ELECTRIC MELTING AND THE VALUE OF MODELLING

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CEO F.I.C. (UK) LIMITED.

14TH INTERNATIONAL SEMINAR ON FURNACE DESIGN

VELKÉ KARLOVICE, 21ST– 22ND JUNE 2017

F.I.C. (UK) LIMITED

ELECTRIC FURNACES AND MODELLING

WHY DISCUSS ELECTRIC MELTING?

ELECTRIC FURNACES AND MODELLING

WHY DISCUSS ELECTRIC MELTING?

BECAUSE WE HAVE TO!!

ELECTRIC FURNACES AND MODELLING

WHY DISCUSS ELECTRIC MELTING? BECAUSE WE HAVE TO!!

EU 2030 – 40% REDUCTION cf 1990

Most of G7+1 group of nations agree

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ELECTRIC FURNACES AND MODELLING

WHY DISCUSS ELECTRIC MELTING? BECAUSE WE HAVE TO!!

EU 2050 – 80% REDUCTION cf 1990

Most of G7+1 group of nations agree

British Glass Roadmap

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ARE ELECTRIC FURNACES SUITABLE FOR MAINSTREAM USE?

ELECTRIC FURNACES AND MODELLING

ARE ELECTRIC FURNACES SUITABLE FOR MAINSTREAM USE?

BECAUSE THEY ARE

- **EXPENSIVE**
- **HAVE SHORT LIFE**
- **LACK FLEXIBILITY**

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ELECTRIC FURNACES AND MODELLING

EXPENSIVE ??

CAPITAL COST IS LOW but operating cost can be high due to electricity pricing, BUT this is changing!

THERMAL EFFICIENCY is considerably better. DOUBLE

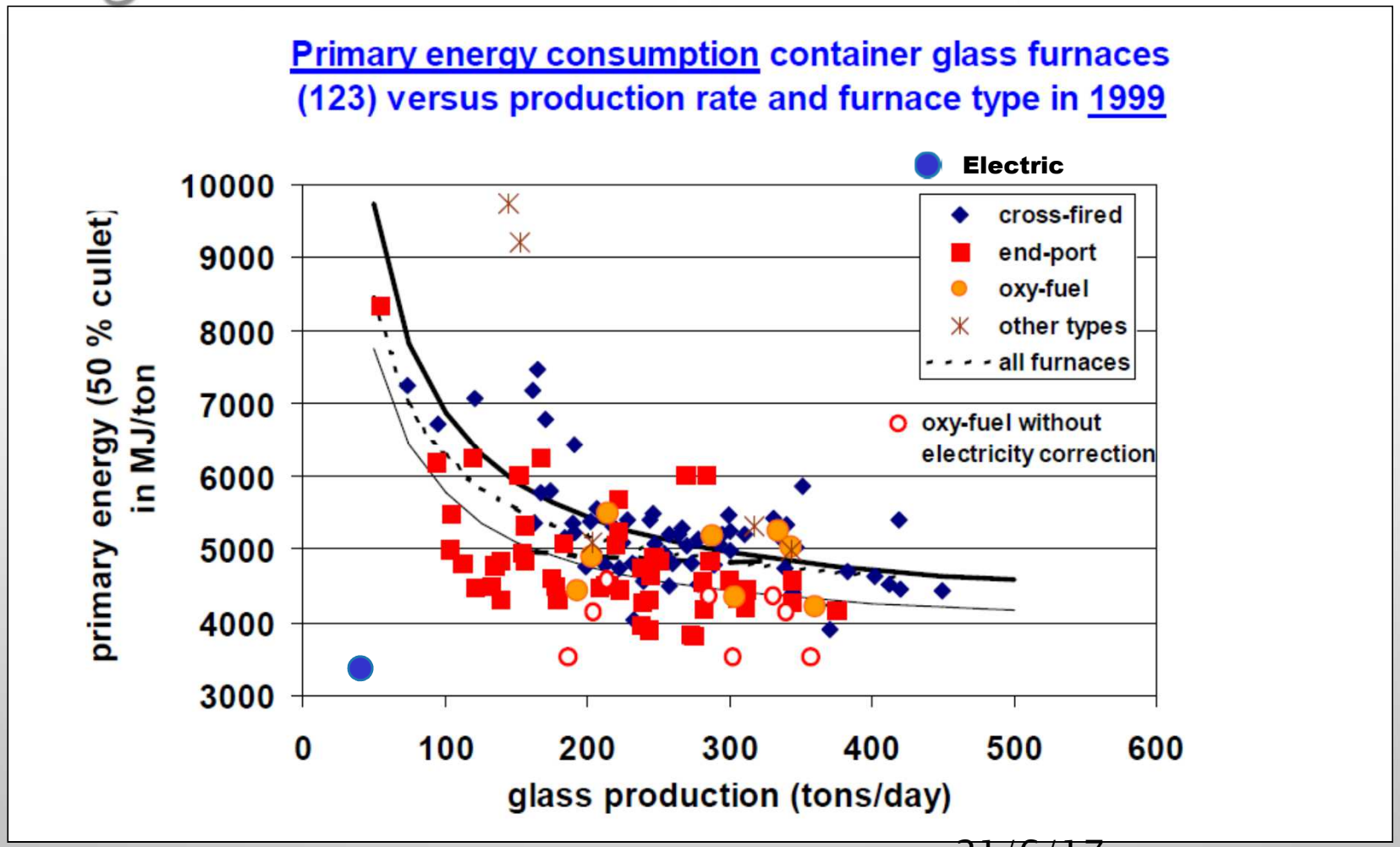
SHORT LIFE – NOT NECESSARILY, could be an advantage

FLEXIBILITY – FAKE NEWS!!

