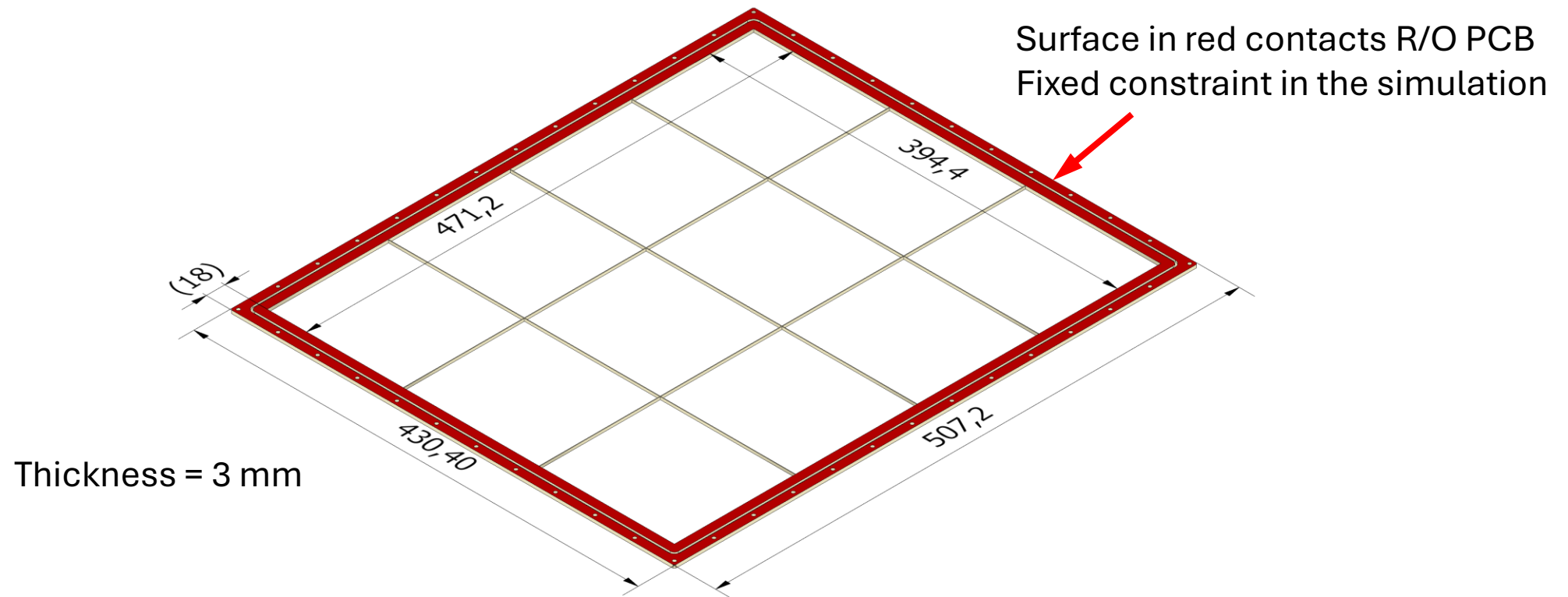


Large Area Spacer Grid Simulation

2025-04-18 - ePIC MPGD ECT Meeting

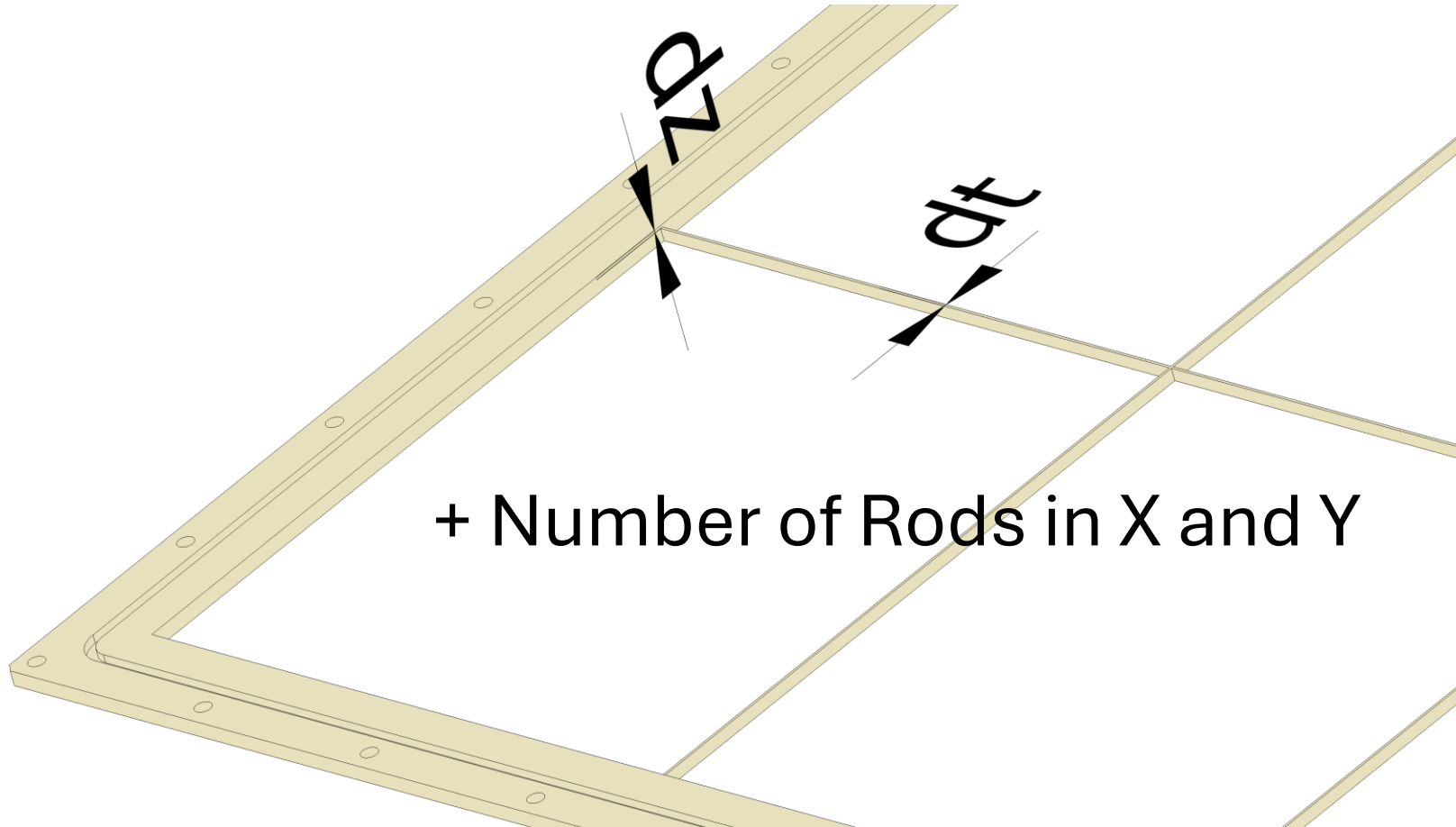
Stefano Gramigna – sgramigna@roma2.infn.it

