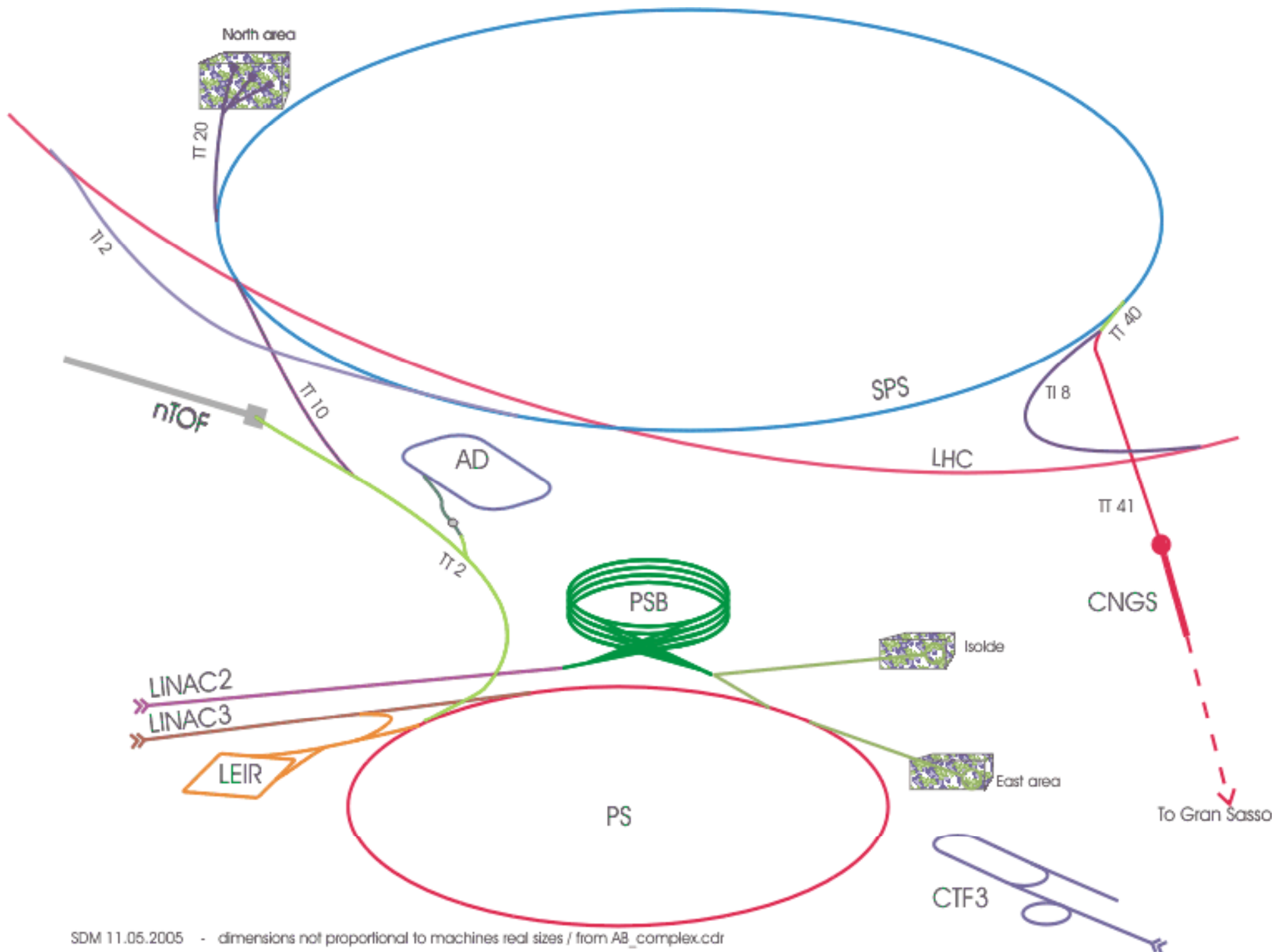


The plans and needs of the experimental areas in 2008 and beyond

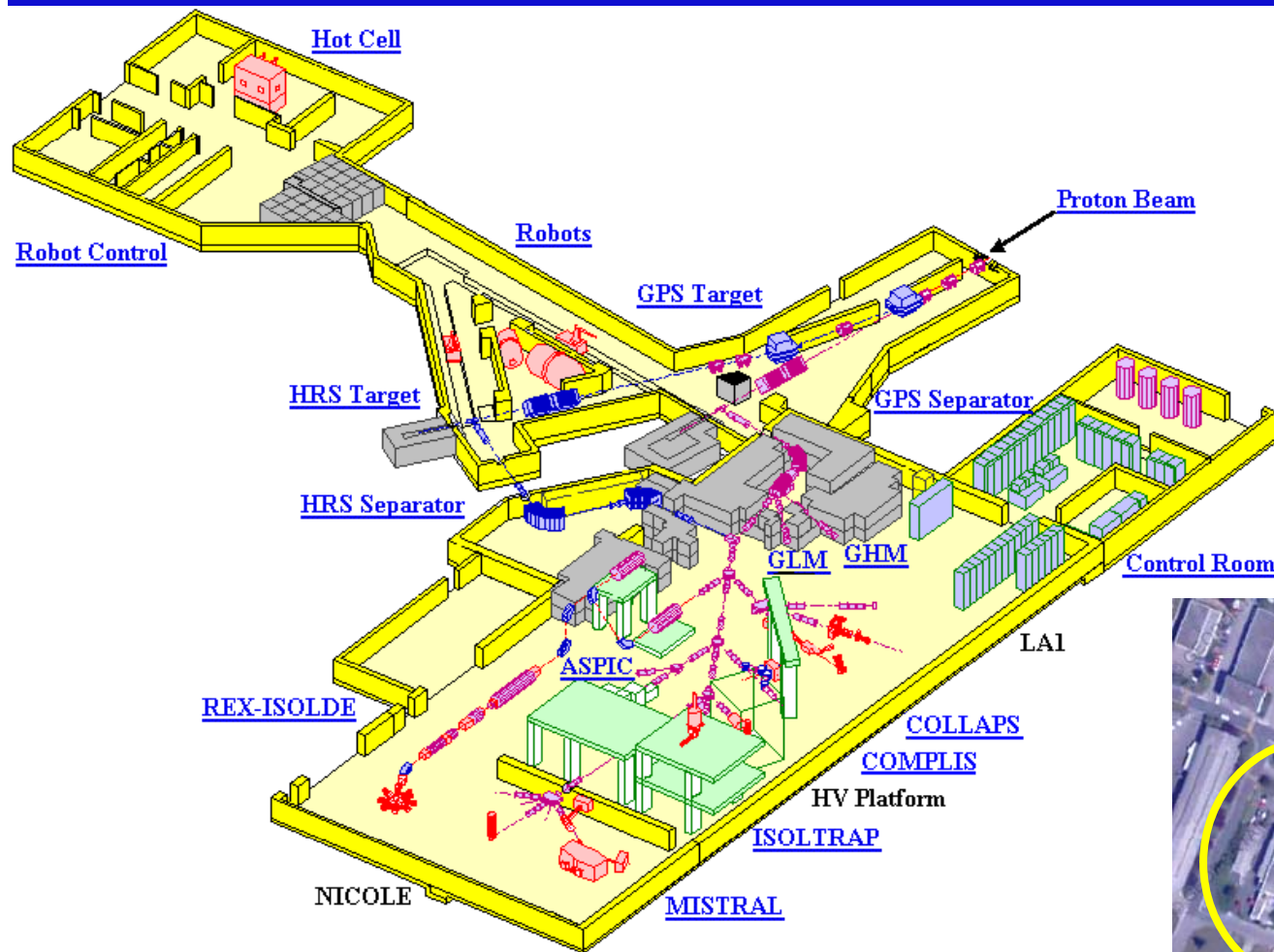
Lau Gatignon / AB-ATB-SBA

*With thanks to all that helped and provided information, including
Richard Catherall, Paolo Cennini, Ilias Efthymiopoulos, Tommy Eriksson,
Massimo Giovannozzi, Edda Gschwendtner, Mats Lindroos,
Roberto Losito, Stephan Maury, Bettina Mikulec, Emmanuelle Perez,
Christoph Rembser, Rende Steerenberg,*





Isolde and Rex





Isolde and Rex



- In 2007 the GPS run suffered from a problem in the ventilation system, that **limited the proton intensity to a maximum of $1 \cdot 10^{13}$ ppp**.

Simulations are ongoing and a solution is being sought for the 2008 run – See session 2

- Instabilities in the steering onto the Isolde targets could be attributed to a too long recovery time of a magnet in the PSB-Isolde transfer line,

This has been fixed for most cases by adjusting reference currents per cycle

This is still an issue when directly changing from GPS to HRS

- The water distribution panel for the targets is being changed to separate the water from the vacuum system (white powder)
- A new solid state pump laser is being installed for the RILIS laser source

This replaces the CVL (Copper Vapor Lasers).

*Some **2-3 weeks offline run are necessary** before start-up for commission them*

- In the experimental area the RFQ cooler is being integrated

Vacuum leak, alignment issues, ...

