

Line 320 at IPN (Institut de Physique Nucléaire d'Orsay)

S. Duzellier



History

⌘ *Tandem Accelerator*

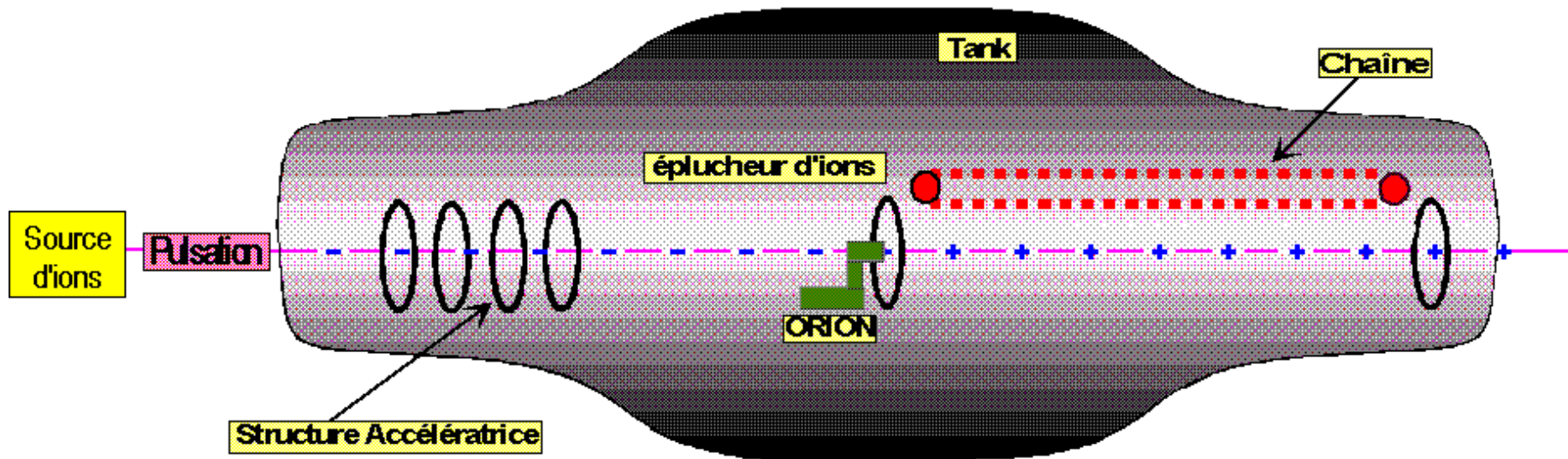
- ◆ IPN (created 1956) belongs to CNRS/IN2P3/ UPS
- ◆ developed in 1970
- ◆ usage : nuclear physics research

⌘ *Line 320 devoted to irradiation of electronics*

- ◆ Development supported by CNES in 1989
- ◆ Initial tests : October 1989
- ◆ Managed by ONERA since 1992

