Magnetic Horn Study for the NuFact

By:

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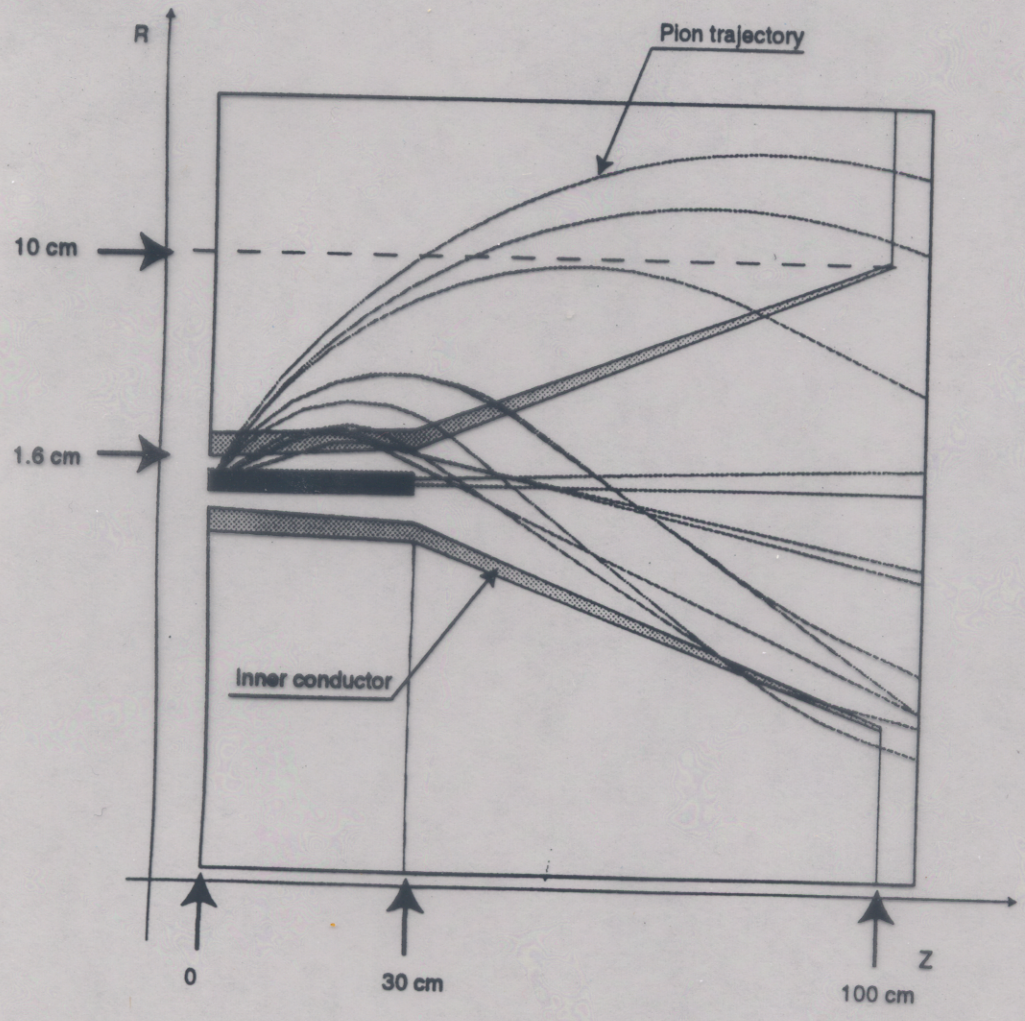
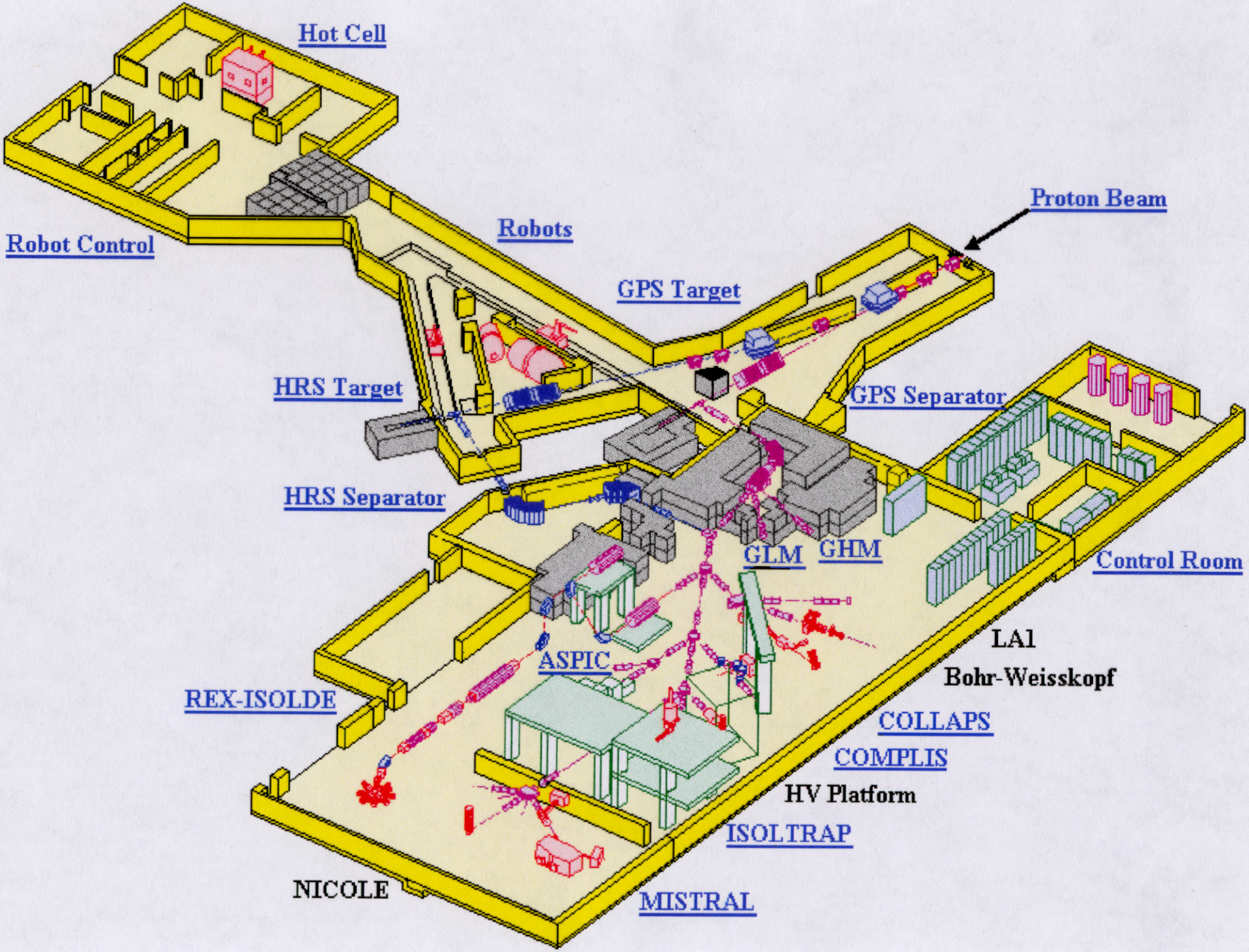
ν-factory 2000

