Workshop Supercapacitors Energy Storage

International Workshop on

Supercapacitors and Energy Storage

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Grand Hotel Salerno, Salerno, Italy

CapTop supercap@thetop

**Spin-off of the University of Naples *Federico II***

# Towards industrialization of a new supercap generation


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&

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# All started from KiteGen...

The idea of founding a production facility of supercapacitors (SCs) in Italy was born within the ***KiteGen*** project: the kite-generation is a special sector of renewable energy production, the High Altitude Wind Energy (HAWE).

A huge kite is pulled by the very strong winds at altitudes greater than 800 m, while two ropes, connected to a ground generator trough pulleys and drums, produce electric energy during unwinding (active phase).

This system has a cyclic mechanism, in which the kite is **recalled** thanks to a certain amount of electricity (passive phase).

**Supercapacitors**, placed in a rack, are able to easily withstand the hundreds of daily charge/discharge cycles, where conventional batteries would be destroyed in day.


# Eolic Energy

By the way, SCs are currently and effectively employed in **Wind energy towers** for **pitch control** of the blades.
The pitch system relies on an energy storage **backup power**, which is served by two different storage technologies for electric systems: SCs and lead-acid batteries.

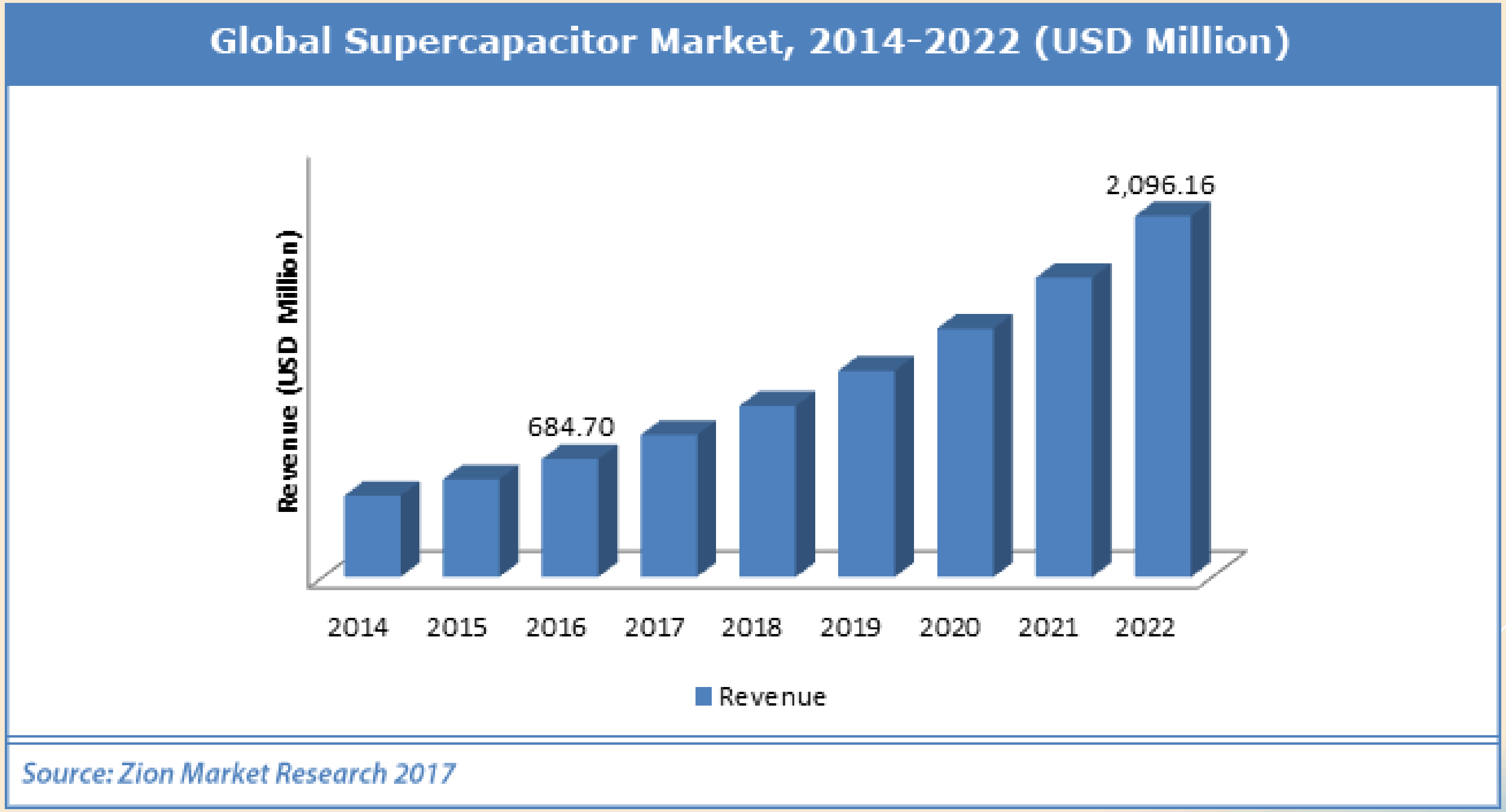
**Both** devices provide the necessary power to rotate the blades during an emergency shut-down situation.
**Nevertheless**, since SCs are electrostatic devices that do not contain lead or acid, they are much more **durable** in hot or cold **weather** conditions, thus prolonging the lifetime of the energy storage system to match closer the lifetime of the turbine itself.

