



NEW DYNAMIS D-FLAME BURNER

Dynamis | Trust Matters



DYNAMIS HISTORY

Dynamis is a company that offers **innovative** solutions to several industry areas, aiming to **optimize energy efficiency** and **cost reduction**

Dynamis offers competence with more than 40 engineers and designers with global experience in Cement, Mining, Metallurgy, Paper, etc, with over 30 years in those areas

- 2003: Start up of Dynamis as Engineering Company
- 2005: First Burner Design to VC Rio Branco
- 2007: First Calcined Clay Plant Design to CIPLAN
- 2010: First Equipment Supplied to Votorantim, a D-Gasifier
- 2016: First D-Flame Supplied to VC Rio Branco
- 2015: Calcining Plant Supplied to CMOC Niobio
- 2017: Internationalization of Dynamis: D-FLAME burners exports to US, Africa and EU
- 2019: Supplied the biggest calcined clay plant in the world, Argos Rio Branco
- 2020: Supplied first Fluidized Bed Hot Gas Generator to VC Pecém



GLOGAL DYNAMIS

Brazilian Company

HeadQuarter: São Paulo
Subsidiary: Colombia
Representation Offices: 07

Check Out Contacts in our website:
https://bit.ly/Dynamis_Contacts



OUR CLIENTS



DYNAMIS TECHNOLOGY

■ R&D – SOFTWARES

Computational Fluid Dynamics – ANSYS Fluent and CFX

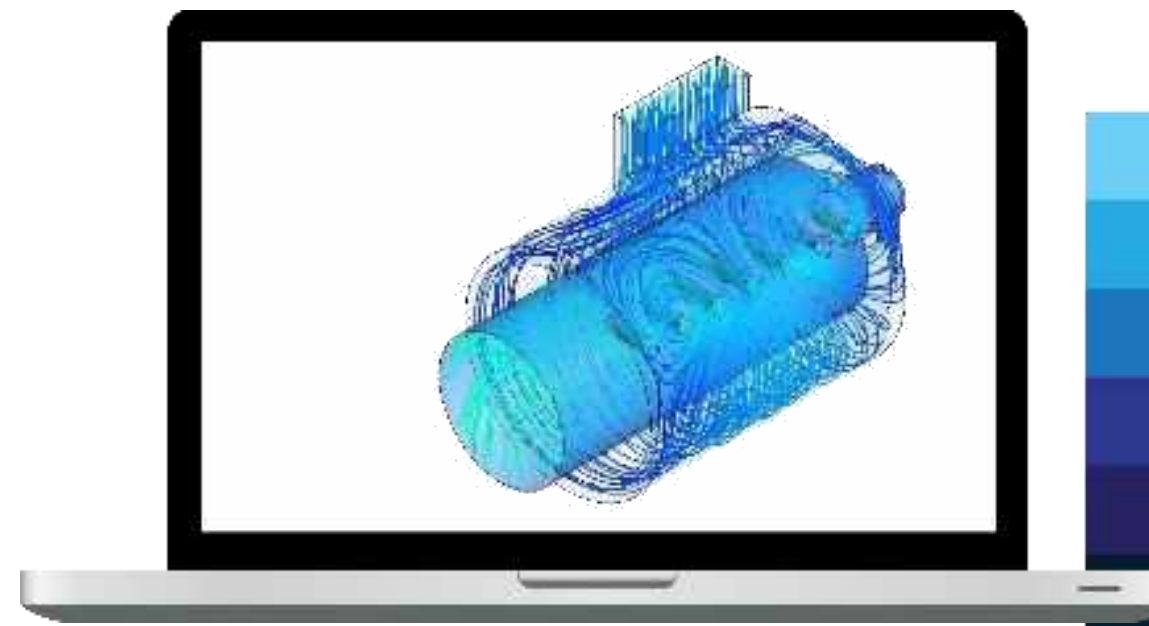
Structural analysis – FEMAP and NASTRAN

3D CAD – Siemens PLM Solid Edge 5T

CeSFaMB™/ CSFMB©

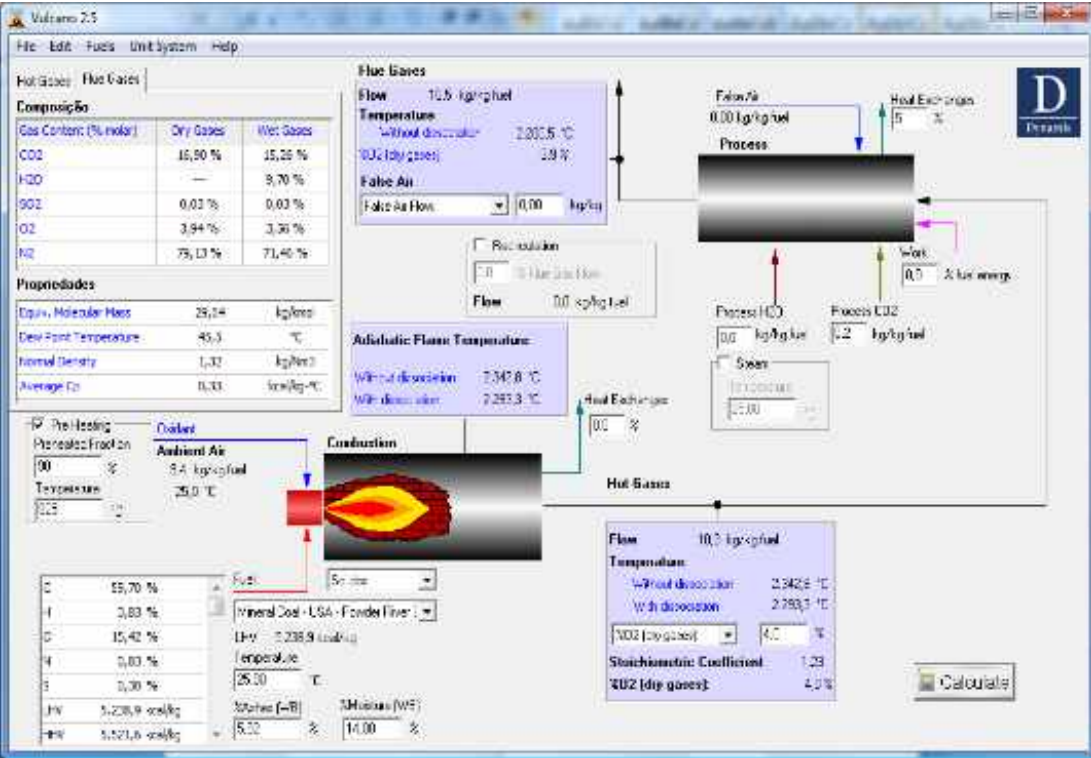
Metalica 3D – Steel Structures Design

Softwares developed in-house

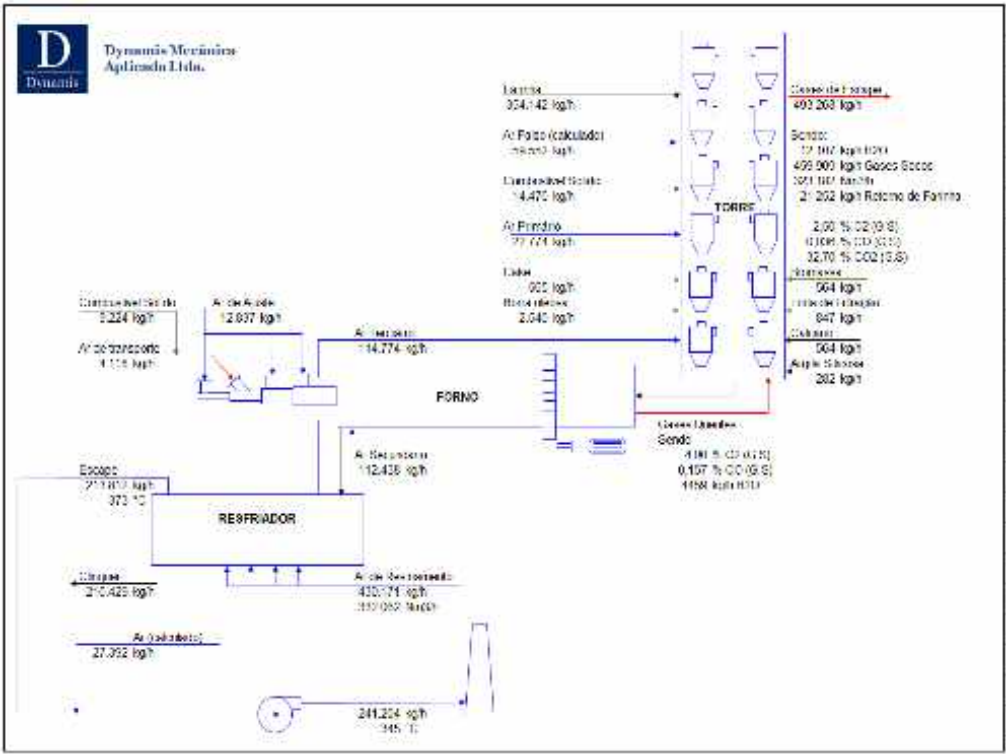
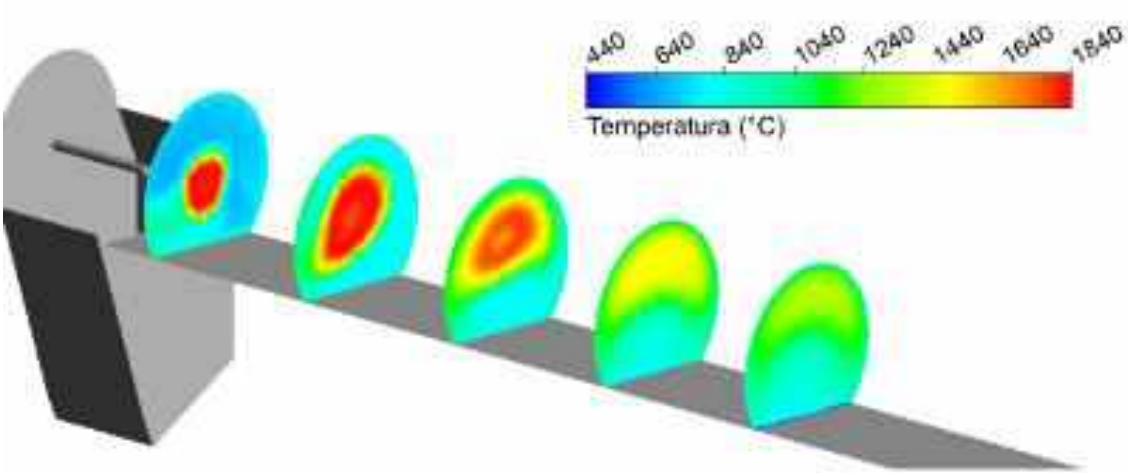


DYNAMIS TECHNOLOGY

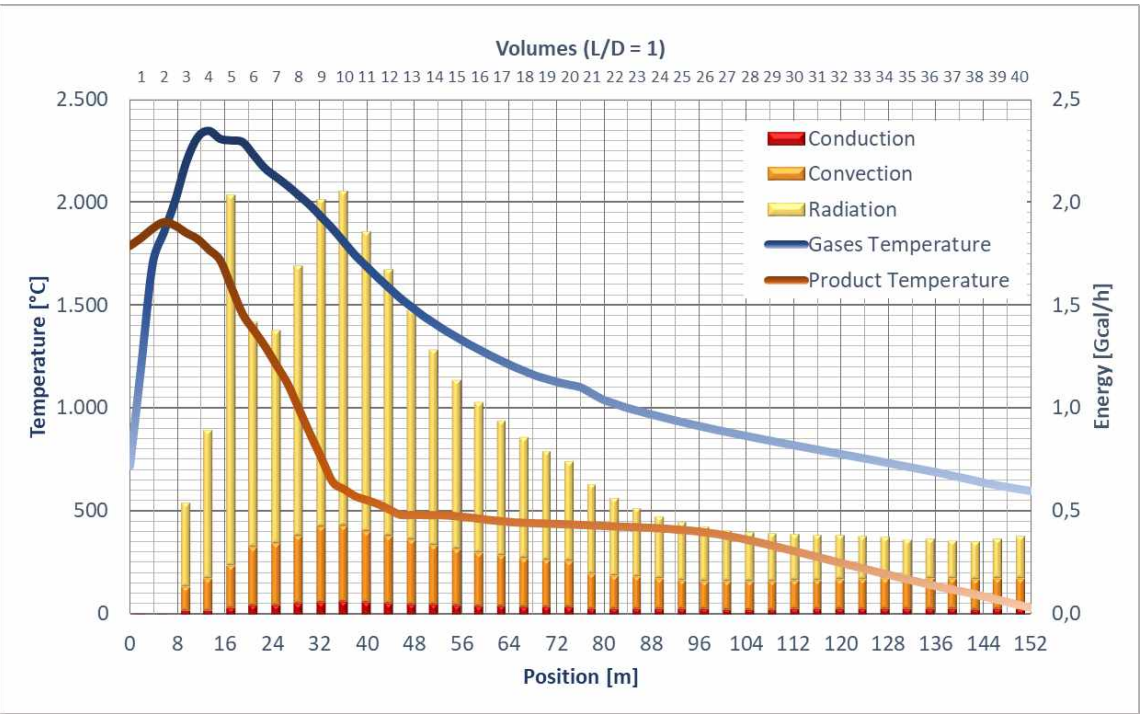
- R&D – SOFTWARES



Combustion (Vulcano Dynamis)



Mass and Energy Balance (Dynamis)



Coupled simulation with Fluent CFD software and the D-RK Simulator developed by DYNAMIS

DYNAMIS TECHNOLOGY

■ R&D – SOFTWARES

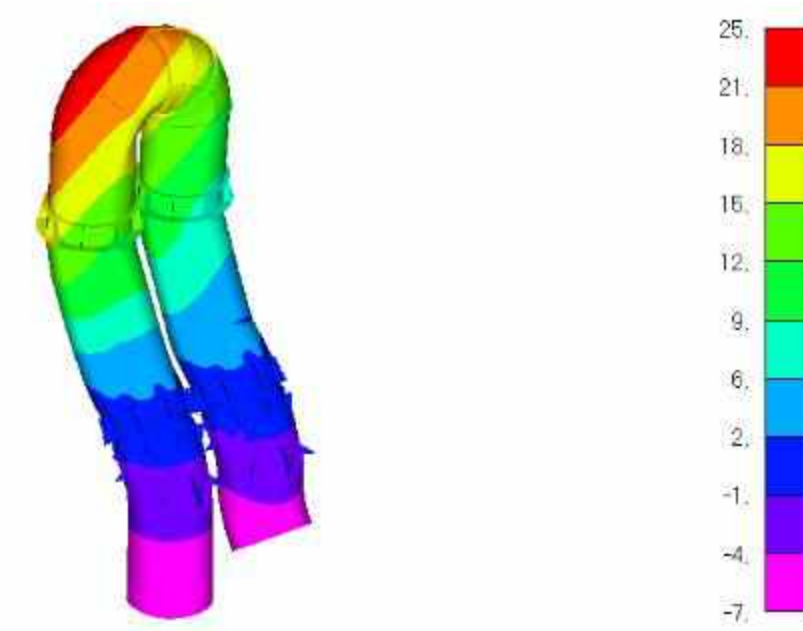
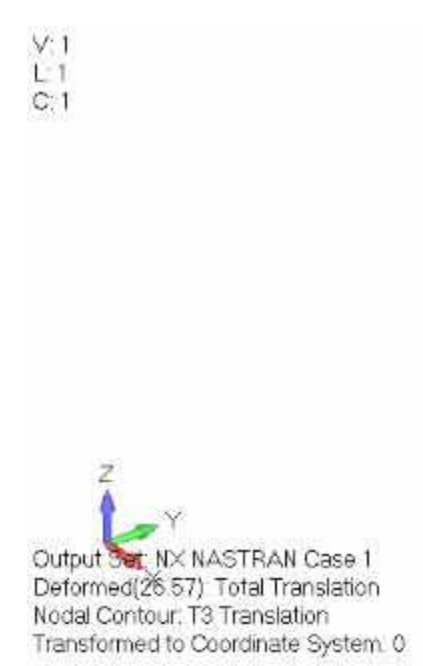
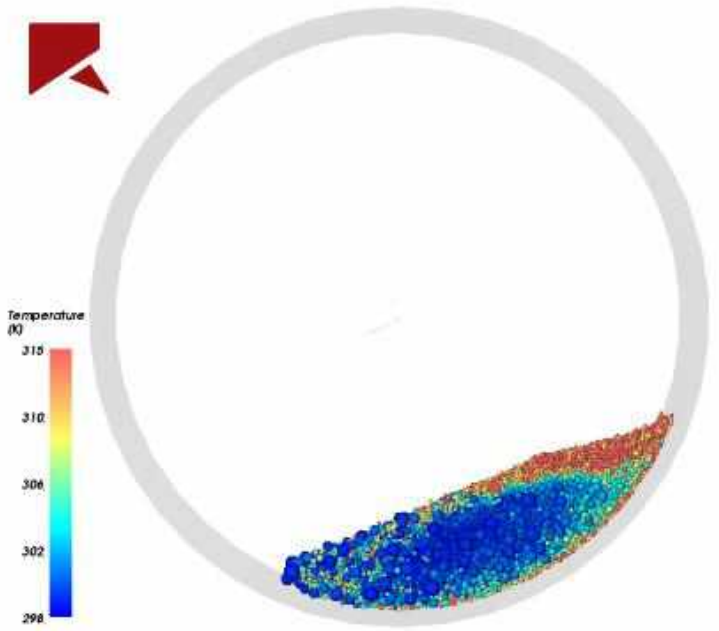
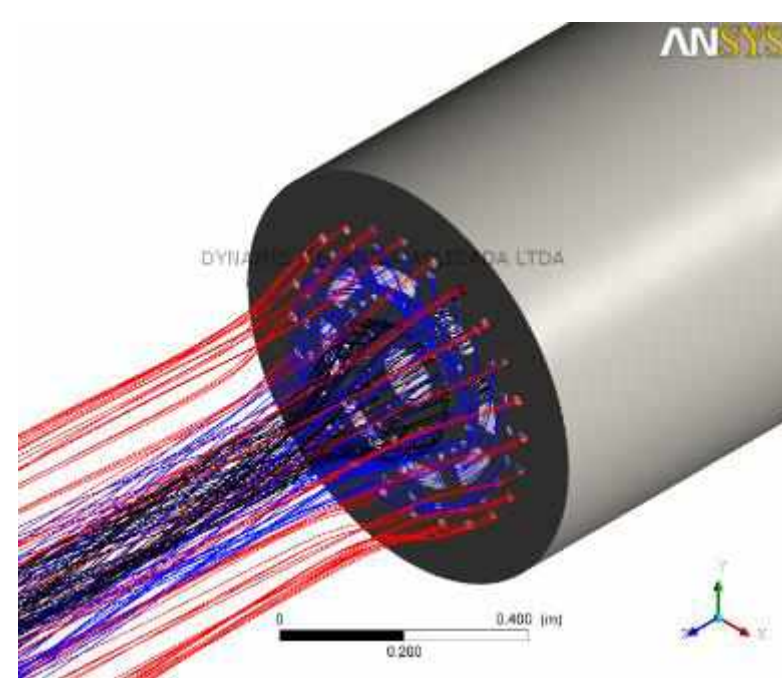
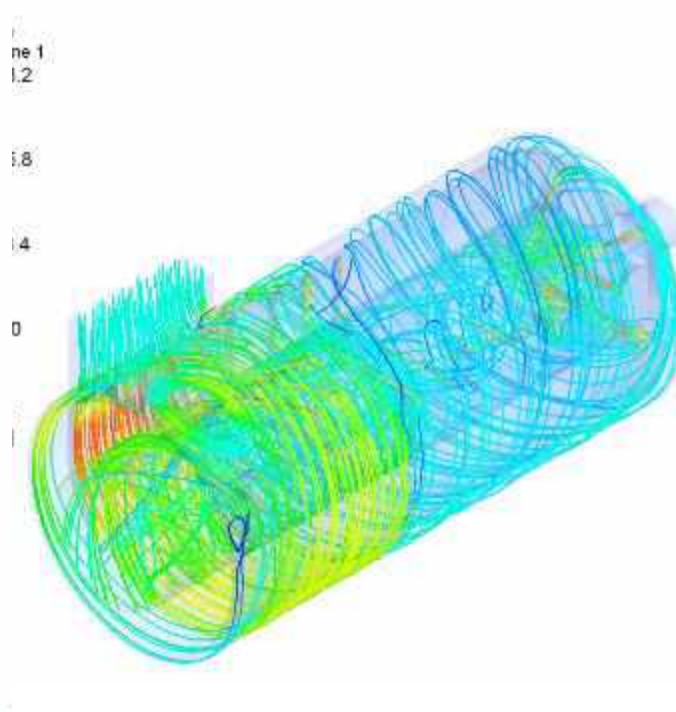
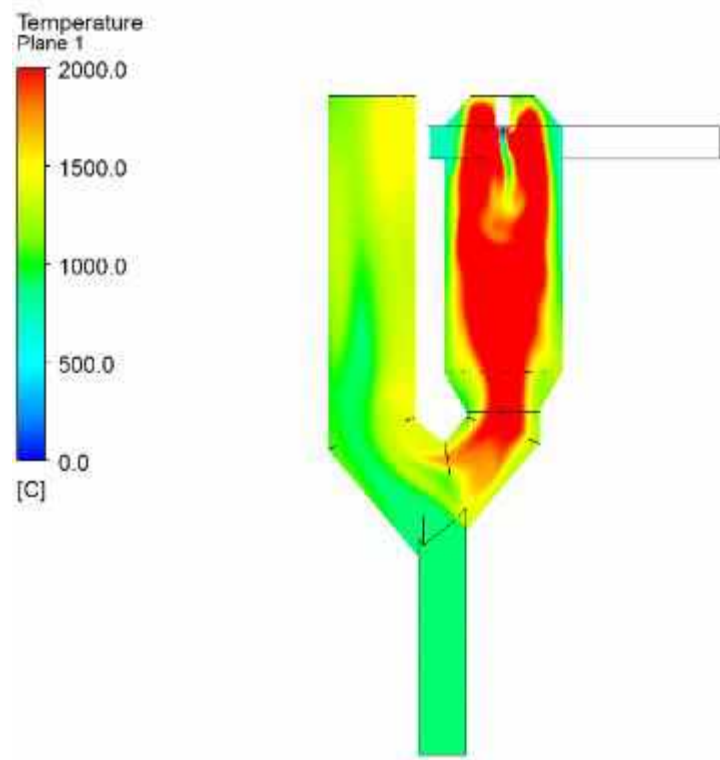
CFD (ANSYS and CFX)

Kinetics and Diffusion Models

Particle Dynamics Model

Turbulence Models

Radiation Model

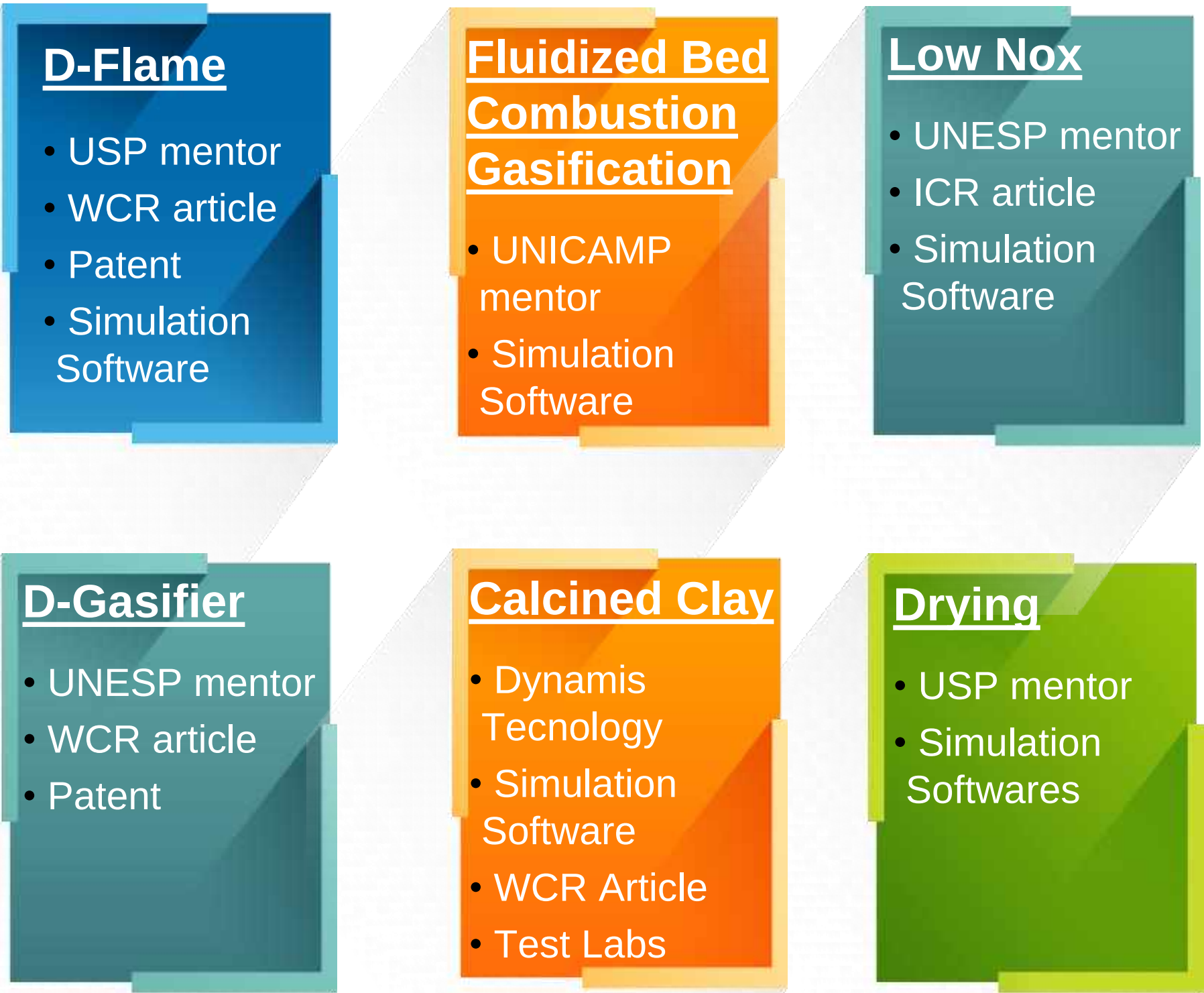


ROCKY DEM (Particle Simulation)

FEA (finite elements analysis)

DYNAMIS TECHNOLOGY

■ R&D – TEAMS & PATENTS



- *Combustion Chamber (Original D-Gasifier)*
- *Gasification System for Solid and Liquid Fuels in a Compact Chamber (D-Gasifier)*
- *Improvements in an Activation Clay System*
- *Clay Color Change Method*
- *Improved Burners for Clinker Kilns*
- *Performance Improvement Method for Burners (D-Flame Method)*
- *D-FLAME Burner Equipment*
- *D-FBED CHAMBER*

