Curriculum Vitae: Juan A, Fuster Verdú

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WoS: W-6189-2018
Scopus: 7102679861

General Scientific Indicators	**#**	**Comments**
PhD advised	12+1 (on going)	
Master Thesis and Diploma Thesis	6	
National and regional projects as principal investigator	35	7,5 M€
International and EU projects as principal investigator at IFIC (Fulbright, ITNs, Marie Curie, RISE)	10	1,7 M€
Contracts (AIDO, CERN)	3	0,8 M€
Innovative Public Procurement (CSIC-CDTI)	1	18 M€
Publications (CELLO, DELPHI, ATLAS, ILC, CLIC, R&D, instrumentation, phenomenology)	1.453 (SLAC spires)	1141 (WoS) 1564 (Scopus)
Invited talks at international conferences, workshops, physics schools and seminars	85	Last five years 17
Organization of conferences, physics schools and workshops (organizing committee, chair, IAC..)	>60	
Outreach and dissemination (talks, activities, etc..)	>80	
Total number of citations	182.477 (SLAC spires)	71.715 (WoS) 92.820 (Scopus)
h-index	191 (SLAC spires)	116 (WoS) 127 (Scopus) 157 (GesBIB)

Juan Antonio Fuster Verdú was born in Alcoi (Alacant, 1960, Spain); Professor of Research at the Instituto de Física Corpuscular (IFIC-Valencia), a joint institute belonging to the University of Valencia and the Spanish Research Council (CSIC). He presently holds the Institutional Delegation of CSIC in the Valencian region, *Comunitat Valenciana*.

He made his PhD thesis at DESY in Hamburg (1984-1987) in the experiment CELLO. He participated in the construction of a new stereo wire chamber and performed searches for New Physics such as excited quarks, charged Higgs and exotic planar events with two jets and two muons back-to-back. He introduced innovative techniques to improve the kinematic reconstruction of jets as measured in the detector. In 1987, he defended his PhD in Valencia. He was awarded with the *premio extraordinario* distinction.

In 1988, he stayed at Valencia and joined the HEP group in DELPHI in the Time-of-Flight project.

During 1989-1996 he started at CERN as Fellow and later as Staff. He participated in the DELPHI experiment where he worked in the trigger system, the Time of Flight (TOF) and data analysis. He became responsible of the trigger operation system, project leader of the TOF and was the DELPHI technical run coordinator for a period of half a year. In the analysis front he joined the DELPHI QCD analysis group, where he became convener and was later promoted to DELPHI physics coordinator. His particular interest was the study of final state topologies including gluon jets. He studied the gluon and b-quark jet properties, the strong coupling constant, its universality and performed the first measurement of the running b-quark mass. He used anti-tagging techniques to identify gluon jets avoiding kinematical biases. He also led activities on searches for new physics such as neutral heavy leptons including topologies with long liftimes decaying inside the detector. These techniques were later expanded to other possible processes both in DELPHI and later to LHC as well.

Upon returning to IFIC in 1996 he pioneered and directed a team focused on implementing micro-strip silicon detectors to particle physics for the first time in Spain. The group became member of the ATLAS Collaboration contributing to the construction of the ATLAS Semiconductor Tracker (SCT). The group successfully built ~15% of the forward modules of this sub-detector. This group, and the infrastructures built constitute an internationally well-recognized hub for constructing and developing silicon detectors. This legacy persists today, upheld by successive members of the group, ensuring continued advancement in the field.

In 2005, while keeping his activity in ATLAS, he embarked in the design and prospective physics studies of a future Linear collider, the ILC (International Linear Collider), later extending his efforts to include contributions to the CLIC project. He has been involved in the physics performance and tracking studies of the detectors in the forward region. During this period, the Valencia group became member of the DEPFET Collaboration. In 2005, he was the first coordinator of the Spanish network for Future Colliders and since then he has played a major role in the Spanish activities on these initiatives and is one of the European leaders of the worldwide effort to develop a Linear Collider for a future Higgs Factory.

He presently works on top-quark related physics in both ATLAS and the Linear Collider studies. His main research line focuses on the top-quark mass in which he is highly engaged to the community's ongoing efforts aimed to determine the top-quark mass with the highest accuracy. His group together with theory colleagues developed a new method to measure the top-quark mass using ttbar+1jet allowing to measure the top-quark pole mass with high precision. Now this subject constitutes the PhD of two students which aim for ultimate accuracy on this parameter using the most recent data. Together with CMS colleagues at DESY a combination of the results obtained by the two experiments is pursued to further improve the precision on this parameter.