ELECTRIC FURNACES AND MODELLING

CURRENT STATE OF THE ART

ENERGY EFFICIENCY COMPARISONS



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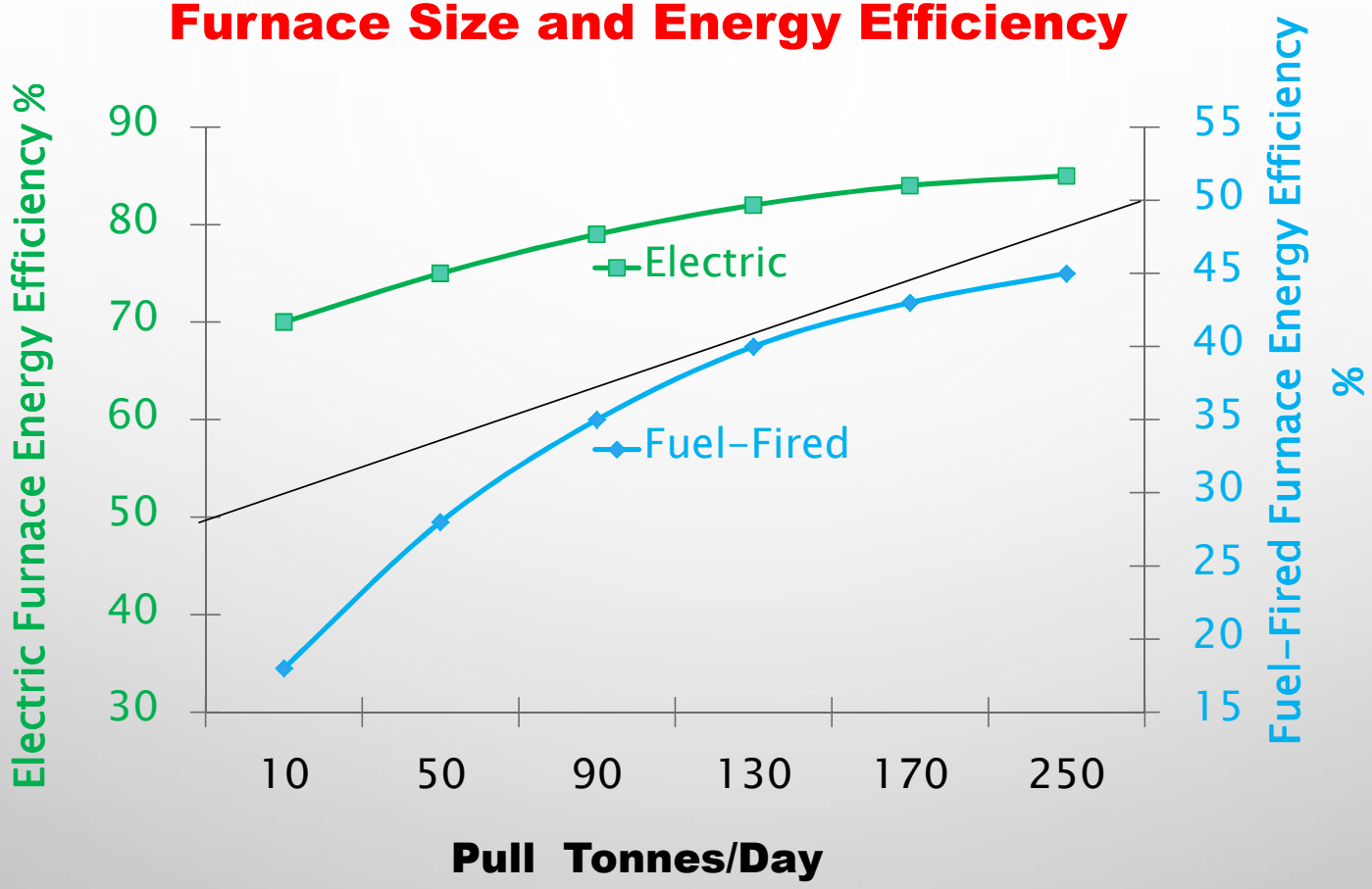
Furnace Size and Energy Efficiency



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ELECTRIC FURNACES AND MODELLING

WHERE ARE WE NOW? SIZES

SMALL	**1 to 30 tpd**
MEDIUM	**30 to 100 tpd**
LARGE	**100 to 250 tpd**

TYPES OF ALL-ELECTRIC FURNACES

COLD TOP, HOT TOP, SEMI-HOT TOP

GEOMETRY

SQUARE

RECTANGULAR

HEXAGONAL

DUODECAGONAL

ROUND

SHELF

TRANSFORMERS

THREE PHASE

DELTA:- OPEN/CLOSED/PARTIAL

STAR

TWO PHASE

SCOTT SQUARES (BALANCED)