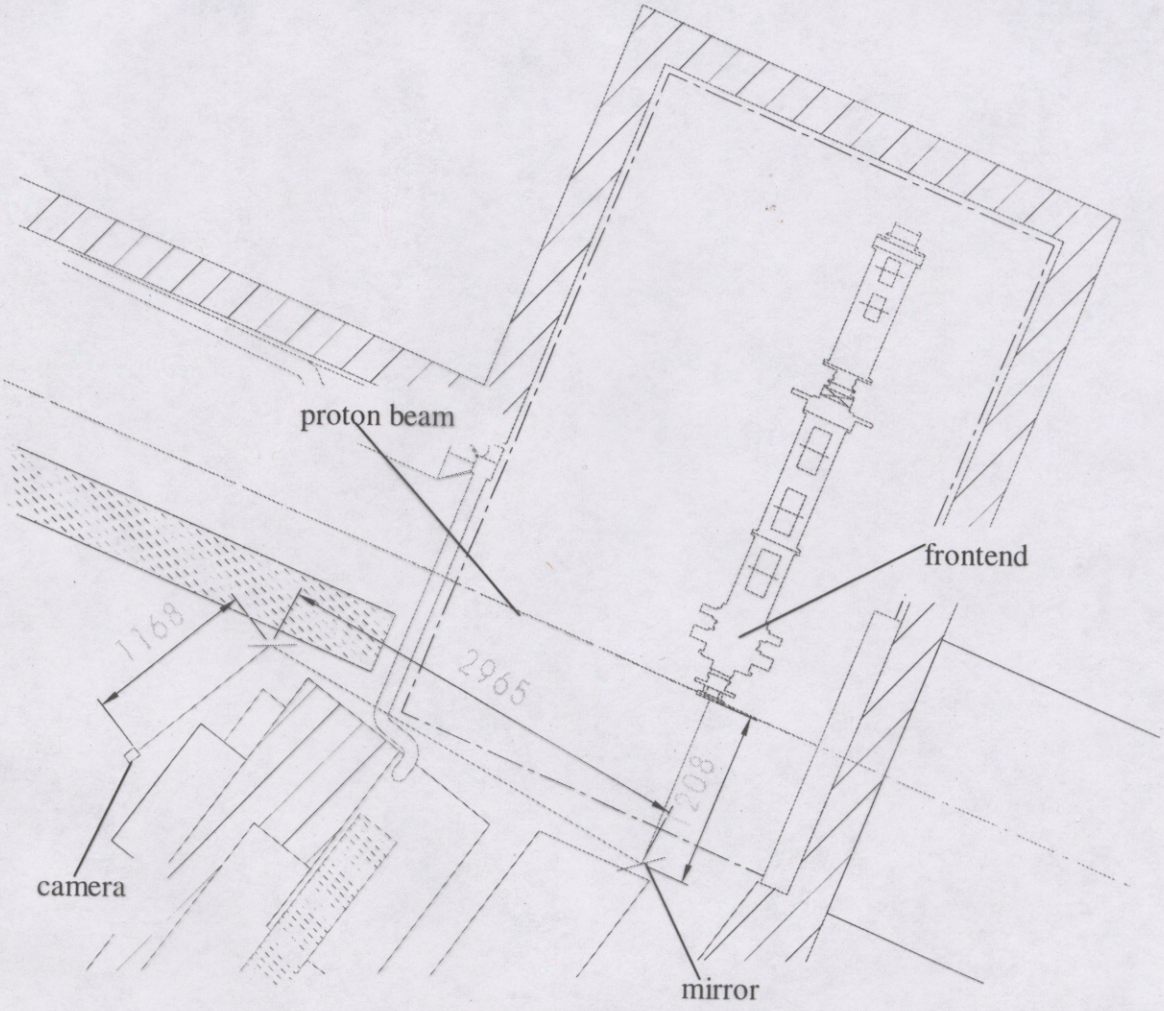
Test beam

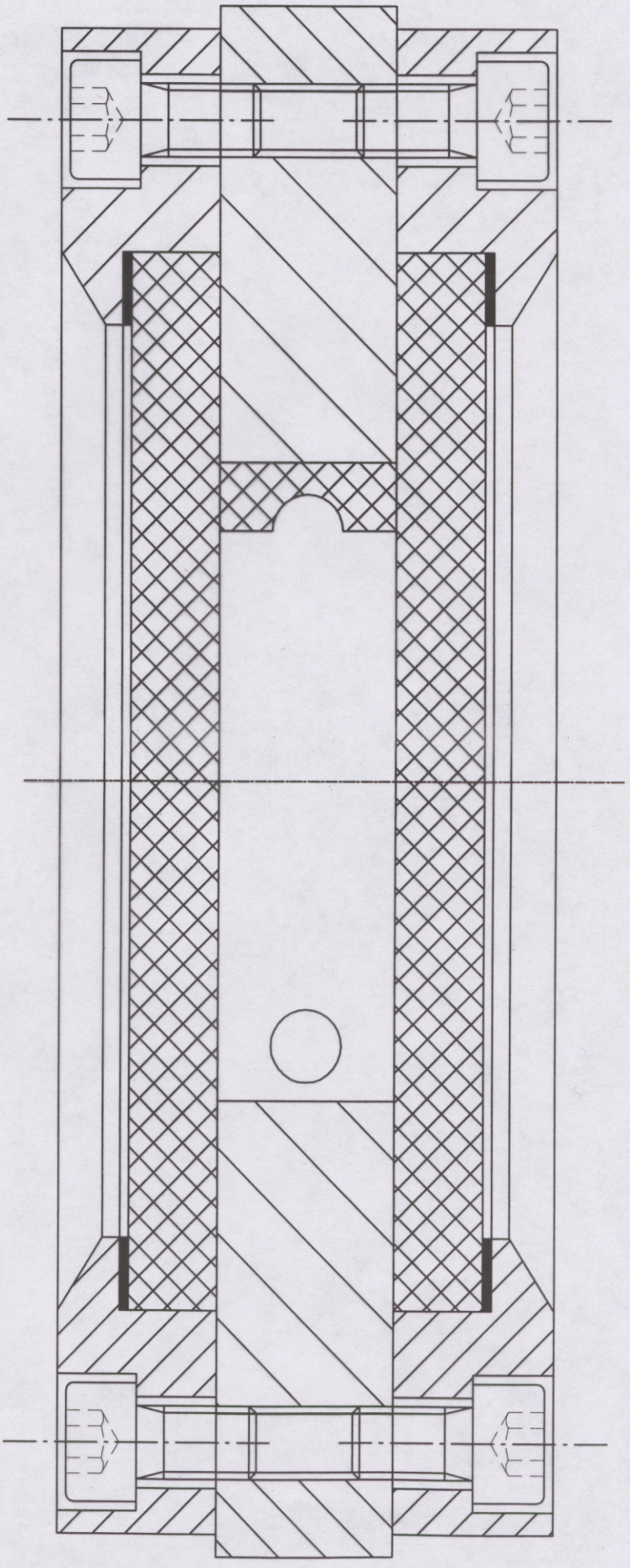
Proton energy: 1 - 1,4 GeV
Repetition rate: 0 - 1 Hz
Pulse length: 2,4 μs
Pulse intensity: $3 \cdot 10^{13}$ p/s
Beam size: < 3 mm Ø



