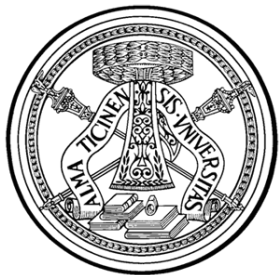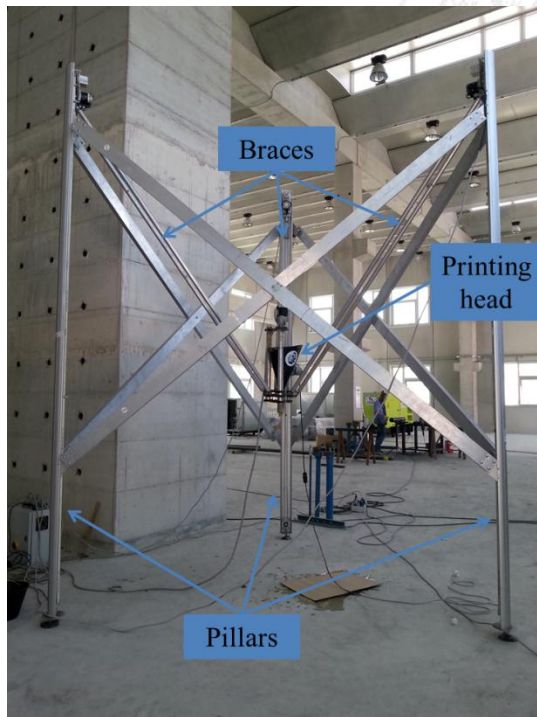# Test 1 :Modular RC beam

Concept
- 3D-print concrete modulus
- Externally applied / post applied bars
- Take advantage of optimization in terms of shapes and in terms of weight vs resistance
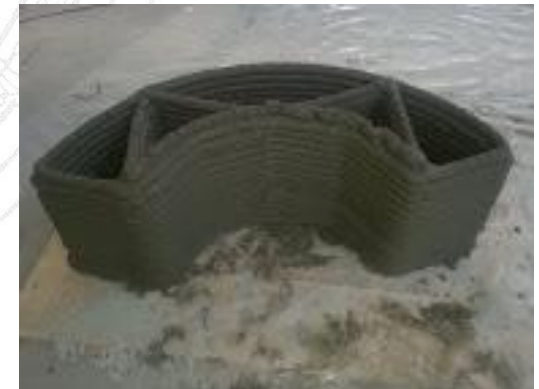
A concrete 3D printer & some initial goals
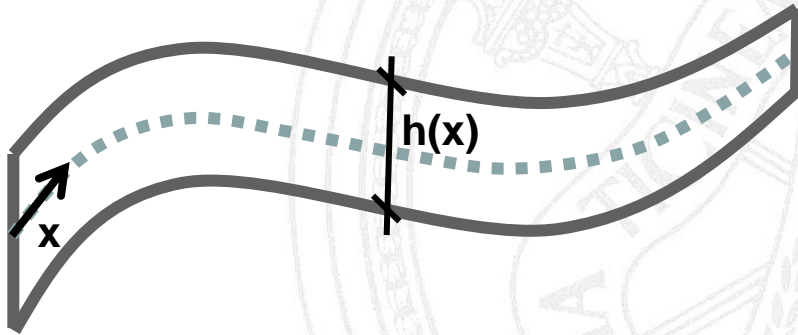

The BigDelta WASP printing machine

Optimal material viscosity ➡ material extrudable from the extrusion head

Mixture not too liquid ➡ material capable of being stacked in layers
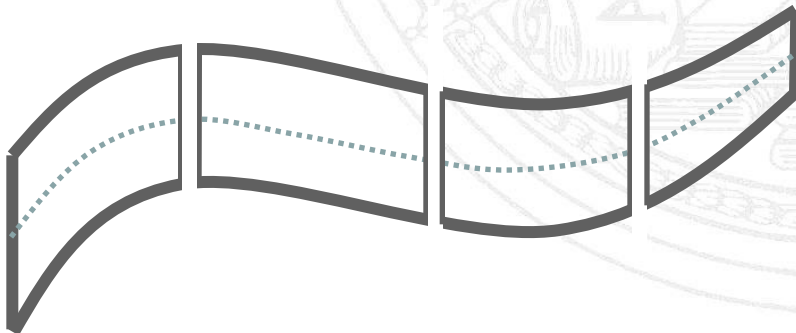
The design concept

