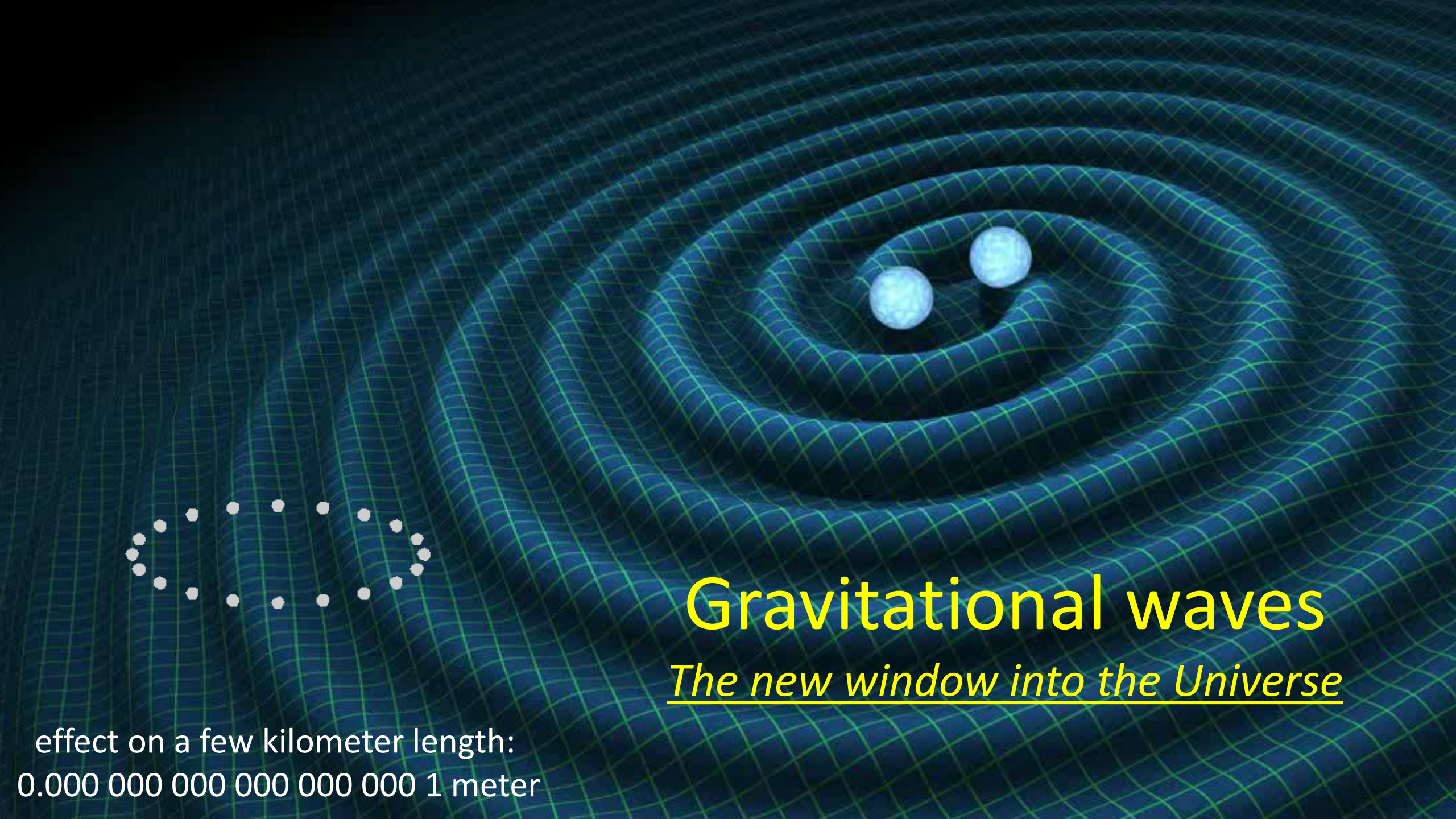


**Einstein**  
**Telescope**  
**/ NL / BE / DE /**

**ET-Challenges**  
**@BigScience.nl -**  
**Industriemiddag**  
**14 oktober 2024**  
**Welcome!