
SPS Experimental Areas and CNGS

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Many thanks to

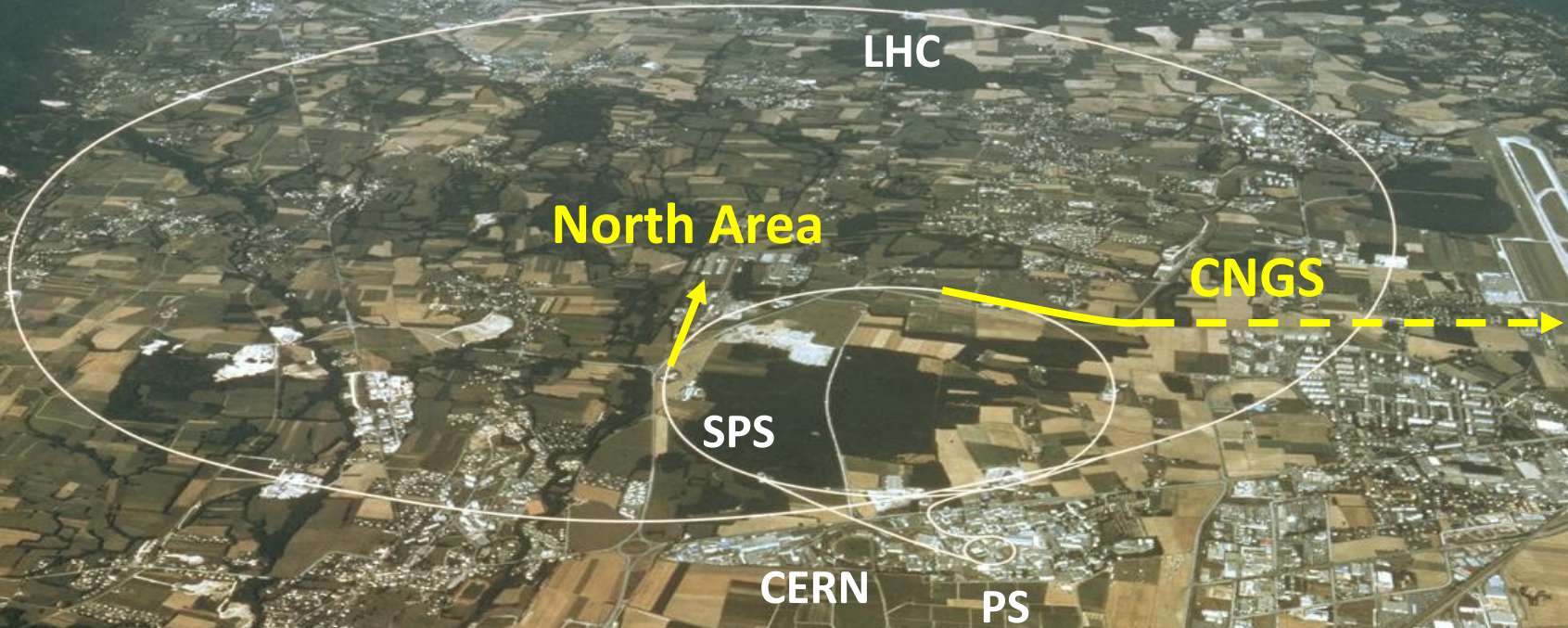
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Outline

- North Area User Requests
- Consolidation Status
 - Access system
 - Beam Obstacles and control
 - Power supplies and magnets
- Fixed target experiments at SPS
 - **COMPASS** (QCD, hadron structure)
 - **NA62** (rare Kaon decays, successor of NA48)
 - **Ion Experiments: NA61, NA63, UA9**
 - **CALICE**
- CNGS
 - Water issue
 - Outlook for next years

