

# Early Stage Researcher



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Master degree – Politecnico di Milano  
Engineering Physics -NanoOptics and Photonics



WHEN

Starting from  
**April 2015**

WHERE



Amplitude  
TECHNOLOGIES

*Nothing but ultrafast.*

**France**

WHO

Dr. Xiaowei **Chen** (AT)  
Dr. Giuseppe **Sansone** (POLIMI)  
Dr. Jean-François **Hergott** (CEA)

WHAT

**Development of a high repetition rate, sub 15 fs laser system optimized for generation of attosecond intense pulses**

# Outline

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- Description of the project and main goals
- Achieved goals since now
- Secondments and outreach activities accomplished
- Career development plan:
  - Future scientific activities
  - Planned secondment
  - Previewed outreach activity
- Conclusions

# The project

The project

Goals achieved

Secondment & Outreach

Career Development Plan

Conclusions

Development of a high energy, high repetition rate laser system

## THE GOALS (WP-1)

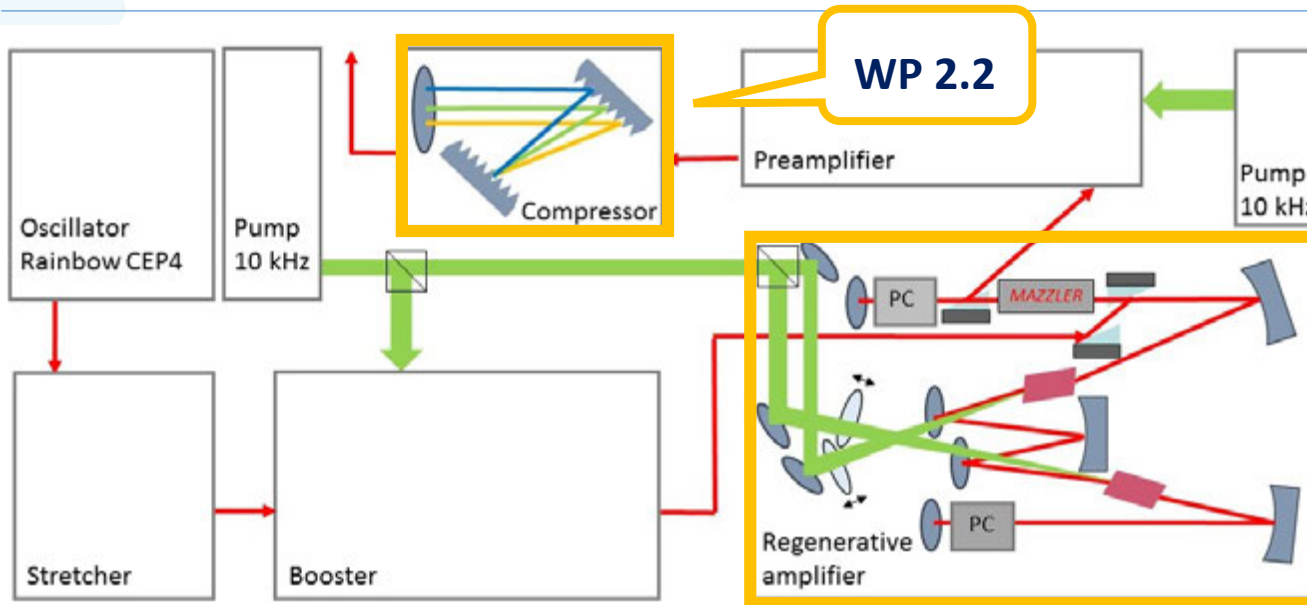
- Energy output > 0,1 mJ for 10 kHz repetition rate amplifier
- Pulse duration < 25 fs
- CEP stabilisation, residual CEP noise < 300 mrad

New amplifier design for thermal effect management

Attosecond physics experiments

# Goals achieved

- The project
- Goals achieved
- Secondment & Outreach
- Career Development Plan
- Conclusions



- Amplitude Technologies laser active medium Ti:Sa
- Chirped pulse amplification configuration
- Grating based stretcher and compressor

