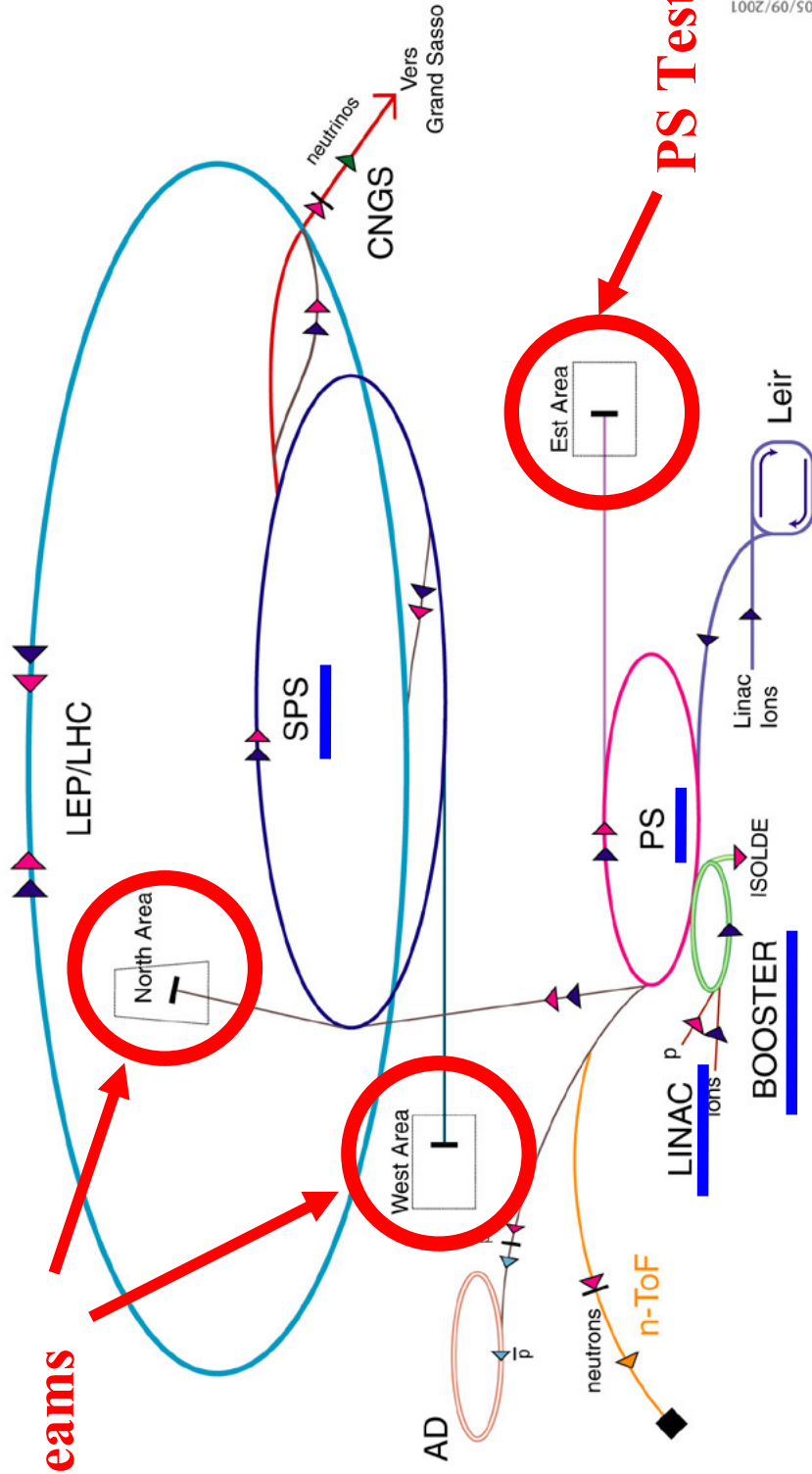


# Test Beams at CERN

## Accelerator chain of CERN (operating or approved projects)

not to scale

SPS Test Beams



PS Test Beams

CERN AC\_HF205\_V05/09/2001

- AD Antiproton Decelerator
- PS Proton Synchrotron
- SPS Super Proton Synchrotron
- LHC Large Hadron Collider
- n-ToF Neutrons Time of Flight
- CNGS Cern Neutrinos Grand Sasso