SINGLE PHASE

ELECTRODE POSITIONS

TOP ELECTRODES

SIDEWALL ELECTRODES

SHELF ELECTRODES

BOTTOM ELECTRODES

PLATE ELECTRODES

ELECTRIC FURNACES AND MODELLING

OPTIONS: 1) TYPES

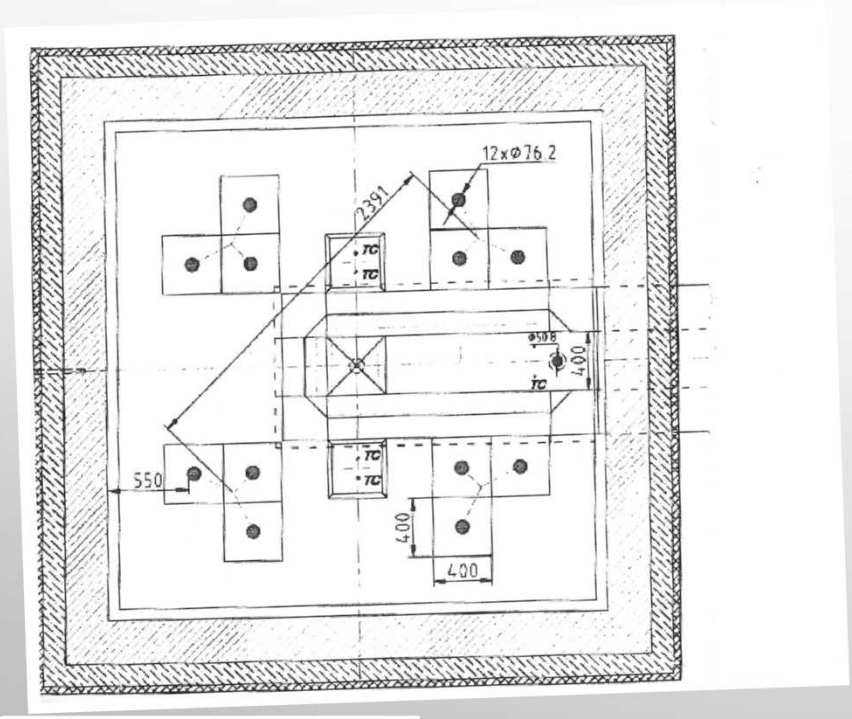
SQUARE

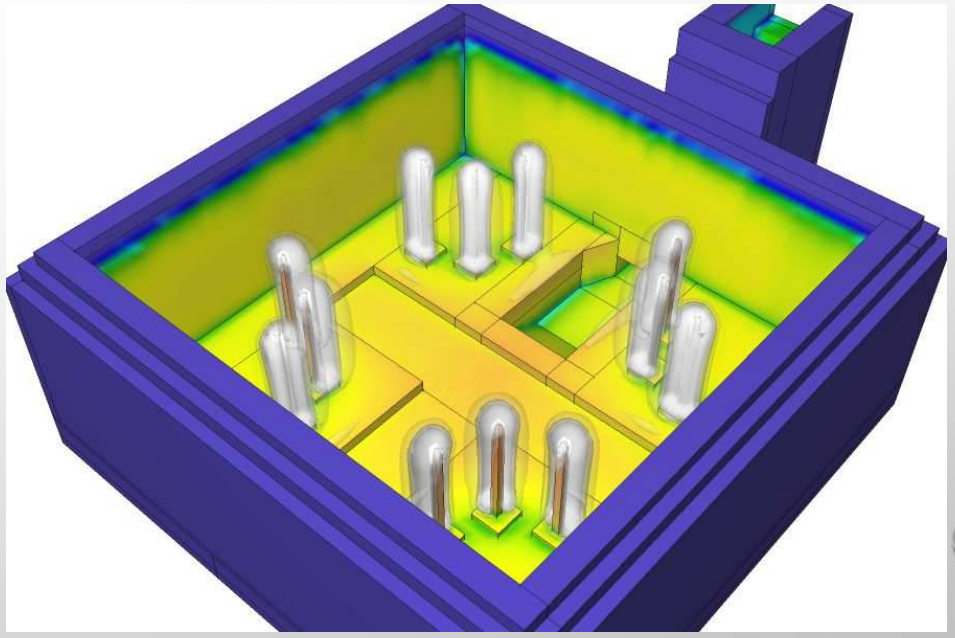
RECTANGULAR