- The X-ray backgrounds in Rex experiments will be reduced by reinforcing the local shielding (?) around the cavities – see Session 2



ISOLDE and REX - 2



- The expectation is that all these actions will allow ISOLDE again to **operate at the nominal beam intensity of $3 \cdot 10^{13}$ ppp**
- **As many cycles as possible!**

Suffers also from missing inflector zone



LEIR & IONS



- The ions commissioning in the SPS in 2007 was very successful and most, but not all of the goals were achieved
- **No ion running in LEIR, PS and SPS in 2008**

*Same manpower is needed for proton RF hardware
Decided by ABMB in 10-12-2007 meeting*

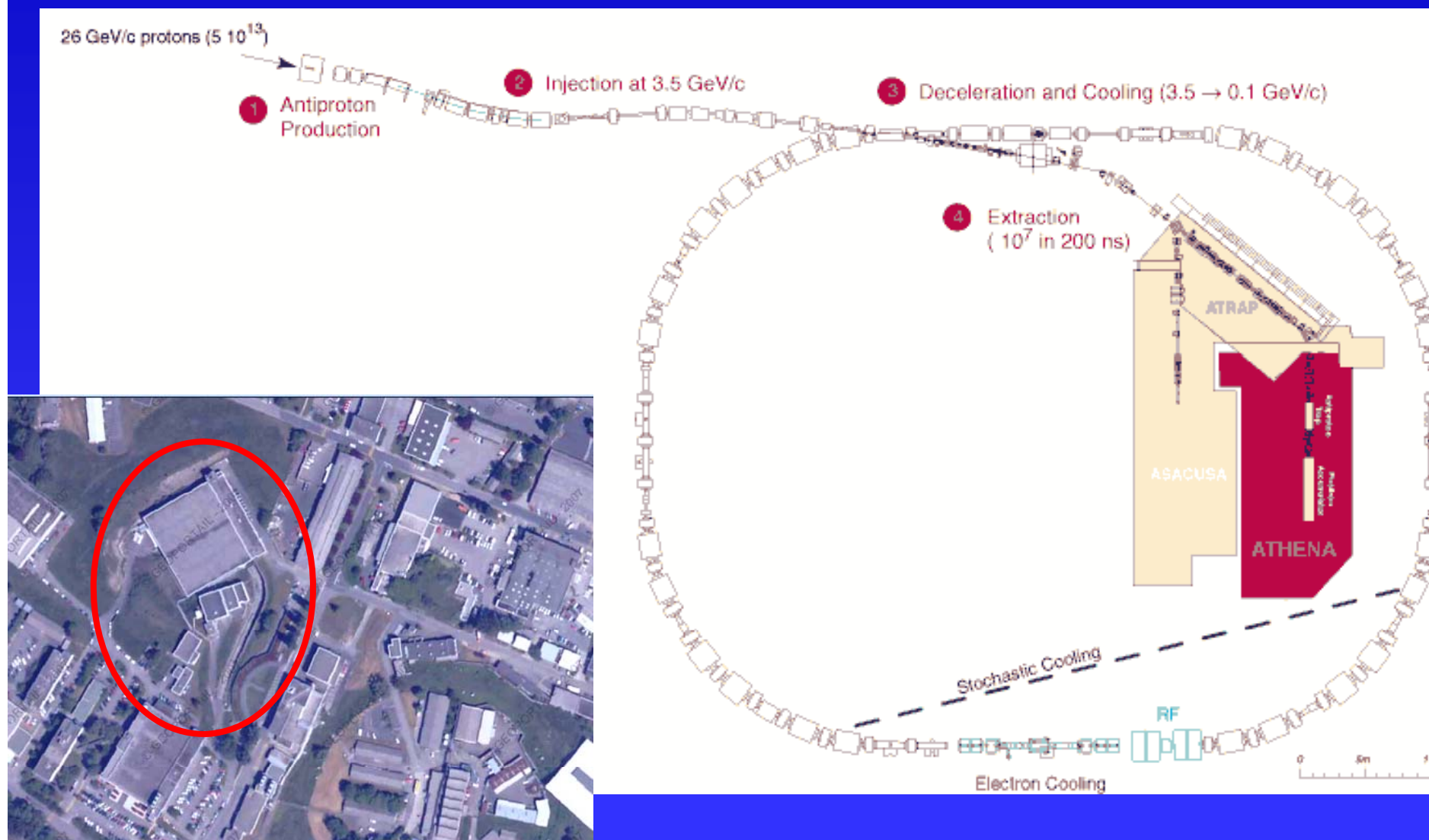
- But the **Source and Linac3 upgrade from 14 to 18 GHz** will take place as foreseen

This will result in an increase of intensity by a factor $\sim (18/14)^2 \approx 1.65$

- The remainder of the Pb ions commissioning will be done at the earliest possible date in 2009, with the "early beam". This will be followed by a 2-3 months shutdown (installation) followed in turn by final SPS tests and LHC commissioning with early beam



AD





AD



- The three main experiments (**ALPHA**, **ASACUSA** and **ATRAP**) have requested their beam time as usual.

*A 1 week beam request from **AD4** is expected and will be granted*

- **ASACUSA requests now to have a test facility on Linac2**

This was an old agreement that they now want to revive

- Most pending radio-protection issues in the AD areas seem now to be under control – see *Session 2*

- The main worry over the last years were **orbit jumps**.

The origin of the problem has been understood and the magnet responsible (DHZ2908) replaced during the last run.

A remaining mismatch in the rectifier was repaired at the beginning of the shutdown.

- The consolidation bears its fruits and should continue (SPSC)

Repair of DR.QFC54 (!!!), BIPM ionisation profile monitors,

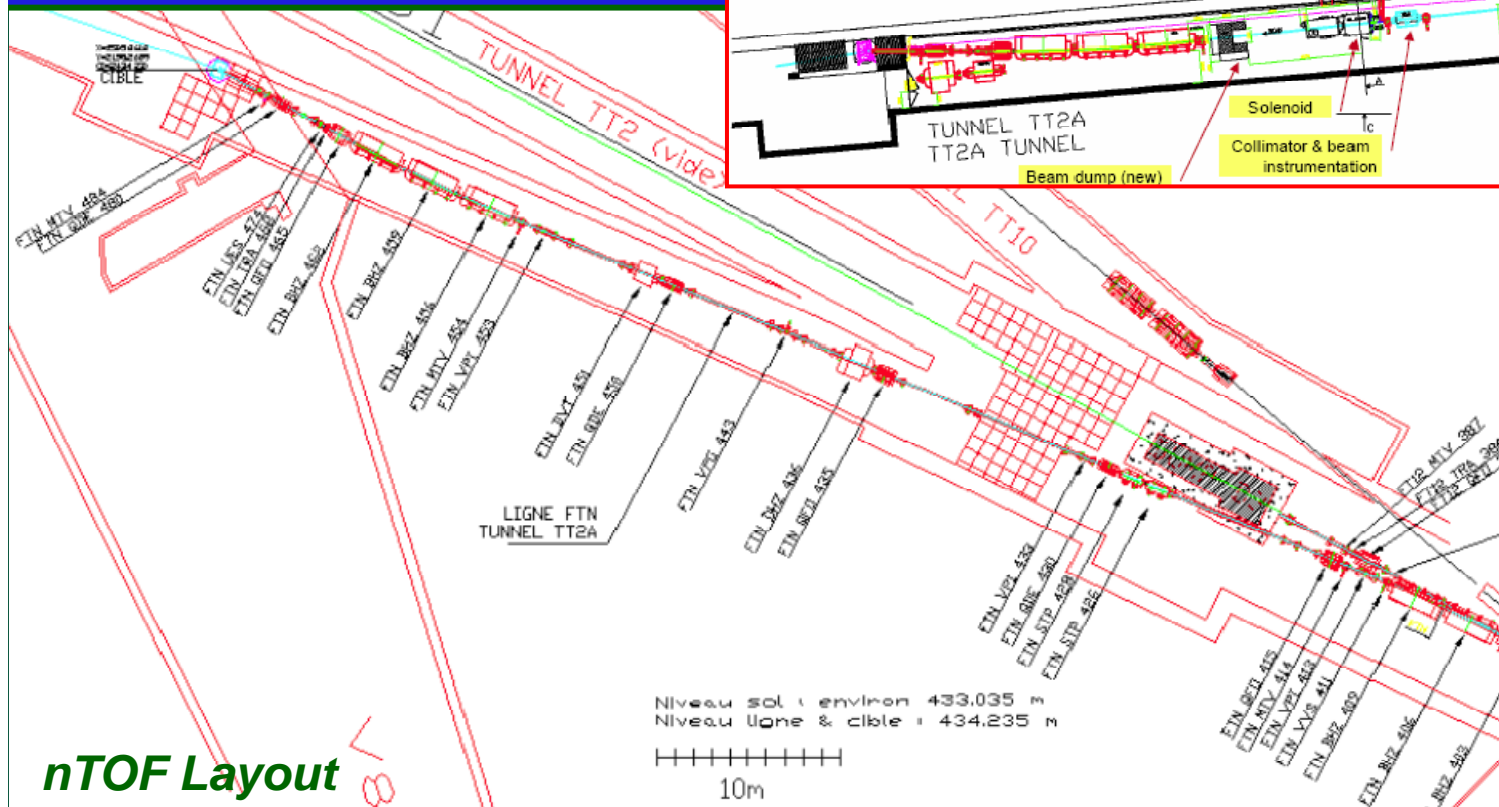
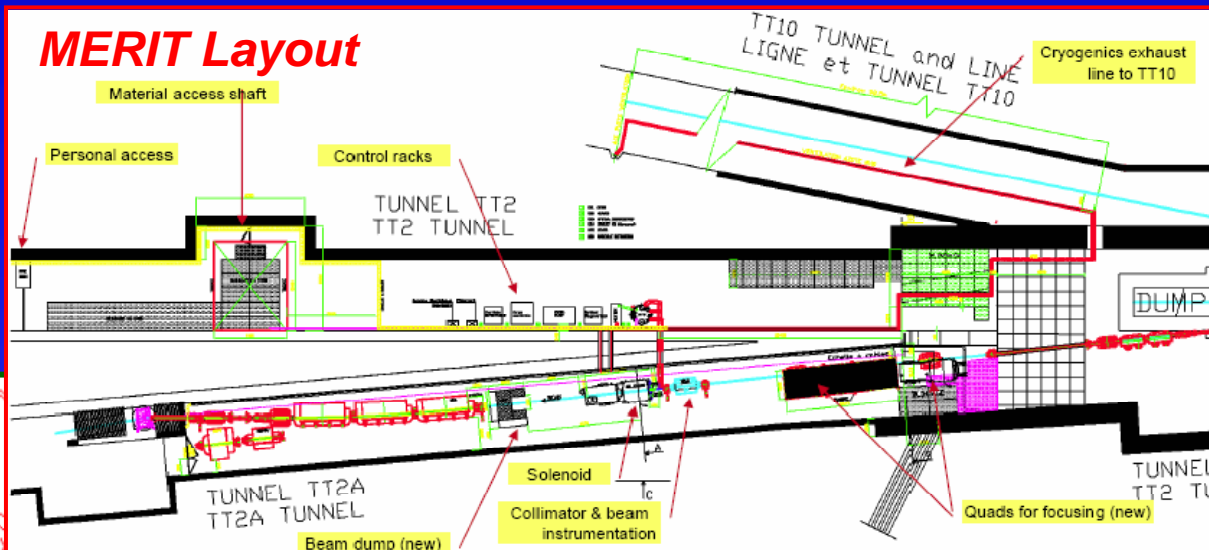
Beam stoppers should be made to work with lower air pressure.



