Structural Aspects of the Dalmarnock Tests

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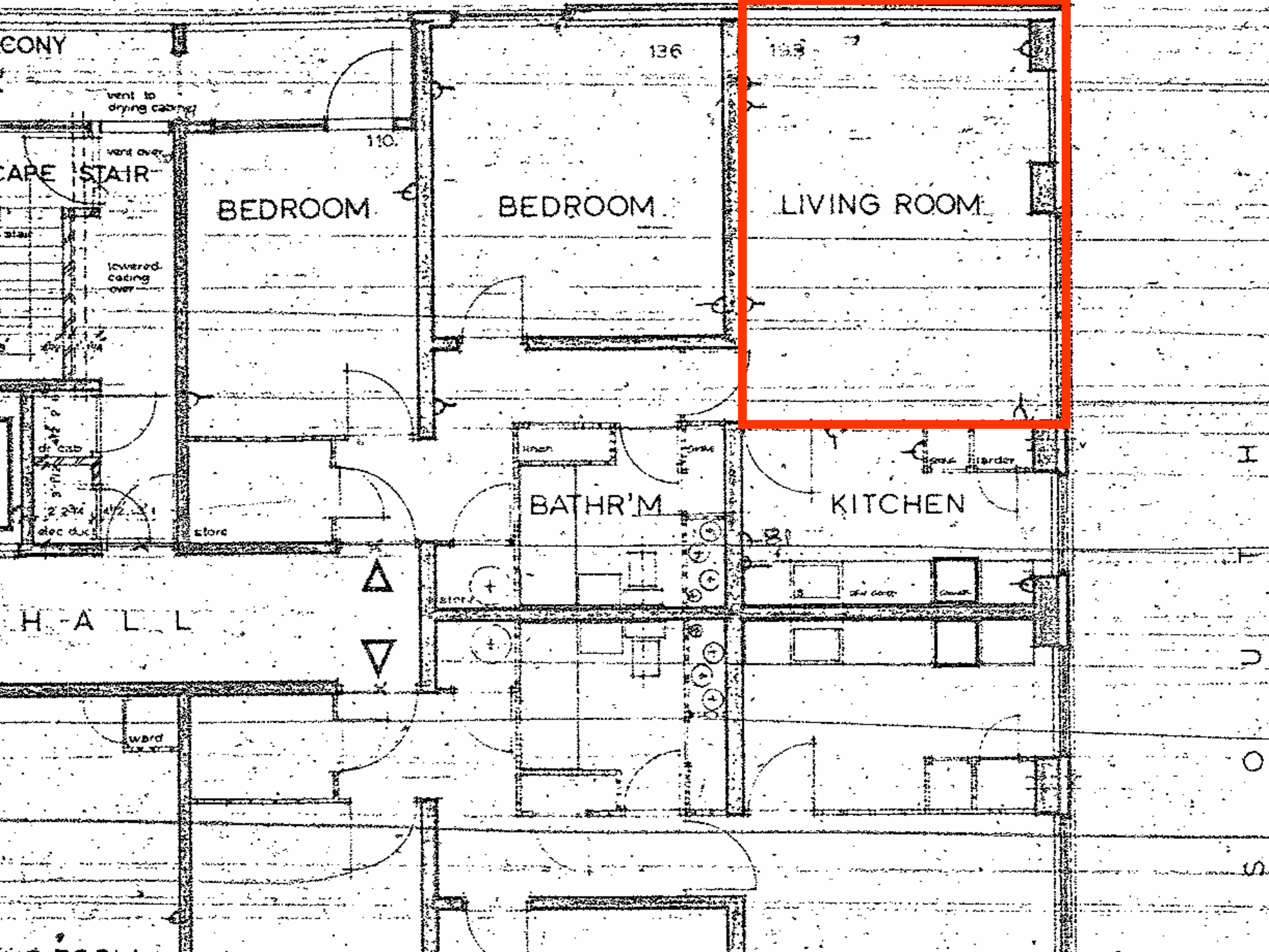
Background

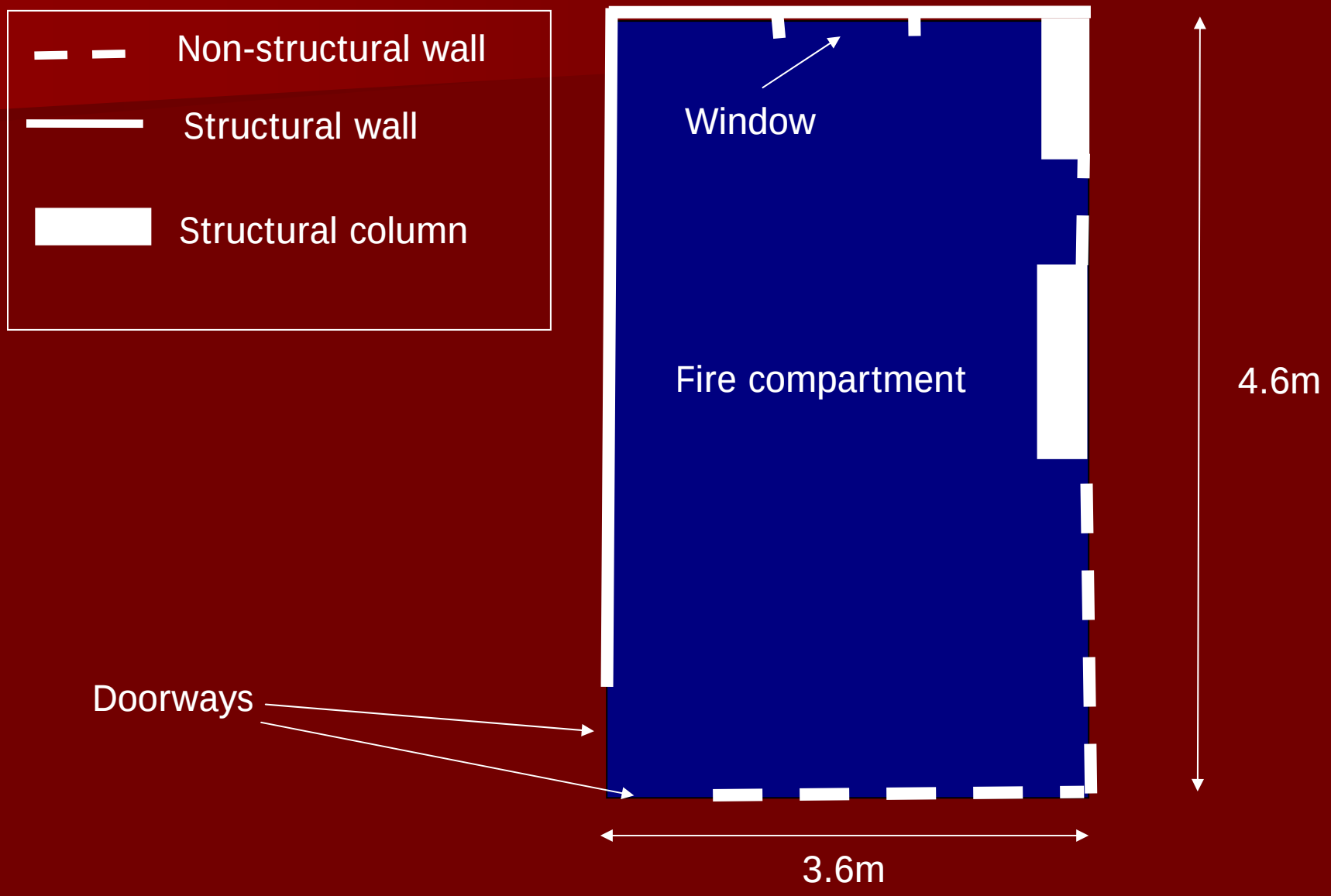
- Few tests of complete structures
  - Cardington concrete structure – data incomplete
  - Lab-scale tests
- Dalmarnock offered
  - Real fire
  - Fire and structural behaviour monitored
  - Unique