**





# Gravitational waves

*The new window into the Universe*

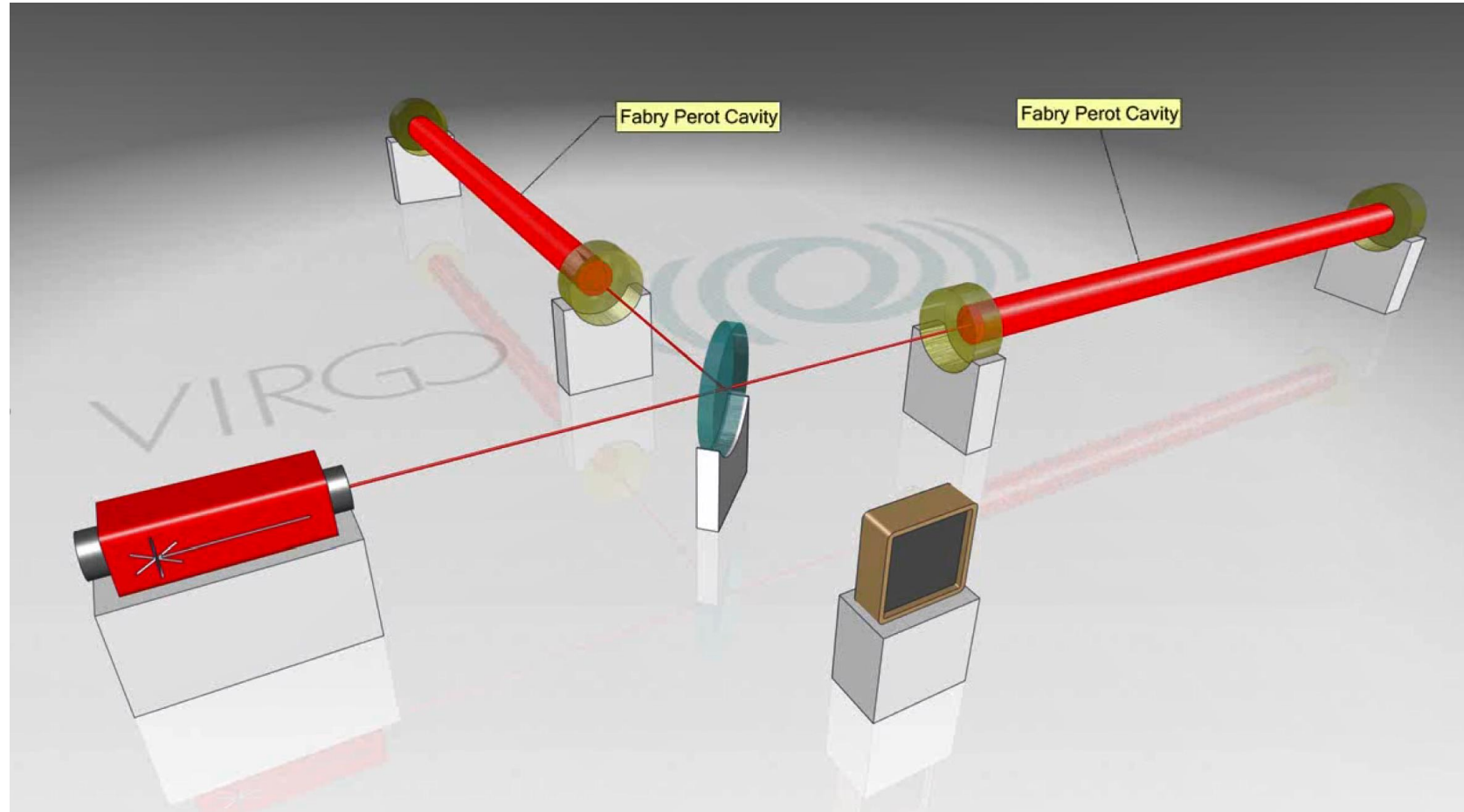
effect on a few kilometer length:

0.000 000 000 000 000 000 1 meter





# Detection principle: Laser interferometer [2]

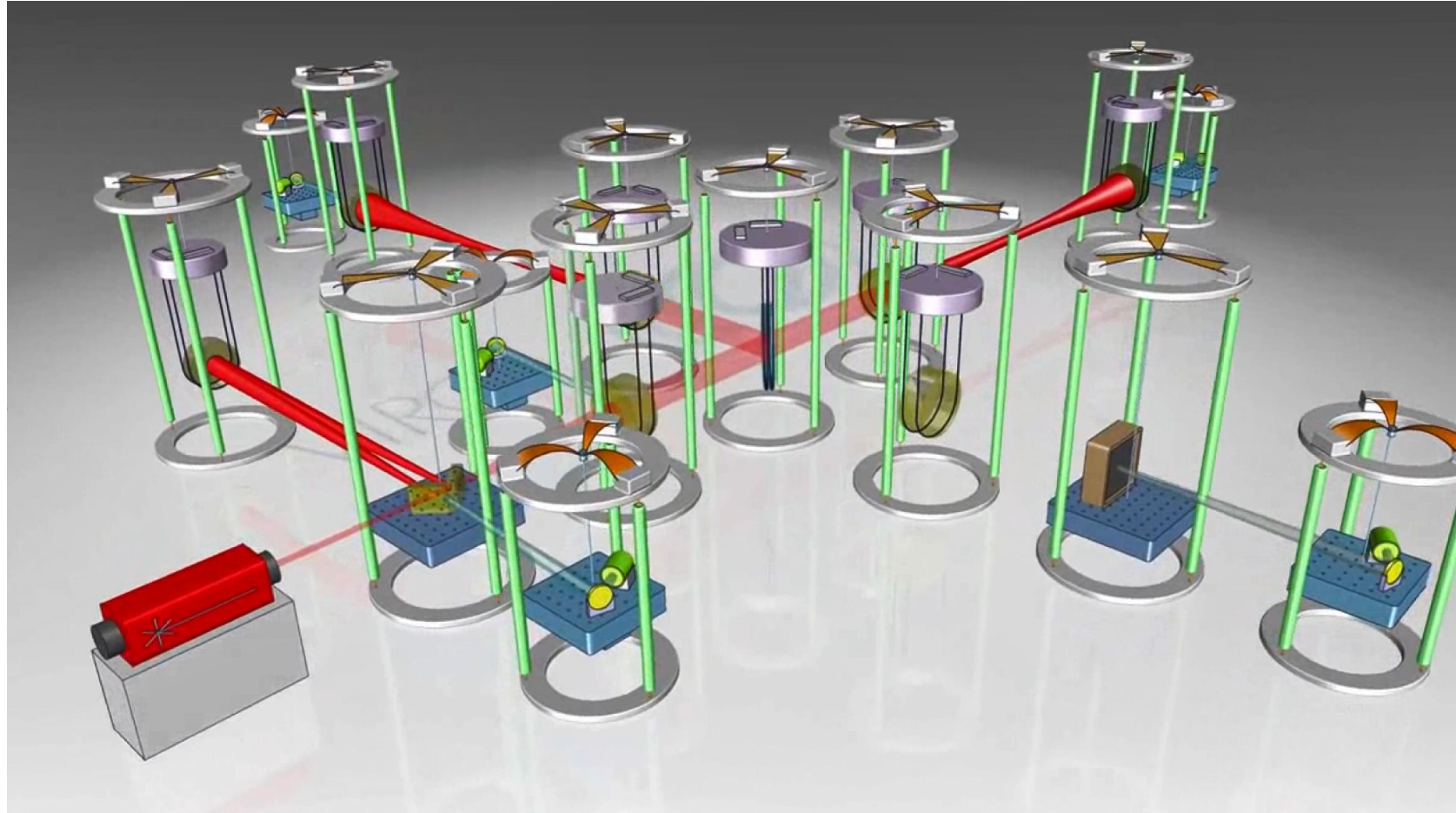


Basic Fabry Perot Interferometer set-up;

Challenge:  
Everything is vibrating with the ground



# Detection principle: Laser interferometer [2]



Added:

- diagnostics and beam improvement equipment
- Vibration isolation instruments:
  - Marionette
  - Super Attenuator
- Vacuum surrounding







*Developed since 1990  
few km long arms  
on surface  
at room temperature  
in USA, Europa & Japan*

$\mathcal{O}(100)$  detections/year

### Global network of detectors

- LIGO Livingston, Louisiana, USA
- LIGO Hanford, Washington, USA
- Virgo, Cascina/Pisa, Italy
- Kagra, Toyama/Kamioka mine, Japan

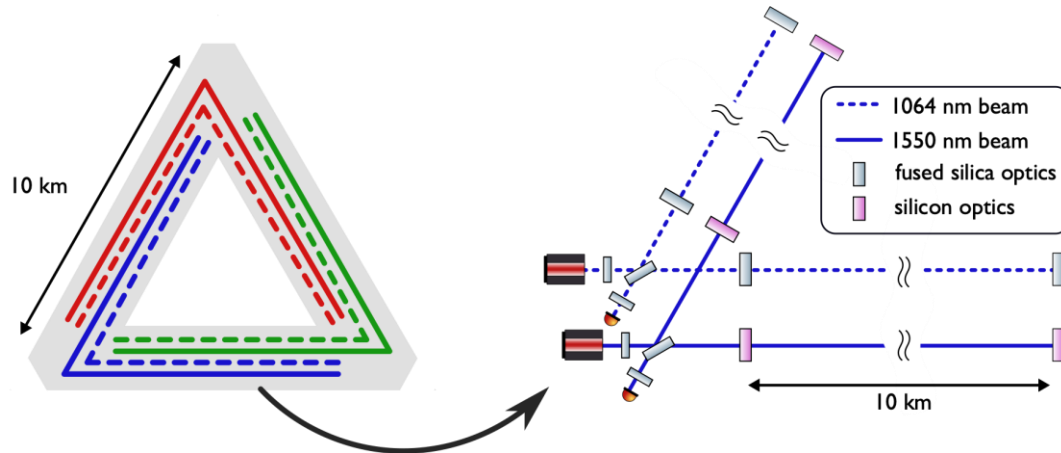
Michelson laser interferometers with km-scale arms, power enhancement with optical resonators

