Specification for CERN-PS IPM

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(after discussion with Simone Gilardoni)

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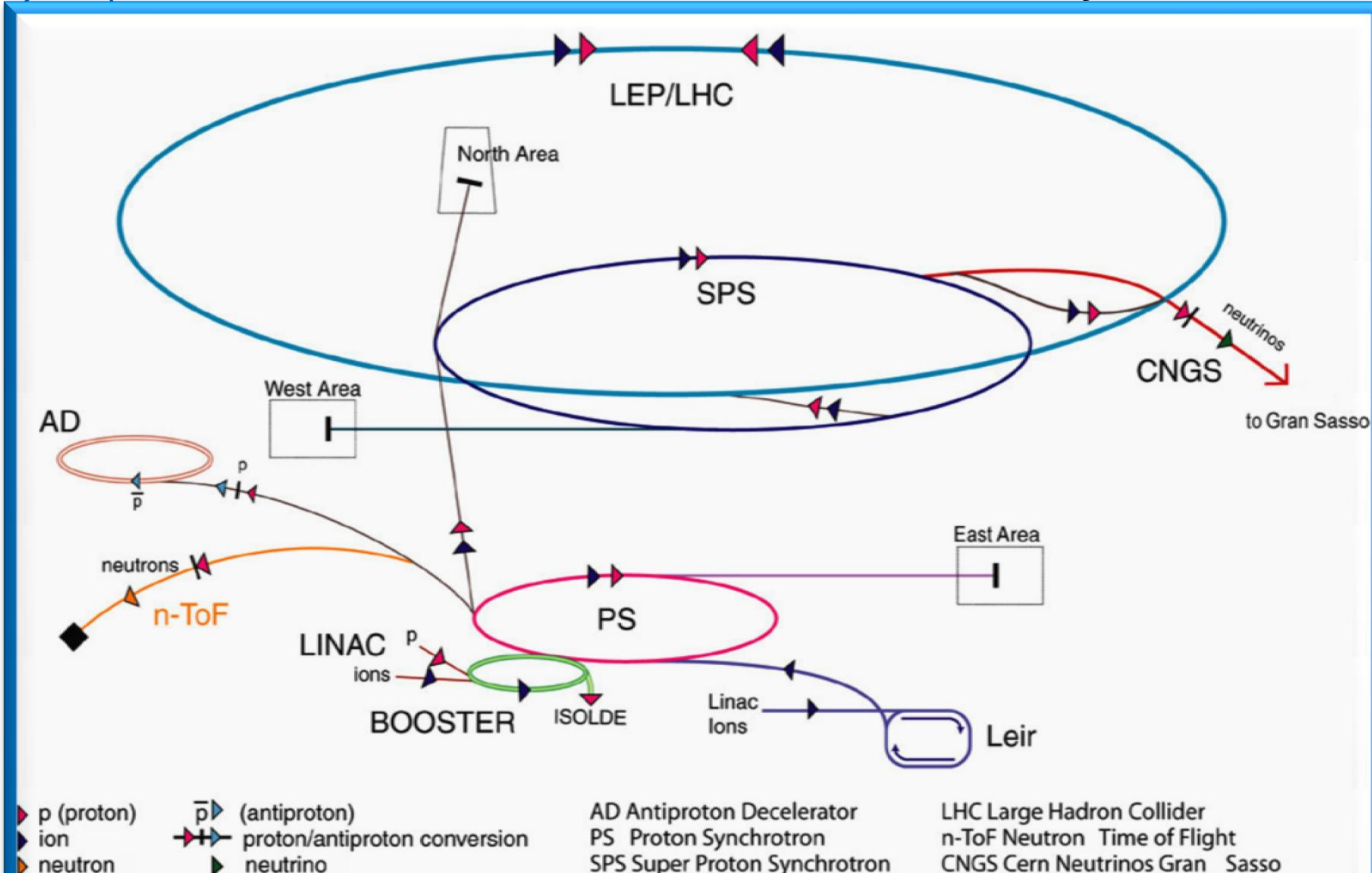
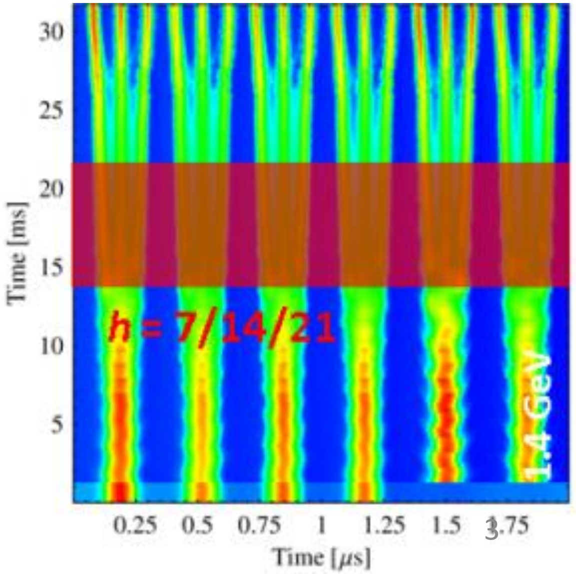
PS in CERN accelerator system



