

DELIVERABLE D40.1

Report on Workshops

WP40 Innovation Towards Industry

1ST Reporting Period

November 2014

PROJECT GENERAL INFORMATION

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1 SOLARNET Workshops

A strong aim of this WP is the extraction of information and data from the SOLARNET consortium members as well as solar astrophysics in general, for presentation to other sectors in order to generate cross sectorial collaborations.

In order to enhance this needs extraction; three workshops will be planned and organized throughout the WP (nominally in months 15, 27, 40). The events are planned to nominally take place in Spain, Germany and the UK in order to make use of existing European network technology broker members.

The original concept of these workshops is one based on a work café methodology where invited experts from solar astrophysics and high-tech companies will share their needs and technology interests. As WP leader Tecnalía has been tasked with conducting specific marketing campaigns; targeted mailings of technology information including technical specifications and profiles of potential applications; presentations of specifically selected solar astrophysics technologies to high-tech companies through face-to-face meetings, meetings between providers and potential receivers, dedicated events, fairs, etc; as well as dissemination of technology information through other networks (in particular the EEN).

Links will be maintained or established with other networks in different sectors (medical, high energy fusion, optics.)

2 1st SOLARNET Technology Transfer Workshop

After the initial extraction and analysis of the technology Offers and Needs of the SOLARNET consortium members, WP40 highlighted the Fusion industry as a sector with strong potential for cross collaboration. Based on this analysis, the SOFT 2014 event in San Sebastian was selected as the location for the first WP40 workshop.

The [28th Symposium on Fusion Technology \(SOFT 2014\)](http://www.soft2014.eu) was held in San Sebastián, Spain, from **29th September to 3rd October 2014**. It was organised by CIEMAT, Spanish Research Centre for Energy, Environment and Technology.



The Symposium on Fusion Technology is the leading event to exchange information on design, construction and operation of fusion experiments and on the technology for present fusion machines and future power plants. With the construction of ITER well under way, fusion research is making a significant step forward. SOFT includes oral and poster presentations as well as industrial and R&D exhibitions.

Around 900 participants from all over the world attended, active in university and research laboratories and in industries. Scientists, engineers, developers, manufacturers and students used the event as an opportunity to exchange views, visions and experiences and to establish fruitful contacts.

This event was selected for a number of reasons. Firstly, it was held within the first period of the project (M18) and therefore resulted in only a slight change from the proposed workshop timetable (original plan for WS1 was M15). Secondly, the event location provided the opportunity for participation throughout the full event (not only the workshop) thereby extending the visibility of the project and providing additional opportunities for discussion outside of just the single event. Thirdly, Tecnalia also provided a stand throughout the week of SOFT 2014. This jointly presented fusion, space and astrophysics related technologies/projects to the attending participants.

2.1 SOLARNET at SOFT 2014

2.1.1 Summary of activities

- Tecnalia participated throughout the week at the Symposium on Fusion Technology International conference and trade fair focused on global fusion activities.
- The Tecnalia stand presented details of SOLARNET activities and specifically the listed technology offers and needs that had been previously compiled through interaction with project partners
- The 1st Technology Transfer Workshop was held to specifically present the SOLARNET project and discuss areas of potential collaboration between the two communities
- As a result of these activities, technology transfer specific meetings were held with Fusion 4 Energy, ESA and the European Commission representatives to discuss current and future technology transfer activities in fusion, as well as potential areas for collaboration.

