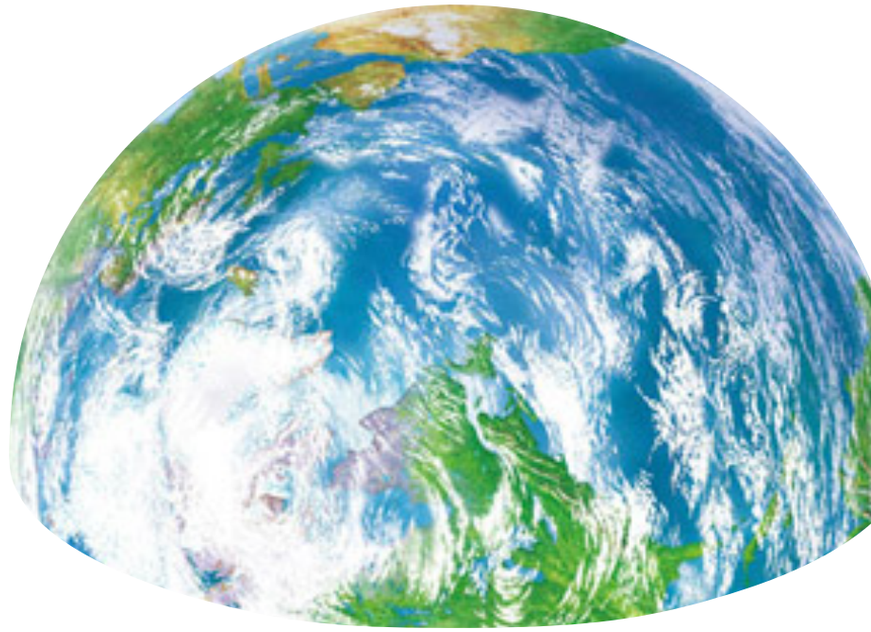

Diffraction of iron on the Mégajoule laser

Tommaso Vinci

Ecole Polytechnique

Goal: achieve and study conditions of matter relevant for geophysics

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Laser compression is a good option

How we diagnose

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How we diagnose

Where

Goal: achieve and study conditions of matter relevant for geophysics

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How we diagnose

Where

What we've done

Goal: achieve and study conditions of matter relevant for geophysics

Laser compression is a good option

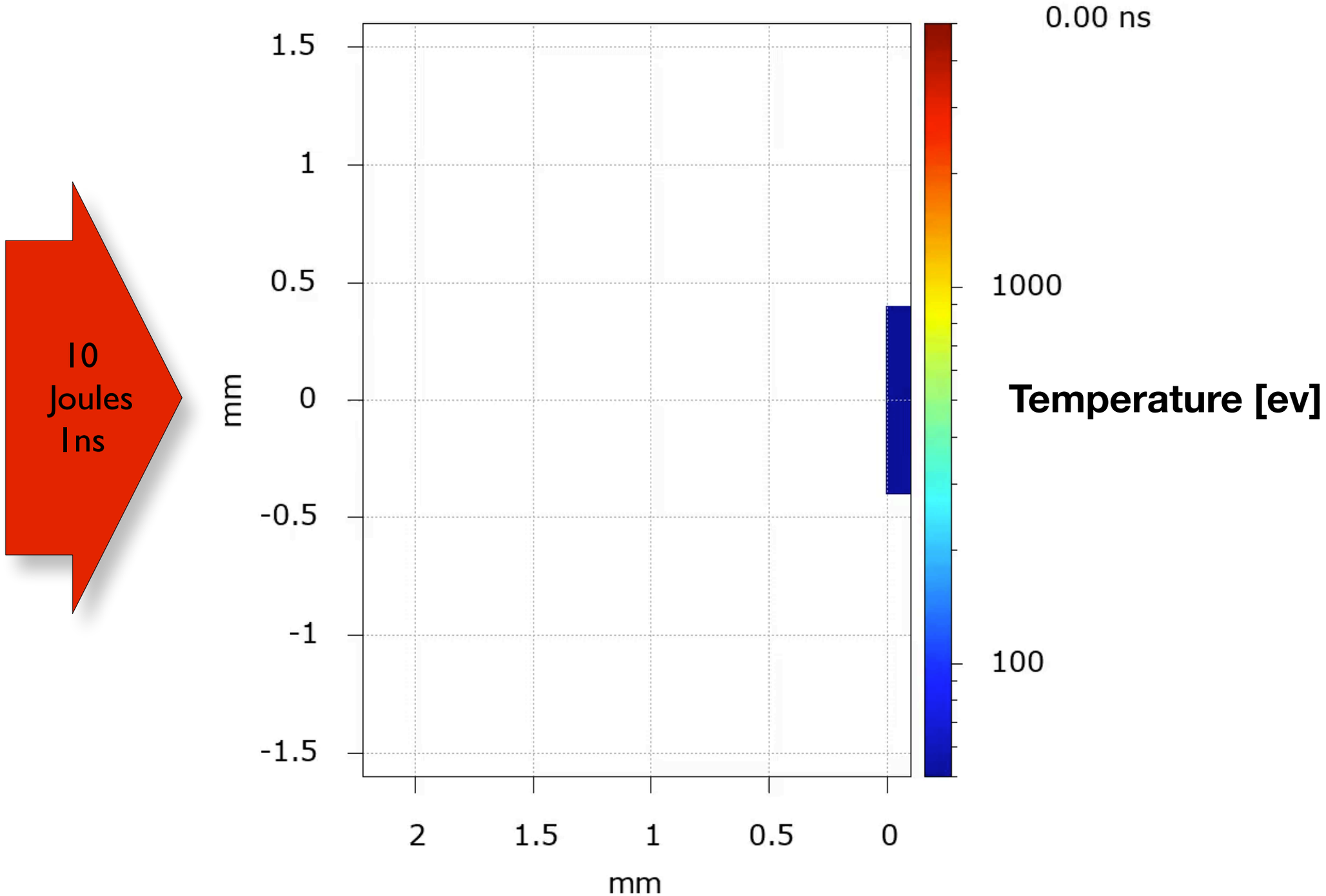
How we diagnose

Where

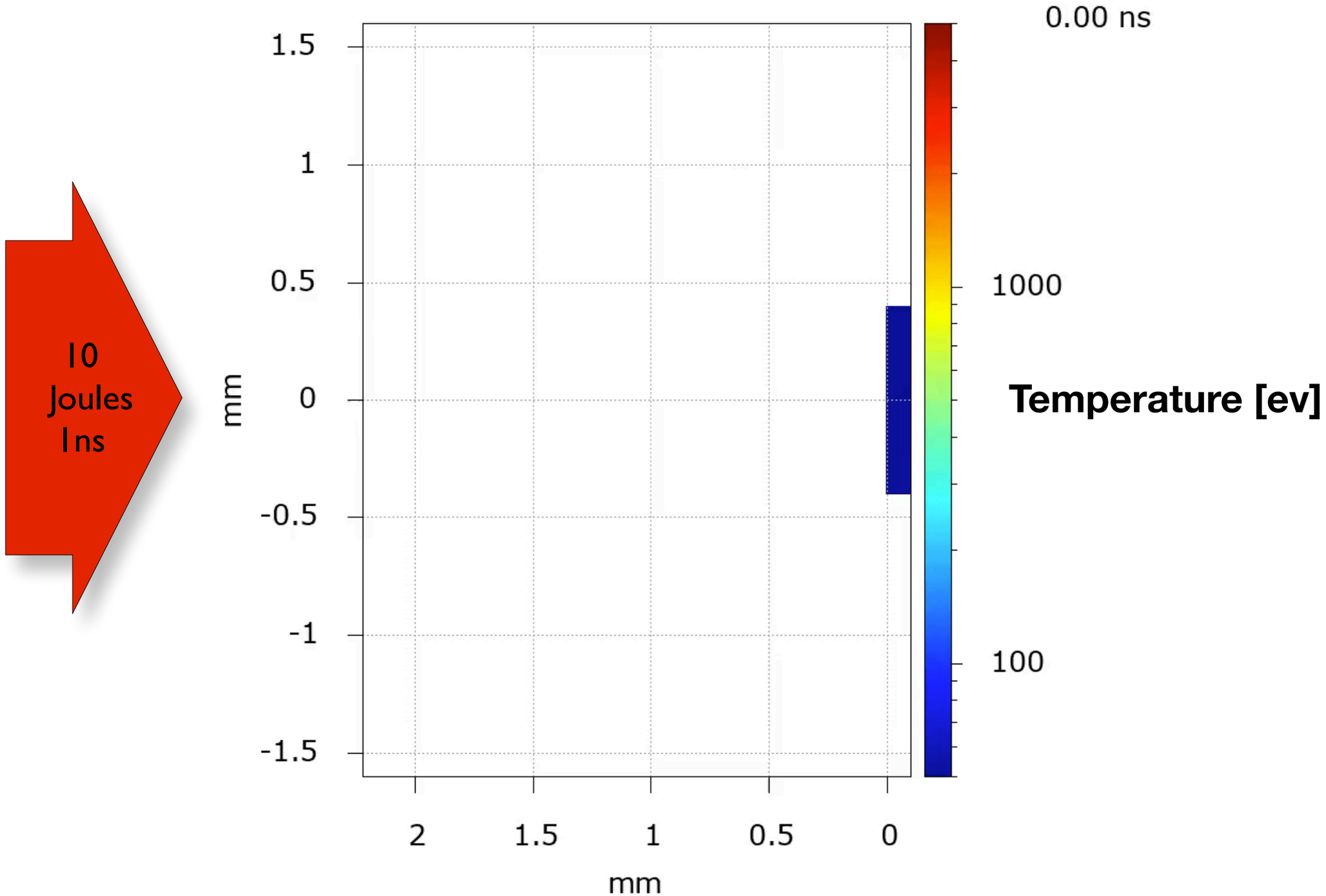
What we've done

What we plan to do

What does a laser do?



What does a laser do?



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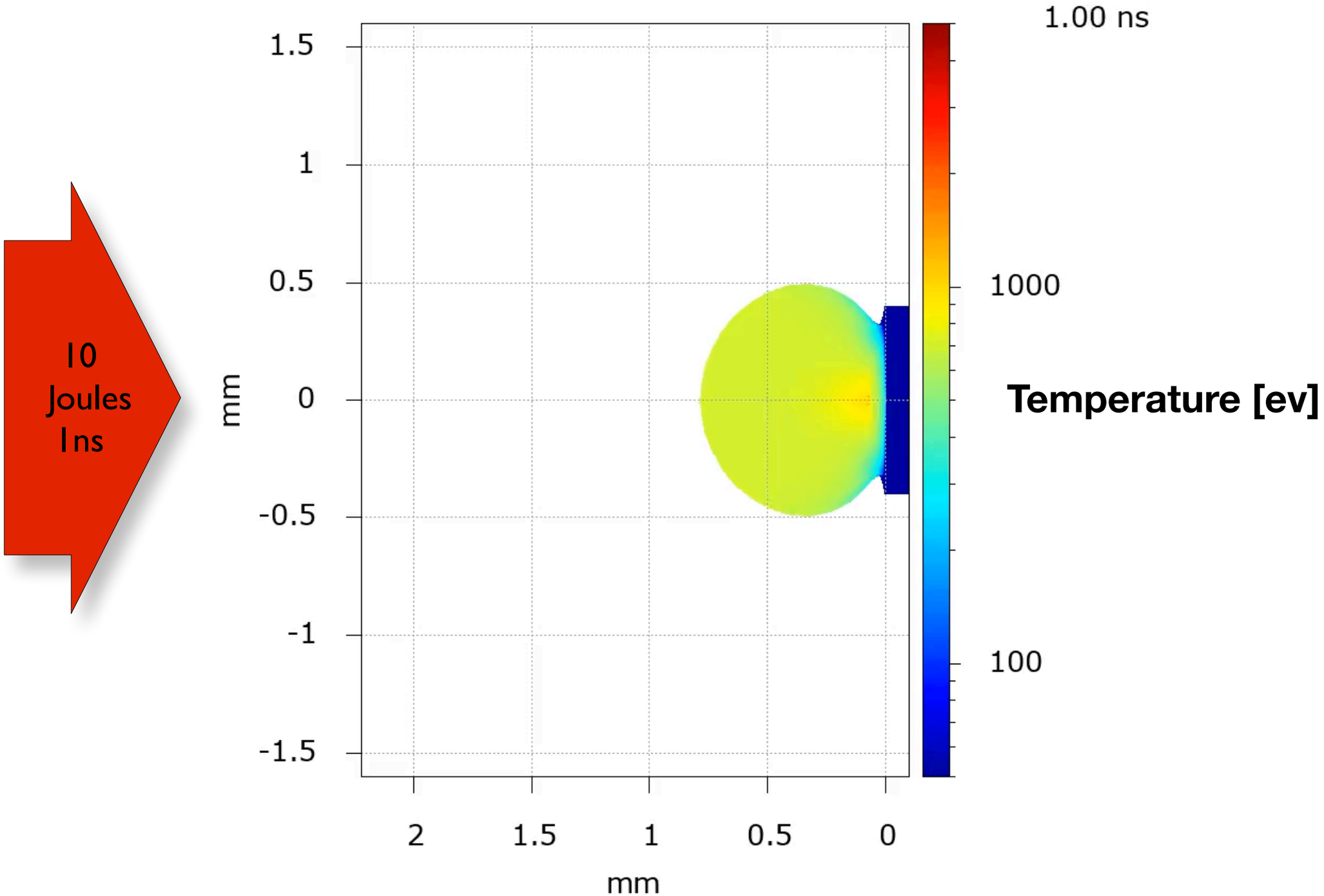

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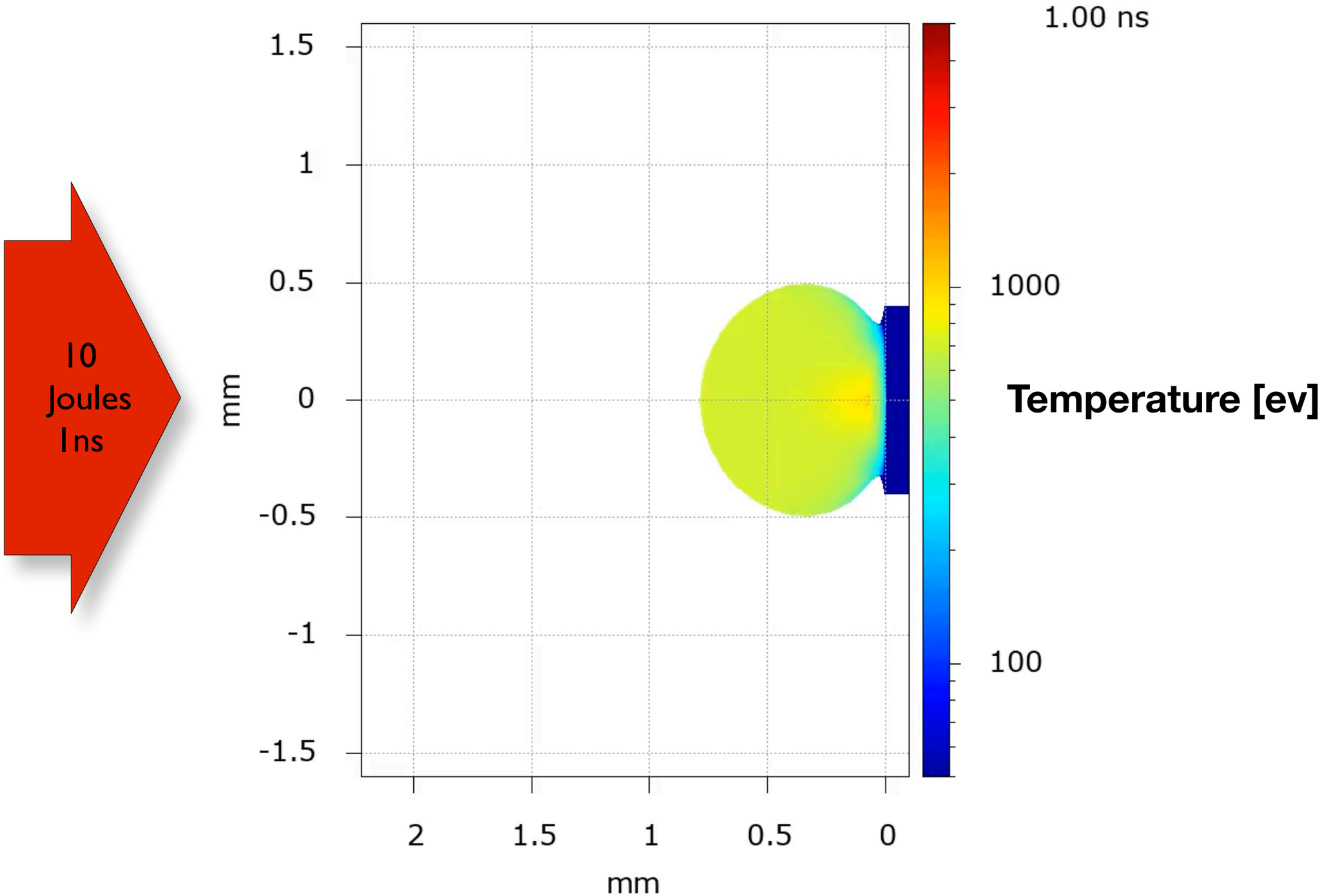
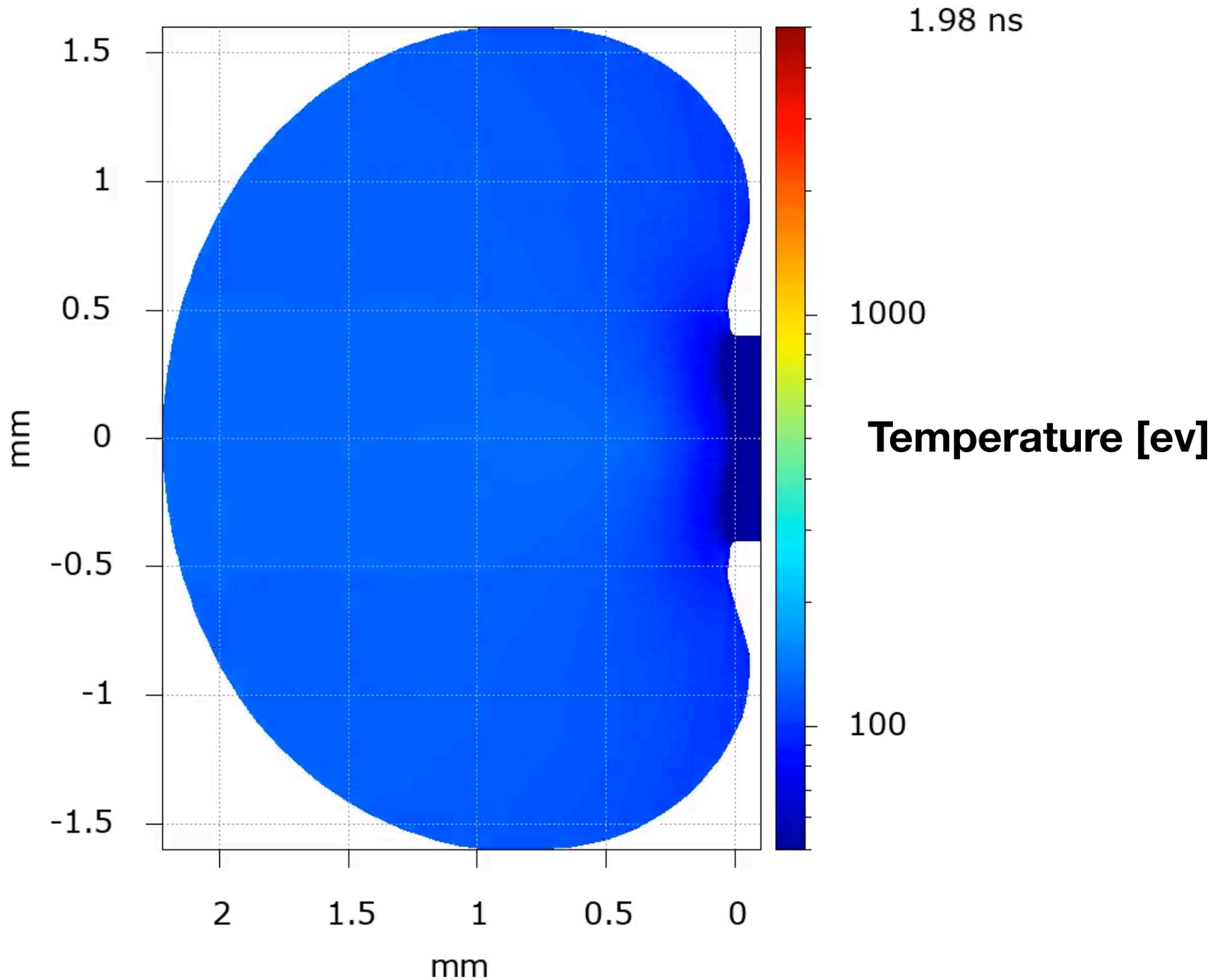


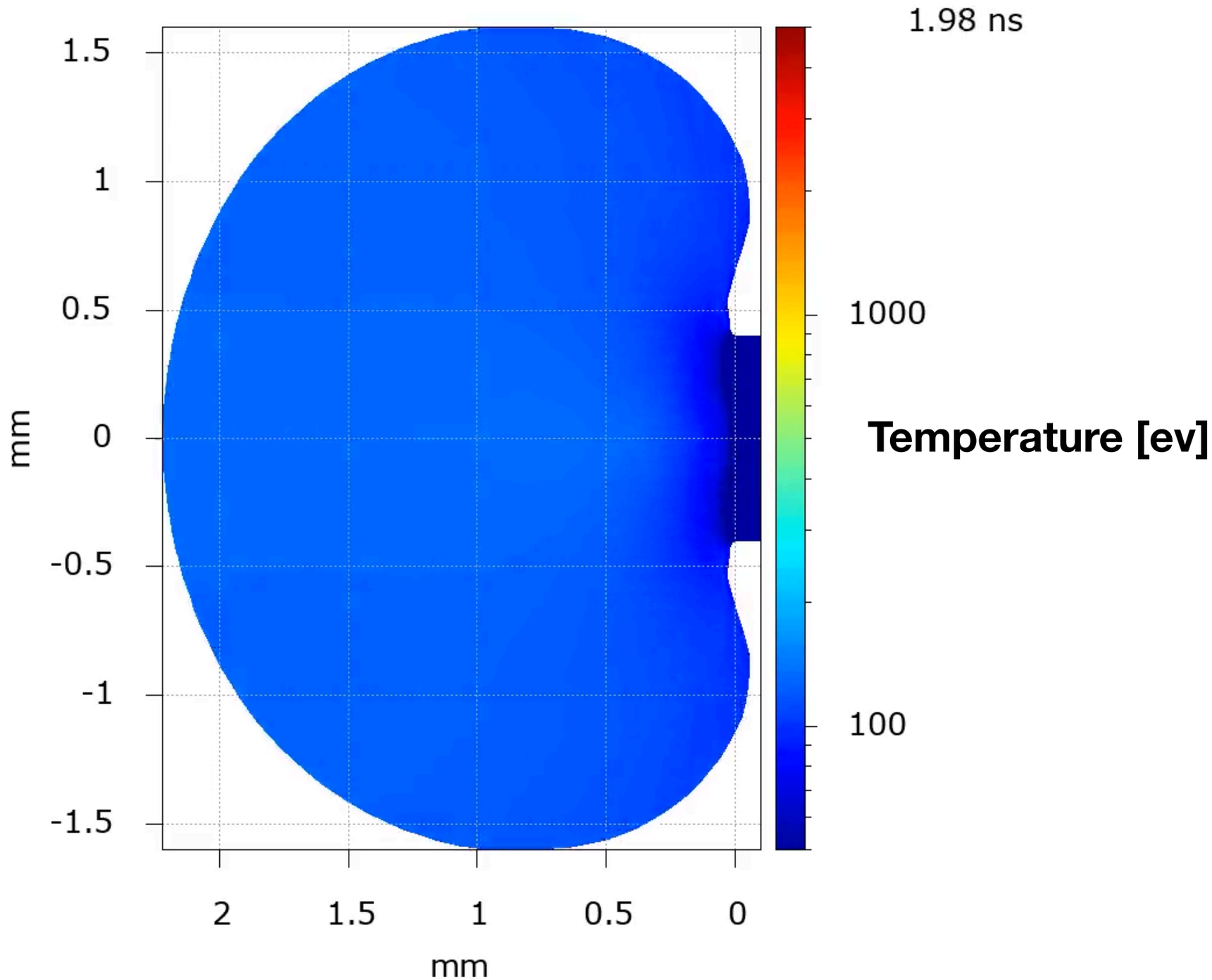
What does a laser do?