CERN PS

- Constructed: 1959
- Circumference: 628 m
- Injection: 1.4 -2.0 GeV
- Extraction: 14-26 GeV
- Cycle length: 1.2-2.4 s
- Revolution period: 2.1μs
- bunch splitting:



CPS IPM A.D. 1968

THE CPS GAS-IONIZATION BEAM SCANNER

C.D. Johnson and L. Thorndahl
CERN, Geneva, Switzerland

PAC 1969

Summary

A non-destructive beam scanner was installed in the CPS ring early in 1968. Deriving a signal from the electrons liberated by the proton beam from the residual gas in the vacuum chamber and using a crossed el...tric and magnetic fields system of electro...ction, the scanner gives the projec... density distributions in the hori... ...tical planes. Spatial re... ...er than 1 mm.

An importan... ...use of a single collector wh... ...ctrons from a slice of the bea... ...ro equipotential surface. ... ...ipotential surfaces are arra... ...l to the beam and scanning is ... ...splacing these equipotentials ... ...e region of the beam. In particular ...ero equipotential, which always ...rough the detector, is scanned right ... the beam.

References

1. HORNSTRA, F. and DELUCA, W.H., Non-destructive beam profile detection systems for the ZGS, ANL internal report, 1967

Argonne, 1967

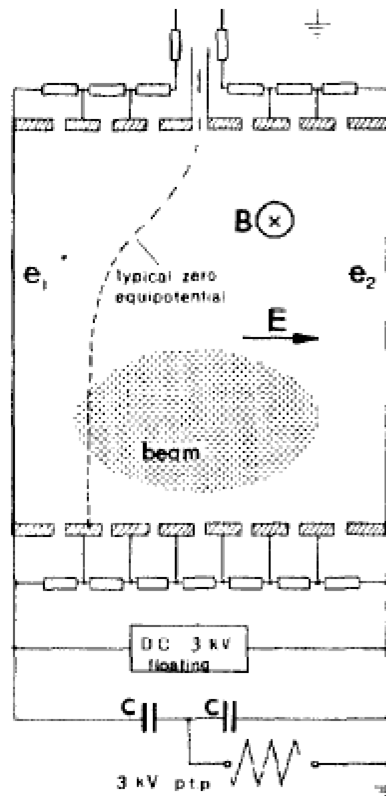


Fig. 1

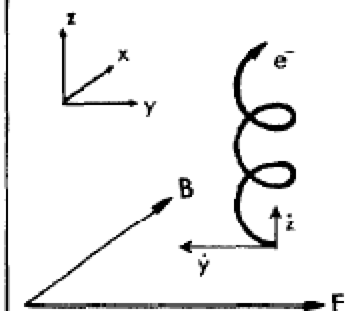


Fig. 2

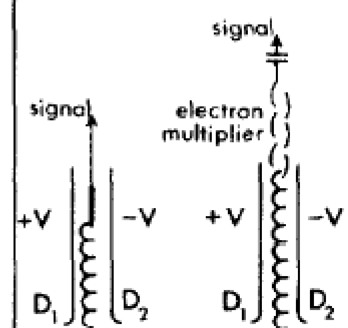


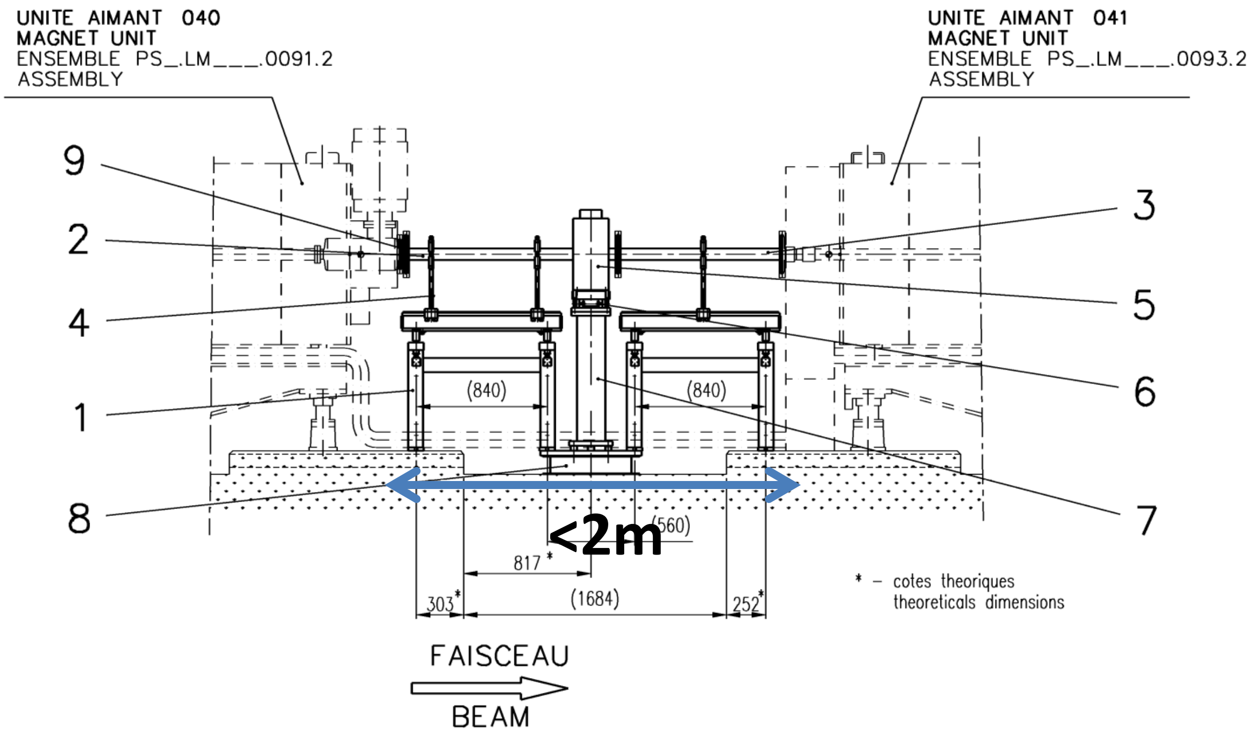
Fig. 3a Fig. 3b
IBS detectors

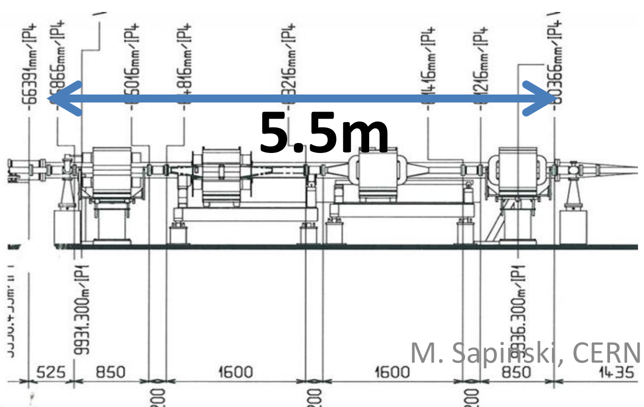
PS beams – examples from LIU

beam	SPS ftarget	TOF	EASTA	LHC 25 ns 72 bunches
		Injection		
Ek [GeV]	2.0	2.0	2.0	2.0/1.4
Bunch nrb	8	1	1	6
Charges/b	3.1E12	8E12	4E11	1.5E12
Bunch len [ns]	150	190	170	180
εH/V [μm rad]	7.6/5.4	9.2/7.8	1.5/1.5	1.5
		Extraction		
Ek [GeV]	14	20	24	26
Bunch nbr	420 (deb)	1	1	72
Charges/b	~5E10	8E12	3.8E11	1.25E11
Bunch len [ns]	5	50	debunched	4
εH/V [μm rad]	11/8	12/10	-	1.5

EDMS 1157752, document in work

Location (1)