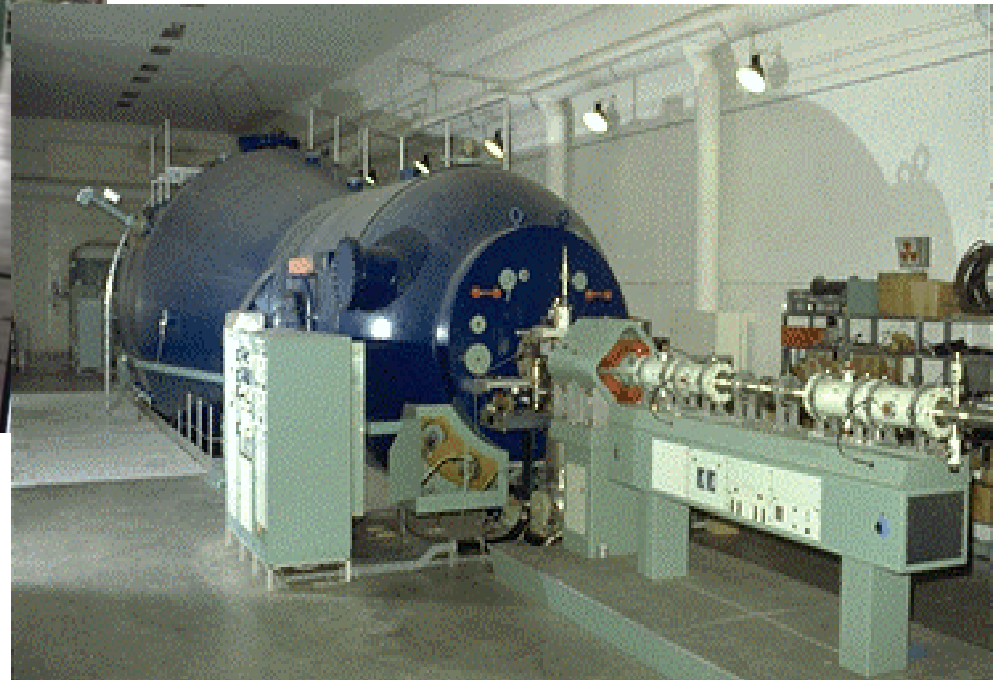
The tandem Van de Graaf

Tandem : Schéma de principe



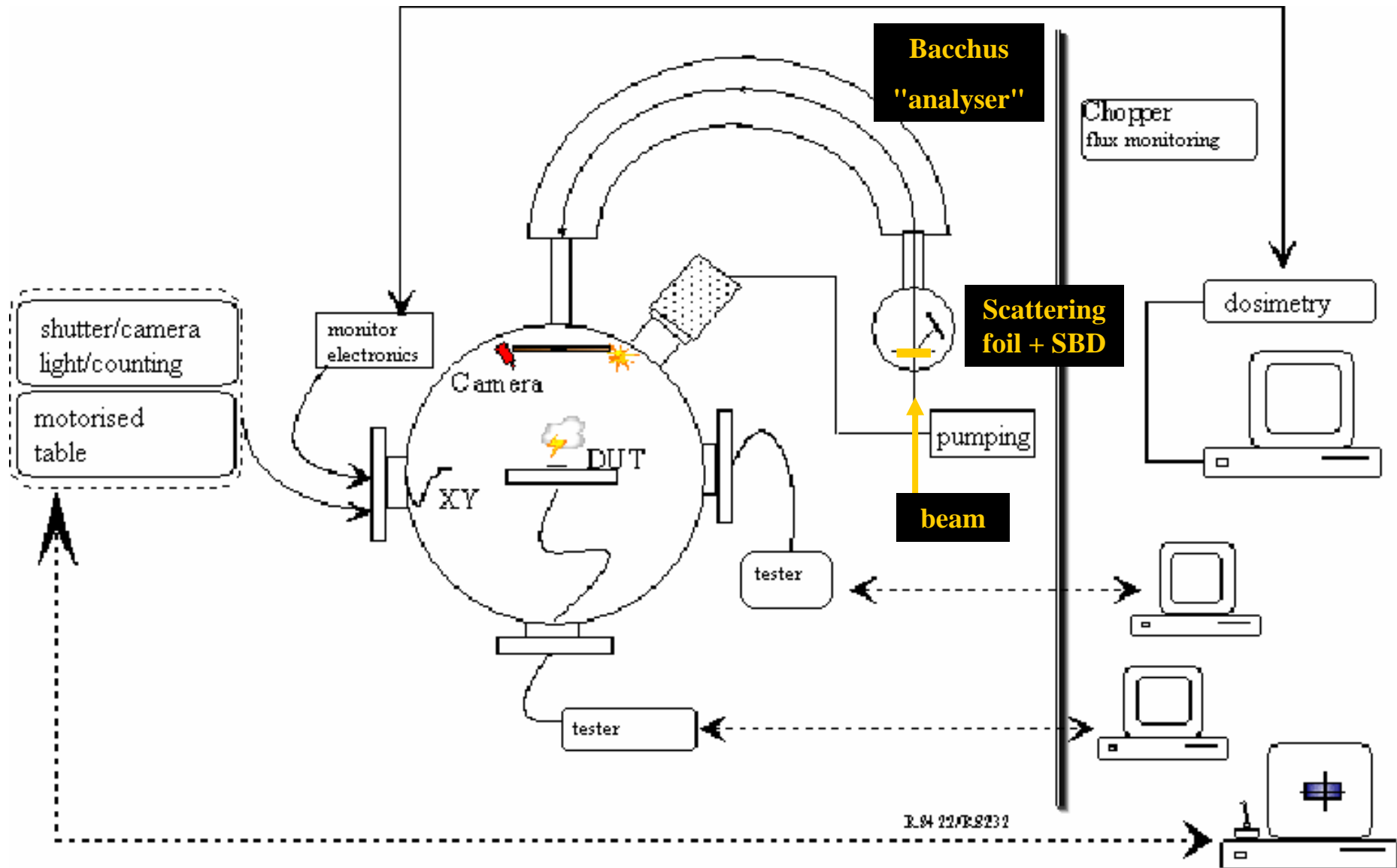
- ⌘ 14MV Tandem Van de Graaff (TVdG): $E = (1+Q) * V$
- ⌘ HICONEX 384 source
- ⌘ Simple/double stripping (foil/gaz)

