



Skills

- Formal education. **PhD** in Plasma Physics and Nuclear Fusion and Ms Eng. **Industrial Engineer**.
- **English** (CAE, U. of Cambridge, advanced), **French** (TCF European B1, intermediate), **Chinese** (elementary), Spanish and Catalan (Mother tongues).
- Ability to work in multinational multidisciplinary teams.
- Prodigious **creativity** and future insight (6 patents and many successful commercial designs).
- Remarkable capability for **systems integration** (~ broad activities developed during 20 years).
- **Practical abilities**: Assembling, tests, urgent repair, maintenance, quick improvements.
- **High productivity** in the production and design of real devices, of technical reports and conceptual designs.
- **Expertise in starting-up** electromechanical facilities.
- **Long experience in programming**. **Java**: stellarator calculation (thousands of code lines). **VBasic** and Basic (youth hobby). **PLC programming** (3 brands). Some experience in **C** and **html**.
- **CAD**: long experience in **AutoCAD** and **CATIA**. VBasic automation of both. Thousands of files of pieces, structures, layouts and patents developed.
- Knowledge of **ANSYS**, Code_ASTER and GMSH (Finite elements packages).
- Basic knowledge of **MCNPX** and **ACAB** (neutronics calculations).
- Proficient in Excel, Word, good at Access, MathCad, PowerPoint and FrontPage.
- Windows, LINUX, Photo-editing, Internet tools, configuration, other tools.

Summary of working periods and results

| | <i>Main results</i> | <i>Date</i> |
|---|---|--|
| National Fusion Laboratory, CIEMAT, as 'Técnico Superior Especialista' of Public Research Centres. Madrid, Spain | Research on high performance 3D-printed stellarators Production of 29 reports mainly for IFMIF, ITER, DEMO (Total ~1500 high quality report pages) 19 publications in international peer-reviewed journals Remote Handling (RH) in CIEMAT has been boosted: Application to calls, participation in projects and programmes, divulgation-presentations, coordination, etc. | July 2007 - Now (From March 2012 to Feb. 2014 on <i>leave of absence</i>) |
| Vying Fusion Energy® (Own Personal Laboratory) Spain (See p. 11) | Design, construction and operation of UST_1, the 3 rd modular stellarator in the world Design and construction of UST_2 (ongoing) by 3Dprinting Development of CASTELL code to design stellarators Generation of international impact: A scaled UST_1 stellarator, the SCR-1, has been built in the 'IT Costa Rica' Seven patents applied. Several talks and seminars given | Dec 2004 - June 2007 March 2012-2014 |
| Freelancer period, R&D and construction of automatic devices Spain (See p. 12) | Design, prototype improvement, installation and start-up of innovative automatic electromechanical machinery, two of them unique in the world and of great success, patented. One patent sold. Important contribution to the exponential growth of one client/company (x 10 times from 1996-2001) Development and successful application of an electronic photofinisher used in many cycling races (in Spain, others) | Feb 1994 - June 2007 (Low workload from Jan. 2002 due to other activities) |

R&D activities in Nuclear Fusion

A) National Fusion Laboratory, CIEMAT, Madrid, Spain

‘Técnico Superior Especialista’ of Public Research Centres

July 2007 - Now
(on leave of absence from March 2012 to Feb. 2014)

Duties:

- 1st **Design and coordination of the Remote Handling System for IFMIF** (International Fusion Materials Irradiation Facility).
- 2nd **Coordination** of all the RH tasks in CIEMAT.
- 3rd Development of **ITER and DEMO** RH projects.
- 4th **Participation in national RH projects** (Technofusión, University projects, etc.). **Boosting** national fusion RH projects.

Main results:

1. Design of the RH system for the Test Facilities of **IFMIF** (*796 pages report*), satisfactorily review by four of the most relevant RH experts in the world, Ref. BA_D_228GVQ.
2. Production of the definition of the Equipment and Components for the ‘Transfer Cask System RH Test Facility’ for **ITER**, Ref. F4E-2008-GRT-016 (MS-RH).
3. Development of a feasibility assessment of in-vessel component connections for RH, for **DEMO**, Ref. TA WP11-DAS-RH-04-CIEMAT
4. **9 publications** in international peer-reviewed journals.

1. Journal publications (Peer reviewed. ▪ Proceedings)

V. Queral, E. Rincón, V. Mirones, L. Rios, S. Cabrera, Dimensional accuracy of additively manufactured structures for modular coil windings of stellarators, *Fusion Engineering and Design*, In Press, DOI: 10.1016/j.fusengdes.2016.12.014, 2016.

V. Queral, Design, construction and validation of the UST_1 modular stellarator, *Fusion Engineering and Design* 112 (2016) 410-417.

Garrido, S. Coda, H. B. Le, J.M. Moret, **V. Queral**, G. Sevillano, A.J. Garrido, Hierarchical Model Predictive Control in Fusion Reactors, *Proceedings of the 2016 World Automation Congress (WAC)* 31 July-4 Aug. 2016 (2016) DOI, 10.1109/WAC.2016.7583003.