Joint observation runs and data-sharing





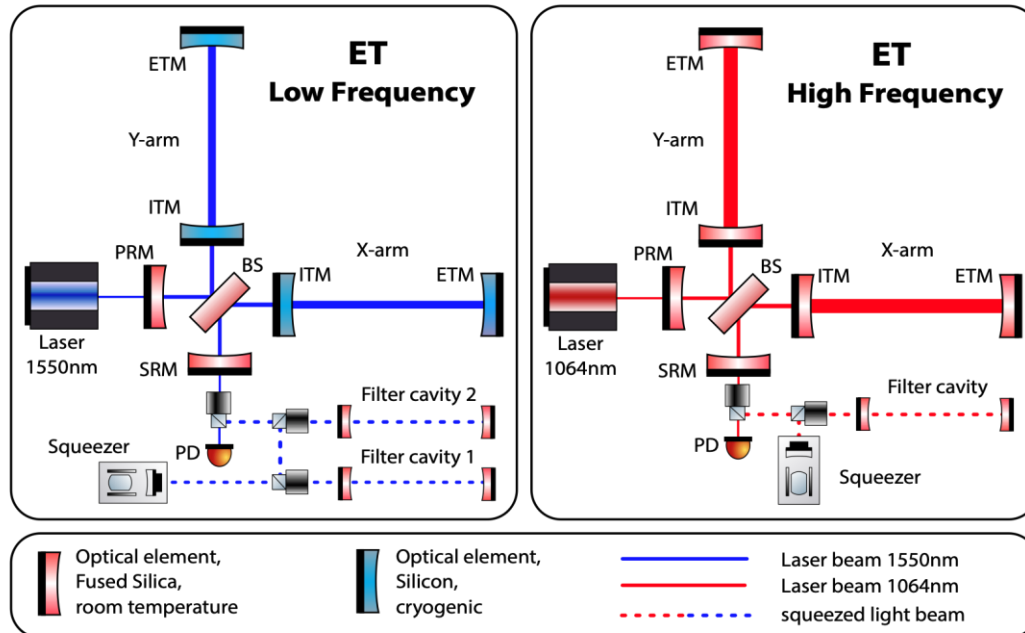
# Next generation GW detectors



**ET goal: 1000 x better**  
 =  $\sim 1/\text{week}$   $\rightarrow$   $\sim 100/\text{day}$  detections

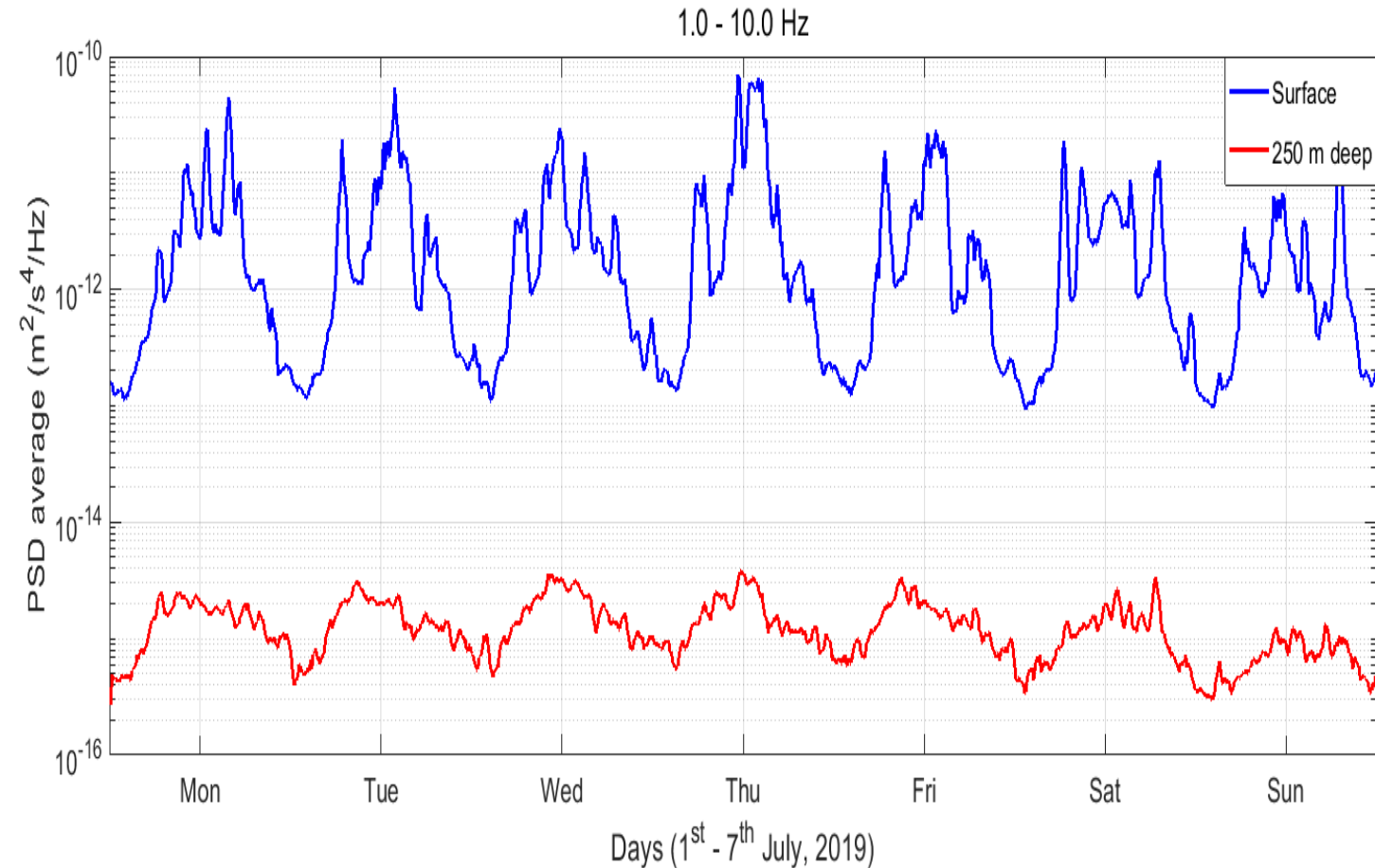
Improvements:

- Longer arms = 10 km
- Reduce noise better:
  - underground,
  - vibration reduction
  - cooled mirror (20 K)
- New mirrors, laser
- Better sensors

