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State of the Laboratory

David A. Shirley
Director, LBL

*A Colloquium given March 25, 1982
at Lawrence Berkeley Laboratory*

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STATE OF THE LABORATORY

BY

DAVID A. SHIRLEY

(LBL COLLOQUIUM MARCH 25, 1982)

IT IS ONE OF MY RESPONSIBILITIES AS DIRECTOR TO REPORT PERIODICALLY TO THE STAFF ON THE LABORATORY'S ACHIEVEMENTS AND PROSPECTS. I REPORTED MY INITIAL IMPRESSIONS IN AN LBL COLLOQUIUM IN JUNE OF 1980. IN THE INTERIM I HAVE ACQUIRED A MORE KNOWLEDGEABLE PERSPECTIVE OF THE DYNAMICS OF THIS GREAT NATIONAL LABORATORY, AND OF ITS INTERACTIONS WITH THE OUTSIDE WORLD. IN ADDITION, MANY EVENTS HAVE TRANSPIRED ON THE NATIONAL SCENE WHICH HAVE A DIRECT BEARING ON THE LABORATORY'S PROGRAM. I BELIEVE IT IS TIME FOR ME TO PRESENT A SECOND COLLOQUIUM, BOTH TO INFORM YOU OF SOME OF THE EVENTS OF THE LAST TWO YEARS AND TO SOLICIT YOUR CREATIVE ASSISTANCE IN HELPING THE LABORATORY TO MEET THE CHALLENGES THAT LIE AHEAD. LET ME BEGIN HISTORICALLY.

DURING THE FIRST THIRTY-FIVE YEARS OF ITS EXISTENCE, THIS LABORATORY WAS THE PRODUCT OF THE GENIUS OF ONE MAN AND OF A GROUP OF BRILLIANT PEOPLE WHO GATHERED AROUND HIM. IT CAME CLOSE TO WHAT WOULD BE TERMED IN TODAY'S JARGON A "SINGLE PURPOSE LABORATORY". AT THE END OF THIS INITIAL PERIOD THE LABORATORY REAPED THE INEVITABLE CONSEQUENCE OF A QUEST FOR EVER LARGER ACCELERATORS: NAMELY, ACCELERATOR BASED HIGH ENERGY PHYSICS OUTGREW THIS SITE, AND THE NEXT MACHINE WENT ELSEWHERE.

AN INSTITUTIONALLY DIFFICULT PERIOD ENSUED IN THE NEXT FEW YEARS. AS ON SITE HIGH ENERGY PHYSICS EXPERIMENTATION DECLINED FROM A HIGH LEVEL OF ACTIVITY TO ZERO. IT WAS INEVITABLE THAT THIS PERIOD WOULD BE DIFFICULT FOR THE LABORATORY, BECAUSE THE VERY SIZE OF THE EXPERIMENTAL HIGH ENERGY PHYSICS PROGRAM PRECLUDED THE LABORATORY'S HAVING PUT IN PLACE OTHER PROGRAMS OF A SUFFICIENT MAGNITUDE TO FILL THE GAP READILY.

SUBSEQUENTLY, UNDER THE LEADERSHIP OF ANDREW SESSLER, THE LABORATORY'S PROGRAMS WERE SUCCESSFULLY DIVERSIFIED TO RESPOND TO NEW NATIONAL CHALLENGES IN ENERGY RESEARCH. NATIONALLY, NEW AGENCIES WERE FORMED -- FIRST ERDA AND THEN DOE -- AND THE MISSION OF THESE AGENCIES WAS DRAMATICALLY BROADENED TO ENCOMPASS RESEARCH IN SEVERAL NEW ENERGY TECHNOLOGIES AS WELL AS IN END-USE EFFICIENCY. THE LABORATORY FORMED NEW PROGRAMS AND NEW DIVISIONS AND IT GREW SIGNIFICANTLY DURING THE LATE 1970'S.

NOW THE PARTICIPATION OF THE FEDERAL GOVERNMENT IN THESE NEW AREAS, WHICH FORMED THE BASIS FOR THE LABORATORY'S RECENT GROWTH, HAS BEEN QUESTIONED. THROUGH BUDGET ACTIONS OF THE PRESENT ADMINISTRATION MUCH OF THIS GROWTH HAS BEEN REVERSED, AS I SHALL ILLUSTRATE IN THE FIRST THREE SLIDES.

SLIDE 1 SHOWS A BRIEF CHRONOLOGY OF SOME OF THE EVENTS SINCE 1980 WHICH HAVE HAD INSTITUTIONAL IMPACT ON THE

SOME EVENTS SINCE 1980

- MAY, 1980 — RESCISSIONS
- SEPTEMBER, 1980 — CONTRACT RENEWAL BEGUN
- MARCH, 1981 — REAGAN ADMIN. FY 1982
 BUDGET ANNOUNCED
- SEPTEMBER, 1981 — NEW FY 1982 BUDGET
 WITH 12% CUTS
- OCTOBER, 1981 — FIFTIETH ANNIVERSARY
- DECEMBER, 1981 — DOE DISMANTLEMENT PROPOSAL
- FEBRUARY, 1982 — CONTRACT SIGNED
- MARCH, 1982 — ADMINISTRATION FY 1983 BUDGET

LABORATORY. IN MAY 1980 A NEW WORD WAS ENTERED INTO THE PRACTICING LEXICON OF SCIENTIFIC ADMINISTRATORS, "RESCISSIONS". THIS IS AN ACTION BY WHICH CONGRESS WITHDRAWS MONEY ALREADY APPROPRIATED. I WELL REMEMBER LEARNING VIA A TELEPHONE CALL TO MY WASHINGTON HOTEL ROOM IN EARLY MAY, 1980 OF RESCISSIONS IN THE DOE BUDGET WHICH HAD TAKEN PLACE ON THAT DAY. AT RISK FOR THE LABORATORY WERE BOTH ITS ATOMIC RESOLUTION MICROSCOPE AND THE BEVALAC SCHEDULE FOR THE REST OF THAT FISCAL YEAR. FORTUNATELY BOTH WERE SAVED.

SEPTEMBER 1980 MARKED THE INITIATION OF NEGOTIATIONS FOR RENEWAL OF THE CONTRACT BETWEEN DOE AND THE UNIVERSITY OF CALIFORNIA. AS YOU KNOW, THE CONTRACT IS RENEWED EVERY FIVE YEARS. BECAUSE RENEWAL IS A COMPLEX PROCESS, THE PROCEDURES ARE INITIATED A FULL TWO YEARS BEFORE THE PREVIOUS CONTRACT EXPIRES.

IN NOVEMBER 1980 A VERY IMPORTANT EVENT OCCURRED ON THE NATIONAL SCENE: A NEW ADMINISTRATION WAS ELECTED WHICH HAS BEEN SUBSEQUENTLY CHARACTERIZED AS HAVING INITIATED MORE PROFOUND CHANGES IN AMERICAN GOVERNMENT THAN HAD ANY OTHER ADMINISTRATION SINCE ROOSEVELT'S NEW DEAL IN 1933. THE IMPLICATIONS OF THESE CHANGES FOR THE DEPARTMENT OF ENERGY'S PROGRAMS BECAME APPARENT IN MARCH 1981, WHEN THE NEW ADMINISTRATION PRESENTED ALTERNATE BUDGETS FOR BOTH FISCAL 1981 AND FISCAL 1982. THE MESSAGE BORNE BY THESE NEW BUDGETS WAS VERY CLEAR. THE NEW ADMINISTRATION TOOK

THE POSITION THAT MOST OF THE ACTIVITIES OF THE DEPARTMENT OF ENERGY RELATED TO CONSERVATION AND TO THE NEW ENERGY TECHNOLOGIES WERE UNWARRANTED AND INAPPROPRIATE FOR FEDERAL SUPPORT. THE NEW ADMINISTRATION WANTED THE FEDERAL GOVERNMENT TO GET OUT OF THESE ACTIVITIES AND LEAVE THEM TO THE PRIVATE SECTOR, AND THEY ENFORCED THIS WISH BY REDUCING THE BUDGETS IN THESE AREAS VERY DRAMATICALLY, TYPICALLY BY TWO-THIRDS. IT SHOULD BE POINTED OUT THAT THESE REDUCTIONS WERE VERY SELECTIVE. THEY WERE AIMED AT GOVERNMENT PARTICIPATION IN THE NEW ENERGY TECHNOLOGIES, AND THEY DID NOT SIGNIFICANTLY AFFECT BASIC RESEARCH IN THE OLDER DOE PROGRAM AREAS. BECAUSE LBL PROGRAMS IN THE NEW AREAS WERE OF HIGH QUALITY AND WERE TO A CONSIDERABLE DEGREE CONCENTRATED ON THE RESEARCH ASPECTS OF THESE NEW TECHNOLOGIES, THE LABORATORY'S PROGRAMS DID RELATIVELY WELL COMPARED TO THE NATIONAL PROGRAM. HOWEVER THE CUTS WERE STILL DRASTIC, AND THE LABORATORY LOST APPROXIMATELY 300 POSITIONS BECAUSE OF THE NEW BUDGETS. THE LABORATORY -- AND BY THIS OF COURSE I MEAN THE PEOPLE IN THE LABORATORY -- MET THIS CHALLENGE IN A MANNER THAT MUST EVOKE OUR ADMIRATION; RELUCTANTLY, BUT REALISTICALLY AND WITHOUT UNDUE COMPLAINT. BY SEPTEMBER 1981 THE NECESSARY REDUCTION HAD TAKEN PLACE, AND THE LABORATORY WAS APPROPRIATELY CONSOLIDATED TO START FISCAL YEAR 1982 ON OCTOBER 1ST WITH A PARED-DOWN WORK FORCE AND

PROGRAM THAT WAS APPROPRIATE FOR THE AUSTERE FISCAL 1982 BUDGET PROPOSED BY THE REAGAN ADMINISTRATION.

ON SEPTEMBER 24TH 1981 WE GOT A VERY UNPLEASANT SURPRISE FROM THE ADMINISTRATION. NEARLY ALL DOMESTIC PROGRAMS APART FROM ENTITLEMENTS AND DEFENSE WERE IDENTIFIED FOR A FURTHER 12% CUT IN THE FISCAL YEAR 1982 BUDGET, IN SPITE OF THE FACT THAT THE NEW FISCAL YEAR WAS ONLY A WEEK AWAY. MOST OF OF THIS LABORATORY'S PROGRAMS WERE POTENTIALLY AFFECTED BY THIS REDUCTION, AND WE WERE THEREFORE UNUSUALLY VULNERABLE. NOW I SHOULD REMIND YOU THAT MOST OF OUR BUDGET GOES INTO OUR PAYROLL. WE THEREFORE HAD NO ALTERNATIVE BUT TO INITIATE ANOTHER ROUND OF LAYOFFS. THE SITUATION WAS FURTHER EXACERBATED BY THE FACT THAT SOME OF OUR REDUCED FUNDS HAD TO BE USED FOR COMPENSATION OF EMPLOYEES WHO HAD BEEN LAID OFF BOTH WHILE THEY WERE ON NOTICE AND LATER AS SEVERANCE PAY. THIS LATTER PROBLEM WAS PARTIALLY ALLEVIATED BY THE TWO WEEKS BREAK AT CHRISTMAS, BUT IT WAS STILL NECESSARY TO ACT VERY FAST IN ORDER TO MINIMIZE THE TOTAL REDUCTION IN FORCE. BY ACTING RESOLUTELY AND FAIRLY, THE LABORATORY STAFF WERE ABLE TO CARRY THROUGH THIS FURTHER CONSOLIDATION WITH MINIMAL DAMAGE TO THE BASIC SCIENTIFIC AND TECHNICAL STRENGTH OF THE LABORATORY, CONSIDERING THE MAGNITUDE OF THE REDUCTION. MOST OF THE REDUCTION TOOK PLACE IN THE FALL OF 1981, AND BY THE END OF FEBRUARY WE WERE ABLE TO DECLARE OFFICIALLY THAT THE REDUCTION IN FORCE PERIOD WAS

OVER. DURING THIS TIME I THINK WE ALL CAME TO APPRECIATE THE FUNDAMENTAL INSTITUTIONAL STRENGTHS OF LAWRENCE BERKELEY LABORATORY. WE WERE FORCED TO RETREAT, BUT WE WERE NOT ROUTED. I'D LIKE TO ACKNOWLEDGE AT THIS TIME THE STRENGTH OF CHARACTER AND LOYALTY TO THE LABORATORY ON THE PART OF MANY MEMBERS OF OUR STAFF WHICH MADE THIS CONSOLIDATION A STRATEGIC RETREAT RATHER THAN A ROUT. I'LL ALSO MAKE AN OPTIMISTIC OBSERVATION THAT, IN CONTRAST TO OUR SITUATION IN THE LATE 1950'S, WE DO HAVE A STRONG AND DIVERSIFIED PROGRAM BASE UPON WHICH TO BUILD FOR THE FUTURE. FOR THIS REASON I PREDICT A MORE FACILE RECOVERY FOR LBL WHEN THIS NATION'S ECONOMIC CONDITIONS IMPROVE SUFFICIENTLY TO END TODAY'S PERIOD OF EXTREME SCIENTIFIC AND TECHNOLOGICAL AUSTERITY.

IN EARLY OCTOBER WE CELEBRATED THE LABORATORY'S GOLDEN ANNIVERSARY. I SAID THEN AND I'LL REPEAT NOW THAT THIS LABORATORY HAS ALL THE NECESSARY INGREDIENTS TO MAKE ITS SECOND 50 YEARS EVERY BIT AS DISTINGUISHED AND FULL OF ACHIEVEMENTS AS ITS FIRST, AND MORE BROADLY BASED.

IN DECEMBER THE ADMINISTRATION PUT FORTH ITS PROPOSAL FOR THE DISMANTLEMENT OF THE DEPARTMENT OF ENERGY. THIS REORGANIZATION POSED A REAL THREAT TO THE SCIENTIFIC PROGRAMS OF THE NATIONAL LABORATORIES. IN ORDER FOR THESE PROGRAMS TO RETAIN THEIR BASE OF SUPPORT, IT WAS ESSENTIAL THAT THEY GO OVER TO THE NEW AGENCY INTACT. I AM VERY PLEASED TO REPORT THAT THE ADMINISTRATION'S PROPOSED

REORGANIZATION SCHEME ACHIEVED JUST THAT. UNDER THIS PLAN THE DOE RESEARCH ACTIVITIES WOULD GO NEARLY ALL INTACT INTO A NEW AGENCY -- THE ENERGY RESEARCH AND TECHNOLOGY ADMINISTRATION -- IN THE DEPARTMENT OF COMMERCE.

IN FEBRUARY 1982 THE NEW FIVE-YEAR CONTRACT BETWEEN THE GOVERNMENT AND THE UNIVERSITY WAS SIGNED. WE THEREFORE HAVE A CONTRACTUAL RELATIONSHIP WITH THE UNITED STATES GOVERNMENT UNTIL 1987.

THE FINAL TOPIC ON THIS SLIDE HAS TO DO WITH THE BUDGET PROPOSED BY THE ADMINISTRATION FOR THE DEPARTMENT OF ENERGY FOR FISCAL YEAR 1983, BEGINNING ON OCTOBER 1ST OF THIS YEAR. THIS BUDGET IS PRESENTLY UNDER SCRUTINY IN CONGRESS, AND AT THIS TIME WE CANNOT PREDICT ITS FINAL FORM. AS WE ALL KNOW FROM READING THE NEWSPAPERS THERE IS A GREAT DEBATE IN CONGRESS ABOUT THIS BUDGET. TO DISCUSS IT IN MORE DETAIL, LET US GO TO THE SECOND SLIDE.

HERE WE SEE IN TABULAR FORM A SUMMARY OF THE LBL BUDGET IN MILLIONS OF DOLLARS FOR THE FISCAL YEARS 1981, 1982 (THE PRESENT YEAR), AND 1983. THE LAST IS SHOWN AT THREE LEVELS: IN THE LEFT COLUMN ARE FIGURES THAT WE HAVE BEEN ABLE TO DERIVE FROM THE PROPOSED ADMINISTRATION BUDGET. THE MIDDLE COLUMN REPRESENTS AN EDUCATED GUESS BASED ON A VARIETY OF FACTORS TOO COMPLICATED TO DISCUSS. IT IS PROBABLY BEST SUMMARIZED BY THE HEADING, WHICH IS THE WORD "PROBABLE". ON THE RIGHT IS SHOWN A COLUMN OF FIGURES BASED ON MORE OPTIMISTIC PROJECTIONS; IT

LBL BUDGET SUMMARY (IN MILLIONS)

PROGRAM	FY81	FY82	FY83		
			ADMIN.	PROBABLE	POSSIBLE
ENERGY RESEARCH (HEP, NP, LS/NM, BES, MFE, HIF, ENV)	69.9	68.5	(69.9)	(72.7)	(73.5)
ENERGY TECHNOLOGY (GT, NWI, F, ES/B, CONS, SOLAR)	29.5	20.9	(4.4)	(13.1)	(20.9)
	99.4	89.4	(74.3)	(85.8)	(94.4)
WORK FOR OTHERS	35.9	29.0	(26.0)	(28.0)	(30.0)
PLANT/EQUIP.	20.4	23.0	(11.3)	(11.3)	(11.3)
TOTAL	155.7	141.4	(111.6)	(125.1)	(135.7)

REPRESENTS THE HIGHEST SET OF FIGURES THAT I REGARD AS BEING REASONABLY POSSIBLE.

IN EXAMINING THE TABLE IN MORE DETAIL, THE FIRST TWO ROWS SHOULD BE TAKEN TOGETHER. THEY REPRESENT RESPECTIVELY WHAT I CALL THE "ENERGY RESEARCH" PROGRAMS AND THE "ENERGY TECHNOLOGY" PROGRAMS FUNDED BY DOE IN LBL. ENERGY RESEARCH IS THE GENERIC NAME GIVEN TO PROGRAMS THAT ARE LARGELY DERIVED FROM THE OLD AEC, WHILE ENERGY TECHNOLOGY PROGRAMS FOR THE MOST PART THE EXPANSION AREAS OF ERDA AND DOE. THEY CONSTITUTED IN 1981 ABOUT 70% AND 30% OF THE LABORATORY'S DOE ACTIVITIES, RESPECTIVELY. FOR THE NEXT TWO YEARS THE ENERGY RESEARCH PROGRAMS ARE SUSTAINED AT A SUBSTANTIALLY CONSTANT LEVEL OF ABOUT 70 MILLION DOLLARS. THE ENERGY TECHNOLOGY PROGRAMS, ON THE OTHER HAND, HAVE ALREADY BEEN REDUCED BY SEVERAL MILLIONS OF DOLLARS FROM 1981 TO 1982, AND ACCORDING TO THE ADMINISTRATION FIGURES ARE DUE FOR A FURTHER VERY SUBSTANTIAL REDUCTION. THE FUNDING LEVEL OF THESE PROGRAMS AS WE APPROACH FISCAL 1983 IS ACCOMPANIED BY SUCH A LARGE UNCERTAINTY THAT IN ADDITION TO ITS LIFE OR DEATH

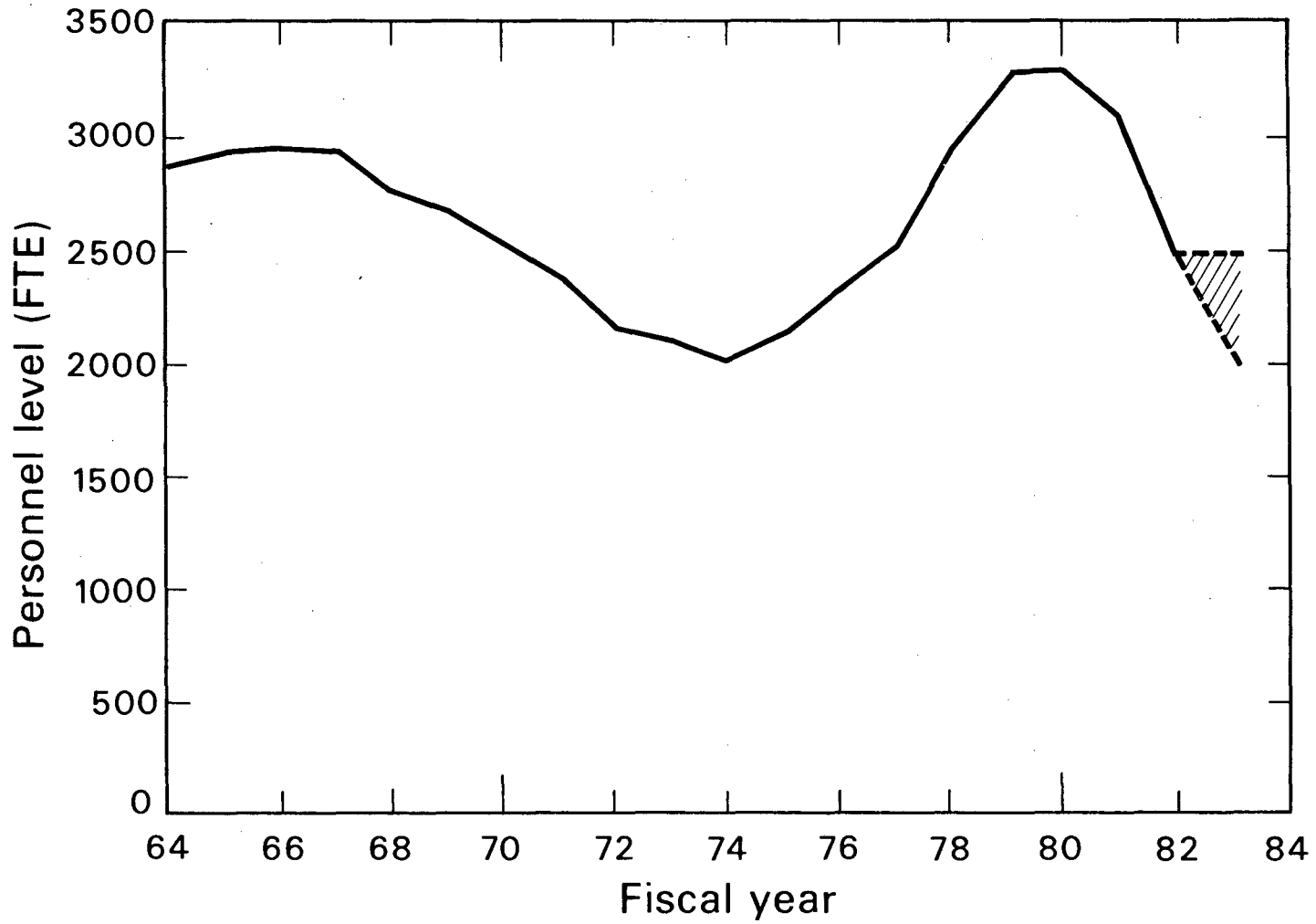
IMPACT ON THE ENERGY TECHNOLOGY PROGRAMS IT REPRESENTS A LARGE VARIATION IN THE PROJECTED FISCAL STRENGTH OF THE LABORATORY AS A WHOLE. THE THIRD MAJOR CATEGORY - WORK FOR OTHERS - HAS UNDERGONE THE EXPECTED 12% REDUCTION FROM 1981 TO 1982, BUT IS EXPECTED TO BE ROUGHLY STABLE DURING THE NEXT YEAR. THE LAST ITEM (PLANT AND EQUIPMENT) WILL BE SUBSTANTIALLY REDUCED BECAUSE SEVERAL MAJOR PROJECTS ARE BEING COMPLETED IN 1982. THIS IS CERTAINLY AN AREA OF CONCERN FOR THE LABORATORY, BECAUSE WE FUNCTION BEST WHEN WE HAVE A MIX OF LARGE PROJECTS UNDERWAY. WE ALREADY HAVE SOME IRONS IN THE FIRE, AND I EXPECT OUR ACTIVITIES IN THIS AREA TO PICK UP IN FISCAL 1984. UNFORTUNATELY, IN AN ERA OF NATIONAL AUSTERITY, PLANT AND EQUIPMENT PROJECTS TEND TO BE DROPPED FIRST -- WITNESS THE CONSTRUCTION INDUSTRY.

IN SUMMARY WE ARE LOOKING FORWARD TO ANOTHER AUSTERE YEAR IN FISCAL 1983, WITH A LARGE UNCERTAINTY IN OUR TOTAL LEVEL OF SUPPORT. WE SHALL DO OUR VERY BEST TO SUSTAIN OUR PRESENT BASE, BUT IT IS HIGHLY PROBABLE THAT FURTHER CONSOLIDATION IN OUR PROGRAMS LIES AHEAD. IN THE COMING WEEKS AND MONTHS WE SHALL LEARN MORE ABOUT OUR PROSPECTS IN THE ENERGY TECHNOLOGY AREAS, AND WE SHALL MAKE EVERY EFFORT TO DIVERSIFY OUR FUNDING SOURCES AS NEED BE TO PROVIDE UNDERPINNING FOR OUR STRONG PROGRAMS IN THAT AREA. I SHALL KEEP THE LABORATORY STAFF INFORMED AS SIGNIFICANT DEVELOPMENTS OCCUR. HOWEVER, THERE EXISTS A

STRONG PROBABILITY THAT WE WILL NOT HAVE A CLEAR AND UNEQUIVOCAL PROJECTION OF OUR FISCAL 1983 BUDGET FOR MANY MONTHS. IN THE MEANTIME I'LL ASK THE LABORATORY STAFF TO GO ABOUT THEIR WORK WITH CONFIDENCE THAT WE DO HAVE A FIRM BASE OF SUPPORT FOR OUR BASIC PROGRAMS IN ENERGY RESEARCH AND WORK FOR OTHERS, AND THAT WE ARE WORKING ON THE ENERGY TECHNOLOGY AREAS.

