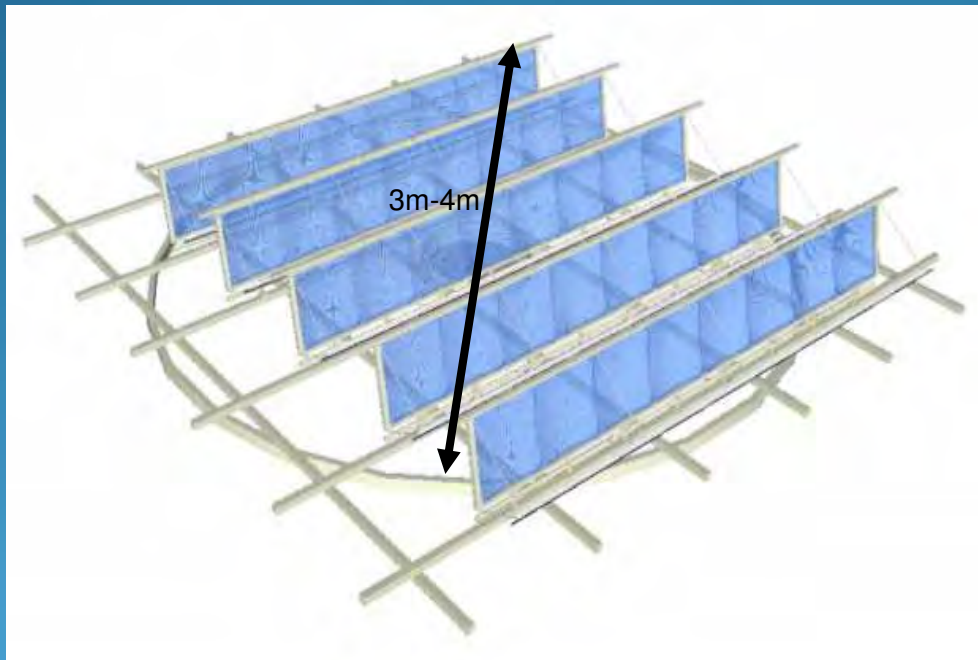
Prototype Modul Solar Polygeneration Unit



PROTEAS Characteristics

➔ Solar Polygeneration System

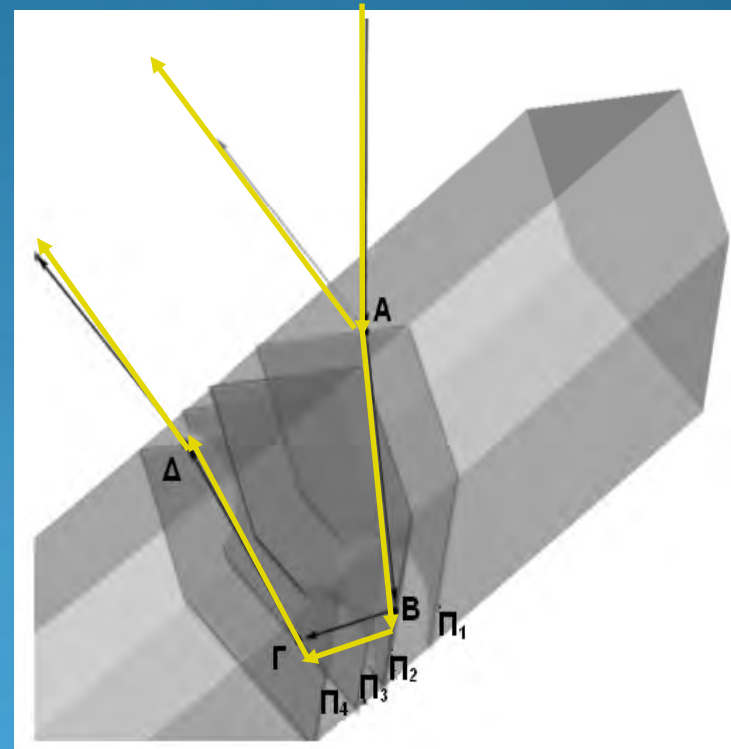
Production of Electric, Two-Level Thermal and Cooling Power.
Standard Unit of 1000Wp | 250-500Lt Hot Water | 8000-16.000BTU | 500-1000Lt Lukewarm Water.
Internationally Patented Total Internal Reflection Reflectors.



- Innovative Optical System
- PV Cells III-V >40%
- COP of Heat Pump >1,6
- Low Cost AL Tracker
- Low Profile Tracker
- Advanced Control System

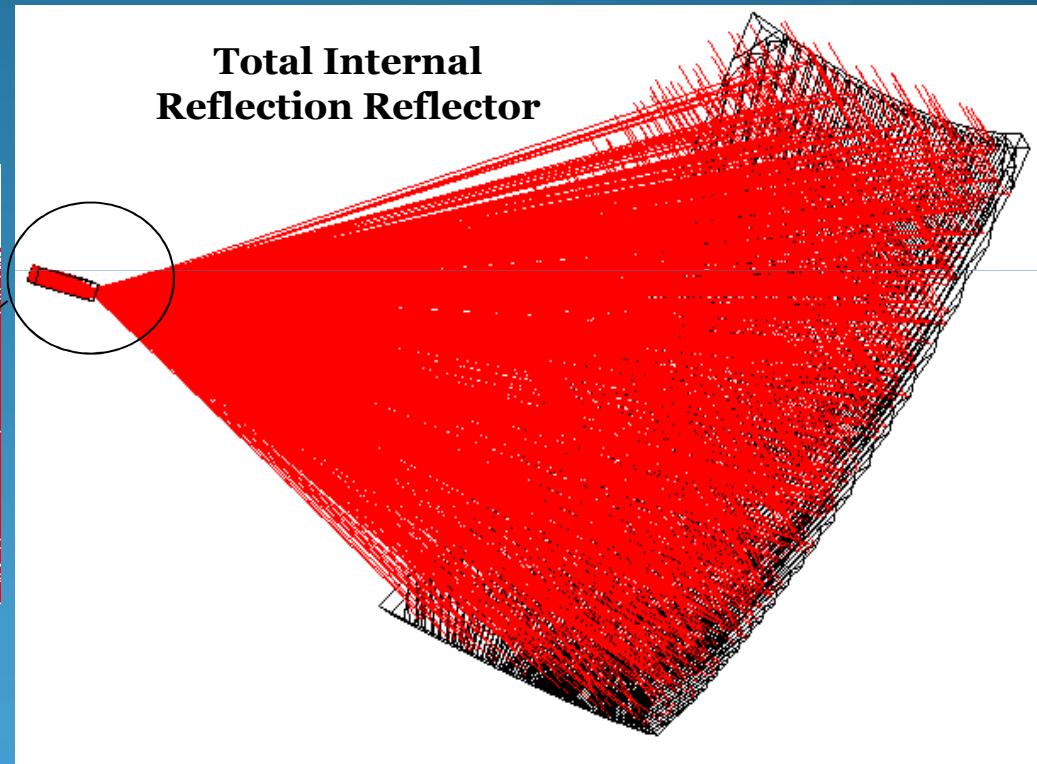
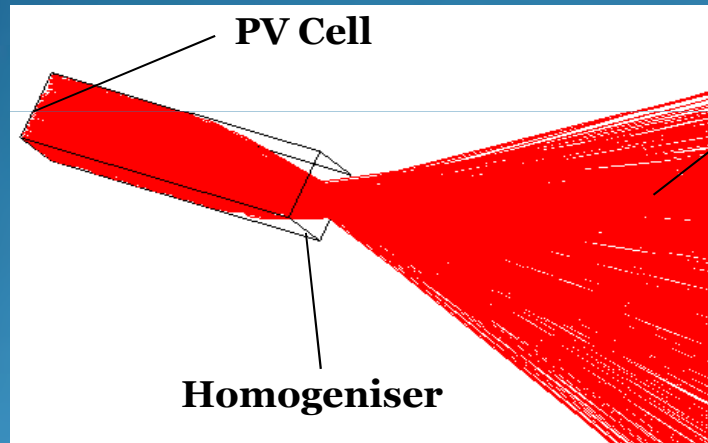
Total Internal Reflection Prisms