DYNAMIS **TECHNOLOGY**

■ D-TECHNICAL ASSISTANCE

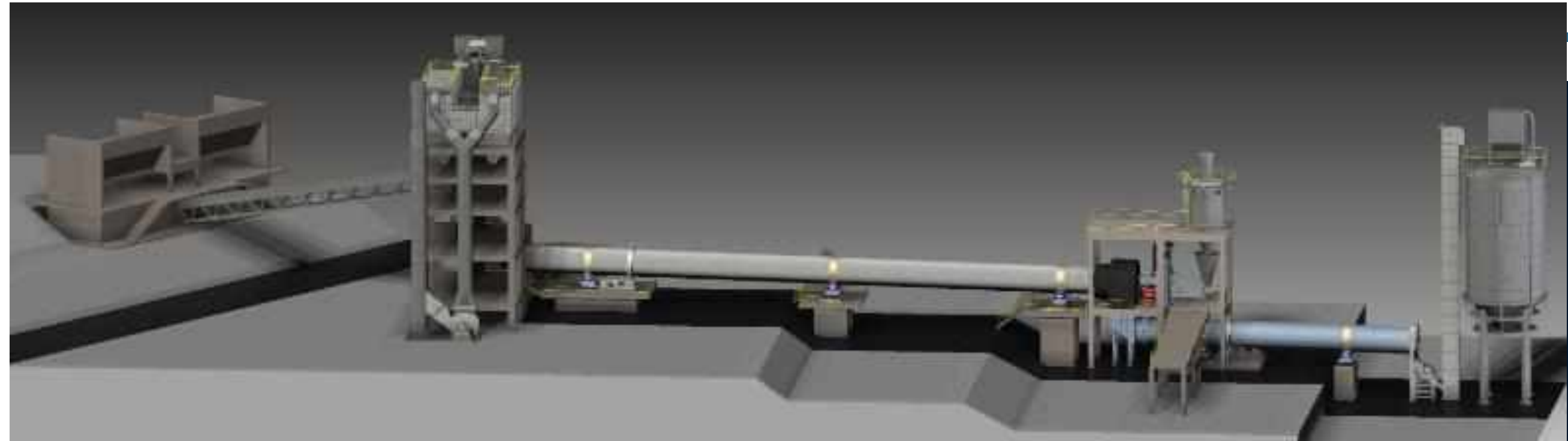
- always supporting our customers
- complete set of modern tools
- excellent technical staff



DYNAMIS INTEGRATED SYSTEMS SUPPLIED



- Calcined Clay Drying and Calcining Lines
- Plant: Ciplan Sobradinho
- Scope of Supply: Scope of Supply: Engineering and Equipment Supply



DYNAMIS INTEGRATED SYSTEMS SUPPLIED

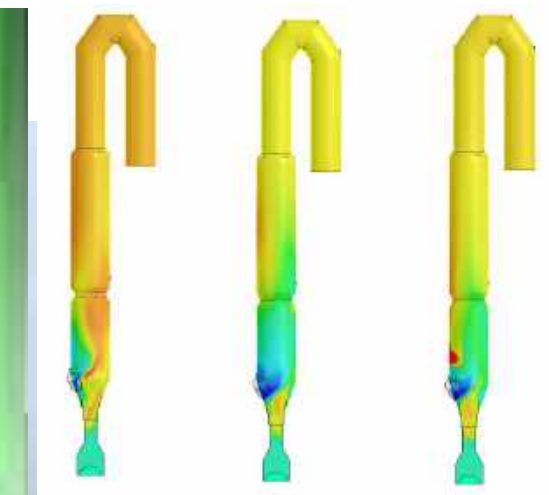
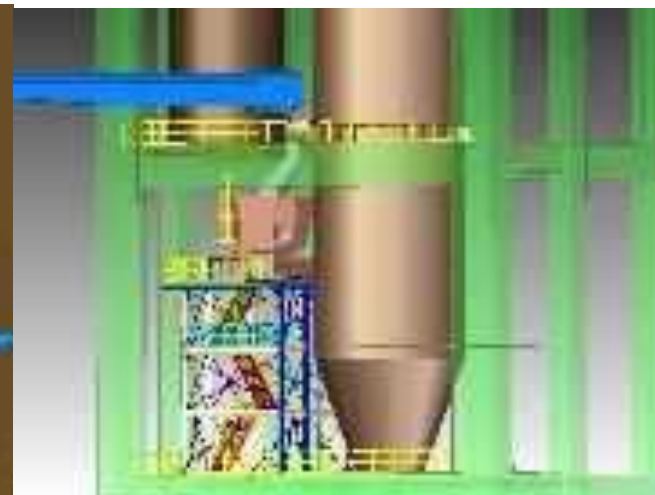
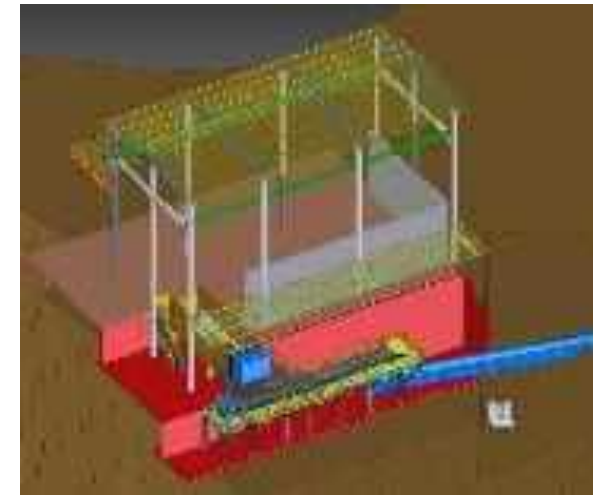


- Alternative Fuel (CDR) System for Calciner
- Plant: VC Cuiabá
- Scope of Supply: Engineering: Concept, Basic and Detailed

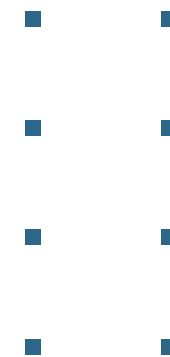
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DYNAMIS INTEGRATED SYSTEMS SUPPLIED



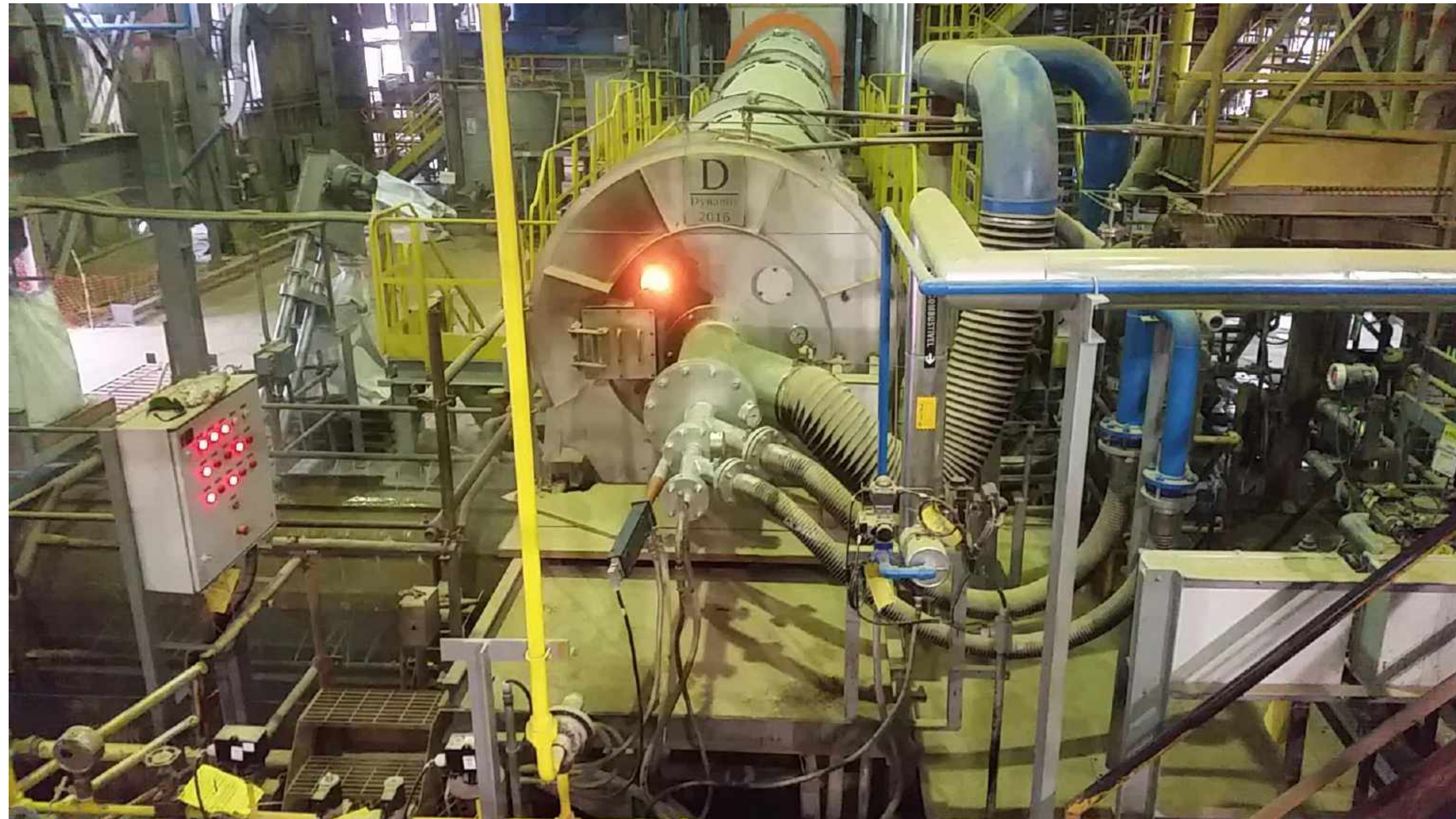
- Alternative Fuel (CDR) System for Calciner
- Plant: Supremo Secil Adrianópolis
- Scope of Supply: Engineering: Concept, Basic and Detailed



DYNAMIS INTEGRATED SYSTEMS SUPPLIED



- New Production Line for Niobium Ore Calcining
- Plant: CMOC Ouvidor
- Scope of Supply: Full Engineering and Equipment Supply



DYNAMIS INTEGRATED SYSTEMS SUPPLIED



- Dryer and Production of Lignin with Acidification Process of Black Liquor
- Plant: Suzano Limeira
- Scope of Supply: Tests, Pilot Plant, Full Engineering and Equipment Supply



DYNAMIS INTEGRATED SYSTEMS SUPPLIED



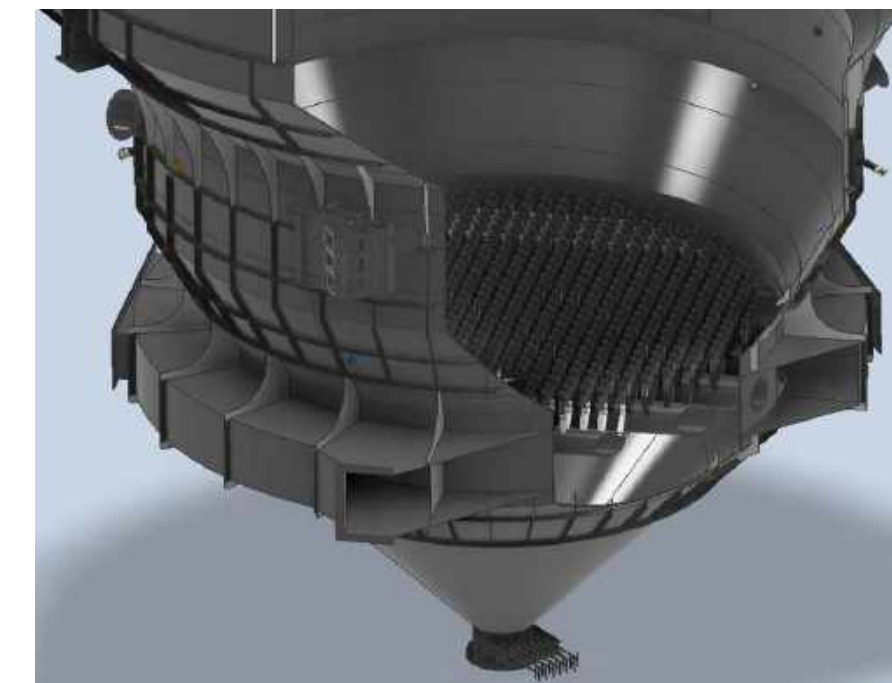
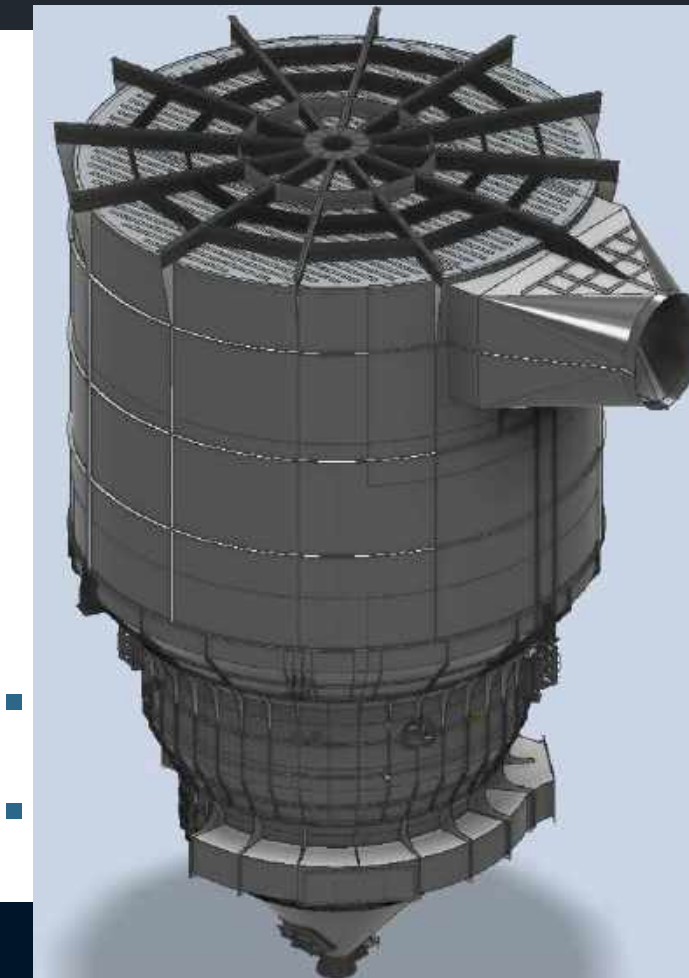
- Calcined Clay Drying and Calcining Line – 1500tpd
- Plant: Argos Rio Claro – Colombia
- Scope of Supply: Tests, Full Engineering and Equipment Supply



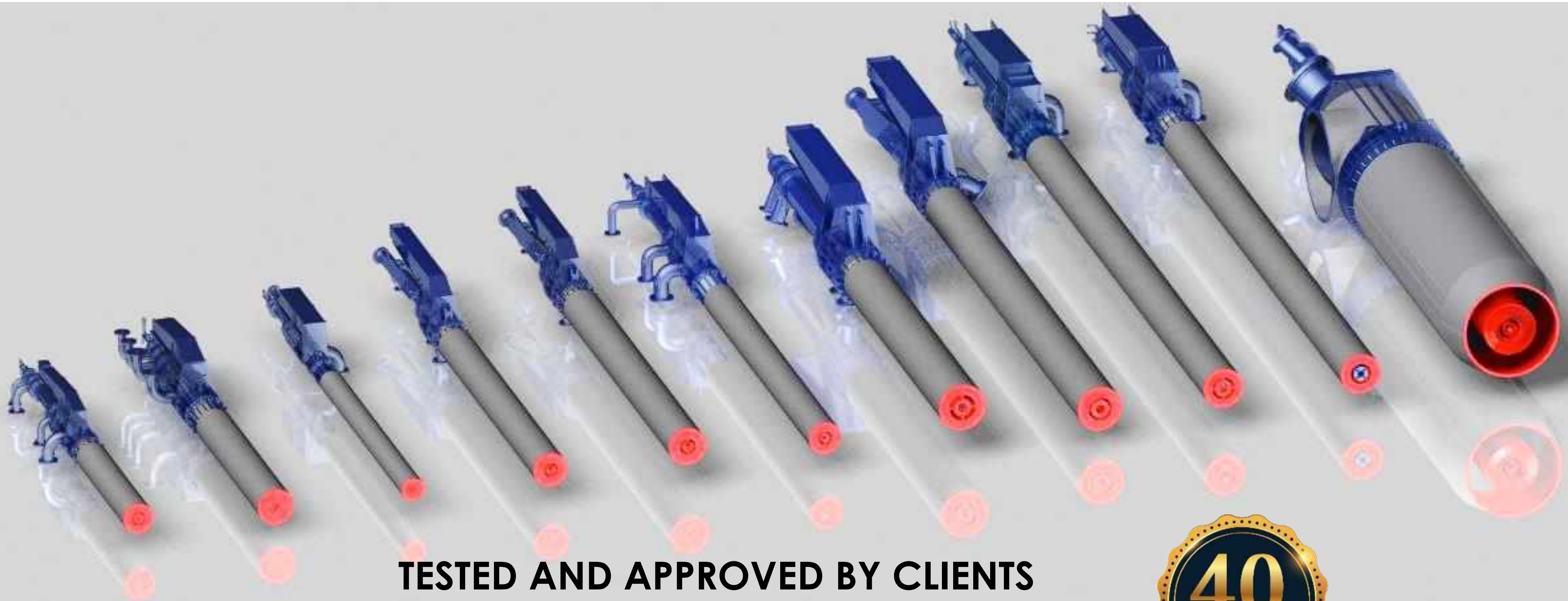
DYNAMIS INTEGRATED SYSTEMS SUPPLIED



- D-FBED CHAMBER (HGG in Fluidized Bed) of 12 Gcal
- Plant: VC Pecém
- Scope of Supply: Engineering and Equipment Supply



DYNAMIS D-FLAME BURNERS



TESTED AND APPROVED BY CLIENTS

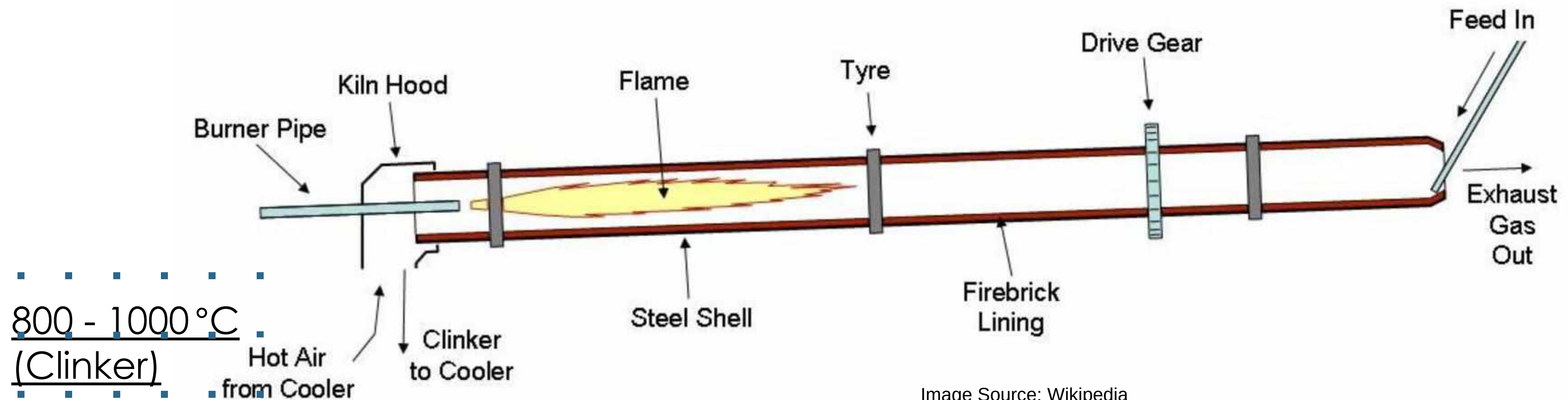
Dynamis has almost 110 D-Flame Burners installed and in operation



DYNAMIS D-FLAME BURNERS

■ FREQUENT CHARACTERISTICS OF ROTARY KILNS

- Several applications: Clinker, Lime, Ores, etc.
- One source of heat (diff. from vertical kilns, tunnel kilns)
- Extreme importance of flame quality - radiation heat transfer at flame zone
- Only a small part of combustion air is injected through the burner (primary air)



DYNAMIS D-FLAME BURNERS

■ GENERAL REQUIREMENTS

- Efficiency
- Reliability
- Durability
- Stable Flame
- As Low as Possible Emissions
- Easy Operation
- Easy Maintenance
- Refractory Conservation

■ SOME SPECIFIC REQUIREMENTS

Lime Kilns (Pulp & Paper):

- Processing of fuels generated inside the plant: hydrogen methanol, lignin, bio-oil

Ore calcining kilns:

- Reducing/Oxydizing atmosphere on material bed

Cement Kilns:

- Short and Intense flame
- Small size of C3S crystals
- High surfur purge
- Co-processing of alternative fuels

DYNAMIS D-FLAME BURNERS

■ GENERAL REQUIREMENTS

What is necessary to design an efficient burner?

- Comprehension of specific customer process and needs
- High-skilled professionals
- High quality materials and manufacturing
- Computational modelling tools
- Intense R&D



DYNAMIS D-FLAME BURNERS

■ SOME BASIC CONCEPTS FOR BURNER SPECIFICATION

$$\text{momentum} = \sum v_i * P_{AR} \quad \text{turbulence index} = \frac{\sum (m_i * v_i^2) / 2}{m_{\text{fuel}} * HV}$$

$$\text{swirl} = \frac{\sum (m_i * v_{\text{tang}_i} * r_i)}{\sum (m_i * v_{\text{axial}_i} * r_i)} \quad \text{impulse} = \frac{\sum (m_i * v_i)}{m_{\text{fuel}} * HV}$$