THE THIRD SLIDE SHOWS THE TIME VARIATION OF OUR PERSONNEL LEVEL AT THE LABORATORY OVER A TWENTY-YEAR SPAN. AS YOU CAN SEE OUR WORKFORCE WENT FROM 3000 FULL TIME EQUIVALENTS IN 1967 DOWN TO 2000 IN 1974. THIS WAS FOLLOWED BY A RAPID BUILDUP MOSTLY IN THE ENERGY TECHNOLOGY PROGRAMS, AND AN EQUALLY RAPID DECLINE, AGAIN MOSTLY IN THESE AREAS. I HAVE DRAWN A SHADED AREA FOR 1983, REFLECTING THE UNCERTAINTY IN OUR PRESENTLY PROJECTED BUDGET LEVELS. IN LEAVING THIS SLIDE I SHOULD NOTE THAT THE PERSONNEL LEVEL IN FULL TIME EQUIVALENTS IS ALWAYS ABOUT 1000 LESS THAN THE NUMBER OF PEOPLE ACTUALLY WORKING ON LABORATORY PROGRAMS BECAUSE WE HAVE MANY PEOPLE (FOR EXAMPLE, FACULTY AND GRADUATE STUDENTS) WHO ARE SUPPORTED ON A PART-TIME BASIS, AS WELL AS DOMESTIC AND FOREIGN VISITORS WHO PARTICIPATE IN OUR PROGRAMS ON A NO-PAY BASIS.

LET ME NOW SUMMARIZE THIS HISTORICAL OVERVIEW OF THE PERIOD 1980 - 1983 BY REFERRING TO THE SUMMARY OF INSTITUTIONAL ISSUES GIVEN ON SLIDE 4. THE FIRST ISSUE -- CONTRACT RENEWAL -- HAS HAD A SUCCESSFUL OUTCOME. THE



LBL PERSONNEL LEVELS, FY 1964-84

XBL 824-8840

**MAJOR INSTITUTIONAL ISSUES
FOR LBL DURING 1980—1983**

CONTRACT RENEWAL
DOE DISMANTLEMENT
LABORATORY REVIEWS
ENERGY RESEARCH
ENERGY TECHNOLOGY
REDIRECTION

SECOND ISSUE -- DOE DISMANTLEMENT -- IS IN AN UNCERTAIN STAGE IN TERMS OF THE SPEED WITH WHICH IT WILL PROGRESS THROUGH THE CONGRESS, AND UNTIL FINAL ACTION IS TAKEN THE ISSUE ITSELF MUST BE REGARDED AS STILL IN DOUBT. HOWEVER, THE STRUCTURE OF THE NEW AGENCY -- WHICH IS A MATTER OF MOST CONCERN TO THE NATIONAL LABORATORIES -- APPEARS TO BE RESOLVED ON A POSITIVE TRACK. WHILE THE AGENCY ITSELF, AND THE LABORATORY PROGRAMS, WILL BE VULNERABLE DURING THE COMING PERIOD OF UNCERTAINTY, THE FACT OF DISMANTLEMENT DOES NOT APPEAR AT THIS TIME TO POSE A SERIOUS THREAT. THE THIRD ITEM - LABORATORY REVIEWS - IS ONE THAT I HAVE NOT DISCUSSED PREVIOUSLY. IT ALLUDES TO REVIEWS OF THE ROLES AND PROGRAMS OF THE NATIONAL LABORATORIES ON AT LEAST THREE LEVELS. ALL OF THESE REVIEWS ARE UNDERWAY IN VARIOUS AGENCIES IN WASHINGTON. WE ARE FOLLOWING THEM CLOSELY AS THEY PROGRESS, AND IT IS REASONABLE TO EXPECT THAT THE REPORTS DERIVED FROM ALL OF THESE REVIEWS WILL BE FAVORABLE TO LAWRENCE BERKELEY LABORATORY. AS THE NEXT LINE IN THIS LIST I HAVE ADDED "ENERGY RESEARCH". THE ISSUE HERE IS COMMITMENT ON THE PART OF THE FEDERAL GOVERNMENT TO CONTINUE SUPPORT OF ENERGY RESEARCH PROGRAMS IN THE TRADITIONAL AREAS. AS I INDICATED IN DISCUSSING THE PREVIOUS TABLE, THE ANSWER IS AFFIRMATIVE. THE IMPORTANCE OF THIS SUPPORT CANNOT BE OVEREMPHASIZED, BECAUSE THE ENERGY RESEARCH PROGRAMS FORM THE BULK OF THE

ACTIVITIES OF THE LABORATORY. THE NEXT LINE -- ENERGY TECHNOLOGIES -- REFERS TO AN ISSUE THAT HAS NOT AS YET BEEN RESOLVED: THE EXTENT TO WHICH THE FEDERAL GOVERNMENT WILL CONTINUE TO SUPPORT RESEARCH IN AREAS RELATED TO THE SO-CALLED NEW ENERGY TECHNOLOGIES. THE PREVIOUS ADMINISTRATION DID SUPPORT THIS WORK: THE PRESENT ADMINISTRATION BELIEVES THAT A LOT OF IT SHOULD BE TURNED OVER TO THE PRIVATE SECTOR. FINALLY I HAVE LISTED AS THE LAST ISSUE "REDIRECTION". BY THIS I MEAN THE POSITIVE RESPONSE THAT THIS LABORATORY MUST MAKE DURING AND AFTER A PERIOD OF CONSOLIDATION SUCH AS THE PRESENT. I TAKE IT AS GIVEN THAT THE LABORATORY WILL SEEK TO REESTABLISH A WORKING LEVEL OF APPROXIMATELY 3000 FULL TIME EQUIVALENT EMPLOYEES. IT IS ALSO CLEAR THAT WE HAVE ALREADY LOST PROGRAMS IN SOME AREAS DURING THE CONSOLIDATION PERIOD, AND WE MAY LOSE MORE. AT THE VERY LEAST SOME OF OUR EXISTING PROGRAMS WILL HAVE TO BE RECONFIGURED. DURING THIS PROCESS WE WILL BE ESTABLISHING A BASE ON WHICH TO BUILD. THE COMPOSITION OF THIS BASE WILL DEPEND UPON THE EVOLUTION OF OUR PRESENT PROGRAMS AND TO A CONSIDERABLE EXTENT ALSO ON THE DIRECTIONS IN WHICH WE WISH TO BUILD. IN THE LONG HAUL, THE PATH THAT OUR REDIRECTION TAKES WILL VERY LIKELY TURN OUT TO BE THE MOST IMPORTANT ISSUE THAT WE ADDRESS DURING THE NEXT FEW YEARS, BECAUSE IT WILL DETERMINE THE CHARACTER OF THE LABORATORY DURING THE

1990s. FOR THIS REASON ONE OF THE MOST IMPORTANT ACTIVITIES OF THE LABORATORY MANAGEMENT AND STAFF DURING THE COMING MONTHS WILL BE THE DESIGN AND ESTABLISHMENT OF MECHANISMS FOR ADDRESSING THE PROBLEM OF REDIRECTION OF THE LABORATORY. OUR GOAL WILL BE TO ESTABLISH NEW PROGRAMS WHICH UTILIZE TO THE GREATEST EXTENT POSSIBLE THE TALENTS THAT ARE UNIQUELY AVAILABLE OR ACCESSIBLE IN BERKELEY. WE WISH TO ADDRESS THESE TALENTS TO THE CREATION OF NEW PROGRAMS WHICH ARE ON THE FRONTIERS OF SCIENCE AND TECHNOLOGY, WHICH WILL SERVE VITAL NATIONAL NEEDS IN THE COMING YEARS, AND WHICH WILL HAVE LONG TERM STAYING POWER. I DO NOT WISH TO PREEMPT ANY DECISIONS THAT WE MAY MAKE ON THIS ISSUE, BUT I WILL STATE MY OWN STRONG PREDILECTION FOR A SMALL NUMBER OF LARGE PROGRAMS HAVING A SUBSTANTIAL HIGH TECHNOLOGY CONTENT.

I'D LIKE NOW TO ADDRESS VERY BRIEFLY A FEW TOPICS HAVING TO DO WITH LABORATORY-WIDE INTERNAL OPERATIONS. FIRST, ON SLIDE 5 WE SHOW A SELECTIVE LIST OF A FEW OF THE MANY LABORATORY-WIDE COMMITTEES THAT SERVE THIS INSTITUTION SO WELL. THE DIRECTOR'S EXECUTIVE COMMITTEE MEETS FOR TWO HOURS WEEKLY, AND ASSISTS ME IN CARRYING OUT A LARGE FRACTION OF THE WEEKLY BUSINESS OF THE LABORATORY. THE COMPUTER POLICY BOARD, CHAIRED BY BILL LESTER, IS VERY BUSILY ENGAGED IN DEVELOPING LONG RANGE LABORATORY WIDE POLICY FOR OUR COMPUTING RESOURCES. THE BOARD IS ADVISORY TO ME, AND IT PROVIDES AN OVERSIGHT

DIRECTOR'S EXECUTIVE COMMITTEE
COMPUTER POLICY BOARD
SCIENTIFIC PROGRAM COUNCIL
LABORATORY STAFF COMMITTEE
EQUAL EMPLOYMENT OPPORTUNITY COUNCIL

FUNCTION FOR THE OFFICE OF COMPUTING RESOURCES, HEADED BY BOB HARVEY. I AM VERY OPTIMISTIC ABOUT THE RESULTS THAT ARE BEGINNING TO EMERGE FROM THE DELIBERATIONS OF THE COMPUTER POLICY BOARD. THE SCIENTIFIC PROGRAM COUNCIL, CHAIRED BY FRANK ROBZEN, HAS GIVEN ME GOOD ADVICE ON MANY SCIENTIFIC TOPICS. I LOOK FORWARD TO EXPANDING THE FUNCTION OF THIS COUNCIL TO ENABLE IT TO BE OF ASSISTANCE FOR LONG-RANGE PLANNING. WHEN THIS HAS BEEN ACCOMPLISHED I SHALL SO REPORT TO THE LABORATORY. THE LABORATORY STAFF COMMITTEE, CHAIRED BY LYNN STEVENSON, HAS BEEN GIVEN THE CHARGE OF SUBSTANTIALLY MODIFYING THE PROCEDURES BY WHICH WE EVALUATE AND STRENGTHEN OUR SENIOR LABORATORY STAFF. THIS WORK IS NOW IN PROGRESS. FINALLY, THE EQUAL EMPLOYMENT OPPORTUNITY COUNCIL HAS, UNDER THE CHAIRMANSHIP OF TOM HAYES, BEEN OF PARTICULAR VALUE IN INSURING FAIR AND EQUITABLE TREATMENT OF LABORATORY EMPLOYEES DURING A DIFFICULT PERIOD. FOR THIS THEY HAVE MY RESPECT AND GRATITUDE. I COULD MENTION A NUMBER OF OTHER COMMITTEES WHO ALSO SERVE THE LABORATORY LOYALLY AND WELL. ONLY TIME PREVENTS ME FROM DOING SO.

AS A LABORATORY-WIDE ISSUE, (SLIDE 5) LET ME MENTION SPACE. AS YOU KNOW, THE LABORATORY HAS BEEN RENTING OFFICE SPACE IN DOWNTOWN BERKELEY FOR SEVERAL YEARS. THIS SPACE WAS REQUIRED DURING A PERIOD OF EXPANSION, AND IT SERVED ITS PURPOSE WELL AT THAT TIME. WE ARE NOW IN A PERIOD OF CONSOLIDATION, AND IN ADDITION THE COST OF

ECONOMY MEASURES

BUILDINGS 930-932 VACATED

BUILDING 50E PLANNED

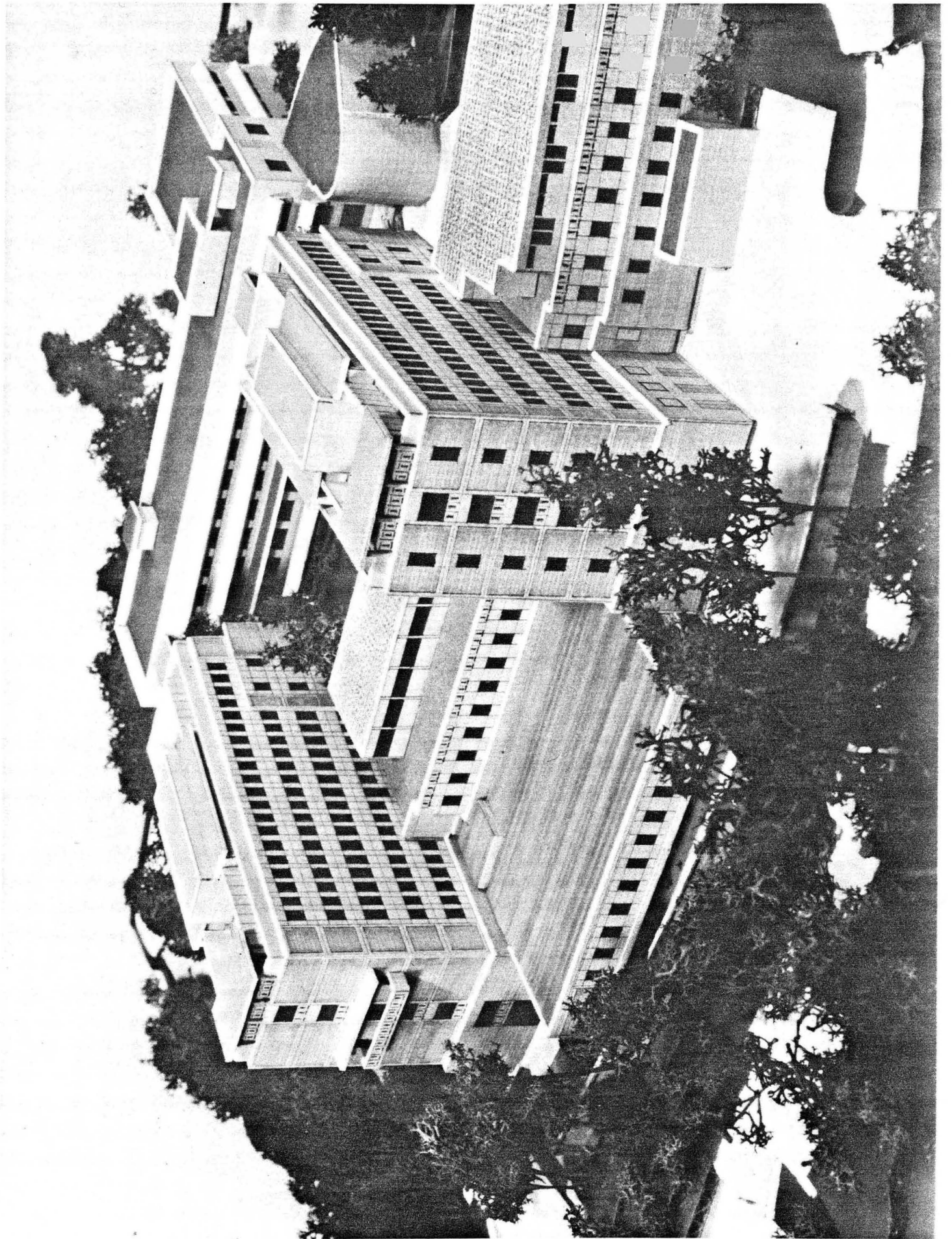
LOWER ELECTRICITY RATES SOUGHT

TRAVEL — TELEPHONES

METROPOLITAN RENTAL OFFICE SPACE HAS GONE UP BY A VERY LARGE FACTOR. FOR THESE REASONS, IN ADDITION TO THE INCONVENIENCE OF WORKING AS A REMOTE LOCATION, I HAVE DECIDED THAT WE WILL VACATE THESE OFFICE BUILDINGS AND MOVE THE AFFECTED DEPARTMENTS BACK TO THE LABORATORY SITE. THIS WILL CAUSE SOME INCONVENIENCE, SOME CROWDING, AND SOME APPARENTLY BIZARRE MOVES DURING THE COMING MONTHS. NEVERTHELESS IT IS PREFERABLE TO THE EXPENSE OF THE ALTERNATIVE. THEREFORE I EXPECT THE FULL COOPERATION OF THE LABORATORY STAFF IN ACCOMMODATING THE INCONVENIENCE THAT THESE MOVES WILL NECESSITATE.

ON A MORE POSITIVE NOTE, WE ARE PLANNING TO ADD A WING OF LIGHT OFFICE SPACE TO THE BUILDING 50 COMPLEX, AS SHOWN IN THE MODEL ON SLIDE 7. THIS WING WILL BE OVER -- NOT IN -- THE PARKING LOT WEST OF BUILDING 50, AND IT WILL HOUSE SOME 70 MEMBERS OF OUR STAFF AT A TOTAL COST OF LESS THAN 1 MILLION DOLLARS. OF COURSE WE NEED LABORATORY SPACE MORE THAN ADDITIONAL OFFICE SPACE. BY BUILDING THIS OFFICE SPACE WE WILL, HOWEVER, FACILITATE MOVEMENTS, THE NET RESULT OF WHICH WILL BE TO RECLAIM LABORATORY SPACE PRESENTLY BEING USED AS OFFICES.

AS THE FINAL MAJOR ITEM, I SHALL REPORT, WITHOUT GOING INTO DETAIL, THAT WE ARE PRESENTLY NEGOTIATING FOR CHEAPER POWER. THIS IS ESPECIALLY IMPORTANT AS RISING PG&E RATES MAKE IT EVER MORE EXPENSIVE TO RUN OUR ACCELERATORS. FOR EXAMPLE, THE COST OF POWER FOR THIS LABORATORY IS



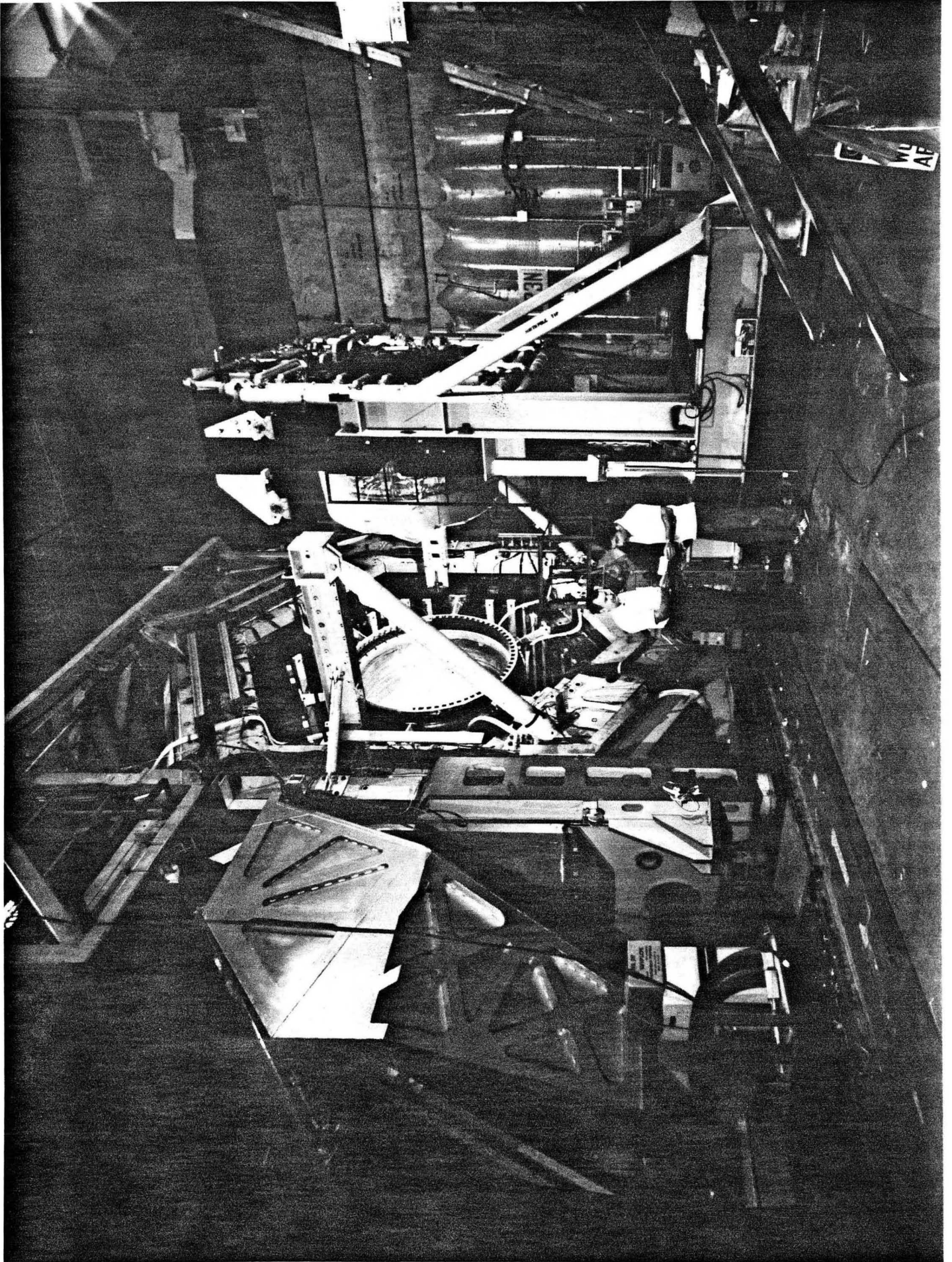
APPROXIMATELY 9 MILLION DOLLARS ANNUALLY AT PRESENT PG&E RATES. AS OUR NEGOTIATIONS BEAR FRUIT, YOU WILL BE INFORMED.

I HAVE ADDED A FINAL LINE ENTITLED "TRAVEL-TELEPHONES" TO THIS SLIDE. ITS PURPOSE IS TO REMIND ME TO REMIND YOU THAT ECONOMY IS A PRACTICE IN WHICH ALL MEMBERS OF THE LABORATORY CAN SHARE. AT THE RISK OF BEING TRIVIAL, LET ME OBSERVE THAT NOTHING WHICH WE DO IS FREE. EVERYTHING COSTS MONEY, AND TO A GOOD APPROXIMATION WE HAVE THE OPTION OF USING OUR FUNDS FOR TRAVEL, FOR TELEPHONES, OR FOR SALARIES. IT BEHOOVES US ALL TO GIVE A LITTLE THOUGHT TO HOW WELL OUR MONEY IS BEING SPENT. I WOULD THEREFORE LIKE TO ENCOURAGE EVERYONE TO PRACTICE ECONOMY IN THOSE AREAS WHERE ITS PRACTICE WILL NOT IMPACT ON THE LABORATORY'S PRIMARY MISSION.

LET US NOW TURN TO A DISCUSSION OF HOW WELL WE ARE FULFILLING THAT MISSION. THE REAL HEALTH OF A LABORATORY IS DETERMINED NOT BY THE NUMBER OF DOLLARS THAT IT REQUIRES TO OPERATE, OR BY THE FACILITIES WITHIN WHICH IT OPERATES, BUT BY THE QUALITY AND CREATIVITY OF ITS SCIENTIFIC AND TECHNICAL STAFF. TWENTY, THIRTY, AND FIFTY YEARS FROM NOW NO ONE WILL REMEMBER OR CARE WHAT OUR FINANCIAL POSITION WAS IN 1982. WHAT HISTORY WILL RECORD ARE THE CONTRIBUTIONS THAT THIS LABORATORY MADE TO SCIENCE AND THE EXTENT TO WHICH IT RESPONDED TO NATIONAL NEEDS.

BY THIS CRITERION I AM PLEASED TO REPORT THAT LAWRENCE BERKELEY LABORATORY IS IN A UNIQUELY HEALTHY POSITION. IN FACT I CAN LOOK ANYONE RIGHT IN THE EYE AND SAY THAT SCIENTIFICALLY LBL IS BY A GOOD MARGIN THE STRONGEST NATIONAL LABORATORY IN THE COUNTRY. LET ME DESCRIBE TO YOU SOME OF THE EVIDENCE THAT CONVINCES ME OF THIS CONCLUSION. I SHOULD LIKE TO SHARE WITH YOU A FEW COMMENTS ON SELECTED ACHIEVEMENTS IN THE LABORATORY SINCE 1980. MY COVERAGE WILL OF NECESSITY HAVE TO BE VERY SELECTIVE, RATHER THAN EXHAUSTIVE. THE FORMAT WILL BE TO DESCRIBE ACHIEVEMENTS IN SOME MAJOR LABORATORY PROGRAMS.