HEXAGONAL & VARIANTS

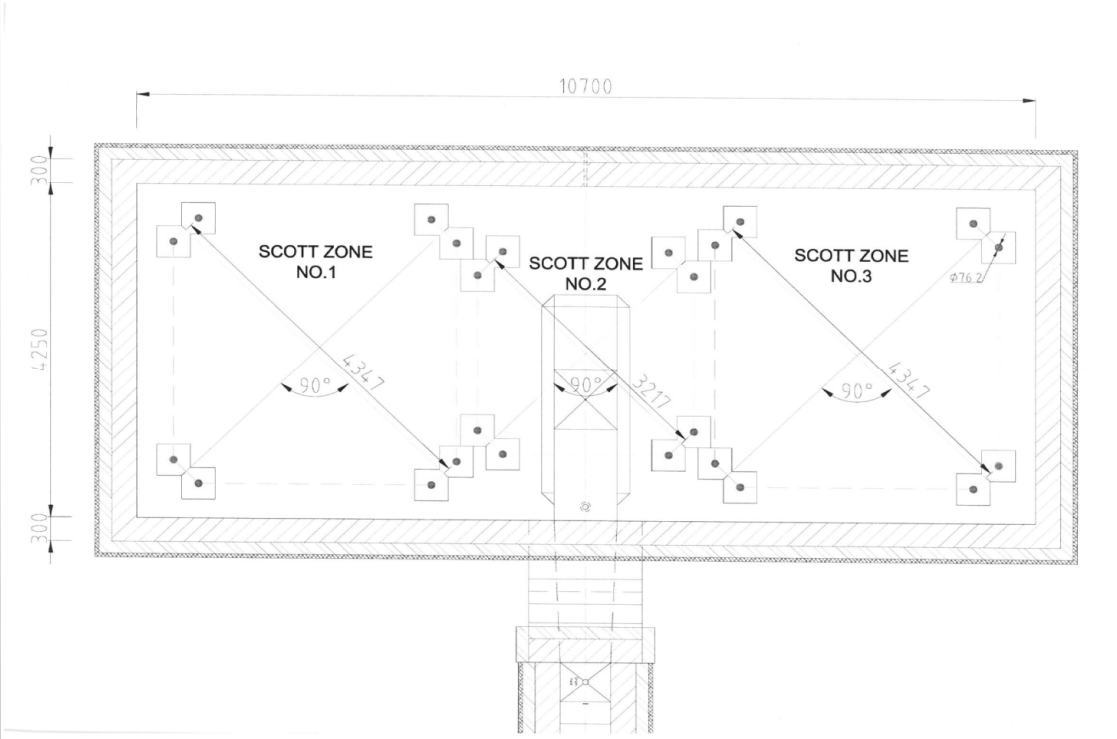
SHELF

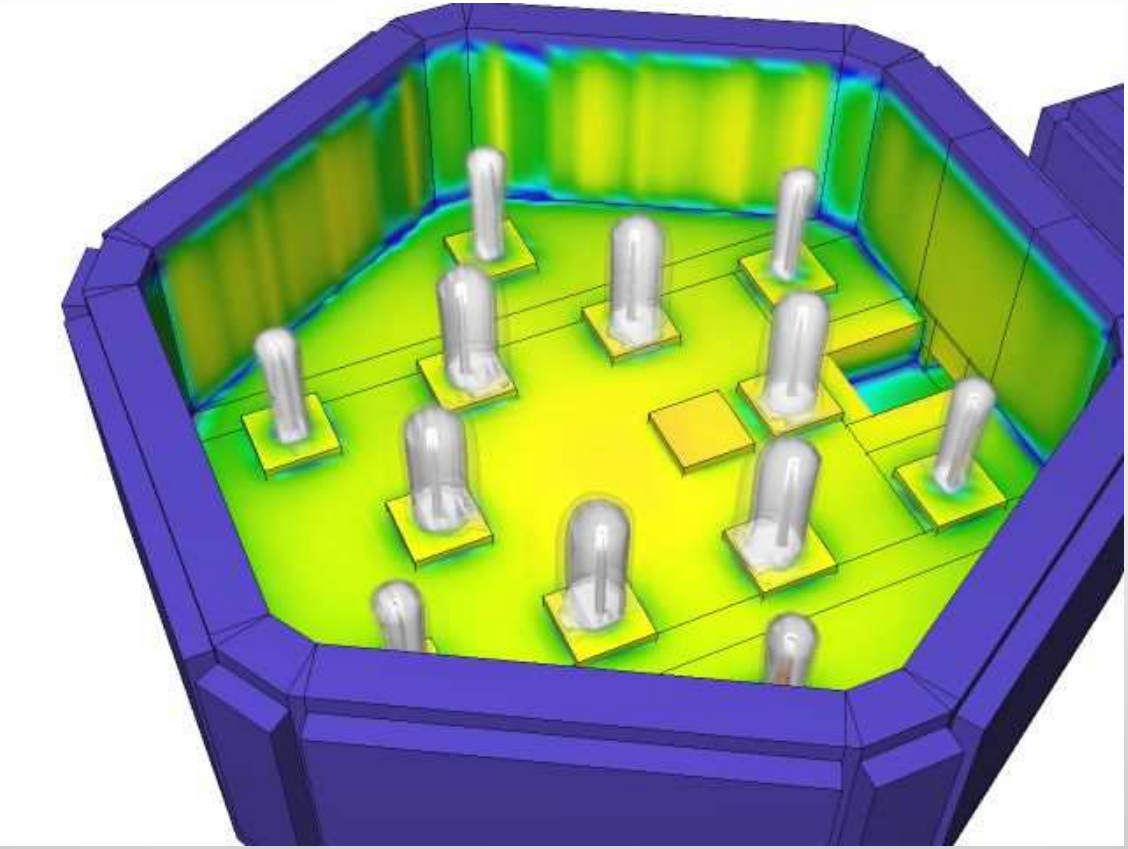
SQUARE FURNACE

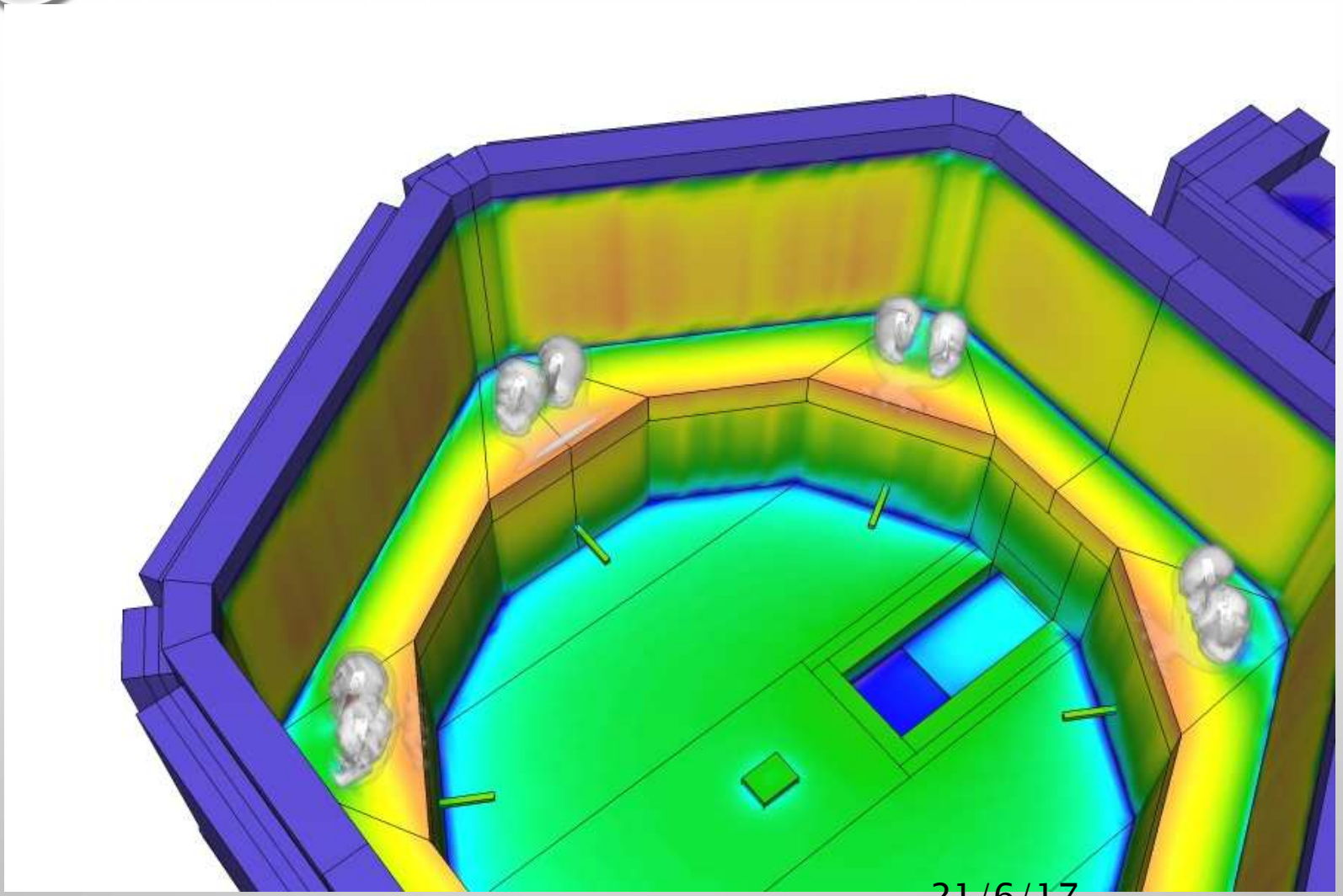




RECTANGULAR FURNACE







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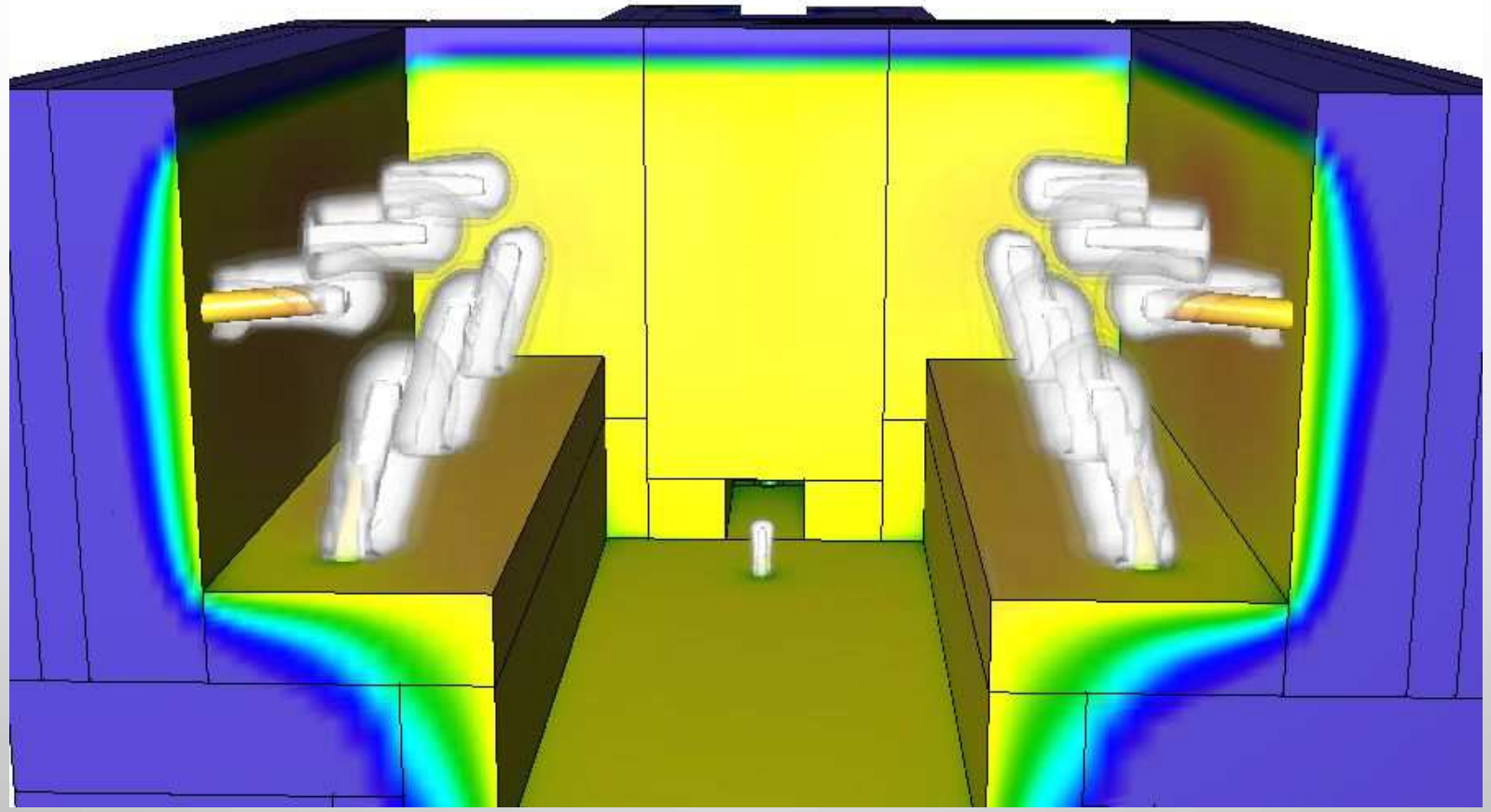