Since 2015 he is also been involved in the development of the accelerator technology at IFIC as he became the leader of the accelerator group. The group has built at IFIC the High-Gradient (HG) Radio-Frequency (RF) laboratory which hosts a high-power infrastructure for testing HG S-band normal-conducting RF accelerating structures to the study of HG phenomena. This constitutes a unique infrastructure at Spain. The design of the laboratory has been made through a collaboration between the IFIC and the CLIC-RF groups at CERN and operates at a central frequency of 2.9985 GHz with a reach on the repetition rate of 400 Hz. The group is modestly involved in accelerator R&D activities for future accelerators.

Medical applications of accelerator technologies are now one of his main activities. A significant milestone occurred in March 2023 when CDTI (Centre for the Development of Technology and Innovation in Spain) signed an Innovative Public Procurement grant to commence the construction of the initial phase of a carbon ion accelerator. This accelerator is intended for applications in hadron therapy and radiobiology studies and is planned to operate in five years. The new infrastructure has the support of the University of Valencia and CSIC and will in future position Spain at the forefront of radiobiological investigations and technological development in hadron therapy. Fuster is the Principal Investigator of this action.

As scientific policy manager, he was IFIC deputy director (2000-2003, 2017-2019) and later IFIC director (2003-2007); manager of the Spanish National Program for Particle Physics at the Spanish Ministry (2007-2010) and Coordinator of the Area of Physics and Physics Technologies of the Spanish Research Council (2010-2012). He has been responsible for various experimental tasks and physics working groups (DELPHI, ATLAS, Linear Collider) including technical developments, organizational matters and physics studies. He is and has been member of several international scientific and advisory committees (CERN, DESY, IFAE, CSIC, etc..). He was chair of the C11 Commission for Particle and Fields of the International Union of Pure and Applied Physics (IUPAP). In addition, he also chaired the European Linear Collider study for physics and detectors as nominated by the European Committee for Future Accelerators (ECFA) and was the Spanish delegate at the OECD Global Science Forum scoping group on Research Infrastructures. Now he is member of the International Advisory Committee set by ECFA to develop the future Higgs Factory. He is presently the Institutional delegate of CSIC for the Valencian region.

Fuster has taught master's level courses at the University of Valencia and participated in physics school instruction contributing to the training of new generations of scientists. Most of his former students have established brilliant careers in particle physics, playing relevant roles in modern experiments in both physics data analyses and detector/accelerator instrumentation. Currently, former students of Juan Fuster play key roles leading the Spanish contribution to the construction of the ATLAS Inner tracker for to next High Luminosity LHC upgrade at CERN, top physics coordination and as chair of the ATLAS Collaboration Board.

Actively involved in outreach, he serves on conference committees and organizes international workshops and conferences. Notably, he chaired the International Conference on High Energy Physics in Valencia (ICHEP 2014). He also played a key role in establishing the Spanish School for Particle Physics (TAE) in 2002.

In 2018 he received the Humboldt Research award.

Juan A. Fuster Verdú, most relevant merits and milestones

1984-1987 CELLO:

- PhD student at DESY (Hamburg), first limit on charged Higgs particles, *Premio extraordinario de doctorado*

1989-1998 DELPHI:

- CERN Fellow/Staff 1989-1994, Trigger coordinator, run coordinator, project-leader of TOF detector, Quantum Chromodynamics physics coordinator, DELPHI physics coordinator, DELPHI speaker's bureau member. Main results/contributions were on the definition of the trigger, operation, efficiency calculation for cross-section measurements.
- Physics studies/publications of gluon and b-quark jet properties, measurement of the strong coupling constant and test of its universality. Jet energy and angle between jets were demonstrated to be the correct scales to make quantitative comparison between data and QCD perturbative predictions. Also performed the first observation of the dynamical nature of the b-quark mass probing the running b-quark mass at the Z scale. First search for neutral heavy leptons considering long lived particles decaying along the detector. This technique has been later used in other searches and models having similar signatures for LEP and LHC analyses.

