STARTPAGE

HUMAN RESOURCES AND MOBILITY (HRM)
ACTIVITY

MARIE CURIE ACTIONS
Marie Curie Outgoing International Fellowships (OIF)

PART B Section 2

This section is to be used only in step 2 of the evaluation

“POT”

B2.1 QUALITY OF THE RESEARCH TRAINING *(Maximum one A4 page)*

Clarity and quality of the research training objectives for the researcher

I expect to realize a list of important goals in my training at Fermilab. I expect to learn:

- Use of programmable logic at a very advanced level. The use of Pulsar boards requires high level firmware development (VHDL and Verilog description language), simulation capabilities, timing and implementation optimization, test capabilities.
- Development of code for the level 2 processors at very advanced level, to be able to optimize the final level 2 decision.
- Capability to evaluate cost versus performance of different technologies: VLSI devices, programmable logic, commercial CPUs.
- Knowledge of trigger selections and study of their dependence on the accelerator luminosity. Understanding of bandwidth and processing problems. Optimization of efficiency and rejection power of the selection.
- Capability to realize new triggers exploiting the hardware upgrades.
- Understanding of the CDF online tracking system problems, relative solutions and standardization of the system to be able to transfer the best of this technology to the future. Capability to improve flexibility and ease of use for the trigger devices, to allow application to different experiments with minimum tailoring and minimum effort.
- Development of a complete set of diagnostic tools, to be used also in future applications.
- Realization of simple expert systems to monitor and find problems in the system.
- Exercise automation of technological follow-up of digital electronics developments, producing clean project descriptions by high level languages and automatic compilation into the most advanced devices at time of construction. This will simplify further developments and applications to future experiments.

On returning to Pisa I expect to be able to manage at least part of the new project whose goal is application of online tracking at level 1. This is an R&D project that should test the pattern recognition on a silicon telescope on a test beam. I will manage a small group of people working with me to test the existing SVT chip in a level 1 application and to develop the new associative memory chip taking into account what we have learnt on the test beam.

Relevance and quality of additional scientific training offered, including acquisition of complimentary skills - Many complimentary fields are accessible working at Fermilab. It is very easy to get in contact with new research fields and to enlarge personal interests. In fact, high-energy physicists rely on four essential scientific tools all of them strongly represented in Fermilab: (1) powerful accelerators to create high-energy particle collisions, (2) superconducting magnets with advanced materials and design to guide particle beams, (3) sophisticated particle detectors with super fast readout technology to observe and record particle collisions, and (4) innovative computing solutions to store, access and analyze huge quantities of data. Fermilab is recognized for experience in pioneering success in parallel computing and willingness to try technically risky new directions. Fermilab collaborates closely with scientists from industry and universities around the world to advance all of these fields.

Fermilab offers seminars and possible interactions on a wide range of topics in high energy physics and technological aspects related to the experiments and accelerators. The fellow work will have the opportunity to be presented to a large and international scientific community. Independence and management capabilities are strongly encouraged and rewarded.

Also Pisa offers a lot of opportunities: the University and Scuola Normale find a common structure in the INFN for high energy physics. A large number of experiments (CDF, Babar, Atlas, CMS, Epsi, Kloe, MEG….) are present in Pisa and share experiences and structures. Training is offered for computing, electronics and others skills, seminars are offered and required.

B2.2 QUALITY OF THE HOST

SCIENTIFIC EXPERTISE IN THE FIELD OF THE HOST *(Maximum two A4 pages)*

Fermilab: As part of the DOE (Department of Energy - USA) strategic goals, Fermilab's mission is to advance the understanding of the fundamental nature of matter and energy. Fermilab's world-class scientific research facility allows qualified researchers from around the world to conduct fundamental research at the frontiers of high-energy physics and related disciplines. Fermilab produced its first high-energy particle beam on March 1, 1972. Since then hundreds of experiments have used Fermilab's accelerators. Fermilab is operated by Universities Research Association, a consortium of 90 research universities.

