CERN Installation

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CERN AB-ATB

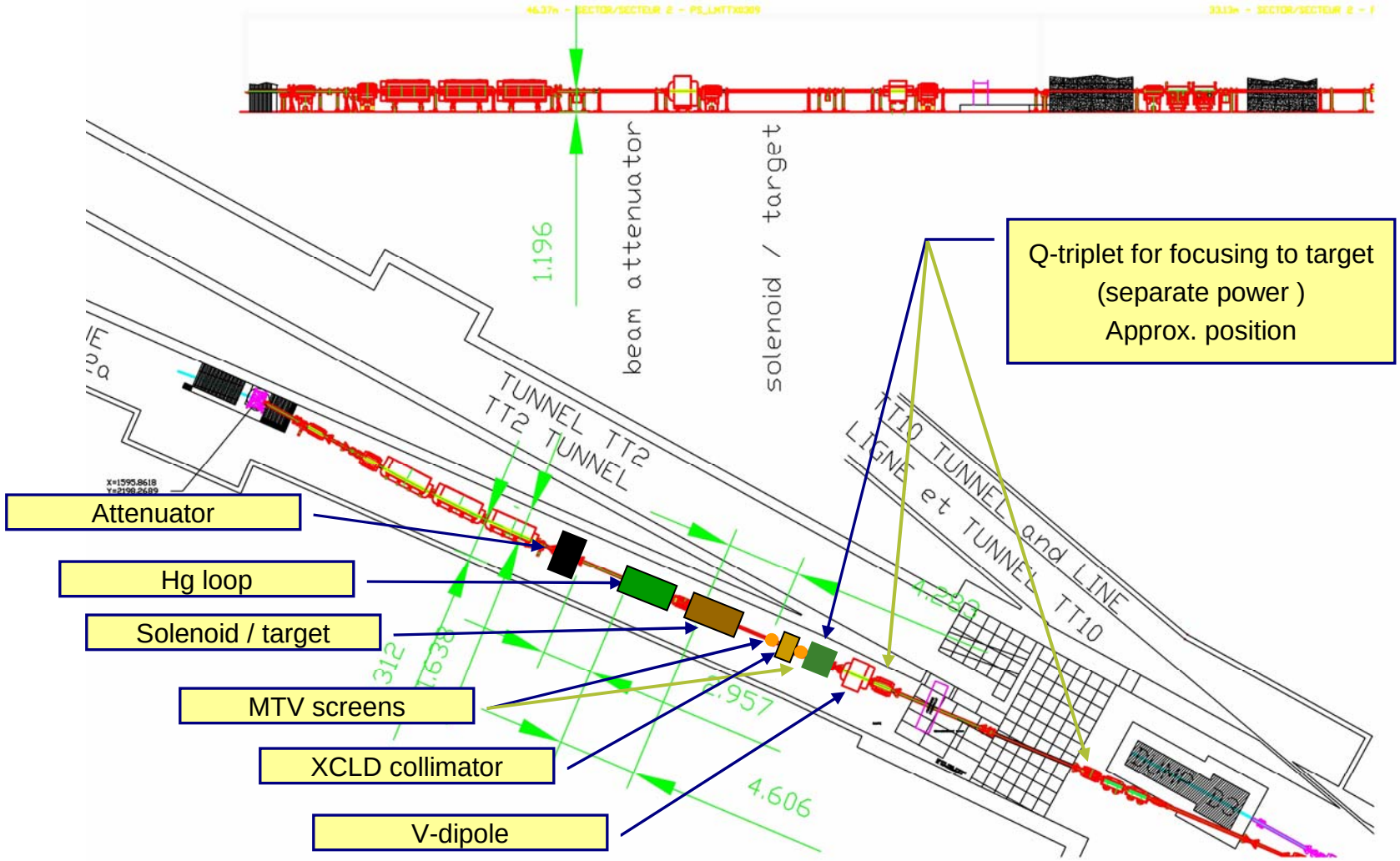
http://cern.ch/proj-hiptarget

MERIT review, Dec 12 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 $3*10^{15}$ protons on target.

