Progress with Brick Manipulator System (BMS)

Inocencio Monteiro & Pierre Mugnier

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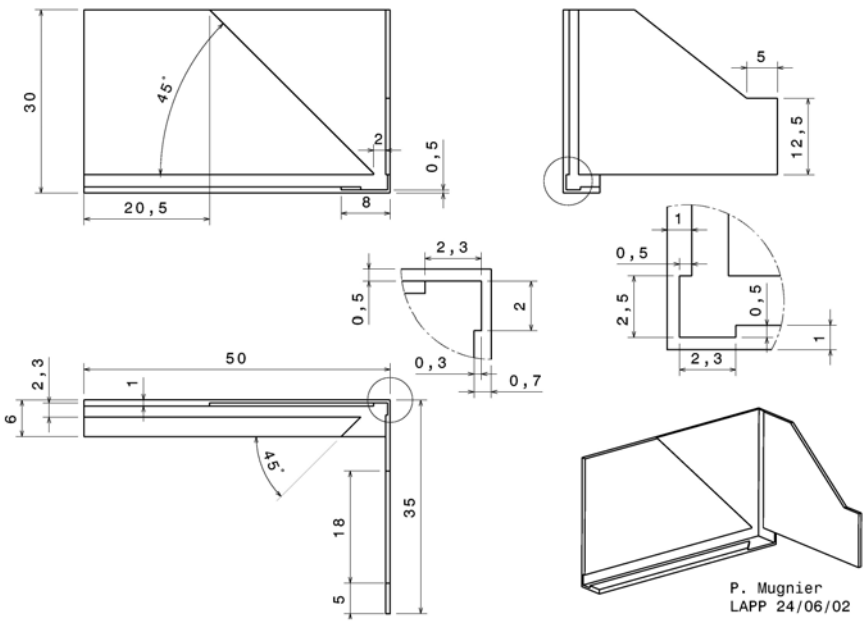
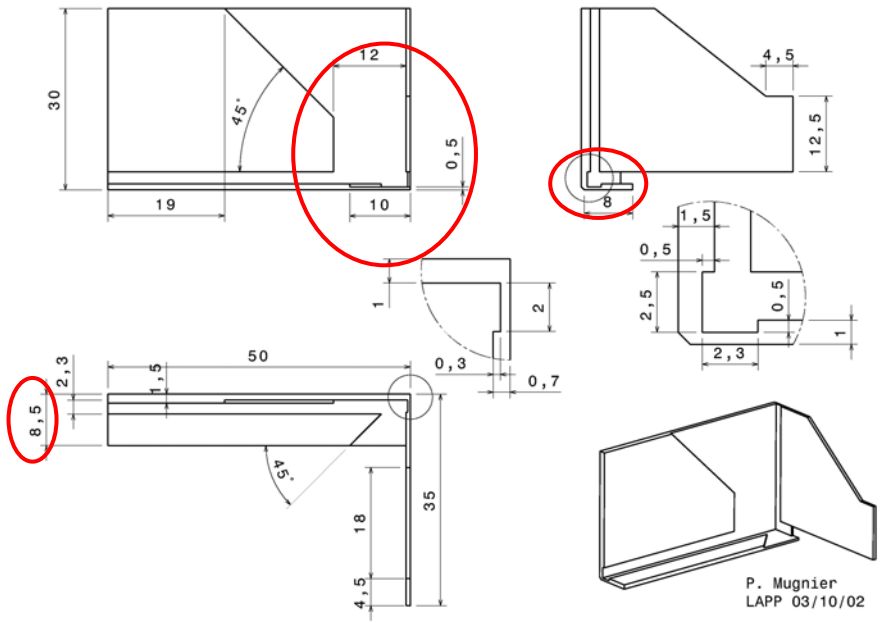
- Protection skates, Changeable Sheet Support
  - Skate upgrade for CS holding
  - Linked protection skates
  - Comparison linked/separate skates
  - CSS
- Tests
  - Measurements of friction coefficient for polyethylene skates
  - Tests of "narrow bricks" running on the tray
  - Deformation of the bridge under loading & conclusions
  - Interface between tray/BMS
- Interface between magnet /BMS
- Platform kinematics
- Progress in automatism
- Schedule

CS holding skates



1st version:

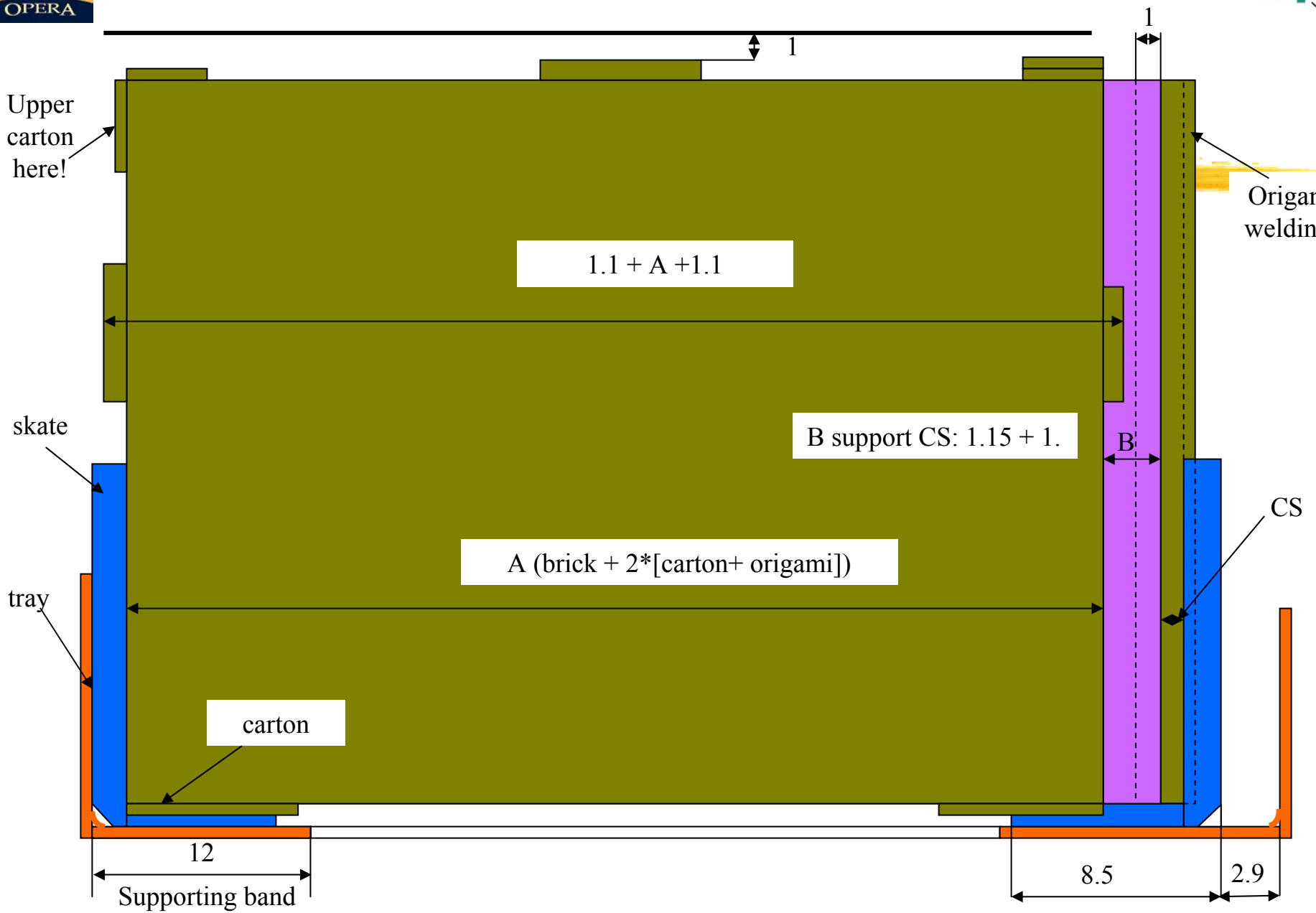
200 skates produced, tests underway



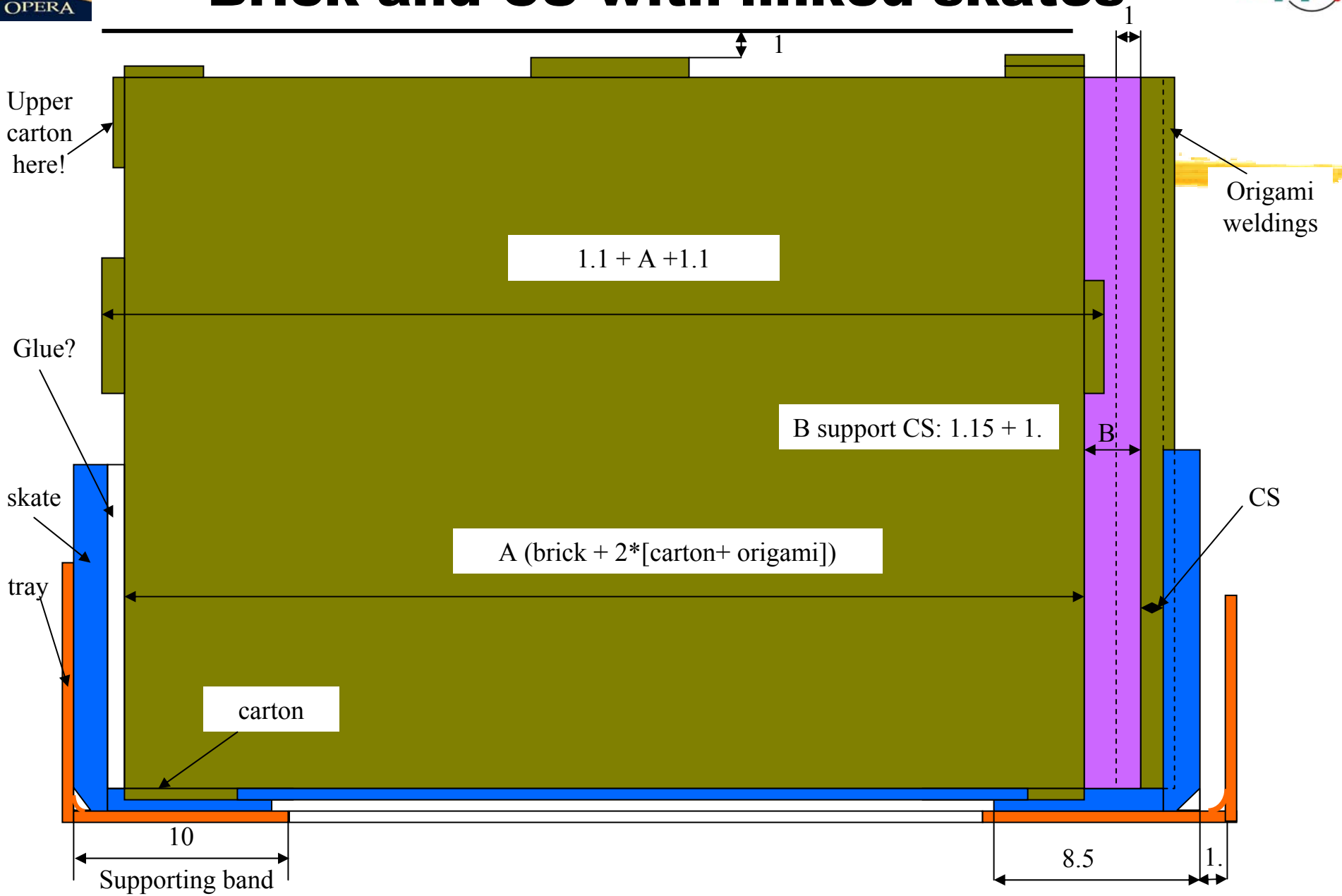
2nd version:

with changeable sheet holding capacity

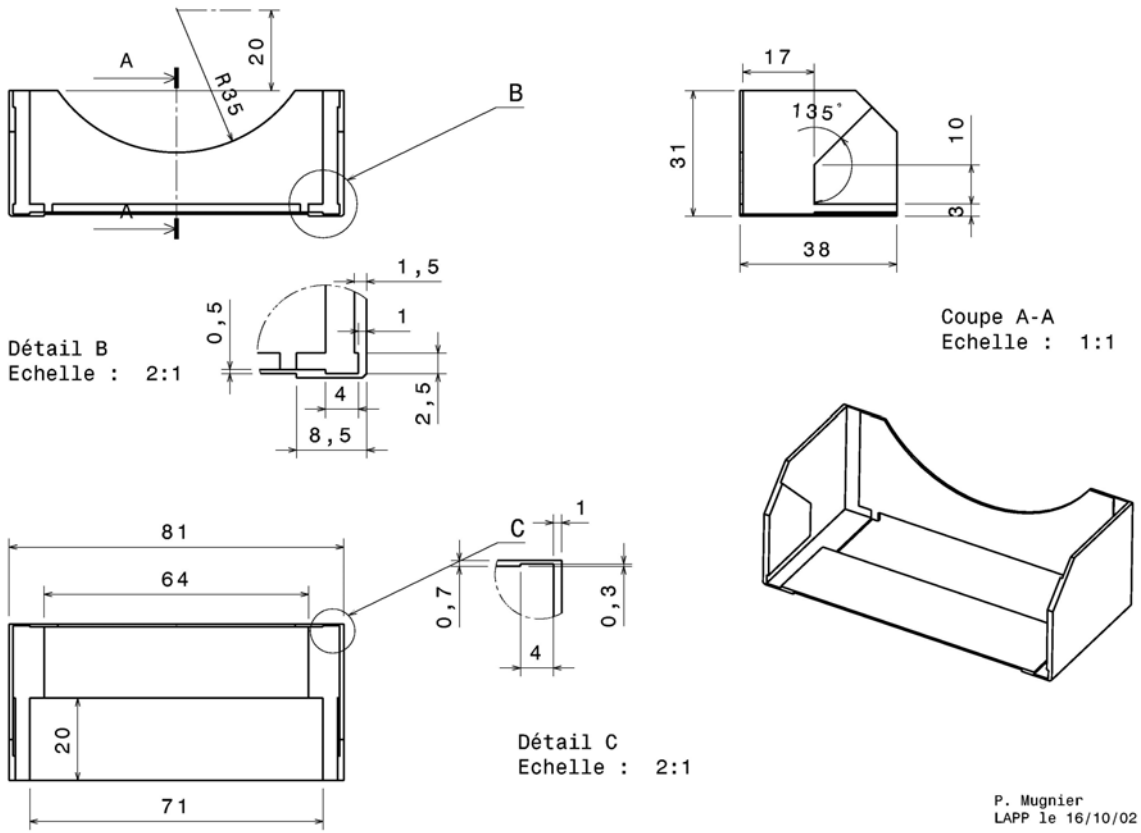
Brick and CS with separate skates



Brick and CS with linked skates



Linked skates



Comparison linked/separate skates

With separate skates:

- clearance depending on the brick size
- Point of application of brick weight on tray changing for small bricks
- Brick position not known to 1 mm
- Supporting band 12 mm