Here is a selected list of active experiments from three main reasearch areas: (1) collider experiments, (2) neutrino physics and (3) astrophysics: (1)Beams of protons and antiprotons collide at nearly the speed of light in Fermilab's Tevatron accelerator. Two huge detectors, CDF and DZero, both consisting of many different detection subsystems, are located in the Tevatron beamline. The detectors observe the collisions taking place at their centers and record all information for later analysis. Physicist look for new phenomena, including supersymmetry, extra dimensions and a mass-carrying particle called the Higgs boson. (2) Fermilab is also home to two new experiments using neutrino beams, MiniBooNE and MINOS. Both experiments search for neutrino oscillations, the transformation of one type of neutrino into another. Results from several experiments, including SuperKamiokande and the Sudbury Neutrino Observatory, have indicated that neutrinos have a very tiny mass. Investigating neutrino oscillations will shed more light on the phenomena of neutrino mass and the neutrino mixing process. (3) Fermilab is also recognized worldwide as a laboratory where advances in particle physics, astrophysics and cosmology converge. Fermilab's 50 theoretical and experimental astrophysicists are actively involved in several astrophysical projects: (1) The Sloan Digital Sky Survey's 2.5 meter monitoring telescope, when completed, will provide scientists with a three-dimensional picture of the sky through a volume one hundred times larger than that explored to date, measuring positions, absolute brightnessess of and distances to millions of celestial objects and galaxies. (2) Fermilab physicists search for dark matter directly through the Cryogenic Dark Matter Search, an experiments located deep underground in Minnesota's Soudan Mine. It looks for weakly-interacting massive particles, or WIMPS, by directly detecting their interactions with ordinary matter. (3) The Pierre Auger Observatory studies the universe's highest-energy particles using a collection of particle detectors spread over an area the size of Rhode Island. The goal is determining the origin of these ultra-high-energy cosmic rays, particles that hit the earth's atmosphere with energies up to 100 million times higher than the Tevatron produces.

Here is a couple of very important achievements taken from a long list of Fermilab discoveries (http://www.fnal.gov/pub/inquiring/physics/discoveries/index.html): **(1) Discovery of the top quark** – CDF/D0 On March 2, 1995 **(2) Discovery of the bottom quark** and subsequent studies of its properties - E288 collaboration, led by Nobel laureate Leon Lederman. **Technology at Fermilab** - The impact of our new understanding can have profound consequences for the way we will live. A direct example is offered by MRI (Magnetic Resonance Imaging) technology that relies on the development of superconducting magnets for the Tevatron. The R&D projects spur the development of new technology in many other areas, including cooling-systems design, vacuum technology, electrical engineering and precision surveying methods. New technical solutions benefit disciplines such as medicine, astronomy, materials science and computer science.

Pisa: The idea of a b-quark real time selection in the CDF experiment was born in Pisa in the 1985, inside the Istituto Nazionale di Fisica Nucleare, University and Scuola Normale of Pisa. All three institutions have been members of the CDF experiment since 1980 and are very active in many CDF physics fields.

The key idea that made it possible to perform real time selection of b-quarks is the use of Associative Memories, as described in section B1. The associative memory idea was born in Pisa in 1989 (see L. Ristori, M. Dell' Orso, "VLSI Structures for Track Finding" Nuclear Instrument and

