NAME OF THE PROJECT

Diffractive Processes and QCD Jets in Experiment DØ, Collaboration between University of Texas, Arlington and Czech Technical University

PROJECT LEADERS AND OTHER PARTICIPANTS

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1 PROJECT DESCRIPTION

1.1 Overview

The aim of the proposed common research project is to facilitate participation of Czech physicists in collaboration with physicists of University of Texas, Arlington (UTA) in the DØ Experiment in the Tevatron accelerator at Fermi National Accelerator Laboratory (Fermilab), Batavia, Illinois, USA.

The DØ Collaboration conducts research into the fundamental structure of matter using proton and antiproton colliding beams at the Tevatron. It is a unique facility, which provides a total proton-antiproton collision energy of near 2 TeV and will be at the energy frontier until the launch of the LHC accelerator at CERN in 2007.
Diffractive processes with jet production are effectively a new phenomena, in that they are not understood in the present theory of particle physics. New detectors in forward beams regions, associated with DØ detectors, have open new facilities to observe and study such diffractive phenomena, especially in conjunction with intermediate bosons and heavy quark production.

1.2 The DØ Experiment

The original DØ detector [1] was constructed over the period 1984–1992. It started operation at the Tevatron Collider during 1992 and with periodic pauses, operated until February 1996. Data from antiproton-proton collisions with a center-of-mass energy of 1800 GeV, corresponding to a total integrated luminosity of about 125 pb$^{-1}$, were collected during Run I.

The DØ collaboration published more than 100 papers in Run I on a variety of particle physics subjects. In 1995, the DØ and CDF collaborations simultaneously reported the observation [2] of the top quark, the heaviest of the quarks yet discovered. Experimental results on the inclusive jet cross section confirm the theoretical prediction of Quantum Chromodynamics (QCD). Figure 1 shows an impressive agreement in jet cross section over a range of several orders of magnitude.

The Tevatron Collider complex was subsequently upgraded, which, with the introduction of the Main Injector accelerator, increased the beam energy by 10%
to near 1 TeV and dramatically increased the $p\bar{p}$ luminosity. The DØ experiment was approved for running with the initial goal of reaching an integrated luminosity of 2 fb$^{-1}$ (Run II). This is a factor of nearly 20 times greater than the present data set. Since the time between bunch crossings in the collider was reduced substantially as part of the luminosity improvements, the DØ detector was upgraded, both to accommodate these new conditions and to enhance the physics reach, primarily through new central and very forward tracking.

1.3 Forward Proton Detector

Improved understanding of the new field of hard diffraction, which probes otherwise inaccessible details of the strong force and vacuum excitation, requires new detectors for tagging and measuring scattered protons. The capability of tagging protons and anti-protons improves our ability to trigger on diffractive events and enables us to trigger on elastic events (primarily for calibration), thus allowing the collection of large well-understood data samples.

Dividing the data into diffractive mass and momentum transfer between initial and final state of proton/antiproton $|t|$, facilitates the comparison of the data with models, in the form of phenomenological Monte Carlos, and allows studies of the diffractive structure function independent of theoretical bias.

The DØ Forward Proton Detector (FPD) [3] consists of momentum spectrometers which make use of accelerator magnets, along with points measured on the track of the scattered proton, to calculate the proton’s momentum and
scattering angle. Tracks are measured using scintillating fiber detectors located in vacuum chambers positioned in the Tevatron tunnel 20–60 meters upstream and downstream of the central DØ detector. The vacuum chambers were built in Brazil and have been installed in the Tevatron beamline. The scintillating fiber detectors were constructed at UTA.

Figure 2 shows the layout of the FPD. In the center of the diagram is the DØ detector. The dipole spectrometer consists of two scintillating fiber detectors located after the Tevatron dipole magnets (D) about 57 meters downstream of the interaction point on the outgoing $\bar{p}$ and measures anti-protons that have lost a few per cent of the beam momentum (and are thus deflected out of the beam envelope and into the detector located on the radial inside of the Tevatron ring). The detectors comprising the quadrupole spectrometers are located adjacent to the electrostatic beam separators (S) on both the proton (P) and anti-proton (A) sides and use the low beta quadrupole magnets (Q) as the primary analyzing magnets. They have acceptance for a large range of proton (anti-proton) momenta and angles.