TVdG generator



usage

- ⌘ User science committee once a year
- ⌘ Programmatic: 30 UBT per year (1 UBT=8h, "Unit of Beam Time")
 - ◆ initially pre-booking of 3 campaigns (1 week = 10 UBT)
 - ◆ presently : shorter campaigns for more *flexible scheduling* (min 3UBT)
- ⌘ commercial/governmental users : CNES, ONERA, TIMA, Hirex, TRAD, Thalès, Atmel, Alcatel, Astrium, ESA
- ⌘ full priority on dedicated blocks of machine time



target chamber

80m

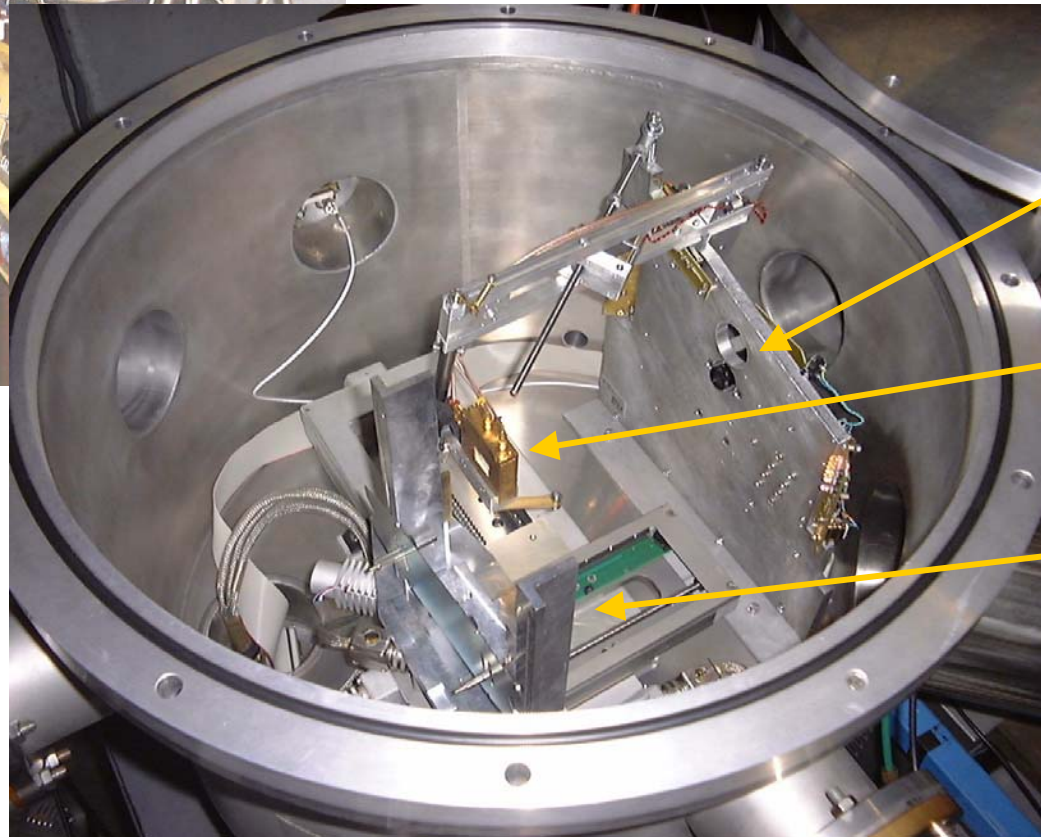
test monitoring



ONERA

accelerator workshop - JYFL 26/05/2005

line 320



shutter,
camera

XY
detector

frame

dosimetry

Homogeneity

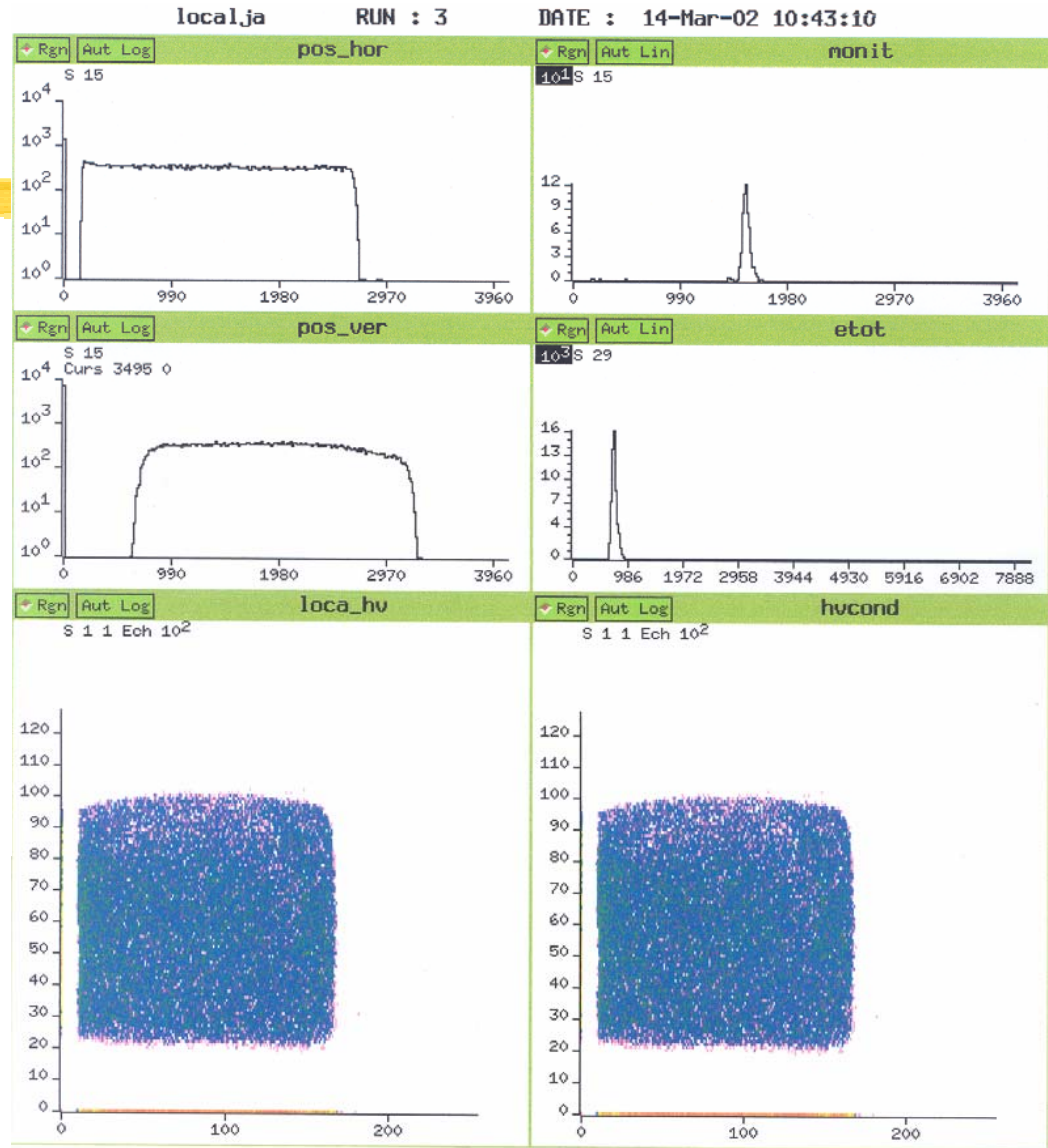
XY detector

Counting on scattered beam

Calibration => ratio K

HI : XY detector

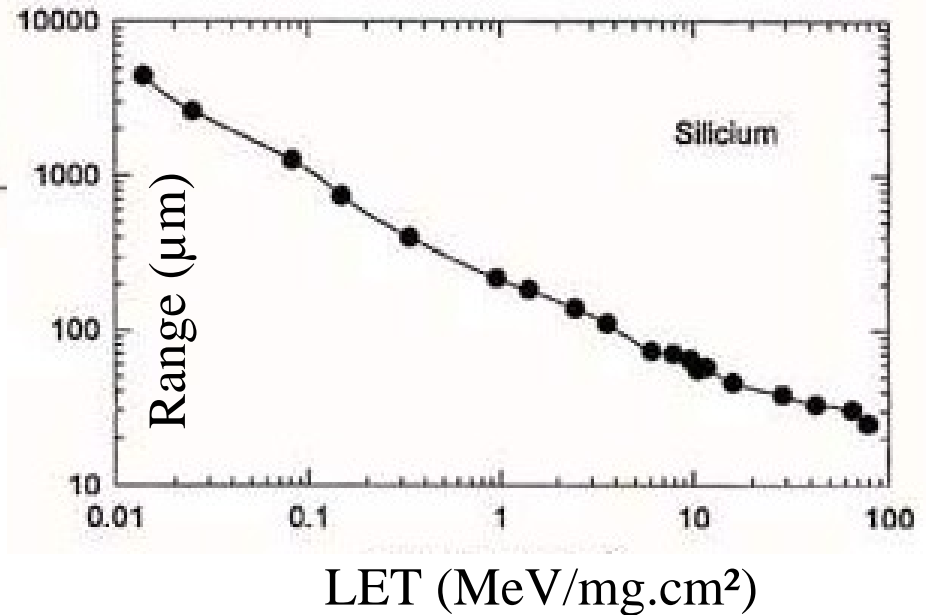
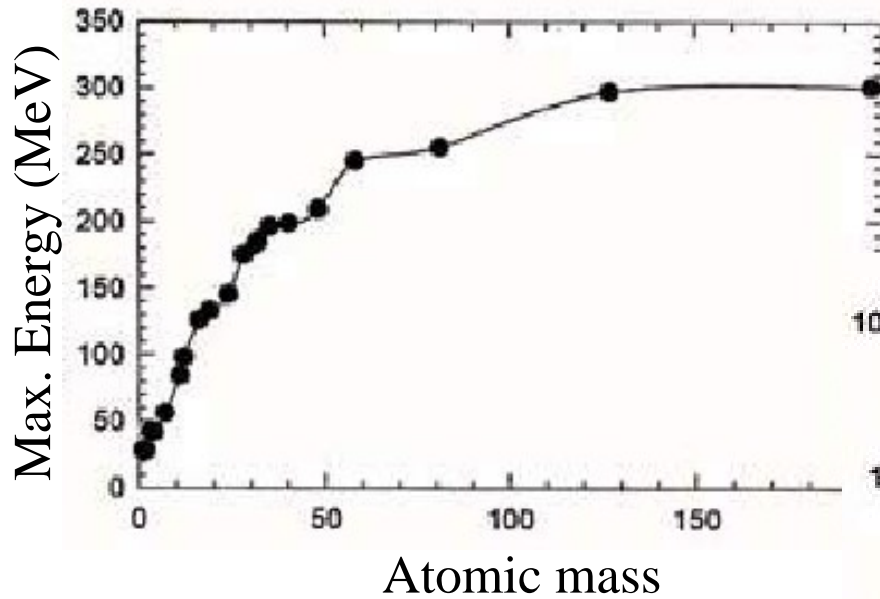
p+: faraday cup / scintillator



safety

- ⌘ remote testing : $\approx 50\text{m}$ between target line and users
- ⌘ possibility to operate from behind shield wall (except for p^+ and light ions irradiation)
- ⌘ 2 locked gates (controlled access by badge/key causing the beam shut down)
- ⌘ experimental area surveyed for radiation level
- ⌘ dosimeters provided by IPN
- ⌘ control and shipping of « hot » samples (p^+ irradiation)