The Structure

- Cast in-situ concrete – built 1960s
- Some plans
- NDT survey prior to tests
- One-way (ish) spanning floor slab
- 6” (15mm) deep
- Bottom reinforcement mesh
- Top reinforcement near supports
- Fire compartment 4.5m x 3.5m

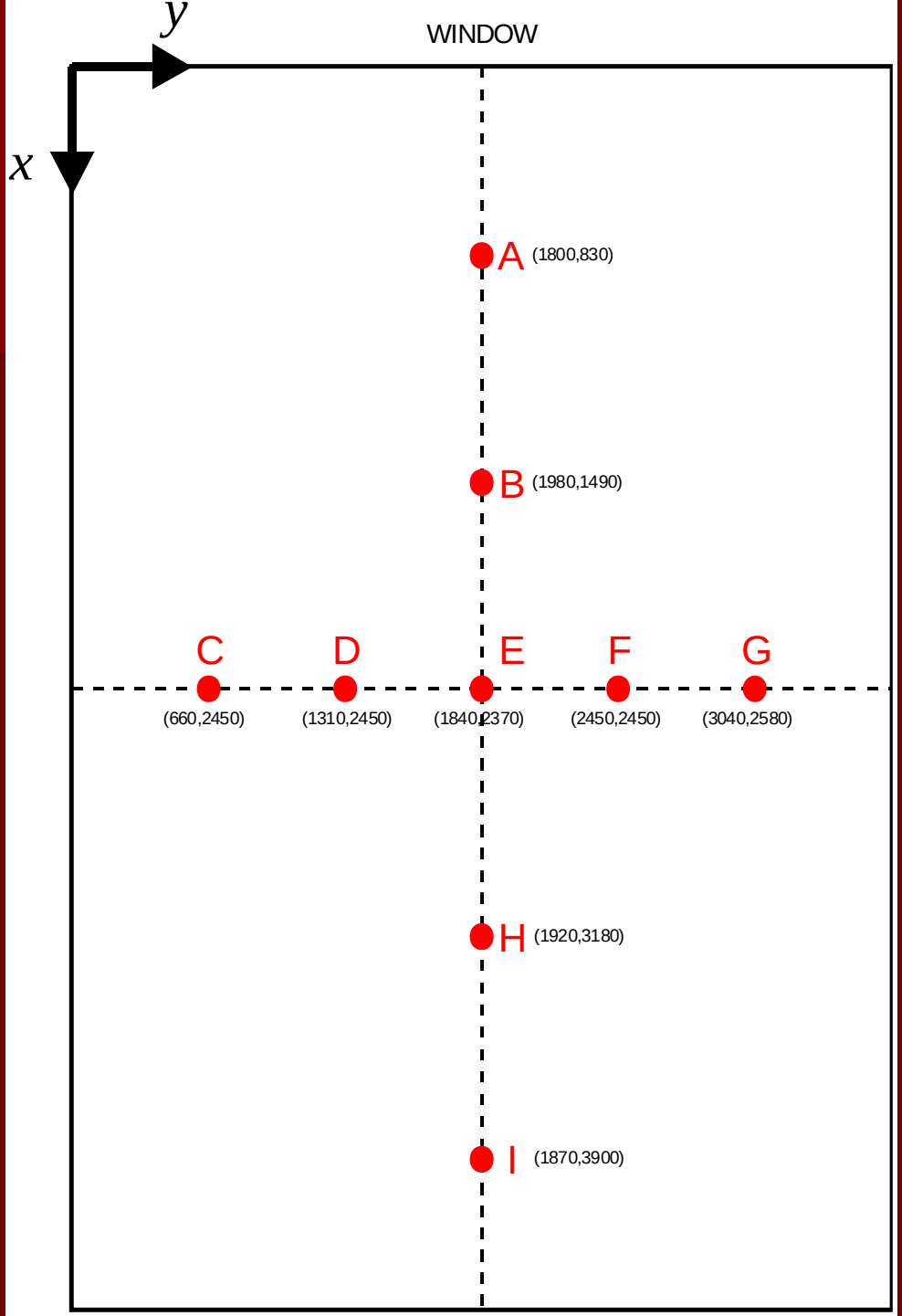

CONY
vent to drying cabinet
CAPE STAIR
vent over
lowered ceiling over
110.
BEDROOM
BEDROOM
136
LIVING ROOM
BATHR'M
KITCHEN
larder
store
HALL
ward