- Constructed as a Total Internal Reflection Reflector with corrected Rectangular Prisms
- High Concentration Point Focus of 1:5000 with Total Internal Reflection of Sunlight
- Material: Colorless Glass or PMMA or Polycarbonate

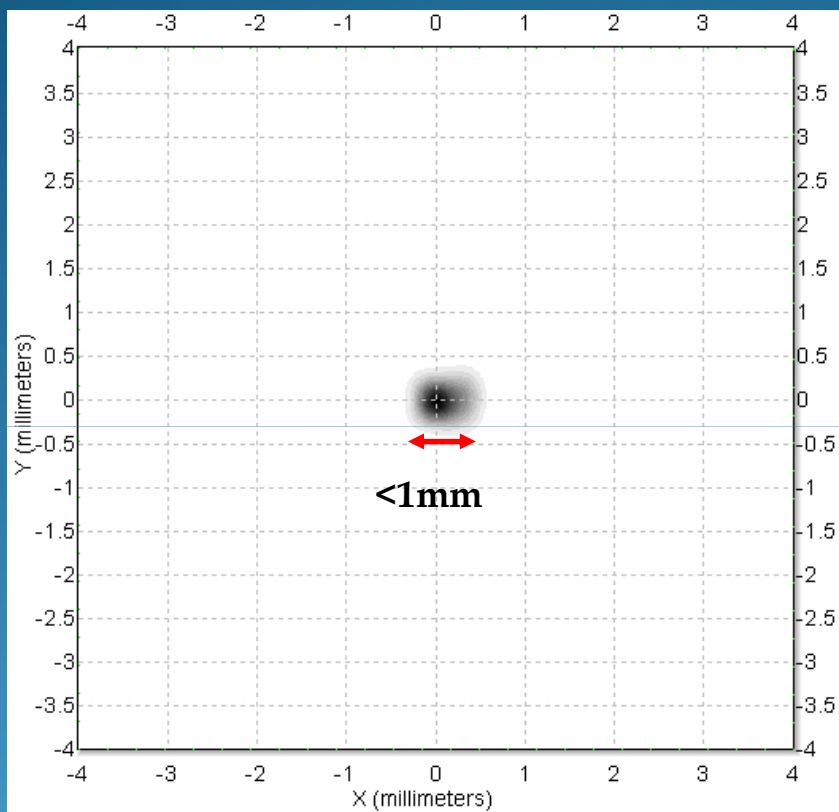


Total Internal Reflection Reflector (TIRR)