CLAS12 LA Prototype Spacer Grid Geometry



According to Rui the spacer grid should never touch the μ -RWELL PCB

Geometrical Parameters



Material Parameters: PEEK Definition

Editor materiali: PEEK

Identità Aspetto **Fisico**

▼ Informazioni

Nome: PEEK

Descrizione: Polietereeterechetone

Parole chiave: PEEK, plastica, polimero, tecnopolimero

Tipo: Generico

Sottoclasse:

Origine: Personalizzato

URL di origine:

▼ Comportamento

Comportamento: Isotropico

▼ Proprietà termiche di base

Conducibilità termica: 2,700E-01 W/(m·K)

Calore specifico: 1,100 J/(g·°C)

Coefficiente di espansione termica: 5,000 µm/(M · °C)

▼ Proprietà meccaniche

Modulo di Young: 4,200 GPa

Coefficiente di Poisson: 0,00

Modulo a taglio: 4200,000 MPa

Densità: 1,310 g/cm³

Coefficiente di smorzamento: 0,00

▼ Resistenza

Sollecitazione di snervamento: 116,000 MPa

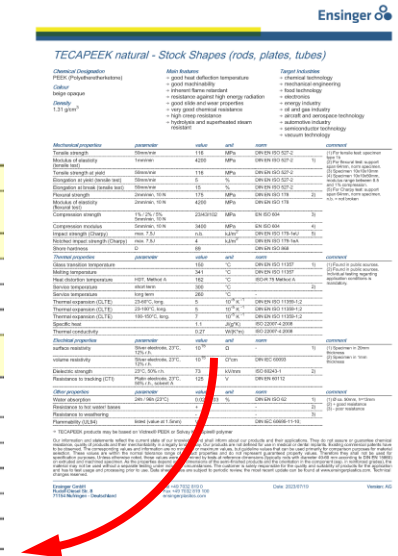
Resistenza alla trazione: 116,000 MPa

Density
1.31 g/cm³

- good slide and wear properties
- very good chemical resistance
- high creep resistance
- hydrolysis and superheated steam resistant

<i>Mechanical properties</i>	<i>parameter</i>	<i>value</i>	<i>unit</i>
Tensile strength	50mm/min	116	MPa
Modulus of elasticity (tensile test)	1mm/min	4200	MPa
Tensile strength at yield	50mm/min	116	MPa
Elongation at yield (tensile test)	50mm/min	5	%
Elongation at break (tensile test)	50mm/min	15	%
Flexural strength	2mm/min, 10 N	175	MPa
Modulus of elasticity (flexural test)	2mm/min, 10 N	4200	MPa
Compression strength	1% / 2% / 5% 5mm/min, 10 N	23/43/102	MPa
Compression modulus	5mm/min, 10 N	3400	MPa
Impact strength (Charpy)	max. 7.5J	n.b.	kJ/m ²
Notched impact strength (Charpy)	max. 7.5J	4	kJ/m ²
Shore hardness	D	89	

<i>Thermal properties</i>	<i>parameter</i>	<i>value</i>	<i>unit</i>
Glass transition temperature		150	°C
Melting temperature		341	°C
Heat distortion temperature	HDT, Method A	162	°C
Service temperature	short term	300	°C
Service temperature	long term	260	°C
Thermal expansion (CLTE)	23-60°C, long.	5	10 ⁻⁵ K ⁻¹
Thermal expansion (CLTE)	23-100°C, long.	5	10 ⁻⁵ K ⁻¹
Thermal expansion (CLTE)	100-150°C, long.	7	10 ⁻⁵ K ⁻¹
Specific heat		1.1	J/(g°K)
Thermal conductivity		0.27	W/(K°m)



Ensinger TECAPEEK Natural Datasheet

Other simulation parameters

The only force applied to the object is the force of gravity

Impostazioni mesh

Impostazioni comuni

Dimensione media elemento
(come frazione della lunghezza del riquadro d'ingombro)

Dimensione minima elemento
(come frazione della dimensione media)

Fattore di gradazione

Angolo di rotazione massimo

☒ Crea elementi mesh curvi



Impostazioni convergenza

Numero massimo di affinamenti H

Criterio interruzione (%)

Soglia di affinamento H (da 0 a 1)