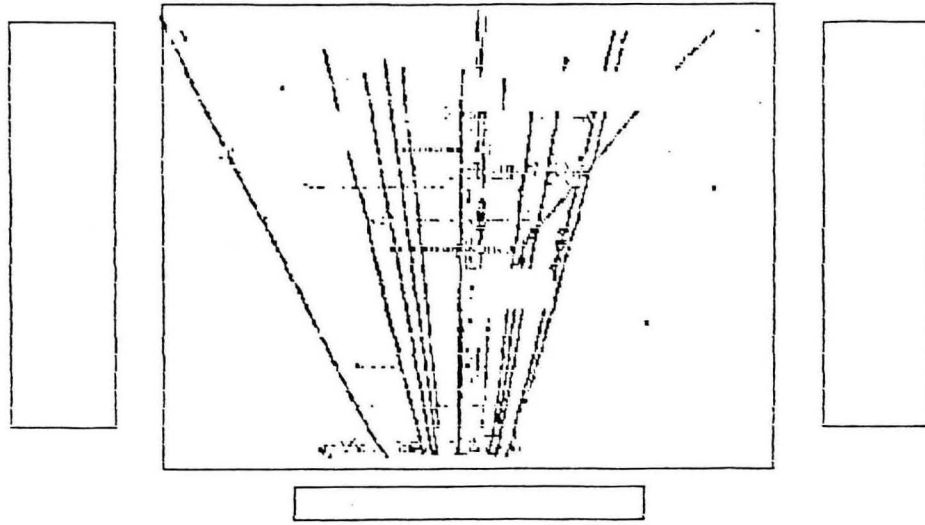
IN HIGH ENERGY PHYSICS A LOT HAS HAPPENED. THE PHYSICS DIVISION HAS ACQUIRED NEW LEADERSHIP IN THE PERSON OF DAVID JACKSON, WHO HAS SUCCEEDED BOB BIRGE. ON THE EXPERIMENTAL SIDE, THE LONG-AWAITED TIME PROJECTION CHAMBER HAS BEEN COMPLETED IN ITS FIRST FORM AND ROLLED INTO THE INTERACTION REGION AT PEP, WHERE IT HAS ALREADY BEGUN RECORDING TRACKS. SLIDE 8 GIVES AN IMPRESSION OF THE SCALE OF THE TIME PROJECTION CHAMBER, A 900 TON, 25 MILLION DOLLAR, ADVANCED PARTICLE DETECTOR THAT WAS 5 YEARS IN THE MAKING. THIS DETECTOR, INVENTED BY DAVID NYGREN, IS UNEQUIVOCALLY THE MOST ADVANCED PARTICLE DETECTOR IN THE WORLD TODAY. AS SUCH IT SERVES AS A DOORWAY TO THE FUTURE IN HIGH ENERGY PHYSICS, AND WE EXPECT IT TO BE MUCH EMULATED. I AM PLEASED TO REPORT THAT THE TIME PROJECTION CHAMBER HAS PASSED ITS FIRST



TESTS VERY SUCCESSFULLY, AS EVIDENCED BY THE RECONSTRUCTED TRACKS SHOWN ON SLIDE 9. HERE WE SEE AN END VIEW OF THE TPC AT THE BOTTOM, AND A ROLLED UP RADIAL VIEW ALONG THE TOP OF THE SLIDE. THE RECORDS OF THE TRACKS OF AT LEAST 14 CHARGED PARTICLES ARE EVIDENT IN THESE PROJECTIONS. WHAT MAKES THE TPC UNIQUE IS ITS ABILITY TO RECORD TRACKS IN THREE DIMENSIONS AND IDENTIFY THE PARTICLES CREATING THE TRACKS. THIS IS ACHIEVED BY SURROUNDING THE INTERACTION REGION WITH A HIGH PRESSURE ARGON-METHANE MIXTURE IN THE PRESENCE OF HIGHLY UNIFORM PARALLEL ELECTRIC AND MAGNETIC FIELDS. CHARGED PARTICLES LEAVE IONIZATION TRACKS, AND THESE TRACKS DRIFT IN THE ELECTRIC FIELD TO END PLATES, PROJECTING THEMSELVES IN TWO DIMENSIONS ON THOSE PLATES. THE PROJECTION OF THE TRACK IN THE THIRD DIMENSION - THE DRIFT DIRECTION -- IS DEDUCED FROM THE ARRIVAL TIME OF THE TRACKS AT THE END OF THE DRIFT REGION. THUS TIME SUBSTITUTES FOR THE THIRD DIMENSION, AND A COMPLETE THREE-DIMENSIONAL PROJECTION OF THE TRACK CAN BE RECONSTRUCTED. DURING THE COMING MONTHS WE EXPECT TO UPGRADE THE TPC IN SEVERAL STAGES, AND YOU CAN EXPECT TO HEAR A LOT MORE ABOUT IT.

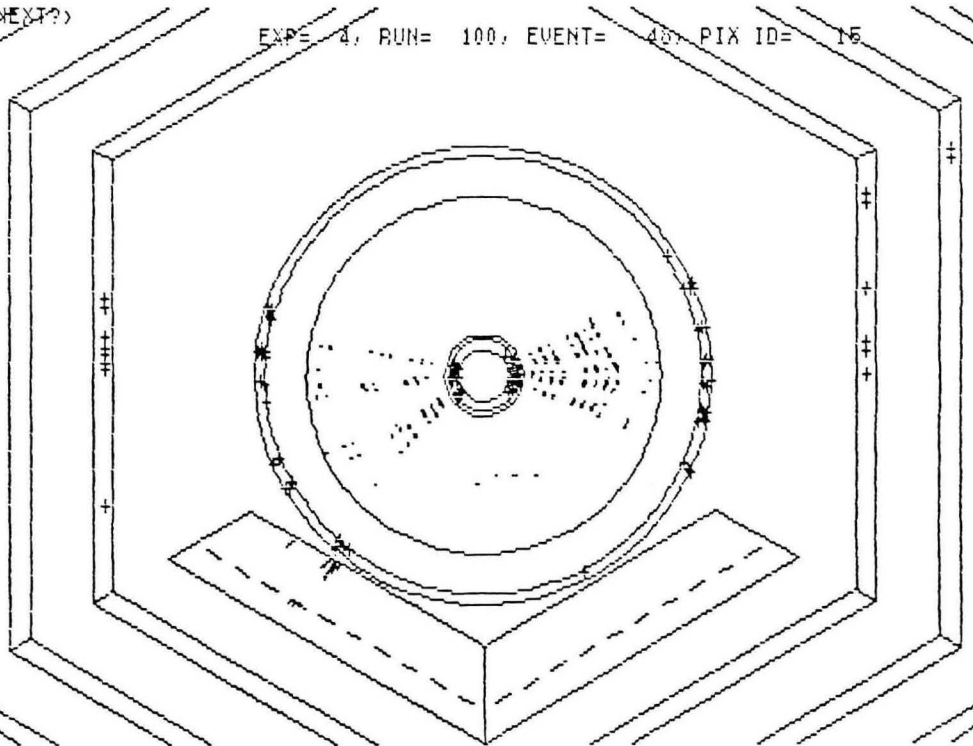
THE LABORATORY HAS ALSO BEEN ACTIVE IN ANOTHER AREA OF HIGH ENERGY PHYSICS - NAMELY, SUPERCONDUCTING MAGNET RESEARCH AND DEVELOPMENT. CLYDE TAYLOR LEADS A VERY ACTIVE GROUP ENGAGED IN RESEARCH DIRECTED TOWARD BUILDING TEN TESLA OR 100 THOUSAND GAUSS SUPERCONDUCTING MAGNETS.

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NEXT?>

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NEXT?>

WHEN BROOKHAVEN NATIONAL LABORATORY'S ISABELLE PROJECT RAN INTO DIFFICULTIES IN PRODUCING SUPERCONDUCTING MAGNETS DURING THE PAST TWO YEARS, THE LBL GROUP BUILT MODEL MAGNETS AS ALTERNATIVES. I AM PLEASED TO REPORT THAT THESE MAGNETS EASILY EXCEEDED THE DESIGN SPECIFICATIONS OF 5 TESLA, AS SHOWN IN SLIDE 10. OF EQUAL IMPORTANCE, THEY HAD EXTRAORDINARY DIMENSIONAL INTEGRITY AND REQUIRED VERY LITTLE QUENCHING. I LOOK FORWARD TO FURTHER EXCITING DEVELOPMENTS FROM THIS GROUP.

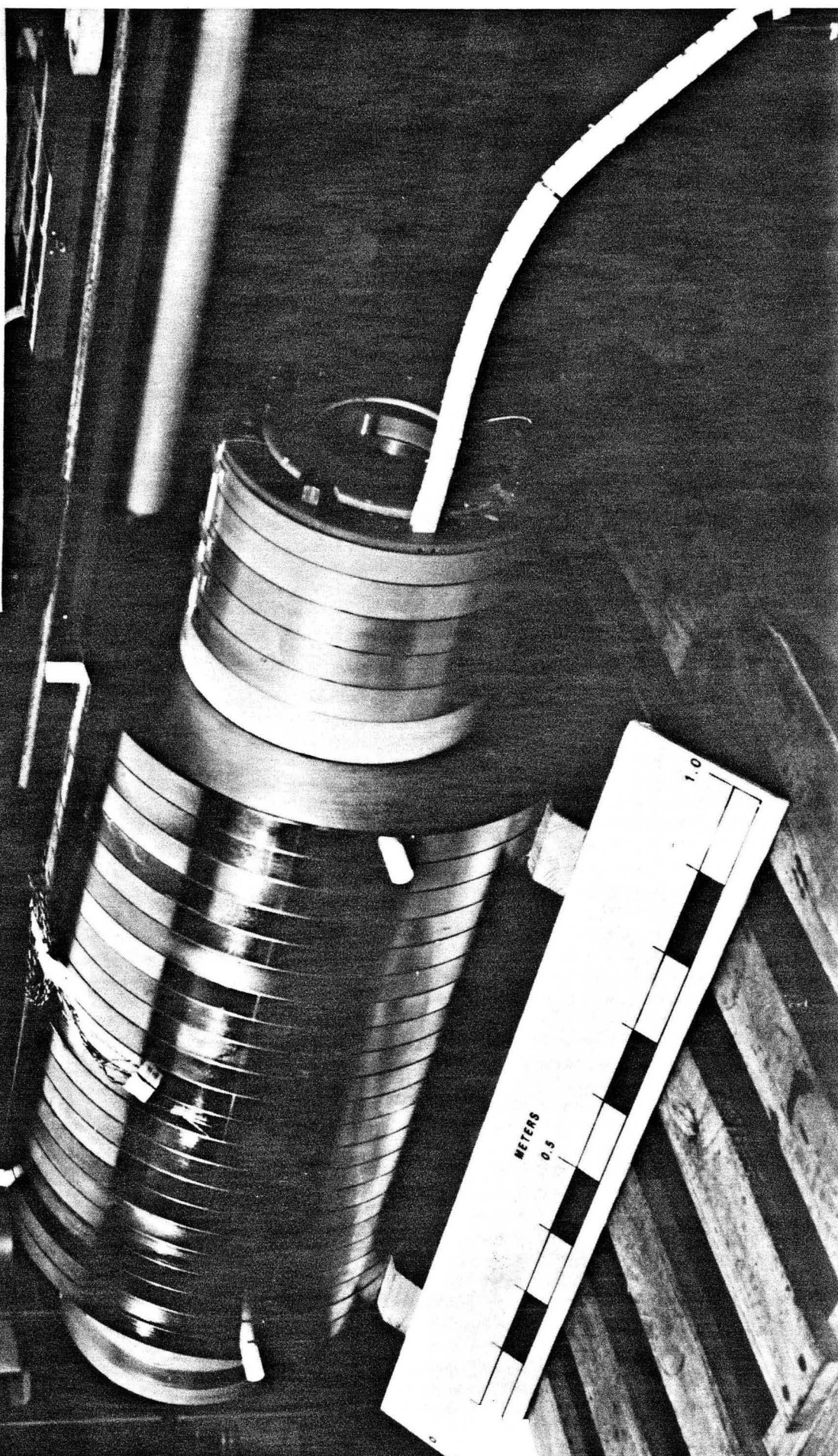
LBL HIGH ENERGY PHYSICISTS RESPONDED TO A NATIONAL NEED IN QUITE A DIFFERENT WAY LAST YEAR. GEORGE TRILLING HEADED UP A SPECIALLY CONSTITUTED NATIONAL "WISE MAN" COMMITTEE OF HIGH ENERGY PHYSICISTS, ON WHICH ANDY SESSLER ALSO SERVED, TO DEVELOP A NATIONAL PLAN AND SET OF PRIORITIES FOR HIGH ENERGY PHYSICS IN THIS COUNTRY DURING THE 1980's. THIS COMMITTEE HAS SUBMITTED ITS REPORT, WHICH IS EXPECTED TO SERVE AS THE MASTER DOCUMENT FOR FURTHER PLANNING.

IN THE FUTURE, I EXPECT THE BERKELEY HIGH ENERGY PHYSICS GROUP TO HAVE A STRONG AND SECURE POSITION WITHIN THE NATIONAL HIGH ENERGY PHYSICS PROGRAM. BASED ON OUR UNIQUE ROLE AS A MULTIPROGRAM LABORATORY SITUATED AT A UNIVERSITY WITH A STRONG HIGH ENERGY PHYSICS GROUP, LBL HIGH ENERGY PHYSICISTS CAN BE EXPECTED TO DEFINE AND PURSUE A UNIQUE MISSION WITHIN HIGH ENERGY PHYSICS. THIS MISSION WILL UNDOUBTEDLY CONSIST IN PART OF SERVING AS A

ISABELLE Magnet Model

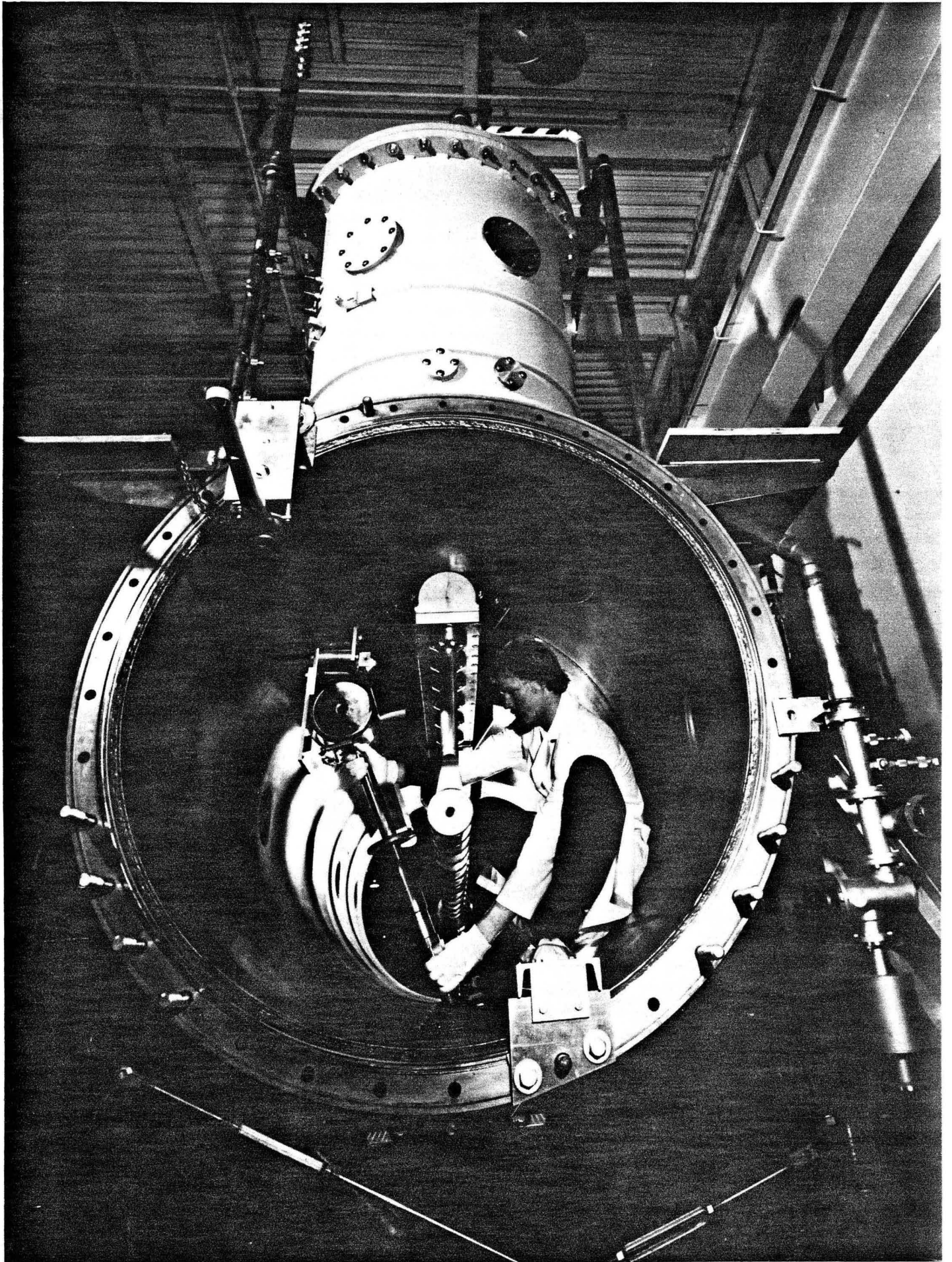
6.5 Tesla at 4.5 Kelvin

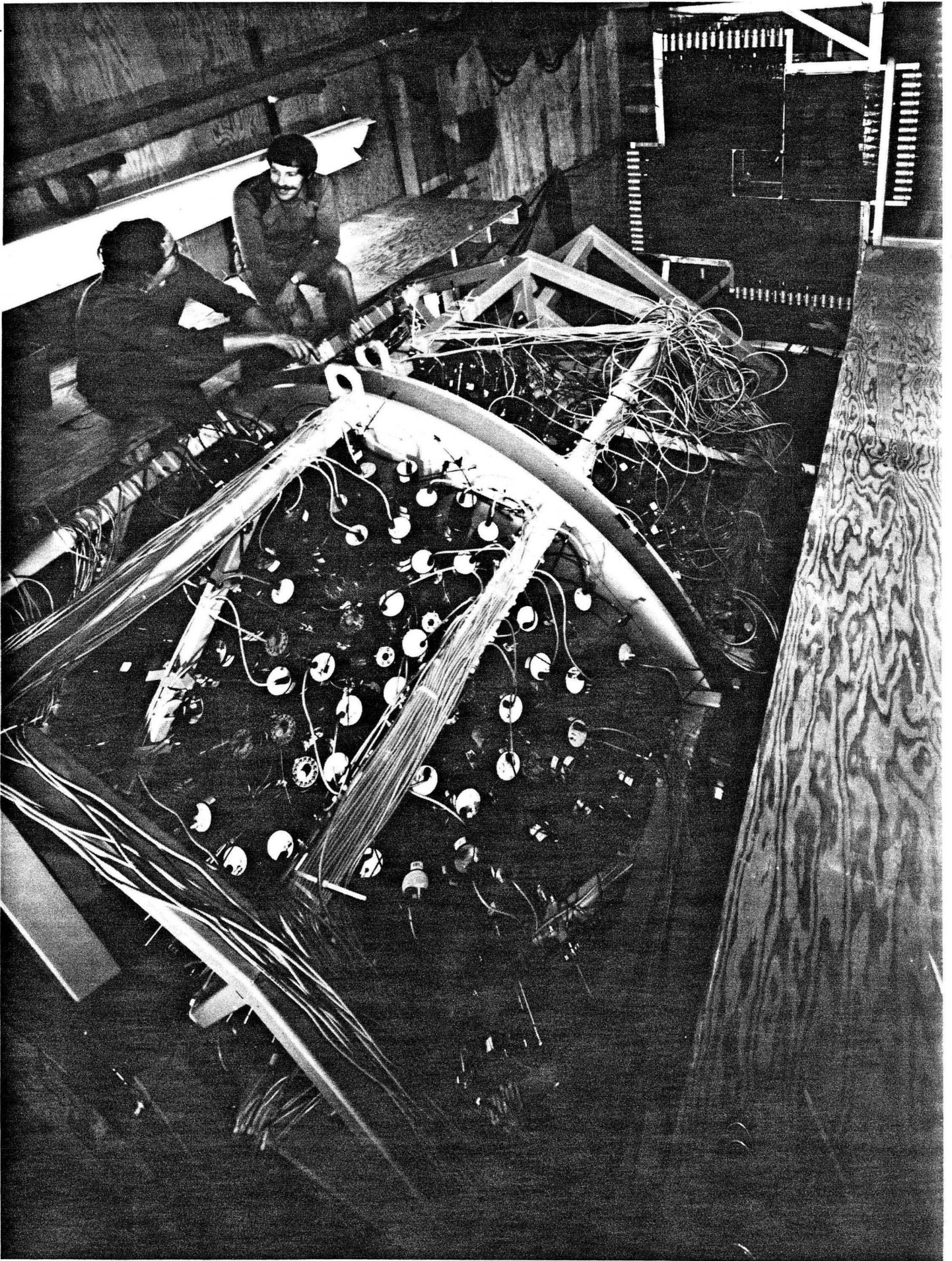
7.6 Tesla at 1.8 Kelvin

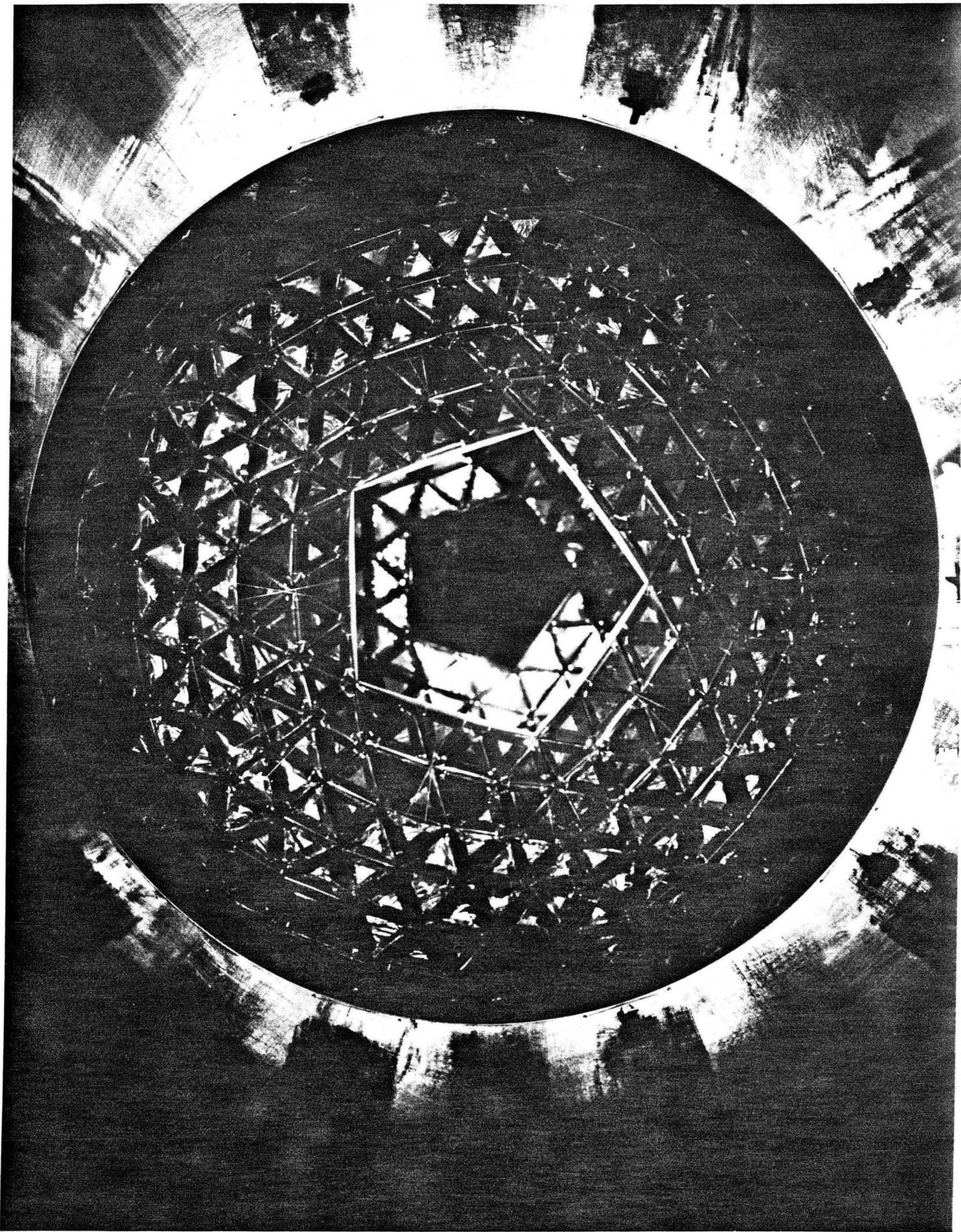


NATIONAL RESOURCE FOR THE DEVELOPMENT AND UTILIZATION OF MAJOR DETECTOR SYSTEMS. IN ADDITION I EXPECT THAT OUR HIGH ENERGY PHYSICS GROUP WILL BE IN A PARTICULARLY ADVANTAGEOUS POSITION FOR ASSISTING THE NATIONAL COMMUNITY IN LONG RANGE PLANNING FOR THE ENTIRE FIELD. IN SHORT I AM OPTIMISTIC ABOUT THE FUTURE OF THIS FIELD OF RESEARCH AT THE LABORATORY.