10
Joules
1ns

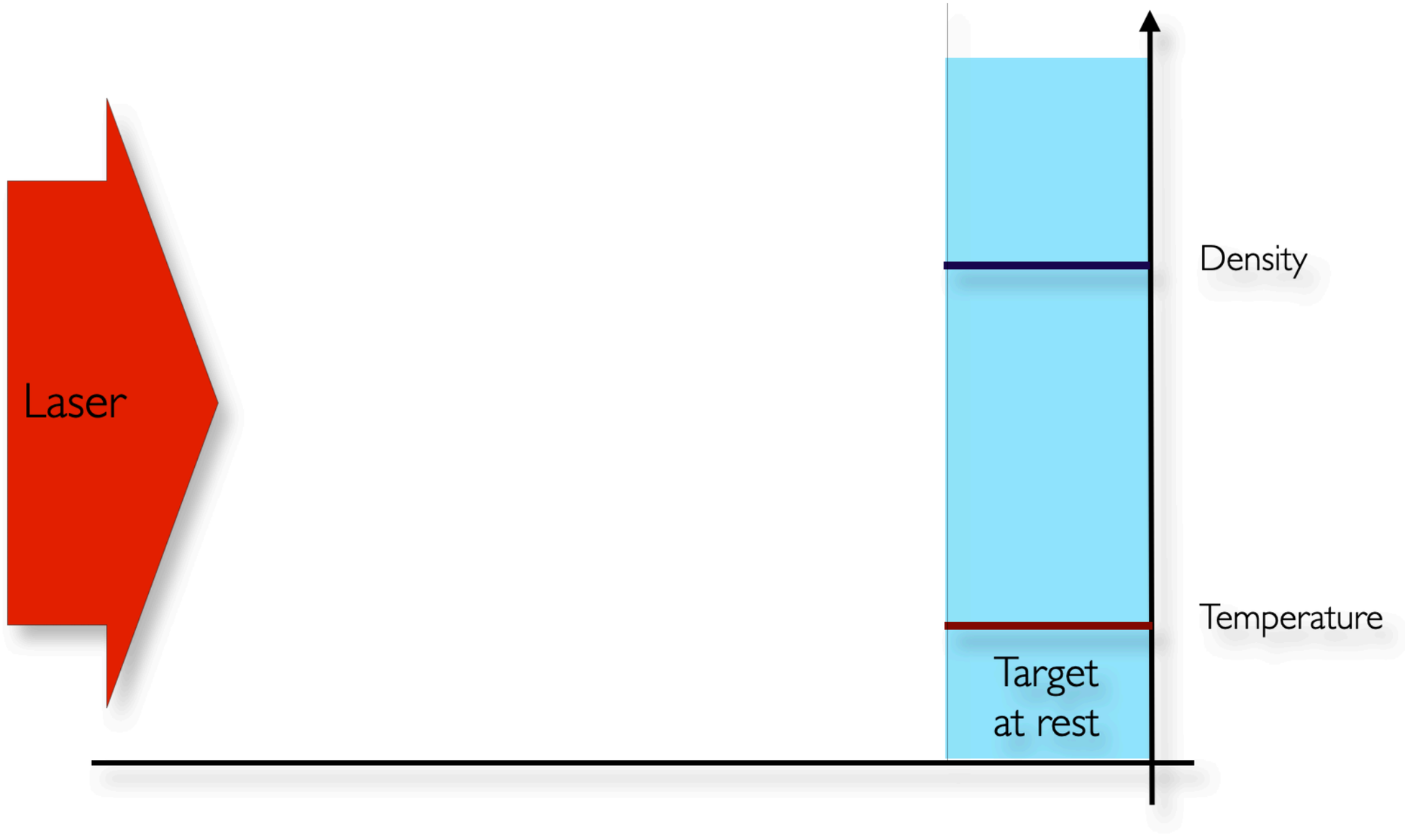


What does a laser do?

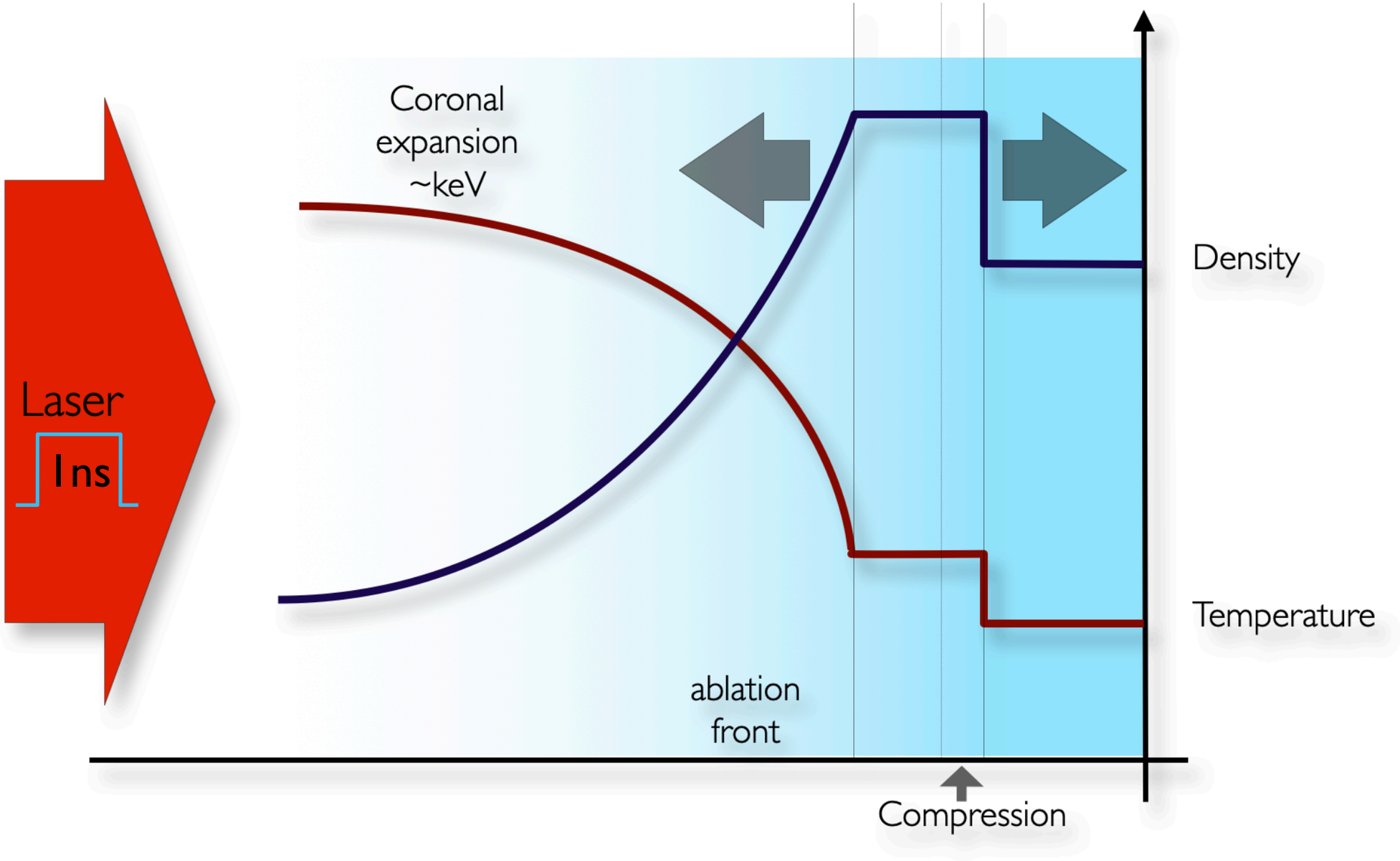
10
Joules
1ns



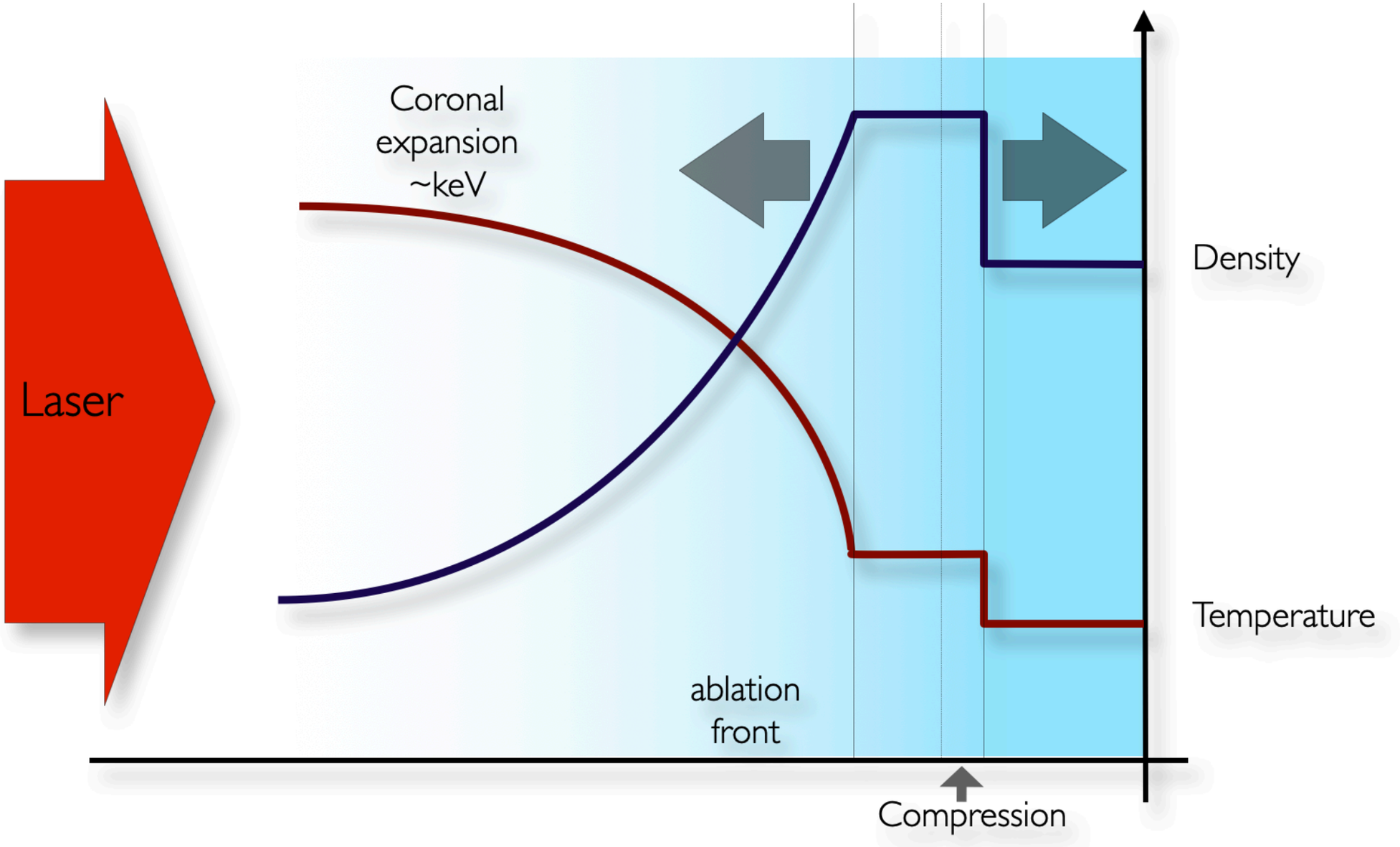
Laser interaction



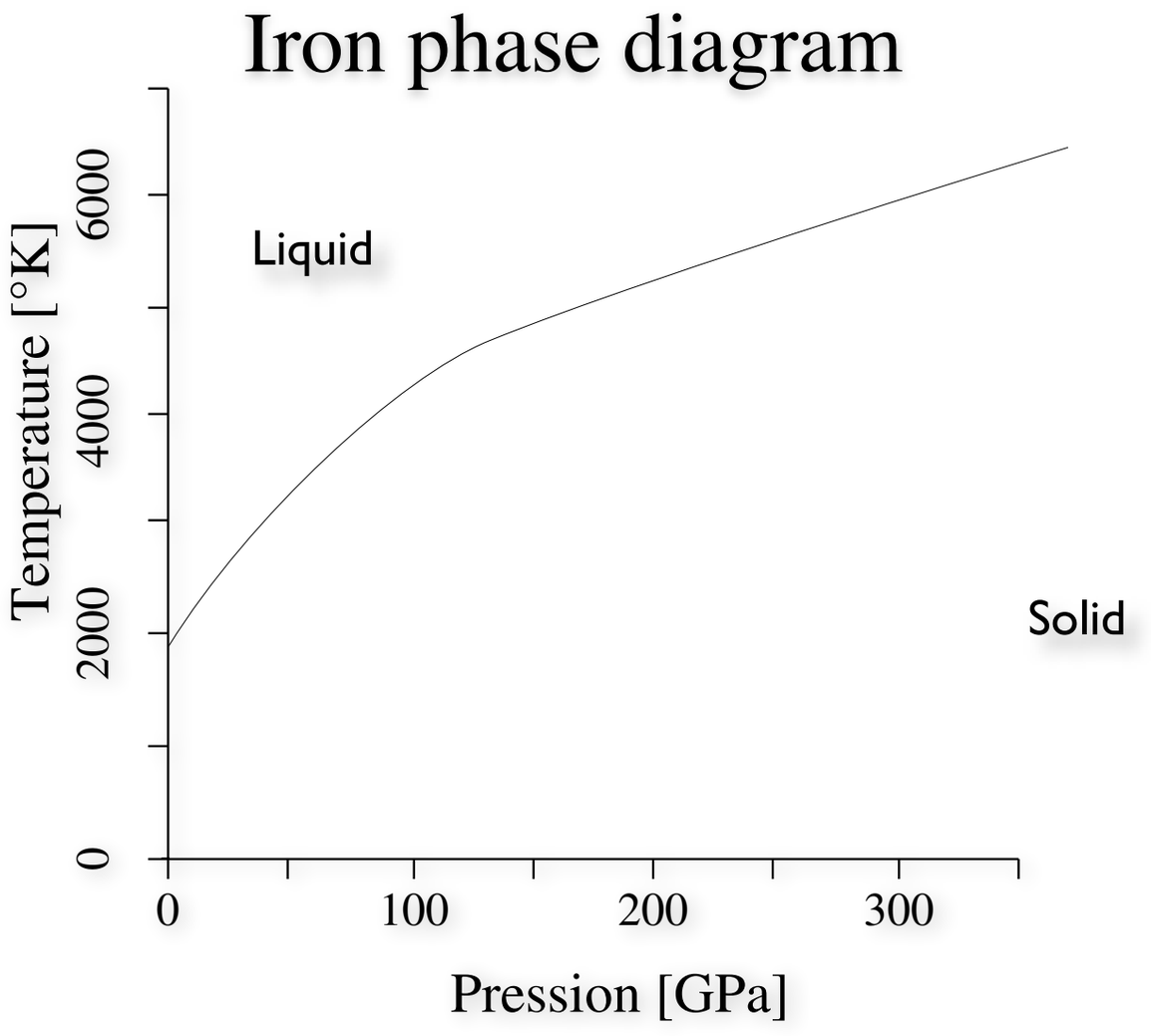
Laser interaction



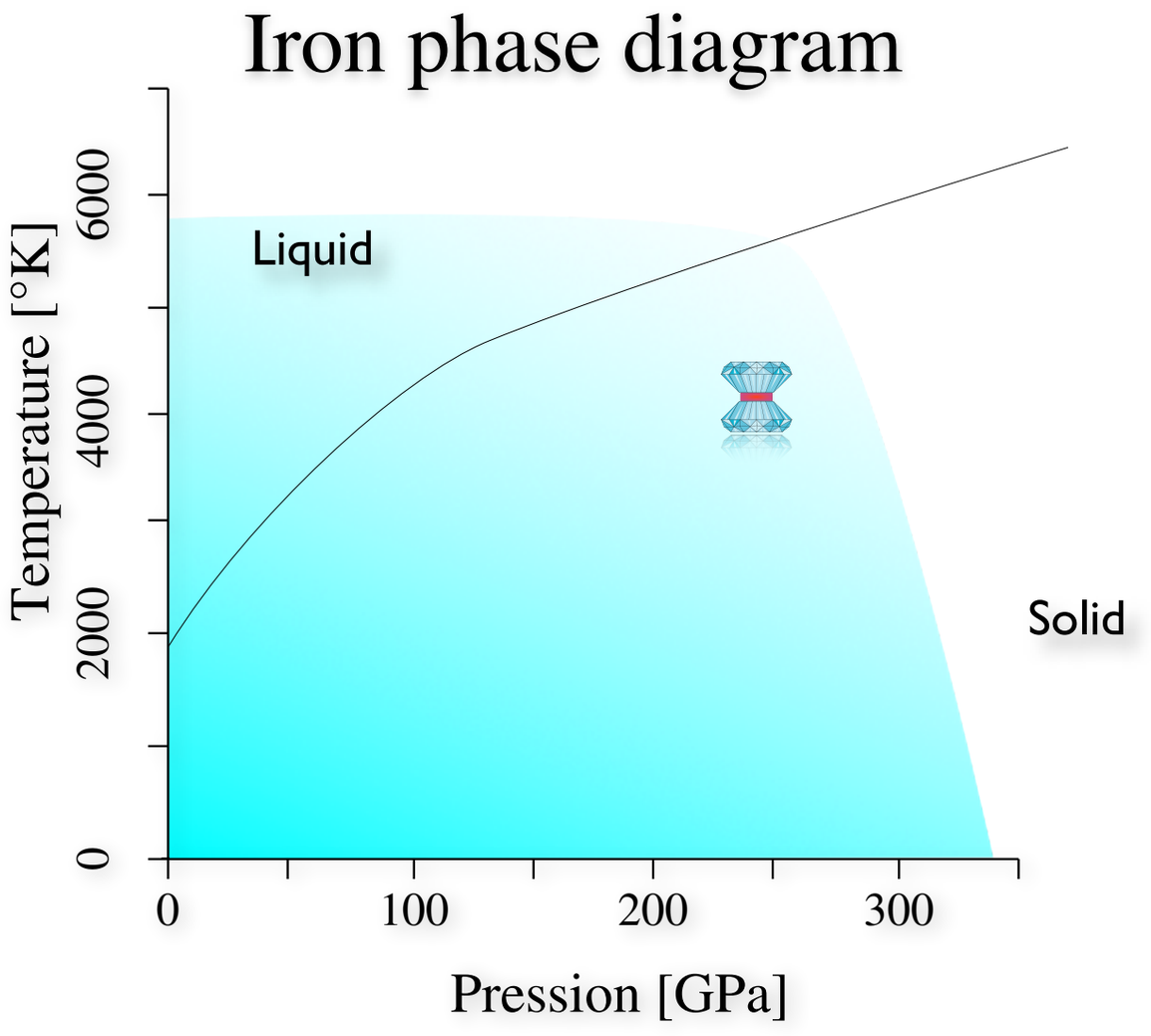
Laser interaction



Compression: static vs. dynamic



Compression: static vs. dynamic



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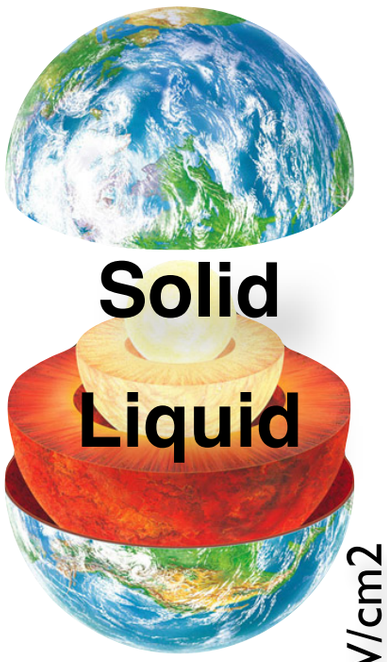