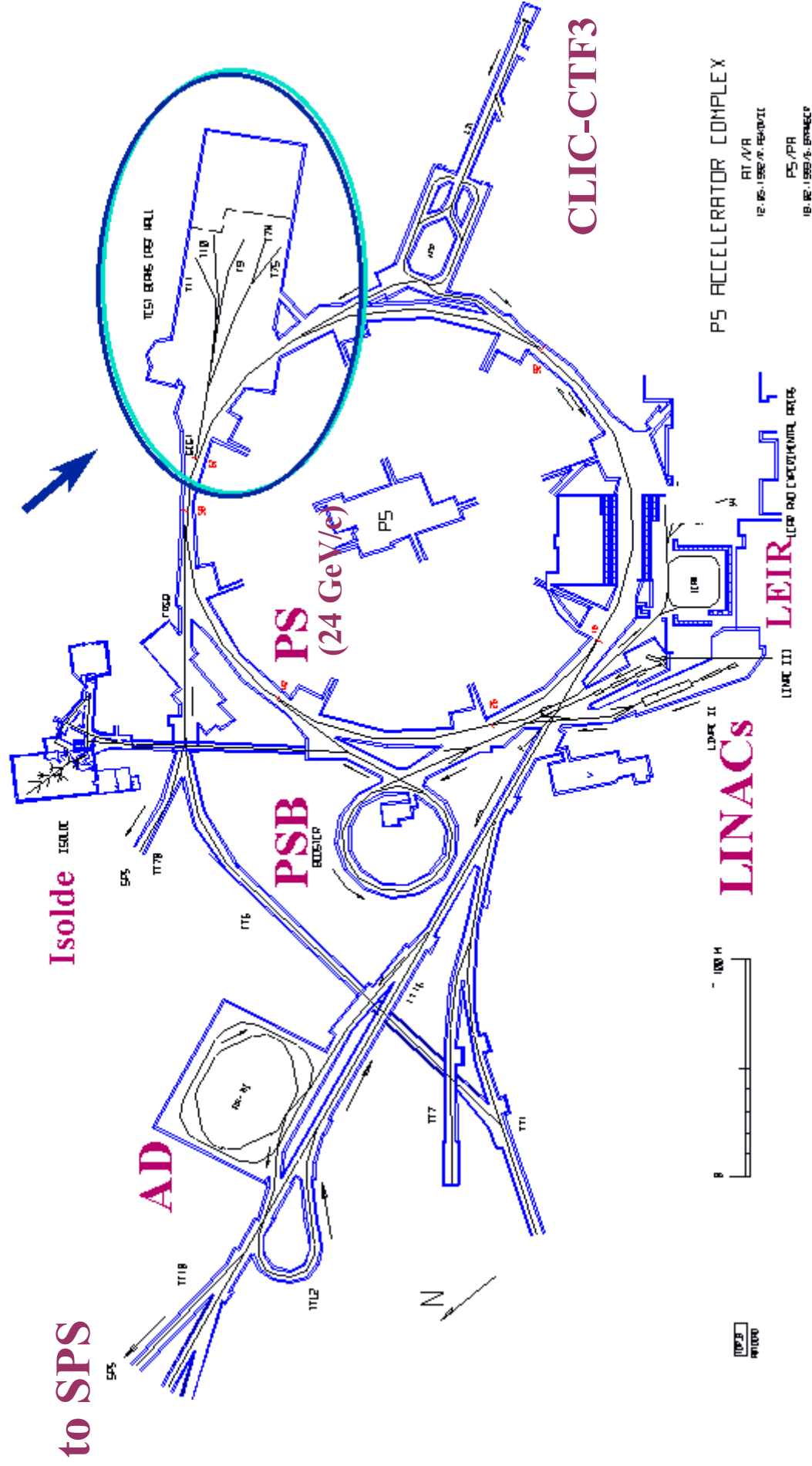
# CERN Test Beam Lines

*(general purpose)*

- **PS East Hall (Meyrin site, Switzerland)**
  - **4 test beam lines** (T7, T9, T10, T11), 1 – 10, **15**, 7, 3.5 GeV/c
- **SPS West Area (Meyrin site, Switzerland)**
  - **2 test beam lines** (X5, X7), 5 – **250** GeV/c
- **SPS North Area (Preveessin site, France)**
  - **4 test beam lines** (H2, H4, H6, H8), 10(2) – **400(450)** GeV/c
- **Irradiation facilities**
  - **Gamma Irradiation Facility (GIF), SPS West Area**
    - **Cs<sup>137</sup> source**, 662 keV photons, 720 GBq + parasitic muons from X5 test beam
  - **Proton/Neutron irradiation facilities, PS East Hall**
    - **24 GeV/c primary protons** from PS, 2 \* 2 cm<sup>2</sup> beam spot, 2.5 \* 10<sup>11</sup> protons/spill
    - **neutrons from proton beam dump**, spectrum similar to LHC environment