IN NUCLEAR SCIENCE, OUR LARGEST AREA OF ACTIVITY HAS CENTERED ABOUT THE DEVELOPMENT AND UTILIZATION OF THE BEVALAC, THE PREMIER HEAVY ION PHYSICS FACILITY IN THE UNITED STATES. LAST YEAR A THIRD INJECTOR, NAMED "ABEL" WAS COMPLETED FOR THE SUPERHILAC. IT IS SHOWN IN SLIDE 11. ALSO COMPLETED LAST YEAR WAS THE PLASTIC BALL DETECTOR, SHOWN IN SLIDE 12 FROM THE OUTSIDE AND IN SLIDE 13 FROM THE INSIDE. THIS DETECTOR WAS BUILT BY A COLLABORATION OF LBL SCIENTISTS WITH COLLEAGUES FROM GSI IN DARMSTADT. IT CONSISTS OF OVER 800 PLASTIC DETECTORS ARRANGED IN A SPHERICAL ARRAY TO FACILITATE THE DETECTION OF MANY PARTICLES EMITTED SIMULTANEOUSLY IN A HIGH-ENERGY HEAVY-ION NUCLEAR REACTION. THE BEVALAC ITSELF IS A STEP ALONG THE WAY TO VERY HIGH ENERGY NUCLEAR REACTIONS WITH VERY HEAVY IONS. TO THIS END ANOTHER MAJOR ACCELERATOR IMPROVEMENT WAS COMPLETED AT THE END OF 1981: THE URANIUM UPGRADE PROJECT ON THE BEVATRON. THIS PROJECT CONSISTED OF IMPROVING THE VACUUM IN THE BEVATRON FROM 10^{-6} TORR TO 10^{-10} TORR BY INSERTION OF A CRYOGENIC VACUUM LINER









NEW BEVATRON COLD-BORE LINER

ROOM TEMPERATURE LINER

77° KELVIN LINER

SUPERINSULATION

10⁻⁶ TORR GUARD VACUUM

SUPERINSULATION

ACTIVATED CHARCOAL

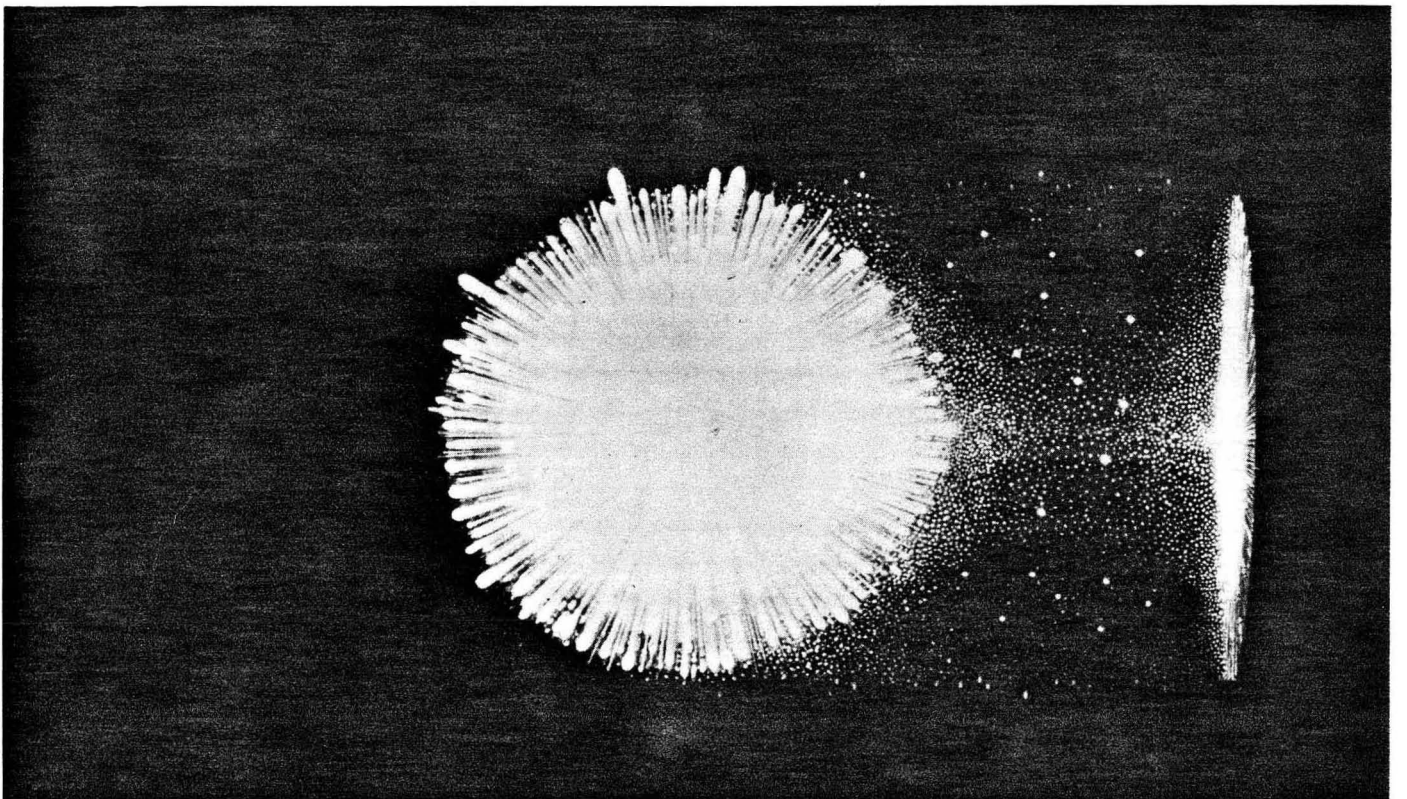
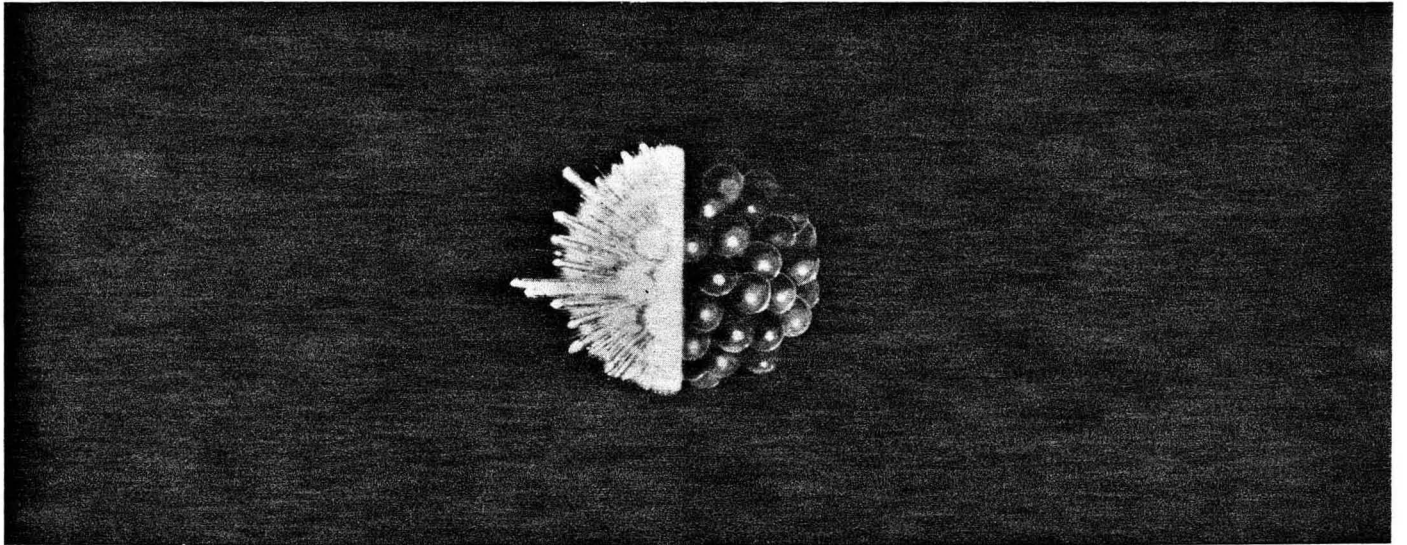
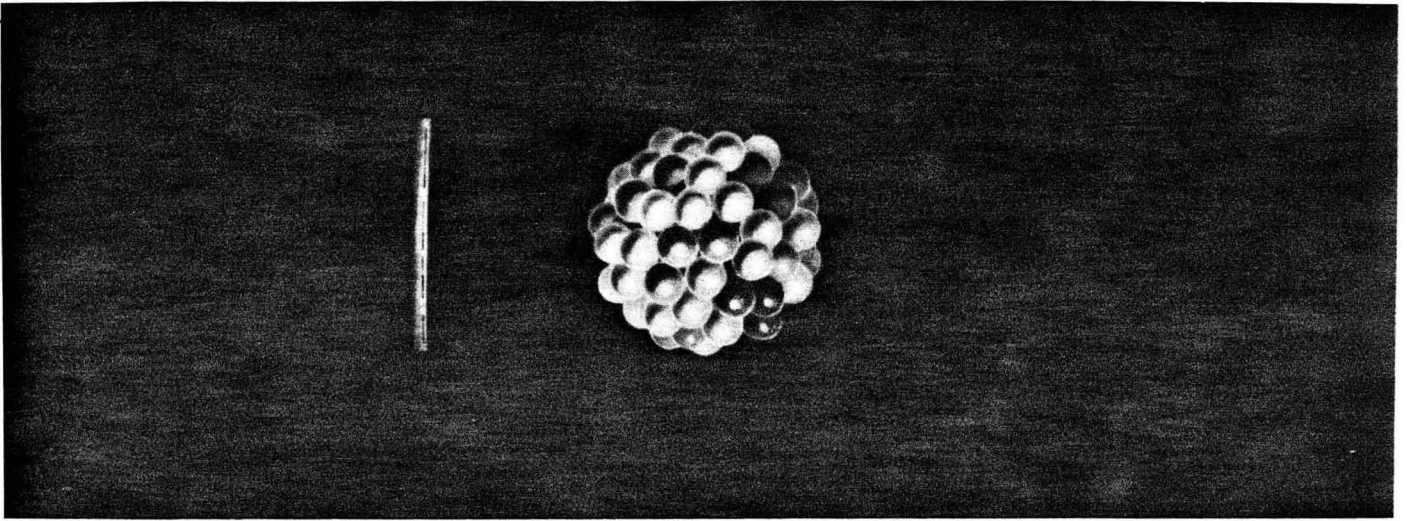
12° KELVIN LINER

10⁻¹⁰ TORR VACUUM

PRINTED CIRCUIT BOARD MATERIAL
PATTERN ETCHED TO REDUCE EDDY CURRENTS

SHOWN IN SLIDE 14. THE GENEROUS INTERIOR DIMENSIONS OF THE BEVATRON VACUUM CHAMBER ALLOWED INSERTION OF HEAT SHIELDS COOLED BY LIQUID NITROGEN AND BY LIQUID HELIUM TO ALLOW THE VERY EFFICIENT CRYOPUMPING OF RESIDUAL GASES, THEREBY ALLOWING THE ACCELERATION OF HEAVY IONS UP TO AND INCLUDING URANIUM.

THE ULTIMATE GOAL OF THE URANIUM UPGRADE OF THE BEVALAC AND OF THE QUEST FOR EVER HIGHER ENERGIES IN NUCLEAR REACTIONS, OF WHICH THE BEVALAC ITSELF IS ONLY A STEP ALONG THE WAY, IS THE STUDY OF NUCLEAR MATTER AT VERY HIGH DENSITIES. AN ARTIST'S CONCEPTION OF A VERY HIGH ENERGY REACTION BETWEEN TWO HEAVY NUCLEI IS DEPICTED ON SLIDE 15. HERE WE SEE IN THE TOP PANEL A NUCLEUS STATIONARY IN A GIVEN FRAME OF REFERENCE BEING APPROACHED BY ANOTHER NUCLEUS MOVING AT A RELATIVISTIC VELOCITY FROM THE LEFT. THIS ILLUSTRATION IS VERY LONG ON RELATIVITY AS EVIDENCED BY THE EXTREME LORENTZ CONTRACTION OF THE MOVING NUCLEUS, AND VERY SHORT ON QUANTUM MECHANICS AS EVIDENCED BY THE SPHERICAL-BALL APPEARANCE OF THE NUCLEUS AT REST. IN THE SECOND FRAME THE NUCLEAR REACTION HAS BEGUN AND THE DISK HAS EATEN HALFWAY THROUGH THE SPHERE. FROM THE PERSPECTIVE OF THE RIGHT HALF OF THE RESTING NUCLEUS NOTHING HAS HAPPENED, BUT OF COURSE THE REACTION IS WELL UNDERWAY FOR THE OTHER HEMISPHERE. IN THE BOTTOM PANEL MOVING NUCLEI HAVE PASSED THROUGH THE REACTION ZONE AND ARE STILL TRAVELING AT RELATIVISTIC VELOCITY. HADRONIC



MATTER IS EXPLODING OUT OF THE REGION OF THE RESTING NUCLEUS, AND CREATED MATTER CAN BE SEEN BETWEEN THE TWO. IT IS INTERESTING TO NOTE THAT FROM THE MIRROR-IMAGE PERSPECTIVE OF THE MOVING NUCLEUS THE WHOLE SLIDE COULD BE VIEWED FROM RIGHT TO LEFT, AND THE SAME STORY COULD BE TOLD FROM A RIGHT TO LEFT. CLEARLY MANY CHALLENGES LIE AHEAD IN SEEKING TO STUDY NUCLEAR INTERACTIONS OF HEAVY IONS AT VERY HIGH ENERGIES. THROUGH THESE REACTIONS IT WILL BE POSSIBLE TO STUDY NUCLEAR MATTER UNDER CONDITIONS THAT HAVE NOT BEEN REALIZED SINCE THE FIRST FEW MOMENTS OF THE UNIVERSE. THE REACTIONS ARE THEREFORE OF ASTROPHYSICAL INTEREST AS WELL AS OF INTEREST IN NUCLEAR PHYSICS. INASMUCH AS THE COLLISIONS TAKE PLACE AT ENERGIES ABOVE THE MASSES OF MANY CREATED PARTICLES, THERE ARE ALSO PREDICTIONS THAT NUCLEAR MATTER WILL EXIST DURING THE COLLISION AS A QUARK-GLUON PLASMA.

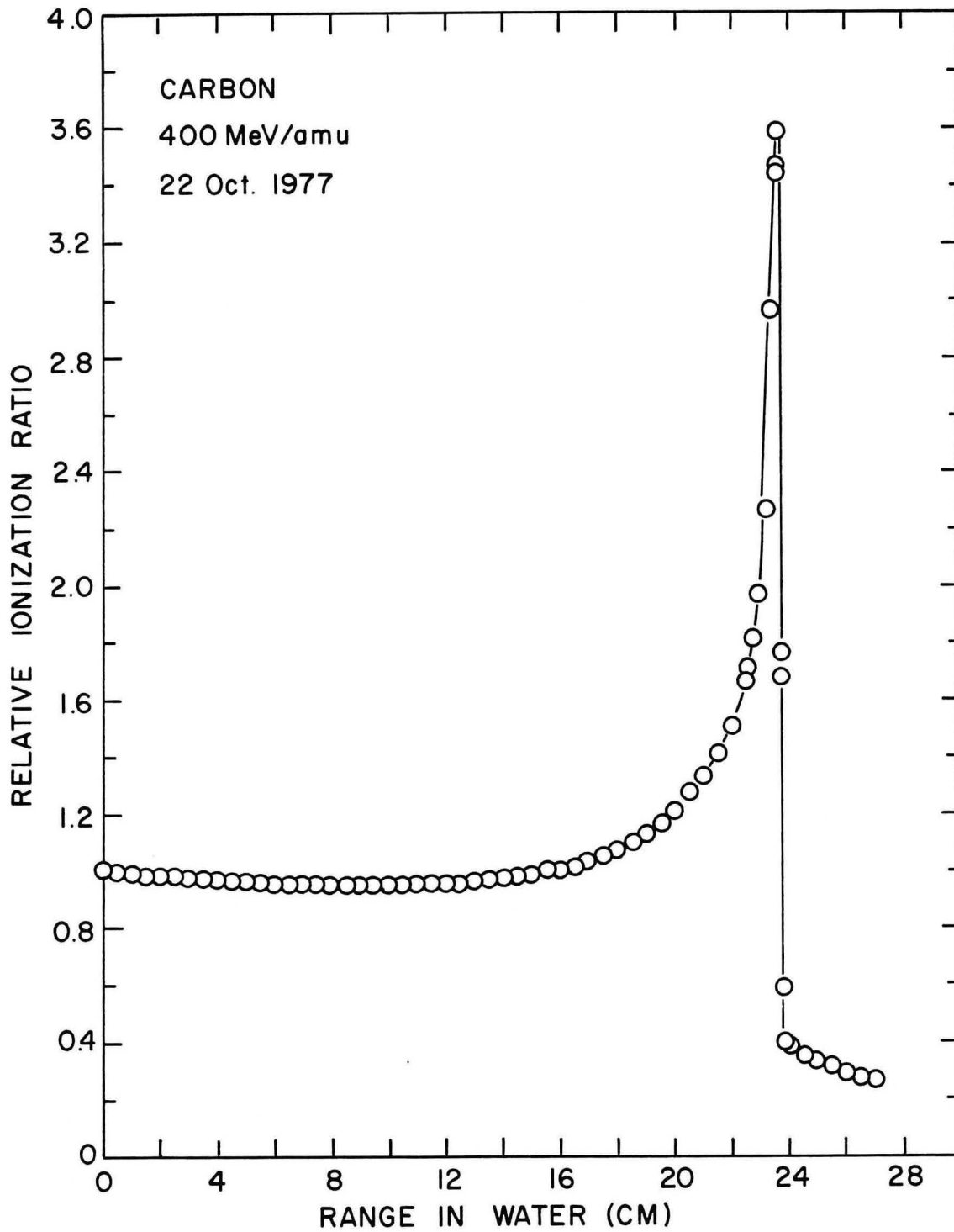
I CAN SUMMARIZE THE EVENTS IN OUR NUCLEAR SCIENCE PROGRAM OVER THE LAST TWO YEARS AS FOLLOWS. MANY IMPROVEMENTS HAVE BEEN MADE BOTH IN THE ACCELERATORS AND IN THE DETECTOR SYSTEMS. WITH THE BEVALAC JUST NOW COMING ON LINE WITH ITS NEW URANIUM UPGRADE, WE CAN EXPECT A BUSY PERIOD OF DATA COLLECTION AND ANALYSIS. FOR THE NEXT FEW YEARS WE CAN LOOK FORWARD TO EXPLORING NUCLEAR PHYSICS AT THE BEVALAC, SUPPORTED BY A STABLE, BUT NOT EXPANDING, NATIONAL PROGRAM. WE HAVE ON THE DRAWING BOARDS A PLAN FOR AN ULTRA-RELATIVISTIC HEAVY ION ACCELERATOR, SHOULD

THE NATIONAL PROGRAM AND THE RESULTS OF NUCLEAR PHYSICS EXPERIMENTS ON THE BEVALAC GENERATE A NEED FOR SUCH A MACHINE.

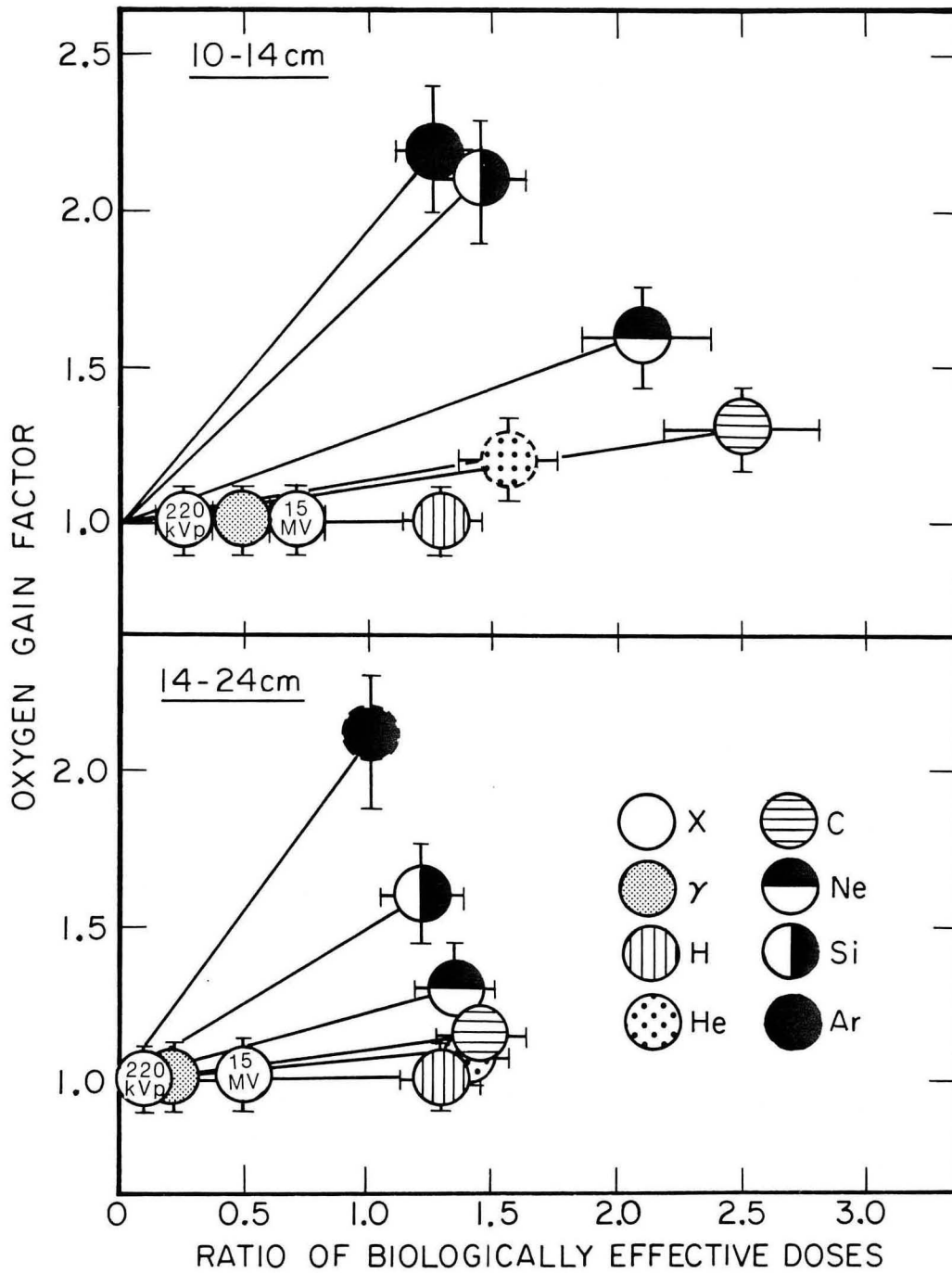
LET ME NOW ADDRESS BRIEFLY OUR PROGRAMS IN THE BIOLOGICAL SCIENCES. IN 1980 TWO IMPORTANT EVENTS TOOK PLACE IN THE LEADERSHIP OF OUR DIVISIONS ENGAGED IN RESEARCH IN THESE PROGRAM AREAS. FIRST, THE LEADERSHIP CHANGED IN BIODYNAMICS WITH THE RETURN OF GEORGE PIMENTEL TO BERKELEY TO TAKE OVER THE CHEMICAL BIODYNAMICS DIVISION, FOLLOWING THE RETIREMENT OF MELVIN CALVIN FROM THAT POSITION. GEORGE IS IN THE PROCESS OF IMPLEMENTING A NUMBER OF EXCITING NEW INITIATIVES IN LCB, UPON WHICH IT WOULD BE TOO EARLY TO REPORT. THE OTHER EVENT WAS THE REAPPOINTMENT OF EDWARD ALPEN AS THE HEAD OF OUR DONNER LABORATORY BIOLOGY AND MEDICINE DIVISION. SINCE ED'S APPOINTMENT IN 1975, HE HAS MADE REMARKABLE PROGRESS IN REDIRECTING AND STRENGTHENING THE ACTIVITIES OF THIS DIVISION. I SHOULD IN PARTICULAR LIKE TO COMMENT ON THE PROGRESS IN THE HEAVY-ION RADIOTHERAPY PROGRAM, ON WHICH JOSEPH CASTRO REPORTED TO AN LBL COLLOQUIUM IN THIS ROOM ONLY TWO WEEKS AGO. MY PERSPECTIVE OF COURSE IS MUCH LESS AUTHORITATIVE AND INFORMED THAN HIS: IT IS THE PERSPECTIVE OF A PHYSICAL SCIENTIST. PERHAPS FOR THIS VERY REASON IT WILL BE CONVINCING FROM A DIFFERENT VIEWPOINT: ONE MIGHT SAY THAT HEAVY ION RADIOTHERAPY IS SO PROMISING THAT ITS PROMISE IS OBVIOUS EVEN TO A