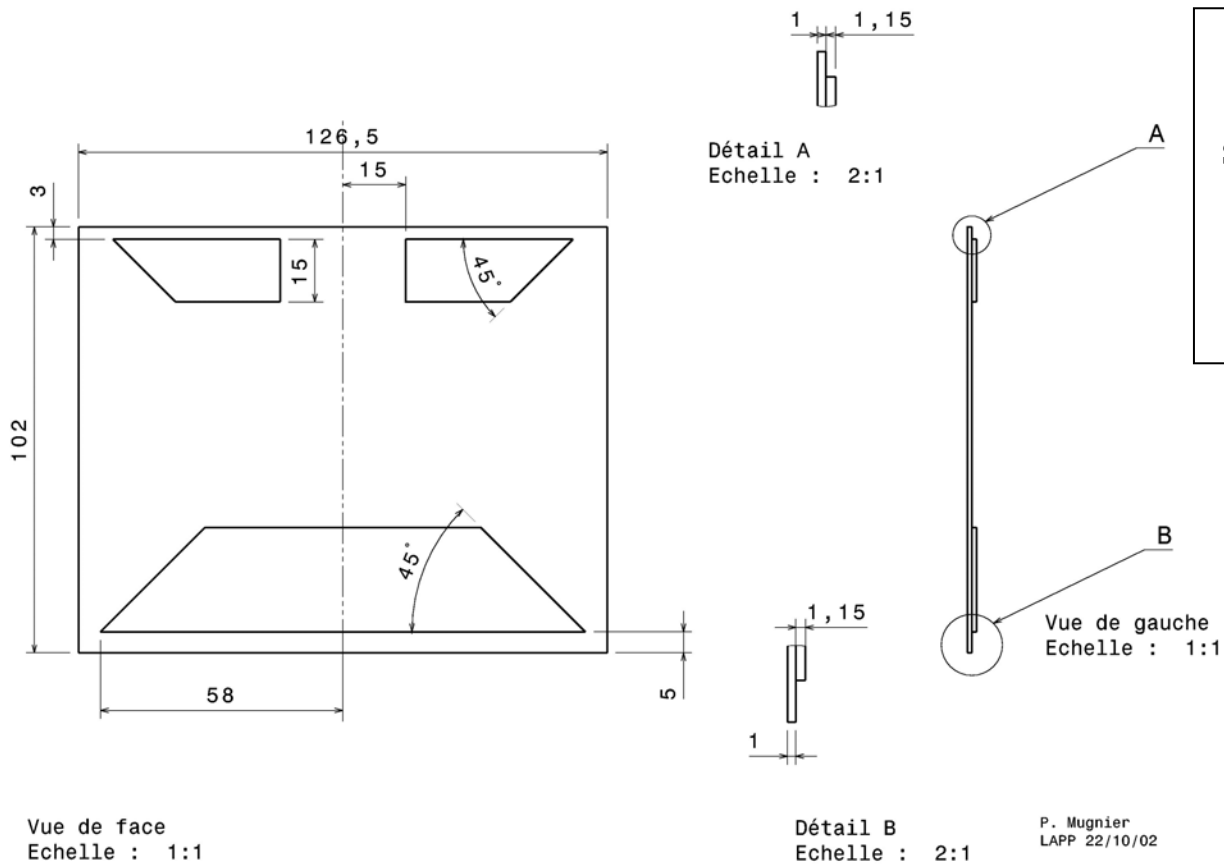
- Dismounting of CS easier (ungluing only rear skates)
- Gluing thickness equally small everywhere

With linked skates:

- Clearance of the brick with respect to the tray fixed
- Brick weight applied on the tray in a more controlled way
- Brick position known within 1 mm
- Supporting band 10 mm

- Dismounting of CS more difficult (ungluing all skates)
- Gluing thickness variable, can be large on front side

CS plastic support

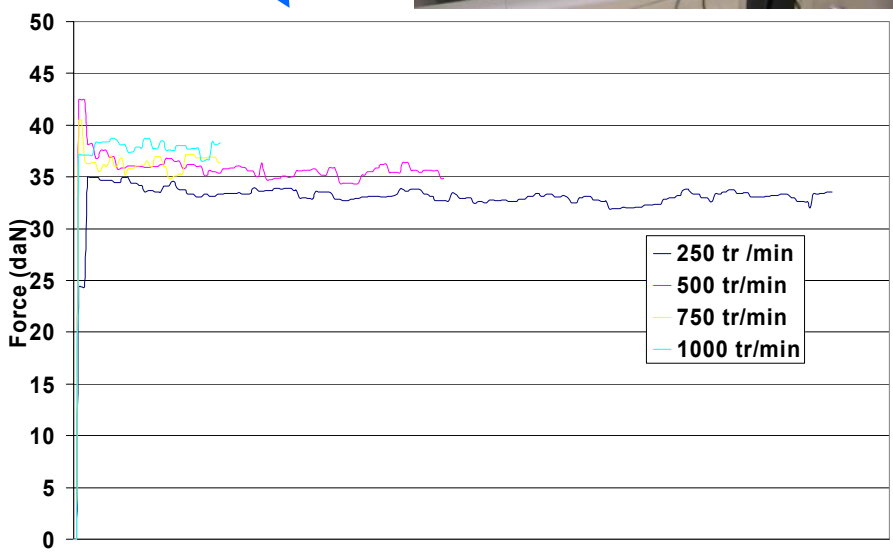


Definition of technical specifications and discussion with companies

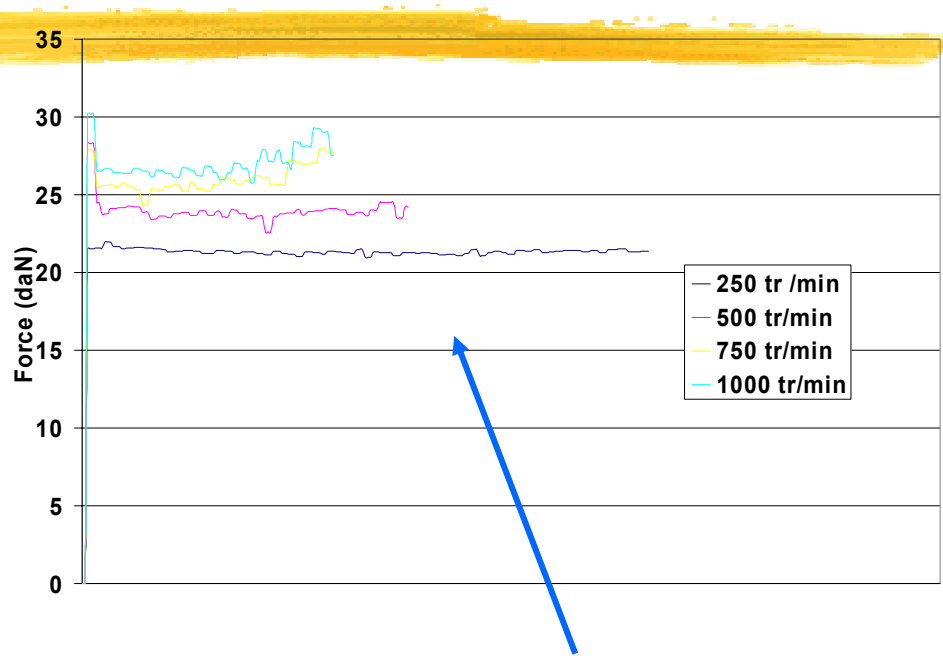
Measurements of friction coefficient for polyethylene skates on bricks equipped with origami

