Introduction
April 1, 2003 - March 31, 2004

This document summarizes the progress in research and operations at the Texas A&M Cyclotron Institute for the period April, 1, 2003 through March 31, 2004. Sections I through IV contain reports from individual research projects. Operation and technical developments are given in Section V. Section VI lists the publications with Cyclotron Institute authors and the Appendix gives additional information including talks presented by members of the Institute during the past year. *Since most of the contributions presented here are truly reports on progress in research, results and conclusions should not be quoted from the report without the consent of the authors.*

This volume of Progress in Research is the second one that will be available solely from our web site (http://cyclotron.tamu.edu). Over the past year, a number of impressive projects have been carried out by Institute researchers. Some recent achievements are noted here.

(1) Extensive comparisons of experimental data for the reaction systems, ^{64}Zn + ^{58}Ni, ^{64}Zn + ^{92}Mo, ^{64}Zn + ^{197}Au, at 26, 35 and 47 MeV/A, with results of Anti-symmetrized Molecular Dynamics transport model calculations have suggested a new scenario for multi-fragmentation reactions.

(2) Secondary fragment beams produced in MARS have been used to measure the evolution toward N/Z equilibration in Deep Inelastic Collisions.

(3) The new "precision decay facility" has been used on-line to measure the half-life and branching ratio for the superallowed beta-decay of ^{34}Ar as part of our program to sharpen the test of CKM unitarity; it has also been used off-line for one of the most precise measurements ever made of an internal conversion coefficient (ICC) – the K-shell ICC for the M4 decay of ^{193m}Ir – which demonstrates that the most recent table of ICCs is based on an invalid approximation.

(4) Experiments on $^{112\text{-}124}$Sn and $^{110\text{-}116}$Cd have shown that the isotopic dependence of the giant monopole resonance energy can be reproduced with Skyrme interactions having their density dependence modified to improve extrapolations to neutron rich systems (and with K_{NM}~220-240MeV) but not with standard Skyrme interactions.

(5) An updated rate for the hot CNO cycle reaction ^{13}N(p,γ)^{14}O has been determined based on new ANC results.

(6) Resonance scattering has been used with several radioactive beams to determine information about nuclear structure in systems of importance to astrophysics.

(7) A comprehensive analysis of the spectra of Ho L x rays excited by 6 MeV/u C, Ne, Ar, and Kr ion impact revealed the scaling properties of the M-shell ionization probability in near-central collisions.

(8) The recently observed enhancement of baryons relative to mesons at intermediate transverse momentum at RHIC and the scaling of hadron elliptic flows according to their quark content can be explained by quark coalescence during hadronization.

(9) Measurements of high-p_T particle production in 200 GeV d+Au collisions by the STAR Collaboration demonstrated that the strong suppression of high-p_T particle yields and back-to-back di-hadron correlations in central Au+Au collisions are due to final-state interactions in the dense medium produced in the Au+Au collisions.

(10) BRAHMS has discovered a marked high-p_T suppression in d+Au collisions that may be related to the existence of the Color Glass Condensate (CGC).

(11) Hadronic many-body calculations of the $\Delta(1232)$ (and nucleon) spectral function in hot and dense matter, consistent with photo-absorption spectra on nuclei, are in qualitative agreement with preliminary RHIC data from STAR for pion-proton invariant mass spectra.

As in the past, Institute scientists remain active in a number of collaborative research efforts around the world. Major programs include: experiments at TRIUMF laboratory to measure heavy (A > 60) superallowed β decays and a measurement of Michel parameters in normal μ^+ decay; new mass measurements using the Canadian Penning Trap (CPT) at Argonne National Laboratory; and continued work with both the BRAHMS and STAR collaborations at RHIC.

The K500 cyclotron continues to serve the broader community through testing of radiation effects on electronics components. Again this past year a bit over 20% of the scheduled accelerator time was devoted to single-event-upset testing. Both U.S. and foreign companies continue to utilize our facility.

I am pleased to acknowledge the effort made by Y.-W. Lui in putting together this report. He managed it in a very prompt and efficient manner.

R.E. Tribble
June 21, 2004