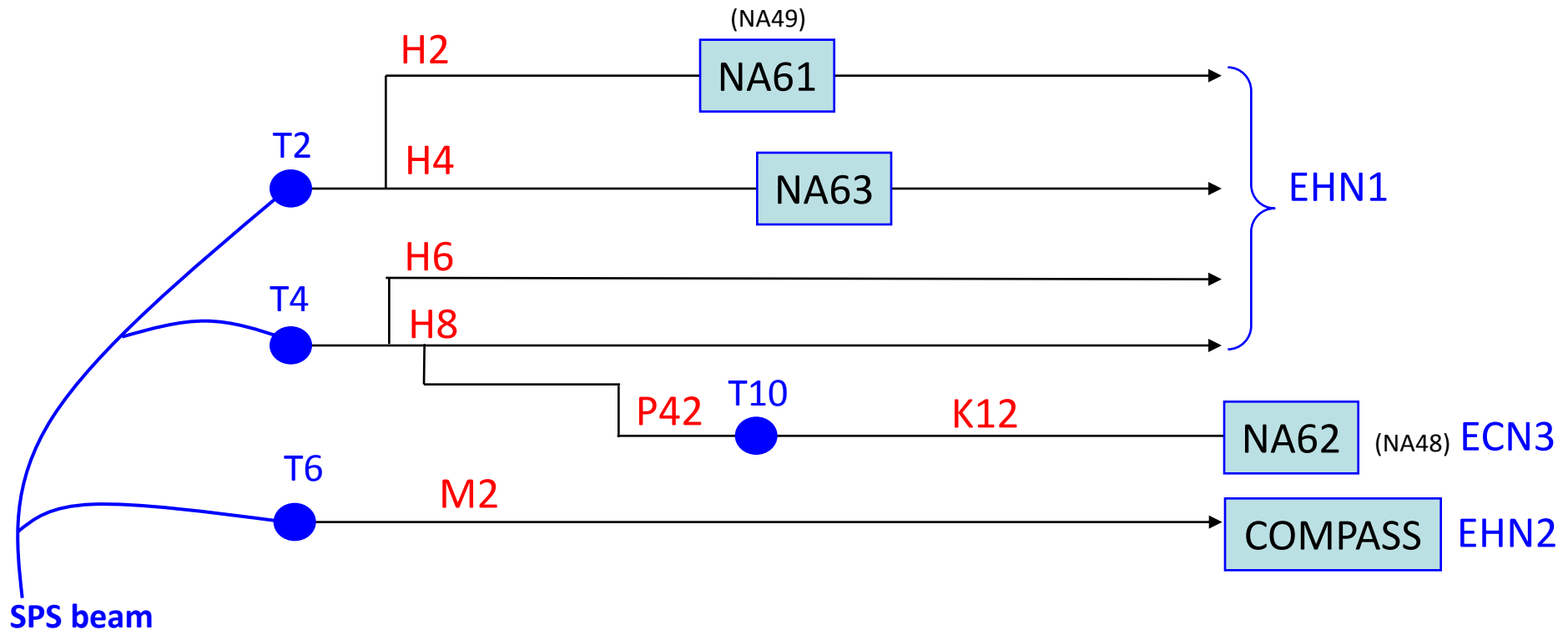
CERN Accelerator Complex

Lake Geneva

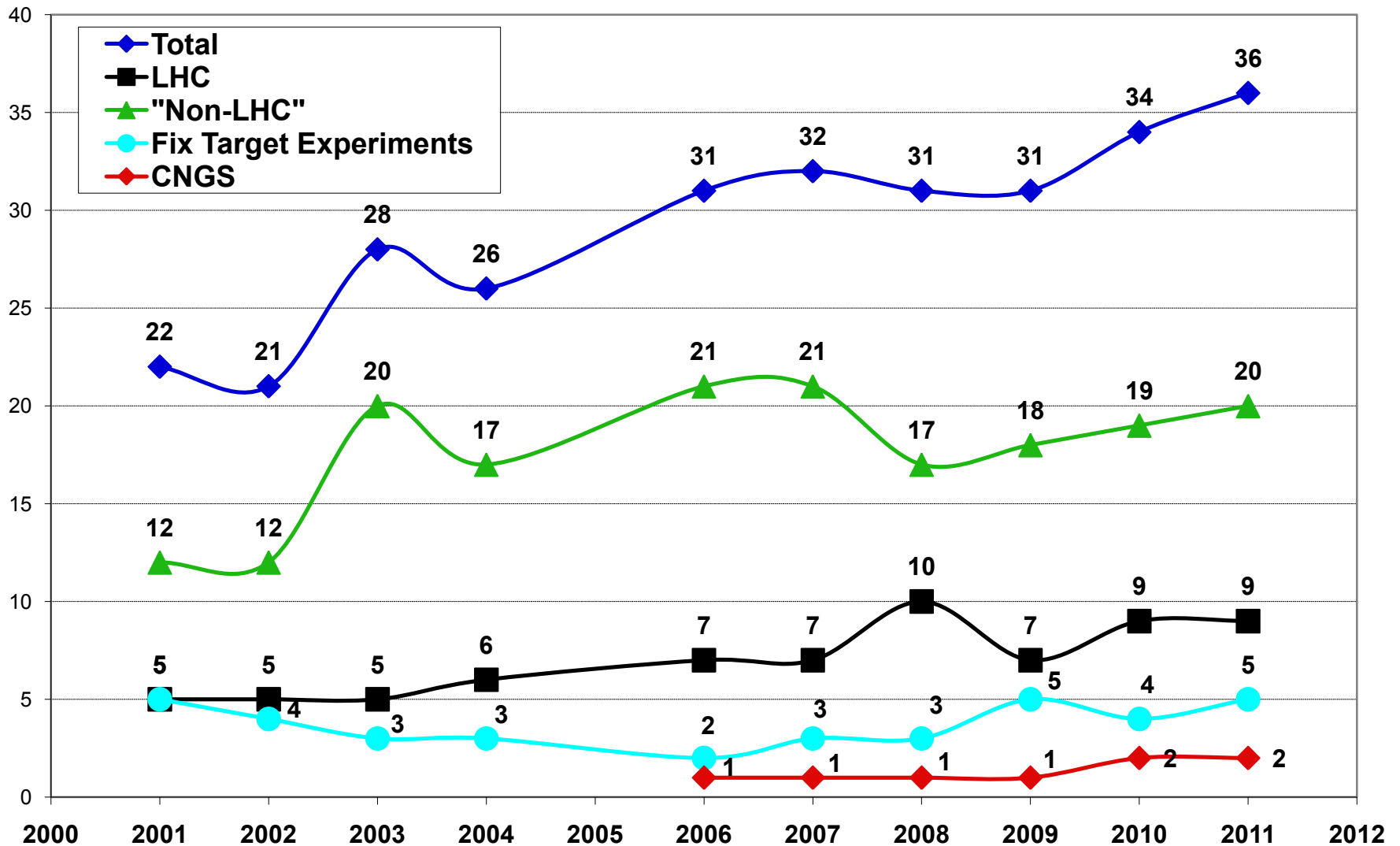


The North Experimental Areas at the SPS

- The SPS proton beam (400/450 GeV/c) is slowly extracted to North Area
- Directed towards the three North Area primary targets **T2**, **T4** and **T6**



SPS User Requests



19-Mar-2011

2011 SPS Fixed Target Programme

Version 1.0

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

	P1		P2		P3		P4		P5		P6							
	35 26 Apr 31 May		35 31 May 5 Jul		35 5 Jul 9 Aug		35 9 Aug 13 Sep		35 13 Sep 18 Oct		34 18 Oct 21 Nov							
T2 -H2	NA 4	22	NA61 TR 10	CALICE SDHCAL 0 25	CMS CALO 11	NA61 Protons 11	NA61-Protons 35		NA61 Protons 6	CMS SiBT 14	CREAM 9	CMS CALO 6	CMS CALO 10	NUCLEON 10	NA61 Krypton-36 14			
T2 -H4	NA 4	H4IRRAD 22	CMS ECAL 10	H4IRRAD 0 12	MONOFIX 5	RD42 8	RD42 9	NA63 Protons 10	CALET 7	PANDA 9	SOIFIX 12	PEBS 7	FAIR 7	RD51 7	CMS ECAL 7	LHCf 7	14	
T4 -H6	NA 4	SILC 7	NA62 STRAW 3 12	MONOFIX 9	ALICE SPD 0 11	CERF RD42 9 6	DEPFET RD42 8	AMMEGAS ALBAVA 12 7	RD42 7	APPs 14	ATLAS 7	BELLE II BVD 8	MONOFIX AMMEGAS 3	NA62 CEDARf GTK 10	MEDIPIX 7	14		
T4 -H8	NA 4	ATLAS IBL 22	LHCb ARPC 6 7	LHCb (CALICE) 16	COHENRAT 6	TOTEM UA9 6	RD50 7	DREAM ARPC ASOSI 14	AMDT ASTGC 8	AMDT ANTGC 6	ARPC APPS 7	ARPC ASOSI 7	UA9 7	LHCb 16	CALICE 6	CALICE 13	DREAM 7	UA9 IONS 14
T4 -P0	NA 4	22	0	35	35	35	35	35	35	35	6	NA62 14	14					
T6 -M2	NA 4	COMPASS 22	COMPASS 0	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 20	COMPASS 14						
CNGS CNGS 27	CNGS 35	CNGS 0	CNGS 35	CNGS 35	CNGS 35	CNGS 35	CNGS 35	CNGS 35	CNGS 35	CNGS 35	CNGS 34							