- Nominal momentum 24 GeV/c
- Corrected intensity/bunch
  - Previously guaranteed:
    - Intensity/bunch ≤ $4*10^{12}$ protons (h=8)
    - Total maximum ≤ $32*10^{12}$ protons (h=8)
  - Updated:
    - **Intensity/bunch 2-2.5*10^{12} protons (h=16)**
    - **total maximum > 32*10^{12} protons/pulse (h16)**
    - **h16 provides potential for increased intensity**
  - Baseline: harmonic 16
- Pulse length up to 20 ms possible (beyond 2 μs: 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

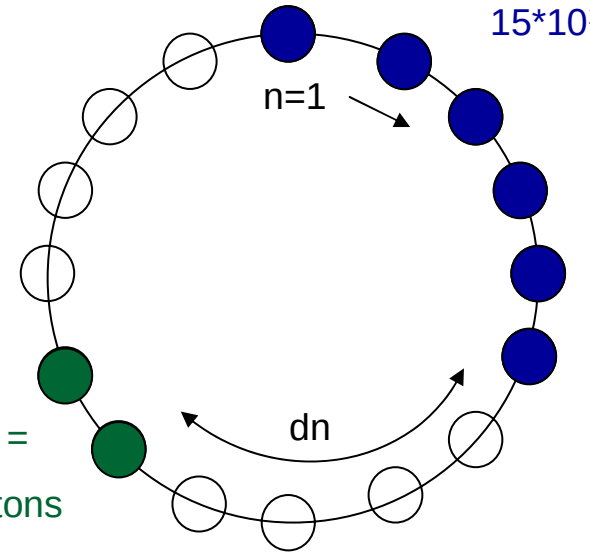
Pump-probe method

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

PUMP:

6 bunches =

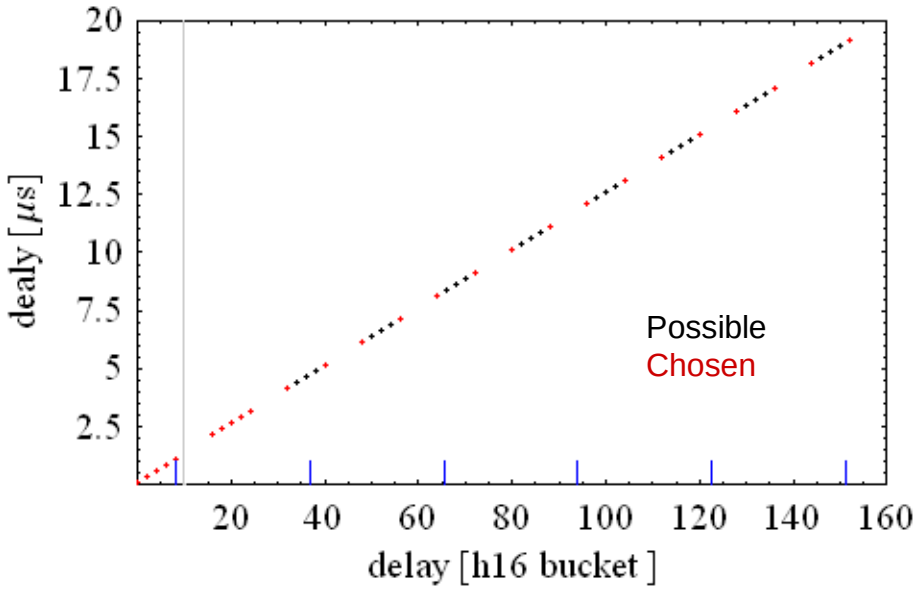
$15*10^{12}$ protons



PROBE:

2 bunches =

$5*10^{12}$ protons



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

Proposition for Priorities

General approach

- Repeat each parameter configuration twice
- Increase intensity to moderate $1.5*10^{13}$ 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.