**Regenerative amplifier**  
 High energy output  
 broad spectrum (<20 fs time duration)

call for  
 high pump energy  
 +  
 high repetition rate

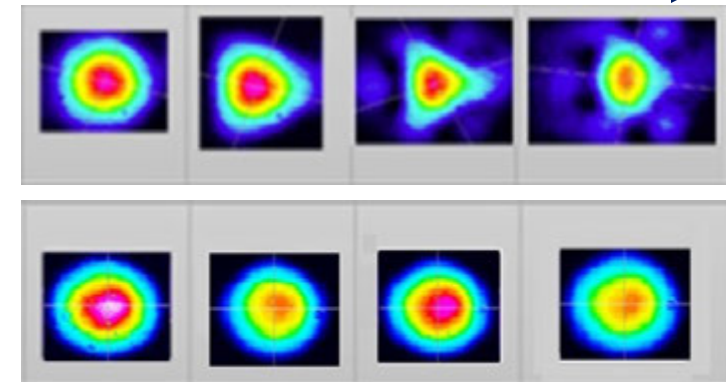
**WP 1.1**

Strong thermal effect

single  
 Ti:Sa

double  
 Ti:Sa

IR beam profile for  
 Increasing pump energy



# Goals achieved

The project

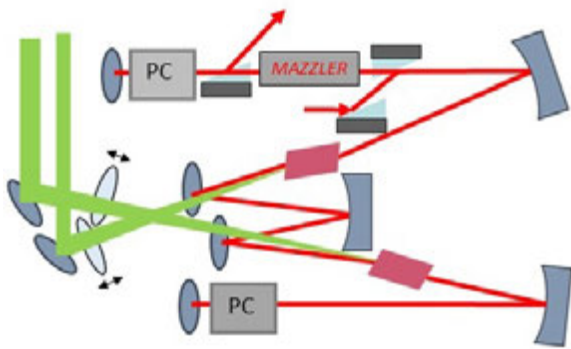
Goals achieved

Secondment & Outreach

Career Development Plan

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## 1. New designed regenerative amplifier

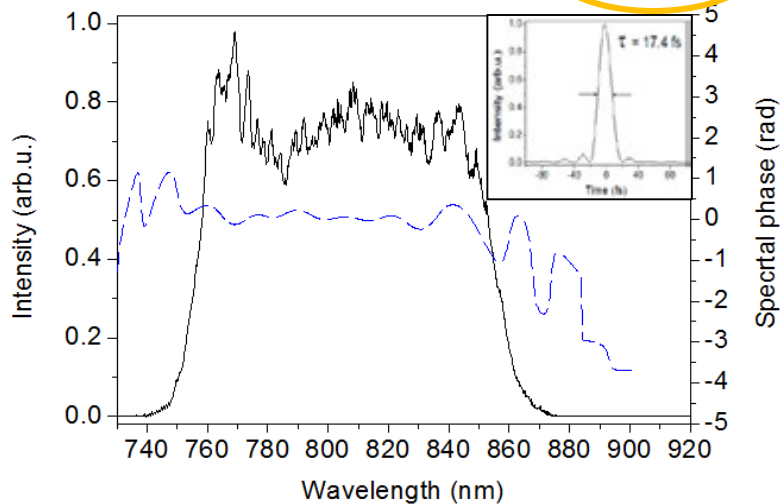


- 0,52 mJ output energy narrow band
- 0,24 mJ output energy broad band
- Excellent quality beam profile
- Broad spectrum ( > 100 nm FWHM)