ELECTRIC FURNACES AND MODELLING

OPTIONS: 2) ELECTRODE PLACEMENT

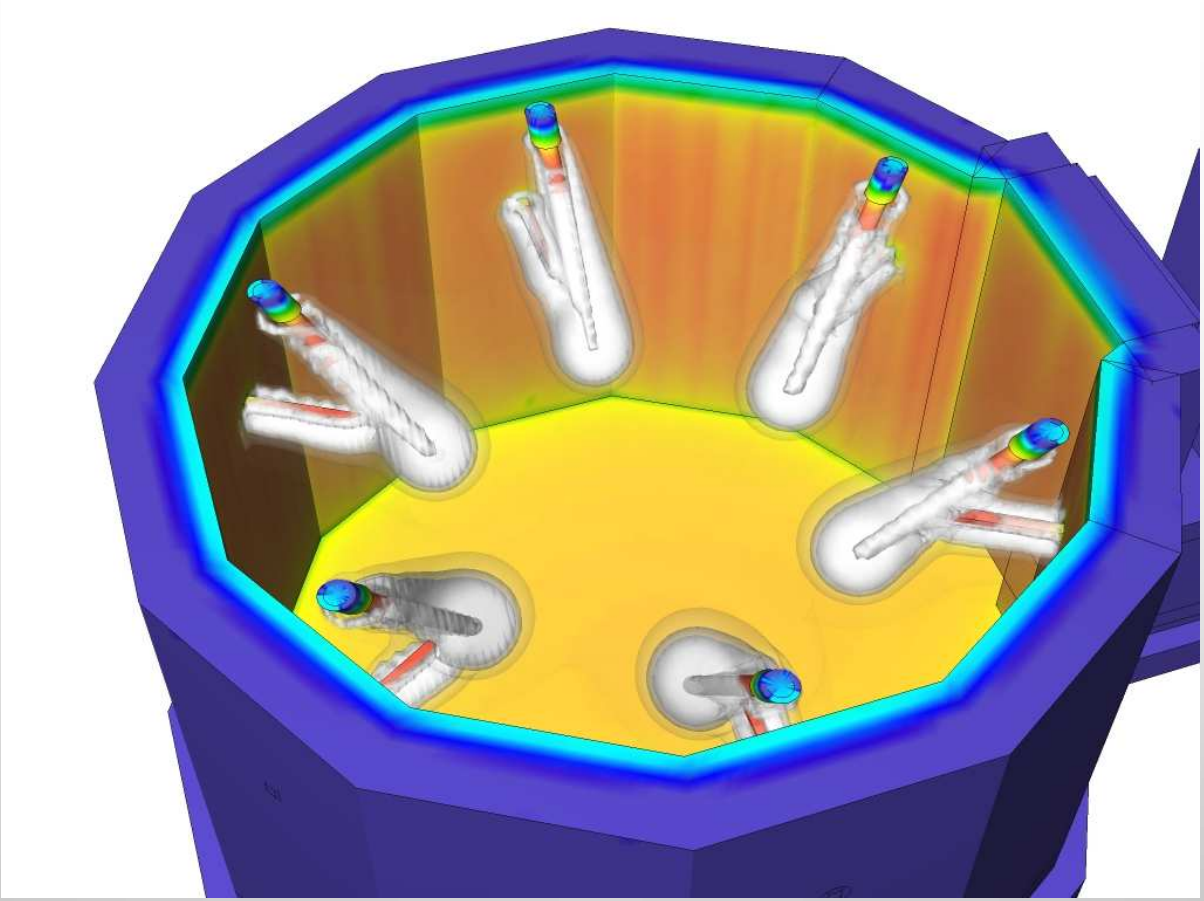
TOP

SIDE

BOTTOM

COMBINATION

PLATES



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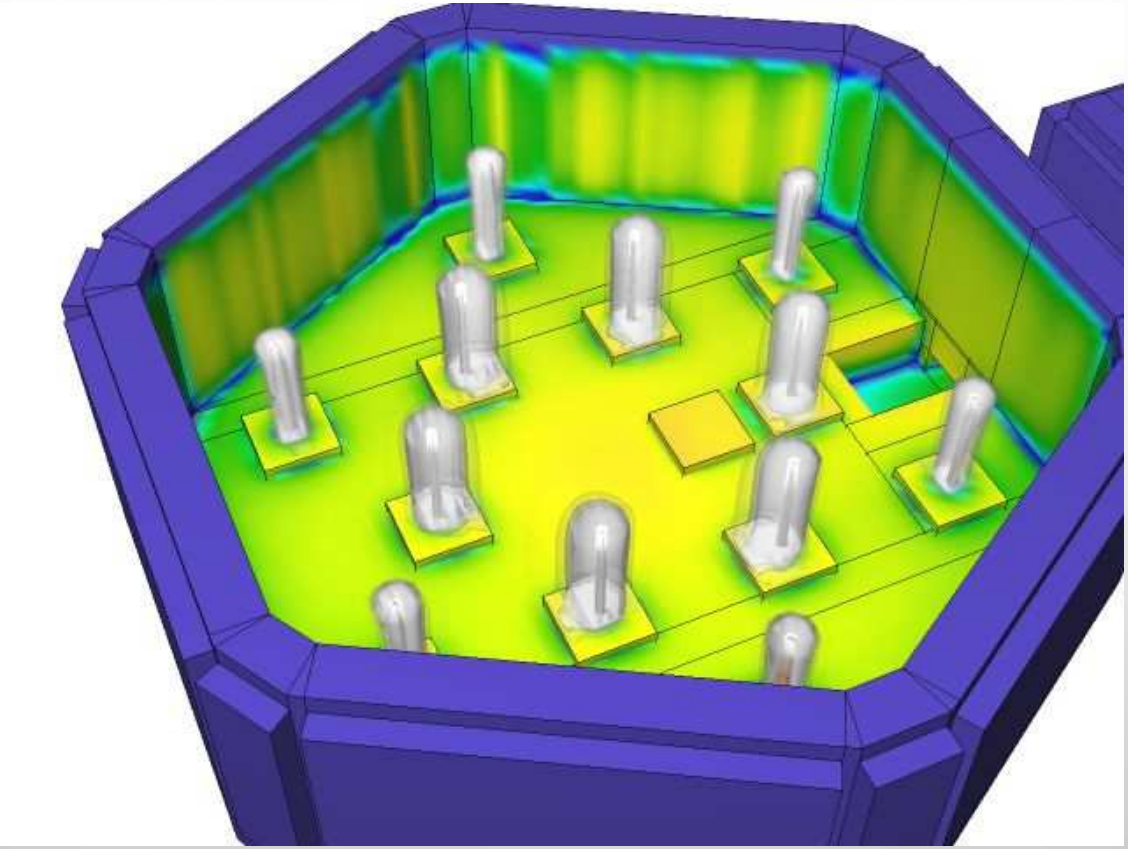