The beam design aims to save material and guarantee adequate mechanical performances against the internal forces acting on it.
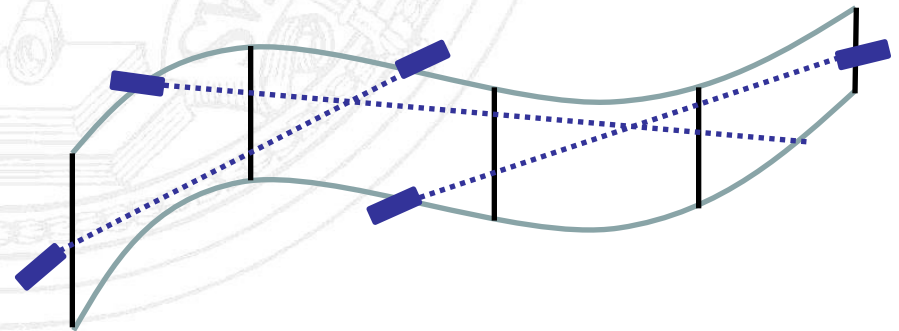

1. The target beam could present a curved longitudinal *x* axis and a variable cross-section *h(x)*
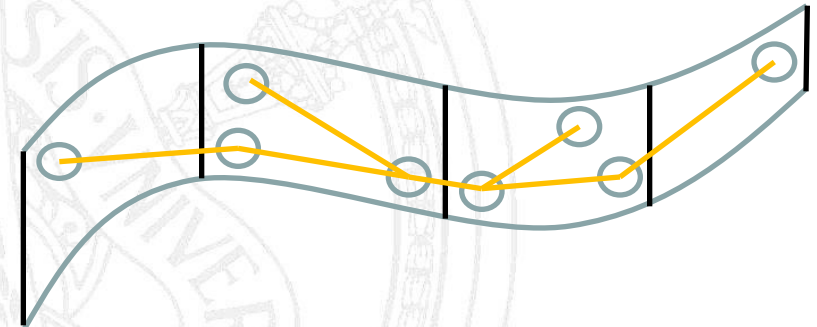
3. Rebar reinforcement scheme (in yellow)
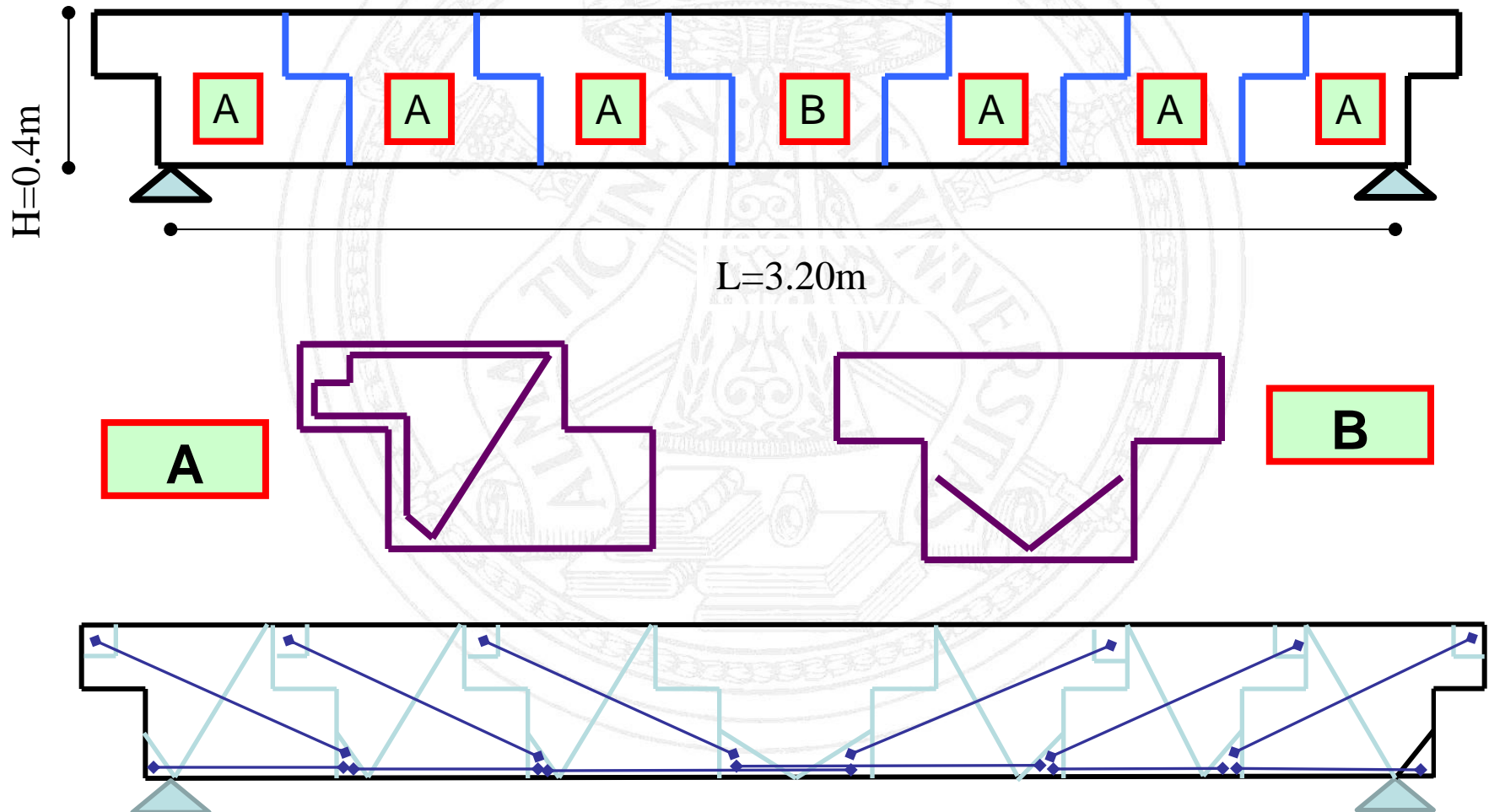
2. The beam is cut into segments