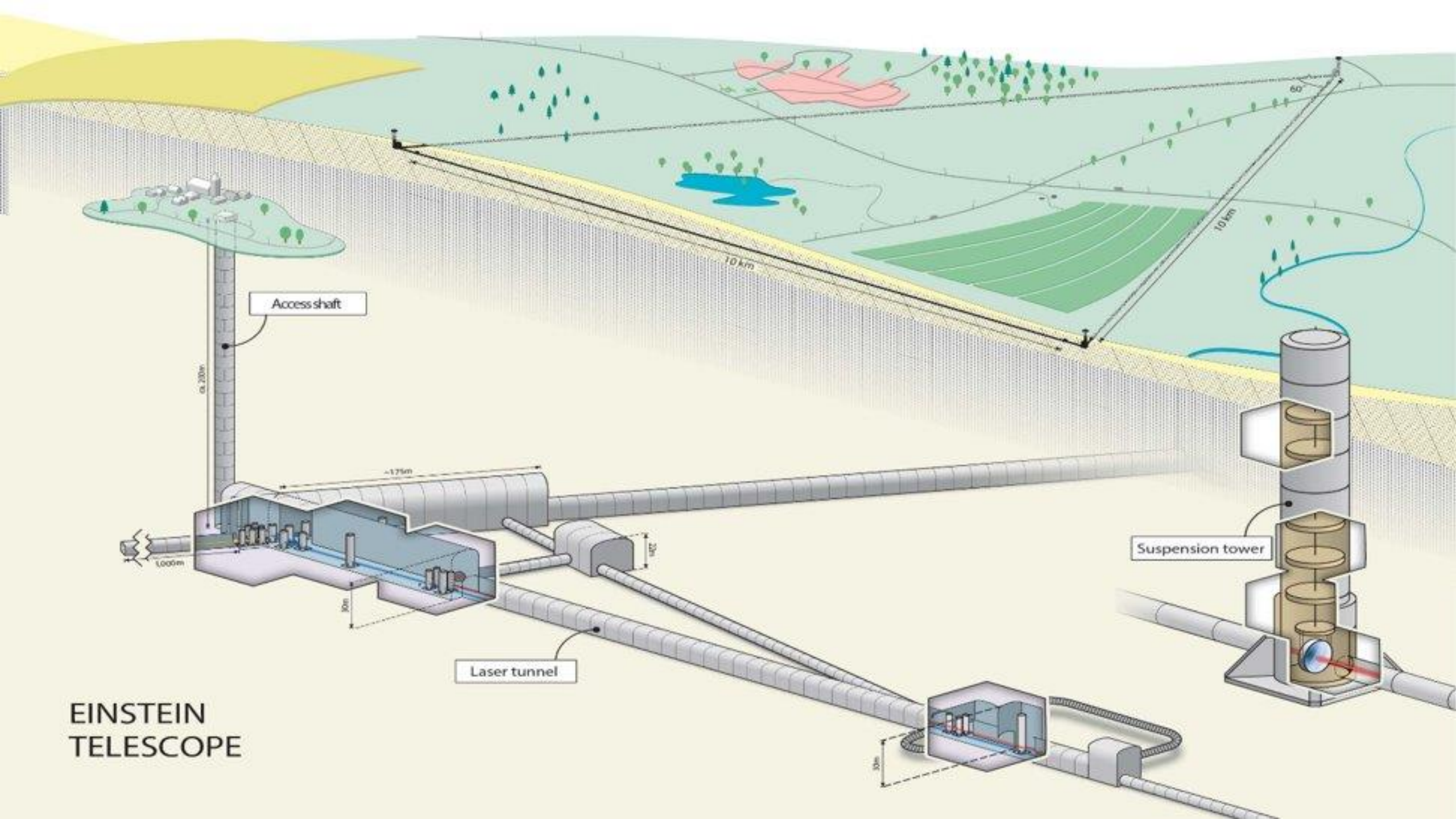


# Under(-)ground

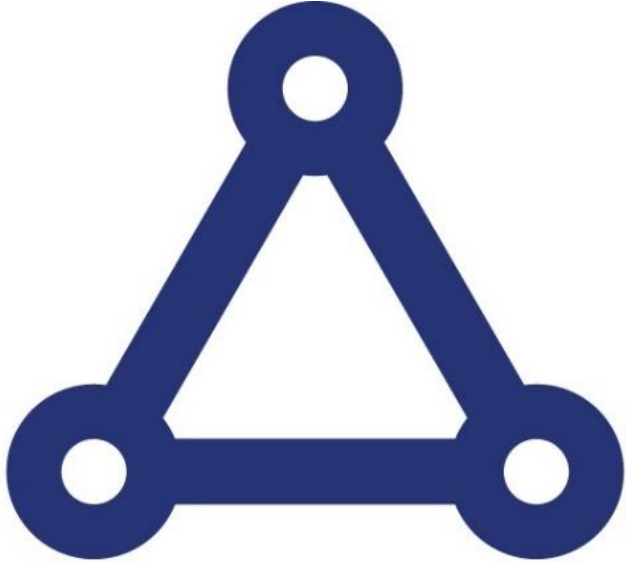
- Considerable noise reduction shown in boreholes in Limburg







# EINSTEIN TELESCOPE



**Einstein**  
**Telescope**

The logo for the Einstein Telescope, featuring a blue triangle with three circular nodes at its vertices, connected by thick blue lines. Below the triangle, the word "Einstein" is written in a bold, blue, sans-serif font, underlined. Below that, the word "Telescope" is written in the same font, also underlined.



# Nationaal Groeifonds (NGF)

Decision in June 2022

- € 42M preparation
  - € 870M reservation
- € 19M – Valorisation  
 € 18M – Geology  
 € 5M – Project office

## Partners NGF-project



Regionale ontwikkelingsmaatschappijen NL

## Onderzoek, ontwikkeling en Innovatie

| High-tech en Materialen                               |            |
|---|------------|
| De revolutie van de zelfdenkende moleculaire systemen | 97         |
| Duurzame MaterialenNL                                 | 228        |
| Einstein Telescope                                    | 42 & (870) |
| NYTGEN HIGHTECH                                       | 450        |
| Photondelta   | 471        |
| Landbouw, voedsel en land- en watergebruik            |            |
| Cellulaire agricultuur                                | 60         |
| CropXR  | 43         |
| Groeiplan Watertechnologie                            | (135)      |
| NL2120, het groene verdienvermogen van Nederland      | (110)      |
| Werklandschappen van de toekomst                      | (26)       |
| Life Sciences & Health                                |            |
| Biotech Booster                                       | 246        |
| Oncode-PACT   | 325        |
| PharmaNL  | 80         |
| Energie en duurzame ontwikkeling                      |            |
| Toekomstbestendige leefomgeving                       | (100)      |
| Groenvermogen II                                      | 500        |
| Nieuwe Warmte Nu!                                     | 200        |
| Mobiliteit  |            |
| Digitaal Ecosysteem Mobiliteit en Smart City          | (85)       |
| Digitale Infrastructuur en Logistiek                  | 51         |
| Luchtvaart in Transitie                               | 383        |
| Zero-emissie binnenvaart batterij-elektrisch          | 50         |