FULLY BOOKED

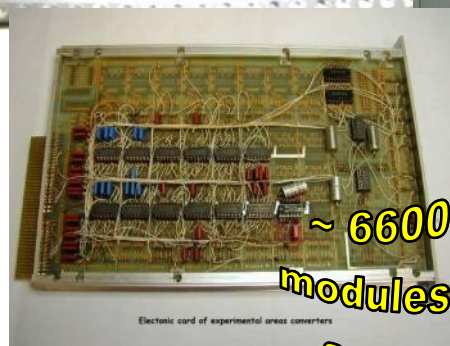
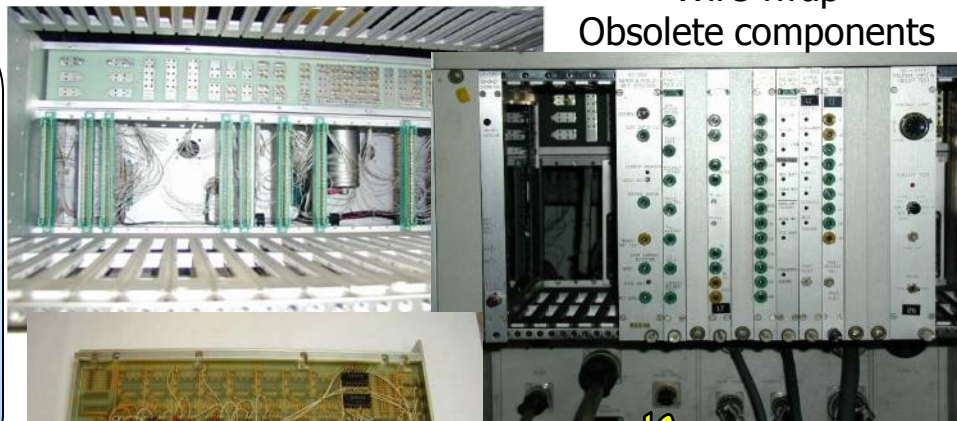
North Area Consolidation

SPS NORTH AREA POWER CONVERTERS

JP Burnet

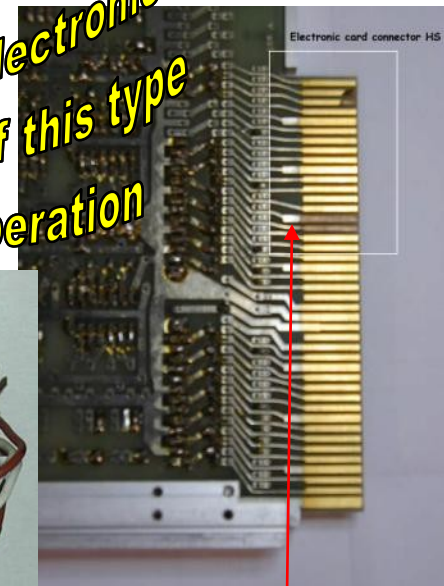
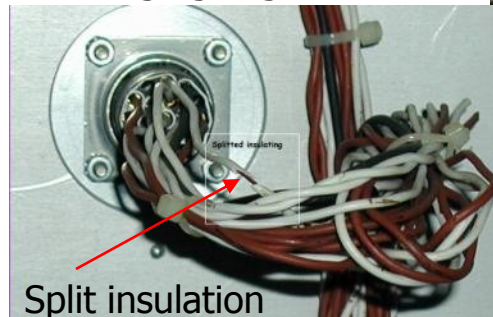
- ◆ Power converters in operation since 1976
- ◆ Original analog & digital electronics
- ◆ Wire wrap technology
- ◆ Old control system (Databus)
- ◆ Power converter MTBF very low: $\approx 7000\text{H}$
- ◆ 180 interventions by the first line team in 2010
- ◆ 100 electronic cards repaired each year

Wire wrap
Obsolete components



~ 6600 electronic modules of this type are in operation

Cabling ageing



Damaged gilded contacts



330 power converters in operation
50 spares

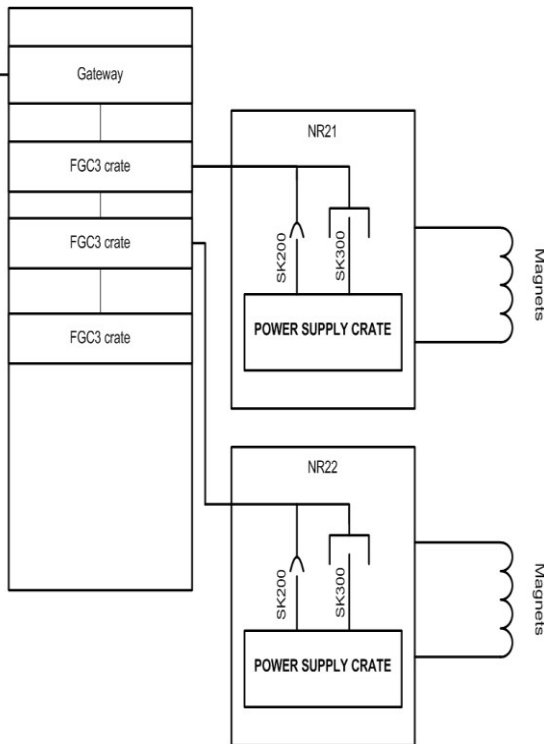
SPS NORTH AREA POWER CONVERTERS

JP Burnet

EA physicists want a better control of the current

Solution → Suppression of Converter crate

New DCCT + FGC3



Short-term consolidation (Approved)

Replace Converter crate by FGC3 and install new DCCT, only for the bending magnets

- 70 power converters (type R21, R22)
- Schedule (already, 1 year of delay)
 - 2011 Prototype + purchasing
 - 2012 Electronic production + software development
 - 2013 installation during LS1
 - 2014 Start NA with 70 FGC3 for bending magnets
- Spending profile: 50kCHF (2011), 300kCHF (2012), 200kCHF (2013)
- Manpower: 6-10 FTE
- Fault reduction: 60% on bending magnets (30% in total)

SPS NORTH AREA POWER CONVERTERS

JP Burnet

Long-term consolidation plan

TECHNICAL SOLUTIONS

- Replace 180 power converters ($\leq 500\text{A}$) by new switch-mode power converters.
 - C11 250A / 100V
 - R11 500A / 150V
 - R12 500A / 300V
- Renovate 150 thyristor converters.
 - R21 1000A / 300V
 - R22 1500A / 250V
 - R31 2500A / 255V
 - R41 6000A / 600V
 - D21 1500A / 200V
 - D31 2500A / 285V
- New electronic control (FGC3)

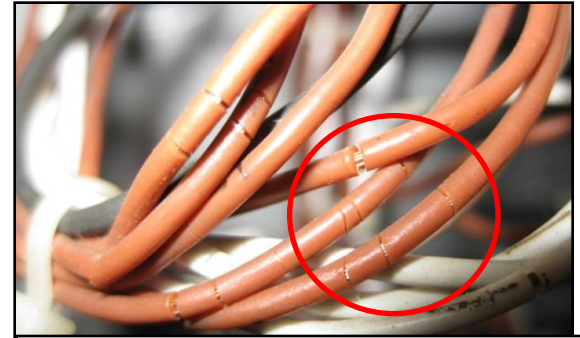
LONG-TERM CONSOLIDATION PLAN **NEVER APPROVED**

- Provisional schedule: 6 years
 - 1-2 years studies and contracts
 - Shutdown 2015-2016 and LS2 (Long Shutdown 2017)

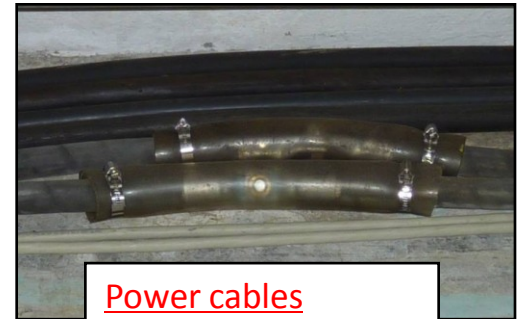
Budget : ~20 MCHF
Manpower: 30 FTE

Magnets

- Interlock systems need consolidation.
 - no resources yet
- Zero field detector: spare sensors are needed
 - not yet started
- Improve connections between power cables.
 - ongoing, K12 already done.



