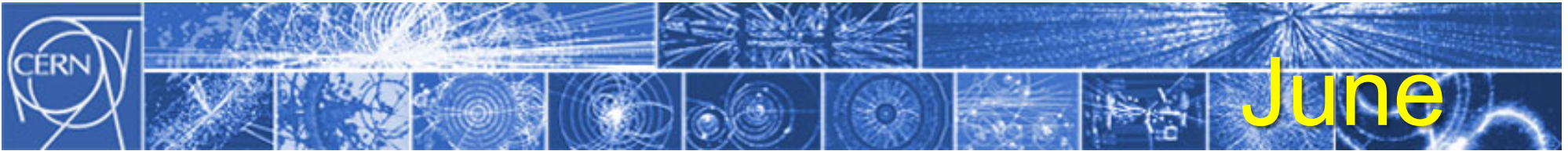


# Medium Term Plan 2011-2015

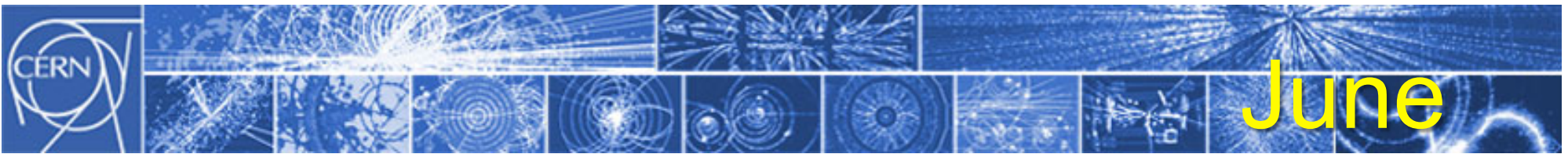
RC 16/09/2010

Rolf Heuer



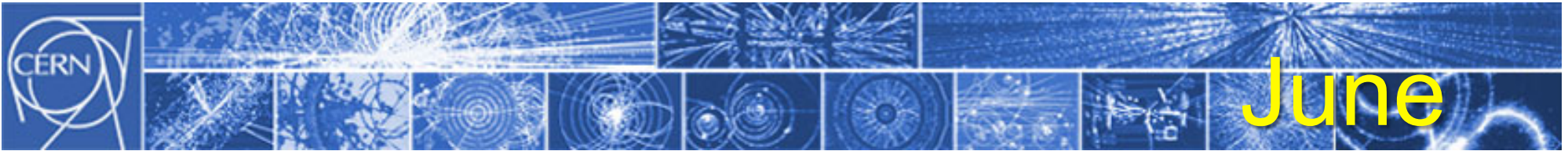
# Scientific Strategy

- Full exploitation of LHC physics potential
  - Reliable operation (including consolidation and LINAC 4)
  - Remove bottlenecks to benefit from nominal luminosity for both machine and detectors
  - Focused R&D and prototyping for High-Luminosity LHC
  - Re-establish standards for technical and general infrastructure
- Preparation for the long-term future (>2015)
  - Energy frontier
    - CLIC/ILC collaboration and R&D (for detectors and machine)
    - Generic R&D for High-Energy LHC (i.e. high field magnets)
  - R&D for high-power proton sources (HP-SPL) e.g for  $\nu$ -physics
- World-class fixed-target physics programme



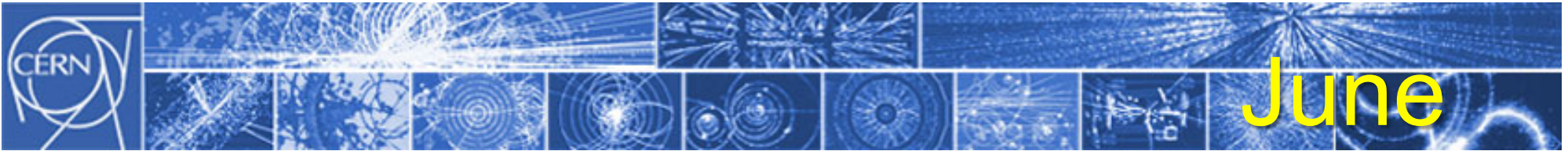
# Background

- LHC long term operation needs consolidation and upgrades
- Great concerns concerning infra-structure and injectors
- General infrastructure needs considerable consolidation  
some facilities below norms for hygiene and safety
- Analysis of the future plans for the laboratory showed that existing plan had become outdated by events and was not focused on the optimum running of the LHC, therefore a new plan is proposed:
  - combination of upgrades of the experimental areas
  - upgrade existing injector chain rather than building a new chain
  - this produces large savings for the future
- This MTP puts together not only the original vision of the present management but incorporates the consolidation and improvements which have emerged over the past 18 months



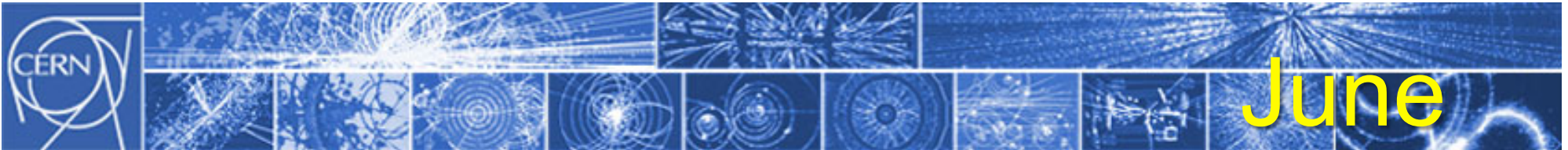
## Full exploitation of the LHC physics potential

- LHC operation until around 2030, aim at  $\int L dt \approx 3000/\text{fb}$ 
  - first decade **2010-2020**  
up to 14 TeV, up to around design luminosity
  - reliable operation of the whole accelerator complex  
(consolidation needs independent of decision on SPL/PS2)
  - shutdown around 2020 for luminosity and detector upgrade
  - second decade **2020-2030**  
up to 14 TeV, luminosity around  $5 \times 10^{34}$ , luminosity leveling  
(HL-LHC)