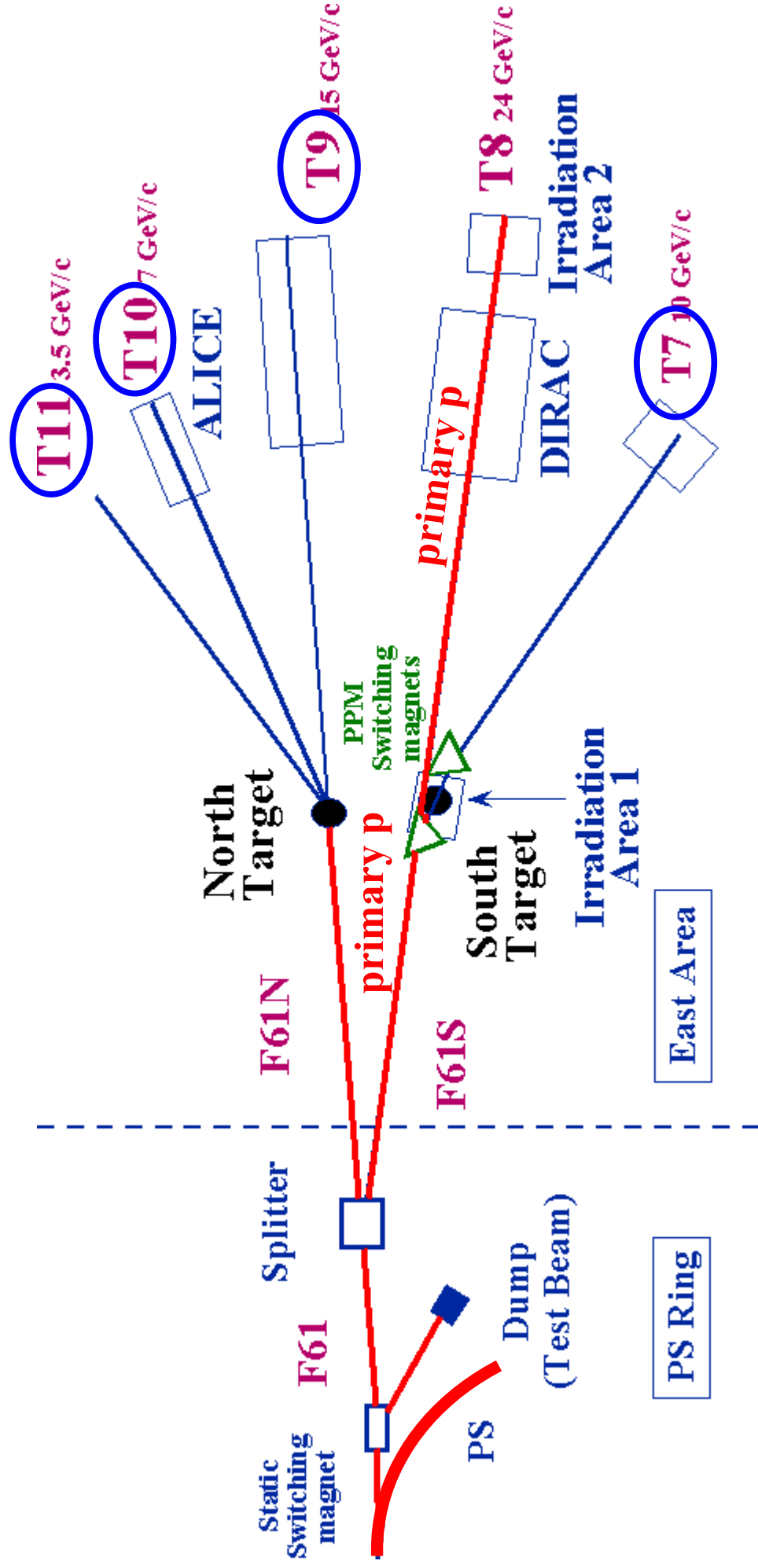
# PS Complex

## The PS East Area in the PS Complex



# PS East Hall beams

- PS East Hall beam schematics



# East Hall Beam Characteristics

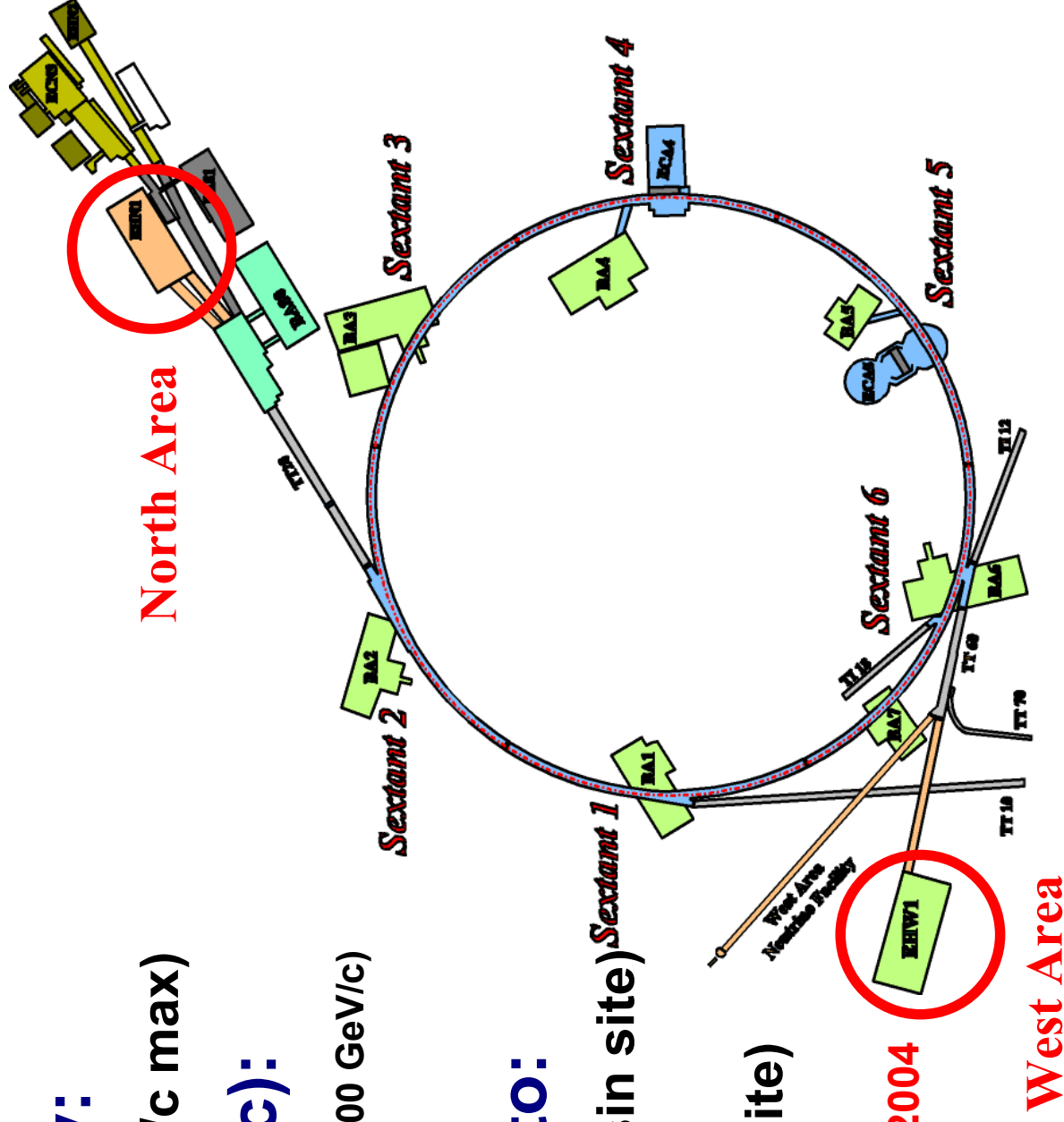
- **Momentum range**
  - min. **1 GeV/c** (all beams)
  - max. **3.5 GeV/c** (T11), **7 GeV/c** (T10), **10 GeV/c** (T7), **15 GeV/c** (T9)
- **Spill structure from PS**
  - **400 ms spill length**, typical 2 spills every 16.8 s, more on request
- **Particle type and intensity**
  - electrons (lower momenta), hadrons, muons
  - Max.  **$1-2 * 10^6$  particles/spill**, typically  $10^3 - 10^4$  used
- **Targets**
  - ~10 different targets, **T9/T10/T11 share same (North) target**
  - most frequently used:
    - standard **hadron target (Al)**
    - **electron enriched (Al + W converter plate)**, 5x – 10x more electrons