In addition, the **speed** with which SCs can release energy and recharge (i.e. its power) is a significant advantage for the wind pitch control application.

# SC market

SC market is clearly growing and so is the expectation for next years, going from 685 M$ in 2016 to over 2.0 B$ in 2022, a growing factor of 3 in 6 years.

However, it is still a niche market, when compared with the global electric energy storage market.



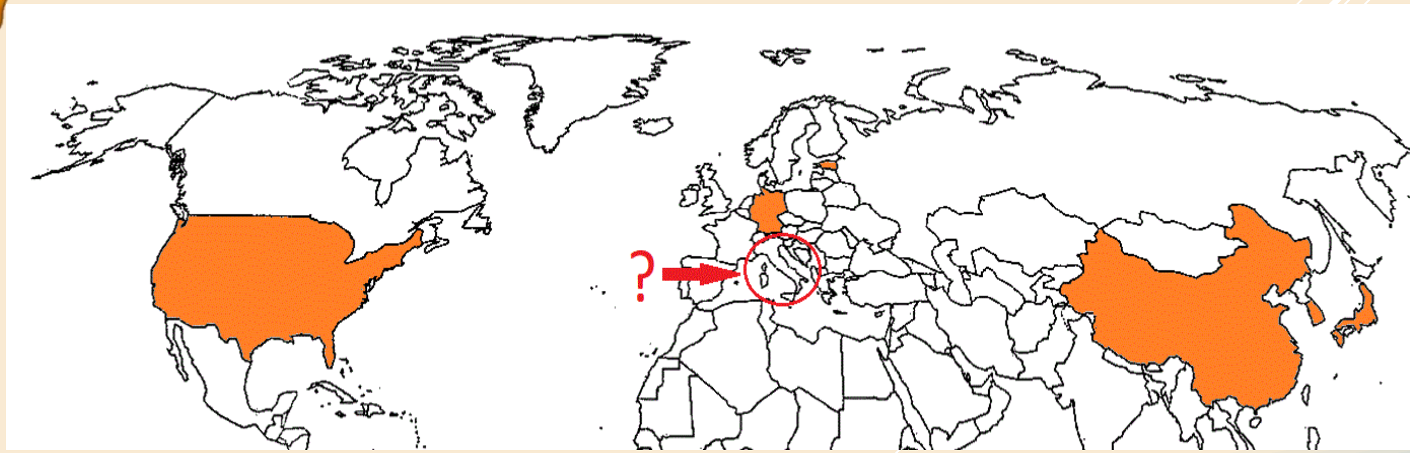
# Principal issues

There is a continuously growing interest for SC in the last decade, the only brakes to its explosion being

1. Cost (too high)

2. Specific energy (too low)

3. No manufacturer in Italy



So, last year, we decided to found CapTop…

# CapTop: who we are

Partners:

- OCIMA s.r.l. (automation and system engineering)
- Three university professors (physics and chemistry)
- Two engineers coming from KiteGen
- A communication and marketing manager

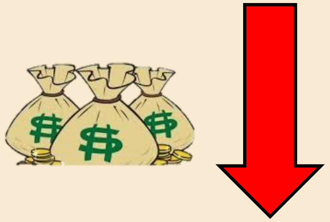

Collaborators

- A PhD student (working on graphene)
- An electronic engineer
- An electric engineer
- The staff of OCIMA (about 30 engineers, designers, and technicians)

