

# BACHELORS DEFENSE

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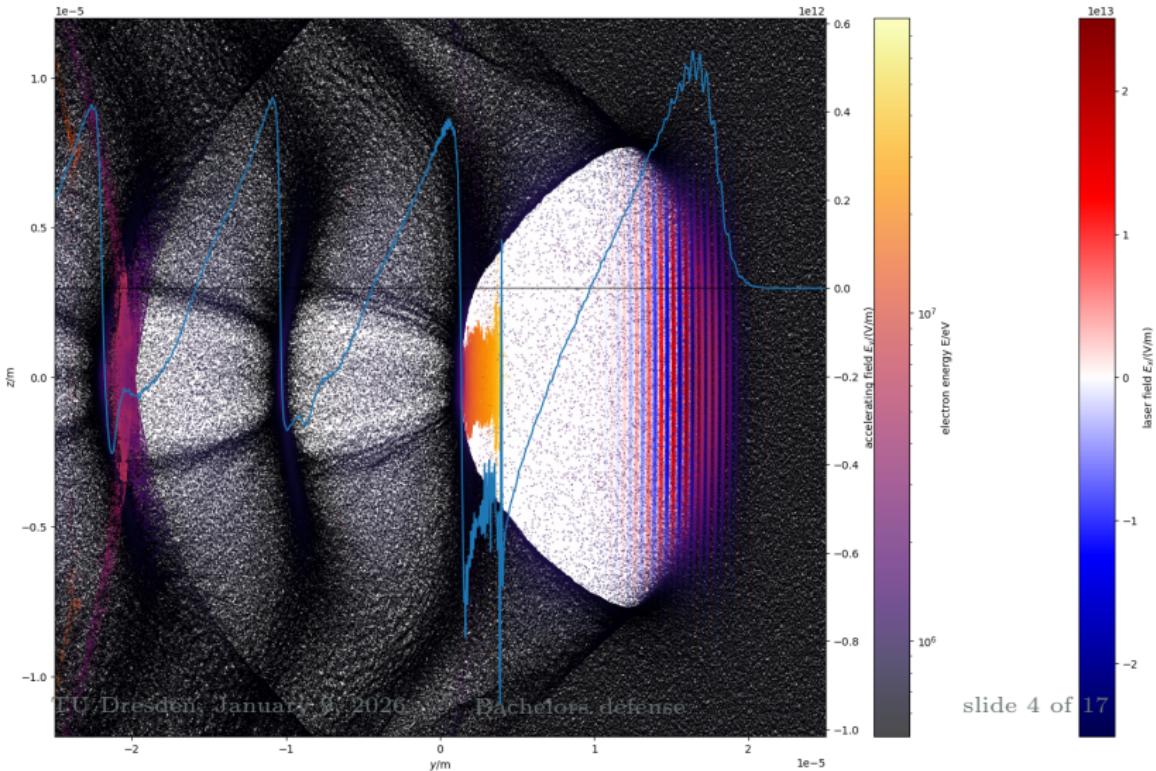
# 00 Contents

- 1 DLWFA
- 2 Flying focus lasers in PIConGPU
- 3 Testing the flying focus laser
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# 00 Plan

- Why? DLWFA (mention tweac)
- Flying focus in PIConGPU
- Lasy + implementation
- Flying focus doesn't work - why?
  - tests
  - tests
- Conclusion
  - why doesn't it work
  - Now Lasy lasers available in PIConGPU
  - back to LWFA

# 01 LWFA [?]

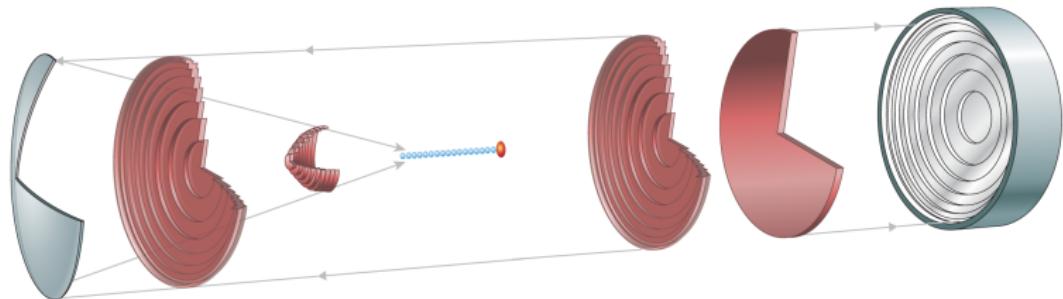


# 01 Properties of flying focus lasers

- tweac
- axiparabola

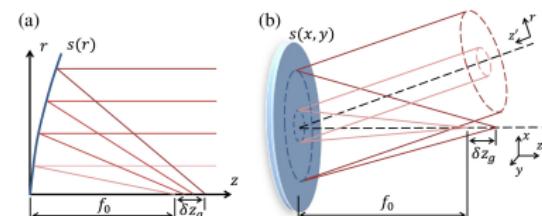
Images:

# 01 Flying focus lasers



The flying focus setup. Image taken from Palastro et al [?].