## Full exploitation of the LHC physics potential

- LHC operation until around 2030, aim at  $\int L dt \approx 3000/\text{fb}$ 
  - two-year running scenario
    - run 2010/11 at 7 TeV cms energy, aim 1/fb
    - refurbish copper stabilizers in 2012
    - run 2013/14 at maximum cms energy
    - earliest 2015 connect LINAC4, detector improvements



## **CERN as laboratory at the energy frontier**

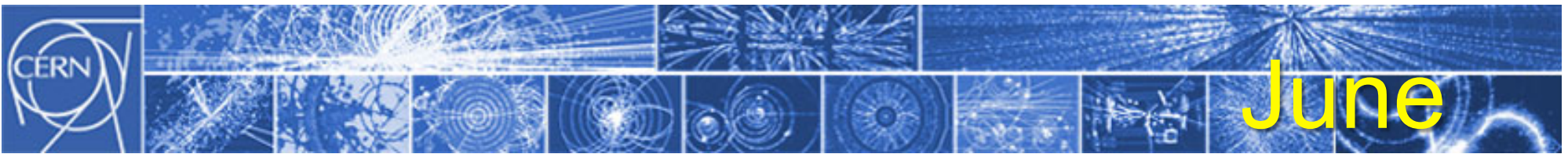
- CLIC/ILC collaboration
  - CLIC CDR 2011, ILC TDR 2012
  - LC detector R&D
  - increased efforts after CDR/TDR accepted
- R&D for high-field magnets (HE-LHC)

## **Focused R&D for Neutrino Physics**

- R&D on high power proton sources

## **Fixed target physics**

- CERN share of HIE-Isolde infrastructure (high priority in NuPECC)
- CNGS, NA62, Cloud, n-TOF, Compass, .....



# New items in 2010 MTP

- Need for injector chain consolidation (max. 30 MCHF p.a. as of 2013)
- General infrastructure consolidation (15 MCHF p.a.)
- Two yearly LHC schedule with energy costs increase (average of about 10 MCHF p.a.)
- CERN's participation in upgrading the detectors to benefit from nominal luminosity (39 MCHF integral)
- CERN share of HIE Isolde infrastructure (16 MCHF integral)
- Possible upgrades of the injectors (PSB about 25 MCHF integral, SPS about 50 MCHF integral)
  
- Start of LP-SPL and PS2 construction kept as fallback - not budgeted



June

## Comparison of scenarios up to 2015:

### Scenario with SPL/PS2 construction

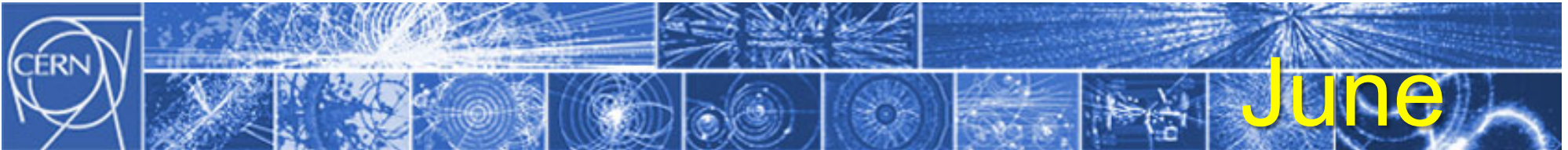
- Start of LP SPL and PS2
- Not ready < 2020
- Cumulative budget deficit increases
- End 2009 -488.7 MCHF
- 2015 about -715 MCHF

### Scenario without SPL/PS2 construction

- Upgrade PSB
- Ready by 2015
- Cumulative budget deficit continues to reduce
- End 2009 -488.7 MCHF
- 2015 about -388 MCHF

=> Obviously not affordable, and thus not the baseline scenario





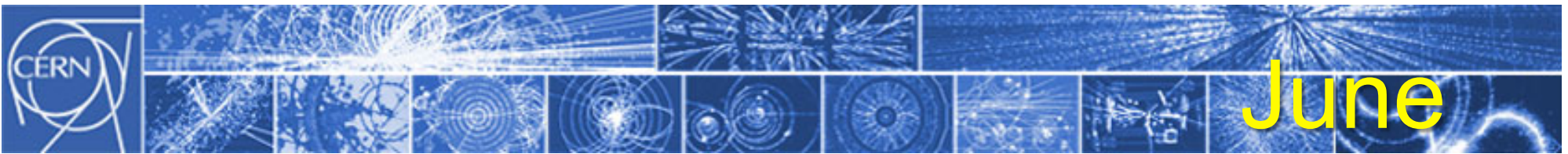
# Revised schedule

## LHC

- 3.5 TeV/beam run in 2010 and 2011 to achieve  $1 \text{ fb}^{-1}$
- Splice consolidation in 2012 and remaining pressure rupture disks to be installed
- Two yearly schedule in 2013/2014 -> connection of LINAC 4 in 2014->2015
- Two-year run schedule has an impact on electricity consumption and costs

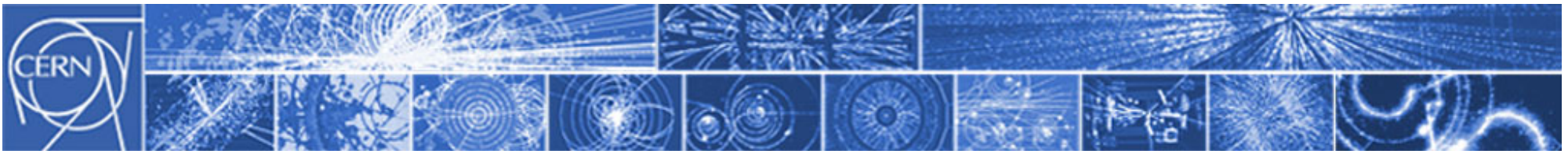
## Future options

- 2012: Final decision feasibility: PS Booster energy extraction upgrade (baseline) or LP-SPL / PS2
- 2012: European Strategy Roadmap assessment
  - CLIC/ILC
  - HE-LHC
  - Neutrino physics
- 2012: Decision on start of CLIC TDR