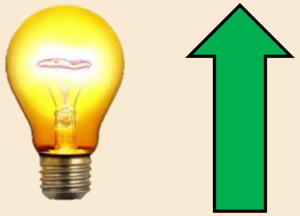
# Our proposal: to enter and to enlarge present SC market

CapTop aim is to enter in the SC field/market following three parallel paths with the final goal of facilitating and/or accelerating the explosion of SCs in the electrical storage market.
These paths are:

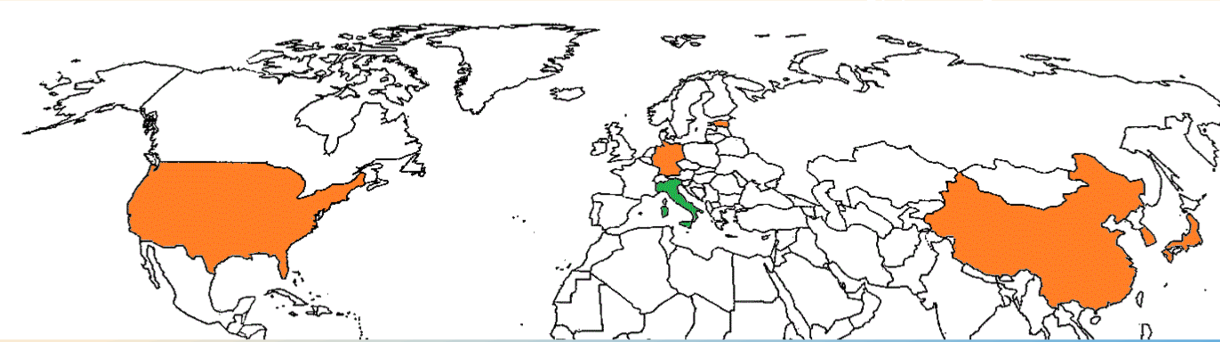
1. Reducing the cost by full automation and optimization of the production process



2. Increasing the specific energy by exploiting the scientific research results and technological developments.



3. Enlarging SC market in Italy



# Our policy

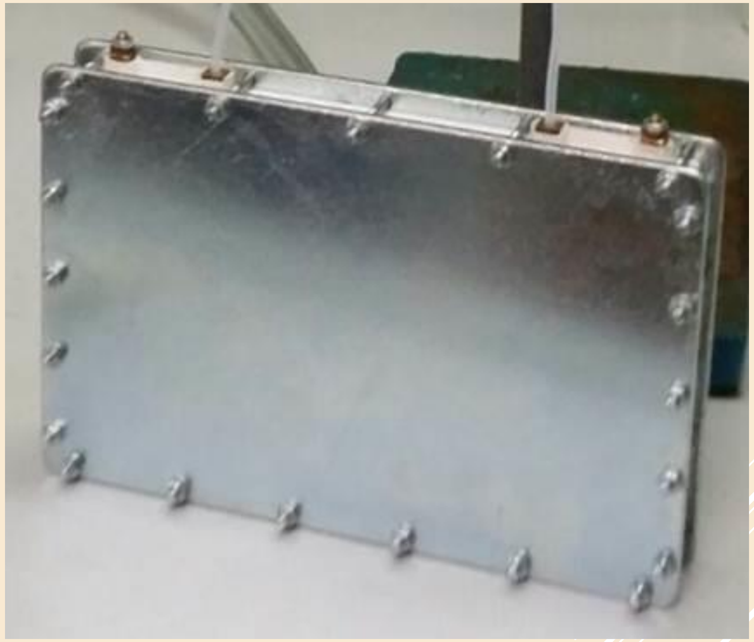
CapTop policy is to consider all worldwide players in SC as possible **collaborators**, even **partners**, and in any case friends who are working to a common objective, and only in the last instance as competitors.

