*Curriculum Vitae of*

# Guido Volpi

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## Summary

I'm Guido Volpi, born in Tivoli (RM) on 16/7/1977. I'd like to apply for the open position MC-PEOPLE-IAPP Project 214318 "FTK" at University of Pisa. I received my Ph.D. in Physics at University of Siena, degree defended on 24/7/2008; in past 3 years I have spent my time in Chicago, between 19/10/2010 to 30/09/2012, as University of Chicago post-doctoral fellow; from 01/10/2012 to today I'm at CERN as Research Associate.

Since 2008 I'm leading and coordinating the development of the FTK simulation. In this role I coordinate the work of several post-docs and students coming from all the institutions involved in the project. My work was crucial in the preparation and planning of the simulation work for the writing of the FTK technical design report. I'm also an important contact point between the FTK project and ATLAS management regarding the integration of the FTK simulation within the ATLAS offline software environment. My personal contribution on the FTK emulation started in 2005 and I had a major in the study and definition of the most important parts of the systems: since the early days of the FTK development I contributed in understanding how to adapt the associative memory technology, successfully used in CDF, to the ATLAS tracker and the expected accelerator performance. I had a major contribution in the definition of the track fitting strategy. I had a leading role in studies about the track fitting techniques, use of variable resolution in the pattern bank, duplicate suppression and dataflow balance between the parts of the system. During the integration of the FTK system with the ATLAS computing facilities I contributed in all the parts. For FTK I was also contact during the Vertical Slice test, I'm writing part of the FTK input mezzanine, related to the clustering property calculation. I'm also participating in the designing the monitoring system for the FTK hardware processor.

In my experience with CDF and ATLAS experiments I also gave an important contribution to the physics researches of both experiments. For the CDF experiment I have contributed to the analysis of rare decays of b-mesons, in hadronic and leptonic final states; I contributed in the study of the performance for heavy flavor analysis in tuning the mass line shape for hadronic decays of c- and b-hadrons collected with the displaced track trigger, crucial for modeling of the signals. I participated in the first evidence of the measure for B0s→Kpi and Lamba0b→ppi and pK, with the first determination of their CP asymmetry. For ATLAS I contributed in H→ZZ(*)→llll analysis, exploring the advantages offered by multivariate analysis techniques in order to improve the sensitivity to the rare signal. Exploring the possibilities offered by these techniques in the Higgs analysis I also contributed in the definition of the ATLAS baseline technique used for the measurement of spin and properties using a Boost Decision Tree.

## Jobs and Positions

### October 19th, 2010 – October 18th, 2013 (On Going)

During this period, as Marie Curie Fellow under the project ARTLHCFE, I spent the first 2 years at "University of Chicago" as Post-doctoral Fellow with the HEP group in the Enrico Fermi Department, in the ATLAS group under the coordination of Distinguished Professor Mel J. Shochet.

From October 2012 I'm spending the return phase at CERN as Scientific Associate.

### September 2008 – July 2009

Teaching Assistant for Prof. Francesco Forti for "*Fisica Generale I*" ("General Physics I"), in the Faculty of Engineer of Pisa University, department of "*Ingegneria Gestionale*". I was also in the exams commission.

### July 2008 – July 2010

Post-doctoral position (Assegno di Ricerca) at the University of Pisa with research argument "*Ricostruzione in tempo reale di traiettorie di particelle cariche ai collider adronici*" ("Real-time reconstruction of charged tracks trajectories at hadronic colliders").

### November 2007 – June 2008

Independent contractor with University of Pisa the development of the GigaFitter and FTK simulations.

### November 2004 – October 2007

Ph.D. Students in Experimental Physics at University of Siena. Supervisors Prof. Giovani Punzi and Dott. Maria Agnese Ciocci. As graduate student I specialized in particle physics, participating to the activities of CDF group of Pisa INFN, where I had my research, with long presences at the Fermilab National Accelerator laboratory to coordinate the research activity with the physics group, participate in the data taking. I then defended my graduation work on the 24th July 2008 with a work "*Rare decays of B mesons and baryons at the Tevatron and the LHC*", final mark "Excellent" .

