

Status of the SPL study

R. Garoby – 11/11/2009

**Third SPL Collaboration Meeting
11-13 November, 2009 - CERN**

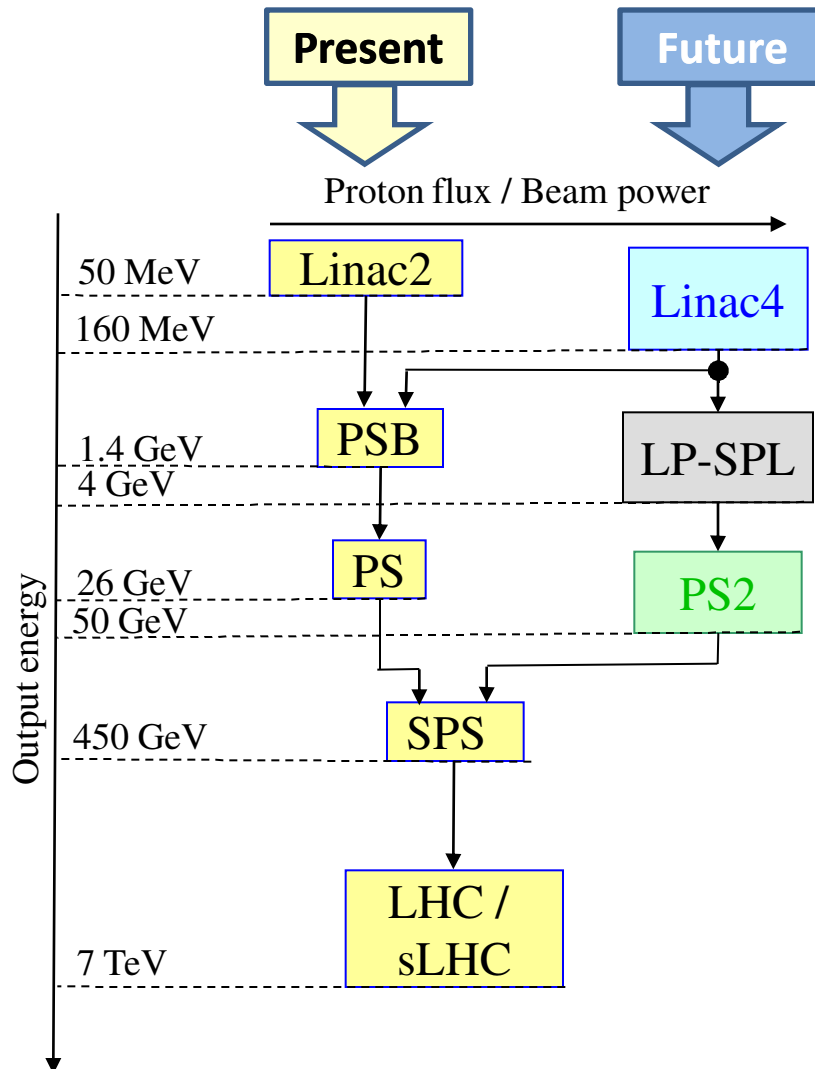
OUTLINE

1. **The full picture (reminder...)**
2. **Context and changes (2009)**
3. **Progress**
4. **Work Plan of the SPL Study**

1. THE FULL PICTURE

(reminder...)

