

DR. TOM GROVES
SECRETARY HIGH-ENERGY ADVISORY COMMITTEE

ANTINEUTRINO INTERACTIONS IN DEUTERIUM AT TEVATRON ENERGIES

AMSTERDAM - BOLOGNA - PADOVA - PISA - SACLAY - TORINO
COLLABORATION

WE PROPOSE TO PERFORM AN EXPERIMENT WITH THE 15' BUBBLE CHAMBER FILLED WITH DEUTERIUM, EXPOSED TO THE HIGHEST TEVATRON ENERGY WIDE BAND ANTINEUTRINO BEAM.

THE PROPOSED EXPERIMENT WOULD BE FOR US A LOGICAL CONTINUATION OF THE EXPERIMENT ON WHICH WE ARE PRESENTLY WORKING, THAT IS ANTINEUTRINO AND NEUTRINO INTERACTIONS IN THE BEBC BUBBLE CHAMBER FILLED WITH DEUTERIUM EXPOSED TO THE CERN-SPS-WIDE BAND NEUTRINO AND ANTINEUTRINO BEAMS.

IN THE WHOLE APPROVED EXPERIMENT WE SHOULD HAVE ABOUT 15000 ANTINEUTRINO-DEUTERIUM AND 15000 NEUTRINO-DEUTERIUM CHARGED CURRENT INTERACTIONS (AFTER APPROPRIATE CUTS).

THE MAIN MOTIVATIONS FOR CONTINUING THIS EXPERIMENT AT HIGHER ENERGIES MAY BE SUMMARIZED AS FOLLOWS:

1. COMPARISON OF ANTINEUTRINO-PROTON AND NEUTRON INTERACTIONS AT THE HIGHEST ENERGY IN ORDER TO SEE POSSIBLE ENERGY DEPENDENT EFFECTS. BECAUSE OF THE LARGE NEUTRINO CONTAMINATION OF THE ANTINEUTRINO BEAM WE WILL ALSO BE ABLE TO COMPARE NEUTRINO-PROTON AND NEUTRON INTERACTIONS. WE SHOULD BE ABLE TO MAKE A COMPLETE ANALYSIS OF THE STRUCTURE FUNCTIONS ON PROTONS AND NEUTRONS.
2. STUDY OF THE RATIOS R , BETWEEN NEUTRON- AND PROTON CROSS SECTIONS FOR ANTINEUTRINO AND NEUTRINO, IN A LARGER RANGE OF Q -SQUARED.
3. STUDIES OF THE FRAGMENTATION OF THE STRUCK QUARKS OF KNOWN FLAVOUR, IN PARTICULAR THIS WILL ALLOW TESTS OF QCD.
4. SEARCH FOR NEW PHENOMENA, IN PARTICULAR SEARCH FOR BOTTOM (BEAUTY) PARTICLES (THE AVERAGE ANTINEUTRINO ENERGY WILL BE CONSIDERABLY HIGHER THAN THE THRESHOLD ENERGY FOR THE PRODUCTION OF BEAUTY PARTICLES).

THE CHOICE OF DEUTERIUM AS A LIQUID FOR THE BUBBLE CHAMBER MAY BE JUSTIFIED BY THE CONSIDERATION THAT IT ALLOWS THE STUDY OF THE ELEMENTARY INTERACTIONS ON PROTONS AND ON NEUTRONS, WHILE YIELDING A REASONABLE NUMBER OF EVENTS. WE HAVE ALREADY ATTACKED AND SOLVED MOST OF THE CORRECTIONS ARISING FROM THE USE OF DEUTERIUM (RESCATTERING, ENERGY BROADENING, ETC.).

WE PROPOSE TO EXPOSE THE 15' BUBBLE CHAMBER TO THE HIGHEST ENERGY WIDE BAND ANTINEUTRINO-ENRICHED BEAM. ACCORDING TO THE PRELIMINARY INFORMATIONS IN OUR HANDS A 100-DAY EXPOSURE SHOULD YIELD ABOUT 120,000 PICTURES CONTAINING A NUMBER OF C.C. ANTINEUTRINO INTERACTIONS OF THE SAME ORDER AS THAT IN OUR PRESENT EXPERIMENT.

ALL GROUPS IN THIS COLLABORATION HAVE EXPERIENCE WITH HIGH ENERGY NEUTRINO INTERACTIONS IN DEUTERIUM AND ARE ABLE TO PROCESS THE COMPLETE SCANNING AND MEASUREMENT OF 800 EVENTS PER WEEK. WE SHOULD THUS BE ABLE TO FINISH THE MEASUREMENTS OF THE FILM IN ABOUT ONE YEAR AFTER THE END OF THE RUN.

2095
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ABOUT 25 PHYSICISTS AND GRADUATE STUDENTS WILL PARTICIPATE IN
THE PROPOSED EXPERIMENT. AN EVENTUAL COLLABORATION OF US GROUPS
WILL BE QUITE WELCOME.

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SUBJECT TO APPROVAL FROM THE NATIONAL INSTITUTIONS.