The Structure



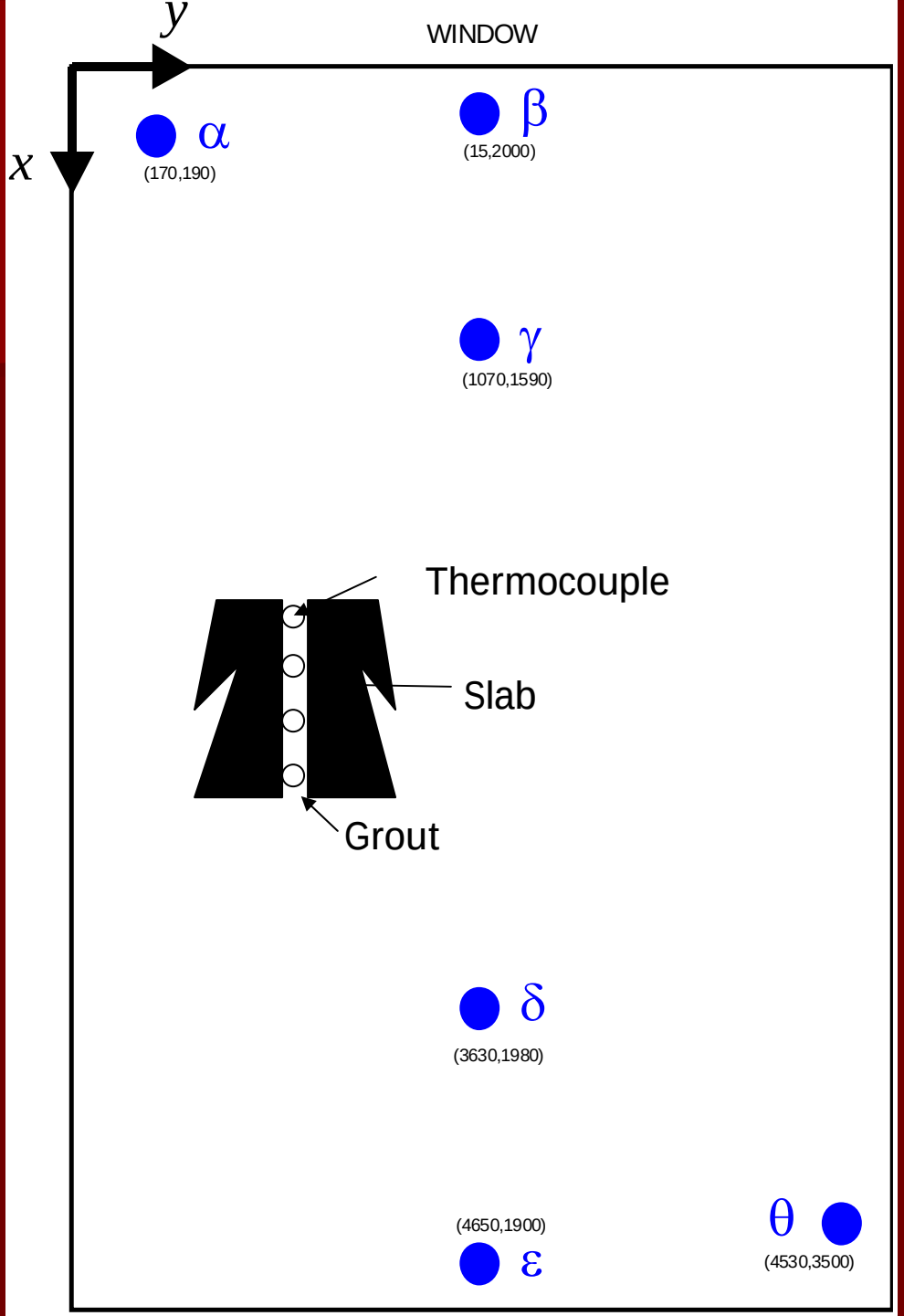
Measurements

- Vertical deflections of the heated floor slab
- Temperatures within the floor slab
- Strains on the upper surface of the floor slab
- Horizontal deflections of the internal structural wall