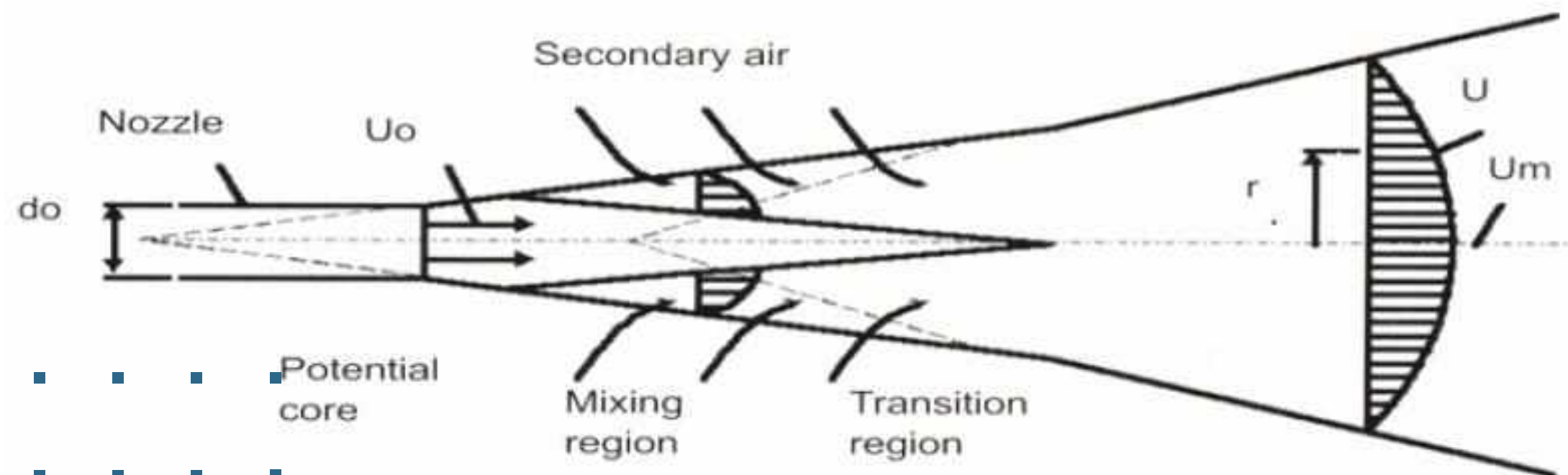


Image Source: Cement Plant Operation Handbook

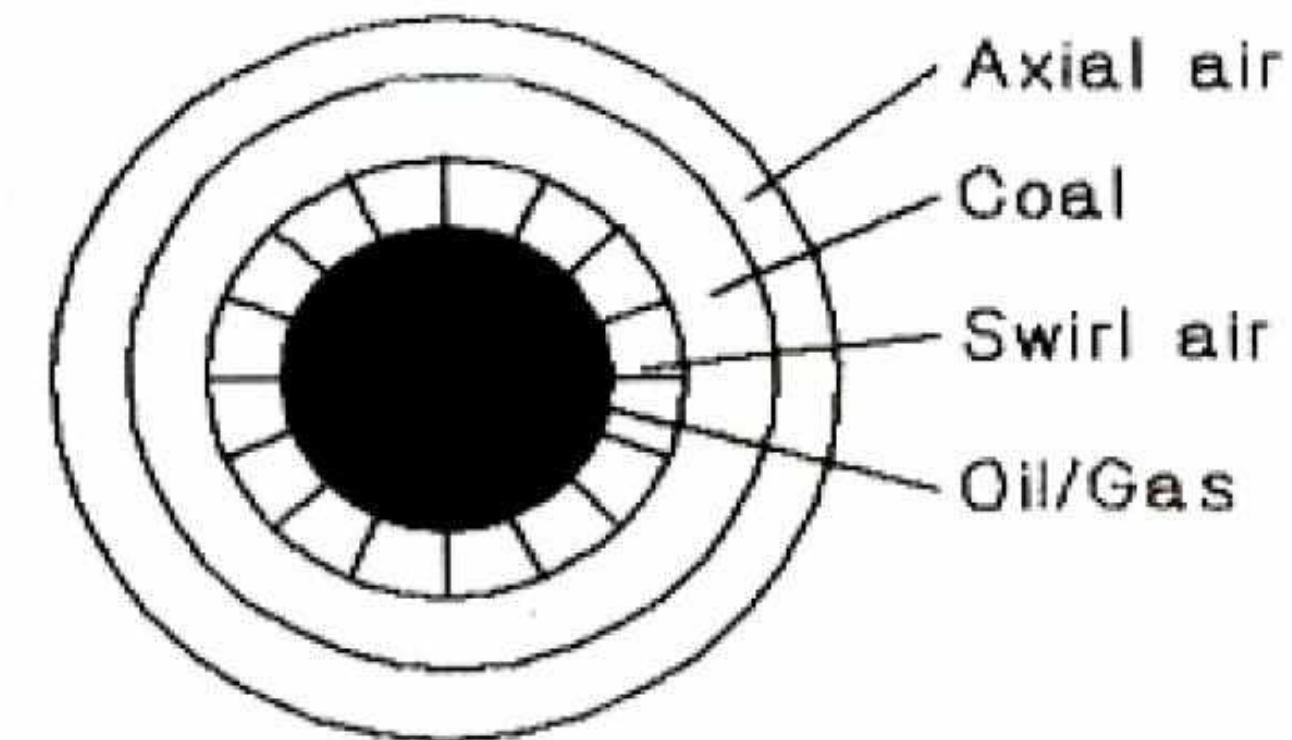
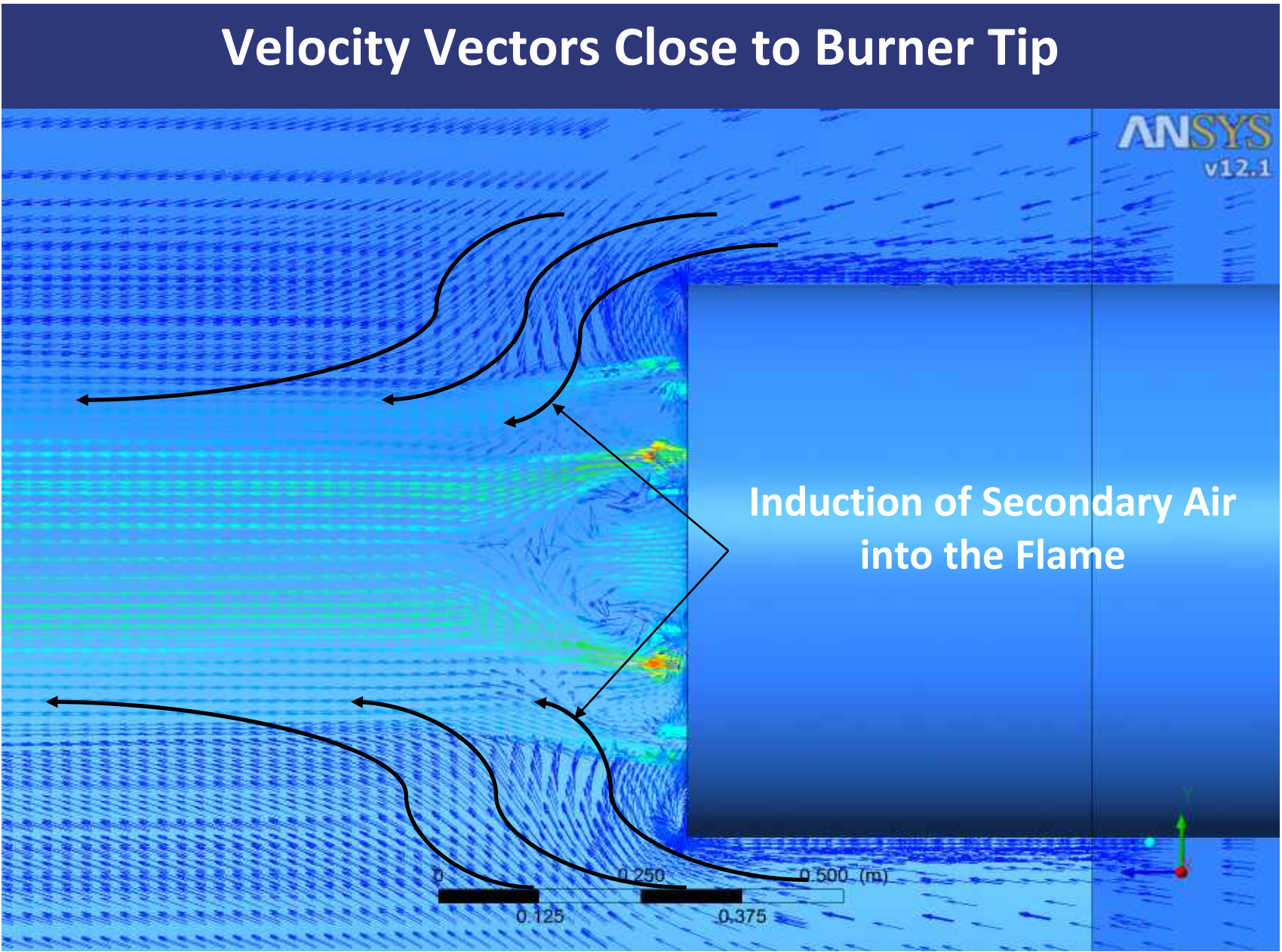
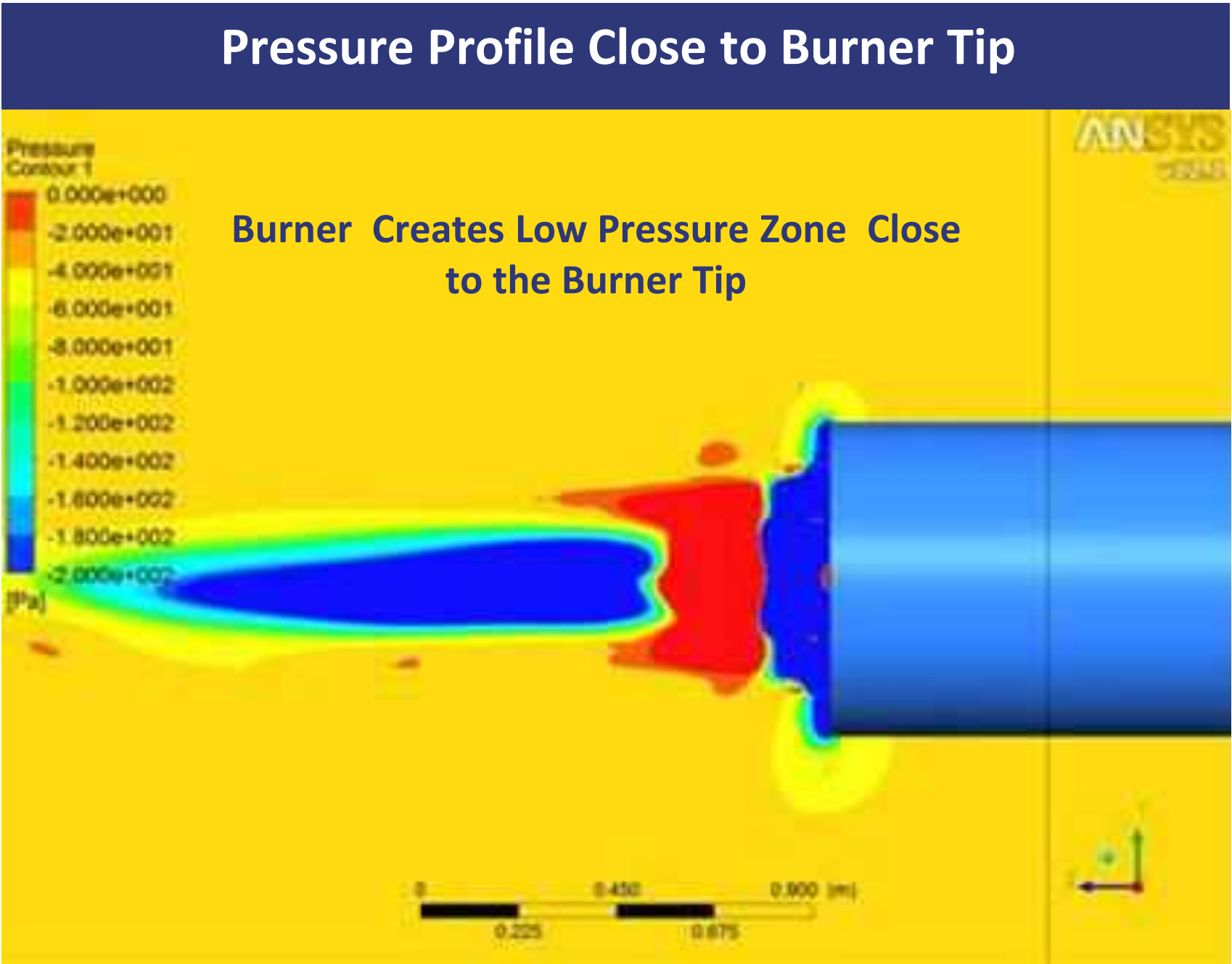


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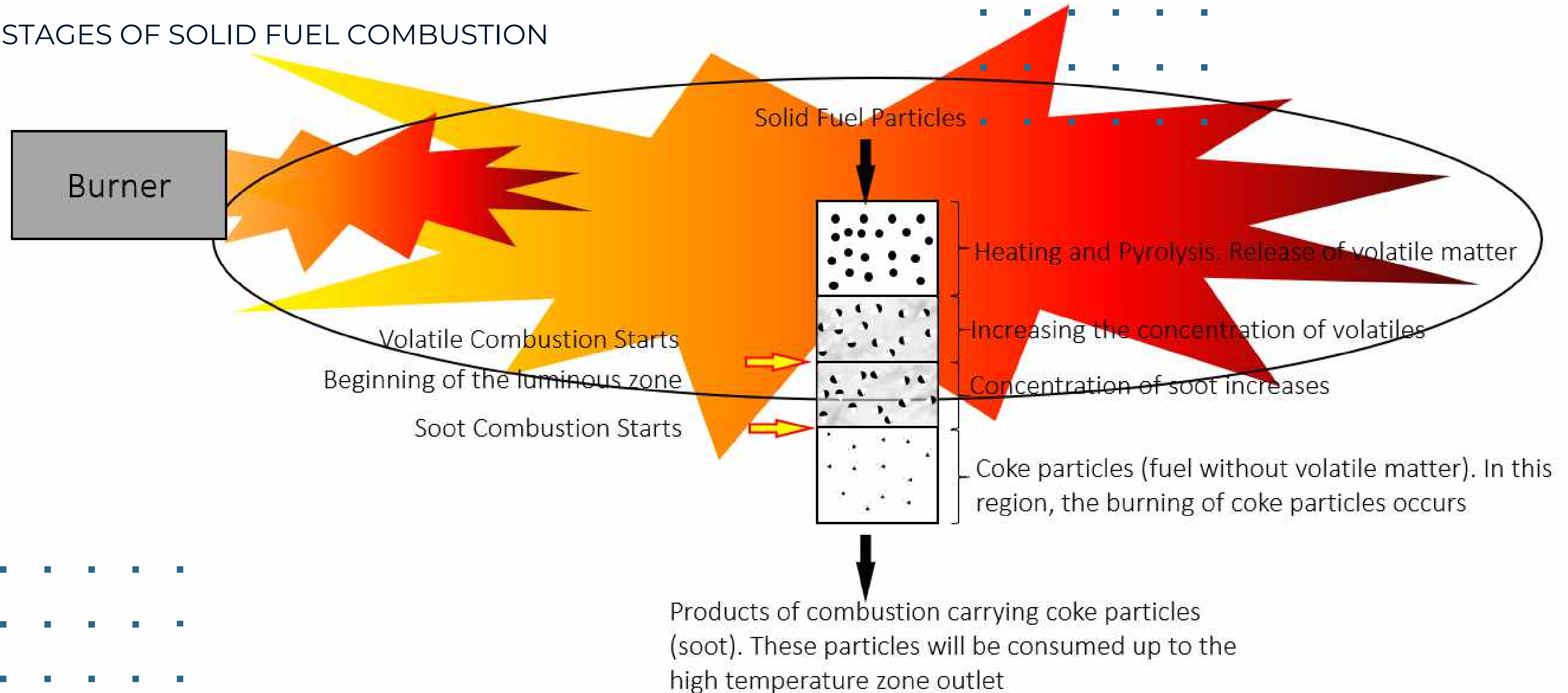
DYNAMIS D-FLAME BURNERS

- SOME BASIC CONCEPTS FOR BURNER SPECIFICATION



DYNAMIS D-FLAME BURNERS

■ STAGES OF SOLID FUEL COMBUSTION



DYNAMIS D-FLAME BURNERS

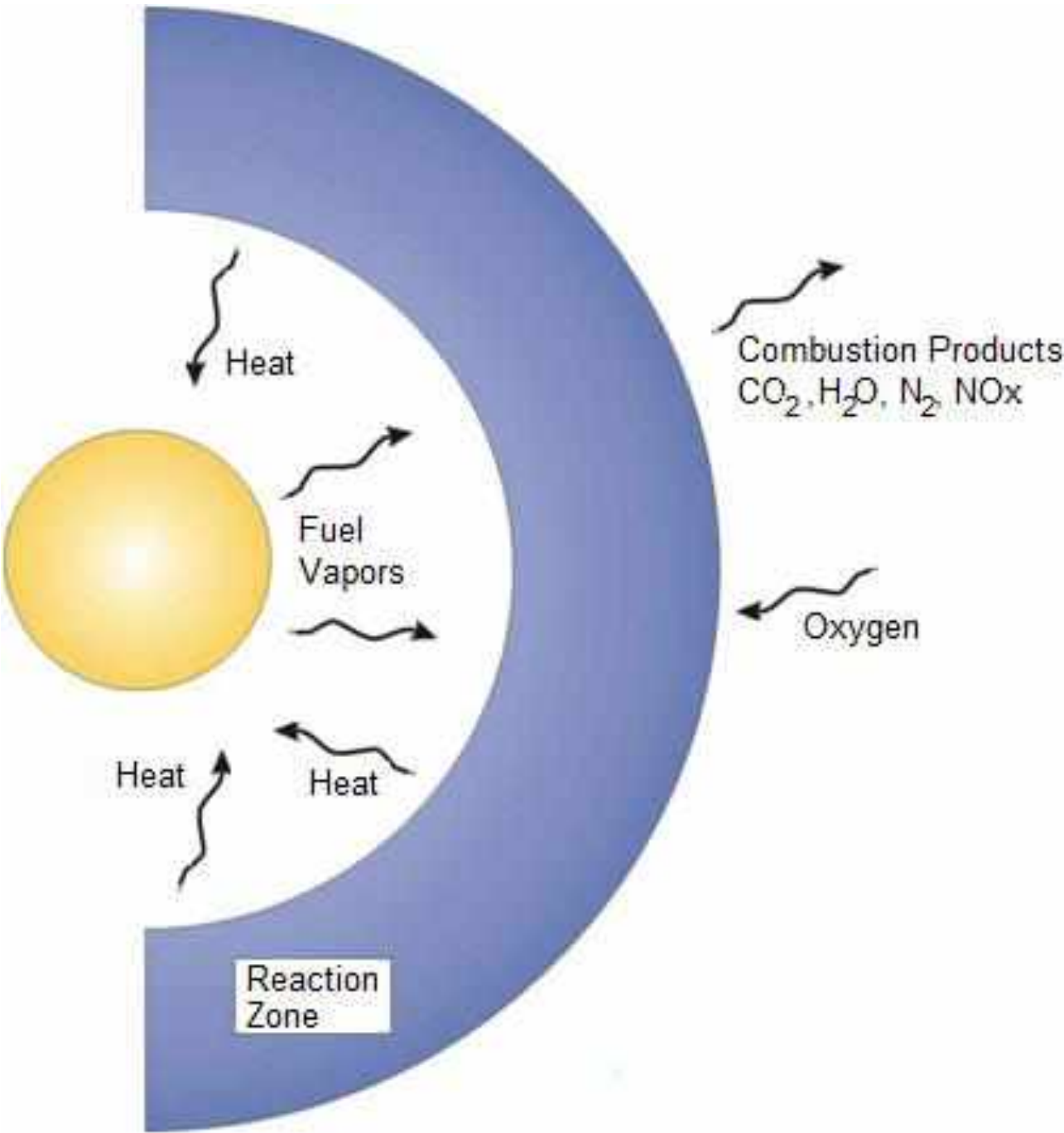
■ STAGES OF SOLID FUEL COMBUSTION

Estimated times of each stage of combustion on the approximate conditions of a clinker kiln:

- Fuel: Petcoke
- Kiln Temperature: 2000°C
- Particle Size: 90 μm

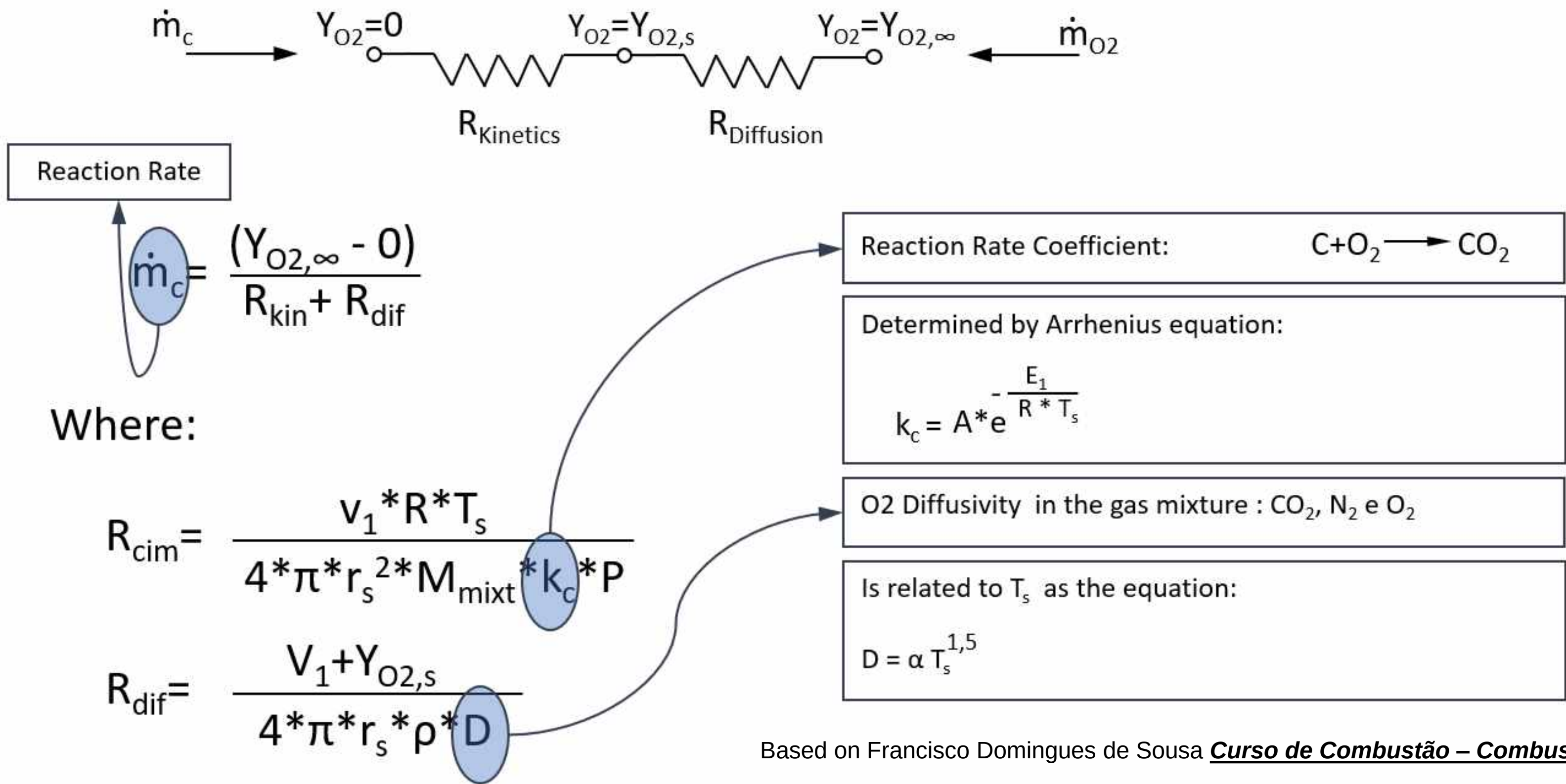
Stage	Time	Notes
Heating	0.1 s	From 800°C to 2000°C
Pyrolysis	0.2 s	Occurs simultaneously to heating
Combustion of Solid Particles (coke)	2.0 s	Heterogeneous reactions between C and O2
TOTAL	2.2 s	

Limiting Step



DYNAMIS D-FLAME BURNERS

■ EQUIVALENT ELECTRICAL CIRCUIT OF SOLID COMBUSTION



Based on Francisco Domingues de Sousa Curso de Combustão – Combustão de Sólidos

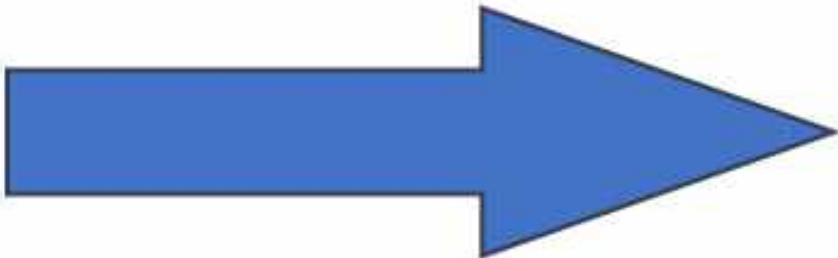
DYNAMIS D-FLAME BURNERS

■ COMBUSTION LIMITING PHENOMENON

$$\begin{matrix} \uparrow T & \uparrow R_{dif} & \uparrow r_s & \uparrow R_{dif} \end{matrix}$$

$$\frac{R_{kin}}{R_{dif}} = \left(\frac{v_1}{v_1 + Y_{O2,s}} \right) * \left(\frac{R^* T_s}{M_{mist} * P} \right) * \left(\frac{\rho * D}{k_c} \right) * \left(\frac{1}{r_s} \right)$$

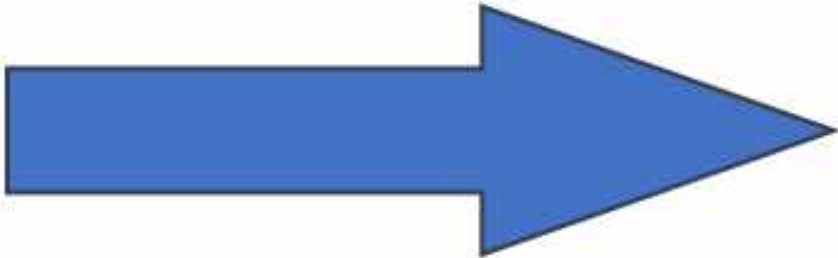
If $\frac{R_{kin}}{R_{dif}} \ll 1$



DIFFUSION-CONTROLLED Combustion

- Large Particles, bigger than 1mm
- High Temperature

If $\frac{R_{kin}}{R_{dif}} \gg 1$



KINETICS-CONTROLLED Combustion

- Small Particles, less than 50µm
- Low Temperature

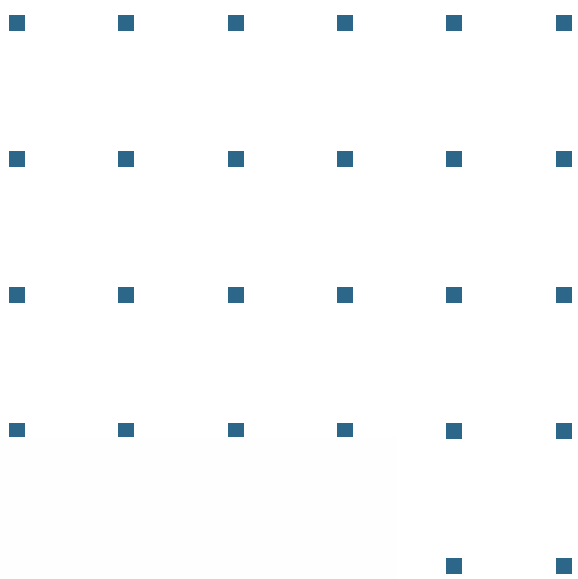
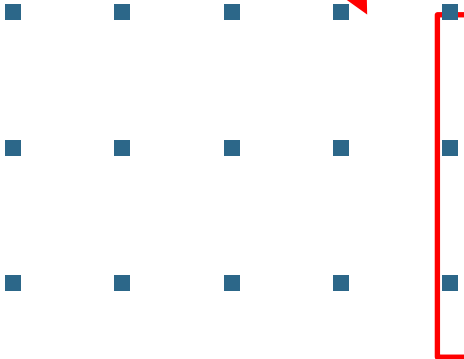
If $\frac{R_{kin}}{R_{dif}} \sim 1$



BOTH MECHANISMS

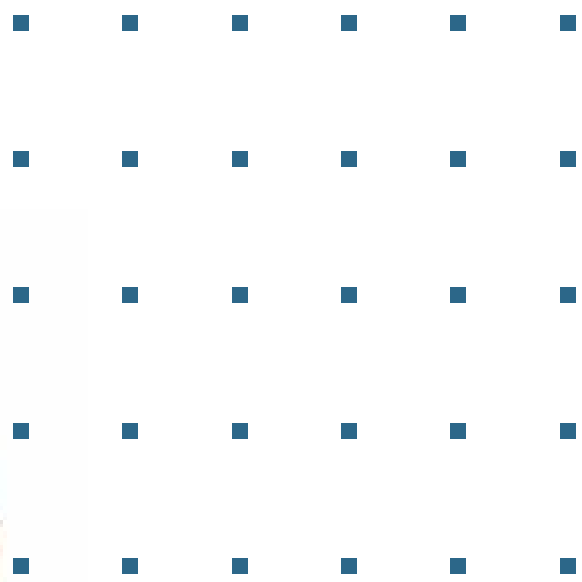
- Particles between 50µm and 1mm

Clinker Kiln



DYNAMIS D-FLAME BURNERS

■ BURNING TIME = $\left[\frac{V_1 \cdot R \cdot T_s}{M_{\text{mist}} \cdot k_c \cdot P} \right] \cdot r_s + \left[\frac{V_1 + Y_{O2,s}}{2 \cdot \rho \cdot D} \right] \cdot r_s^2 \cdot \frac{\rho_c}{Y_{O2,\infty}}$



How to reduce burning time ?

Increasing the particle temperature

Increasing the turbulence

■ ■ ■ Decreasing the particle size (diameter).

■ ■ ■ Increasing the oxygen concentration

■ ■ ■ ■ ■

- Increasing the kiln temperature
- Substituting the solid fuel by other with higher volatile matter
- Bringing intermediate combustion products back to the reaction starting zone (THROUGH SWIRL)

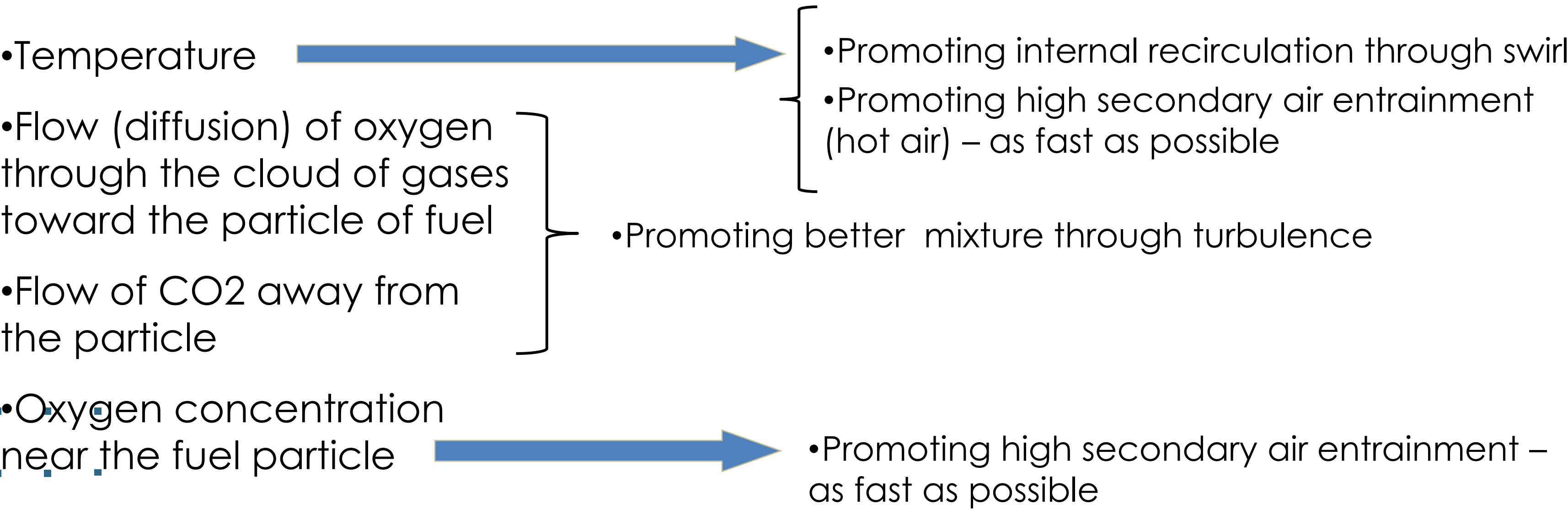
• Increasing the KINETIC ENERGY

• Increasing the turbulence

DYNAMIS D-FLAME BURNERS

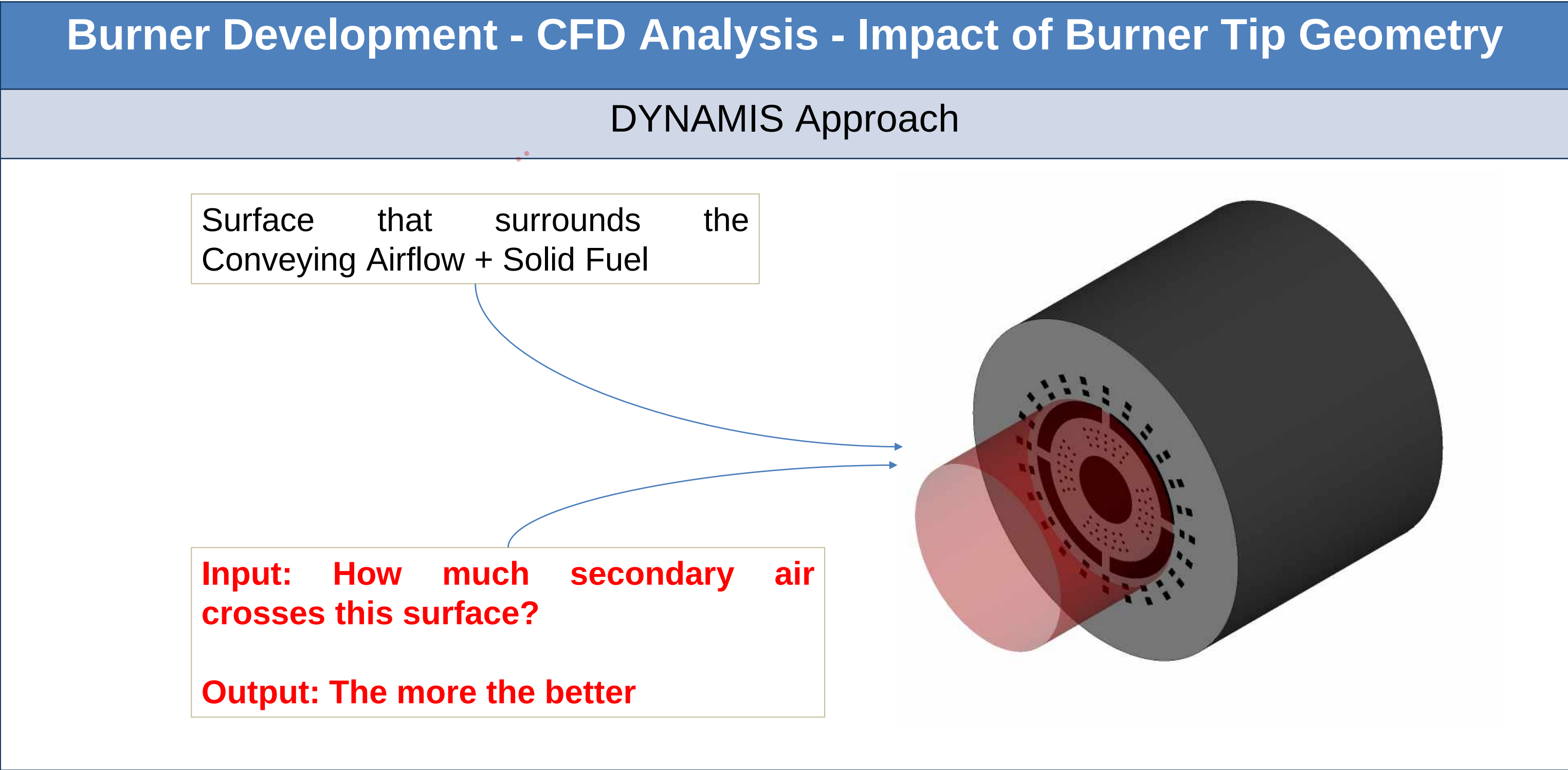
■ SUMMARY

Combustion Concepts show that a burner design can interfere in the quality of combustion acting on four main points:



DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D



DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D

RESEARCH TEAM

- How is it possible to increase secondary air entrainment?
- What are the main parameters that govern secondary air entrainment?