2.1.2 Tecnalia stand

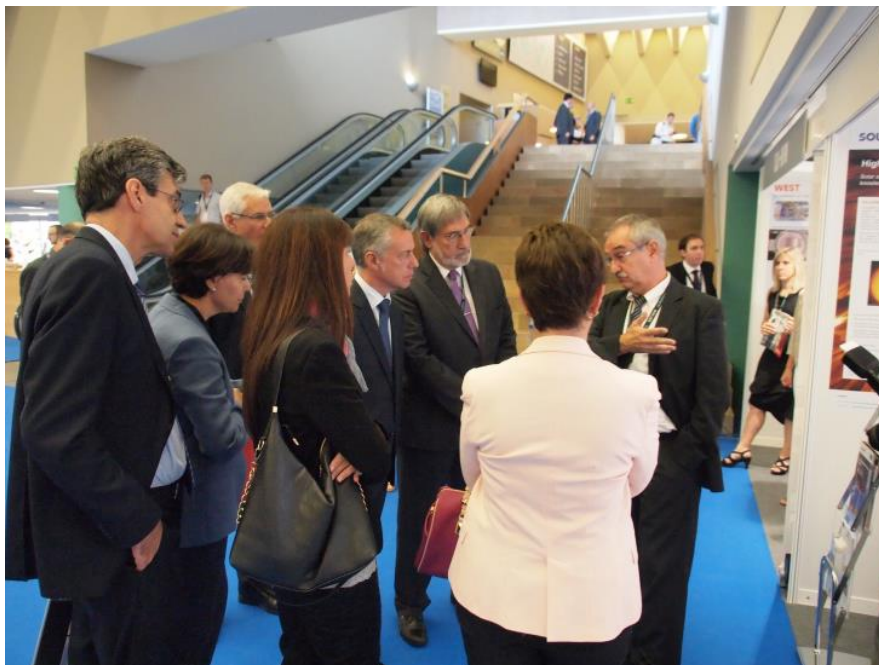
The Tecnalia stand jointly presented the involvement of the company in Big Science related programs, and more specifically fusion related activities. SOLARNET activities were presented in the form of a poster as well as a brochure listing key extracted Technology Offers and Needs.

The stand was well positioned and highly visible being located in the central area of the event – in between the main auditorium and the workshop/posters/B2B meeting rooms. Event attendees regularly visited the stand throughout the week.

In addition to the scientific, industrial and academic attendees, the stand was also achieved visibility through visits from high profile visitors. Iñigo Urkullu, Lehendakari (President of the Basque Government) attended the stand along with Javier Caceres (Ineustar) and members of the Basque Government.



Tecnalia stand showing SOLARNET promotional material (left)



Iñaki Azkarate (Tecnalia Programs Director, Energy Division) presents Tecnalia activities (including SOLARNET) to Iñigo Urkullu, Lehendakari (President of the Basque Government), Javier Caceres (Ineustar) and government delegates.

2.1.3 Poster

A poster was prepared for the event and visible throughout the week long event. Further details of the workshop were described on the poster.





High-Resolution Solar Physics Network

Solar astrophysics technologies: opportunities for the exchange of knowledge with high-tech industries

SOLARNET High Resolution Solar Physics

SOLARNET brings together and integrates the major European research infrastructures in the field of high-resolution solar physics, in order to promote their coordinated use and development. This network involves all pertinent European research institutions, infrastructures, and data repositories. Together, these represent first-class facilities. The additional participation by private companies and non-European research institutions maximizes the impact on the world-wide scale.

Networking activities, access to first-class infrastructures and joint research and development activities are covered under SOLARNET to improve, in quantity and quality, the service provided by this European community.

The consortium is led by the Instituto de Astrofísica de Canarias (IAC).



In summary, SOLARNET involves:

- More than 500 solar physics researchers.
- 32 partners from 16 countries: 24 EU research institutions; 6 EU private companies; 2 USA research institutions.
- SOLARNET Project achievements will be of paramount relevance to contribute towards the realization of the 4m European Solar Telescope (EST).

For further information :
<http://www.solarnet-east.eu/>

To register for the SOLARNET workshop, please contact a Tecnalia staff member or register online at:
<http://www.tecnalia.com/en/industry-and-transport/events/synergies-between-solar-astrophysics-and-nuclear-fusion.htm>

Innovation Towards Industry

Alongside the open access and joint research activities, one of the networking activities within SOLARNET is focused on a strategic approach to innovation, aligned with the Innovation Union initiative, to reinforce the partnership with industry by promoting the transfer of knowledge to high-technology industries.

Currently, solar physics is very dependent on high technology and robust partnerships with industry are needed to confront the large scale engineering challenges of the present and next generation telescopes and instruments. This discipline is also an excellent provider of new concepts and technologies for other fields of wide industrial and socio-economic impact.

Technology Transfer Opportunities

The SOLARNET consortium members have identified and compiled a list of technologies that are available for transfer from the solar astrophysics community for development into other industrial applications.

All interested parties are invited to contact the consortium for further details.

Similarly a list of key enabling technologies has been identified for ongoing and future solar research related projects. These technologies are essential for the further development of solar research programs.

Suitable solutions continue to be identified. The consortium invites interested technology providers to contact the Innovation WP Leader (Tecnalia) or Project Coordinator (IAC) in order to present their enabling technology.