Risultati da far convergere

☐ Sollecitazione di Von Mises

☐ Prima sollecitazione principale

☐ Terza sollecitazione principale

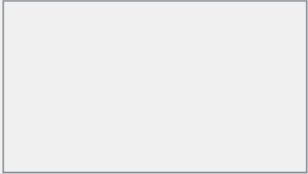
☒ Spostamento

Selezioni geometria

☒ Tutta la geometria

☐ Includi la geometria selezionata

☐ Escludi la geometria selezionata

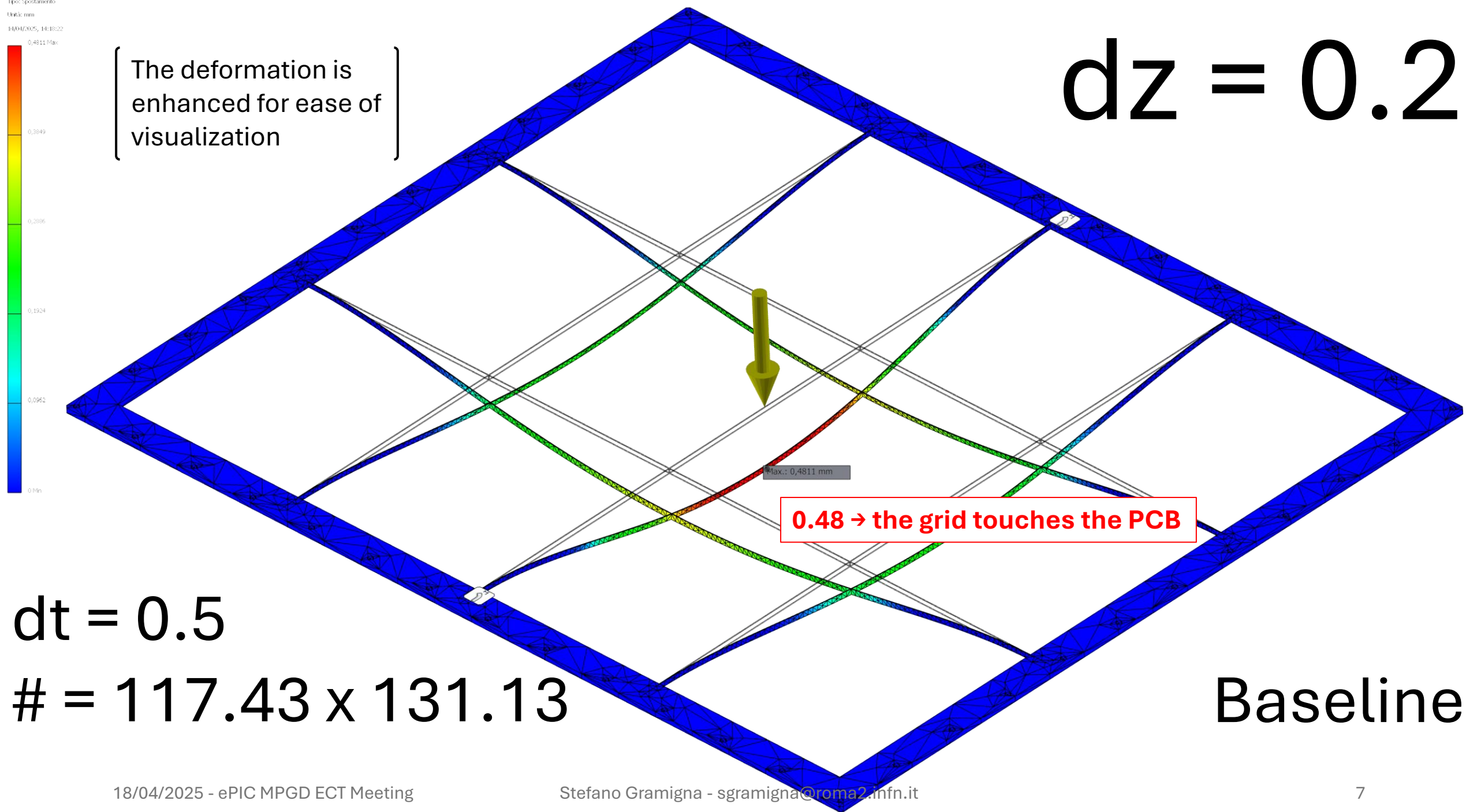
 Facce 



Simulation Results

$dz = 0.2$

The deformation is enhanced for ease of visualization



$dt = 0.5$

$\# = 117.43 \times 131.13$

Summary of Tested Configurations

Variant	dz	dt	Rods in X	Rods in Y	Mesh size	Max deformation
Baseline	0.2	0.5	3	2	117.43 x 131.13	0.48
Baseline	0.5	0.5	3	2	117.43 x 131.13	0.60
Baseline	1.0	0.5	3	2	117.43 x 131.13	0.93
Thick rods	0.5	1.0	4	3	117.05 x 130.80	0.57
Thin rods	0.5	0.3	4	3	117.58 x 131.25	0.61
Fine mesh	0.2	0.5	4	3	93.84 x 98.20	0.49
Fine mesh	0.5	0.5	4	3	93.84 x 98.20	0.61
Fine mesh	1.0	0.5	4	3	93.84 x 98.20	0.95
Slab	0.2	NA	NA	NA	NA	0.25

The grid either touches the PCB or it is ineffective in containing GEM displacement

Proposed Solutions

1. Small reliefs on the bottom face of the spacer grid to contact the PCB in matching dead regions

PROS

- Easiest implementation
- No additional tooling required
- Limited requirement for studies/simulations

CONS

- Largest loss of active area and efficiency

2. No spacer grid, high mechanical tension applied to the GEM

PROS

- No active area loss
- No additional tooling required

CONS

- Risky
- Long term stability uncertain
- GEM Holes may be deformed
- Might require a modification of the GEM stretcher clamps
- Requires studies/simulations (of an anisotropic and inhomogeneous material...)

