Robotic Manipulation for Extreme Environments

Handling what others can’t. From nuclear decommissioning to extreme environments as a whole

GraphiCore

Automation fails in extreme environments

Where it is needed the most

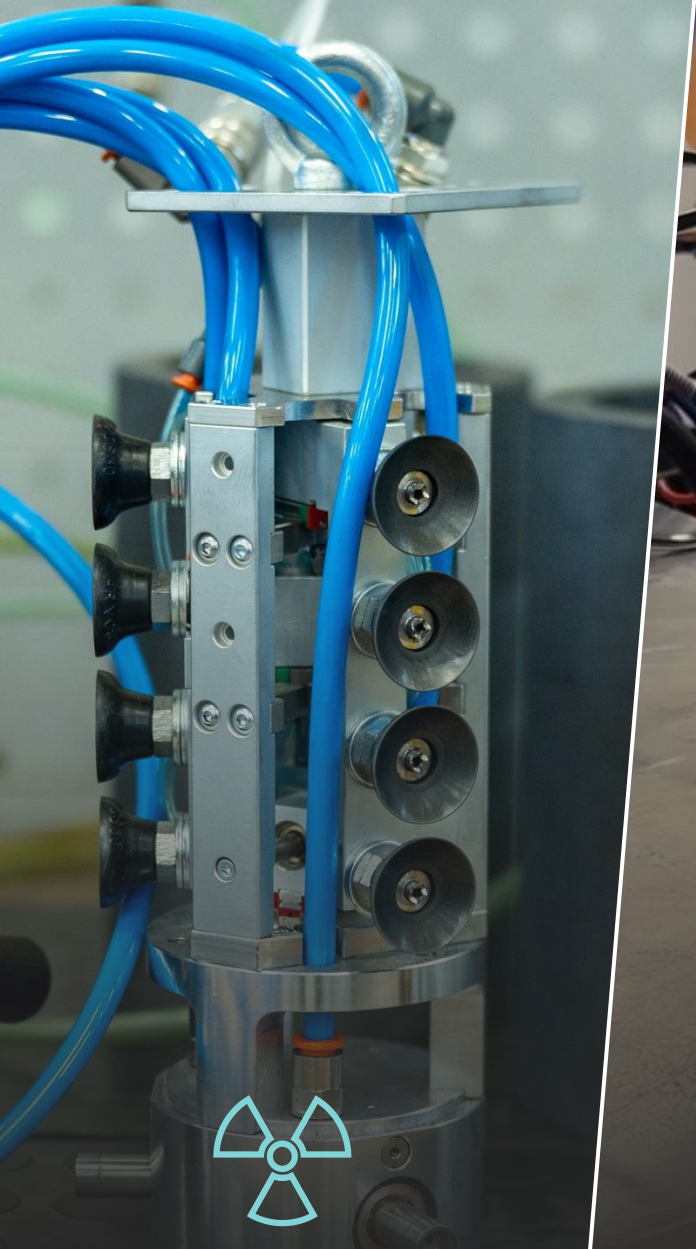
High Temperatures
Cooling cycles → downtime