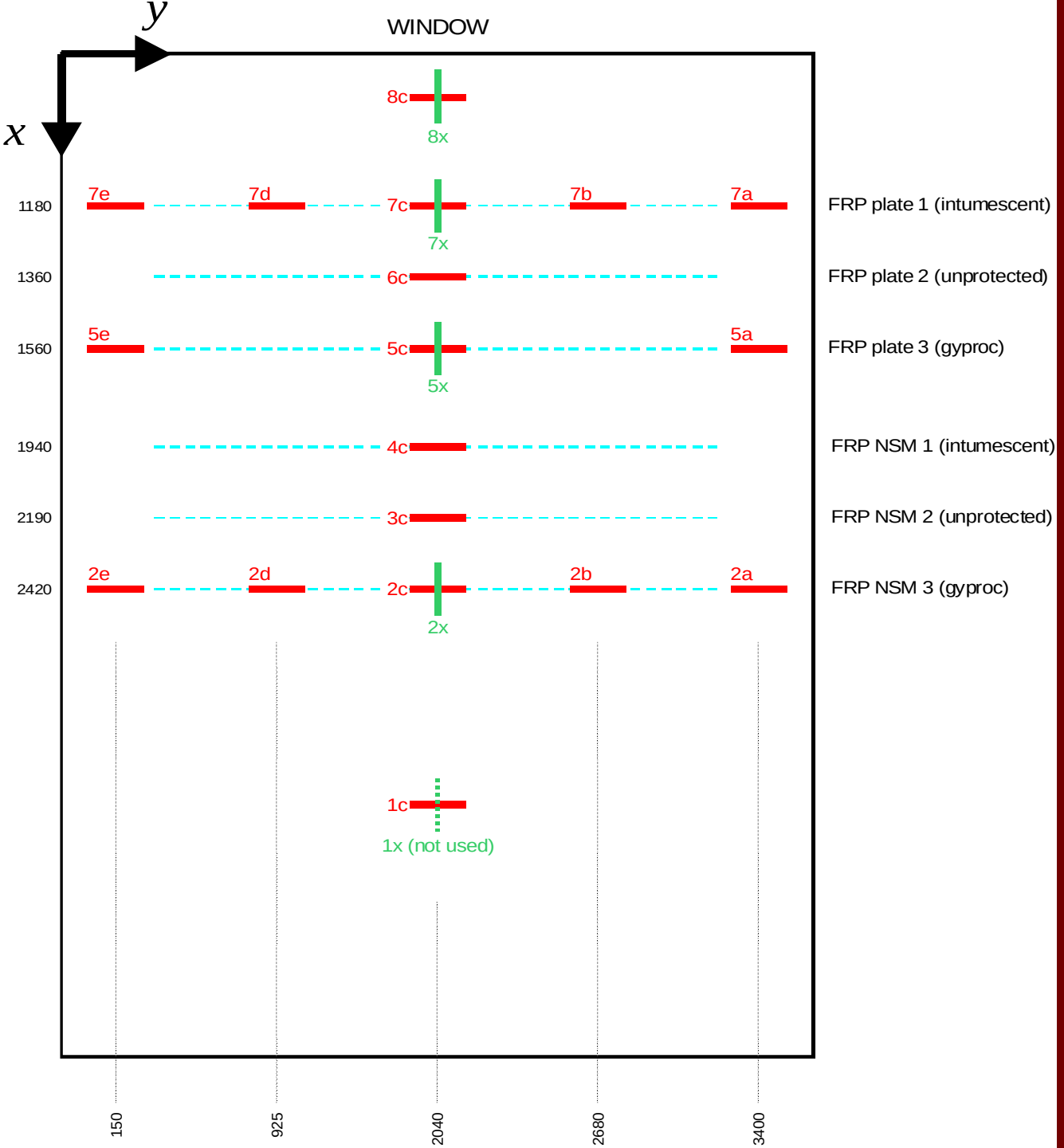
Deflection gauge locations


TAKE
CAKE!