re 1: Pion trajectories for triangular horn shape

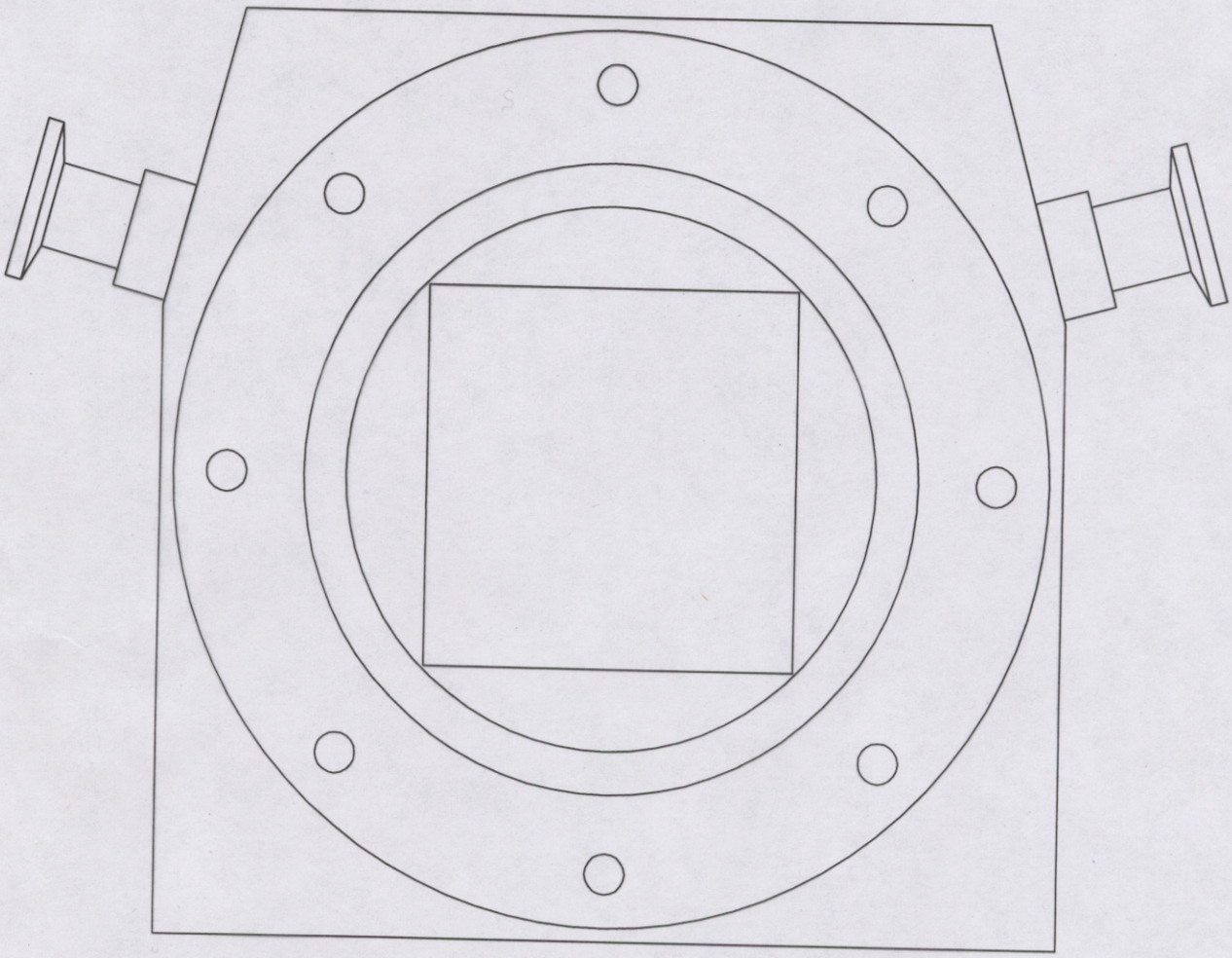

Hot Cell
Robot Control
Robots
Proton Beam
GPS Target
HRS Target
GPS Separator
HRS Separator
GLM
GHM
Control Room
LA1
Bohr-Weisskopf
ASPIC
REX-ISOLDE
COLLAPS
COMPLIS
HV Platform
ISOLTRAP
NICOLE
MISTRAL