Cracked insulation on cables
-> Risk of short circuit on the interlock electronic rack.
-> Risk of "shunting" magnet securities.



Power cables connections

Strategy: Careful monitoring of the magnet, notably during each technical stop, during the run. Magnet piquet is available in any case 24/24 h.

Obstacles Control

Scope:

Renovation of motorizations used in objects in North experimental area on the equipment inherited by BI (Collimators, Converter, Target Absorber, In/Out Dumps)

→ 76 AC Motors, 213 DC Motors

Objectives:

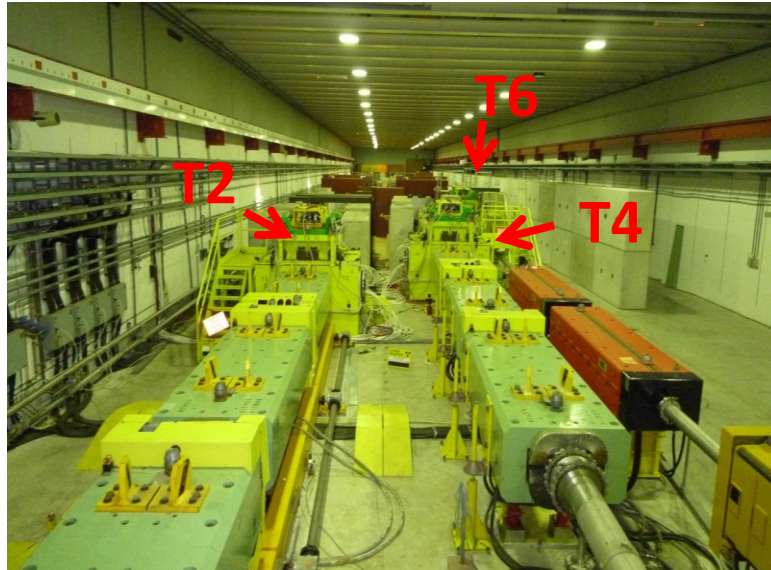
Replace old controls with a new solution based on PLC and FESA gateway fully supported by CO, solves severe operational problems experienced due to the limited bandwidth of the equipment bus.

→ 2009/10 shutdown (TAX)

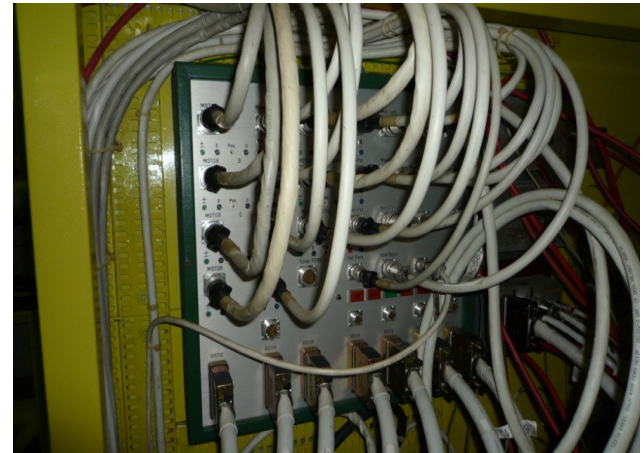
→ 2010/2011 collimators (69 devices with 157 axes)

→ 2011/2012 scraper motors, dump motors and maintenance of local cabling and sensors for T6

T6 Target Motorization Cabling Renovation



Cables between panel and equipments to replace (26 cables)



- Movable obstacles mechanics in good shape
 - Yearly maintenance and covered by operational budget
- Target stations (T2, T4, T6, T10) in bad shape:
 - Rust, loss of oil, cable breaking, failure of switches
 - Difficult to intervene, regular maintenance limited
 - operation of targets for more than 5 years would need complete renovation
 - Renewal of the monitor drivers, target boxes and collimators plus two new spare chassis
 - Consolidation budget for mechanics renewal of 750 kCHF over 5 years needed.

Access System



Installation of a new access system as the one installed in the PS experimental areas (i.e. PS AD and East Hall)

→ Ready for 2011 run

- In case of mode changes: need badge
- EDH authorisation
- New further zones will be created
 - H4IRRAD
 - GIF++
 - New Interlock mode 'ION' for 2012
- For CNGS: renovation/replacement of ventilation doors

North Area

→ Prepare an upgrade plan for the infrastructure

- started with BI, STI, access, power converters, magnets

- next is CV

→ see Mauro Nonis' Talk

- study of system upgrade in BA80/BA81 already launched
- then Experimental Areas

→ Put North Area to the consolidation plans

- so far was left out due to the risk analysis.

Current and Future Approved Experiments

COMPASS-II

Study the **hadron structure** and **hadron spectroscopy** with high intensity **muon** and **hadron beams**.

COMPASS:

2011 Muon beam for transversity

2012 Proposal to SPSC in June

COMPASS-II: approved

2014-2016 2 years muon beam for GPD physics

1 year Drell-Yan with hadron beams



→ Intention to continue for another decade at least (not yet approved).

→ A consolidation program of the facilities is being defined.