TECHNOLOGICAL TOOLS

- CFD Analysis
- In-house developed softwares (Vulcano, D-RK Simulator, etc.)

NEW CONCEPT

Geometrical Optimization of burner tip in order to enhance secondary air entrainment

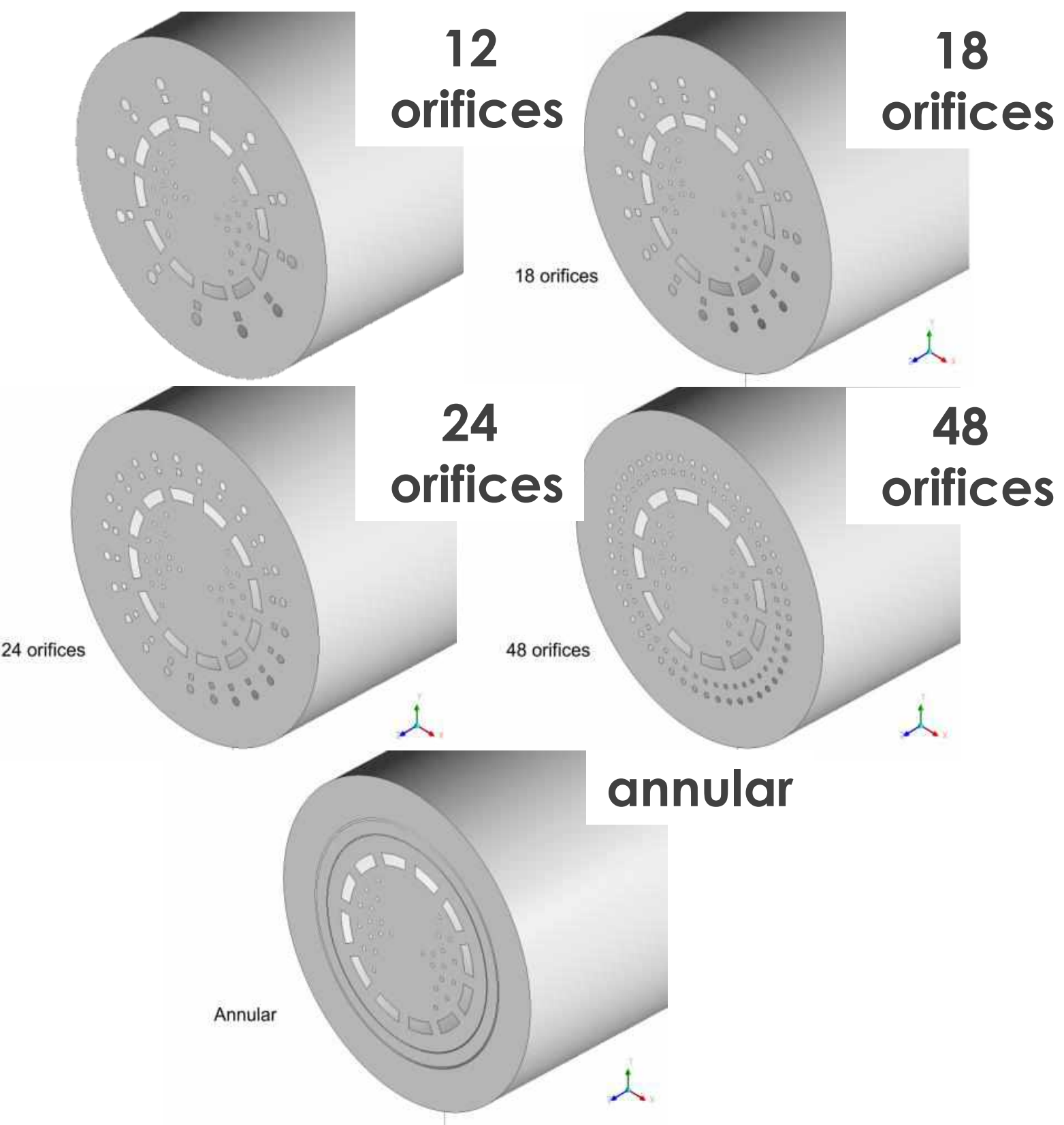
DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D

- Same primary and secondary air flow
- Same turbulence index and impulse
- Same swirl
- Same thermal power

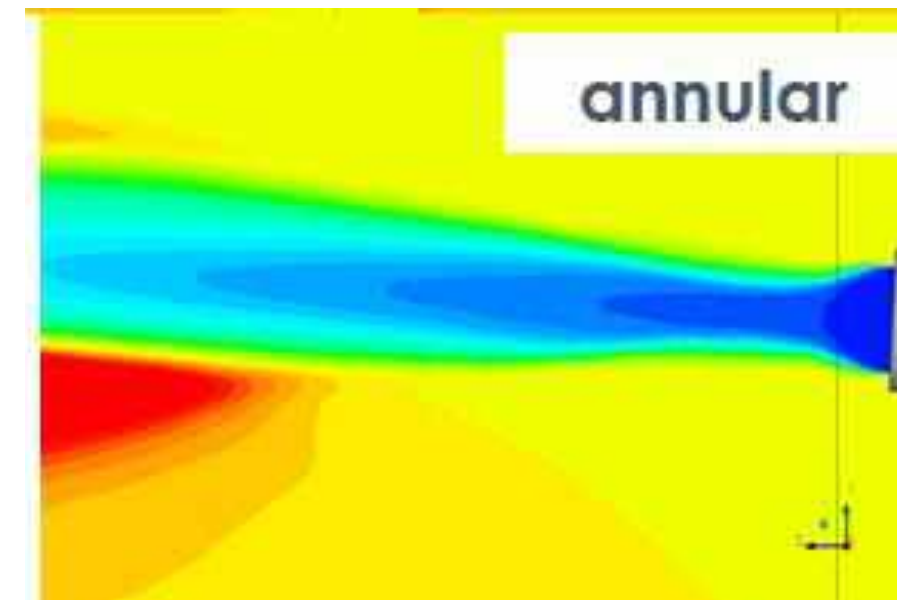
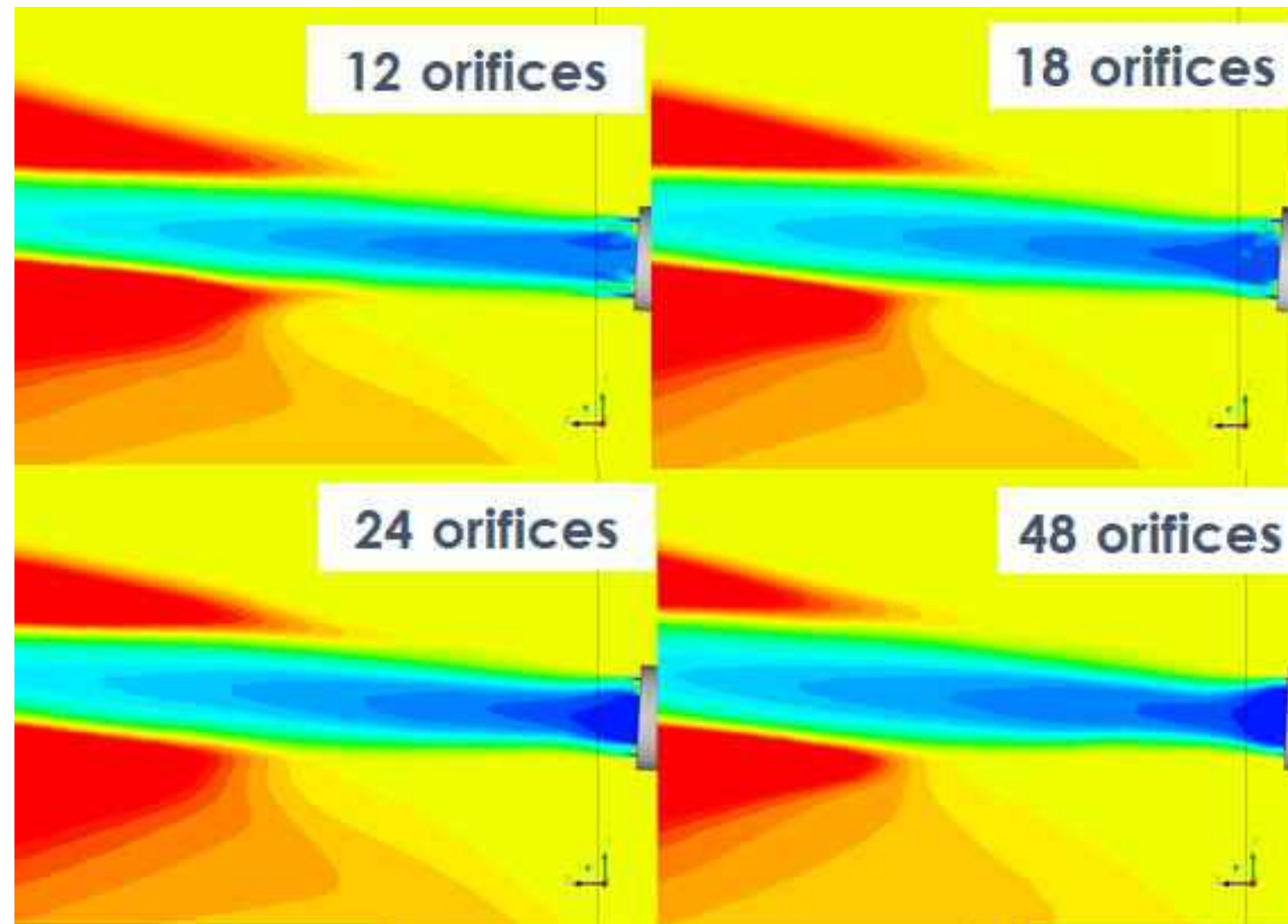
**SAME
BURNERS
?**

	Flow rate	Pressure	Temperature
	[kg/h]	[mbar]	[°C]
External	4018	300	56
Tangential	1100	60	33
Inner	628	60	33
Transport	2512		50
Petcoke	6582		50
Secondary air	87230		900



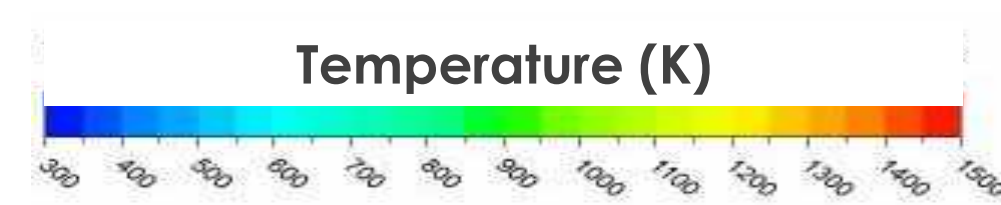
DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D



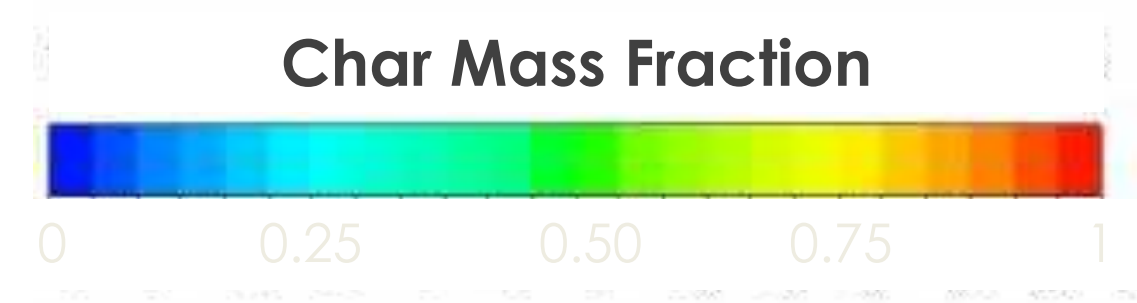
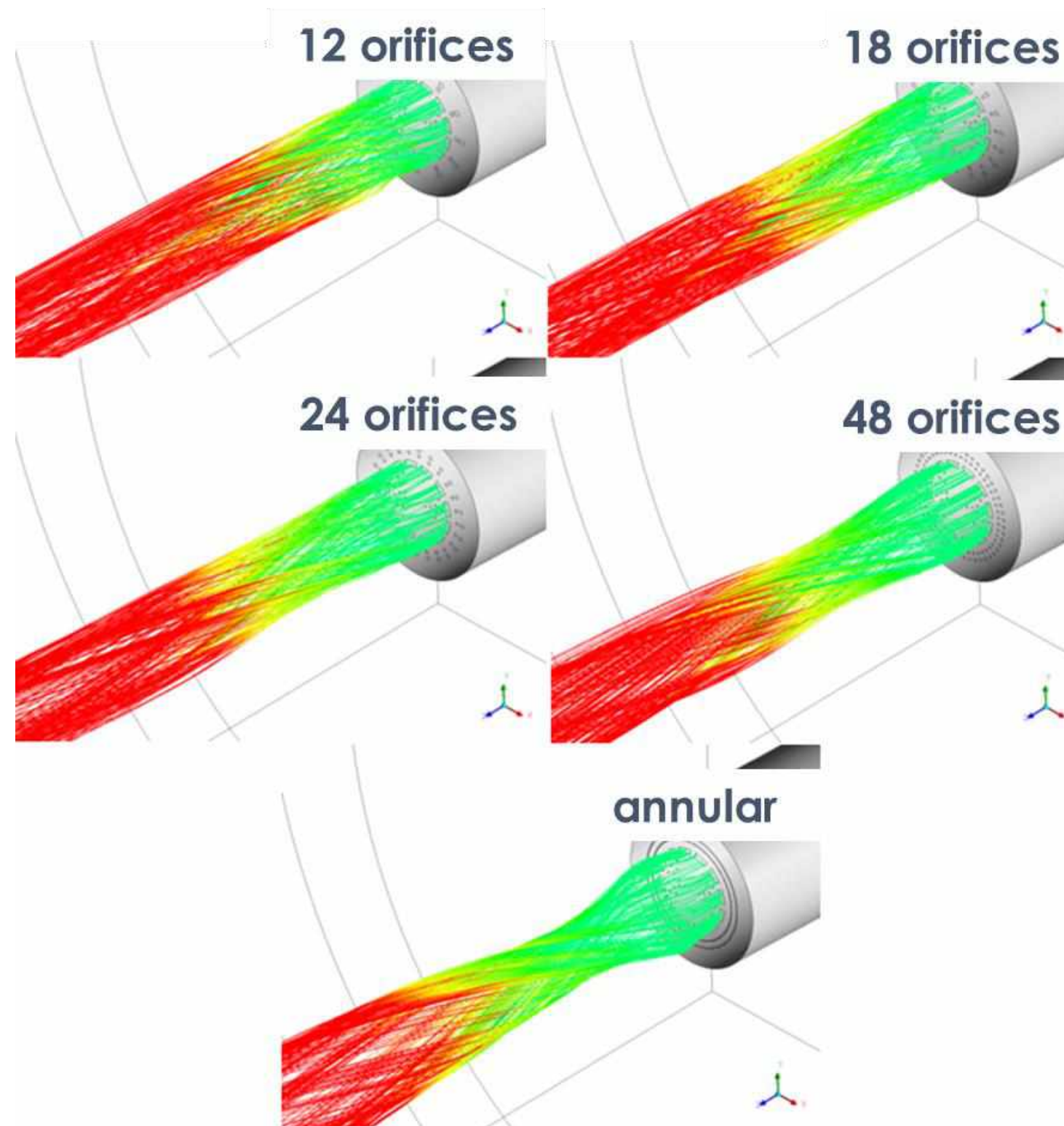
Evidence:

Cold region next to the burner tip is influenced by the number of external air orifices



DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D

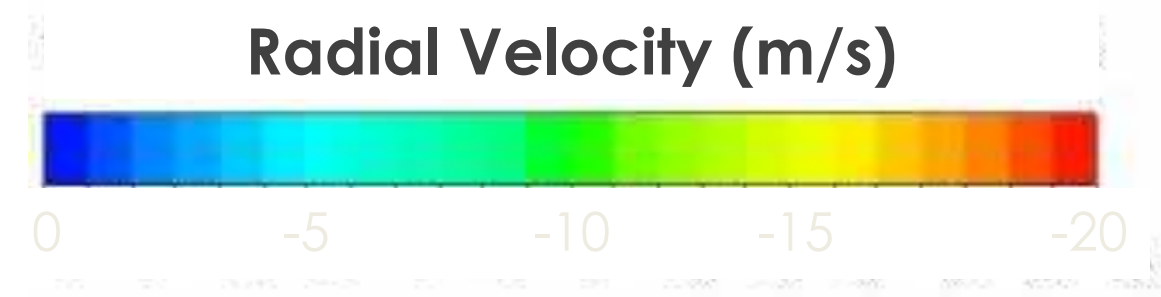
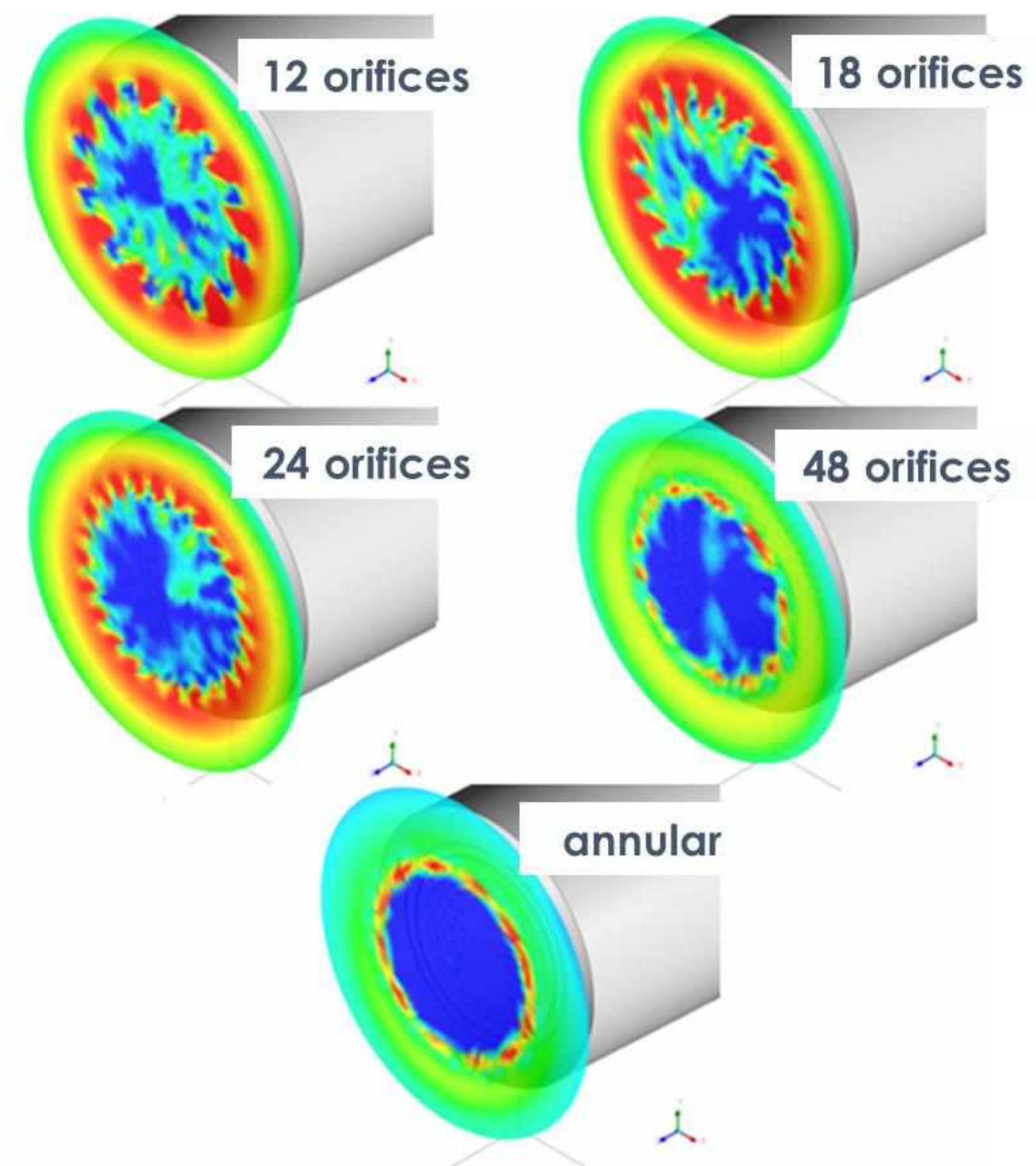


Evidence:

Beginning of char burning is influenced by the number of external air orifices

DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D

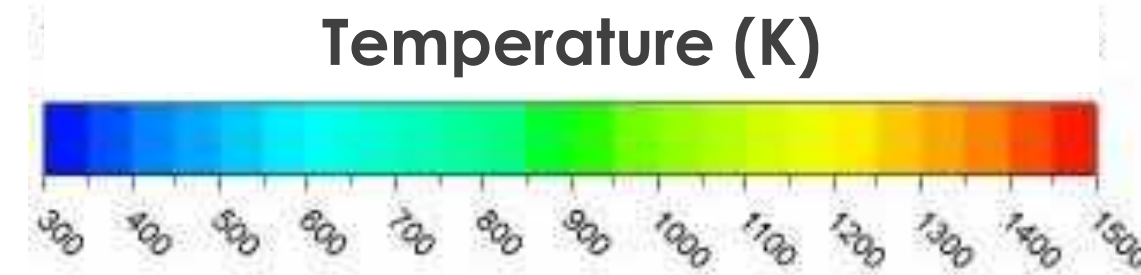
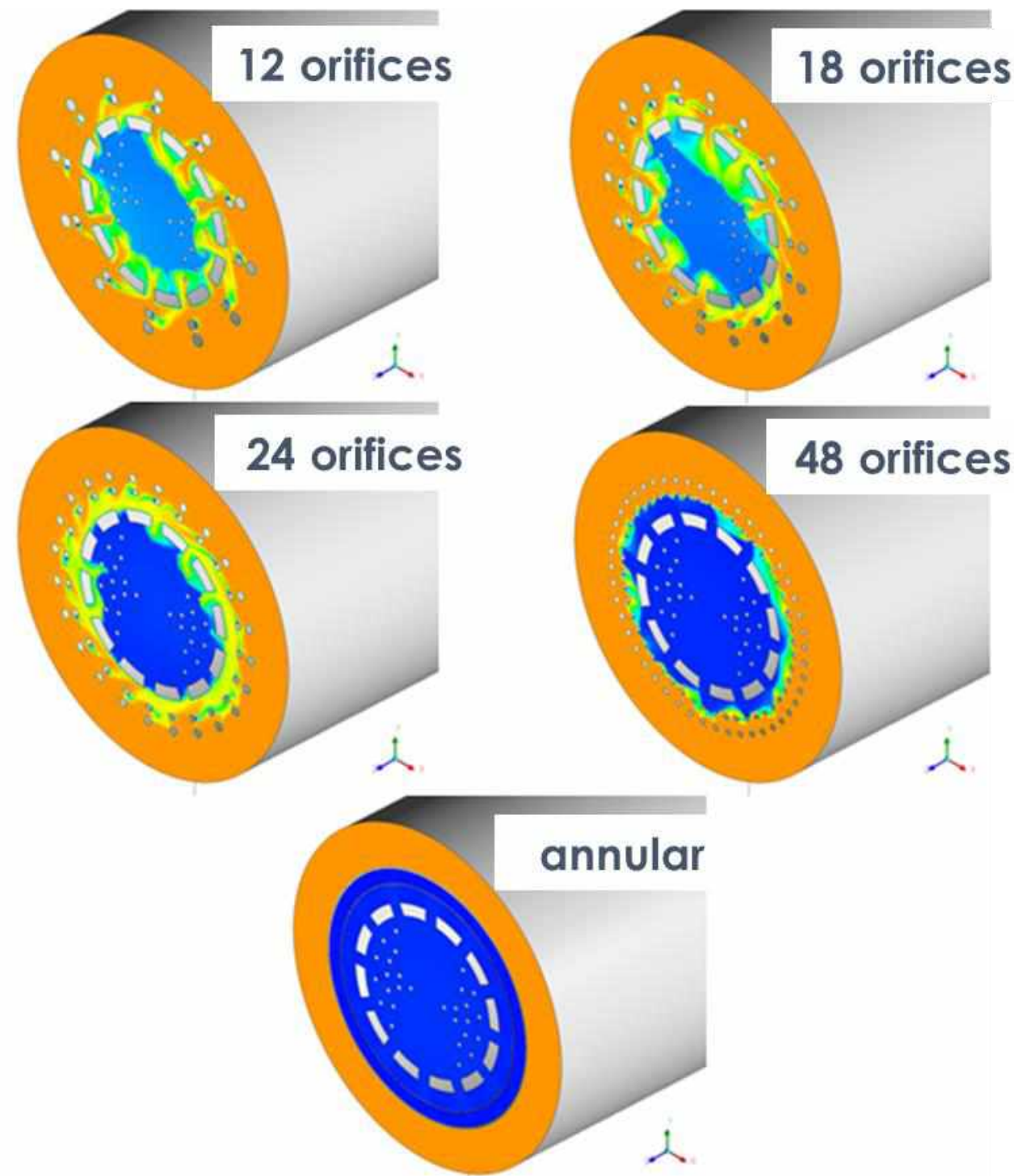