- Ray Tracing Simulation

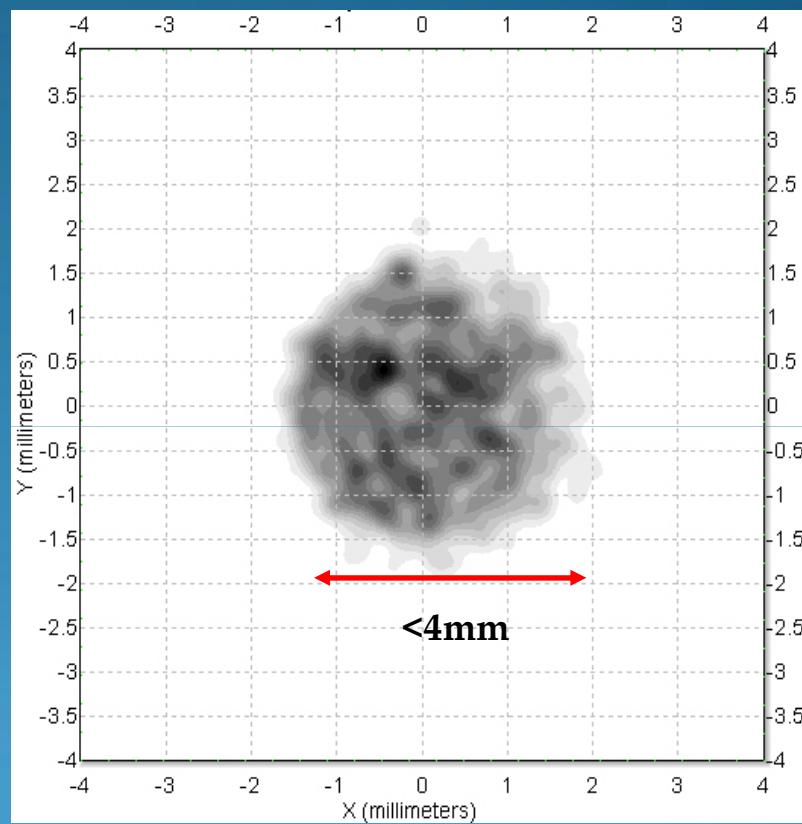


Ray Tracing Simulation Results



Geometrical Distribution

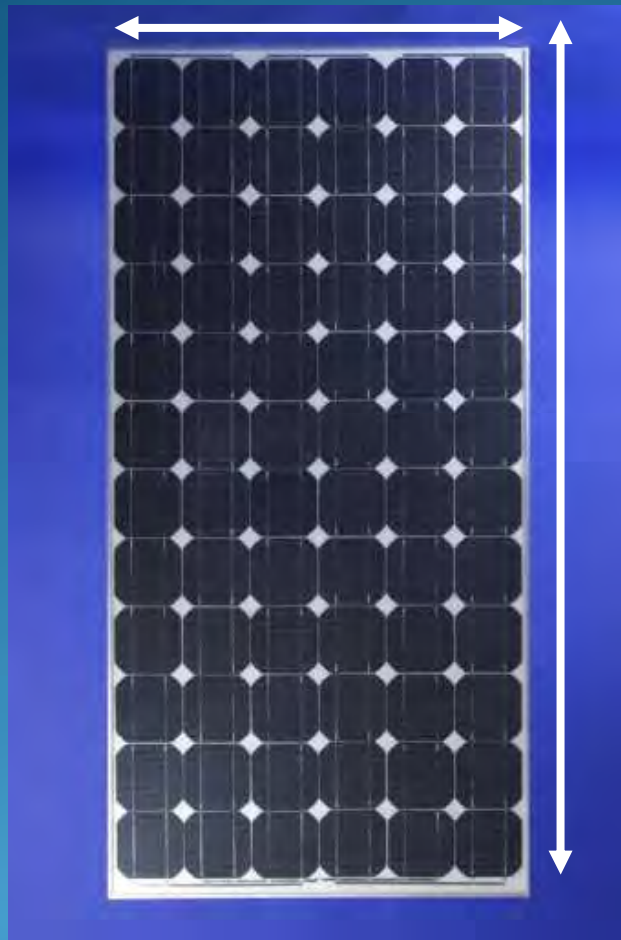
1:90.000



Solar Distribution

1:5.000

Concentrating Type PV 1:1000



60cm x 120cm

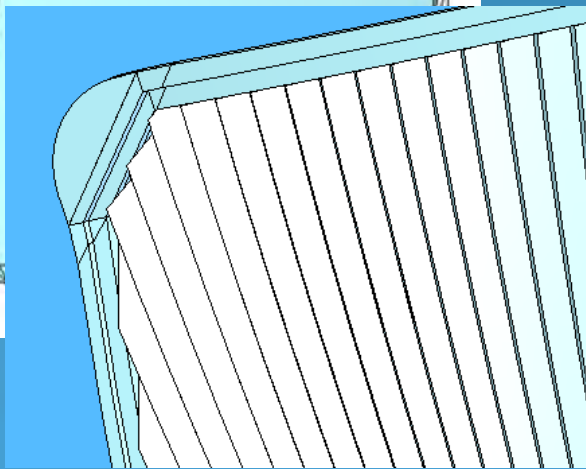
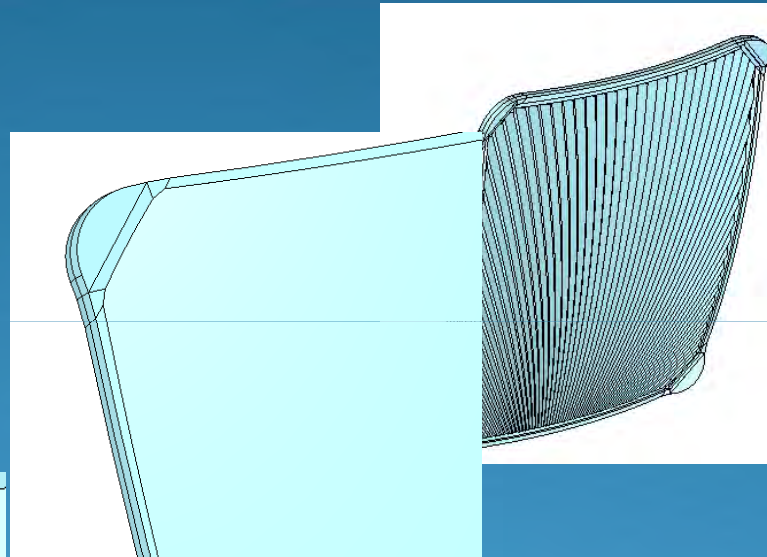
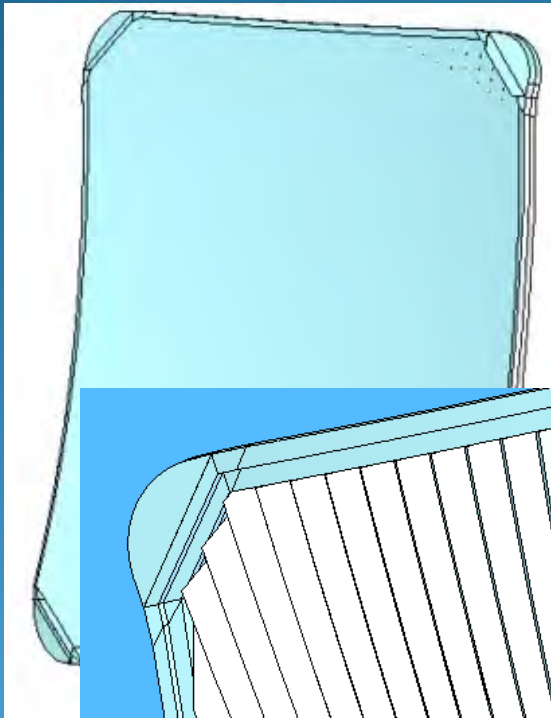
100Wp