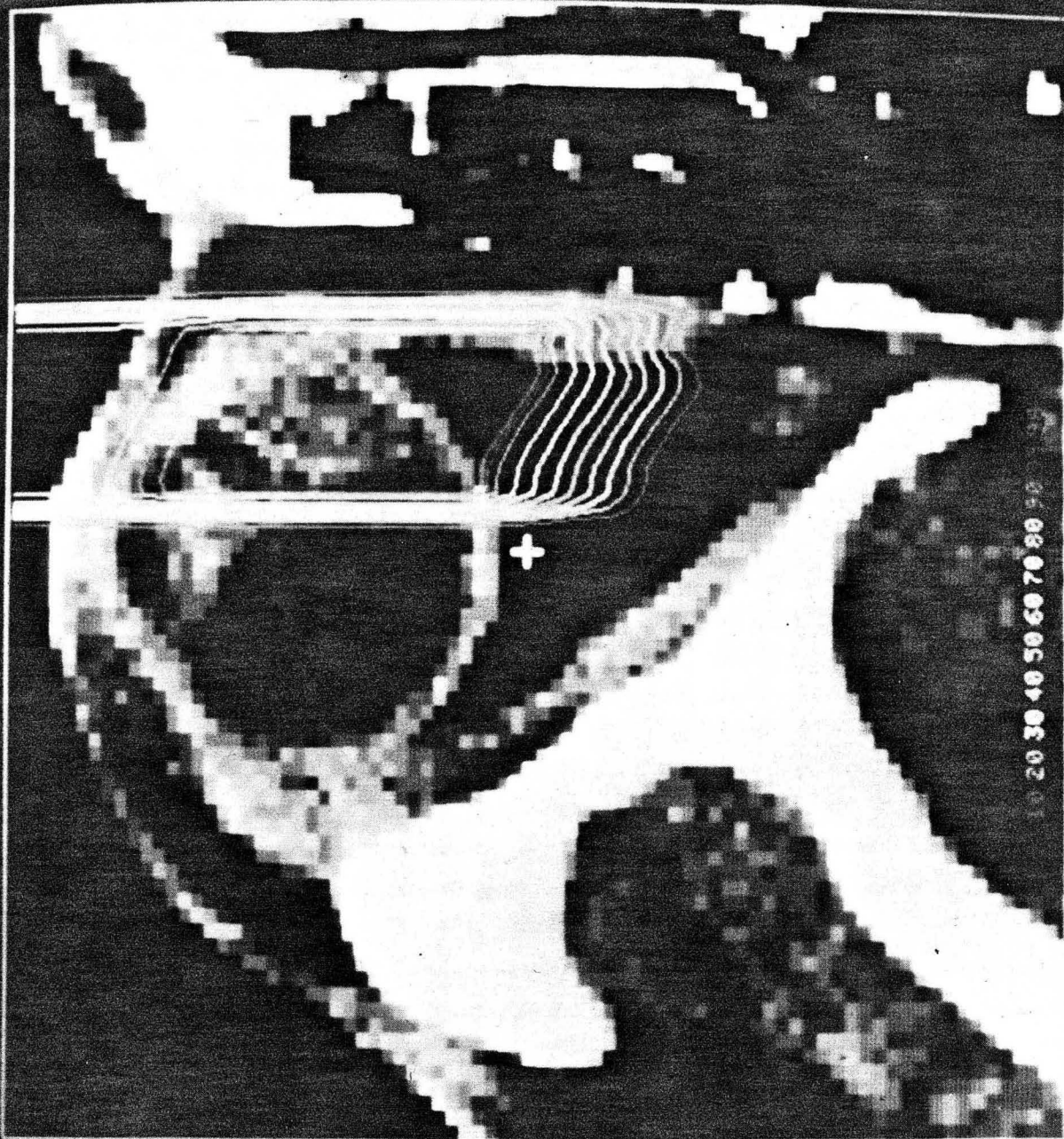
PHYSICAL SCIENTIST. SLIDE 16 SHOWS THE SO-CALLED BRAGG CURVE FOR ENERGY DEPOSITION OF A HEAVY ION TRAVELING THROUGH MATTER. THE LARGEST ENERGY DEPOSITION PER UNIT LENGTH CLEARLY OCCURS AT THE END OF THE TRACK. MAKING IT POSSIBLE FOR THE ION TO TRAVEL THROUGH THE NORMAL TISSUE AND TO DELIVER A SIGNIFICANT DOSE OF IONIZING RADIATION TO SOME TARGET, SUCH AS A TUMOR, THAT IS DEEPLY BURIED AND INACCESSIBLE. THE REAL VALUE OF THE HEAVY ION RADIOTHERAPY METHOD IS NOT ONLY THAT IT CAN TRAVEL THROUGH NORMAL TISSUE WITH RELATIVELY LITTLE DAMAGE, BUT PARTICULARLY THAT THE EDGE AT THE END OF THE BRAGG PEAK IS ESPECIALLY SHARP, SO THAT NORMAL TISSUE BEYOND THE PEAK WILL NOT BE SIGNIFICANTLY DAMAGED. THIS CURVE, COMBINED WITH PRECISE CONTROL OF THE BEAM POSITION, PROVIDES FOR A FORM OF RADIOTHERAPY THAT IS UNEQUALLED BY ANY OTHER PARTICLE. SLIDE 17 ILLUSTRATES THIS COMPARISON IN THE FORM OF A VECTOR DIAGRAM, PLOTTING THE OXYGEN GAIN FACTOR AGAINST THE RATIO OF BIOLOGICAL EFFECTIVENESS. THE FIGURE OF MERIT ON THIS PLOT IS THE SLOPE OF THE LINE LEADING TO A POINT CORRESPONDING TO A GIVEN PARTICLE. CLEARLY, BY THIS CRITERION, HEAVY IONS IN THE ARGON OR SILICON REGION ARE DRAMATICALLY SUPERIOR TO ANY OTHER PARTICLE USED FOR RADIOTHERAPY.

A STEP TOWARD USING THESE HEAVY IONS IS THE HELIUM ION RADIOTHERAPY PRESENTLY IN PRACTICE AT THE 184" CYCLOTRON. SLIDE 18 ILLUSTRATES AN APPLICATION OF THIS MODALITY TO



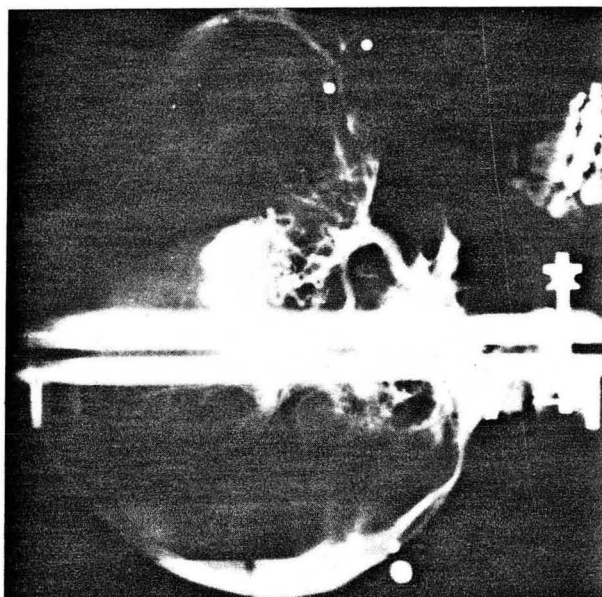
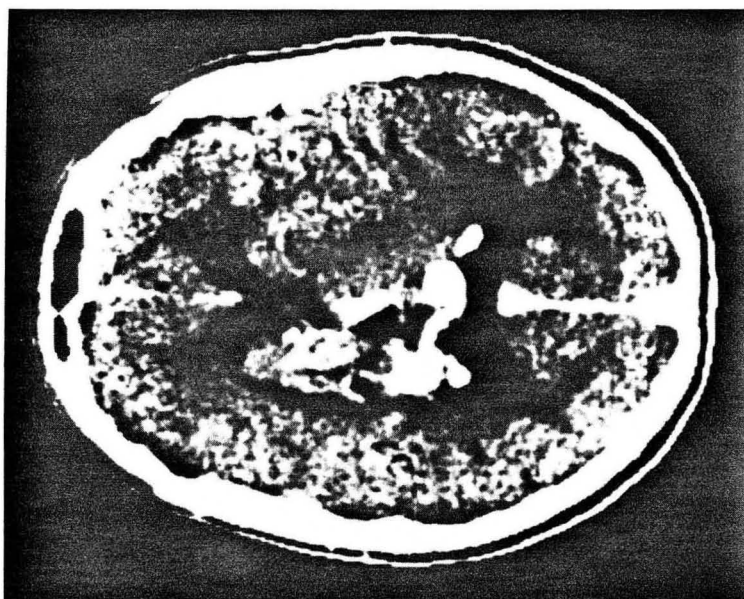
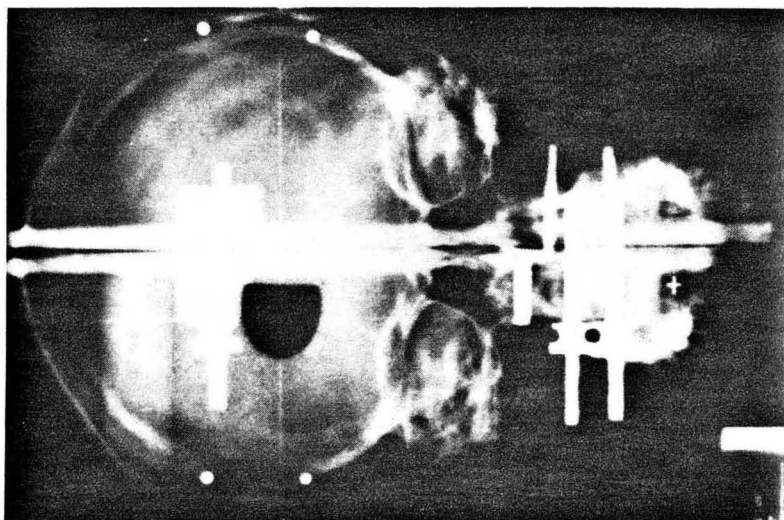
VECTOR REPRESENTATION OF THERAPY MODALITIES

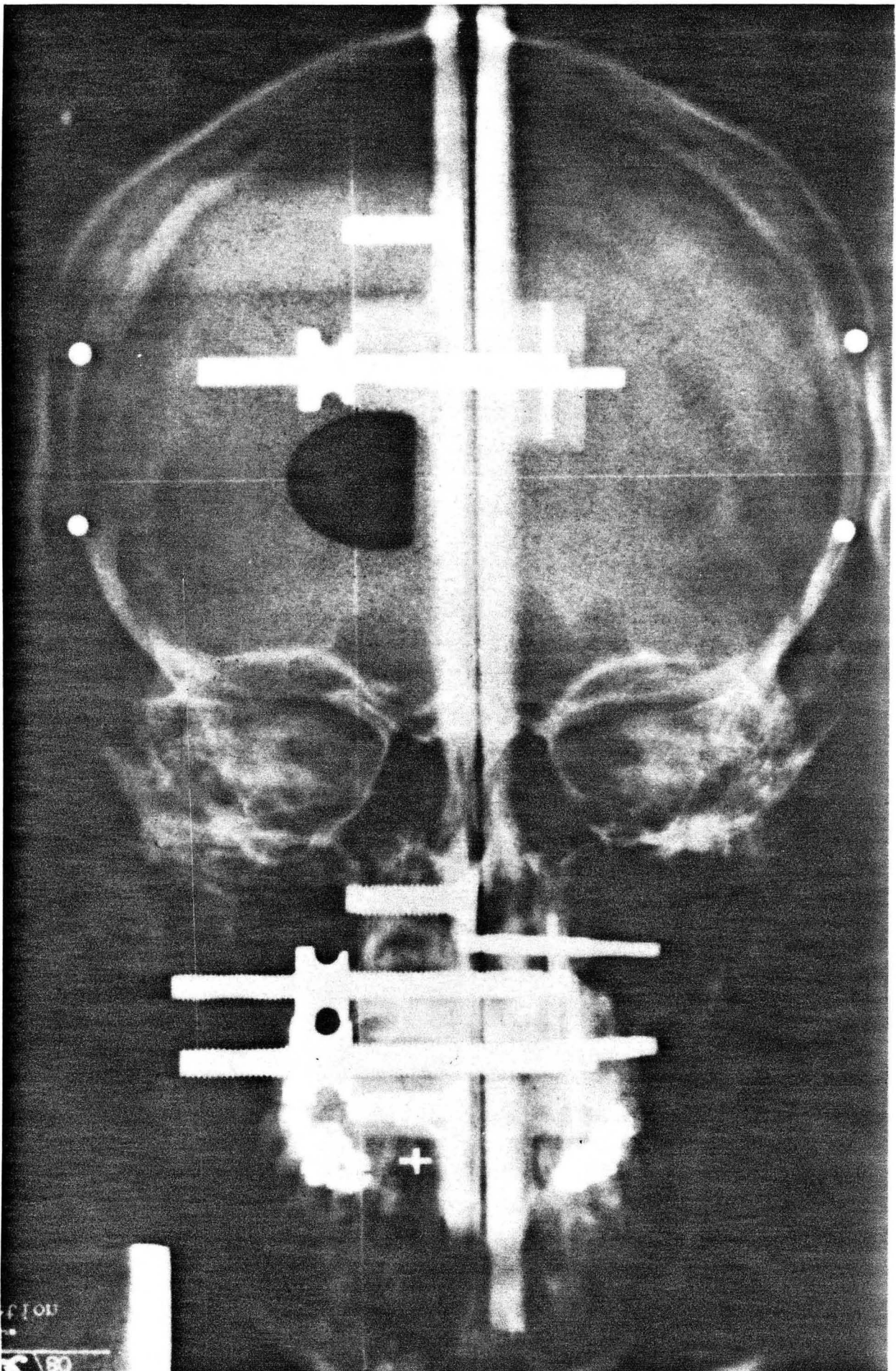




OCULAR MELANOMA, A CANCER THAT OCCURS INSIDE THE EYEBALL. THE TOMOGRAPH ILLUSTRATES SUCH A MELANOMA. IT ALSO SHOWS THE REGION ACCESSED BY THE HELIUM IONS, AND ILLUSTRATES THE WAY IN WHICH A HEAVY DOSE OF IONIZING RADIATION CAN BE DELIVERED TO THE MELANOMA WITHOUT AFFECTING DELICATE SURROUNDING STRUCTURES SUCH AS THE OPTIC NERVE. TO DATE SOME 50 PATIENTS HAVE BEEN TREATED FOR OCULAR MELANOMA BY HELIUM ION RADIOTHERAPY AT LBL, WITH A SUCCESS RATE IN THE NEIGHBORHOOD OF 90%. THIS IS A VERY WELCOME MODALITY, GIVEN THAT MOST PATIENTS TREATED SUCCESSFULLY TEND TO RETAIN GOOD VISION, WHEREAS THE ALTERNATE THERAPY IS REMOVAL OF THE EYE.

ANOTHER APPLICATION OF HELIUM ION RADIOTHERAPY IS IN THE TREATMENT OF ARTERIAL-VENOUS MALFORMATIONS, IN WHICH BLOOD VESSELS GROW TOGETHER IN A PATHOLOGICAL WAY IN INACCESSIBLE LOCATIONS SUCH AS THE BRAIN AND BY BLEEDING CAUSE IMPAIRMENT OF FUNCTION AND ARE ULTIMATELY USUALLY FATAL. SLIDE 19 SHOWS A TOMOGRAPHIC REPRESENTATION OF SUCH A MALFORMATION IN THE BRAIN OF AN INDIVIDUAL WHO HAS BEEN TREATED AT LBL. IN THE FIRST TWO PANELS THE MALFORMATION HAS BEEN HIGHLIGHTED BY RADIOGRAPHIC TECHNIQUES, AND IN THE RIGHT HAND PANEL THE TREATMENT AREA IS DEFINED: IT IS EXPANDED ON SLIDE 20. BEFORE TREATMENT THIS PATIENT HAD BEEN SIGNIFICANTLY FUNCTIONALLY IMPAIRED, HAVING LOST VISION AND BEEN PARAPLEGIC. AFTER THE ARTERIAL-VENOUS MALFORMATION WAS "VULCANIZED" BY ALPHA

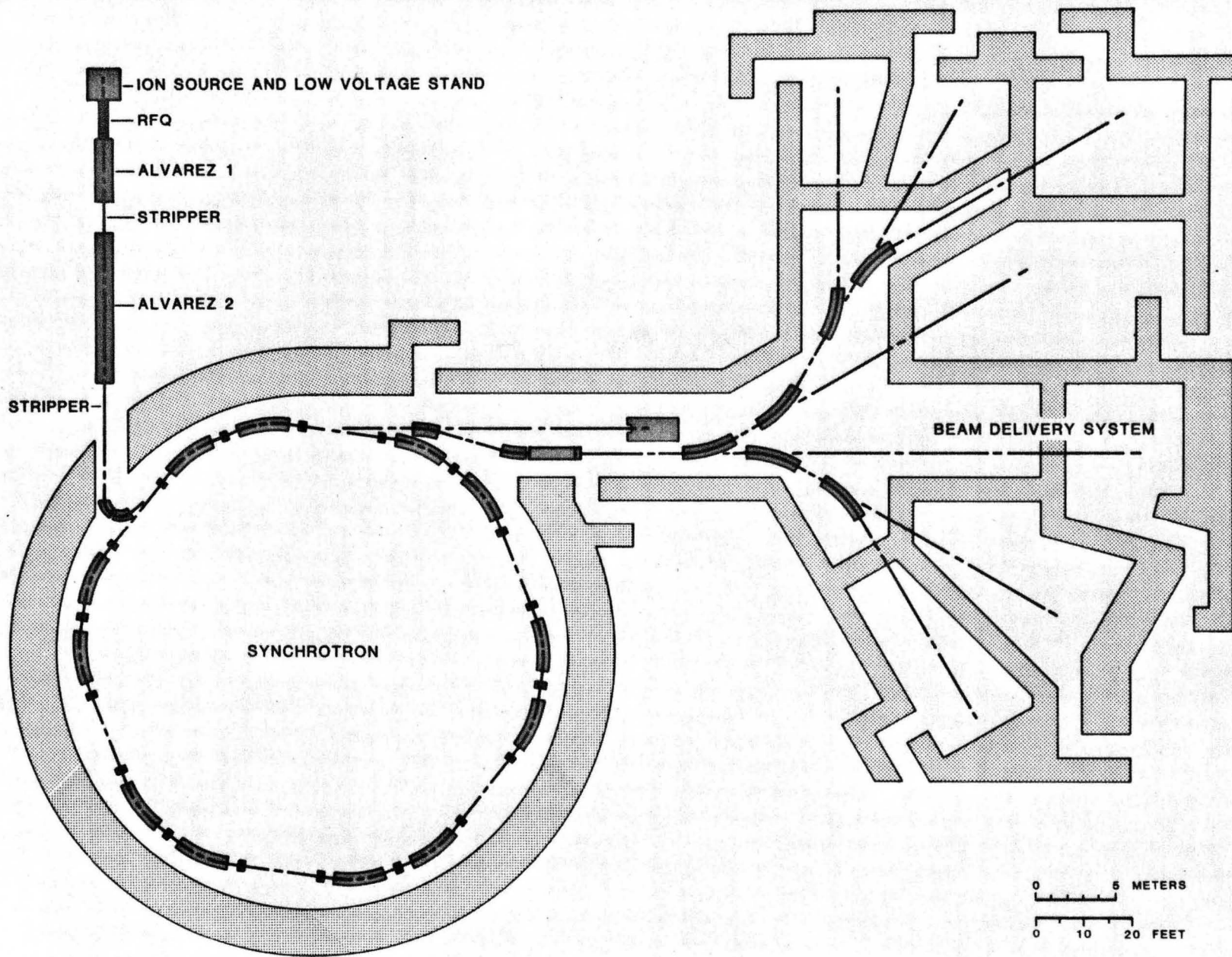




PARTICLE RADIOTHERAPY THE BLEEDING STOPPED AND THE PATIENT HAS REGAINED BOTH SIGHT AND MOTOR CONTROL.

THUS THE PROMISE OF HEAVY ION RADIOTHERAPY IS VERY EXCITING. TO PURSUE THIS THEME FURTHER, THE LABORATORY IS ENGAGED IN A COOPERATIVE PROJECT FOR DESIGNING A MEDICAL ACCELERATOR, WITH PARTICIPATION BOTH FROM OUR ACCELERATOR AND FUSION RESEARCH DIVISION AND FROM THE DONNER LABORATORY BIOLOGY AND MEDICINE DIVISION. THIS DESIGN PROJECT, WHICH IS FUNDED BY THE NATIONAL CANCER INSTITUTE, WILL TAKE A TOTAL OF ABOUT THREE YEARS. IT SHOULD LEAD TO AN ACCELERATOR OF THE FORM SCHEMATICALLY DEPICTED ON SLIDE 21. HERE WE SEE A SYNCHROCYCLOTRON WHICH HAS BEEN DESIGNED TO ACCELERATE SILICON IONS TO ENERGIES AS HIGH AS 800 MEV, SO THAT THEY WILL PENETRATE UP TO 30 CENTIMETERS IN NORMAL TISSUE. IN THIS SCHEME THERE ARE A TOTAL OF SEVEN TREATMENT AREAS, TO FACILITATE EFFICIENT UTILIZATION OF THE BEAM, RECOGNIZING THAT IT TAKES UP TO HALF AN HOUR OR MORE TO PREPARE AND ORIENT A PATIENT, BUT ONLY A FEW MINUTES TO DELIVER THE BEAM. WE LOOK FORWARD TO BUILDING AND OPERATING SUCH A MEDICAL ACCELERATOR IN THE BAY AREA WITHIN THE NEXT FEW YEARS. IN SUMMARY, OUR PROGRAM IN THE BIOLOGICAL SCIENCES IS THRIVING.

IN THE FIELD OF FUSION RESEARCH, LAWRENCE BERKELEY LABORATORY IS ACTIVE IN TWO AREAS. LABORATORY SCIENTISTS PLAYED A KEY ROLE IN THE DEVELOPMENT OF NEUTRAL BEAM INJECTORS FOR HEATING PLASMAS TO AN IGNITION TEMPERATURE



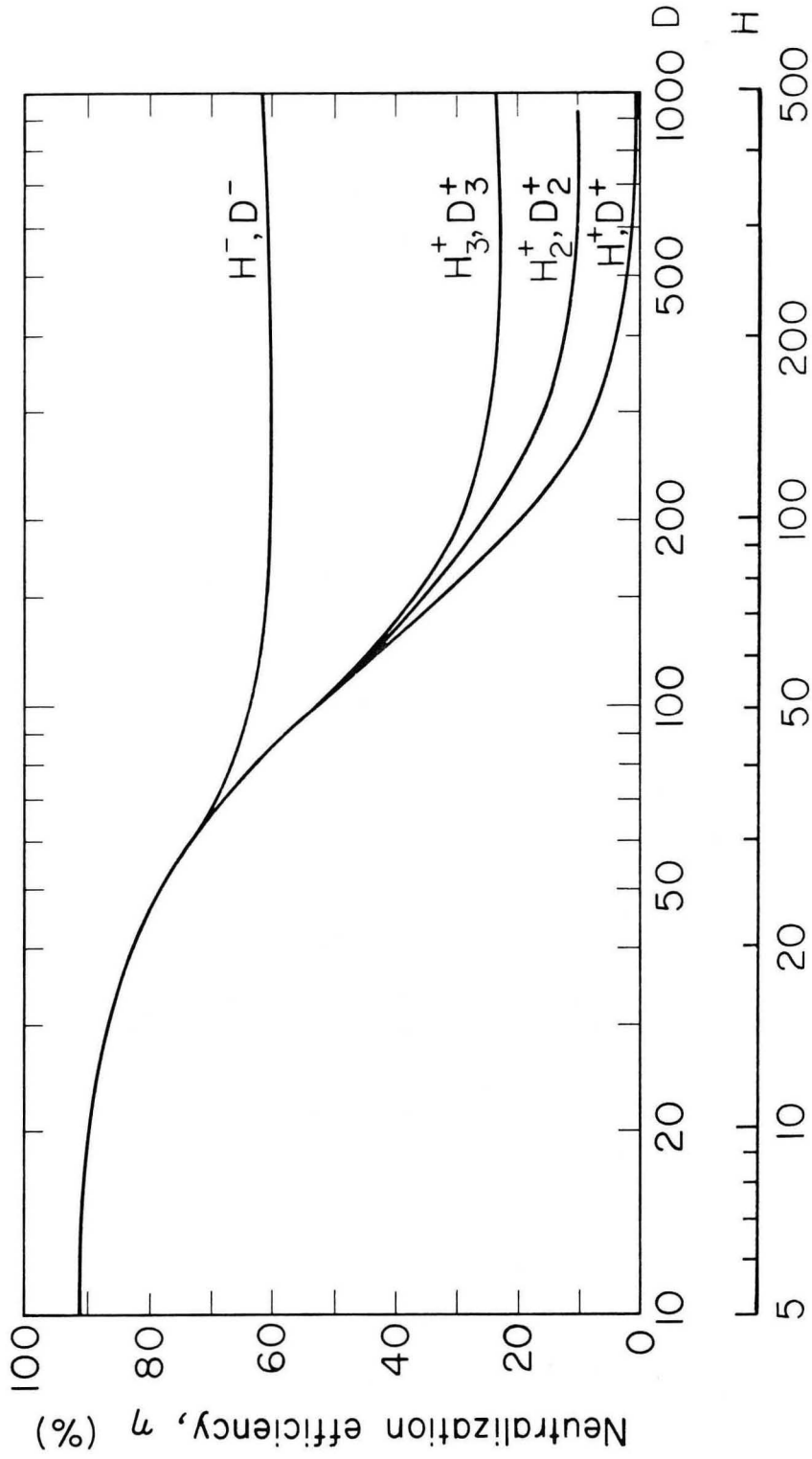
**HEAVY ION MEDICAL ACCELERATOR
CONCEPT 2**

XBL 821-7769

WHERE FUSION CAN OCCUR. THE LBL GROUP HAS DEVELOPED POSITIVE ION NEUTRAL BEAM INJECTORS THROUGHOUT THE 1970'S FOR USE IN ALL THE MAJOR MAGNETIC FUSION DEVICES. BUT NEUTRAL BEAMS BASED ON POSITIVE IONS BECOME LESS EFFICIENT AT ENERGIES IN EXCESS OF APPROXIMATELY 100 KV, AS SHOWN IN SLIDE 22. THE NATURAL NEXT STEP IS THE DEVELOPMENT OF THE HIGHER EFFICIENCY NEGATIVE ION NEUTRAL BEAMS. I AM PLEASED TO REPORT THAT THE LBL GROUP WILL BE CONSTRUCTING A NEUTRAL BEAM ENGINEERING TEST FACILITY, AND THAT THEY HAVE THE ASSIGNMENT OF DEVELOPING NEGATIVE ION NEUTRAL BEAM SOURCES. SLIDE 23 SHOWS KEN EHLERS WITH A SOURCE OF SURFACE PRODUCED NEGATIVE IONS THAT HE INVENTED AND WHICH CONSTITUTES A MAJOR STEP IN THE DEVELOPMENT OF NEUTRAL BEAM INJECTORS. FINALLY, ON SLIDE 24, A TABLE IS SHOWN OF THE PROGRESS IN DEVELOPMENT OF NEGATIVE ION NEUTRAL BEAM SOURCES.

