

Fusion yield

MJ

3.2

3.0

2.8

2.6

2.4

2.2

2.0

1.8

1.6

1.4

1.2

1.0

0.8

0.6

0.4

0.2

0

The Road to Ignition

On 5 December 2022, the National Ignition Facility (NIF) of the Lawrence Livermore National Laboratory (LLNL), USA, demonstrated fusion ignition for the first time. Here we look at key events at NIF leading to ignition. For more on the optics behind laser fusion, see p. 18.

NIF

MAY 1997

NIF groundbreaking ceremony

OCTOBER 2001

First laser light created

MAY 2003

NIF produces **10.4 kJ** of UV light in a single laser beam, setting a world record for laser performance

DECEMBER 2008

All 192 target chamber final optics installed

MARCH 2009

1.1 MJ of UV energy fired to target chamber center

SUMMER 2009

192-beam experimental shots to target chamber center begin

SEPTEMBER 2010

First integrated ignition experiment performed

JULY 2012

>1.8 MJ of UV energy and 500 trillion watts of peak power delivered to target chamber center

SEPTEMBER 2013

NIF implosion yields more energy than the energy absorbed by the fuel, a key step on the path to ignition

JANUARY 2014

NIF experiment produces **27 kJ** of fusion energy, more than half of yield attributed to alpha heating

MAY 2018

NIF lasers fire **2.15 MJ** of energy into the target chamber, setting a new energy record

5 DECEMBER 2022

NIF demonstrates fusion ignition, producing **3.15 MJ** of energy from a 2.05 MJ input of laser light for an energy gain of **~1.5**

8 AUGUST 2021

NIF experiment yields world's first burning plasma, estimated to be **70%** of the laser input energy

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

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