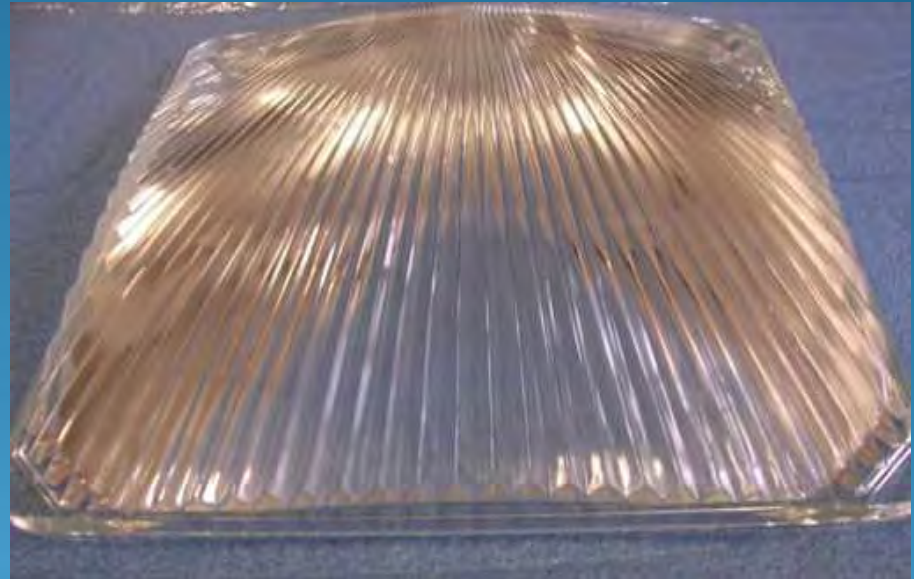
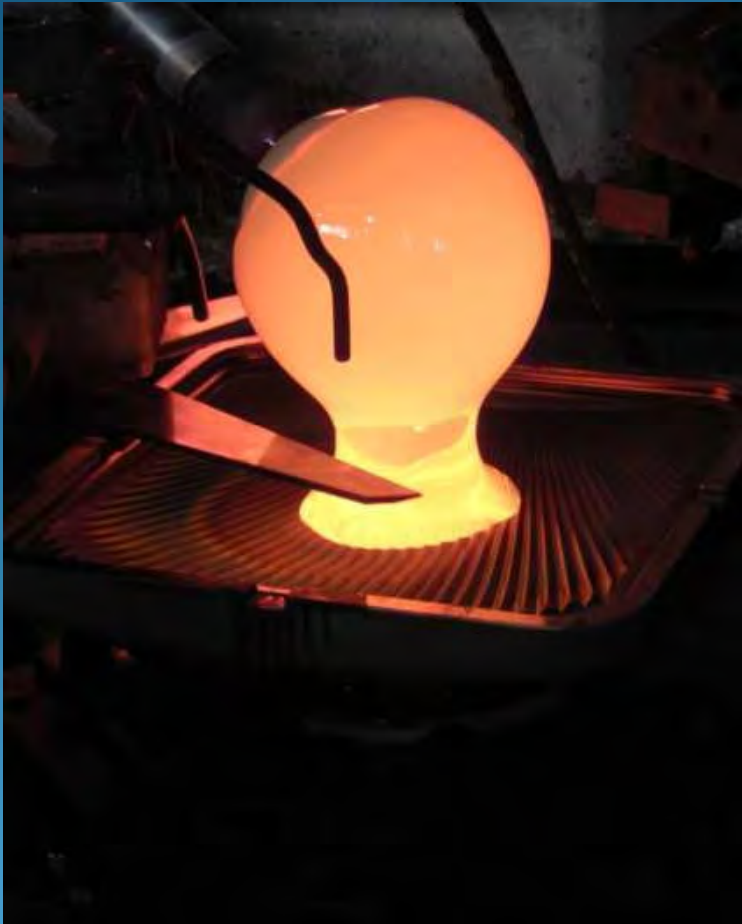
2,5cm x 2,5cm

TIRR Final Design

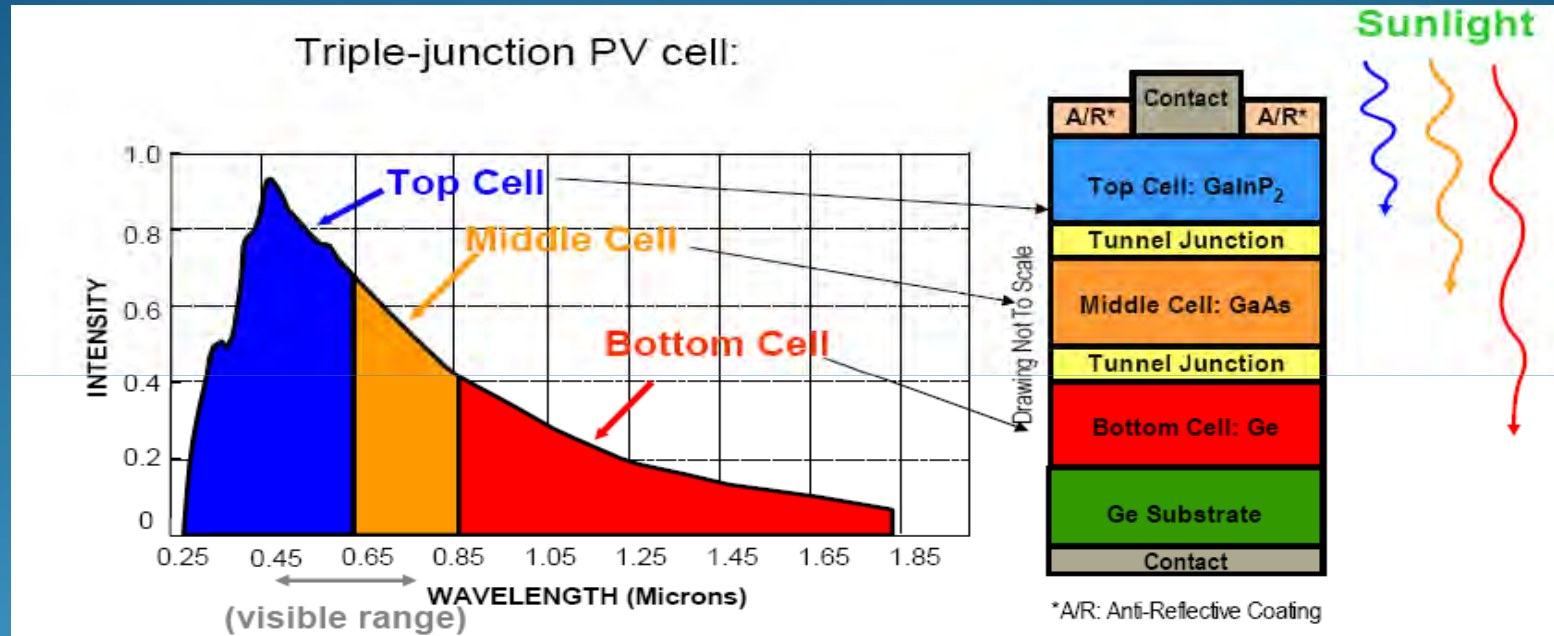
- According to Industrial Specifications



Glass TIRR in Press



High Efficiency Multi-Junction Solar Cells of Spectrolab-BOEING, Efficiency $\eta > 40\%$, with a 20 Years Warrantee