## Het Nationaal Groeifonds

### Resultaten tweede ronde

## Kennisontwikkeling

| Onderwijs   |     |
|---|-----|
| Digitaal Onderwijs Goed Geregeld                                | 5   |
| Digitaliseringsimpuls onderwijs NL                              | 5   |
| Impuls Open Leermateriaal                                       | 1   |
| Ontwikkelkracht   | 33  |
| Leven Lang Ontwikkelen  |     |
| Collectief laagopgeleiden en laaggeletterden                    | 51  |
| Nationale LLO Katalysator                                       | 392 |
| Opschaling publiek private samenwerking in het beroepsonderwijs | 210 |

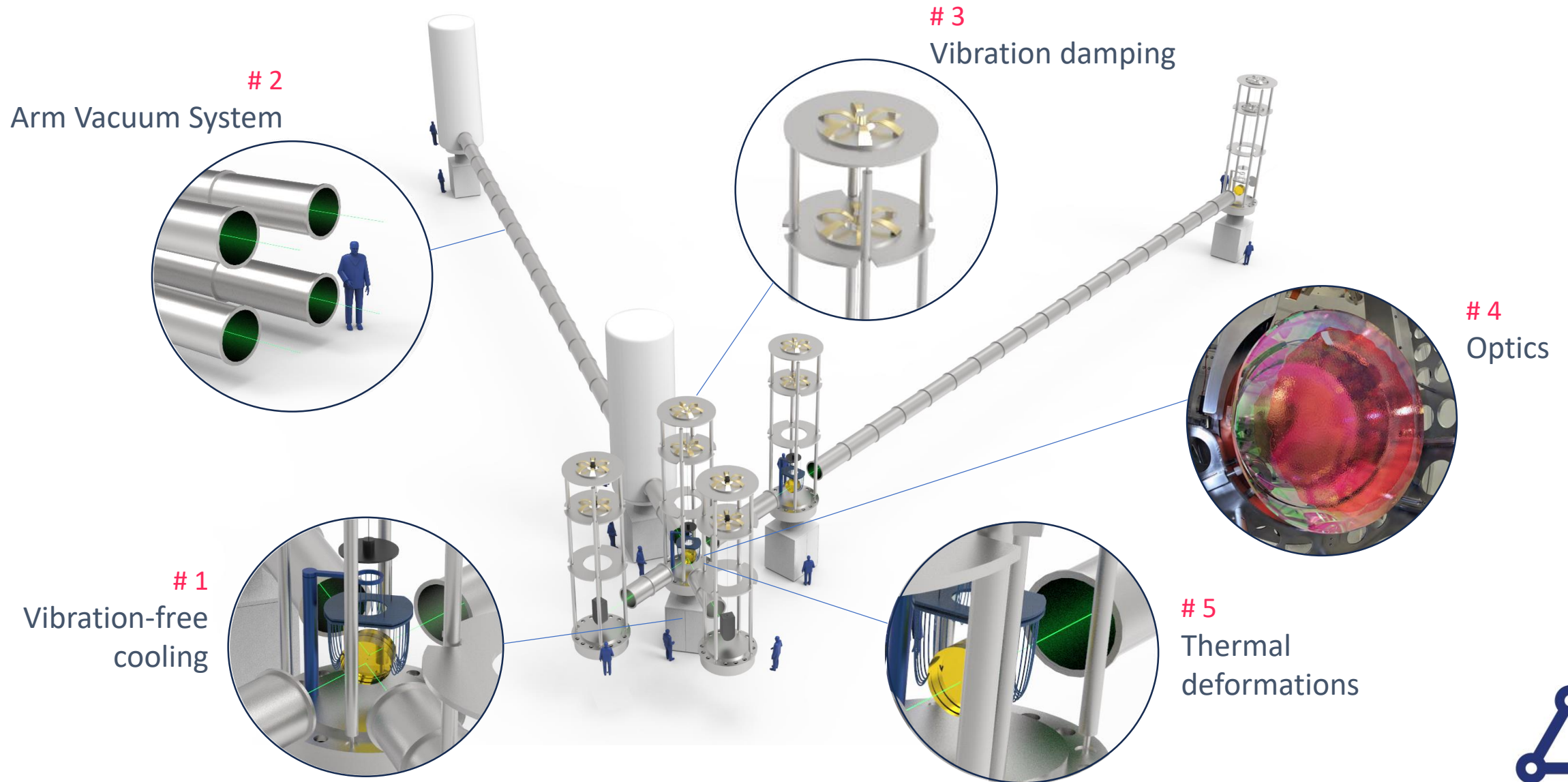
Totaal € 1.657 mln

## Infrastructuur

|                           |                 |
|---------------------------|-----------------|
| Rail Gent-Terneuzen       | 105             |
| Totaal                    | € 105 mln       |
| Toegekend:                | € 1.317 miljoen |
| Voorwaardelijk toegekend: | € 3.663 miljoen |
| Gereserveerd:             |                 |

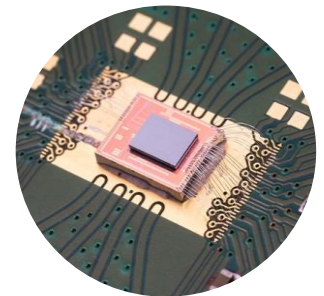
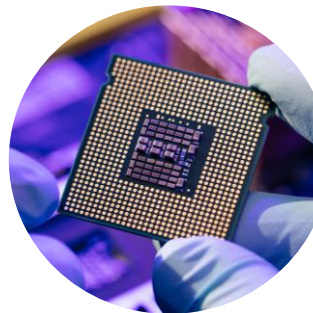
