



Upgrade of the LMA infrastructure and progresses for ET mirrors in Lyon

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XIII Einstein Telescope Symposium

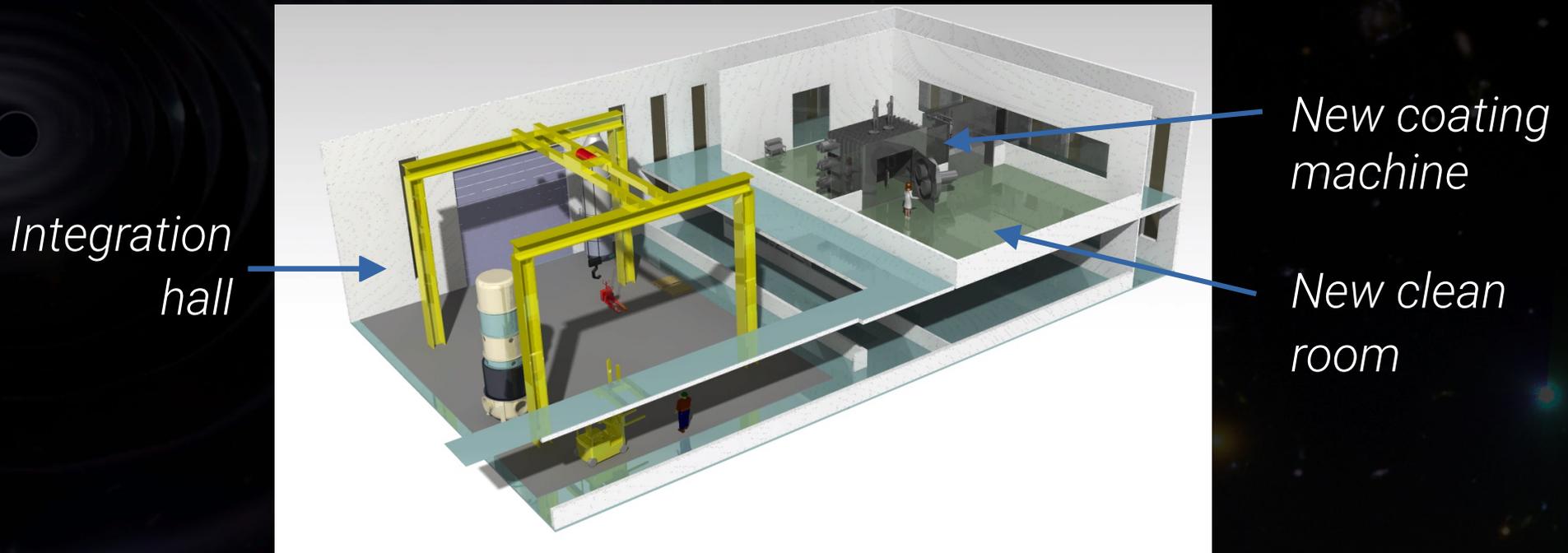
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News from LMA

A new very large coating machine...

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- to meet ET and CE specifications in term of size / weight
- still able to coat 2 mirrors at the same time
- chamber size: $3.5 \times 3.5 \times 2.5 \text{ m}^3$ for amorphous IBS coating



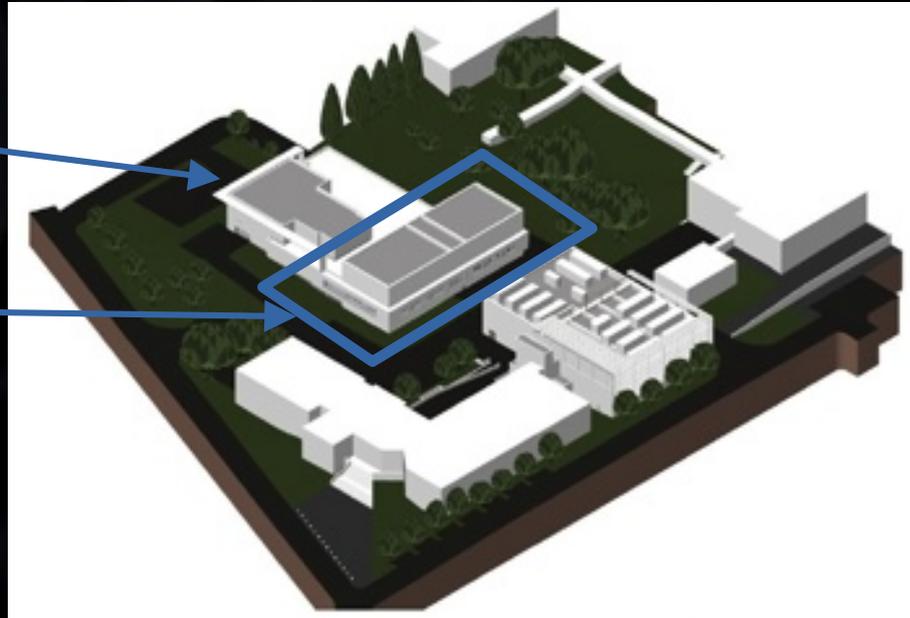
... inside a new building



- machine to be hosted in a new building linked to the current LMA clean room
- available budget: 12 M€
- expected completion: end of 2026

