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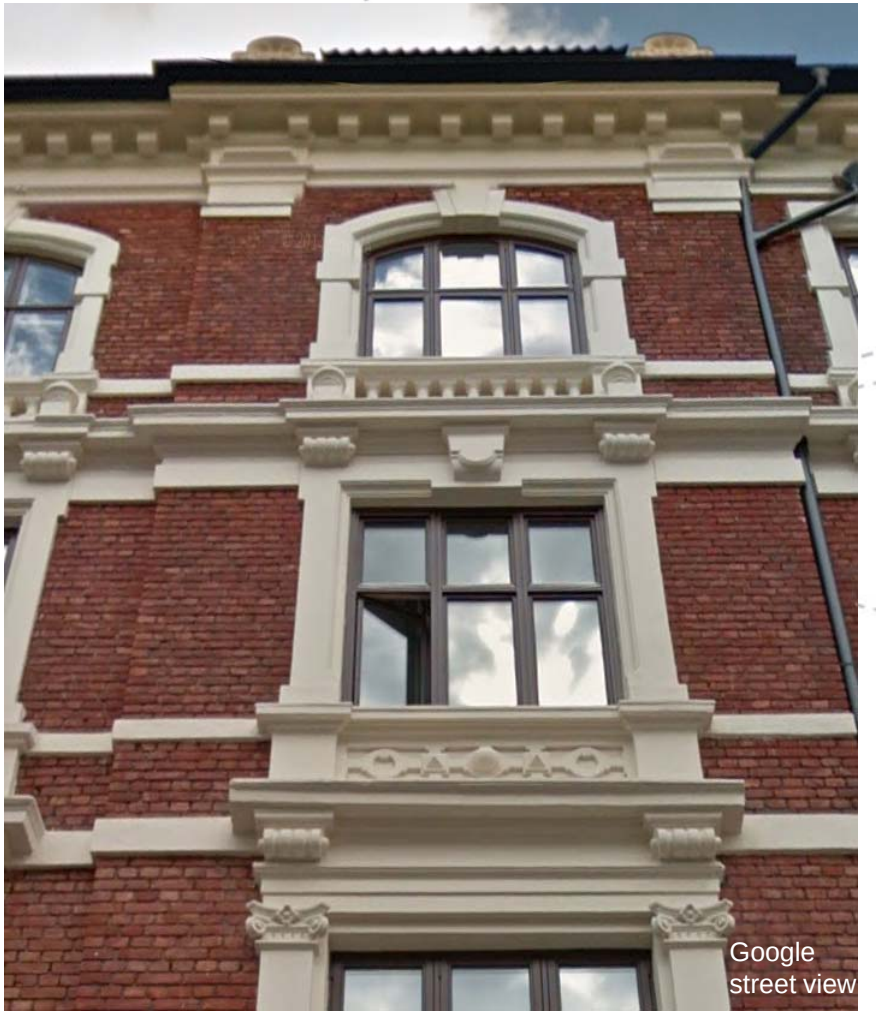
Innvendig etterisolering av murvegger - Utfordringer

Av Jon Ivar Belghaug Knarud

Norsk Bygningsfysikkdag, Oslo – 26.11-2014

Motivasjon

- Stort antall murgårder i Norge (>3000 i Oslo)
  - 1890 gårdene
- Redusere energiforbruk
- Øke komfort
- Ta vare på opprinnelig fasade



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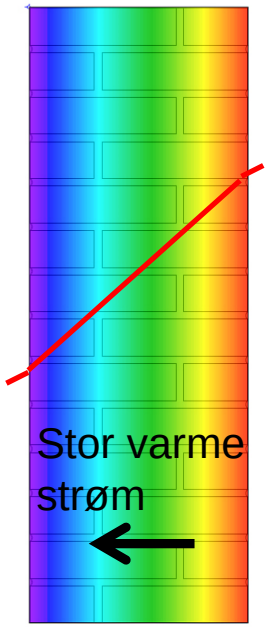
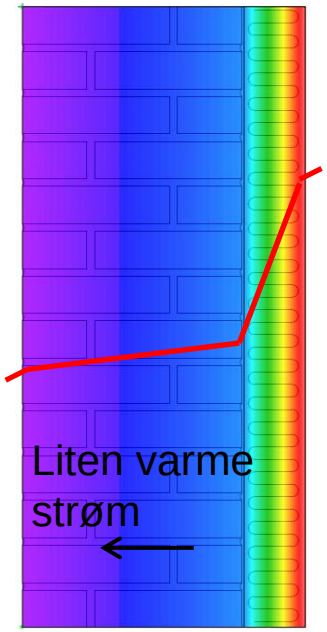
Temperaturgradient

Opprinnelig vegg



Etterisolert vegg



Innvendig konstruksjon
→ økt motstand mot fukttransport

Redusert temperatur
→ lavere uttørkingspotensiale

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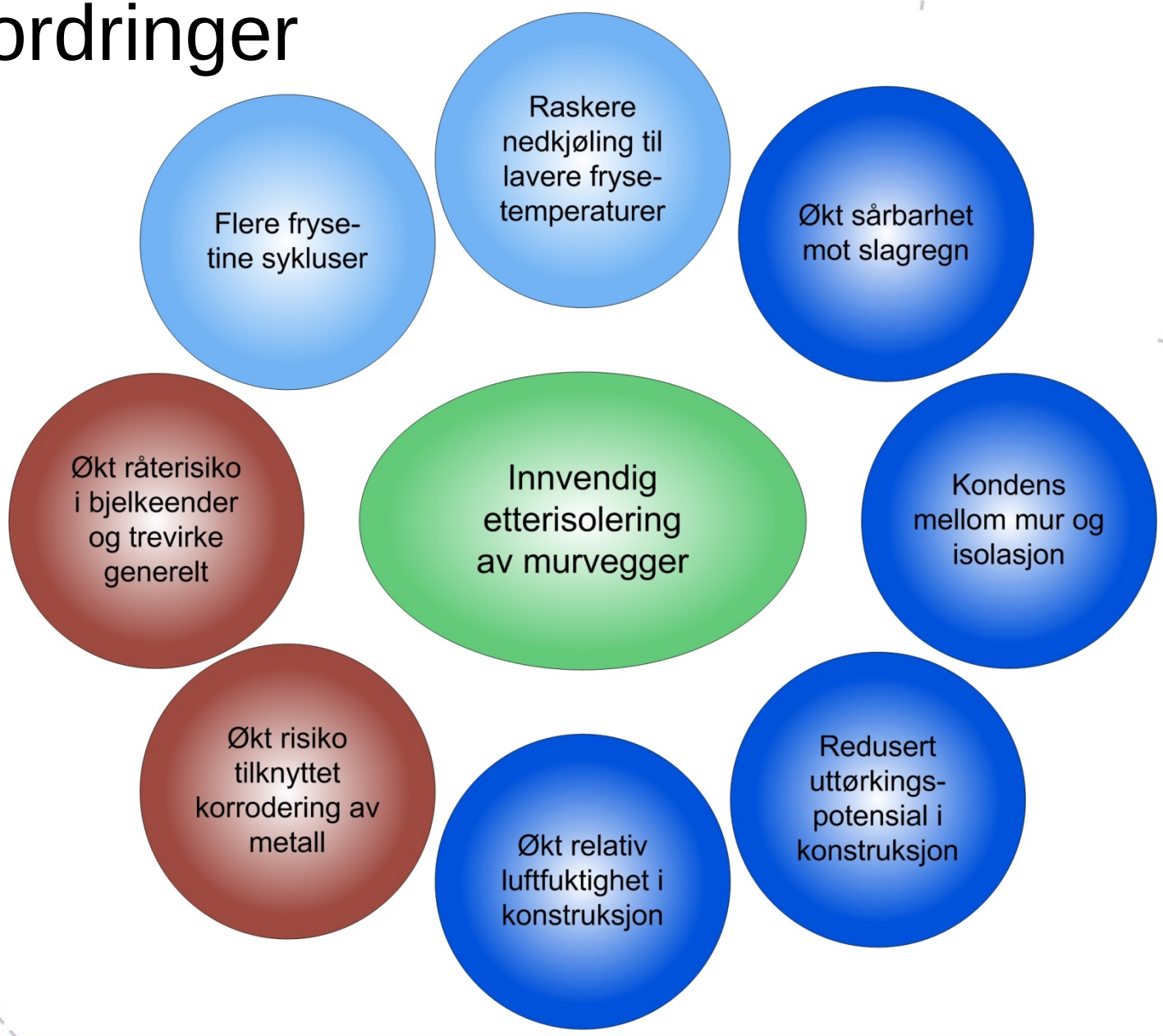
Utfordringer

