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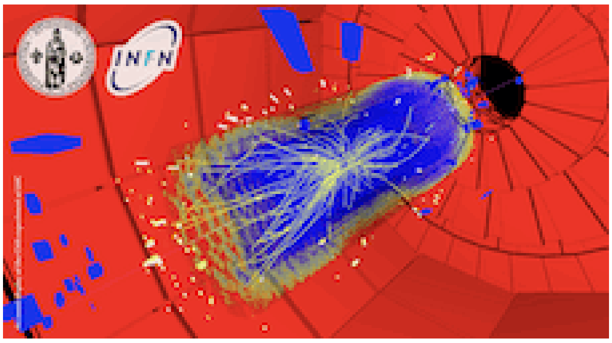

Book of Abstracts

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Radiation Damage Effects in the LHCb Vertex Locator

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LHCb is a dedicated experiment to study new physics in the decays of beauty and charm hadrons at the Large Hadron Collider (LHC) at CERN. The beauty and charm hadrons are identified through their flight distance in the Vertex Locator (VELO), and hence the detector is critical for both the trigger and offline physics analyses. The VELO is the highest resolution vertex detector at the LHC.

The VELO is the silicon detector surrounding the LHCb interaction point, and is located only 7 mm from the LHC beam during normal operation. The VELO is moved into position for each fill of the LHC, once stable beams are obtained. The detector is centred around the LHC beam during the insertion by the online reconstruction of the primary vertex position. The detector operates in an extreme and highly non-uniform radiation environment. The effects of surface and bulk radiation damage have already been measured.

Radiation damage is studied in the VELO through the measurement of IV curves, noise versus voltage, and charge collection efficiency versus voltage. IV curves are taken weekly on the detector at the operating temperature (-10C), and warm IV curves are taken at up to +25C during the shutdown - this has allowed the separation of bulk and surface effects. The detector was annealed over the 2010-2011 shutdown and the effect of this is also seen and compared with the prediction. noise versus voltage scans are also taken monthly. In addition an automatic procedure has been defined which scans patterns of one in every four detectors in voltage, while maintaining the other detectors at operating voltage. This allows charge collection efficiency to be studied using the detectors at nominal voltage for tracking. This procedure has allowed the radiation damage as a function of radius to be studied.

The VELO consists of two retractable detector halves with 21 silicon micro-strip tracking modules each. A module is composed of two n+-on-n 300 micron thick half disc sensors with R-measuring and Phi-measuring micro-strip geometry, mounted on a carbon fibre support paddle. The minimum pitch is approximately 40 µm. The detector is also equipped with one n-on-p module. The detectors are operated in vacuum and a bi-phase C02 cooling system used. The detectors are readout with an analogue front-end chip and the signals processed by a set of algorithms in FPGA processing boards. The performance of the algorithms is tuned for each individual strip using a bit-perfect emulation of the FPGA code run in the full software framework of the experiment.

The VELO has been successfully operated for the first LHC physics run. Operational results show a signal to noise ratio of around 20:1 and a cluster finding efficiency relative to the design of 99.5 %. The small pitch and analogue readout, result in a best single hit precision of 4 µm having been achieved at the optimal track angle.

Summary:

Submitted by the project leader, the speaker will be identified once the talk is accepted.

DAY 1 / 7

A 3-D large area imaging sistem with very high performances.

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In this paper we describe a new detection system both for tracking and measurement of the residual range, designed and developed with the aim of achieving real-time imaging, large detection areas with high space and time resolutions. The tracker has been designed and tested as a prototype, with a large area of 20 x 20 sqcm, consisting in two ribbons of scintillating fibers positioned in the classic bi-dimensional scheme. Their information are extracted in an innovative way, using a reduced number of electronics channels A very accurate space resolution can be achieved. Besides we are designing the device for the measurement of the particle residual. It is essentially a hodoscope made by scintillating fiber ribbons which, employing the same technique, is capable of real time measurement of particle residual range with very high space resolution.

Summary:

Cutting edge research in the treatment of tumours has oriented itself towards hadron therapy, one of the most effective external radiotherapy techniques, that uses charge particle beams (protons and carbon ions) with energy up to 400 AMeV. Such beams make it possible to release accurately the required dose to control the cancerous mass while at the same time leaving the surrounding healthy tissue almost totally untouched. If the maximum advantage is to be made of the potential of these beams, this property must be accompanied by information on the stopping power of the particles used for radio-therapy treatments.
The direct use of these informations, rather than that from X-ray tomography, leads to a more accurate evaluation of the distribution of the dose. The radiographies transmitted can then be used to verify the positioning of the patient and, therefore, the availability of very accurate systems of imaging is of fundamental importance.
The prefixed tasks were to design and build an imaging system for charged particles based on the consolidated principle of the residual range measurement, taking advantage of new detection techniques. The aim is to use this system to reach great dimensions (up to 40x40 sq cm), suitable for almost all medical physics applications, and high spatial resolution (up to approximately 100 micron) and time resolution (up to 5 ns) mainly employing scintillating optical fibers for the trackers and for the residual range measurement, coupled to multi-anode photomultipliers.
It is possible to reduce the number of channels (up to 20 times) both for the tracker and the hodoscope employing an innovative idea.
In order to reach the prefixed objectives and to determine the main choices, accurate simulations of the detector and a precise characterization of the different types and dimensions of commercially available scintillators have been performed. Studies have been carried out on the techniques of cutting and manipulating the fibers, on the preparation of the scintillating layers and on the optical coupling of these with photo-sensitive detectors. It has been also necessary to study the optimization of the construction and mechanical assembly of this delicate set of devices. The developed prototypes have been accurately tested with radioactive sources and particle beams, which are available, at the INFN Laboratorio Nazionale del Sud (LNS). The test results have been useful for the optimization of the final detector.

DAY 3 / 8

Study of the Radiation-Hardness of VCSEL/PIN

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We investigate the feasibility of using VCSEL and PIN arrays in the optical links for the planned upgrades of the detectors at the LHC, CERN. We irradiated high-speed VCSEL (Vertical-Cavity Surface-Emitting Laser) and PIN arrays with 24 GeV/c protons at CERN and 300 MeV/c pions at PSI up to the equivalent dose of a few 10^15 1-MeV neq/cm^2. The arrays irradiated were fabricated by Finisar, Optowell, and ULM Photonics. The irradiation using two species of particles allows us to test the hypothesis that the damage is proportional to the non-ionizing energy loss (NIEL) in a device. The results from the irradiations will be presented.

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RADIATION-HARD ASICS FOR OPTICAL DATA TRANSMISSION

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The LHC at CERN is currently the highest energy and luminosity hadron collider. To take advantage of the physics offered by this new frontier, the ATLAS experiment plans to add a new pixel layer to the current pixel detector during the 2013 shutdown. The optical data transmission system will also be upgraded to handle the higher data transmission speed. Two ASICs have been prototyped for this new generation of optical links to incorporate the experience gained from the current system. The ASICs were designed using a 130 nm CMOS process. One ASIC contains a 4-channel VCSEL driver array and the other a 4-channel PIN receiver/decoder array with one channel of each array designated as a spare to bypass a malfunctioning VCSEL or PIN channel. We characterized the ASICs and then irradiated them to measure their radiation hardness and single event upset (SEU) tolerance. We will present results from this study. In addition, a new version of the ASIC has been submitted for fabrication. The new ASICs have been expanded to 12 channels with improvements based on the prototype results. We will briefly discuss this new design.