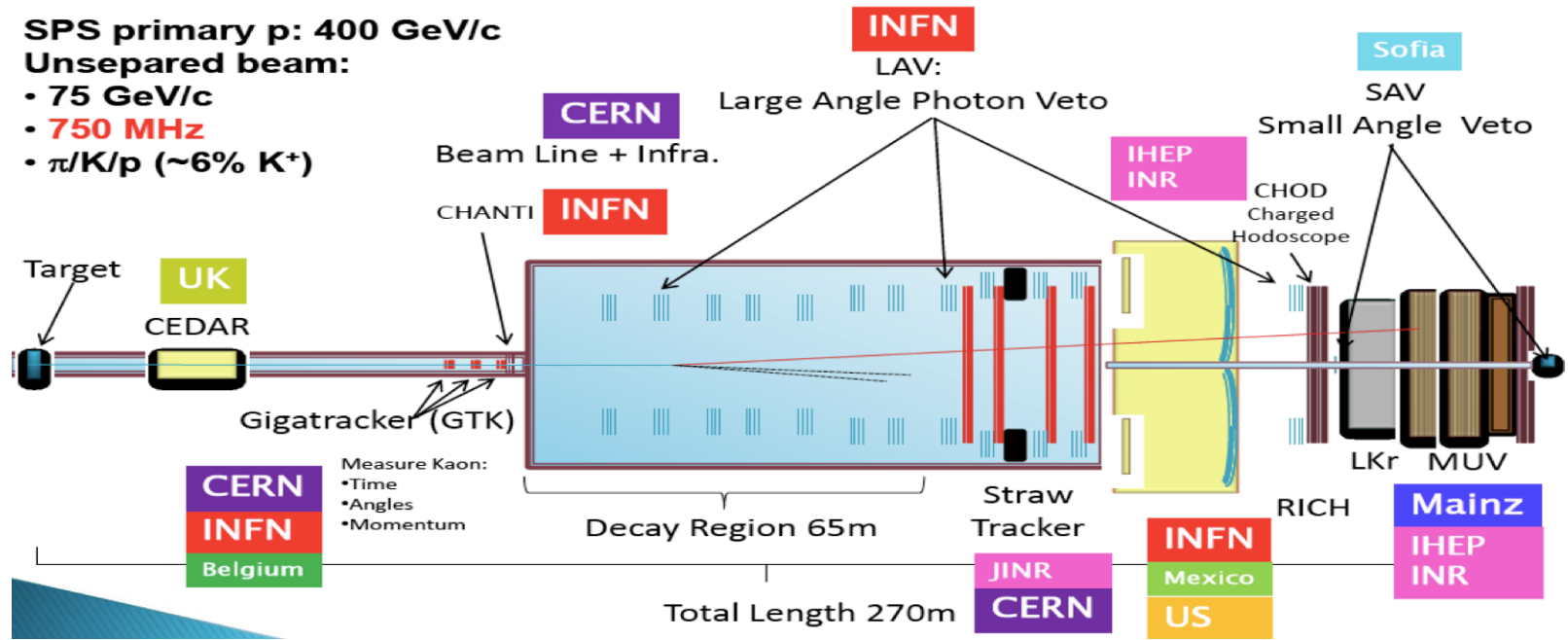
COMPASS-II

Item	Specific Cost [kCHF]	Cost covered otherwise [kCHF]
Civil engineering	340-540	
Rectifiers SM1,SM2	650	
Rectifiers beam line		< 4000
Studies CV	15	
CV consolidation	≈ 250	
Recommended air-conditioning upgrade	≈ 1200	
Smoke detection	80	
Working at height	160	
RP migration to ARCON	280	
Total (incl improved ventilation)	1775-1975 (~3075)	< 4000

NA62

Measure very rare kaon decay $K^+ \rightarrow \pi^+ \nu \nu'$

- Branching ratio of $\sim 10^{-10}$, Sensitivity of ~ 55 events/year with 13-17% background
- Sensitivity to new physics



→ New beam-line, → Dismantling NA60, NA48

NA62

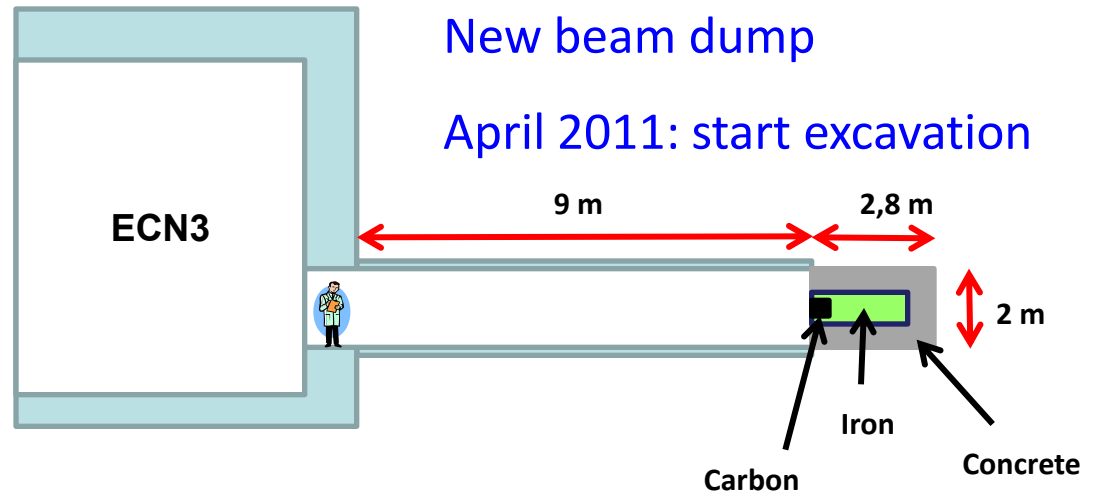
Time line:

2011: Beam line

2011-2012: Detectors

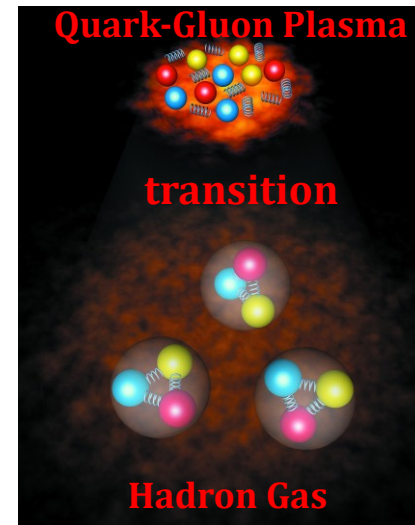
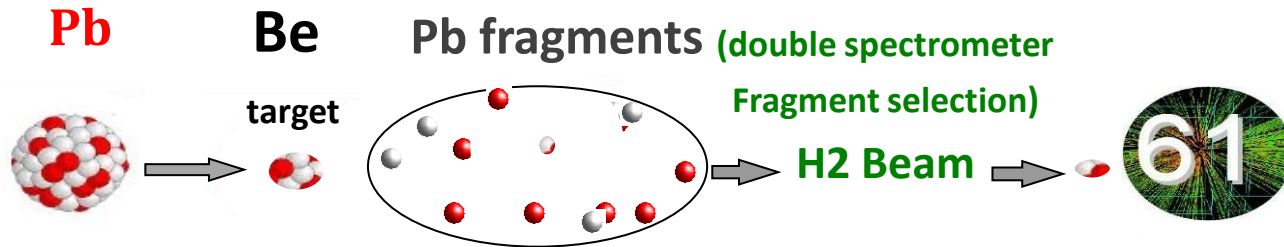
End 2012: First beam