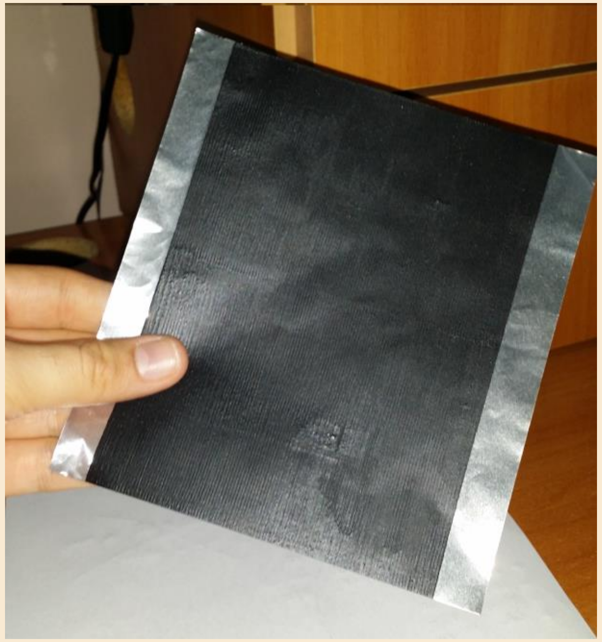
In our opinion, is much more worthy to **enlarge** the present niche **market** of SCs, and to further accelerate its growth, taking advantage of scientific, technical, and even, if possible, industrial cooperation among several/all players.

# Our short-term goals (1/3)

We have first prototypes that are currently under test in our academic laboratories and in the company workshop.
Of course, it takes different kind of researches:

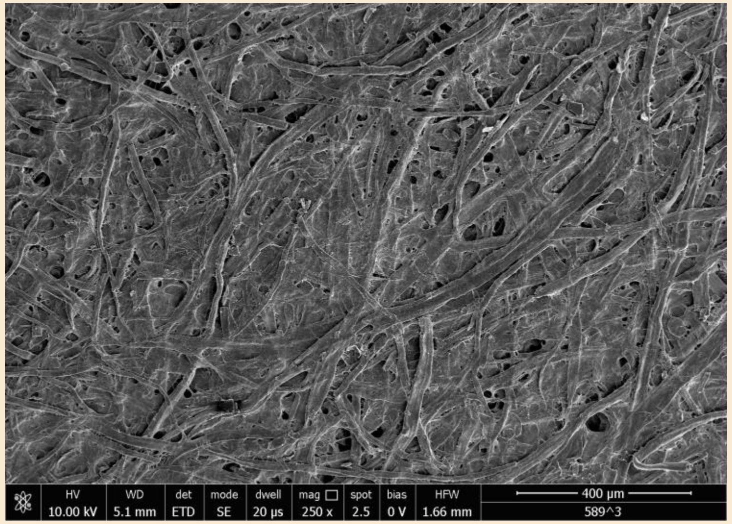
- We are studying different activated carbon electrodes and, thanks to the collaboration of researchers of Laminazione Sottile Group, the way to make carbon coated aluminium foils for our devices (glues, concentrations and procedures).