A. J. Garrido, I. Garrido, **V. Queral**, J. Romero, Control-oriented Models for Plasma Magnetic Confinement Coils, *Proceedings of IEEE International Conference on Mechatronics and Automation* (2015) 618-624.

▪ **V. Queral**, Generic configuration stellarator based on several concentric Fourier windings, Arxiv.org, arXiv:1601.02908 [physics.plasm-ph]. En proceso de publicación en revista revisada.

J. Knaster, A. Ibarra, J. Abal, ..., **V. Queral**, et al., The accomplishment of the Engineering Design Activities of IFMIF/EVEDA: The European–Japanese project towards a Li(d,xn) fusion relevant neutron source, *Nuclear Fusion* **55** 086003 (30pp), 2015.

Oliver Crofts, Antony Loving, Daniel Iglesias, Matti Coleman, Mikko Siuko, Martin Mittwollen, **Vicente Queral**, Alberto Vale, Eric Villedieu, Overview of progress on the European DEMO remote maintenance strategy, *Fusion Engineering and Design*, 109–111 (2016) 1392–1398.

V. Queral, 3D-printed fusion components concepts and validation for the UST_2 stellarator, *Fusion Engineering and Design* **96–97** 343–347, 2015.

▪ **V. Queral**, ‘Construction concepts and validation of the 3D printed UST_2 modular stellarator’, *Journal of Physics: Conference Series*, **591** 012015, (Open Access) 2015.

V. Queral, ‘Concept, production and validation of a 3D-printed coil frame for the UST_2 modular stellarator’, *Fusion Engineering and Design* **89** 2145–2149, 2014.

V. Queral, Coil fabrication of the UST 1 modular stellarator and potential enhancements, *Fusion Engineering and Design* **88** (6–8) 683–686, 2013.

▪ **V. Queral**, J.A. Romero, J.A. Ferreira, ‘High-field pulsed Allure Ignition Stellarator’, Article in ORNL publication *Stellarator News* n. 125, April 2010.

▪ **V. Queral**, ‘UST_1, a small, low-cost stellarator’. Article in ORNL publication *Stellarator News* n. 118, December 2008.

V. Queral, J. Urbón, A. García, I. Cuarental, F. Mota, G. Micciché, A. Ibarra, D. Rapisarda, N. Casal, Preliminary definition of the remote handling system for the current IFMIF Test Facilities, *Fusion Engineering and Design* **86** 1941–1945, 2011.

V. Queral, A. García, G. Micciché, A. Ibarra, N. Casal, F. Mota, D. Rapisarda, Proposal of an improved design of IFMIF Test Cell components for enhanced handling and reliability, *Fusion Engineering and Design* **84** 1548–1552, 2009.

Elena V. Rosa, Luis Rios, **Vicente Queral**, “Progress on the interface between UPP and CPRHS (Cask and Plug Remote Handling System) tractor/gripping tool for ITER”, *Fusion Engineering and Design* **88** 2168–2172, 2013.

“TechnoFusión, a relevant facility for fusion technologies: The Remote Handling area” ; A. Ibarra, M. Perlado, R. Aracil, D. Blanco, M. Ferre, I. García-Cortes, P. García-Robledo, M. González, P. González, D. Jiménez-Rey, J.L. Martínez-Albertos, L. Moreno, J. de No, **V. M. Queral**, L. Ríos, R. Román, *Fusion Engineering and Design*, vol. 85, issues 7-9, December 2010.

▪ **V. Queral**, J. Urbón, A. García, I. Cuarental, F. Mota, A. Ibarra, D. Rapisarda, N. Casal, G. Micciché, “Progress on the maintenance and RH systems for the IFMIF Test Facilities”, Proceedings of the 3 IFMIF/EVEDA Workshop, Madrid September 2010.

“Enhancement of the remote handling strategy for the refurbishment of the backplate bayonet concept of IFMIF target system” ; G. Micciché, L. Lorenzelli, D. Bernardi, **V. Queral**, *Fusion Engineering and Design* **86** 2109–2112, 2011.

▪ “Verificación de trabajos de manipulación remota en IFMIF” ; P. García-Borrás, P. García-Robledo, R. Aracil, **V. Queral**, M. Ferre, Interacción Persona-Robot, Madrid, España, 2009, cap. 6, pp. 78-89. Serie: RoboCity2030. ISBN: 978-84-692-5987-0.

“Tritium permeation experiment at IFMIF Medium Flux Test Module” ; N. Casal, A. García, A. Ibarra, F. Sordo, D. Rapisarda, **V. Queral**, F. Mota, *Fusion Engineering and Design* **84** 559–564, 2009.

“Feasibility of fission chambers as a neutron diagnostic in the IFMIF—Test Cell” ; David Rapisarda, Angela García, Óscar Cabellos, Fernando Mota, Jose M. Gómez-Ros, Ángel Ibarra, Natalia Casal, **Vicente Queral**, Javier Sanz ; *Fusion Engineering and Design* **84** 1570–1574, 2009.