Evidence:

Radial velocity (related to flame stability) is influenced by the number of external air orifices

DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D

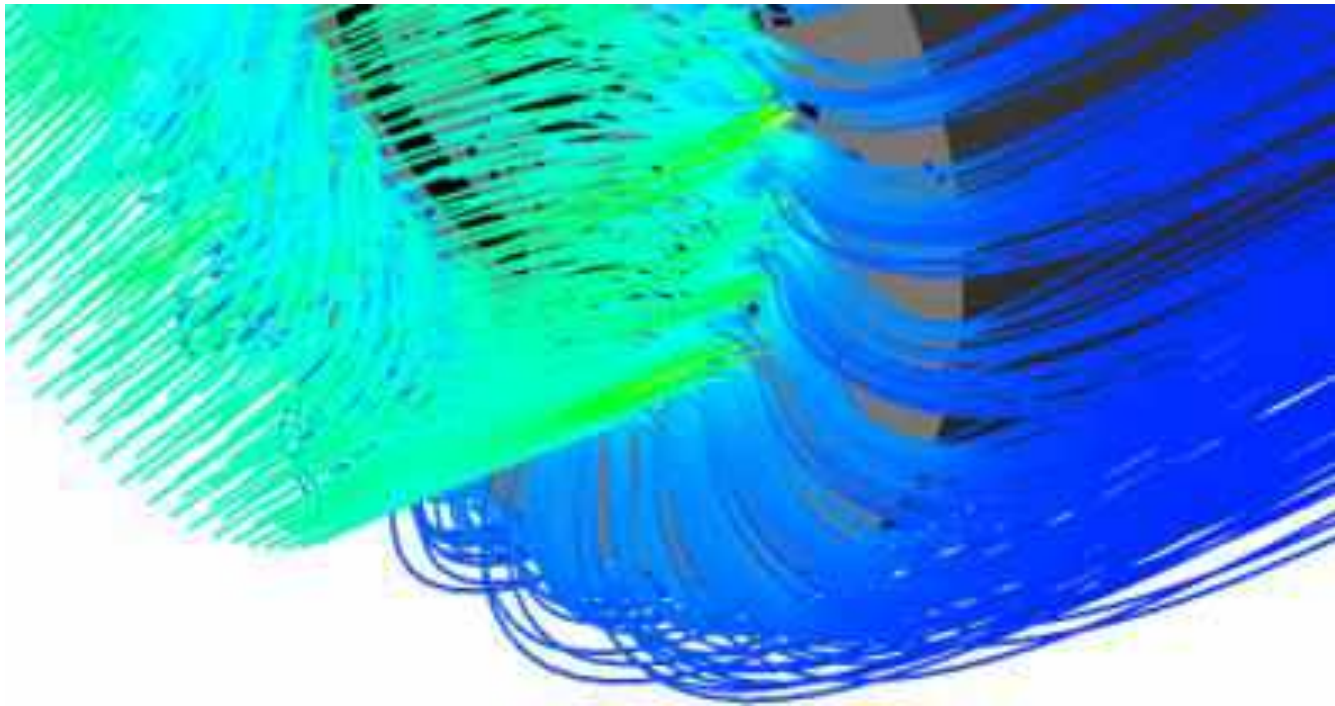


Evidence:

Temperature around the fuel injection orifices is influenced by secondary air entrainment

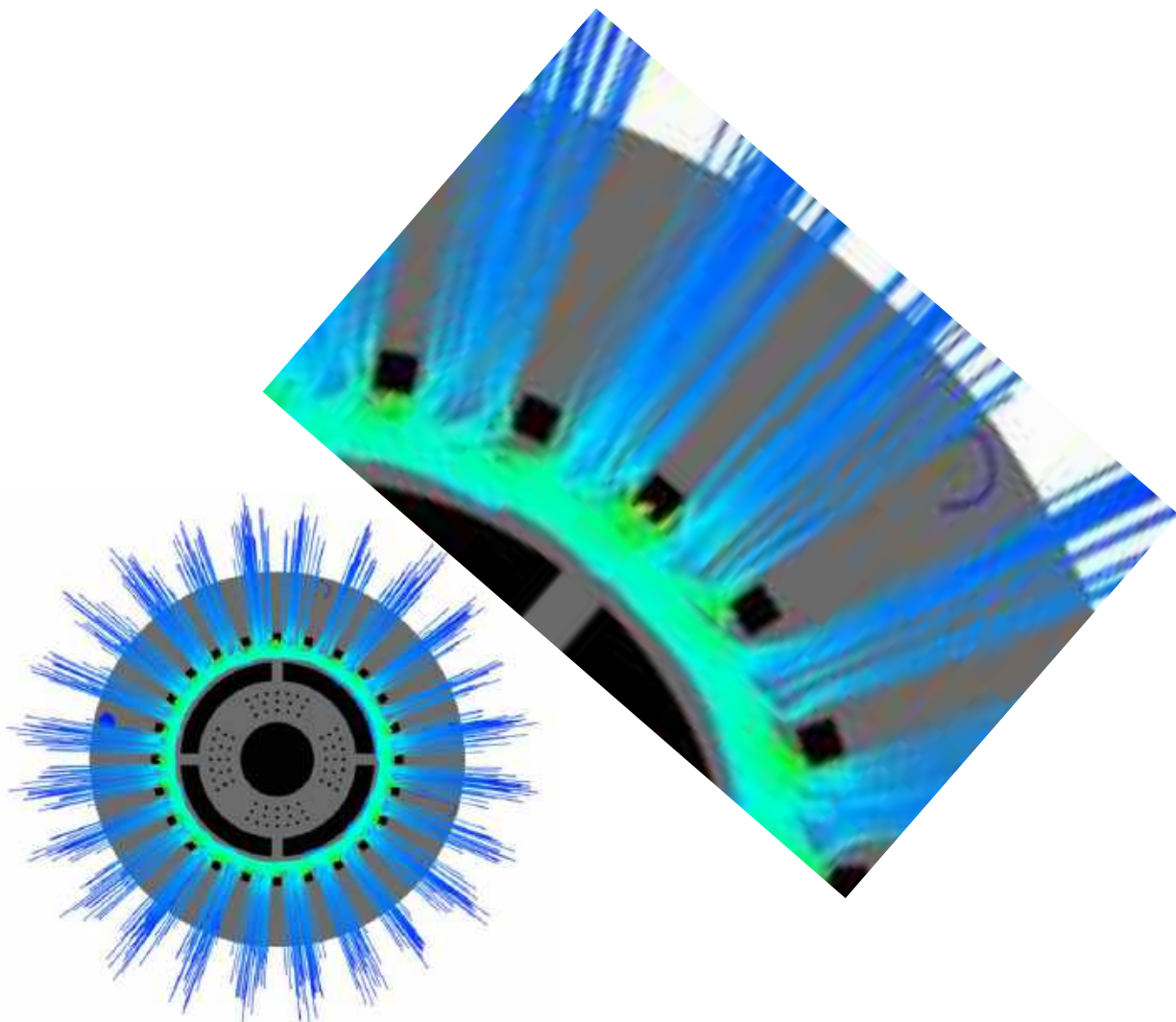
DYNAMIS D-FLAME BURNERS

■ D-FLAME R&D



TURBULENCE

- High injection velocity
- High pressure of primary air flow



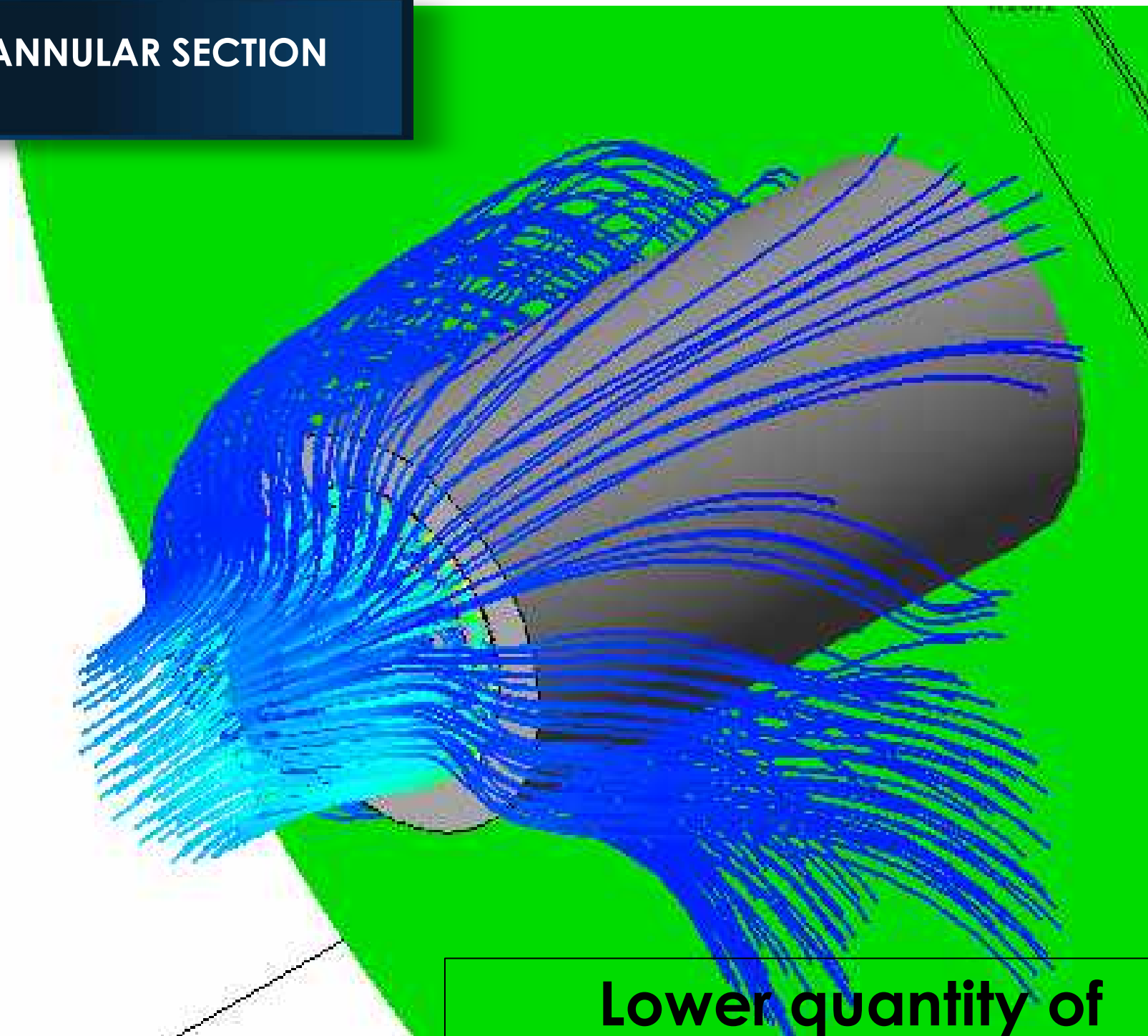
BURNER TIP GEOMETRY

- Empty spaces allow secondary air entrainment

DYNAMIS D-FLAME BURNERS

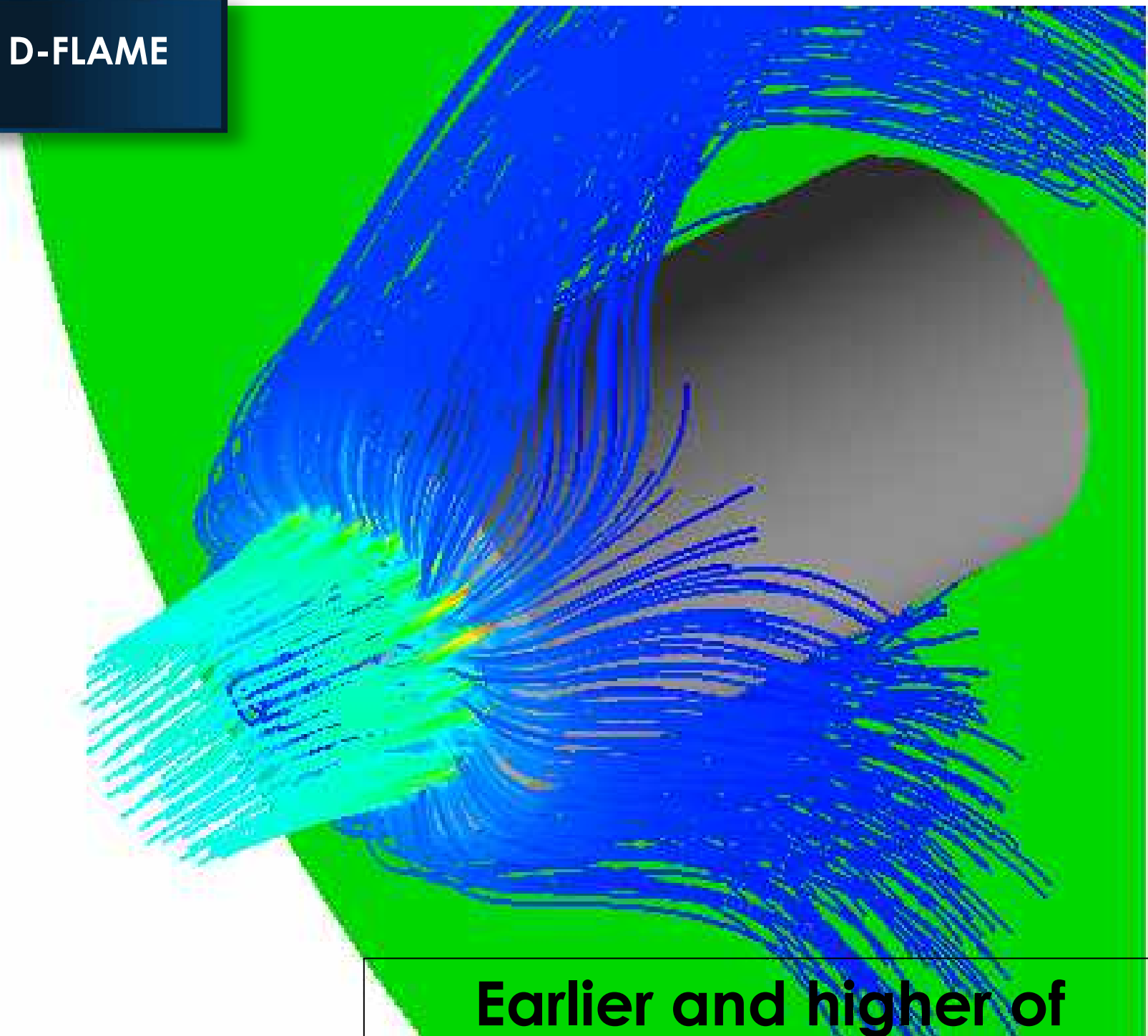
■ D-FLAME R&D

ANNULAR SECTION



Lower quantity of
secondary air entrainment

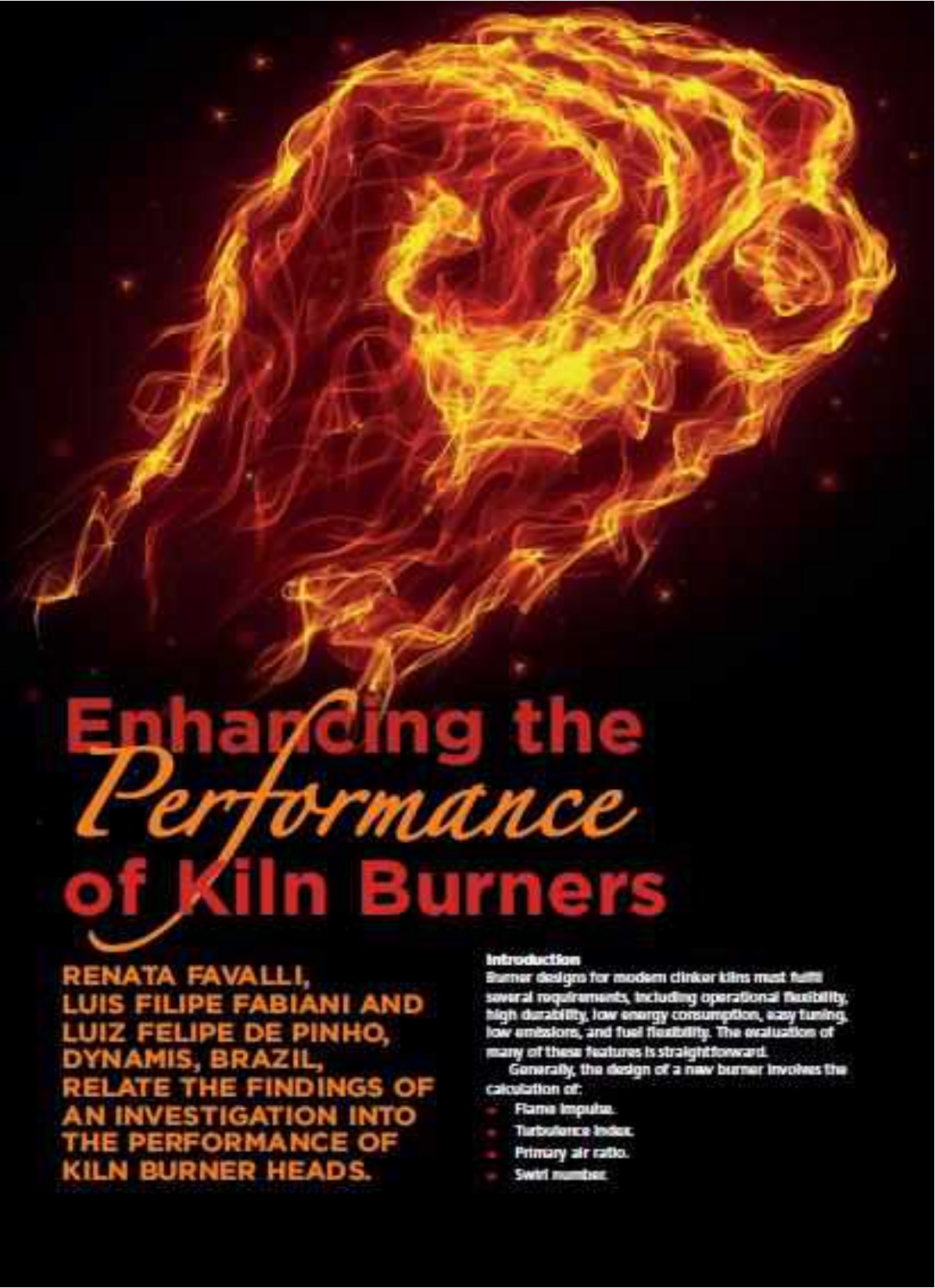
D-FLAME



Earlier and higher of
secondary air entrainment

DYNAMIS D-FLAME BURNERS

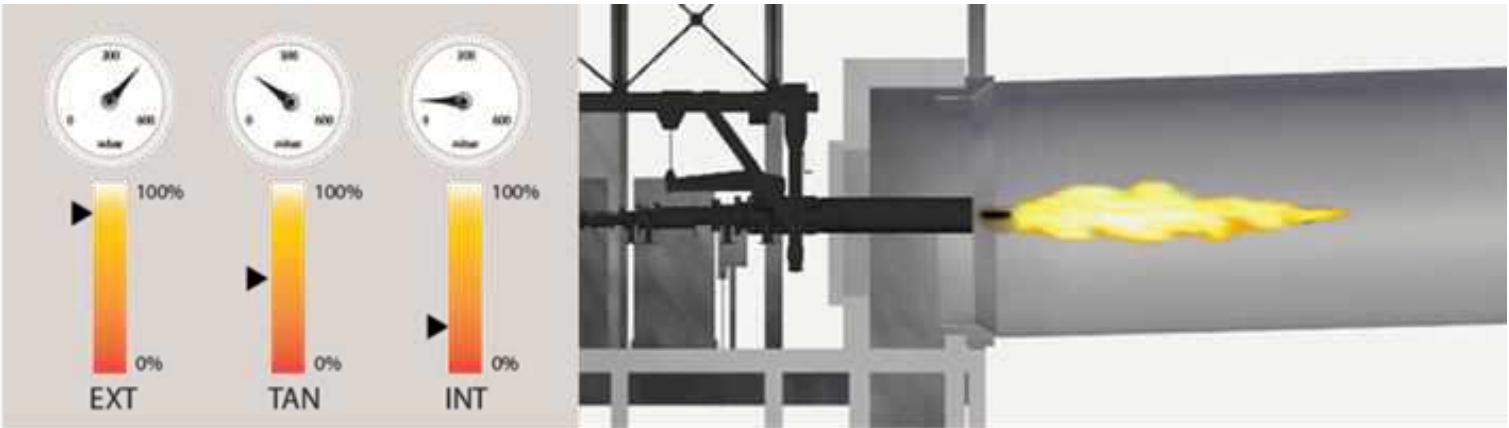
■ D-FLAME R&D



Article published in World Cement magazine in its issue of November 2015

DYNAMIS D-FLAME BURNERS

D-FLAME DESIGN PARAMETERS



Short Flame Settings



Short and wide Flame Settings



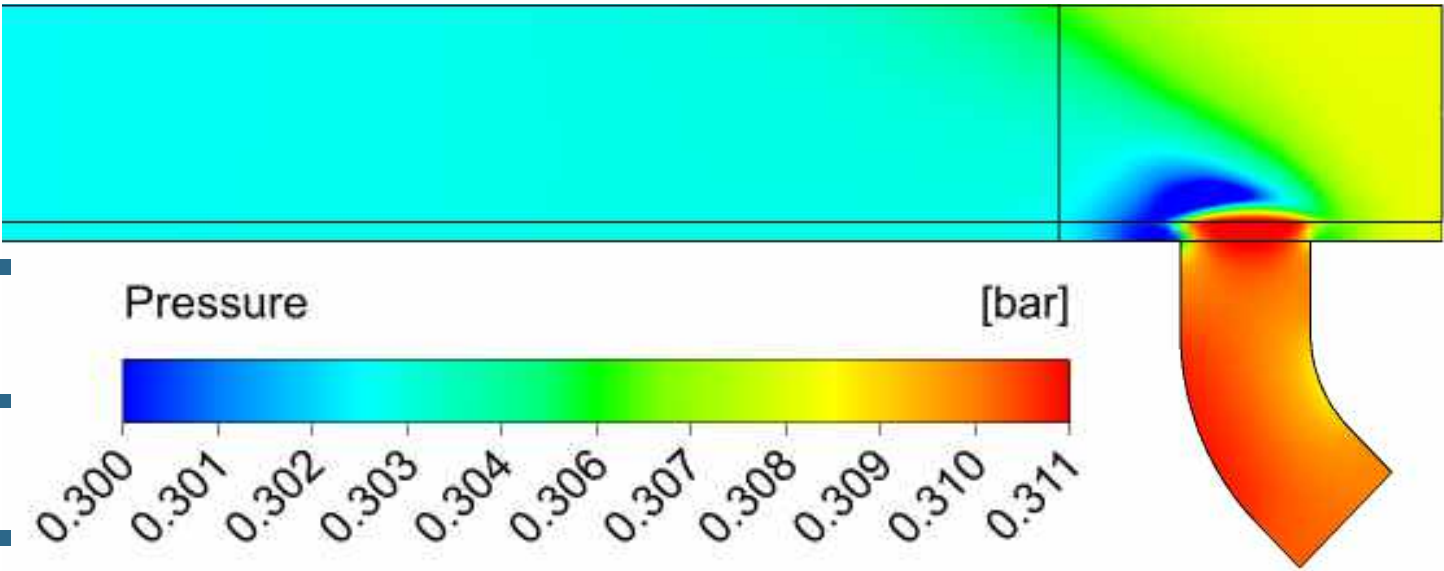
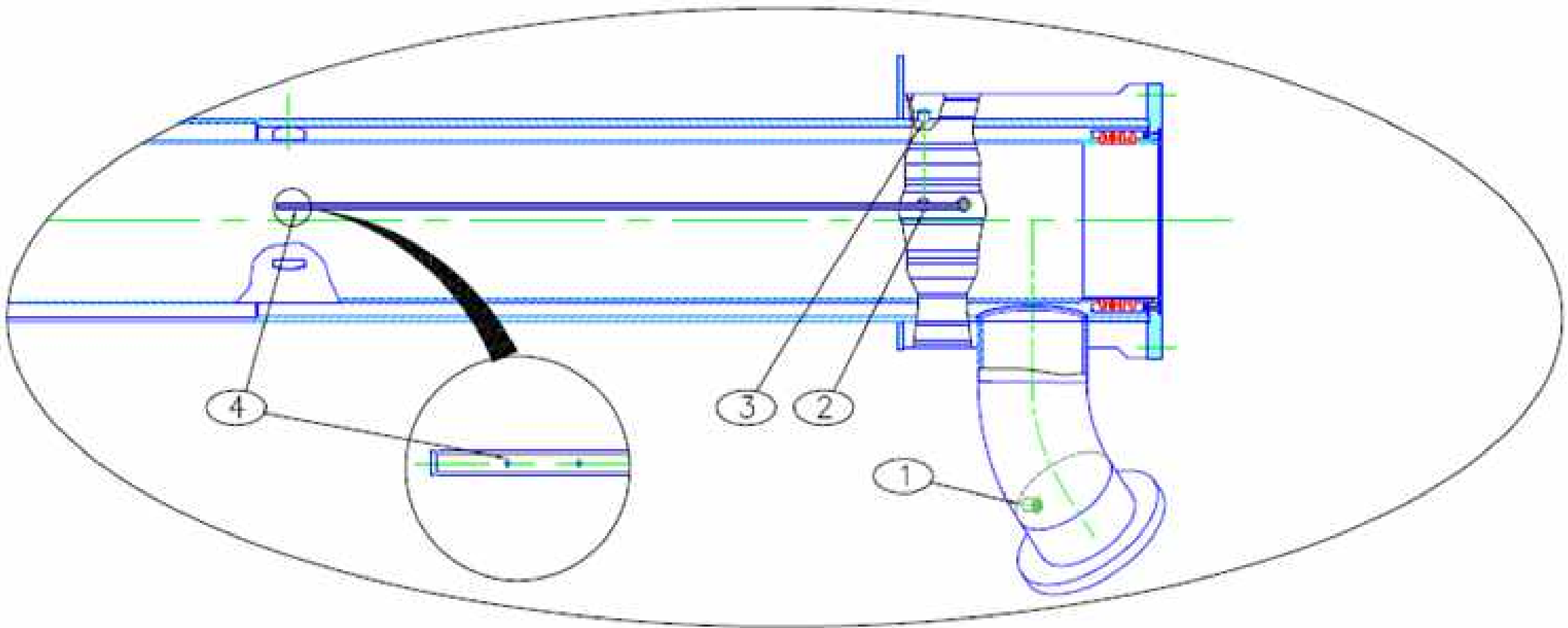
Long Flame Settings



	Stoichoimetric Air	Static Pressure (mbar)	Injection Velocity (m/s)
External Air	5.0 – 7.0 %	250 – 500	190 – 280
Tangential Air	1.5 – 3.0 %	70 – 200	110 – 180
Internal Air	0.2 – 1.0 %	10 – 150	45 – 160