4. Post-tensioned cable scheme (in blue)

The design concept

Topology optimization for the case of a simply supported beam under distributed load.

The printing

Printing time for each segment ≈ 20 min

TOTAL printing time ≈ 2 hours

Phases of the 3d printing process of the beam segments.

A number of holes needs to be designed to anchor the rebar.
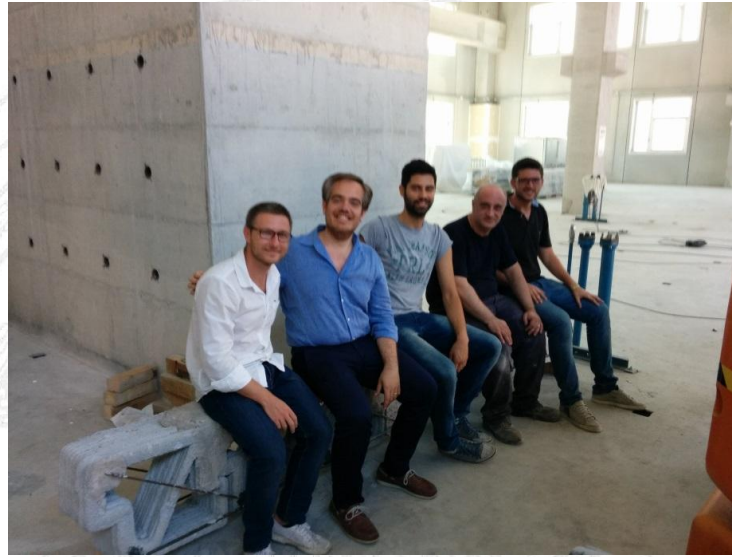
The assembly

Fixing of rebars: Securing the bar anchorages in the holes with an epoxy resin.