# Summary

- MTP 2010 assumes the same revenues from Member States as presented in all MTPs since 2007 inclusive
- Proposal to delay balancing the cumulative budget deficit up to 2020 to cope with
  - the need to consolidate the site as agreed by Council
  - the need to consolidate the social security systems
  - the full exploitation of the LHC physics potential (including HL-LHC R&D)
  - the R&D to position CERN at the energy frontier (CLIC/ILC, HE-LHC)
  - R&D for possible future neutrino physics (i.e. HP-SPL)



CERN

European Organization for Nuclear Research  
Organisation Européenne pour la Recherche Nucléaire

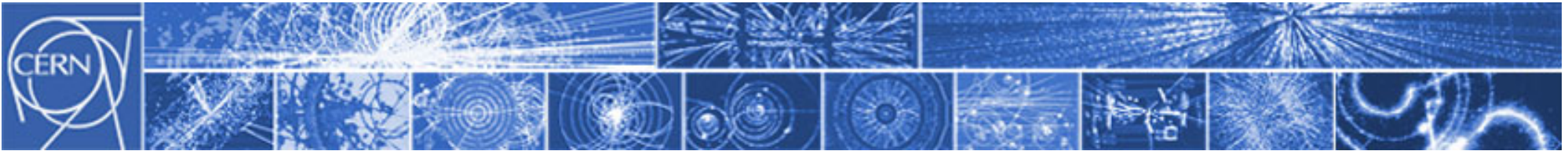
# REVISED

# Medium-Term Plan 2011-2015

CERN/SPC/948/rev - CERN/FC/5450/rev - CERN/2915/rev

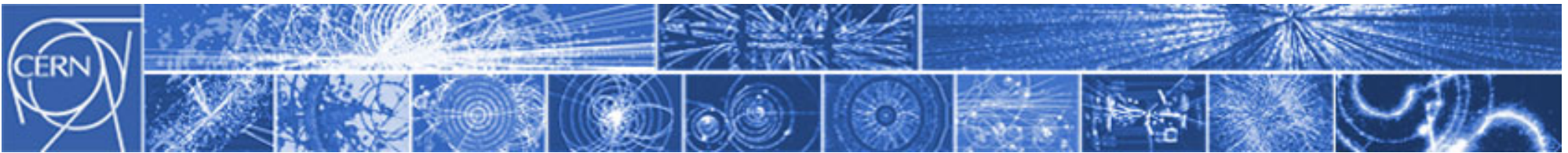
R-D Heuer

SPC meeting August 24, 2010



# Background

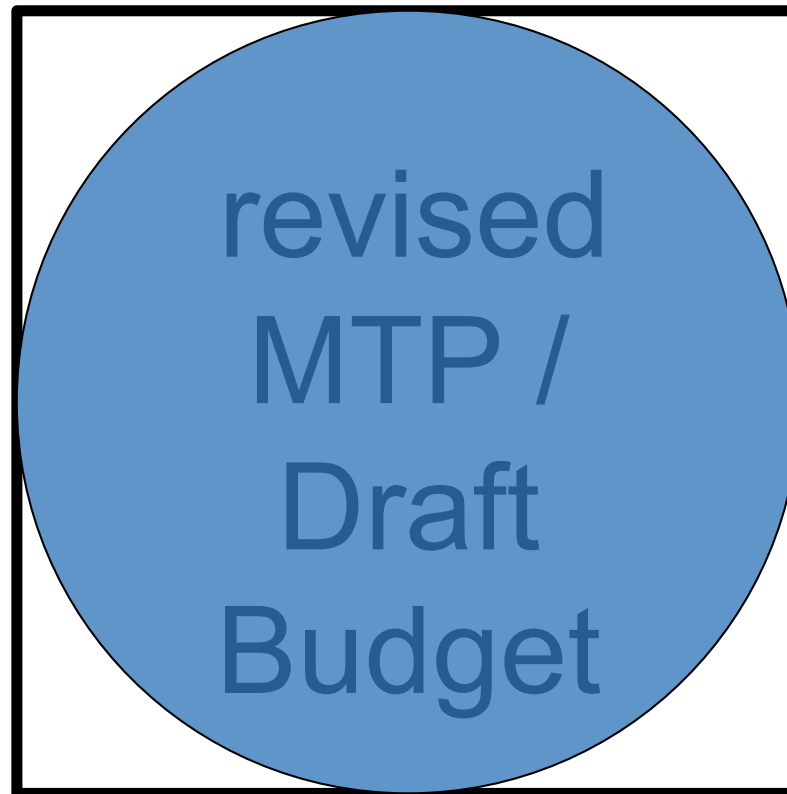
- SPC strongly supported the MTP in June
- FC could not recommend this MTP to Council for approval
- FC requests
  - Reduction of contributions
  - Consolidation of the social security systems
  - Reduction of the cumulative budget deficit
- Management
  - Protect science from cuts