proton beam
frontend
1168
2965
1208
camera
mirror

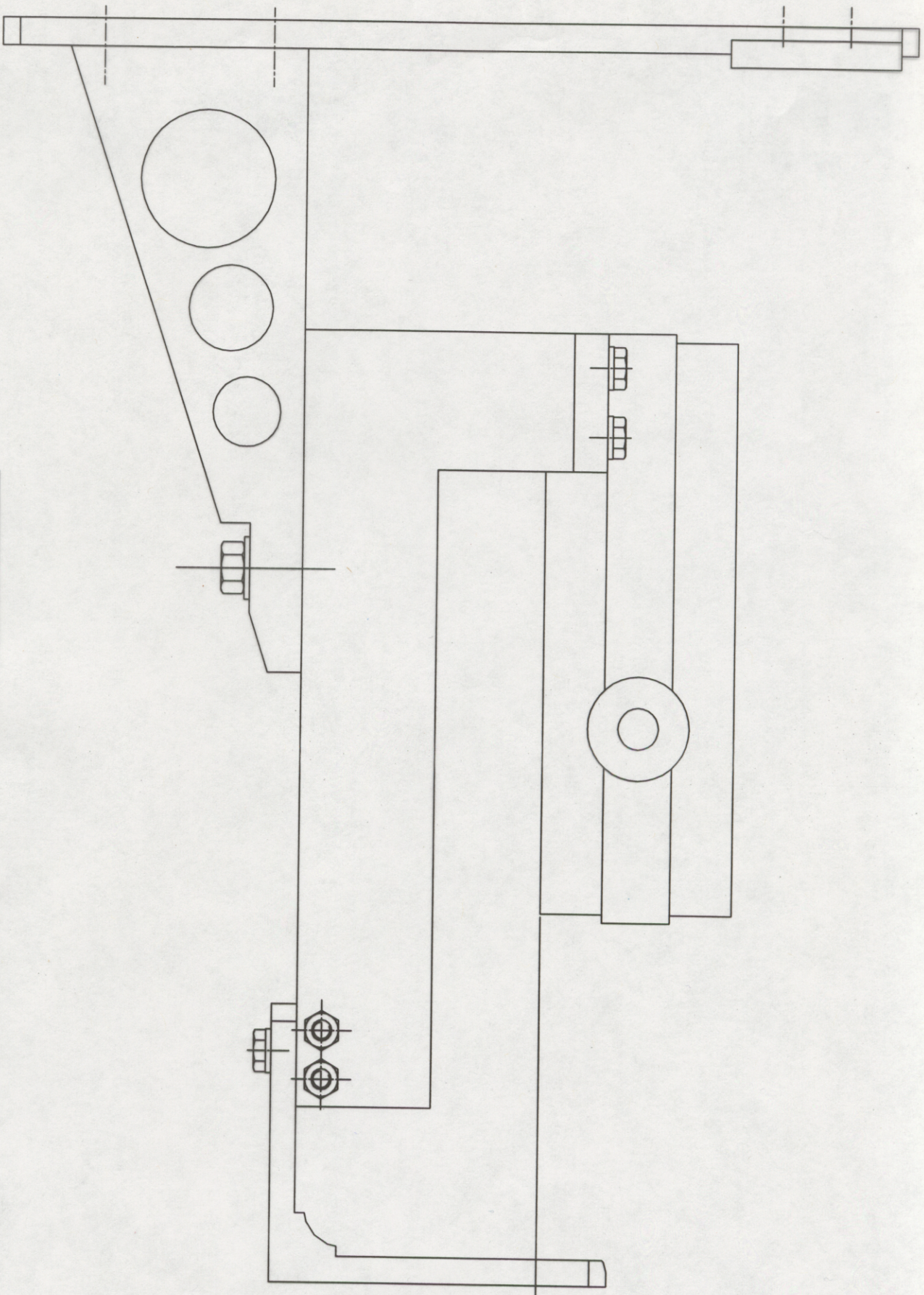


Experimental Chamber for In Beam Experiment

(Front View)

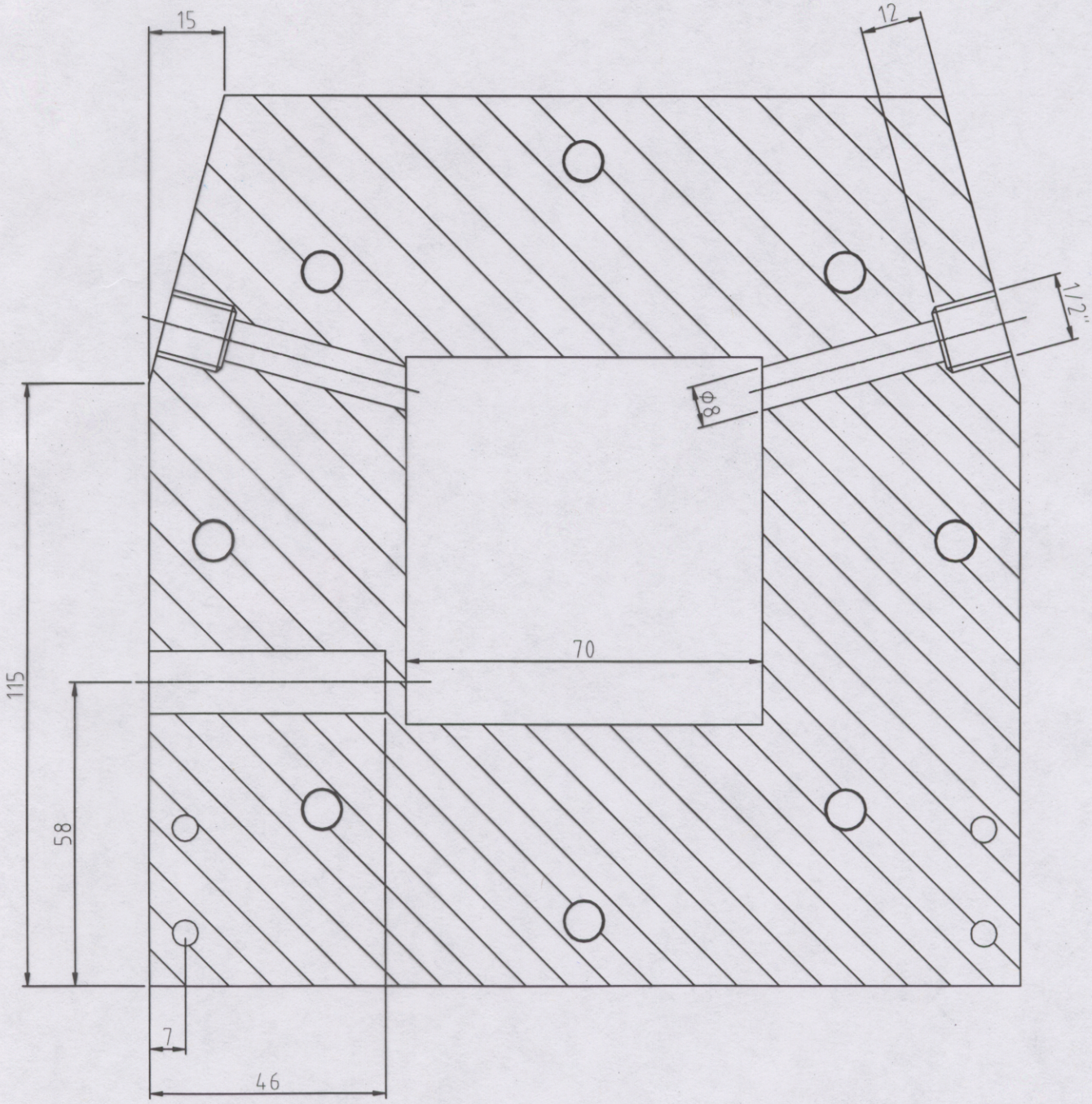


Daniel Schaffarzick / CERN



Experimental Chamber for In Beam Experiment

(Cut)