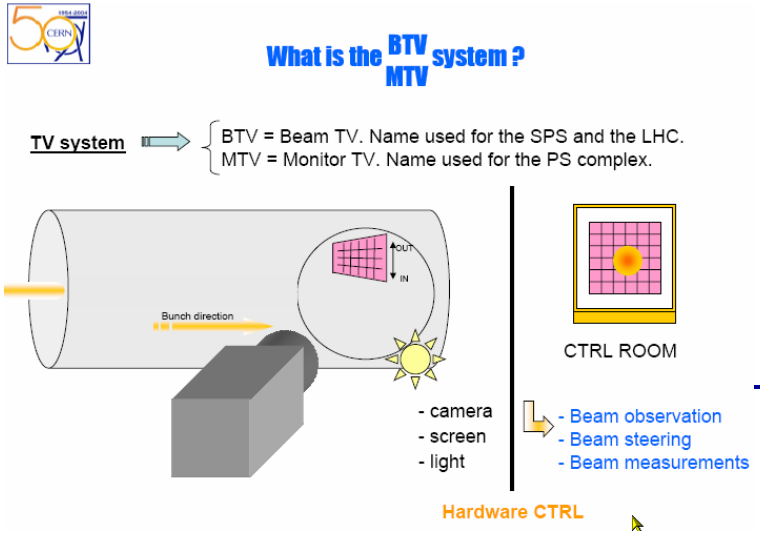
Beam profile measurement

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



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

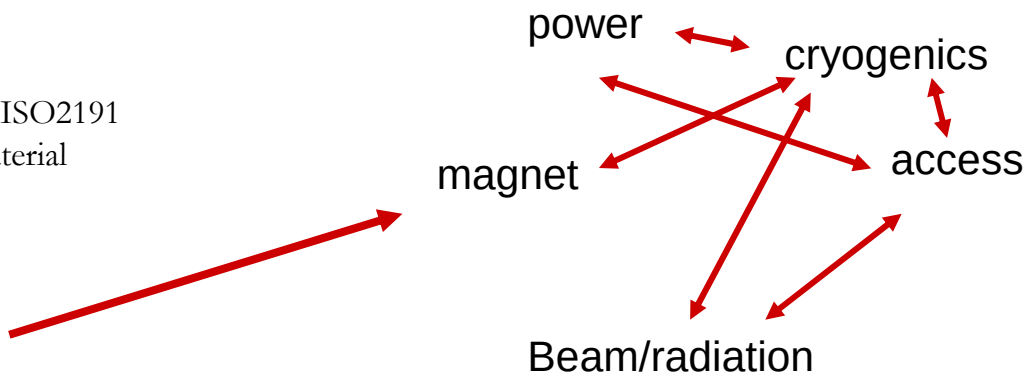
Longitudinal beam parameters

- 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

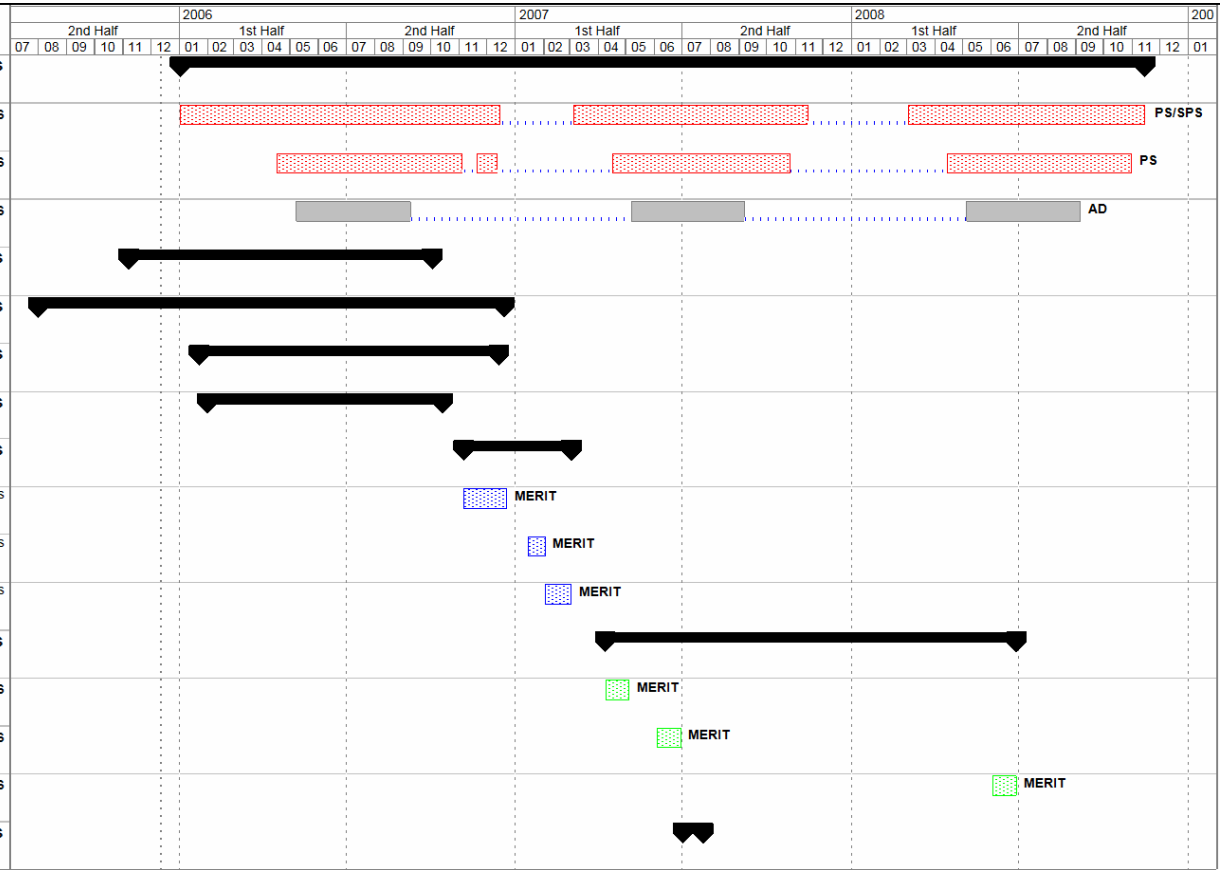
- ODH
  - Generally followed up by AT-ECR
  - Monitors to be installed
    - TT2/A (AT-ECR)
    - TT10 (ATB-EA)
- Fire
  - Followed up by ATB-EA
  - Identification of fire risk
  - Monitors to be installed in TT2/A
- Mechanics
  - Followed up by ATB-EA
  - Pressure vessel
- Radiation
  - Followed up 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