Methods in Physics Research, Volume A278). The group created in Pisa (which included Mauro Dell'Orso and Paola Giannetti from the beginning) around this main idea proposed the Silicon Vertex Tracker (SVT) at CDF. The experience gained during the development and construction of the associative memory device in Pisa at the beginning of the 90's ("The AMchip, a Full-custom CMOS VLSI Associative Memory for Pattern Recognition", IEEE Trans. On Nucl. Sci. Vol 39, N4, 1992) was a very important step toward further development. It was the starting point for the following studies on different technologies: (a) FPGA technology used for a user-friendly, low-density associative memory ("A programmable associative memory for track finding" published in Nuclear Instruments and Methods in Physics Research, Volume 413, 1998); (b) third generation standard cell technology AM. The last step was made by a collaboration of the CDF Pisa group and the Pisa APE group, which moved to Ferrara in 2000. Raffaele Tripiccione is the leader of the APE group and I was part of this group before moving to the CDF activity. The experience of the APE group on standard cell technology has been very important for the recent uprade to SVT upgrade. The upgrade was proposed and largely built by Pisa. The Pisa group also managed the associative memory chip and the board production for SVT and is now doing the same job for the SVT upgrade. We have managed the production and assembly of hundreds of boards and thousands of AMchips. The experience of the Pisa group is not limited to the associative memory device. Many different 9U VME boards were developed for the original SVT processor, strongly based on the use of Field Programmable Gate Arrays (FPGA) and Complex Programmable Logic Devices (CPLD). Pisa has studied the density, complexity, and performance of these devices for many years, following an evolution that is well beyond the limits imagined just a few years ago. We prepared the test procedures to validate the chips and the boards and we performed the tests on the boards. We installed the system at Fermilab and developed the software for its management, monitoring and diagnostics. The group developed the physics case for the SVT proposal and a realistic simulation of the system to be able to predict the SVT capabilities to produce B-physics results. The performance of the system is as good as expected from the simulation. The system was installed efficiently and without particular problems. The original SVT system has taken data since the year 2000. The Pisa group participated actively in the data taking, the b-quark trigger definition and evolution and finally the B-physics analyses. In conclusion, the group has a dominant role in b-quark physics at the Tevatron and in the related technologies. It has vast experience in all phases of this project.

Supervisors- The fellow supervisors at Pisa, P. Giannetti and M. Dell'Orso, have been CDF members from the beginning, participating mainly on trigger and physics studies. The fellow supervisor at Fermilab, P. Wilson, has been a member of CDF since 1992 working on trigger and front-end electronics, new particle searches and studies for B physics He was project leader for Front-end and Trigger Electronics for the CDF Run 2 Upgrade (1998-2000) and is now project leader for Trigger and DAQ for the CDF Run 2B Upgrade (2004-2006). The particle physics returns of their work include the top quark discovery and an accurate measurement of its mass $M_T = 173.\ 5 \pm 3.9$ GeV/c^2, precision measurement of $M_W = 80.433 \pm 0.079$ GeV/c^2, measurement of the inclusive jet cross section out to transverse energies of 400 GeV, precision measurement of many b hadron lifetimes, and many of the most stringent limits on nonstandard processes. The complete CDF RUN I physics archive is a collection of published papers ranging over the full state of the art in hadron collider physics. CDF Run II, with the accelerator and experiment upgrade, moves the experimental program into a regime of precision hadron collider physics, and already has produced many papers. Precision capability at the energy frontier will allow simultaneous attack on the open questions of high energy physics from many complementary directions, including: (1) characterization of the properties of the top quark (2) a global precision electroweak program (3) direct search for new phenomena (4) tests of perturbative QCD at Next to Leading Order and large Q^2 (5) constraint of the CKM matrix with high statistics B decays. Each of these topics has the potential for revealing new physics; taken together they offer the most comprehensive discovery potential in an ongoing particle physics experiment.

QUALITY OF THE GROUP/SUPERVISORS

More than 50 students got their Master/Laurea and PHD working on our real time tracking project and related physics, finding after that interesting positions in european-USA institutions or industries. We report here some examples: **(1)** A.Annovi (physicist), Laurea&phd with Pisa 2004 "Hadron collider physics with real time trajectory reconstruction" now staff at Frascati Laboratory (Italy), "project leader" of the SVT upgrade. **(2)** A. Cerri(physicist), Laurea&phd "Study of trigger with secondary vertexes at CDF"- now post-doc at Berkeley University (USA). **(3)** M.D'Onofrio (physicist), Laurea 1999,"The Higgs in hadronic events Htt" - now post-doc at University of Barcellona (Spain). **(4)** G.Varotto, (engineer), Laurea 1999, "Design of an FPGA based associative memory, for track reconstruction at hadronic colliders" 2005 phd at Ecole Polytechnique Federale de Lausanne. **(5)** P. Giovacchini, (engineer), Laurea 2005 "Design & test of a standard cell associative memory for the Silicon Vertex Tracker of the CDF experiment" – now at STMicroelectronics Srl, Milan. **(6)** One more engineer (Michele Lamalfa) and physicist (Barbara Simoni) working with us have found a permanent position at STMicroelectronics, Milan .