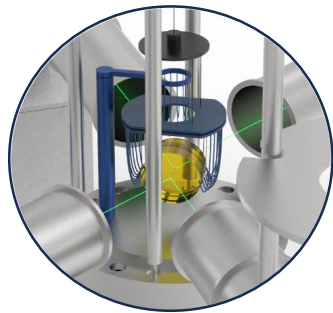
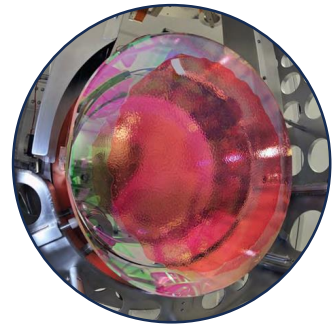
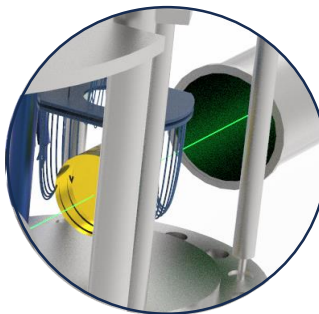
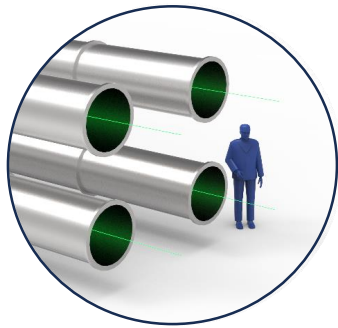
(100) : bedrag tussen haakjes = reservering

# Visual representation of the five technology domains

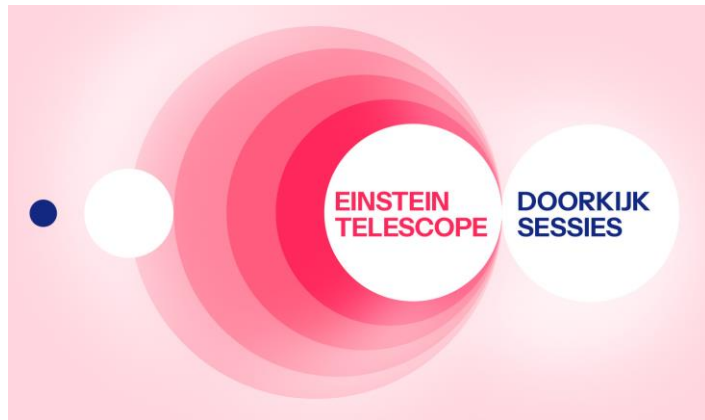




# Valorisation: technology to market



# ET-NGF R&D calls



| Domain                         | Status               | Call                     |
|--------------------------------|----------------------|--------------------------|
| 1: Vibration free cryo cooling | Started January 2024 |                          |
| 2: Vacuüm                      | Call tekst defined   | October - November       |
| 3: Trillingsdemping            | Started summer 2024  | April 8 – May 31         |
| 4: Optics                      | Decision October     | June 24 – September 12   |
| 5: Thermal deformations        | Decision November    | September 2 – October 17 |





# Support needed?



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Regio Limburg en overige regio's

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