XXXV Physics in Collision

Tuesday, 15 September 2015 - Saturday, 19 September 2015

University of Warwick

Book of Abstracts

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PERSPECTIVE STUDY OF EXOTICS AND BARYONS WITH CHARM AND STRANGENESS

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The spectroscopy of exotics states with hidden charm together with the spectroscopy of charmed and strange baryons is discussed. It is a good testing tool for the theories of strong interactions, including: QCD in both the perturbative and non-perturbative regimes, LQCD, potential models and phenomenological models [1, 2, 3]. An understanding of the baryon spectrum is one of the primary goals of non-perturbative QCD. In the nucleon sector, where most of the experimental information is available, the agreement with quark model predictions is astonishingly small, and the situation is even worse in the strange and charmed baryon sector. The experiments with antiproton-proton annihilation and proton-proton collisions are well suited for a comprehensive baryon spectroscopy program, in particular, in the spectroscopy of strange and charmed baryons. Charmed and strange baryons can be produced abundantly in both processes, and their properties can be studied in detail [1, 2, 3]. This gives a possibility to get information about their structure and nucleon-hyperon and hyperon-hyperon interaction.
For this purpose an elaborated analysis of charmed hybrids and tetraquark spectrum together with spectrum of charmed and strange baryons is given. The recent experimental data from different collaborations are analyzed. A special attention was given to the XYZ-particles. The attempts of their possible interpretation are considered [4, 5]. Some of these states can be interpreted as higher-lying charmonium and tetraquarks with a hidden charm. It has been shown that charge/neutral tetraquarks must have their neutral/charged partners with mass values which differ by few MeV. This hypothesis coincides with that proposed by Maiani and Polosa [6]. Many heavy baryons with charm and strangeness are expected to exist. But much more data on different decay modes are needed before firmer conclusions can be made. These data can be derived directly from the experiments using a high quality antiproton beam with momentum up to 15 GeV/c planned at FAIR and proton-proton collisions with momentum up to 26 GeV/c planned at the superconducting accelerator complex NICA that is being built in Dubna nowadays.

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[2] N. Brambilla et al., European Physical Journal C 71:1534, (2011) 1
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[4] M.Yu. Barabanov, A.S. Vodopyanov, Physics of Particles and Nuclei Letters, V.8, N.10, (2011) 1069
[5] M.Yu. Barabanov, A.S. Vodopyanov, S.L. Olsen, Physics of Atomic Nuclei, V.77, N.1, (2014) 126
[6] L. Maiani, F. Piccinini, A.D. Polosa, V. Riquer, Phys. Rev. Lett. 99 (2007) 182003

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Underground Physics with DUNE

Author: DUNE Collaboration[1]

[1] *Fermilab*

The Deep Underground Neutrino Experiment (DUNE) plans a 34-kton (fiducial mass) liquid argon time projection chamber to be sited at 4850 ft depth at the Sanford Underground Research Facility in South Dakota. The significant overburden at this site gives DUNE significant physics reach for

several non-beam physics topics. These include neutrino oscillation studies with atmospheric neutrinos, for which the LAr TPC enables precision reconstruction, baryon number violation searches, for which detection of kaon modes has particularly high efficiency, and detection of neutrino bursts from core-collapse supernovae, for which the electron-neutrino flavor sensitivity will be unprecedented. This talk will discuss the unique underground physics capabilities of DUNE.

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An Experimental Programme in Neutrinos, Nucleon Decay and Astroparticle Physics at the DUNE Experiment

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A new International Collaboration (DUNE - Deep Underground Neutrino Experiment) has been formed to pursue an accelerator-based long-baseline neutrino experiment, as well as neutrino astrophysics and nucleon decay, with an approximately 40-kt (fiducial) modular liquid argon TPC (LAr-TPC) detector located deep underground and a high-resolution near detector. Several independent worldwide efforts, developed through years of detailed studies, are converging around the opportunity provided by the megawatt neutrino beam facility planned at Fermilab and by the new significant expansion with improved access at the Sanford Underground Research Facility in South Dakota, 1,300 km from Fermilab.

The principle goals of this experiment are a comprehensive investigation of neutrino oscillations to test CP violation in the lepton sector, determining the ordering of the neutrino masses, and testing the three-neutrino paradigm. The experiment will perform a broad set of neutrino scattering measurements with the near detector and exploit the large, high-resolution, underground far detector for non-accelerator physics topics including atmospheric neutrino measurements, searches for nucleon decay, and measurement of astrophysical neutrinos especially those from a core-collapse supernova.