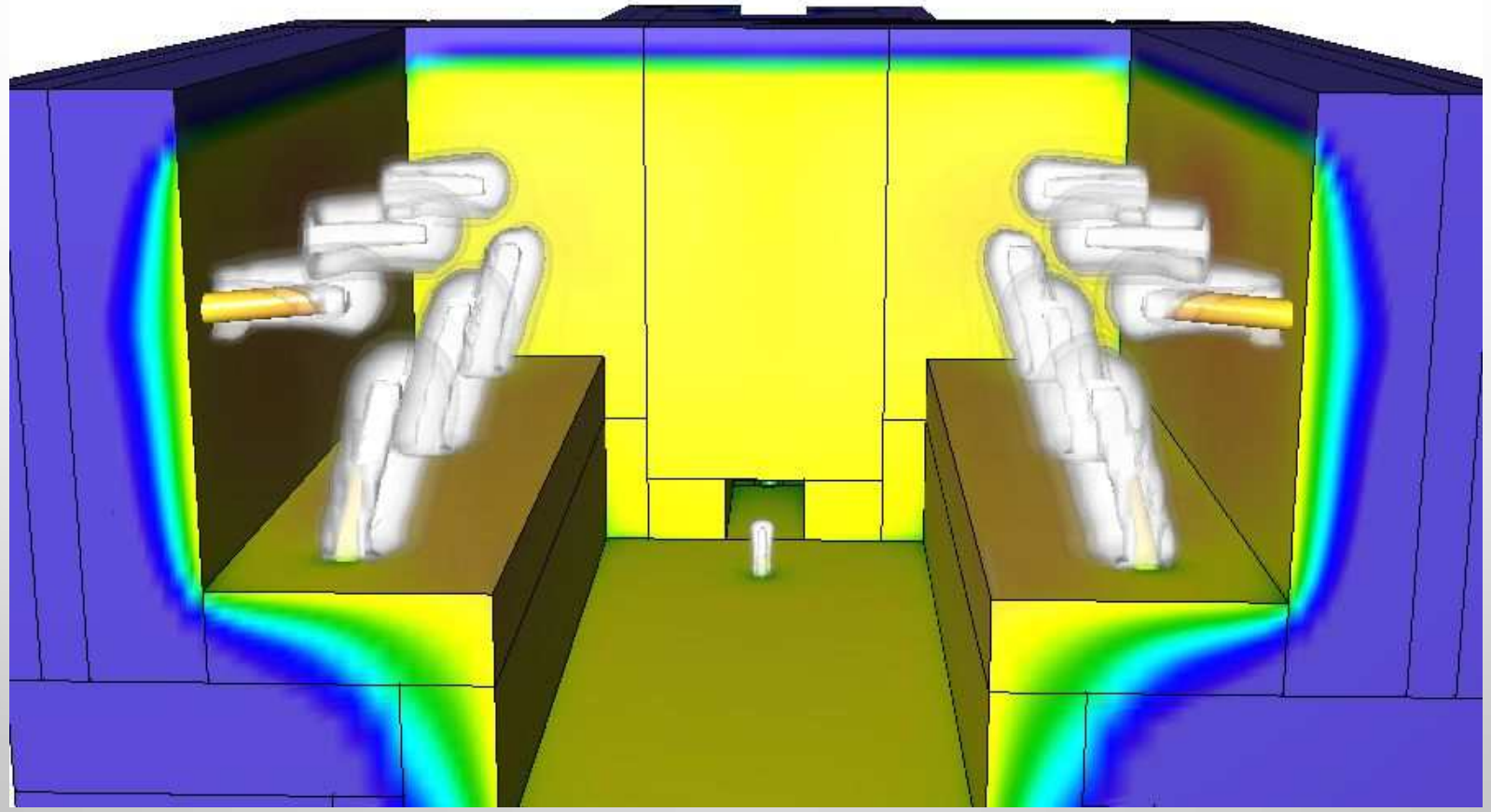

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ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

SO WHAT DO WE DO AND WHERE DO WE GO

WHAT ARE OUR OPTIONS?

WHAT ARE OUR OPTIONS?

STEP CHANGE REQUIRED

U.S.A – G.M.I.C NEXTGEN MELTER PROJECT

SUBMERGED BURNERS ?

INFLIGHT PLASMA FURNACES

WE HAVE TO CONSIDER THE ENVIRONMENT! CO_2 NOX SOX

FOSSIL FUEL LONG TERM AVAILABILITY

ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

STATUS QUO

- CONTINUE TO FINE TUNE EXISTING METHODOLOGY
- TAKE A CAUTIOUS STEPWISE APPROACH

ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

STATUS QUO

- THE INDUSTRY IS NOTORIOUSLY CONSERVATIVE
- SOME OF YOUR COMPETITORS ARE THINKING RADICALLY
- THEY ARE SEEKING STEP CHANGES
- WE NEED TO WAKE UP BEFORE ITS TOO LATE!

ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

MAINTAIN STATUS QUO

AND GET LEFT BEHIND??

!!

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ELECTRIC FURNACES AND MODELLING
WHAT IS THE FUTURE?

WHAT ARE OUR OPTIONS?

ELECTRIC FURNACES AND MODELLING
WHAT IS THE FUTURE?

WE NEED A SAFE STEP CHANGE

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ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

O.O.B.T.

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ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

O.O.B.T. = OUT OF THE BOX THINKING

- **WE NEED TO RE-EXAMINE OLD WAYS WITH NEW TECHNOLOGY**
- **WE NEED TO THINK CREATIVELY – START FROM SCRATCH**
- **WE NEED A STEP CHANGE (A PARADIGM SHIFT)**

ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

HOW?

ELECTRIC FURNACES AND MODELLING DREAMING OF MODELLING AND MODELLING DREAMS

HOW?

