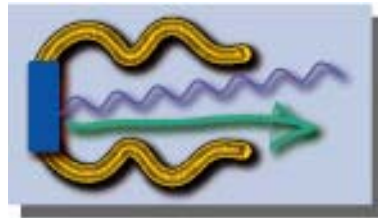


# CARE - JRA2 - PHIN

## Status of the deliverables

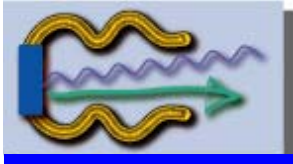


L. Rinolfi

on behalf of PHIN collaboration



CERN 2<sup>nd</sup> December 2008



# JRA2-PHIN Main Objectives

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- Perform Research and Development on charge-production by interaction of laser with photo-cathodes or gas jet. RF fields are produced at room temperature or in superconducting RF guns.
- Improve or extend existing facilities.
- Coordinate the efforts done at various Institutes.
- Contribute to the dissemination of knowledge in the field of photo-injectors.

**PHIN has foreseen to reach these objectives over 4 years: 2004-2007**

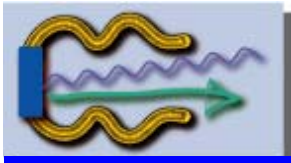
**PHIN used one more year but it will provide all deliverables  
at the end 2008**



<b>Institutes and existing facilities</b>	<b>Acronym</b>	<b>Country</b>
<b>CCLRC<sup>1</sup>-Rutherford Appleton Laboratory (RAL) - Didcot</b>	<b>RAL</b>	<b>UK</b>
<b>CERN<sup>2</sup> – Geneva</b> <b>CTF3</b>	<b>CERN</b>	<b>CH</b>
<b>CNRS<sup>3</sup>-Laboratoire de l'Accélérateur Linéaire (LAL)Orsay</b> <b>NEPAL</b>	<b>LAL</b>	<b>F</b>
<b>CNRS-Laboratoire d'Optique Appliqué (LOA) - Palaiseau</b>	<b>LOA</b>	<b>F</b>
<b>ForschungsZentrum - Rossendorf</b> <b>ELBE</b>	<b>FZR</b>	<b>D</b>
<b>INFN<sup>4</sup> - Laboratorio Nazionali di Frascati (LNF) - Frascati</b>	<b>INFN-LNF</b>	<b>I</b>
<b>INFN-Milano</b>	<b>INFN-Mi</b>	<b>I</b>
<b>Twente University – Enschede</b> <b>TEUFEL</b>	<b>TEU</b>	<b>NL</b>

- 1) CCLRC Council for the Central Laboratory of the Research Councils
- 2) CERN European Organization for Nuclear Research
- 3) CNRS Centre National de la Recherche Scientifique
- 4) INFN Istituto Nazionale di Fisica Nucleare





## PHIN: 8 institutes within 3 Work Packages (\*)

### Photocathodes

CERN (CH)

FZR (D)

TEU (NL)

### RF guns

LAL (F)

FZR (D)

INFN (I)

### Lasers

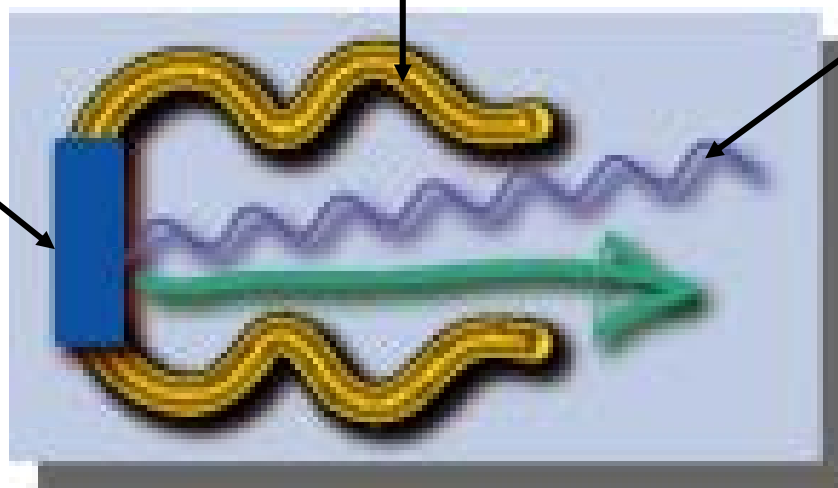
RAL (GB)

LAL (F)

LOA (F)

CERN (CH)

INFN (I)