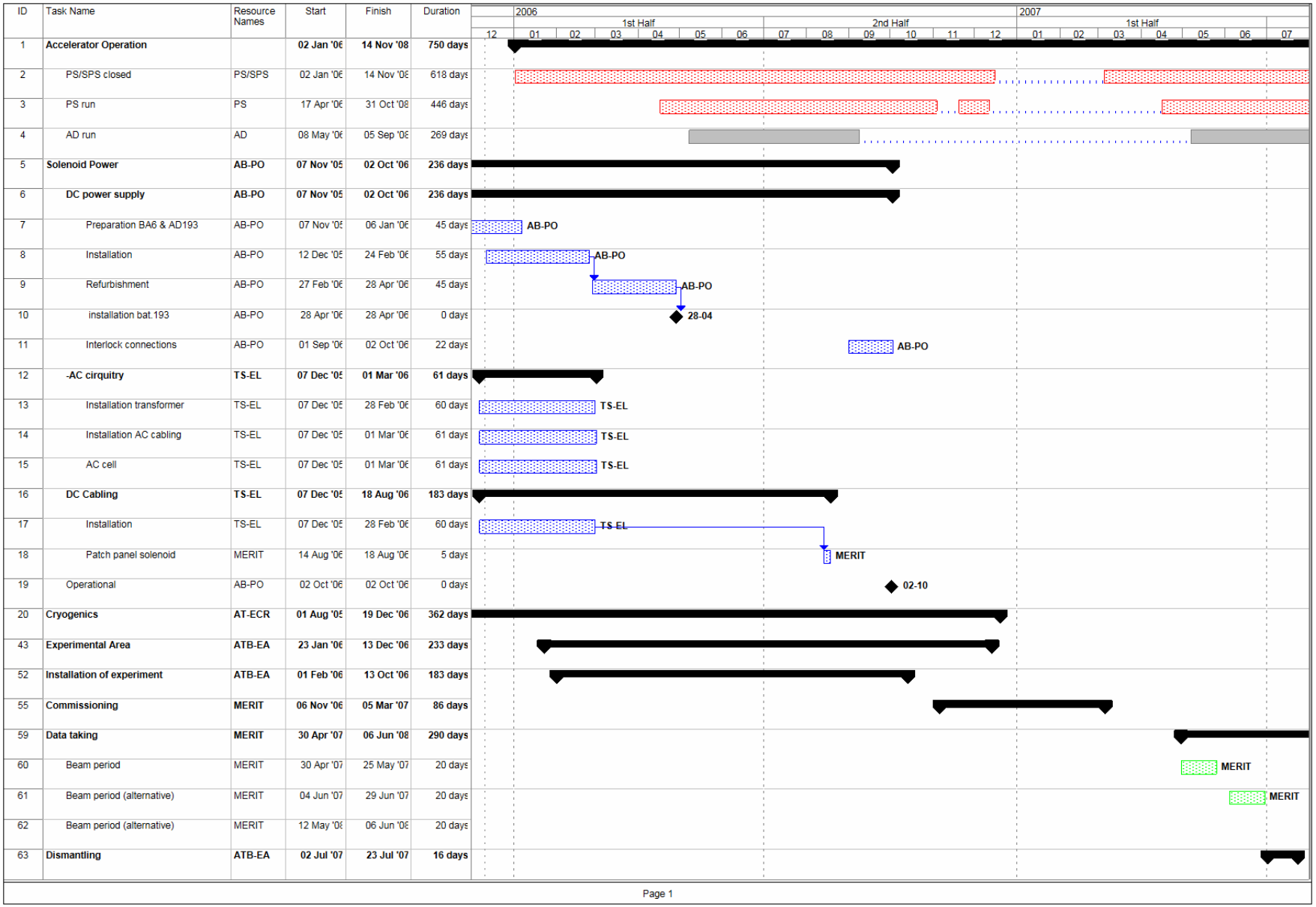
Schedule at CERN

- 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)

ID	Task Name	Resource Names	Start	Finish	Duration
1	**Accelerator Operation**		**02 Jan '06**	**14 Nov '08**	**750 days**
2	PS/SPS closed	PS/SPS	02 Jan '06	14 Nov '08	618 days
3	PS run	PS	17 Apr '06	31 Oct '08	446 days
4	AD run	AD	08 May '06	05 Sep '08	269 days
5	**Solenoid Power**	**AB-PO**	**07 Nov '05**	**02 Oct '06**	**236 days**
20	**Cryogenics**	**AT-ECR**	**01 Aug '05**	**19 Dec '06**	**362 days**
43	**Experimental Area**	**ATB-EA**	**23 Jan '06**	**13 Dec '06**	**233 days**
52	**Installation of experiment**	**ATB-EA**	**01 Feb '06**	**13 Oct '06**	**183 days**
55	**Commissioning**	**MERIT**	**06 Nov '06**	**02 Mar '07**	**85 days**
56	Solenoid	MERIT	06 Nov '06	22 Dec '06	35 days
57	Mercury loop	MERIT	15 Jan '07	02 Feb '07	15 days
58	Hg-jet diagnostics	MERIT	02 Feb '07	02 Mar '07	21 days
59	**Data taking**	**MERIT**	**09 Apr '07**	**27 Jun '08**	**320 days**
60	Beam period	MERIT	09 Apr '07	04 May '07	20 days
61	Beam period (alternative)	MERIT	04 Jun '07	29 Jun '07	20 days
62	Beam period (alternative)	MERIT	02 Jun '08	27 Jun '08	20 days
63	**Dismantling**	**ATB-EA**	**02 Jul '07**	**23 Jul '07**	**16 days**