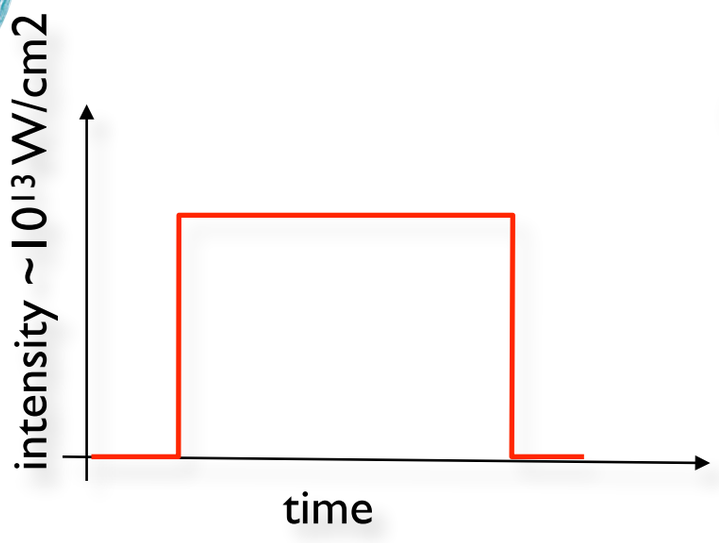

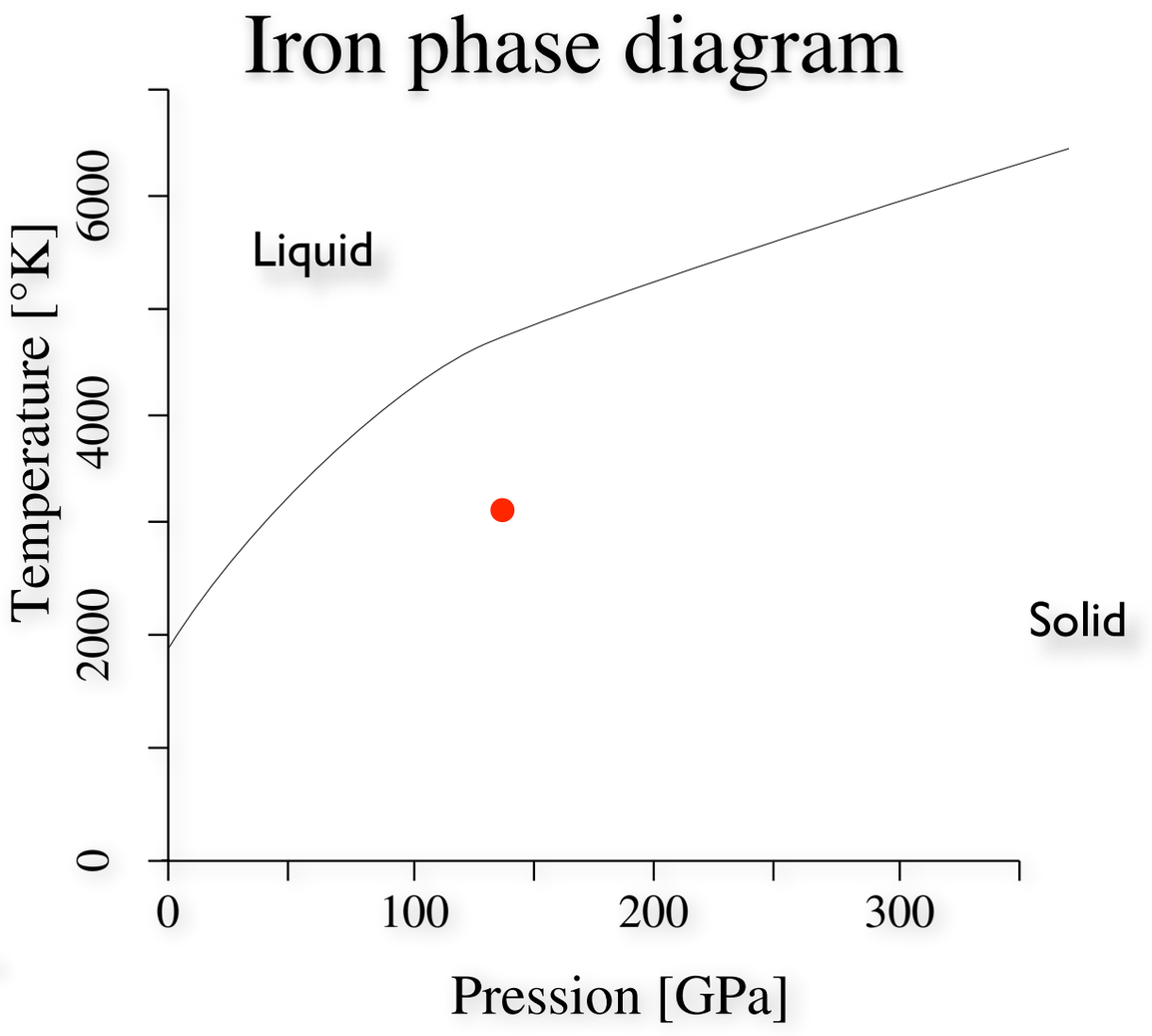

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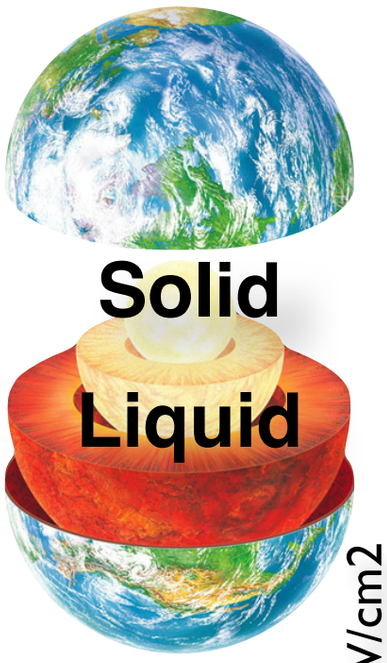

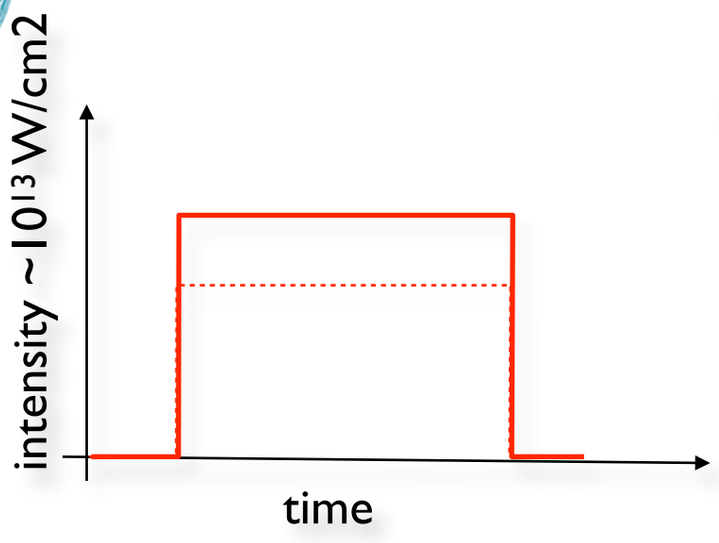

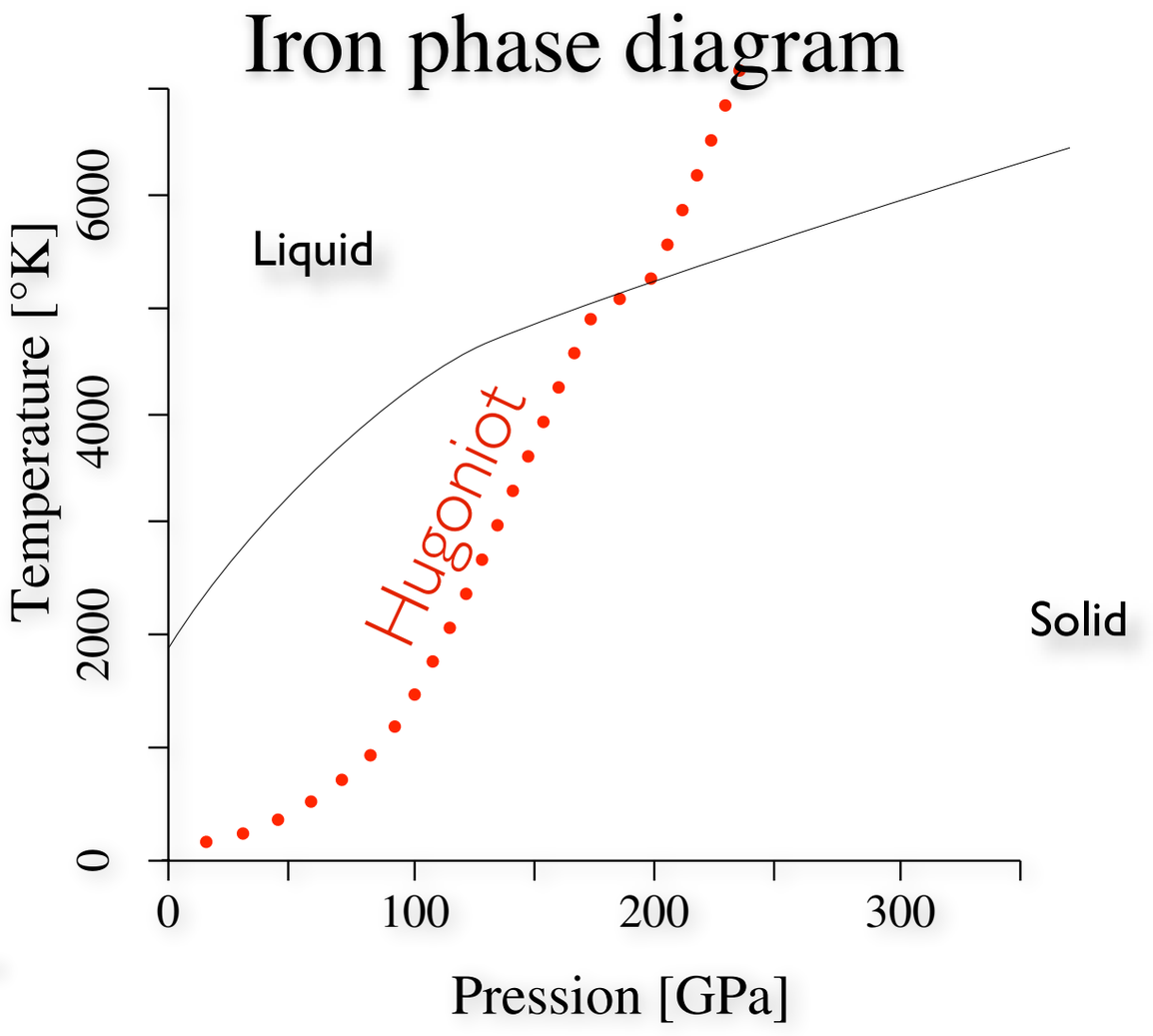

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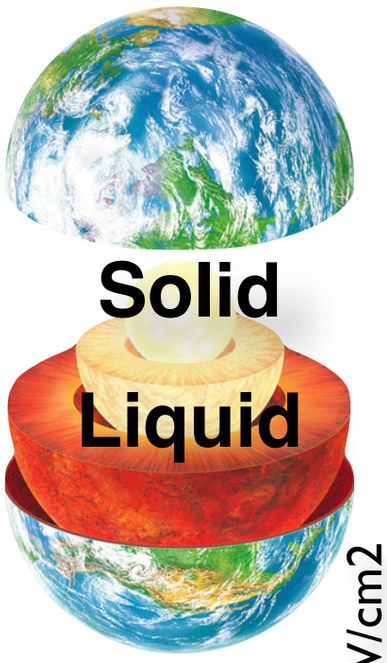
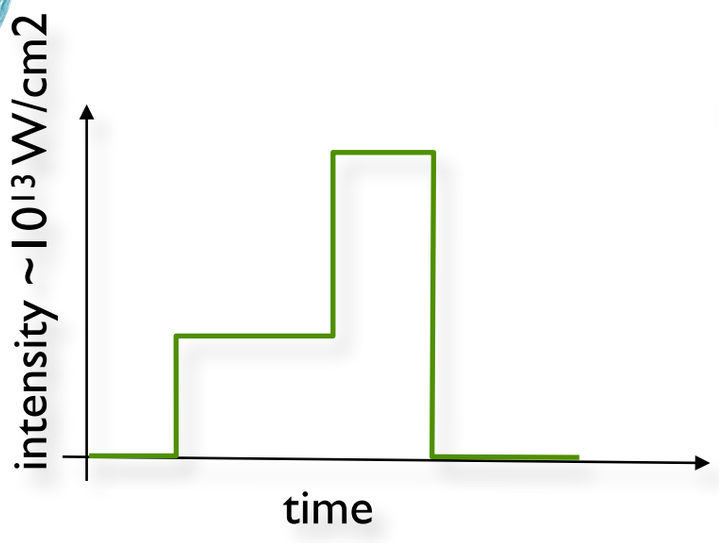
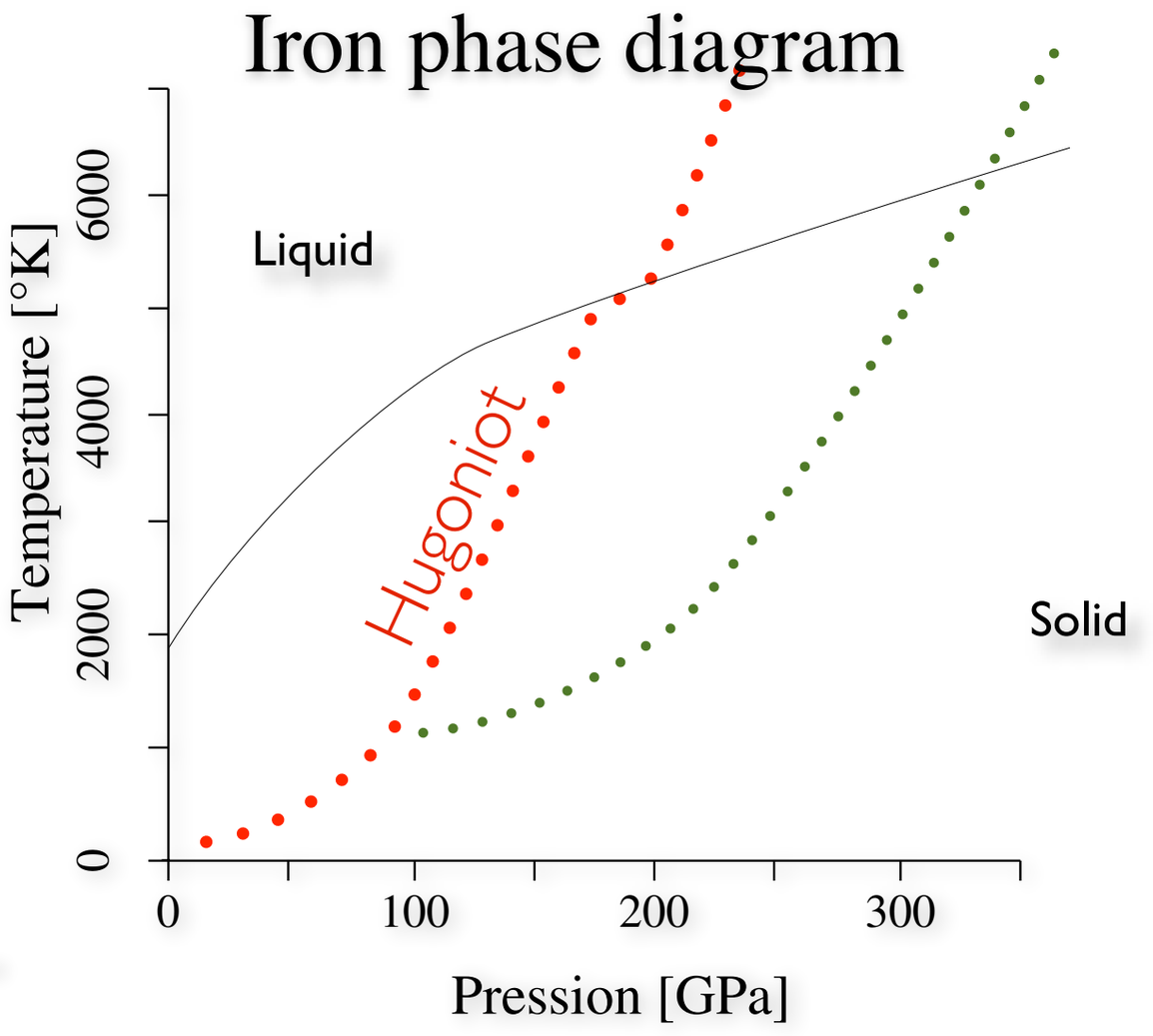
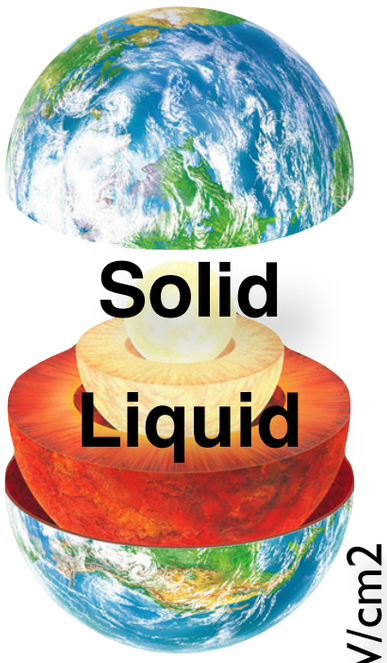
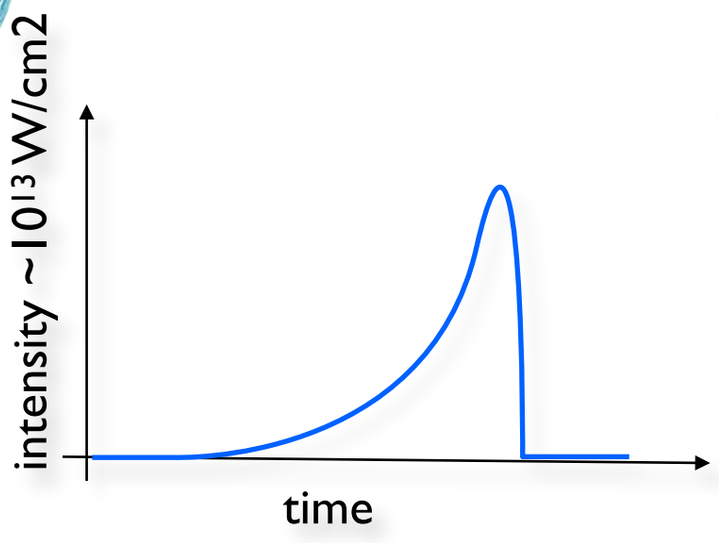