nTOF and MERIT



- Remove MERIT elements
- Reinstall nTOF beam 'as before'. Alignment?





nTOF and MERIT (2)

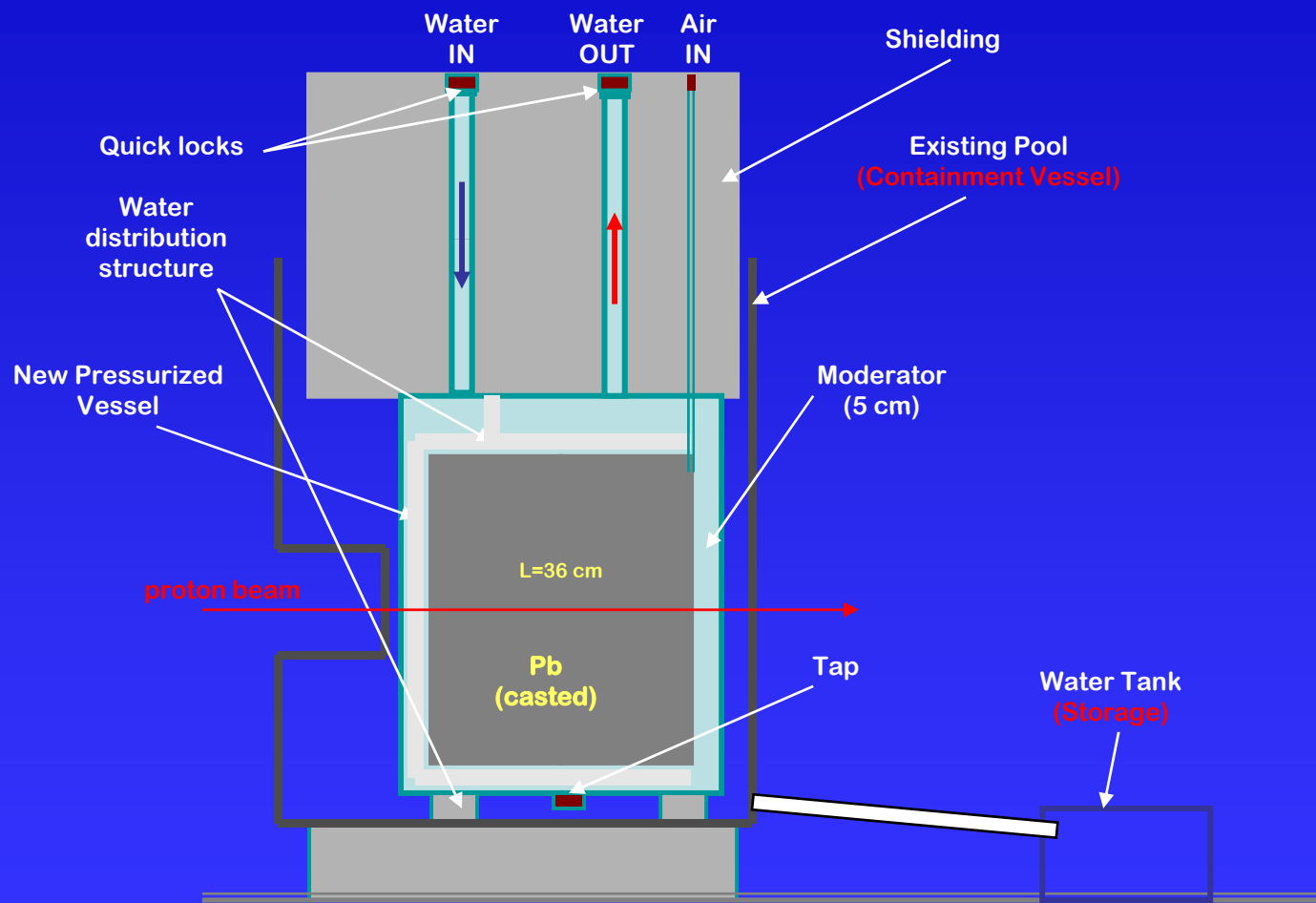


- The **MERIT installation will be dismantled** (see ABMB of 3-12-2007)
Profit to check alignment issues
- nTOF operation in 2008 is fully supported by the DG and a MoU is expected to be signed very soon.
Budget will be made available when?
- Three experiments have been approved by RB (1-3-2006), subject to MoU
P204, P208, P209 for $(0.2 + 1.8 + 0.15) 10^{19} = 2.15 10^{19}$ p.o.t.
- Need to construct new lead target
*Based on same principles as before, but better optimised:
smaller volume, better cooling water flow, control of pH and chemistry*
- Installation of new target **via the pit** into volume defined by old pool
*Therefore **possibility to work while beam in the PS***
- Water cooling system of the target must be replaced
The old one will be dismantled
- Installation of ventilation in target chamber is ongoing. Design exists

Aim to be ready for beam by ~ October 1st 2008



New n_TOF target



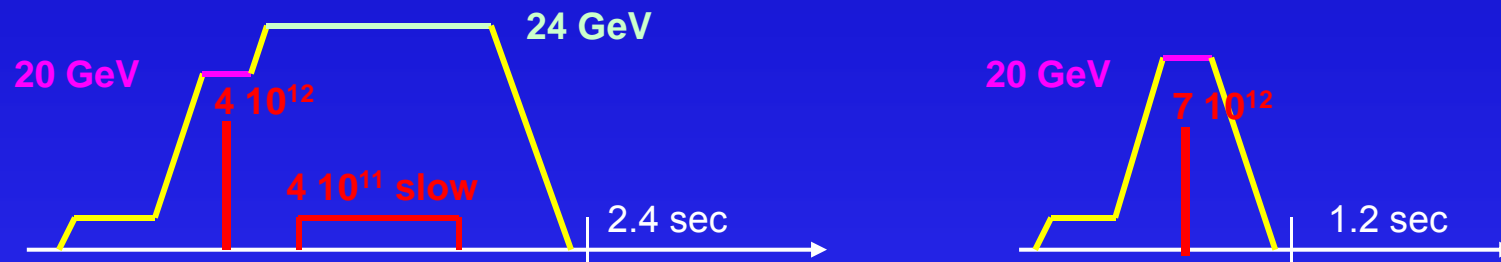
Lead $\varnothing_{\text{ext}} = 55 \text{ cm}$, $L = 36 \text{ cm}$, Volume = 86 l, Density = 11.34 ~970 kg



nTOF Beam requirements



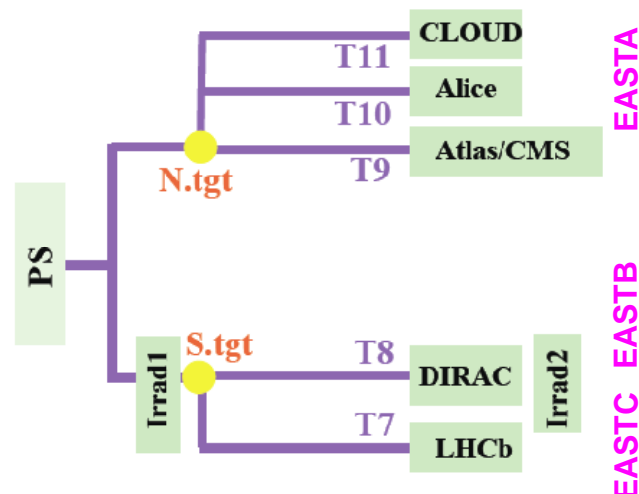
- **As many cycles as possible** with up to $7 \cdot 10^{12}$ ppp
Used to have ~2 dedicated ($7 \cdot 10^{12}$) + 2 parasitic ($4 \cdot 10^{12}$) per 16.8 sec s.c.