DAY 3 / 10

Development of readout system for double-sided silicon strip modules

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The inner tracker of the ATLAS detector will be replaced at the future upgrade to keep the performance at high luminosity operation. We have been developing super-module concept for the upgrade, based on double-sided silicon strip modules. In the super-module concept, one super-module consists of 12 double-sided modules and one double-sided module has 80 readout ASICs which read 128 strips per one ASIC. Then, we have 122,880 readout strips for one super-module. Since the number of the readout strips becomes large to keep hit occupancy at an acceptable level, the data readout is one of the key issues. We developed readout system by using a "Seabas"DAQ boards. Seabas processes the data from the super modules with an FPGA (User-FPGA) and transfers data to a computer via Ether-net with SiTCP protocol. SiTCP is a technology to realize direct access and transfer of the data in the memory of User-FPGA from the PC by utilizing TCP/IP and UDP communication with a dedicated FPGA. We developed firmware and software for Seabas, together with readout hardware chain, and established basic functionality for reading out the super-module.

DAY 2 / 11

RD50: Radiation-Hard Silicon for HL-LHC Trackers

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To harvest the maximum physics potential of the LHC, it is foreseen to significantly increase the luminosity by upgrading towards the HL-LHC (High Luminosity LHC). This will mean unprecedented radiation levels, exceeding the LHC fluences tenfold. Due to radiation damage to the silicon sensors presently used, the physics experiments will require new tracking detectors. Within the CERN RD50 Collaboration, a massive R&D programme is underway across experimental boundaries to develop HL-LHC silicon sensors. One research topic is the connection between the macroscopic sensor properties such as radiation-induced increase of leakage current, doping concentration and trapping, and the microscopic properties. We also study sensors made from p-type silicon bulk, which have a superior radiation hardness as they collect electrons instead of holes, exploiting the lower trapping probability of the electrons. A further area of activity is the development of advanced sensor types like 3D detectors designed for the extreme radiation levels expected for the vertexing layers. We will present the latest results of several detector technologies and silicon materials at radiation levels corresponding to HL-LHC fluences. Based on these results, we will give recommendations for the silicon detectors to be used for tracking systems in the LHC upgrades.

Summary:

This presentation will cover the most recent RD50 results in a number of areas:

We will show the performance of 3D detectors before and after HL-LHC irradiation, demonstrating that the 3D technology has become a reliable candidate for LHC-Upgrades.

Electric field measurements in heavily irradiated planar detectors will be presented, obtained in an edge-TCT setup with an infrared laser shining onto the polished edge of silicon detectors parallel to the detector surface. The field measurements are showing surprisingly high electric fields in the range of 0.5 V per micrometer in the undepleted silicon. The existence of this strong field can help to explain the unexpectedly good performance of planar silicon detectors after more than 10E16 Neutron-equivalent per cm2.

Observations of charge multiplication effects at very high bias voltages in a number of detectors will be reported. We will also describe a set of dedicated detectors designed in order to better understand the charge multiplication mechanism, thought to originate from avalanche multiplication in the high-field region of the detectors.

DAY 1 / 12

The Silicon Strip Tracker of the Fermi Large Area Telescope

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The Large Area Telescope (LAT) is the main instrument onboard the Fermi Gamma-ray Space Telescope, an orbital observatory launched in low-Earth orbit on June 11 2008 to survey the high-energy gamma-ray sky. The LAT tracker/converter serves the twofold purpose of converting the incoming gamma-ray into an electron-positron pair and tracking the latter in order to measure the original photon direction. With its 73 square meters of single-sided silicon-strip detectors, read out by some 900,000 independent electronics channel, it is the largest solid-state tracker ever built for a space application. The tracker system operates on 160 W of conditioned power while achieving a single-plane hit efficiency in excess of 99% and a noise occupancy at the level of 1 channel per million.

We describe the basic tracker design and the performance throughout the first three years of operation in orbit.

DAY 1 / 13

ATLAS Silicon Microstrip Tracker Operation and Performance

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The SemiConductor Tracker (SCT), comprising of silicon micro-strip detectors is one of the key precision tracking devices in the ATLAS Inner Detector. ATLAS is one of the experiments at CERN LHC.
The completed SCT is in very good shapes with 99.3% of the SCT's 4088 modules (a total of 6.3 million strips) are operational. The noise occupancy and hit efficiency exceed the design specifications. In the talk the current status of the SCT will be reviewed. We will report on the operation of the detector, its performance and observed problems, with stress on the sensor and electronics performance.
In December 2009 the ATLAS experiment at the CERN Large Hadron Collider (LHC) recorded the first proton-proton collisions at a centre-of-mass energy of 900 GeV and this was followed by the unprecedented energy of 7 TeV in March 2010. The Semi-Conductor Tracker (SCT) is the key precision tracking device in ATLAS, made from silicon micro-strip detectors processed in the planar p-in-n technology. The signals from the strips are processed in the front-end ASICS ABCD3TA, working in the binary readout mode. Data is transferred to the off-detector readout electronics via optical fibers.
The completed SCT has been installed inside the ATLAS experimental hall since 2007 and has been operational since then. Calibration data has been taken and analyzed to determine the noise performance of the system. In addition, extensive commissioning with cosmic ray events has been performed both with and without magnetic field. The sensor behavior in the 2 Tesla solonoidal magnetic field was studied by measurements of the Lorentz angle. After this commissioning phase, the SCT was ready for the first LHC pp collision run. We find 99.3% of the SCT modules are operational, noise occupancy and hit efficiency exceed the design specifications, the alignment is already close enough to the ideal to allow on-line track reconstruction and invariant mass determination.
In the talk the current status of the SCT will be reviewed, including results from the latest data-taking periods in 2009 and 2010, and from the detector alignment. We will report on the operation of the detector including overviews on services, connectivity and observed problems. The main emphasis will be given to the performance of the SCT with the LHC in collision mode and to the performance of individual electronic components. The SCT commissioning and running experience will then be used to extract valuable lessons for future silicon strip detector projects.