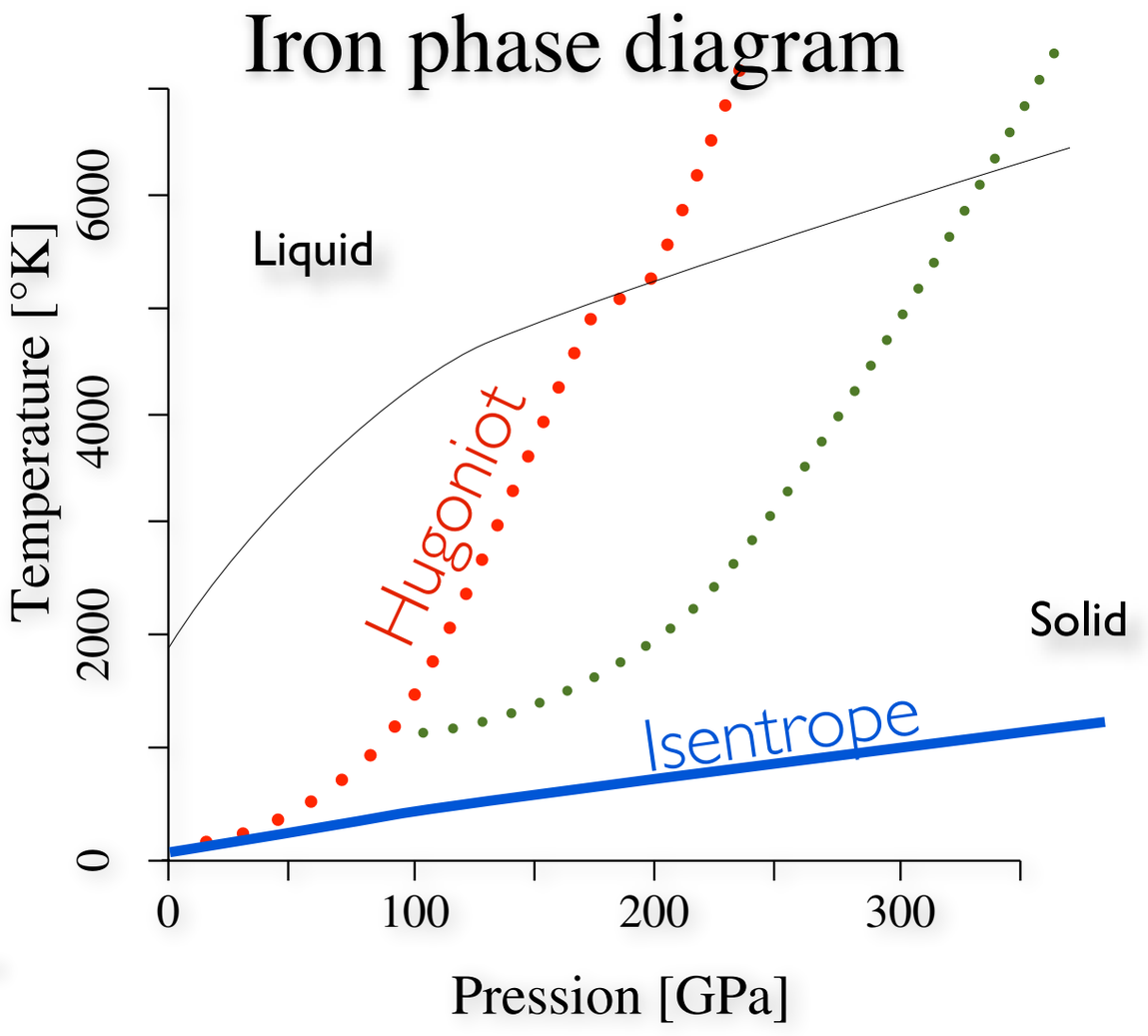




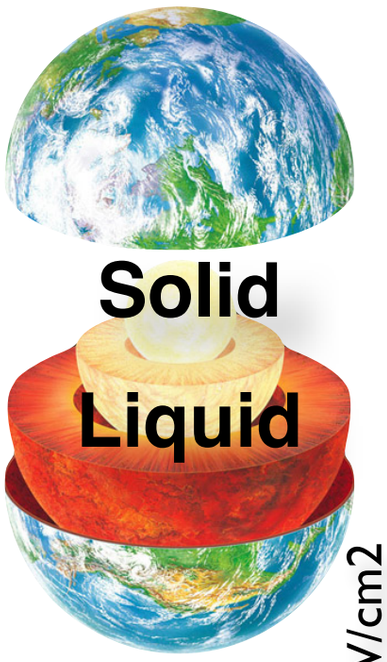
Compression: static vs. dynamic

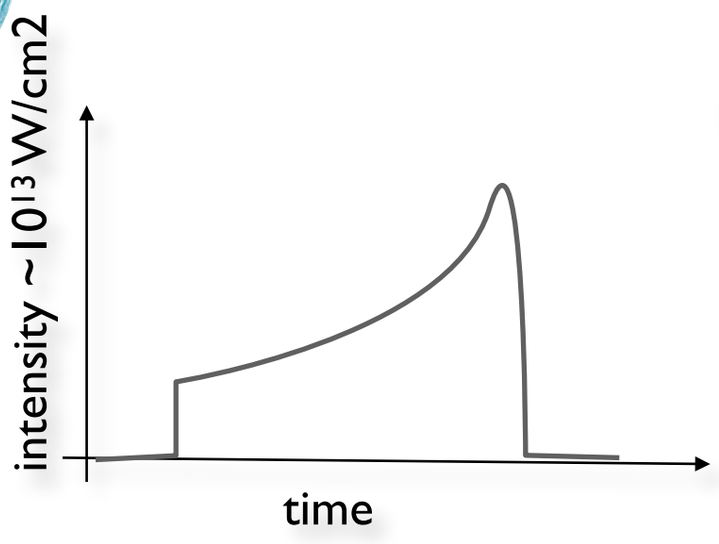


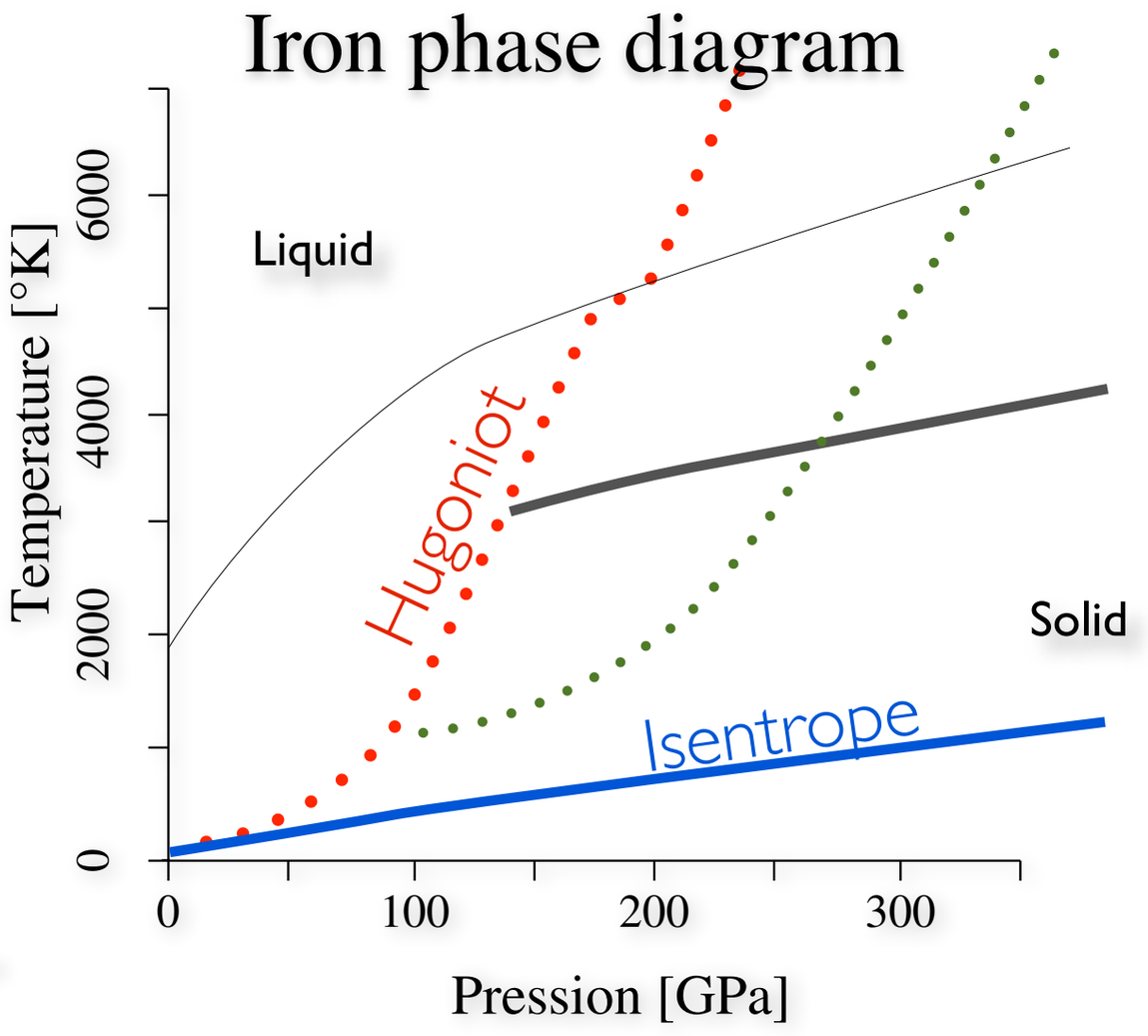




Compression: static vs. dynamic







What can we measure?

- Shock speed : Velocity interferometer system for any reflector **VISAR**
- Temperature: Streaked Optical Pyrometer **SOP**
- Density: **X-rays radiography**
- Microscopic structure:
  - X-Ray diffraction **XRD**
  - X-ray Absorption Near Edge Structure **XANES**
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Structure

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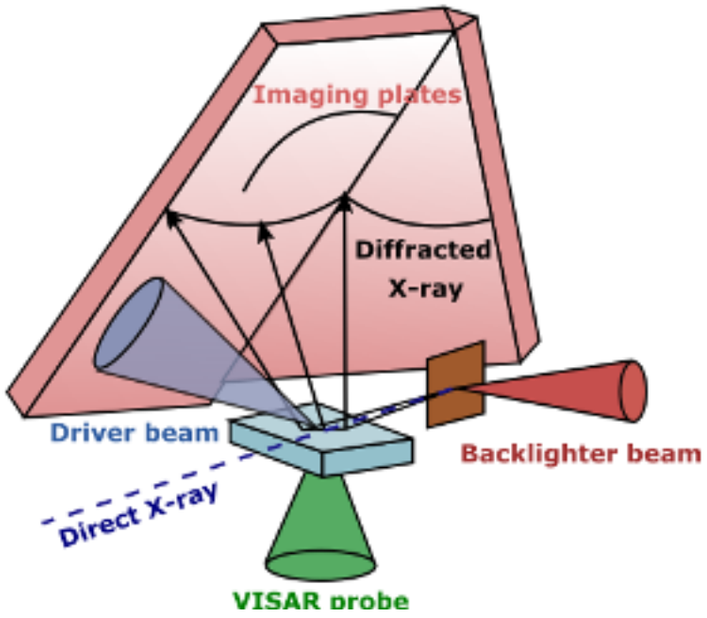
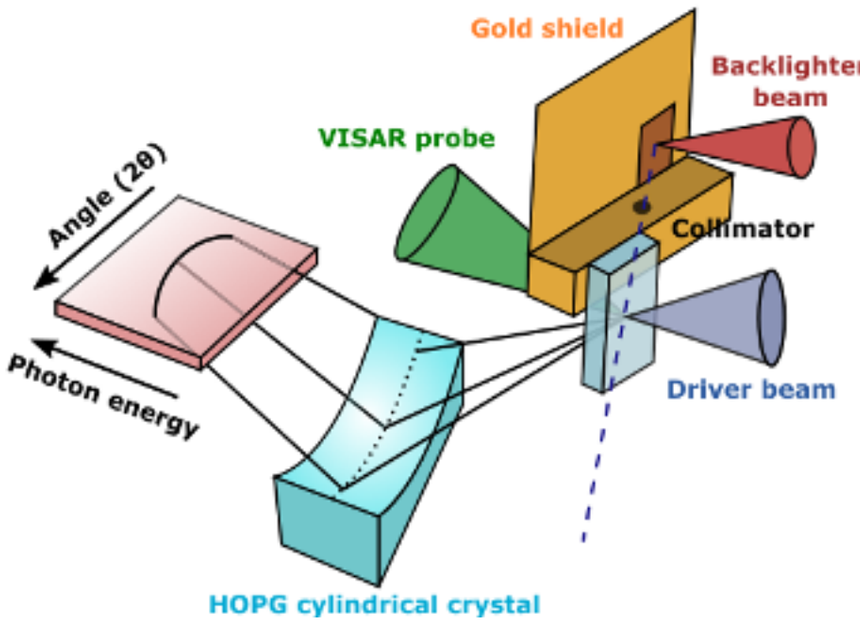
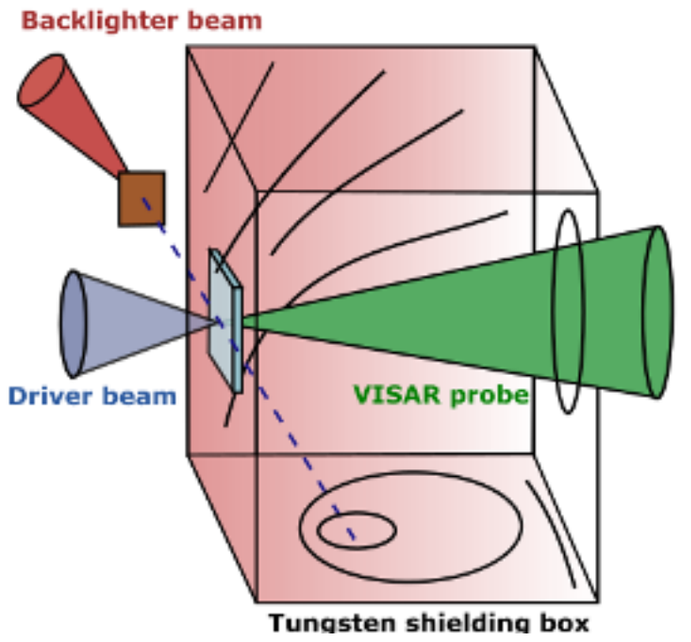
laser based X-ray probing



Kalentar 2005

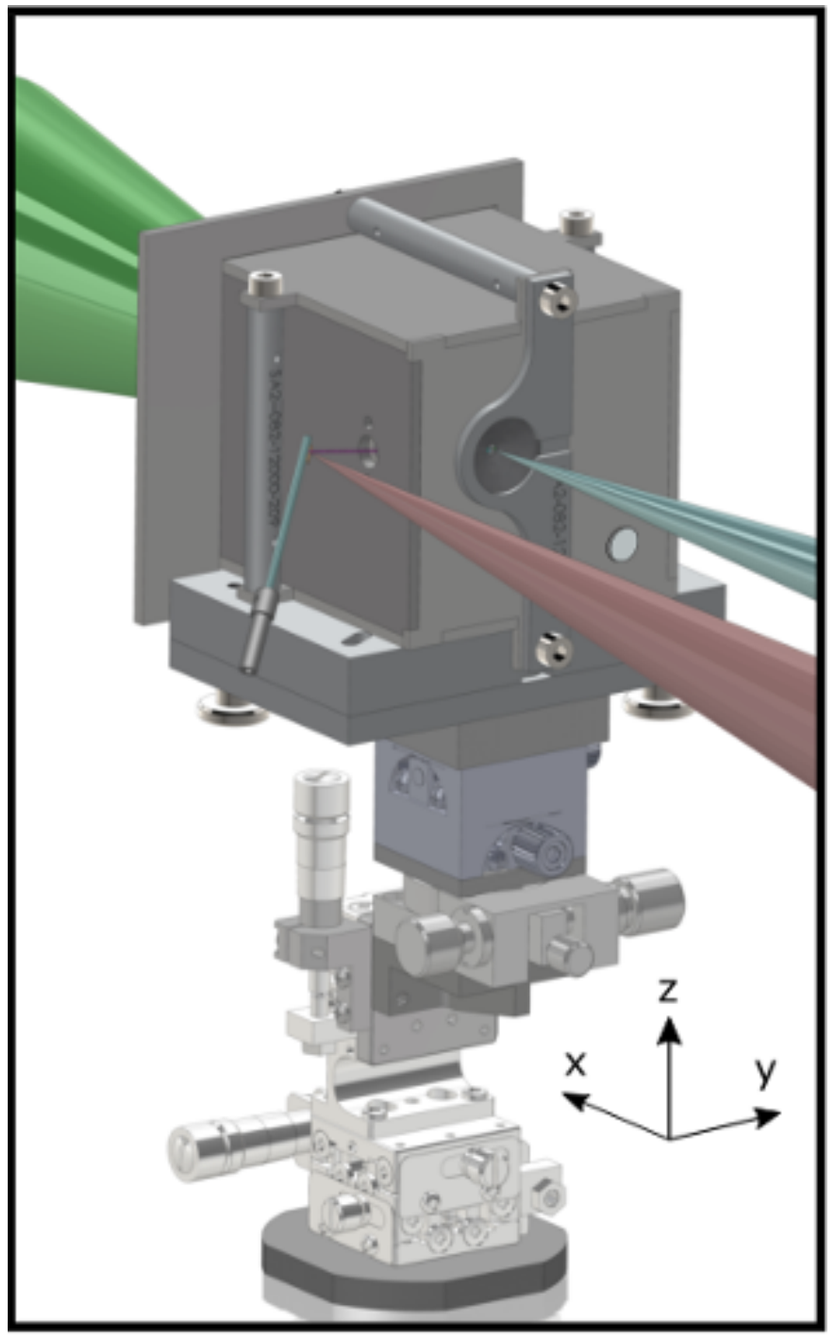


Denoeud 2016



Rygg 2020

Diffraction: reflection geometry



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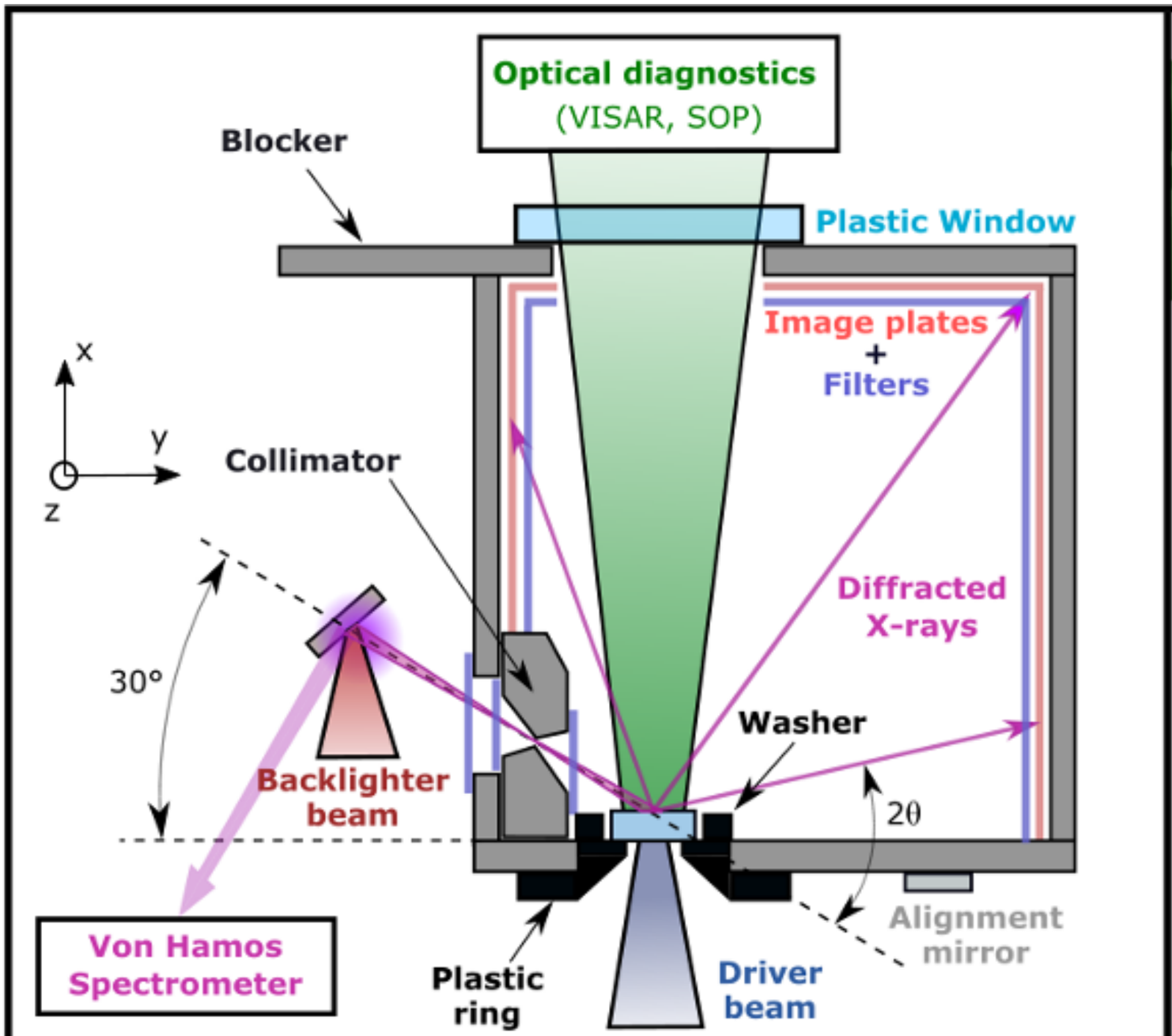