▪ “Neutronic Calculations at Ciemat for IFMIF Test Facilities” ; F. Mota, N. Casal, D. Rapisarda, A. Mas, **V. Queral**, J. Urbon, A. García, A. Ibarra, Proceedings of the 3 IFMIF/EVEDA Workshop, Madrid, Sept. 2010.

▪ “Liquid Breeder Validation Module” ; N. Casal, F. Mota, A. Mas, **V. Queral**, J. Urbon, D. Rapisarda, A. García, R. Vila, A. Ibarra, Proceedings of the 3 IFMIF/EVEDA Workshop, Madrid Sept. 2010.

“IFMIF suitability for evaluation of fusion functional materials” ; N. Casal, F. Sordo, ... **V. Queral** ; *Journal of Nuclear Materials* **417** 1316–132, 2011.

“Study on the response of IFMIF fission chambers to mixed neutron-gamma fields: PH-2 experimental tests” ; Rapisarda, D., Vermeeren, L., García, Á., Cabellos, Ó., García, J.M., Ibarra, Á., Gómez-Ros, J.M., Mota, F., Casal, N., **Queral, V.** ; *Fusion Engineering and Design* **86** 1232–1235, 2011.

“ANALYSIS OF DISPLACEMENT DAMAGE IN MATERIALS IN NUCLEAR FUSION FACILITIES (DEMO, IFMIF AND TECHNOFUSIÓN)” ; F. Mota, C. Ortiz, A. Garcia, N. Casal, R. Vila, A. Ibarra, D. Rapisarda, **V. Queral** ; *Fusion Engineering and Design* **86** 2425–2428, 2011.

2. Technical reports and oral presentations in technical meetings

♦ **First author reports** (Date ordered. The four more relevant in bold):

V. Queral, J.M. Arroyo, 'RAMI assessment of the proposed 2015 blanket RM concepts and IT codes comparison' (DEMO), EFDA ref: EFDA_D_2M8SGX, 98 pg., 20 Diciembre 2016.

V. Queral, J.M. Arroyo, 'Updated RAMI assessment of the proposed 2014 schemes' (DEMO), EFDA ref: EFDA_D_2KZXR9, 85 pg., 30 Noviembre 2015.

V. Queral, J.M. Arroyo, 'RAMI assessment of the proposed in-vessel RMS for a significant case (blanket exchange)' (DEMO), EFDA ref: EFDA_D_2D37NK, 65 pg., (29 Junio 2015) 31 Marzo 2015.

V. Queral, J.M. Arroyo, 'Draft RAMI assessment of the proposed in-vessel RMS for a significant case (blanket exchange)' (DEMO), EFDA ref: EFDA_D_2LBBKK, 57 pg., 19 Diciembre 2014.

"Feasibility assessment of in-vessel component connections for Remote Handling" (DEMO) ; EFDA ref : EFDA_D_2LM5NS, v.2.1 , CIEMAT ref.: IN-DE-INRH-022, **105 pg.** ; **V. Queral** ; 30 January 2012

"Assessment of operational time for attachment of IFMIF Test Cell connectors" ; **V. Queral** , I. Galiana , J. Breñosa , A. Owen-Hill , J. Barrio , M. Ferré ; 7 pg. paper-like ; January 2012

"Definition Report of Maintenance and RH System of the Test Facilities in IFMIF" ; IFMIF DMS ref: BA_D_228GVQ , CIEMAT ref. IN-IF-TFRH-024 , **406 pg.** ; **V. Queral** , J. Urbon, et al. ; May 2011

"RH Procedures and Operations in the Test Facilities of IFMIF. Preliminary database of operations for the September 09 model of TTC", CIEMAT ref. IN-IF-TFRH-025 , 44 pg. ; **V. Queral**, J.Urbón ; Feb. 2011

"Relevant RH procedures in fusion facilities for the TEMAR project" ; CIEMAT ref. NT-HA-RHPR-001 ; **V. Queral** ; 19 January 2011

"Activities Related To the Development of an Air Transfer System Prototype and Cask Transfer System Virtual Mock-Up" (ITER) ; F4E Ref F4E-2008-GRT-016 (MS-RH) Deliverable DLM.4 , 678 pg. ; Isabel Ribeiro, Alberto Vale, Pierre Ruibanys, Vicente Queral, Daniel Fonte, Filipe Valente, Christophe Reig, Etienne Gazeau, Pedro Lima ; Part **"Equipment and Components Requirements"**, **120p.**, **V.Queral** ; October 2010

"Preliminary assessment of the recovery and rescue scenarios and implications in the design of the RH System and buildings of the Test Facilities in IFMIF", CIEMAT ref. CI-IF-TFRH-019 , 41 pg. ; **V. Queral**, J. Urbón, I. Cuarental ; September 2010

"Interfaces RH Test Facility & Lithium Facility for the ITR of TF System Group EU for interfaces Test Facility (Eu) & Lithium Facility (JA)", CIEMAT ref. NT-IF-TFRH-022 , 16 pg. ; **V. Queral** ; 1 July 2010