Existing LMA building

Extension



Fundings from state and local areas



Anticipating heavier mirrors

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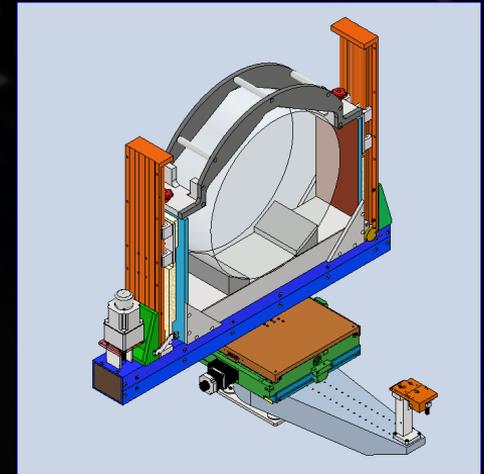
- upgraded the handling, cleaning, annealing tools to handle 100 kg mirrors for Advanced Virgo+
- an intermediate step before the 200 kg mirrors for ET



*Mobile crane
for the clean room*



*Lifting a 100 kg
piece of glass*



*New mounts
for the metrology*

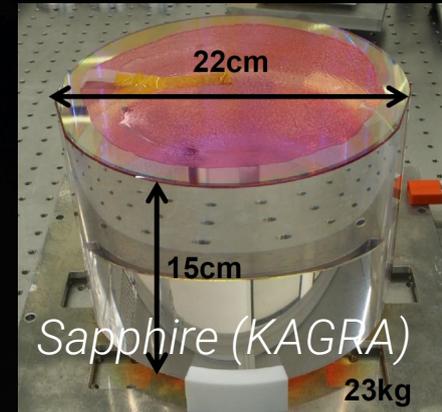
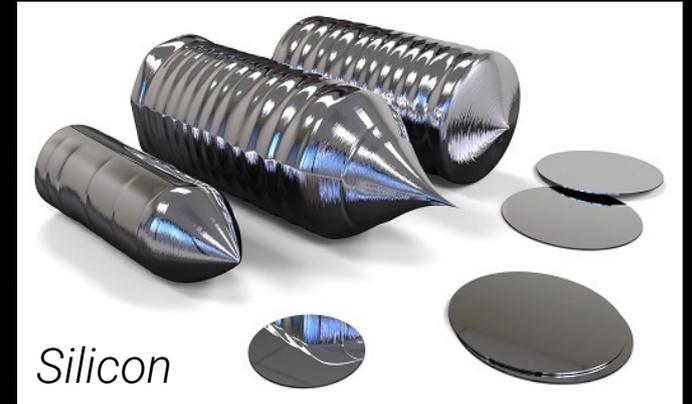
II

Beyond the coating: substrate growth and polishing

The cryogenic substrates



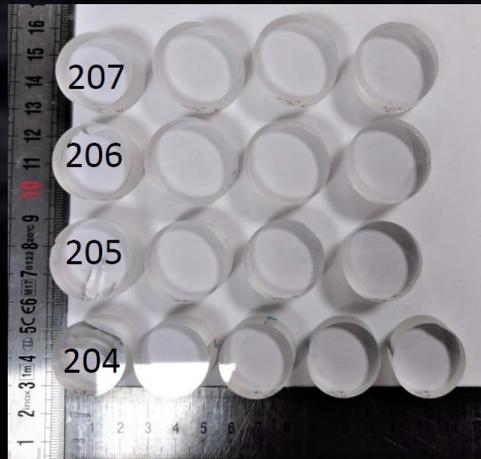
- 2 crystalline candidates
 - ▶ silicon
 - ▶ sapphire
- Very difficult to find large ingots with the required optical properties
- Some interesting properties of sapphire
 - ▶ transparent at 1064 nm
 - ▶ 1.7× denser than silicon
 - ▶ Young's modulus 2.7× higher



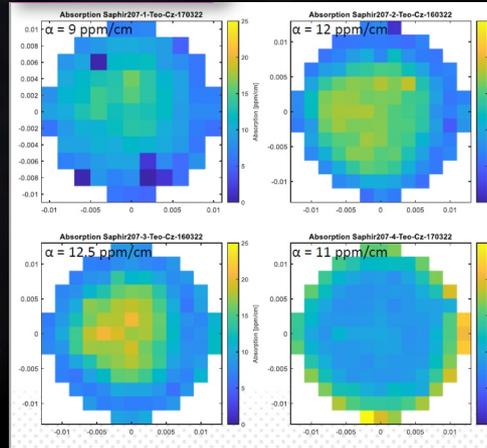
Results on smaller parts



- validating the starting raw material and growth parameters
- absorption < 20 ppm / cm consistently achieved (@1064 nm)
- started to measure the birefringence
- demonstrated fiber production



\varnothing 30 mm ingot cut
in 4 parts



Absorption maps



Monocrystalline
sapphire fibers

New horizons on Lyon's site

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Illustration

Substrate



Coating machine

New polishing equipments (compatible all substrate materials)



mechanical
ion beam figuring



*7 axis polishing robot for
Ø 400 mm (50 kg).*

*Delivery before
the end of 2023*

*Demonstrator of IBF on small substrates
with a innovative ion source.*

*To be upgraded this year with a larger
chamber and stages*



