




Status of the SPL study

R. Garoby – 25/11/2010

**Fifth SPL Collaboration Meeting
25-26 November 2010 / CERN**

OUTLINE

-  1. Updated plans for the SPL R & D
2. Recent progress
3. Near future...



CERN Medium Term Plan 2011-2015

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Action to be taken

Voting procedure

For discussion	SCIENTIFIC POLICY COMMITTEE 267 th Meeting 24 August 2010	—
For recommendation to Council	FINANCE COMMITTEE 331 st Meeting 25 August 2010	Chapter I and II: Simple majority of Member States represented and voting (abstentions are not counted) and 70% of the contributions of the Member States represented and present for the voting (abstentions are counted as votes against) and at least 51% of the contributions of all Member States Chapter IV: Two-thirds majority of Member States represented and voting (abstentions are not counted) and 70% of the contributions of the Member States represented and present for the voting (abstentions are counted as votes against) and at least 51% of the contributions of all Member States
For approval	COUNCIL 156 th Session 16 September 2010	Chapter I and II: Simple majority of Member States represented and voting (abstentions are not counted) Chapter IV: Two-thirds majority of Member States represented and voting (abstentions are not counted)

Medium-Term Plan for the period 2011-2015 and Draft Budget of the Organization for the fifty-seventh financial year 2011

...
Expenses

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)
2. Reduce the pace of LHC spares procurement and consolidation (34.2 MCHF, zero in 2011); (fact sheets 1, 7, figure 2)
3. 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)



...

...




...



Summary from CERN MTP

- No construction of LP-SPL and PS2.
- Termination of studies to allow for the LP-SPL and PS2 to remain as possible fall-back solutions.
- **Continuation of SPL R & D for high beam power in view of potential use in a neutrino facility.**
- **Material budget: 2 MCHF/year**
- **Upgrade of the existing LHC injectors**
[e.g. increasing the PSB to PS transfer energy]
- **Consolidation and upgrade of PSB, PS and SPS.**



« LIU » Project
Completion
in ~2016

HP-SPL basic characteristics

Beam characteristics of the main options

	Option 1	Option 2
Energy (GeV)	2.5 or 5	2.5 and 5
Beam power (MW)	2.25 MW (2.5 GeV) <u>or</u> 4.5 MW (5 GeV)	5 MW (2.5 GeV) <u>and</u> 4 MW (5 GeV)
Rep. frequency (Hz)	(circled)	
Protons/pulse ($\times 10^{14}$)	1.1	2 (2.5 GeV) + 1 (5 GeV)
Av. Pulse current (mA)	20	(circled)
Pulse duration (ms)	0.9	1 (2.5 GeV) + 0.4 (5 GeV)

2 × beam current ⇒ 2 × nb. of klystrons etc .



Objectives of the SPL R & D

(in continuity with the work previously done for the LP-SPL)

Motivation

- Preserve potential for some alternative physics programmes (Neutrinos, RIB)
- Preserve possibility of new injectors at long term
- Update CERN competences in superconducting RF

Description

- Focused on high beam power
- R & D only (no work on integration / civil engineering / environmental impact)

Main objectives

- End 2010-2011: ~simultaneously with the PS2 CDR): LP-SPL CDR
- 2013:
 - High power test of 4 sc cavities in a short horizontal cryostat
 - SPL CDR
- Beyond 2013:
 - Construction of a full size cryomodule, development of full performance modulator...
 - Study and development in view of a specific project (neutrino facility?): integration, safety, civil engineering environmental impact study...

SPL R & D subjects until 2015

(in continuity with the work previously done for the LP-SPL)

Partly
addressed in
sLHC-PP

- H⁻ source R & D (to be continued after end of SLHC-PP for the needs of Linac4)

Treated in
sLHC-PP

- Study of the optimum high power RF architecture for a high power SPL

Partly
addressed in
"EuCARD"

- Design, construction and test of superconducting RF cavities (704 MHz – 5 cells – $\beta=1$)

Partly supported
by French "in-
kind" contrib.

- Development of high power RF coupler, HOM damper and adaptation of tuner

With ESS
support for the
modulator

- Upgrade of the SM18 test place [2 K cooling + pulsed RF source at 704 MHz (1 MW @ 50 Hz)]
- Pulsed high power RF tests of contiguous cavities in a common cryostat
- (Design, construction and test a high power klystron modulator: delayed)
- (Design, construction and test of a prototype cryomodule equipped with 8 $\beta=1$ cavities: delayed)

Planning for cavities and cryomodule

?