"Preliminary Definition Report of maintenance and RH System of the Test Facilities in IFMIF", IFMIF DMS Ref. BA_D_226XK9 v1.0 , CIEMAT ref. IN-IF-TFRH-021, **171 pg.** ; **V. Queral** ; 30 April 2010

"Comments on the April 2009 TTC Concept and the EU Internal Meeting", CIEMAT ref. NT-IF-TFRH-018 , 12 pg. ; **V. Queral**, I. Cuarental ; 28 July 2009

"Recomendaciones, tareas propuestas y comentarios respecto a ROBOT.ES 2009 para Tecnatom", CIEMAT ref. NT-IT-CORH-001 , 5 pg. ; **V. Queral** ; 03 June 2009

"Assessment of the in-TTC RH operation of connection of TMs in the April 09 TTC", CIEMAT ref. CI-IF-TFRH-016, 16 pg. ; **V. Queral** ; 27 May 2009

"RH Procedures and Operations in the Test Facilities of IFMIF. Preliminary database of main operations", CIEMAT Ref : IN-IF-TFRH-014 , 93 pg. ; **V. Queral**, I. Cuarental ; April 2009

"Comments on Referential Table and Merged TTC Concept", CIEMAT Ref: CI-IF-TFRH-013 , 22 pg. ; **V. Queral** et al. ; February 2009

“Basic guidelines for the design of remotely maintained components in the Test Facilities of IFMIF”, CIEMAT Ref : IN-IF-TFRH-004 , **75 pg.** ; **V. Queral** ; 22 December 2008

“Brief list of projects/experiments suitable for the initial phase of the RH Lab. in Technofusion” ; CI-TF-RHSF-003 , 19 pg. ; **V. Queral** ; 28 October 2008

“Analysis of the flow of HFTM Rigs and specimens. A proposal”, CIEMAT Ref : CI-IF-TFRH-011 ; **V. Queral** , 30 pg. ; 5 September 2008

“Proposals to provide access at the Back Plate through modified Plugs and to lighten the Test Cell Covers”, CIEMAT Ref: IN-IF-TFRH-003 , 27 pg. ; **V. Queral** ; 7 May 2008

“Proposals to improve the installation and removal of VTAs” ; CIEMAT Ref. IN-IF-TFRH-002 , 22 pg. ; **V. Queral** ; 5 May 2008

“Preliminary data for ITER Hot Cell RH facilities in Technofusión” , CIEMAT Ref. CI-TF-RHSF-002 , 43 pg. ; **V. Queral** ; 14 Mar 2008

“Initial assessment about the feasibility and difficulties in URS” ; CIEMAT Ref. IN-IF-TFRH-001 , 13 pg. ; **V. Queral** ; 30 April 2008

“Disassembling HFTM Rigs: Review of present information about the procedure and location”, CIEMAT Ref. NT-IF-TFRH-010 , 16 pg. ; **V. Queral** ; 27 February 2008

“Review of the Remote Handling tasks in the Test Facilities”, CIEMAT Ref. IN-IF-RHTA-001 , 130 pg. ; **V. Queral**, A. García, A. Ibarra ; 16 January 2008

“Preliminary data for IFMIF Remote Handling facilities in Technofusión” ; **V. Queral** ; CIEMAT ref. CI-TF-RHSF-001 , 10 pg. ; 21 November 2007

“Analysis of the introduction and removal of VTAs in the Test Cell” ; CIEMAT Ref. CI-IF-VTIN-001 , 15 pg. ; **V. Queral** ; 09 October 2007

“Radiation resistance of cameras and some materials. Relation with the radiation doses in Access Cell” ; CI-IF-RRCA-001 , 16 pg. ; **V. Queral** ; 12 September 2007

◆ **As relevant contributor or reviewer:**

“Basic review of commercial manipulators and cranes”, CIEMAT ref. IN-IF-TFRH-020 , 43 pg. ; I. Cuarental, **V. Queral** ; December 2009

“Review of (modified)-commercial RH tools focussed on the TF of IFMIF”, CIEMAT ref. IN-IF-TFRH-015 , 44 pg. ; I. Cuarental, **V. Queral** ; October 2009

“National Centre For Fusion Technologies” ; J. M. Arroyo, **V. Queral**, et. al. ; September 2009

“Technofusion: Centro Nacional de Tecnologías para la Fusión” ; J. M. Arroyo, **V. Queral**, et. al. ; June 2009

“Assessment of alternatives for connections at the Test Module Intermediate Head” ; CIEMAT ref. NT-IF-TFRH-023 , 18 pg. ; J. Urbón ; 6 September 2010

◆ **Oral presentations in international meetings**

Generation and oral presentation of **about 50 presentations** for international meetings of the involved projects. Defence, discussion, agreements.

Attendance to about **100 international working meetings** and workshops.

3. Symposiums contributions (international)

V. Queral, E. Rincón, V. Mirones, L. Rios, S. Cabrera, 'Dimensional accuracy of Additively Manufactured structures for modular coil windings of stellarators', Poster P2.92 en el 29th Symposium on Fusion Technology (**SOFT**), Praga (Czech Republic), 5-9 Septiembre 2016.