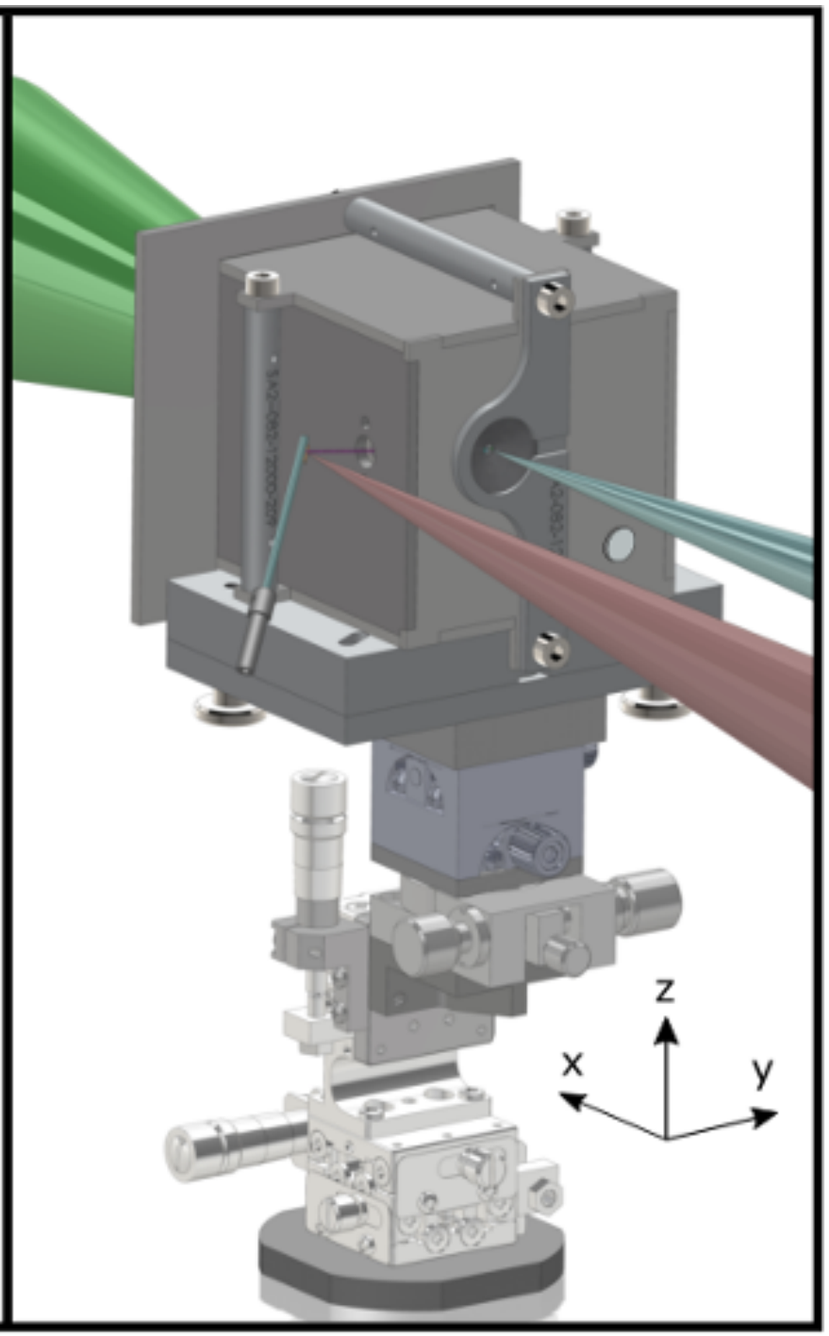
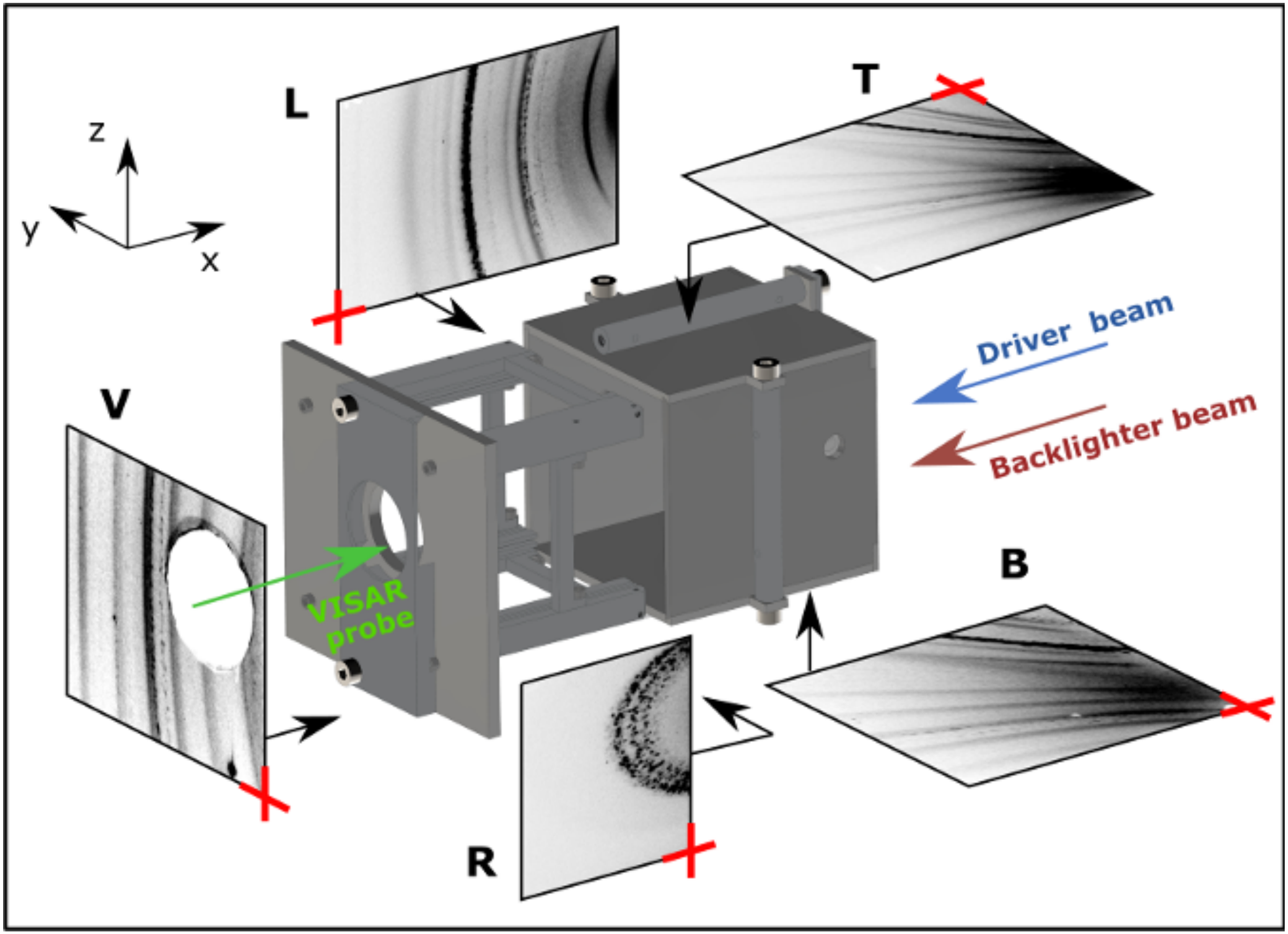
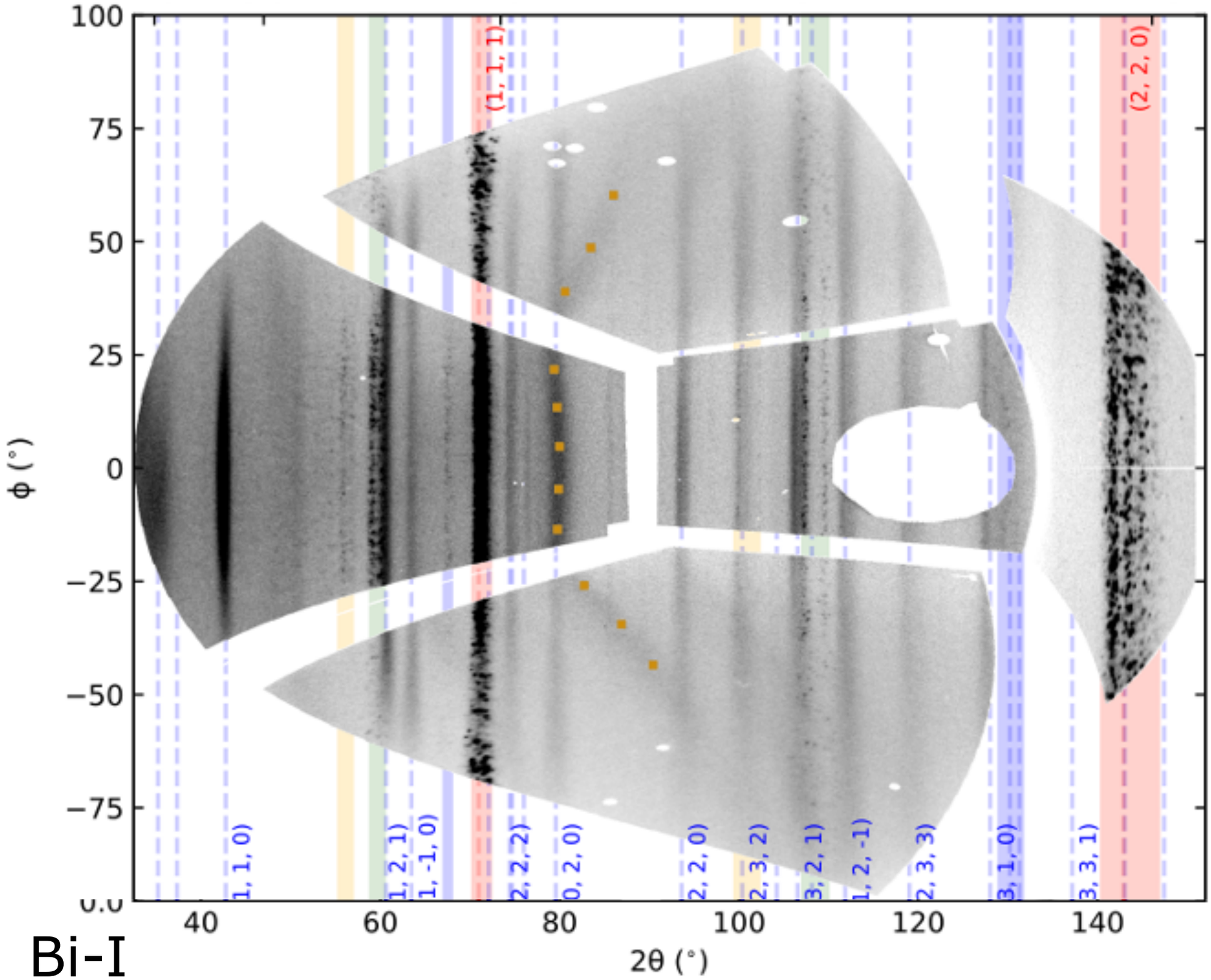