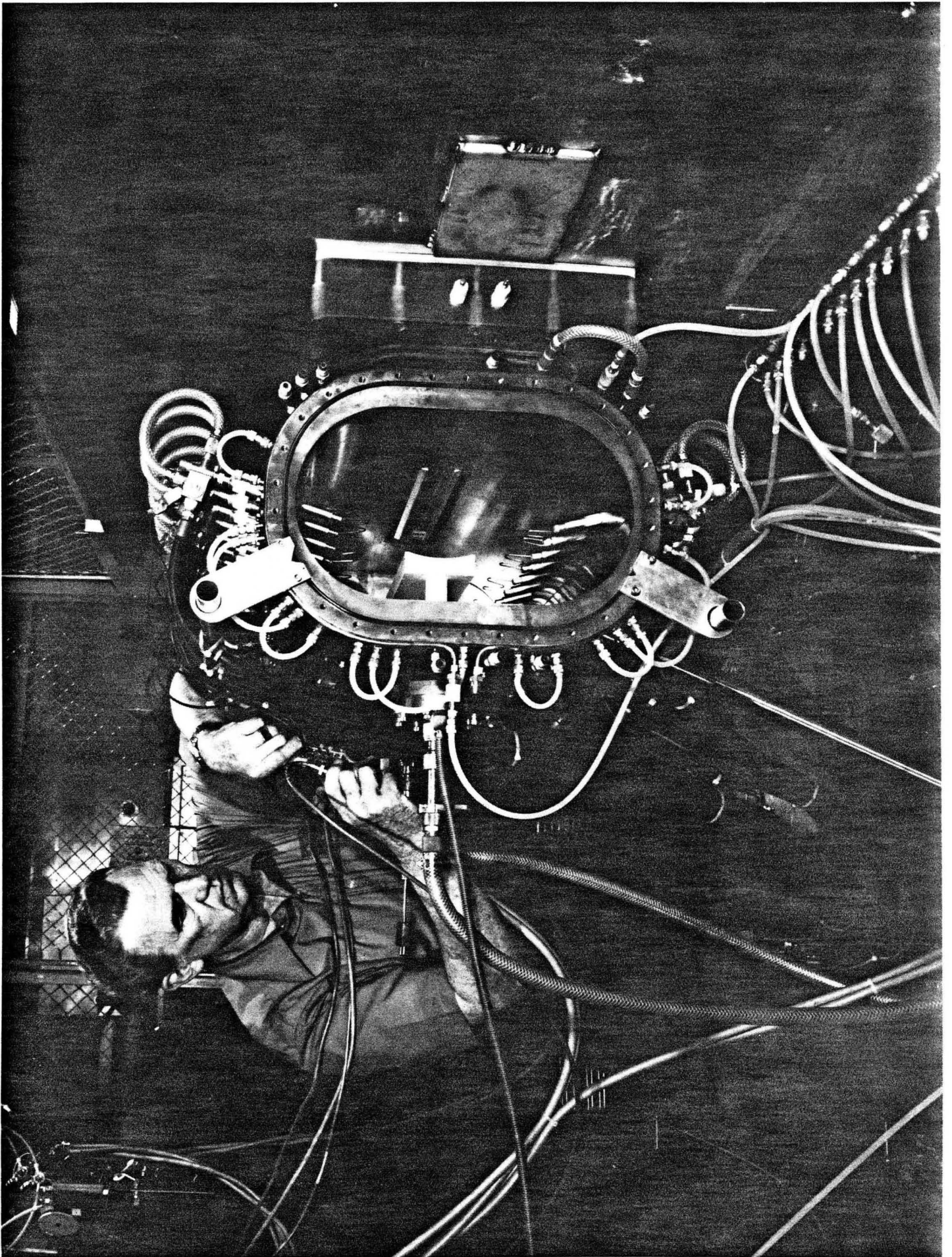
LBL EXPERTISE WITH INDUCTION LINACS PROVIDE ANOTHER ENTREE FOR THE LABORATORY IN FUSION, IN THE AREA OF HEAVY ION INERTIAL FUSION. FOR SEVERAL YEARS THE LABORATORY HAS PROPOSED TO DESIGN AN INDUCTION LINAC TO TEST THE HEAVY ION FUSION CONCEPT. AS YET THIS OPTION HAS NOT BEEN PICKED UP AS PART OF A NATIONAL PROGRAM, BUT WE HOPE THAT IT WILL IN THE FUTURE.

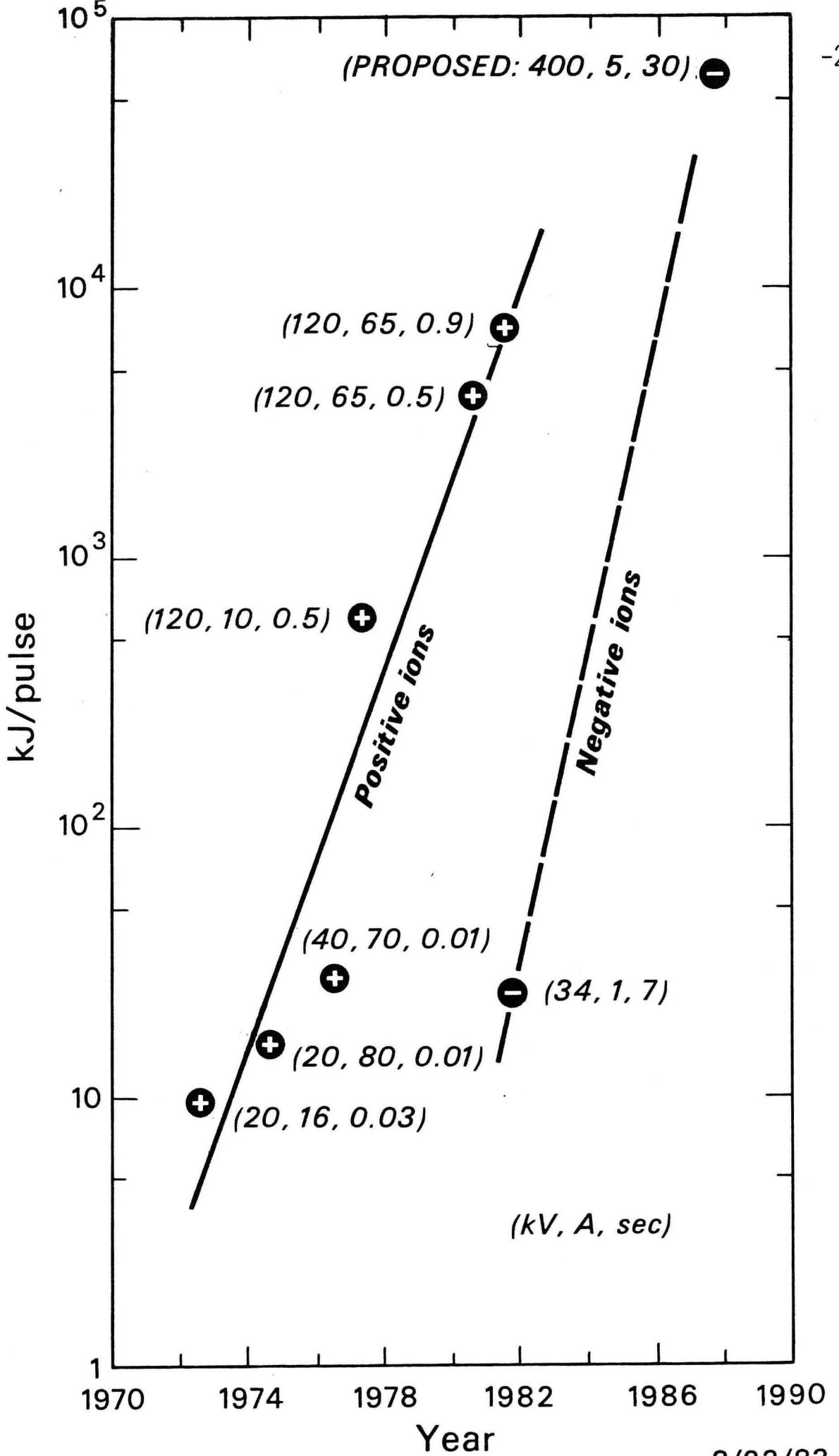
THE PROGNOSIS FOR THE FUSION PROGRAM IS OPTIMISTIC, BASED ON THE GREAT TECHNICAL EXPERTISE PRESENT AT LBL. THIS IS A DYNAMIC AREA BOTH NATIONALLY AND LOCALLY, AND THERE ARE REAL PROSPECTS FOR GROWTH HERE.



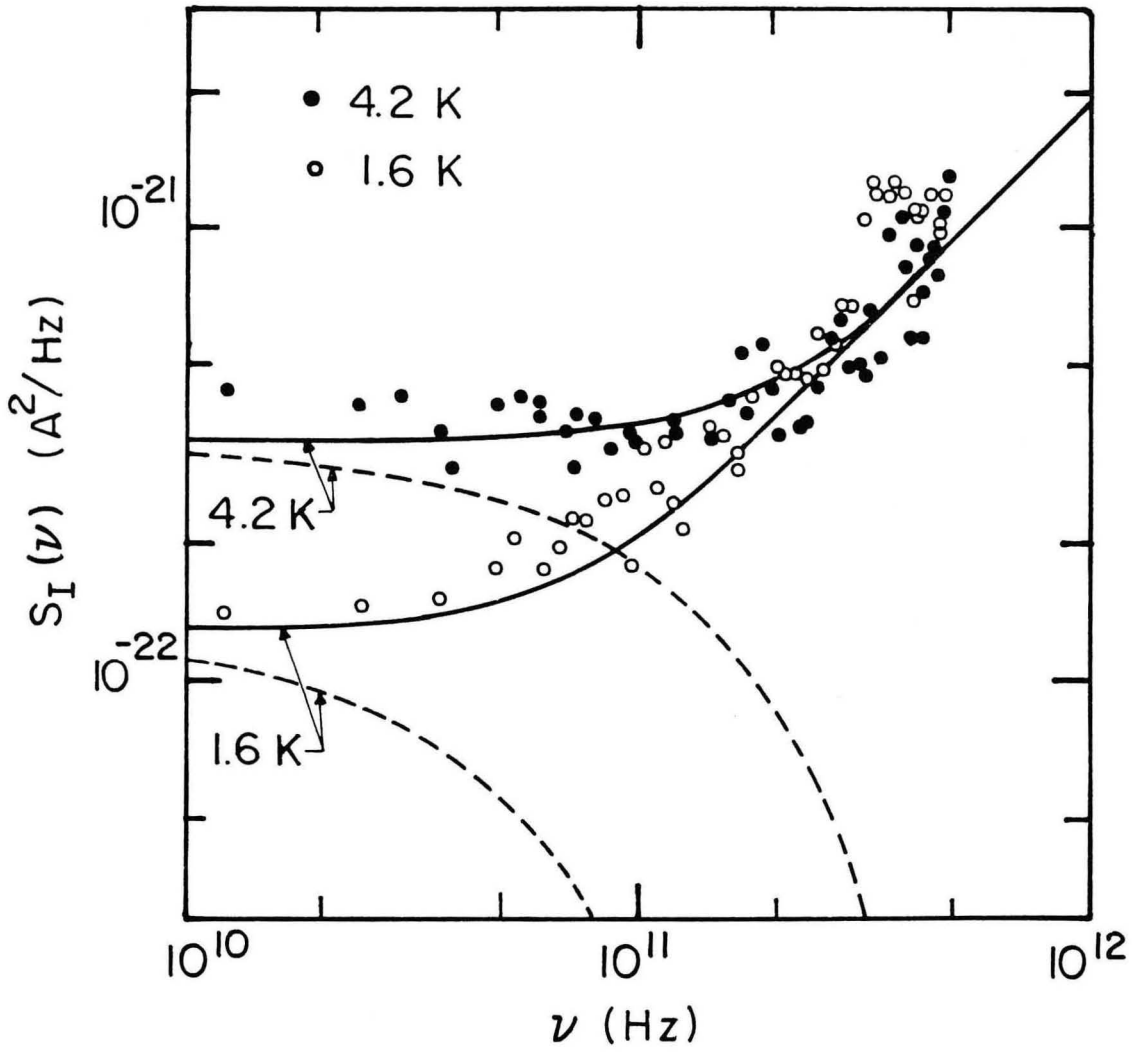
Energy of H or D atoms (keV)

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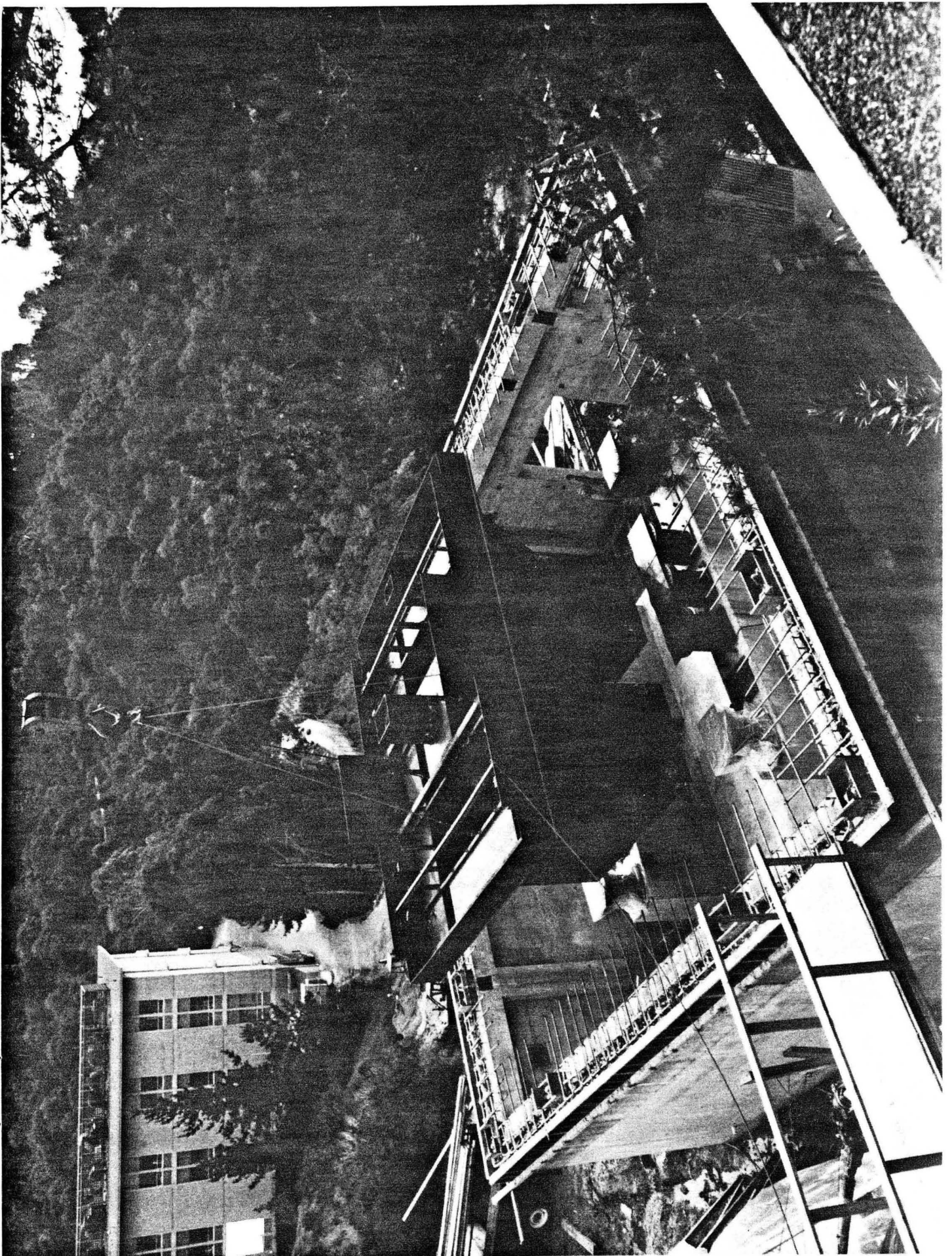
TURNING NOW TO THE BASIC ENERGY SCIENCES, WE FIND A HIGH QUALITY AND VIGOROUS LBL PROGRAM, WITH PARTICULAR STRENGTH IN THE CHEMICAL AND MATERIALS SCIENCES. AS A FIRST EXAMPLE OF A RECENT ACHIEVEMENT IN THIS PROGRAM, I WOULD LIKE TO CALL YOUR ATTENTION TO THE OBSERVATION OF ZERO-POINT NOISE IN A JOSEPHSON TUNNEL JUNCTION BY JOHN CLARKE AND CO-WORKERS. TUNNEL JUNCTIONS FORM THE CENTRAL COMPONENTS OF DC SQUIDS (SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES), WHICH ARE THEORETICALLY CAPABLE OF EXTREMELY LOW NOISE OPERATION. CLARKE AND CO-WORKERS HAVE DEVELOPED BOTH A THEORY OF QUANTUM NOISE, AND VERY HIGH PERFORMANCE TUNNEL JUNCTIONS. SLIDE 25 SHOWS THE MEASURED SPECTRAL DENSITY OF CURRENT NOISE IN A SHUNT RESISTANCE AT VERY LOW TEMPERATURES. THE CURVES GIVE THEORETICAL PREDICTIONS WITH AND WITHOUT ZERO-POINT FLUCTUATIONS. CLEARLY THE FULL CURVES, IN WHICH ZERO-POINT FLUCTUATIONS ARE TAKEN INTO ACCOUNT, DESCRIBE THE DATA QUITE WELL. THUS, CLARKE AND CO-WORKERS HAVE OBSERVED THE EFFECTS OF THE QUANTUM-MECHANICAL LOWER NOISE LIMIT. THE THEORY HAS ALSO BEEN USED TO COMPUTE THE ULTIMATE ENERGY RESOLUTION OF A DC SQUID, YIELDING AN ULTIMATE ENERGY RESOLUTION PER UNIT BANDWIDTH OF \hbar . AN EXPERIMENTAL ENERGY RESOLUTION OF APPROXIMATELY $2 \hbar$ HAS ACTUALLY BEEN ACHIEVED.



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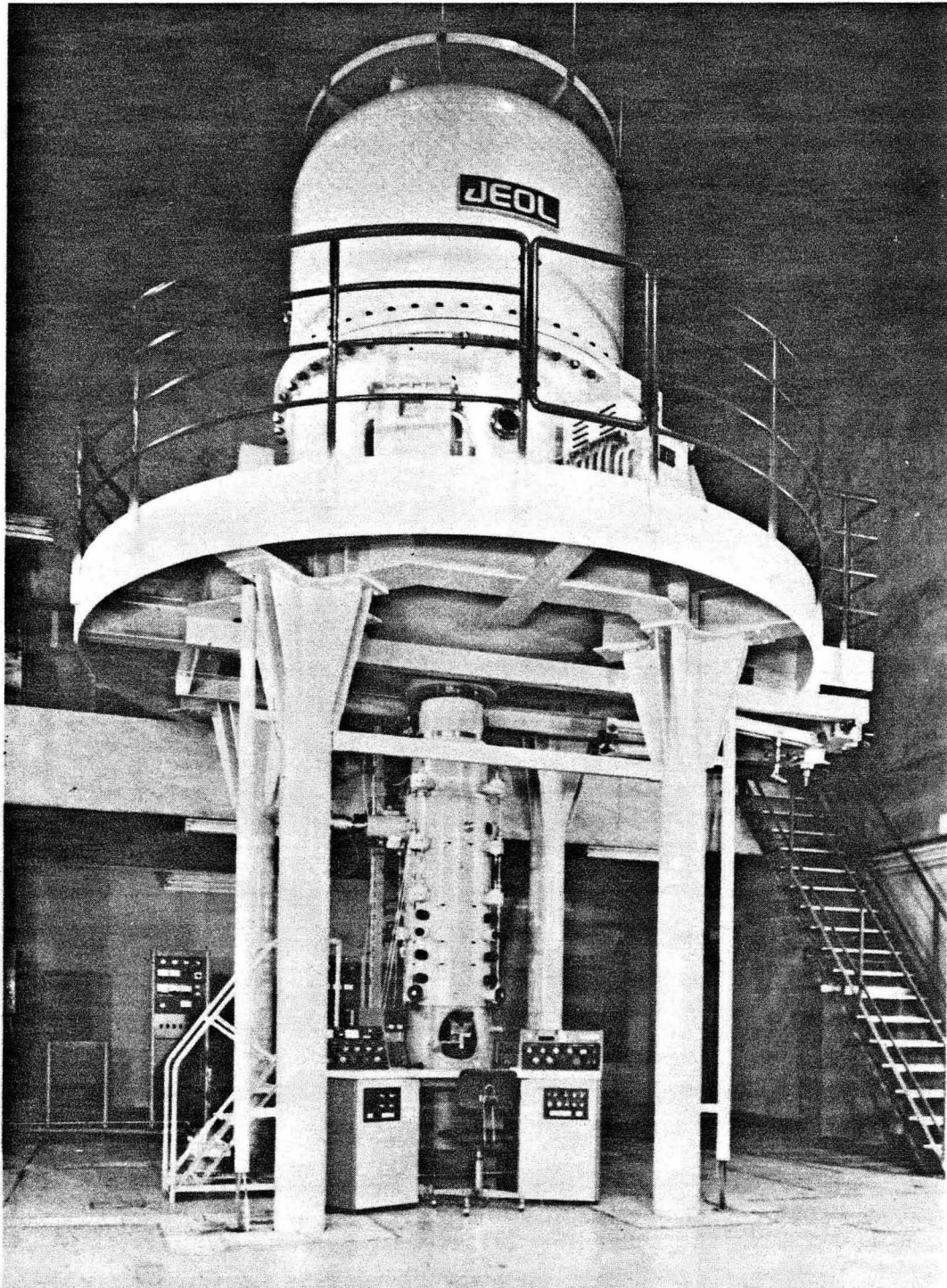
TURNING NOW TO BIG SCIENCE, WE SEE IN SLIDE 26 A PICTURE OF THE VIBRATION ISOLATION SUPPORT FOR THE ATOMIC RESOLUTION MICROSCOPE BEING LOWERED INTO PLACE NEAR BUILDING 72. THE MICROSCOPE ITSELF IS APPROACHING COMPLETION BY JEOL IN JAPAN. IT IS SHOWN IN SLIDE 27. AT THE BASE OF THIS GODZILLA-LIKE STRUCTURE IS THE EXPERIMENTAL CONSOLE. IN SLIDE 28 WE SEE GARETH THOMAS POSING WITH A GROUP OF JAPANESE ENGINEERS IN FRONT OF THE CONSOLE. WITH THE ATOMIC RESOLUTION MICROSCOPE IT SHOULD BE POSSIBLE TO VISUALIZE IN A RELATIVELY ROUTINE FASHION THE ATOMS IN MATERIALS OF TECHNOLOGICAL INTEREST.