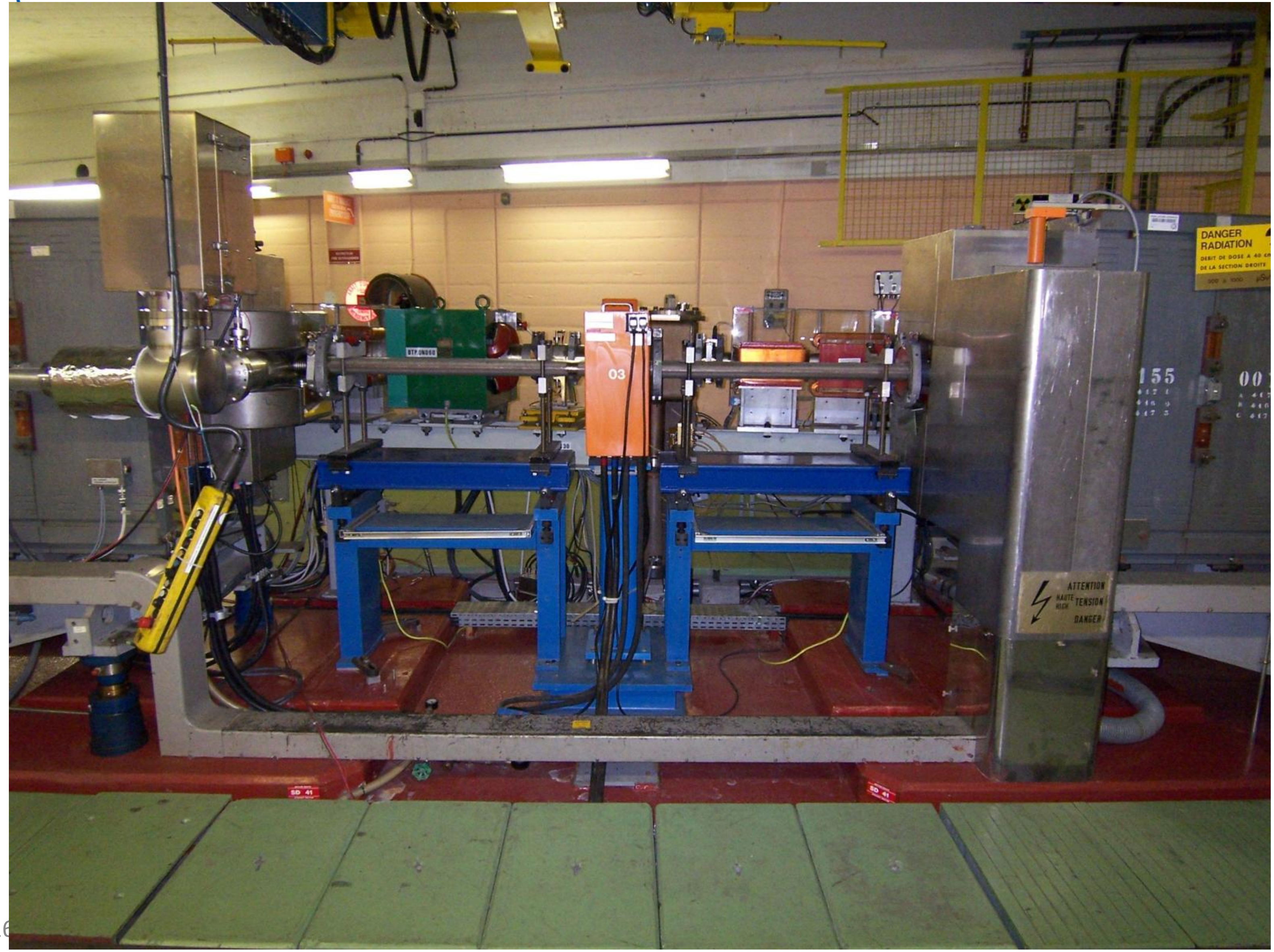
The largest available space: SS41 near injection region (radiation!)