1st SOLARNET Technology Transfer Workshop

Synergies between Solar Astrophysics and Nuclear Fusion

Thursday 2nd October 2014

09:00-13:00 SOFT 2014 – Room 4

A dedicated workshop to promote the technology transfer opportunities between solar astrophysics and fusion is available to all attendees of the SOFT 2014 conference (no fee).

- Presentation of the SOLARNET project.
- Innovation towards industry
 - Technology offers - solar astrophysics to fusion.
 - Technology requests - fusion to solar astrophysics.
- B2B meetings with SOLARNET technology brokers.

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This project is supported by the European Commission's FP7 Capacities Programme for the period April 2013 – March 2017 under the Grant Agreement number 312495




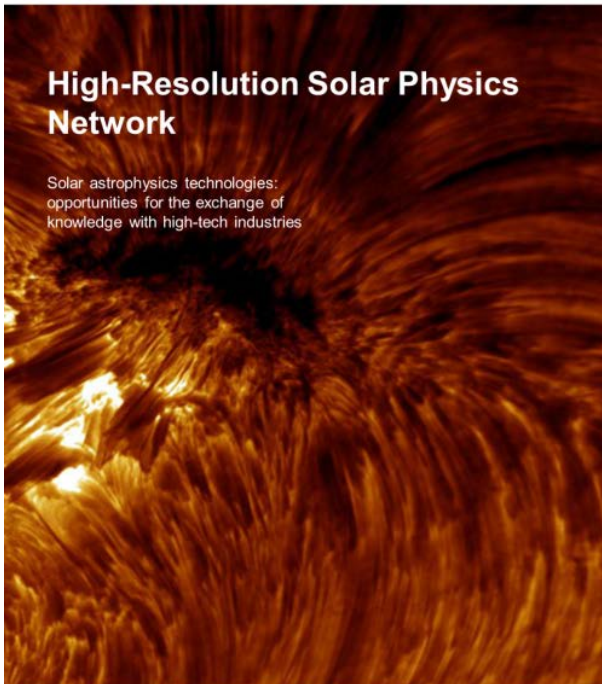
TECNALIA

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Mikaletegi Pasealekua, 2
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www.tecnalia.com

SOLARNET poster, including promotion of 1st SOLARNET Technology Transfer Workshop

2.1.4 Brochure

A SOLARNET technology brochure was prepared for the event, describing the project in general as well as the technology transfer specific activities.

High-Resolution Solar Physics Network

Solar astrophysics technologies: opportunities for the exchange of knowledge with high-tech industries

This project is supported by the European Commission's FP7 Capacities Programme for the period April 2013 – March 2017 under the Grant Agreement number 312495



SOLARNET

High Resolution Solar Physics Network

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Further project information:
<http://www.solarnet-east.eu/>

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Currently, solar physics is very dependent on high technology and robust partnerships with industry are needed to confront the large scale engineering challenges of the present and next generation telescopes and instruments. This discipline is also an excellent provider of new concepts and technologies for other fields of wide industrial and socio-economic impact.

Technology Transfer Opportunities

This document describes the collaborative opportunities available to high technology industries, as well as other infrastructures related to solar astrophysics research, through the exchange of knowledge and technologies.

The SOLARNET consortium members have identified and compiled a list of technologies that are available for transfer from the solar astrophysics community for development into other industrial applications. All interested parties are invited to contact the consortium for further details.

Similarly a list of key enabling technologies has been identified for ongoing and future solar research related projects. These technologies are essential for the further development of solar research programs.

Suitable solutions continue to be identified. The consortium invites interested technology providers to contact the Innovation WP Leader (Technalia) or Project Coordinator (IAC) in order to present their enabling technology, as well as to express their interest and/or to request further information on any of the technology requests in this document.

Cover image credit: Swedish 1-m Solar Telescope (SST) operated by the Royal Swedish Academy of Sciences (Ödbygrän Etnograf), Jan Elin Wik, Luc Rogge van der Voort.



Solar Astrophysics Technologies

The table describes a list of technologies from the SOLARNET consortium (and associated partners) that are available for development into other industrial fields. For further details, or to express an interest in any of the listed technologies, please contact the consortium representatives (see final page for contact details.)