- Beam momentum 20 GeV/c
- Prefer to increase beam spot to ~ 1 cm in each plane to reduce local stress on target
- Need interlock to dump beam in case PS would send full beam to nTOF
either S/W interlock based on BCT reading, cutting 2 rectifiers and/or H/W interlock based on image current in existing cable
- Shortage of cycles with MCB instead of MNP23, if short s.c.



EAST AREA



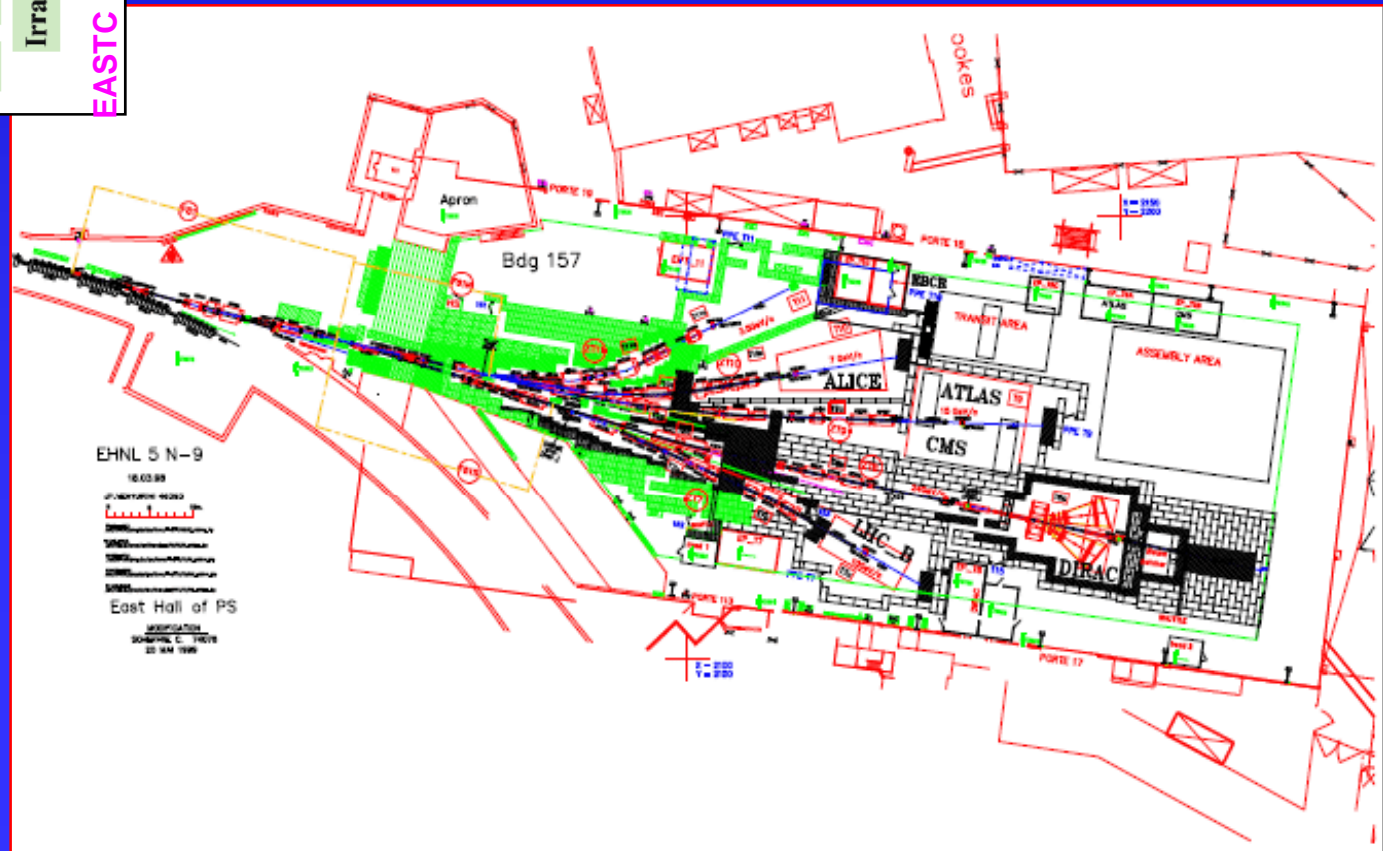
Physics experiments: DIRAC (T8 primary beam)
 CLOUD (T11, North branch)

Irradiations:
 T7 – primary beam mode
 T8 – parasitic on DIRAC

Test beams:
 T9, T10, T11 (North)
 T7 – secondary beam (not used)

Priority for protons:

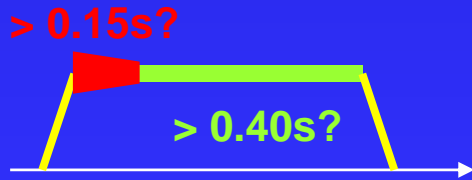
DIRAC





DIRAC



- DIRAC is somewhat short of statistics so far
Only 700 π K atoms collected so far, 5000 needed in total → 14% ONLY
- As many cycles per s.c. as possible
Shielding reinforced – 7x gain
- Intensity has increased from $8 \cdot 10^{10}$ in 2003/4 to $2 \cdot 10^{11}$ ppp.
Will probably be enough as target becomes “thicker”
But maybe some increase will turn out to be possible
Limited by DAQ & trigger rate (pileup - *in begin of spill*) and DCH current
Better with 2- (or even 4-) bunch operation
- Profit from **longer flat top**, if at all possible
Debunching time vs length of extraction

- Interlock on secondaries intensity – current surveillance
- Requests: spare margu rite, removal of SEM chamber ???

Colour code: dark blue (dark shading) = not yet allocated ; yellow (light shading) = not allocatable or Machine Development

		P1			P2		P3		P4		P5			P6		
		24 19 May 12 Jun			28 12 Jun 10 Jul		35 10 Jul 14 Aug		28 14 Aug 11 Sep		28 11 Sep 9 Oct			34 9 Oct 12 Nov		
T7	Setup	Irradiation	Pixel <small>Beam Loss Study*</small>	Irradiation			Irradiation		Irradiation			Irradiation				
	7	9	15	28			20		15		28			28		
T8	Setup	DIRAC			DIRAC		DIRAC		DIRAC		DIRAC			DIRAC		
	7	24			28		35		28		28			34		
T9	Setup	GOSIP	MICE EMP	AMS 2	KLOE 2	CHIC 3	SPER BRKS 7	20		SLIM5 8	SUMS 6	OPERA BRICKS 7	T2K TPC 15	COMPASS SHASHLIK 13	COMPASS CALO 15	6
	7	7	17	13	15	13	7	15		20		8	6	7	15	13
T10	Setup	ALICE TOF	ALICE HMPID	ALICE HMPID	ALICE PHOS	ALICE PHOS	ALICE PHOS 7	20		ALICE TOF 8	ALICE TOF 6	AMS TRDUP 22		6	ALICE FARICH 14	ALICE TOF 14
	7	9	15	15	22	13	7	15		20		8	6	22	6	14
T11	Setup	24			28		35		28		28			34		
	7	24			28		35		28		28			34		

Unofficial and very preliminary

T7: Accidental Beam dump tests for CMS/LHCb - no request up to now

T10: EUDET and DEPFET (Si detectors) were combined and shortened to 1 week, need SPS run afterwards

T10: AMS-TRDUPGRADE requested T9, but needs MIPS and no magnet thus scheduled for T10

T11: Period 4 is used for CLOUD set-up

T7: IRRAD requested 4months with 2 spills, now 16 weeks Possible additional request: RD52

SPS/PS-Coordinator: Emmanuelle Perez

E-mail: SPS.Coordinator@cern.ch

phone: 7XXXX (ext. +41 22 767 XXXX)

mobile: 16XXXX (ext. +41 76 487 XXXX)



East Area test beams



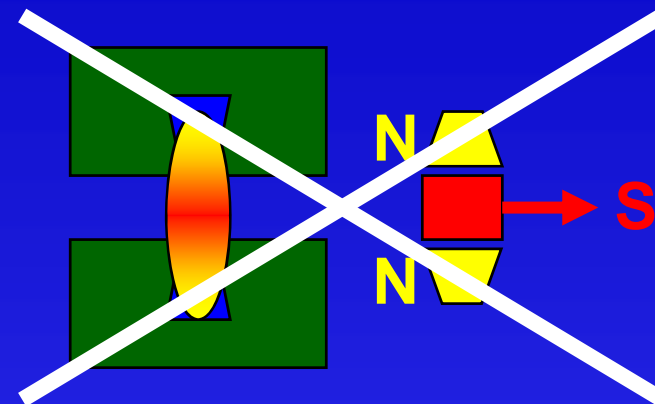
- East Area still operated with **MCB** instead of **MNP23**

Loss of cycle efficiency

No hope for MNP23 in 2008.

What about later?