Fragile Materials
Risk of damaging parts → yield loss

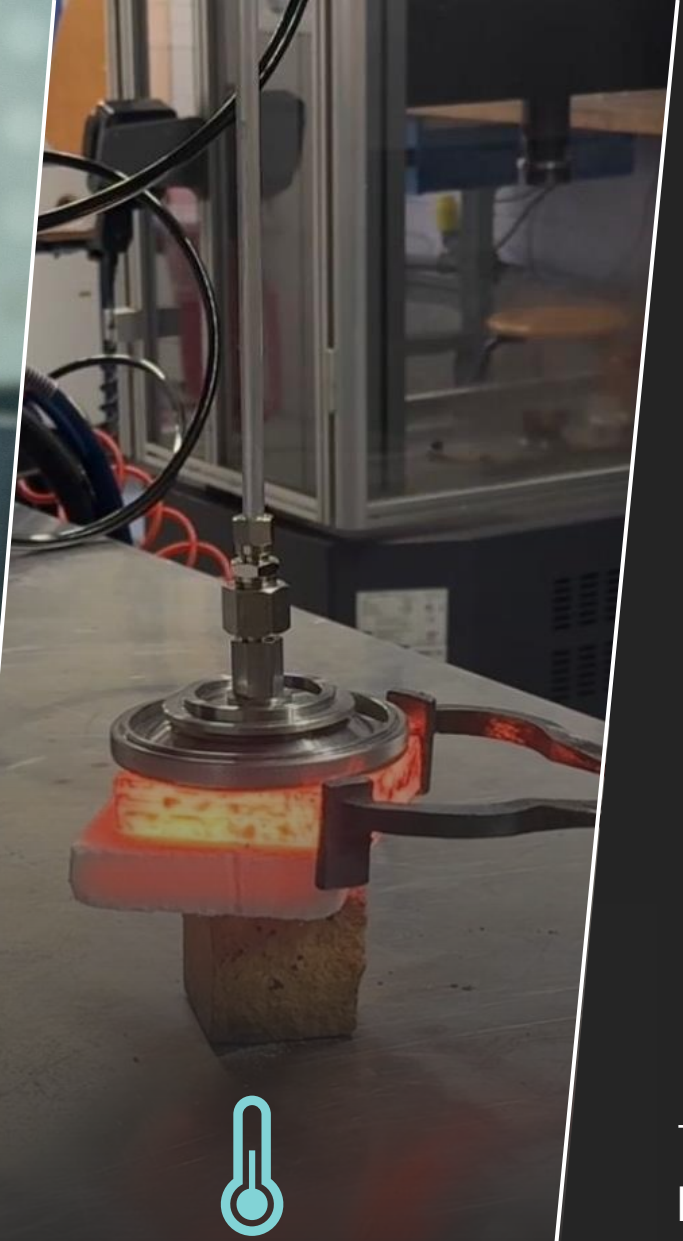
Harsh Conditions
Tasks require manual intervention → unsafe

Radioactive Environment
Remote tasks → operationally complex

Critical industries still heavily rely on outdated handling systems



Graphite Handling
Radioactive, fragile, porous, irregular.



High-Temp Handling
Up to 1400°C with no cooling

A new approach to materials handling

Two proprietary end-effector technologies

Radioactive Graphite handling

- Up to 17x increase in lifting capability
- Full 3D handling of complex geometries
- Validated in nuclear environments

High-Temperature handling

- Stable on rough and irregular surfaces
  No surface damage or contamination
- Enables in-line industrial automation

Platform Architecture

- Soft robotics
- Computer vision
- Tactile sensing (WIP)

Both technologies originate from a shared approach to adaptive, non-invasive, and high-performance manipulation

Growth stage: Currently in the pilot deployment phase followed by commercialization