No:	Technology Description
SO-01	Prediction-based servo-closed loop control algorithm for adaptive optics systems
SO-02	High-cadence high-spectral-resolution Fabry-Perot interferometer prototype
SO-03	Precision optics design methodology (10 ⁻⁴ positioning)
SO-04	Primary mirror with cavities for advanced cooling
SO-05	Mirror cooling system for reduction of optical aberration-perturbation
SO-06	Hexapod mechanism with integrated cooling system
SO-07	Continuous rotary mechanism with integrated optics transfer for large telescope structures
SO-08	Coating with high polarimetric performance and reflectivity
SO-09	Data control loop for multi-mirrors and their actuation mechanism
SO-10	Correlating Wave front Sensor (CWS) for image stabilisation and fine guiding
SO-11	High resolution multi-slicers
SO-12	Image acquisition and processing (synchronisation at microsecond level)
SO-13	CCD sensors
SO-14	Method for optical design with polarimetry compensation.

Requests for enabling technologies

The SOLARNET consortium members have also identified a list of essential technology requirements for ongoing and future solar research programs. The requests represent an opportunity for interested parties to offer enabling technologies to the solar astrophysics community.

No:	Technology Request Description
SN-01	Multi-micro actuator network
SN-02	Primary mirror: Novel high stability material
SN-03	Radiative-convective thermal analysis
SN-04	Large structure rotation stabilisation (including optical part)
SN-05	Integration of multiple actuators for adaptive optics
SN-06	Solutions for manufacturing and mounting large (200mm diameter, 7kg) etalon glass mirror to required precision
SN-07	Micro-machining of micro-lenses
SN-08	Thin image slicer (30 microns) for 2D spectroscopy
SN-09	Visible and near-infrared detectors capable of integrating multi-image signals on-chip
SN-10	Ferroelectric liquid crystal for optical and near-infrared polarimetry
SN-15	IR detector - close to visible range (2,5 µm)
SN-17	Neural network for fast data processing
SN-18	Big data signal management and video data compression solution without degradation or data perturbation losses
SN-19	Common data base for standardisation of big data processing and management

SOLARNET Consortium Members

Instituto de Astrofísica de Canarias	Spain	University of Graz	Austria
Kiepenheuer-Institut für Sonnenphysik	Germany	Astronomical Institute University of Wrocław	Poland
Istituto Nazionale di Astrofisica	Italy	Università di Calabria	Italy
Centre National de la Recherche Scientifique	France	Universität Wuppertal	The Netherlands
Università degli Studi di Roma Tor Vergata	Italy	Istituto Ricerche Solari Locarno	Switzerland
Utrecht University	The Netherlands	Consejo Superior de Investigaciones Científicas - Instituto de Astrofísica de Andalucía	Spain
Max-Planck-Gesellschaft	Germany	CNR - Istituto Nazionale di Ottica	Italy
Universität Oslo	Norway	University of Birmingham	United Kingdom
Leibniz Institute for Astrophysics	Germany	HANKOM-Engineering	The Netherlands
Kungliga Vetenskapsakademien	Sweden	Centre International de Méthodes Numériques en Ingénierie	Spain
Université de Paul Sabatier (Toulouse III)	France	S.R.S. Engineering Design S.r.l.	Italy
Queens University Belfast	United Kingdom	Grao Telescopio de Canarias, S.A.	Spain
University College London - MSSL	United Kingdom	PhSensor, GmbH	Germany
Astronomical Institute of the Slovak Academy of Sciences	Slovakia	Wright Optics	France
Astronomický ústav ASCR v.ř.	Czech Republic	Tecnalia Research and Innovation	Spain
Hvar Observatory	Croatia	National Solar Observatory	USA
Royal Observatory of Belgium	Belgium	Harvard Smithsonian Center for Astrophysics	USA

Contact and Further Information

For information related to the technology opportunities and requests, as well as all future listings, please contact the Innovation Towards Industry WP Leader:

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Prepared on behalf of the SOLARNET consortium by TECNALIA RESEARCH AND INNOVATION



SOLARNET brochure, with Technology Offer and Needs listings.