5 times higher than standard amplifier

Milestone 3 achieved

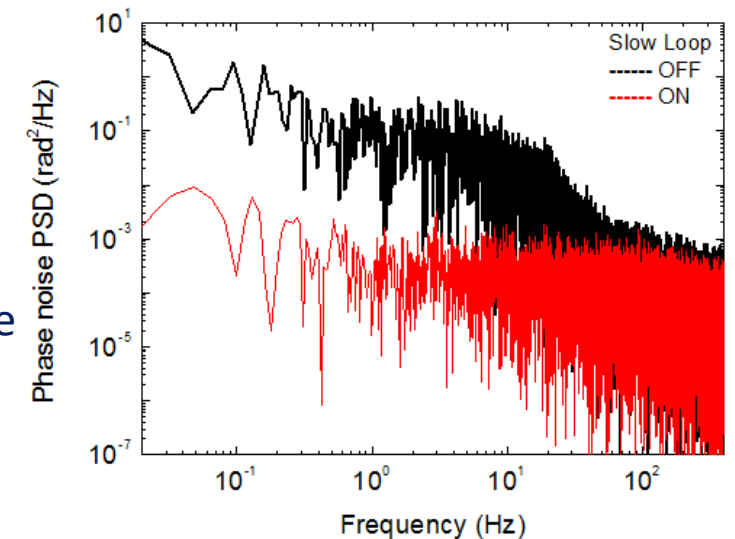
## 2. Pulse compression down to 17 fs



## 3. CEP stabilisation with residual CEP noise 210 mrad over 4 hours shot to shot

Home-made Analogic detection module BIRD

High performances Ti:Sa laser





# Goals achieved

The project

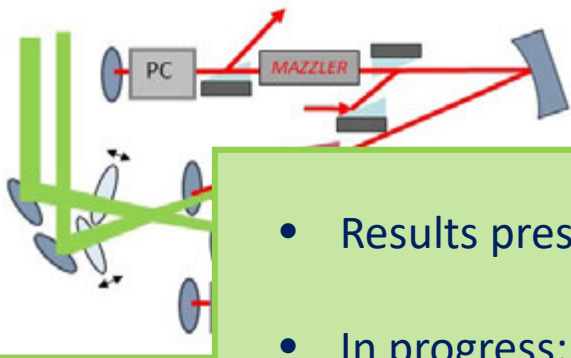
Goals achieved

Secondment & Outreach

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## 1. New designed regenerative amplifier



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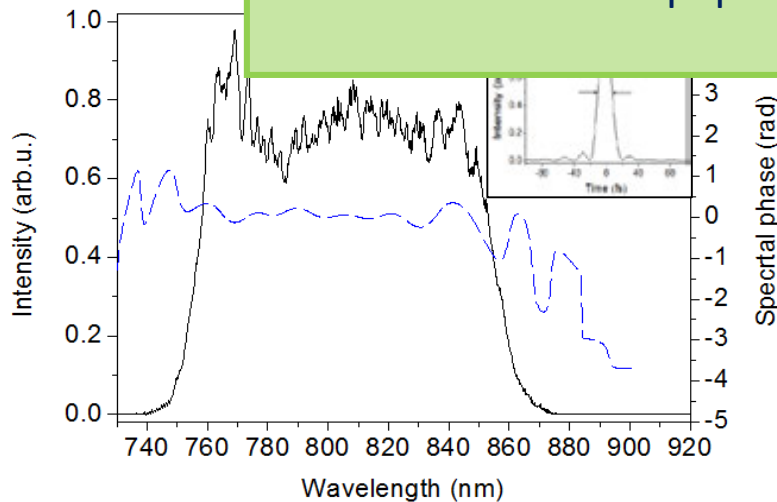


5 times higher than standard amplifier

- Results presented to UVX2016 conference – Chinon (France)
- In progress:
  1. Abstract submission to CLEO US and EU 2017
  2. Scientific paper - Optics Letters