Image Plates in the Box

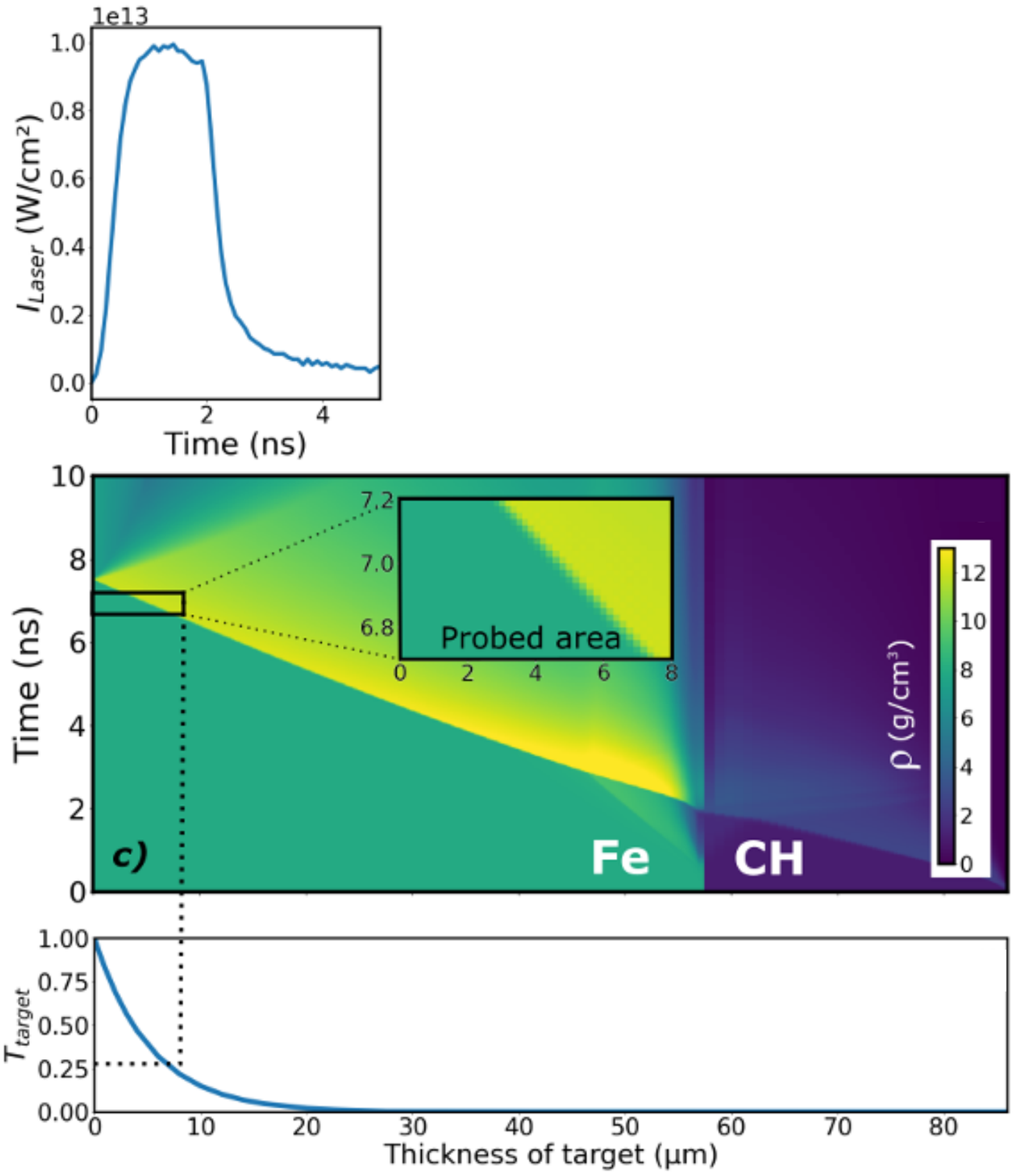


IPs projection on θ-ϕ plane

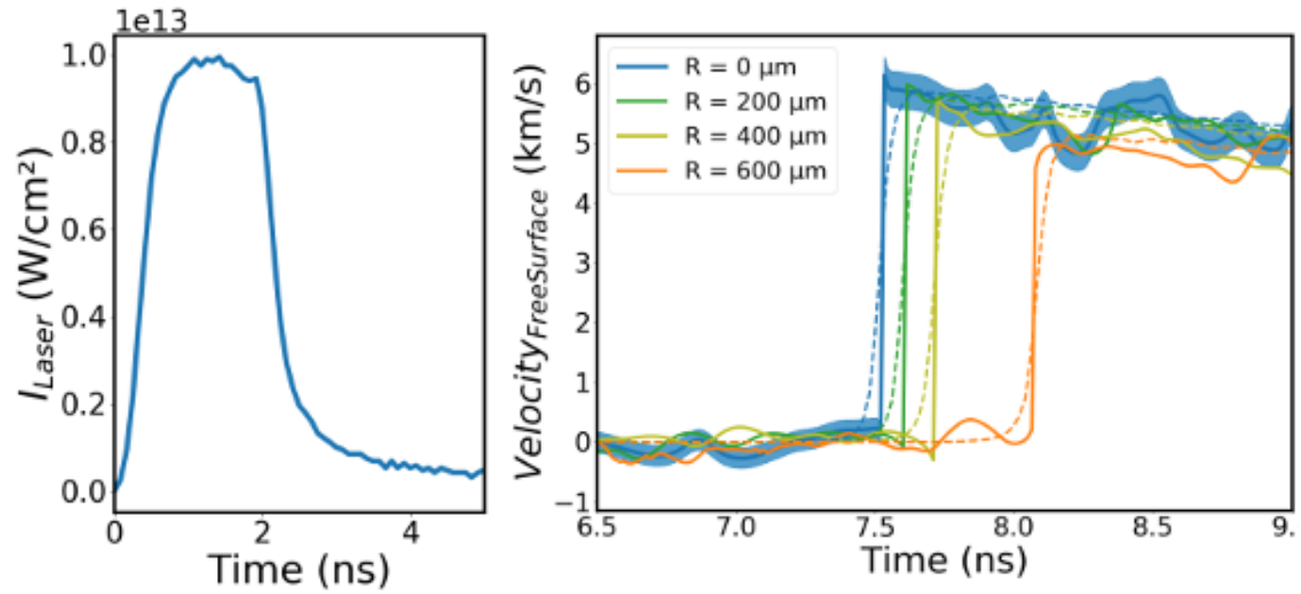


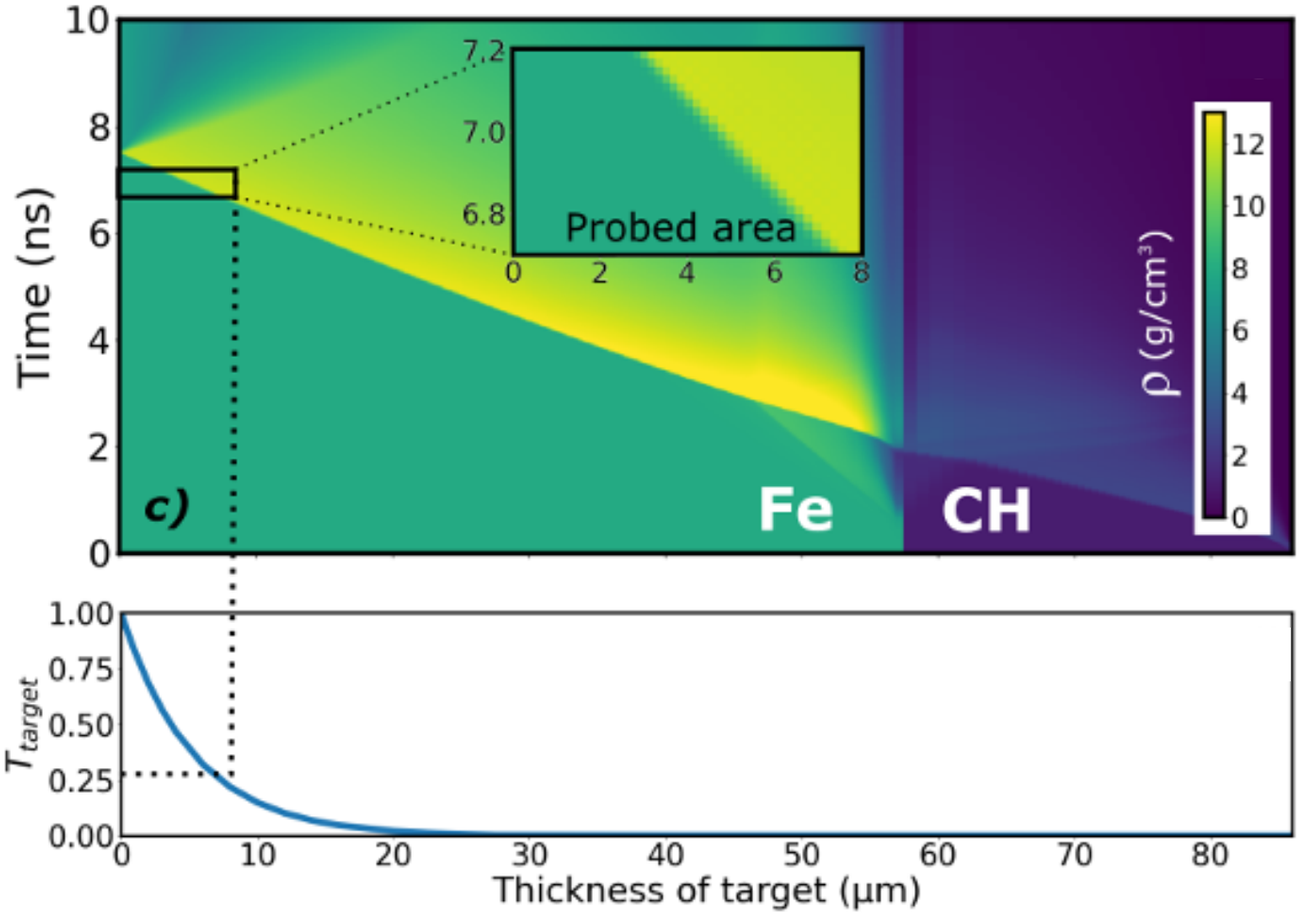
blue: Bi-I

Shock compressed iron

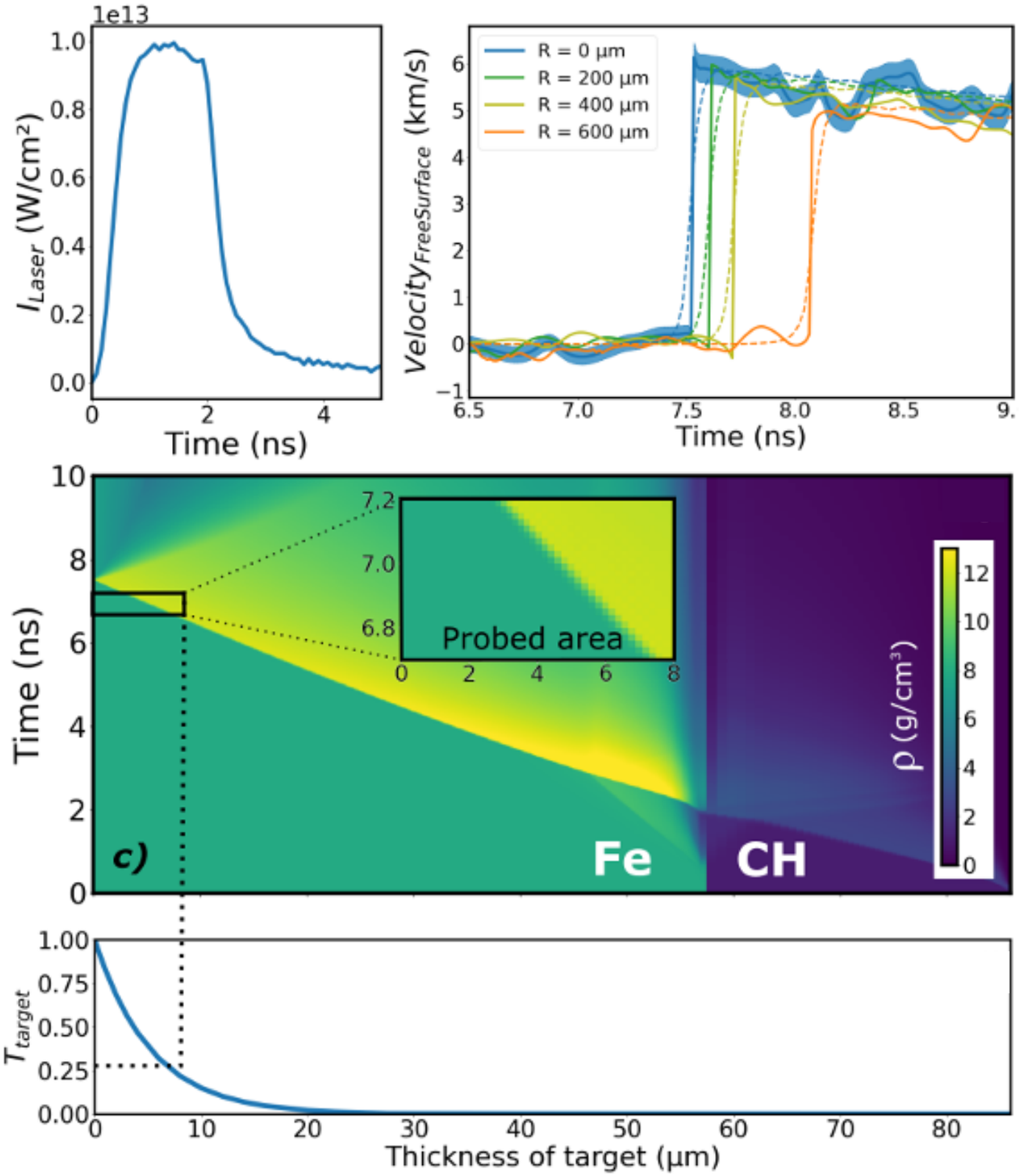


Shock compressed iron

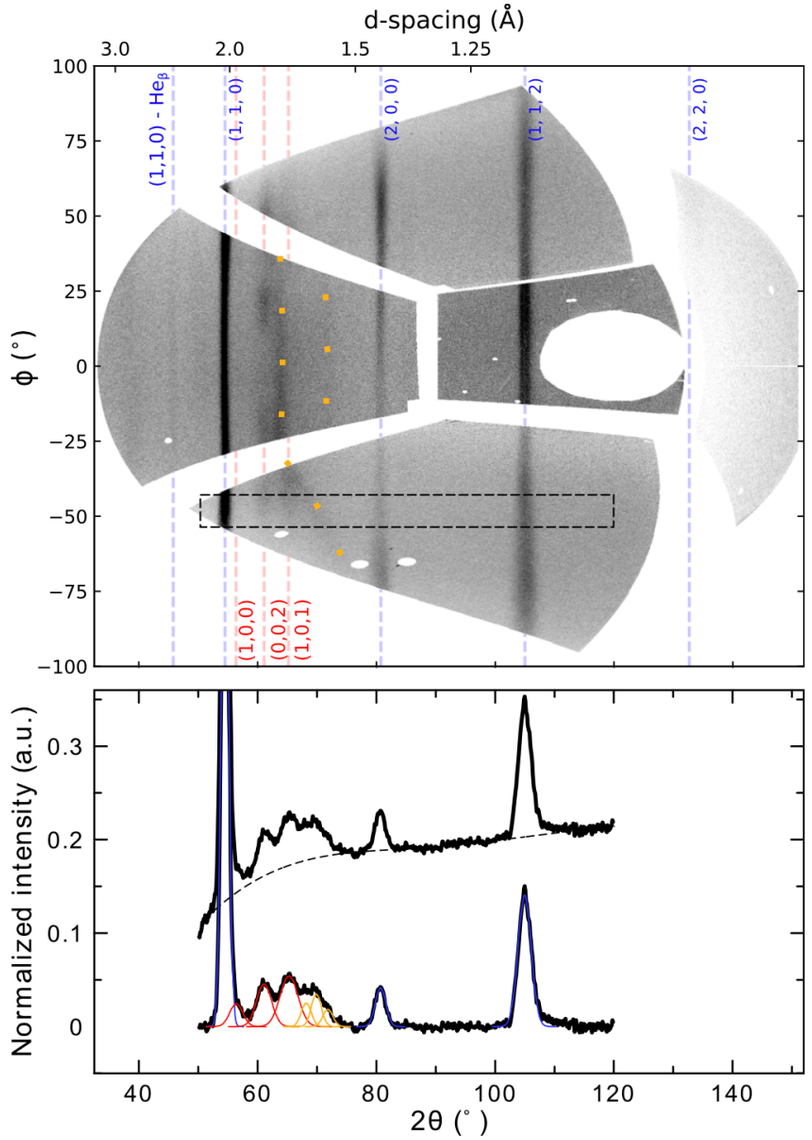




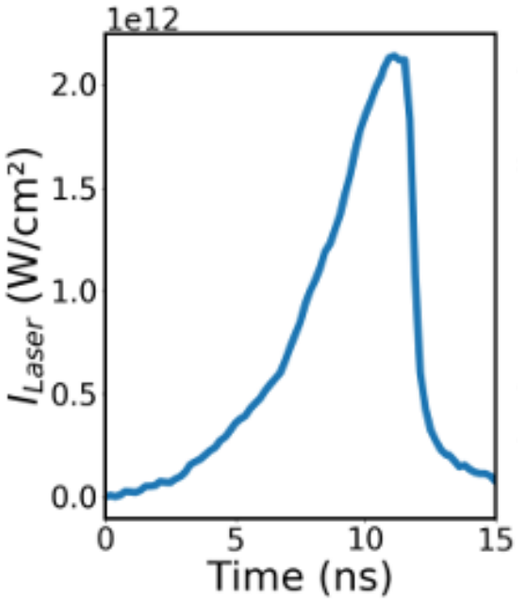
Shock compressed iron

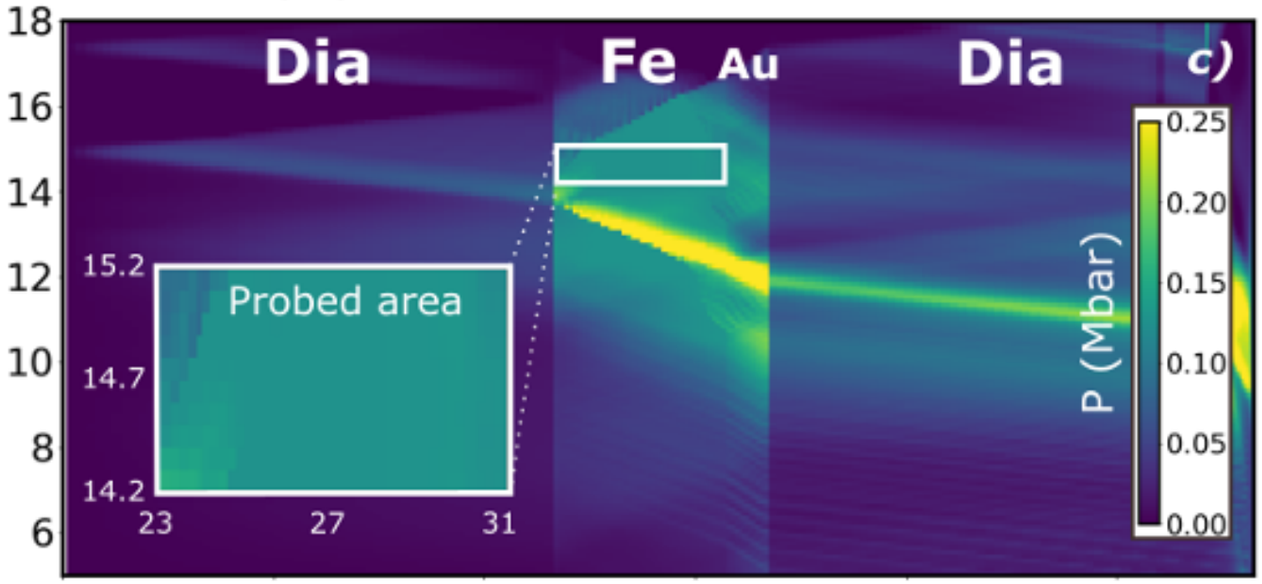


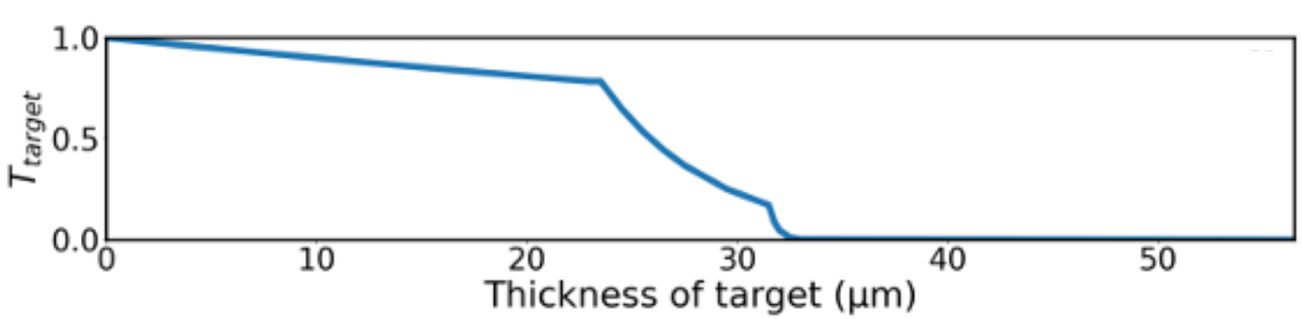
bcc_{repos} 7.87g/cm³
hcp_{choc} 11.5g/cm³



Ramp compressed Iron







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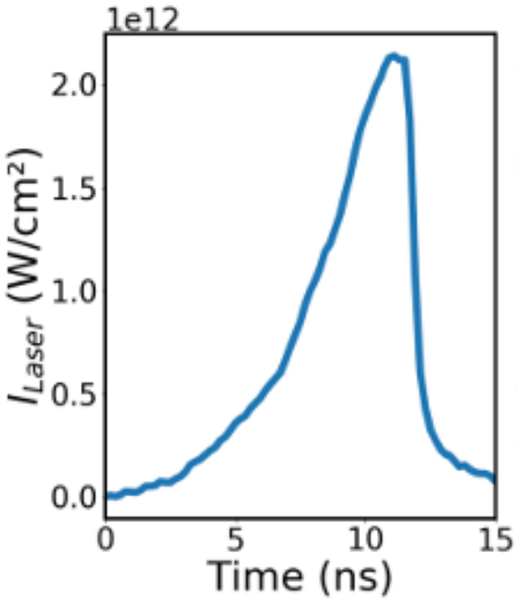
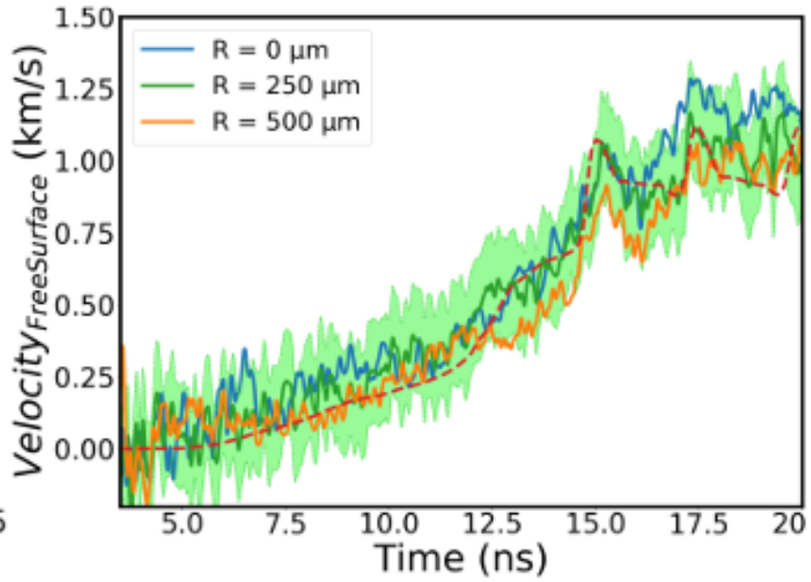
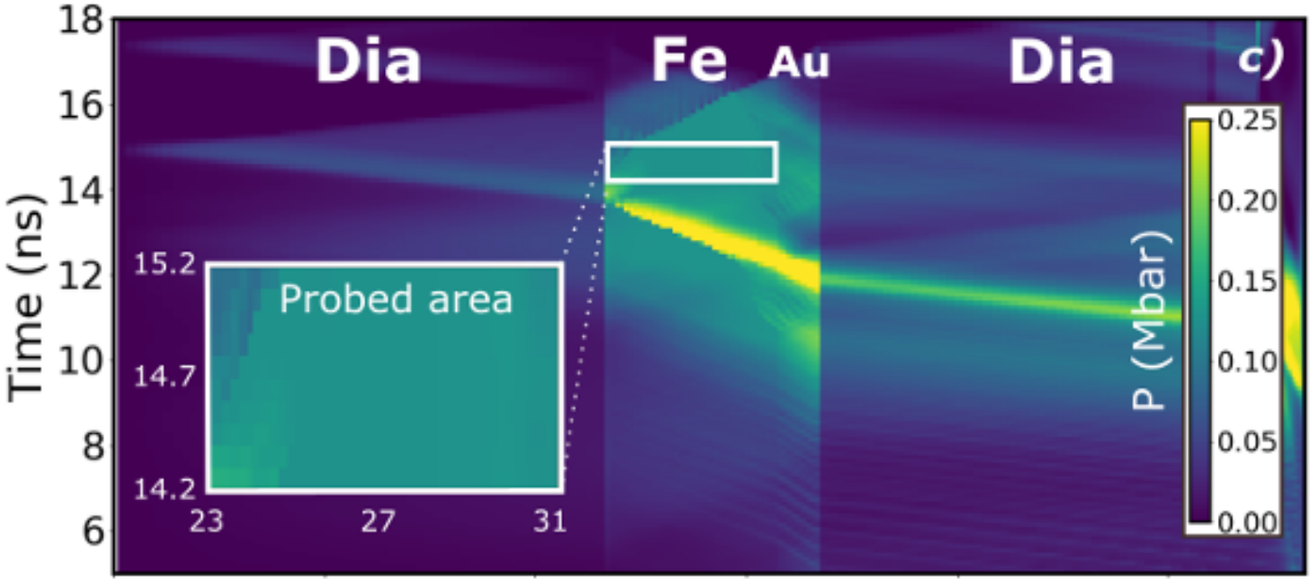
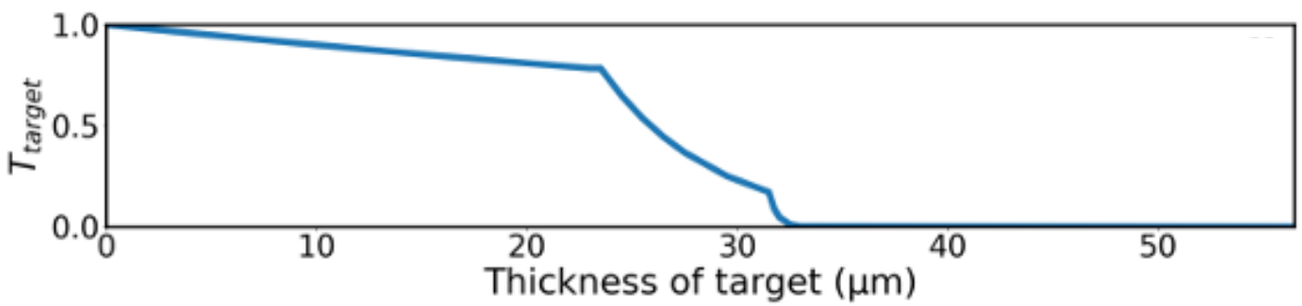