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Silicon Strip Detectors for the ATLAS sLHC Upgrade

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While the Large Hadron Collider (LHC) at CERN is continuing to deliver an ever-increasing luminosity to the experiments, plans for an upgraded machine called Super-LHC (sLHC) are progressing. The upgrade is foreseen to increase the LHC design luminosity by a factor ten. The ATLAS experiment will need to build a new tracker for sLHC operation, which needs to be suited to the harsh sLHC conditions in terms of particle rates and radiation doses. In order to cope with the increase in pile-up backgrounds at the higher luminosity, an all silicon detector is being designed. To successfully face the increased radiation dose, a new generation of extremely radiation hard silicon detectors is being designed.
Silicon sensors with sufficient radiation hardness are the subject of an international R&D programme, working on pixel and strip sensors. The efforts presented here concentrate on the innermost strip layers. We have developed a large number of prototype planar detectors produced on p-type wafers in a number of different designs. These prototype detectors were then irradiated to a set of fluences matched to sLHC expectations. The irradiated sensors were subsequently tested with prototype sLHC readout electronics in order to study the radiation-induced degradation, and determine their performance after serious hadron irradiation of up to a few 1015 1-MeV neutron-equivalent per cm2. One key figure of merit is the signal that can still be measured with a silicon detector after irradiation to increasing radiation doses representative of the severe sLHC conditions. Due to radiation-damage effects such as carrier trapping and growing depletion voltage of the detectors, the measurable signal is degraded as a function of irradiation. We measure a signal of roughly 25,000 electrons for an unirradiated sensor, which reduces to about 17,500 electrons after 2·1015 1-MeV neutron-equivalent per cm2 . We have also measured signals around 9,500 electrons for radiation doses expected for the pixel detectors in the ATLAS tracker upgrade.
From these data, it is evident that sufficient charge can still be recorded even at the highest fluence. In our presentation, we will give an overview of the ATLAS tracker upgrade project, in particular focusing on the crucial innermost silicon strip layers. Results from a wide range of irradiated silicon detectors will be presented, and layout concepts for lightweight yet mechanically very rigid detector modules with high service integration will be shown.
We will draw conclusions on what type and design of strip detectors to employ for the upgrades of the tracking layers in the sLHC upgrades of LHC experiments.

DAY 1 / 16

Operational experience with the ATLAS Pixel Detector at the LHC.

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The ATLAS Pixel Detector is the innermost detector of the ATLAS experiment at the Large Hadron Collider at CERN, providing high-resolution measurements of charged particle tracks in the high radiation environment close to the collision region. This capability is vital for the identification and measurement of proper decay times of long-lived particles such as b-hadrons, and thus vital for the ATLAS physics program.
The detector provides hermetic coverage with three cylindrical layers and three layers of forward and backward pixel detectors.
It consists of approximately 80 million pixels that are individually read out via chips bump-bonded to 1744 n-in-n silicon substrates.

In this talk, results from the successful operation of the Pixel Detector at the LHC will be presented, including monitoring, calibration procedures, timing optimization and detector performance. The detector performance is excellent: 97,5% of the pixels are operational, noise occupancy and hit

efficiency exceed the design specification, and a good alignment allows high quality track resolution.

DAY 1 / 18

Offline calibrations and performance of the ATLAS Pixel Detector

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The ATLAS Pixel Detector is the innermost detector of the ATLAS experiment at the Large Hadron Collider at CERN. It consists of 1744 silicon sensors equipped with approximately 80 M electronic channels, providing typically three measurement points with high resolution for particles emerging from the beam-interaction region, thus allowing to measure particle tracks and secondary vertices with very high precision.
In this talk the performance reached by the Pixel Detector with LHC collision data will be presented, with particular attention to its spatial resolution, efficiency, particle identification properties, the measurement of the Lorentz angle. In addition, depletion depth has been measured, allowing to monitor
sensors radiation damage.
Offline calibration procedures and optimization techniques will be discussed in detail.

DAY 2 / 19

Extremely fine grained electro-magnetic calorimeter

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Calorimetry at small forward angles at the LHC poses several challenges. The particle density is very high, especially in Pb-Pb. Further, in the electromagnetic case the discrimination of photons and pi0 requires extremely fine granularity due to the small angle between the decay photons of the pion.
We present a design of a silicon - tungsten calorimeter with Monolithic Active Pixels as sensing element. With a Moliere radius of pure tungsten of 9 mm it seems overkill to use pixels of 30 .. 100 um size. However, in the preshower phase this spatial resolution is helpful. The small pixelsize allows to count pixels to obtain the energy signal without the problem of saturation. Due to the on chip digitization a longitudinal read-out every radiation length becomes feasible.
Simulations have shown that a spatial resolution of better than 1 mm can be achieved, together with a moderate energy resolution.
A full depth (20 radiation length) prototype will be put in the testbeam later this year.

DAY 1 / 20

Performance results of the LHCb Silicon Tracker detector at the LHC

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The LHCb experiment is one of the four big experiments at the Large Hadron Collider (LHC) and it is designed to perform high-precision measurements of CP violation and search for New Physics. It is constructed as a forward single-arm spectrometer covering the polar angle 15-300 mrad. The Silicon Tracker (ST) of LHCb is a silicon micro-strip detector designed to perform a precise measurement of the particle trajectories produced by the proton-proton interactions. It consists of two sub-detectors, the Tracker Turicensis and the Inner Tracker and covers an area of about 12 m2 in the highest occupancy region around the beam axis. Results of the detector calibration and performance using data from the LHC p-p collisions collected in the 2010 and 2011 campaigns are reported here: the time and spatial alignment of the detector was performed using data from both campaigns; studies about the intrinsic detector efficiency and resolution are also shown; recent results on the detector performance compared to the expectations will be shown as well.

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Calculation of effective doping concentration alternation due to displacement damage in the n-type silicon detectors irradiated by protons of cosmic radiation

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Cosmic radiation consist of Galactic Cosmic Ray (GCR) and Solar Particle Events (SPE), affect on electronic devices. Because of their high energy and fluence, space radiation can induced a kind of long term radiation damage mechanism, so called "displacement damage". Therefore the silicon detectors exhibit macroscopic changes in their electrical characteristics which lead to a degradation in performance. This research has been focused on effective doping concentration (Neff) alternation in n-type silicon detectors in three consecutive stages. First is the estimation of 1-MeV neutron equivalent fluence using FLUKA code and second is numerical calculation for investigating of complex defects formed during irradiation via kinetic model. Eventually electric field profiles have been computed for every significant defect concentration. The results indicated that effective doping concentration alternation due to protons of SPE spectra is more significant than protons of GCR spectra and also n-type silicon is inverted to p-type in the amount of approximately10^12 [1/cm^2]of 1-MeV neutron equivalent fluence and after inversion, trend of Neff has increased linearly with 1-MeV neutron equivalent fluence. This value is generated when the actual amount of SPE fluence might reach up to 10^15 [1/cm^2] in several days during of solar events. It should be mention that maximum neutron equivalent fluence written in available valuable literature in CERN and other related research centers are up to 10^14 [1/cm^2].

Summary:

In order to estimate the probable consequences of the long term exposure and to evaluate the displacement damage effects on electrical characteristics of silicon devices, the following steps have been followed:
•Determination of space radiation environment at 1AU using proportional models.
•Simulation of space environment (Source, target material and geometry) with FLUKA and processing of given estimators.
•Calculation of molecular dynamics and prediction of complex defect concentration via Davies model.

•Replacement of complex defect concentration value in the Poisson's equations via applying finite element and then preparing electrical field profiles.
•Calculating effective doping concentration (Neff) by means of relevant governing equations.

In this work, it has been tried to simulate and follow-up time and spatial conditions as in Extra Vehicular Activity (EVA). In what follows assessment of displacement damage on n-type Float-zone silicon detector 300 µm thick, caused by protons of GCR and SPE spectra in deep space has been investigated. It should be mentioned that all the proporthinal formula and resulted curves are available.