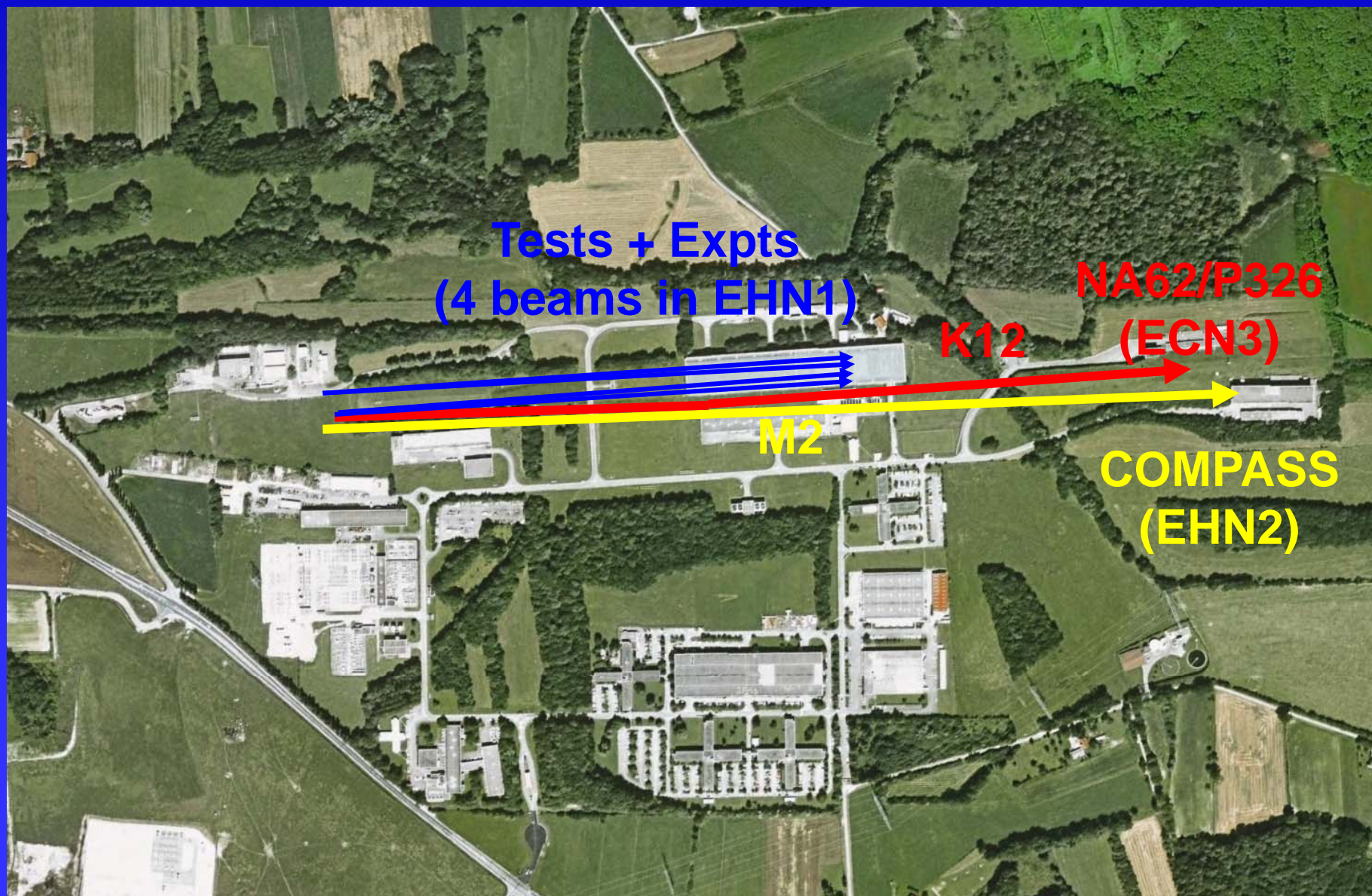
Combining 2 SPS cycles in longer s.c. can increase overall flexibility



- Grouping of North branch users to minimize losses of cycles to DIRAC
- Heavy exploitation of T9 and T10 for 70% of the year
- **CLOUD** comes back with request for 2x2 m² beam spot
 - No particular implications for F61N intensity*
 - But modifications of shielding in T11 area*
- **IRRAD** is running most of the year with “standard” EASTC but **fast extraction for Pixel test starting** end May (tbc)

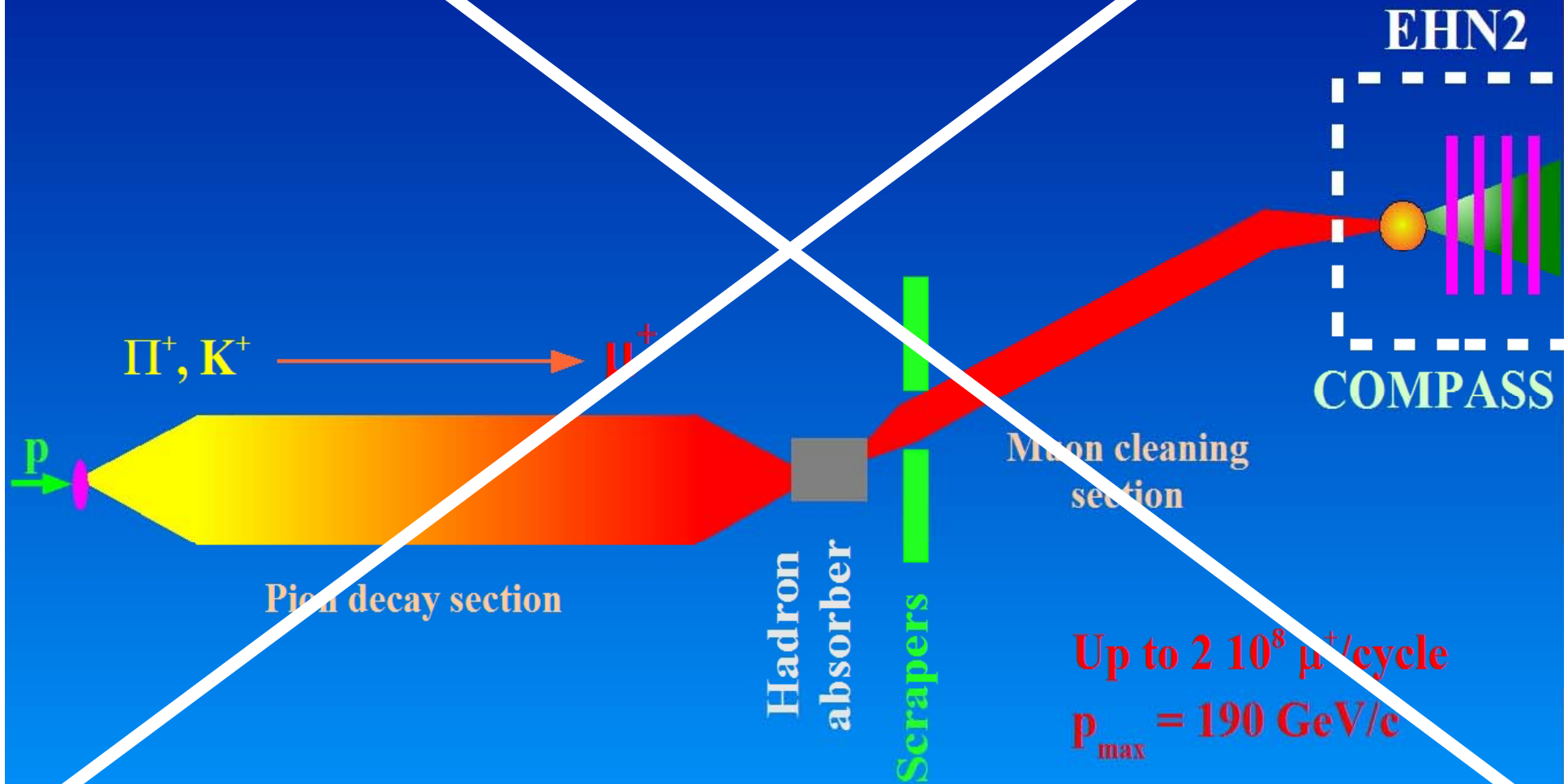


NORTH AREA



THE M2 MUON BEAM

FOR COMPASS / NA58





COMPASS



- Muon beam operation is completed for the time being
- COMPASS will almost exclusively run with **hadron beams**
 - Mostly 190 GeV/c π^- . Intensity requested $\sim 2.5 \cdot 10^7$, should be 'easy'*
 - But lots of material along the beam line (lots of air).*
 - Higher radiation levels w.r.t. muon running, but under control (\rightarrow session 2)*
- Proton intensity required on T6 not yet known precisely
 - Most likely significantly below $2.4 \cdot 10^{13}$ ppp on T6*
 - Need tuning to make a firm statement.*
- However, this **does not help** with the “FT-CNGS conflict”:
 - The main requirement remains **optimal duty cycle**
 - The limitation for FT experiments is usually **instantaneous rate**.*
 - The intensity delivered during the flat top was not very critical so far.*
 - However, with long flat top **the needs are 2x higher for the same instantaneous rate***
- **Important to have a long flat top** *at least when COMPASS runs*

