



# CERN installation

---

I. Efthymiopoulos, A. Fabich, J. Lettry  
CERN AB-ATB

<http://cern.ch/proj-hiptarget>

MERIT review, Dec 2005

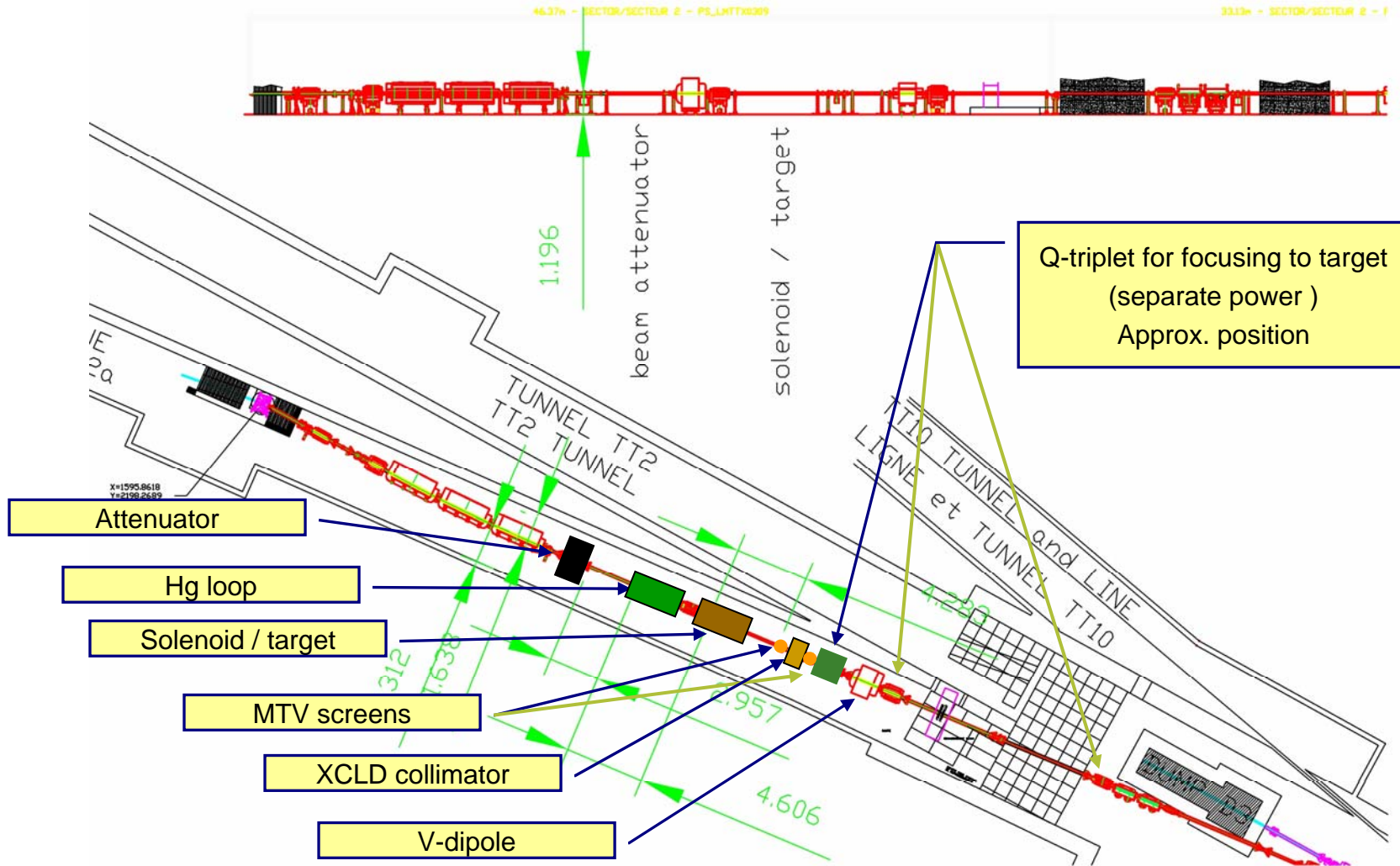


# Contents



- Layout TT2A and periphery
  - Beam line
  - Control room
- Proton beam
  - Installation
  - Proton synchrotron beam
- Safety
  - Cryogenics, fire, access, radiation, chemicals interlocks
- Schedule
- Budget