MODELLING OF COURSE

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DREAMING OF MODELLING AND MODELLING DREAMS

MODELLING FROM SCRATCH IS NOT THE WAY FORWARD

BECAUSE WE NEED TO BUILD FROM AN RELIABLE BASE CASE

DREAMING OF MODELLING AND MODELLING DREAMS

GLASS SERVICE/ FIC

HAVE THE KNOWLEDGE

AND EXPERIENCE

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DREAMING OF MODELLING AND MODELLING DREAMS

BUT WE NEED TO BE SMART

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DREAMING OF MODELLING AND MODELLING DREAMS

MODEL FOR LONGER FURNACE LIFE

DESIGN FOR LONGER FURNACE LIFE

OPERATE FOR LONGER FURNACE

DREAMING OF MODELLING AND MODELLING DREAMS

MODEL FOR LONGER FURNACE LIFE

BORMIOLI DID JUST THIS

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BORMIOLI LUIGI
GLASSMAKER

GS GLASS SERVICE
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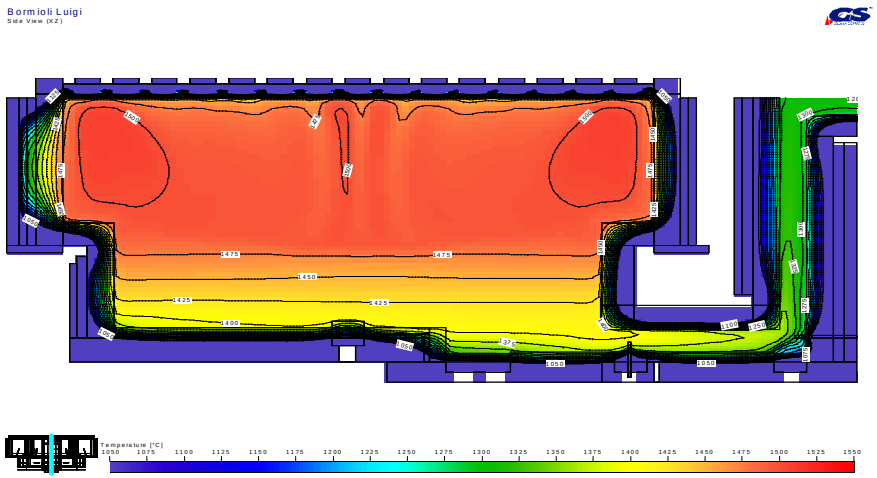
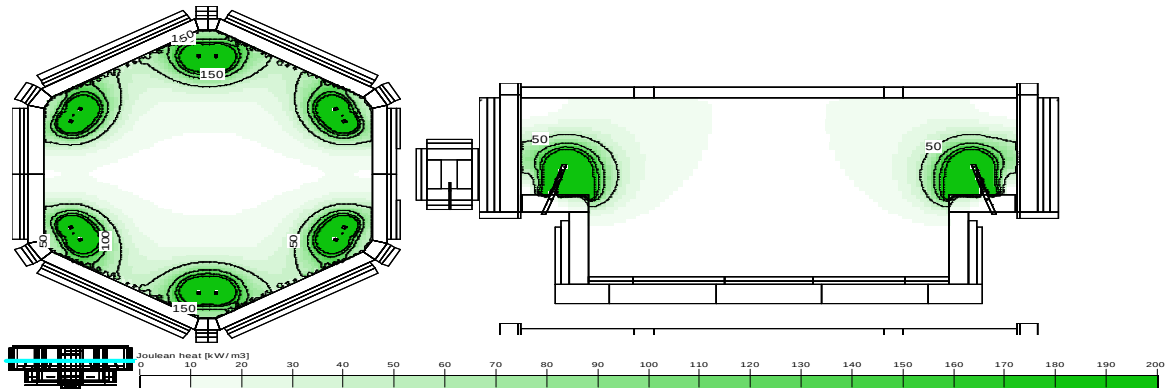
Observations

- Irregular corrosion



- Irregular thermal distribution



- Energy transmission
- Current density

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Strategic parameters

- Energetic Efficency
- Lifetime
- Pull range and flexibility
- Cullet recycling
- Maximum pull

Aim of the study is to verify the impact of design and materials evolution in the last 30 years and 20 furnaces on the strategic parameters of the furnace, by comparing at least three evolution steps, and understand if electrical melting is becoming more competitive in the hollow glass market.

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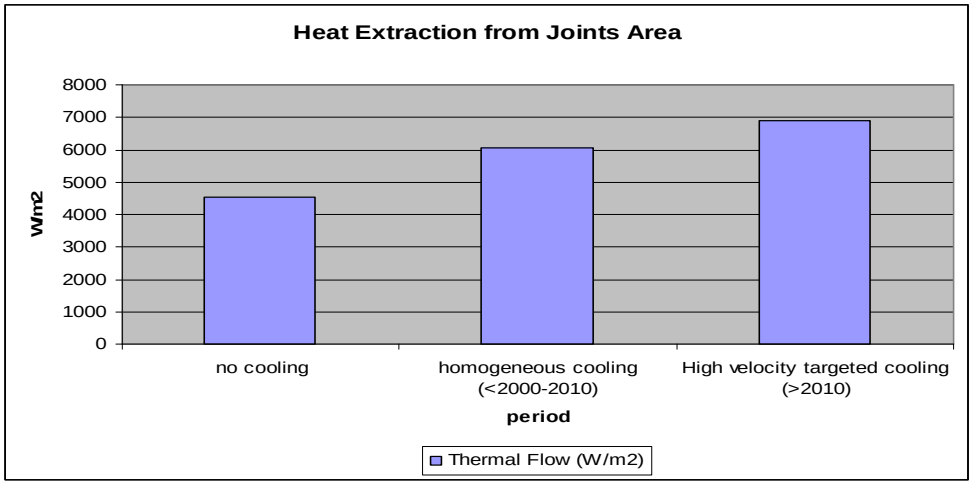
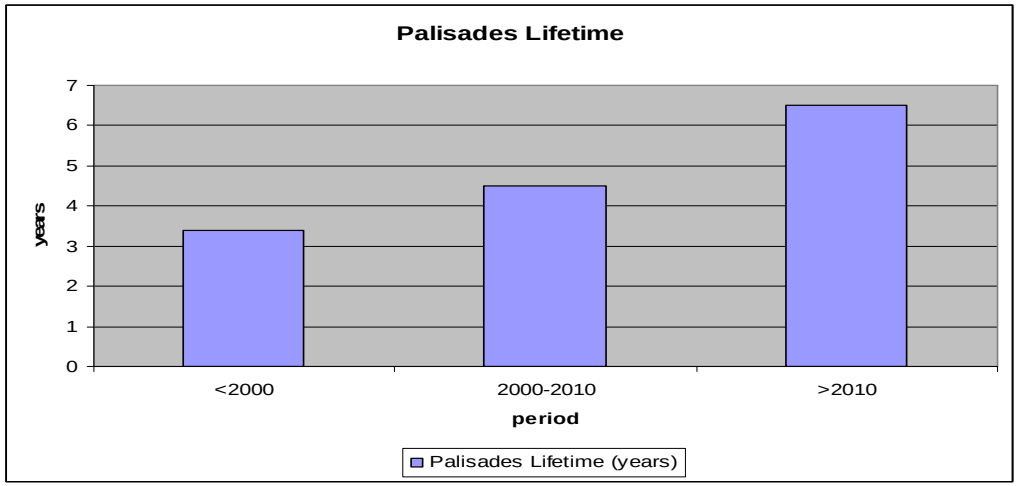
Lifetime