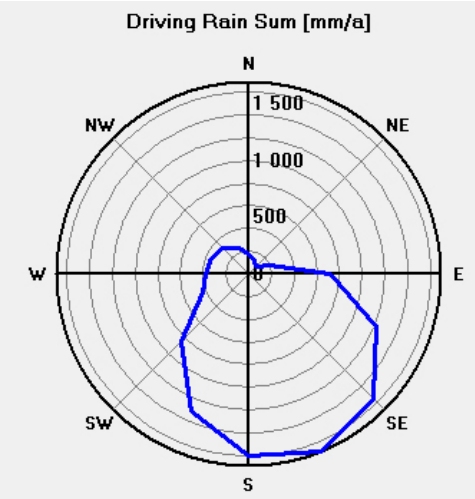


Slagregnpåkjenning

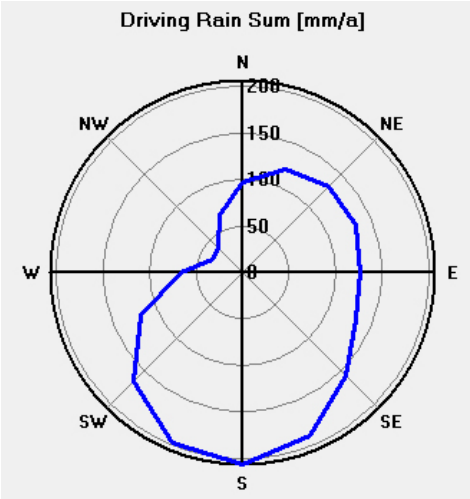
- Sted
- Veggorientering
- Utvendig skjerming

} Opptredende vind og regn

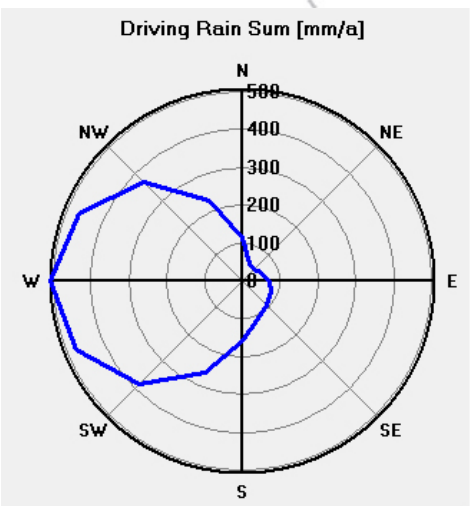
Slagregnpåkjenning er veldig steds og retningsbestemt



Bergen



Oslo



Værnes

Figurene er fra WUFI

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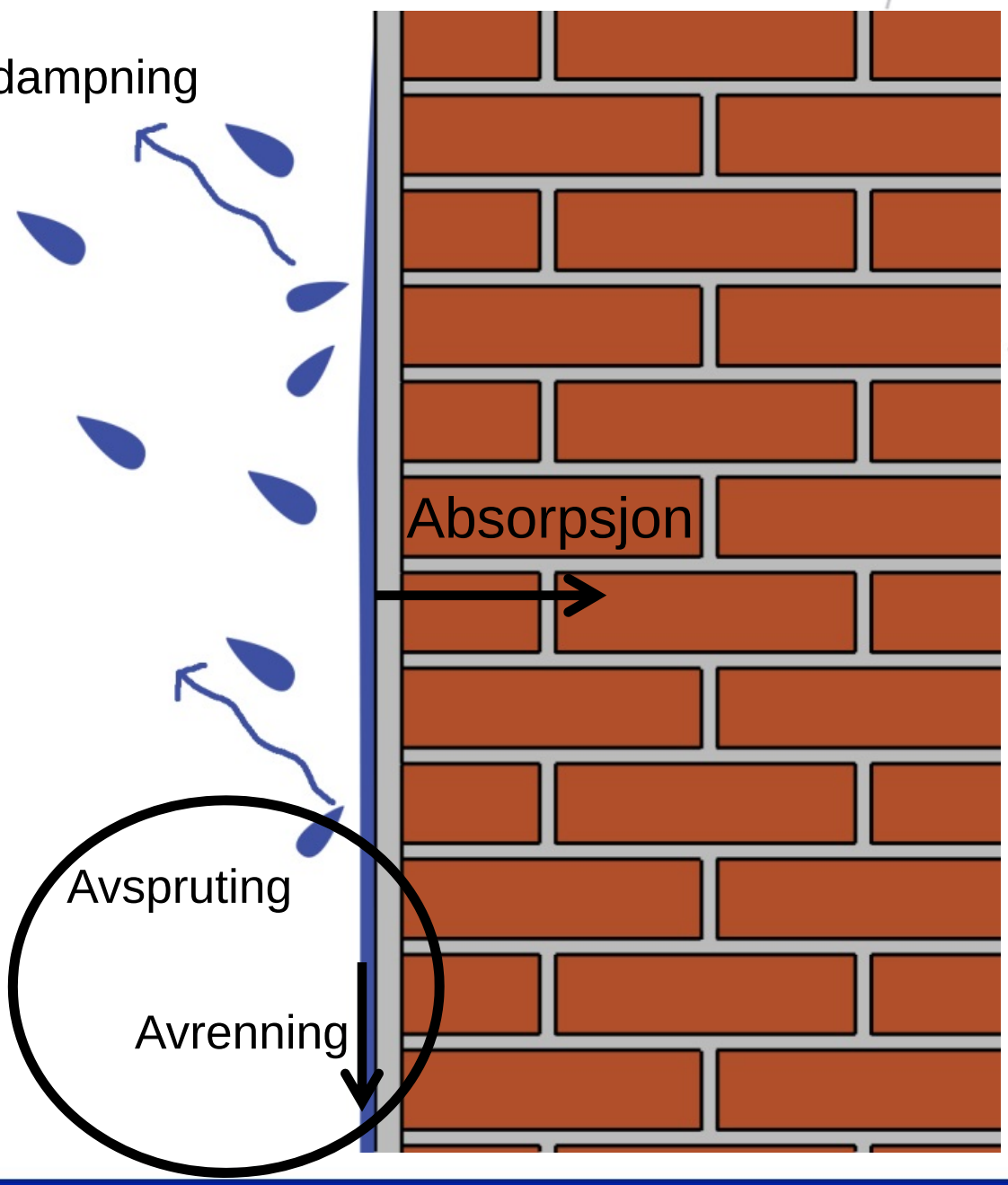
Slagregnspåkjenning forts.