3. Tensioned spacer grid

PROS

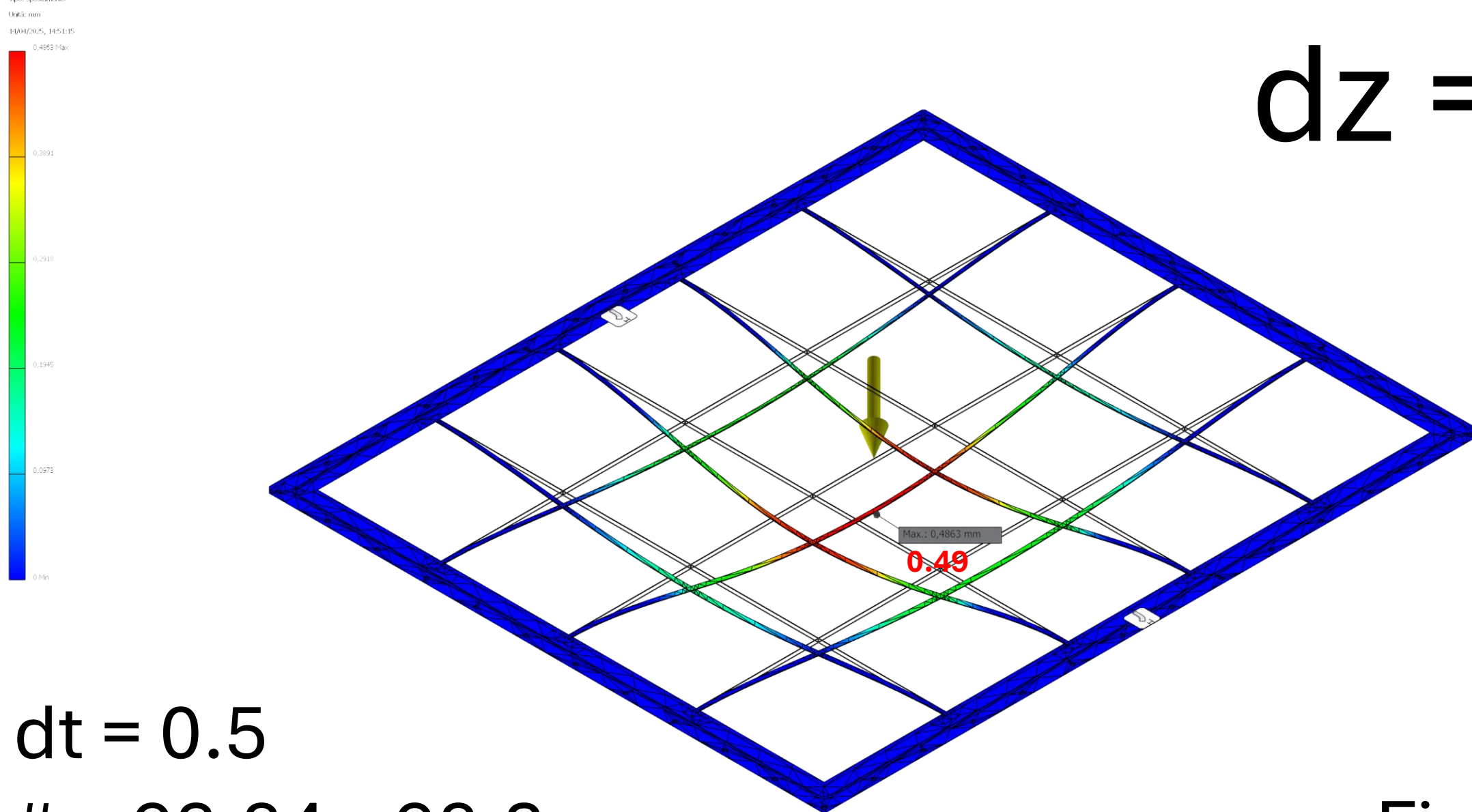
- Moderate efficiency loss

CONS

- Long term stability uncertain
- Requires dedicated assembly gig
- Might increase frame bulk
- Requires studies/simulation (of a homogeneous material)