	2011				2012				2013				2014				2015			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SM18 - 2K Cryogenics			V cryo.					X												
SM18 modulator								1												
SM18 - 704 MHz High Power RF								X												
High Power RF couplers		4+4		4															8	
Superconducting cavities				4															8	
Assembled string of 4 cavities						X														
Horiz. test cryostat (4 cav.)						X														
Equipped horiz. test cryostat								X												
High power RF tests in test cryo.									X											
Assembled string of 8 cavities														X						
8 cavities cryomodule...														X						
Conceptual Design Report																X				

From industry (ESS)

CERN design

~ in-phase with ESS design update

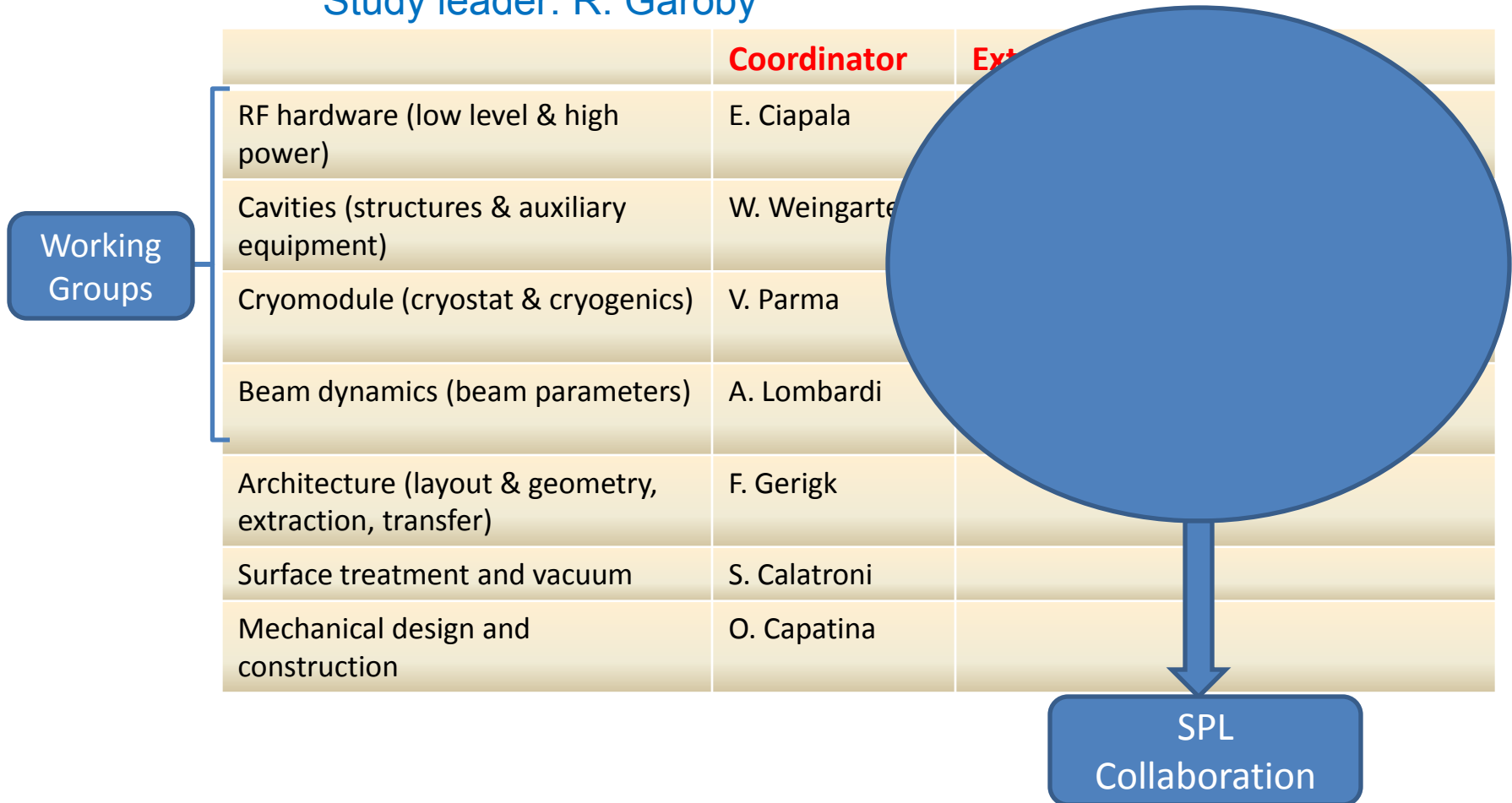
CDR & future plans

+ 2 years



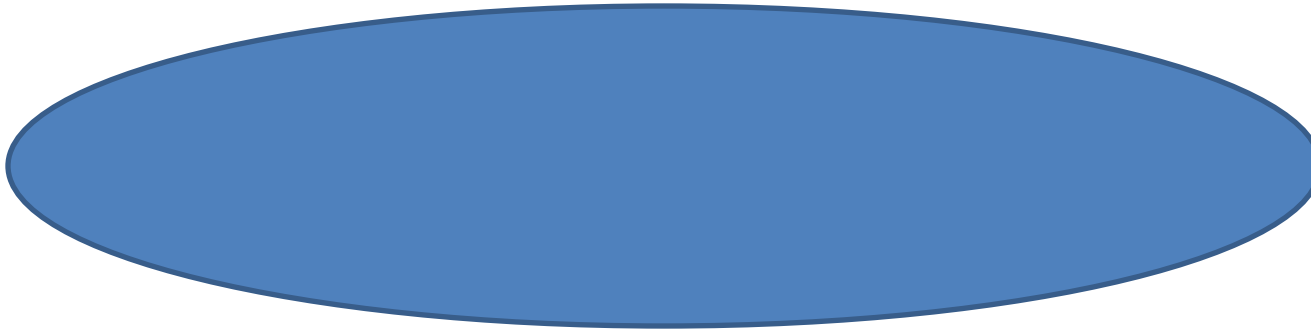
Organization (Reminder...)

Study leader: R. Garoby



- [SPL documentation](https://edms.cern.ch/nav/SLHC-000008) in EDMS [<https://edms.cern.ch/nav/SLHC-000008>]
- [SPL meetings](http://indico.cern.ch/categoryDisplay.py?categId=1893) in Indico [<http://indico.cern.ch/categoryDisplay.py?categId=1893>]

SPL Work Packages inside CERN



- **Cryomodule (V. Parma)**
- **Cavities (W. Weingarten/O. Capatina)**
- **RF couplers (E. Montesinos)**
- **RF for SM18 (O. Brunner)**
- **Diagnostics and infrastructure in SM18 (W. Weingarten)**
- **Cryogenics in SM18 (L. Tavian)**
- **General (R. Garoby)**



Related R & D (Proposals)

1. Nb coating of Cu cavities, using the HIPIMS (High Power Impulse Magnetron Sputtering) technology

- In collaboration with **Sheffield Hallam University** (UK).
- Supported in the context of the construction of LHC spare cavities.
- **Potentially very attractive technology for the SPL (raw material cost, mechanical stiffness).**
- **First results on low beta 704 MHz cavity: end 2012**

2. R & D on H⁻ ion source

- CERN internal activity
- Continuation of the work done for the Linac4 H⁻ source and the SPL R & D supported within the SLHC-PP (until March 2011)
- Focused on the immediate needs of Linac4 (2015)

3. Proposals submitted to the EC (today!)

- **“CRISP”** : WP jointly with ESS and XFEL concerning the test of sc cavities
- **“LAGUNA-LBNO” DS**: WP about proton driver for a neutrino facility at CERN