### November 1996 – September 2004

Student at University of Rome "La Sapienza". Study in Particle Physics and final Thesis with title "*Studio della calibrazione delle camere per muoni dell'esperimento ATLAS al CERN*" ("Study of the calibration of the muon chambers of the ATLAS experiment at CERN"), defended on the 30th September 2004, final mark 106/110, supervisor Prof. Paolo Bagnaia.

## Additional Awards and recognitions

### June 2012

I was selected by a joint INFN and CERN committee to receive a fellowship to finance one year of residence at CERN as Scientific Associate.

### November 2010

Declared "idoneo non vincitore" for INFN national selection for permanent staff positions, reference INFN document: BANDO 13705/2010.

### December 2009

Selected to receive a Grant under as Marie-Curie Fellowship for "International Outgoing Fellow" for the project *"Accurate Real-time Tracking in LHC Full Events"*, ARTLHCFE. The grant was received under the European Community FP07 program, assigned to post-doctoral researchers that presents an argument of particular interested. The proposed program focuses on the participation to the development of the Fast Tracker processor for the ATLAS detector and physics analysis at the ATLAS detector. The program finances a 3 years contract with the INFN with an exchange program with *"University of Chicago"*, supervisors Prof. Mel Shochet, for the 2 years outgoing phase, Dott. Alberto Annovi for the returning phase in Europe.

# Acquired skills and responsibilities

## Marie Curie Fellowship period

During this period I was involved in the ATLAS experiment and worked on both trigger upgrades, particularly focusing on the Fast Tracker processor, and Higgs analysis.

I continued my work of coordination and development of the FTK simulation, leading the simulation development and increasing my impact in the group. I became a reference across the FTK groups and an important connection person for the ATLAS High Level Trigger (HLT) community in the interaction with the FTK collaboration. I was in charge of the coordination of the emulation development and organization in order to obtain performance studies of the system. I was responsible in organizing the service work related to the simulation and performance studies, identifying the tasks that need to performed and prioritize them.

In particular the group of students and post-docs working on the simulation need to prepare the FTK technical design report (TDR) studies at the time counted more than 10 people, with different involvement and skills, my goal is maintain the group productive. I had a leading contribution in preparation of the simulation code for the TDR. The code in fact was updated to both evolve the simulation according the hardware specifications and to better define the best working conditions. Together with the more FTK specific activities a lot work goes in the integration with the ATLAS HLT software infrastructure and the inclusion of the FTK emulation within the full ATLAS simulation. These steps are necessary to understand the performance of the future FTK hardware and prepare the DAQ chains, understanding the way to integrate it within the ATLAS DAQ system. The simulation work for the TDR is also particularly detailed and computationally intensive, updates of the simulation to meet these requirements is necessary.

The use of FTK tracks as input in different HLT algorithms requires also additional studies to verify how these algorithms can use the new information at the best for complex particle identification algorithms, as b-tagging or tau-tagging, or simpler as muon and electron reconstruction; other use as beam spot determination monitor. I'm giving a major contribution in deciding how the FTK tracks or other information are used by HLT algorithms.

I also continued the study on the pattern matching algorithm in the associative memory giving a major contribution in the definition of the associative memory resolution idea. After the FTK TP I studied different methods that can be used to define how the pre-calculated patterns are selected and how the don't care bits (DC), responsible for the variable resolution, are set. An optimal method was found, scalable to an arbitrary number of DC bits, and the results up 75 pileup events showed how this approach keeps the pattern bank size under the limit of the FTK system with a good performance in rejecting fakes, without the

technical complication of having a "tree search processor". I'm coordinating the further optimization study that the FTK group is doing to select the final working point for the LHC Phase I expected pileup scenario.

