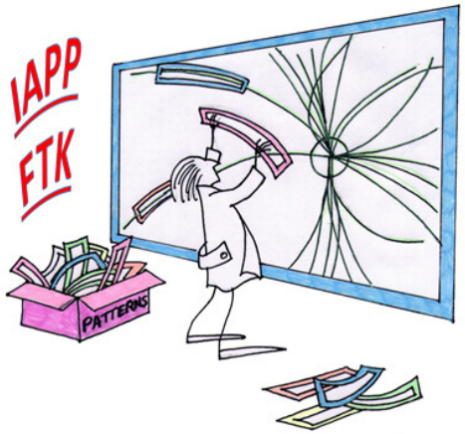

Project number: 324318

FTK Web Site

Simone Donati – University of Pisa

Pisa, November 12th, 2015

FTK - Fast Tracker for Hadron Colliders

An FP7 IAPP project (February 1, 2103 - January 31, 2017)

Home

FTK Consortium Jobs

Partners

- Pisa (coord)
- AUTH
- CAEN
- CERN
- CNRS/Paris
- Prisma Electronics

The Project

- The FTK Project
- FTK application in HEP
- Other FTK applications
- Transfer of Knowledge

Dissemination

- Talks and Proceedings
- Papers
- FTK events

Collaboration

This project aims to develop an extremely fast but compact processor, with supercomputer performances, for pattern recognition, data reduction, and information extraction in high quality image processing.

The proposed hardware prototype features flexibility for potential applications in a wide range of fields, from triggering in high energy physics to simulating human brain functions in experimental psychology or to automating diagnosis by imaging in medical physics. In general, any artificial intelligence process based on massive pattern recognition could largely profit from our device, provided data are suitably prepared and formatted.

The project has received funding from the
European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement n.324318
Participants (2 SMEs and 4 Academic Institutions)

FP7 Project 324318

University of Pisa, Italy

Aristotle University of Thessaloniki (AUTH), Greece

CAEN SpA, Italy

CERN, Switzerland

CNRS, France

Prisma Electronics ABEE, Greece

Contact: Mauro Dell'Orso

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Added FTK Consortium

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Hic sunt leones

Dissimination

- Talks and Proceedings
- Papers
- FTK events

Organisation

- Management
- Workpackages & Deliverables
- Timeline & Milestones
- Secondments and Recruitments

Documentation

- Financial
- Agreement Docs
- Meetings
- Deliverables
- Reports
- Public documents (in writing)
- Career Development plan
- Web site Development plan

This is adiabatically evolving and under control

The Project

- The FTK Project
- FTK application in HEP
- Other FTK Applications
- Transfer of Knowledge

Almost totally Missing

But we have One submitted Paper

Reasonably good shape
Detailed description of FTK at ATLAS, of its progenitor SVT at CDF, Fermilab, triggering at hadron colliders, CERN, Associative Memory, a lot of interesting details

This is all we have for Other FTK Applications

We are studying models of image processing performed by human brain as possible applications of the Associative Memory technology beyond High Energy Physics. We know the first function performed by the visual system is to summarize complex scenes and extract their basic features. They are later processed by the higher cortical levels of the brain. This is a multilayer processing, with a preliminary sketch of the input image based of the identification of zero crossings, blobs, edges, bars, virtual lines, groups and curve boundaries. This is followed by the identification of local surfaces orientation, and discontinuities in depth and surfaces orientation, and then by the development of 3D models hierarchically organized in terms of surface and volumetric primitives.
Our proposal is to use Associative Memory and FPGAs to perform image processing. The functions of extracting relevant features and clustering contiguous pixels with an intensity above threshold to identify basic shapes could be performed by dedicated hardware. This would be followed by a more complex level of analysis to understand and measure the shapes and take consequent actions. An example of this is the problem of "edge detection", shown in the right figure. Edge detection used to identify sharp discontinuities in an image, such as changes in luminosity or in intensity. The implementation leads to a set of connected curves that indicate the boundaries of objects or surfaces. It is used to reduce the amount of data to be processed and to remove irrelevant information from the following processing steps. It is used as the first step of many image processing algorithms, such as pattern matching, motion estimate, feature extraction, an texture analysis. We are studying the use of the Associative Memory as an edge detector.

- The web site of the Italian National Institute of Nuclear Physics

The Project

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Reasonably good shape
Detailed description of FTK at ATLAS, of its progenitor SVT at CDF, Fermilab, triggering at hadron colliders, CERN, Associative Memory, a lot of interesting details

Almost totally missing

Transfer of Knowledge

FTK-IAPP - Home - Hadron Colliders - Understanding the image content - Links

An important goal of this complex project is the transfer of competencies to new teams that should be strong enough to support the new applications and developments. The new members (**PRIELE**, **CAEN**, and **AUTH**) after a first period dedicated to learn the technology became the leading actors of new tasks. **UNIPISA**, **LPNHE**, and **CERN** interacted strongly to achieve at best the integration of the new members since they are fundamental collaborators for the FTK production phase. We can summarize here the main results obtained by the collaboration:

(1) Personnel from PRIELE entered the project on 3 different areas: (a) design of boards with the Cadence tool: a very successful ToK was activated between Sakellariou and UNIPI personnel (Citraro and Piendibene) during his secondments (spring 2013 and end of summer 2014); (b) firmware development and related tests: ToK was activated between D. Dimas and personnel from UNIPISA (2013 secondment), and AUTH (2014 secondment); (c) software development: ToK is now going on with Mermikli's secondment at UNIPI. Piendibene and Donati have been seconded to Alexandroupolis to build a setup for tests of future production. PRIELE has learnt a lot about the boards to assembly; in fact, the first AMBSLP and LAMBSLP have been successfully assembled in Alexandroupolis and are going to be tested by AUTH personnel. Overall, we became a strong unified team ready for production.