From 2014: Physics

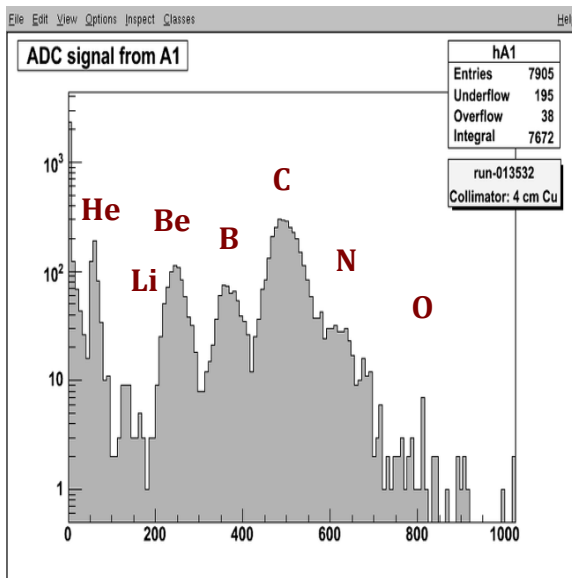


NA61

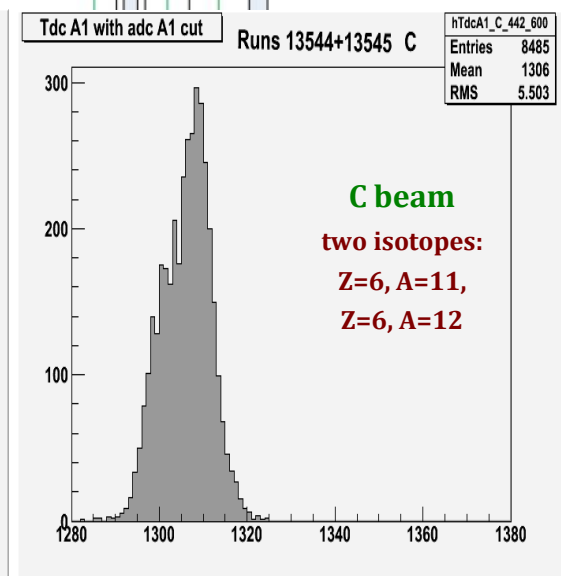
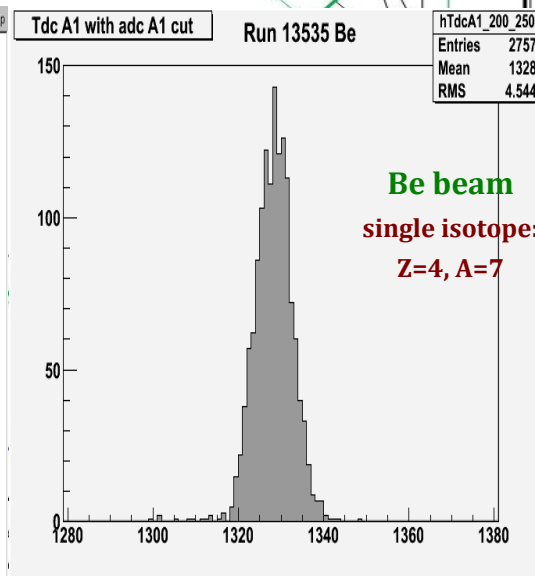
→ Search for critical point of strongly interacting matter
 2010: Light ion fragmented beam in H2 for NA61



Full spectrum:



... and with optimized beam setting and identification



NA61, NA63, UA9 Ion Program

2011: Weeks 47-50: physics with fragmented ion beam

→NA61: 2 weeks of testing and commissioning in week 45, 46

→Improve H2 beam instrumentation

→Prepare tunes for all requested energies (13-80 GeV)

→UA9: Test in North Area and in SPS

→NA63: need debunched beam →no ion beam request in 2011

2012:

→NA61: physics with fragmented Pb ion beam at different energies (20, 40, 158 GeV)

→NA63: physics with primary ion beam (need debunching)

→UA9: Tests in North Area and in SPS

More details see Stephan Maury's Talk

CALICE (Calorimeter for ILC)

330 physicists/engineers from 57 institutes and 17 countries.

Linear Collider Calorimeter:

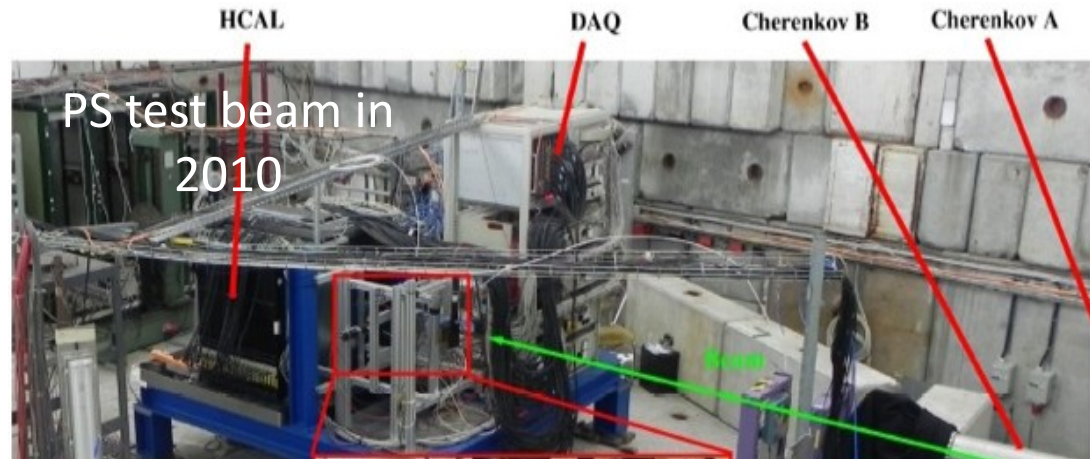
compact-hermetic-high granularity (i.e. excellent jet energy resolution)

→ Requested 20 weeks of test beam in 2011 in North Area

- ILC: TDR in 2012
- CLIC: CDR in 2011
 - Time constraints for CALICE requests
- Approval of CALICE request allows linear collider detector R&D to be in phase with time scale of European strategy for particle physics
 - To be defined until the end of 2012