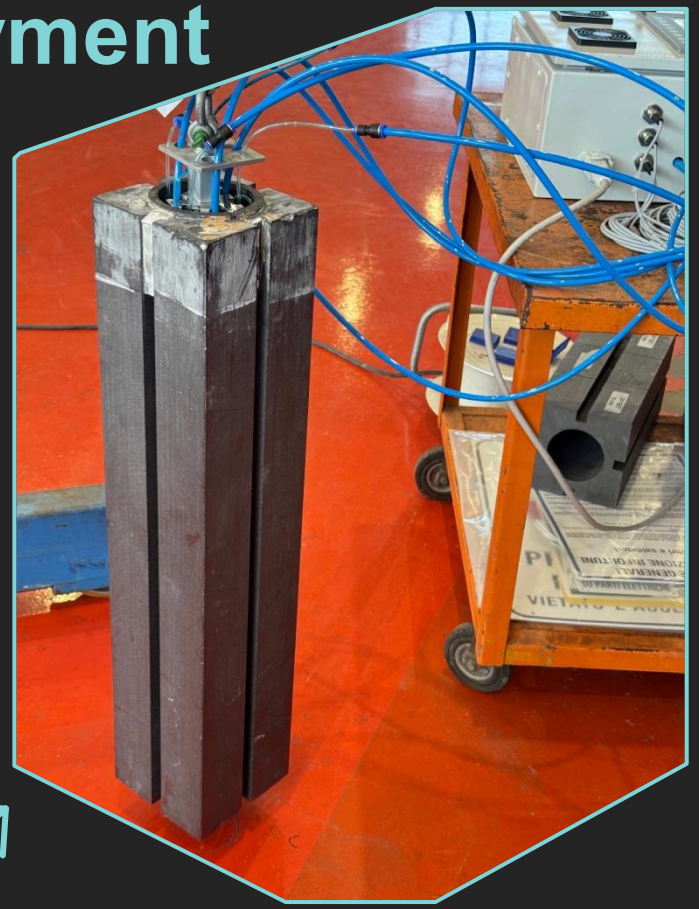
Transitioning from validation to industrial deployment

Company Stage

- Industrial validation completed in nuclear environments
- Expanding toward high-temperature industrial applications
- Moving from prototype validation to pilot

Current Status

- PoCs with industrial partners
- Early customer engagement in UK and EU markets
- Technology scale-up and industrial integration underway



GraphiCore Today

Research
Technology exploration and fundamentals

Validation
Prototypes and tests in relevant environments

Pilot Deployments
PoCs with industrial partners and real-world validation

Commercialization
Industrial rollout and scale-up

Note: photo taken at the Latina nuclear power plant tests with the graphite handling end-effector

Significant results and traction metrics have been gathered before even a year of operations

Currently focusing on delivering PoCs in different sectors and improving the tech in parallel

TRL Milestones

- TRL 7 for nuclear graphite dismantling
- TRL 5 for extreme environments
- Computer vision algorithm validated

- 2026 will be focused on testing the nuclear tech on real environments and build confidence with our potential clients
- On the ExEn side GC will continue the developments to increase TRL and start commercialization

PoCs & Partners

SOGIN

createc

TheiaSense
Sensorize the space

FWR

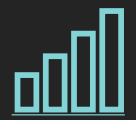
MANCHESTER 1824

itg
Insul.Tecno Group

METAL WORK
SERVICE

gr²
GRAPHOIDAL RADDON RONDOT

Performance Proof Points



Safety Factor
>6

Highest reached for nuclear graphite

Maximum Payload
>175 Kg

Enables multiple graphite bricks lifting

Lifting Capability
>1.3 t/m²

Closing the gaps with magnetic lifting

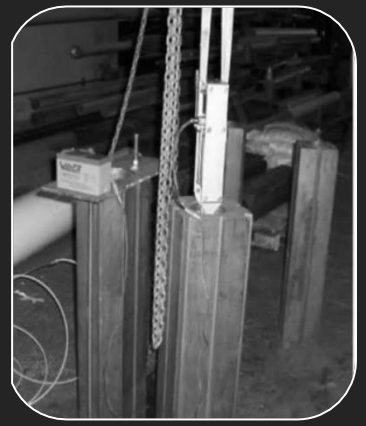
Max Temperatures
>1400°C

More than 2x the previous industrial limit for vacuum systems

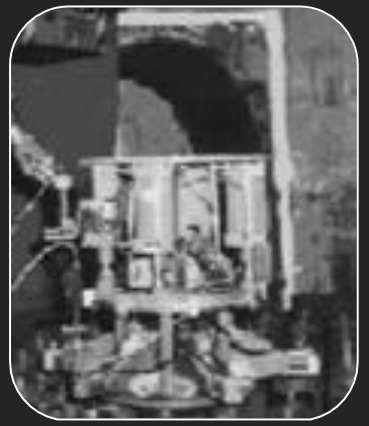
Previous attempts to lift graphite bricks have either failed to scale or were not satisfactory