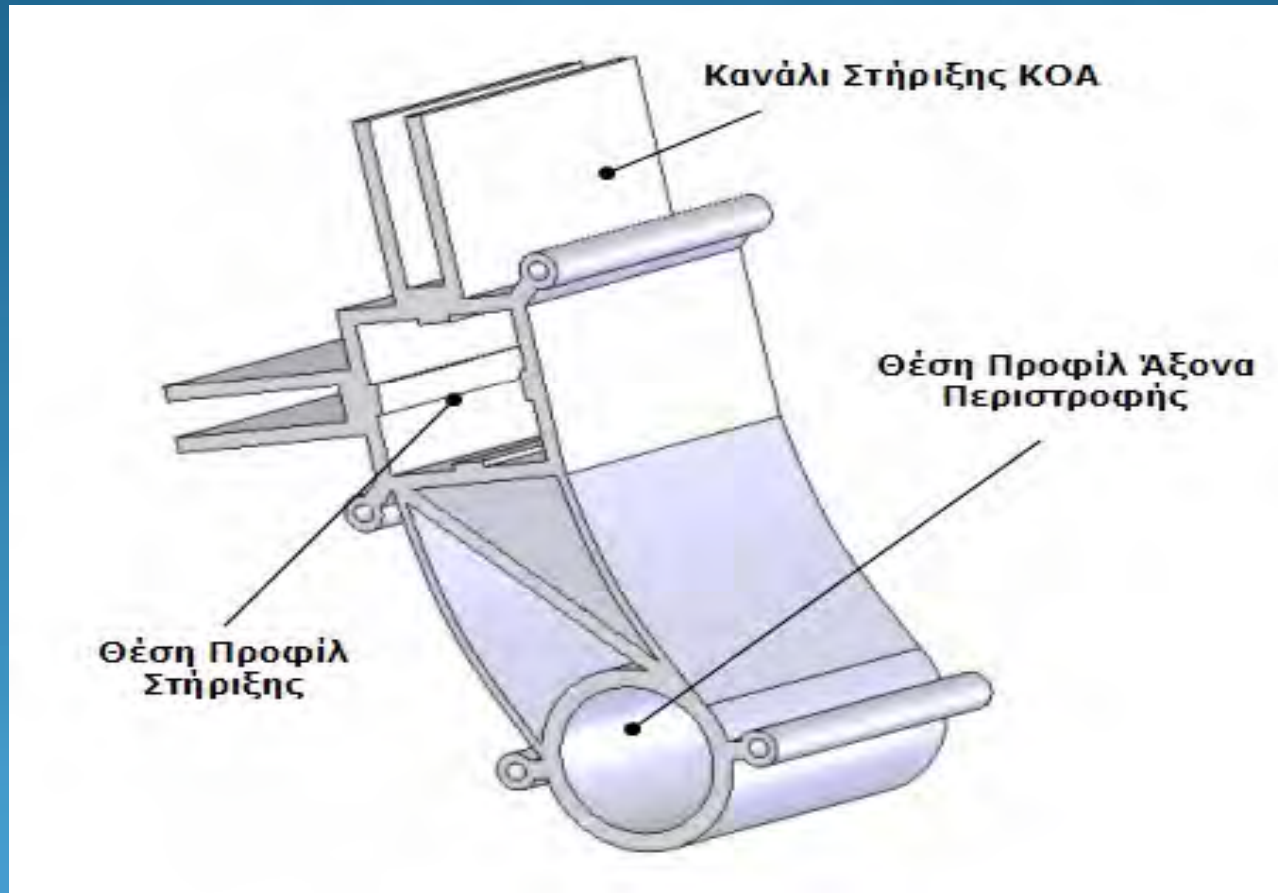


- Sandwich of materials distributes the solar spectrum to maximize performance.
- The Power is the product of the voltage on the current.
- Each junction adds voltage, the current between junctions is matched in monolithic cells.
- Presents almost half the temperature coefficient compared to conventional PV modules.
- Suitable for efficient high temperatures (80-95 degrees) operation and hot water yield.

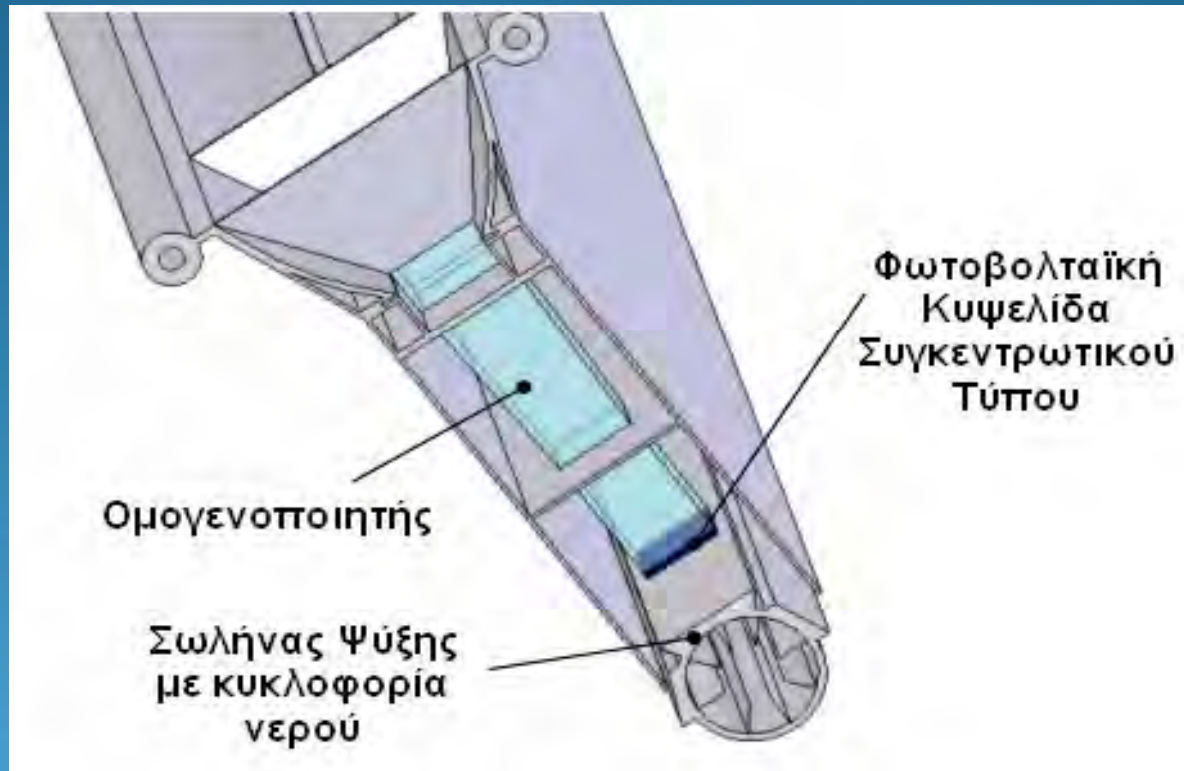
PMMA Reflector Package - Connection Profile