THE NATIONAL LABORATORY SETTING OF THE BASIC ENERGY SCIENCES PROGRAM IS PARTICULARLY VALUABLE IN THAT IT FACILITATES INTERACTION AMONG INVESTIGATORS WITH DIVERSE INTERESTS, FOCUSING THEIR ATTENTION ON SIMILAR PROBLEMS. SLIDE 29 SHOWS A TRANSMISSION ELECTRON MICROGRAPH OF A CATALYTIC REACTION IN WHICH DROPLETS OF POTASSIUM HYDROXIDE ARE CATALYZING THE GASIFICATION OF GRAPHITE. IN THE SUCCESSIVE PANELS ONE CAN SEE THE KOH DROPLETS OPENING WIDER CHANNELS. THIS WORK WAS CARRIED OUT BY E. J. COATES AND J. W. EVANS IN MMRD, USING AN ENVIRONMENTAL CHAMBER ON AN ELECTRON MICROSCOPE. A SIMILAR REACTION UNDER VERY DIFFERENT CONDITIONS IS ALSO UNDER STUDY IN GABOR SOMORJAI'S LABORATORY, WHERE METHANE HAS BEEN OBSERVED AS THE PRIMARY GASEOUS PRODUCT. BY ATTACKING THE PROBLEM WITH DIFFERENT TOOLS UNDER DIFFERENT CONDITIONS AND FROM

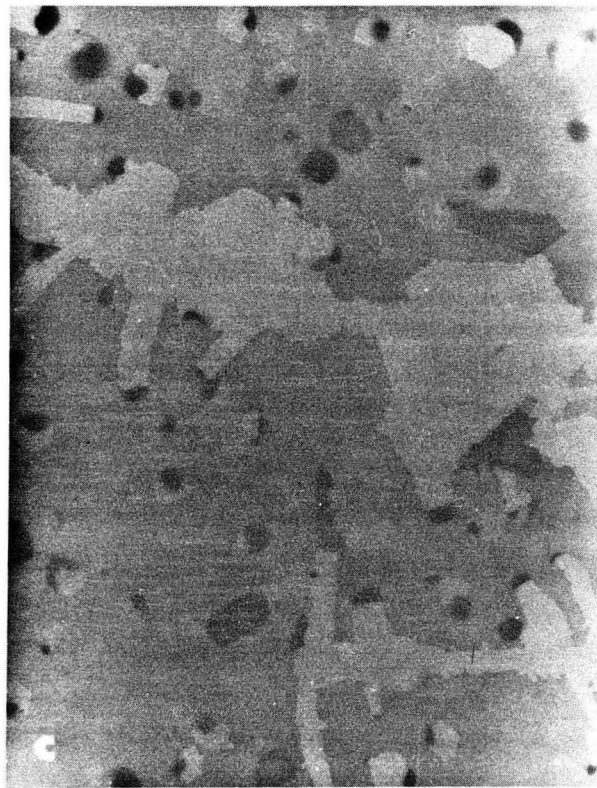
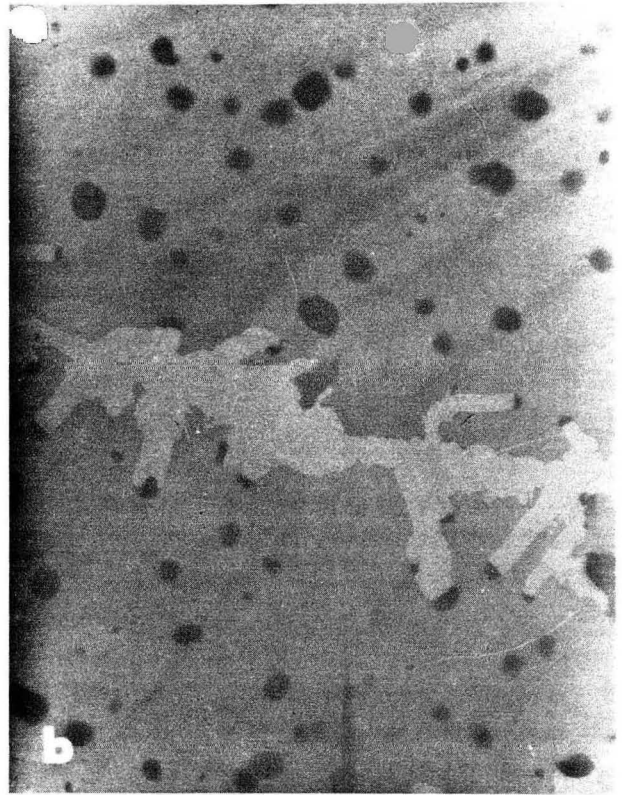
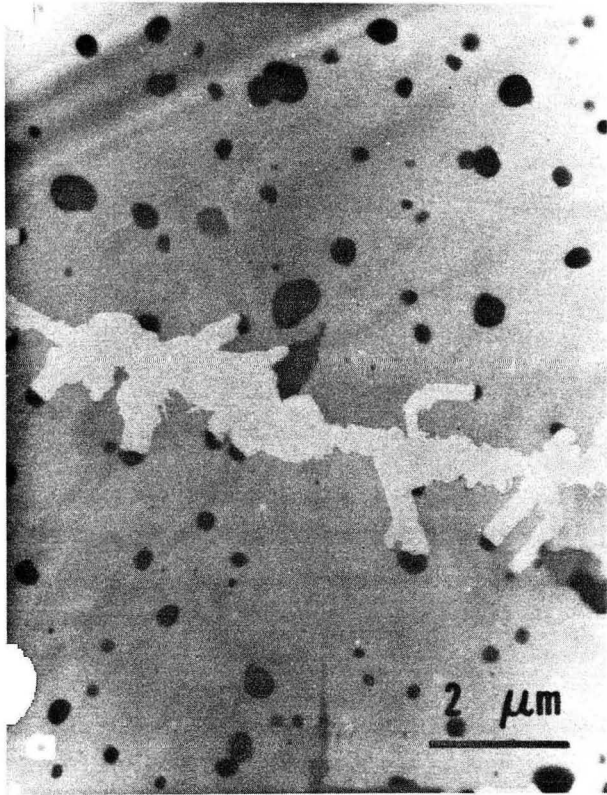


JEM-1000/1250

HIGH VOLTAGE ELECTRON MICROSCOPE





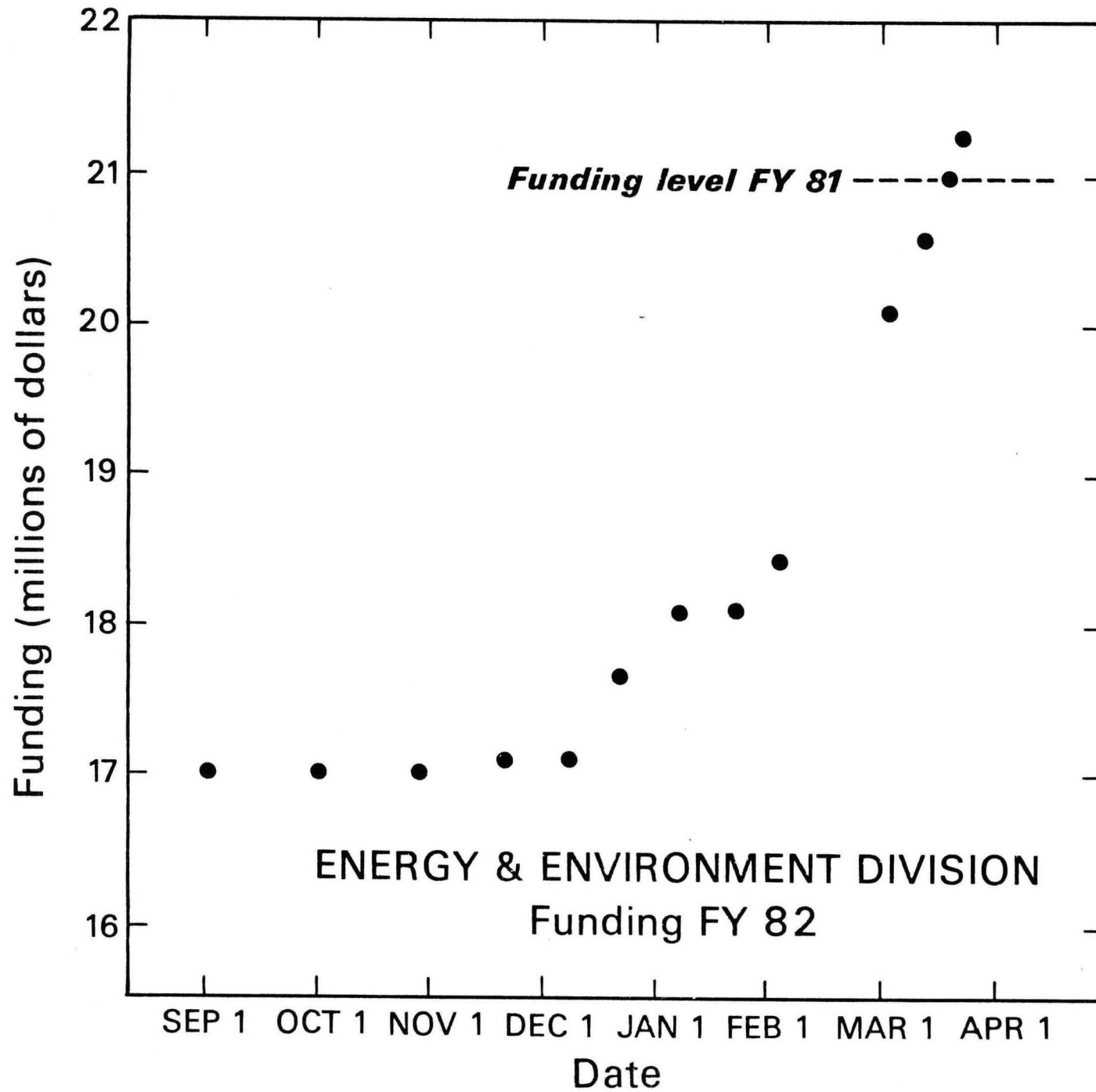


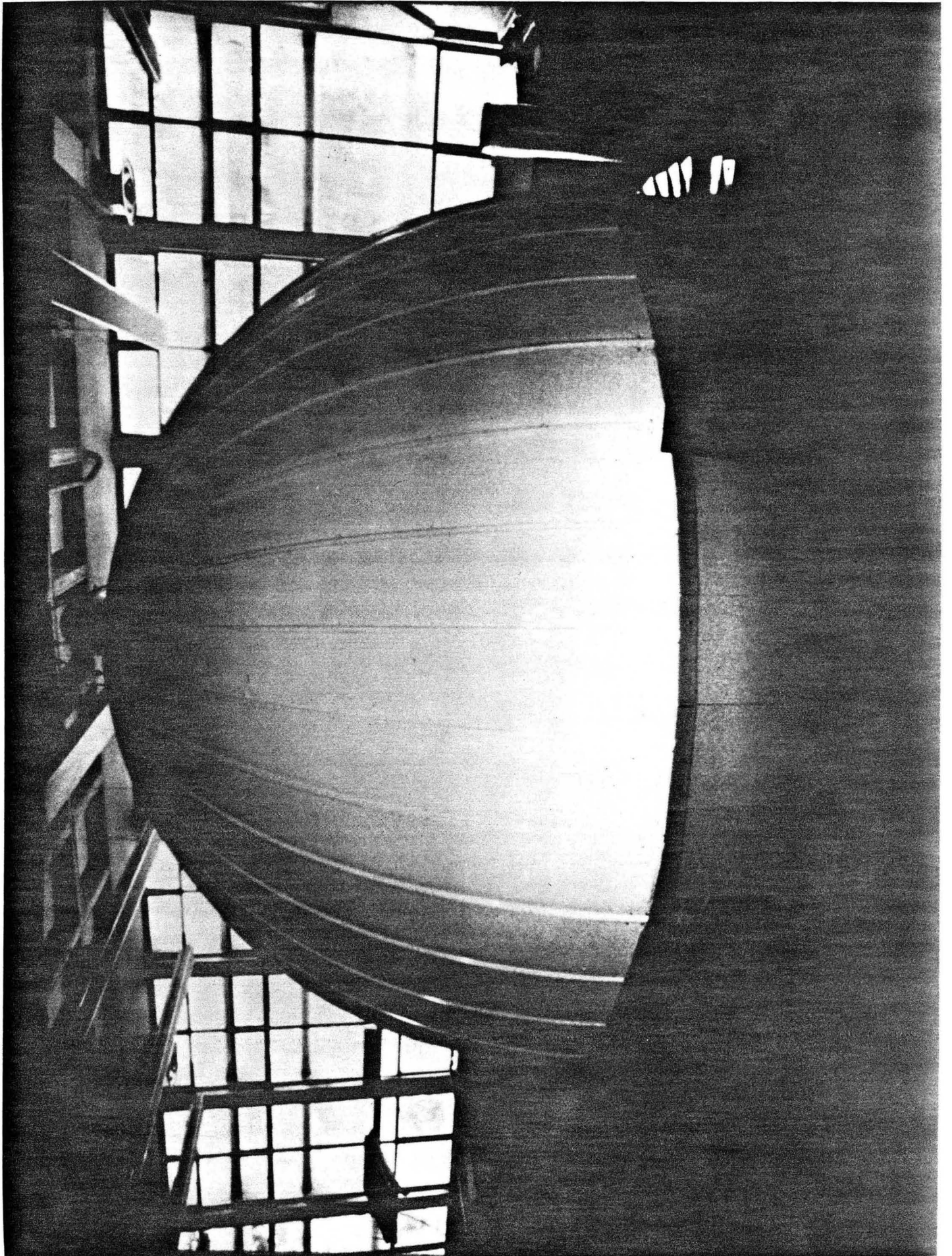
DIFFERENT PERSPECTIVES. MMRD SCIENTISTS ARE ACQUIRING AN UNDERSTANDING OF A WHOLE RANGE OF CATALYTIC REACTIONS ON GRAPHITE.

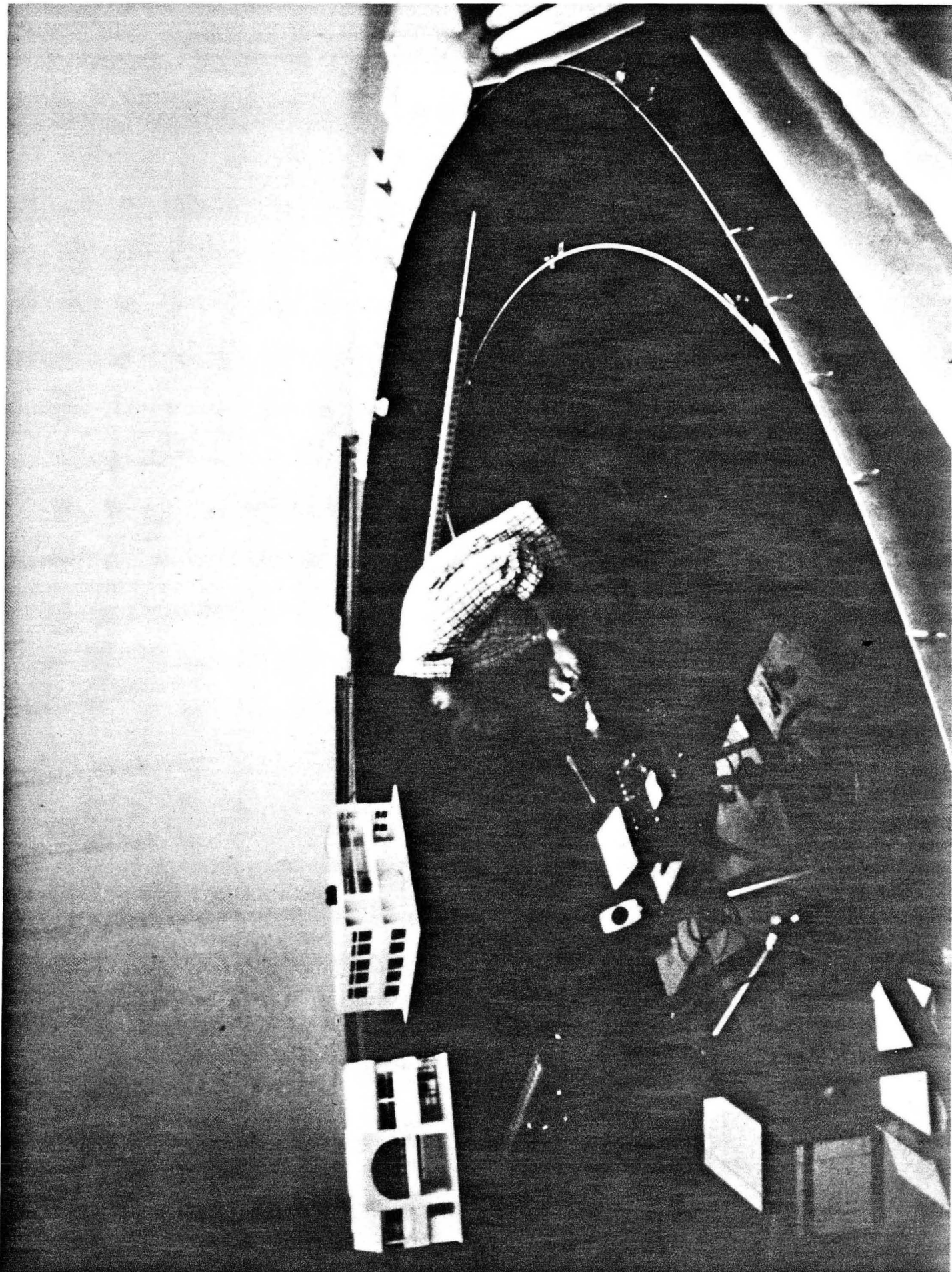
LET ME TURN NOW TO THE LABORATORY'S ENERGY TECHNOLOGY PROGRAMS WHICH ARE SITUATED PRIMARILY IN THE ENERGY AND ENVIRONMENT DIVISION AND THE EARTH SCIENCES DIVISION. FIRST I WILL SHOW A SLIDE ON A SUBJECT WHICH CONSUMES FAR TOO MUCH OF OUR ATTENTION THESE DAYS -- NAMELY THE FUNDING OF THESE PROGRAMS. SLIDE 30 SHOWS THE TIME EVOLUTION OF THE FUNDING LEVEL IN THE ENERGY AND ENVIRONMENT DIVISION DURING FY 1982. AS YOU CAN SEE, THIS FUNCTION CROSSED THE 1981 LEVEL EARLIER THIS MONTH. THIS IS A VERY WELCOME RESULT, BUT THE TIME VARIATION ILLUSTRATES THE UNCERTAINTIES IN THE SUPPORT OF ENERGY TECHNOLOGY PROGRAMS WHICH CAUSE GREAT CONCERN.

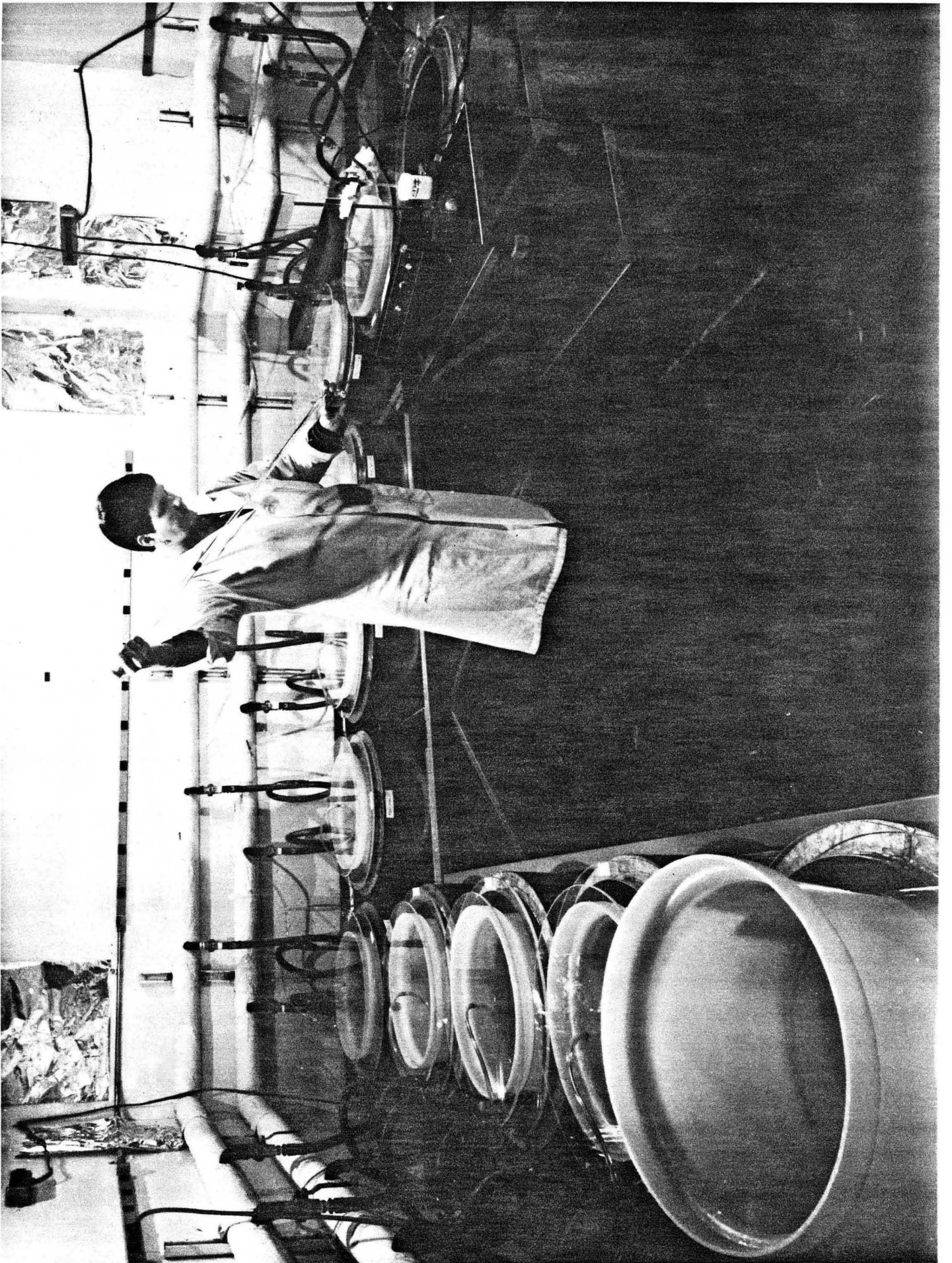
TURNING TO SCIENCE, WE SEE IN SLIDES 31 AND 32 PHOTOGRAPHS OF A 24-FOOT DIAMETER ARTIFICIAL SKYDOME WHICH HAS BEEN CONSTRUCTED ON THE UC CAMPUS FOR OUR DAYLIGHT STUDIES PROGRAM TO FACILITATE MODEL STUDIES OF DAYLIGHTING BY ASSESSING THE EFFICIENCY OF ARCHITECTURAL MODELS OF BUILDINGS IN PASSING LIGHT TO THE INTERIOR.

THE RESEARCH PROGRAM OF THE LBL AQUATIC MICROCOSM GROUP EMPHASIZES THE EFFECTS OF ACID RAIN ON AQUATIC SYSTEMS. CHANGES IN LAKE WATER CHEMISTRY AND BIOLOGY DUE TO ACID INPUT ARE THE FOCUS OF THE RESEARCH OF THIS GROUP. SLIDE 33 SHOWS JOAN OLDFATHER WORKING WITH





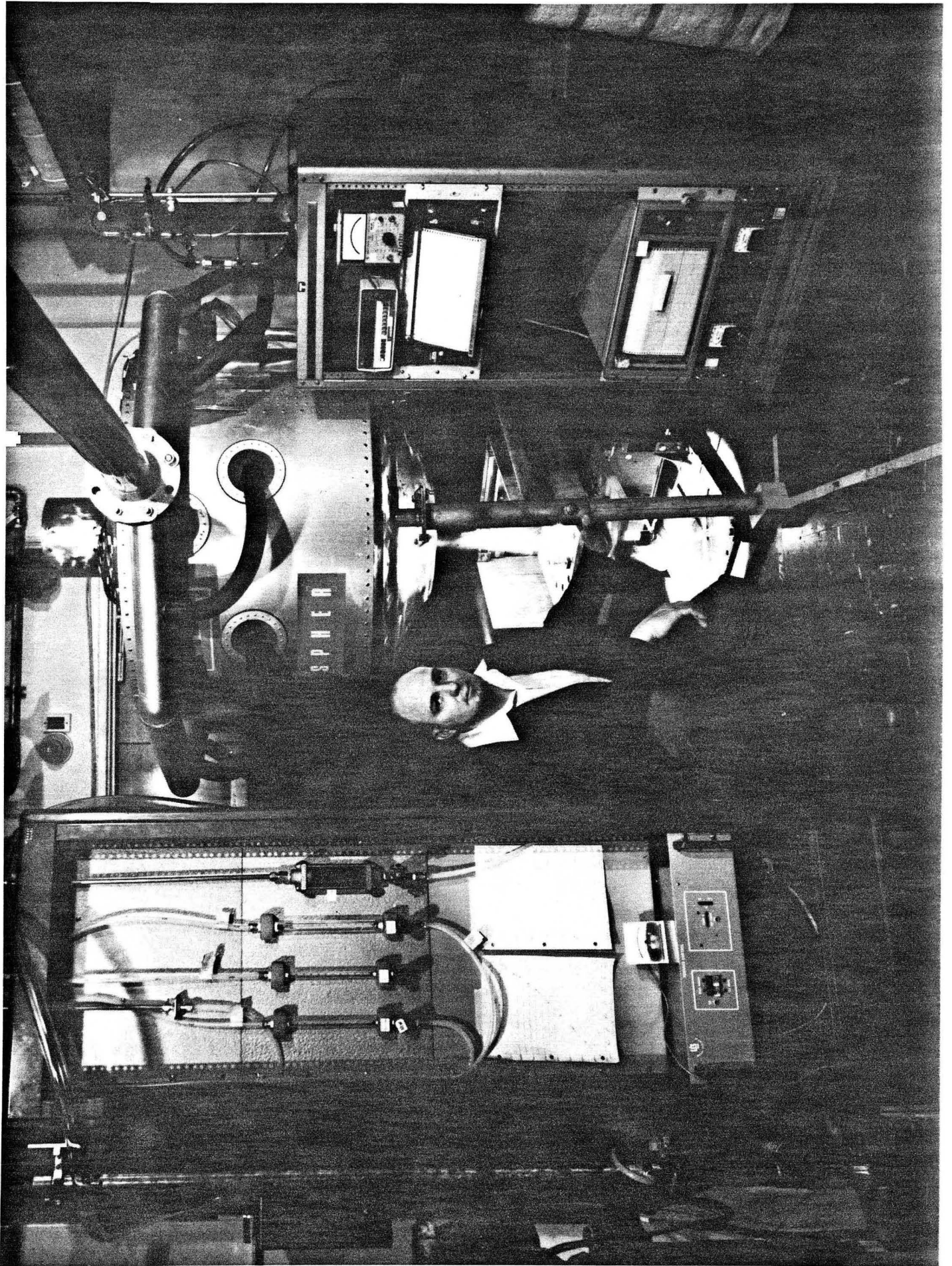




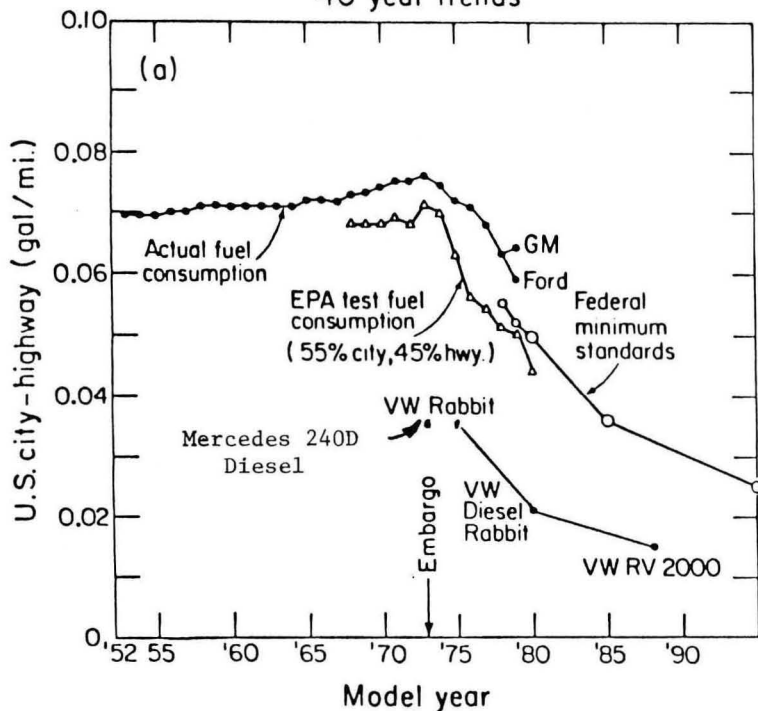
SIMULATED LAKE SYSTEMS UNDER CONTROLLED CONDITIONS TO STUDY THE MECHANISMS BY WHICH LAKES BECOME ACIDIFIED IN NATURE.