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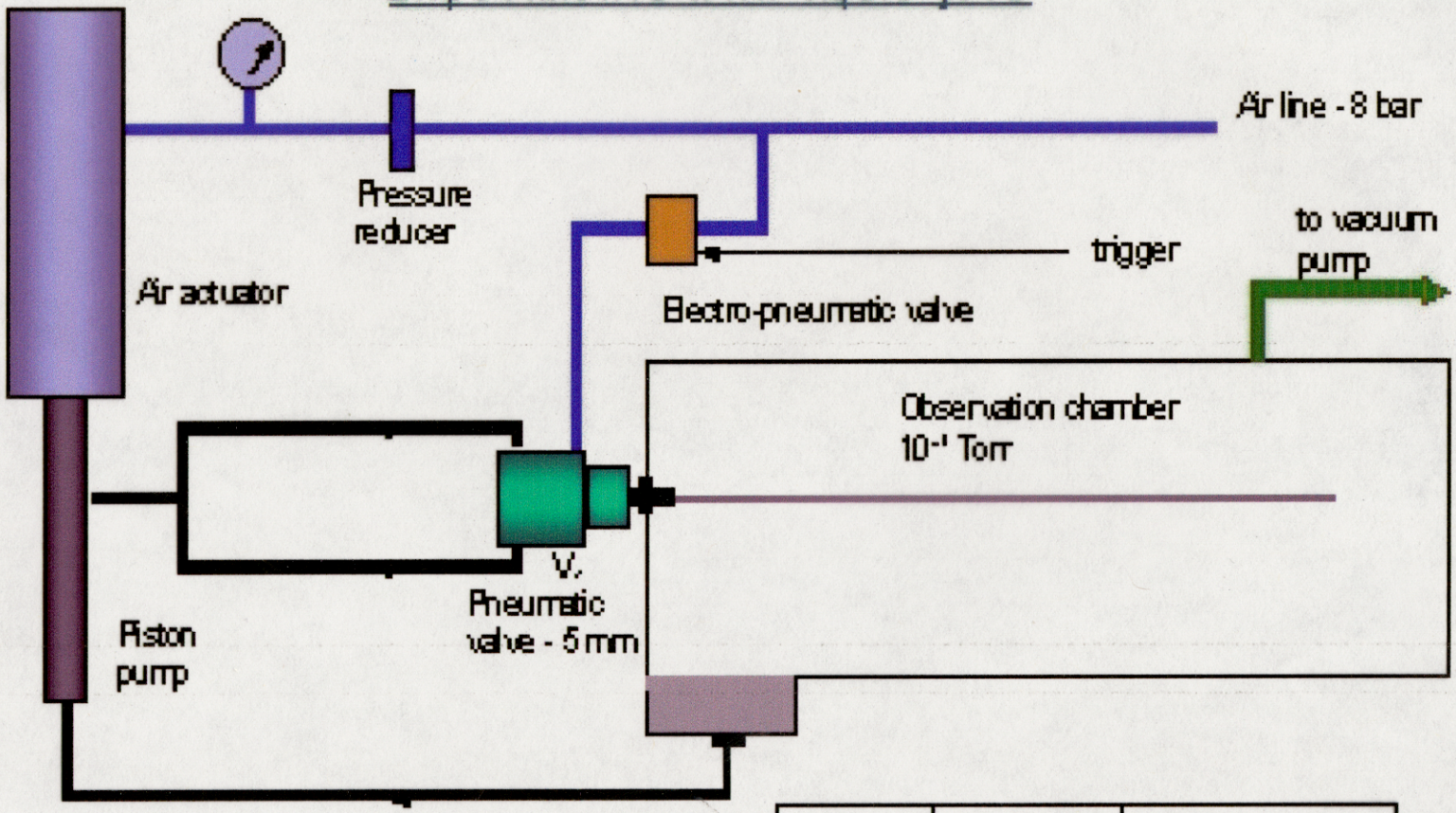
Experiments with liquid jets