# Task

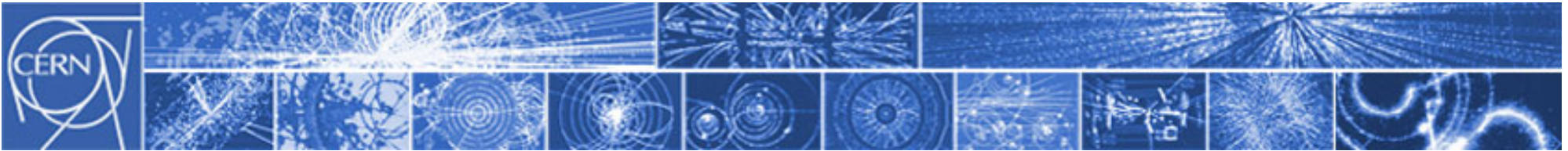
reduce contributions

protect science



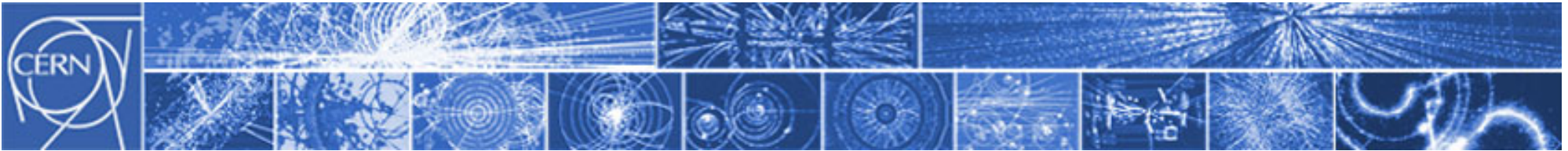
consolidate social security systems

reduce cumulative deficit



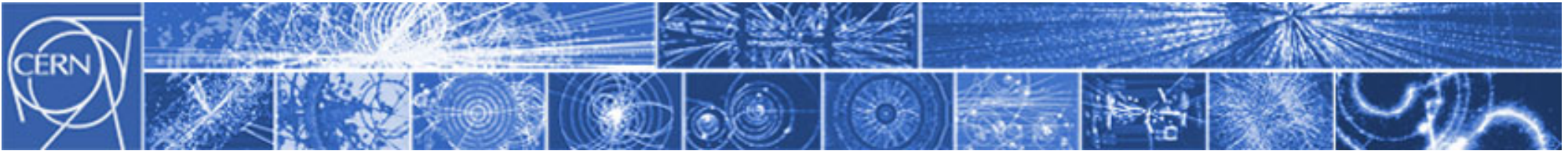
# Approach

- Objectives unchanged
  - LHC highest priority
  - Keep diversity in research
  - Prepare CERN for the future
    - emphasis on energy frontier
    - participation in neutrino physics
  - Continue consolidation



# Result (1)

- Painful cuts and stretches
  - Reduced pace for entire consolidation program
  - Delay possible TDR for CLIC
  - Stop of the entire accelerator complex in 2012
  - Reduced resources for non-LHC experiments
  - Reduced R&D



## Result (2)

The revised MTP presented here combines

reduced revenues

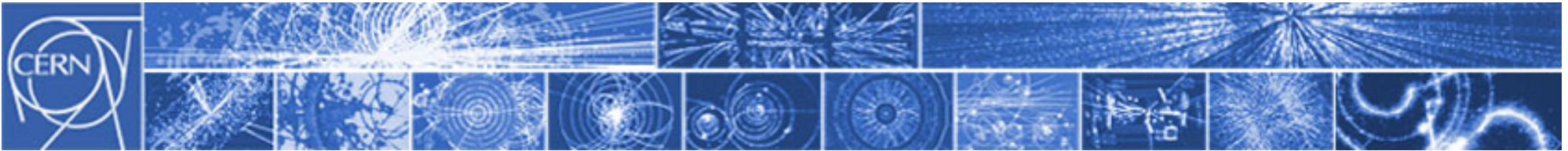
reduced spending on research and consolidation by a careful  
and responsible adjustment of the pace  
originally foreseen

increased injection of capital into the social security systems

with

an acceptable decrease of the budget deficit, lower than  
anticipated in June.

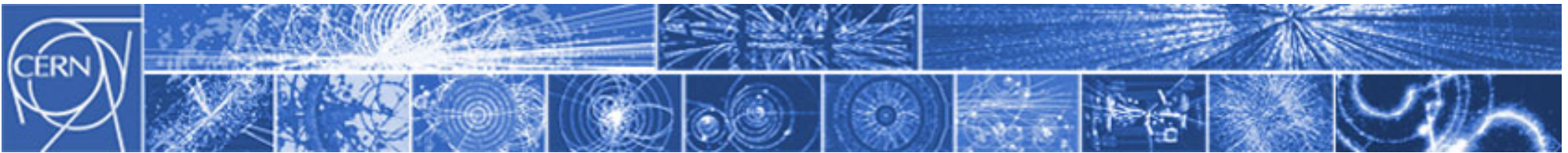




# Revenues

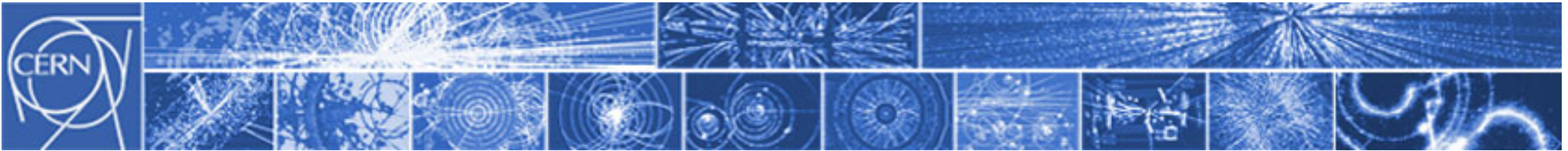
- Cut by 15 MCHF of Member States' contributions in 2011
- Cut by 30 MCHF p.a. of Member States' contributions as of 2012 with respect to the MTP presented in June