During this period I participate in the search for the Higgs boson in the $H \to ZZ^* \to 4l$ decay mode. The importance of the potential discovery and the competition with other experiment required an extremely intense effort, in all the possible direction to extract all the information from the collected sample. I contributed in exploring the potential offered by multivariate technique, in particular boosted decision tree and artificial neural networks, in order to improve the signal over background ratio and the overall sensitivity of the analysis; without introducing effects that can potentially distort the signal. After the discovery of the new Higgs-like particle I contributed significantly in the study of its properties. I had an important contribution in the definition of the method used to distinguish between different spin states. The baseline technique used by the collaboration is a BDT based on angular and kinematic variables, among the ones with limited theoretical uncertainties, that can maximize the separation power between the different possible states. This allowed then to identify the new particle like a spin 0 resonance, confirming this as the Higgs boson at a very high degree of confidence, more than 95%.

## Postdoctoral research at INFN Pisa

During this period I continued to share my time between B-physics analysis at CDF and R&D for the FTK processor at ATLAS. For the CDF I continued working in the hadronic decays of B, working to prepare the update of the *B→hh* analysis using the most recent data. I also continued to maintain and adapt the "final state radiation" tool to be used in other in the CDF analysis, in both $B$ and $D$ CP asymmetry studies. I also joined an effort to improve the sensitivity of the search for the FCNC decay mode including the data collected with the hadronic trigger the study showed a possible 15% gain.

For the FTK collaboration I continued with my role of coordination and development of the simulation and study for the Technical Proposal submission to the ATLAS collaboration. I had a central role in the definition of the physics case for the FTK processor studying one of the two possible architectures for the processing unit. I have studied the architectural choice with a very challenging associative memory chip, connected to a tree search processor, and a 2-stage fit scheme. The scheme was showed to be flexible and with a good performance in limiting the load of the system at very high pileup. This scheme later has been accepted as the best choice for the processing unit.

I was tutor of Summer Student Valerio Vagelli, for the INFN-Fermilab summer school program, during summer 2008. With a work on the search for $B^0_{(s)} \to \mu^+\mu^-$ using the hadronic trigger.

For the CDF group I was also contact person for the computing at Pisa and Fermilab.

## Contractor at University of Pisa

During this short term contract I focused on the development of the FTK simulation and the preparation studies for the Technical Proposal. During this period I acquired the role of coordination for the development of the system simulation, to respond to the necessity of updating and improving its infrastructure to meet the challenge requirements of the very high pileup simulation. I also participate in the GigaFitter project.

## PhD Student at University of Siena, INFN Pisa

During my graduate student period I worked on both physics analysis and detector R&D and maintenance.

I gave a very important contribution to the analysis on charmless decays of B-hadrons. In this analysis eight different decay channels from three neutral bottomed baryons, $B^0$, $B^0_s$, and $\Lambda^0_b$, overlap. To separate the different modes and particle a very refined statistical analysis is used, combining kinematics and particle identification, exploiting the very good CDF mass resolution. The decay modes are extracted using a maximum likelihood fit, with 5 input variables: the mass candidate in two $\pi$s hypothesis, the momentum of the tracks, and the energy loss in the central drift chamber for each track. In order the succeed a very good calibration of all the variables and the detector and experimental effects is required, this requires a very carefully set of preliminary study in order to achieve this knowledge. With the increase of the data sample collected by CDF the was possibility to observe the rarest channels is enhanced. My personal contribution was devoted to the study and mass line shape of the different signals, improving it with respect the previous version of the analysis. This knowledge increased the power to separate a rare signal lying in the tail of the more abundant decays. I studied in depth the discrepancies in the mass distribution between the CDF detailed Monte Carlo and the data for B and D mesons decays. The study showed that these differences were due to the soft-photons emission in the Final State Radiation, an effect not included in a reliable way in the detailed Monte Carlo. I developed a new parametric Monte Carlo, it had the same quality of the detailed one on mass line shape and other kinematics distributions used in the analysis, and offered some additional features. In particular this new tool was faster than the detailed Monte Carlo, and it was capable to add the FSR effect using analytical formulas. I implemented a technique that reduced the impact of the FSR uncertainties from about 20% to less than 5%, with a good result on the statistical significance of rare decay modes, in particular for the previously unseen $B_s^0 \to K^-\pi^+$ mode. My tool has become a standard CDF tool and was used also in other analysis sensible to the mass line shape, as for the B$\to$DK analysis, $D^0 \to h\,h$, or in the B$\to\mu\mu$ analysis were the B$\to$hh modes are a physics background.