Power installation - schedule



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4	AD run	AD	08 May '06	05 Sep '08	269 days
5	**Solenoid Power**	**AB-PO**	**07 Nov '05**	**02 Oct '06**	**236 days**
6	**DC power supply**	**AB-PO**	**07 Nov '05**	**02 Oct '06**	**236 days**
7	Preparation BA6 & AD193	AB-PO	07 Nov '05	06 Jan '06	45 days
8	Installation	AB-PO	12 Dec '05	24 Feb '06	55 days
9	Refurbishment	AB-PO	27 Feb '06	28 Apr '06	45 days
10	installation bat.193	AB-PO	28 Apr '06	28 Apr '06	0 days
11	Interlock connections	AB-PO	01 Sep '06	02 Oct '06	22 days
12	**-AC cirquitry**	**TS-EL**	**07 Dec '05**	**01 Mar '06**	**61 days**
13	Installation transformer	TS-EL	07 Dec '05	28 Feb '06	60 days
14	Installation AC cabling	TS-EL	07 Dec '05	01 Mar '06	61 days
15	AC cell	TS-EL	07 Dec '05	01 Mar '06	61 days
16	**DC Cabling**	**TS-EL**	**07 Dec '05**	**18 Aug '06**	**183 days**
17	Installation	TS-EL	07 Dec '05	28 Feb '06	60 days
18	Patch panel solenoid	MERIT	14 Aug '06	18 Aug '06	5 days
19	Operational	AB-PO	02 Oct '06	02 Oct '06	0 days
20	**Cryogenics**	**AT-ECR**	**01 Aug '05**	**19 Dec '06**	**362 days**
43	**Experimental Area**	**ATB-EA**	**23 Jan '06**	**13 Dec '06**	**233 days**
52	**Installation of experiment**	**ATB-EA**	**01 Feb '06**	**13 Oct '06**	**183 days**
55	**Commissioning**	**MERIT**	**06 Nov '06**	**05 Mar '07**	**86 days**
59	**Data taking**	**MERIT**	**30 Apr '07**	**06 Jun '08**	**290 days**
60	Beam period	MERIT	30 Apr '07	25 May '07	20 days
61	Beam period (alternative)	MERIT	04 Jun '07	29 Jun '07	20 days
62	Beam period (alternative)	MERIT	12 May '08	06 Jun '08	20 days
63	**Dismantling**	**ATB-EA**	**02 Jul '07**	**23 Jul '07**	**16 days**