Each of the nine independent spectrometers consists of a pair of detectors, both in the same plane: above, below, to the right, or to the left of the beam. This combination of spectrometers maximizes the acceptance for protons and anti-protons given the available space for locating the detectors. Particles traverse thin steel windows at the entrance and exit of each Roman pot (the stainless steel vessel that houses the detector). The pots are remotely controlled and can be moved close to the beam (within a few mm) during stable beam conditions and retracted otherwise. The scintillating fiber detectors are read out by multi-anode photomultiplier tubes (MAPMT’s) and are incorporated into the standard DØ triggering and data acquisition system.

The FPD project was initiated by Andrew Brandt while he was a Wilson Fellow at Fermilab along with a dedicated group from Brazil led by Alberto Santoro. Czech specialists on vacuum pumps contributed to the project design, and Czech graduate students have been involved in the commissioning phase.

The FPD allows new insight into an intriguing class of events that are not currently understood within the Standard Model. It allows us to trigger directly on events with a scattered proton, anti-proton, or both, along with activity in the DØ detector. In addition to improved studies of hard diffractive processes, the new detector will allow a search for glueballs and exotic phenomena. The FPD will also provide improved luminosity measurements, which are an important component to all DØ analysis.
2 PARTICIPATING LABORATORIES

2.1 The Czech Technical University in Prague

The participation of the Czech physicists in experiment DØ was enabled due to the grant of the National Science Foundation obtained for years 1998 - 2001. The success of collaboration of Czech physicists in the DØ experiment has triggered new support for the DØ experiment from Czech institutions.

The contribution to the DØ upgrade from the Czech side was based on the utilization of Prague laboratories constructed for the ATLAS project. Participation in data analysis, and in shifts for data-taking runs will provide young researchers an opportunity to do their PhD theses on frontier problems in particle physics.

In recent years the Czech side took part in the following activities:

- **Development, production and installation of parts of detectors:**
  
  *Production of components of the high voltage distribution system for the muon detector*
  
  The work on this item has already been completed in Prague. The power supply distribution boxes for more than 4500 photomultipliers of the muon detector were produced. Use was made of the experience of the Czech engineers working on the power supply modules for the photomultipliers of the ATLAS hadron calorimeter. Two students and one technician participate in the mounting and commissioning of the muon pixel detector.

  *Contribution to the Si - central detector*
  
  The Czech activity in the central detector was focused on the silicon system. These detectors were constructed at Fermilab and fabricated in Micron factory in Great Britain. The essential part of the detectors was tested directly in the Micron factory by experienced Czech engineers. Some of the electronics for silicon detectors were also tested in Fermilab by Czech technicians.

  *Forward Proton Detector (FPD)*
  
  The DØ The ion vacuum pumps produced in Prague, were used for testing components of the FPD in collaboration with Brazilian physicists. Testing of scintillating fibers for FPD detectors at Fermilab were also performed by a Czech graduate student.

- **Analysis of data from $p\bar{p}$ interactions from Run I**
  
  DØ has recorded more than 500,000 events with five or more jets in the final state (so called multi-jets). These interactions contain contributions from W and Z bosons and from top-quark production where the top quark decays into a b-quark and W boson with the W decaying into quark-antiquark pairs.
Because of the presence of a large background from QCD processes, the analysis of the multi-jet interactions is demanding. The Prague group uses its previous experience from the UA2 Experiment at the CERN SppS Collider to contribute to the analysis of multi-jet events with following goals:

- to compare the kinematics quantities with QCD predictions (with the help of the PYTHIA and HERWIG generators)
- to search for W and Z bosons decaying into quark and antiquark pairs
- to search for the t-quark and its properties in multi-jet final states
- Reconstruction of events with top-antitop production, where there are two leptons in final states, is most challenging problem in top-quark physics. From the knowledge of two leptons momenta and assumption of top-quark mass and decays of W bosons into neutrino and lepton, the neutrino momenta could be determined. From the complete reconstruction of such events, one can learn about: mass of the top-quark, spin properties of top-antitop and essential information on dynamic of top quarks production. In those topics, the Czech physicists would participate in analysis of data taken in Run II, where the statistics of such events will be much larger compared to Run I.
- New phenomena of diffraction processes will be investigated using the FPD detector. Czech physicists would like to participate in the following terms: properties of diffracted processes with hard jets, angular correlations, and mass of two jet events in comparison with QCD.
- Czech participation in DØ experiment has already resulted in common publications of Run I experimental data and in active presentation of DØ results in international conferences [4].

• Data taking and analysis during Run II

Effective analysis of the new data will require a good understanding of the entire detector which can be best gained from active participation in Run II. The Czech physicists are involved in studies to improve the precision of the detector and are taking part in the analysis of the data for the topics discussed earlier in this document.