Beam characteristics



Standard cocktail

Ion species	Energy (MeV)	LET (MeV/mg.cm ²)	Range (μm)
127 Iodine	325	62	30
79 Bromine	236	40	31
58 Nickel	182	29.9	29
43 Titane	160	21	31.7
35 Chlorine	199	11.8	60
19 Fluorine	120	4	93
12 Carbon	84	1.63	143

+ protons 1-20MeV (mono-energetic beam)

Line 320 : user manual

- ⌘ specific frame, no motorized Z-axis
- ⌘ standard DN100 flanges : D-Sub connectors (25p x2, 37p x4), coaxials (x8)
- ⌘ beam spot : 1.7 x 2.3 cm²
- ⌘ flux adjustment in real time by the user (chopper system)
 - ☑ Heavy ions : few tens – 1.E5 HI/cm².s
 - ☑ Protons : 1.E7-1.E9 p/cm².s
- ⌘ pumping/venting: few minutes
- ⌘ ion/E change (tuning and calibration) : <1/2h
- ⌘ HI/p+ testing during the same irradiation campaign (incl. CPO)

administrative

- ⌘ start-up: 8-4h to be shared between users
- ⌘ minimum billing: 8 hours + set-up (1x UBT)
- ⌘ scheduling: beam slot available every ≈ 6 weeks
- ⌘ booking: 1 month in advance (ONERA)
- ⌘ cancellation: depends ...
- ⌘ closure periods: July>mid-Sept, mid-Dec>mid-Jan
- ⌘ technical support from IPN scientists/technicians (beam extraction/dosimetry, line operation, safety)
- ⌘ 576 €/effective beam hour

http://ipnweb.in2p3.fr/activitech/frame_actech.html

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ALTO

Electron beam (LEP Injector).

Energy : 10 - 50 MeV

Max. average current : 5-10 μA

DE/E < 5%

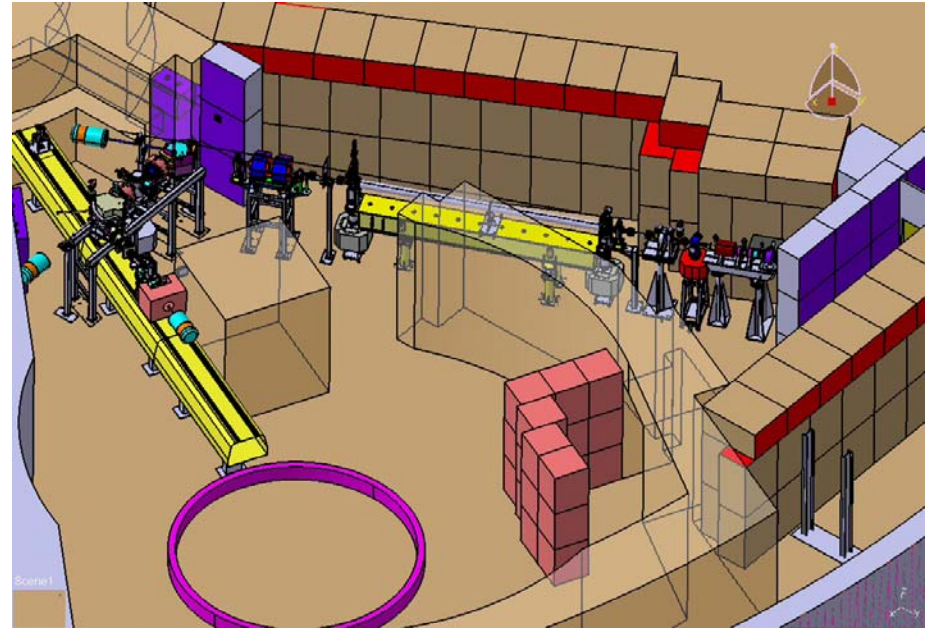
Diameter of the beam : ~ 10 mm

Frequency : 0 to 100 Hz

Pulse width : ~ 1.7 μs to 10 ns

Max. Pulse current : 12 mA

Accelerator length : ~ 12 m



Beam available 2006.