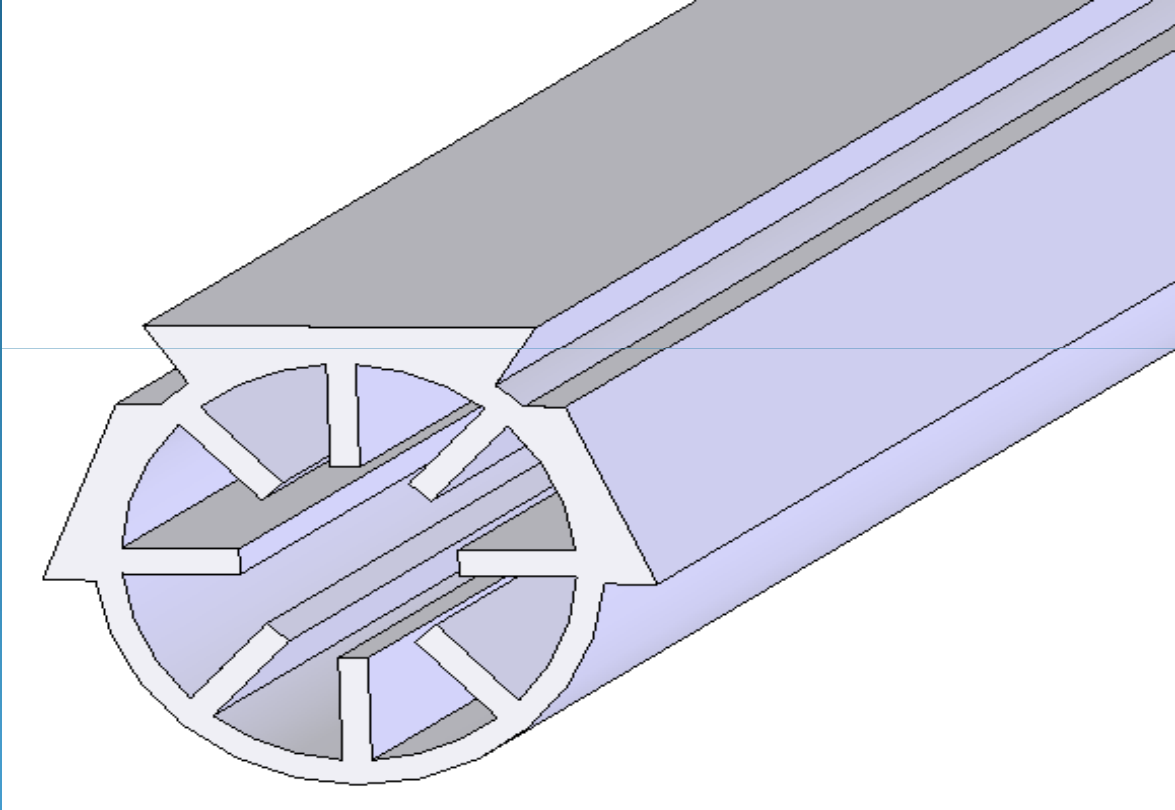
Production Design – Connection Profile



Secondary Optical System & Heat Sink Profile



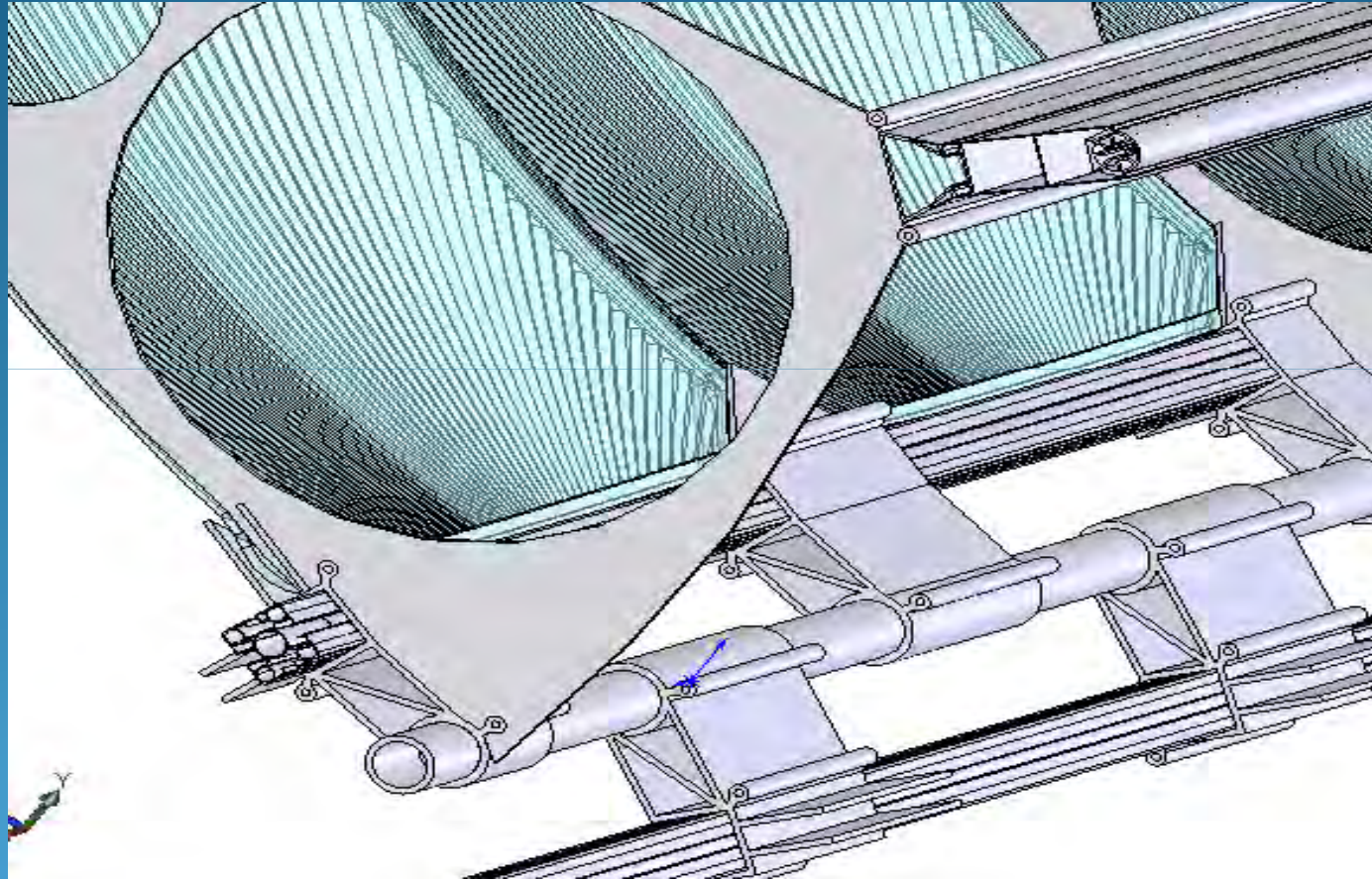
PV Shells Heat Sink Profile