Within this project we assume Czech participants spending 24 person-months per year at Fermilab. This is the primary budget component of this proposal. Other visits and activities at Fermilab will also be supported by Czech institutions.

In addition, in order to enhance effective communication, we propose one or two visits per year to Prague, of relatively short duration, for a U.S.
physicist active in a research subject directly related to the Czech activity on DØ.

The participation of the Czech Institutions in DØ will yield new interesting experimental results and discoveries in the field of elementary particle physics, and have positive consequences such as:

– the education of young physicists who will be able to solve problems in current and future particle physics experiments
– the transfer of special technology for detectors between laboratories
– establish an international collaboration and new scientific contacts

2.2 The University of Texas at Arlington

The University of Texas at Arlington (UTA) group established by Andrew White has been a major contributor in the DØ experiment since 1992, including the construction of the Intercryostat Calorimeter Detector. Andrew Brandt joined the group in 1999 and has led the construction and commissioning of the FPD in addition to leading the Run I rapidity gap physics group and being a Run I physics convenor. Brandt was lead author of several of the diffractive papers discussed in the following sections including Ref. [5] on diffractive $W$ and $Z$ boson production. Under the supervision of Brandt and UTA graduate student Michael Strang, 20 scintillating fiber detectors were constructed at UTA by several graduate and undergraduate students over a three year period. The detectors were shipped to Fermilab for final assembly and polishing.

Data was taken with a partial system in 2002 and 2003 (early analysis and results are discussed in Sec. 4). An NSF MRI grant with Northern Illinois University (Gerald Blazey) and Brandt has allowed the instrumentation of the full system in fall 2003. Post-doc Duncan Brown is supervising the final trigger commissioning needed to make full use of the FPD, and is leading a a group of seven graduate students that are performing diffractive analyses. Strang’s diffractive jet analysis will be the first thesis using the FPD integrated with the central DØ detector. UTA will continue to play a lead role in the operations and physics analysis using the FPD, as discussed in following sections.

3 OUTLOOK FOR PHYSICS

3.1 Diffractive Processes

The study of hard diffractive processes has expanded dramatically in recent years. Results from HERA and the Tevatron include the observation of diffractive jet production [6, 7, 8, 9, 10], diffractive $W$ boson production [11, 5], and rapidity gaps between high transverse energy jets [12, 13].
Figure 3: Topology of diffractive processes (elastic, single diffraction, double pomeron exchange, and hard double diffraction). Topology of two jet production is also marked in $\eta - \varphi$ plane. Some kinematical variable with limits of the mass of the diffractive system are also mentioned.

Although rapidity gap studies have been used to gain some insight into hard diffraction, these studies can be vastly improved through the addition of the FPD. Tagging the forward proton removes the ambiguity of a rapidity gap tag, which suffers from background due to low multiplicity non-diffractive events. The rapidity gap tag also does not give information on whether the scattered proton remains intact or is excited into a low-mass state, which could still yield a rapidity gap.

The use of a scattered proton as the diffractive tag also allows the full rapidity range of the detector to be exploited to study the diffractive system. This in turn allows a search for the effects of the super-hard pomeron, which is expected to frequently result in back-scattered jets in the rapidity interval normally used to tag rapidity gaps. The super-hard pomeron is of great theoretical interest [16], partly because if the entire pomeron momentum participates in the hard scatter, there is a dramatic increase in the cross section for the diffractive production of heavy objects, such as $b$ quarks [17]. The cross section for hard double pomeron exchange is also enhanced by super-hard pomeron exchange [18, 19].

In Fig. 3 various pomeron exchange topologies are presented together with
the region of particle production in $\eta - \varphi$ plane and associated kinematics.

**Double Pomeron Exchange.** Double pomeron exchange is one of the most intriguing processes that can be studied effectively using the FPD. In this process both the incoming proton and anti-proton are scattered but remain intact, and a massive central system may be produced. At the Tevatron objects with a mass of more than 100 GeV can be created. Current measurements have used rapidity gap tags [20], or a $\bar{p}$ on one side and a gap on the other [8]. With both arms instrumented it would be possible to make definitive measurements and detect the entire event: the $p$ and $\bar{p}$ using the FPD, and jets (for example) using the calorimeter.