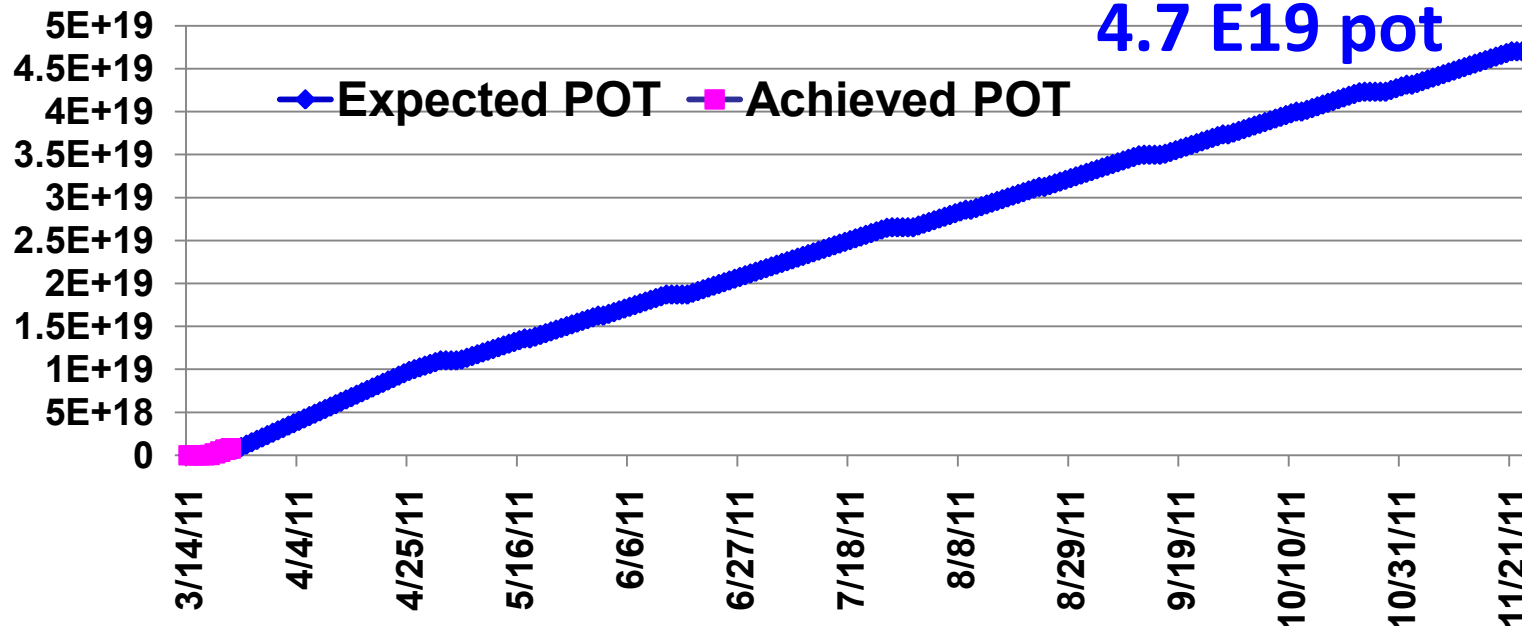
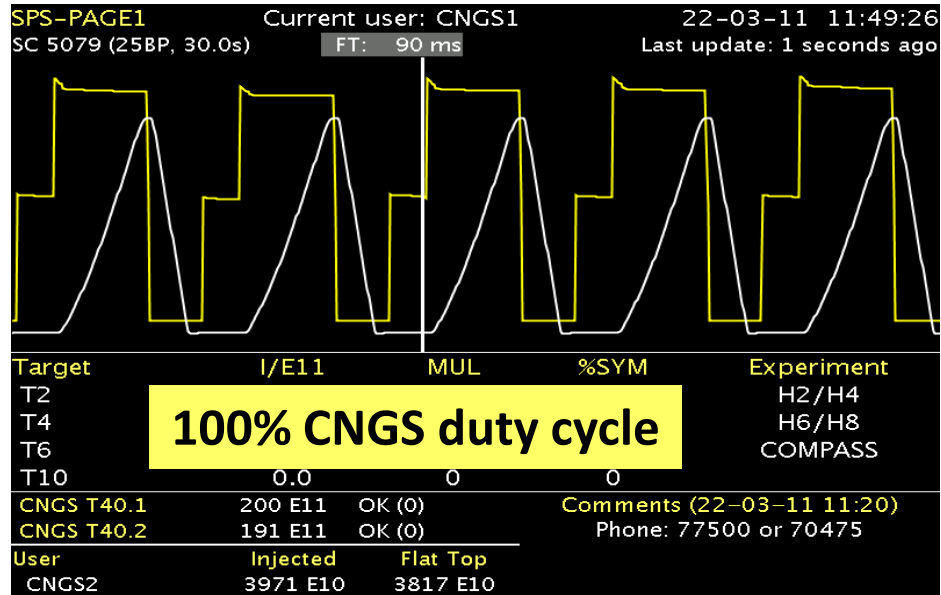
→ 4 different calorimeter types to test different properties

→ Scheduled for several periods in H2 and H8

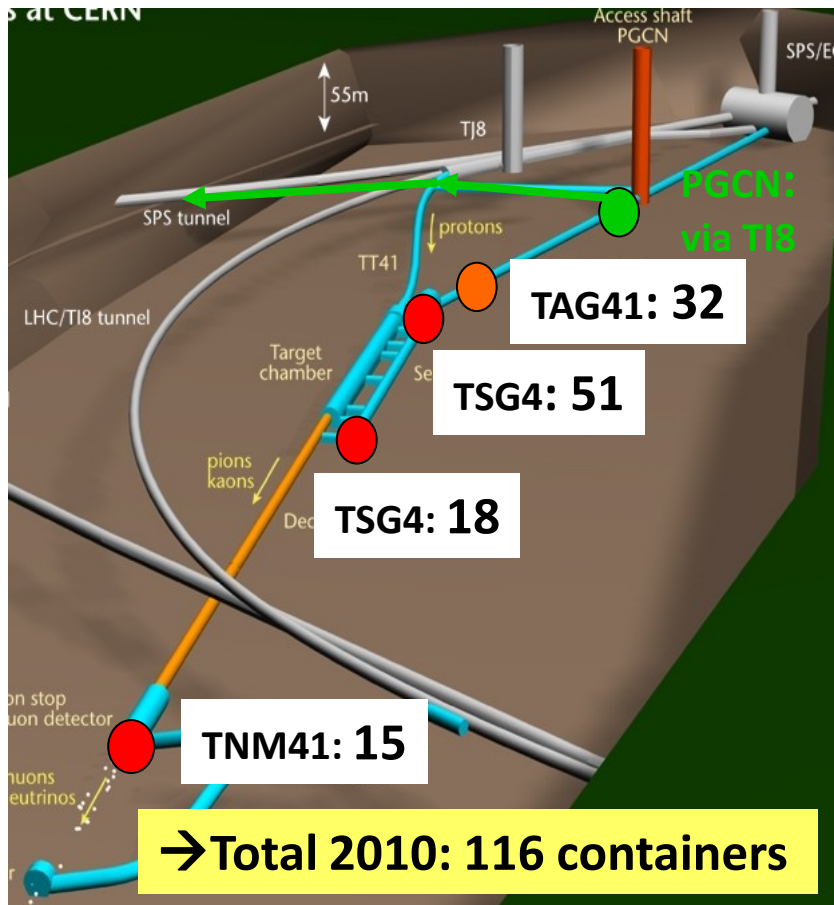


CNGS

CNGS Physics Run started on 18 March 2011



CNGS – Water Issue



- Ventilation modifications:
 - Keep under-pressure in target chamber
 - Water from TAG41 might possibly be disposed again via TI8
- All containers will be transferred and stored in **ISR**