Backup

$$dz = 0.2$$

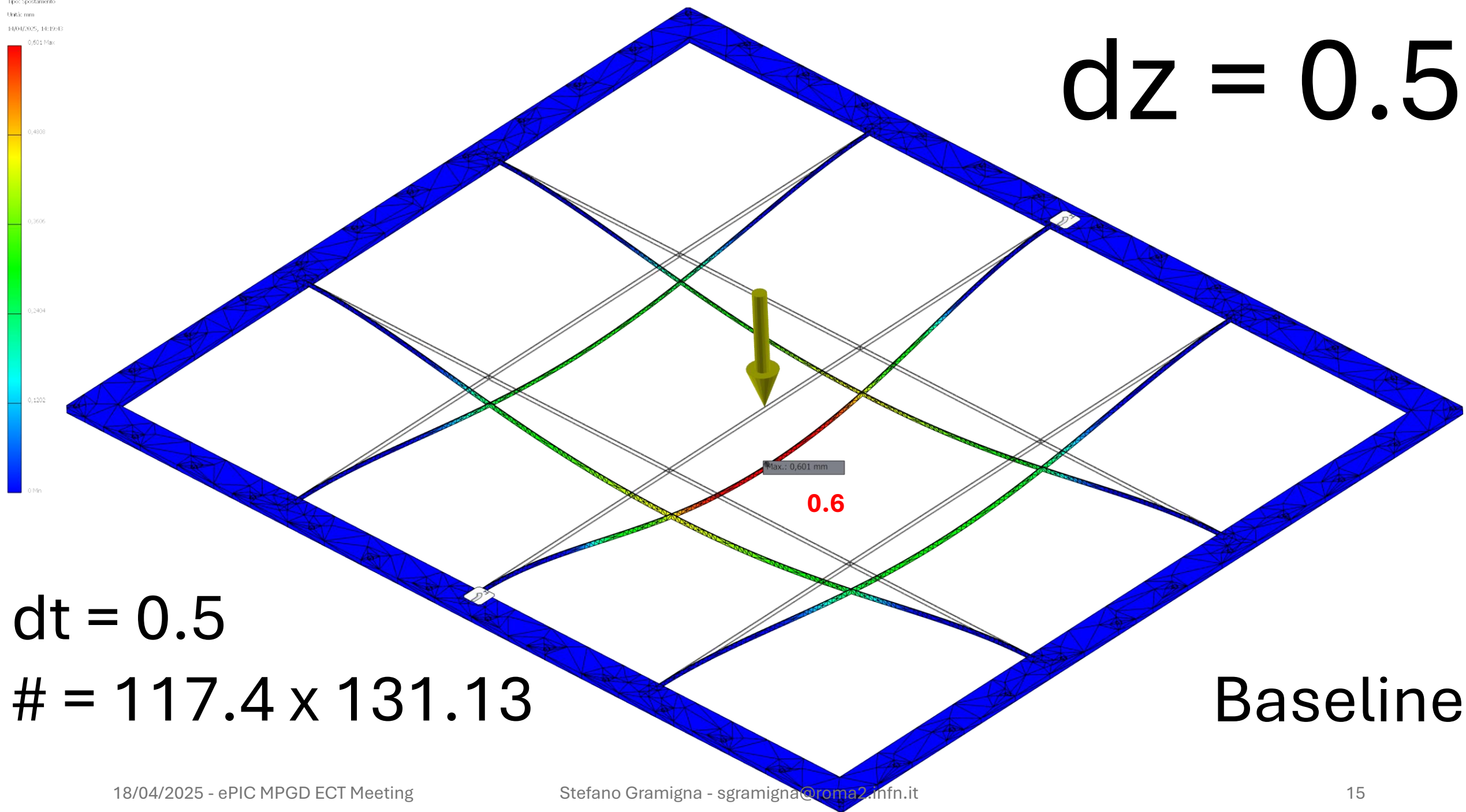


$$dt = 0.5$$

$$\# = 93.84 \times 98.2$$

Fine mesh

$dz = 0.5$



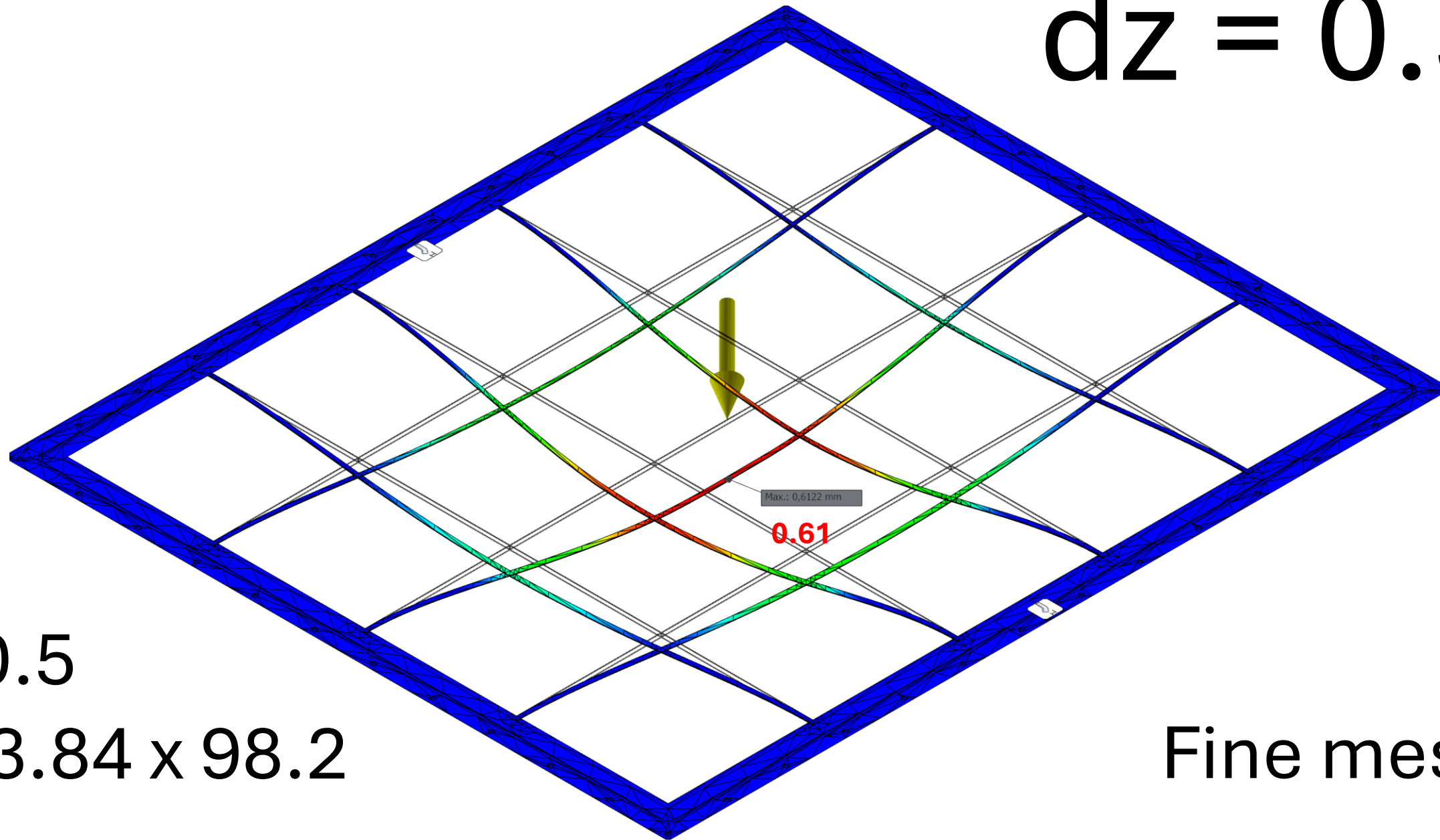