1995-now ATLAS:

- Project-leader of the first group in Spain to work on micro-strip silicon detectors applied to collider particle physics. The group became member of the ATLAS Collaboration and participated in the construction of the ATLAS Semiconductor Tracker (SCT). The group successfully built ~15% of the forward modules of this sub-detector which is still operational.
- Member of the Steering Group of the ATLAS Semiconductor tracker
- Chair of the conference and publication committee of the Semiconductor tracker of ATLAS.
- Physics studies/publications on top-quark related physics. Main research line focuses on the top-quark mass. Developed a new method to measure the top-quark pole mass in a theoretically well-defined framework using ttbar+1jet topologies.

2015-now Accelerators

- Project leader and Construction of the IFIC the High-Gradient (HG) Radio-Frequency (RF) laboratory
- Project leader of CSIC-CDTI agreement (signed Mar. 2023) to build the first stage of a carbon ion accelerator for hadron therapy and radiobiology studies. Estimated cost of ~18 M€

2002-now ECFA & Future Colliders

- Spanish delegate in ECFA (European Committee for Future Accelerators, 2015-2022)
- Chair of the ECFA Linear Collider Studies in Europe (2010-2020)
- Member of the ECFA Higgs Factory's International Advisory Committee representing "the Linear Collider option" (2021 – now)
- First Coordinator and promoter of the national Spanish network for Future Colliders (2005)

IFIC:

- Vice-director (1999-2003)
- Director (2003-2007)
- Vice-director of innovation (2016-2019)

CSIC & Ministry:

- Manager for the Particle Physics Area of the Spanish National Plan**.** Spanish delegate in all International Committees and finance boards for particle physics (2007-2010)
- Member of the expert group elaborating the OECD Global Science Forum report on large infrastructures
- Coordinator of the Area of Physics and Physics Technologies of Spanish Research Council (CSIC) (2010-2012)
- Institutional Delegate of CSIC at the Valencian Community Region (2019-now)

International Committees:

- Member of the Super Proton Synchrotron CERN committee (SPSC) (2005-2008)
- Member of Scientific Committee of the Underground Laboratory at Canfranc (2007-2010)
- Member of the CERN advisory committee for permanent research physicist positions (IC) (2010-2013)
- Member of the Spanish National Committee of IUPAP (International Union of Pure and Applied Physics) at C11 Commission on Particles and Fields (2011-2014)
- Chair of C11 Commission of IUPAP (2014-2018)
- Member of the International Scientific Committee of IFAE-Barcelona (2013-2018)
- Member of the DESY-Hamburg International Physics Research Committee (2016-2022)
- Member of the Research Evaluation Team at the Institute for Basic Science in South Korea (2017)
- Member of the International Committee for Future Accelerators (ICFA) (2014-2017)

Others & prizes:

- Co-founder and first chair of the *Taller de Altas Energías* in 2002, the Spanish school for Particle Physics
- Chair of ICHEP-2014
- Humboldt Research Prize in 2018

EU:

- IFIC coordinator in 10 EU-funded projects: ITNs, Marie Curie, Infrastructure and RISE

Juan A. Fuster Verdú, relevant publications and impact (SPIRES data base)

CELLO - Thesis

A search for the production of charged Higgs particles, (CELLO Collab., Behrend et al.) Phys. Lett. 193B (1987) 376 (52 Citations). First search for charged Higgs bosons including hadronic final states and using reconstructed jets with kinematical constraints among them. This technique increased the sensitivity to hadron final states at the same level as for lepton final state topologies. Other publications were: *Search for Excited Quarks In e+e- Interactions with The CELLO Detector* (CELLO Collab., Behrend et al.) Phys. Lett. B 181 (1986) 178 and *an analysis of multi-hadronic events produced with two energetic leptons in e+e- annihilation* (CELLO Collab., Behrend et al.) Phys. Lett. B, 212 (1988) 515. These three papers were the basis of my PhD.

DELPHI - Trigger/ToF/Instrumentation

The DELPHI detector at LEP, P. Arnio et al., Nucl. Instr. and Method. A303 (1991) 365 (1262 citations) and *Performance of the DELPHI* detector, P. Abreu et al., Nucl. Instr. And Method. A378 (1996) 57 13 (857 citations). These papers include technological personal contributions to the DELPHI trigger system and TOF detector. Design, operation and analysis of the trigger efficiencies were my main contributions.