Observation and measurement of hard double pomeron exchange would help determine the pomeron structure and provide unique information on the pomeron flux. Double pomeron exchange would have a normalization proportional to the square of the flux factor, unlike other hard diffractive processes. Double pomeron interactions are also an ideal place to look for glueball production (bound states of gluons) and states with exotic quantum numbers, and the clean event topologies would make them easier to detect.

**Diffractive Production of Massive States.** Diffractive systems with masses greater than 450 GeV/$c^2$ can be produced at the Tevatron compared to only about 70 GeV/$c^2$ at HERA. In addition to large jet cross sections, this allows for the production of massive objects, such as $W$ and $Z$ bosons, which have recently been definitively observed [5]. Diffractive production of top quarks is not out of the question, and the quiet environment may allow for improved measurements of event properties. The FPD combined with the excellent particle identification of the upgraded DØ detector will allow searches for a large range of hard diffractive final states. Combining the information from different diffractive channels will allow the determination of the diffractive quark and gluon structure.

**Soft Diffraction.** Finally, many properties of inclusive elastic and diffractive scattering have been measured at the Tevatron [21, 22], but there is little data on the momentum transfer dependence of these results. The FPD will allow us to measure these cross sections up to a few GeV$^2$, and thus make significant contributions to the understanding of soft as well as hard diffraction.

**Luminosity Measurement.** The primary physics goal of the FPD is to measure hard diffractive processes. Since the quadrupole spectrometers have good acceptance for elastic events, the FPD could also be used to reduce the luminosity uncertainties for all DØ processes. The dominant uncertainty in the 5.3% luminosity error of Run I [23] was the discrepancy between the total cross section values measured by the CDF [24], E710 [25], and E811 [26] collaborations. Preliminary studies indicate that we could measure the total cross section with comparable accuracy, which could reduce the total uncertainty by up to a factor of two. The FPD can also provide a run-by-run luminosity measurement to complement the Luminosity Monitor sub-detector, thereby improving the accuracy
Figure 4: Experimental observation of two jets production in detector DØ presented as legoplot ($\eta - \varphi$ plain) with transversal energy for normal and diffractive processes (HSD - hard single diffraction, HDPE - double diffractive pomeron exchange).

of all physics studies at DØ.

### 3.2 Experimental Plan

Here we give a brief overview of some of the data samples that will be obtained with the FPD and how they can be used to further understanding of hard diffraction. Diffractive processes with jet production has been already seen and analyzed from Run I experimental data (see Fig. 4).

**Data Samples.** Based on preliminary measurements with rapidity gap triggers and with FPD triggers, we expect to accumulate large data samples for hard diffraction (dijets with $E_T > 25$ GeV and a tagged proton), hard double pomeron exchange (dijets with $E_T > 15$ GeV and a tagged $p$ and $\bar{p}$) and inclusive double pomeron exchange (tagged $p$ and $\bar{p}$), in excess of 100,000 events for the former and 1,000 events for the two latter samples in Run IIa (by 2006). The capabilities of the trigger system currently being commissioned are crucial for keeping the fake background from multiple $\bar{p}p$ interaction events and halo under control and reducing trigger rates to an acceptable level. Other event samples, such as diffractive $W$ bosons (hundreds of events with a $p$ or $\bar{p}$ tag are expected in 2 fb$^{-1}$) will be obtained by recording the Forward Proton Detector data block for every event and do not require special triggers.
Data Interpretation. To effectively utilize the large data samples that will be obtained with the FPD, it is useful to have Monte Carlo (MC) simulations of the physics processes. The POMPYT [14] and POMWIG [15] Monte Carlos incorporate the Ingelman-Schlein model and are used to generate samples to compare to hard diffractive data. They allow for the choice of different pomeron structure functions and quark and gluon combinations, and can thus be used in conjunction with the data to derive a pomeron structure, or to determine if the concept of a pomeron structure is valid. MC programs for Soft Color Interactions and other alternate descriptions of hard diffraction are under development, and should be available soon for comparison with FPD data.

We have performed Monte Carlo studies of diffractive dijet production and have identified several variables with sensitivity to pomeron structure, such as the \( \eta \) distribution of the leading two jets.

To derive the quark and gluon content of the pomeron, we need to measure the dijet cross section as well as the cross section for other processes, such as diffractive \( W \)-boson and diffractive \( b \)-quark production. These processes have different dependencies on the quark and gluon content of the pomeron, as well as the pomeron structure function. Measuring the cross sections thus gives complementary information to that obtained from various angular and kinematic distributions.