$dt = 0.5$

$\# = 117.4 \times 131.13$

Baseline



$dz = 0.5$

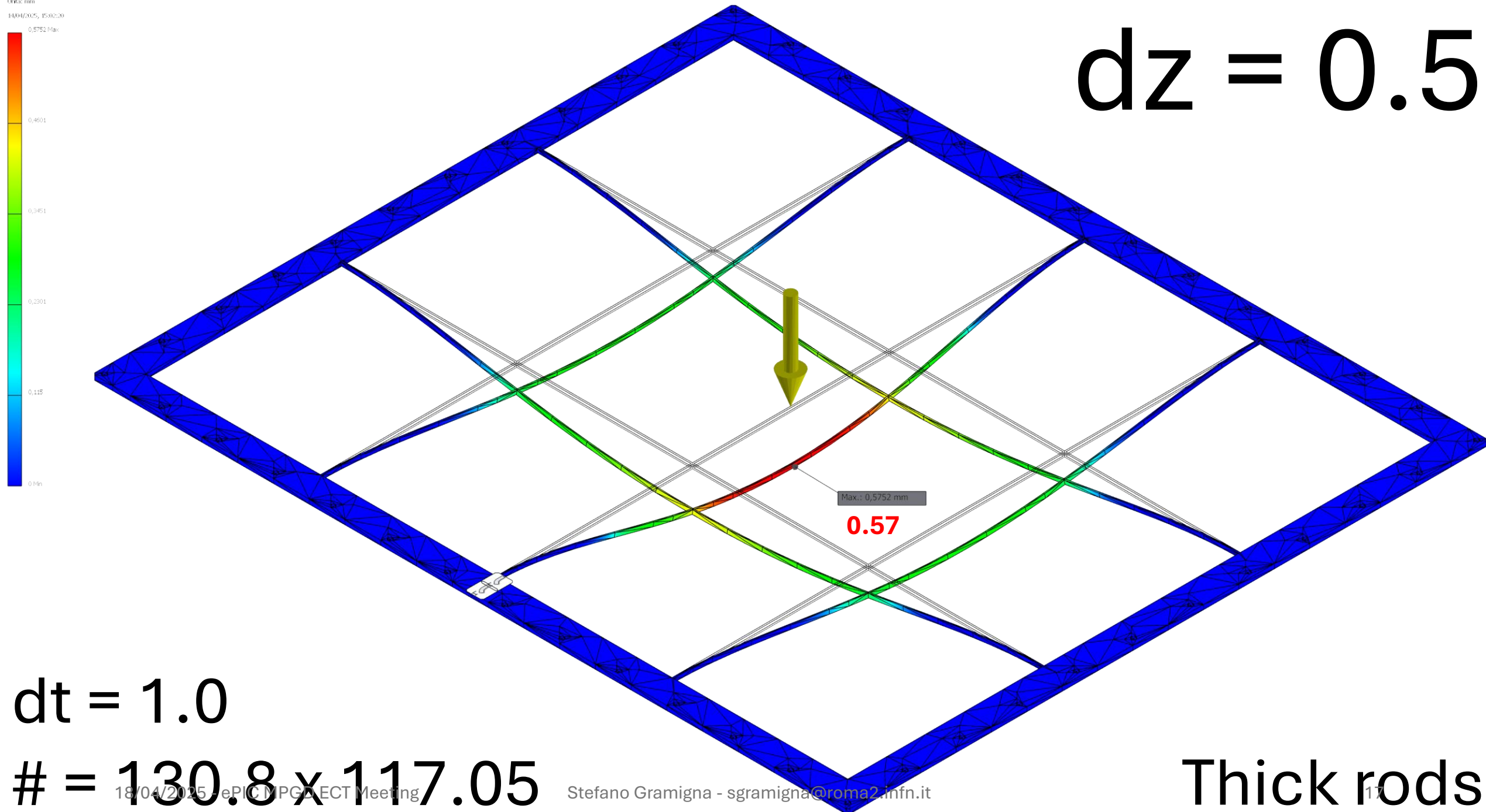


$dt = 0.5$

$\# = 93.84 \times 98.2$

Fine mesh