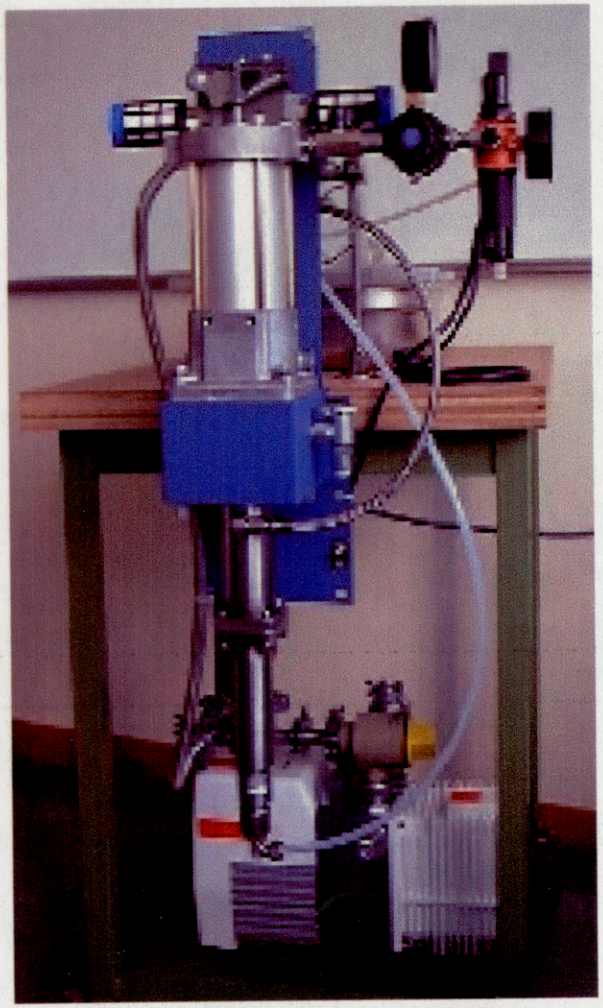


	Single shot	Continuous pulsed jet 15 Hz
V_1	triggered	open

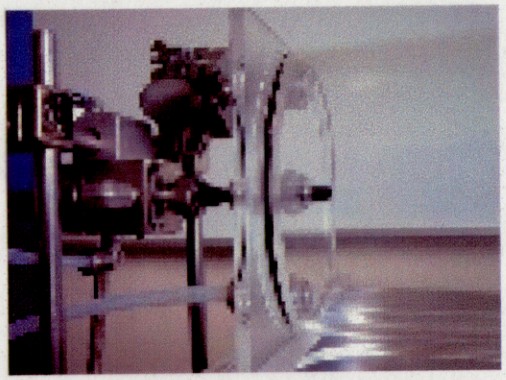
Model liquid-metal jet target

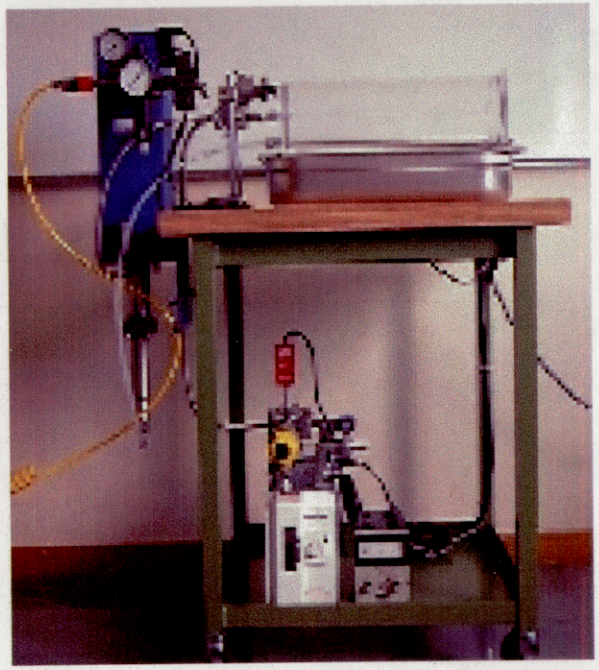
CERN 1999

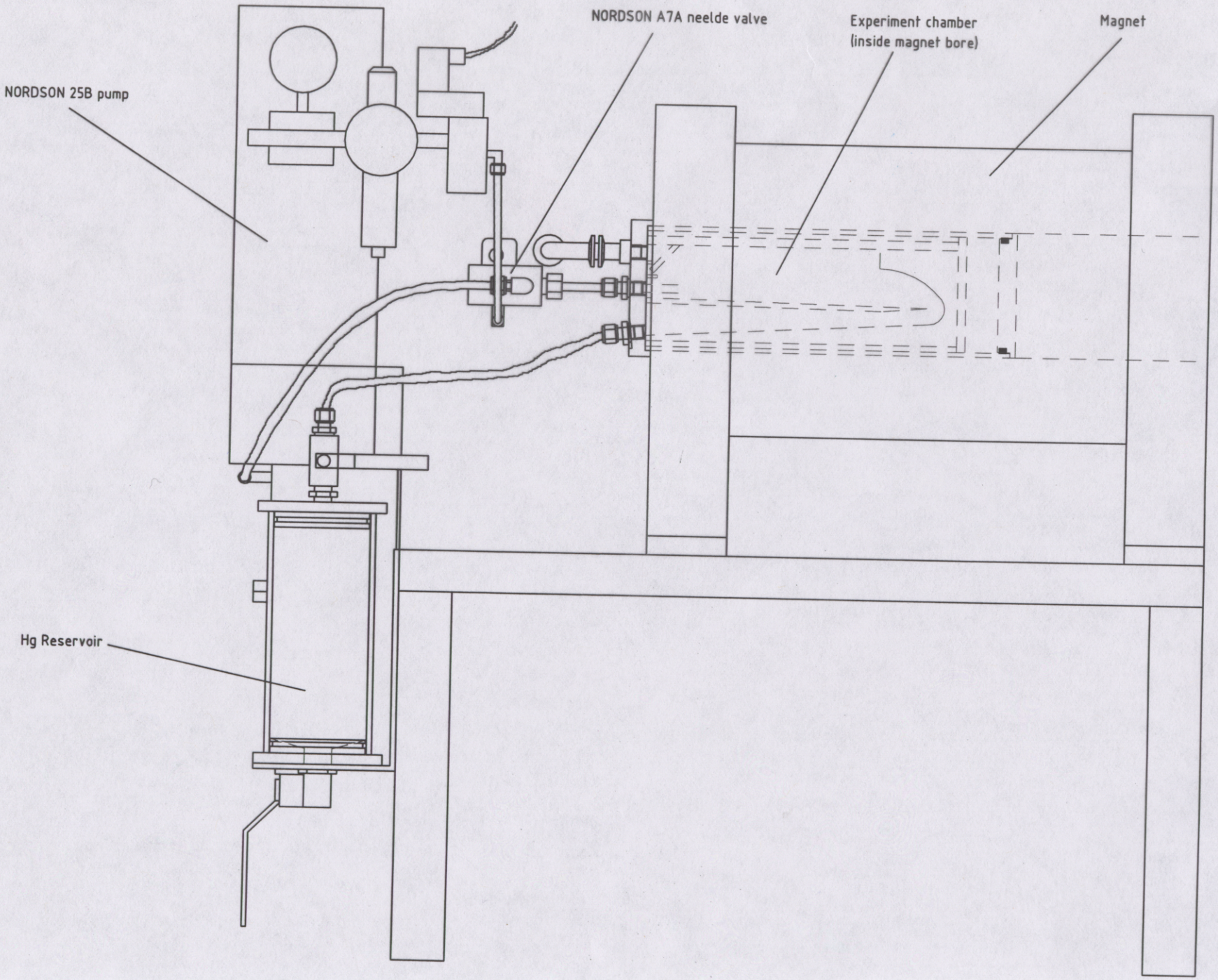
Experiments with liquid jets

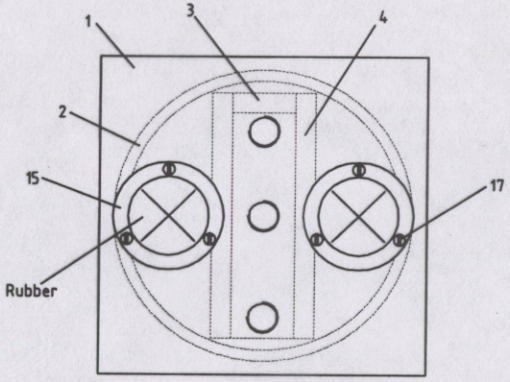


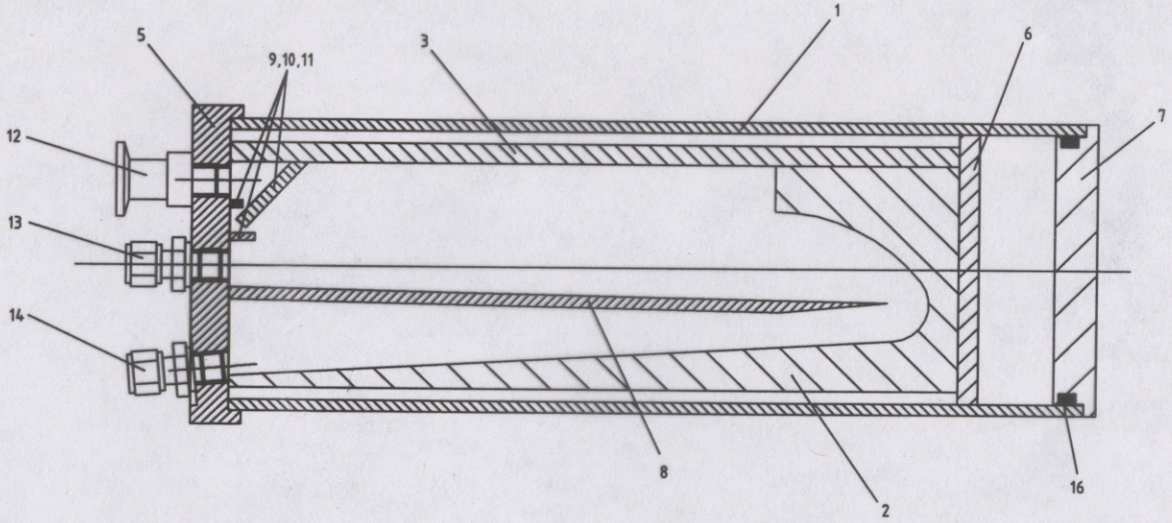
Model jet target






NORDSON 25B pump
NORDSON A7A neelde valve
Experiment chamber
(inside magnet bore)
Magnet
Hg Reservoir





9,10,11: Protection against Hg droplets

12: ISO-K 16 Flange for connecting a filter and a vacuum pump (stainless steel)

13: Feedthrough for nozzle (stainless steel)

14: Outlet for Hg (stainless steel)

16: O-Ring EPDM

17: Screw M3x6, stainless steel

Parts 1-11: PMMA (Polymethyl-Methacrylate, Plexiglas)

Part 15: stainless steel 316

In 2001

1. Make a plan for which parameters of solid and liquid metal targets should be experimentally determined by in-beam tests of a stationary Hg bath in the ISOLDE target area.