Resulting in a growing global stockpile of irradiated graphite

Hydraulic Splitter



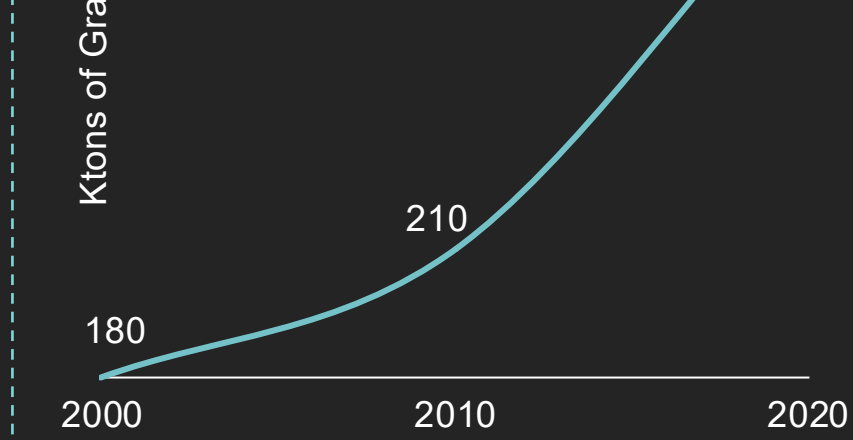
Drill & Tap



Underwater

Remote Excavator

No existing approach achieved safe, scalable, low-damage graphite retrieval



300,000 Tons

Estimated irradiated graphite inventory requiring retrieval and

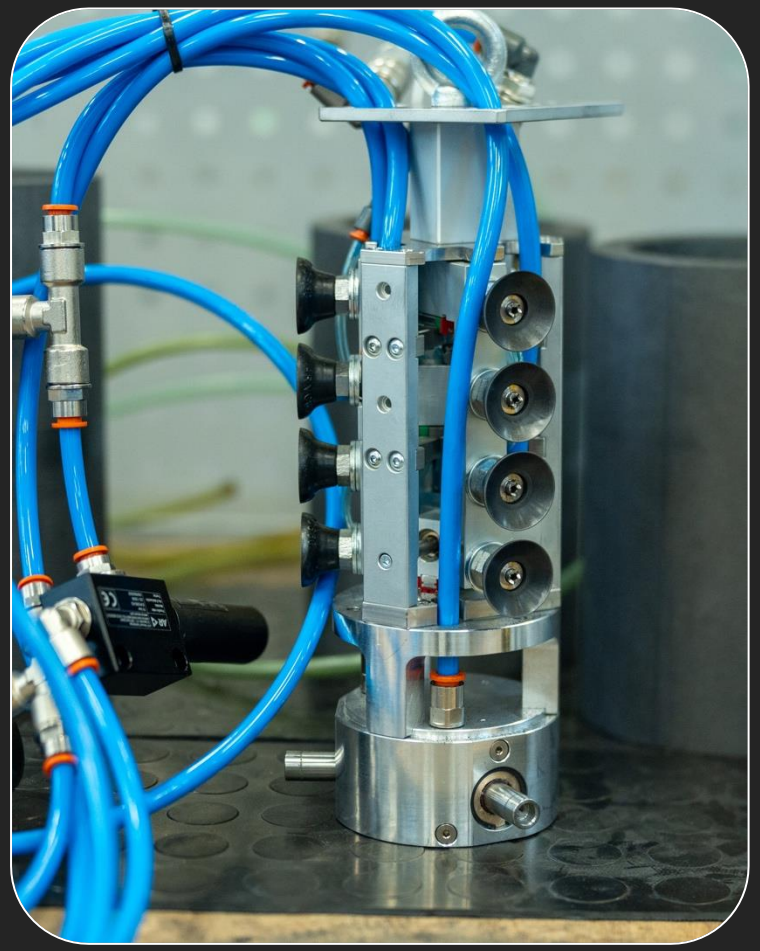
40+

graphite-moderated reactors scheduled for shutdown by 2040

https://www.iaea.org/publications/10978/processing-of-irradiated-graphite-to-meet-acceptance-criteria-for-waste-disposal