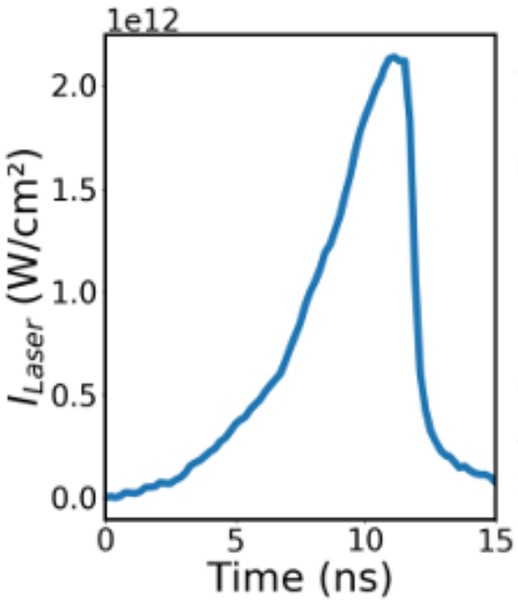


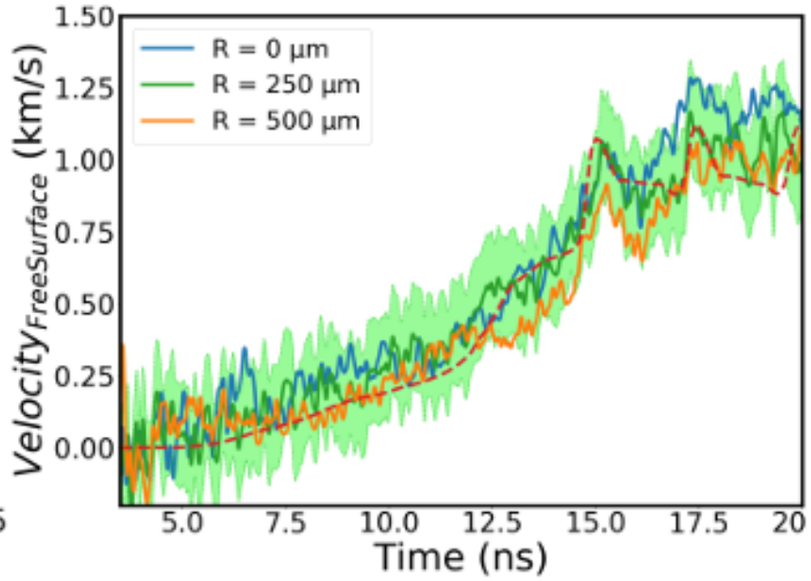


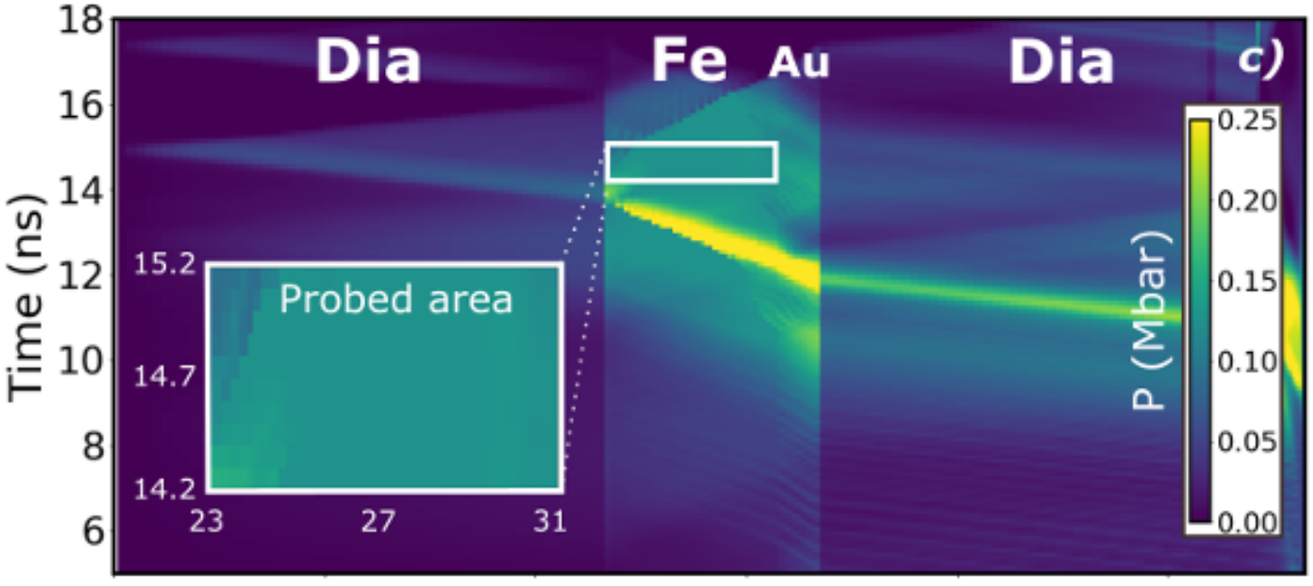


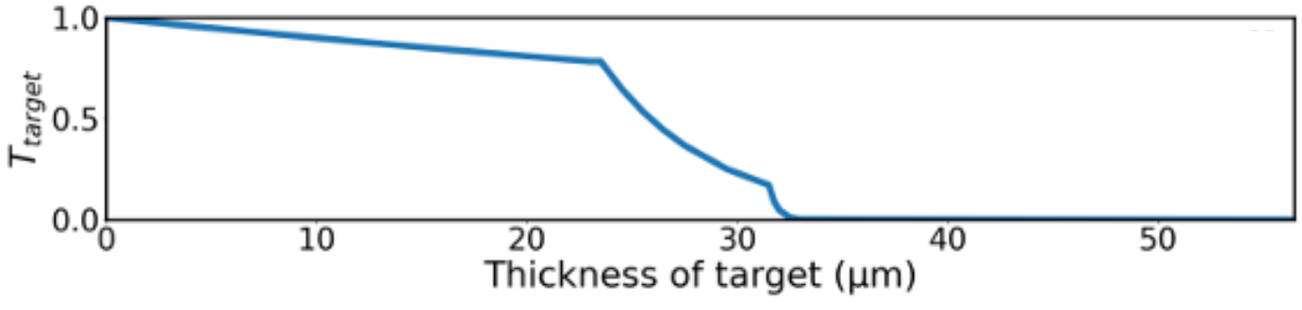
Ramp compressed Iron

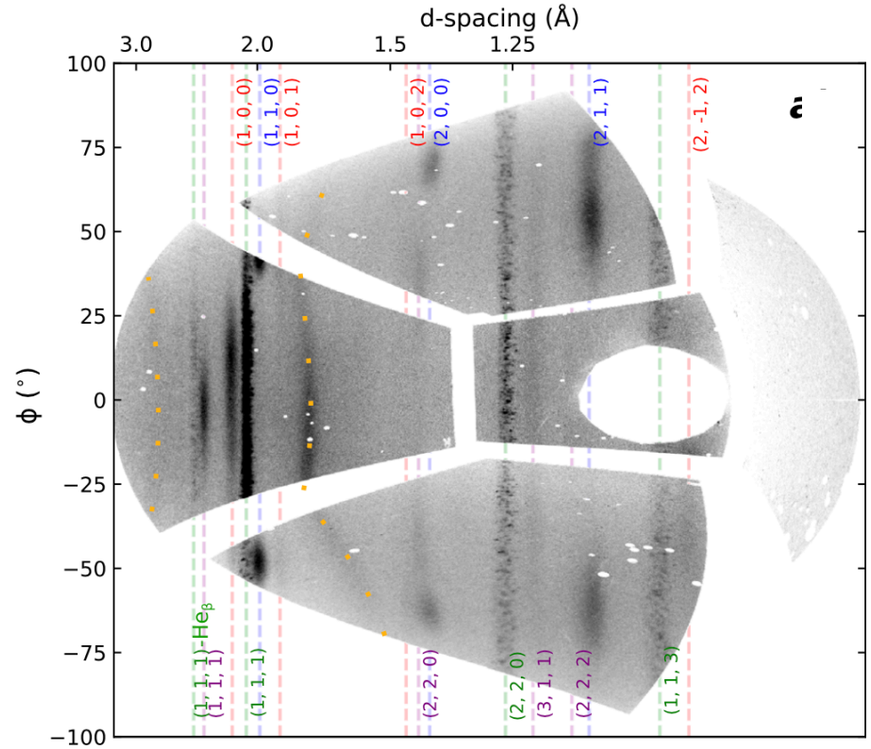
bcc 8.40g/cm³
hcp 8.74g/cm³

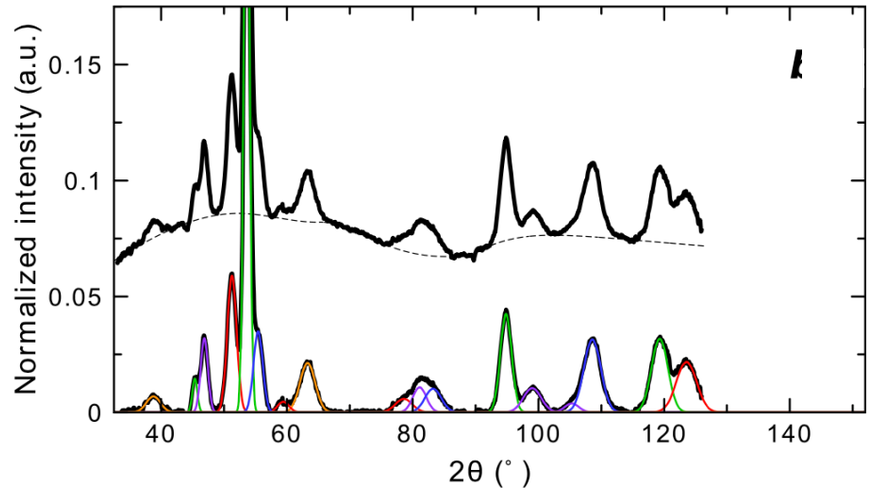








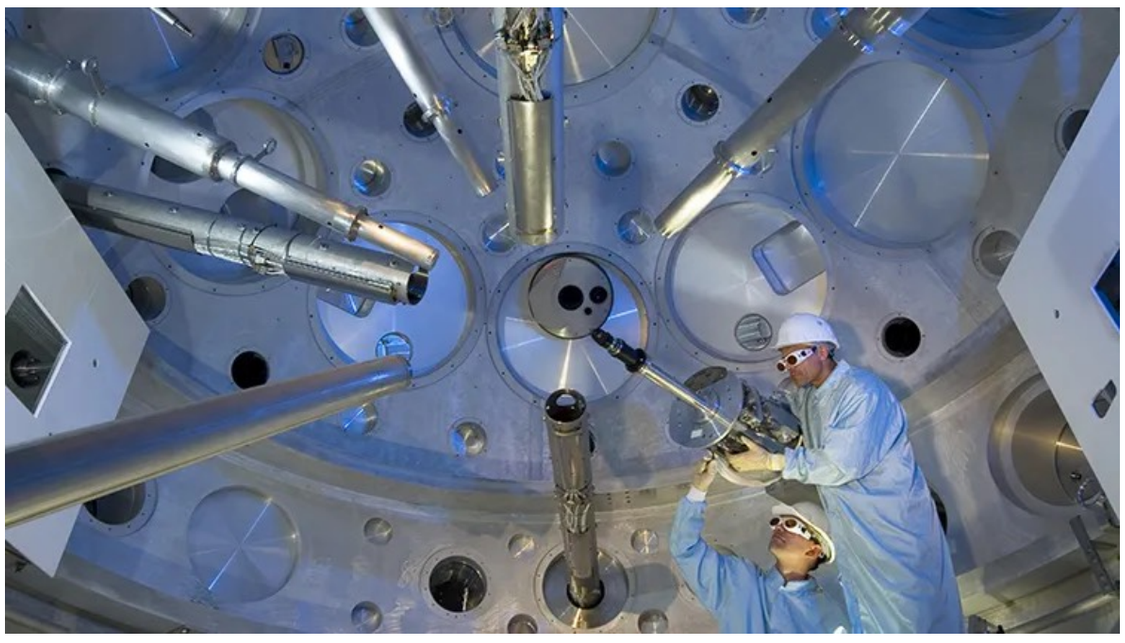




Towards a really BIG experiment

2 laser beams
0.5 kJ per beam

176 laser beams
7.5 kJ per beam



Goals of the experiement

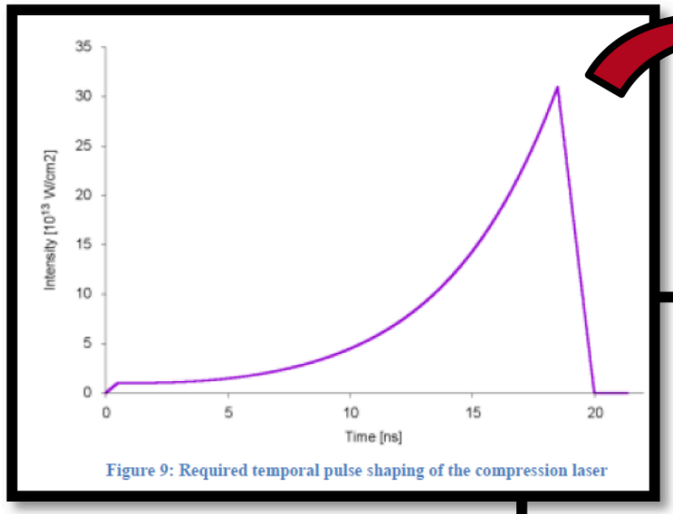
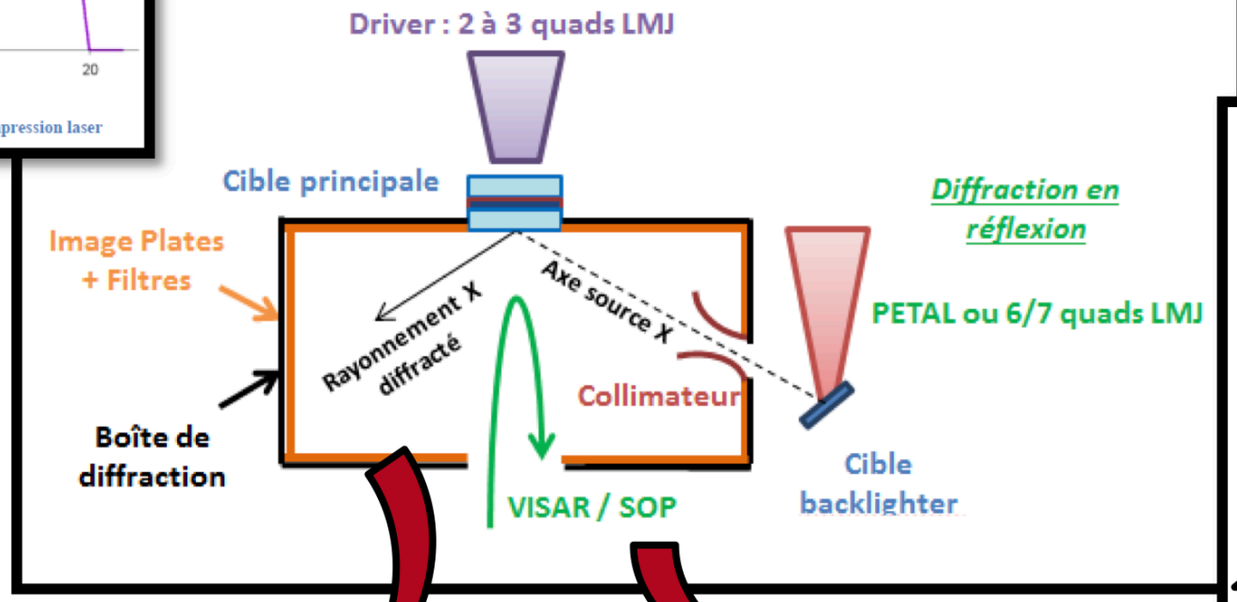
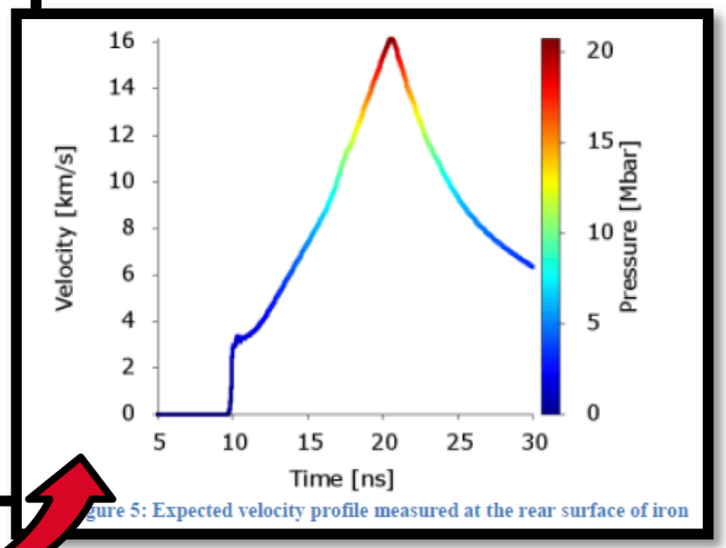
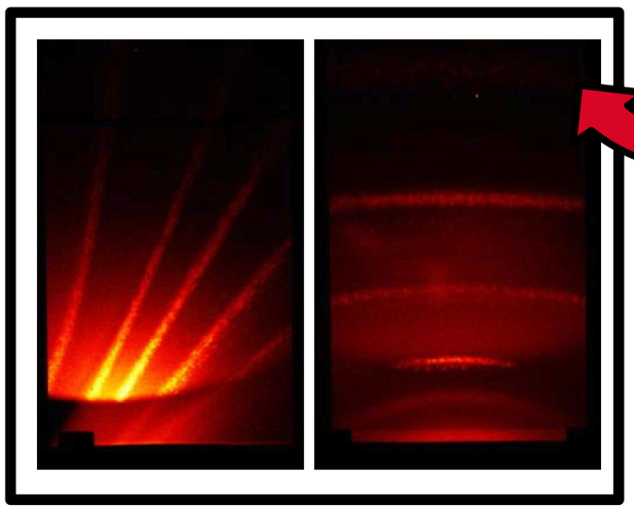


Figure 9: Required temporal pulse shaping of the compression laser



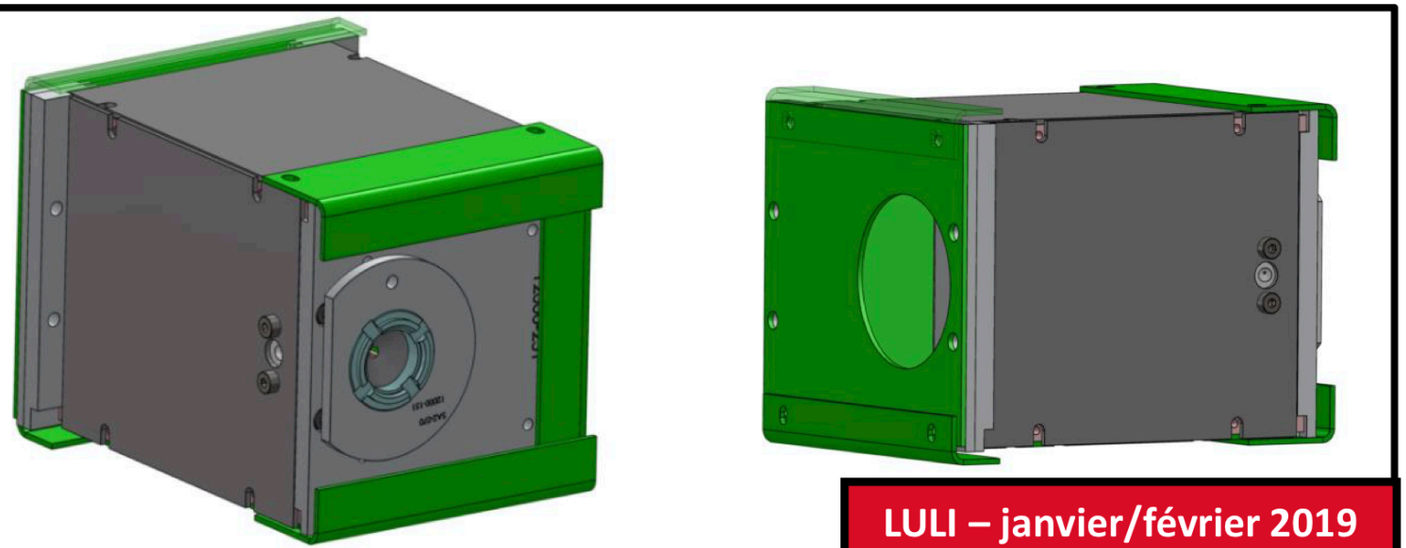


gure 5: Expected velocity profile measured at the rear surface of iron



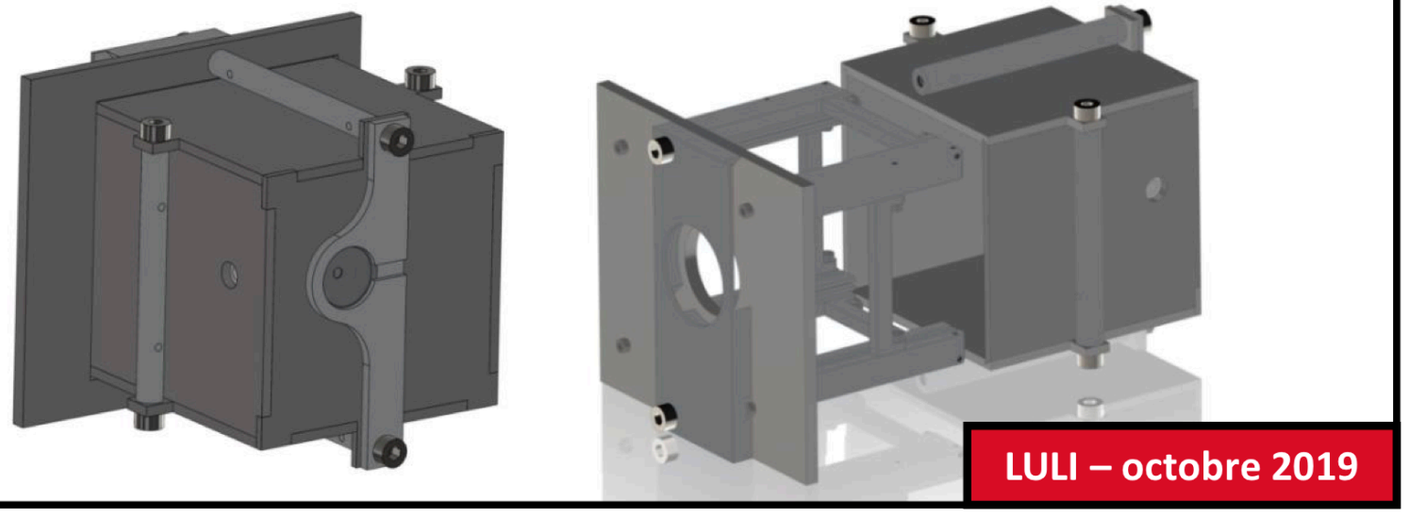
3 + 3 shots

XRD box evolution



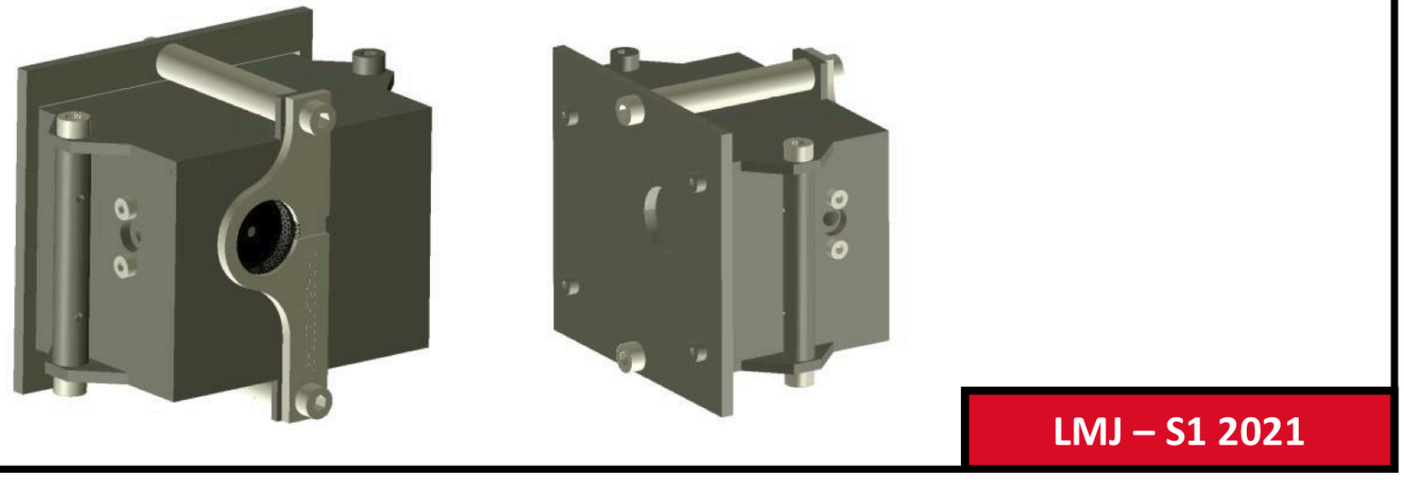
LULI – janvier/février 2019

- Poids : 1100 g
- Taille : 60 x 55 x 90 mm
- Matériau : Pb



LULI – octobre 2019

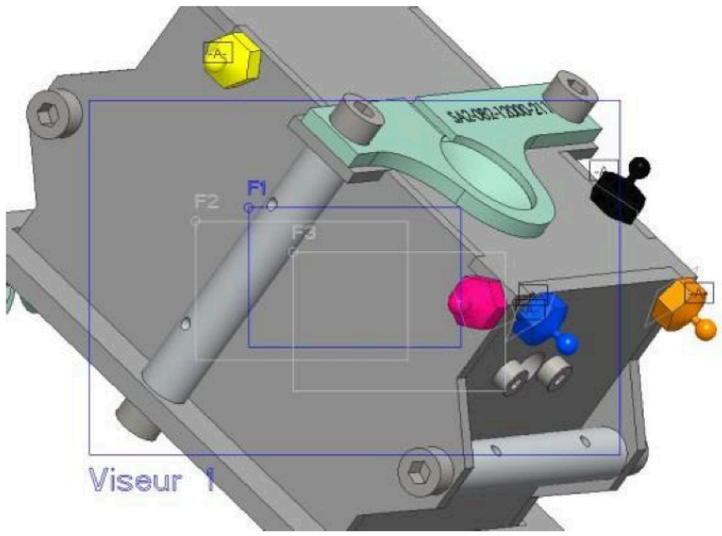
- Poids : 720 g
- Taille : 55 x 52 x 54 mm
- Matériau : WC

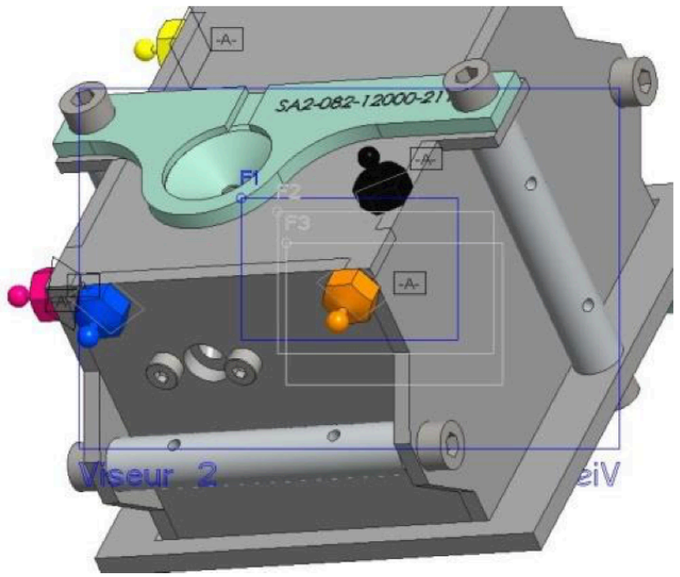


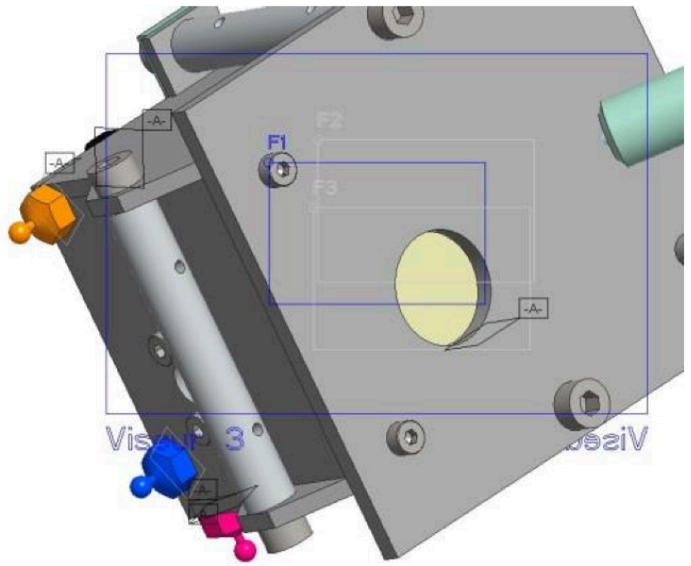
LMJ – S1 2021

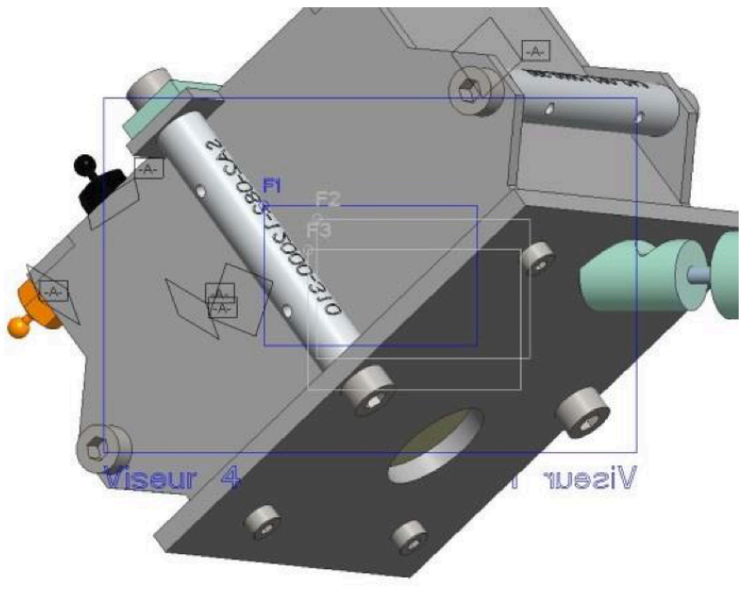
- Poids : **515 g**
- Taille : **55 x 42 x 38 mm**
- Matériau : **WC ??**