Further details of SOLARNET were also available in the Tecnalia Big Science catalogue:

<http://www.tecnalia.com/images/stories/Catalogos/catalogo-Big-Science-EN.pdf>

2.2 1st Technology Transfer Workshop

2.2.1 Event Promotion

The workshop was promoted in the months preceding the event and was specifically aimed at the attendees of the Fusion conference. The following links detail the event and registration details:

http://www.soft2014.eu/satellite_meetings.html

<http://www.soft2014.eu/img/Satellites.pdf>

<http://www.tecnalia.com/images/stories/Eventos/1st%20SOLARNET%20technology%20transfer%20workshop%202%20Oct%202014.pdf>

<http://www.tecnalia.com/en/industry-and-transport/events/synergies-between-solar-astrophysics-and-nuclear-fusion.htm>

In addition the workshop was promoted by the conference organizers throughout the SOFT 2014 event.

2.2.2 Workshop Agenda

The final workshop agenda was as follows:

- 09:00-09:15 Welcome
- 09:15-10:00 SOLARNET project overview – R. Seddon (Tecnalia)
- 10:00-10:15 Space Solutions – ESA TTN – J. Marcos (Tecnalia)
- 10:15-13:00 B2B meeting session (including EST and Gregor promotional videos)

The workshop was an open door session event to all interested parties from those attending the fusion conference. The SOLARNET project was first presented in detail including technology offer and need descriptions, as follows:

- Introduction
- SOLARNET project
 - European Solar Telescope
 - GREGOR telescope
- Innovation towards industry
 - Technology transfer to and from astrophysics
 - Assessment of technology portfolio
 - Suitable industries for transfer opportunities
- European Transfer Networks
 - ESA Technology Transfer Network
 - FUTTA: Fusion Technology Transfer Action
- Opportunities between high tech industries

A presentation of the activities related to technology transfer was also included in the workshop. This served to reinforce the involvement of ESA in the Round Table event on Tuesday 30th September in which the model of the ESA Technology Transfer Program was described to the Fusion community.

The round table Technology Transfer and Collaboration Models between labs and industry was chaired by Tony Donn , EUROfusion Programme Manager with the involvement of:

- Ansaldo Nucleare, Roberto Adinolfi, CEO
- Elytt Energy, Julio Lucas, Co-founder and Scientific Director,
- F4E, Victor Saez, Group Leader- Market Policies, Analysis and Reporting
- IO, Sergio Orlandi, ITER Project Department ,Chief Engineer
- ESA, Lluc D az, Technology Transfer Officer
- W7-X, Stephan Bosch, Director W7-X Operations

Tecnal a discussed collaboration between different EU technology transfer initiatives (ESA TTN – Space technologies, FUTTA – Fusion, SOLARNET – Solar Astrophysics).

The session then closed with an invite for B2B meetings with the attendees of the workshop. During the B2B session, the promotional videos of both the GREGOR and EST telescopes were shown (with permission from IAC).

The videos were well received and served to reinforce the technology descriptions provided in the earlier presentation.

The event was reasonably well attended with delegates from the US, Europe, Japan and China in attendance.

2.2.3 Workshop B2B Meetings

Through the workshop B2B session, as well as participation at the conference and trade fair events, Tecnal a was able to organize a number of meetings with key actors in the Fusion industry, and more particularly in the area of Technology Transfer.

Across the whole event it was clear that in general there is currently *a relatively low level of interest towards tech transfer in the Fusion industry*. The main focus for the majority of the companies and institutes involved is on the development of the ITER and other experimental systems. Technology transfer is seen as an interesting (but not currently critical) side development.

Tecnal a was able to speak with the following representatives with regards to fusion related technology transfer activities. SOLARNET activities were presented in all cases and agreements were made for further discussions for collaboration activities between the two sectors.

Key meetings were held with the following:

- Simon WEBSTER DG RTD – Head of Unit K6
- Chris Ibbott – EC – JRC (Brussels)
- Lander Gonzalez Larrea – Scientifica
- Victor Saez, F4E, Group Leader- Market Policies, Analysis and Reporting
- Lluc Díaz, ESA, Technology Transfer Officer (FUTTA Program Officer)

ESA and F4E are trying to create critical mass through technology offer extraction (and are going through a similar process to SOLARNET at this moment).

Tecnalia presented the details of SOLARNET to ESA, F4E, JRC and DG RTD (Simon WEBSTER – Head of Unit K6) to generate interest in collaboration between sectors. There was considerable interest due to the potential for increasing critical mass between the studies and Tecnalia will continue to liaise with ESA, as well as the UK and German fusion brokers, for further exchange of data.