GraphiCore's design can outperform all graphite retrieval technologies tested since 1992

Attempted graphite removal technologies and GC's Prototype



	Safety	Operational Simplicity	Speed	Waste Minimization
GraphiCore				
Hydraulic Splitter				
Drill & Tap				
Underwater				
Remote Excavator				

Source: CARBOWASTE Treatment and Disposal of Irradiated Graphite and Other Carbonaceous Waste, European commission

TRL 7 design achieved a safety factor of >6 and can lift broken, scratched, and non-ideal graphite blocks

TRL 7 design test results at Latina Nuclear Power Plant

Lifting Performance

- Lifted ***72.3 kg*** of graphite using 1/5 of the surface
- Safety factor **>6**
- **17x** higher lifting capability

Reliability

- Damaged or broken blocks
- Dusty surface
- Passive safety
- 3D handling

System Advantages

- Minimal graphite damage
- No dust production
- No secondary waste
- 3D Handling

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Our ExEn system delivers reliable high-temperature vacuum gripping for critical industrial applications

TRL 5 validated performance in extreme environments

Up to 1.3 tons/m²

lifting capacity in relevant industrial conditions

Up to 1400°C

operates at temperatures up to 1400°C

Material-agnostic

successfully tested on steel and refractory ceramics (e.g. mullite)

Works on rough & porous surfaces

consistent performance on challenging surfaces

No active cooling

no active cooling or consumable interfaces

TRL 5 – Validated Performance

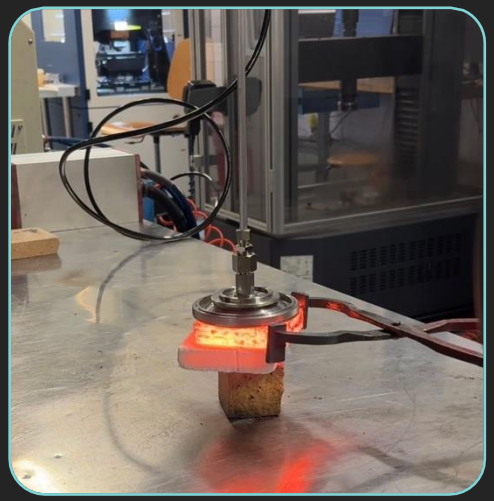
- ✓ Demonstrated high-temperature vacuum gripping on metals and refractories
- ✓ Validated in extreme environments relevant to industrial operations
- ✓ Reliable, robust, and ready for further scaling

Next Steps

Increase lifting capacity to

3 – 5 tons/m²

And validate under thermal and mechanical cycling



High-temp vacuum gripping tests

Thermal image during operations

Our technology fills a gap in high-temperature material handling, with high lifting performance at over 1400°C

Overview of material handling technologies

	Temperature (°C)	Geometry Adaptability	Lifting Performance	Material Compatibility	Surface Damage Risk
GraphiCore	>1400			Surface-dependent	
Mechanical Grippers	<800			Damage-dependent	
Magnets	<700			Ferrous only	
Suction Cup	<600			Surface-dependent	
Soft Robotics	<200			Broad compatibility	
Sponge Vacuum	<100			Surface-dependent	

Concept designs currently in development and with patent pending

Overview of high-temperature handling

Concept Design		Pros/Cons	KPIs to Test
Vacuum-based System Suction cup design **TRL 5**		✓ High grip ✓ Ideal for repeatable geometries x Poor seal on rough or porous surfaces	• Max grip force • Failure rate after 500+ hot cycles • Material degradation (dose tolerance)
Mechanical Gripper Soft, adaptable tweezers with tactile sensing **TRL 3**		✓ Highest payload potential ✓ Conforms to complex shapes ✓ Force feedback option x Not suitable for flat geometries	• Grip adaptability on irregular shapes • Surface damage after repeated use • Thermal resistance of tips

Next-gen glass manufacturing

Grip, lift and precisely position glass at extreme temperatures.