- Properties
  - Brick weight: 7.75 kg
  - Clearance between tray/brick: 0.5 ➡ 1mm without chamfer (skate edges were not cut)
- Results
  - Friction coefficient: 0.16
  - Friction coefficient measured on a inclined plane: 0.10
- Conclusion
  - A realistic train of bricks has a lot more friction than a brick: train internal friction, side frictions (small clearance case)
  - Increased efforts, but still manageable

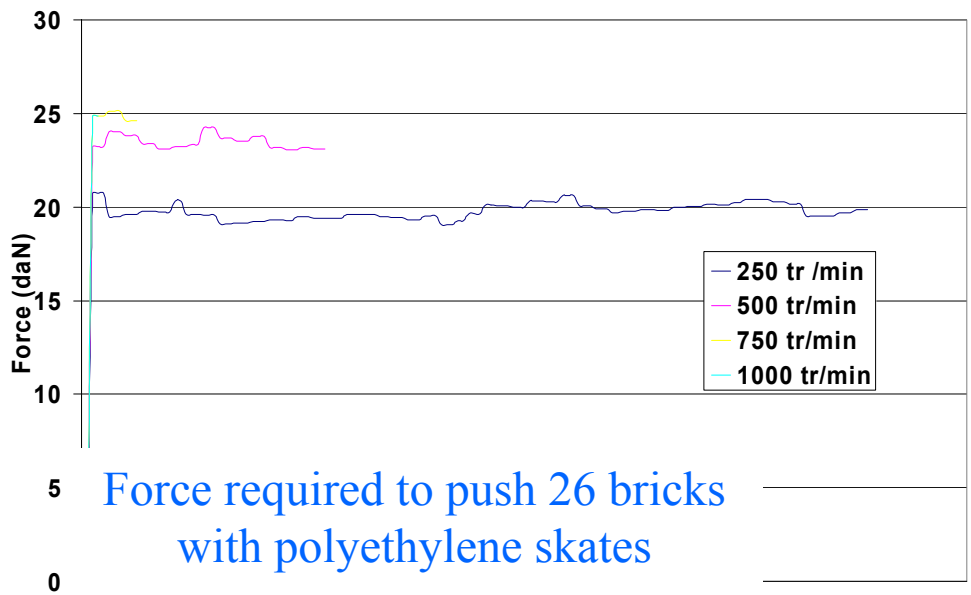
Force required to push 26 bricks



Tests of “narrow bricks” running on the tray



Force required to push 26 bricks with POM (polyoxymethylene) skates

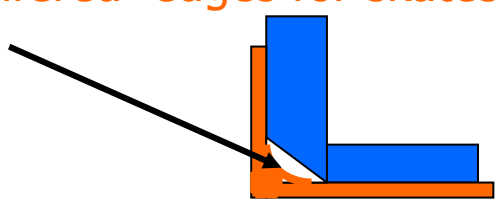


Force required to push 26 bricks with polyethylene skates

narrow bricks: the clearance with respect to the tray is ≥3mm

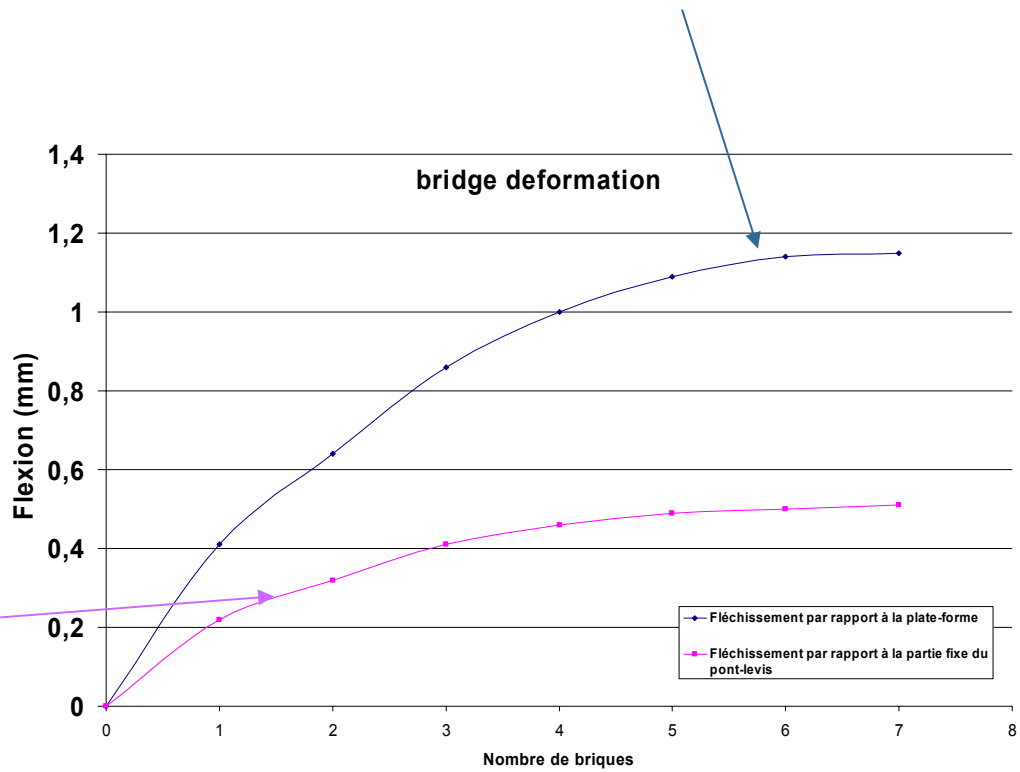
Conclusions of the tests with "narrow bricks"