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Type-III seesaw fermionic triplets at the International Linear Collider

Author: Deepanjali Goswami[1]

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We investigated the signature of heavy fermionic triplets belonging to Type III seesaw model through their direct production at the International Linear Collider (ILC). In particular we looked into the decay distributions of charged ($\Sigma^{\pm}$) and neutral (Σ^0) triplets in the processes $e^+e^- \to \Sigma^+\Sigma^-, \Sigma^0\Sigma^0, \Sigma^0\nu, \Sigma^{\pm}\ell$ and studied how they can be used to reduce the SM background. These heavy triplets mix with SM leptons and thus opens up the possibility of studying various interesting channels. The triplet state(Σ) having mass around 500 GeV, will be produced in large numbers at the ILC with CM energy of 2000 GeV and a moderate integrated luminosty of 300 fb^{-1}. Further we have found that it is possible to distinguish scenarios involving different mixings.

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Muon reconstruction performance in ATLAS at Run-II

Author: Arthur Lesage[1]

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The ATLAS muon reconstruction has been improved for the Run-II of the LHC.
In this presentation, we will discuss the new reconstruction algorithm and its performance as measured during the early run of the LHC in 2015 at sqrt(s)= 13 TeV using samples of $J/\psi \rightarrow \mu\mu$ and $Z \rightarrow \mu\mu$ decays.
Reconstruction efficiency, transverse momentum resolution and momentum scales are measured in the various regions of the detector and for muon momenta between 6 and hundreds of GeV.

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A search for an additional heavy higgs boson in the H->ZZ->2l2q/2v2q decay channel at √s = 8 TeV in pp collision data with ATLAS detector

Author: ATLAS Poster Presenter[1]

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In Run I, a search for high mass higgs decaying to two Z bosons has been performed in both ATLAS and CMS experiments. The search in ATLAS consists of 4 channels depending on the Z decays, llll, llvv, llqq and vvqq. This poster will mainly focus on the decay channels where one of the Z decay leptonicly and the other hadronically, meaning the vvqq and llqq channels from ATLAS.

The search uses the proton-proton collision data sample at the centre-of-mass energy of 8TeV with an integrated luminosity of 20.3fb-1. The assumed high mass higgs width is narrow compared with the experimental mass resolution. The mass range in the search is from 200(llqq)/400(vvqq) GeV to 1TeV.

The search strategy will be presented in the poster ,particularly, the event selection , background estimation, control regions, systematic uncertainties , and the final result will be described.

No significant excess of events over the Standard Model prediction is found. The upper limits are set on the production cross-section of a heavy higgs boson times branching ratios to Z pairs. And the interpretation to 2HDM will be briefly mentioned.

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Search for the Higgs boson decaying to b quark pairs in the W/Z associated production channels with ATLAS

Author: ATLAS Poster Presenter[1]

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In 2012, the ATLAS and CMS experiments at CERN discovered a Higgs-like boson in LHC pp collisions at √s = 7 and 8 TeV with an approximate mass of 125 GeV.

More recent experimental results, exploring the complete Run1 dataset, indicate that the observed boson is consistent with the Standard Model Higgs Boson within uncertainties. The results include spin and parity properties and couplings to the other SM particles and are mostly based in bosonic channels.

Despite the increasing experimental knowledge about the Higgs boson, its couplings to down-type quarks have still to be proven. The SM 125 GeV Higgs boson decays to b quark pairs with a branching ratio of 58% but the bb production cross-section in √s = 8 TeV pp collisions is 7 orders of magnitude greater than the Higgs production cross section, making this decay one of the most challenging to search for at the LHC. In the associated production in which the Higgs is produced with a W/Z boson, one can use the leptonic decay of the W/Z to trigger the event and substantially reduce the backgrounds.

This poster presents the ATLAS Run I search for the H->bb, describing the analysis methods and the results with the combination of the ZH->vvbb, ZH->llbb and WH->lvbb search channels. The data set used correspond to integrated luminosities of 4.7 fb-1 at √s= 7 TeV and 20.3 fb-1 at √s= 8 TeV. The observed (expected) deviation from the background only hypothesis corresponds to a significance of 1.4 (2.6) standard deviations and the ratio of the measured signal yield to the Standard Model expectation is found to be μ = 0.52 ± 0.32 (stat) ± 0.24 (syst) for a Higgs boson mass of 125.36 GeV.

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Search for high mass resonances with boson-tagged jets with the ATLAS detector

Author: Joseph Stanford Ennis[1]

[1] *University of Warwick (GB)*

Many extensions to the Standard Model predict new particles which couple to the electroweak bosons. Using recently developed jet substructure techniques it is possible to tag jets consistent with hadronically decaying bosons whilst rejecting the QCD background. Studying the all-hadronic final state with this strategy was used in run-1 to perform a search for new high mass resonances. This final state has significantly more statistics than its leptonic or semi-leptonic counterparts allowing the search to explore a higher mass range. This poster will present the techniques and results of the run-1 analysis and discuss the improvements and challenges expected for its run-2 counterpart.