New accelerators



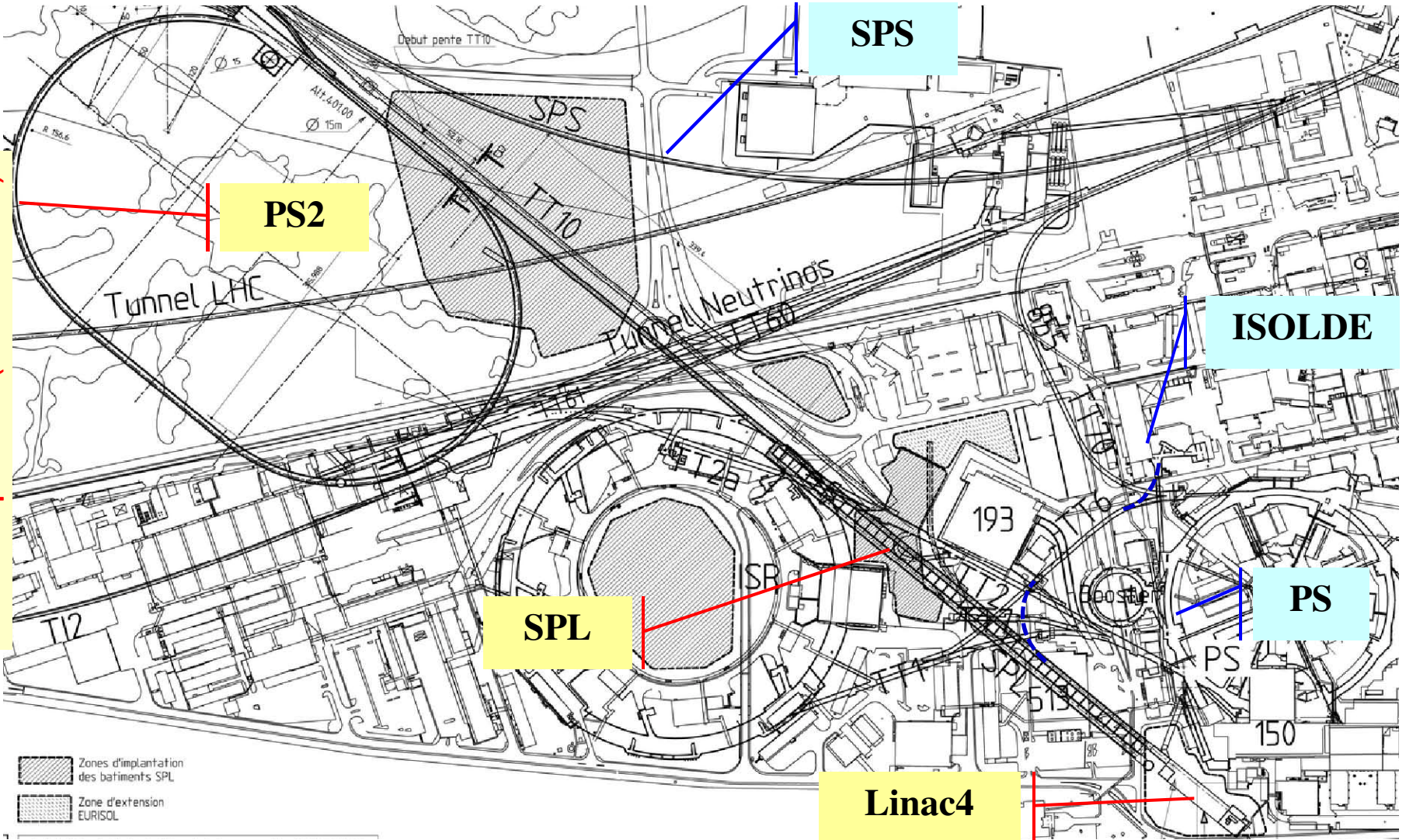
LP-SPL:
Low Power-Superconducting Proton Linac (4 GeV)

PS2:
High Energy PS (~ 5 to 50 GeV
– 0.3 Hz)

sLHC:
“Super-luminosity” LHC (up to
 10^{35} cm⁻²s⁻¹)

The full picture (reminder...)

The full picture (reminder...)





from M. Vretenar



Linac4 tunnel ("cut and cover" excavation) seen from high-energy side.

Final concrete works starting at low-energy side, excavation proceeding at high energy side.

Tunnel level -12 m, length 100 m.

Delivery of tunnel and surface equipment building end of 2010.

The full picture (reminder...)