- Properties
  - Brick weight: 7.75 kg
  - Clearance between tray/brick: 3mm (edges of skates not cut)
- Results
  - POM
    - friction coefficient measured on a train of 26 bricks: 0.11
    - Friction coefficient measured on a inclined plane: 0.114
  - Polyethylene
    - friction coefficient measured on a train of 26 bricks: 0.10
    - Friction coefficient measured on a inclined plane: 0.096
- Conclusions
  - Coherent results: less friction in case of large clearances
  - Improvement of skates: define chamfered edges for skates to take into account the tray radius



Deformation of the bridge under loading (7 bricks)

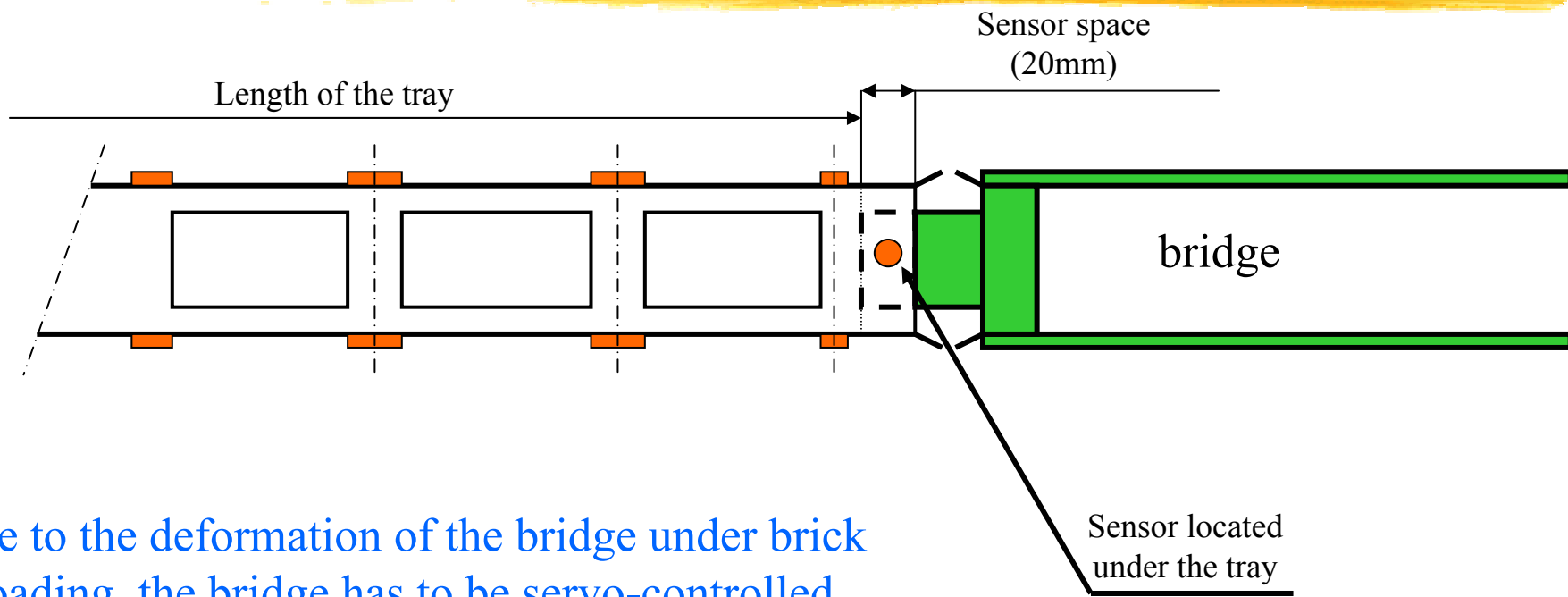
Bridge deformation with respect to the platform up to 1.2 mm



Bridge deformation with respect to the bridge support.

Measurements agree with computation (0.5mm)