V. Queral, 'Vacuum vessel for the 3D-printed UST_2 stellarator', Oral contribution in 22 IAEA TM on 'Research Using Small Fusion Devices' (**RUSFD**), Praga (República Checa), 12-14 October 2015.

V. Queral, 3D-printed UST_2 stellarator status and first e-beam mapping experiments, Oral contribution in the 21st Topical Meeting on the Technology of Fusion Energy (TOFE), Anaheim, CA (USA), 9-13 November 2014.

V. Queral, '3D-printed fusion components concepts and validation', Poster P1.014 en el 28th Symposium on Fusion Technology (**SOFT**), San Sebastián (Spain), 29 September - 3 October 2014.

V. Queral, 3D printed modular stellarator UST_2, Oral contribution in the 21st IAEA Technical meeting on 'Research Using Small Fusion Devices (RUSFD)', San José, Costa Rica. 27 - 29 January 2014.

V. Queral, Concept, production and validation of a 3D-printed coil frame for the UST_2 modular stellarator, Poster presentation P1.140 in the 11th International Symposium on Fusion Nuclear Technology, Barcelona, 16-20 September 2013.

V. Queral, Coil fabrication of the UST_1 modular stellarator and potential enhancements, Poster P1.7 in 27th Symposium on Fusion Technology (SOFT), Liège, Belgium. 24-28 September 2012.

V. Queral, J. Urbón, A. García, I. Cuarental, F. Mota, A. Ibarra, D. Rapisarda, N. Casal, G. Micciché "Progress on the maintenance and RH systems for the IFMIF Test Facilities"
Poster en Proc. 3rd IFMIF/EVEDA Workshop, CIEMAT, Madrid, Spain. 20 – 22 September 2010

V. Queral, A. García, I. Cuarental, F. Mota, G. Micciché, A. Ibarra, D. Rapisarda, N. Casal "Preliminary definition of the remote handling system for the current IFMIF Test Facilities"
26th Symposium on Fusion Technology (SOFT), Porto, Portugal. 27 Sept. - 1 Oct., Poster P2-018 (2010).

V. Queral, Á. García, G. Micciché, Á. Ibarra, N. Casal, F. Mota and D. Rapisarda "Proposal of an improved design of IFMIF test cell components for enhanced handling and reliability"
25th Symposium on Fusion Technology (SOFT), Rostock, Germany. 15 – 19 Sept., Poster P-1.93 (2008).

G. Micciché, L. Lorenzelli, D. Bernardi, **V. Queral**
"Enhancement of the remote handling strategy for the refurbishment of the backplate bayonet concept of IFMIF target system"
Poster en Symposium on Fusion Technology (SOFT), Porto, Portugal. 27 Sept. - 1 Oct.

D. Rapisarda, L. Vermeeren, Á. García, Ó. Cabellos, J.M. García, Á. Ibarra, J.M. Gómez-Ros, F. Mota, N. Casal, **V. Queral**
"Study on the response of IFMIF fission chambers to mixed neutron-gamma fields: PH-2 experimental tests"
26th Symposium on Fusion Technology (SOFT), Porto, Portugal. Sept. 27 - Oct. 1, Poster P2-017 (2010).

F. Mota, C. Ortiz, A. García, N. Casal, R. Vila, A. Ibarra, D. Rapisarda, **V. Queral**
"Analysis of displacement damage in materials in nuclear fusion facilities (DEMO, IFMIF and TECHNOFUSIÓN)"
26th Symposium on Fusion Technology (SOFT), Porto, Portugal. 27 Sept. - 1 Oct., Poster P2-019 (2010).

F. Mota, N. Casal, D. Rapisarda, A. Mas, **V. Queral**, J. Urbon, A. García, A. Ibarra ;
"Neutronic Calculations at Ciemat for IFMIF Test Facilities"

Poster en Proc. 3rd IFMIF/EVEDA Workshop, CIEMAT, Madrid, Spain. 20 – 22 September 2010

N. Casal, F. Mota, A. Más, **V. Queral**, J. Urbón, D. Rapisarda, A. García, R. Vila, A. Ibarra
“Liquid Breeder Validation Module”

Poster en Proc. 3rd IFMIF/EVEDA Workshop, CIEMAT, Madrid, Spain. 20 – 22 September 2010

D. Rapisarda, Á. García, J.M. García, J.M. Gómez-Ros, F. Mota, Á. Ibarra, N. Casal, and **V. Queral**
“First gamma and X-ray irradiation tests of the IFMIF fission chamber prototypes”

Proc. 14th International Conference on Emerging Nuclear Energy Systems, Ericeira, Portugal. 29 Junio - 3 July, Poster P-10 (2009).

D. Rapisarda, Á. García, Á. Ibarra, N. Casal, **V. Queral**, F. Mota, J.M. Gómez-Ros, O. Cabellos and J. Sanz

“Feasibility of a neutron diagnostic for the IFMIF - Test Cell”

25th Symposium on Fusion Technology (SOFT), Rostock, Germany. 15 - 19 Sept., Poster P-1.91 (2008).