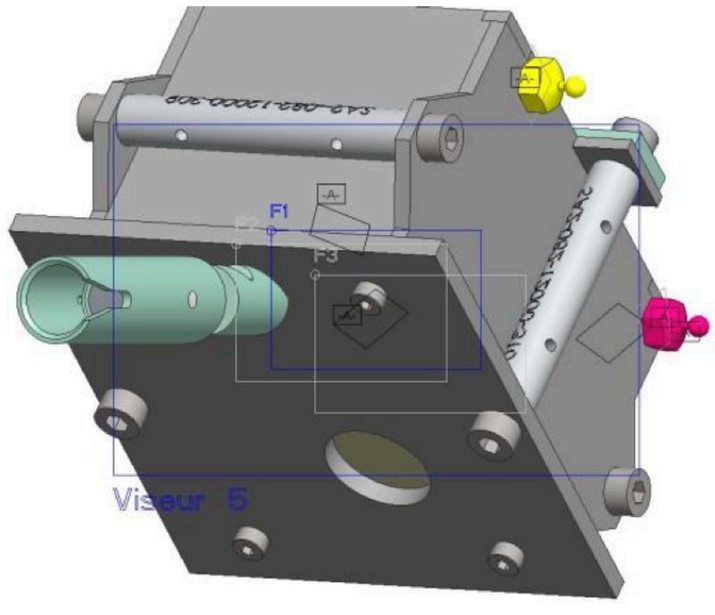
Alignements

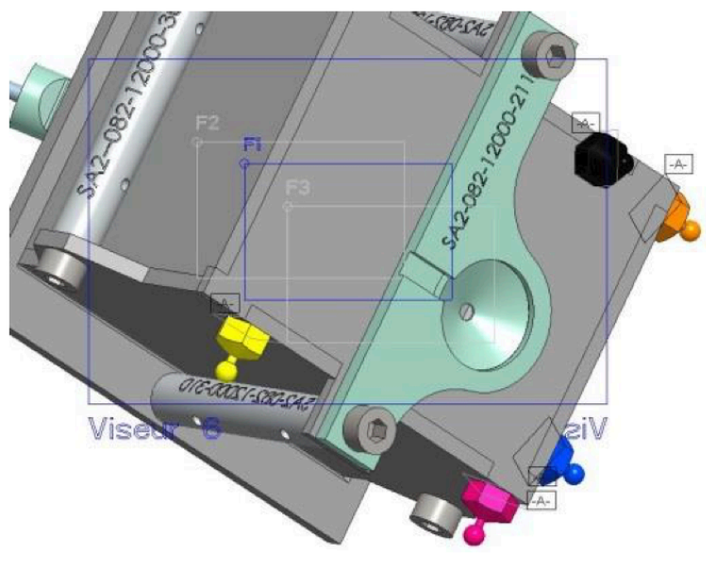






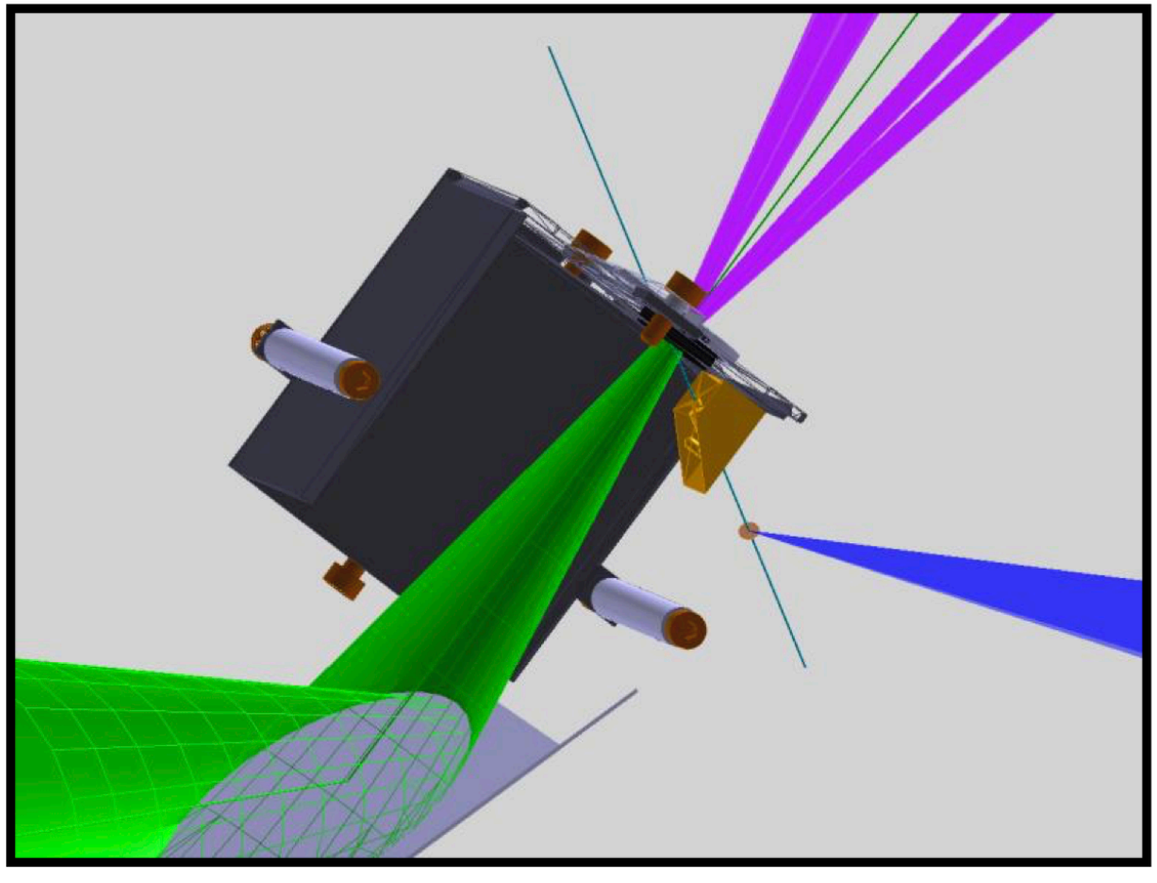


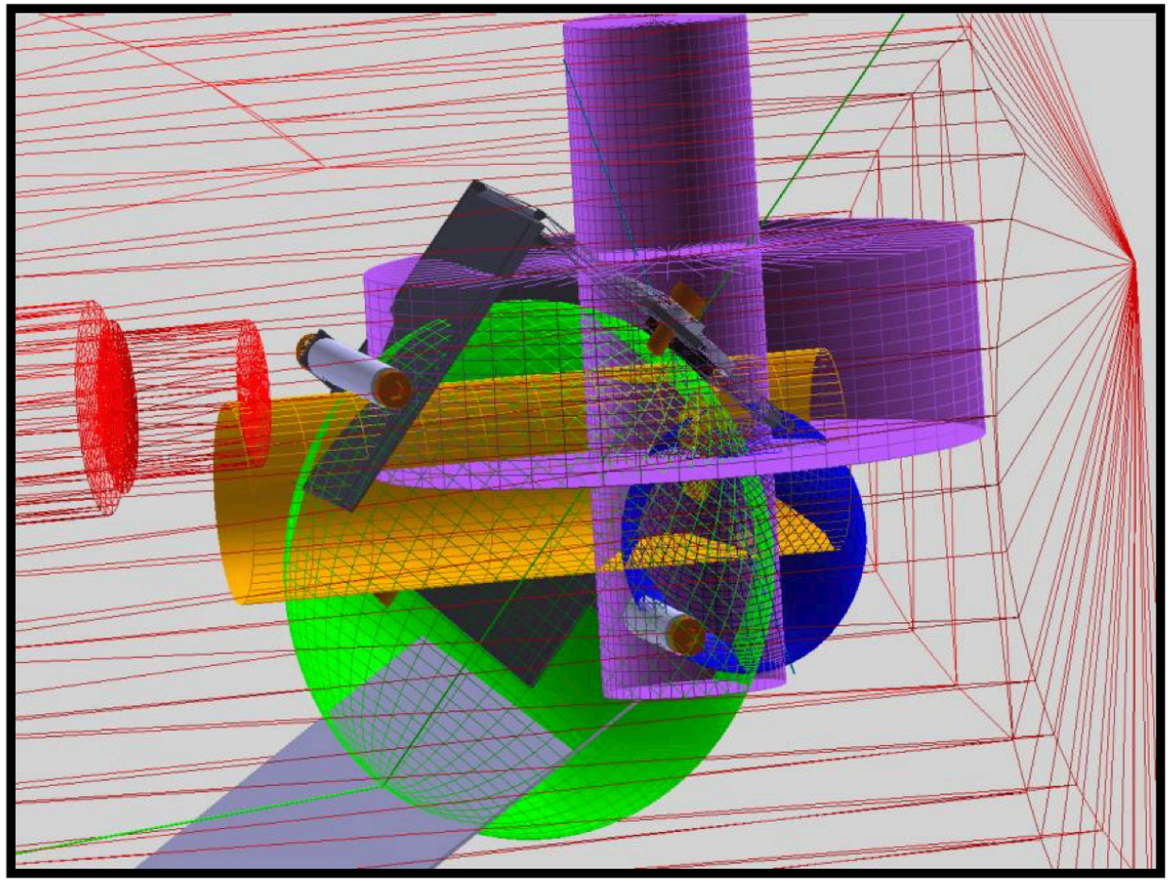




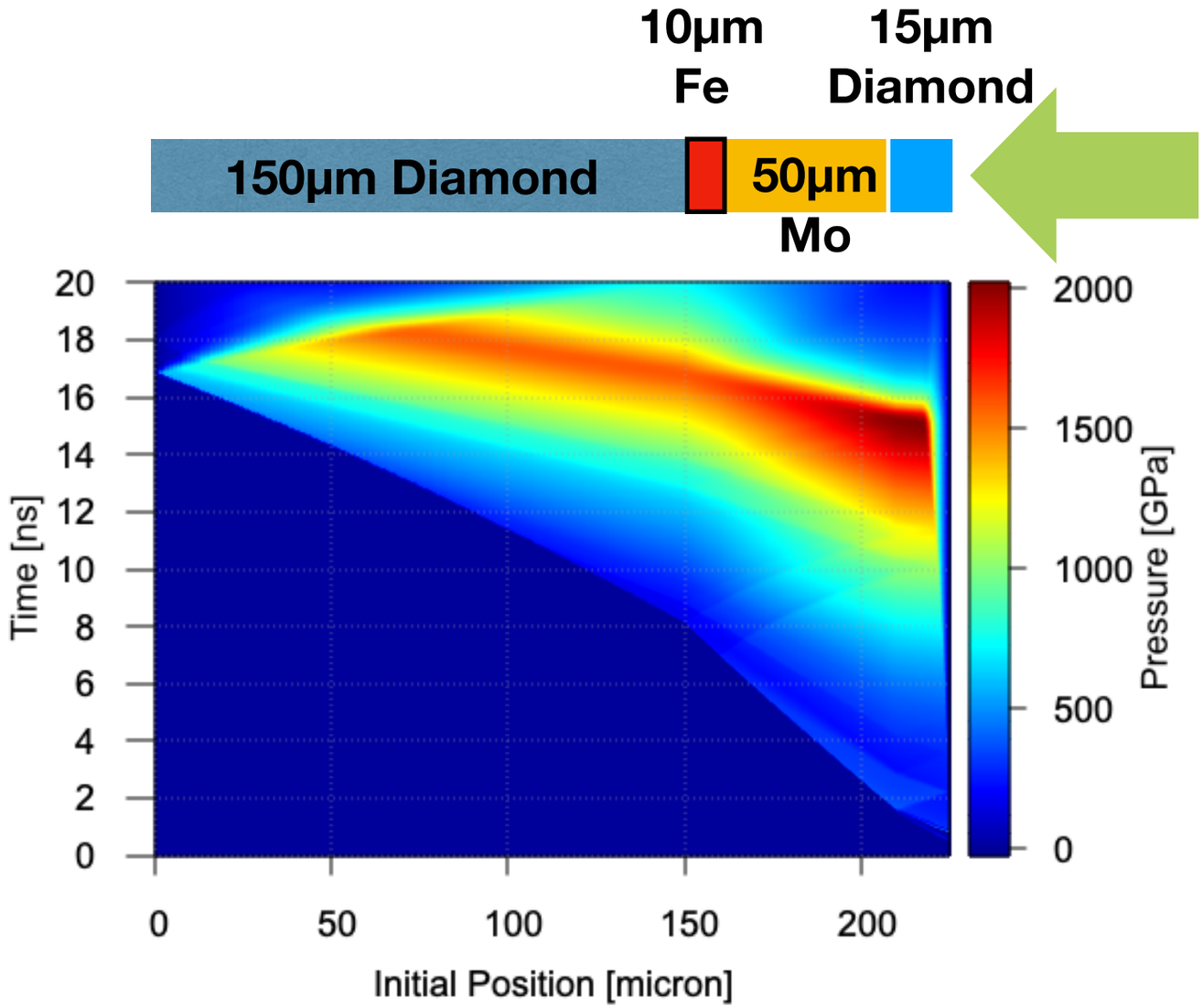
Contraints

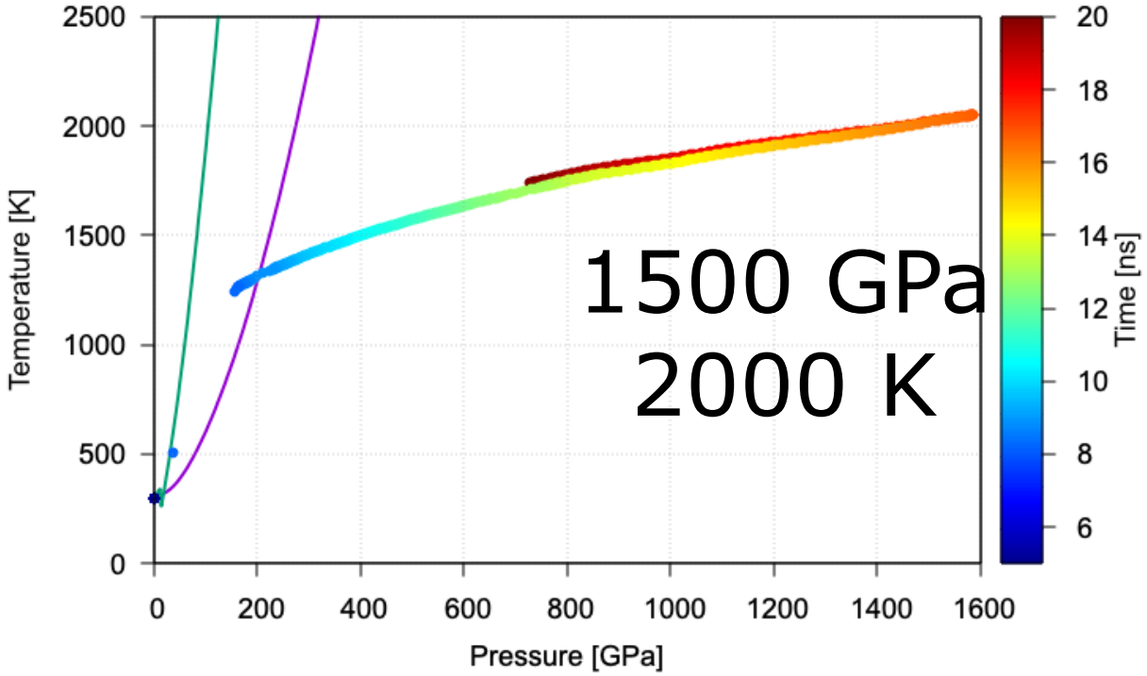
Volume accessible by target (box)
Pointing of LMJ
Center of mass
VISAR pointing



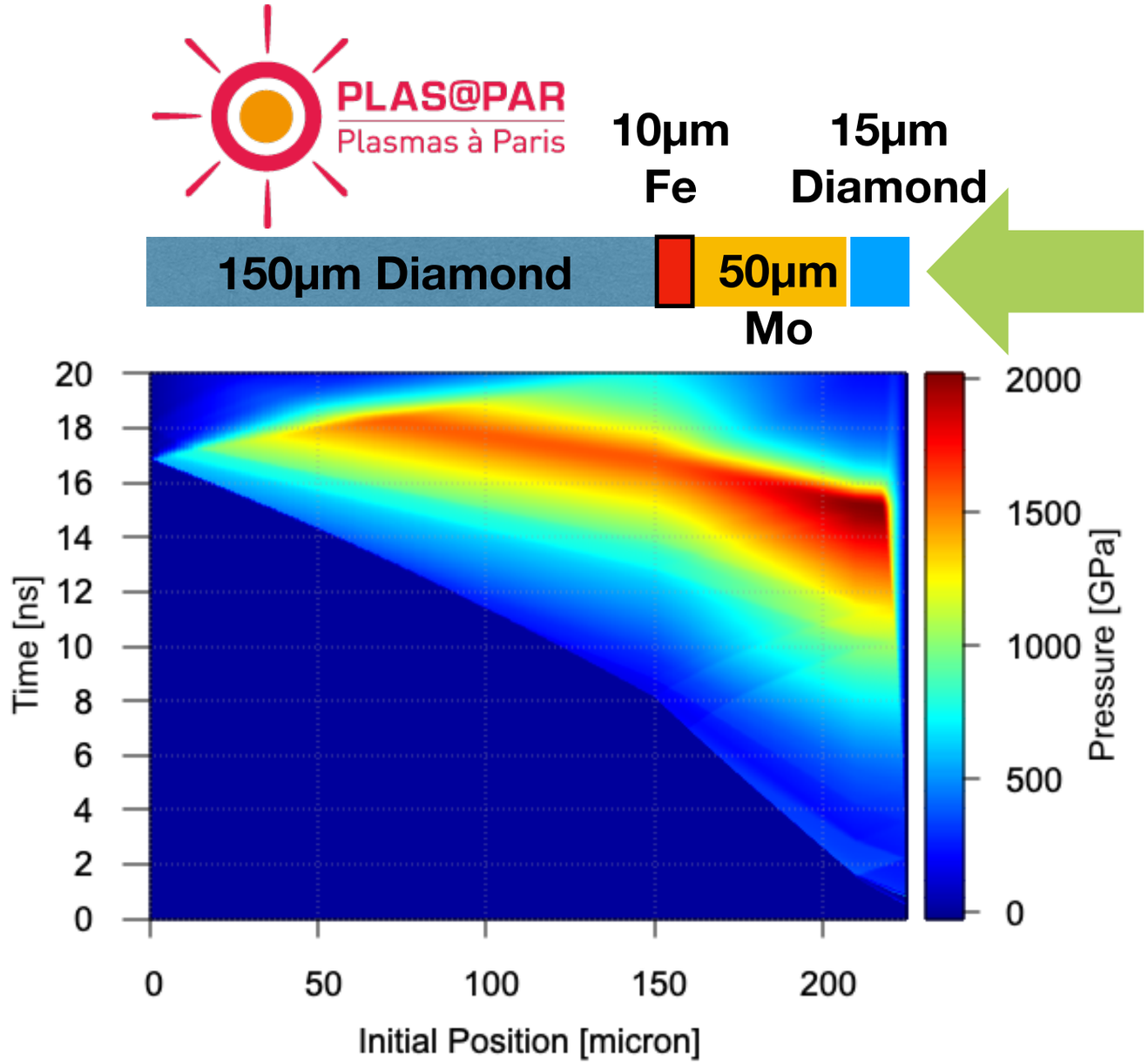


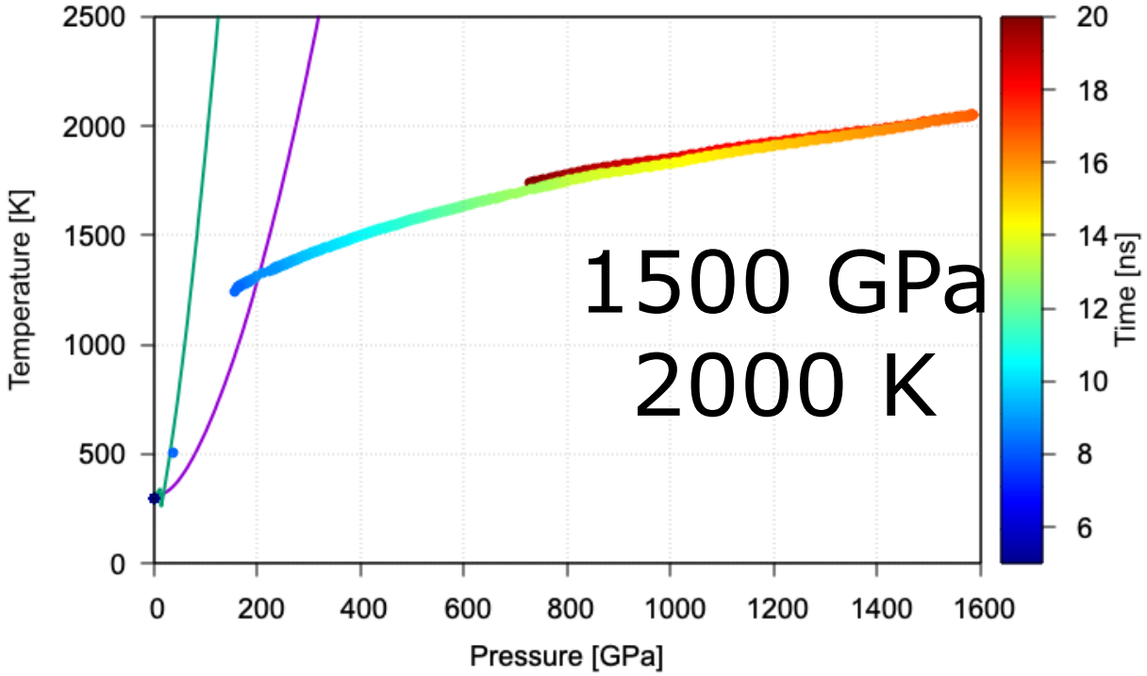
Achievable conditions





Achievable conditions





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