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Dark Matter Searches with the ATLAS detector

Author: Mengqing Wu[1]

[1] *Centre National de la Recherche Scientifique (FR)*

The poster will give an overview of the dark matter searches in ATLAS based on the presence of a high pT object accompanied by large missing transverse momentum. LHC Run-1 results at a centre-of-mass energy of 8 TeV will be shown along with prospects for the ongoing LHC Run-2, including relevant performance studies based on the 13 TeV data.

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Measurement of the Transverse Momentum and Phiˆ* distributions of Drell–Yan lepton pairs in proton-proton collisions with the ATLAS Detector

Author: ATLAS Poster Presenter[1]

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The ATLAS experiment measured the differential production cross-section of Drell-Yan lepton pairs in proton-proton collisions versus their transverse momentum and the phi* observable. These measurements allow for a precise test of perturbative and resummed QCD predictions and are the basis for electroweak precision measurements at the LHC, such as the measurement of the W boson mass. In this presentation, we discuss the latest results and compare them to various QCD predictions, allowing to put significant constraints on model uncertainties.

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Production of X(3872) in ATLAS at sqrt(s)=8 TeV

Author: Michael David Beattie[1]

[1] *Lancaster University (GB)*

The differential cross sections for prompt and non-prompt production of psi(2S) and X(3872) is measured in the J/psi pi+ pi- decay mode in pp collisions at sqrt(s)= 8 TeV, using the integrated luminosity of 11.4 fb-1 taken by the ATLAS detector. The non-prompt fraction of X(3872) production and the ratio of X(3872) and psi(2S) production cross sections are also measured. Results are compared with theoretical predictions.

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The status of MICE Step IV

Author: Vittorio Palladino[1]

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Muon beams of low emittance provide the basis for the intense, well-characterised neutrino beams of the Neutrino Factory and for lepton-antilepton collisions at energies of up to several TeV at the Muon Collider. The International Muon Ionization Cooling Experiment (MICE) will demonstrate ionization cooling –the technique by which it is proposed to reduce the μ phase-space volume. MICE is being constructed in a series of Steps. At Step IV, MICE will study the properties of liquid hydrogen and lithium hydride that affect cooling. A solenoidal spectrometer will measure emittance up and downstream of the absorber vessel, where a focusing coil will focus muons. The construction of Step IV at RAL is nearing completion. Its status will be described together with a summary of the

performance of the principal components. Plans for the commissioning and operation and the Step IV measurement programme will be described.

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The MICE Demonstration of Muon Ionization Cooling

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Muon beams of low emittance provide the basis for the intense, well characterised, neutrino beams necessary to elucidate the physics of flavour at the Neutrino Factory and to provide lepton-antilepton collisions up to several TeV at the Muon Collider. The international Muon Ionization Cooling Experiment (MICE) will demonstrate ionization cooling, the technique proposed to reduce the phase-space volume of the muon beam at such facilities. In an ionization cooling channel, the muon beam traverses a material (the absorber) loosing energy, then replaced by reaccelerating RF cavities. The combined effect is to reduce the transverse emittance (transverse cooling). The rebaselined project will deliver a demonstration of ionization cooling by September 2017. In the revised configuration 1) a central lithium hydride absorber provides the main cooling effect 2) the magnetic lattice is two SC focus-coil modules 3) acceleration is provided by two 201 MHz single-cavity modules. The phase space of the muons in and out of the cooling cell will be measured by two SC solenoidal spectrometers. All the SC magnets for the ionization-cooling demonstration are available at RAL and the first singlecavity prototype has been tested successfully in the MuCool Test Area at Fermilab. The design of the cooling demonstration experiment, a summary of the performance of each of its components and the cooling performanceof the revised configuration will be described.

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Welcome

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General event characteristics at 13 TeV

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Heavy flavour production at 13 TeV

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Current picture and understanding of QCD

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Top quark properties

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Top quark production

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Gauge bosons production and properties

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SM Higgs couplings

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SM Higgs properties

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BSM Higgs

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Heavy ion collisions

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Electroweak penguin B decays

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Semileptonic tree level B decays

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Hadronic B Decays

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CP Violation, CKM angles

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Kaon decays

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Charm physics

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Charge lepton flavour physics

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Lepton dipole moments

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Lattice QCD

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Heavy quark spectroscopy

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Supersymmetry searches

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Measurement of the Inclusive Isolated Prompt Photon production cross section in p\bar{p} collisions at \sqrt{s}=1.96TeV using the full CDF dataset

Author: ALESSANDRA LUCA'[1]