# SPS Layout

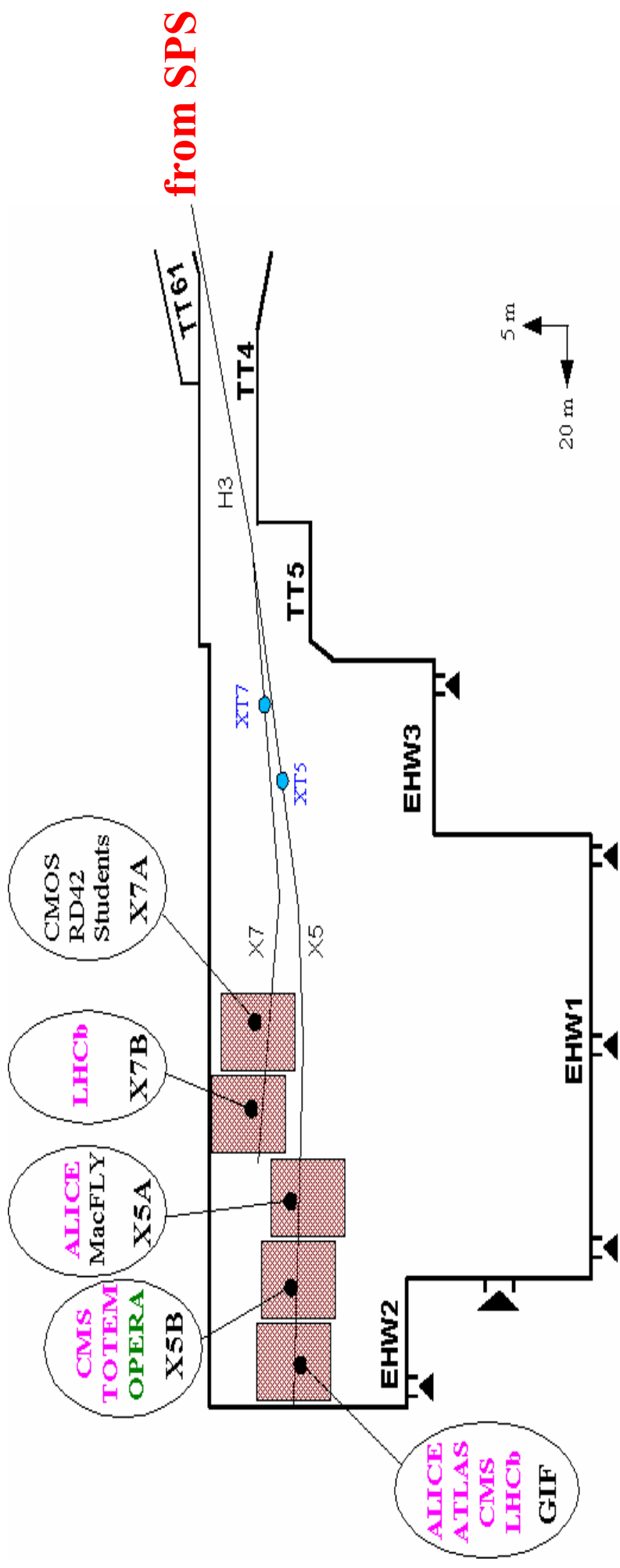
- SPS beam energy:
  - 400 GeV/c (450 GeV/c max)
- Spill (at 400 GeV/c):
  - 4.8 s spill length (at 400 GeV/c)
  - 1 spill every 16.8 s