The CDF group at Fermilab has had almost 30 postdoctoral fellows work in the group since 1993. Of the twenty who have completed their terms, nineteen have found tenured or tenure track positions with a university or particle physics laboratory in USA, Europe or Asia. Over the past seven years, Peter Wilson has supervised the efforts of several engineers and postdoctoral fellows working on front-end and trigger electronics projects. These include the following physicists: J. Dittmann working on original XFT track processor – now Asst Prof at Baylor University, R. Erbacher working on calorimeter front-end electronics – now at University of California at Davis, and P. Gris working on calorimeter front-end electronics – now at Laboratorie Physique de Corpusculaire de Clermont-Ferrand.

EXPERTISE IN TRAINING EXPERIENCED RESEARCHERS IN THE FIELD AND CAPACITY TO PROVIDE MENTORING/TUTORING

I will work in collaboration with the CDF Trigger group at Fermilab. The work planned and done (see work plan below) will be daily discussed and planned with the supervisors and weekly presented by me and discussed in the trigger meetings, with the whole trigger group. In Pisa the style is equivalent. I will belong to the enlarged SLIM5 group, approved at INFN for an R&D project for future experiments.

QUALITY OF INFRASTRUCTURE/FACILITIES AND INTERNATIONAL COLLABORATIONS *(MAXIMUM ONE A4 PAGE)*

The high level facilities available to the researcher will be the CDF experiment itself. The CDF (Collider Detector experiment at Fermilab) is an international collaboration of about 800 Physicists from about 30 American universities and National laboratories, plus about 30 groups from universities and national laboratories from Italy, Japan, UK, Canada, Germany, Spain, Russia, Finland, France, Taiwan, Korea, Switzerland, etc. We have built the 100-ton CDF detector (about 40' high by 40' x 40' base at the Fermilab Tevatron collider with the goal of measuring exceptional events out of the billions of collisions. CDF is a complex detector, which measures most of the interesting particles that come out of the P-bar P collision. Several collisions occur every time p-bar and p bunches collide. Out of the millions of collisions per second, only a few are "Hard" collisions, between constituents of the proton and antiproton and are interesting. I will work to optimize the event selection strategy (experiment trigger) and my work will be strongly related to the detector used to observe the events. Here follows a short description of the whole facility.

CDF measures the particles produced in the event using several detector sub-systems. Starting from the beam collision point the particle is seen by: **(1)** Silicon Vertex Tracker-(Charged particle only) -SVX measures the position of charged particles with an accuracy of about few tens of microns on six layers providing an accurate determination of the track impact parameters. **(2)** COT --Central Tracker --(Charged particle only) --It measures the position of a charged track in a large gas volume, and, based on the track curvature due to the magnetic field B=1,5 Tesla, also the momentum of the track **(3)** EM Calorimetry that consists of Lead sheets sandwiched with scintillator to measure the energy of electrons or photons. **(4)** HAD Calorimetry --iron plates with scintillator sandwiched in-between to measure the energy of hadrons (charged pions, kaons, and protons). **(5)** IRON Absorber is placed behind the calorimetry and used to absorb all Hadronic showers. **(6)** MUON Chambers to measure the position of charged particles escaping the calorimeter. **(7) TRIGGER**-We only record about 100 events per second out of the millions of collisions. The CDF electronics systems were substantially altered to handle the upgraded accelerator conditions of Run 2. The increased instantaneous luminosity requires a similar increase in data transfer rates. However it is the reduced separation between accelerator bunches that has the greatest impact, necessitating a new architecture for the readout system. All frontend electronics is fully pipelined, with onboard buffering for many beam crossings. Data from the calorimeters, the central tracking chamber, and the muon detectors are sent to the Level1 trigger system, which makes a decision based on them to hold the data for the Level2 trigger hardware. The Level1 trigger is a synchronous system with a decision reaching each front-end card at the end of the pipeline. Upon a Level1 trigger accept, the data on each front-end card are transferred to one of four local Level2 buffers. The second trigger level is an asynchronous system with an average decision time of 20 μs. A Level2 trigger accept flags an event for read out. Data are collected in DAQ buffers and then transferred via a network switch to a Level3 CPU node, where the complete event is assembled, analysed, and, if accepted, written out to tape. These events can also be viewed by online monitoring programs running on other workstations.