DELPHI - Trigger/Physics

Measurement of the mass and width of the Z0 particle from multihadronic final states produced in e+e- annihilations, P. Aarnio et al., 16 October 1989 Phys. Lett. 231B (1989) 539 (413 citations). First DELPHI paper on the Z0 resonance measuring its mass, width and the number of light neutrinos. Personal contributions included in this publication were in the operation and hardware definition of the trigger system allowing to collect the events and the calculation of efficiency factors to evaluate the hadronic cross section using real data directly -data driven- without any assumption based on simulation. The method developed was also used to calculate all trigger efficiencies for any physics channel in all following studies and DELPHI papers on the subject, for instance *Determination of Z resonance parameters and couplings from its hadronic and leptonic decays*. P. Abreu et al. Nucl. Phys. B367 (1991) 511-574 (193 citations*).* This method was used over all the DELPHI lifetime whenever the trigger efficiencies were needed to compute the physics results.

DELPHI – QCD&Searches/Physics

Energy dependence of the differences between the quark and gluon Jet fragmentation, P. Abreu et al. Zeit. Phys. C70 (1996) 179 (167 citations) and *mb at MZ*, P. Abreu et al., Phys. Lett. B418 (1998) 430 (109 citations). These two papers made use of a novel and original technique to identify gluon jets. Jet energy and angle between jets were demonstrated to be the correct scales to make quantitative comparison between data and QCD perturbative predictions.
In three-jet final state events with two b-jets being identified the gluon jet was anti-tagged. This method allowed to study gluon jets without any kinematical constraint contrary to what previous analyses were doing. A much better agreement between theoretical QCD predictions and experimental results was achieved. This technique was later exported to other LEP experiments and used in different type of studies and analyses. These papers were followed by others such as *Determination of the b quark mass at the MZ scale with the DELPHI detector at LEP*, J. Abdallah et al., Eur. Phys. J. C46 (2006) 569 (20 citations) and *Study of b-quark mass effects in multijet topologies with the DELPHI detector at LEP,* J. Abdallah et al., Eur. Phys. J. C55 (2008) 525 (29 citations), *b-tagging in DELPHI at LEP*, J. Abdallah et al., Eur. Phys. J. C32 (2004) (121 citations). As a result of these papers emerged a complete study of the properties for gluon and b-quark jets, b-quark mass measurement, mass effects in four jet event topologies, determinations of the strong coupling constant and its flavour universality. It was also very relevant that some these results could be contrasted with perturbative QCD predictions. Recovering techniques from this time we recently have published a related study using LHC data, *mb at mH: The running bottom quark mass and the Higgs bosson* Phys. Rev. Lett. 128 (2022) 12 (11 citations).

In this context Fuster´s team also performed the first analysis for Neutral Heavy Leptons including topologies where the NHL could have long liftimes and therefore could decay inside the detector. This type of technicque was later expanded to other possible process mainly SUSY models with RV-P violation both in DELPHI and laterto LHC as well. *Search for Neutral Heavy Leptons at LHC* , Zeit. Phys. C70 (1997) 57-71 & C 75 (1997) 580 (368 citations).

ATLAS - Semiconductor Tracker (SCT)

The ATLAS semiconductor tracker end-cap module, Abdesselam et al., Nucl. Instrum. Meth. A575 (2007) 353 (185 citations), *The Silicon microstrip sensors of the ATLAS semiconductor tracker* , A. Ahmad et al., Nucl. Instrum. Meth. A578 (2007) 98 (215 citations). A total of 8 papers from 2005 to 2008 summarized the complete technological performance of the ATLAS silicon tracker (SCT) including sensors, modules, electronics, readout, test-beams results, etc. I was in charge to coordinate and organize all these publications and editor for all papers produced. The results obtained were also used and included in the general description of the ATLAS experiment implemented at *The ATLAS Experiment at the CERN Large Hadron Collider,* G. Aad et al., JINST 3 (2008) S08003 (10694 citations). Participation in generic detector R&D such as *Radiation hard silicon detectors developments by the RD40 (ROSE) collaboration*, G. Lindstrom et al., Nucl. Instr. and Method. A466 (2001) (304 citations).

