

ENTRY No. 43

NAME OF MACHINE MILAN SUPERCONDUCTING CYCLOTRON DATE 15 MAY 1989  
INSTITUTION UNIVERSITY OF MILAN - INFN (ITALIAN NATIONAL INSTITUTE FOR NUCLEAR PHYSICS)  
ADDRESS L.A.S.A. LABORATORY - Via F.lli Cervi, 201 - 20090 SEGRATE (MI) - Italy  
TEL 02/2392571/2392500 TELEX 32 45 73 LASAMI I  
IN CHARGE E. ACERBI REPORTED BY E. ACERBI

#### HISTORY AND STATUS

DESIGN, date 1975-76 Model tests 1977  
ENG DESIGN, date 1979  
CONSTRUCTION, date Started Feb. 1981  
FIRST BEAM, date (or goal) 1990  
MAJOR ALTERATIONS

COST, ACCELERATOR \$ 5 10<sup>6</sup>  
COST, FACILITY, total \$10 10<sup>6</sup>  
FUNDED BY INFN

#### ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS ENGINEERS  
TECHNICIANS CRAFTS  
GRAD STUDENTS involved during year  
OPERATED BY Research staff or Operators  
OPERATION hr/wk, On target hr/wk  
TIME DISTR. in house %, Outside %  
BUDGET, op & dev

FUNDED BY

RESEARCH STAFF, not included above

USERS, in house outside

GRAD STUDENTS involved during year

RESEARCH BUDGET, in house

FUNDED BY

#### MAGNET

POLE FACE, diameter (compact) 180 cm, R extraction 86,7 cm

R injection 16-25 cm

GAP, min 8,6 cm, Field 56 kG

max 91,6 cm, Field 40 kG } at 6,55 10<sup>6</sup>

AVERAGE FIELD at R ext 48 kG } Ampere turns

B max/ <B> 1,17

NUMBER OF SECTORS { compact 3 } Spiral, max 69 deg

SECTOR ANGLE (SSC) deg 2

TRIMMING COILS 20 CONDUCTOR: COPPER 6x6 mm

3 mm  $\phi$  hole

CONDUCTOR, material and type Main Coil: NbTi in Cu matrix

STORED ENERGY (cryogenic) 40 MJ

POWER: main coils 0 max, kW; current stability 10<sup>-5</sup>

trimming coils 60 max, kW; current stability 10<sup>-4</sup>

WEIGHT: Fe 176 tons; coils 9,7 tons

COOLING system LHe bath

ION ENERGY (bending limit) E/A = 800 q<sup>2</sup>/a<sup>2</sup> MeV/amu

(focusing limit) E/A = 200 q<sup>2</sup>/a<sup>2</sup> MeV/amu

#### ACCELERATION SYSTEM

DEES, number 3; angle 58 deg

BEAM APERTURE 2,5 cm; DC Bias kV

TUNED by, coarse Short circuit fine Tuning capacitor

RF 15 to 49 MHz, stable  $\pm 1 \cdot 10^{-6}$

Orb F 5 to 24,1 MHz

HARMONICS, RF/Orb F, used 1 and 2

DEE - Gnd, max 100 kV, min gap 1,5 cm

STABILITY, (pk-pk noise)/(pk RF volt) 10<sup>-4</sup>

ENERGY GAIN, max 600 x (Z/A) kV/turn

RF PHASE, stable to  $\pm 2$  deg

RF POWER input, max 180 kW

FREQUENCY MODULATION, rate /s

modulator, type

beam pulse, width

#### VACUUM SYSTEM

OPERATING PRESSURE 10<sup>-7</sup> Torr or mbar

PUMPS, No, Type, Size 4 Cryopumps

#### ION SOURCES

ECR external source

#### INJECTION SYSTEM

Radial from 15 MV tandem and axial from ECR source

#### EXTRACTION SYSTEM

Electrostatic deflectors (2) - Magnetic channels (7)

#### FACILITIES FOR RESEARCH

SHIELDED AREA, fixed m<sup>2</sup>; movable m<sup>2</sup>

TARGET STATIONS in rooms

STATIONS served at same time, max

MAG SPECTROGRAPH, type

COMPUTER model

OTHER FACILITIES

#### CHARACTERISTIC BEAMS

PARTICLE ENERGY (MeV) CURRENT ( $\mu$ A)

Goal Achieved Internal External

q/A=0,5 100 MeV/n 10<sup>12</sup> pps

38 20 MeV/n 10<sup>12</sup> pps

U

SECONDARY (part/s)

#### BEAM PROPERTIES

MEASURED CONDITIONS

PULSE WIDTH RF deg  $\mu$  A of MeV ions

PHASE EXC, max RF deg  $\mu$  A of MeV ions

EXTRACT eff %  $\mu$  A of MeV ions

RESOL  $\Delta E/E$  %  $\mu$  A of MeV ions

EMITTANCE

( $\pi$  mm. mrad) { axial }  $\mu$  A of MeV ions

{ rad }

#### OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS .. SOLID STATES PHYSICS ..

BIOMEDICAL APPLICAT. .... ISOTOPE PRODUCTIONS ..

#### REFERENCES/NOTES

1) E. Acerbi et al. IX Int. Conf. on Cycl. 169 (1981)

2) E. Acerbi et al. X Int. Conf. on Cycl. 251 (1984)

3) E. Acerbi et al. XI Int. Conf. on Cycl. 168 (1986)

#### PLAN VIEW OF FACILITY, NOTEWORTHY FEATURES, COMMENTS

The cyclotron, after the acceleration tests, will be installed at the Laboratorio Nazionale del Sud in Catania and coupled with a 15 MV Tandem.