Tracking processors at LVL1 (XFT) and LVL2 (SVT) are a relevant part of the trigger (see sec.B1).

In addition to the facilities of the experiment itself, there are two large electrical engineering groups at Fermilab. These groups have extensive experience in electronics design from printed circuit boards to firmware for programmable devices (PLDs, FPGAs, DSPs) and design of full custom ASICs. Engineers in these groups have extensive experience on projects with CDF, other high particle physics experiments, astrophysics experiments and accelerator control and monitoring systems. This experience includes design of printed circuits and firmware for the XFT and the XFT upgrade and Pulsar firmware for the SVT upgrade. These groups can provide support of the fellows work at Fermilab ranging from technical support for modifications to printed circuit boards to providing tools for simulation and compilation of firmware for programmable devices.

B2.3 MANAGEMENT AND FEASIBILITY *(Maximum two A4 pages)*

Practical arrangements for the implementation and management of the scientific project

My work at Fermilab will be done directly on the CDF experiment where all the necessary facilities and arrangements are available. The hardware is installed in the trigger room that is also provided of oscilloscopes and many computers and terminals for access, control, monitoring.

A laptop is available with CADs to download directly through Boundary Scan any kind of necessary new firmware. Very near the trigger room two very useful laboratories are available. The laboratories are provided of digital analyzers and many racks providing resources for independent test stands. One test stand is private for SVT, others are allocated to the development of XFT, Level 2 (Pulsar) and various front-end systems. In the control room, placed immediately after the trigger room, the shift team, helped by others experts, has the responsibility of the data taking. It is very easy for people working on trigger issues to interact with the shift crew to obtain the capability to perform their tests and their work. The tests are planned weekly at the trigger meetings.

Data collected in CDF are processed by a large computing facility located near the experiment building. It is easy to ask for specific high priority processings, to evaluate early the effect of a particular action. The data analysis is performed by physicists of the collaboration that work in the trailers located all around the experiment building or at their home institution. Analysis meeting on all items under process are weekly available at Fermilab. Again it is very easy, staying in Fermilab, to interact with any kind of ongoing analysis.

The collection of so many facilities inside and all around the experiment building will make achievable and easy the implementation and management of the fellowship. The project will be the result of my interaction with many physicists, engineers and technicians belonging to CDF.

Feasibility and credibility of the project, including work plan

The SVT upgrade has already been developed and the hardware installation is planned to finish before spring 2006. The XFT upgrade is in the process of installation and the core of the system should be completed by summer 2006. Completion of the XFT installation including full stereo tracking in the Level 2 trigger will occur in late 2006 and early 2007.

Work plan in Fermilab – items are listed following the planned time evolution**:**

1) Participation in the final installation of the XFT processor. Optimization of the combined upgraded XFT and SVT systems possibly including some additional features to take full advantage of the combined systems. Tests, related software development.
2) Diagnostic development for XFT and diagnostic optimization for SVT. Realization of simple expert systems to monitor and find problems in the system.
3) Knowledge of trigger selections and study of their dependence on the accelerator luminosity. Understanding of bandwidth, level-1, level-2 rates, rescale factors and processing problems.
4) Optimization of efficiency and rejection power of the trigger selections, improving the SVT/XFT firmware (programmable logic used at a very advanced level:VHDL and Verilog description language, simulation capabilities, timing and implementation optimization, test capabilities), developing new level 2 processors code.
5) Realization of new triggers exploiting the hardware upgrades. In particular, we plan implement "silicon only" tracks to select muons, electrons and taus in the forward/backward region where the COT coverage is poor. This work will enlarge the geometrical acceptance for leptons.