IN THE FIELD OF SOLAR ENERGY RESEARCH, LBL SCIENTIST ARLON HUNT HAS INVENTED A SMALL-PARTICLE HEAT-EXCHANGE RECEIVER BASED ON THE ABILITY OF SUSPENDED SMALL PARTICLES TO ABSORB HEAT AND RELEASE IT QUICKLY. SLIDE 34 SHOWS HIM POSING WITH AN EXPERIMENTAL RECEIVER THAT WAS DESIGNED AND FABRICATED AT LBL DURING THE PAST YEAR. THE RECEIVER WILL BE TAKEN TO THE SOLAR THERMAL TEST FACILITY AT GEORGIA TECH WHERE A FIELD OF SUNTRACKING MIRRORS (HELIOSTATS) WILL PROVIDE CONCENTRATED SUNLIGHT TO TEST ITS EFFECTIVENESS.

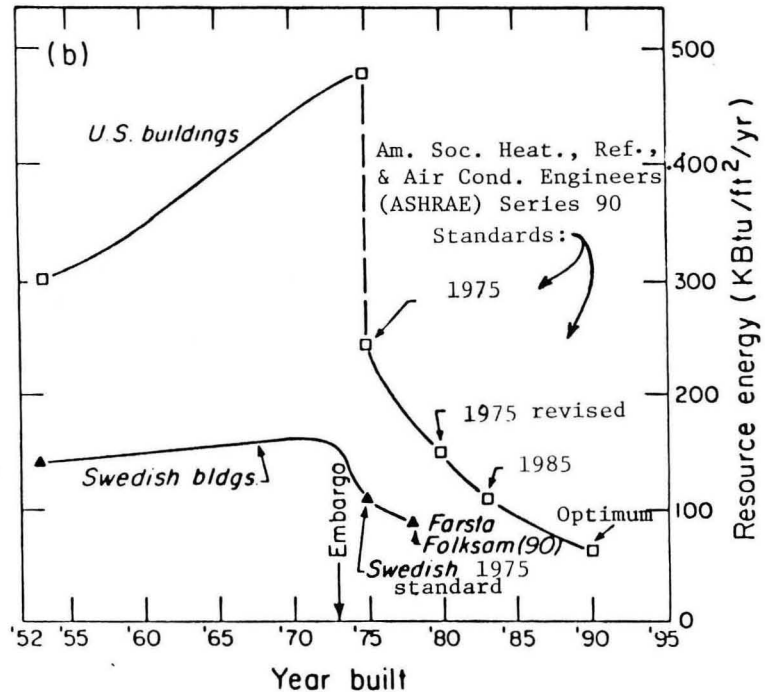
CONSERVATION HAS BECOME A VERY ATTRACTIVE OPTION IN THE UNITED STATES DURING THE PAST TEN YEARS, AS ECONOMIC FORCES HAVE DRIVEN THE PRICE OF ENERGY UP SEVERALFOLD. SLIDE 35 HAS BEEN USED VERY EFFECTIVELY BY LBL'S ENERGY EFFICIENT BUILDINGS PROGRAM, AND IT IS ONE OF MY FAVORITE SLIDES. IT DRAWS OUR ATTENTION TO TWO BASIC FACTS. FIRST, THE ENERGY CONSUMED IN TRANSPORTATION IS APPROXIMATELY EQUAL TO THAT CONSUMED IN TEMPERATURE CONTROL OF BUILDINGS, AND EACH IS ABOUT ONE-THIRD OF THE TOTAL ENERGY CONSUMED IN THIS COUNTRY. SECOND, AMERICANS HAVE HISTORICALLY DONE A VERY INEFFICIENT JOB OF ENERGY UTILIZATION FOR BOTH OF THESE PURPOSES -- ABOUT A FACTOR OF TWO LESS EFFICIENT THAN THE BEST EUROPEAN PRACTICE. A



Auto Fuel Consumption
40 year trends



Office Building Resource Energy Intensity,
40 year trends



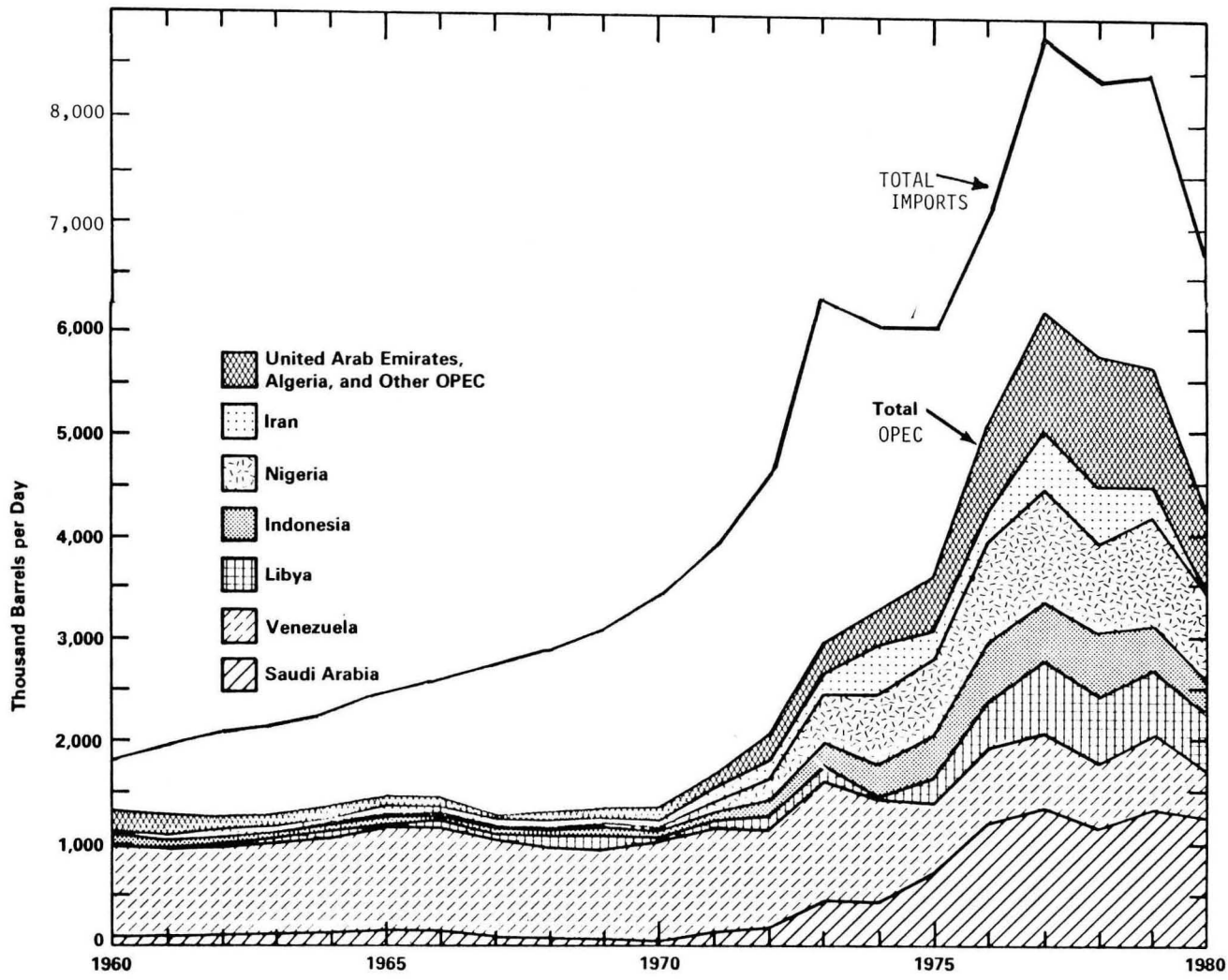
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COMBINATION OF MARKET FORCES AND REGULATION HAS GREATLY IMPROVED THE ENERGY EFFICIENCY IN THE TRANSPORTATION AREA: SIMILAR IMPROVEMENT IS CERTAINLY POSSIBLE IN THE ENERGY EFFICIENCY OF BUILDINGS. HOW IS CONSERVATION WORKING IN THIS COUNTRY? IN SLIDE 36 WE SEE A PLOT OF OIL IMPORTS AS A FUNCTION OF TIME OVER THE LAST 20 YEARS. IMPORTS DECLINED SUBSTANTIALLY IN 1980.

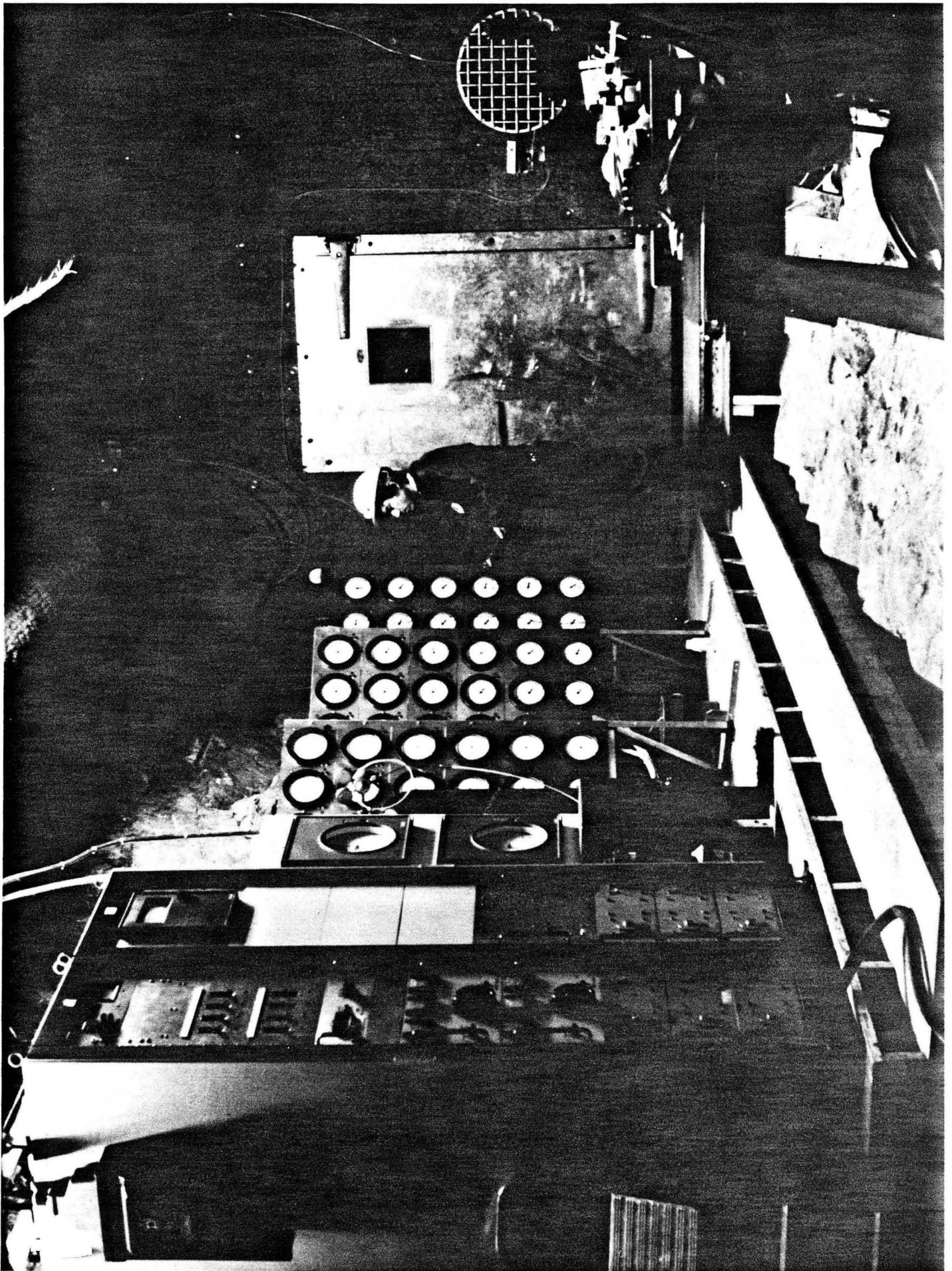
THE EARTH SCIENCES DIVISION HAS CONTINUED THEIR GOOD WORK RELATED TO THE STRIPA MINE PROJECT IN SWEDEN. FIELD WORK WAS COMPLETED AND A SUMMARY REPORT WAS PUBLISHED AS A LEAD ARTICLE IN THE SCIENCE. SLIDE 37 SHOWS A PHOTOGRAPH OF THE CONTROL STATION OF A PROTOTYPE EXPERIMENT -- THE MACROPERMEABILITY TEST -- CONDUCTED ON A MILLION CUBIC METER ROCK MASS AT STRIPA TO MEASURE THE PERMEABILITY OF THIS VERY LARGE SAMPLE. SLIDE 38 SHOWS THE ULTRA LARGE CORE TEST FACILITY AT RICHMOND FIELD STATION WITH A ROCK CORE BEING PREPARED FOR TESTS TO INVESTIGATE THE CHARACTERISTICS OF WATER FLOW THROUGH FRACTURES UNDER VARYING HYDRAULIC AND MECHANICAL LOADS. AS NATIONAL INTEREST CONTINUES IN ESTABLISHING UNDERGROUND REPOSITORIES IN THE UNITED STATES, THERE WILL BE A SUSTAINED DEMAND FOR THE SKILLS OF OUR EARTH SCIENCE DIVISION GROUP. THEY ARE NOW FOCUSING THEIR ATTENTION ON OTHER CANDIDATE ROCK TYPES SUCH AS BASALT.

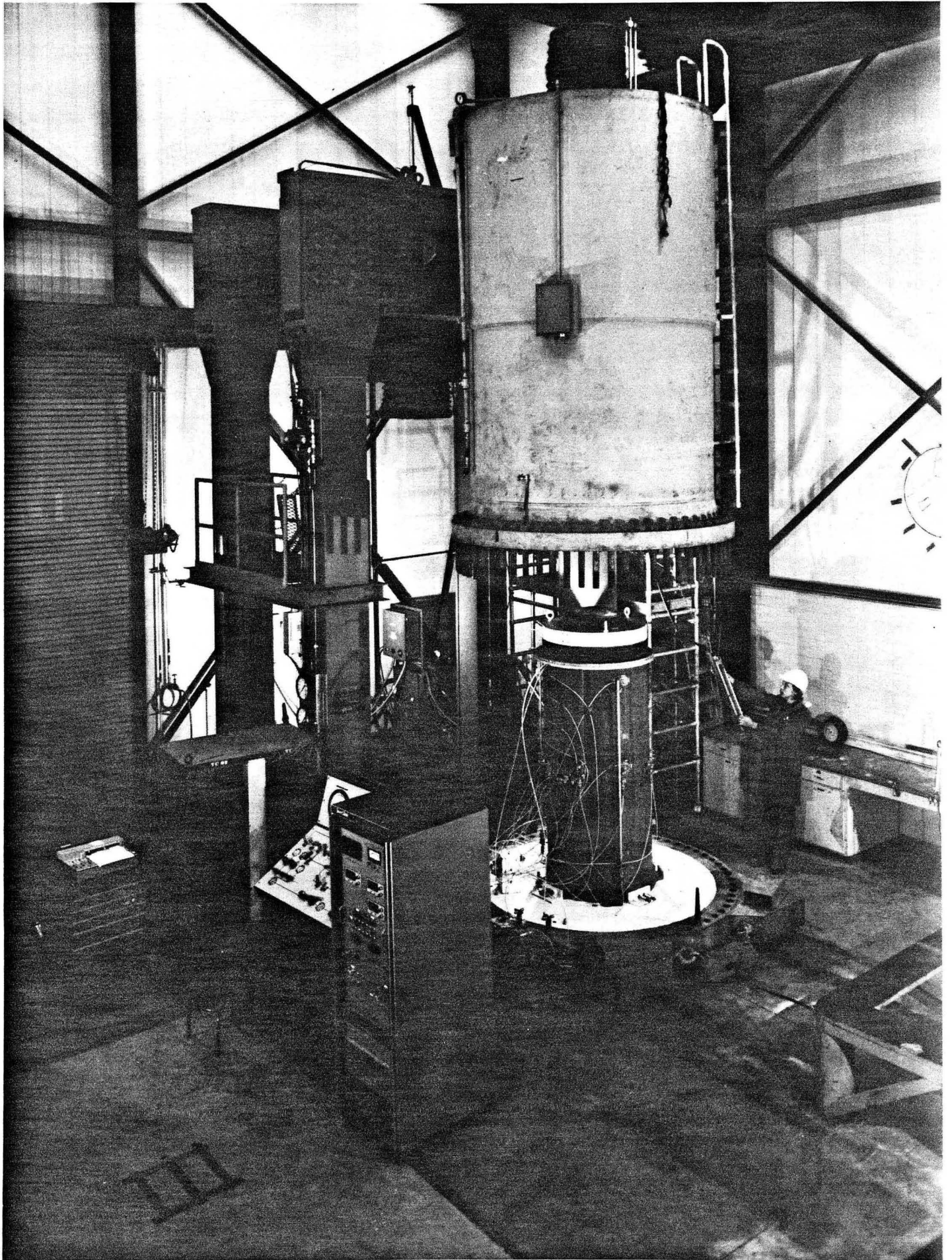
THERE YOU HAVE A SELECTIVE AND VERY SUPERFICIAL OVERVIEW OF A FEW OF THE MAJOR ACTIVITIES OF THIS

IMPORTED PETROLEUM

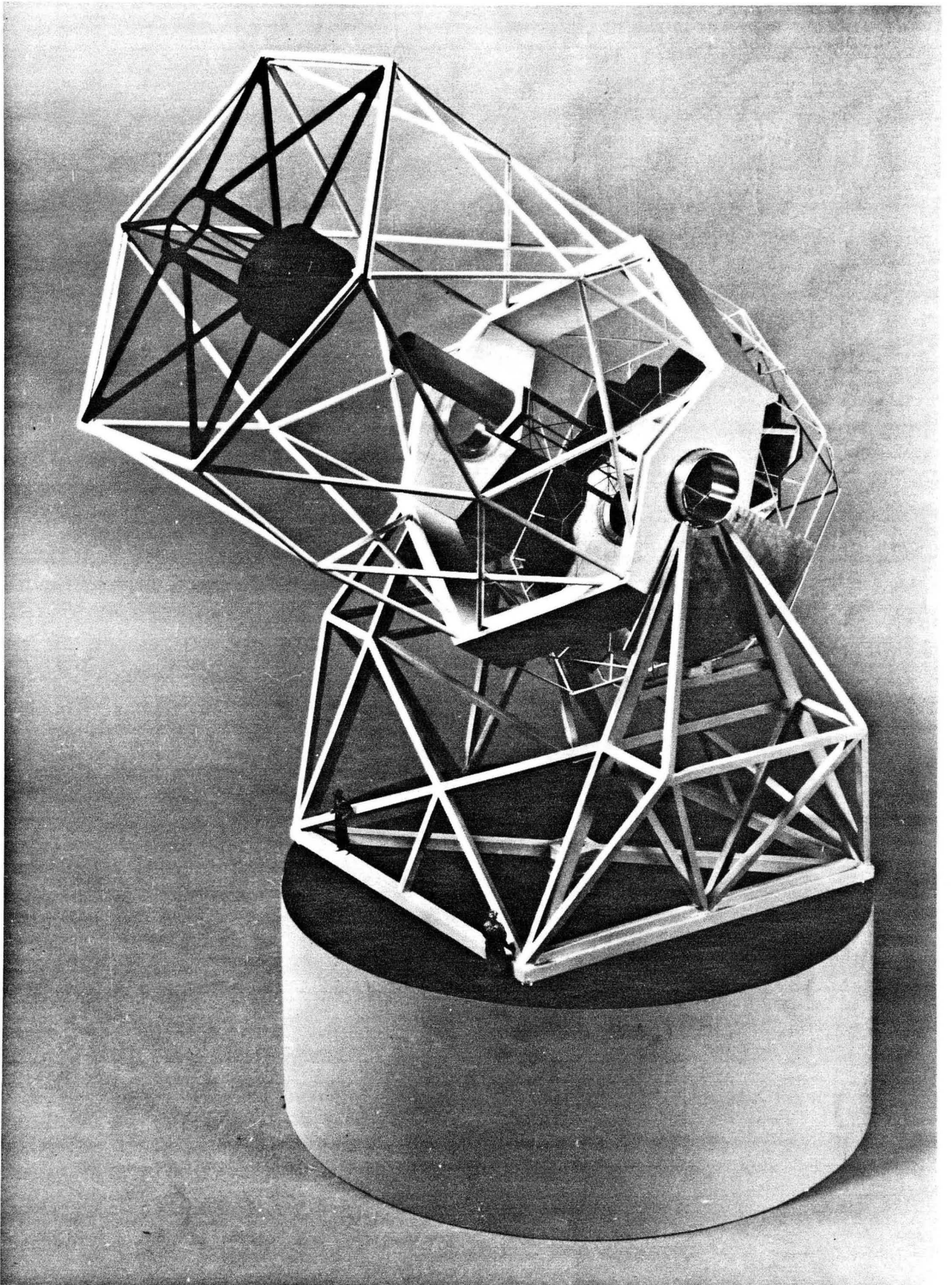


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LABORATORY DURING THE PAST TWO YEARS. I COULD CITE MANY MORE EXAMPLES. I WOULD LIKE TO MENTION JUST ONE: JERRY NELSON'S PROPOSED MULTISEGMENTED MIRROR DESIGN FOR THE UNIVERSITY OF CALIFORNIA TEN METER TELESCOPE. THIS IS A UNIVERSITYWIDE PROJECT WITH WHICH I AM VERY FAMILIAR, BOTH BECAUSE IT WAS BORN IN LBL AND BECAUSE I AM A MEMBER OF THE EXECUTIVE MANAGEMENT COMMITTEE. IT IS CHARACTERISTIC OF LAWRENCE BERKELEY LABORATORY THAT WHILE WE REACH FOR THE FRONTIER ON AN ATOMIC SCALE WITH THE ATOMIC RESOLUTION MICROSCOPE WE ARE ALSO REACHING FOR THE STARS BY PROPOSING TO BUILD THE WORLD'S LARGEST TELESCOPE. IT IS ALSO CHARACTERISTIC THAT JERRY'S DESIGN IS BASED ON STATE-OF-THE-ART TECHNOLOGY. SLIDE 39 SHOWS A MODEL OF THE TELESCOPE AND IN SLIDE 40 WE SEE A PHOTOGRAPH OF ITS PROPOSED LOCATION ON TOP OF MAUNA KEA ON THE ISLAND OF HAWAII. I CANNOT THINK OF A BETTER SCIENTIFIC SUBJECT WITH WHICH TO END THIS REPORT.





This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

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