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Measurements with a Si-strip telescope

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A tracking station composed of silicon strip sensors has been designed, built and tested.
It is a beam telescope equipped with four boxes containing single-sided and double-sided silicon strip sensors.
The boxes can be moved along the longitudinal direction and one module can be rotated changing the incident angle of the beam. These features allow studying in detail the effects of changes in the setup on energy loss, cluster size and resolution.
The tracking station has been used with particle beams at different facilities (COSY,DESY,ELSA).
A selection of scatterers has been placed in the center of the station, allowing the measurement of deflection angle distributions. This allows a validation of hadron physics simulation tools in the low energy range, where the previous input from measurements was incongruently described.
Furthermore, light materials such as carbon foams with different densities and compositions where characterized during these tests.
The construction of the tracking station included the realization of a DAQ chain, with fast online data processing performed with FPGA based devices.
On–and offline analyses will be compared and the simulations will be discussed on the background of the data.
Supported by BMBF and BCGS

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Operational Experience of the LHC RADiation MONitoring (RADMON) System

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The 'Large Hadron Collider (LHC) is a complex radiation environment consisting of several particles types at different energies. The RadMon detector is conceived to measure the radiation effects on the electronics in the LHC tunnel and its adjacent shielded areas in order to monitor the radiation levels, anticipate possible device degradation and identify instantaneous failures of the electronic equipments, not correlated to their typical MTBF (Mean Time Between Failure) as caused by radiation. The RadMon monitoring aims also to validate the FLUKA Monte-Carlo calculations of the radiation environment. For these purposes, the RadMon provides the measurement of the Total Ionizing Dose in Silicon by means of RadFets, of the Displacement Damage (DD) in Silicon by means of p-i-n diodes, and of the High Energy Hadrons (HEH) and thermal neutrons fluence by counting Single Events Upsets (SEU) of SRAM memory. The calibration curves of the sensors have been measured in various certified facilities with different particle energies and also successfully applied to a mixed radiation field. The detailed characterization and evaluation of the detector system being used in an environment of mixed particle types and energies requires not only an extensive calibration campaign, but also leads to certain measurement limitations, both outlined in this paper. Currently in the LHC, about 400 RadMons, are continuously read out at a rate of one Hertz. The data acquisition and monitor control is assured via a field bus and special tools were developed to allow users to easily retrieve the data, as well as visualize the monitor locations. The important calibration efforts, together with the good coverage of monitors in the LHC accelerator successfully allowed for a detailed monitoring the LHC underground areas during the first two years of operation, confirming electronics failures due to radiation, relating them to the observed radiation levels, and providing detailed bench-marks for the FLUKA calculations.

DAY 3 / 24

Monitoring radiation damage in the ATLAS Silicon Tracker

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The record breaking instantaneous luminosities of 10^33 cm-2 s-1 recently surpassed at the Large Hadron Collider generate a rapidly increasing particle fluence in the ATLAS silicon tracker. As the radiation dose accumulates, the first effects of radiation damage are now observable in the silicon sensors. A regular monitoring program has been conducted and reveals an increase in the silicon leakage current, which is found to be correlated with the rising radiation dose recorded by independent sensors within the inner detector volume. Such measurements are useful to validate the digitization model that has been developed to simulate radiation damage effects, including charge trapping, electric field modification and realistic signal induction on the electrodes. In the longer-term crystal defect formation in the silicon bulk is expected to alter the effective doping concentration, producing type-inversion and ultimately an increase the voltage required to fully deplete the sensor. Together with autonomous measurements of the depletion voltage, we present a track-based method that has been developed to estimate the depth of the depleted zone, allowing a continuous monitoring of the sensor performance. In the Pixel detector, Lorentz angle effects are reduced by a novel implementation of the method in the longitudinal pixel dimension.

DAY 1 / 25

Upgrade of the Proton Computed Tomography System of the PRIMA Project

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Proton Computed Tomography (pCT) is a medical imaging method based on the use of proton beams with kinetic energy of the order of 250 MeV, aimed at directly measuring the stopping power distribution of tissues (presently calculated from X-rays attenuation coefficients) to improve the accuracy of treatment planning in hadron therapy. A pCT system should be able to measure tissue electron density with an accuracy better than 1% and with a spatial resolution better than 1 mm. The blurring effect due to multiple Coulomb scattering can be circumvented by single proton tracking. In the framework of the PRIMA project (INFN-CSN5) we manufactured a first proprietary apparatus to undergo proton computed tomography (pCT). The system, able to carry out single projections at different rotating angles of the phantom, is characterized by a field of view of about 5x5cm2 and an acquisition time of the order of 10s (10 kHz, 105 events). It includes a tracker, made of silicon microstrip detectors, to measure proton trajectory, and a calorimeter, made of four YAG:Ce optically separated crystals, to measure the residual energy. The complete system has been characterized with 62MeV protons at Laboratori Nazionali del Sud (LNS-INFN) and first tomographic images have been reconstructed with this prototype: main results will be showed and discussed. The design and manufacture of a novel prototype of pCT system for pre-clinical applications is now under process. The system is characterized by: (a) A larger active area and (b) An acquisition system able to store data from a whole tomographic image without dead times. The larger active area will be obtained by considering a slice of four silicon microstrip detectors on each x-y plane of the tracker, to cover a 5x20cm2 rectangular area and a larger calorimeter volume. When completed, the system will be able to undergo pre-clinical validations with hadron-therapy machines.

DAY 1 / 26

Large-area high-quality polycrystalline Chemical Vapour Deposited diamond films as pixel detectors for Intensity Modulated Radiotherapy applications

Authors: Antonio De Sio[1]; Cinzia Talamonti[2]; Emanuele Pace[1]; Lorenzo Tozzetti[3]; Mara Bruzzi[4]; Margherita Zani[5]; Marta Bucciolini[2]; Monica Scaringella[4]

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We present first results of a project devoted to the development of a large-area modular detector for intensity modulated radiotherapy based on high –quality polycrystalline diamond produced by Chemical Vapour Deposition. The work is performed in the framework of the DIAPIX project of INFN CSN5. The proposed modular system is based on an electronic-grade quality polycrystalline diamond film, with area 2.5x2.5cm2 from Diamond Detectors Ltd, which has been metalized by University of Firenze on both sides to produce a matrix of pixels with approximately 1mm pitch. First results under radiotherapic beams of the pixilated device are reported.

DAY 1 / 27

CMS Tracker alignment and material budget measurement

Author: Ernesto Migliore[1]

[1] *University of Torino and INFN*

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The CMS Silicon Tracker consists of 16'588 modules covering an area of more than 200m2. To achieve an optimal track-parameter resolution, the position and orientation of the modules must be determined with a precision of a few microns and an accurate representation of the distribution of material in the tracker is needed. Results of the alignment of the tracker are presented, based on the analysis of data from cosmic ray muons and proton-proton collisions. The alignment is validated by data-driven studies and compared with predictions from a detailed detector simulation. Reconstructed photon conversions and nuclear interactions are used to evaluate the material in the tracker while reconstruction of decays such as Kshort and J/psi are used to understand the magnetic field and momentum measurements.