(\*) A fourth work package is "Management and Communication"

## Reference PHIN document in the CARE Web page

~~JRA3~~<sup>2</sup> in the CARE proposal

**Title: Charge production with Photo-injectors**

**Acronym: PHIN Coordinator: A. Ghigo (INFN-LNF)**

**Deputy: L. Rinolfi (CERN)**

### **Participating Laboratories and Institutes:**

Institute	Acronym	Country	Coordinator	PHIN Scientific Contact	Associated to
CCLRC Rutheford Appleton Lab. (20)	CCLRC-RAL	UK	P. Norton	I.N. Ross	
CERN Geneva (17)	CERN	CH	H. Haseroth	G. Suberlucq	
CNRS-IN2P3 Orsay (3)	CNRS-Orsay	F	T. Garvey	G. Bienvenu	CNRS
CNRS Lab. Optique Appl. Palaiseau (3)	CNRS-LOA	F	T. Garvey	V. Malka	CNRS
ForschungsZentrum ELBE (9)	FZR-ELBE	D	J. Teichert	J. Teichert	
INFN-Lab. Nazionali di Frascati (10)	INFN-LNF	I	S. Guiducci	A. Ghigo	INFN
INFN- Milan (10)	INFN-MI	I	S. Guiducci	I. Boscolo	INFN
Twente University- Enschede (11)	TEU	NL	A. den Ouden	J.W.J. Verschuur	

## Execution plan for Work-package 2 – Charge Production

- Reports on photo-cathode production and improved preparation equipments.
- Photo-cathode preparation chamber with ultra high vacuum technology.
- Reports on test results, with optimised properties according to the needs of the photo-injectors of the project partners, improved diagnostics.
- Reports on tests with mono-energetic electrons up to 50 MeV, to benchmark the model with improved diagnostics.
- Reports on tests with the generation of high energy (200 MeV) mono-energetic electron beams with low emittance for injector application.

# Execution plan for Work-package 3 - Lasers

Laser-System CTF3 requirements:

- High power oscillator.
- Specific amplifiers.
- Specific frequency conversion stages.
- Test of feedback systems.

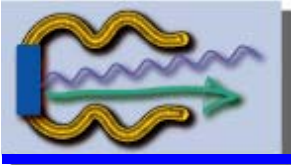
Pulse shaper:

- Model, waveform synthesis.
- Assessment of various temporal-profile pulses.
- Photo-cathode test results on timing, jitter and stability.

## **Execution plan for Work-package 4 – RF guns and beam dynamics.**

- Design evaluation of high-charge photo-injector.
- Engineering of SC photo-gun.
- Prototype of SC gun.
- RF gun for CTF3 and NEPAL high-charge short bunches.
- Prototype of RF gun with CLIC characteristics for test.
- Spectrometers at different energy range for mono-energetic e- beam diagnostics.
- Improvements of test facilities CTF3 and NEPAL.





## Number of deliverables for PHIN

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Charge production:	4
Lasers system:	9
RF gun & beam dynamics:	8
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Total	21

## Reference CARE Deliverables for PHIN in the CARE Web page

### 2005 PHIN deliverables

Activity	Deliverable N°	Deliverable Name	Deliverable Type	Workpackage/Task N°	Delivered by Contractor (s)	Planned (in months)	Achieved (in months)
PHIN	15	High efficiency photocathode comparison	<a href="#">Report</a>	WP2	FZR	24	24
PHIN	16	High power laser oscillator	<a href="#">Report</a>	WP3	STFC-RAL	13	13
PHIN	17	Amplifier construction	<a href="#">Prototype</a>	WP3	CERN, INFN	19	54
PHIN	18	Oscillator + amplifier test	<a href="#">Report</a>	WP3	STFC-RAL	23	30
PHIN	19	Pulse shaping system: phase mask acquisition and test	<a href="#">Report</a>	WP3	INFN-Milano	16	23
PHIN	20	Pulse shaping system: Dazzler acquisition and test	<a href="#">Report</a>	WP3	INFN-LNF	17	41
PHIN	21	Pulse shaping comparison	<a href="#">Prototype</a>	WP3	INFN-LNF, INFN-Milano	22	47
PHIN	22	UV harmonic generator test	Prototype	WP3	STFC-RAL	16	delayed, 43
PHIN	23	Laser RF feedback development	Report	WP3	CERN	21	delayed, 43
PHIN	24	Two 3 GHz RF guns construction	<a href="#">Prototype</a>	WP4	CNRS-Orsay	18	54
PHIN	25	1-50 MeV spectrometer construction	<a href="#">Prototype</a>	WP4	CNRS-LOA	24	36