Interface between tray/BMS

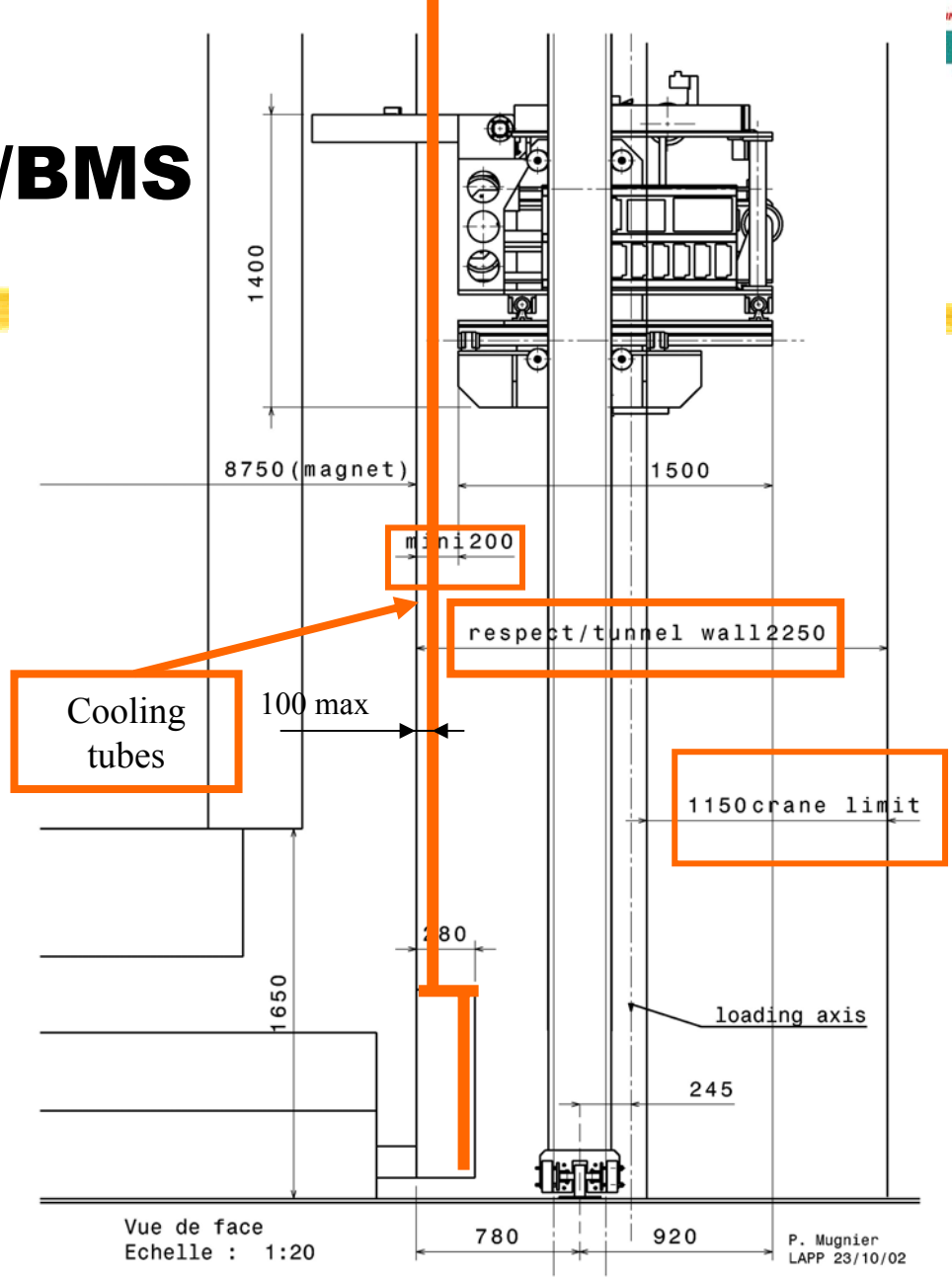


Due to the deformation of the bridge under brick loading, the bridge has to be servo-controlled

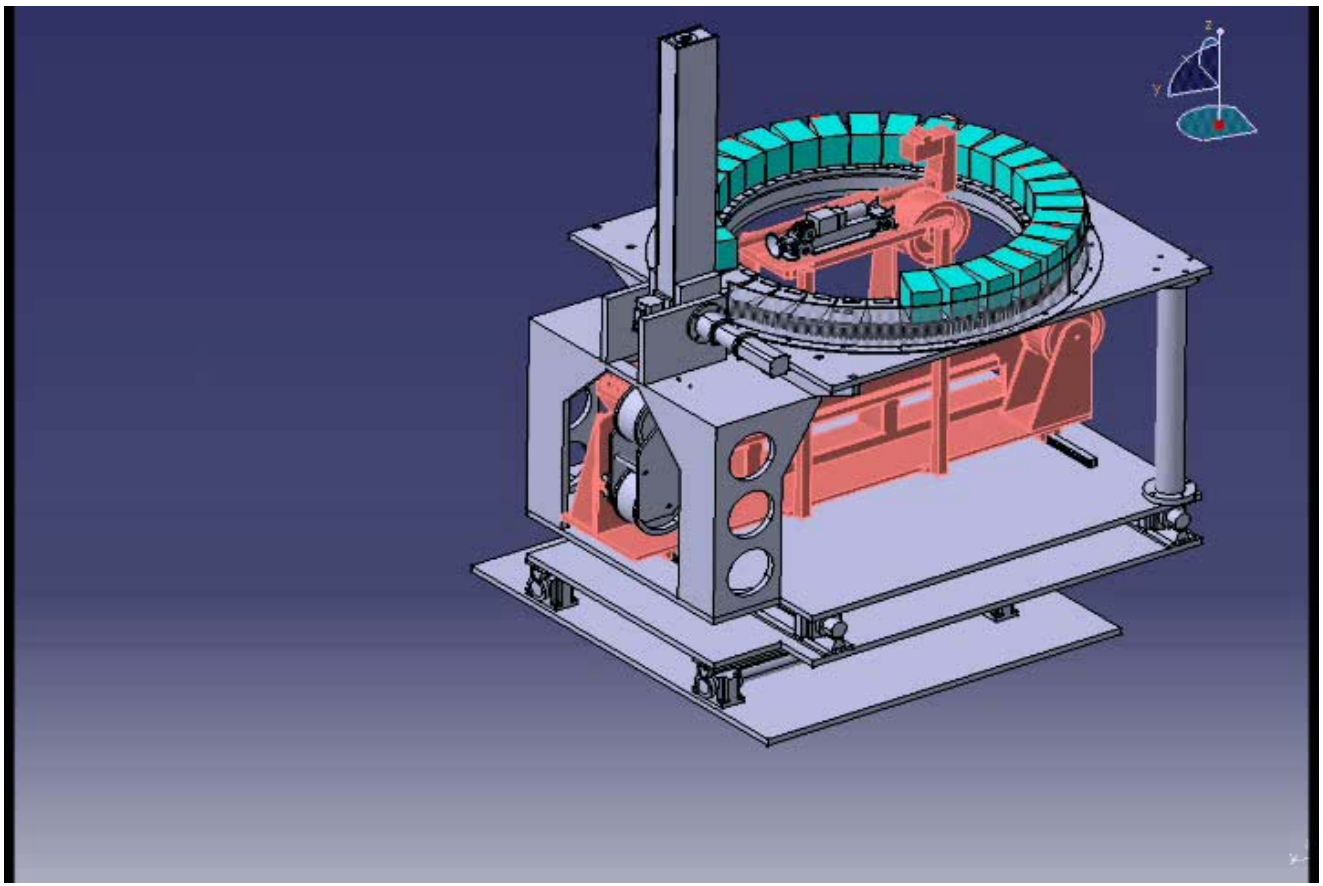
The requirement is an extension of about 20 mm space at the end of the tray