- Kortbølget og langbølget stråling (sol og omgivelser)
- Uttørkingspotensial
- Materialegenskaper (tegl, mørtel, puss, overflatebehandling)

Solstråling?
Slagregnpåkjenning?
Google street view



WUFI bruker 70% som “default” tilgjengelig for absorpsjon

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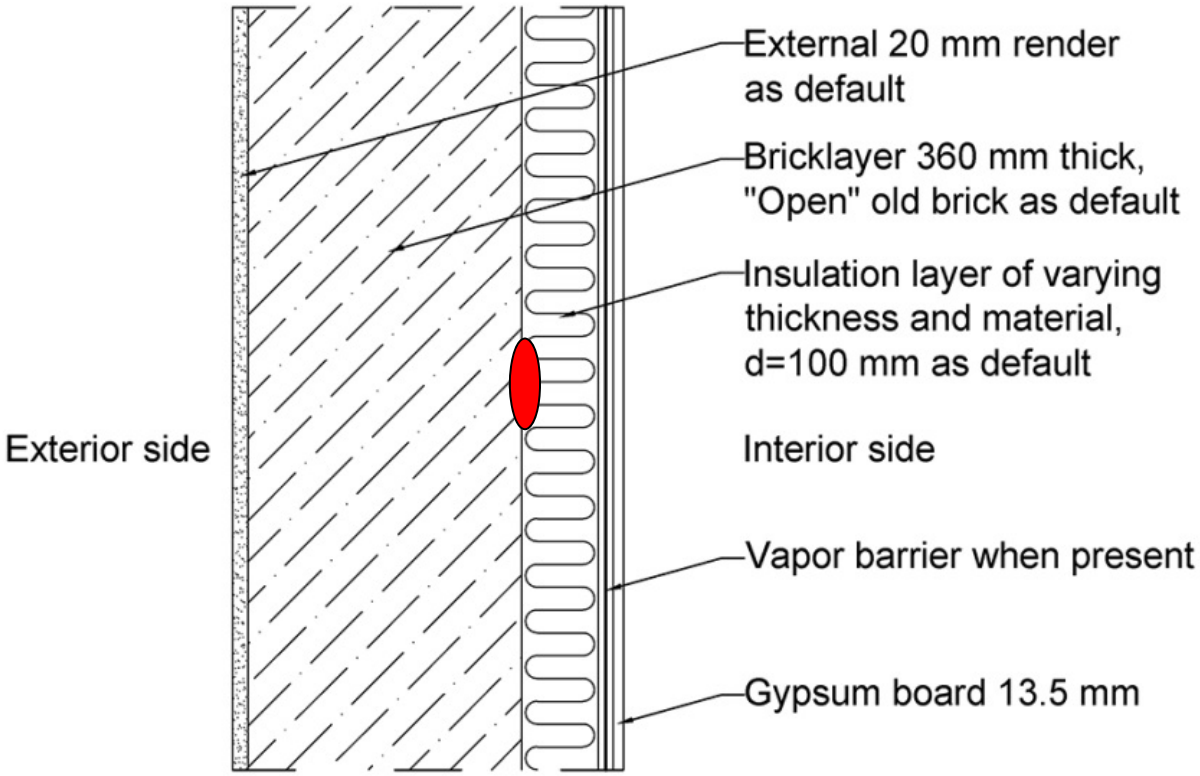
Simulering av innvendig etterisolering



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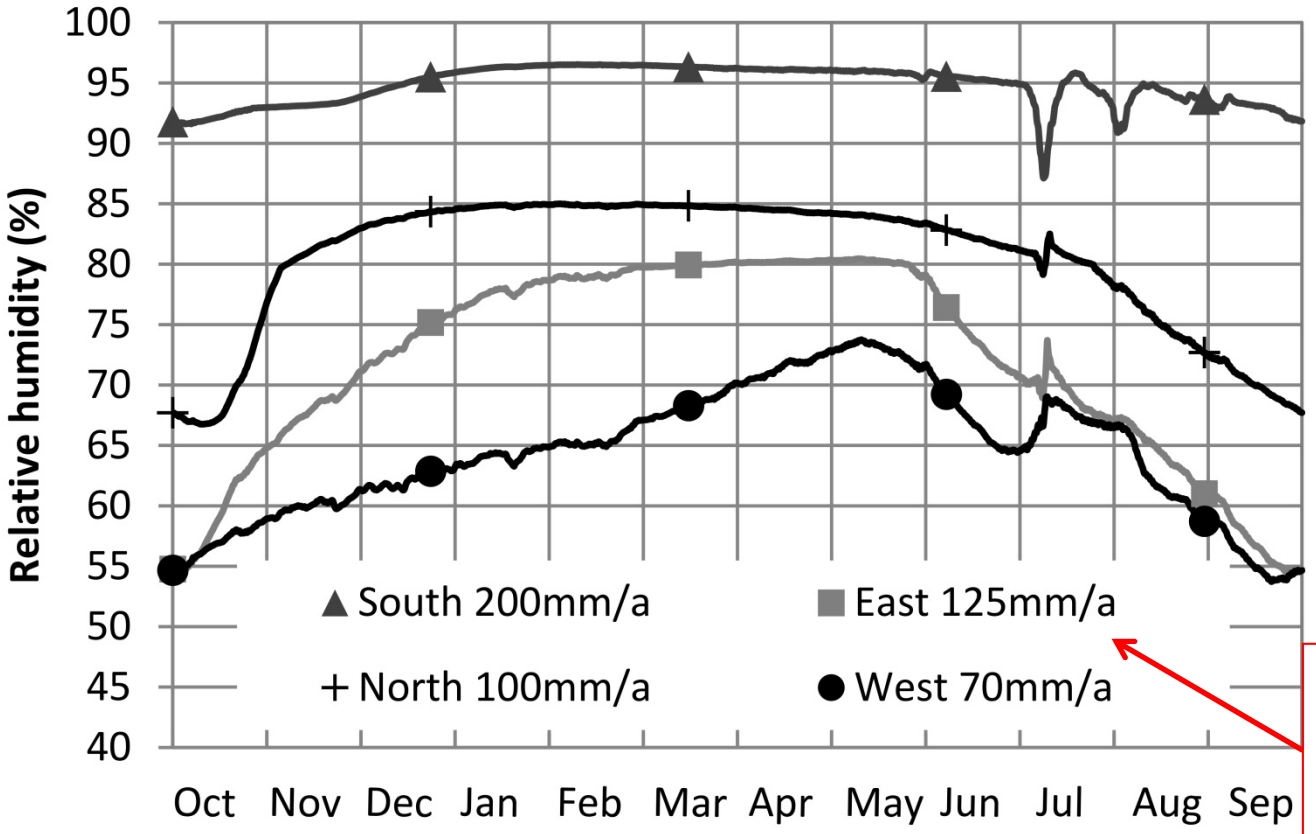
Orientering av ytterveggen



Slagregn-
påkjenning
[mm per år]

Teglvegg, isolert med 100mm mineralull
Værpåkjenning: Oslo
Med dampsperre

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Simuleringsmuligheter

Tradisjonell software:

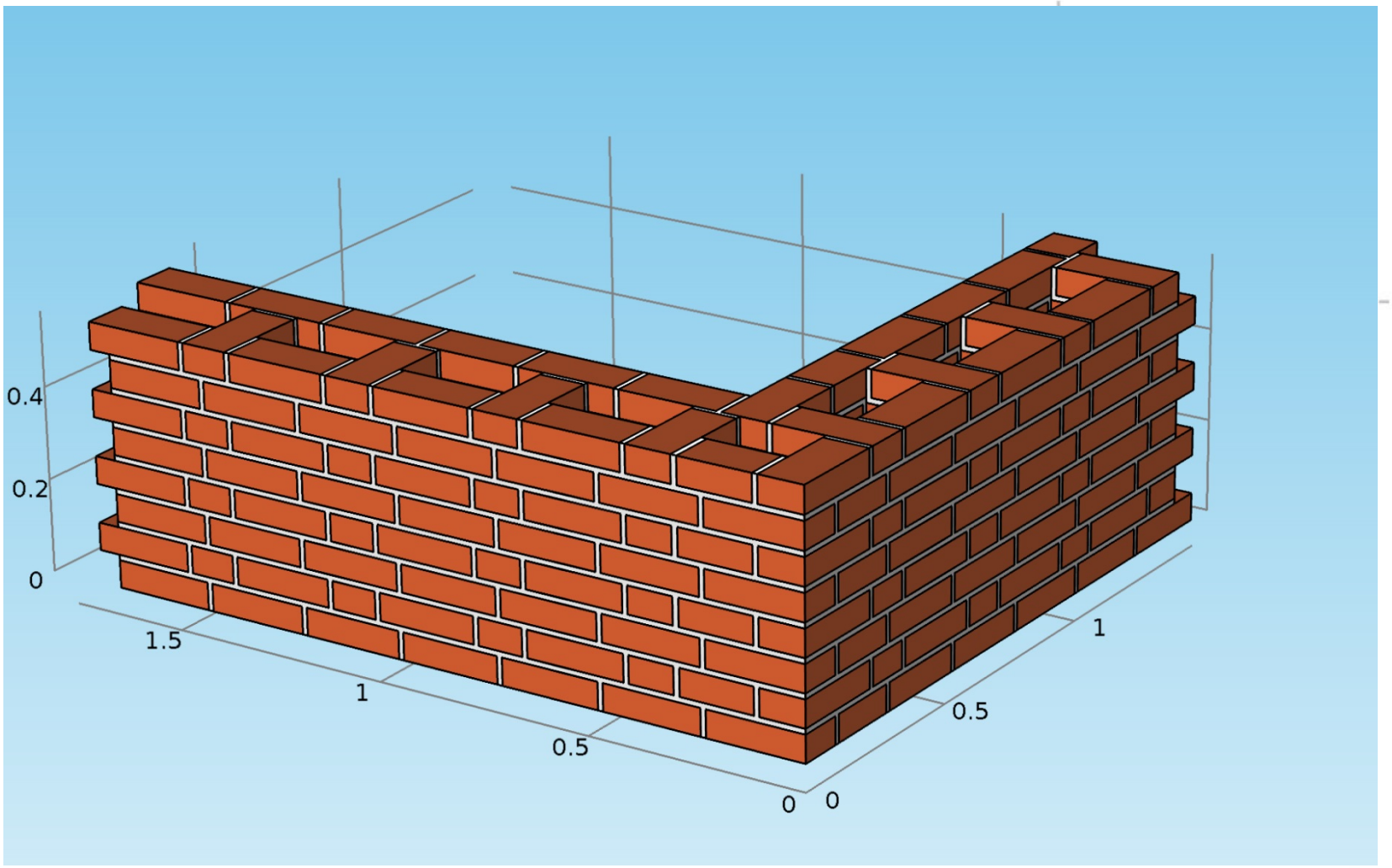
- WUFI
- DELFIN

Nye muligheter:

- COMSOL Multiphysics

Generelle utfordringer

- Kvantifisere slagregn påkjenning og absorpsjon
- Luftlekkasjer
- Konvektiv lufttransport i konstruksjonen
- Regn-penetrering pga. vind trykk



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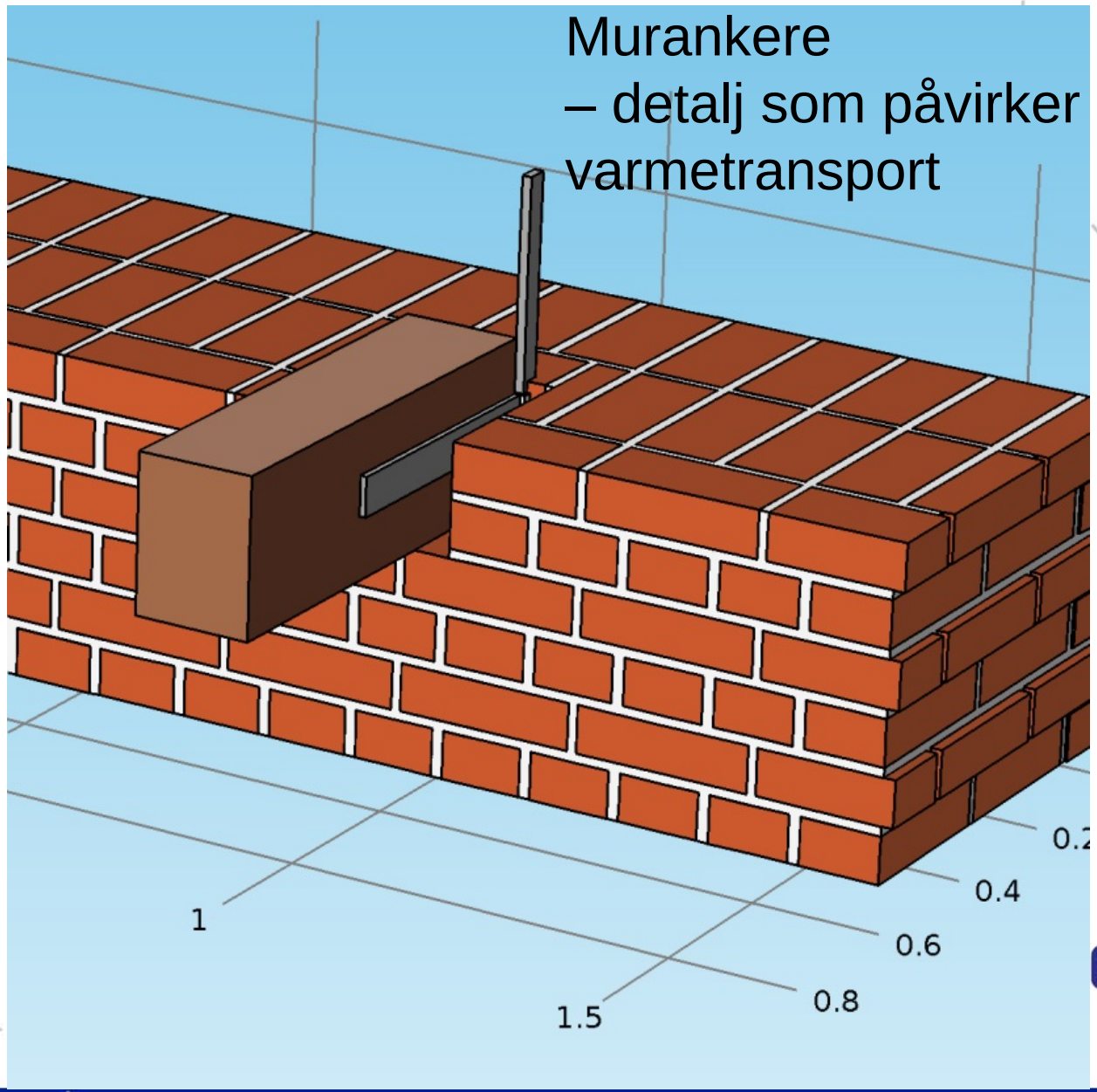
Murankere
– detalj som påvirker varmetransport