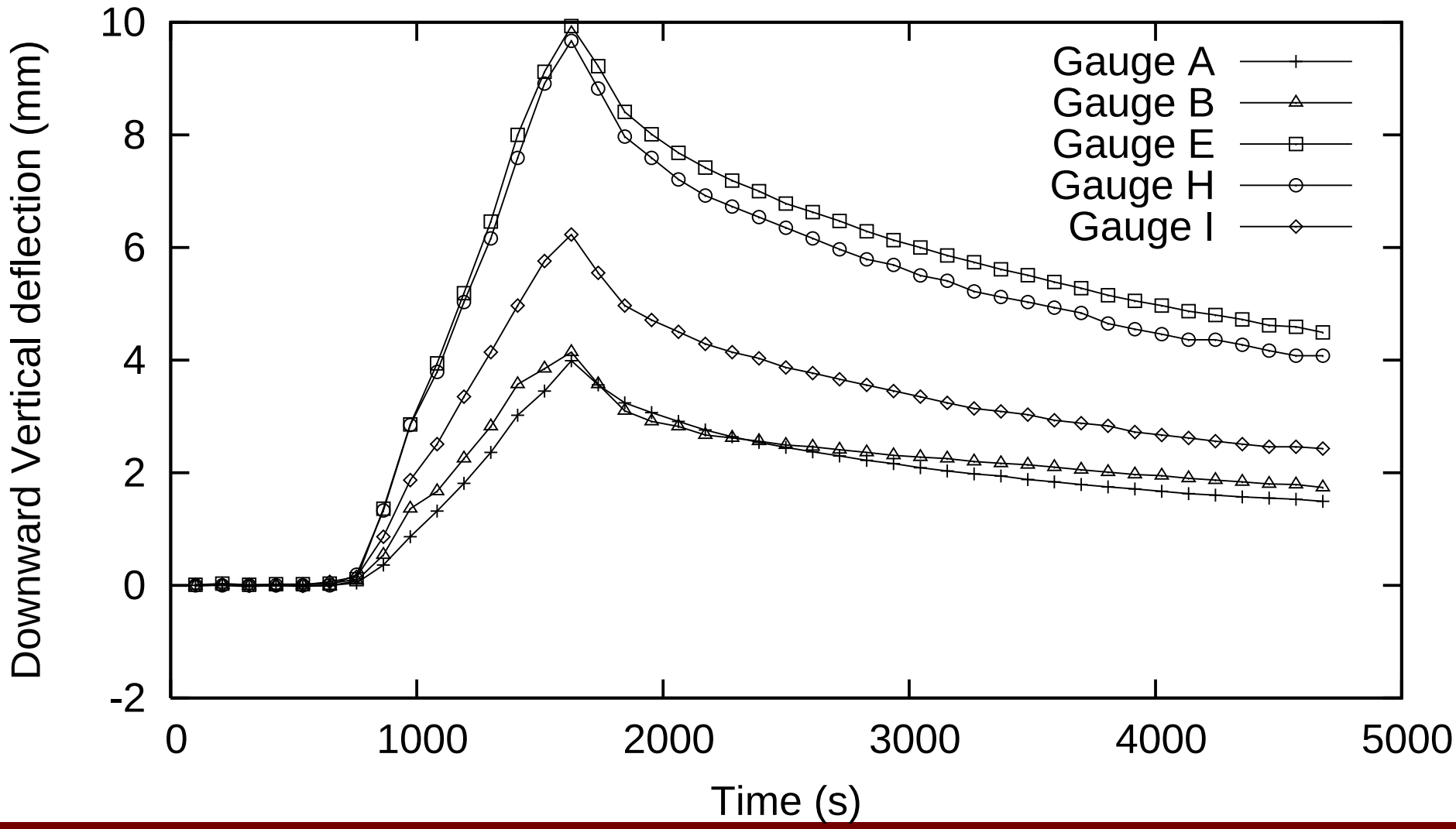
Thermocouple locations

- 6 stations in plan
- 4 t-cs at each station
- Holes grout-filled

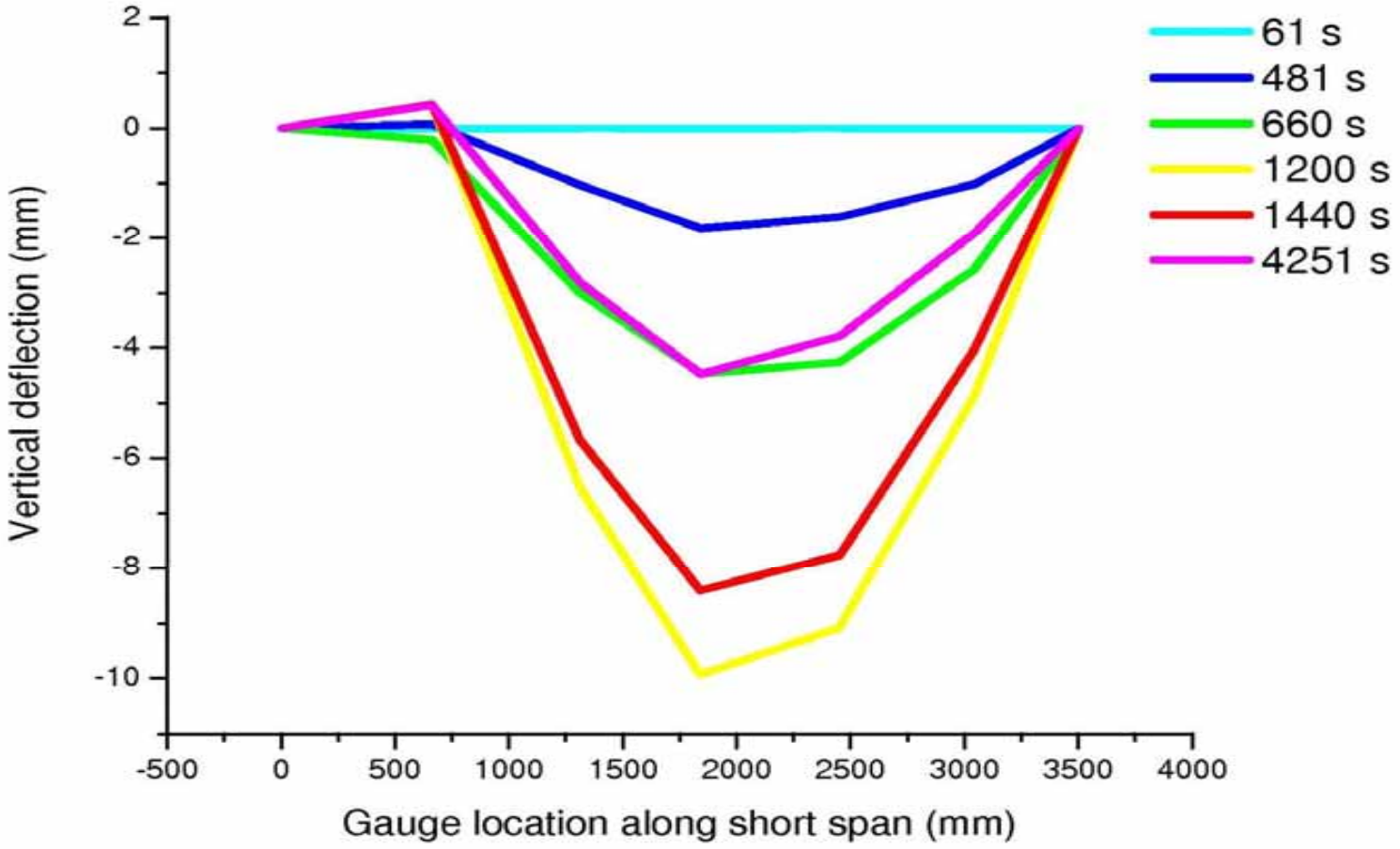


Strain gauge locations

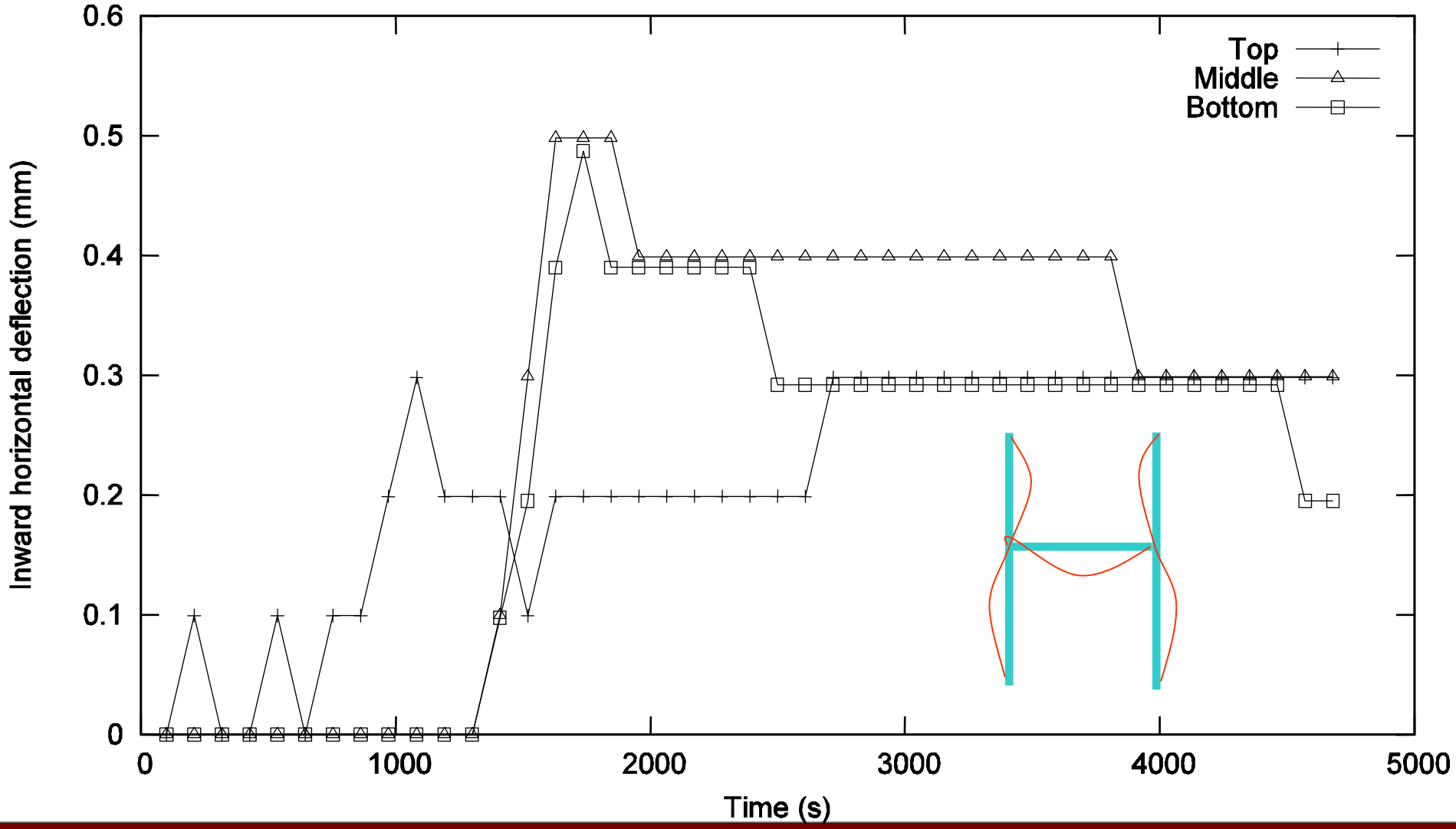
Results - Deflections



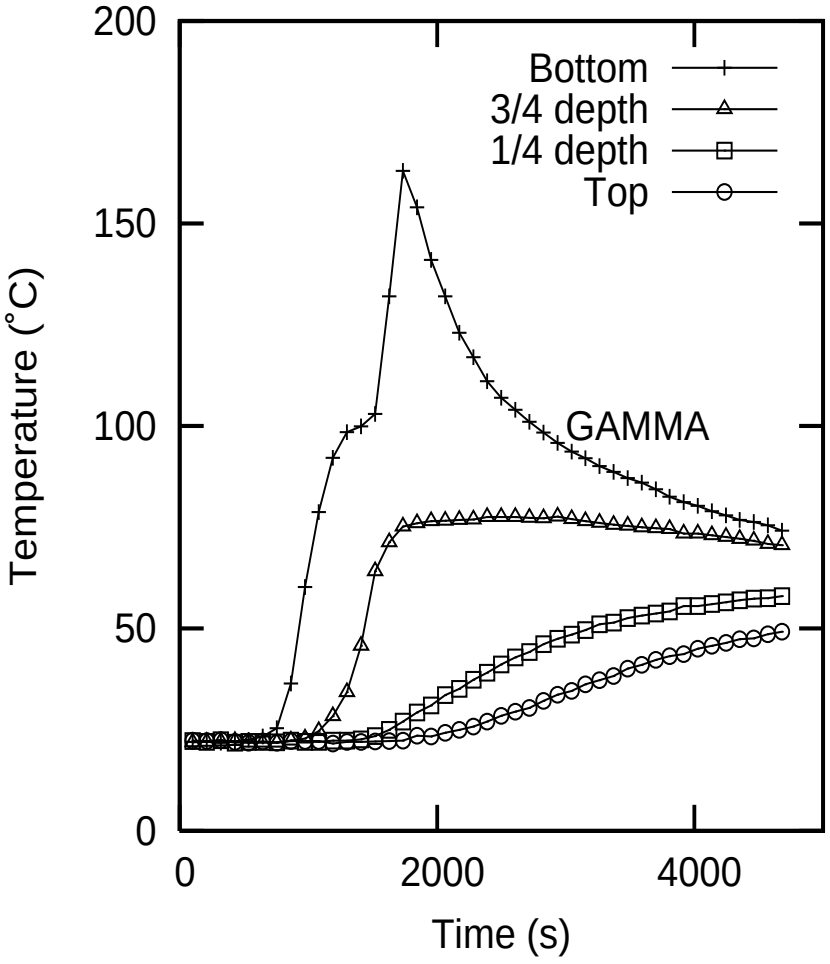
Deflections – Short Span

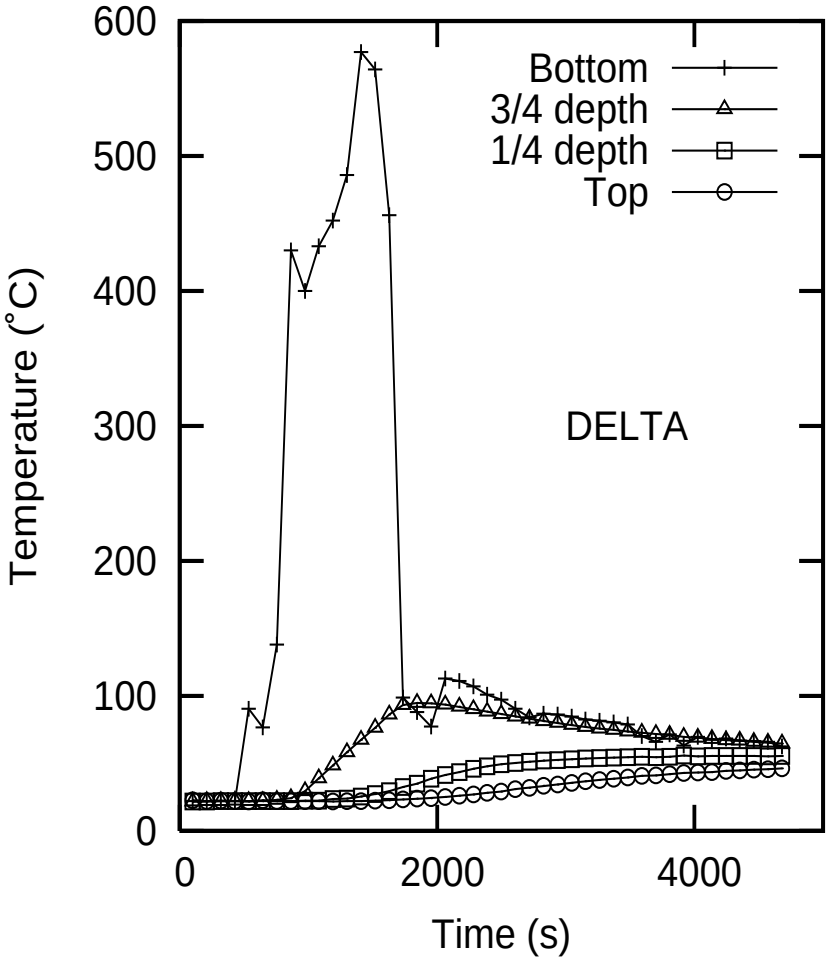