DYNAMIS D-FLAME BURNERS

D-FLAME AIR BURNER INLET – CFD ANALYSIS



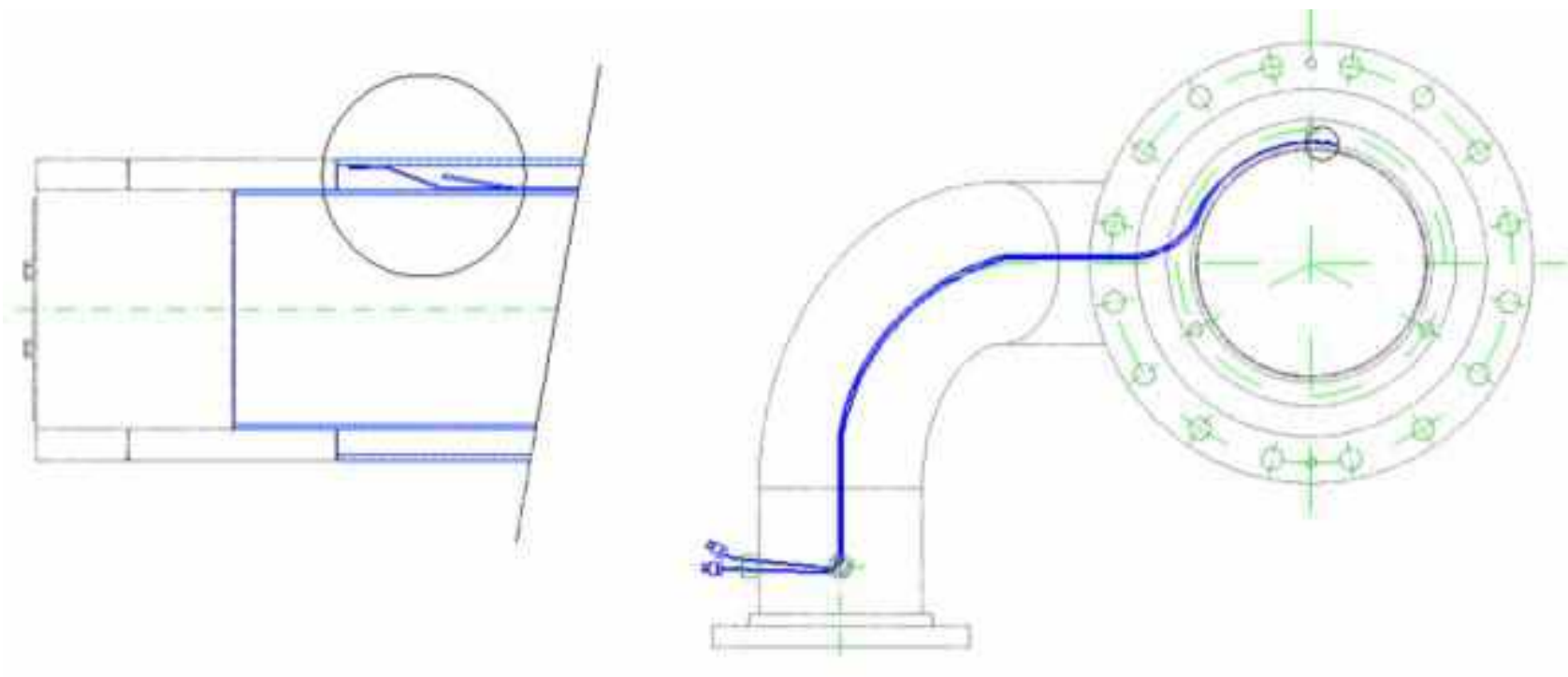
	CFD	Measured
P_1 (mbar)	310	308
P_2 (mbar)	304	303
P_3 (mbar)	307	307
P_4 (mbar)	302	301

Pressure drop at the burner
external air inlet:

$$\Delta p = 7 \text{ mbar (2\%)}$$

DYNAMIS D-FLAME BURNERS

■ TEMPERATURE MEASURES



Temperature of external air



injection velocity

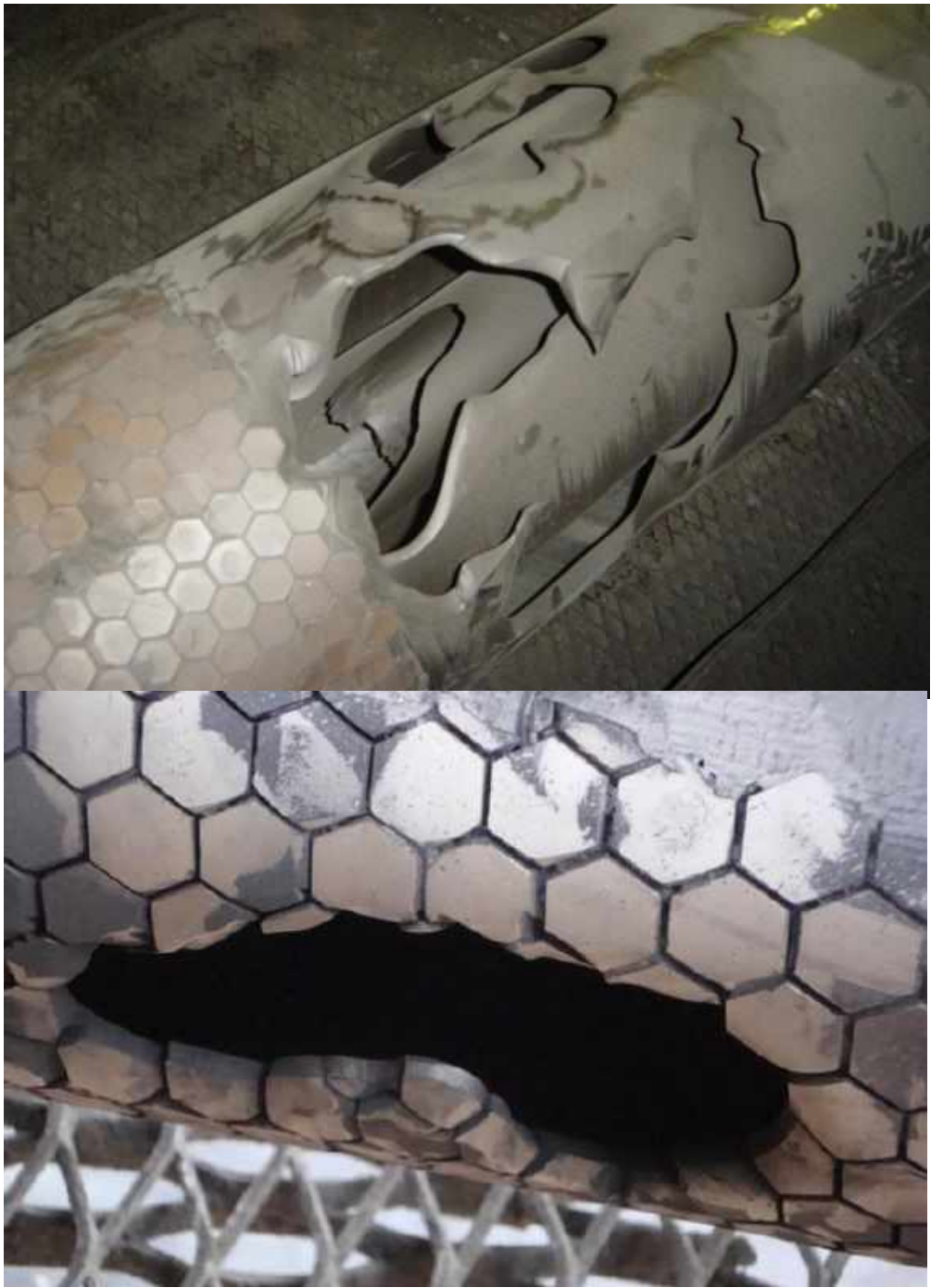
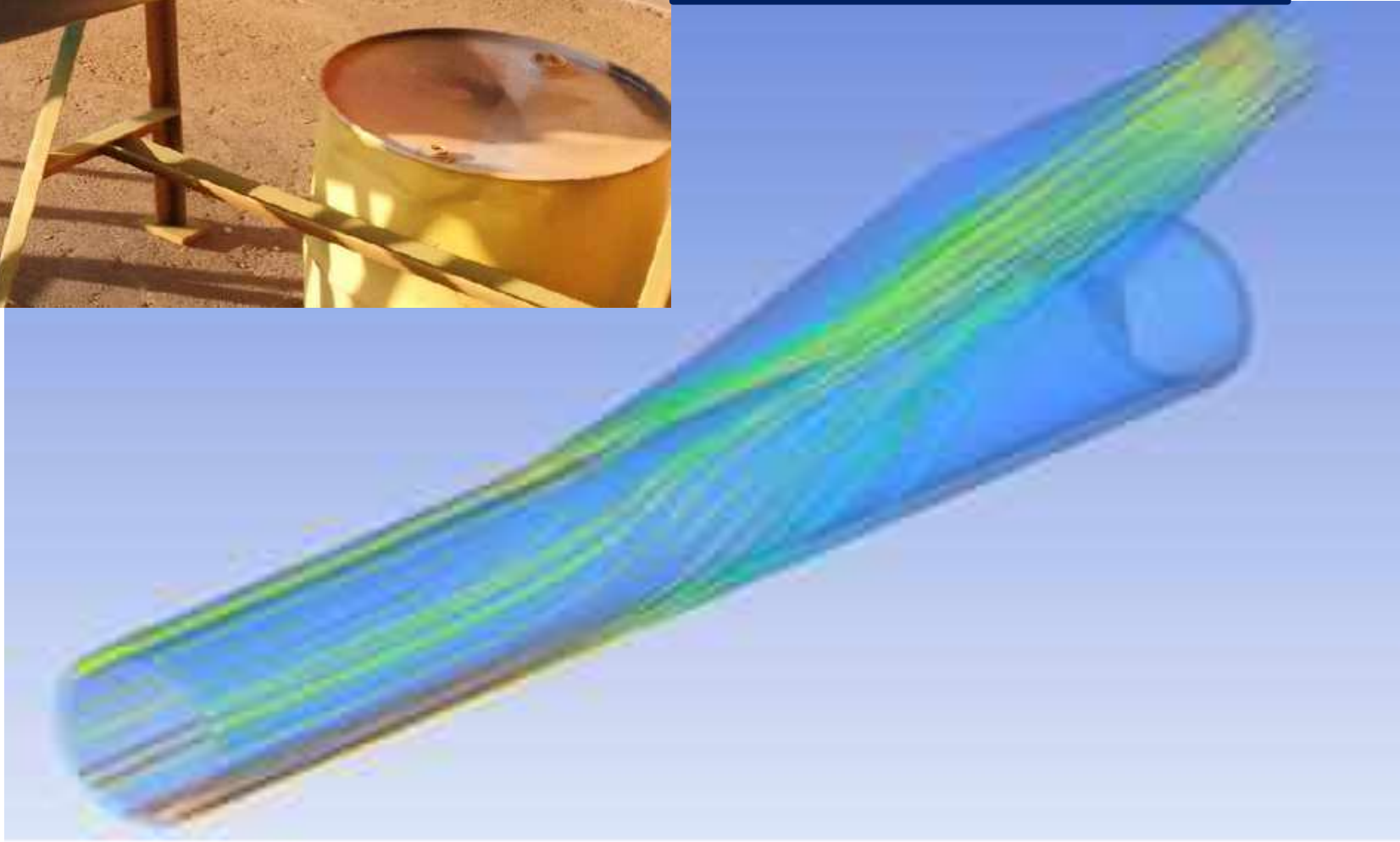
Temperature of outer pipe



thermal expansion

DYNAMIS D-FLAME BURNERS

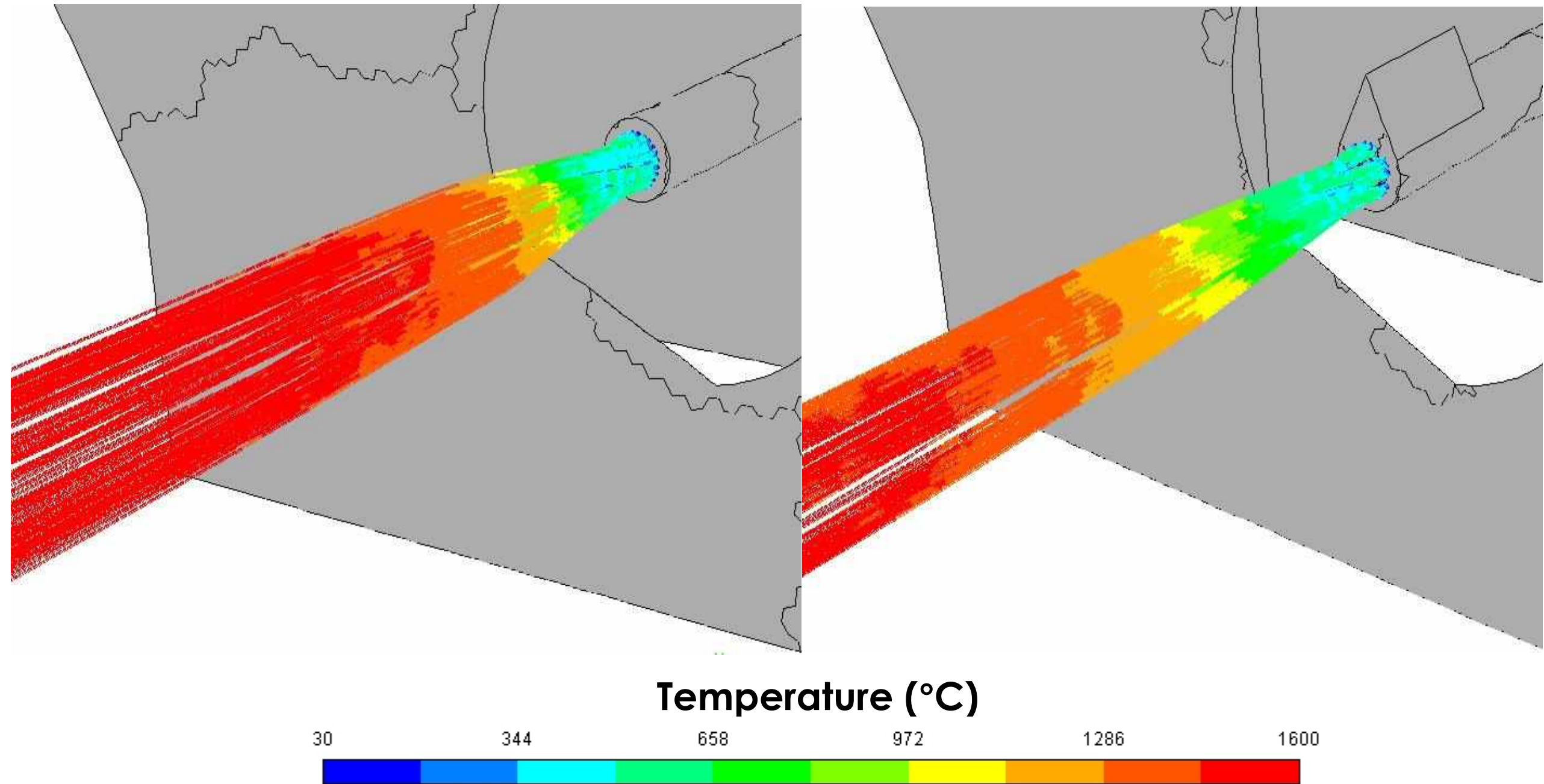
■ OPTIMIZATION OF SOLID FUEL INLET



Erosion Issues to be avoided in D-Flame Development

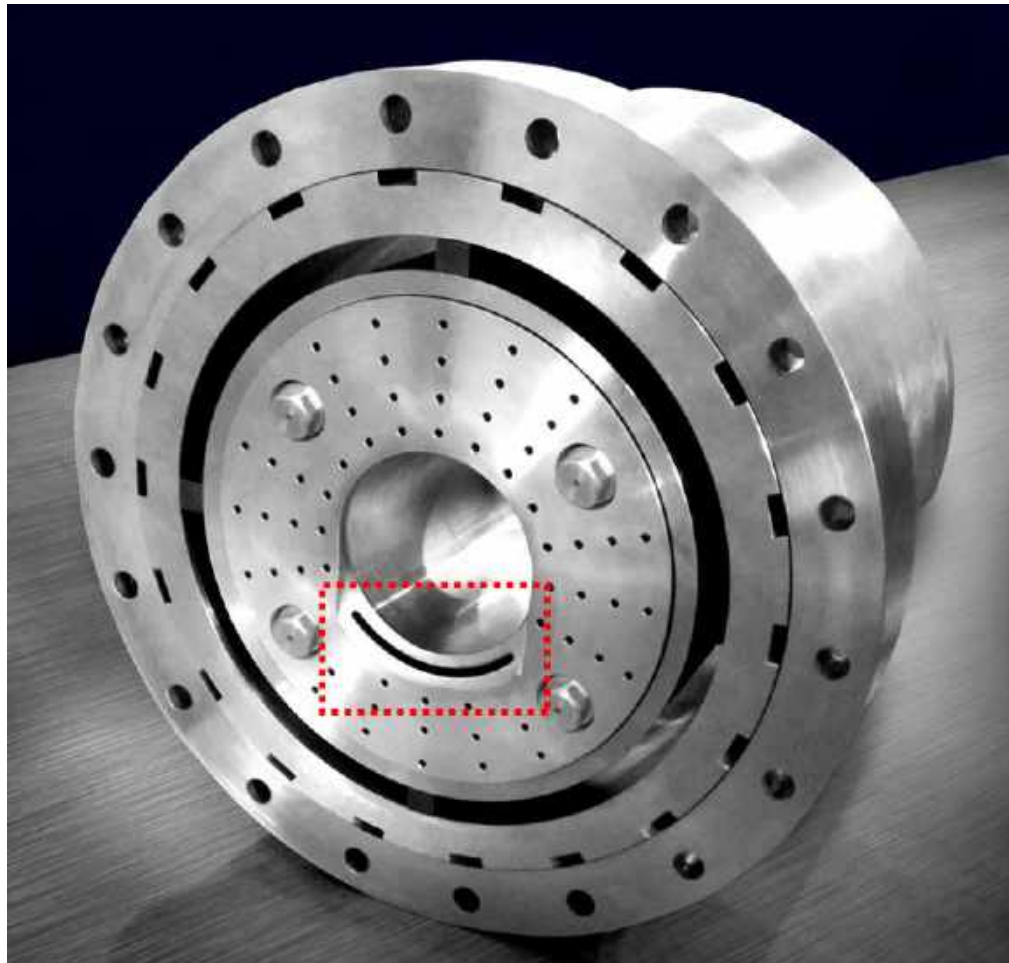
DYNAMIS D-FLAME BURNERS

■ CONCRETE LINING SHAPE OPTIMIZATION



DYNAMIS D-FLAME BURNERS

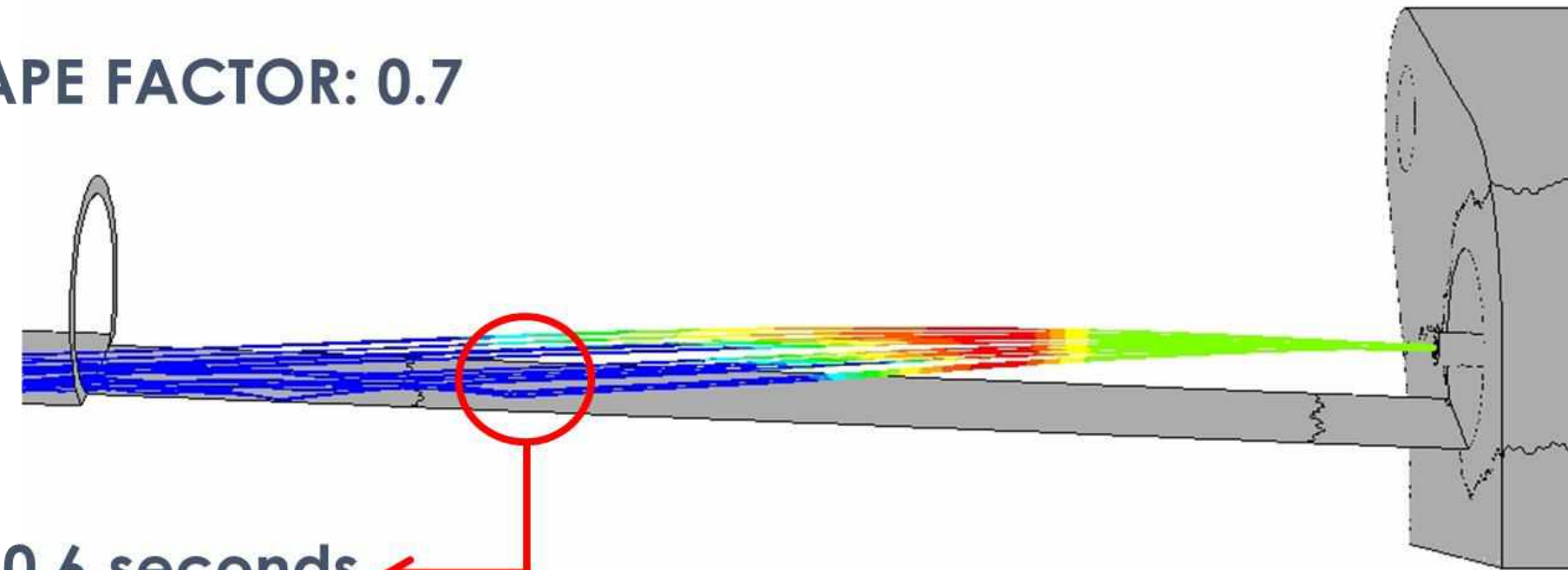
■ INJECTION OF ALTERNATIVE FUELS



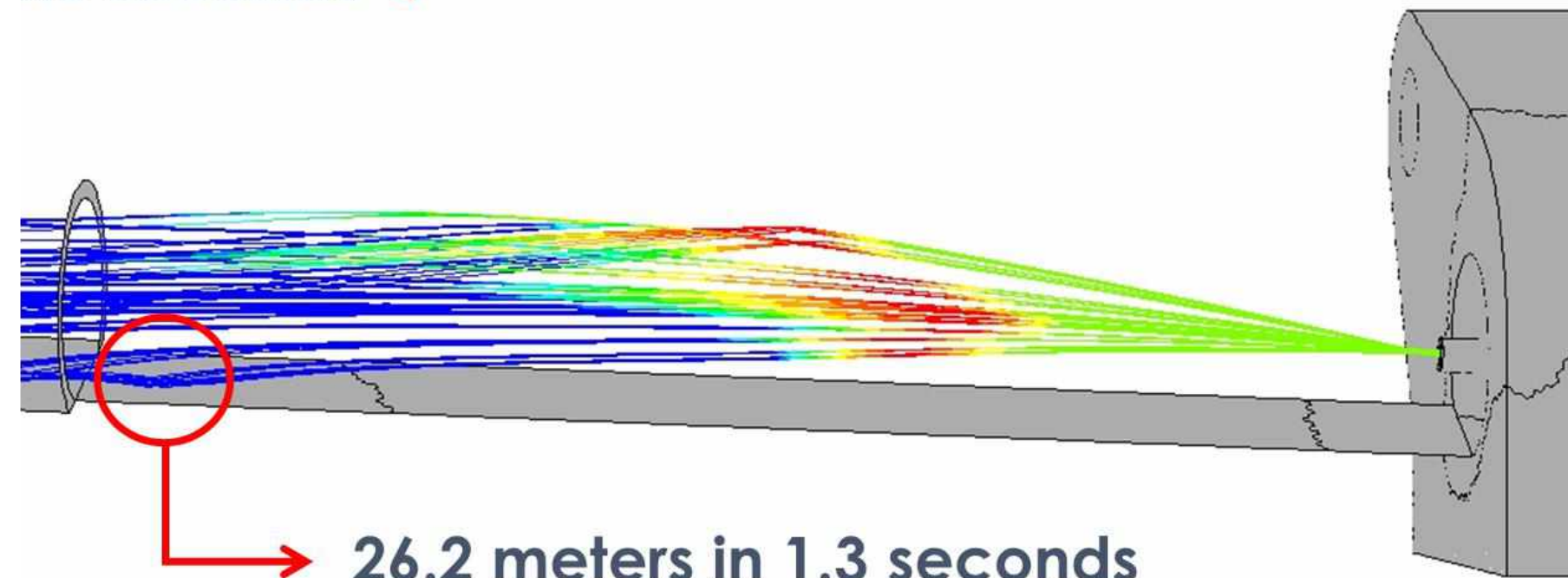
ACCELERATION AIR ■ Injected at 200 m/s

PARTICLE SHAPE FACTOR: 0.7

16.3 meters in 0.6 seconds



Without air of acceleration



With air of acceleration

26.2 meters in 1.3 seconds

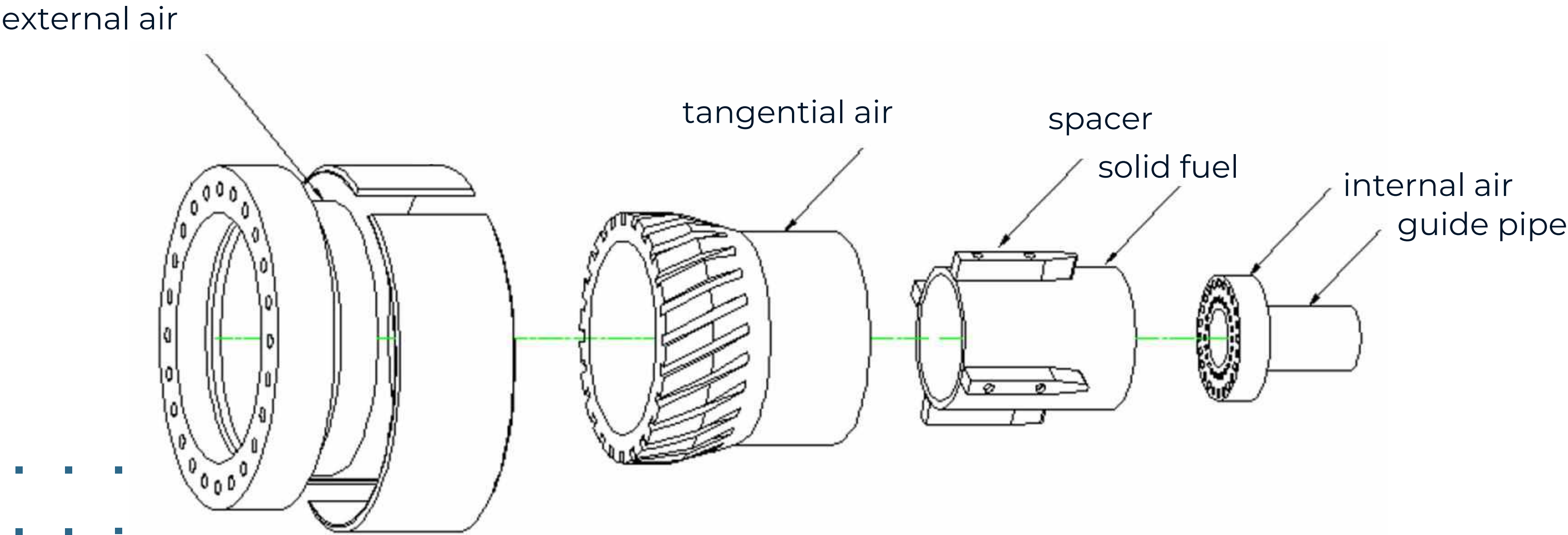
DYNAMIS D-FLAME CONSTRUCTION FEATURES

- BURNER TIP FABRICATED IN CAST STAINLESS STEEL
- EXTERNAL AIR PARTS – ASTM A-297 Gr.HK, ASTM A-240 Gr310 AND ASTM A-312 TP310
- TANGENTIAL AIR PARTS – ASTM A-297 Gr.HK OR ASTM A-240 Gr310
- PETCOKE INJECTION PARTS – ASTM A-241 Gr310 AND ASTM A-681 Type 2 (SPACER PIECES)
- INTERNAL AIR PARTS – ASTM A-241 Gr310
- EXTERNAL AIR PARTS WELDED TOGETHER TO PREVENT AIR LEAKAGE (BETWEEN GAPS)