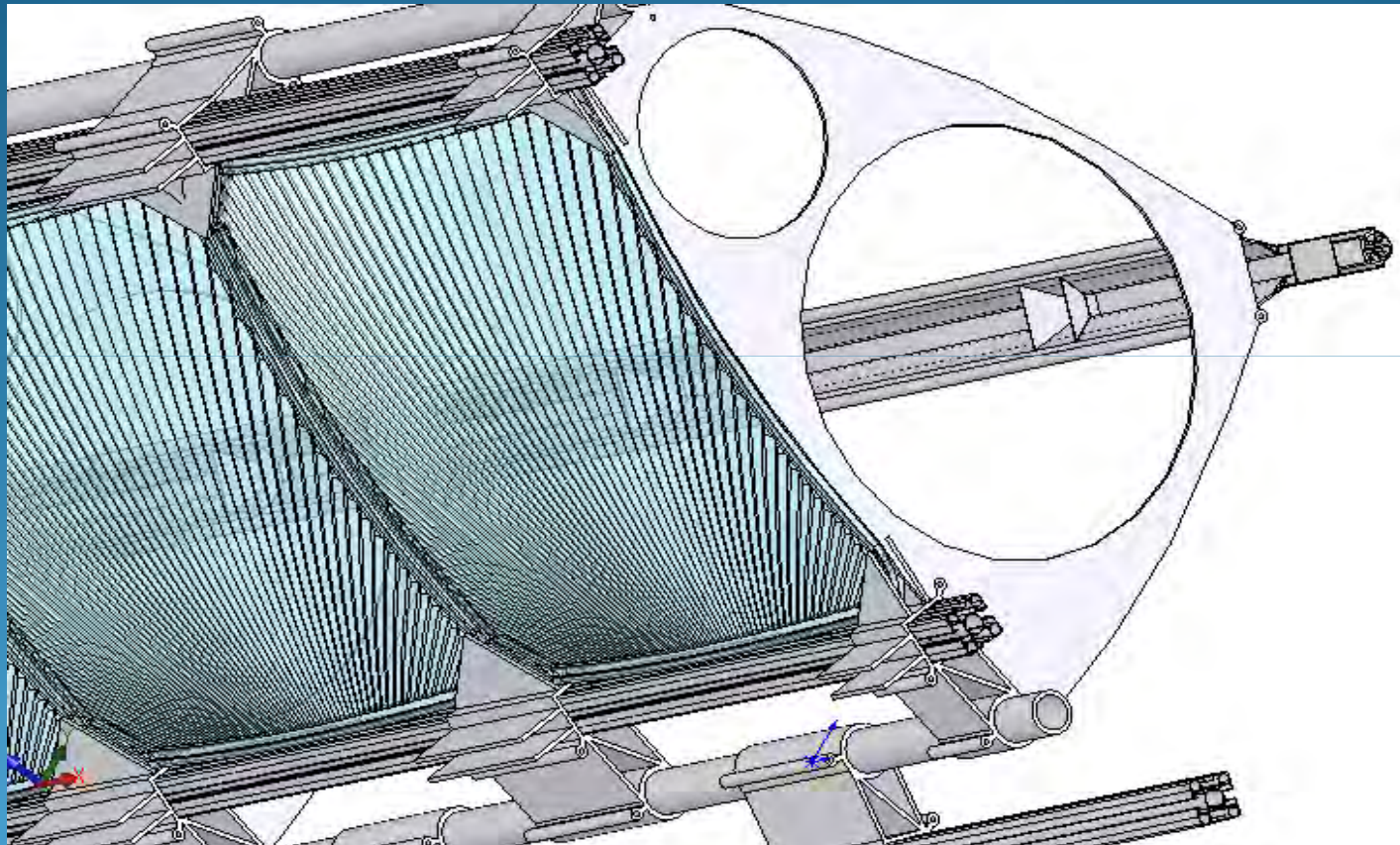
PV Heat Sink Profile (with detail in connection)



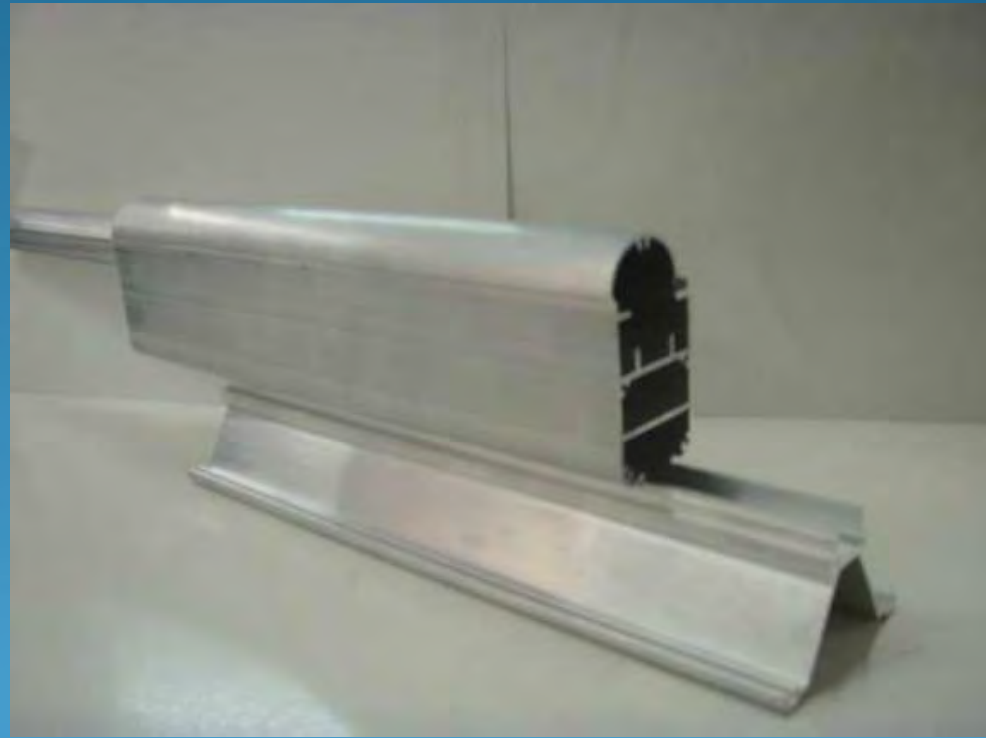
Concentrating Array (Front View)



Concentrating Array- Secondary (Rear View)