## Beam extraction to:

- North Area (Prevezin site)
  - physics + test beams
- West Area (Meyrin site)
  - test beams only
  - will be closed end of 2004



# SPS West Area beams



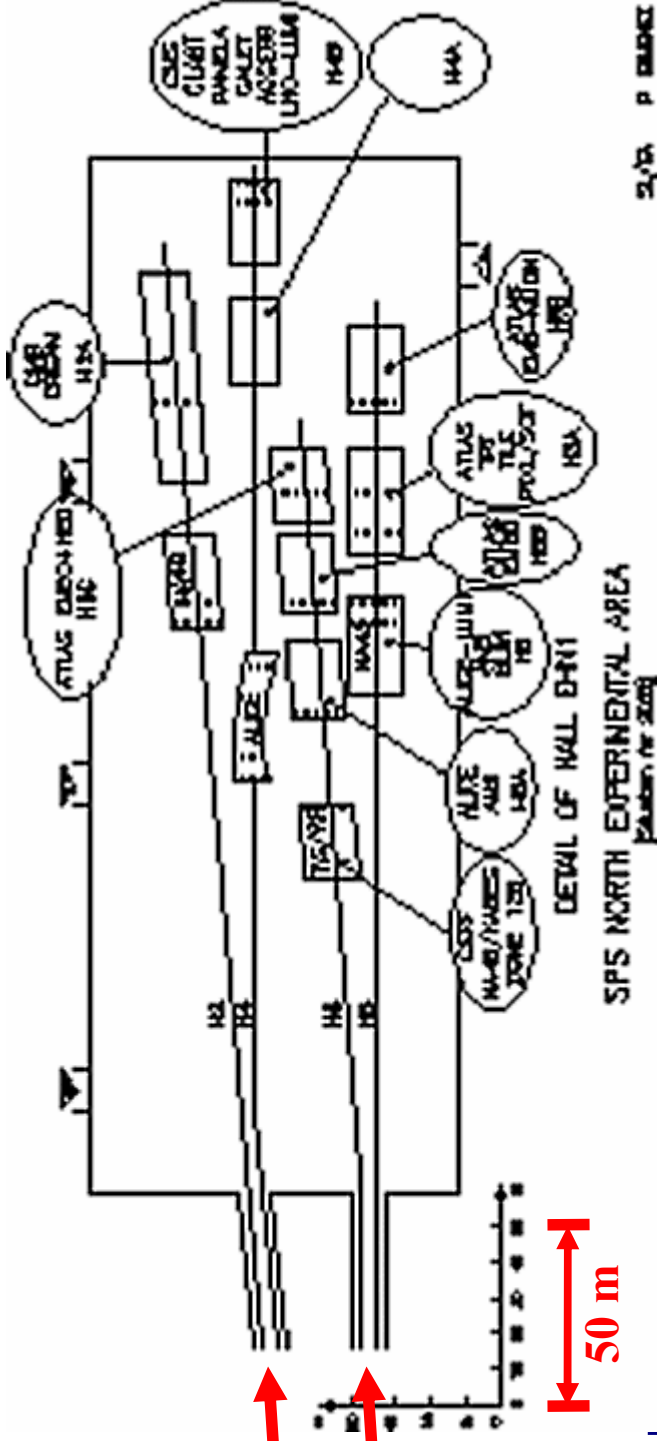
## SPS WEST EXPERIMENTAL AREA

(Situation for 2004)

### 4 beam lines (X5, X7, X1)

- 2 user areas per line (X5A+X5B, X7A+X7B) + GIF area behind X5
- 5 – 250 GeV/c, electrons/muons/hadrons, < 10<sup>6</sup> particles/spill

# SPS North Area



from SPS

T2 target

T4 target

50 m

- **H2, H4 and H8 beams**

- 10 - 400 GeV/c, up to  $10^8$  particles/spill ( $\pi^+$ )
  - **H4** can be set-up for very clean electron beam (up to  $\sim 300$  GeV/c)
  - **H2** and **H8** also have low energy tertiary beams (2 – 10 GeV/c)
- **H6 beam**
  - 10 – 205 GeV/c, up to  $10^8$  particles/spill ( $\pi^+$ )