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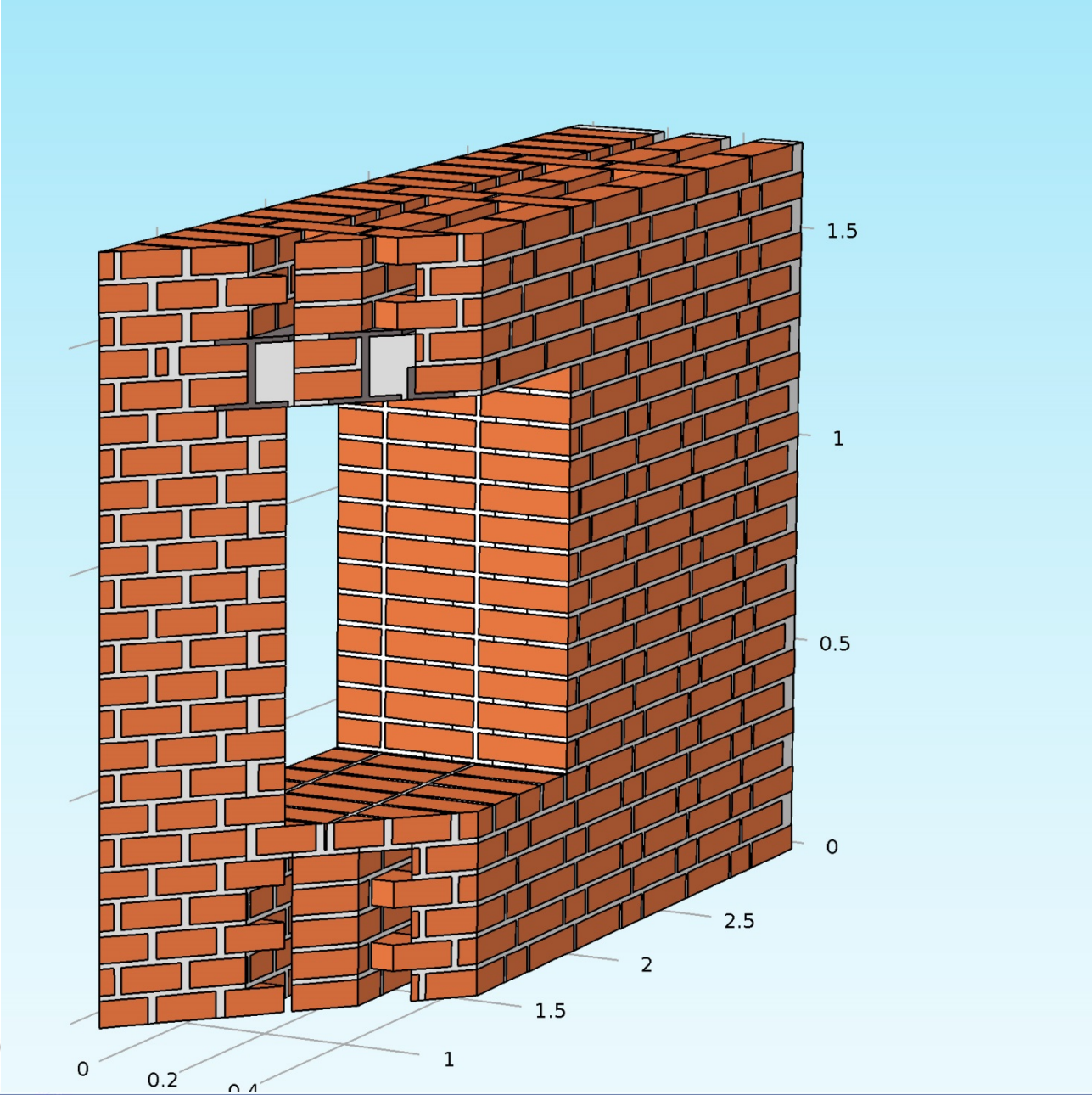

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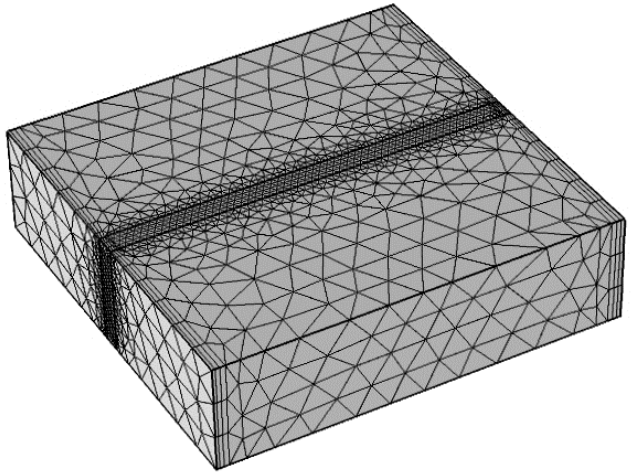
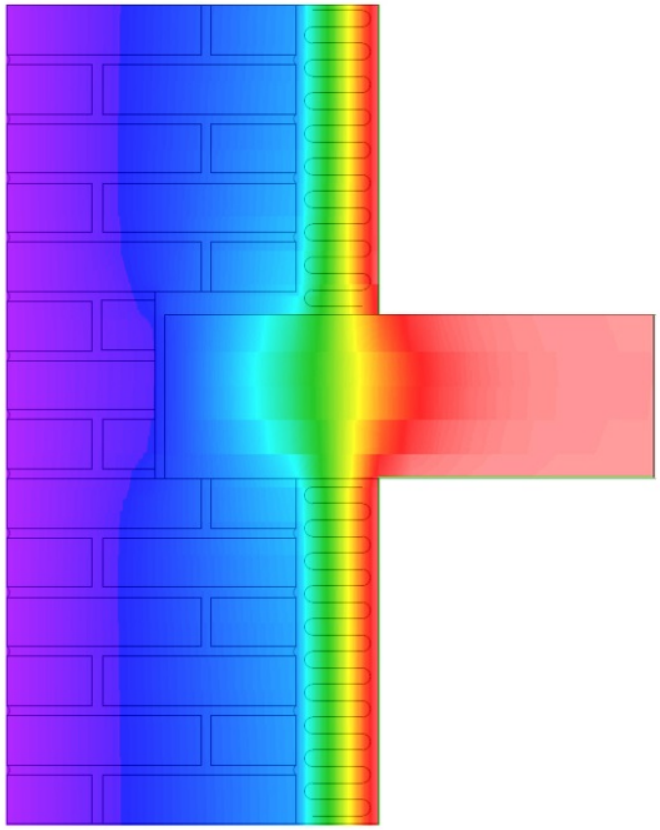
Utfordringer (COMSOL)

- Tidsressurs-vennlig simulering av luftstrømmer
  - Fukttransport – treg mekanisme
  - Lufttransport – rask mekanisme

- Optimalisering av modellmesh



Bjelkeende av trevirke



<u>Mulige forbedringer</u>

- Redusere isolasjonstykkelsen
- Holde et område over og under bjelken fritt for isolasjon
- Legge inn varmeoverførende materiale (metall)
- Erstatte bjelkeender
- Kartlegge og begrense fuktpåkjenning