N. Casal, Á. García, Á. Ibarra, F. Mota, D. Rapisarda and **V. Queral**

“Tritium permeation experiment at IFMIF medium flux test module”

25th Symposium on Fusion Technology (SOFT), Rostock, Germany. 15 - 19 Sept., Poster P-1.92 (2008).

A. García, A. Ibarra, **V. Queral**, G. Micciché

“Sistemas de manipulación remota para las instalaciones del Test de IFMIF”

Poster en 33ª Reunión anual de la Sociedad Nuclear Española (Segovia, 26-28 September 2007)

4. Participation in R&D projects

Ref.: **ENE2015-64981-R**

Title: **Estudio de la fabricación aditiva para su aplicación a dispositivos de fusión tipo stellarator de altas prestaciones.**

Funding entity: **Ministerio de Economía y Competitividad**

Principal Investigator: **Dr. Vicente M. Queral**

Period: **01/01/2016 a 31/12/2018**

Budget: **30,000 €**

Role: **Principal Investigator**

Ref.:

Title: **Estudio de materiales, diseño y métodos de manufactura aditiva, para estructura modular de soporte para bobinas superconductoras**

Funding entity: **Instituto Tecnológico de Costa Rica**

Principal Investigator: **Ing. MEng. Carlos Otárola Zúñiga**

Period: **01/01/2017 a 31/12/2018**

Budget: **17,589 \$**

Role: **External Collaborator**

Ref.: **AWP2016-RM-2-T05 (Eurofusion, DEMO, WPRM = Work Package Remote Maintenance)**

Title: **RAMI assessment of the proposed 2015 blanket RM concepts and IT codes comparison**

Funding entity: **EUROFusion**

Principal Investigator: **Dr. Vicente M. Queral**

Period: **01/01/2016 a 30/11/2016**

Role : **Principal Investigator**

Budget: **0.3 ppy**

Ref.: **ENE2010-18345**

Title: **Modelado y Control de Tokamaks**

Funding entity: **Ministerio de Economía y Competitividad**

Principal Investigator: **Dr. Izaskun Garrido Hernández** (Universidad del País Vasco)

Period: **01/01/2011 a 31/12/2014** (4 años incluyendo prorroga). V. Queral participó desde el 27/02/2014 al 31/12/2014.

Role: **Participation in the research group**

Budget: **50,000 €**

Title of the project: “Engineering design of Maintenance and Remote Handling Systems of Test Cell, Access Cell, and Test Module Handling Cell”

Framework of the project: Activity II in the Procurement Arrangement ED04 of the project **IFMIF/EVEDA**, in the framework of the Broader Approach. (EVEDA = Engineering Validation and Engineering Design Activities. IFMIF = International Fusion Materials Irradiation Facility).

Funding entity, costs: **Broader Approach IFMIF/EVEDA** (Europe and Japan). Total cost EVEDA ~88.4 M€. Total cost IFMIF : ~2700 M€.

Period: **Middle 2007 to middle 2013 (6 years)**

Budget: **~1 M€**

Main researcher: **Vicente Queral**

Number of participant researchers: **~15**

Title of the project: “ATS/TCS Test Facility Specifications. Equipment and Components”.

Framework of the project: Grant **F4E-2008-GRT-016 (MS-RH)** “Activities related to the development of an Air Transfer System prototype and Cask Transfer System Virtual Mockup”, **ITER** (International Thermonuclear Experimental Reactor).

Funding entity, cost: **Fusion for Energy (F4E)**. Total ITER cost ~12000 M€

Main researcher: **Vicente Queral** (José Botija)

Period: **October 2009 to July 2010**

Budget: **40600 €**

Number of participant researchers: **~4**

Title of the project: “Técnicas de Manipulación Remota para Centros de Investigación de Fusión Nuclear”, referencia DPI2009-12283

Funding entity: **Plan Nacional de I+D+i Ministerio de Ciencia e Innovación**

Period: **2008 to 2011 (3 years)**

Budget: **270000 €**

Main researcher: **Manuel Ferré Pérez** (UPM)

Number of participant researchers: **~8**

Title of the project: National Centre for fusion Technologies “Technofusión”, Remote Handling Laboratory

Funding entity, total budget: **Several entities**. Higher than **~3 M€** up to now

Budget for this task:

Main researchers: **Ángel Ibarra** (CIEMAT), **Manuel Perlado** (UPM)