Cumulative impact over the period: 135 MCHF



# Restore full funding for Pension Fund

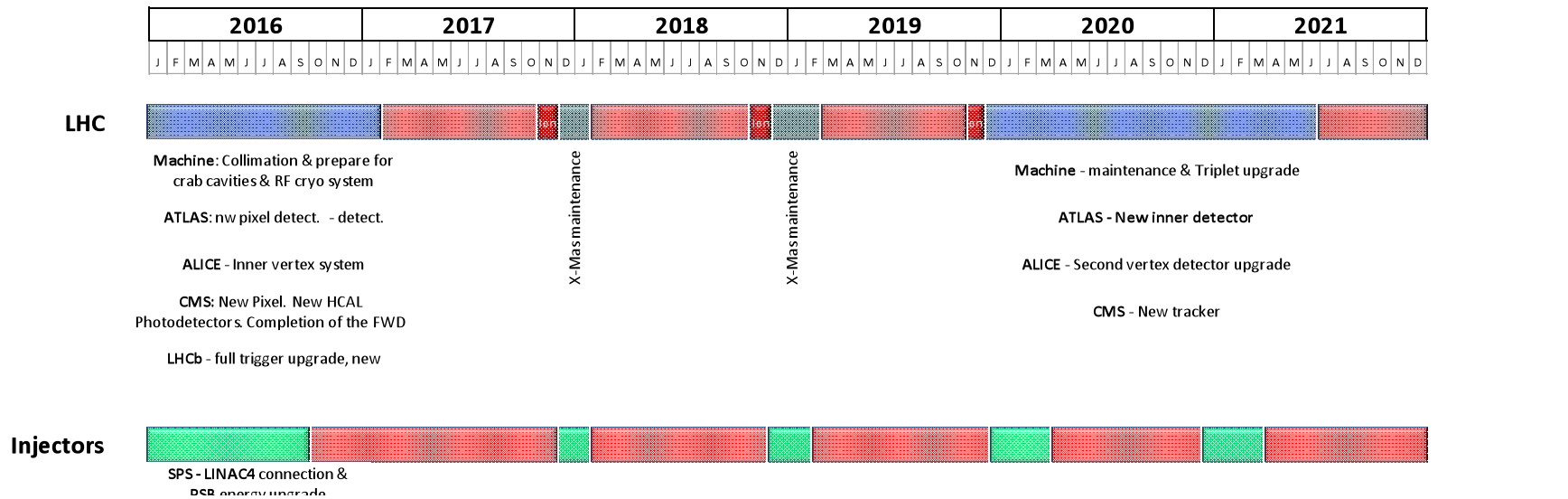
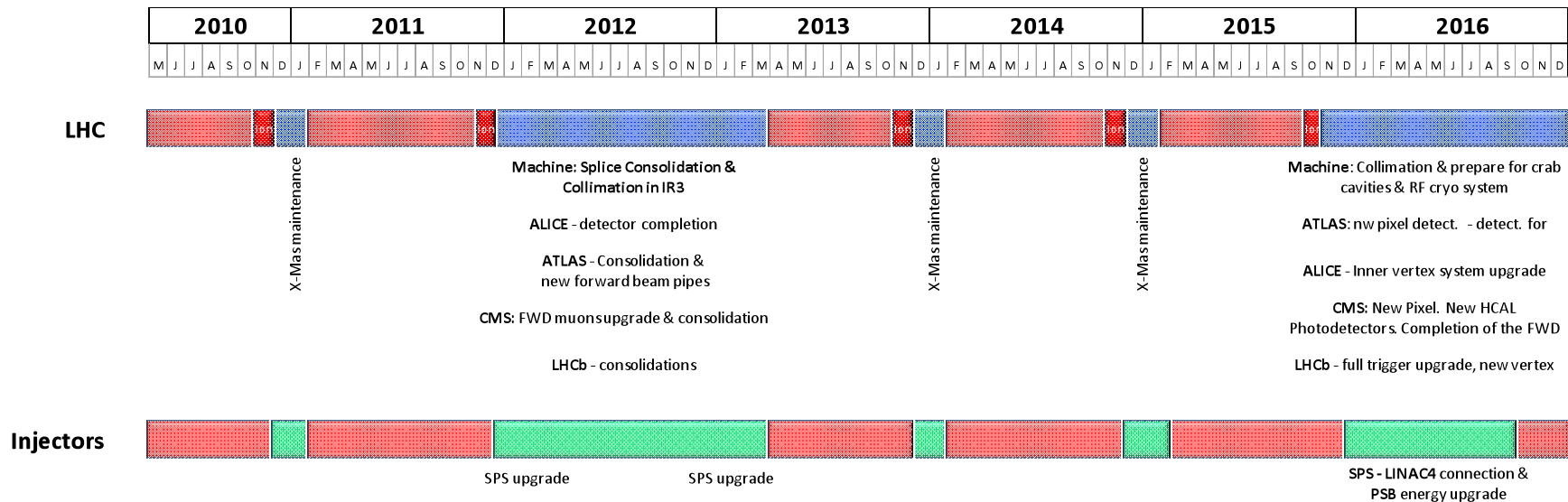
- Decided by Council in June 2007
- Requires a set of measures  
(subject to separate Council approval)
  - **One measure being a direct capital injection**
  - 30 MCHF p.a. stabilize the fund (as presented in June)
  - 60 MCHF (30 + 30 MCHF) p.a. sustainable to restore full funding by 2033 (Management Proposal)

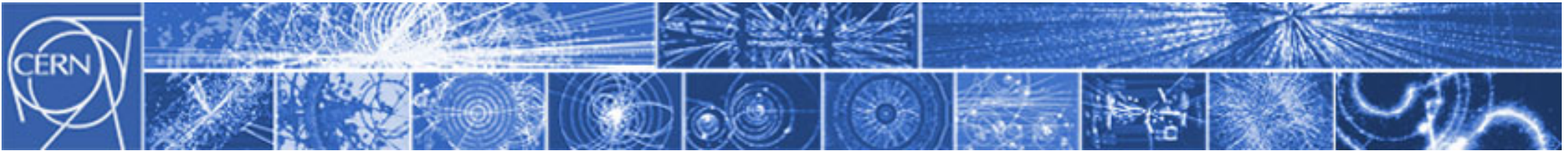


# Impact on Research and Consolidation



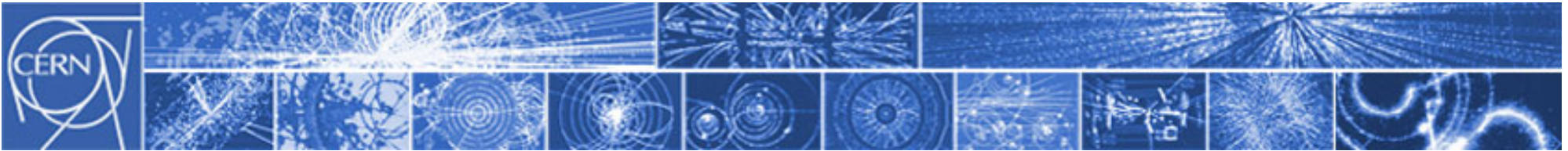
# Provisional schedule





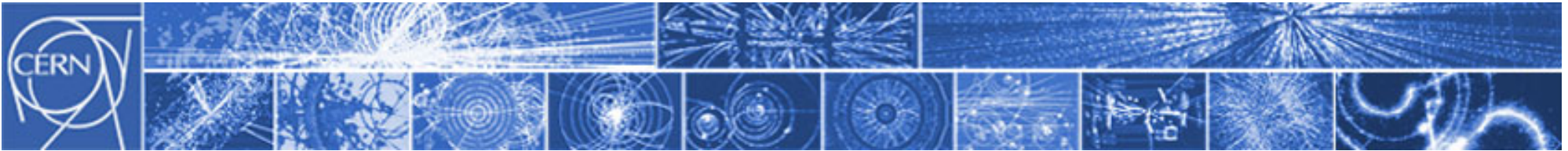
# Impact (1)