Fellow is expected to take over leadership of SVT effort at Fermilab. There is apotential for taking on a leadership position in the CDF experiment overseeing operation of all level 1 and level 2 trigger operations.

Work plan in Pisa

1) Develop an updated associative memory device producing a new chip that can work both in level-1 and level-2 applications.
2) Participate to the R&D project SLIM5 for track finding in silicon detectors at level 1. Test beam activity.

The work plan includes participation in conferences and related paper production. **I** plan at least two technological conference contributions (IEEE or similar) in 3 years and more than two technological papers. Points 3-4-5 will allow me to understand and contribute seriously to the CDF physics plan. This kind of work starts from the analysis of the present situation to planning new actions that should increase the significance of the current physics analysis. This work includes critical thinking to determine what can be improved, capability to use statistical issues and knowledge of analysis techniques. After one year of service work for CDF, I will be allowed to enter the CDF default author list and sign the full CDF physics output.

The work plan also includes frequent presentations of the work inside the trigger/SLIM5 group and seminars to the CDF collaboration or Pisa high energy community. It will include also supervision/tutoring of Italian students working in CDF.

Practical and administrative arrangements and support for the hosting of the fellow

Fermilab is a well organized lab. It has been hosting visitors for decades and it has a turnover of hundreds of new visitors each year and help is available on virtually everything. Childcare and summer camps are provided inside the lab for children of employees and visiting users. Many recreation/cultural activities are also provided, including a gymnasium, a summer pool, and concert and film series. We report the content of the Fermilab web site providing all kind of informations for new Users. The 4 links at the end of the page are particularly useful to do all the necessary steps joining Fermilab the first time (help for visa, buying a car, getting the security number, finding a house, getting insurance etc. etc.).

Resources for Users (http://www.fnal.gov/pub/forphysicists/users/resources.html)

- Fermilab Safety Video- All Users are required to watch
- ID Cards - Each user at Fermilab must register with the Users' Office to get the ID car
- Visa Waiver program
- Apply for Computing Privileges - read and sign the Fermilab Policy on Computing
- Medical Insurance - Users' Office has applications for short-term medical insurance
- Rental Cars - available through the Users' Office…..
- Taxis – help for users
- Fermilab On-site Accommodations
- Off-site Accommodations and Local Restaurants
- Users Executive Committee (UEC) – The UEC represents the Fermilab User Community.
- Graduate Student Association (GSA) - The GSA organizes classes, tours etc. etc.
- NALWO - The Fermi National Accelerator Women's Organisation
- Users' Center - The Users' Center is a place for people to socialize after work.
- Chez Leon - The Chez Leon restaurant located in the User Center Building
- Social Security Administration - Application for a social security number.
- Illinois Secretary of State (Driver's License) - Rules of the Road and a map
- Helpful Information for Users (1) Procedures for Experimenters (2) Guide for Newcomers (3) GSA'sGuide To Life at Fermilab (4) Fermilab's Recreation Office

B2.4 ADDED VALUE AND RELEVANCE TO THE OBJECTIVES OF THE ACTIVITY *(Maximum two A4 pages)*

Relevance of the proposal to one or more of the specific objectives of the action

The fellow will reinforce the international dimension of my career giving me the opportunity to be trained and acquire new knowledge in a very high level third country research organization. I have already participated in the CDF experiment, but have not had the opportunity to work outside Italy.

I will be able to apply the experience gained on returning to Italy, inside INFN. High Energy physics in Italy will profit of the competencies that I will acquire (see below).