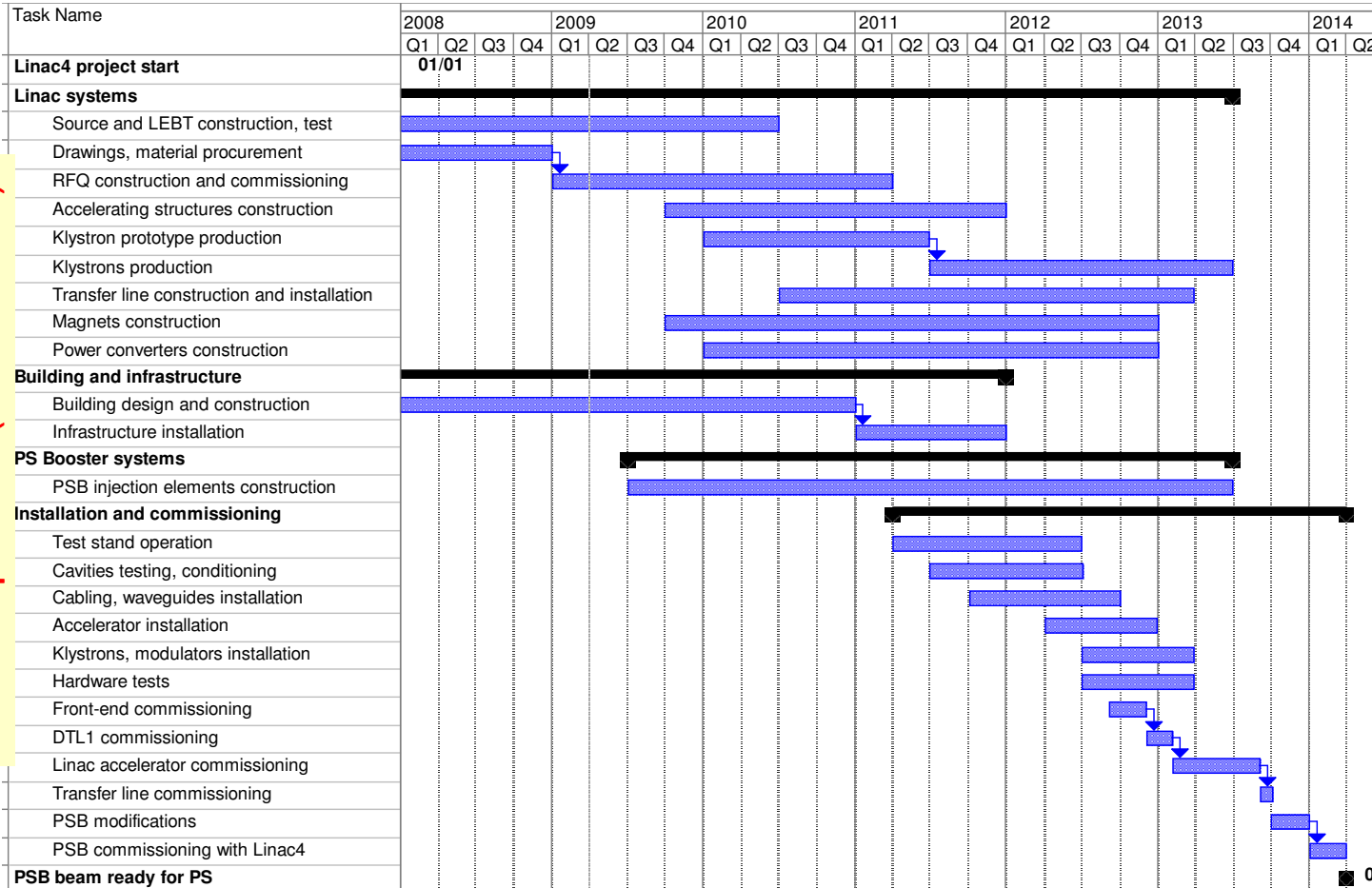
from M. Vretenar



The full picture (reminder...)

High-energy side of Linac4 tunnel, with beam dump chamber and connecting tunnel to the end of Linac2.