- Built from an axiparabola and a radial group delay echelon (RGD)
- Axiparabola:
  - Focuses light onto a line
  - ?
- RGD:

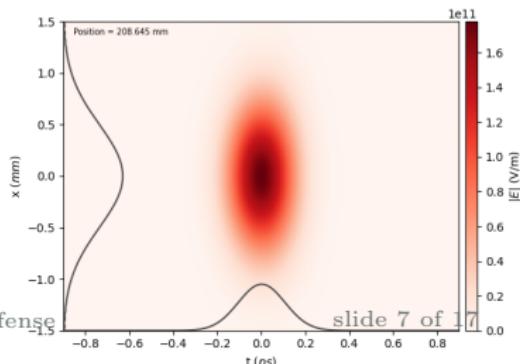
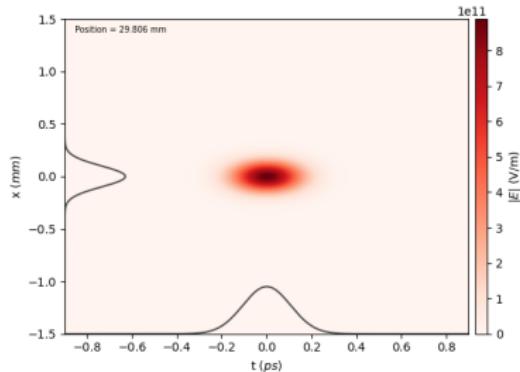


Axiparabola functionality. Image taken from Smartsev et al [?]

## 02 Lasy [?]

- A python library for simulating Laser pulses in a vacuum
- Uses complex envelope of the laser field
- angular spectrum propagation

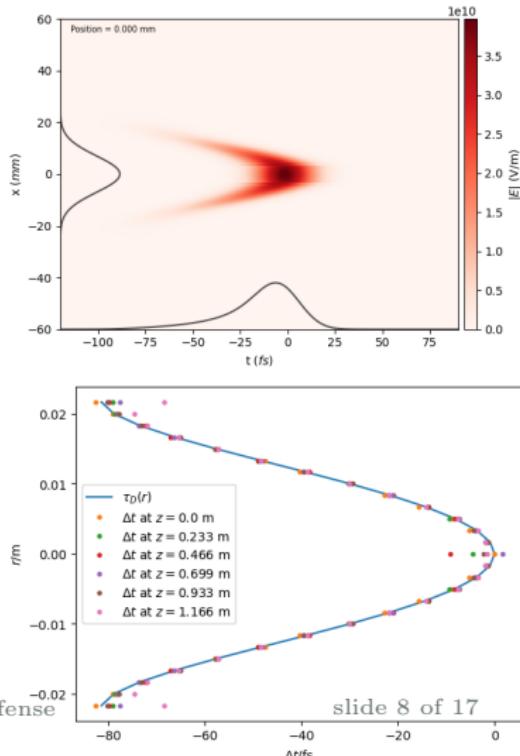
Images: Example of a Gaussian pulse being propagated by Lasy. Top: generated at the focus, Bottom:  $6 z_R$  after the focus.



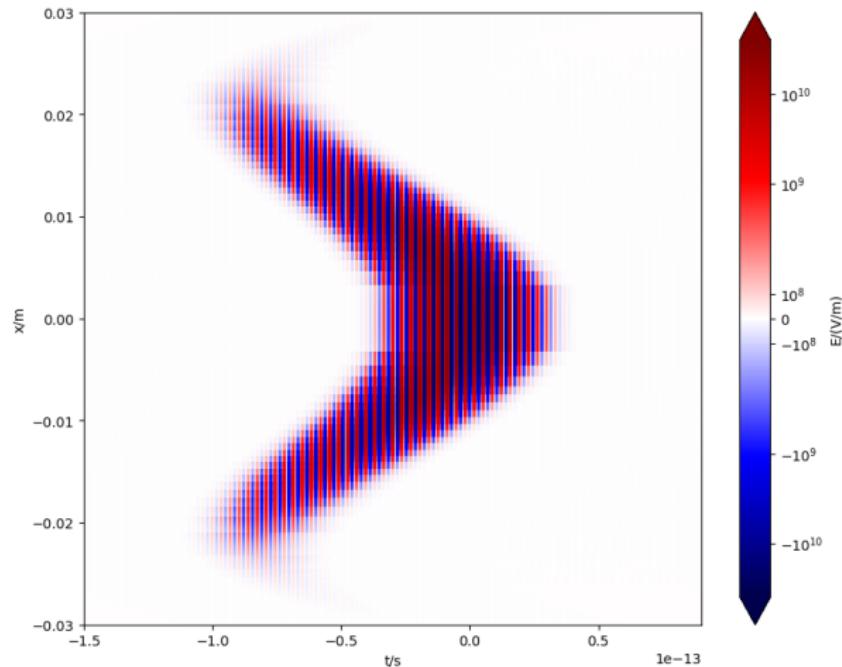
## 02 Implementing the flying focus: RGD

- Implemented from scratch as Lasy optical element
- Following the description by Ambat et al [?]
- Shapes the pulse temporally without focusing or defocussing

Images: A Gaussian pulse after interacting with the RGD. Top: field envelope, Bottom: Test results. even after long distances the shape still holds.