The mass templates produced with this tool, in fact, had a better agreement with the data than the CDF Monte Carlo. It was included in the $B\to h^+h^-$ analysis update for the 1 $fb^{-1}$, where for the first time the $B^0_s \to K^-\pi^+$ and $\Lambda^0_b$ charm less decays were observed, and it was also used in other analysis. Using the $B^0_{(s)}\to h^+h^-$ analysis framework then I finalized the measurements of the Branching Fraction and CP asymmetry for the charm less $\Lambda$0b decays: $\Lambda_b^0 \to p\pi$ and $\Lambda_b^0 \to pK$. These were the first observations and measurements for these decay channels and are the most original part of my PhD thesis. The $\Lambda^0_b$ analysis with respect to the $B_s^0 \to K^-\pi^+$ analysis required to me many efforts to specialize it. Taking into account the different production mechanisms of the $\Lambda^0_b$, I defined a different set of analysis cuts to reduce the systematic uncertainties. For this reason I needed to recalculate all the probability distribution templates and to perform a different set of checks to validate the fit results. The decay of spin 1/2 and the presence of a proton (anti-proton) in the final state requested: (a) to take into account the impact of the polarization in the systematic, (b) a calculation of the related detector efficiency and corrections. I did these measurements, I discussed and defended them in the collaboration up to the authorization ("blessing") to show them in public.

On instrumentation side I have joined to the final part of the SVT upgrade activity, giving a contribution to the monitoring infrastructure. With the same group I started my work for the development of the FTK system. I worked to evaluate the impact of the system on rare decay channels, at Atlas, as the B$\to\mu\mu$. The application of the SVT idea in ATLAS showed some important new issues and challenges, due to the larger complexity of the ATLAS inner detector geometry, the larger number of input channels and the higher efficiency required to this "second generation processor". First of all I had an important role in the development of the whole processor simulation (FTKSim) that is able to reconstruct fully simulated events in

ATLAS (Athena). I introduced algorithms to understand and solve found problems, i.e. majority logic, ghost-track handling, and new features needed because of the different geometry with respect to CDF (i.e. silicon module overlaps, highly Z segmented detectors, etc..). With FTKSim it is possible to estimate the number of needed pre-calculated tracks, and the main processor parameters to evaluate the size and cost of the hardware. It is also possible to evaluate the tracking and timing performances. The preliminary results showed that the system can reconstruct all three-dimensional track parameters with a resolution and efficiency very close to the off-line performances, but with a much greater speed than any CPU based algorithm. I used FTKSim to study the physics case of the $B \rightarrow \mu\mu$. Preliminary results, (presented by me at IEEE RT07) showed that we can increase the trigger acceptance of a factor three or better using FTK in ATLAS. I also worked to understand performances at L2 developing of a trigger to select the calibration sample $Z \rightarrow bb$. The very interesting results reported in an ATLAS public note**Errore. L'origine riferimento non è stata trovata.**, showing that even at low luminosity it will be possible to use this calibration sample to monitor the b-jet resolution and energy scale.

I participated to the CDF data taking as *"acquisition control expert"* (ACE) in 2008

## Student University of Roma

As student I followed the standard courses in physics and the particle physics specialization exams: phenomenology of particle physics, quantum field theory, laboratory of nuclear and particle physics, probability.