Number of participant researchers: **~8**

5. Seminars and talks given

- Seminar "E-beam field line mapping in UST_1" , given to ITCR in CIEMAT, 21 April 2016.
- Seminar "3D-printed UST_2 stellarator: an overview", IPP Max IPP Max-Planck, Greifswald (Germany), 16 October 2015.
- Seminar "3D printed UST_2 stellarator, a small innovative fusion device", given in University of California San Diego, California, USA, 17th November 2014.
- Seminar "UST_1 stellarator and Status of the 3D printed UST_2 stellarator" given in Princeton Plasma Physics Lab. (PPPL), Princeton, USA. 3rd October 2013.
- Seminar "UST_1 stellarator and Status of the 3D printed UST_2 stellarator" given in Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee, USA. 27th September 2013.
- Talk "UST_1 stellarator and Status of the 3D printed UST_2 stellarator" given in Columbia University, New York, USA. 1st October 2013.
- Seminar "Status of UST_2 Stellarator Construction" given at 'National Fusion Laboratory', CIEMAT, Madrid, Spain. 31 May 2013.
- Seminar "Status of UST_2 Stellarator Construction" given at 'Departamento de Física', 'Escuela Politécnica Superior', Carlos III University of Madrid, Madrid, Spain. 10 May 2013.
- Talk "Construction of low-cost stellarators by Innovative Rapid Prototyping Methods" given at Physics Meetings in 'National Fusion Laboratory', CIEMAT. 15 November 2010.
- Seminar "Innovative reactor stellarators and construction methods" given at 'National Fusion Laboratory', CIEMAT, Spain. April 2009.
- Talk "La fusión más cercana. Un sencillo experimento de bajo coste", 'Fusion nearer. An easy low-cost experiment', offered in relation to the ZIVIS project (fusion supercomputing grids), Zaragoza, Spain. April 2007.
- Seminar "Design, construction and results in UST_1, a small low-cost educational stellarator" given at 'National Fusion Laboratory', CIEMAT, Spain. December 2006.

6. Patents

- Patent applied for. Inventor Vicente M. Queral, P201631018, Procedimiento de consolidación de estructuras ligeras obtenidas por fabricación aditiva, Spain, 26/07/2016, owner CIEMAT.
- Patent applied for. Inventor Vicente M. Queral, P201531609, Método de obtención de una estructura de bobinas magnéticas para dispositivo de ensayo de configuraciones de plasma, Spain, 6/11/2015, owner CIEMAT.
- Utility Model granted. “Dispositivo stellarator de fácil mantenimiento”. Translated title: ‘Easy maintenance stellarator device’. U201300725, August 2013.
- Patent applied for. “Método y estructura para la generación de bobinas de stellarators” (3D printing+moulding method). April 2013.
- Patent granted. “Reactor thermonuclear stellarator multicámara vertical” (a pulsed stellarator of high field and easy maintenance, located at a vertical position). P201000049, February 2010.
- Utility Model granted. “Dispositivo para la simultánea mecanización y posicionamiento de ranuras para bobinados de stellarators”. U200901520 , June 2010.
- Patent applied for (abandoned). “Dispositivo de fusión de tipo stellarator de bajo coste y alta disponibilidad”. Translated title: ‘Low cost and high availability stellarator device’. P200900660, March 2009.
- Patent applied for (changed into Utility Model) “Procedimiento y dispositivo para la simultánea mecanización y posicionamiento de ranuras para bobinados de stellarators”. Translated title: ‘Method and mechanism for the simultaneous mechanization and positioning of grooves for stellarator coils’. P200600427, February 2006.

Main results: See also: www.fusionvic.org

■ **Design and construction of UST_1, 3rd modular stellarator in the world:** Obtained correct magnetic surfaces and plasma pulses. More than 250 pulses produced. E-beam field mapping system (e-guns + rod system + camera) built. Designed and built the vacuum vessel, coil frame and modular coils. Designed, built and patented a toroidal milling machine to mechanise grooves for modular coils. Vacuum system, power supplies and CODA System. Designed and built the microwave heating system (2.45GHz, 0.8Kw).

■ **Design and construction of UST_2 (ongoing), first 3D printed and 4th modular stellarator in the world:** An optimized quasi-isodynamic stellarator (originated from an IPP Max Plank physics design) of easy maintenance and large divertors for high power extraction has been designed. A coil frame, defined as a 3D printed hollow truss structure internally cast with resin, has been produced. A module (1/6) of vacuum vessel has been satisfactorily manufactured. The base of the stellarator, supports, a coil frame, a frame structure, and the vacuum vessel have been assembled. E-beam field line mapping experiments have been successfully carried out. Calculations and experiments agree.

■ **CASTELL Java code** developed: 3D simulation of orbits of particles under drifts, magnetic surfaces. Calculation of Iota and magnetic well profiles, ripple, plasma volume. Calculation of LCFS Fourier coefficients from a geometrical 3D shape by a Levenberg-Marquardt optimizer. Generation of modular coils from a current potential function from NESCOIL code. Calculation and representation of B'n errors on LCFS. Calculation of forces on coils. Neoclassical calculations (pitch angle collisions implemented). Optimization of engineering optimized plasmas (i.e. generating straight zones) by iterations of: geometrical modification of the LCFS, Fourier coefficients calculation, NESCOIL, calculation of neoclassical confinement, iota profile and magnetic well, selection of best LCFS.

► **More than 7000 hours of study, calculations, design and practical experience**

■ A scaled UST_1 stellarator (the same definition of coils) is being built in the 'Instituto Tecnológico de Costa Rica'.