- Reduce the pace of additional accelerator consolidation by 10 MCHF from 30 MCHF p.a. to 20 MCHF p.a. (integral over the period 48.4 MCHF, 0.8 MCHF in 2011); (fact sheet 15, figure 3)
- Reduce the pace of LHC spares procurement and consolidation (34.2 MCHF, zero in 2011); (fact sheets 1, 7, figure 2)



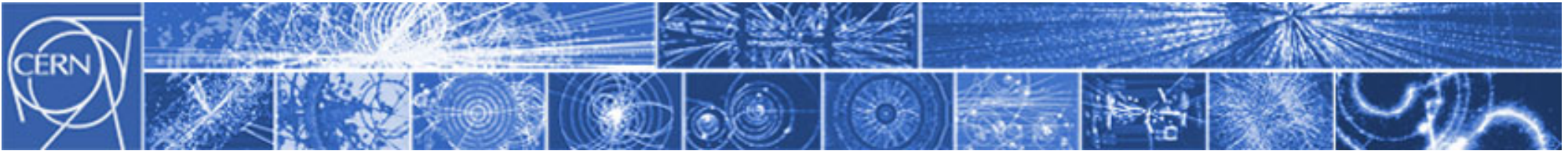
## Impact (2)

- Re-profile PS Booster extraction energy and SPS upgrades to 2016 (i.e. over six years instead of five) (10.5 MCHF, 2.1 MCHF in 2011); (fact sheet 30, figure 5)
- Reduce pace of HL-LHC detector preparations (19.3 MCHF, 3.9 MCHF in 2011); (fact sheet 31, figure 5)
- Reduce materials for LCG and desktop computing services (12 MCHF, 3.1 MCHF in 2011); (fact sheet 9, figure 2)



## Impact (3)

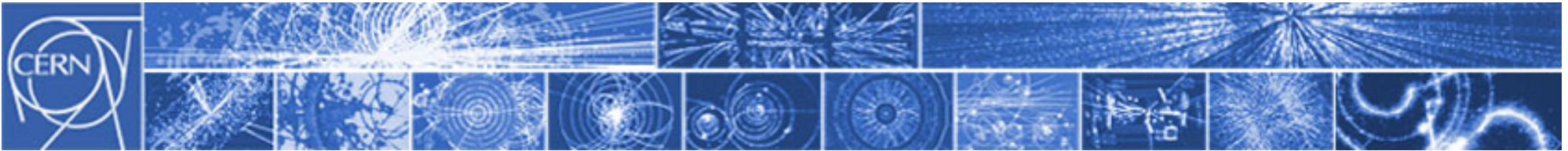
- No increased resources for CLIC from 2011 onwards (106.1 MCHF, 3.4 MCHF in 2011); (fact sheet 24, figure 5)
- Reduce materials for linear collider detector R&D (2.8 MCHF, 0.4 MCHF); (fact sheet 25, figure 5)
- Reduce the allocation for HP-SPL R&D from 3 MCHF p.a. to 2 MCHF p.a. (5 MCHF, 1 MCHF in 2011); (fact sheet 28, figure 5)



## Impact (4)

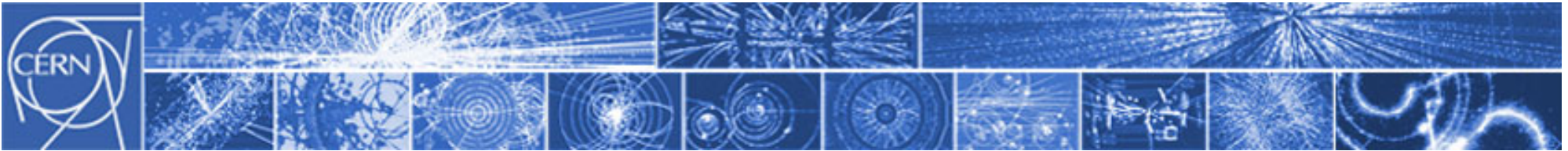
- Delay start of HIE-ISOLDE and reschedule completion to 2014 instead of 2013 (3.3 MCHF in 2011); (fact sheet 27, figure 5)
- Reduce funds earmarked for diversification and generic R&D (12.9 MCHF, 2.5 MCHF in 2011); (fact sheet 29b, figure 5)





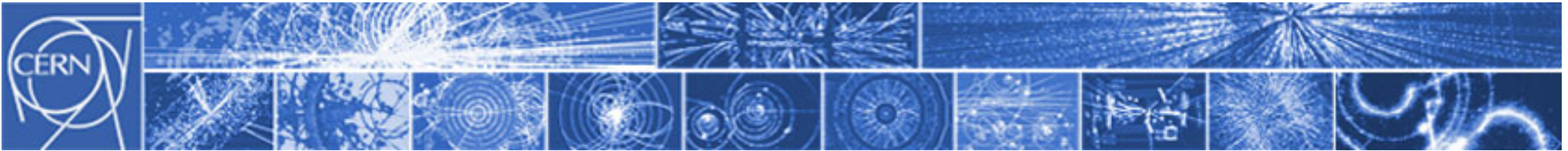
## Impact (5)

- Reduction in energy consumption in 2012 due to a complete shutdown of the accelerator complex (25 MCHF); (fact sheet 23, figure 4)
- Shutdown delayed to 2016, higher energy consumption in 2015 (impact -20 MCHF on savings; this amount will be saved in 2016); (fact sheet 23, figure 4)



