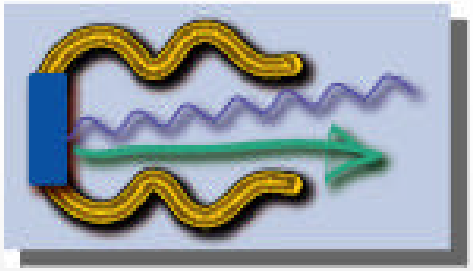
ELAN – PHIN JRA connection



Andrea Ghigo on behalf of PHIN collaboration

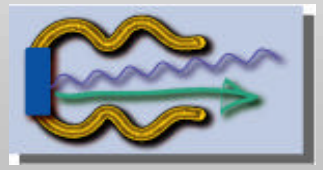
ELAN Collaboration Meeting ELAN Frascati 4 - 6 May 2004

PHIN Main Objectives

Perform Research and Development on charge-production by interaction of laser pulse with material within RF field and improve or extend the existing infrastructures in order to fulfil the objectives.

Coordinate the efforts done at various Institutes on photo-injectors.

The goal is to produce an electron source with brightness unachievable with conventional thermoionic gun.

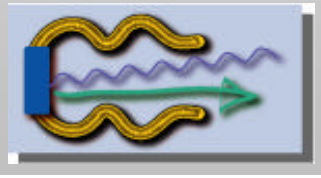


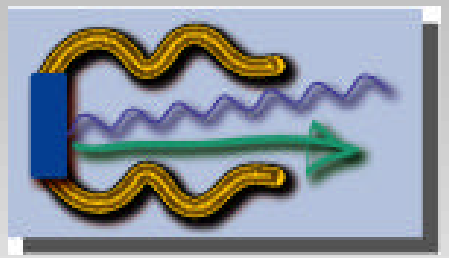
Two features contribute to improve simultaneously the charge, the current and the emittance of the beam:

1 - Electron current density production is more efficient in the photoemission process respect to the thermoionic one.

2 - Voltage on cathode, necessary to reduce the space charge and the electron shielding effects, is much higher in an RF gun (100M V/m) respect the DC one (200 kV/m).

The peak current from photoinjector is at least one order of magnitude higher than a thermoionic injector, the emittance is one order of magnitude lower and the choice of bunch train temporal structure much more flexible





Institute	Acronym	Country	Coordinator	PHIN Scientific Contact	Associated to
CCLRC Rutheford Appletone Lab. (22)	**CCLRC-RAL**	**UK**	P. Norton	I.N. Ross	
CERN Geneva (19)	**CERN**	**CH**	H. Haseroth	G. Suberlucq	
CNRS-IN2P3 Orsay (3)	**CNRS-LAL**	**F**	T. Garvey	G. Bienvenu	CNRS
CNRS Lab. Optique Appl. Palaiseau (3)	**CNRS-LOA**	**F**	T. Garvey	V. Malka	CNRS
ForschungsZentrum ELBE (10)	**FZR-ELBE**	**D**	J. Teichert	J. Teichert	
INFN-Lab. Nazionali di Frascati (11)	**INFN-LNF**	**I**	S. Guiducci	A. Ghigo	INFN
INFN- Milan (11)	**INFN-MI**	**I**	C. Pagani	I. Boscolo	INFN
Twente University- Enschede (13)	**TEU**	**NL**	J.W.J. Verschuur	J.W.J. Verschuur	

PHIN JRA main tasks

- CTF3 Drive beam photoinjector
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- Superconducting photoinjector for ELBE
- Plasma photoinjector
- R&D for High Brightness Photoinjector for Future Colliders: CLIC and TESLA main beams
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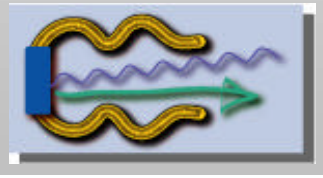
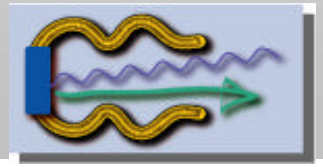


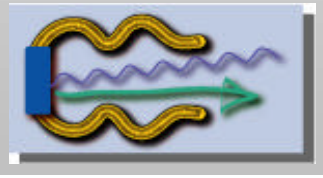
PHIN JRA addressed to

- Development of the high charge e^- beam (drive beam) for the RF power source of the two-beam linear collider CLIC (CERN).
- Study the high brightness e^- beam for CLIC main beam.
- Realisation of the first high power photoinjector that uses a photocathode, laser driven, in a superconducting RF gun for application in ELBE (Rossendorf) and possible use in TESLA Test Facility (Desy).
- Study of the TESLA electron source.
- Realisation of new electron source for NEPAL (Orsay) test stand.
- Realisation of the new injector for TEU-FEL (Twente).



PHIN JRA is divided in three work packages

- Charge Production
- Laser
- Gun



Execution plan for Work-package - Charge Production

Deliverables

- **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 of high-energy (up tp200 MeV) mono-energetic electron beams with low emittance for injector application.**

Execution plan for Work-package - Lasers

Deliverables

Laser-System meeting 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

RF guns and beam dynamics.

Deliverables

- 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.

Connection of ELAN to JRA PHIN

- Exchange information on Linear Collider main parameters
- Study solutions for the electron sources parameters for Linear Collider in terms of **emittance, charge per bunch, bunch and bunch train temporal structure**
- Propose dedicated experiments or measurements with photoinjectors developed for PHIN JRA
- Integration of experiences of the different Test Facilities