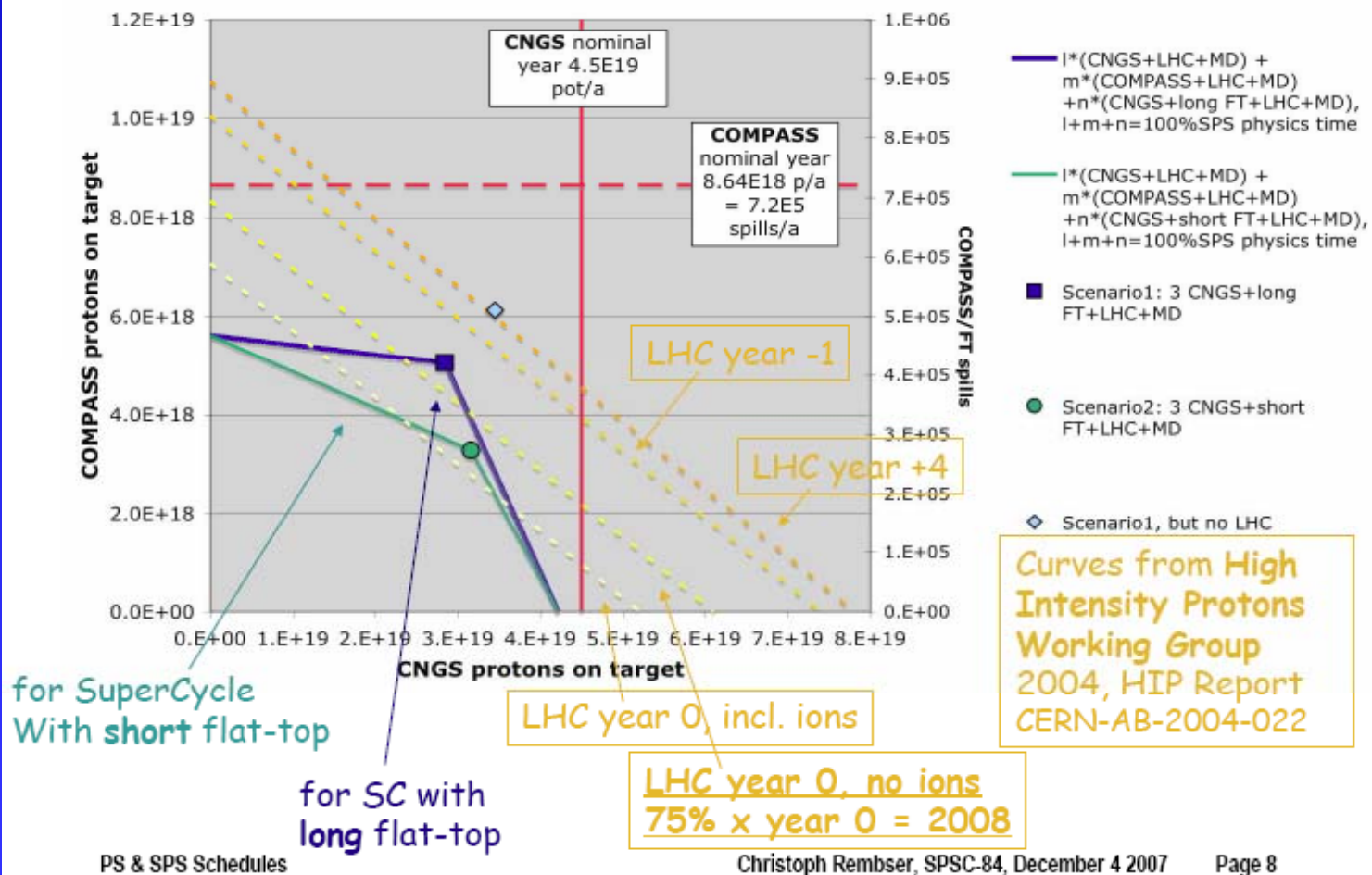


FT- CNGS cohabitation -1



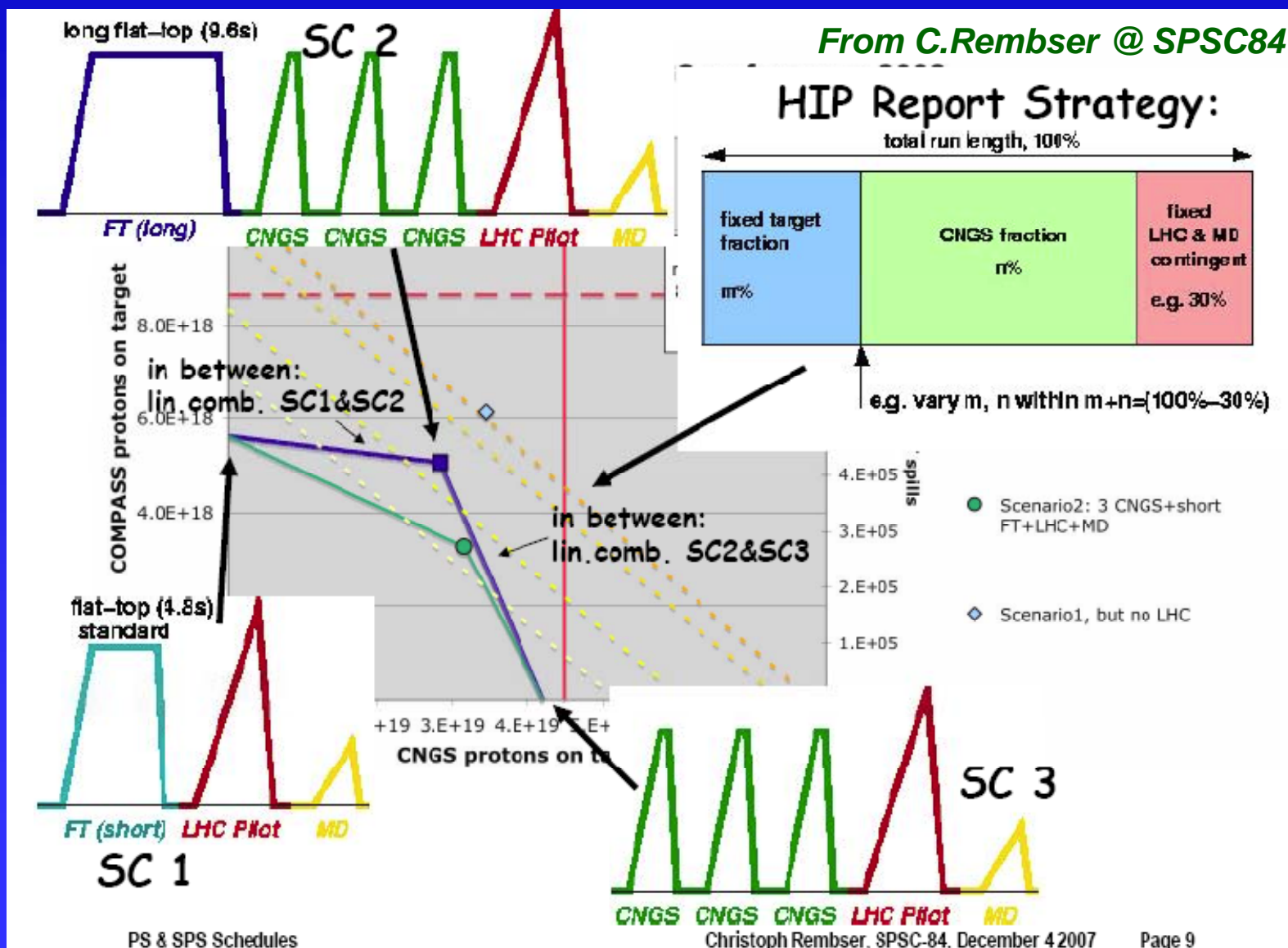
From C.Rembser @ SPSC84

COMPASS vs CNGS performance 2008





FT-CNGS cohabitation - 2





Other Physics Experiments



- **NA61** proposes to study light ion interactions (S, C, In) and to measure **production cross sections** with hadron beams. In 2008 NA61 will take **hadron beam** in the H2 line, from T2, with conditions as in 2007 ($< 7-8 \cdot 10^{12}$ ppp if long FT).

Some installation work required to partly dismantle VLE beam

The NA61 ion program is for the moment put on hold.

- **NA62** (P42+K12 beam – ECN3) is continuing its preparations for a new experiment to measure $K^+ \rightarrow \pi^+ \nu \bar{\nu}$. In 2008 the main emphasis is on R&D for straw tracker, RICH prototype and anti-ring system. Possibly a short physics run. Total request 2 x 3 weeks

No special requirements on beam intensity.

- **NA63** had to cancel (most of) the 2008 run due to budget cuts in Denmark.

Probably back in 2009.



Test beam activities in EHN1



- **RD22** will do further tests on reflection and channeling in bent crystals, both with proton (H8) and e^+, e^- (H4) beams.
Possible applications in LHC collimation, e.g. for ions
Significant installation work needed, both in H4 and H8
Very high degree of beam parallelism required (few μrad for p , few tens of μrad for e^\pm).
- Very **intensive test beam program** in all 4 EHN1 beams
Number of different users as high as ever
- High intensities in EHN1 (from modest primary beam intensities) required for irradiation activities (e.g. CERF⁺⁺)
Radiation levels in hall to be closely monitored
Heavy shielding required
Budget situation for CERF⁺⁺ unclear so far
- No request for 25 nsec running (so far?).

