Test beams status

➔ Protvino

source: V. Ammosov

➔ Dubna

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IHEP accelerator

70 GeV accelerator complex for protons =

Linac - URAL-30, 30MeV
+
Booster – 1.5 GeV
+
Main ring – 70 GeV proton synchrotron

Works two times per year
March-April
Nov-Dec
For each run 1 month for physics

IHEP accelerator parameters

- cycle time - **10 s**
- spill time - **1.8 s**
- intensity ~ **$1 \cdot 10^{13}$ p/cycle**
- number of bunches - **30**
- RF structure: bunch length – **40 ns,**
  bunch spacing – **160 ns**
- beams are from extracted protons and internal targets

Beams

In the 1BV exp hall are from internal targets with limited intensity (<107 part/spill):**

-negative hadrons up to 55 GeV

-positive hadrons up to 20 GeV

-photons, electrons up to 30 GeV

-70 GeV protons from crystals

In the exp gallery are from extracted protons, have high intensity :

-protons

-intensive secondary hadrons

-neutrino

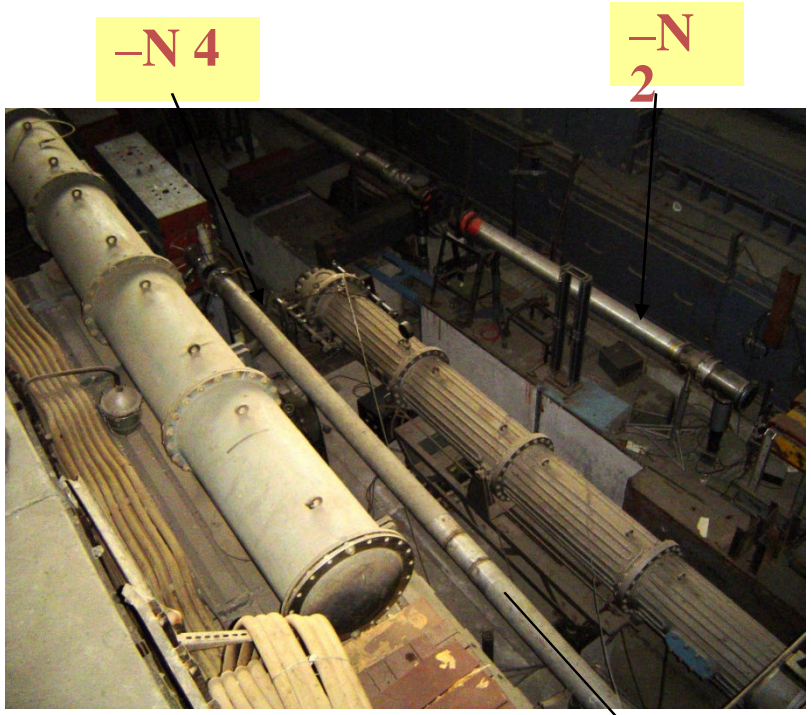
Beam line N 2B

–Tests with e and h beams can be done in one zone of beam line N 2B.

Particle type	Electron beam range, GeV/c	Hadron beam range, GeV/c
e^-	1- 45	-
h^-	1- 45	33 - 55
μ^-	1- 45	33 - 55

–Muon halo over 1 m2 with intensity ~ 10**6 can be used for monitoring purposes

–Heads of beams



Beam line N 2B

–Electron beam

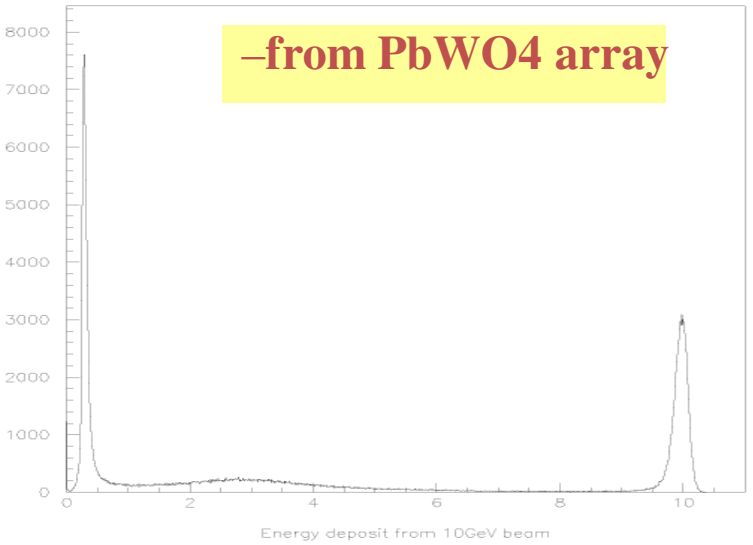
Energy, GeV	Beam resol., %	ECAL resol., %	BTS resol., %
1	4.3	11.0	2.05
2	5.5	7.8	1.03
5	5.6	4.9	0.43
10	3.8	3.5	0.24
27	1.2	2.1	0.15
45	1.0	1.6	0.13