## Impact (6)

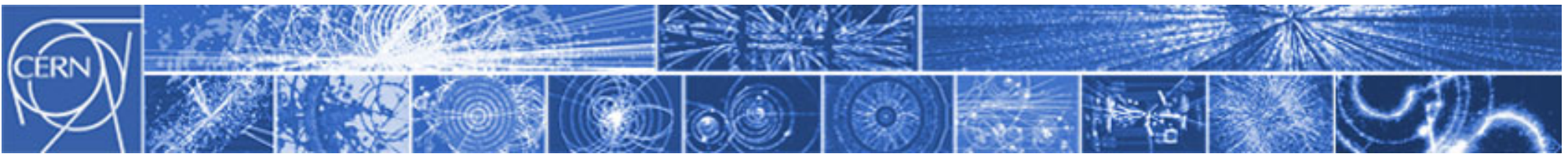
- No new Restaurant 3 (6.5 MCHF, 4 MCHF); (fact sheet 22, figure 4)
- No earmarked funding for Building 33bis (60 MCHF, zero in 2011); (fact sheet 22, figure 4)
- No active asbestos removal (20 MCHF, zero in 2011); (fact sheet 22, figure 4)



# Expenses

The above items result in an impact of

- 24.5 MCHF in 2011
- Cumulative 343 MCHF (2011 to 2015)

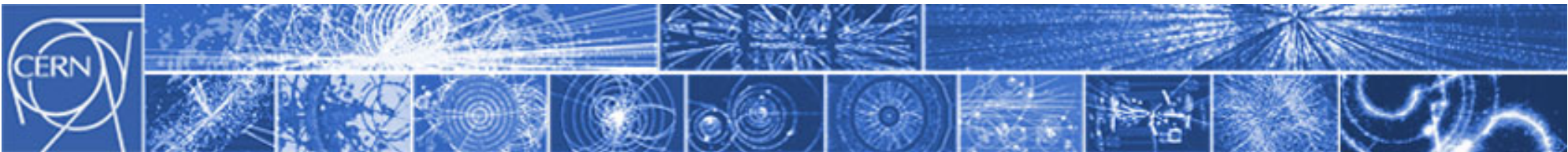


# Cumulative deficit at the end of 2015

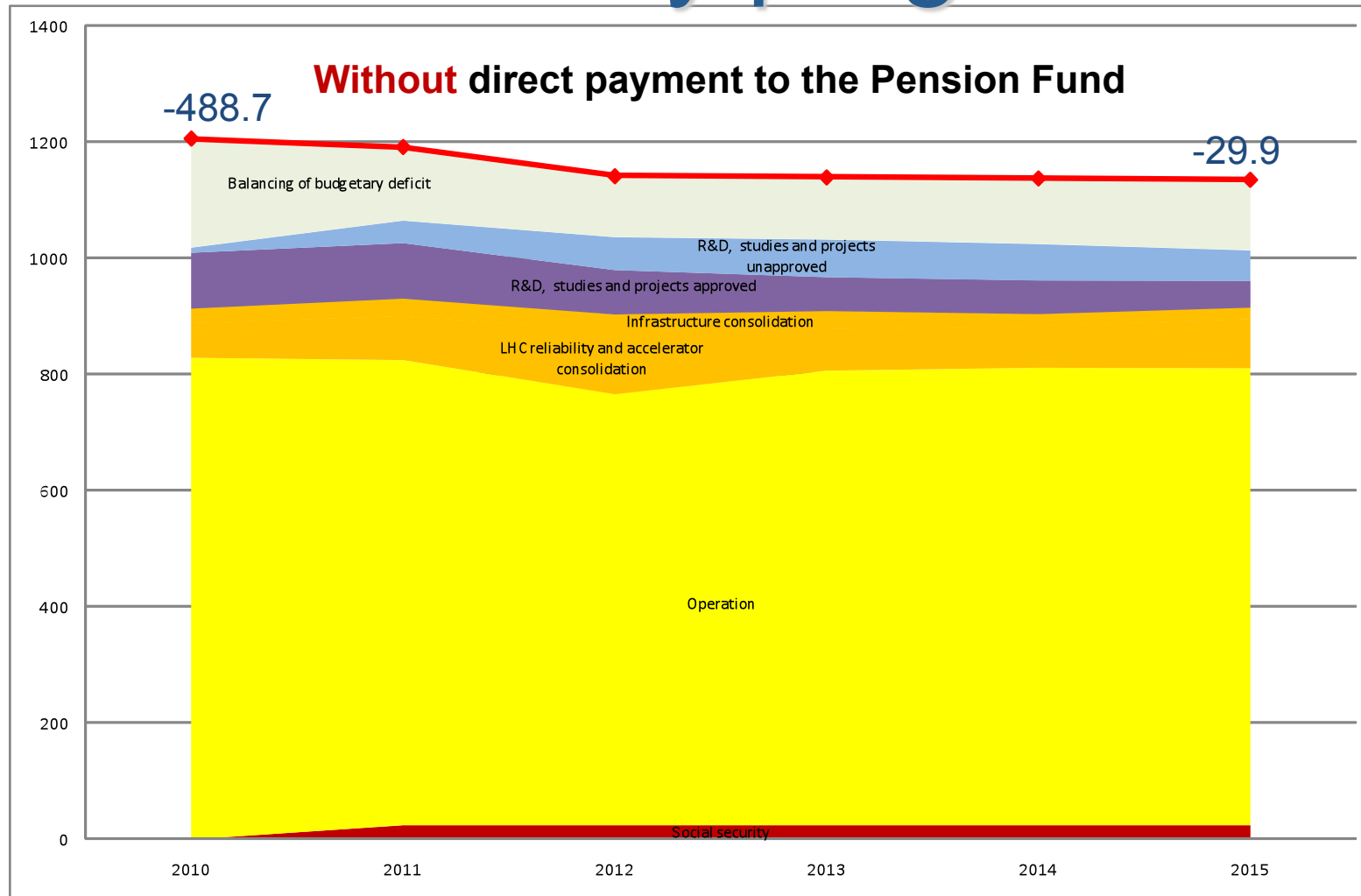
-388 MCHF proposed and discussed in June