Following the workshop, Tecnalia has held discussions with the UK broker for FUTTA, and will discuss both fusion and solar astrophysics in greater detail with the UK STFC's Astronomy Technology Centre in Edinburgh as well as RAL Space's Solar Physics Group in Harwell. They have developed a large array of different technologies & instruments for astrophysics applications and are more closely linked with technology transfer programs and can therefore offer recommendations for development steps.

It is also hoped that further discussions with workshop attendees from the USA, including Princeton Plasma Physics Laboratory - <http://www.pppl.gov/>, will help to develop further links to transfer activities in the US.

2.2.4 European Fusion Transfer Initiatives

Following the discussions with F4E, DG RTD, ESA and JRC, the following information was made available with regards to the current fusion technology transfer program.

The Fusion Industry Innovation Forum (FIIF) has made comments and recommendations on the EU fusion programme with regards to transfer initiatives. They state that the attainment of the goal of fusion power is an exciting and stimulating challenge. Along the way many of the leading-edge technologies involved will be pushed to new limits and in many cases the innovative solutions to the challenging problems will find applications far beyond the bounds of fusion.

Due to the expected long time-to-maturity of the development of the fusion power plant technologies and the related systems know-how, *an early capitalization of the results of fusion energy research and development needs to focus on spin-offs to other domains than fusion energy*. This already occurs at a national level but could be expanded and become more visible if a coordinated European approach is taken. Only in a somewhat later stage the know-how transfer to potential prime contractors of commercial fusion power plants and service providers would become relevant.

Accordingly, a technology transfer roadmap shall comprise both near and long term activities:

- a phase focusing on the identification of spin-off opportunities and the corresponding technology transfer to SMEs and other interested entities
- and a phase fostering the transfer of technology and systems engineering knowhow to potential power plant builders

The Forum performed case studies of the technology transfer activities of CERN, KIT and ESA and considered that the general approach of these organizations should be considered in the fusion programme organized mainly through the establishment of a Technology Transfer Programme Office (TTPO) supported by the Community but also drawing on the many European and national funding opportunities available for technology transfer and spin-off generation. The mission for such a TTPO would be:

- Analyse processes, tools, best practices and lessons learnt of existing international transfer initiatives
- Contact national spin-off generation initiatives and repeat the a.m. step, as far as is possible
- Taking the results of the a.m. two steps into account, establish, both w.r.t. processes and tools, the details of an EU-driven Technology Transfer Programme such that the national initiatives are incorporated in a most efficient (win-win) way
- Contact potential technology brokerage companies and establish a Europe wide Technology Brokerage Network (TBN)
- Implement a Europe-wide accessible web-based Technology Marketplace
- Seek entrepreneurs with innovative ideas for using fusion energy technology, applications and services in domains other than fusion energy
- Implement a Business acceleration Incubation Centre providing technological, financial and legal advice to start-up companies
- Implement a seed money funding scheme
- Enable technology transfer with existing knowledge in existing companies
- Once means and processes are established, supervise its proper operation, perform industrial information events and implement a continuous improvement programme w.r.t. the spin-off generation systems

The funding framework should take benefit of all the funding resources and bodies that the Fusion Program has access to in order to create a suitable amount of resources that will ensure a stable running and outstanding performance of the Technology Transfer Program. This should include funding from the CSA program, the CIP program, interested venture capitalist, corporate venture funds, and the returns of the Technology Transfer program itself.

Once the feasibility of exploitation of fusion energy has been adequately assessed through the successful mission of ITER and an advanced stage in the detailed design of a demonstration electricity generating fusion power plant, specific technologies including know-how concerning the overall system engineering, the system design for remote handling, RAMS- and FDIR, the design and manufacturing of subsystems and equipment, and the transfer of know-how w.r.t. operational processes should be transferred from research to power plant industry, both primes and subcontractors.

This implies capturing:

- complete spectrum of knowledge generated from ITER and other
- demonstrators that is required by industry to build fusion power plants
- a format suitable for its transfer into industrial processes

More specifically this means that a knowledge management process should be initiated, coordinated and managed by the TTPO using project management orientated tools to guarantee the maximum knowledge return and storage from ITER and other projects.