Interface Magnet/BMS

- Parameters
  - When platform in rear position
    - 200mm/magnet
    - 100mm min/cooling tubes!
  - Magnet distance/tunnel wall increased 2000 to 2250 (as agreed with the technical coordinator)
    - To be able to use the crane for exchanging "brick baskets" of the loading station.

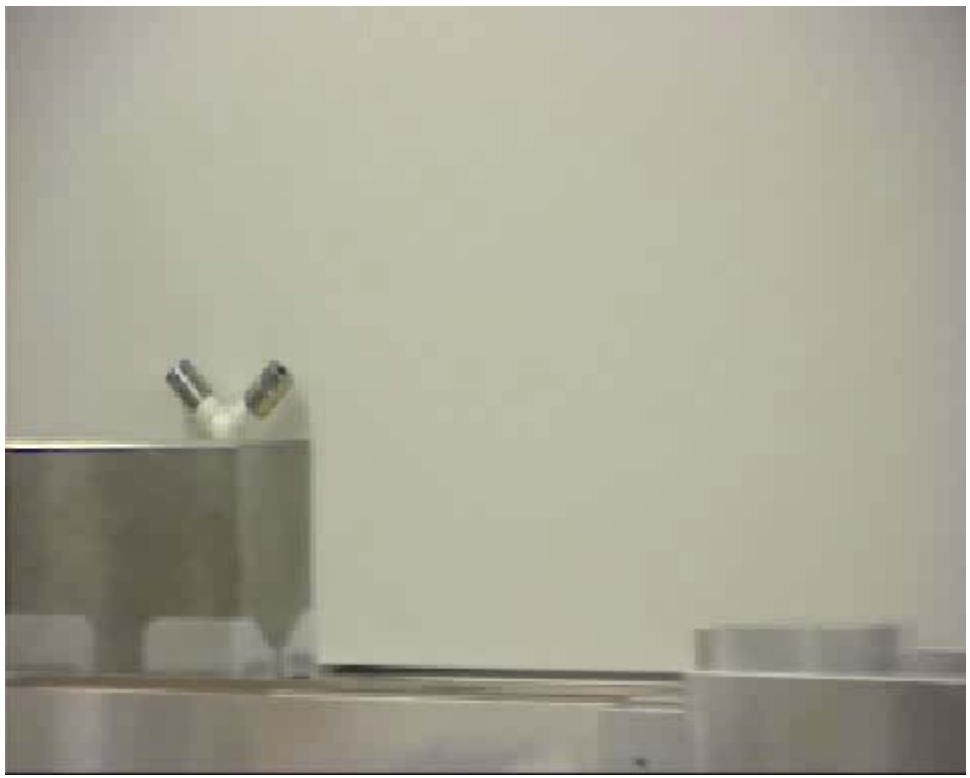


Platform kinematics

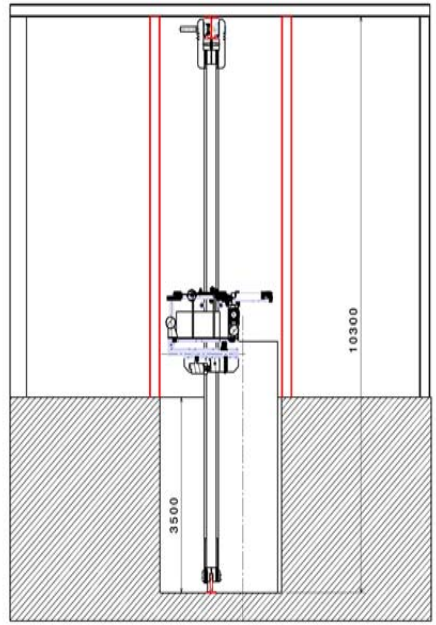


Progress in automatism

(Pusher installs 26 bricks on the tray, then VV extracts the third brick)



Schedule



- End of 2002
  - Call for tender of "porticos"
- 2003
  - Fabrication of platforms
  - Fabrication of "porticos"
  - Preparation of the lift installation in a LAPP laboratory
- 2004
  - Tests of the BMS at LAPP