- Beam tagging system allows to keep beam resolution
  ~10 times better than expected ECAL resolution
- Beam spot, ∅ ~ 3 cm

Beam line N 2B

–Electron beam

Energy, GeV	Intensity in spill on 10^{12} pot	Content		
		e , %	μ , %	h , %
1	$4 \cdot 10^2$	82	10	5
2	$1 \cdot 10^3$	77	15	8
5	$2 \cdot 10^3$	50	32	18
10	$5 \cdot 10^3$	34	35	30
27	$4 \cdot 10^4$	77	9	13
45	$2 \cdot 10^4$	91	4	5



Admixtures of h^- and μ^- allow to measure calorimetric response simultaneously for e^- , h^- and μ^- using Cherenkov counter

Beam line N 2B

–Hadron beam

- Momentum range
  (33-55) GeV/c
- Beam composition

π^-	96.4 %
μ^-	1.0 %
k^-	2.3 %
p^-	0.3 %

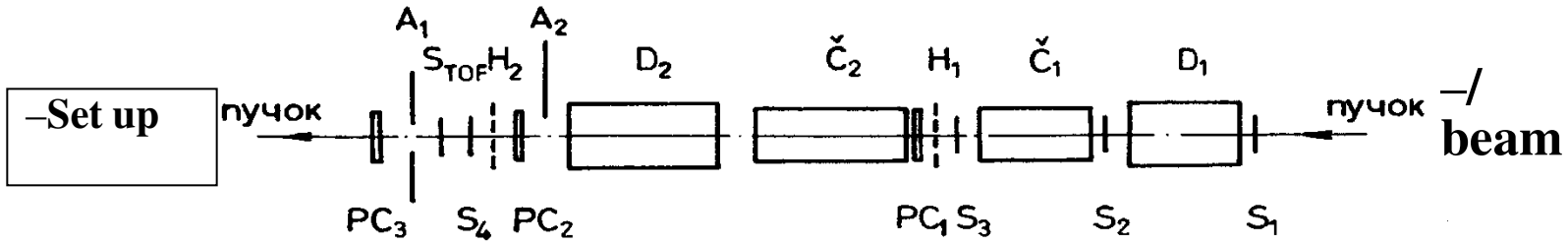
–Intensity for $\Delta p/p = \pm 1\%$

Energy, GeV	Intensity in spill on 10^{12} pot
33	$1 \cdot 10^6$
40	$3 \cdot 10^6$
55	$2 \cdot 10^5$

–70 GeV proton beam is also available

Beam line N 2B

– Beam monitoring system



$S_1 \div S_4$, A_1 , A_2 - scintillation counters

PC_1 , PC_2 - proportional chambers

H_1 , H_2 - scintillation hodoscopes

C_1 , C_2 - threshold cherenkov counters

D_1 , D_2 - differential cherenkov counters

S_{TOF} - time-of-flight scintillation counter

–Own DAQ system
–Trigger signals are available
–Beam experts are available

Beam line N 2B

Zone sizes:

- Beam height above flow 2.15 m
- 5/40 ton crane hook height 8 m
- Horizontal space +/-3 m
- Longitudinal space 10 m

Two counting rooms (32 m2 each) above zone are available with local net and internet connections

–Part of test zone
–Beam axis is indicated by tube

–Antipov's SIGMA magnet

Universal beam line N 22

- **Proton beam: up to 70 GeV/c , I = 10^6 – 10^{10} pps**

- **Secondary hadron beam**
  - **negative: 7 - 60 GeV/c, I < $6 \cdot 10^8$ pps**
  - **positive : 7 - 60 GeV/c, I < 10^{10} pps**

- **electron/positron beam: 7 – 40 GeV/c , I < $5 \cdot 10^5$ pps**

Conclusion

Protvino is ideal site for ILC beam tests

1. Suitable range of particle momentum

e^- : (1-45) GeV/c
$h^{+/-}$: (1-60) GeV/c
μ^- : (1-55) GeV/c

2. Variety of test beam zones are available

You are welcome !