As research work I joined the ATLAS collaboration in 2003, working on the auto-calibration procedure of monitored drift camber (MDT), under the supervision of Prof. Paolo Bagnaia. I shortly participated to the 2003 test-beam monitoring the performance of the MDT tubes as function of the gas distribution system. The MDT tubes in ATLAS give a time measurement and a charge measurement. The time measurement can be related to the distance from the center of the tube which a charged particle crossed the sensitive volume. The space-time relation, r(t), and the data-driven procedure used to determine it are effected by the presence of a magnetic field parallel perpendicular to the charge avalanche that generates the electric signal. I used the ATLAS full simulation and a specific simulation for gaseous detector, GARFIELD, to verify the effect and the procedure that ATLAS should have be taken to mitigate it.

## Other skills

As technical knowledge acquired I can cite an extremely good knowledge in many different programming language, in particular: C, C++, Python. I have also developed very good abilities in mixing different compiled and not compiled languages to use the best features of each. I also have a wide knowledge and experience in the use of the debugging tools, as valgrind and gdb under Linux, Eclipse development framework or Microsoft Visual Studio.

In the research related to the trigger studies I acquired a good knowledge in NVIDIA GPU programming. I have used this to compare the FPGA and GPU performance in the algorithms used by FTK and other studies related to track triggers.

Among common mathematical and data analysis tools I have a good knowledge of Wolfram Mathematica, R statistical analysis program, ROOT, RooFit, and RooStats. I am among the ROOT contributors since 2007.

I have a very good knowledge of the ATLAS distributed computing model, with experience in most of the tools used in the experiment.

## Participation to conferences, Workshops and Schools

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| June 11-15, 2012 | *"A Hardware Track Finder for ATLAS Trigger"*, Real Time 2012 Conference, Berkeley, USA |
| May 20-26, 2012 | *"A Fast Hardware Tracker for the ATLAS Trigger System"*, *"ARAMIS: Advanced Real-time Architectures of Data processing, Pattern Recognition and Data Transmission for Frontier Applications in High Energy Physics, High Reliability Systems and Visual Science"*. 12th Pisa Meeting on Advanced Detectors |
| June 6-11, 2011 | *"A new variable-resolution Associative Memory for high energy physics"*, Advancements in Nuclear Instrumentation Measurement Methods and their Applications (ANIMMA ) 2011, Ghent, Belgium |
| June 21-26, 2010 | *"Search for non-standard model physics in rare decays at the Tevatron"*, Beach 2011, 21-26 June, Perugia |
| July 16-22, 2009 | *"The Fast Tracker Architecture for the LHC baseline luminosity"*, the 2009 Europhysics Conference on High Energy Physics, Krakow, Poland |
| April 16-19, 2009 | *"Rare and Charmless decays at Tevatron"*, Incontri di Fisica delle Alte Energie 2009, Bari, Italia |
| October 6-9, 2008 | *"II Scuola per utenti INFN della GRID"*, Bologna, Italia |
| September 9-13, 2008 | *"$\gamma$ angle from $B_s^0 \to h^+h'^-$ decays"*, CKM workshop, Rome, Italia |
| April 3-4, 2008 | *"Rare hadronic d-decays at CDF II"*, Incontri di Fisica del B, Cagliari, Italy |
| March 26-28, 2008 | *"Rare and Charmless decays of b-hadrons at CDF"*, Incontri di Fisica delle Alte Energie 2008, Bologna, Italia |
| September 24-27, 2007 | *"Measurement of Branching Fractions and ACP of $\Lambda_b^0 \to p\pi^-$ and $\Lambda_b^0 \to pK^-$ Modes at CDF II"*, SIF conference 2007, Pisa, Italia |
| 29 April – 2 May, 2007 | *"The Fast Tracker Processor Performances for Rare Decays at the ATLAS Experiment"*, IEEE Real Time 2007, Batavia, IL, USA |
| 14-17 April, 2007 | *"Observation of the $B_s^0 \to K\pi$, $\Lambda_b^0 \to p\pi^-$ and $\Lambda_b^0 \to pK^-$ Modes at CDF"*, American Physical Society, April Meeting 2007, Jacksonville, FL, USA |

# List of publications

I'm in the ATLAS author list since 2010 and before in the CDF author list since 2006. Because my participation to those experiments my name appear in more than 580 publications on international journals, with a h-index ranging between 70 and 74 according the website. This is a shirt list of publications due to paper submissions or a conference proceedings where I had a major contributor or my work for the collaboration was relevant.