Based on the above analysis and conclusions the Forum made the following recommendations for the near and long term fusion technology transfer actions:

Near term

- Launch a pilot project (Coordination and support action with minimum of 3 years duration) to set up the organisation and management requirements for a EU Fusion TTPO that will enable and incentivise technology transfer from the fusion programme to industry and to the market. This pilot project should have the following deliverables:
 - Provide three TT success stories from fusion IPR assets
 - Provide a web based fusion technology market place;
 - Provide a best practice guide to technology transfer and spin off generation
 - Provide the necessary infrastructure for effective and efficient TT and
 - Spin off (e.g. technology broker network, incubator network, funding network, legal framework)

Long term:

The output from the pilot project should then be embedded in the instrument that will provide the basis for the fusion power plant conceptual design activities managing:

- The Professional technology transfer from ITER with complete documentation management and transfer provided for industry involved in Power Plant activities
- Technology Transfer and spin off from the fusion Power Plant design and development activities to all industry
- Technology Transfer and spin off generation from the general fusion research programme to all industry
- Annual Indicators for the performance of the TTPO should be: Number of marketable technologies and possible application field, number of patents/copyright/knowhow licensed, number of successful agreements, no of spin-offs created, return on investment.

This provides considerable scope for cross sector collaboration as it is clear that the two industries are at a similar point for development of transfer activities. To develop this transfer, Tecnalia has requested the initial findings of the technology extraction through the FUTTA initiative. Similarly, Tecnalia can offer the technology offer and needs profiles generated through SOLARNET to enhance the cross collaboration.

The Fusion Technology Transfer Action (FUTTA) pilot project set up for the near term incentivisation of technology transfer from the fusion industry has the following goals:

- To increase the amount of Technology Transfer from Euratom fusion programme to industry and society in general.
- To capture and record as well as publicize the new successes of Technology Transfers of Euratom fusion technology developments that have been created as a consequence of the proposed activity.
- To increase technology transfer in both directions between fusion and space entities.

In the UK the approach has been to establish contacts with the following entities:

- Joint European Torus (JET)
- Culham Centre for Fusion Energy (CCFE)

The UK targets at the end of contact are the following:

- Technology Descriptions in the EEN-BBS format
- Mediations completed (or near completion)
- Success Stories

Similarly in Germany, the fusion broker has contacted, the following, with the similar output aims of technology descriptions, mediations and success stories:

- Max Planck Institut for Plasmaphysik
- Karlsruhe Institut of Technology
- Forschungszentrum Julich

The initiative is currently compiling a database of technology offers that will shortly be made available for analysis to the SOLARNET consortium.

3 Summary

- Individual B2B meetings to establish specific technology transfer interest with specific companies were not as successful as hoped.
- This was mainly because in general, the fusion industry in Europe is focused on prime contracts and less so on spin off of developed technologies.
- Individual companies are not, in general, currently focused on the spin out of fusion related activities unless this process already occurs within their company or through other European incentives.
- A clear message was stated at the Round Table Technology Transfer and Collaboration Models between labs and industry event at the SOFT conference, in which the companies supplying technologies to the fusion industry stated that their current, and most urgent focus, is on the development and supply of the core technologies. Transfer, or spin-out activities, to other sectors is seen as an added “luxury” that many are unable to consider.
- Tecnia therefore spoke directly with the leading actors in the fusion transfer initiative to discuss collaboration directly with those promoting transfer in their industry.
- The Fusion Industry Innovation Forum has defined a clear set of targets for the development of technology transfer actions in order to better justify the short and medium term justification of the large scale fusion projects.
- Tecnia is in discussion with the FUTTA coordinator and also the UK and German brokers (of the pilot project) to establish a transfer of data and to establish cross collaboration between the two initiatives (SOLARNET and FUTTA).
- This collaboration appears to be the most useful route for the short term development of cross collaborations, due to the previously stated general low interest/budget currently invested in fusion technology transfer.
- Tecnia hopes that the development of cross sector interest at this key stage will help to position the astrophysics community alongside the fusion sector for future technology transfer developments.
- If successful, the FUTTA pilot will be expanded in the future and it is hoped that the establishment of a strong link between astrophysics and fusion related transfer activities over the coming 6 months, will help to prepare a base for further collaborations in the near future.



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4 ANNEX

- Examples of Fusion related technologies developed alongside space technology programs

4.1 Examples of Fusion related technologies developed alongside space technology programs

4.1.1 TNO, The Netherlands

The Annex provides several brief descriptions of technology transfers that have taken place within TNO, in which fusion related technologies have been developed alongside, or based on knowledge developed through, space technology programs.