Secondary Shell Profile



Secondary Optical System



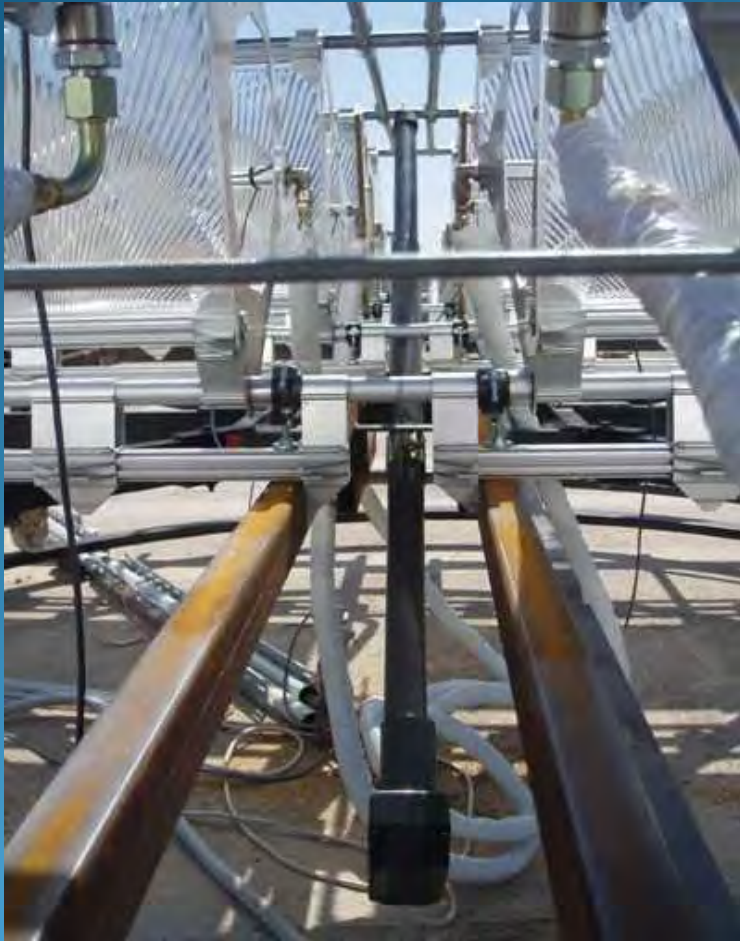
Concentrating Array (Front View)



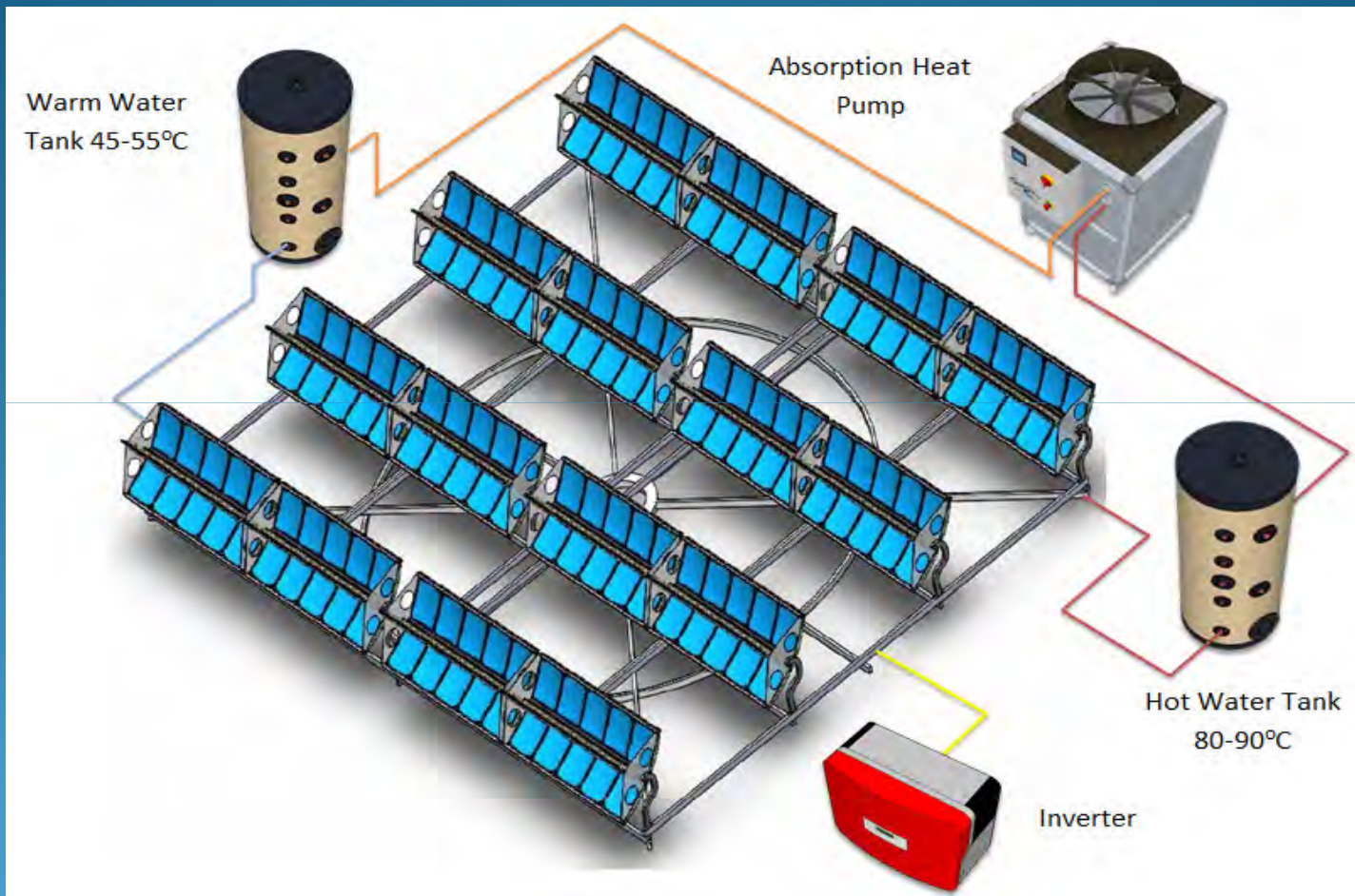
TIRR Molding for PMMA Production



SUN MONITORING MECHANISMS



PROTEAS FINAL DESIGN



HIGH POWER HEAT PUMPS FOR HOTELS



HEAT PUMPS IN COOPERATION WITH
PROTEAS SOLAR SYSTEMS
 $P > 11000\text{kW}$ WITH HIGH COEFFICIENT
OF PERFORMANCE ($\text{COP} > 1,6$)

LOW POWER COOLERS FOR RESIDENCIES



EFFICIENT HEAT PUMPS FOR RESIDENCIES
FROM 23kW IN COOPERATION WITH
SOLAR SYSTEMS WITH COP > 1,1

The image features a solid blue background with a subtle gradient. The top edge is decorated with a series of overlapping, wavy lines in various shades of blue and cyan, creating a dynamic, flowing effect. Centered in the lower half of the image is the text "THANK YOU FOR YOUR ATTENTION" in a clean, white, sans-serif font.

THANK YOU FOR YOUR ATTENTION