4 FPD STATUS AND EARLY ANALYSIS

The past year has been one of steady progress in commissioning the FPD. We routinely inserted the pots during every store and have integrated the FPD into the DØ data acquisition. The FPD detectors and system work as designed, and we have already recorded a significant amount of physics quality data with the complete fiber detector system.

4.1 Elastic Scattering.

A stand-alone NIM- and CAMAC-based data acquisition system was used for early commissioning of the FPD. This system allowed only two detectors at a time to be read out, although all of the trigger scintillator information was available. As part of the commissioning effort we took a sample of elastic events which can be used to make a new physics measurement. For elastic events, we require that both detectors of a given spectrometer have hits at times consistent with a collision at the interaction point (IP) at the center of the DØ detector. Both detectors of the diagonally opposite spectrometer are also required to have in time hits (for the P-Down spectrometer, which was read out for this analysis, the opposite side is A-Up). In addition, we require that forward scintillation counters have no hits, since elastic events should only contain a scattered proton
and anti-proton. To reduce halo background, we also require that none of the
detectors have early time hits that would be consistent with halo particles.

The events remaining after background cuts are processed through the track-
ing reconstruction code. This software uses the lattice of the Tevatron magnets
to map the path of a particle from the IP through the quadrupole magnets and
then through both detectors, giving unique $\xi$ and $|t|$ values for the track. Monte
Carlo was used to help with detector alignment. After an alignment correction
is applied, the $\xi$ distribution in Fig. 5 (left plot) is obtained, which is centered
around $\xi = 0$ as expected for elastic events. A Gaussian fit to the distribution
is also shown in the figure yielding a preliminary resolution of 0.018. The full
FPD system will have a much improved alignment capability and 30-40% better
resolution is expected. Figure 5 (right plot) shows the $|t|$ distribution for these
events, where the minimum $|t|$ value of about 0.8 GeV$^2$ is determined by the
location of the detectors with respect to the beam (the closer the pots the lower
the $|t|$).

Figure 5: left plot: Reconstructed $\xi$ of the proton tracks in the P-Down spec-
trometer for elastic events after alignment correction and data quality cuts. A
Gaussian fit to the data is also shown. right plot: dN/dt distribution of recon-
structed elastic events.

The turn-on at low-$|t|$ is due to limited acceptance for these events. The
acceptance is well-known in the fit region, and a small correction for the non-
uniform acceptance in this region is applied. At $|t| > 1.3$ GeV$^2$, there is still
contamination from halo, so this data is not used in the slope determination.
The preliminary measured value of the slope from $0.96 < |t| < 1.3$ GeV$^2$ is
$b = -3.8 \pm 0.8$ GeV$^{-2}$, where the largest souces of error are due to acceptance
corrections, halo background subtraction, and unsmearing corrections to account for the $|t|$ resolution.

Finally, in Fig. 6, we plot $d\sigma/dt$ for our data points compared to the phenomenological prediction of Martin Block [27] and the low $|t|$ measurements of the E710 experiment [28]. The agreement is excellent, although it should be noted that our points are normalized to the E710 points and the error bars are not yet final. There are no other measurements at $\sqrt{s} \sim 2$ TeV. A special run tentatively planned for early 2005 would allow us to fill in the dip region and overlap the E710 points.

![Figure 6: Elastic $d\sigma/dt$ distribution showing the E710 experimental data, a phenomenological prediction by Block, and the new DØ data points normalized to the E710 points.](image)

4.2 Integration

A major task over the past year has been to integrate the FPD system into the DØ data acquisition and trigger system [29]. The trigger system is modeled after the Central Track Trigger (CTT), but with fiber detectors read out by MAPMT’s instead of VLPC’s (visible light photon counters).

Figure 7 shows the (a) $x$ correlations and (b) $y$ correlations between hits in both dipole detectors (D1 and D2) for a sample of diffractive jet events. For the dipole detectors, the $+x$ direction is up relative to the plane of the Tevatron while the $+y$ direction is radially inside the Tevatron ring. For the $x$ correlation we expect the particle to pass through both detectors at the same value of $x$, as the dipole bending field is only in the $y$ view. This should hold both for diffracted $\bar{p}$’s as well as halo particles. For the $y$ correlation diffractive $\bar{p}$’s and halo particles are expected to behave differently. Incoming proton halo particles are not affected by
the dipole magnets so they should stay at a fixed distance from the beam and give
the same \( y \) value, as seen in the lower band of Fig. 7(b). The excess of events at
low \( y \) in both detectors is believed to be \( \bar{p} \) halo, which does go through the dipole
field, but is bent less than the diffracted \( \bar{p} \)'s that have lost several per cent of the
beam momentum. A TDC cut demanding that the time at the second detector
(D2) is greater than the time at the first detector (D1) removes all of the proton
halo contamination. Diffracted particles, on the other hand, that have lost in
excess of 4\% of their momentum will be bent by the dipole magnets such that
they will pass at a higher value of \( y \) in D2 than in D1. This is observed in the
upper band of the \( y \) correlation plot. The correlations observed in Figure 7 for
jet data are similar to those observed using the stand-alone system (not shown)
and are being used for Strang’s diffractive jet thesis analysis, which is expected
to be completed at the end of 2004.