Colour code: green = SPS-exp ; purple = LHC-exp ; dark blue = Outside exp ; yellow = not allocatable or Machine Development

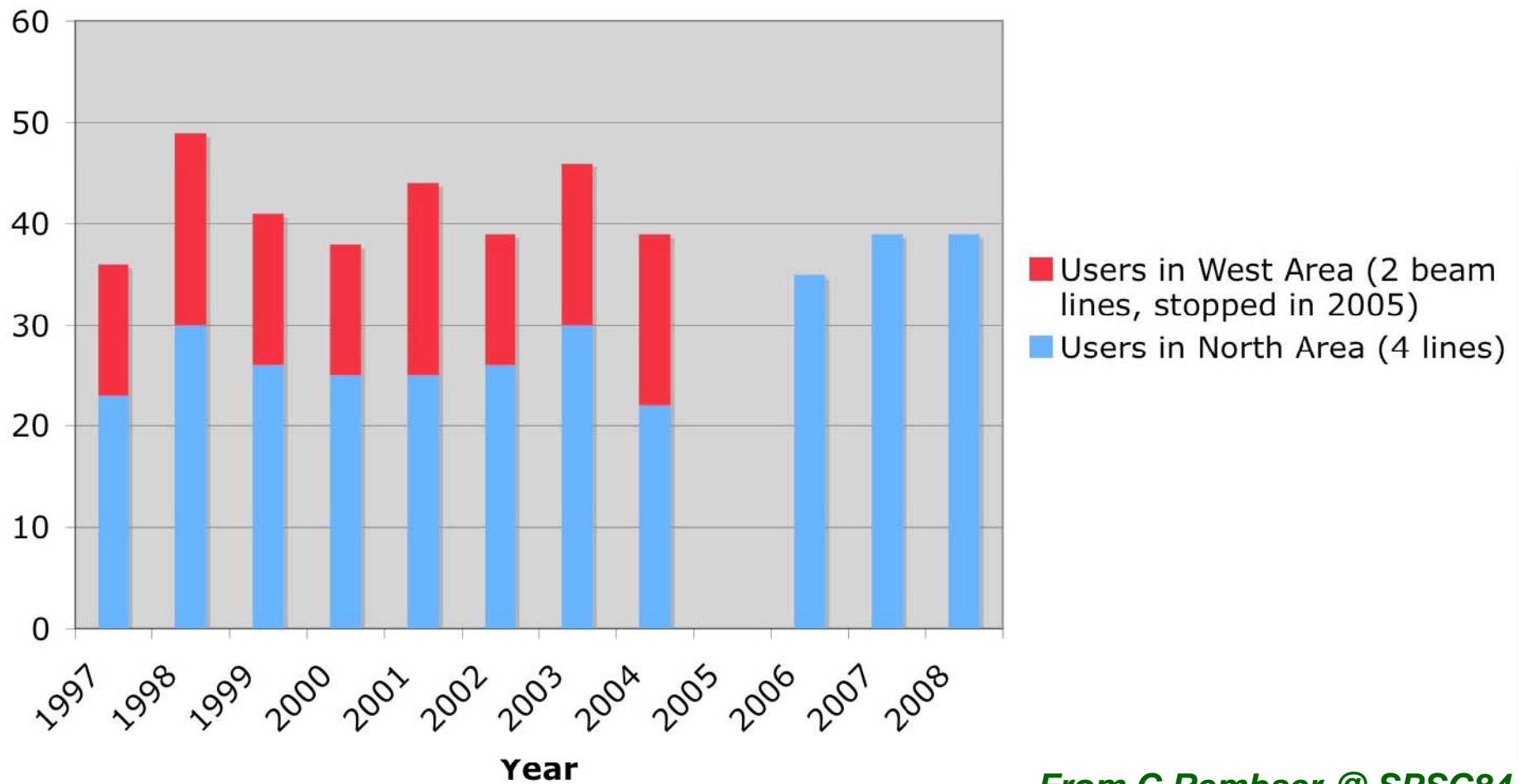
	P1	P2	P3	F4	P5	P6															
	24 19 May 12 Jun	28 12 Jun 10 Jul	35 10 Jul 14 Aug	28 14 Aug 11 Sep	28 11 Sep 9 Oct	34 9 Oct 12 Nov															
T2 -H2	EA 3 NUCLEON 3	CMS CASTOR 11	CMS HCAL R&D 17	CMS SIUP 13	NA61 7	COMPASS SHASHLIK 15	NA61 28	CREAM 6													
T2 -H4	EA 3 URAN 5	CERF 8	CMS ECAL 20	ECC 8	DREAM 20	LHCf 7	RD22 8	RD22 1	CMS ECAL 15	CMS ECAL 6	SITROPCH 14	NA63 8	NA63 6	22	LHCf 6						
T4 -H6	EA 3 SILC R&D 5	ATLAS BCM 8	ATLAS TRUSS 6	ATLAS TRUSS 7	ATLAS DIAMOND 7	ATLAS DIAMOND 8	CERF 6	ATLAS MUMUCH 4	MONOPIX 3	ELDE 7	DEPFET 14	LCFI 7	RD42 7	RD42 6	CERF 7	SILC R&D 15	ATLAS DIAMOND 6	ATLAS DIAMOND 7	ATLAS BCM 7	MONOPIX 2	12
T4 -H8	EA 3 ATLAS ROMAN-POT 13	ATLAS PINKPOT 6	ATLAS LLCID 7	TOTEM 7	ATLAS MEDIPIX 6	VELO 3	TOTEM 5	ATLAS TGCUP 15	ATLAS TRDUP 6	ATLAS LUCID 9	TOTEM 5	RD22 8	RD22 13	ATLAS FR420 6	AMS 2	AMS 7	AMS 22	TOTEM 5	ATLAS 3DSi 7		
T4 -P0	EA 3 13	NA62 20	8	35	28	28	20	14													
T6 -M2	EA 3 COMPASS 13	COMPASS 28	COMPASS 35	COMPASS 28	COMPASS 28	COMPASS 34															
CNGS	EA 3 CNGS 13	CNGS 28	CNGS 35	CNGS 28	CNGS 28	CNGS 34															

Unofficial and very preliminary

SPS/PS-Coordinator: Emmanuelle Perez
 E-mail: SPS.Coordinator@cern.ch
 phone: 7XXXX (ext. +41 22 767 XXXX)
 mobile: 16XXXX (ext. +41 76 487 XXXX)

Comments:
 - H8: LHCb Vel 1 requested week missing (Nov)
 - H6: one 3-days-slot for MEDIPIX missing...

Number of Users in NORTH AREA Test Beam Lines



From C.Rembser @ SPSC84

i.e. as many users as ever in the North Area



CNGS



- **CNGS Commissioning in 2007** was very successful

The repair of water inlets and outlets was successful

The provisional consolidation of the strip lines was successful

The beam performance was excellent, according to expectations

- However, the **production run** ended prematurely due to radiation effects and single event upsets in the ventilation electronics.

Run ended 5 days before the scheduled end of run

Nevertheless OPERA got 38 events in the emulsions, from $0.08 \cdot 10^{19}$ pot

- For 2008 start-up need to install final version of strip lines and to **solve the radiation problems** affecting the electronics

A crash program has been set up (I.Efthymiopoulos) and is followed on a weekly basis by the ABMB.

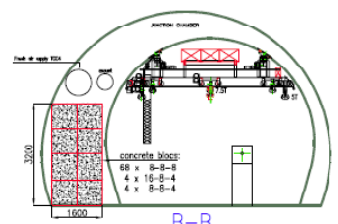
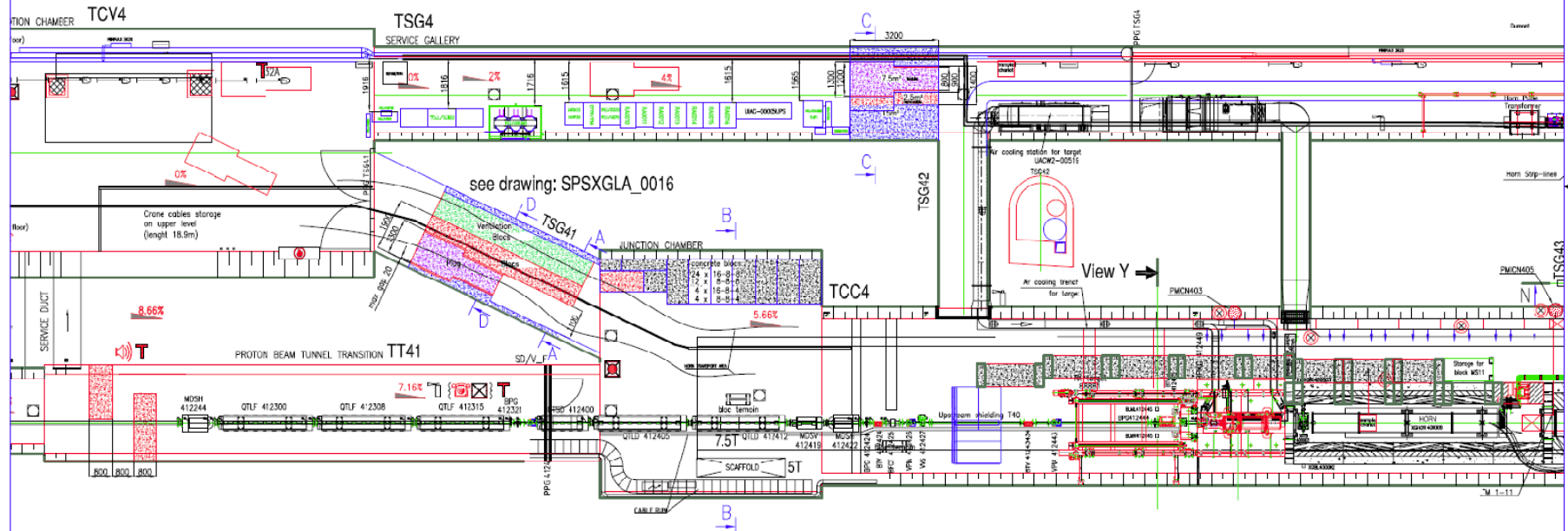
See session 2 (E.Gschwendtner's presentation).