**2004:** 1 -12

**2005:** 13 - 24

**2006:** 25 - 36

**2007:** 37 - 48

**2008:** 49 -60

## 2006 PHIN deliverables

Activity	Deliverable N°	Deliverable Name	Deliverable Type	Workpackage/Task N°	Delivered by Contractor (s)	Planned (in months)	Achieved (in months)
PHIN	11	Photocathode ready for 3 GHz RF guns	<a href="#">Prototype</a>	WP2	CERN	25	41
PHIN	12	UV generation and feedback: overall system assembly and tests	Prototype	WP3	STFC	30	delayed, 44
PHIN	13	SC RF gun realisation	<a href="#">Prototype</a>	WP4	FZR	26	36
PHIN	14	SC RF gun test	<a href="#">Report</a>	WP4	FZR	36	part 1: 39 final : 42
PHIN	15	CTF3 3 GHz RF gun test at CERN	Report	WP4	CNRS-Orsay, CERN	33	delayed, 54

## 2007 PHIN deliverables

PHIN	27	Superconducting cavity photocathode tests	Report	WP2	FZR	37	delayed, 43
PHIN	28	Final report on 100 MeV laser driven plasma source R&D	<a href="#">Report</a>	WP2	CNRS-LOA	48	47
PHIN	29	NEPAL 3 GHz RF gun test at Orsay	Report	WP4	CNRS-Orsay	37	delayed, ?
PHIN	30	50 MeV (low energy) spectrometer test	<a href="#">Report</a>	WP4	CNRS-LOA	42	36
PHIN	31	1 GeV spectrometer development	<a href="#">Report</a>	WP4	CNRS-LOA	48	47

**2004:** 1 -12

**2005:** 13 - 24

**2006:** 25 - 36

**2007:** 37 - 48

**2008:** 49 -60

# PHIN deliverables related to CERN compared to last PHIN Collaboration meeting at Lecce

Activity	Deliverable N°	Deliverable Name	Deliverable Type	Workpackage/Task N°	Delivered by Contractor (s)	Planned (in months)	Achieved (in months)
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July

PHIN	22	UV harmonic generator test	Prototype	WP3	STFC-RAL	16	delayed, 55
PHIN	23	Laser RF feedback development	Report	WP3	CERN	21	delayed, 56

Both done

Done

September

PHIN	12	UV generation and feedback: overall system assembly and tests	Prototype	WP3	STFC	30	delayed, 57
PHIN	15	CTF3 3 GHz RF gun test at CERN	Report	WP4	CNRS-Orsay, CERN	33	delayed, 59

December

Expected soon

2004: 1 -12

2005: 13 - 24

2006: 25 - 36

2007: 37 - 48

2008: 49 -60

# PHIN deliverables related to LAL compared to last PHIN Collaboration meeting at Lecce

Activity	Deliverable N°	Deliverable Name	Deliverable Type	Workpackage/Task N°	Delivered by Contractor (s)	Planned (in months)	Achieved (in months)
PHIN	15	CTF3 3 GHz RF gun test at CERN	Report	WP4	CNRS-Orsay, CERN	33	delayed, 59

Done **November**

PHIN	29	NEPAL 3 GHz RF gun test at Orsay	Report	WP4	CNRS-Orsay	37	delayed, 57
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Done **September**

**2004:** 1 -12

**2005:** 13 - 24

**2006:** 25 - 36

**2007:** 37 - 48

**2008:** 49 -60

# PHIN deliverables related to FZR compared to last PHIN Collaboration meeting at Lecce

Activity	Deliverable N°	Deliverable Name	Deliverable Type	Workpackage/Task N°	Delivered by Contractor (s)	Planned (in months)	Achieved (in months)
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PHIN	14	SC RF gun test	<a href="#">Report</a>	WP4	FZR	36	part 1: 39 final : 55
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July

Done

PHIN	27	Superconducting cavity photocathode tests	Report	WP2	FZR	37	delayed, 55
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July

Done

2004: 1 -12

2005: 13 - 24

2006: 25 - 36

2007: 37 - 48

2008: 49 -60

# Summary

- All deliverables have been produced for PHIN except the “CTF3 RF gun tests”
- Nevertheless very good results have been obtained for the PHIN gun with beam  
=> see talk K. Elsener as “Highlight at CARE 08 meeting”
- The last report corresponding to this deliverable 15 would be produced before the end of this year.