DAY 1 / 28

Operation of the CMS Silicon Tracker

Author: Derek Strom[1]

[1] *University of Illinois at Chicago*

The CMS tracker is the largest silicon detector ever built, covering 200 square meters and providing an average of 14 high-precision measurements per track. The use of tracker data for reconstruction of charged particles and primary and secondary vertices requires fine-grained monitoring and calibration procedures as well as accurate alignment. Results from timing and threshold optimization, gain calibration, and Lorentz angle determination are shown and the impact on resolution and dE/dx measurements is discussed.

DAY 3 / 29

Irradiations on DEPFET-like test structures

Author: Andreas Ritter[1]

Co-authors: Andreas Wassatsch [1]; Andricek Ladislav [1]; Christian Koffmane [1]; Hans-Günther Moser [1]; Jelena Ninkovic [1]; Rainer Richter [1]

[1] *Max-Planck-Institute for Physics - Semiconductor laboratory*

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For the upgrade of the Belle II detector DEPFET (Depleted p-channel field effect transistor) pixels are foreseen for the two innermost layers of the vertex detector. As a MOS device, the DEPFET is susceptible to ionizing radiation, which will be created near the interaction point.
One effect of ionizing radiation is the build-up of positive charge in the oxide insulation layer near the silicon interface. This positive charge leads to a change in the threshold voltage of the transistors. The readout of the individual ladders of the pixel detector is organized in a rolling shutter mode, switching one row on at a time. As the switching chips provide only one voltage, careful adaption to this shift is necessary.

To increase the radiation hardness of the detector, thinner oxides in addition with various layers of nitride are under investigation. Therefore special test structures (FETs) have been developed and irradiated with a 60keV x-ray tube. These structures correspond to several critical regions of the DEPFET, like the gate or the clear-gate. Change in the transistor parameters, like threshold voltage or subthreshold swing have been measured and will be presented.

DAY 2 / 30

Silicon Sensor Developments for the CMS Tracker Upgrade

Author: Joachim Erfle[1]

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CMS started a campaign to identify the future silicon sensor technology baseline for a new Tracker for the high-luminosity phase of LHC. We ordered a large variety of 6"wafers in different thicknesses and technologies at HPK. Thicknesses ranging from 50µm to 300µm are explored on floatzone, magnetic Czochralski and epitaxial material both in n-in-p and p-in-n versions. P-stop and p-spray are explored as isolation technology for the n-in-p type sensors as well as the feasibility of double metal routing on 6"wafers. Each wafer contains different structures to answer different questions, e.g. geometry, Lorentz angle, radiation tolerance, annealing behavior, read-out schemes. Dedicated process test-structures, as well as diodes, mini-sensors, long and very short strip sensors and real pixel sensors have been designed for this evaluation. This contribution provides an overview of the individual structures and their characteristics and summarizes interesting measurements performed so far.

DAY 3 / 31

Results from the NA62 Gigatracker prototype: a lowmass and sub-ns time resolution silicon pixel detector

Author: Sara Garbolino[1]

[1] *Università di Torino and INFN*

Corresponding Author: sara.garbolino@to.infn.it

The Gigatracker (GTK) is a hybrid silicon pixel detector developed for NA62, the experiment studying ultra-rare kaon decays at the CERN SPS. Three GTK stations will provide precise momentum and angular measurements on every track of the high intensity NA62 hadron beam with a time-tagging resolution of 150 ps. Multiple scattering and hadronic interactions of beam particles in the GTK has to be minimized to keep background events at acceptable levels, hence the total material budget is fixed to 0.5% X0 per station. In addition the calculated fluence for 100 days of running is 2 × 1014 1 MeV neq/cm2, comparable to the one expected for the inner trackers of LHC detectors in 10 years of operation. These requirements pose challenges for the development of an efficient and low-mass cooling system, to be operated in vacuum, and on the thinning of read-out chips to 100 µm or less.
The most challenging requirement is represented by the time resolution, which can be achieved by carefully compensating for the discriminator time-walk. For this purpose, two complementary read-out architectures have been designed and produced as small-scale prototypes: the first is based on the use of a Time-over-Threshold circuit followed by a TDC shared by a group of pixels, while the other uses a constant-fraction discriminator followed by an on-pixel TDC. The readout pixel ASICs are produced in 130 nm IBM CMOS technology and bump-bonded to 200 µm thick silicon sensors.
The Gigatracker detector system is described with particular emphasis on recent experimental results obtained from laboratory and beam tests of prototype bump-bonded assemblies, which show a time resolution of less than 200 ps for single hits.

DAY 1 / 32

Performance of the CMS Silicon Tracker

Author: Matthew Chan[1]

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Corresponding Author: matthew.chan@cern.ch

The CMS tracker is the largest silicon detector ever built, covering 200 square meters and providing an average of 14 high-precision measurements per track. Data from proton-proton collisions at a center-of-mass energy of 7 TeV are used to measure the performance of the detector and the reconstruction algorithms. The resolution and efficiency of the track, vertex, and beam line reconstruction are measured in data and compared to the results from simulation. An example of the culmination of this effort is shown in the performance of the b-tagging algorithms, critical to many physics analyses at CMS.

DAY 3 / 33

The SuperB Silicon Vertex Tracker

Author: Stefano Bettarini[1]

[1] *Università di Pisa and INFN*

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The SuperB asymmetric e+e- collider has been recently approved
by the Italian Government and within few years with a luminosity two orders of magnitude greater than past B-Factories, it is expected to
start the study of rare B and D meson decays, where New Physics might show up, and lepton flavour violation in tau decays, profiting from polarized beam.
Due to the reduced center of mass boost, the vertex resolution must be
improved to achieve the same proper-time difference resolution for B
decays obtained in BaBar.
Thus, based on the layout of the BaBar vertex detector, the SuperB
Silicon Vertex Tracker must be equipped with an extra innermost Layer0,
very close to the interaction point.
The most stringent physics requirements concern the low material budget
and the high-background working conditions of the Layer0: striplets modules,
with short strips on high resistivity silicon sensors, are the baseline
solution for the beginning of data taking; an upgrade to pixel sensors,
more robust against background occupancy, is foreseen at the full luminosity.
The latest results on the various pixel options explored by a specific
R&D program on different pixel technologies will be described: CMOS MAPS,
pixel sensors realized on multiple layers with a vertical integration technology
and hybrid pixels.

DAY 1 / 34

Tracking and vertexing performance of the ATLAS Inner Detector at the LHC

Author: Salvador Marti'-Garcia[1]

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The ATLAS experiment at the LHC is equipped with a charged particle tracking system, the Inner Detector, built on three subdetectors, which provide high precision measurements made from a fine detector granularity. The Pixel and microstrip (SCT) subdetectors, which use the silicon technology, are complemented with the Transition Radiation Tracker.
Since the LHC startup in 2009, the ATLAS inner tracker has played a central role in many ATLAS physics analyses. Rapid improvements in the calibration and alignment of the detector allowed it to reach nearly the nominal performance in the timespan of a few months. The tracking performance proved to be stable as the LHC luminosity increased by five orders of magnitude during the 2010 proton run, while the performance was only slightly degraded in the extremely dense heavy ion collisions. New developments in the offline reconstruction for the 2011 run will improve the tracking performance in high pile-up conditions, as well as in highly boosted jets.
(Abstract submitted by the ATLAS Inner Detector Speaker Committee.
The speaker will be defined later)

Summary:

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(Abstract submitted by the ATLAS Inner Detector Speaker Committee.
The speaker will be defined later)

DAY 2 / **36**

Overview of the ATLAS Insertable B-Layer (IBL) Project

Author: Claudia Gemme[1]

[1] *INFN Genova*

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The upgrades for the ATLAS Pixel Detector will be staged in preparation for high luminosity LHC. The first upgrade for the Pixel Detector will be the construction of a new pixel layer which will be installed during the first shutdown of the LHC machine, foreseen in 2013-14. The new detector, called the Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new, smaller radius beam-pipe at a radius of 3.2 cm. The IBL will require the development of several new technologies to cope with increased radiation and pixel occupancy and also to improve the physics performance through reduction of the pixel size and a more stringent material budget. Two different and promising silicon sensor technologies, planar n-in-n and 3D, are currently under investigation for the IBL. An overview of the IBL project, of the module design and the qualification for these sensor technologies with particular emphasis on irradiation and beam tests will be presented.