# Published papers and proceedings

1. Fast TracKer (FTK) Technical Design Report, Shochet, M ; Tompkins, L ; Cavaliere, V ; Giannetti, P ; Annovi, A ; Volpi, G; CERN-LHCC-2013-007
2. A particle consistent with the Higgs Boson observed with the ATLAS Detector at the Large Hadron Collider ATLAS Collaboration (Georges Aad (Freiburg U.) et al.). 2012. 7 pp
3. Andreani, A. et al. "The AMchip04 and the processing unit prototype for the FastTracker." JINST 7 (2012) C08007.
4. Andreani, A. et al "The Fast Tracker real time processor and its impact on muon isolation, tau and b-Jet online selections at ATLAS." IEEE Trans.Nucl.Sci. 59 (2012) 348-357.
5. ATLAS Collaboration "Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC." Phys.Lett. B716 (2012) 1-29
6. Annovi, A.; Amerio, S.; Beretta, M.; Bossini, E.; Crescioli, F.; Dell'Orso, M.; Giannetti, P.; Hoff, J.; Liu, T.; Magalotti, D.; Piendibene, M.; Sacco, I.; Schoening, A.; Soltveit, H.; Stabile, A.; Tripiccione, R.; Liberali, V.; Vitillo, R.; Volpi, G.; , "A new variable-resolution Associative Memory for high energy physics," Advancements in Nuclear Instrumentation Measurement Methods and their Applications (ANIMMA), 2011 2nd International Conference on , vol., no., pp.1-6, 6-9 June 2011
7. Search for the Standard Model Higgs boson in the decay channel H->ZZ(*)->4l with 4.8 fb-1 of pp collision data at sqrt(s) = 7 TeV with ATLAS By ATLAS Collaboration (Georges Aad et al.). arXiv:1202.1415 [hep-ex]. Phys. Lett. B710 (2012) 383-402.
8. Search for the Standard Model Higgs boson in the diphoton decay channel with 4.9 fb-1 of pp collisions at sqrt(s)=7 TeV with ATLAS By ATLAS Collaboration (Georges Aad et al.). arXiv:1202.1414 [hep-ex]. Phys.Rev.Lett. 108 (2012) 111803.
9. Combined search for the Standard Model Higgs boson using up to 4.9 fb-1 of pp collision data at sqrt(s) = 7 TeV with the ATLAS detector at the LHC By ATLAS Collaboration (Georges Aad et al.). arXiv:1202.1408 [hep-ex]. Phys.Lett. B710 (2012) 49-66.
10. Measurement of CP--violating asymmetries in $D^0\to\pi^+\pi^-$ and $D^0\to K^+K^-$ decays at CDF By CDF Collaboration (T. Aaltonen et al.). arXiv:1111.5023 [hep-ex]. Phys.Rev. D85 (2012) 012009.
11. Measurements of branching fraction ratios and CP-asymmetries in suppressed $B^- \to D(\to K^+ \pi^-)K^-$ and $B^- \to D(\to K^+ \pi^-)\pi^-$ decays By CDF Collaboration (T. Aaltonen et al.). arXiv:1108.5765 [hep-ex]. Phys.Rev. D84 (2011) 091504.
12. Search for $B_s \to \mu^+\mu^-$ and $B_d \to \mu^+\mu^-$ Decays with CDF II By CDF Collaboration (T. Aaltonen et al.). arXiv:1107.2304 [hep-ex]. Phys.Rev.Lett. 107 (2011) 239903, Phys.Rev.Lett. 107 (2011) 191801.
13. Limits on the production of the Standard Model Higgs Boson in pp collisions at sqrt(s) =7 TeV with the ATLAS detector By ATLAS Collaboration (Georges Aad et al.). arXiv:1106.2748 [hep-ex]. Eur.Phys.J. C71 (2011) 1728.
14. Search for non-standard model physics in rare decays at the Tevatron By CDF and D0 Collaboration (G. Volpi for the collaboration). Nucl.Phys.Proc.Suppl. 210-211 (2011) 131-136.
15. Measurements of Direct CP Violating Asymmetries in Charmless Decays of Strange Bottom Mesons and Bottom Baryons By CDF Collaboration (T. Aaltonen et al.). arXiv:1103.5762 [hep-ex]. Phys.Rev.Lett. 106 (2011) 181802.