ATB schedule

ID	Task Name	Resource Names	Start	Finish	Duration
1	**Accelerator Operation**		**02 Jan '06**	**14 Nov '08**	**750 days**
2	PS/SPS closed	PS/SPS	02 Jan '06	14 Nov '08	618 days
3	PS run	PS	17 Apr '06	31 Oct '08	446 days
4	AD run	AD	08 May '06	05 Sep '08	269 days
5	**Solenoid Power**	**AB-PO**	**07 Nov '05**	**02 Oct '06**	**236 days**
20	**Cryogenics**	**AT-ECR**	**01 Aug '05**	**19 Dec '06**	**362 days**
43	**Experimental Area**	**ATB-EA**	**23 Jan '06**	**13 Dec '06**	**233 days**
44	Open shaft	ATB-EA	23 Oct '06	27 Oct '06	5 days
45	Drill holes TT2 - TT2A	ATB-EA	23 May '06	05 Jun '06	10 days
46	transport platform TT2 - TT2A	ATB-EA	24 Apr '06	28 Apr '06	5 days
47	Transport of solenoid	ATB-EA	23 Oct '06	27 Oct '06	5 days
48	Beam attenuator	ATB-EA	23 Jun '06	29 Jun '06	5 days
49	Beam layout	ATB-EA	23 Jan '06	03 Feb '06	10 days
50	Dismount nTOF line elements	ATB-EA	23 May '06	05 Jun '06	10 days
51	Installation of beam elements	ATB-EA	23 Nov '06	13 Dec '06	15 days
52	**Installation of experiment**	**ATB-EA**	**01 Feb '06**	**13 Oct '06**	**183 days**
55	**Commissioning**	**MERIT**	**06 Nov '06**	**05 Mar '07**	**86 days**
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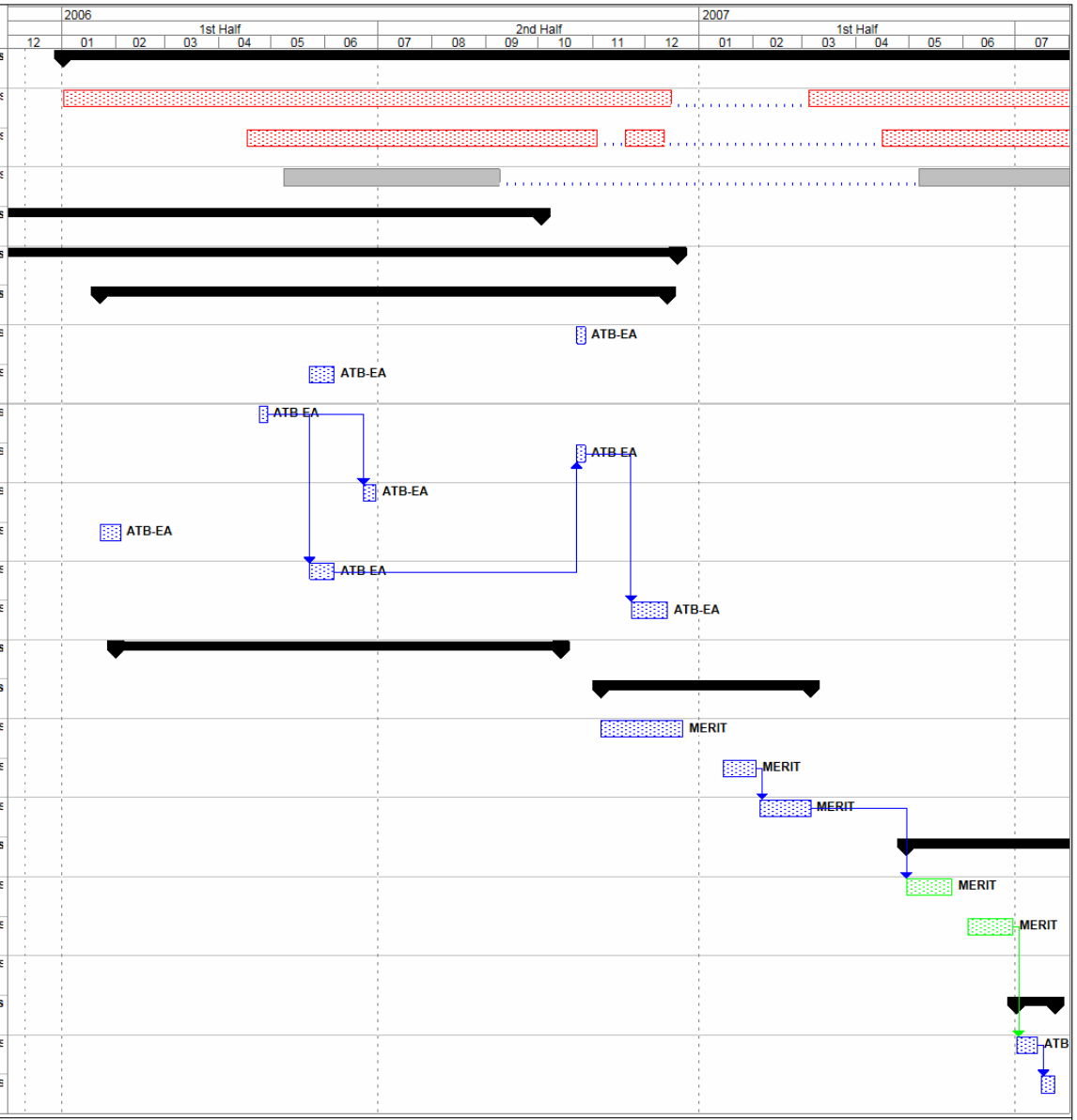
62	Beam period (alternative)	MERIT	12 May '08	06 Jun '08	20 days
63	**Dismantling**	**ATB-EA**	**02 Jul '07**	**23 Jul '07**	**16 days**
64	Removal MERIT	ATB-EA	02 Jul '07	13 Jul '07	10 days
65	Reinstallation FTN line	ATB-EA	16 Jul '07	23 Jul '07	6 days



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