Summary:

The upgrades for the ATLAS Pixel Detector will be staged in preparation for high luminosity LHC. The first upgrade for the Pixel Detector will be the construction of a new pixel layer which will be installed during the first shutdown of the LHC machine, foreseen in 2013-14. The new detector, called the Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new, smaller radius beam-pipe at a radius of 3.2 cm. The IBL will require the development of several new technologies to cope with increased radiation and pixel occupancy and also to improve the physics performance through reduction of the pixel size and a more stringent material budget. Two different and promising silicon sensor technologies, planar n-in-n and 3D, are currently under investigation for the IBL. An overview of the IBL project, of the module design and the qualification for these sensor technologies with particular emphasis on irradiation and beam tests will be presented.

DAY 3 / **37**

A DEPFET Pixel Detector for Belle II Experiment

Author: Benjamin Schwenker[1]

[1] *Universität Göttingen*

Corresponding Author: benjamin.schwenker@phys.uni-goettingen.de

The B factories BABAR and Belle made important contributions to our understanding of CP violation and confirmed the CKM mechanism. In more than ten years of successful operation, the Belle experiment at the asymmetric e+e- collider KEKB recorded about 10^9 BBbar decays and achieved a world record luminosity of 2.11x10^34/cm^2s. The Belle II collaboration plans to upgrade the KEKB accelerator towards a Super Flavor Factory with an even 40x higher luminosity by spring 2014. A major part of the upgrade is the installation of a two layer active pixel detector based on fully depleted field effect transistors (DEPFET). The DEPFET pixel detector combines an excellent signal to noise ratio for thinned sensors with low power consumption. The current mechanical design of the detector achieves stable operating conditions with an overall material budget of 0.2% radiation length in order to minimize the impact of multiple scattering for low-pt tracking. The current background estimates indicate a pixel occupancy below 1% in the innermost layer. This presentation provides an overview of the Belle II pixel detector including results from recent irradiation campaigns and first lab measurements with thinned DEPFET sensors.

DAY 3 / **38**

Performance of the CMS Pixel detector for the Phase I upgrade at HL-LHC

Author: Mark Grimes[1]

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The luminosity upgrade of the Large Hadron Collider is foreseen to proceed in two phases. An eventual factor-of-ten increase in LHC statistics will have a major impact in the LHC Physics program. However, the HL-LHC as well as offering the possibility to increase the physics potential will create an extreme operating environment for the detectors, particularly the tracking devices and the trigger system. An increase in the number of minimum-bias events beyond the levels envisioned for design luminosity creates the need to handle much higher occupancies and for the innermost layers unprecedented levels of radiation. This can degrade the performance of the current detector. In order to recover and improve the current level of seeding, tracking, and b-tagging performance an upgrade of the CMS pixel detector system has been proposed for the Phase I of the HL-LHC. Results of Monte Carlo simulation studies for the new pixel detector will be presented and compared

to that of the current CMS detector. The upgraded pixel system will provide improved b-tagging, pixel track seeding and stand-alone tracking capabilities, which will be key elements of many CMS physics analyses at the HL-LHC.

DAY 3 / 39

Time-Resolved Studies of Single-Event-Upset effects in Optical Data Receiver for the First LHC Upgrade Phase of the ATLAS Pixel Detector.

Author: Michael Ziolkowski[1]

Co-authors: Andreas Wiese [1]; Harris Kagan [2]; K.K. Gan [2]; Peter Buchholz [1]; Richard Kass [2]; Shane Smith [2]

[1] *University of Siegen, Physics Department, D-57068 Siegen, Germany*

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A multi-channel optical receiver board housing a PiN array coupled to an amplifier-and-decoding ASIC designed in 130 nm CMOS process for bi-phase-mark encoded input signals, was exposed to a proton beam of 24 GeV/c momentum together with a reference receiver board containing the same ASIC coupled to an electrical input-signal-source instead. The 40 MHz clock and 40 Mbit/s data signals supplied to the devices under test, were restored directly on both boards and then transmitted back to the counting room for on-line checking of consistency. In the case of a data bit error or a missing clock transition, indicating an occurrence of a SEU, a sequence of time aligned data bits and corresponding clock states were recorded binary and in part as oscilloscope-waveforms for off-line analyses. Measurements were performed using a custom-developed, FPGA-based, DAQ system for input signals covering a certain range of optical and electrical amplitudes. We present results obtained from the latest 2010 run at the CERN irradiation facility, including the SEU cross-section dependence on input signal amplitude, for various types of effects on clock and data consistency, along with the time-resolved structure of the SEU incidents.

DAY 3 / 40

CMS Silicon Tracker upgrade for HL-LHC

Author: Stefano Mersi[1]

[1] *CERN*

Corresponding Author: stefano.mersi@cern.ch

LHC is expected to increase its luminosity above the original nominal value of 1034 cm−2s−1, eventually achieving an order of magnitude increase after major upgrades will be performed after 2020. This configuration of the machine is known as High Luminosity-LHC (HL-LHC).

CMS needs a completely new tracking system to maintain adequate performance in the HL-LHC environment and to provide tracking information for the Level-1 trigger decision.

The most relevant requirements and constraints are summarized, along with highlights from some of the R&D activities.

DAY 2 / 41

Laser graphitization for polarization of diamond sensors

Author: Giuliano Parrini[1]

[1] *INFN-FI and Università degli Studi Firenze*

Corresponding Author: parrini@fi.infn.it

Silicon and its technology are the reference points in the sensor/electronics fields. Anyway niche sectors exist where Diamond plays either a competitive or an exclusive role with respect to Silicon. Broadly speaking, sensors placed near the accelerator beams, biological Multi Electrode Arrays (MEA) and neuro-prosthesis applications are such sectors.
In these last years the rise of laser applications to "write"graphite pattern in diamond, the implementation of electronic circuits on diamond and the more recent bonding laser technique between diamond and Si chips are opening new roads for sensor device architecture and their electronics.
All that is the background scenario of the research work we have promoted on Silicon-on-Diamond devices and of which we report the most recent results concerning the production of strip like graphite electrodes on a diamond particle sensor. The employed graphitization technique and the preliminary experimental results are presented. Limits and improvements are discussed together with different electrode and contact geometry applications.