Defect-free handling

No marking, contamination, or thermal shock.

High-temp Operations

1400°C. No cooling. No consumables.

Better yield

Soft, contact reduces chipping and micro-cracks

Drop-in automation

Integrates with existing robotic lines

In-line maintenance of ovens

Replace, reposition and inspect refractory components without shutting down the

No Shutdowns

Maintain production continuity

Up to 1400°C

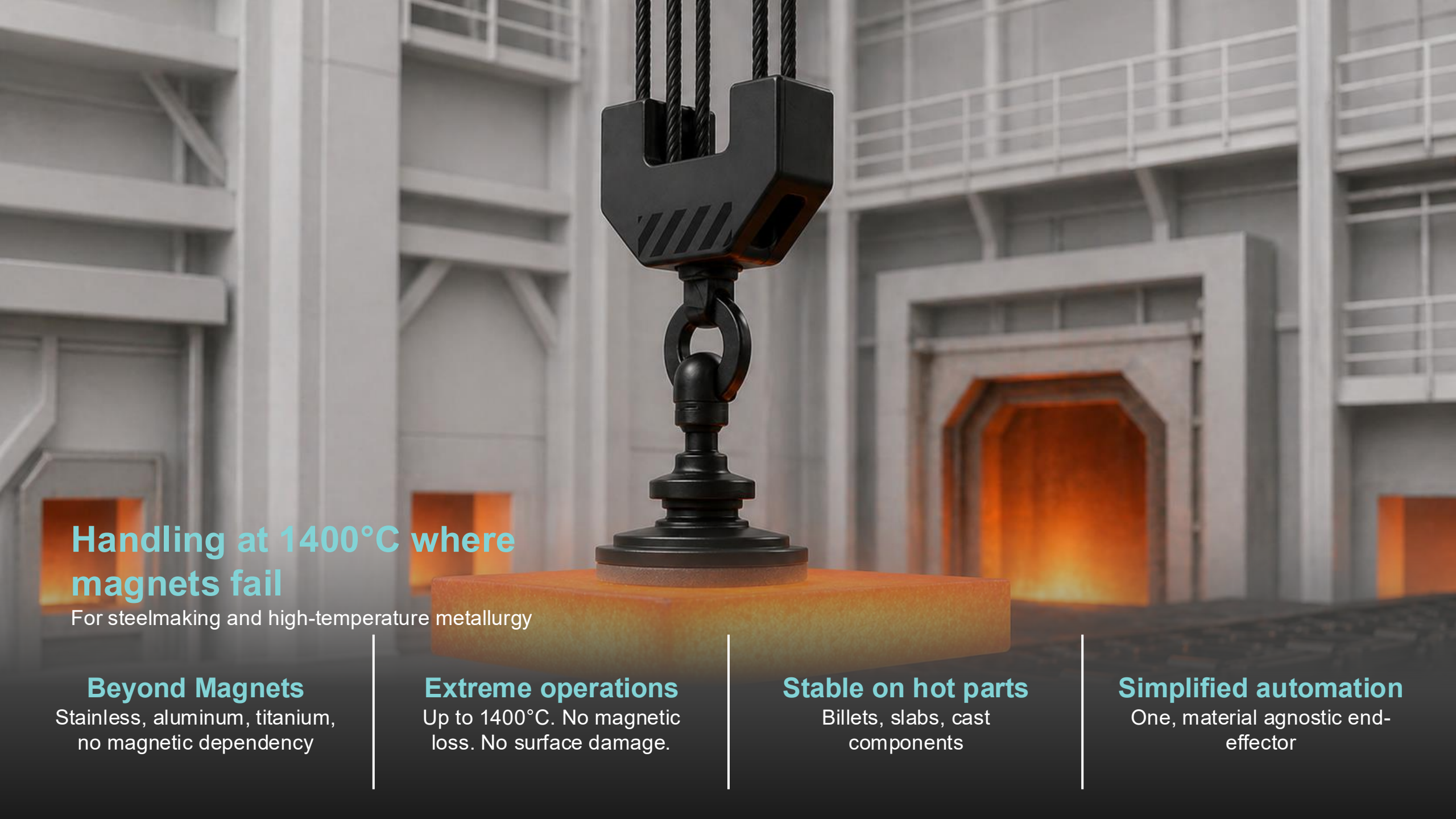
Operate directly inside the oven

Safe and Reliable

Secure grip even in extreme conditions

Lower Costs

Reduce downtime and thermal cycling damage



Handling at 1400°C where magnets fail

For steelmaking and high-temperature metallurgy

Beyond Magnets

Stainless, aluminum, titanium, no magnetic dependency

Extreme operations

Up to 1400°C. No magnetic loss. No surface damage.

Stable on hot parts

Billets, slabs, cast components

Simplified automation

One, material agnostic end-effector

Fragile parts handling

For 3D printing and advanced manufacturing

Damage-free Contact

Adaptive and soft grippers reduce chipping and damage of green parts

Increased Output

Parts can be handled while hot reducing downtime

Enable automation

Reliable pick-and-place of fragile parts

Tactile Perception

First high-temp gripper with sensing

We built a highly competent team of professionals and advisors capable of facing the challenges ahead

Dr. Riccardo Chebac
CEO

- Ph.D. in Nuclear Engineering on graphite decommissioning and waste management
- 5+ years of industry experience with WSP, OECD-NEA RWMD
- Researcher at Polimi and UC Berkeley

Fabio Vanoni
CTO