# SPS North Area beams

- **H2/H4 originate from same (T2) target**
  - due to beam optics, **H2 and H4 should run with opposite polarity beams**
    - e.g. H2: protons or  $\pi^+$ , H4: electrons
    - beam conditions of H2 and H4 users need to be coordinated
- **H6/H8 originate from same (T4) target**
  - due to beam optics, **H6 should run at ~half H8 energy**
    - otherwise reduced particle intensity
    - also H6 and H8 users need to be coordinated
- **Up to 3 user areas per beam line**
  - can be used to take parasitic muons behind main user
  - some areas permanently occupied by ATLAS/CMS
  - some areas equipped with movable tables/platforms

# Support by CERN

(all free of charge)

- **Basic installation support**
  - **electronics hut** with beam control terminal
  - **computer network connection**
  - **crane usage** (with operator)
- **Assistance for beam tuning and operation**
  - **provision of beam position monitors**
    - MWPCs in PS East Hall
    - Delay wire chambers and wire filament scanners at SPS (higher accuracy)
  - **provision of (threshold) Čerenkov counter(s)**
    - usually 1 counter available per beam line, 2 can be requested
    - also more sophisticated differential Čerenkov counters (CEDAR) available at SPS (but tricky to commission and to operate, only on STRONG request)
- **NOT available: Storage space! (Very valuable these days)**

# (Some) Practical Details

- **When working at CERN**
  - need to **register** as CERN user or short term visitor (< 3 months)
  - might need visa for **Switzerland and/or France** (SPS North Area)
- **When working in test beam areas**
  - need **film badge** (medical certificate from home institute required)
  - **safety course** obligatory (every Tuesday, beam period usually starts on Wednesdays)
  - may need access / search patrol **authorizations**
- **Your equipment**
  - only **halogen free cables** allowed
  - use of **flammable gas** requires advanced contact to **Flammable Gas Safety Officer**
  - **safety inspection** obligatory before beam start (ISIEC form to be filled)



# Conditions to Use

*(for external users)*

- **External users = users/groups NOT related to an approved CERN experiment**
  - **can nevertheless use CERN beams without any charge**
- **Beam Requests should be sent to the SPS/PS Physics Coordinator ([SPS.Coordinator@cern.ch](mailto:SPS.Coordinator@cern.ch))**
- **Maximum time to request (to be allocated by Coordinator)**
  - PS East Hall: **2 weeks per year and group (can be split)**
  - SPS West and North Areas: **1 week per year and group**
- **More beam time requires to write a detailed proposal**
  - to be submitted to the relevant CERN Scientific Committee = **SPSC** for SPS and PS beams
  - **needs to be recommended by SPSC and finally approved by CERN Research Board (unlikely...)**

# Time Schedule

- **Beam requests should be submitted until October of the foregoing year**
- **2004**
  - **PS East Hall and SPS West + North Area running from May – October**
  - **end of 2004: SPS West Area is closing and will be dismantled**
- **2005**
  - **NO BEAM at PS and SPS**
- **2006**
  - **PS East Hall + SPS North Area running (?) (under revision...)**
- **2007**
  - **LHC start, PS East Hall + SPS North Area running**

# Contact Persons

- **General contact, PS and SPS beam requests, schedules, any problems...**
  - [SPS/PS Physics Coordinator](#) (= Michael Hauschild presently)
- **Beam Physicists of PS and SPS Experimental Areas**

(direct contact concerning technical help, beam conditions, user areas etc)

  - PS East Hall ([Luc Durieu](#))
  - SPS West Area ([Lau Gatignon](#))
  - SPS North Area test beams ([Ilias Eftymiopoulos](#))
- **Irradiation facilities**
  - Gamma Irradiation Facility (GIF)
    - [Hans Reithler](#) (User Schedule), [Mike Clayton](#) (Technical Coordinator)
  - IRRADx proton/neutron irradiation facilities
    - [Maurice Glaser](#), [Michael Moll](#)

# More Informations

- **About:**

- Beam requests
- Schedules (CERN accelerators, users)
- Description of beam areas, beams
- Registration, access, safety
- Practical details, useful links
- etc.

- **PS Users:**

<http://ps-schedule.web.cern.ch/ps-schedule/>

- **SPS Users:**

<http://sps-schedule.web.cern.ch/sps-schedule/>