# Layout - beam elements





# Layout MERIT experiment



## MERIT physical integration

- TT2A/TT2
  - Draftsman started on ACAD drawing week 49
  - Ready by January 2006
- Transport & installation
  - solenoid base plate and transport vehicle: “kinematics”
  - cryogenics/power to solenoid
- Control room: ISR or elsewhere (?)
  - Are cables installations required between TT2 & CR?
    - Can all communication be based on Ethernet network?
    - List of communication connections
  - Required for definition of place and distance to TT2A
    - to be defined by March 2006



# Pulse list program



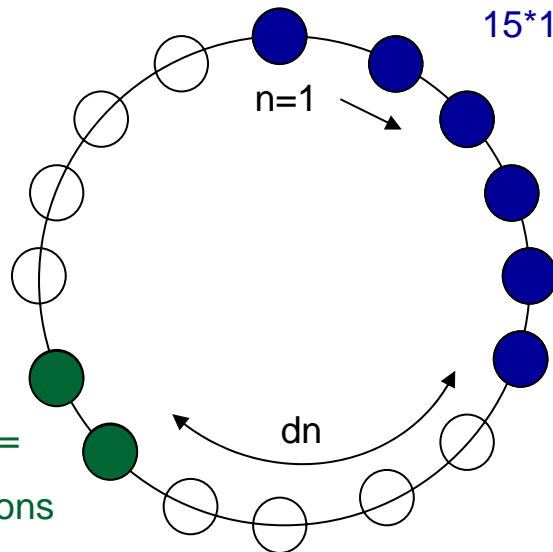
- Based on pulse list July 2005
  - <http://proj-hiptarget.web.cern.ch/proj-hiptarget/default/Documents/subsystems/ProtonBeam/pulselist.xls>
- Total dose limited to  $3 \cdot 10^{15}$  protons on target.
  
- Nominal momentum 24 GeV/c
- Corrected intensity/bunch
  - Previously guaranteed:
    - Intensity/bunch  $\leq 4 \cdot 10^{12}$  protons (h=8)
    - Total maximum  $\leq 32 \cdot 10^{12}$  protons (h=8)
  - Updated:
    - **Intensity/bunch 2-2.5\*10<sup>12</sup> protons (h=16)**
    - **total maximum > 32\*10<sup>12</sup> protons/pulse (h16)**
    - **h16 provides potential for increased intensity**
  - Baseline: harmonic 16
- Pulse length up to 20 ms possible (beyond 2  $\mu$ s: p=14 GeV/c)
  
- Updated pulse list by beginning Jan 2006
  - Define priority list
  - Needs to be approved by collaboration by end Jan. 2006
  - Request MD time in 2006; set-up time in 2007

- splitting h8 → h16 creates bunch pairs
  - Bunch pairs located in bucket n and n+1

PUMP:

6 bunches =

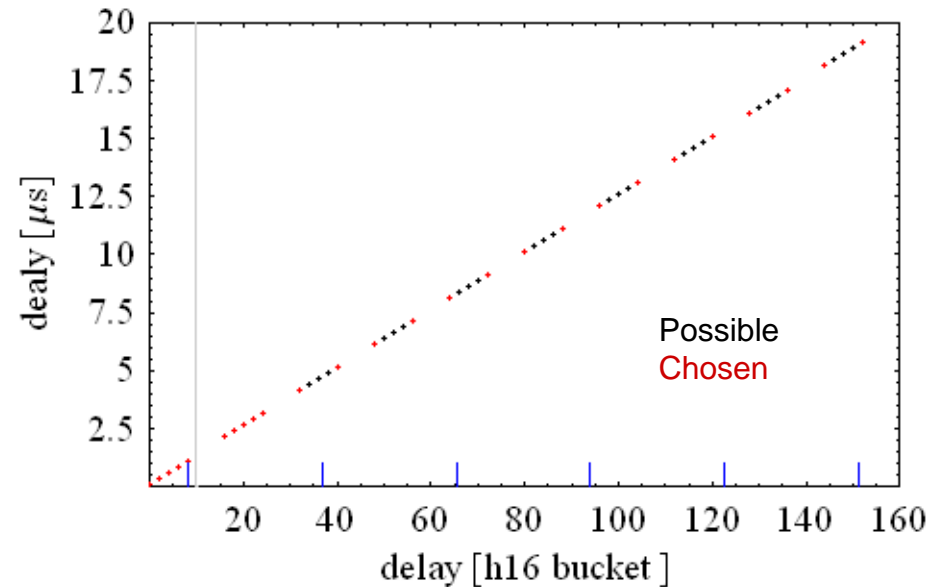
$15 \cdot 10^{12}$  protons



PROBE:

2 bunches =

$5 \cdot 10^{12}$  protons



- $dn_{\text{experiment}} = 0, 2, 4, 6, 8, 16, 18, 20, 22, 24, 32, 40, 48, 56, \dots$
- Inhomogeneous intensity distribution causes intensity limits → MD required



# Proposition for Priorities



## General approach

- Repeat each parameter configuration twice
- Increase intensity to moderate  $1.5 \cdot 10^{13}$  protons/pulse
- Do basic program, MHD first
- Each proton pulse configuration is performed at  $B=15$  T (solenoid) and  $B=0$  T (horn)
- Consider effort for PS operation to change settings

0. beam setup
1. MHD
2. beam position
3. Pulse structure
  - a) Cavitation
  - b) 50 Hz operation
4. Spot size
5. Intensity

Pulse should include operation scenarios.

## 3 Monitor types considered

Based on beam properties to be measured

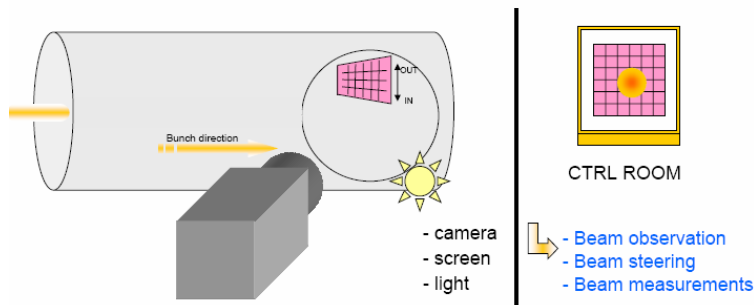
- MTV screens
  - “almost” readily available
  - Minor effort
  - Minimum budget
- SEM-grid
  - None available - needs new construction
  - Costly: >50 kChF
  - Manpower these days very little at CERN
- Wire scanner
  - “Slow” measurement

## Baseline: MTV screens



What is the **BTV** / **MTV** system?

**TV system** → { BTV = Beam TV. Name used for the SPS and the LHC.  
MTV = Monitor TV. Name used for the PS complex.



Hardware CTRL

## Transverse beam parameters

- Position & spot size → MTV screens
- Direction → 2× MTV screens & collimator
- Divergence → not a direct measurement
  - Rely on beam simulations
  - Estimate from spot size monitors

## Longitudinal beam parameters

- Measured by pick-ups in the PS & TT2 line upstream of MERIT
- Log values and make available the information for the MERIT collaboration
- Parameters measured:
  - Bunch length
  - Bunch spacing
  - Pulse length
  - Intensity



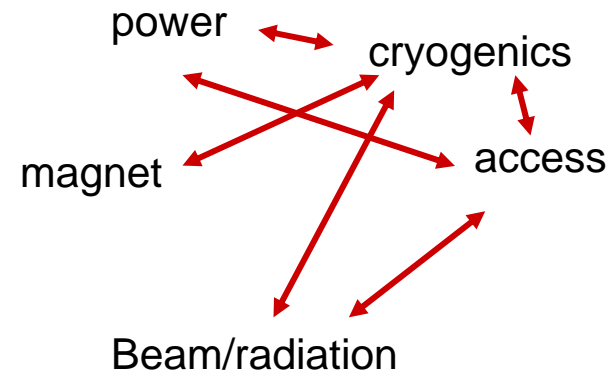


# Safety



Partly settled, partly in negotiation with CERN safety commission

- ODH
  - Generally followed up by AT-ECR
  - Monitors to be installed
    - TT2/A (AT-ECR)
    - TT10 (ATB-EA)
- Fire
  - Followed up by ATB-EA
  - Identification of fire risk
  - Monitors to be installed in TT2/A
- Mechanics
  - Followed up by ATB-EA
  - Pressure vessel
- Radiation
  - Followed up by ATB-EA
  - Activation of mercury -> ISO2191
  - Transport of activated material
- Chemicals
  - Mercury handling
- Interlock, access
  - Followed up by ATB-EA
  - Implementation by TS-CSE