Linac 4 planning



Milestones

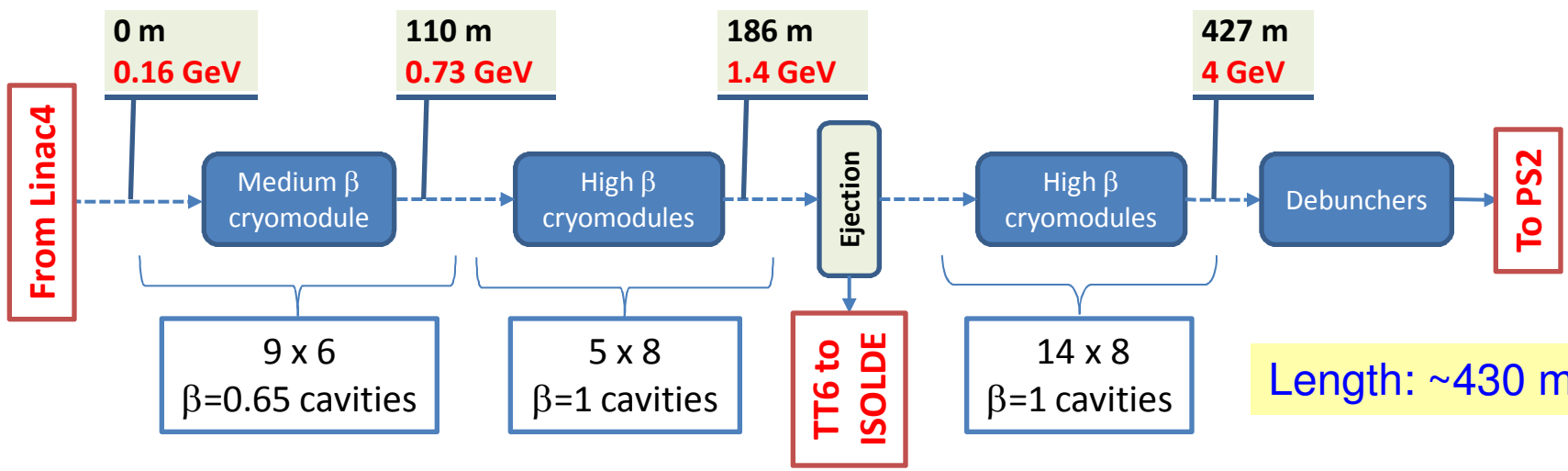
- End CE works: December 2010
- Infrastructure: 2011
- Installation: 2011-2012
- Commissioning: 2012-2013
- Modifications PSB: shut-down 2013/14
- **Operation: 1st of April 2014**

project duration: ~ 6 years

The full picture (reminder...)

LP-SPL

The full picture (reminder...)



Ion species	H ⁻	
Output Energy	4	GeV
Bunch Frequency	352.2	MHz
Max. Rep. Rate	2	Hz
Max. Beam Pulse Length	0.9	ms
Linac pulse current	20	mA
Number of ions per pulse	1.1	$\times 10^{14}$
RF frequency	704.4	MHz
Cooling temperature	2	K
Max. rep. rate for acc. structures & klystrons:	50	Hz

- Upgrade of infrastructure (cooling water, electricity, cryogenics etc.)
- Replacement of klystron power supplies,
- Addition of 5 high β cryomodules to accelerate up to 5 GeV (π production for ν Factory)?

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)	50	50
Protons/pulse ($\times 10^{14}$)	1.1	2 (2.5 GeV) + 1 (5 GeV)
Av. Pulse current (mA)	20	40
Pulse duration (ms)	0.9	1 (2.5 GeV) + 0.4 (5 GeV)

The full picture (reminder...)

Faster rep. rate
⇒ new power supplies, more cooling etc.

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

2. CONTEXT AND CHANGES (2009)

SPL inside CERN

- SPL (leader: R. Garoby) is part of the sLHC project (leader: L. Evans)
Administrative assistant: C. Noels (Cecile.Noels@cern.ch)
- Organization of the SPL Study inside CERN

Context and changes (2009)

**Working Groups
matched with the
SPL collaboration**

	Coordinator
RF hardware (low level & high power)	E. Ciapala
Cavities (structures & auxiliary equipment)	W. Weingarten
Cryomodule (cryostat & cryogenics)	V. Parma
Beam dynamics (beam parameters)	A. Lombardi
Architecture (layout & geometry, extraction, transfer)	F. Gerigk
Surface treatment and vacuum	S. Calatroni
Integration* (interface with Civil Engineering and all services)	S. Weisz
Safety* (safety file, INB procedures)	F. Haug ?
Linac4	M. Vretenar

* For all accelerators

Better organized access to documentation and meetings:

- [sLHC Web site](#) (work in progress...)
- New series for sLHC reports and project notes on the [CERN Document Server](#)
- Structured storage for all [SPL documentation](#) in EDMS
- Structured filing of all [SPL meetings](#) in Indico

New CERN DG and new management since January 2009

⇒ Analysis of the scientific strategy:

⇒ Workshop on “New Opportunities in the Physics Landscape at CERN”
10-13 May, 2009

<http://indico.cern.ch/conferenceDisplay.py?confId=51128>

⇒ Workshop on “European Strategy for Future Neutrino Physics”
1-3 October, 2009

<http://indico.cern.ch/conferenceDisplay.py?confId=59378>

⇒ CERN Medium Term Plan 2010-2014 (June 2009)

⇒ Directorate retreat (end of November 2009)

⇒ CERN Medium Term Plan 2011-2015 (June 2010)

- DOE grant allocation to Stony Brook/BNL/AES team for designing, building and testing a 5 cell $\beta=1$ SPL cavity.
- In-kind contributions to the SPL study in the context of the French stimulation plan (design of cryomodule, He tanks, tuners...)
- European countries decision:
 - To build an accelerator-based Long Pulse Spallation Source
 - To locate it in Lund (Sweden)
 ⇒ Concrete discussion of collaboration ESS/SPL looking for synergy and cost sharing...