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The production of photons with large transverse energy in hadronic collisions is an important testing ground for perturbative Quantum Chromodynamics (pQCD), enabling to probe parton distribution functions

(PDFs) and the parton-to-photon fragmentation functions (FFs). In addition, high-ET photons can also constitute an irreducible background for important searches such as H⟶γγ, or SUSY and extra-dimensions with energetic photons in the final state.
We present the measurement of the cross section for the inclusive production of isolated prompt photons in p\bar{p} collisions at the Tevatron, using the full dataset collected with the upgraded Collider Detector at Fermilab (CDF). Measurements are performed as a function of the photon transverse energy in the range 30 GeV < E_T < 500 GeV and pseudorapidity region |\eta| < 1.0. The results are compared to the state-of-art calculations.

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Searches for Exotic phenomena

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Hidden sector searches

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Long baseline oscillation results

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Results from reactor experiments

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Non-reactor/non-accelerator neutrino results

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Dark Energy

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Low energy cosmic rays

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Extreme high energy Cosmic Rays

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Cosmic microwave background

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Dark Matter Searches

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Poster winner - DEAP-3600 Dark Matter experiment

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Poster winner - Dark Matter Searches with the ATLAS detector

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Poster talk 3

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Search for electron tau Lepton Flavour Violating Higgs Decay with CMS

Author: Annika Vanhoefer[1]

[1] *Hamburg University (DE)*

The direct search for the Higgs boson Lepton Flavour Violating decay H -> e tau_mu in the 19.7/fb proton-proton collisions data collected with the CMS detector at 8 TeV centre-of-mass energy is presented. The observed (expected) limit on the Higgs boson branching fraction is discussed and compared with the H-> mu tau_e and H -> e mu Lepton Flavour Violating decay modes.

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Testing CPT symmetry

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First Oscillation Results from NOvA

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ATLAS LAr Calorimeter Commissioning and Performance in LHC Run-2

Author: Arno Straessner[1]

[1] *Technische Universitaet Dresden (DE)*

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The ATLAS detector was designed and built to study proton-proton collisions produced at the LHC at centre-of-mass energies up to 14 TeV and instantaneous luminosities up to $10^{34}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$. Liquid argon (LAr) sampling calorimeters are employed for all electromagnetic calorimetry in the pseudorapidity region $|\eta| < 3.2$, and for hadronic calorimetry in the region from $|\eta| = 1.5$ to $|\eta| = 4.9$. In the first LHC run a total luminosity of $27\ \mathrm{fb}^{-1}$ has been collected at center-of-mass energies of 7-8 TeV with very high operational efficiency of the LAr Calorimeters and excellent performance. The well calibrated and highly granular detector achieved its design values both in energy measurement as well as in direction resolution, which was a main ingredient for the successul discovery of a Higgs boson in the di-photon decay channel.

This contribution will give an overview of the commissioning and performance of the ATLAS LAr Calorimeters during the 13-14 TeV run of the LHC, the so-called Run-2. Synchronisation of the signal timing in the different detector areas was verified from beam-splash events, even before the proton collisions started. First Run-2 results on data quality and LAr Calorimeter performance for electrons, photons and jets at 13-14 TeV centre-of-mass energy will be presented.

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DEAP-3600 Dark Matter experiment

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DEAP-3600 is a single phase liquid argon (LAr) dark matter experiment, located 2 km underground at SNOLAB, in Sudbury, Ontario. The detector has 1 tonne fiducial mass of LAr. The target sensitivity to spin-independent scattering of 100 GeV WIMPs is 10^{-46} cm^2 which gives one order of magnitude improvement over current results. The DEAP-3600 background target is < 1 background events in the WIMP region of interest in 3 tonne-years. The strategies to achieve this background are pulse shape discrimination to mitigate electron recoils, ultra low radioactive materials for detector construction to reduce neutron and alpha backgrounds, in-situ sanding of the acrylic vessel to mitigate radon exposure of surfaces during construction and fabrication. The experiment is currently in commissioning phase and will begin physics data taking later this year. This presentation gives an overview of the DEAP-3600 experiment and shows some of the recent commissioning data.

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Neutrino cross section ratios at the T2K near detector

Author: Iain Lamont[1]

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A study of differences in electron neutrino and muon neutrino interactions using the T2K ND280 detector will be performed in this analysis. The low peak energy of the T2K beam is ideal for studying these differences as this is the region with the largest expected difference. To cancel the large beam flux uncertainties, the ratio of the number of CCQE interactions to the number of CC inclusive interactions is calculated for nue and numu. The ratio of these ratios is then calculated to study the differences between them for energies starting at the muon production threshold to 2GeV. Understanding these ratios for both nue and numu well will help reduce the uncertainties on future oscillation measurements.