Horizontal Deflections of Wall

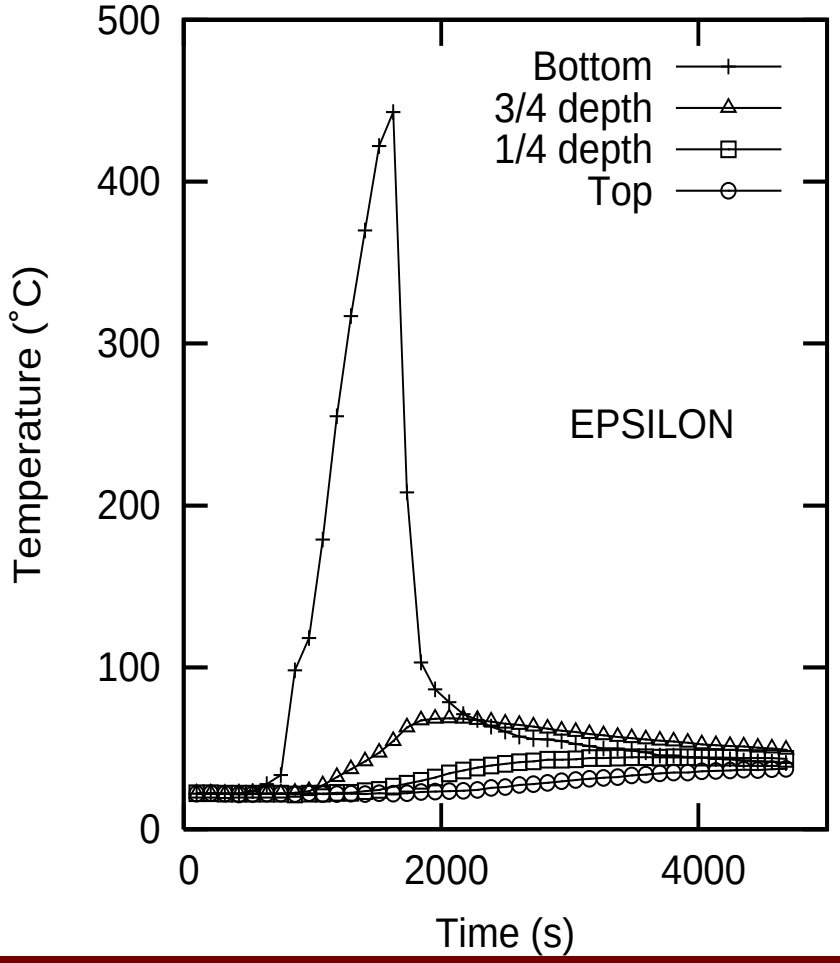


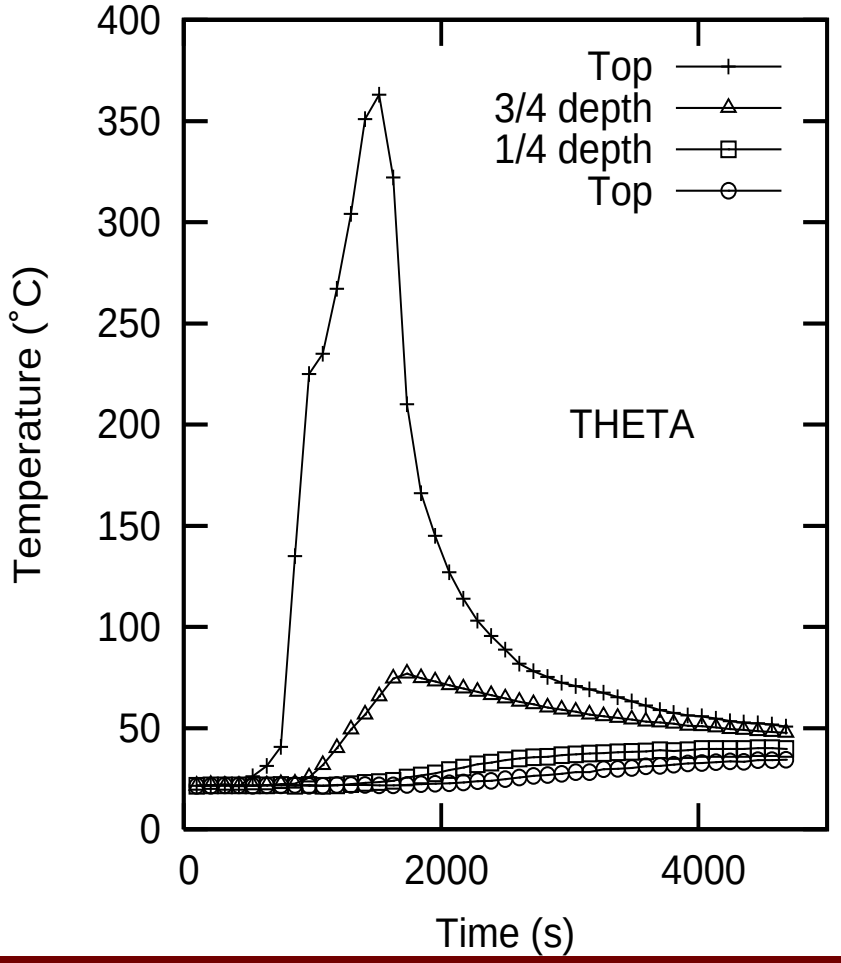
Results - Temperatures





Results - Temperatures

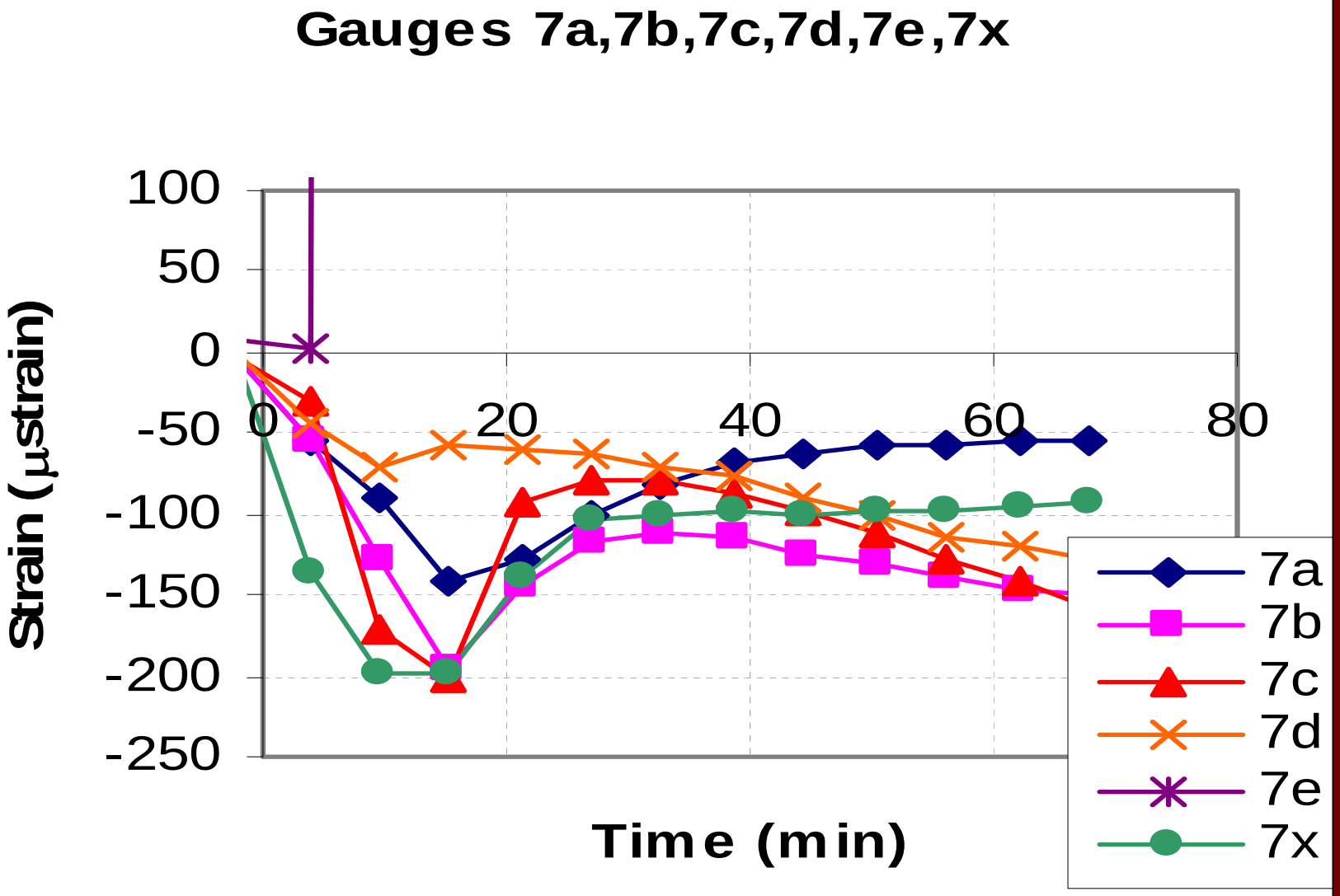




Results -Temperatures

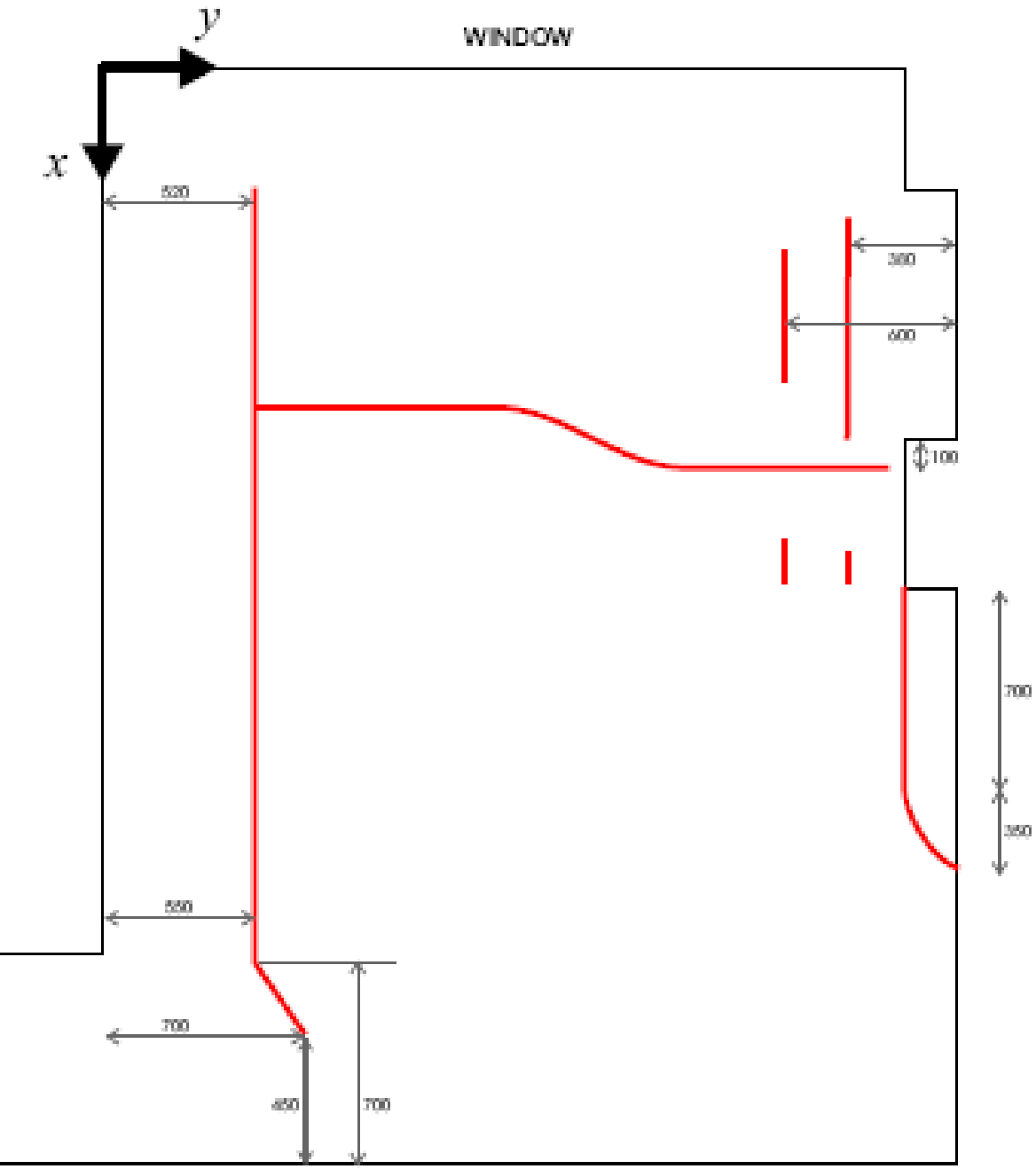
- Temperatures in slab not uniform
- Not captured by previous structural tests
- This runs counter to most design guidance
  - Is the guidance conservative?
  - Less energy absorbed by most of the slab...
  - ...but much more locally
  - Adjacent areas hot and cold
  - Fires travel – implications?
- Work on travelling fires and cooling being undertaken

Results - Strains



Results – Crack Patterns

- Cracks developed above lines of rebar curtailment
- Possibility of compartmentation breach with larger spans
- Recommend non-uniform curtailment of rebar



Crack Pattern after the Fire

To do

- Use the results as basis for numerical modelling to
  - Explore the behaviour in more detail
  - Examine a greater range of structural geometries
  - Understand the implication of local and travelling fires

Close

- Comprehensive data set available – please ask
- Numerical modelling in hand
- Any questions