Additional resources have been earmarked in the CERN budget for the years 2010-2012 to fulfill the goals of the SPL study:

- Design, construction and characterization of superconducting cavities (8 of them under direct CERN supervision, with processing at CERN),
- Construction and assembly of a complete cryomodule, equipped with 8 $\beta=1$ cavities,
- Upgrade of the SM18 test place for testing simultaneously at high RF power multiple cavities in the cryomodule, at their nominal operating temperature of 2 K,
- Development towards the H⁻ ion source of the SPL,
- Design of the architecture of the SPL RF system,
- Study of Civil Engineering and General Services for estimating construction costs.

Context and changes (2009)

3. PROGRESS

- Choice of $\beta=1$ for the high energy cavities (F. Gerigk et al., “Choice of the optimum beta for the SPL SC cavities”)
- Information/discussion during an ESS-Bilbao workshop on March 16-18 [<http://workshop2009.essbilbao.com/cas/index.aspx>]
- Debate & conclusion on HOMs damping needs [outcome of workshop on June 25-26 at CERN]
- Decision to pass one waveguide per cavity from technical gallery to accelerator tunnel
- Refinement of SPL beam parameters [for PS2, RIB and neutrino facilities]
- Updated accelerator layout with intermediate energy ejections
- Progress in the analysis of high power RF
- Start of work on SPL high power RF coupler
- Start of coordination of sc cavities development

Three technical workshops:

- **November 2009 09** [Workshop on cryogenic and vacuum sectorisations of the SPL](#)
- **September 2009 30** [Mechanical issues SPL cavities/cryomodules](#)
- **June 2009 25** [SPL HOM workshop](#)

Progress

Two Collaboration Meetings:

- **November 2009 11** [3rd SPL Collaboration Meeting](#)
- **May 2009 09** [2nd SPL Collaboration Meeting](#)

First meeting of the SPL Collaboration Board on Friday 13, Nov. pm

Progress towards a formal SPL Collaboration

- “Final” version of the MoU
- Start of write-up of Addenda
 - CERN
 - CEA
- First meeting of the SPL Collaboration Board on Friday 13, Nov. pm

MEMORANDUM OF UNDERSTANDING FOR A MULTI-LATERAL COLLABORATION ADDENDUM

DEFINING THE CONTRIBUTION OF THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN) TO THE SPL COLLABORATION

1. Introduction **THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN)**

1.1 The Memorandum of Understanding for a multi-lateral Collaboration between the European Organization for Nuclear Research (CERN) and the Institutions of the SPL Collaboration (“the MoU”) specifies in article 1 that it shall be complemented by Addenda defining for each Party the contribution pledged by it in terms of time schedule, funds, facilities, equipment and man-years.

1.2 Section 3 of this Addendum defines the contribution by CERN.

THE INSTITUTIONS OF THE SPL COLLABORATION

for the study and development of prototypes for the Superconducting Proton Linac (SPL), with a view to the establishment of its detailed design parameters and the preparation of its construction.

4. Workplan

Goals in 2010 and 2011:

- Design, construction and test of prototypes [cavities and auxiliary equipment (couplers, dampers, tuners), Klystron modulator, ...]
- Order /installation/commissioning of high power RF amplifier
- CE preliminary study and geological investigations
- Impact study
- Upgrade of the SM18 test place [cryogenics and RF]
- Design and construction of prototype cryomodule
- Report writing

Goals in 2012:

- Final edition of report
- Preparation of CE tender documentation
- Impact study report
- Cost estimate
- Equipment and test in SM18 of the fully equipped cryomodule
- Design and preparation of orders for pre-series equipment
- Negotiations for construction

Next 12 months...

To meet the deadline of 2012, activity will be especially intense in the next 12 months. Prototypes must be launched, SM18 test place must be upgraded...

The outcome of this meeting will be essential to the progress of the SPL development.

YOUR CONTRIBUTION WILL BE VERY IMPORTANT

THANK YOU FOR BEING HERE!