$dz = 0.5$

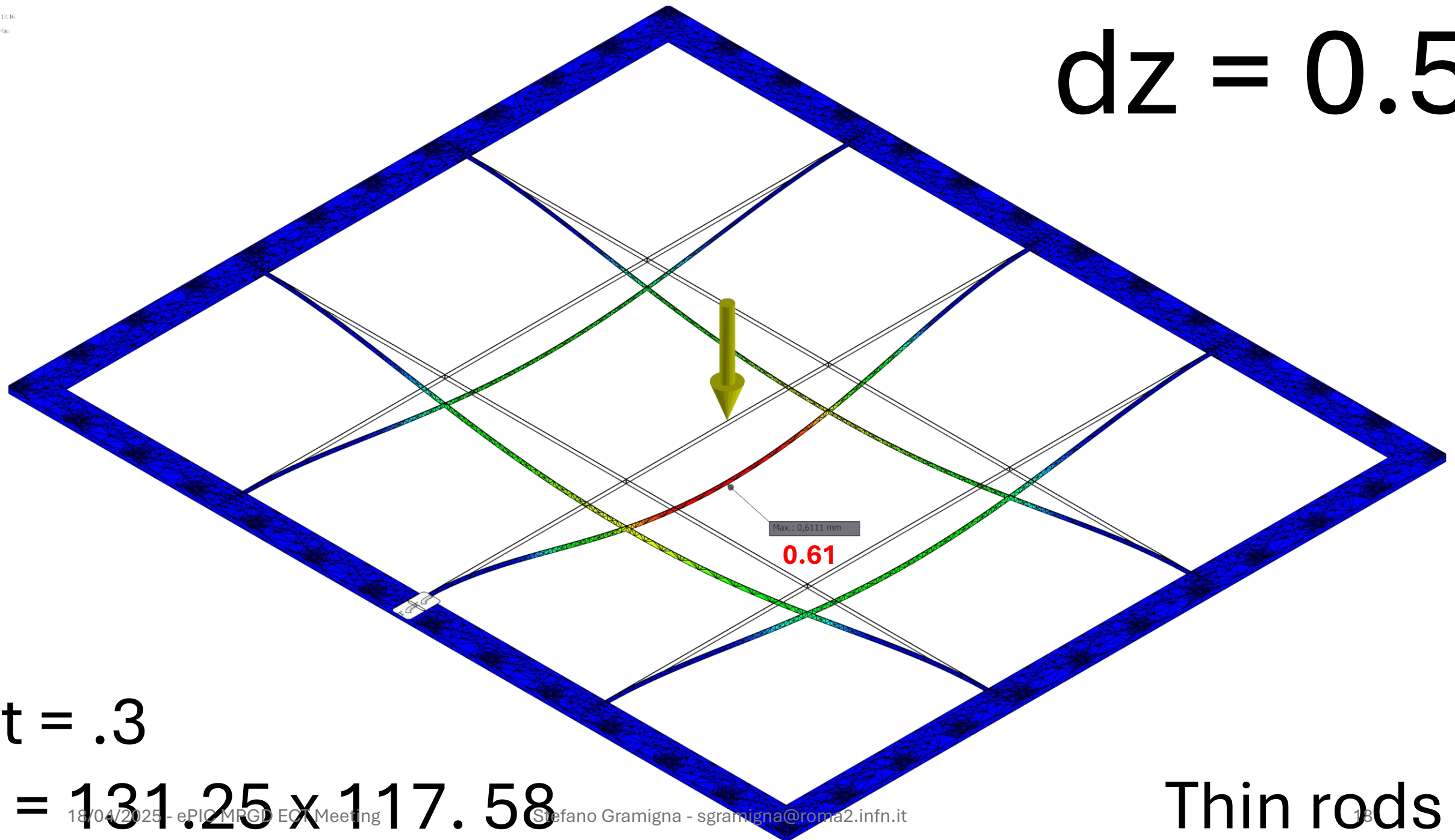


$dt = 1.0$

$\# = 130.8 \times 117.05$

Thick rods

$dz = 0.5$

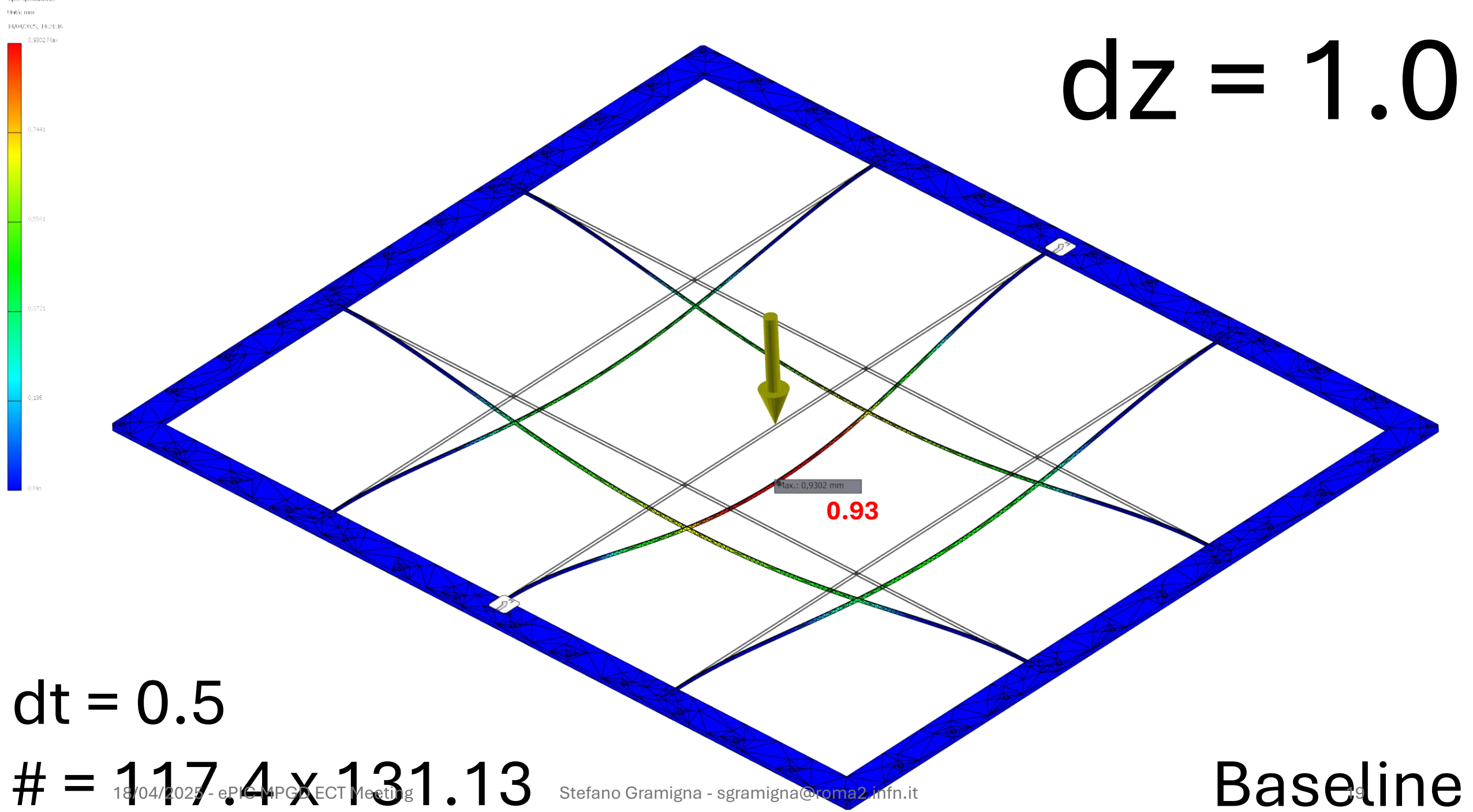