2. Determine after the off-line what further equipment is needed for the measurement.

3. Identify and do the hydrodynamic calculations the experimental results should be compared to.

4. Organise a test in Europe of the injection of the Mercury jet into a strong magnetic field.

5. Start to make a preliminary design of the vacuum vessels and support including Hg circulation and possibly on-line distillation needed for the in-beam Hg-jet tests at ISOLDE.

6. Building and off-line testing of the in-beam set up.

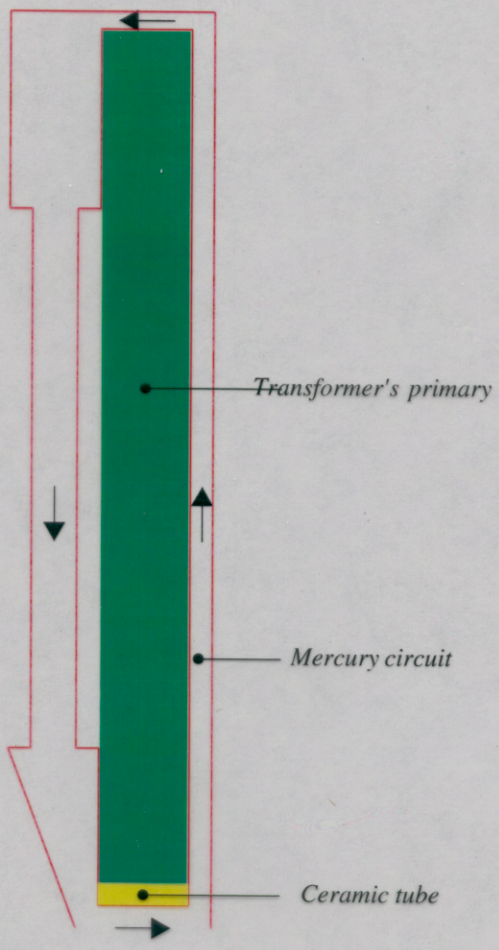
7. Request and perform on-line tests of the Hg jet in the ISOLDE proton beam.

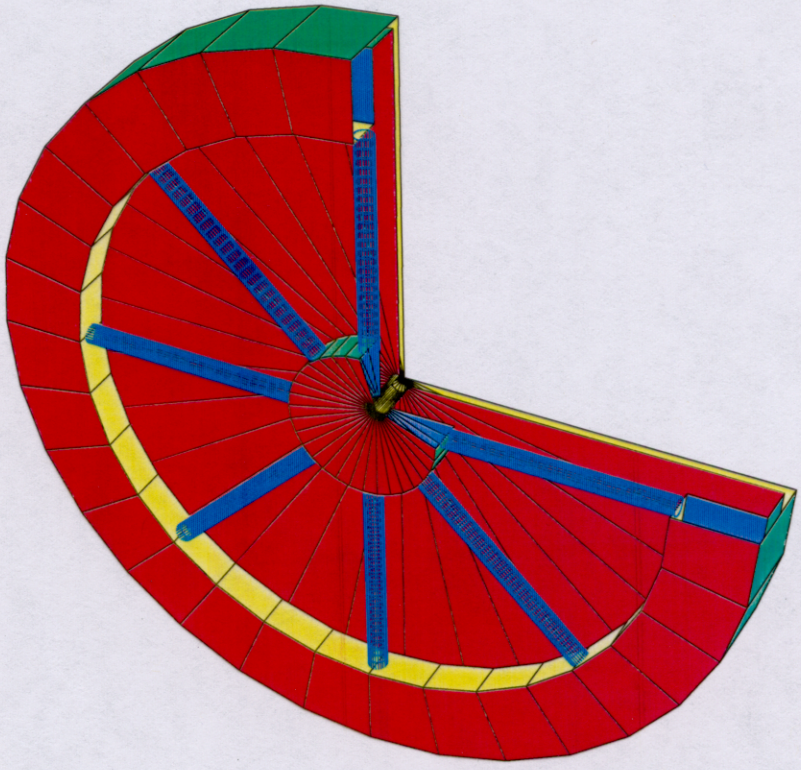
8. Start planning of a dedicated NuFACT target test laboratory at CERN.

9. Start designing a prototype target and its connection to the neutrino collector.

10. With the help of external specialists evaluate the cost to set up liquid Li technology at CERN

B. Autin, S. Gilardoni, P. Sievers and F. Volker





	Lithium	Beryllium	Mercury
Power [W]	5.03939×10^{7}	1.4919×10^{7}	4.76614
Power density [W m^{-3}]	2.03632×10^{10}	2.09106×10^{10}	2.27651
Field [T]	20.8426	21.1209	22.0376
Intensity [A]	2.4948×10^{6}	2.4948×10^{6}	2.4948
Frequency [Hz]	75	75	75
Phase [π]	10.	3.	1.
Pulse length [s]	0.00062847	0.00467983	0.00026
Target length [m]	1.37453	0.406926	0.13
Target radius [m]	0.0239394	0.023624	0.02264