(2) Secondments of Crescioli, Calderini and Piendibene at CAEN resulted in two integration test stands, one for WP2 and one for WP6, where board prototypes and silicon detectors have been tested, interacting with CAEN personnel, Paola Garosi, Alessandro Iovene and Stefano Petrucci (see WP2 and WP6 Deliverables). Stefano Petrucci produced a first power supply in CAEN, and installed it at CERN in collaboration with Piendibene. This setup was used for cooling tests, defining the final architecture of the infrastructures. Petrucci's experience on power supplies was precious for Piendibene, who in turn taught Petrucci about FTK. The power consumption has been discussed with CAEN engineers and they will collaborate with Piendibene for the design of the final device. The groups are well integrated.

(3) AUTH had a very fast integration in FTK. Sotiropoulou and Gentsos, two very brilliant Ph.D students, have chosen the most complex algorithms in FTK to be implemented for their thesis. Their long secondments to CAEN allowed them to learn deeply about FTK from Crescioli, Piendibene and very quickly they became pillars of the project. Kordas (on hardware with Piendibene) and Sampsonidis (on software with G. Volpi) worked for the tests of the integrated system at CAEN. Volpi was recruited by UNIPISA on WP4, as he is the most expert on the FTK simulation. Both Kordas and Sampsonidis increased the background knowledge of the AUTH group. Finally, Naoki Kimura from Japan was recruited in AUTH. He is a very experienced researcher who has worked in FTK since the beginning, before 2010. Naoki has reinforced the group, which has now an important position in the full ATLAS FTK collaboration.

(4) LPNHE has provided a lot of knowledge to the new Institutions, but has also recruited a very experienced researcher in the field of WP6. Beccherle participated to the construction and commissioning of the front end electronics of the pixel detector now installed in ATLAS, so he is a perfect element to reinforce the group R&D for pixel upgrades (WP6).

(5) CERN has provided its great experience in board layout, placement and routing, collaborating with PRIELE and UNIPI to complete the AMBSLP and LAMBSLP prototypes.

IMPACT - We have a strong collaboration that has a good probability to become lasting and tackle future developments. The complexity increase of FTK compared to the state of the art, requires this level of organization also for possible future expansions at other experiments like CMS and spin offs outside High Energy Physics. In addition, a new market could be opened to our companies: intensive, parallel computation based on FPGAs and specific VLSIs is a field where electronics has an enormous potential, and this is obviously very interesting for the SMEs participating to this network. At an individual level,

Description is rather terse

Dissimination

- Talks and Proceedings
- Papers
- FTK events

Organisation

- Management
- Workpackages & Deliverables
- Timeline & Milestones
- Secondments and Recruitments

Documentation

- Financial
- Agreement Docs
- Meetings
- Deliverables
- Reports
- Public documents (in writing)
- Career Development plan
- Web site Development plan

For Dissimination, Organization, and Documentation we simply have to add material and information, i.e. update the list of talks, of papers and FTK events, or copy new files, i.e. reports or documents, to specific Areas. We are doing this

We do have a “Web site development plan” written on our web page

- February 1, 2013: first steps in this web page development
- February 15, 2013: completed "Collaboration" closed Section
- March 1, 2013: completed "Project Partners" Section
- May 1, 2013: completed "FTK Project" sub-Section
- June 1, 2013: completed "FTK applications in HEP" sub-Section
- December 31, 2013: completed list of 2013 Talks/Papers/Schhol/Workshops in "Dissemination" Section
- December 31, 2013: completed list of 2013 Recruitments in "Jobs" Section
- February 1, 2014: collected all Reports of the Secondments/Recruitments of the year 2013, YearI
- June 30, 2014: updated list of 2014 Talks/Papers/Schools/Workshops in "Dissimination" Section
- December 1, 2014: preliminary description of Image Processing activity in the "Other FTK applications" Section
- June 1, 2015: complete technical description of the FTK project in the "FTK application in HEP" Section
- December 1, 2015: complete description of Image Processing activity in the "Other FTK applications" Section
- June 1, 2016: complete description of links with companies and research institutions active outside High Energy Physics

We are behind our schedule

Some news

MUSE: Muon campus in US and Europe contribution

H2020-MSCA-RISE-2015, Grant Agreement 690835

Muon (g-2) and Mu2e Experiments

Participants:

Istituto Nazionale Fisica Nucleare

Helmholtz-Zentrum Dresden-Rossendorf EV

University College London

The University of Liverpool

Prisma Electronics ABEE

CAEN

Advansid

Fermilab

Possible collaboration

Outreach (European Researchers Night, Night of Science,

Masterclasses, U. of Pisa Summer School at FNAL)

Trainings of Seconded Researchers

Conclusions

The FTK Web site is in reasonable shape, but a significant and continuous amount of work is still and is going to be necessary throughout the project duration

- The Introductory part is OK
- The “bureaucratic” part is OK
- The more “modern” part is largely missing
    - FTK Applications outside HEP
    - Transfer of Knowledge
    - Seconded Researchers Interviews