DAY 3 / **42**

Research of the Silicon Photomultipliers for various applications

Author: Oleksandr Starodubtsev[1]

Co-authors: Enrico Scarlini [1]; Mirko Brianzi [1]; Oscar Adriani [1]; Raffaello D'Alessandro [1]; Roberto Ciaranfi [1]

[1] *FI*

Corresponding Author: oleksandr.starodubtsev@fi.infn.it

In these last few years, Silicon Photomultipliers (SiPMs) have become a very popular in the detector research community because of their promising new features.
These novel photo-detectors promise to deliver high quantum efficiency, wide spectral range, low noise coupled to high gains (105-106), and very fast time response. Our group is currently evaluating and designing new devices for applications ranging from high energy physics and astroparticle physics, to earth imaging, and gas and plasma spectroscopy.
Here we will present device signal and current characterizations performed at various temperatures and at different photon wavelengths. We have used fast laser pulsing to ascertain the temporal properties of the devices. A comparison is also made between current commercial devices and custom built ones delivered by FBK-IRST.
As a last item, new front-end amplifier developments and their application to some of the above mentioned fields will also be discussed.

DAY 2 / **43**

Recent Results of the ATLAS Upgrade Planar Pixel Sensor R&D Project

Author: Giovanni Marchiori[1]

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To extend the physics reach of the LHC, upgrades to the accelerator are planned which will increase the peak luminosity by a factor 5 to 10. To cope with the increased occupancy and radiation damage, the ATLAS experiment plans to introduce an all-silicon inner tracker with the HL-LHC upgrade. For radiation damage reasons, only electron-collecting sensors designs are considered (n-in-p and n-in-n).

To investigate the suitability of pixel sensors using the proven planar technology for the upgraded tracker, the ATLAS Planar Pixel Sensor R&D Project was established comprising 17 institutes and more than 80 scientists. Main areas of research are the performance of planar pixel sensors at highest fluences, the exploration of possibilities for cost reduction to enable the instrumentation of large areas, the achievement of slim or active edges to provide low geometric inefficiencies without the need for shingling of modules and the investigation of the operation of highly irradiated sensors at low thresholds to increase the efficiency.

The presentation will give an overview of the recent accomplishments of the R&D project. Among these are laboratory and testbeam results obtained with irradiated FE-I3 and FE-I4 n-in-n pixel detectors and investigations of the edge efficiency of dedicated slim-edge designs.

DAY 3 / 44

The Fast Tracker Real Time Processor: high quality real-time tracking at ATLAS

Authors: Alberto Stabile[1]; Paola Giannetti[2]

[1] *INFN and University in Milan*

[2] *PI*

Corresponding Authors: paola.giannetti@pi.infn.it, alberto.stabile@unimi.it

As the LHC luminosity is ramped up to the design level of 1x1034 cm−2 s−1 and beyond, the high rates, multiplicities, and energies of particles seen by the detectors will pose a unique challenge. Only a tiny fraction of the produced collisions can be stored on tape and immense real-time data reduction is needed. An effective trigger system must maintain high trigger efficiencies for the most important physics and at the same time suppress the enormous QCD backgrounds. This requires massive computing power to minimize the online execution time of complex algorithms. A multi-level trigger is an effective solution for an otherwise impossible problem. The Fast Tracker (FTK)[1], [2] is a proposed upgrade to the current ATLAS trigger system that will operate at full Level-1 output rates and provide high quality tracks reconstructed over the entire detector by the start of processing in Level-2. FTK is a dedicated Super Computer based on a mixture of advanced technologies. The architecture broadly employs powerful Field Programmable Gate Arrays (FPGAs), the modern programmable devices, but the greatest computing power is provided by ASICs named Associative Memories (AM), containing full-custom CAM cells. FTK solves the combinatorial challenge inherent to tracking by exploiting massive parallelism of the AM so that inner detector hits can be compared to millions of pre-calculated patterns simultaneously. Pattern recognition is complete by the time the data are loaded into the devices. Track fitting within matched patterns is simplified by using pre-computed linearized fitting constants and leveraging fast DSPs in modern commercial FPGAs. Overall, FTK is able to compute the helix parameters for all tracks in an event and apply quality cuts in less than 100 microseconds. We present the architecture, the performance and the technical challenges of the boards and the ASIC in the project.

[1] IEEE Trans. Nucl. Sci. 48, 575 (2001)
[2] IEEE Trans. Nucl. Sci. 51, 391 (2004)

DAY 3 / 45

The EDRO board connected to the Associative Memory: a "Baby" FastTracKer processor for the ATLAS experiment

Authors: Matteo Beretta[1]; Paola Giannetti[2]

[1] *Laboratori Nazionali di Frascati (LNF)*

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The FastTracKer (FTK) is a dedicated hardware system able to perform online fast and precise track reconstruction of full events in the Atlas experiment within an average latency of a few dozen microseconds. It consists of two pipelined processors: the Associative Memory (AM), which finds low precision tracks called "roads", and the Track Fitter (TF), which refines the track quality with high precision fits.

The FTK design [1] that works well at the Large Hadron Collider (LHC) Phase I upgrade luminosity requires the best of the available technology for tracking in a high occupancy environment. While the new processor is designed for the most demanding LHC conditions, we will begin with existing prototypes, some developed for the SLIM5 collaboration [2], to exercise the FTK functions in the new Atlas environment. The goal is to learn early about the FTK integration in the Atlas TDAQ.

The EDRO board (Event Dispatch and Read-Out) receives on a clustering mezzanine (able to calculate the pixel and SCT cluster centroids) simulated detector raw data on S-links from a "pseudo-front-end"(a CPU). The clusters are transferred through the P3 connector to the AM board that finds roads that in turn are sent back to the EDRO. The EDRO delivers the found roads to the CPU using an S-link connection.
This system will grow to become the FTK "Vertical Slice": the EDRO will also have the capability to send the roads and the clusters in them to the TF that will initially be the GigaFitter developed for the SVT processor at CDF [3]. Our goal is to take data before the end of the 2012 run. The vertical slice will cover a small projective tower in the detector, but it will be a demonstrator since it will be functionally complete.

We report on the performance and structure of the nucleus of the vertical slice, including the pixel/strip hit clustering (clustering mezzanine), hit organization and distribution (EDRO) and the Associative Memory road-finding function.

[1] A. Andreani et al., The FastTracker Real Time Processor and Its Impact on Muon Isolation, Tau and b-Jet Online Selections at ATLAS, Conference Record 17th IEEE NPSS Real Time Conference Record of the 17th Real Time Conference, Lisbon, Portugal, 24 - 28 May 2010.