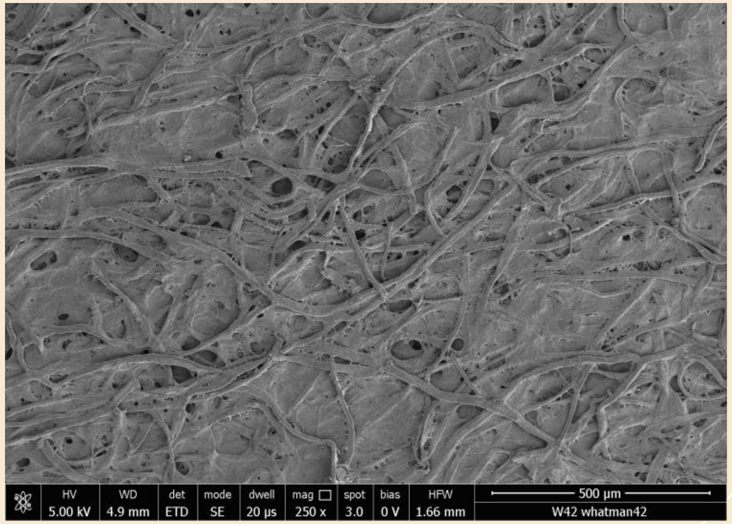


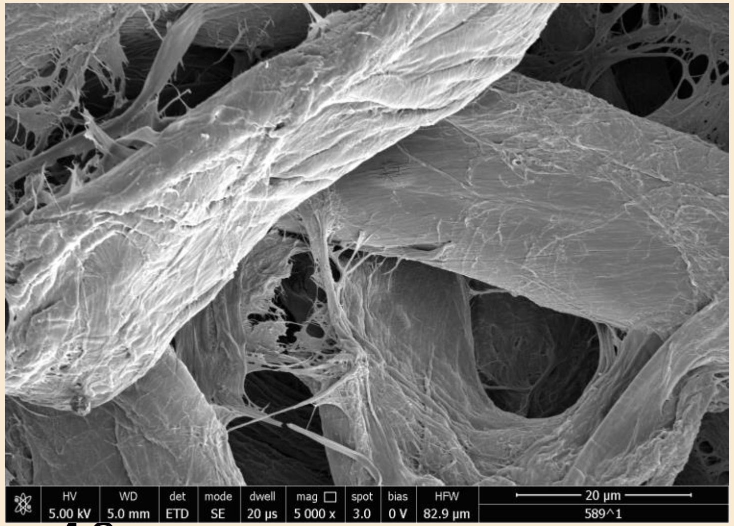


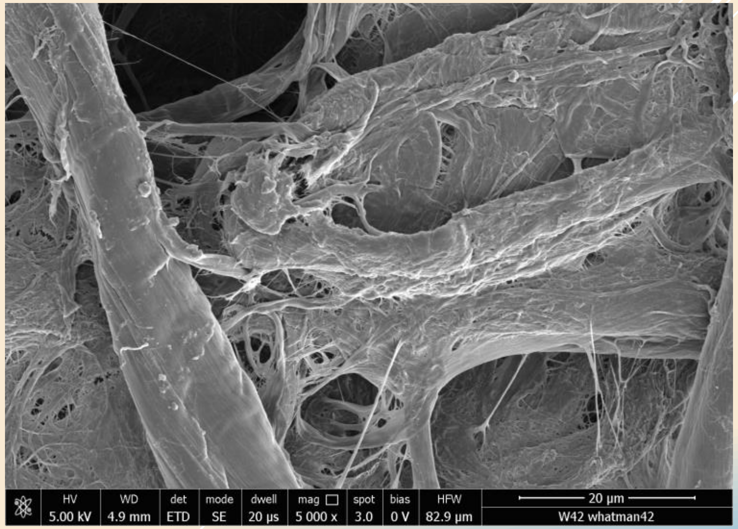
# Our short-term goals (2/3)

- We are studying different electrolytical papers, in order to make the best choice for the separator, comparing morphological analysis with electrical and mechanical performances.



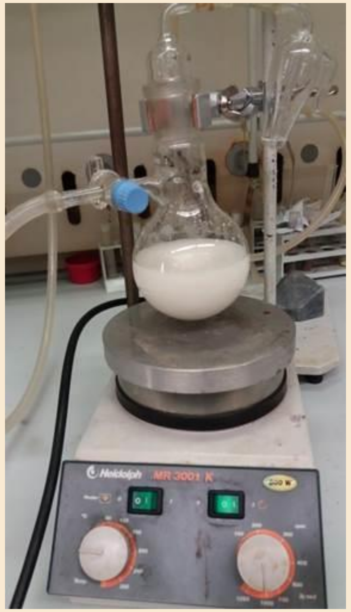



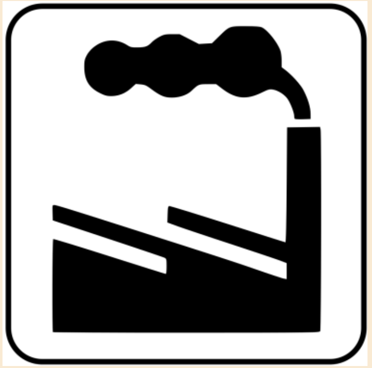
# Our short-term goals (3/3)

- We are studying synthesis of electrolytic components to envisage possible new solutions for SCs, with improved performances.

At the moment, our first aim is to align as close as possible to the current standard SC performances, subsequently we shall afford the industrial production phase. In parallel, we are doing researches on advanced materials. In a third stage, also thanks to the know-how and the resources of our current industrial partners and scientific collaborators we shall try to fit the research results into industrial processes.