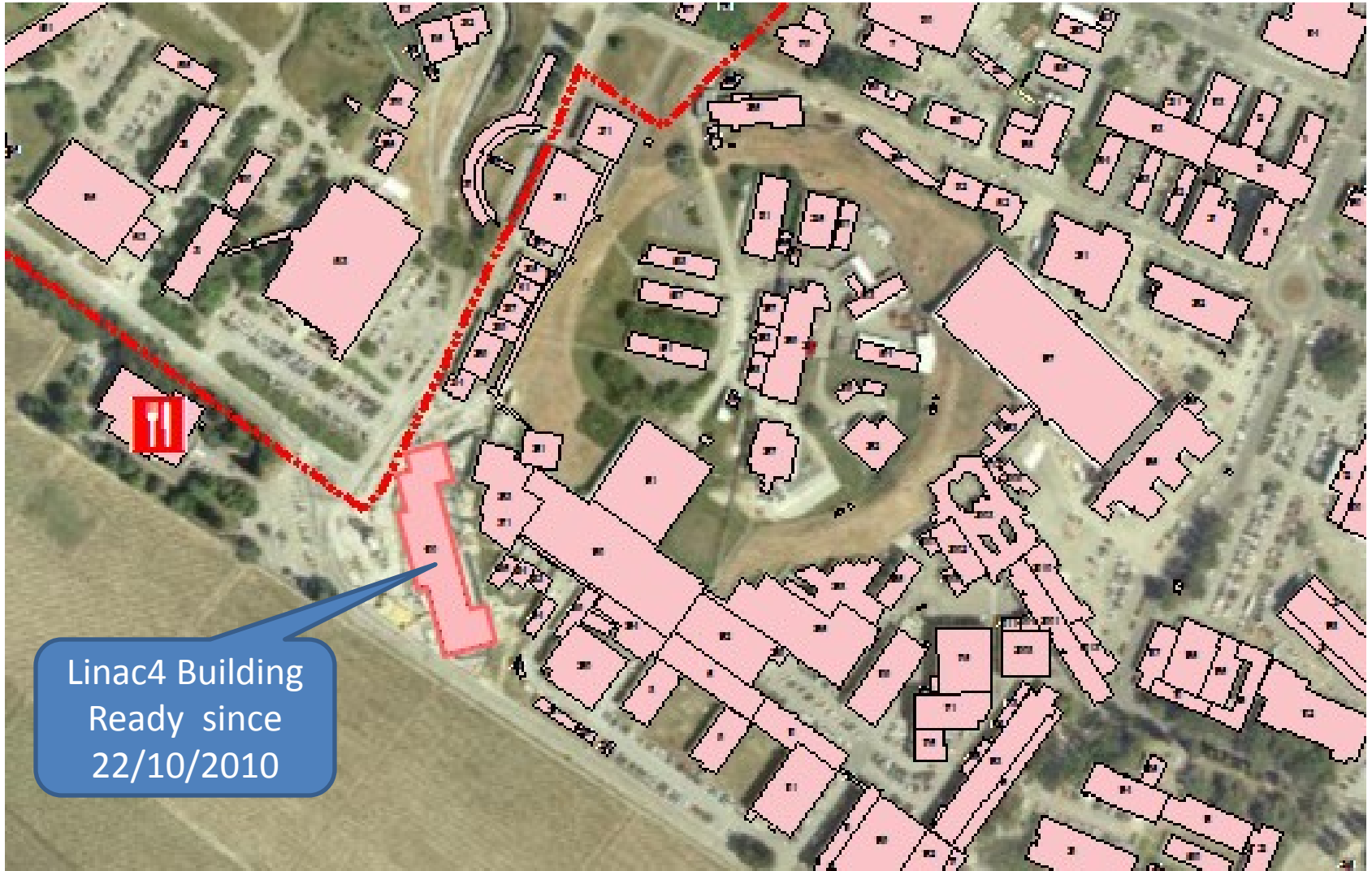
OUTLINE

1. Updated plans for the SPL R & D

 **2. Recent progress**

3. Near future...

Linac4 Civil Engineering



Linac4 Building construction – 2008/10



Construction status

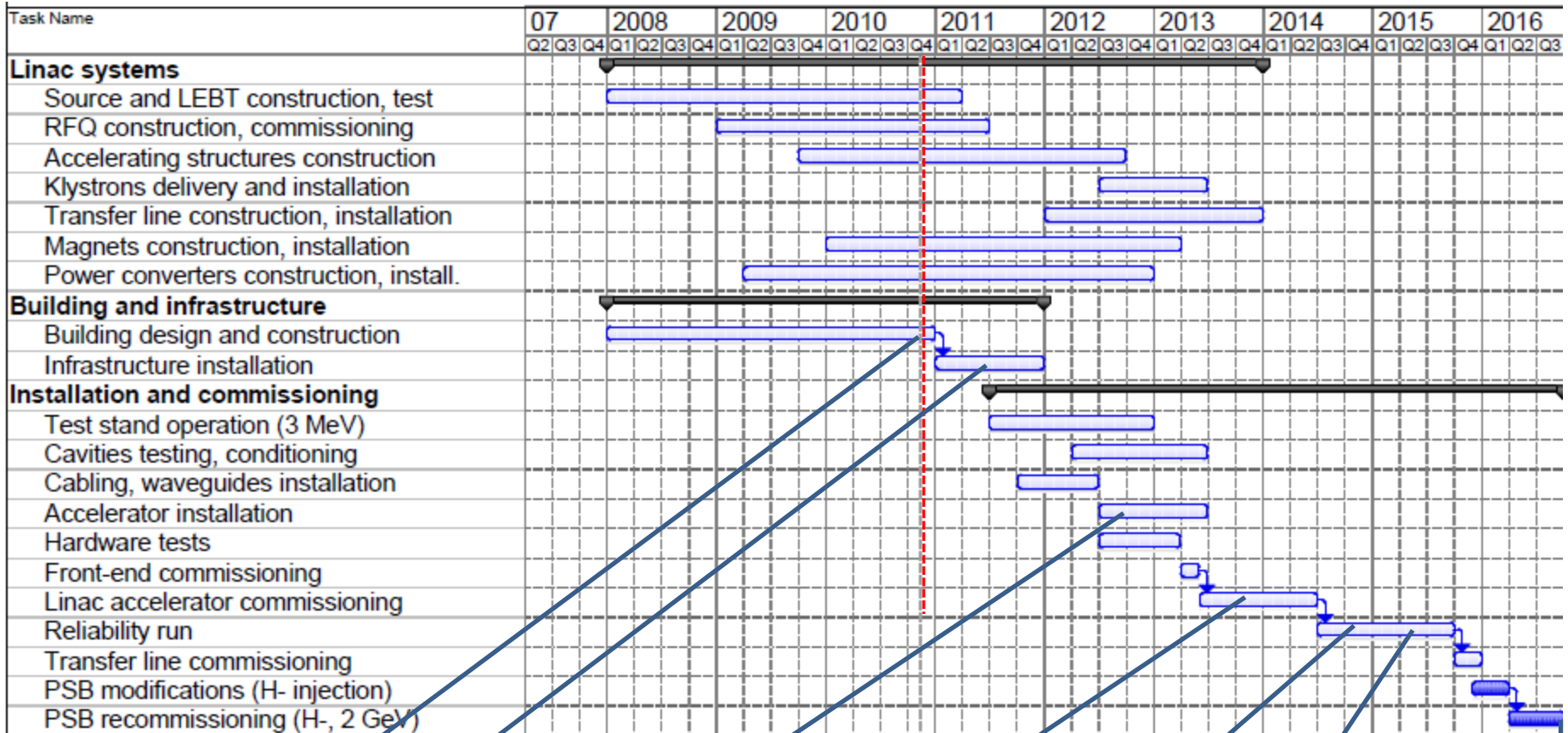


Civil engineering completed in exactly 2 years (delivery on 29.10.2010).

2011: installation of infrastructure (crane, lift, false floor, electrical and cooling networks, safety equipment, cabling, waveguides, ...).



Linac4 – schedule



Building delivery

2011:
Infrastructure installation

2012/13:
Accelerator installation

2013/14:
Commissioning

End 2014:
Linac4 ready

2014/15:
Reliability run

2016: foreseen shutdown
for connection to PSB



Activity since June 2010

Redefinition of the workplan to fit with the MTP

Integrated planning in preparation

- + **Work within WGs** [e.g. video-conferences of WG2 ([~1/ month](#)), technical discussions, contributions to conferences and workshops, visits, etc.]
- + **Workshop on specification of prototype cryomodule:**
 - 19 October 2010: <http://indico.cern.ch/conferenceDisplay.py?confid=108640>
- + **Collaboration Meeting:**
 - End November 2010: [5th SPL Collaboration Meeting](#)
- + **Coordination** ([~2 meetings/month](#))
- + **Collaborations:**
 - **Departure of TRIUMF**
 - **Letter of agreement with FNAL**
 - **Interest of TAC (Turkey)**

OUTLINE

1. Updated plans for the SPL R & D

2. Recent progress

 **3. Near future...**

Near future

- Extension of the study to a full proton driver for a neutrino factory
- Optimization & cost estimate of full proton driver (contribution to the IDS-NF)

... concerning the SPL itself (non-exhaustive list):

- Construction of cavities in industry
- Start of upgrade of cryogenics and overall infrastructure in SM18
- Specification & order of klystron modulator from industry (ESS)
- Cryomodule design review (early 2011) + beginning of construction (IN2P3)
- Specification & construction of tuners and He tanks (CEA)
- LP-SPL CDR (jointly with PS2) (Beginning of 2011)
- Construction & test of High power RF couplers + Review (March 2011)
- Test of single cell sc cavity
- Joint ESS-SPL meeting (June 2011)



**THANK YOU FOR
YOUR
ATTENTION!**