S. GILARDONI

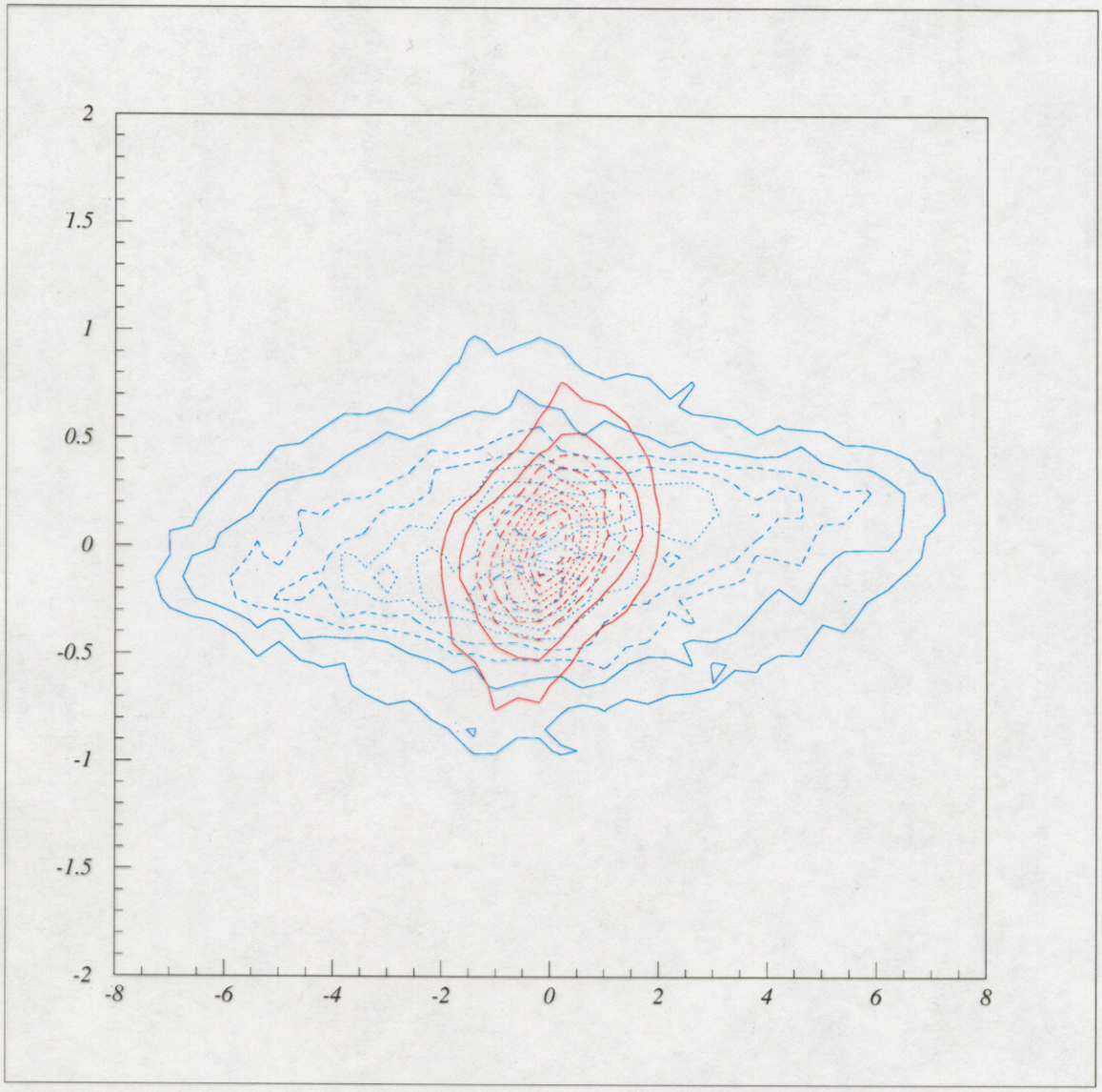
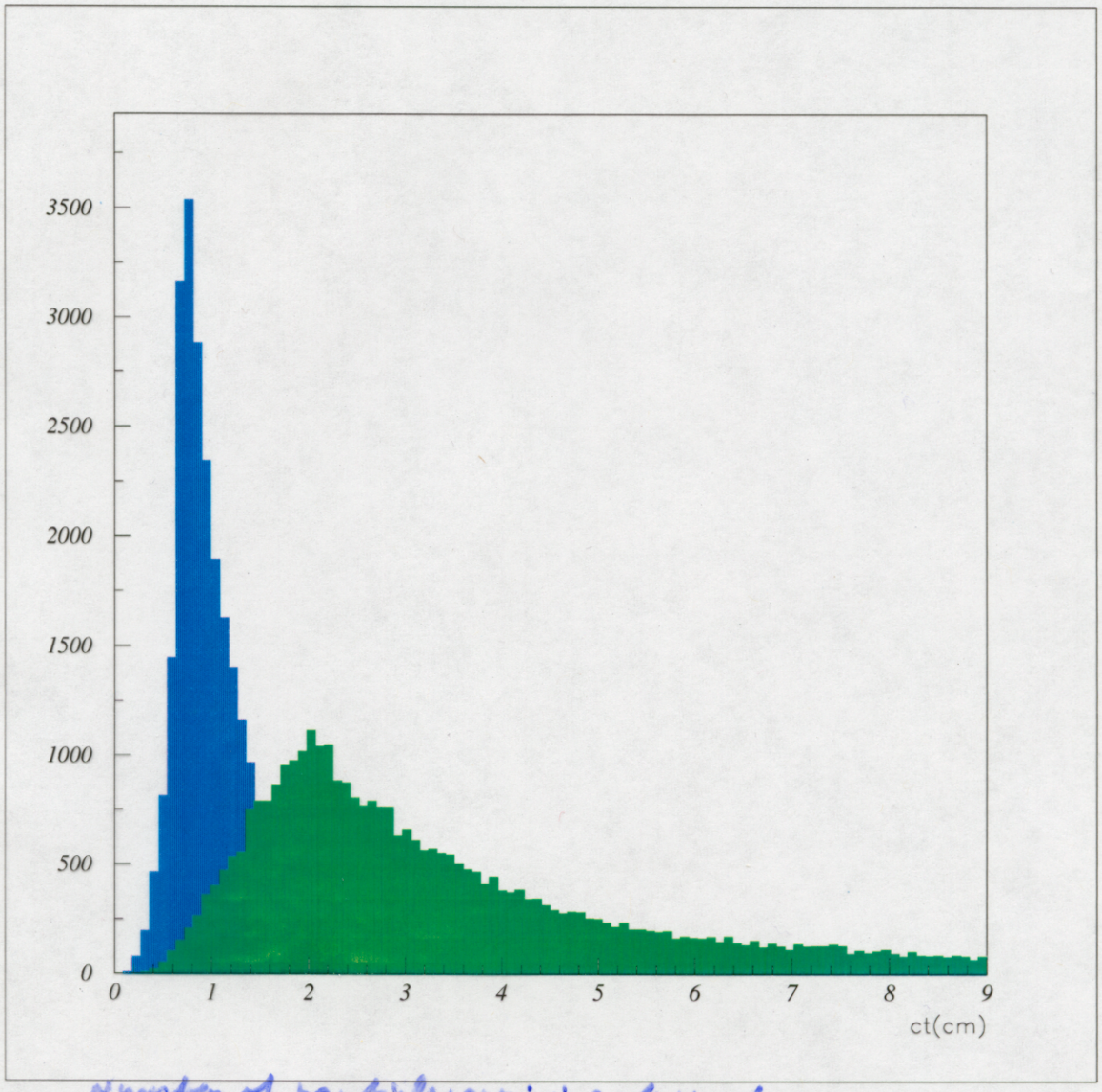


Fig. 4. Transverse pion beam emittance at the end of a target of radius r_t without magnetization (blue) and with magnetization (red).

S. Gilardoni / B. Autin



Number of particles arriving at time t

Fig. 1. ~~Longitudinal pion beam emittance~~ at the ~~end~~ of a target ~~of radius~~ r_t without magnetization (green) and with magnetization (blue).