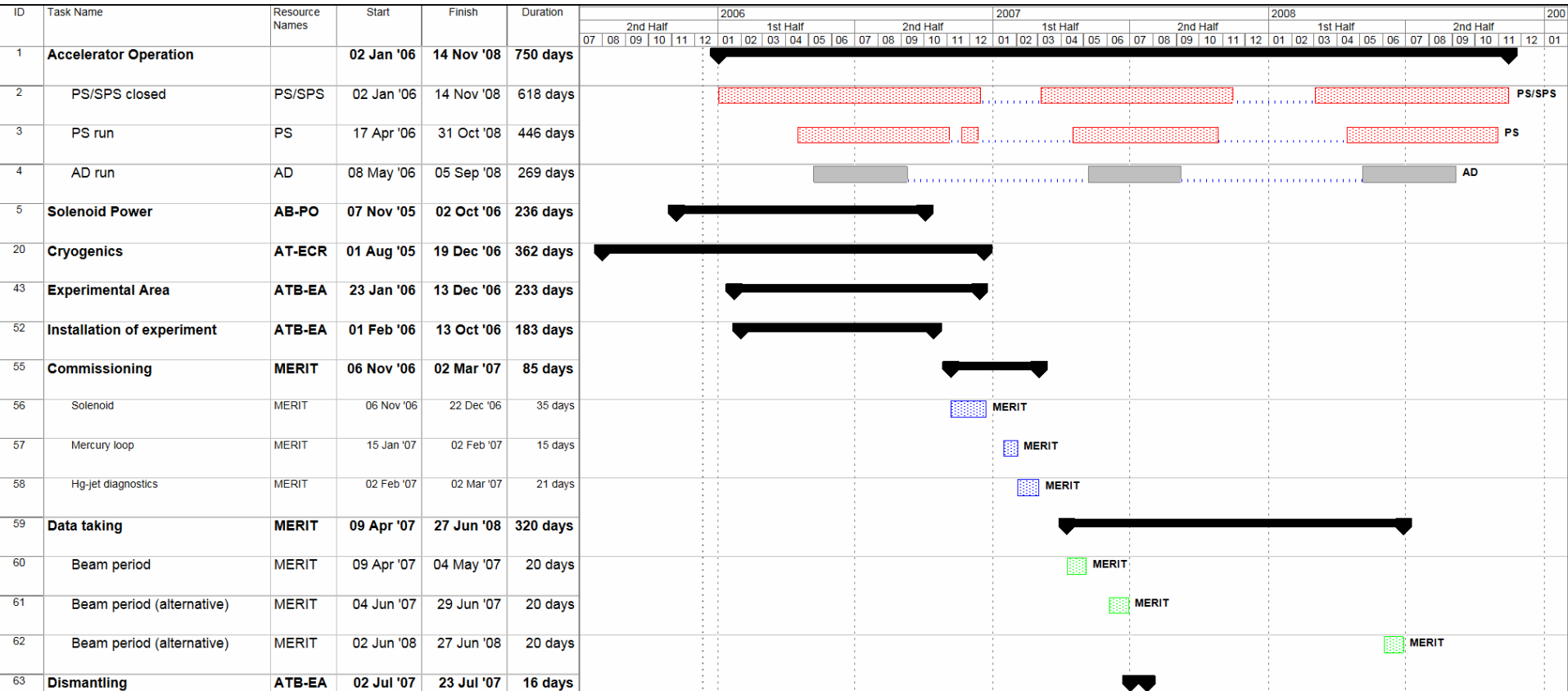




# Schedule at CERN

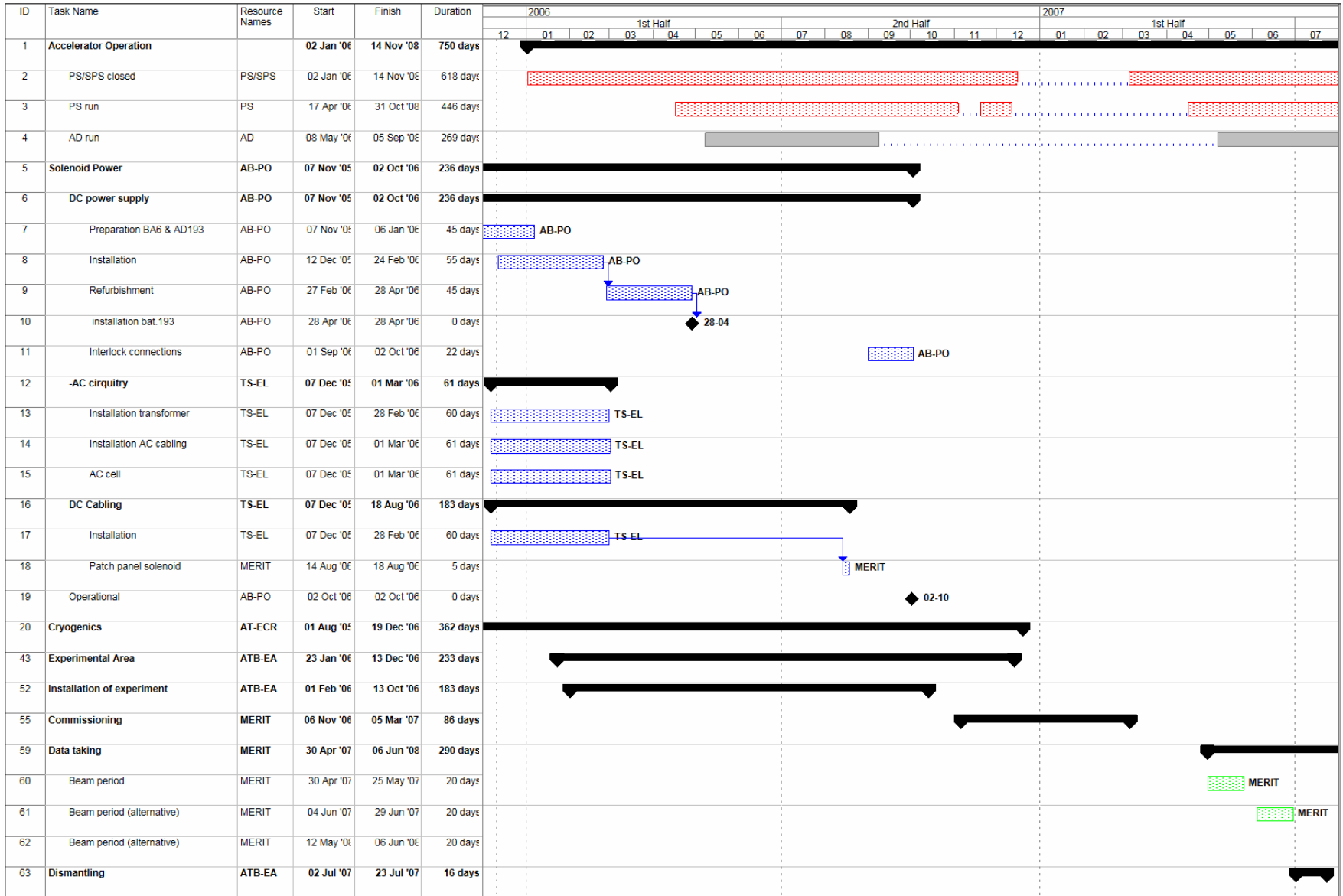


- Target date: November 2006!
  - Infrastructure to be finished before arrival of solenoid/mercury loop
  - Followed by installation and commissioning including all systems
- Consider restrictions by
  - Installation delay (manpower, tendering, ordering, ...)
  - Access limitations (2006 beam run)