These plots show that the integrated system is working at a reasonable level.
We have been collecting diffractive data for the dipole spectrometer since Febru-
ary 2003 and have a large sample of jet data as well as data with other DØ triggers
that is in the preliminary analysis stages. During the November 2003 shutdown,
we installed the final 8 detectors in the Tevatron and have been taking data with
the full integrated FPD system since January 2004. We are in the final stages of
commissioning the integrated trigger system.

Figure 7: (a) \( x \) correlations in D1 and D2 detectors for data taken with a jet
trigger plus a rapidity gap requirement and the standard DØ data acquisition
system; (b) \( y \) correlations in D1 and D2 detectors.
5 IMPACT OF PROJECT

The intellectual merit of this project is strong on many fronts, and the funding of this initiative will have a large impact, far greater than its modest requested budget. The understanding of strong interactions is incomplete without the inclusion of soft and hard diffractive processes. The DØ rapidity gap group, formed and led by one of the proponents of this proposal, has played a large role in the expansion of the field of hard diffraction. This field has been driven by experimental results and experiment should continue to lead theory. More precise results are needed to improve the understanding of the nature and structure of diffraction and to distinguish between different theoretical models. The Tevatron is the ideal collider to study this physics due to the large center-of-mass energy and luminosity available. The addition of the FPD provides DØ with a unique new capability of tagging scattered protons and anti-protons. This allows us to collect large data samples for precise measurements, and could lead to new physics discoveries as well, especially in the area of double pomeron exchange where both the $p$ and $\bar{p}$ will be detected. In addition, recent studies show that knowledge gained with the FPD could have an impact on the Higgs search at the LHC. Preliminary data analysis show that the detector is working well, and that we are able to reconstruct tracks from both elastic and diffractive events.

This proposal offers the NSF the opportunity to contribute to the collaboration of physicists from Czech Technical University in Prague with the Physicists from University of Texas, Arlington on new frontier of physics of diffractive processes. Although the Czech group and UTA have collaborated for some time, the effort has been hampered by a lack of travel funds, limiting the Czech students participation.

The return on the NSF investment is large, since the infrastructure for the FPD is now fully in place, provided partially through foreign funding sources, contributions from several universities including NIU and UTA, as well as the state of Texas, DOE, and NSF.

The NSF has made major contributions to the DØ experiment including funds to complete the FPD, and has also enabled Czech physicist to participate in the DØ experiment since 1997. This suggested project of collaboration would enable continuation of work in DØ Run II and bring new results in physics research to Texas and Czech physicists. This modest additional request will aid significantly in the full realization of the physics potential of DØ and the FPD.
References


6 PROJECT DURATION AND PROPOSED BUDGET

6.1 Program of activities in next 3 years

Year 1
- Participation in shifts in data taking in D0 detectors
- Analysis of interactions with jets in diffractive processes
- Comparison of results with Monte Carlo theoretical predictions

Year 2
- Participation in Run II data taking
- Data analysis and first publications
- Start analysis of heavy particle production in diffractive processes

Year 3
- Participation in Run II data taking
- Continuation of data analysis of Run II
- Preparation of common publication of obtained results and completion of PhD theses of Czech students
6.2 Proposed budget

The following budget request is to cover living expenses for Czech participants at Fermilab, trips for Czech participants to UTA, and trips for UTA physicists (including post-doc and students) to Prague.

Year 1  
4x6 months living expenses at Fermilab ($40/day): $9 600  
Monthly Lodging (Fermilab Dorm $20/day) $4 800  
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Total Support per person/month ($60/day) $14 400  
Two one-week visits of Czech students to UTA $2 000  
Visit of U. S. Physicists to Prague $3 000  
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Total $19 400

Year 2  
Total + 2% inflation $19 800

Year 3  
Total + 4% inflation $20 200