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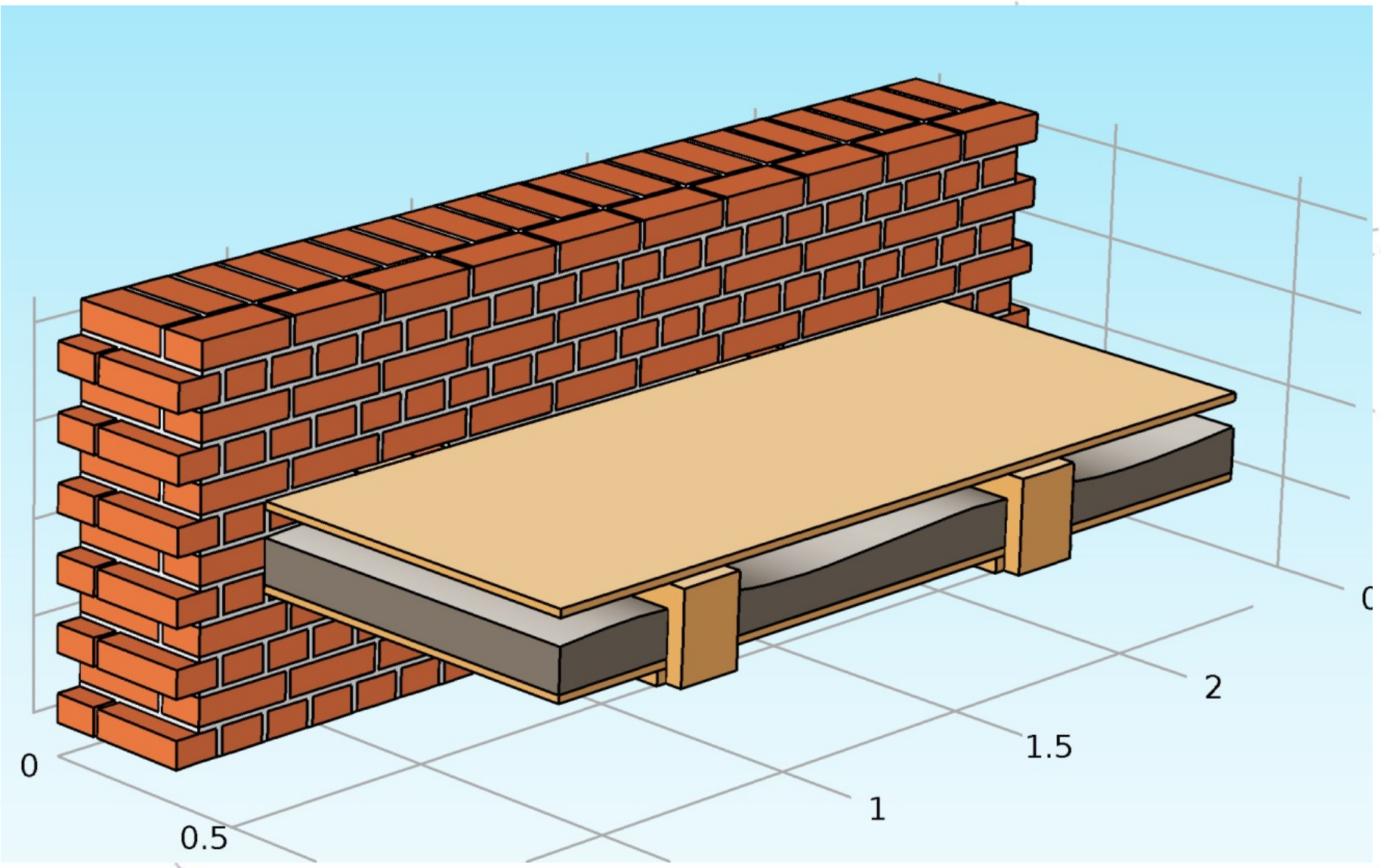