Beam time is available ~2 months/year (April, Nov-Dec)

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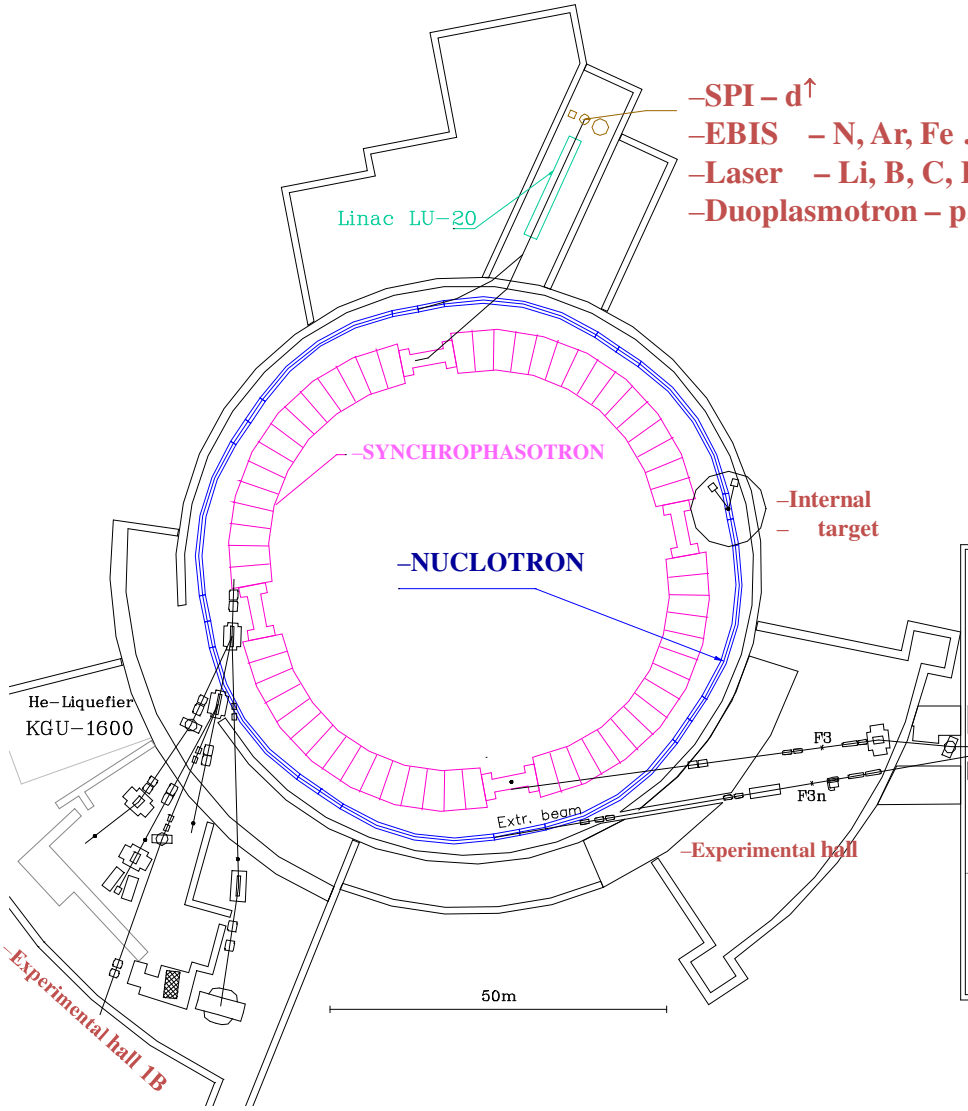
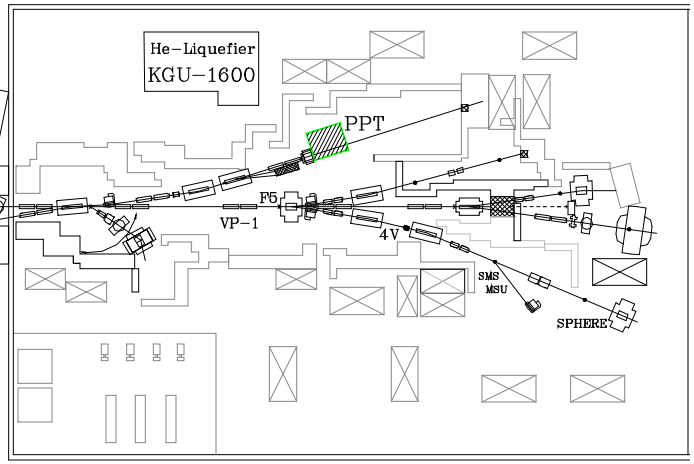
–Present accelerator facilities of LHEP