ATLAS - Top/Physics

A new observable to measure the top-quark mass at hadron colliders, S. Alioli et al., Eur. Phys. J. C73 (2013) 2438 (122 citations); The ATLAS Collab., *Determination of the top-quark pole mass usin ttbar+1-jet events collected with the ATLAS experiment in 7 TeV pp collisions*, JHEP 1510 (2015) 121 (109 citations). The first publication described a new method to measure the top-quark pole mass which was developed together with theorists and was later implemented in ATLAS for its experimental determination. This effort is being continued seeking for increased precision in view of new data collected at the LHC at higher energies (13 TeV) and luminosities. For instance, *Extracting the top-quark running mass using tt+1-jet events produced at the Large Hadron Collider,* J. Fuster et al., Eur. Phys. J. C. (2017) 77:794 (34 citations), *Measurement of the top-quark mass in ttbar+1jet evets collected by ATLAS detector in pp collisions at 8 TeV,* Eur. Phys. J. C (2019) 77:794. And now we still pursue to reach the ultimate precision on the top-quark pole mass using this method with the latest set of data collected by ATLAS and two new PhD students being engaged to perform the analyses studying the top lepton and semileptonic channels, Phenomenology *of ttbarj+X production at LHC*, S. Alioli et al. JHEP 05 (2022) 146 (12 citations).

Linear Collider Detector R&D/Physics

The International Linear Collider Technical Design Report - Volume 1: Executive Summary, T. Behnke et al., ISBN 978-3-935702-74-4; (483 citations) and *The International Linear Collider Technical Design Report - Volume 4: Detectors*, T. Behnke et al., ISBN 978-3-935702-78-2; (582 citations); *The International Linear Collider: A Global Project,* Ph. Bambade et al. ArXiv:1903.01629v3 (329 citations). These publications refer to the executive summary and the detector description included in the Technical Design Report of the International Linear Collider submitted in 2013. Member of the editorial team of all these reports. In the case of the CLIC proposal (124 citations), *Updated baseline for a staged Compact Linear Collider* ISBN 9789290834328 (2016), (236 citations) or The Compact Linear Collider (CLIC) – 2018 report summary (127 citations). On the detector R&D and LC physics fronts, Belle II Technical Design Report. (2010), Belle II Collab. (1145 citations) for the contributions to the construction of the vertex detector based on DEPFET technology, *A robust jet reconstruction algorithm for high-energy lepton colliders,* M. Boronat et al., Phys. Lett. B 750, 95 (2015) (45 citations), Higgs *Physics at the CLIC electron-positron linear collider* H. Abramowicz et al., Eur Phys. J.C.77 (2017) 7:475 (211 citations), *Top quark physics at the CLIC electron-positron linear collider* JHEP 11 (2019) 003 (112 citations) or *Top quark mass measurement in radiative events at electron-positron colliders,* M. Boronat et al. Phys.Lett.B 804 (2020) 135353 (14 citations).

Accelerator Technology & Medical Applications

My main contribution to this area has been to lead and manage the accelerator group at IFIC for the past years since 2015. The IFIC High-Gradient (HG) Radio-Frequency (RF) laboratory hosts a high-power infrastructure for testing HG S-band normal-conducting RF accelerating structures to the study of HG phenomena. With the present capabilities of the laboratory a 39 MV/m accelerating gradient at a pulse length of 1.2 ms was achieved. This is the first time that this novel RF accelerating cavity design reaches this level of accelerating gradient. The already collected HG phenomena will be analyzed for a better understanding of the applicability of this technology for future colliders (CLIC) and for application to medical accelerators. Several publications were produced on these topics *X-band RF photoinjector design for the CompactLight project, D. González-Iglesias et al.,* Nucl. Instrum. Meth. A 1014 (2021) 165709 or Analytical RF Pulse Heating Analysis for High Gradient Accelerating Structures, D. González-Iglesias et al., *IEEE Trans.Nucl.Sci.* 68 (2021) 2, 78-91. Also very relevant is the number of technological projects and contracts obtained by the group in the past years which amount for more than 1,5 M€.

In addition, Fuster is the CSIC responsible person for the CSIC-CDTI agreement (Mar. 2023) to build the first stage of a carbon ion accelerator for hadron therapy and radiobiology studies with an estimated cost of 18 M€ which will be built in the next five years.