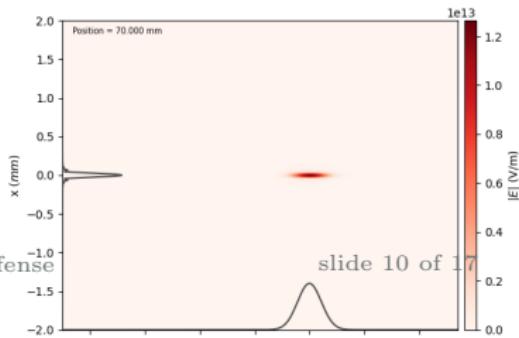
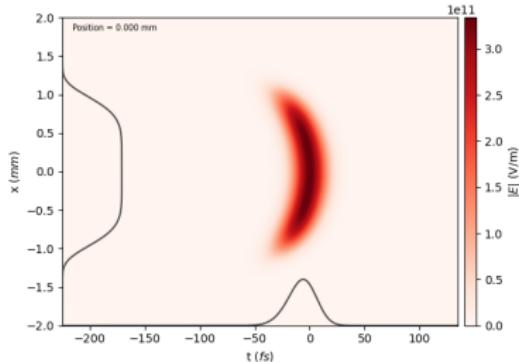
## 02 Implementing the flying focus: RGD



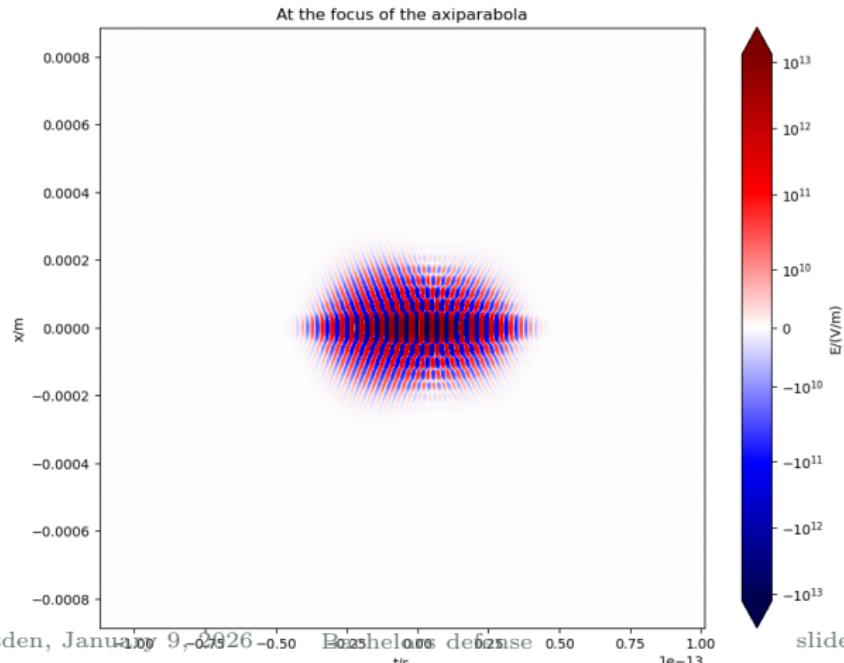
## 02 Implementing the flying focus: Axiparabola

- Included in Lasy
- Following Smartsev et al [?]
- ?

Images: A super-Gaussian laser pulse after reflecting off the axiparabola.  
Top: in the near field, Bottom: in the far field at the beginning of the focus region.



## 02 Implementing the flying focus: Axiparabola



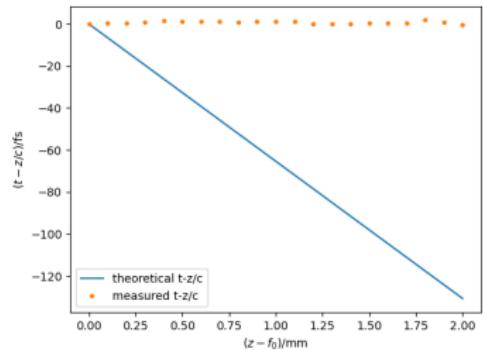
The electric field of the laser at the beginning of the focus

## 02 Importing to PICOnGPU

- New module `full_field`
- Generates full electric field and saves it using `openPMD-api`
- 

Images:

## 03 Testing the flying focus laser: First results



## 03 Testing the flying focus laser:

## 04 Remaining Possible reasons for failure

- The Axiparabola
- The Propagation
- The Findings in the other papers

## 04 Outlook

- Lasy lasers available in PIConGPU
- ...
- LWFA with new laser setups possible

## 05 References I