[2] S. Bettarini et al., The SLIM5 low mass silicon tracker demonstrator, Nuclear Instruments and Methods in Physics Research A 623 (2010) 942–953

[3] S. Amerio et al., GigaFitter: Performance at CDF and perspective for future applications, Nuclear Instruments and Methods in Physics Research A 623(2010)540–542

DAY 2 / 46

Low Temperature Thermally Stimulated Currents in nanostructured TiO2

Author: Riccardo Mori[1]

Co-authors: Alessandro Cavallaro [1]; Franco Bogani [2]; Mara Bruzzi [1]; Monica Scaringella [1]

[1] *INFN Firenze and Dip Energetica Univ. Firenze*

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Investigation on the influence of defect states on the electrical properties of disordered semiconductor materials is strategic in the perspective of increasing the efficiency of devices in several application fields as clinical radiotherapy (a-Si, polycrystalline diamond..), solar cells (a-Si, nanostructured TiO2, ..) , particle detectors (Si, SiC …). It is well known that materials used for radiation detection suffer of radiation damage effects due to the formation of localized defects and clusters. Multi trapping mechanisms at localized states are responsible of polarization, slow dynamics and degradation of the efficiency. Combined conduction mechanisms related to extended state diffusive transport and localized state hopping transport can occur. Moreover, in such heavily disordered systems, conduction and valence band tails have to be taken into account. Thermally Stimulated Currents is a powerful tool to investigate defects responsible for conduction mechanisms. In this work we develop a model which explains the TSC spectra observed at low temperature by taking into account of both hopping, dispersive conduction and band tail filling. Measurements after illumination with a UV Xe lamp have been carried out on nanostructured TiO2 films in the temperature range 10-300K. Our model, not being based on specific assumptions, can be extended to investigate the incidence of extended defects in the electrical behaviour of heavily irradiated semiconductors used for particle detection and dosimetry.

DAY 1 / 48

Welcome Address

Corresponding Author: mando@fi.infn.it

Summary:

Welcome address by the Director of the Florence division of INFN

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T.B.D. 1

DAY 1 / 52

CONCERTO ORGANO E TROMBA

Organ and Trumpet Concert

Summary:

G. Fantini (1602-?)
- Sonata per Tromba e Organo detta del Colloreto
- Sonata per Tromba e Organo detta del Gonzaga
- Sonata per Tromba e Organo detta del Nero

B. Storace (1637-1707)
- Aria sopra la Spagnoletta

G. B. Viviani (1638-1692)
- Sonata n. 1 per Tromba e Organo:
Preludio; Fanfara; Giga, Bourrèe; Finale.

Anonimo
- Dalla Messa in V tono: Elevazione e Toccata

Luigi Gherardeschi (1791-1871)
-Gran marcia per organo

A. Corelli (1653-1713)
- Sonata in Fa:
Grave; Allegro; Sarabanda; Gigue.

Padre Davide da Bergamo (1791-1863)
- Sinfonia col tanto applaudito Inno Popolare

G. Martini (1706-1784)
- Toccata per Tromba e Organ

DAY 1 / 53

Welcome Cocktail

DAY 2 / 54

Bus Departure to the Conference Dinner

Summary:

Information about place and time of the bus departure will be specified during the conference

DAY 2 / 55

Conference Dinner

The Conference Dinner will be held at the Marchesi de'Frescobaldi's 'Castello di Nipozzano', some 30km east of Florence on the Rufina hill.

After the visit to the Castle historical wine cellar an appetizer will be served followed by the dinner in the Castle courtyard.

In case you have have special requests (vegetarian) about the dinner menu, please let us know as soon as possible.

Summary:

The Castello di Nipozzano, built in year 1000 as a defensive fortress, became the centre of communal life for the village of the same name. Today the castle houses the wine cellar, where the estate red wines are produced and cask-aged. Nipozzano also serves as Frescobaldi's hospitality centre and as site for its fine food and wine initiatives.

The estate lies in the heart of the Chianti Rufina area, covering 626 hectares at elevations between 250 and 400 metres. There are Sangiovese, Cabernet Sauvignon, Cabernet Franc, Merlot, and Petit Verdot. The soil, rich in clay and limestone, and its dry, well-ventilated weather compose the ideal terroir for the production of wines that are elegant and well balanced, full bodied, with firm structures to last them over many years. Those qualities are amply demonstrated by Nipozzano Chianti Rufina Riserva DOCG and by the Montesodi and Mormoreto crus.

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The AMS-02 Silicon Tracker Status

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The Alpha Magnetic Spectrometer (AMS-02) is a high-energy physics experiment operating in space on the International Space Station since the 16th of May. Thanks to a large acceptance and a data taking period of, at least, 10 years, AMS-02 will measure over 1010 charged particles in the rigidity range 500 MV - 2 TV. AMS-02 is able to measure the energy spectrum of the cosmic ray components (antideuterons, antiprotons, electrons, positrons, $\cdots$) allowing the searching of primordial antimatter and dark matter annihilation products.

7 planes of Silicon sensors in the permanent magnet (0.15T) bore and 2 planes at the ends of the detector act as tracking device. The measurement of the curvature radius of the charged particles bent trajectories allows the computation of the particle rigidity and charge sign.

With an effective sensible area of 6.2m2 the AMS-02 Silicon Tracker is the largest tracker never built for space application. It is composed by 2264 double-sided Silicon sensors (72x41mm2, 300µm thick) assembled in 192 read-out units, for a total of 200.000 read-out channels.

At the end of July 2010 the AMS-02 Silicon Tracker has been successfully integrated and installed within the AMS-02 detector. Then an extensive muon data acquisition on ground, a beam test, and the first month of data taking in space, allowed for the study of the Si Tracker performances that will be presented.

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The Gamma-400 space mission

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GAMMA-400 is a space mission included in the Russian Federal Space Program and supported by the Russian Federal Space Agency. The main characteristics of the mission are a high elliptical orbit (initial parameters: perigee 500 km, apogee 300 000 km), a total mass for the scientific payload of 2600 kg, and a power budget for the instrument of 2 kW. The experiment is intended to improve the angular and energy resolutions obtained by other space missions for gamma-rays in a very large energy range (0.1-3000 GeV), to measure the cosmic-ray electron flux up to 3 TeV and to measure the cosmic-ray proton and nuclei fluxes up to (and above) 1 PeV/nucleon, thus allowing to reach the "knee"at least for protons and He. The apparatus will consist of a finely segmented converter/tracker (made by thin tungsten layers and sensitive planes of silicon microstrip detectors), and a deep (≥ 25X0), homogeneous imaging calorimeter for energy measurement. On the top of the Si-W converter/tracker, a light multilayer silicon tracking detector will extend the GAMMA-400 measuring capabilities for low- and medium-energy gamma rays in the range 50-300 MeV.

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Performance of the ALICE Inner Tracking System and studies for the upgrade.

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The Inner Tracking System (ITS) of the ALICE experiment is made out of six layers of silicon detectors exploiting three different technologies (pixel, drift and strip). It covers the central pseudorapidity range of $|\eta| < 0.9$ and its distance from the beam line ranges from r = 3.9 cm for the innermost pixel layer up to r = 43 cm for the outermost strip layer. The main tasks of the ITS are to reconstruct the primary and secondary vertices with high resolution; to track and identify charged particles with a low pt cutoff as a standalone tracker; to improve the momentum and angle resolution for tracks reconstructed in the outside tracking detectors.
In this talk I will present the performance of the ITS in p-p and Pb-Pb collisions in 2010, both from the hardware point of view, with a brief overview of the features of the system, and the physics achievements for what concerns the vertexing, the tracking and the particle identification.
Furthermore, I will give an outlook on a possible upgrade of the ALICE ITS which is presently being studied, in order to extend its physics performance by improving the measurements of charmed hadrons and accessing new physics items like the measurement of the beauty hadrons.