# Other collaborations

With this vision, CapTop, in its first steps towards the industrialization of a new generation of SCs, enjoys not only the experience in automation of production processes of its industrial partner OCIMA, but also the following collaborations:

1. *University of Salerno*. Department of Industrial Engineering – NanoMates (Proff. M. Sarno and P. Ciambelli).
2. *Narrando srl*, spin-off University of Salerno
3. *University of Calabria*. Dpt. of Ind. Engin., and Dpt. of Physics (Proff. D. Menniti and L. Caputi)
4. *ENEA*, Centro Ricerche *Casaccia*, Lab. of Development of Chemical Processes and Lab. of Systems and Techn. for Mobility and Storage (Dr. P. Prosini and Ing. F. Vellucci)
5. *CNR-IPCB* (Institute for Polymers …), Portici, Naples (Dr. M. Lavorgna)
6. *Laminazione Sottile* Group, Caserta – Aluminium transformation (Dr. C. Sinagra)

# Possible collaborations

Furthermore, we are looking for other possible collaborations, e.g. with

*ACM Advanced Carbon Materials*, Grupo Antolin Ingeniería, (Spain),

and with *NANESA srl* (Arezzo, Italy) for nanocarbon products,

but we are **open** to work together with any public or private players, which really want to enlarge the SC niche market, reducing costs and improving performances of the devices.

# A special application: K-Bus

KiteGen gave us a license to exploit its patent related to a quick-recharging system for an electric bus, called **K-Bus**, based on SCs (for R&D purposes).
K-Bus uses a mobile socket, placed under the bus, which takes energy from a conductive carpet; this carpet is in turn connected to a SC rack near each bus stop.

The feeding system gets down, recharges the K-Bus and rises up in about 10-30 s.
During this time, passengers can get in and out from the K-Bus.
After the recharge, K-Bus has 2/3 km of autonomy, till a new recharge at the next bus stop.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: QUICK-RECHARGING ENERGY FEEDING SYSTEM FOR MEANS OF TRANSPORT WITH ELECTRIC TRACTION

# A special application: K-Bus

Running prototype and demo circuit

See demo video at
https://www.youtube.com/watch?v=ReIRDL70frc


# A special application: K-Bus

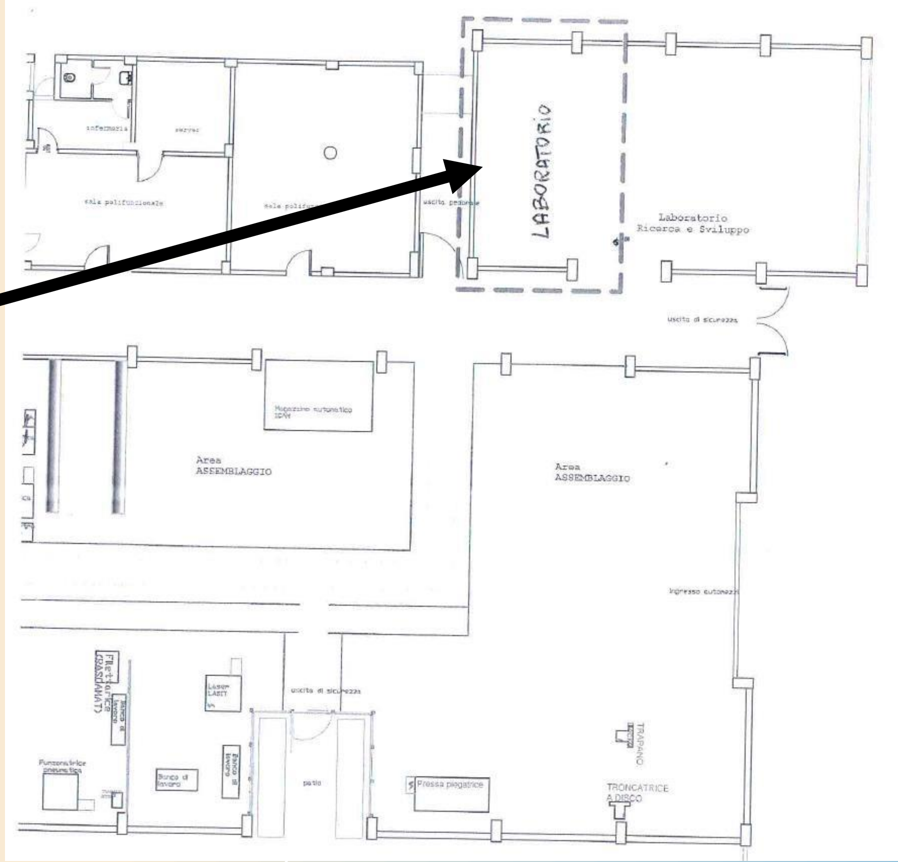
Running prototype and demo circuit

# Our facility

OCIMA, a company focused on factory automation, is the first partner of CapTop.