The final beam

TOTAL weight ≈ 29 kN
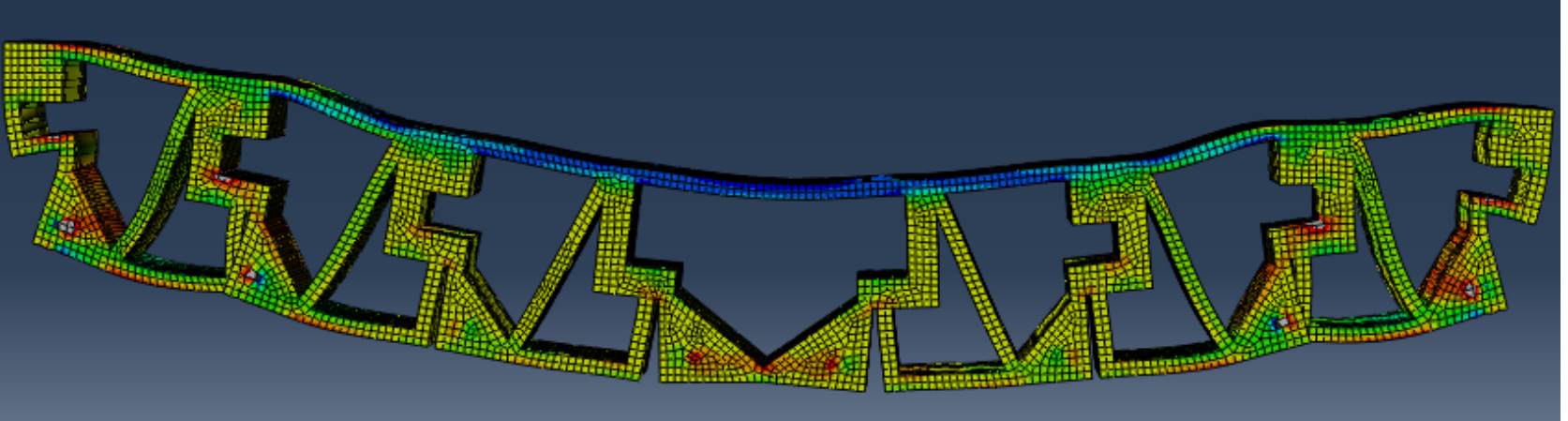about the 45 % of the weight
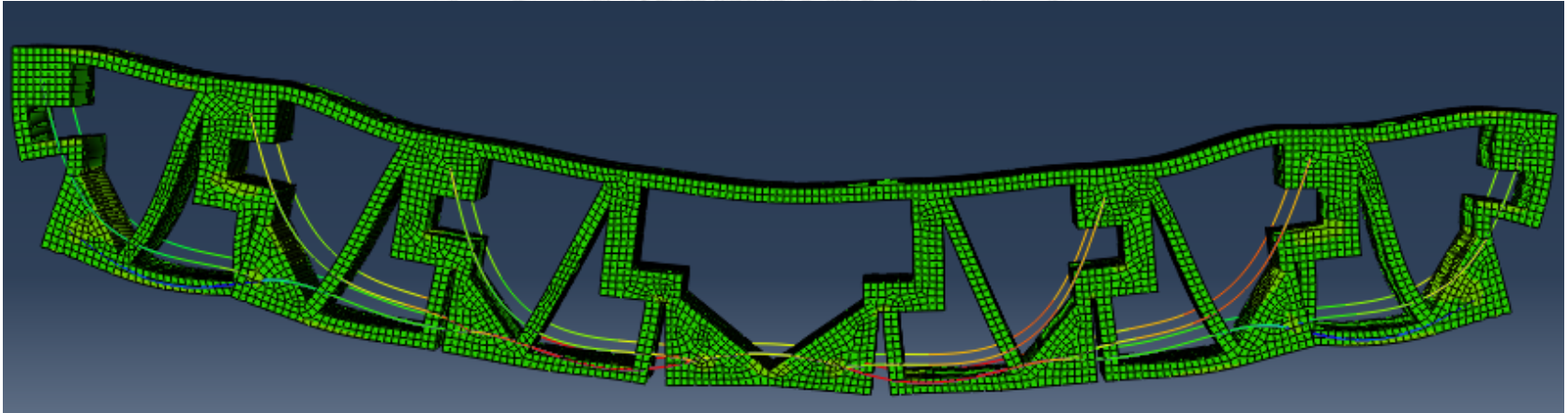of the equivalent solid beam

The printed beam is able to bear people!

Beam numerical model (Abaqus software)

The overall deformability of such elements seems to be governed within acceptable ranges if compared with homologous solid cracked ones.