Milestone 3 achieved

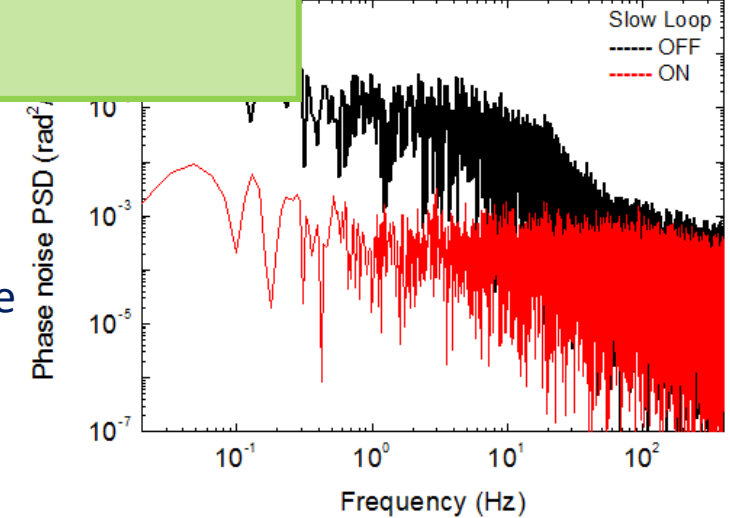
## 2. Pulse com



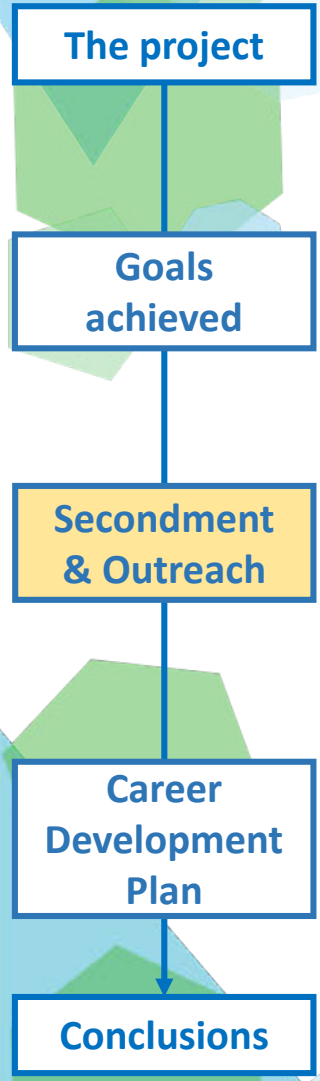
shot to shot

Home-made Analogic detection module BIRD


High performances Ti:Sa laser



# Secondments and Outreach activities



**SECONDMENT**

**WHERE**  
  
 Dr. **Hergott**

**WHEN**  
 October – Decembre 2015

**WHAT**  
 CEP diagnostic and correction

**SOFT SKILLS AND FORMATIONS**

**SCIENTIFIC**  
 Attosecond dynamics  
 Crete 2016

Joint Journal Club  
 Webinars

**TRANSVERSAL**

Laser & electrical safety

Scientific communication  
 Milano 2016

French language

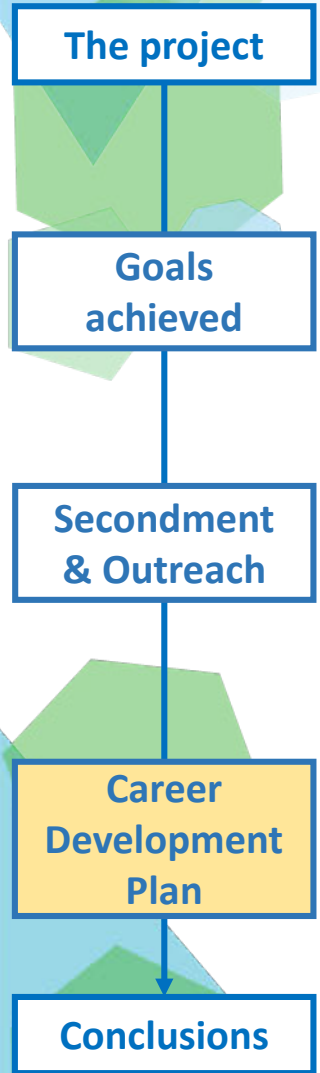
**OUTREACH ACTIVITIES based on PHOTONICS KIT**

Lycée Kleber (scientific), Strasbourg (France)

Date	Number of students	Age
7th November	17	17-18 years old
	15	15-16 years old
8th November	101 (shared 3 ESRs)	14-18 years old



# Career Development Plan



## FUTURE SCIENTIFIC ACTIVITIES

- Laser system improvements, goal: 15 fs
- Thermal effect studies for different amplifier configurations
- Simulation: influence of laser parameters on CEP noise
- Application of the laser source to Attosecond pulse generation

## PLANNED SECONDMENT

WHERE



WHAT

Passive CEP stabilisation

WHEN

March-April 2017

## OUTREACH FUTURE ACTIVITIES

Positive feedback from Lycée Kleber



Further outreach sections scheduled in 2017



# Conclusion

The project

Goals  
achieved

Secondment  
& Outreach



Career  
Development  
Plan

Conclusions

## SCIENTIFIC ACTIVITIES (WP-1)

- Validation of new designed amplifier :
- Output energy > 0,1mJ ✓ 0,24 mJ
  - CEP residual noise < 300 mrad ✓ 210 mrad
  - Pulse duration < 25 fs ✓ 17 fs

## SECONDMENTS

-  1,5 month – carried out (October 2015)
-  2 months – planned (March 2017)

## OUTREACH ACTIVITY

- Lycée Kleber

## TO DO

- Laser system improvements
- Theoretical studies
- Conferences
- Outreach activity

# Conclusion

The project

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## SCIENTIFIC ACTIVITIES (WP-1)

- Validation of new designed amplifier :
- Output energy > 0,1mJ ✓ 0,24 mJ
  - CEP residual noise < 300 mrad ✓ 210 mrad

## SECONDM



- 2 months – planned (March 2017)

## OUTREACH ACTIVITY

- Lycée Kleber

Thank you for your attention

## TO DO

- Laser system improvements
- Theoretical studies
- Conferences
- Outreach activity