- **Aim to be ready for CNGS operation on May 28th.**

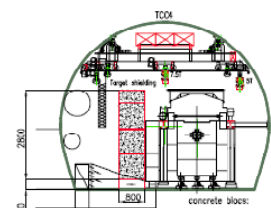
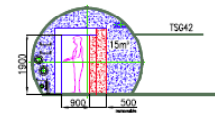
CNGS Status - 2

Validation by FLUKA simulations is under way

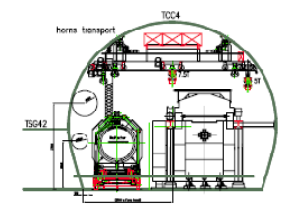
TSG4
see drawing: SPSXGLA_0017



see drawing: SPSXGHA_0132



View Y



DESIGN, DIMENSIONS, TOLERANCES
SECON NORMES SO
DRAWINGS, RUGOSITY, TOLERANCES
WITH RESPECT TO THE STANDARDS
THIS DRAWING MAY NOT BE USED FOR COMMERCIAL PURPOSES WITHOUT THE AUTHOR'S PERMISSION.

IND.	DATE	NOM/NAME	ZONE	MODIFICATION
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

08 Jan 2008

CNGS - Experimental Area - TCC4 Layout
CNGS ADDITIONAL SHIELDING LAYOUT TCC4 TSG4
BLINDAGES ADDITIONNEL CNGS LAYOUT TCC4 TSG4

ESCHILLE SCALE 1:100
 DES/DRA. S. GIROD 2008-01-07
 CONTROLLED
 RELEASED
 APPROVED
 SPS\XCLA_0\XCLA_018
 REMPLACE/REPLACES

NON VALABLE POUR EXECUTION
 NOT VALID FOR EXECUTION

SPSXGLA_0018



Experiment Status & Plans



- From known machine performance, assuming realistic operations scenarios, expect **max. $2.9 \cdot 10^{19}$ p.o.t. in 2008**, see C.Rembser's slide shown before (request $4.5 \cdot 10^{19}$ pot)

Based on 3 CNGS + 1 long FT + LHC Pilot + MD cycle

Assume $4.5 \cdot 10^{13}$ protons onto CNGS target per CNGS cycle

Priority for CNGS in case 'free protons' (i.e. cycle time) would be available

- **ICARUS** expects to be ready with T600 by end of May 2008
- **OPERA** is expected to have final target mass by June 10th

This now means 154 k bricks, ~76% of Proposal mass (206 k bricks)

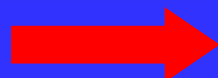
- With reduced integr.intensity (~66%) and mass → **50% of evts!**

4σ discovery potential significantly affected

Need to run OPERA more than 5 years???

But emulsion fading, competition from T2K?

- Need for long runs and highest proton intensity



MTE needed as soon as possible

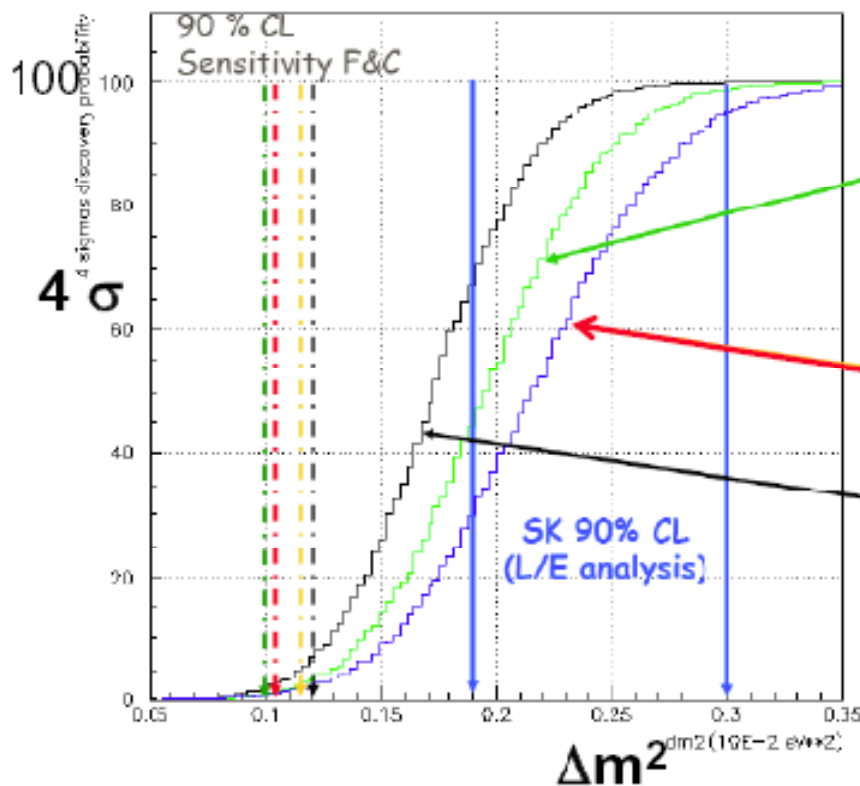


CNGS discovery potential



Opera Physics Goal: 5 years?

OPERA sensitivity with reduced target mass



- target mass reduced by $160000/210000=0.76$
- less protons on target $3 / 4.5 = 0.66$

Opera with 50% reduction

50%

In 2008

time scale of OPERA may become a issue

From SPSC review in December



MTE planning



- Complete MTE installation in the PS ring during the shutdown
 - Sextupoles and octupoles for introducing controlled non-linearities → 5 islands*
 - Extraction kickers to kick out individual islands*
 - More kickers in TT2 to be installed in 2008/09 shutdown (turn-by-turn variations)*
- Inject 8 bunches from PSB into CPS
 - Focus on intensities 3-4 10^{12} p/bunch → 2.4 – 3.2 10^{13} p in PS*
 - Higher intensities need much more effort – **not before 2009** (depending on resources)?*
- Commissioning schedule has been defined, extra MD sessions reserved

First period: May – June (kickers not yet ready for beam)

- *Setting up of operation cycle at low intensity, single bunch*
- *Setting up of new slow bump 16; implies full control of trimming magnets*
- *Resume splitting (3 10^{12} p/bunch)*
- *Switch to multi-bunch operation (3 10^{12} p/bunch giving 2.4 10^{13} ppp)*
- *Few sessions for kicker H/W tests*

Second period: from July

- *Test of fast bump at low intensity*
- *5-turn extraction tests with single bunch; steering to D3 dump*
- *Multi-bunch extraction (3 10^{12} p/bunch giving 2.4 10^{13} ppp)*
- *Commissioning of **full transfer to SPS**, possibly before multi-bunch operation*



Outlook and Perspectives



ISOLDE & REX

- The **900 msec booster cycle** is still eagerly awaited by the ISOLDE user community
- On the long term preparations are ongoing towards **HIE-ISOLDE**, a new target area that is capable to receive the increased proton intensity from Linac4 and Booster (later SPL)
 - Intensities up to $6 \cdot 10^{13}$ ppp*
 - To be ready for ~2013, if approved and financed*
 - Robot (lifetime up to 2010), transformers and vacuum system need consolidation (even if no HIE-ISOLDE)*

nTOF

- Continued running with new target from 2009 onward
- Installation of new, shorter (20m long) beam line?
 - Higher neutron flux, but shorter flight time. **Compatible with new target design!***



Outlook and Perspectives - 2



LEIR & IONS

- The RB has confirmed the **priority for lead ions in the LHC.**
- **The earliest possible date to inject light ions into the SPS is 2010,**
i.e. SPS physics runs not before 2011.
- The p-Pb running in LHC is not yet officially approved by the RB, but considered crucial for ALICE by the LHCC (in 2002).
- Light ion commissioning for NA61 is incompatible with p-Pb commissioning.
Need to prepare proton RF to be compatible with RF structure for ions
- If priority is given to p-Pb, **the light ions for the SPS can start only in 2012, which means beam for physics from 2013**



Outlook and Perspectives - 3



AD

- ALPHA, ASACUSA, ATRAP expected to run till end 2010 (at least)
- AEGIS proposal for measurement of gravitational constant for \bar{H} to 1%

Strongly supported by SPSC, 'almost' recommended for approval

Need to prolong DEM beam line, not incompatible with AD4. Data-taking 2010-2012?

- PAX is working on a proposal. Major modifications in ring required.

May have to reserve a full AD year for PAX. Or integrate in overall upgrade.

- ELENA?

First layout and cost estimate exists. Cockroft Institute has offered help.

The user community is actively looking for additional funding.

East Area

- DIRAC expected to ask for extension into 2009 – discuss in April
- CLOUD runs with Mk2 chamber in 2008/09 and final chamber from 2010
- Overall magnet situation still worrying (e.g. MNP23). New beams layout?
- Upgrade of IRRAD facilities – request in preparation by PH (FP7, RECFA)



Outlook and Perspectives - 4



North Area

- P326 (NA48') seems to be rapidly converging towards final approval
Requires new beam line in TCC8+ECN3, install 2008/9, physics \geq 2011???
- Lol and proposals in preparation by COMPASS collaboration for running beyond 2010
GPD, Drell-Yan, RF separated \bar{p} beam, more muons...
- FP7 proposals in preparation for test beam and irradiation facilities
e.g. CERF++, GIF'
- Light ion program for NA61 – yes/no, when?
> 2010, > 2012 ?
- Future DIRAC, NA60?

CNGS

- Important to maximize intensity – MTE, ...
- How many years of CNGS operation for OPERA?



Thanks



Many thanks to all that helped and provided information, including:

*Richard Catherall, Paolo Cennini, Ilias Efthymiopoulos,
Tommy Eriksson, Massimo Giovannozzi,
Edda Gschwendtner, Mats Lindroos, Roberto Losito,
Stephan Maury, Bettina Mikulec, Emmanuelle Perez,
Christoph Rembser, Rende Steerenberg,*