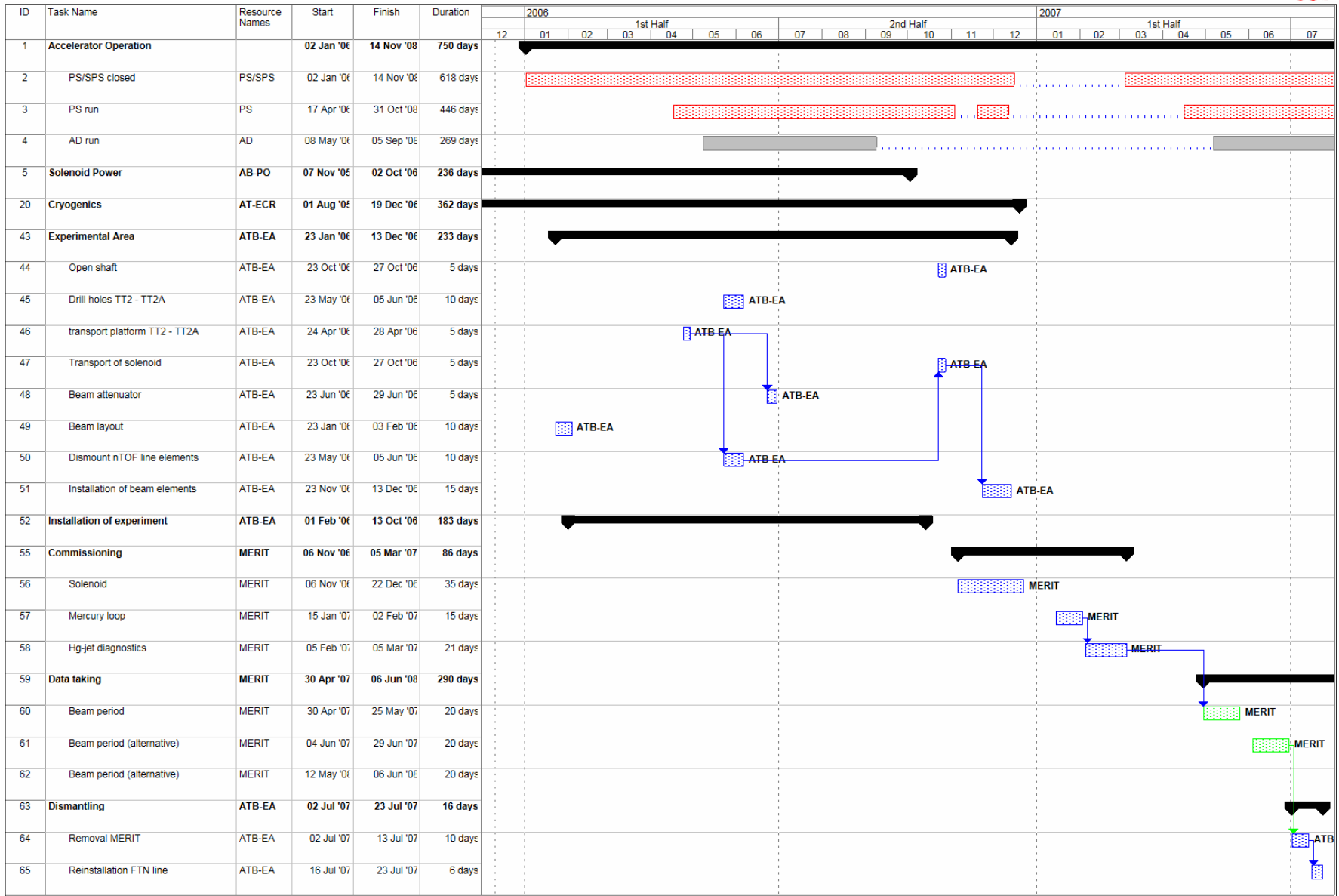


# Power installation - schedule





# ATB schedule





# Budget breakdown 2005



- MERIT budget code at CERN
  - + 49 kChF
  - -31 kChF spent to date
  - Balance 9.Dec. 05: 18 kChF

Summary		
Nature	Estimate [kChF]	Expended [kChF]
Travel	10 (2005)	7
Power supply	110 (all)	10.6
Designer	-	3.8
Cables	95 (all)	10.2



# Budget estimate 2006 (CERN)



- To come soon (within weeks)
  - Water cooling PS: 5 kChF
  - DC cable installation
    - 20 kChF including material and manpower
  - AC cable installation
    - 10 kChF
  
- Total estimate 2006 (draft)
  - power: 100 kChF until spring 2006
  - cables: 95 kChF until Feb. 2006
  - cryogenics: 360 kChF until Nov. 2006
  - Beam diagnostics: 15 kChF
  - Particle detectors: 40 kChF
  - AB-ATB: 50 kChF (draftsman, transport, safety, ...)
  
- Travel
  - 5 x 3000 ChF = 15 kChF



# EDMS



- Electronic Document Management System

<http://edms.cern.ch/AB-001130/>

- All official documents at CERN are passed here
  - “version” handling integrated
  - Approval processes integrated
- 
- Will be used by CERN collaboration members.
  - Can be used worldwide.
- 
- Can also be used for a parameter list document.



# Conclusions



- MERIT integration (planning) on track.
- Installation of power/cables on track.
- Safety issues carefully considered.
- Critical items
  - Cryogenics must proceed to schedule
  - Start tender soon