DYNAMIS D-FLAME CONSTRUCTION FEATURES

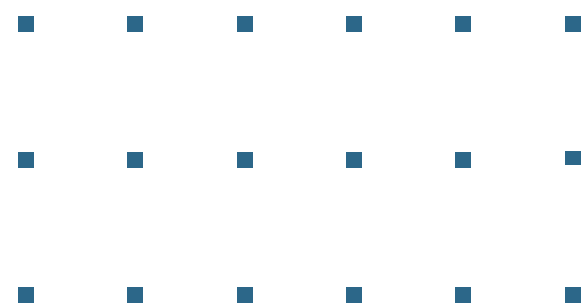
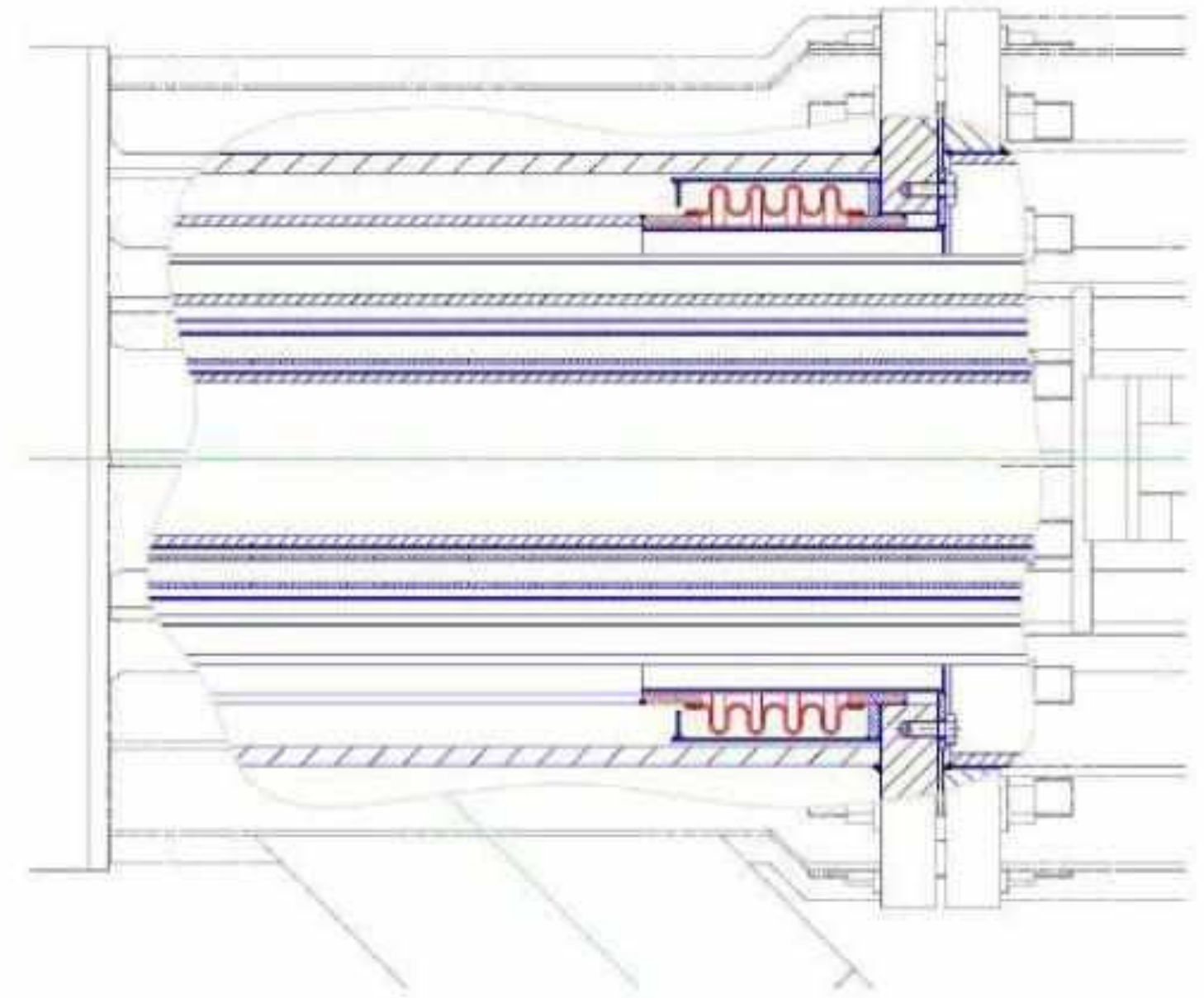
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DYNAMIS D-FLAME CONSTRUCTION FEATURES

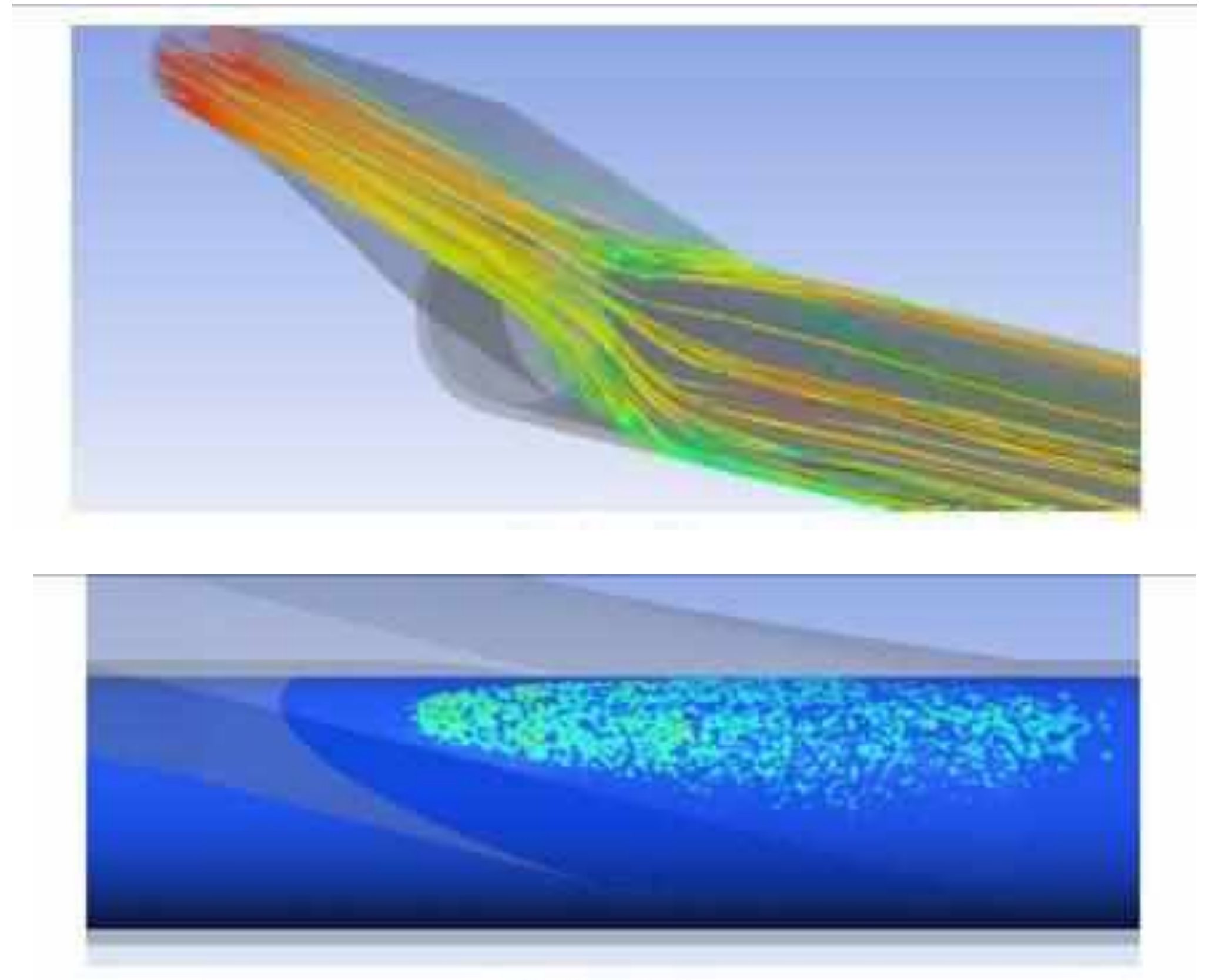
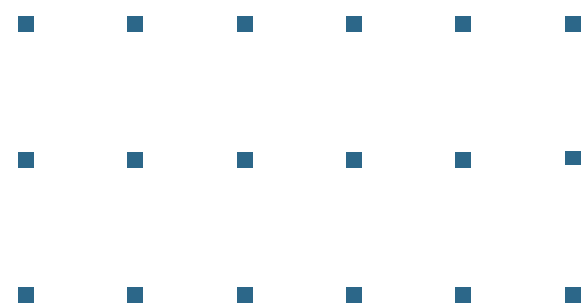
- INTERNAL EXPANSION JOINT
- USED TO COMPENSATE THE THERMAL DILATATION DIFFERENCE BETWEEN THE TWO MORE EXTERNAL PIPES OF THE BURNER
- WELDED TO THE EXTERNAL TUBE FLANGE AND TANGENTIAL TUBE, FACILITATING THE DISASSEMBLY OF THE BURNER FOR MAINTENANCE



DYNAMIS D-FLAME CONSTRUCTION FEATURES

- COAL/PETCOKE INLET

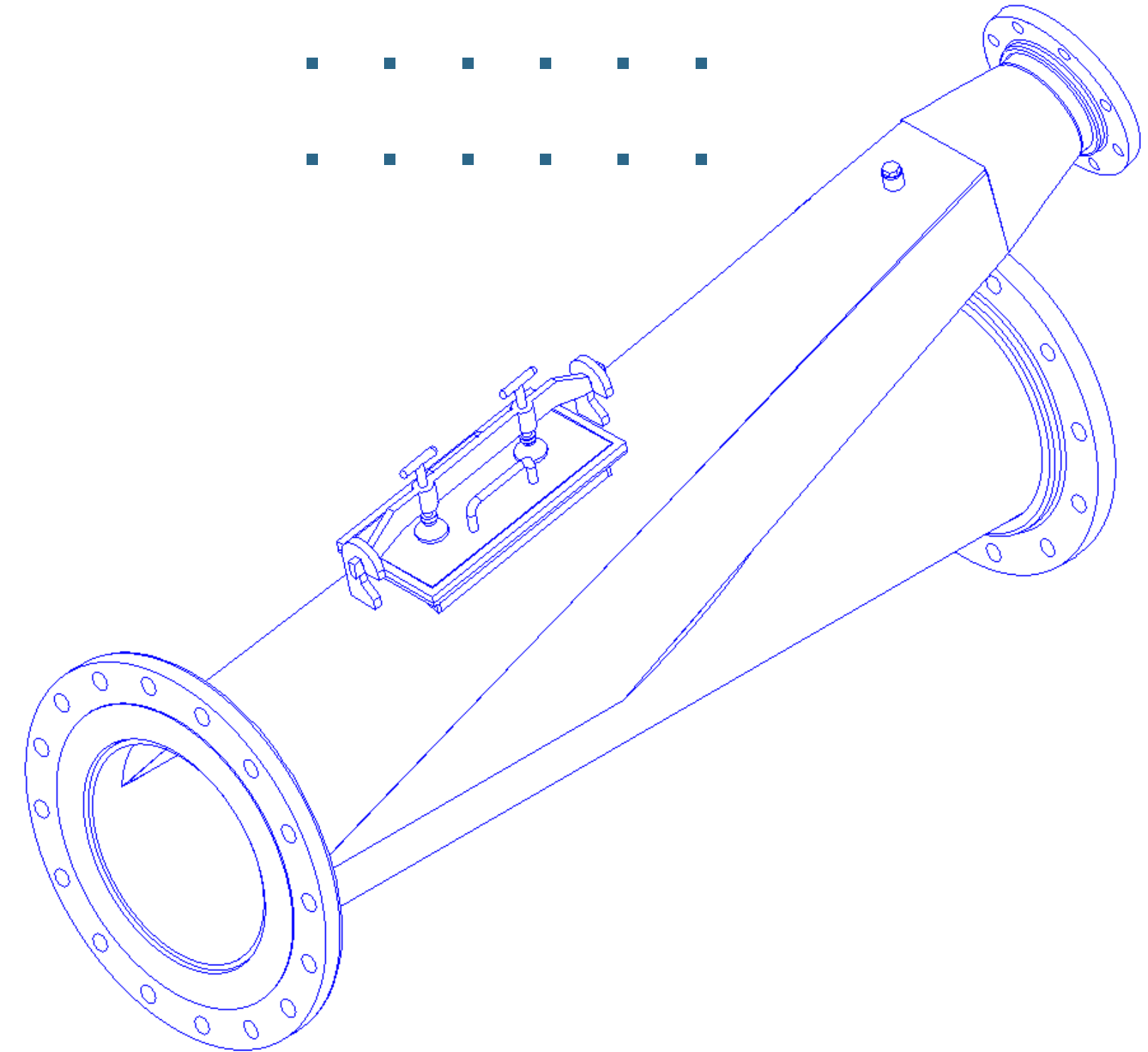
- GEOMETRY DEFINED AFTER CFD SIMULATIONS AIMING BETTER FUEL DISTRIBUTION AND EROSIVE WEAR REDUCTION



DYNAMIS D-FLAME CONSTRUCTION FEATURES

■ OPENING HATCH FOR INSPECTION

■ INTERNALLY COATED WITH ANTI-ABRASIVE CERAMIC COATING



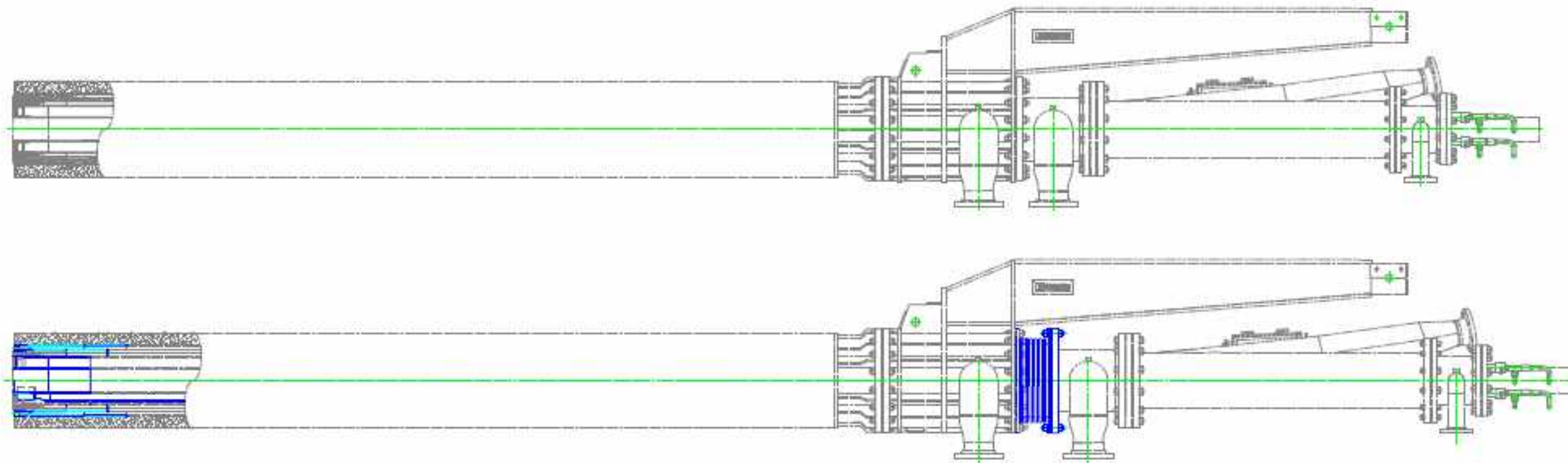
DYNAMIS **RBS CASE**

- YEAR: 2016
- APPLICATION: MAIN BURNER FOR CEMENT ROTARY KILN
- PLACE: RIO BRANCO DO SUL – PR
- EQUIPMENT: MAIN BURNER RETROFIT D-FLAME TECHNOLOGY
- POWER: 51 GCAL/H
- FUELS: PETCOKE, OIL 1A, SAF (RT 25), LIQUID WASTE



DYNAMIS RBS CASE

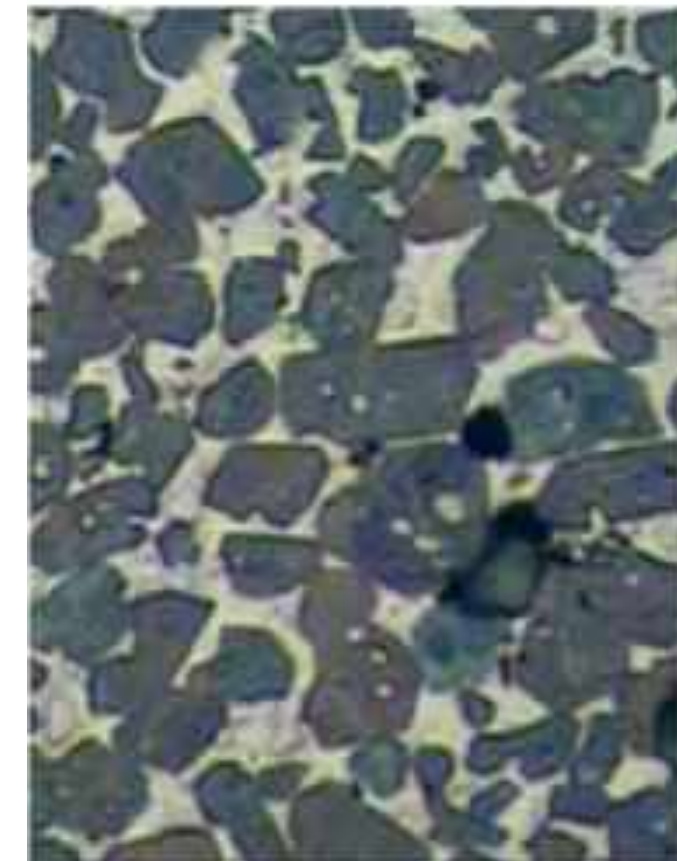
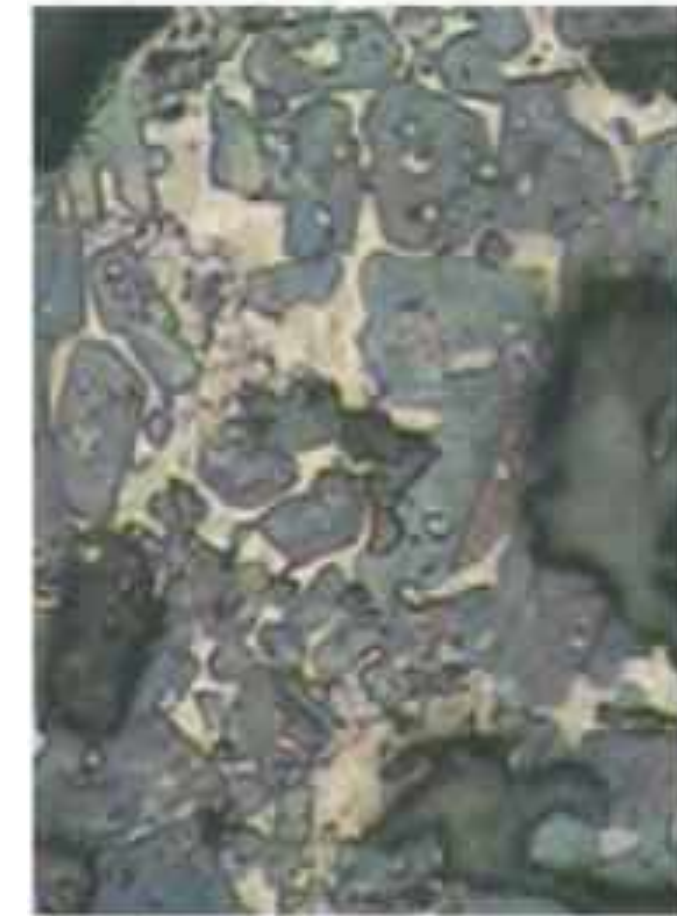
- RETROFIT OF EXISTING BURNER TO D-FLAME TECHNOLOGY
- LOWER COST COMPARED TO A COMPLETELY NEW BURNER
- ASSEMBLY DONE AT THE CLIENT'S SITE WITH DYNAMIS SUPERVISION



DYNAMIS **RBS CASE**

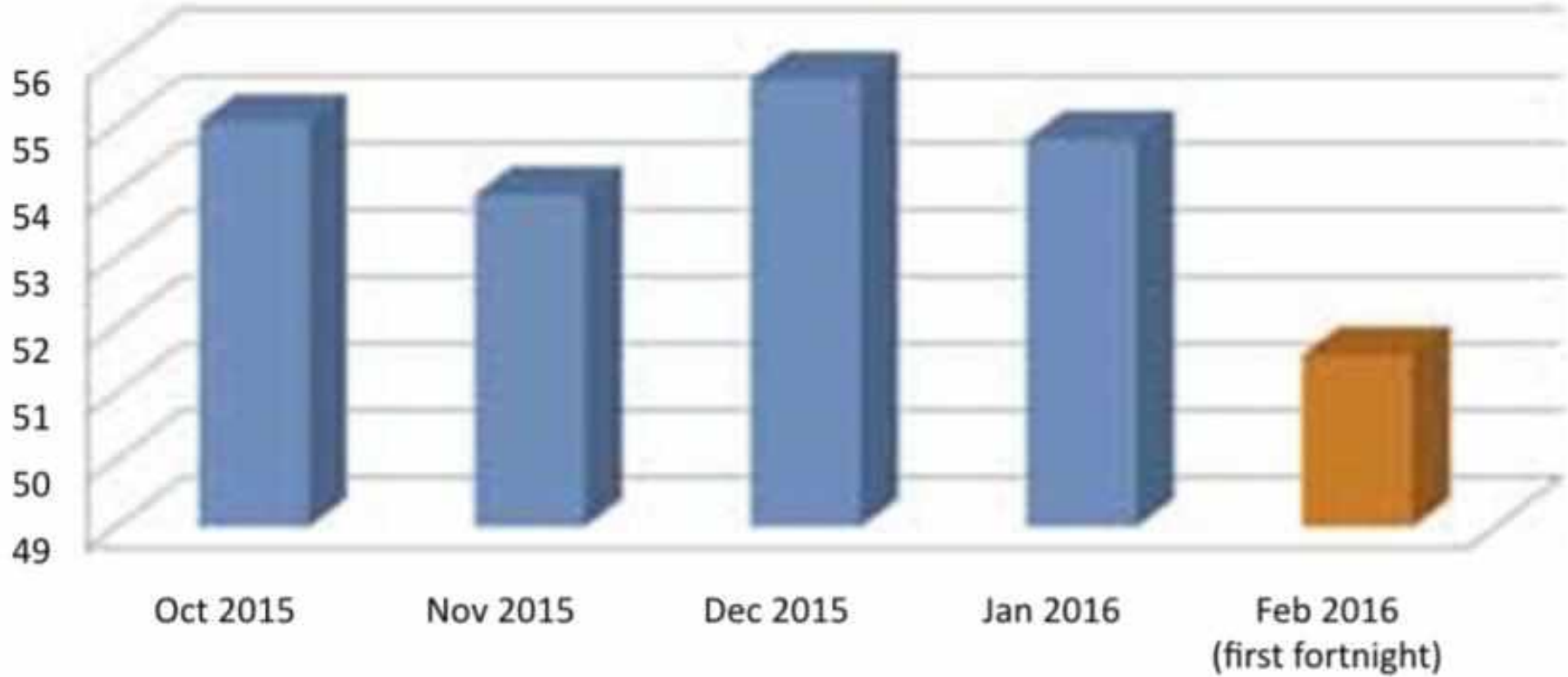
- FASTER OPERATION RETRIEVE THAN USUAL, ACCORDING TO OPERATORS
- KILN HEATING AND RESPONSE TO HEATING STIMULI (STABILIZATION OF 4 HOURS FOR 3.800 TPD)
- D-FLAME PROVIDED BETTER BURNING PERFORMANCE IN THE KILN
- PRODUCTIVITY INCREASE
- C3S CRYSTALS 14% SMALLER

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DYNAMIS RBS CASE

- GOOD PERFORMANCE OF THE BURNER WHEN OPERATING WITH PETCOKE OF HIGH SULFUR CONTENT (ONE OF THE PLANT'S NEEDS)
- HIGHER BURNER MOMENTUM WAS ENOUGH TO COMPENSATE FOR THE NEGATIVE EFFECTS OF THE SULFUR, MAINTAINING THE SIZE AND THE FORM OF THE CRYSTALS
- DECREASE IN ELECTRIC ENERGY CONSUMPTION OF THE MILL



DYNAMIS RBS CASE



Article published in World Cement magazine in its issue of July 2017

DYNAMIS **ADRIANÓPOLIS CASE**

- YEAR: 2019
- APPLICATION: MAIN BURNER FOR CEMENT DRY ROTARY KILN
- PLACE: ADRIANÓPOLIS – PR
- EQUIPMENT: NEW D-FLAME BURNER
- POWER: 48 GCAL/H
- FUELS: PETCOKE, DIESEL, SAF (RT 25), LIQUID WASTE



DYNAMIS **ADRIANÓPOLIS CASE**

■ REPLACED BURNER

- SUBSTITUTION OF EXISTING ANNULAR BURNER FOR A NEW DYNAMIS D-FLAME BURNER
- EXISTING BURNER WITH LIMITED OPERATIONAL FLEXIBILITY – ONLY ONE INLET FOR BOTH AXIAL AND SWIRL AIR, WITH CHANNEL DISTRIBUTION MADE BY TIGHTENING OR LOOSING A FLEXIBLE JOINT, AND NO SOLID ALTERNATIVE FUEL CHANNEL
- PLANT NEEDED A BURNER WITH IMPROVED FLEXIBILITY THAT MUST BE 100% REMOTELY CONTROLLED FROM THE CONTROL ROOM AND A NEW CHANNEL FOR SOLID AF FUTURE USE

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DYNAMIS **ADRIANÓPOLIS CASE**