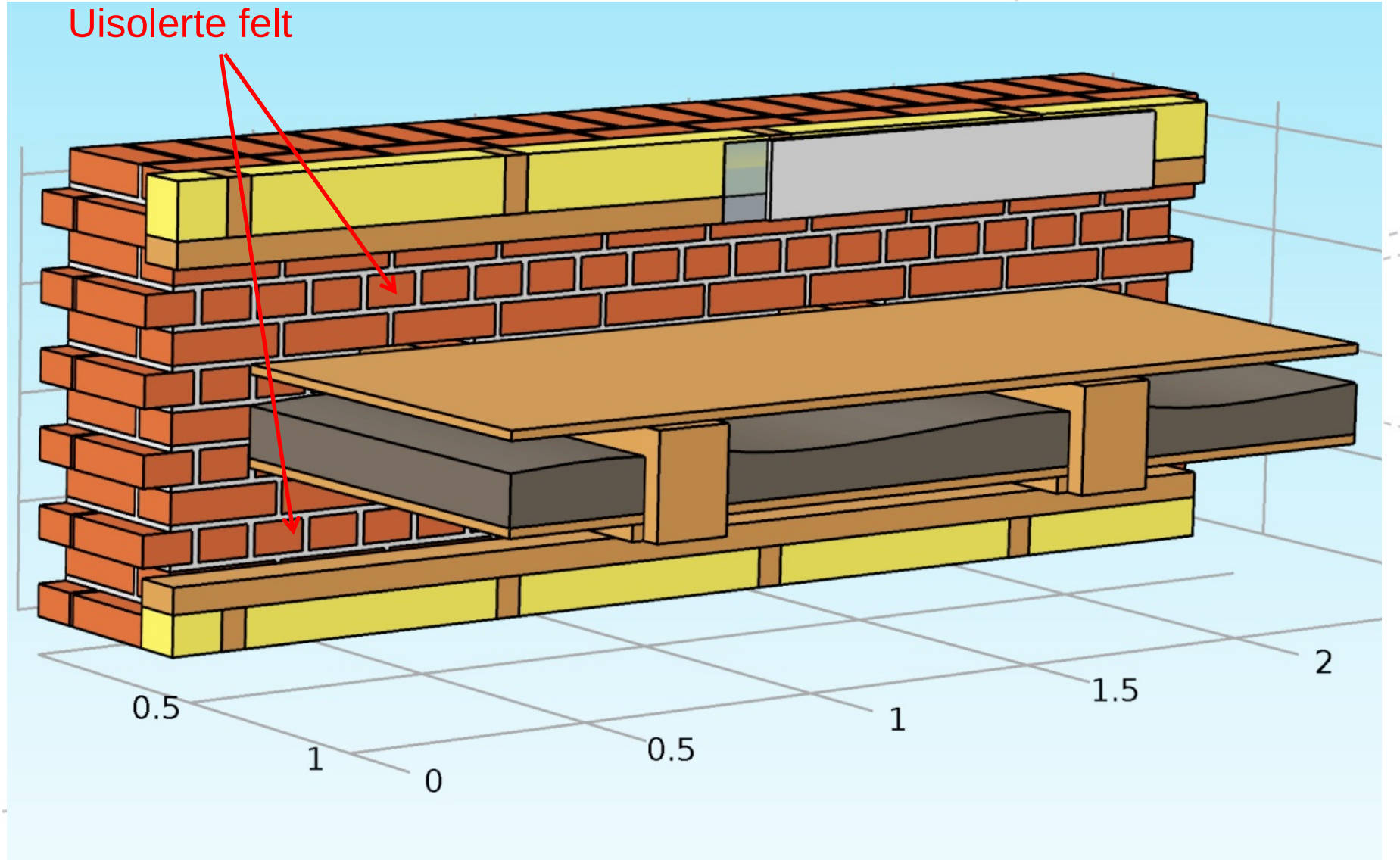
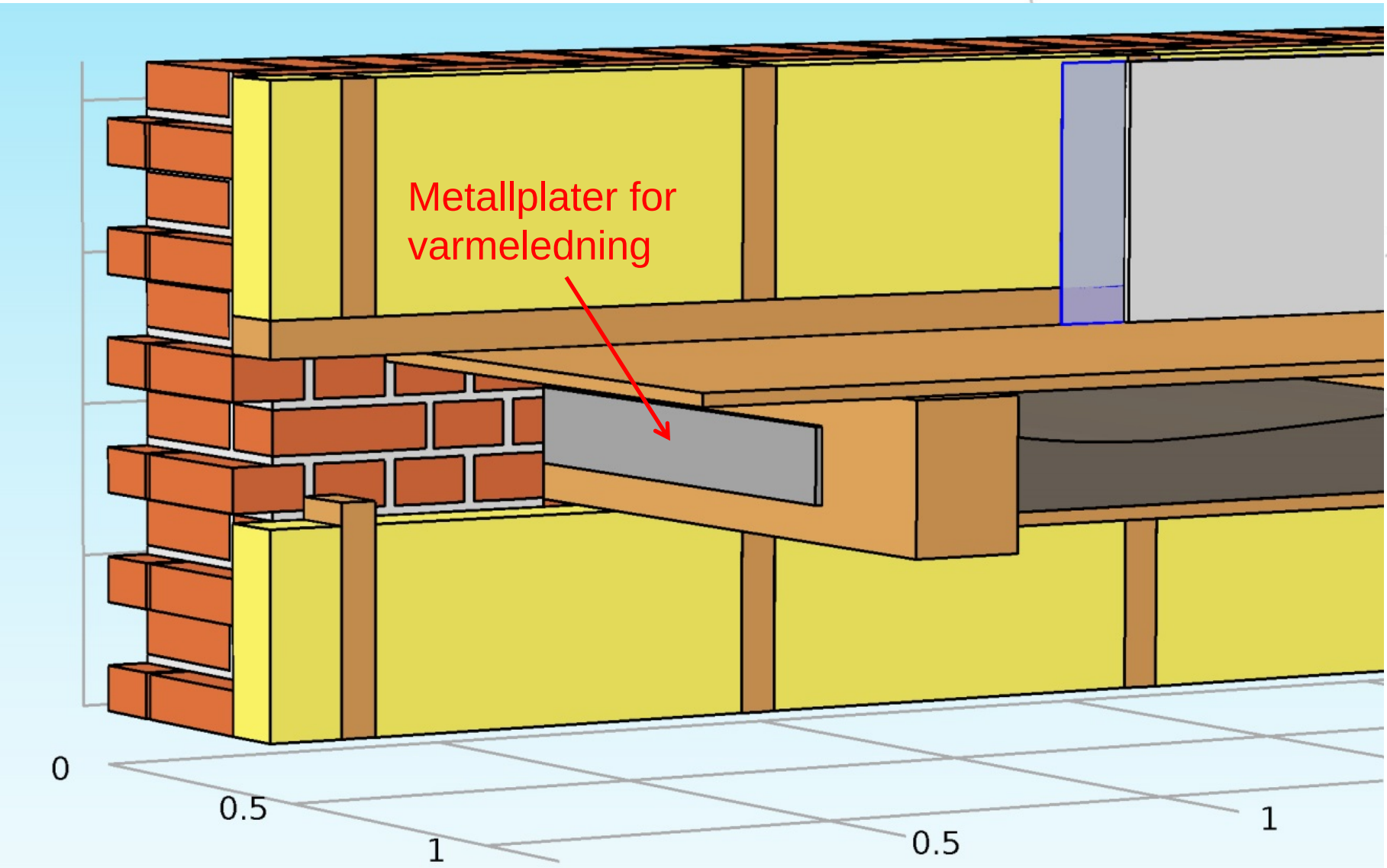
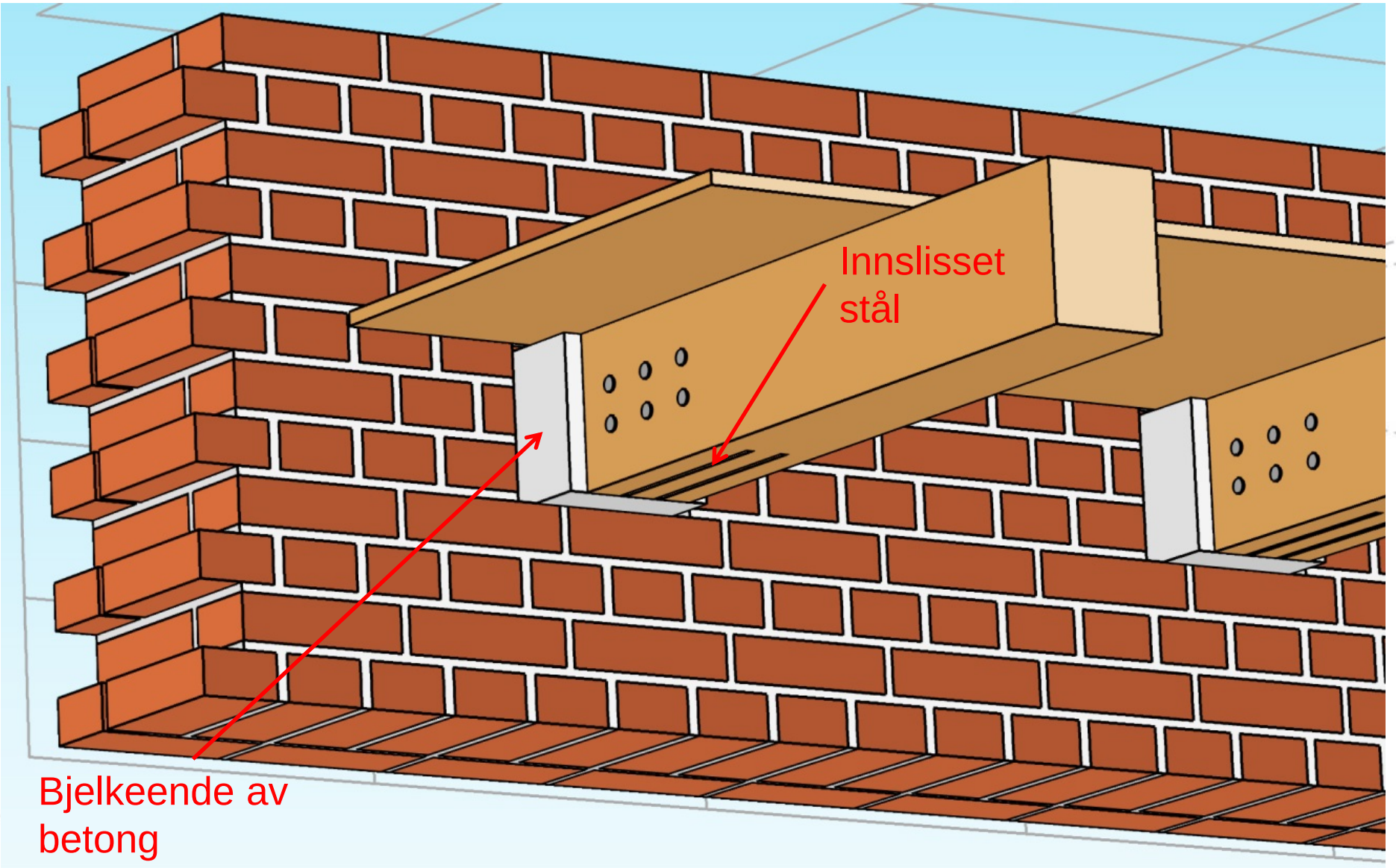

