

**ENTRY NO:**C27**Date:** 4 Feb 2005 17:43:07**Machine Name:** AGOR**Institution:** Kernfysisch Versneller Instituut (KVI)**Address:** Zernikelaan 25 9747 AA Groningen the Netherlands

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**Web Address:** www.kvi.nl**Person in Charge of Cyclotron:** S. Brandenburg**Person Reporting Information:** S. Brandenburg**E-mail Address:** brandenburg@kvi.nl**History****Designed by:** IPN Orsay (France) and KVI**Construction Dates:** 1987 - 1993 design and construction Orsay

1994 - 1995 transport and reassembly Groningen

**First Beam Date:** april 1994 Orsay; januari 1996 Groningen**Characteristic Beams**

protons 120 - 190 MeV 6e12 pps

Q/A = 0.5 35 - 90 MeV 6e11 pps

Q/A = 0.25 10 - 30 MeV 6e11 pps

Q/A = 0.1 6 MeV 6e11 pps

**Transmission Efficiency (source to extracted beam)****Typical (%)**: 15**Best (%)**: 30**Emittance****Emittance Definition:** FWHM**Vertical (pi mm mrad)**: 6**Horizontal (pi mm mrad)**: 3**Longitudinal (dE/E[%] x RF[deg.])**: 0.2 % x 15 deg.**USES****Basic Research (%)**: 60**Development (%)**: 10**Therapy (%)**: 0**Isotope Production (%)**: 0**Other Application (%)**: 5**Maintenance (%)**: 15**Beam Tuning (%)**: 10**Total Time (h/year)**: 4000**TECHNICAL DATA****(a)Magnet****Type:** compact**Kb (MeV)**: 600**Kf (MeV/A)**: 200**Average Field (min./max. T)**: 1.7 - 4.1 T**Number of Sectors**: 3**Hill Angular Width (deg.)**: 54**Spiral (deg.)**: 70**Pole Diameter (m)**: 1.9**Injection Radius (m)**: 0.015**Extraction Radius (m)**: 0.89**Hill Gap (m)**: 0.07**Valley Gap (m)**: 1.68**Trim Coils****Number:** 15 sets of 3 (separate windings on each hill)**Maximum Current (A-turns)**: 3000**Harmonic Coils****Number:** 4 sets of 3 (separate windings on each hill)**Maximum Current (A-turns)**: 3000**Main Coils****Number:** 2**Total Ampere Turns:** 5.1e6 resp. 1.2e6**Maximum Current (A)**: 1800 resp. 900**Stored Energy (MJ)**: 56**Total Iron Weight (tons)**: 330**Total Coil Weight (tons)**: 30 (incl. cryostat)**Power****Main Coils (total KW)**: 0**Trim Coils (total, maximum, KW)**: 30**Refrigerator (cryogenic, KW)**: electric power 250 kW; cooling power 50 W at 4 K and 600 W at 80 K, additional liquid He production 50 liter/hour**(b)RF****Acceleration****Frequency Range (MHz)**: 24 - 62**Harmonic Modes**: 2, 3 and 4**Number of Dees**: 3**Number of Cavities**: 3**Dee Angular Width (deg.)**: 60**Voltage****At Injection (peak to ground, KV)**: 80**At Extraction (peak to ground, KV)**: 100

Peak (peak to ground, KV):

Line Power (max, KW): 70 per cavity

**Phase Stability (deg.)**: 0.1**Voltage Stability (%)**: 0.01**(c)Injection****Ion Source:** multicusp (p, d and 4He1+)

14 GHz ECRIS (heavy ions)

atomic beam + 2.5 GHz ECRIS (polarized p and d)

**Source Bias Voltage (kV)**: 10 - 35**External Injection:** axial**Buncher Type:** sinusoidal double gap (RF frequency)

sawtooth quasi-single gap (freq. max. 15 MHz, operating at suitable subharmonic of RF frequency)

**Injection Energy (MeV/n)**: 0.002 - 0.03**Component:****Injection Efficiency (%)**: 30**Injector:****(d)Extraction****Elements, Characteristic:** ESD: electrostatic, 4 movements, 55 kV, 10.5 MV/mEMC1: electromagnetic, roomtemperature, dB = 0.2 T, dB/dr = 13 T/m, J = 140 A/mm<sup>2</sup>, 2 correction windings, P = 80 kW

EMC2: electromagnetic, superconducting, dB = 0.4T, dB/dr = 22 T/m, correction winding

QPOLE: electromagnetic, superconducting, dB/dx = 26 T/m, horizontal and vertical steering

**Typical Efficiency (%)**: 60**Best Efficiency (%)**: 85**(e)Vacuum****Pumps:** 2 x 1000 l/s turbomolecular outside yoke

3 x 1000 l/s (air) cryogenic inside Dees

**Achieved Vacuum (Pa)**: 4 x 10<sup>-5</sup> Pa**REFERENCES** H.W. Schreuder et al. Proc. 15th Int. Conf. on Cyclotrons and their Applications, IoP Bristol (1999), pg. 592 and references therein**EXPERIMENTAL FACILITIES**

QQD magnetic spectrometer

Small Angle Large Acceptance wire chamber system for light ions

Plastic Ball 4pi detector for high E gammas and electrons

Scattering Chamber 1.2 m

Irradiation setup

Fragment separator + low energy setups

**COMMENTS**