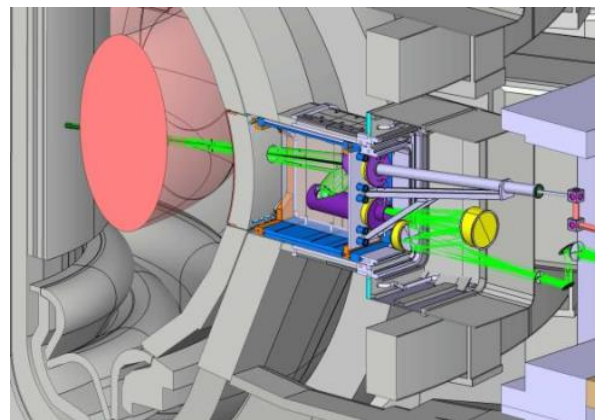


CXRS Spectrometer

ITER (2010 – current)

USP: optics instrumentation

Unique 3-band spectrometry for plasma profiling

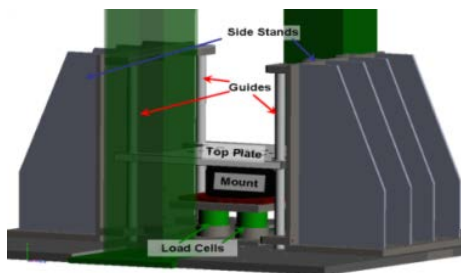


Lidar system

ITER (2010 – current)

USP: optics instrumentation

Measuring particles at half the speed of light over a light path of 30 m

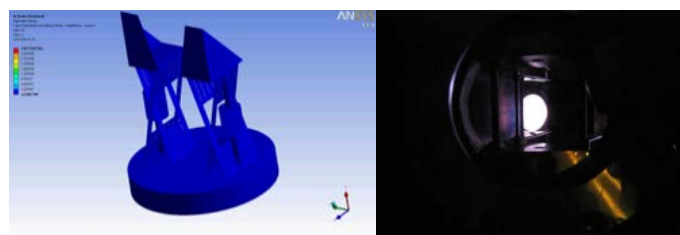


Structural integrity testing

ITER (- 2010 – current)

High pressure testing

Unique testing facility

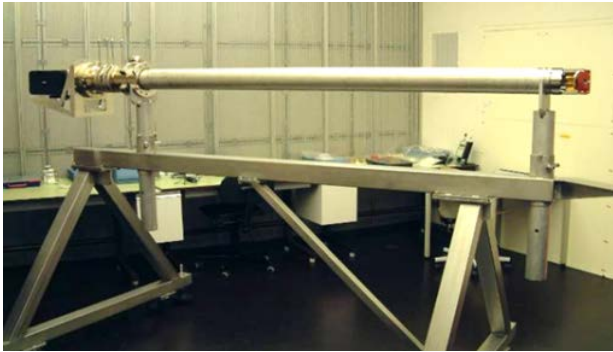


Cleaning system & shutter

ITER diagnostics (2010 – current)

USP: plasma cleaning, precision mechanics

Increasing lifetime from days to tens of years



Endoscope (wall temperature)

JET (in use), W7X (10x) and ITER (2006)

USP: optics instrumentation

High resolution monitoring of the inside of 100 M°C Tokamak

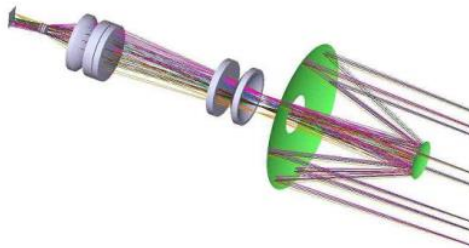


Plasma facing mirror

ITER (2009)

USP: optics manufacturing

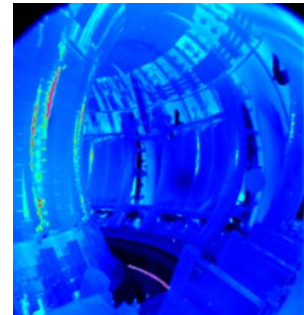
World's first concave single crystal Mo mirror



JET Endoscope

JET (No date)

Opto-mechanical design



Thermal image of reactor wall during operation
(note that the plasma (~1080 °C) is invisible)