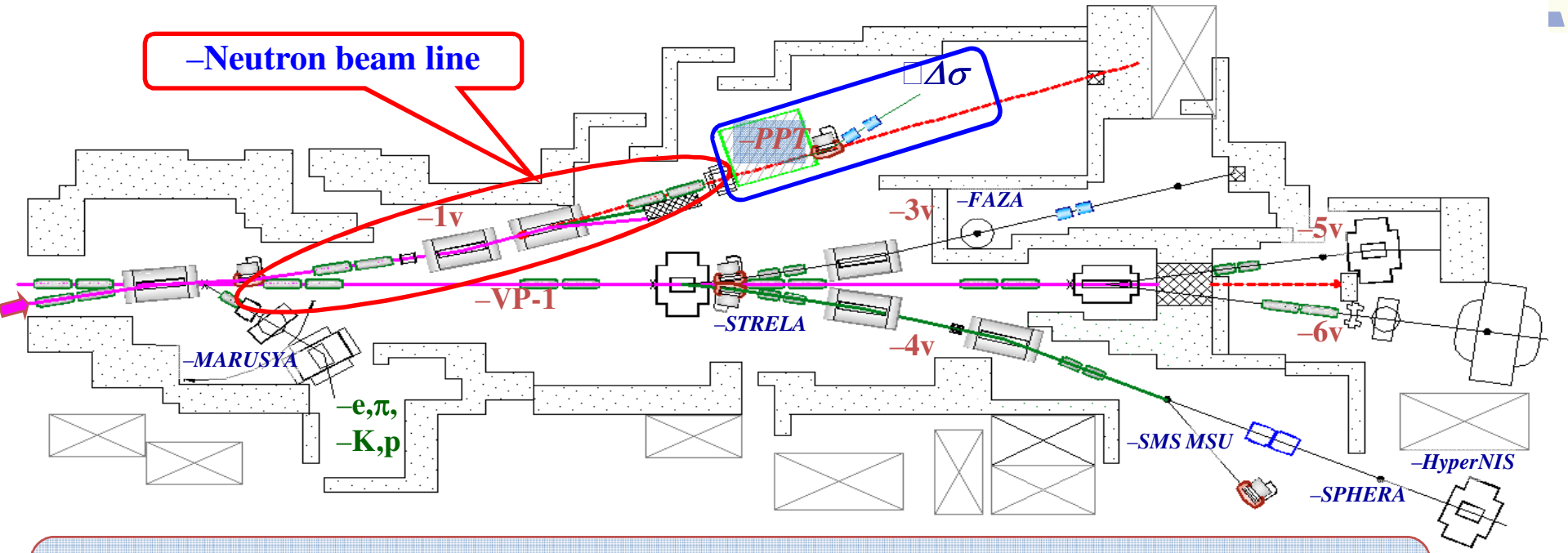
–SPI – d↑
–EBIS – N, Ar, Fe …
–Laser – Li, B, C, F, Mg …
–Duoplasmotron – p, d, α, ^{3}He



–Experimental hall 205



–Beam lines and setups in the experimental area



–Slowly extracted beam input

–Primary polarized deuteron traces –at secondary polarized beams forming

–Neutron beam line

–Sec. polarized protons

–*PPT* – Polarized Proton Target

Δσ, HyperNIS … – setups

Parameter	Units	I	II
Momentum range	GeV/c	≅ 1 – 4.5	≅ 1 – 6.5 (6.8)
Intensity at p_{max}	ppc	$2 – 4 \cdot 10^6$	$2 – 4 \cdot 10^7$
Polarization		≅ 0.55	≅ 0.90
Momentum spread (FWHM)	%	≅ 5	≅ 5
Angular spread (σ)	mr	1 – 1.5	1
Full beam size at PPT	mm	≤ 30	≤ 30

–Polarized neutron beam parameters

I - Synchrophasotron + Polaris

II- Nuclotron-M + SPI

$(P^2I)_{II}/(P^2I)_I \cong 25$

–P.Rukoyatkin, "Nuclotron beam lines…", SPIN-Praha-2009