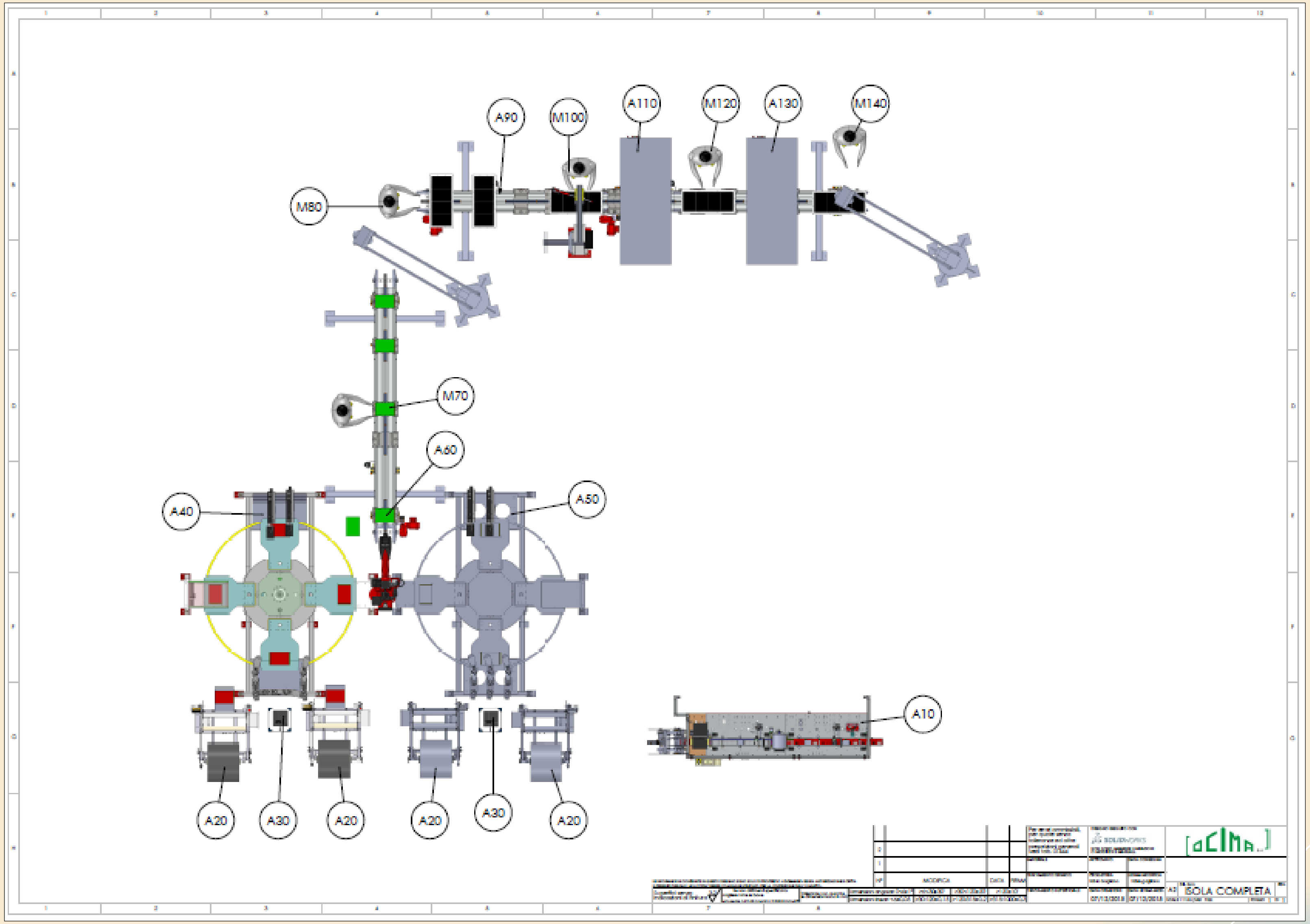
OCIMA has a 12,000 sq. meters facility and has dedicated a specific space for a R&D lab to CapTop activities.

Area reserved
to CapTop R&D




We are in the region of Naples, about 20 km from the city centre.

# Component Sheet



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# Thank you for your attention!