$dt = .3$

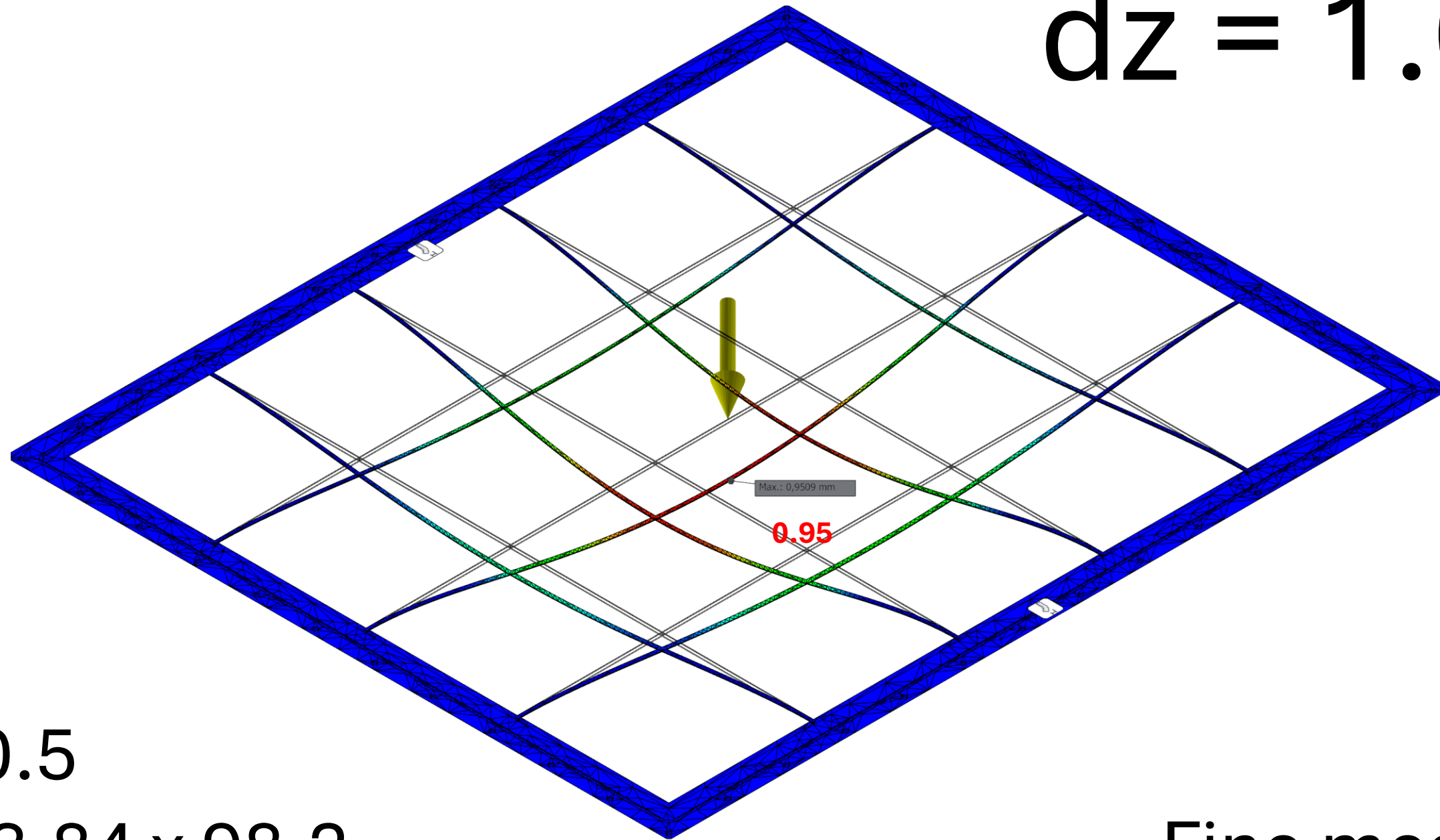
$\# = 131.25 \times 117.58$

Thin rods

$dz = 1.0$



$dz = 1.0$



$dt = 0.5$

$\# = 93.84 \times 98.2$

Fine mesh