- Research fellow at Politecnico di Milano
- 5+ years of research experience in graphite
- M.Sc. in Nuclear Engineering @ Politecnico di Milano

Jonathan Giovannacci
CFO

- 5+ years of industry and strategy consulting experience with PWC, IAEA, OECD-NEA RWMD
- M.Sc. @ UC Berkeley

Founding team

Giorgio Guidi
Business & Market Analyst

- M.Sc. student in Nuclear Engineering @ Politecnico di Milano
- Supporting market analysis and business development for extreme environment sector

Advisory Board

Prof. Marco Enrico Ricotti Ex-President @ Sogin	Prof. Alessandro Antonio Porta Qualified expert in radioprotection	Prof. Silvia Barella Metallurgical processes expert	Prof Andrea Gruttadauria Metallurgical processes expert
Prof. Fabrizio Campi Head of decommissioning of L-54M	Prof. Nicola Cefis Materials and structural analysis expert	Gabriele Rampinelli COO Rampinelli S.p.A.	Filippo Zanetti Founding partner Blueshift-Group

GraphiCore managed to raise >600K€ since inception between public and private capital, and grants

GraphiCore’s objective is to have a sustainable equity path

Capital Raised (Equity)

€450.000

Pre-seed round

- ✓ Closed in Q2 2025
- ✓ Used for technology development, prototyping, increase in TRL and salaries
- ✓ Validation in relevant environments

Grants and Non-Dilutive Funding

€280.000

Grants awarded

- ✓ Euratom Nuclear Innovation Prize
- ✓ PNICube: Industrial Track
- ✓ Startcup Lombardia 2025: “Sustainability”
- ✓ Pre-seed Plus Lazio Innova
- ✓ TEF Ph.D. & more

Strong foundation to accelerate product validation and prepare for commercial roll-out

Any Questions?

Contact: Riccardo.Chebac@GraphiCore.eu