0
0.5
1
1.5
2

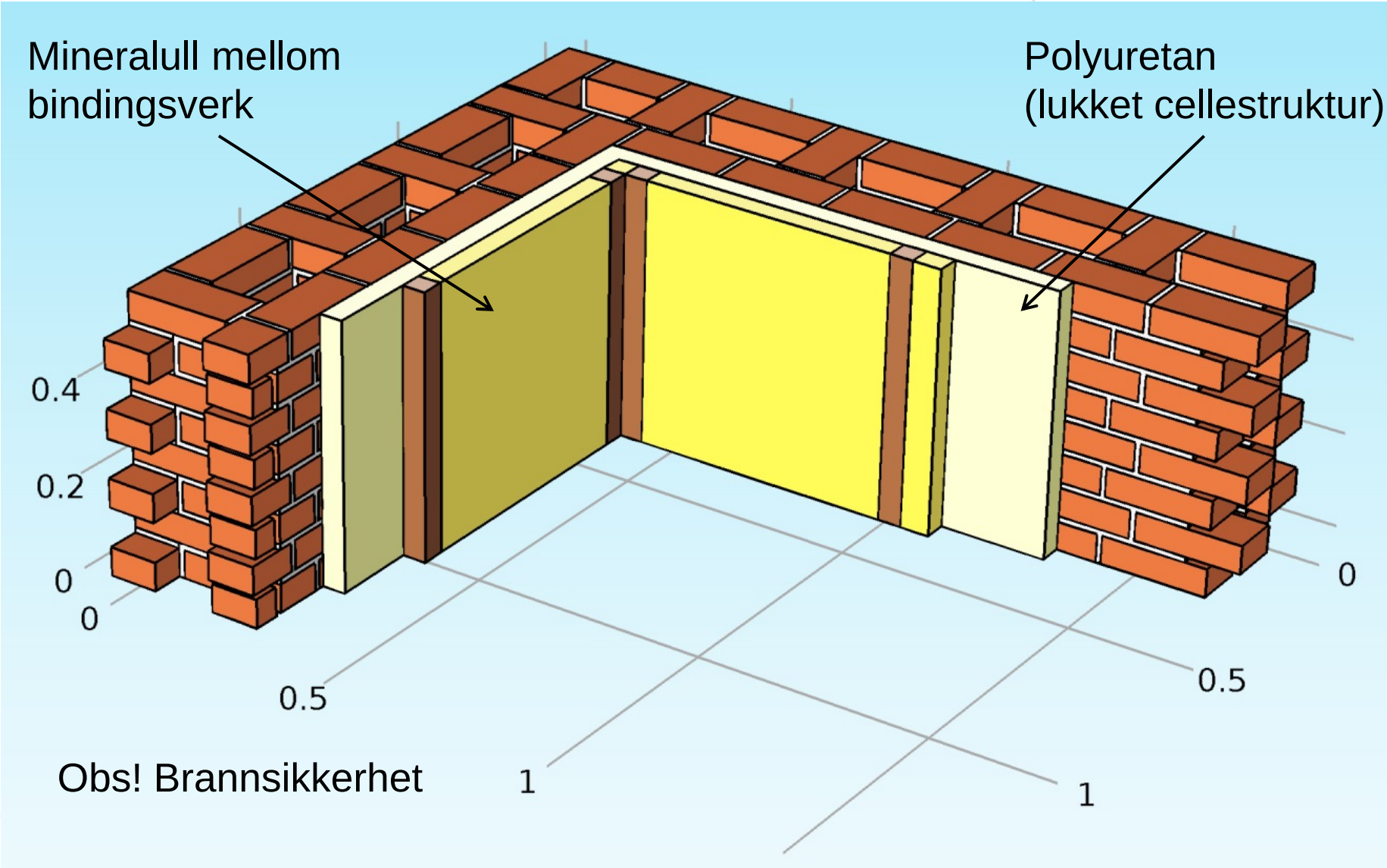

Uisolerte felt
0.5
1
0
0.5
1
1.5
2


Metallplater for
varmeledning
0
0.5
1
0.5
1

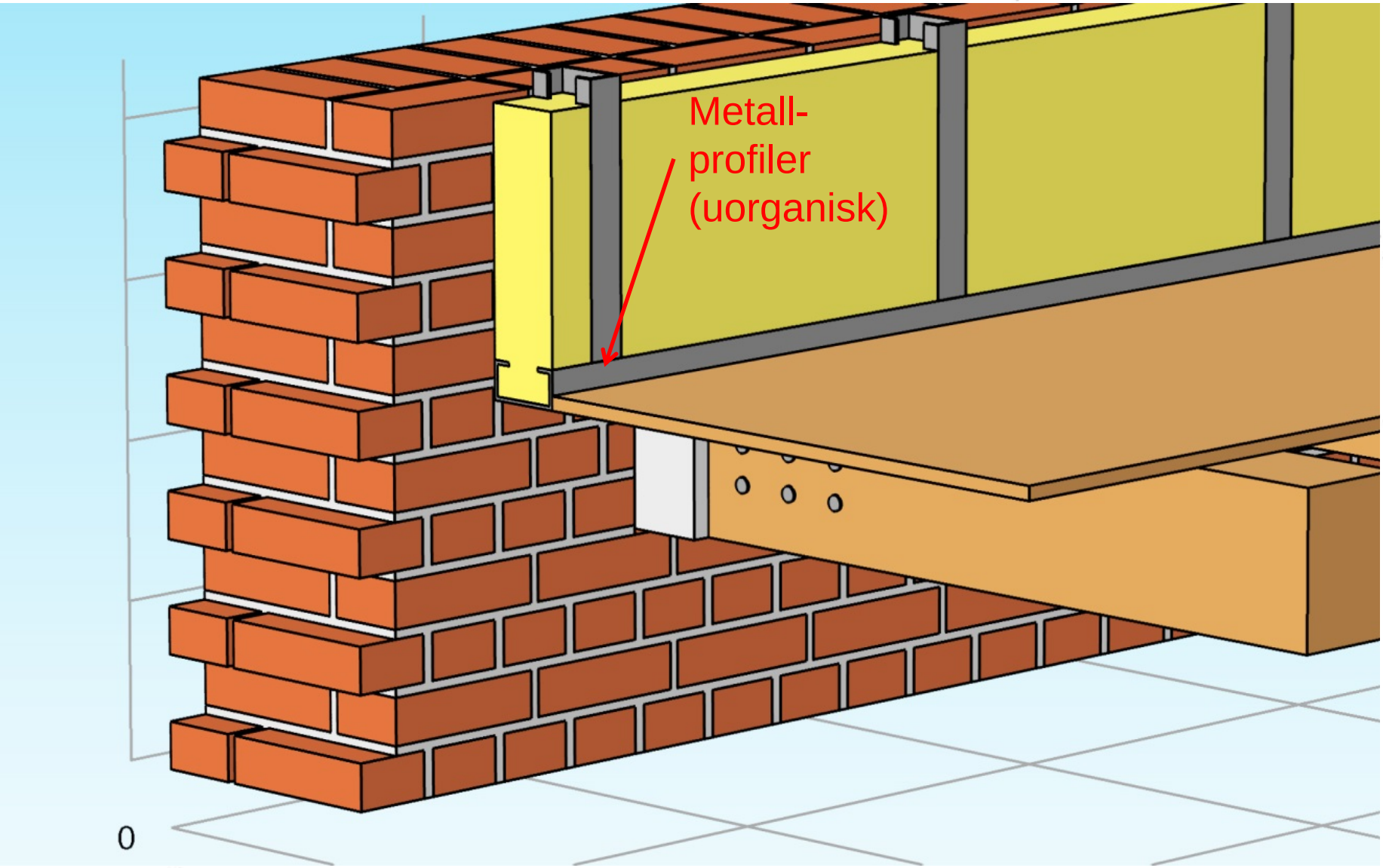

Innslisset
stål
Bjelkeende av
betong

Foreslåtte løsninger (internasjonalt)

- Polyuretan-sjikt (lukket cellestruktur)
- Ventilert innvendig spalte
- Kapillært aktivt isolasjonssjikt
- Stenderverk av metallprofiler
- «Smart» dampsperre



Obs! Brannsikkerhet


Metall-
profiler
(uorganisk)
0

Oppsummering

- Balanse oppfukting – uttørking
- Sted, orientering og skjerming influerer stort på slagregn
- 3D detaljer
  - Vært vanskelig å vurdere
  - COMSOL kan være en mulighet
- Bjelkeender må vurderes ekstra nøye

Takk for oppmerksomheten!