Potential of acquiring competencies during the fellowship to improve the prospects of reaching and/or reinforcing a position of professional maturity, diversity, independence, in particular through exposure to complimentary skills training.

The CDF and Fermilab organization is such that I will be strongly pushed to discuss/plan before and defend my work after. I will exercise a management position: supervision, organization of a team, presentation of the work to conferences. The goal coming back is that I participate in new proposals and work as referee for other group proposals. After the fellow, I will have the competencies to attain such an important position. These items will be part of my work: writing documentation, negotiations with founders, financial planning and resource management. I will also participate in the effort to increase the team for the new project

The activity in USA will allow me to improve my natural capability for independent thinking and my managerial capabilities

Contribution to career development or re-establishment where relevant

I will have significant experience with programmable logic, standard cell technology and computer technologies. I will be able to evaluate cost and performance of different technologies as a function of different applications. This knowledge will give me an important role inside INFN. I will be particularly helpful choosing the right technology for online algorithm implementation. Moreover I will gain knowledge of hadron collider physics processes and the best strategies for online selection of such events. I will learn about monitoring/diagnostic/standardization problems for very complex electronic systems.

Potential for creating long-term collaborations and mutually beneficial co-operation between Europe and the third country

I will be inserted in projects common to Pisa (INFN, University and Scuola Normale) and the University of Chicago and Fermilab. This is a stable beneficial collaboration which started at the beginnings of the CDF experiment (1985-86). I would like to be part of this collaboration and to reinforce it. We plan to work together in supercomputing and microelectronics, even after the CDF experiment will be closed (2009). Supercomputers like the ones used in CDF can have wide applications even outside of high energy physics. For this reason it is a research item favoring the continuation and expansion of the collaboration.

Extent to which the research contributes to the objectives of the European Research Area or other European Policy objectives

Our goal is the use of our supercomputers (upgraded for the newer available technologies) in future more complex applications. We want to standardize a single processor that can work on both level-1 and level-2 applications at future high energy physics experiments. Interest is growing around this project: for the level-2 application a USA-Italy collaboration does exists and it is a very high level international collaboration, including USA institutions like the Chicago, University of Illinios, Boston University and USA laboratories Fermilab and Argonne. The interest in the level-1 application is shown by the Italian SLIM5 collaboration.

Moreover the use of such supercomputers based on an optimized mixture of FPGA/standard cell microelectronics can be enlarged to different fields requiring very large computing power. We think this is a very attractive development for European research.

B2.5 PREVIOUS PROPOSALS AND CONTRACTS *(Maximum 1 A4 Page)*

We did not receive any support from the European Community before this application. This is the first time we apply.

We received support from INFN Pisa and Italian University funds to participate in the CDF and SLIM5 experiments.

B2.6 OTHER ISSUES *(Maximum one A4 page)*

Information required from proposers on the ethical aspects of the research presented

A. Proposers are requested to fill in the following table

Does the research presented in this proposal raise sensitive ethical questions related to:	**YES**	**NO**
Human beings		NO
Human biological samples		NO
Personal data (whether identified by name or not)		NO
Genetic information		NO
Animals		NO

B. Proposers are requested to confirm that the research presented in this proposal does not involve:

- *Research activity aimed at human cloning for reproductive purposes,*
- *Research activity intended to modify the genetic heritage of human beings which could make such changes heritable*[1]*;*
- *Research activity intended to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer;*

Confirmation : the proposed research involves none of the issues listed under heading B	**YES**	

If there are ethical or safety issues associated with the subject of the proposal, show they have been adequately taken into account - indicate which national and international regulations are applicable and explain how they will be respected. Explore potential ethical aspects of the implementation of project results. Demonstrate a readiness to engage with actors beyond the immediate area of research to help spread awareness and knowledge and to explore the wider

[1] Research relating to cancer treatment of the gonads can be financed

societal implications of the proposed work; if relevant set out synergies with education at all levels.

Further information on ethics requirements and rules are given at the science and ethics website at http://europa.eu.int/comm/research/science-society/ethics/ethics_en.html.

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