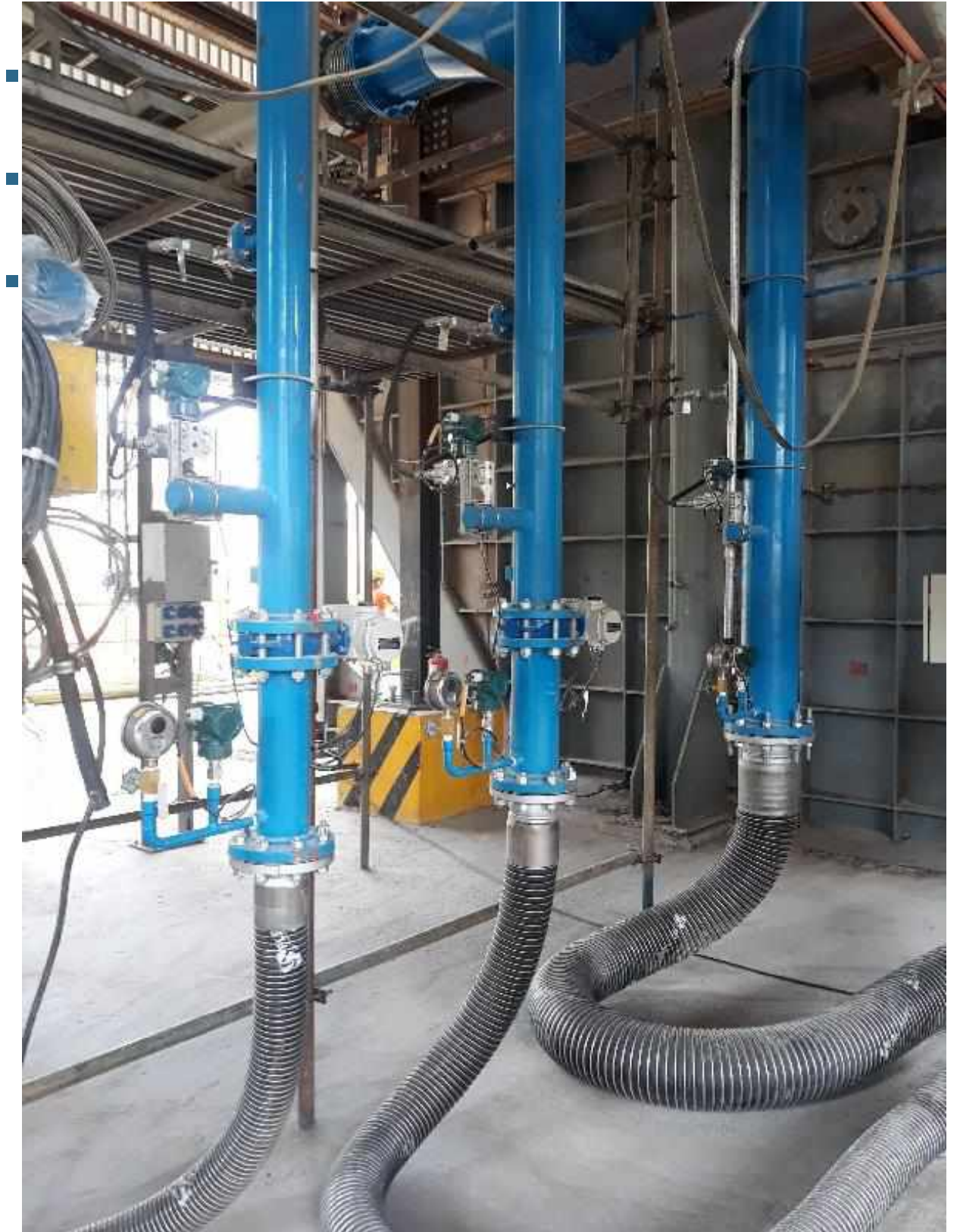
- NEW DYNAMIS D-FLAME BURNER
 - FULLY AUTOMATED D-FLAME BURNER WITH 3 INDEPENDENT SHAPING AIR CHANNELS (EXTERNAL AIR, TANGENTIAL AIR AND INTERNAL AIR)
 - POSSIBILITY TO CONTROL EACH SHAPING AIR CHANNEL INDEPENDENTLY IN ORDER TO HAVE MULTIPLE FLAME CONFIGURATIONS FOR DIFFERENT KILN OPERATION MODES (STARTUP, NORMAL OPERATION, ALTERNATIVE FUEL BURN, ETC)
 - NEW SOLID ALTERNATIVE FUEL CHANNEL WITH ACCELERATION AIR ("SMILE") FOR LONGER SUSPENSION TIME AND INCREASED BURNING
 - D-FLAME PROVIDED BETTER BURNING PERFORMANCE IN THE KILN
 - C3S CRYSTALS 29% SMALLER



DYNAMIS **ADRIANÓPOLIS CASE**

■ D-FLAME AUTOMATION

- DYNAMIS SUPPLIED A NEW SHAPING AIR MANIFOLD SPLIT IN 2 PARTS (ONE FOR EXTERNAL AIR SUPPLIED BY A NEW BLOWER AND ANOTHER FOR TANGENTIAL AND INTERNAL AIR SUPPLIED BY THE EXISTING AIR FAN)
- SHAPING AIR SUPPLY FULLY CONTROLLED FROM THE CONTROL ROOM USING THE NEW ELECTRIC ACTUATED BUTTERFLY VALVES SUPPLIED BY DYNAMIS
- SUPPLY OF NEW PRESSURE TRANSMITTERS, DIFFERENTIAL PRESSURE TRANSMITTERS AND FLOW METERS FOR SHAPING AIR MONITORING FROM THE CONTROL ROOM



DYNAMIS ADRIANÓPOLIS CASE

- DYNAMIS supplied: D-FPUMP (Pump Skid) for liquid residue (and HFO or diesel if necessary)



- DYNAMIS supplied: D-RACK (Valve Rack) for liquid residue (and HFO or diesel if necessary)

DYNAMIS CLINCHFIELD CASE

- YEAR: 2019
- APPLICATION: MAIN BURNER FOR CEMENT ROTARY KILN
- PLACE: CLINCHFIELD – USA
- EQUIPMENT: NEW D-FLAME BURNER
- POWER: 91 GCAL/H
- FUELS: NATURAL GAS, PEANUT SHELLS, PECAN SHELLS, DIESEL



DYNAMIS CLINCHFIELD CASE

■ NEW DYNAMIS D-FLAME BURNER

- EXISTING BURNER OPERATING WAS A COAL/PETCOKE DIRECT FIRING SYSTEM
- CLIENT NEEDED TO IMPROVE THE FLAME FLEXIBILITY OF THE BURNER
- NECESSITY TO INCREASE THE SOLID ALTERNATIVE FUELS USE (UP TO 100% THERMAL SUBSTITUTION BURNING PEANUT SHELLS)



DYNAMIS CLINCHFIELD CASE

- DYNAMIS SUPPLIED A NEW NATURAL GAS VALVE RACK
- NATURAL GAS MAX. FLOW: 8.650 KG/H
- INLET PRESSURE: 3.5 TO 8.0 BAR
- OUTLET PRESSURE: 300 MBAR TO 2.0 BAR
OULET PRESSURE – IGNITER: 200 MBAR
- FIRST CLASS COMPONENTS: BRAY, JAMESBURY,
PIETRO FIORENTINI, DUNGS AND JEFFERSON



DYNAMIS CLINCHFIELD CASE

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Thermal power: 45 kW
Flame relay/Flame detection
High temperature rubber silicone Air cooling
LPG or NG
110 or 220 V

D-IGNITER



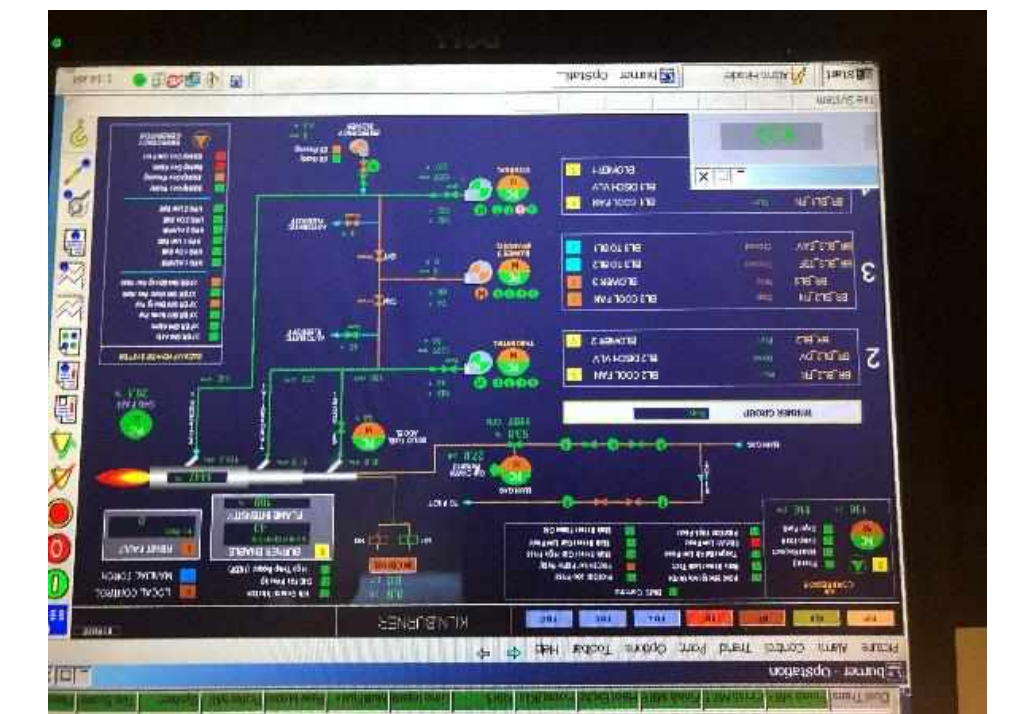
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Gas Valve Train and Burner Management System with
light up sequence in automatic control



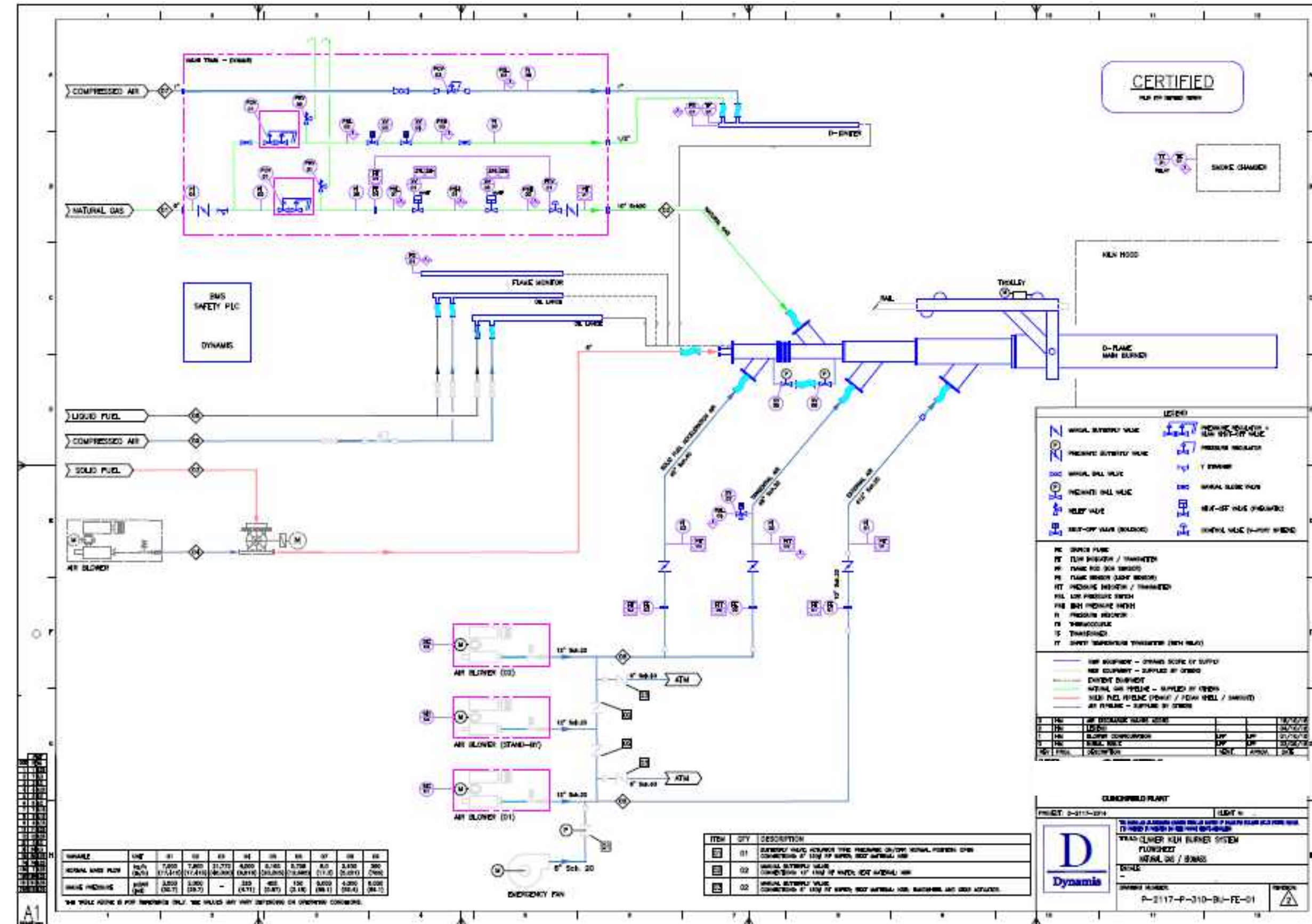
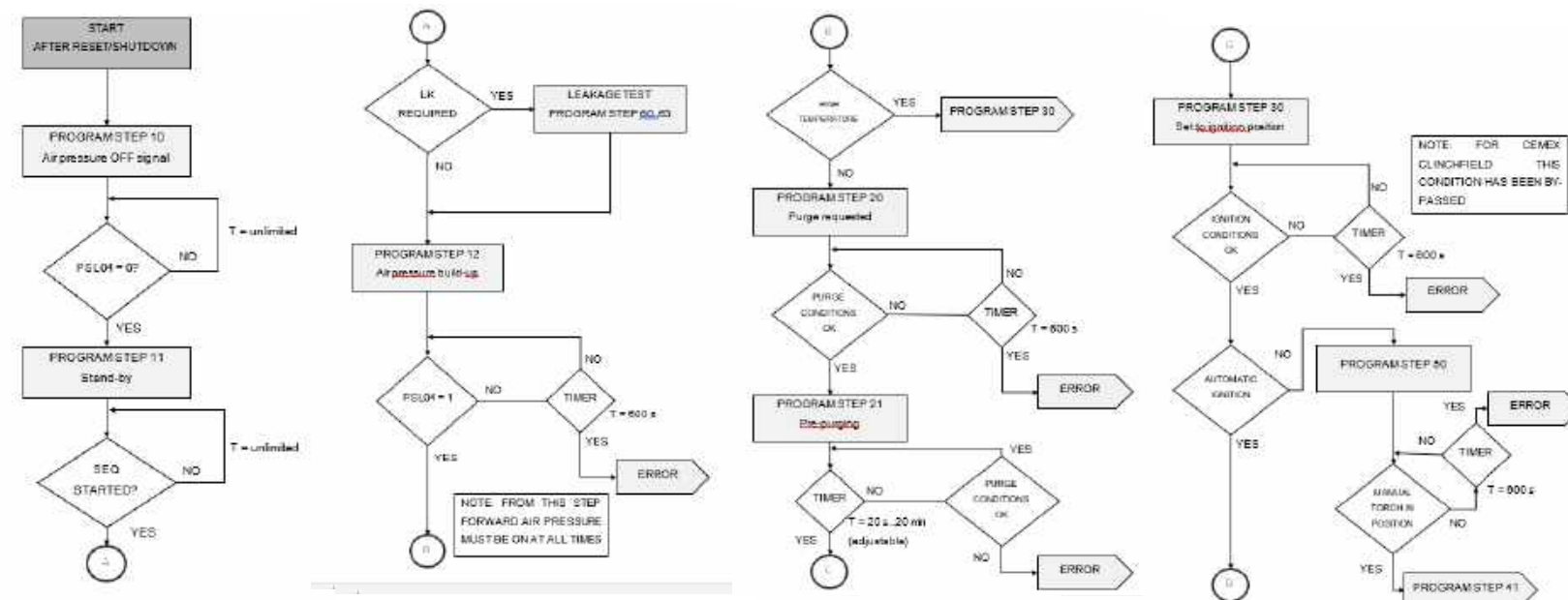
DYNAMIS CLINCHFIELD CASE

- DYNAMIS SUPPLIED A BURNER MANAGEMENT SYSTEM WITH SAFETY PLC TO CONTROL THE NATURAL GAS D-RACK
- RESPONSIBLE FOR STARTUP SEQUENCE CONTROL AND NATURAL GAS OPERATION CONTROL
- BMS CABINET WITH HMI INTERFACE RIGHT AT THE BURNER PLATFORM
- COMMUNICATION WITH THE PLANT PLC



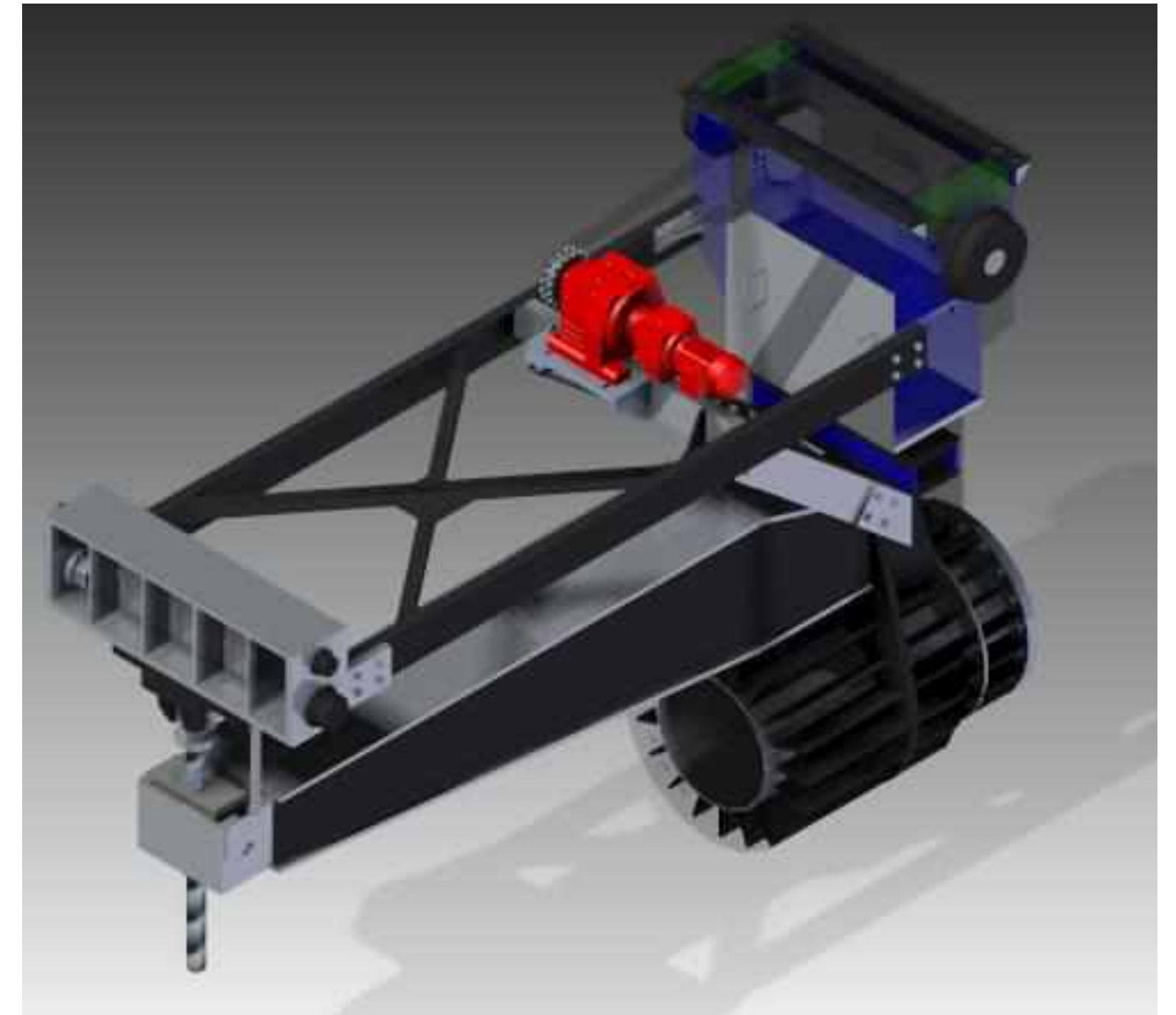
DYNAMIS CLINCHFIELD CASE

- The Dynamis BMS Safety PLC 100% programmed
- Fully compliant with NFPA 85, 86 and EN 298, or other standards



DYNAMIS CLINCHFIELD CASE

- DYNAMIS SUPPLIED A NEW MAIN BURNER D-TROLLEY
- CARBON STEEL STRUCTURE
- FRONT AND BACK HEIGHT ADJUSTMENT (VERTICAL)
- BACK HORIZONTAL ADJUSTMENT
- ASSEMBLED WITH GEAR MOTOR, SPUR GEARS AND ROLLER CHAIN FOR TRANSMISSION
- ALLOWS BURNER TO OPERATE IN HORIZONTAL POSITION OR ALIGNED WITH THE KILN AXIS



DYNAMIS **TOLU CASE**

- YEAR: 2019
- APPLICATION: MAIN BURNER FOR CEMENT ROTARY KILN (DIRECT FIRING SYSTEM)
- PLACE: TOLUVIEJO – COLOMBIA
- EQUIPMENT: NEW D-FLAME BURNER
- POWER: 36 GCAL/H
- FUELS: COAL (DIRECT FIRING) AND NATURAL GAS



DYNAMIS **TOLU CASE**

■ REPLACED BURNER

- EXISTING BURNER HAD PROBLEMS WITH THE FLAME SHAPE
- LONG AND WIDE FLAME, NOT SUITABLE FOR THE KILN
- NO SHAPING AIR, LOW FLAME MOMENTUM
- DIFFICULTY IN CONTROLLING THE FLAME



DYNAMIS TOLU CASE

- NEW DYNAMIS D-FLAME BURNER

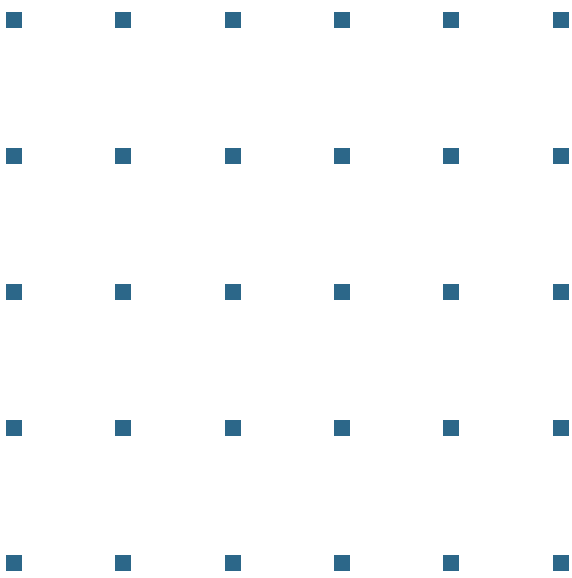
- DYNAMIS SUPPLIED A BURNER TAYLOR MADE SPECIALLY FOR A DIRECT-FIRING SYSTEM
- TWO NEW SHAPING AIR CHANNELS (EXTERNAL AND TANGENTIAL) FOR BETTER FLAME CONTROL, HIGHER FLAME MOMENTUM AND AIR ENTRAINMENT
- USE OF HIGH PRESSURE AND HIGH VELOCITY AIRFLOW AT THE EXTERNAL CHANNEL, PROVIDING A SHORT AND NARROW FLAME



DYNAMIS MARACÁS CASE

- YEAR: 2020
- APPLICATION: MAIN BURNER FOR VANADIUM ROTARY KILN
- PLACE: MARACÁS – BA
- EQUIPMENT: NEW D-FLAME BURNER
- POWER: 25 GCAL/H
- FUELS: CHARCOAL, OIL 1A AND LPG

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DYNAMIS MARACÁS CASE

- DIFFERENT FROM CEMENT, THIS IS CASE IS OF AN OXIDANT KILN, WITH A DIFFERENT LEVEL OF O₂ DUE TO THE REACTIONS THAT MUST OCCUR INSIDE OF IT
- HIGH FLAME TEMPERATURES MAY CAUSE UNDESIRED MELTING OF THE SILICA, PREVENTING THE VANADIUM TO REACT PROPERLY
- PRESENCE OF CHARCOAL ON THE MATERIAL BED IS ALSO NOT DESIRED
- DYNAMIS PROVIDED A TAYLOR MADE SOLUTION THAT DEVIATES FROM THE USUAL CEMENT KILN BURNER APPLICATION
- SPACER COATED WITH TUNGSTEN CARBIDE TO AVOID EROSION BY HIGH ABRASIVE CHARCOAL

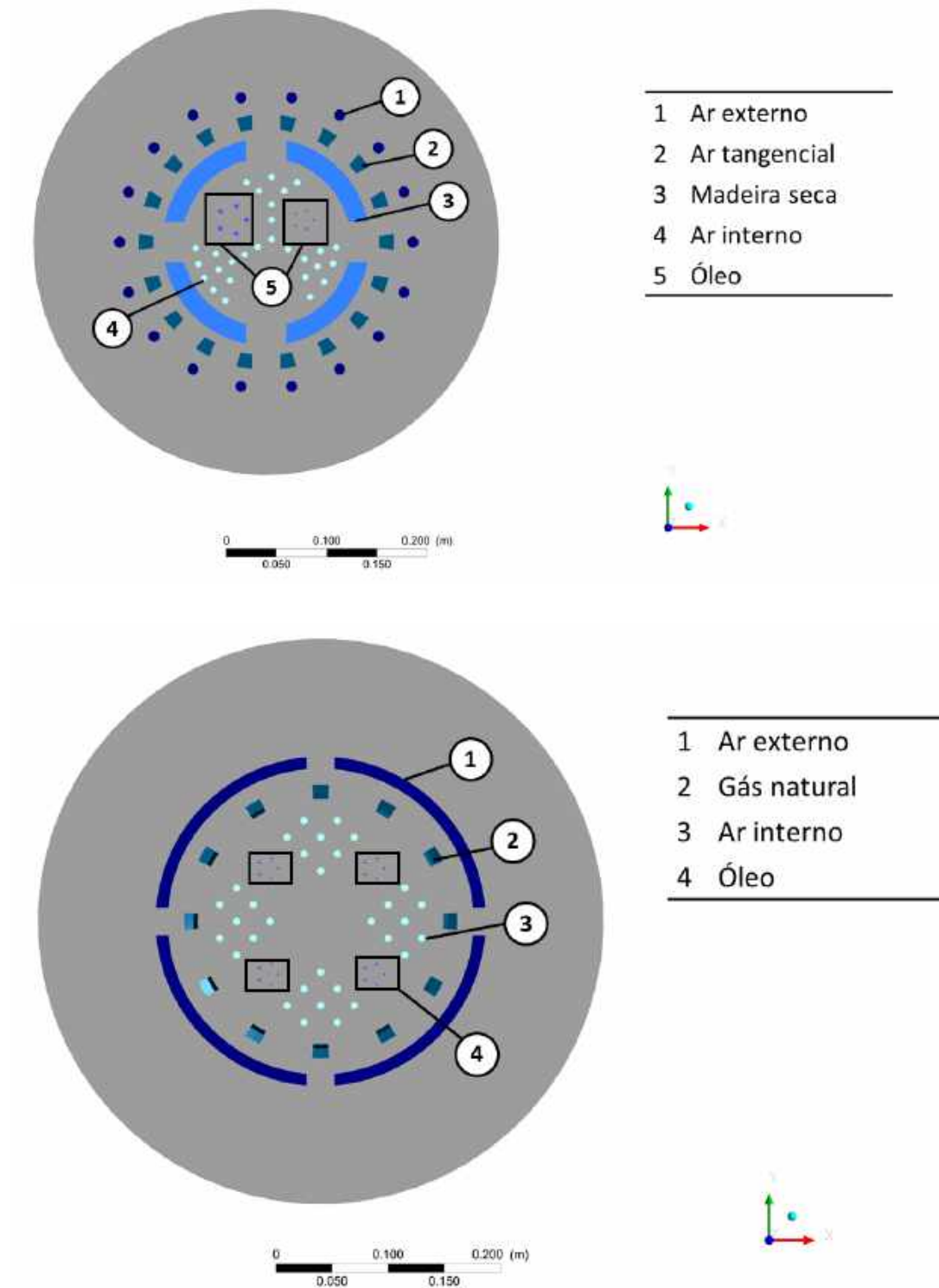


DYNAMIS MARACÁS CASE

- THE D-FLAME BURNER FOR THE MARACÁS PLANT WAS DESIGNED WITH THE HELP OF IMPORTANT TOOLS SUCH AS THE D-RKILN SIMULATOR (DEVELOPED BY DYNAMIS) AND MULTIPLE CFD ANALYSIS OF THE PROCESS
- TWO OPERATION MODES, ONE FOR CHARCOAL USE AND THE OTHER ONE FOR LPG OR OIL USE
- EXTERNAL AND TANGENTIAL AIR CHANNELS FOR AIR ENTRAINMENT WHEN OPERATING WITH COAL, BUT AT LOWER PRESSURE
- TWO ANNULAR AXIAL AIR CHANNELS TO ENCAPSULATE THE LIQUID/GASEOUS FUEL AND PROVIDE A LONGER FLAME (ONE OF THE AXIAL AIR CHANNELS IS THE CHARCOAL CHANNEL)

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