Today: 324 Containers

→ Bat 954, BA4, EHN1

CNGS - Outlook

Approved for $22.5 \cdot 10^{19}$ protons on target

i.e. 5 years with $4.5 \cdot 10^{19}$ pot/ year

→ Expect ~ 10 ν_{τ} events in OPERA

2011, 2012: $4.7E19$ pot

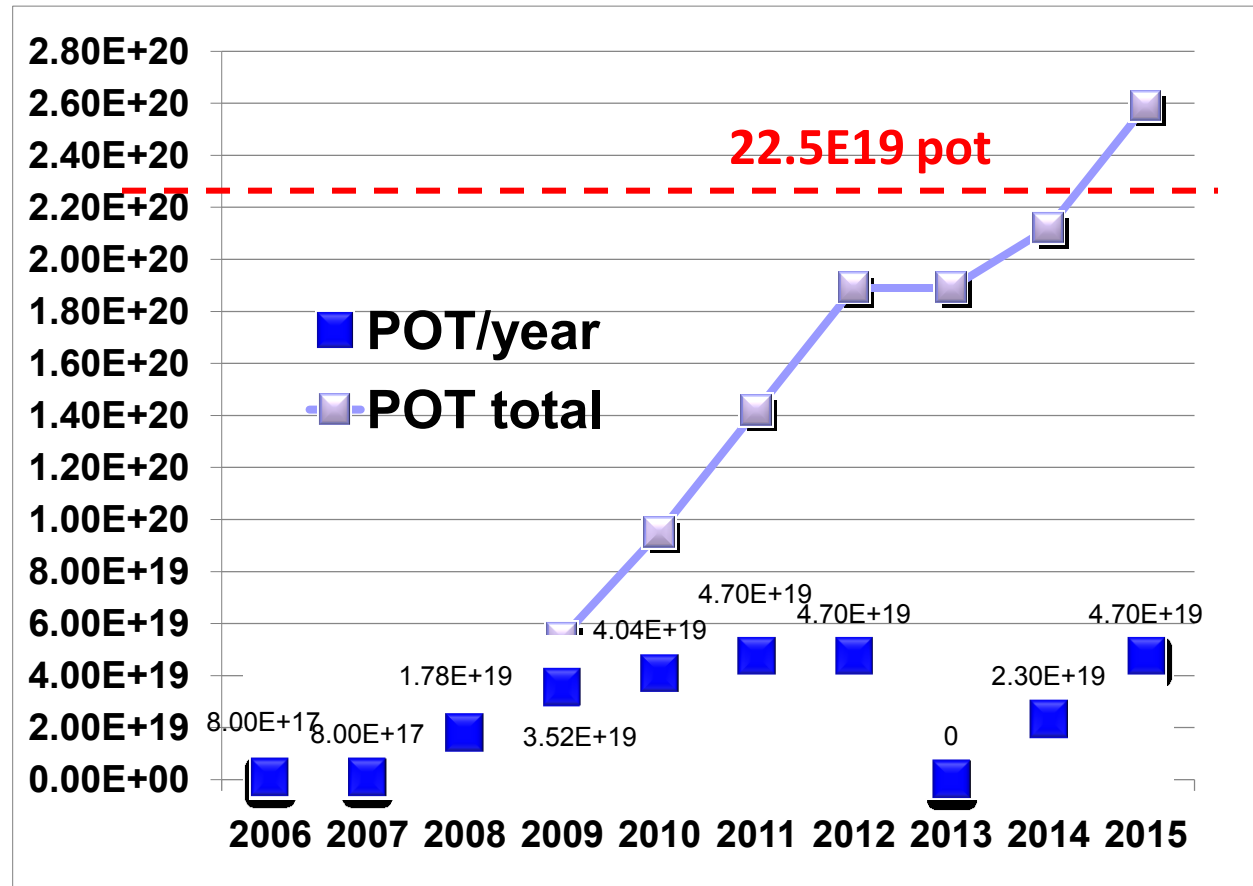
2013: 0 pot

2014: $2.3E19$ pot

2015: $4.7E19$ pot

LS1

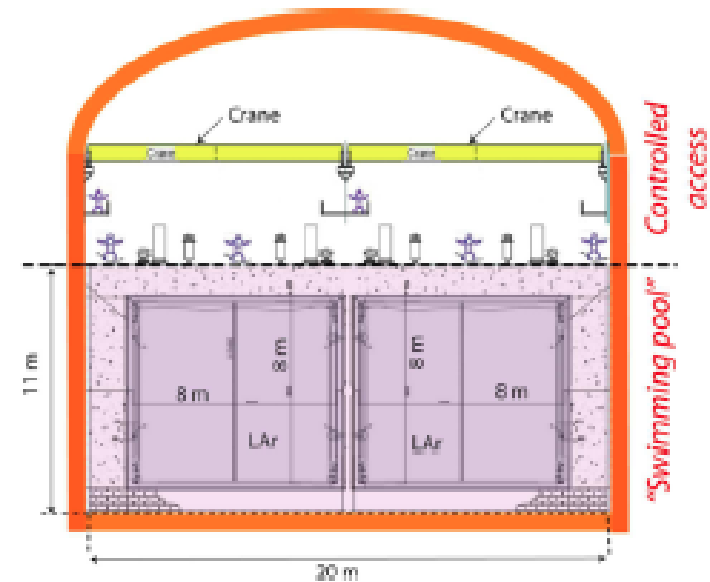
→ Physics program
would finish in 2015



CNGS: Future Proposal

MODULAR:

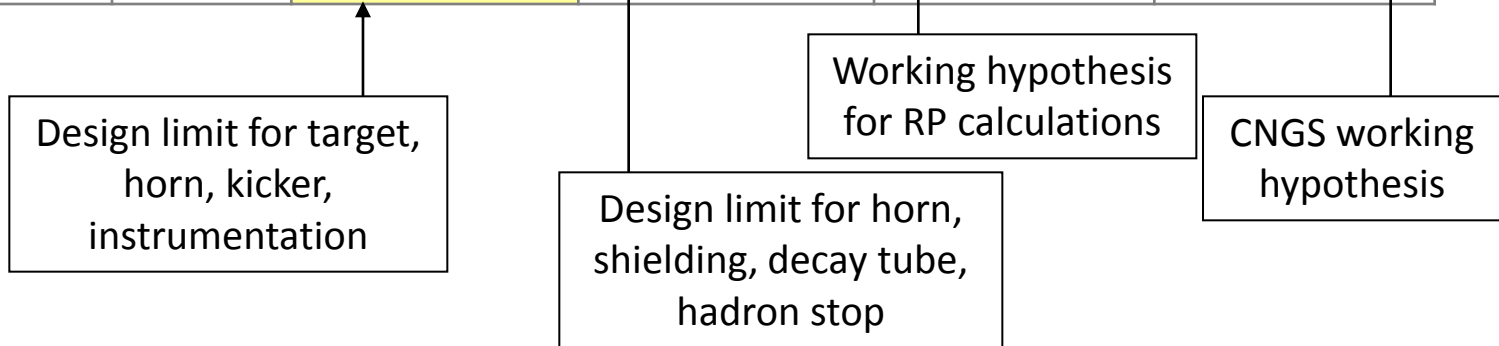
- Off-axis CNGS neutrino beam; 400 GeV/c, 1.2E20 pot/yr
- Improve $\nu_\mu \rightarrow \nu_e$ θ_{13} mixing angle by \sim factor 10 wrt to T2K.
- 20kT liquid Argon TPC installed at shallow-depth at Gran Sasso with modular approach.



CNGS Facility: Intensity Limitations

- Design of secondary beam line elements, RP calculations
 - (Horn designed for $2E7$ pulses, today we have $1.4E7$ pulses → spare horn)
- Intensity upgrade from the injectors are being now evaluated within the LIU

Intensity per PS batch	# PS batches	Int. per SPS cycle	200 days, 100% efficiency, no sharing	200 days, 55% efficiency, no sharing	200 days, 55% efficiency, 60% CNGS sharing
		<i>[prot./6s cycle]</i>	<i>[pot/year]</i>	<i>[pot/year]</i>	<i>[pot/year]</i>
2.4×10^{13} - Nominal CNGS	2	4.8×10^{13}	1.38×10^{20}	7.6×10^{19}	4.56×10^{19}
3.5×10^{13} - Ultimate CNGS	2	7.0×10^{13}	(2.02×10^{20})	(1.11×10^{20})	(6.65×10^{19})



Summary

- CERN has a worldwide unique opportunity for versatile physics programs and detector tests
 - PS and SPS beam-lines
 - Technical support and infrastructure provided by CERN
- Facilities are heavily used, very popular
 - Always fully (over!) booked
- Very broad Fixed Target program
 - Lifetime >10 years
- Many more proposals in pipeline
- Add North Area to the consolidation plans