β_H=22 m

β_V=12 m

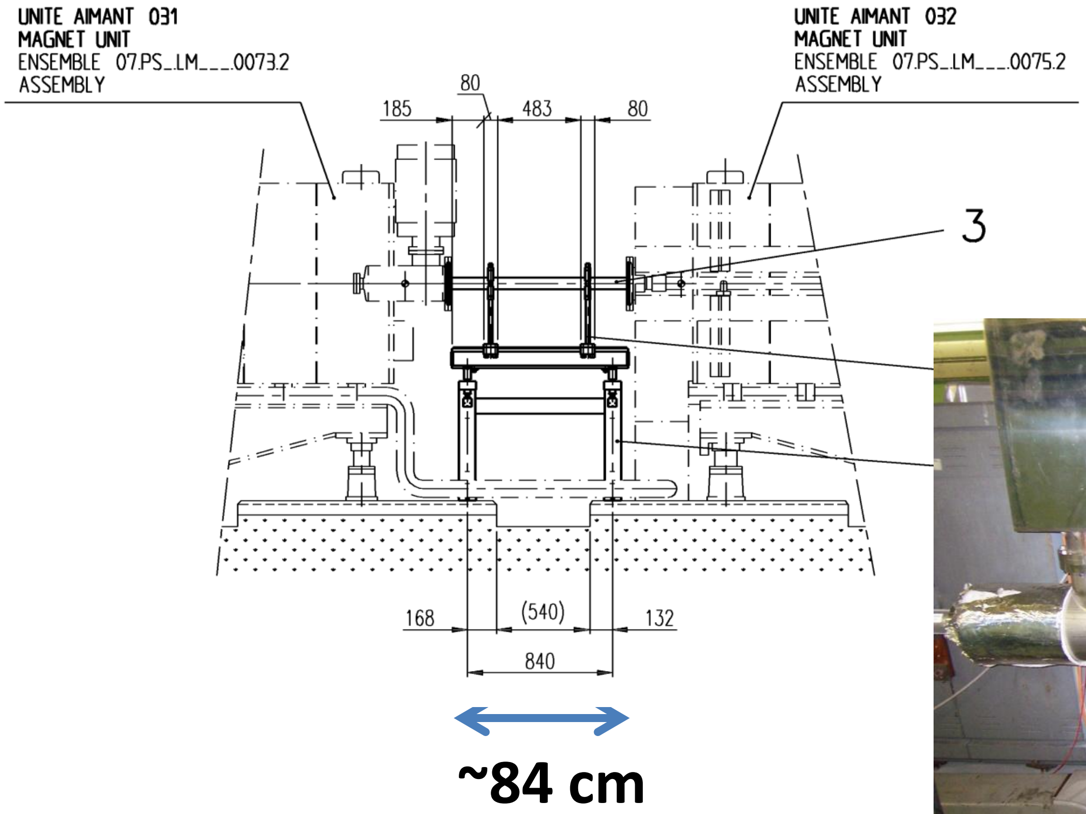
Beam size = 0.8-8.5 mm

Location (2)

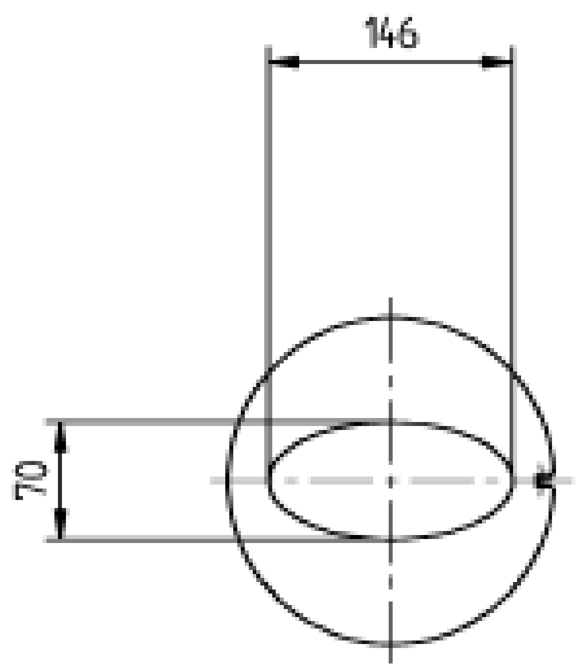


Location (3)

5 other locations: SS24, 32, 33, 62, 82



Typical vacuum chamber



First specification

- Integration time: 1 ms or better
- Acquisition frequency: 1 kHz or better
- Bunch-by-bunch (72 bunches max, not 420)
- Rest gas pressure: ~10^{-8} mbar
- Beam sizes: σ = 0.5-10 mm (but small ones more important)
- Emittance accuracy: 10% or better

Increasing number of bunches during the cycle might be a challenge.

What could it be…?

- Small detector, but we have more space than IFMIF.
- We could likely go for:
  - Electron collection with compact magnets.
  - Ion collection, compensating for space charge
  - …
- Multi-strip detector (silicon detector?) as the smallest beam is quite large
- MCP probably needed - need to measure fast.
- No gas injection system? Or yes? Fluorescence monitor possible with new cameras?
- …………………………………………………………………….