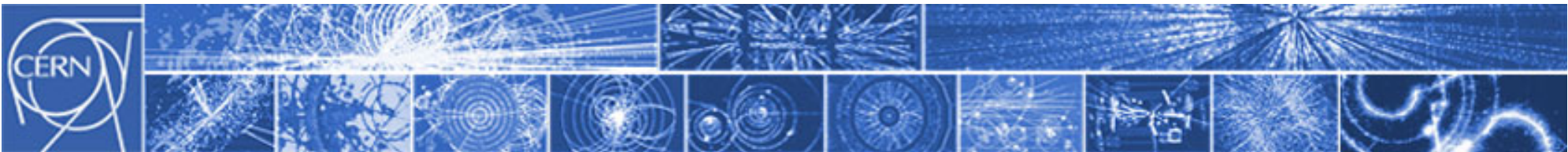
-180 MCHF (-388-135 rev.+343 cuts) which already includes a direct payment of 30 MCHF p.a. to stabilize the pension fund AND incorporates the cut in revenues with respect to the proposed MTP in June

-330 MCHF (-180 MCHF – 5 x 30 MCHF) to increase direct payment to **60 MCHF** p.a. to start restoring full funding of the pension fund

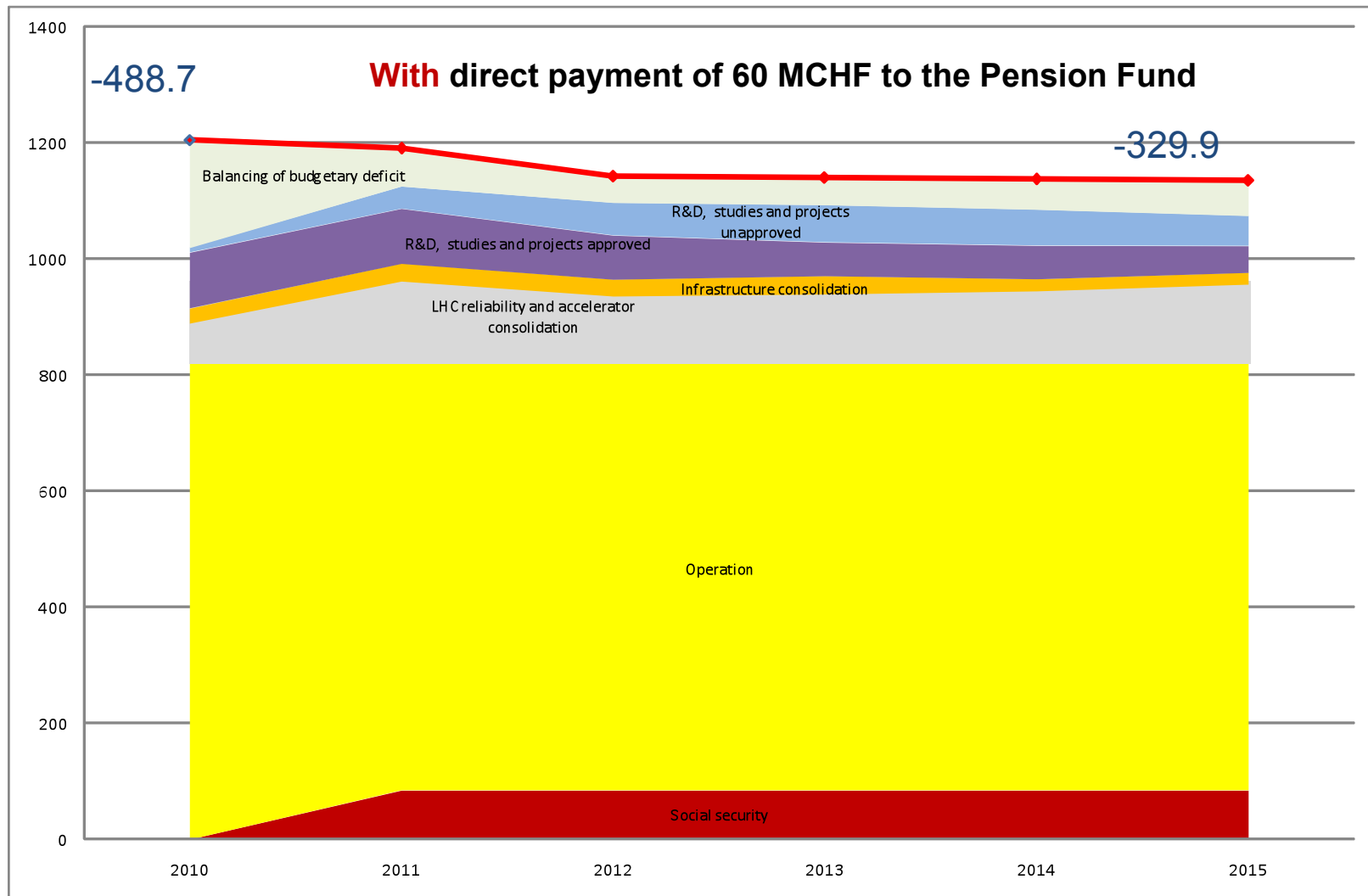


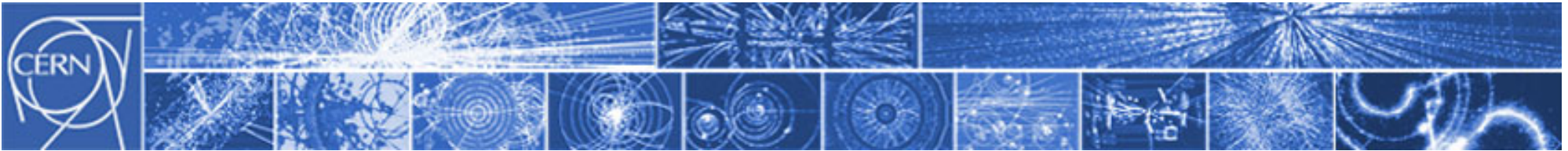
# Breakdown by programme





# Breakdown by programme





# Conclusions

- This revised MTP
  - addresses all requests of the Council and its Committees as expressed in June
  - reduces painfully the available resources for the scientific and non-scientific programmes
  - restores the social security scheme
  - allows for an important reduction of the cumulative budget deficit in spite of the requested cuts in Member States' contributions and the provision to restore full funding of the Pension Fund by 2033