- In the analyzed period it was obtained a good improvement in the heat extraction from joints (+ 13%)

- Lifetime for the palisades is increased by 85%.
- Some other elements are now more critical
- Introduce the concept of Minor Repair



DREAMING OF MODELLING AND MODELLING DREAMS

DESIGN FOR LONGER FURNACE LIFE

ELIMINATE THE THROAT

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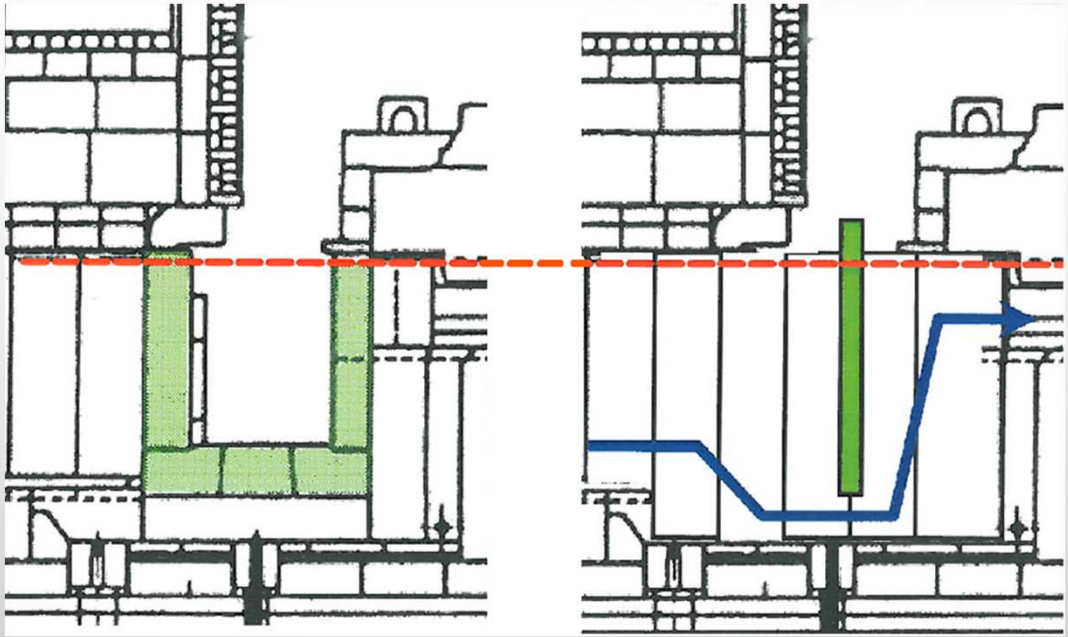

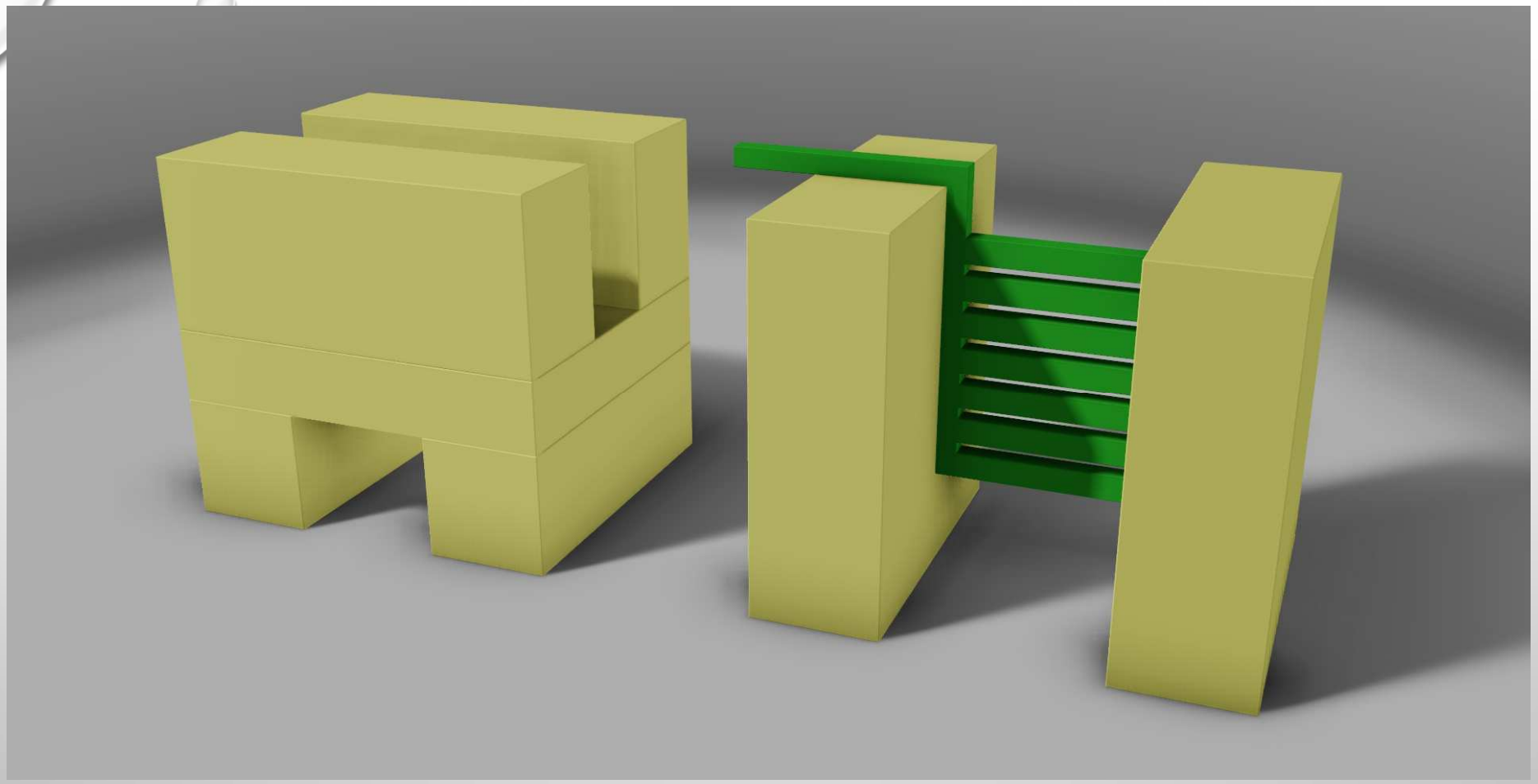

ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

BUT I'M FORGETTING

YOU'RE ALL RISK

ADVERSE!!

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ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

SO A STRUCTURED, SAFE APPROACH IS REQUIRED BY SOME OF YOU

ELECTRIC FURNACES AND MODELLING WHAT IS THE FUTURE?

SUPERBOOSTING