16. Enhancement of the ATLAS trigger system with a hardware tracker finder FTK By A. Andreani, A. Andreazza, A. Annovi, M. Beretta, V. Bevacqua, M. Bogdan, E. Bossini, A. Boveia et al.. JINST 5 (2010) C12037.
17. The fast tracker architecture for the LHC baseline luminosity By A. Annovi, M. Beretta, E. Bossini, A. Boveia, E. Brubaker, F. Canelli, V. Cavasinni, F. Crescioli et al.. PoS EPS-HEP2009 (2009) 136.
18. The GigaFitter: Performance at CDF and perspectives for future applications By S. Amerio, A. Annovi, M. Bettini, M. Bucciantonio, P. Catastini, F. Crescioli, M. Dell'Orso, P. Giannetti et al.. J.Phys.Conf.Ser. 219 (2010) 022001, Nucl.Instrum.Meth. A623 (2010) 540-542.
19. G. Volpi et al. "The Fast Tracker architecture for the LHC baseline luminosity". Proceedings of EPS-HEP 2009.
20. G. Volpi et al. "Rare and charmless decays at Tevatron". Nuovo Cimento B, 2009.
21. A hardware track finder for the ATLAS trigger. By A. Annovi, et al., Nuovo Cim.123B:981-983,2008,.
22. Rare and charmless decays of b- and c-hadrons at CDF. By CDF Collaboration Nuovo Cim.123B:818-820,2008,.
23. Search for the Decays $B_s^0 \to e^+\mu^-$ and $B_s^0 \to e^+e^-$ in CDF Run II. By CDF Collaboration Phys.Rev.Lett.102:201801,2009,. [arXiv:0901.3803]
24. Observation of New Charmless Decays of Bottom Hadrons. By CDF Collaboration Phys.Rev.Lett.103:031801,2009,. [arXiv:0812.4271]
25. Search for $B_s^0 \to \mu^+\mu^-$ and $B^0 \to \mu^+\mu^-$decays with 2 $fb^{-1}$ of p anti-p collisions. By CDF Collaboration Phys.Rev.Lett.100:101802,2008,. [arXiv:0712.1708]
26. The Fast Track Processor Performances for Rare Decays at the ATLAS Experiment. By E. Brubaker, et al., IEEE Trans.Nucl.Sci.55:145-150,2008,.
27. Observation of $B_s^0 - \bar{B}_s^0$ Oscillations. by CDF Collaboration. Phys.Rev.Lett.97:242003,2006 [hep-ex/0609040]
28. J. Adelman et alt., "On-line tracking processors at hadron colliders: The SVT experience at CDF II and beyond", NIM.A Vol 581, Issue 1-2, October 2007, Pag 473-475.
29. Observation of $B_s^0 \to K^+K^-$ and Measurements of Branching Fractions of Charmless Two-body Decays of $B^0$ and $B_s^0$ Mesons in anti-p p Collisions $\sqrt{s} = 1.96\,TeV$ a t. By CDF Collaboration Phys.Rev.Lett.97:211802,2006,. [hep-ex/0607021]
30. Measurement of the $B_s^0 - \bar{B}_s^0$ Oscillation Frequency. By CDF - Run II Collaboration Phys.Rev.Lett.97:062003,2006,. [hep-ex/0606027]

**Guido Volpi, 04/09/2013**