* With some contribution of means from CIEMAT.

R&D in professional activities

Freelancer period, R&D and construction of automatic devices

(The following were my clients)

SISTEMAS FRUTICOLAS S.L.
Spain

**Research and Development
Engineer**

Feb 1994 – June 2007
(From Jan. 2002 only patents and
minor designs due to study and R&D)

Duties:

- Research and development of new electromechanical machines: Feasibility studies, first conceptual ideas, prototypes and tests, search for adequate new commercial materials and components, detailed design of pieces, arrange the orders and the assembling of prototypes, definitive tests, installation layouts, starting installations for the new designs. (From 1996).
- Patent issues: Documents, management and technical defence of 29 patents.
- Programming logic controllers and PC's and starting installations. (Until 1996)

Most successful developments:

1. First useful and careful orange boxing machine in the world (Pat: P9602416).
2. Own invention (Pat U9700950): Quickest orange calibrator in the world combining two important functions, weighing and computer vision.

■ Important contribution to the exponential growing of the company (x 10 times from 1996-2001) partially due to the successful designs.

Some further details: The designs comprise from big machines (6x3x70 m), for example the twin orange sizer in the well known company 'Naranjas Torres' (Pat U97....) to small high precision mechanisms like the high speed actuator (Pat: P99.....) diameter 8x3cm and 100 movements/sec. Other : Dryer tunnel (4x4x3m , U2001....), mobile mechanism to gather fruits (U2001....), small version of the boxing machine, versions of sizers for 2, 4, 6, and 8 lines, transporters, plastic and rubber pieces for moulds.

- More information and photos are available in www.fusionvic.org/Exposicion_2005_Eng.pdf

WARE S.L.

R & D Engineer

1992 - 1995

Duties: Development of electronic devices for photofinisher at end of races.

Main results:

Device used in most of the cycling races around Spain and some in Portugal and France.

MOATI S.L.

Sound Projects Engineer

Jun 1996 - Apr 2001

Duties: Carry out sound control projects: measurement, calculation and corrective measures

Employee Positions

| | | |
|--|---|----------------------------|
| Manufacturas de Precision S.A. | Developer | Aug – Dec 1995 |
| <i>Duties:</i> Developing the program and electrical control of a large new piling machine. Starting and programming other new installations. | | |
| UPS España | Supervisory Engineer | Feb – Aug 1992 |
| <i>Duties:</i> Organization and improvement of processes. | | |
| Polytechnic University of Valencia | Computer Systems Administrator in the Master CAD/CAM | Jan 1990 – Mar 1991 |
| <i>Duties:</i> Maintenance of HP-9000 systems, research in simulation of industrial plants. Attendance at Autocad, ANSYS and me30 subjects of the Master. | | |

Education, further training, interests and hobbies

Education

| | <i>(Marks) as out of 10</i> | |
|--|---|---|
| Carlos III University of Madrid | PhD in Plasma Physics and Nuclear Fusion , Excellent (Cum Laude, proposed) | June 2015 |
| European Master on Nuclear Fusion Science and Engineering Physics, Carlos III University of Madrid | Master Thesis | Defence in Sep 2012 |
| PhD subjects in the European Master on Nuclear Fusion Science and Engineering Physics | Fusion Reactor Physics (9) | Sep 2011- Jun 2012 |
| | Engineering of Fusion Devices, Robotics and Control (10) | |
| | Plasma Diagnostics and Materials Technology (8.6) | |
| | Plasma Physics (9.5) | |
| | Laboratory project (7.9) | |
| Subjects to obtain the Civil Servant chair of 'Técnico Superior Especialista' of Public Research Centres in Magnetic Confinement Fusion | <i>Subjects:</i> Systems related to coils, heating, cooling and refrigeration, diagnostics, vacuum, power supplies, control and maintenance for W7-X, ITER and TJ-II. General matters: confinement, power balance, tokamaks, stellarators, plasma-wall interaction, superconductor coils, vacuum vessel, safety and reactors. | Aug 2007- Dec 2007 Aug 2004 - Nov 2004 |
| National Distance Learning University FORD Spain | Relativity. Quantum Physics. Ms Thesis (10) | Oct 2002 – Jun 2004 Apr – Jul 1991 |
| Polytechnic University of Valencia | Industrial Engineering (Master Eng. Speciality Electric Systems , 6-years plan. 13% superior marks) | Oct 1985 – Nov 1991 |
| 'Instituto Nacional de Bachillerato' | Secondary School | Sep 1981 – Jun 1985 |

Further Training

| | | |
|--|--|---------------------|
| TCF, Test de connaissance du français (French Education Ministry's test) | European Level B1 = Intermediate | January 2006 |
| University of Cambridge (ESSOL) | CAE , Certificate in Advanced Eng. | Jul 2004 |
| EOI , Official Language School | 5th course of English = Advanced | Jun 2004 |
| UPS Training Courses | International Management. Cost Analysis | 1992 |

Interests and Hobbies

I enjoy reading, handyman, tennis and I am very interested in the environment and sociology.