

PaperTech
2010



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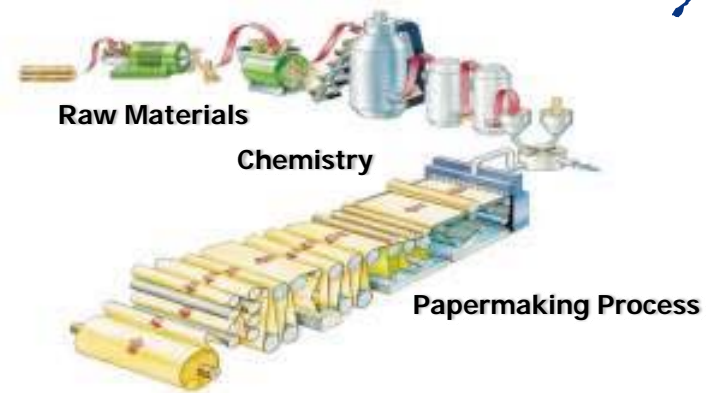
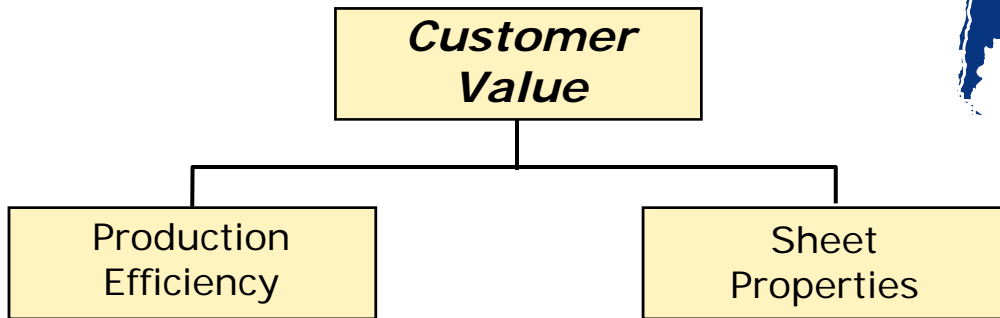
PARETO™ Wet-End Optimization Technology

Ram Santhanam

Strategic Positioning of R&D Centers

Nalco R&D for P&P Industry

- CHIGACO (USA) - Chemistry
- HELSINKI (FINLAND) - Papermaking
- SHANGHAI (CHINA) - Raw materials



Nalco Papermaking Centre of Excellence (NPCE)

- Multi-technological R&D group
 - 9 researchers with various backgrounds, experiences and competences
- Strict focus on the most potential applications in P&P
 - Retention, Drainage and Formation (RDF) & functional chemicals
- Location in the heart of the leading P&P technology cluster
 - Helsinki Univ. of Technology, KCL, Head offices of SE, UPM & M-real
- Co-operation and networking
 - Paper and chemical analysis by local cluster or Nalco internally
 - Co-operation R&D projects
 - M.Sc. and D.Sc. Thesis
- Novel tools and technologies
 - Nalco Approach System Simulator (NASS™)
 - PARETO™ Wet-End Optimization Technology

Comprehensive Approach For Wet End

CUSTOMER PREFERENCES

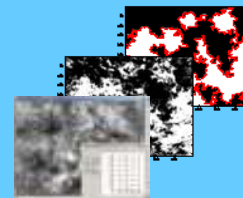
- technical performance
- grade & existing process
- economics
- pricing

A CHEMICAL RDF PROGRAMME – e.g. *Ultra Positek™*

- chemical compatibility (furnish, white water)
- chemical performance

APPLICATION STRATEGY - *NASS*

- process compatibility (Δt , τ , k , ε)
- feeding order
- feeding position



FEEDING ARRANGEMENT - *PARETO™*

- feeding liquid compatibility
- RDF chemical compatibility
- Energy and water conservation



MONITORING PERFORMANCE – *ONASS, TRENDGEN*

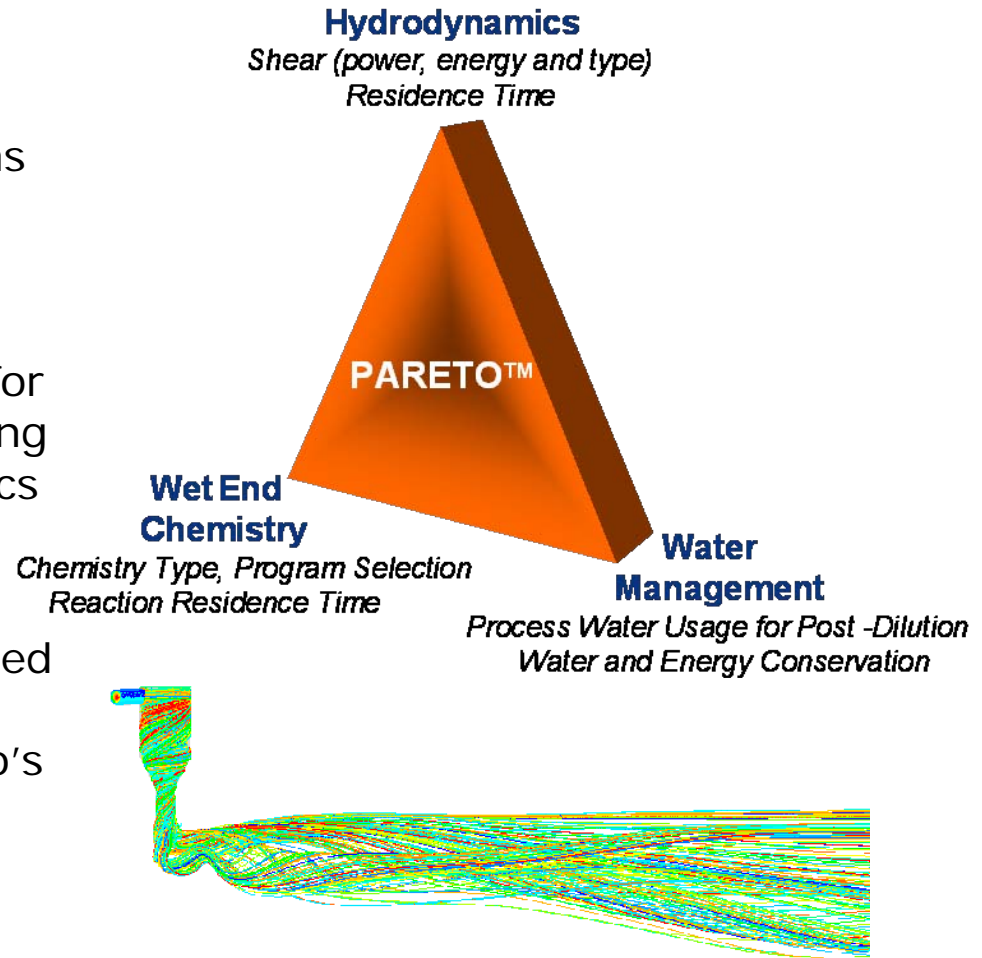
- Process conditions
- RDF program added value



PARETO Wet-End Optimization Technology

SMART Solutions™ for Efficiency

- Nalco's PARETO™ is a new proprietary feeding arrangement for wet-end chemistry applications (launched May 06)
- Integrates wet-end specialty chemicals into approach system for the best performance by optimizing wet-end chemistry, hydrodynamics and water management
- The technology has been developed by using Computational Fluid Dynamics (CFD), NASS and Nalco's application expertise



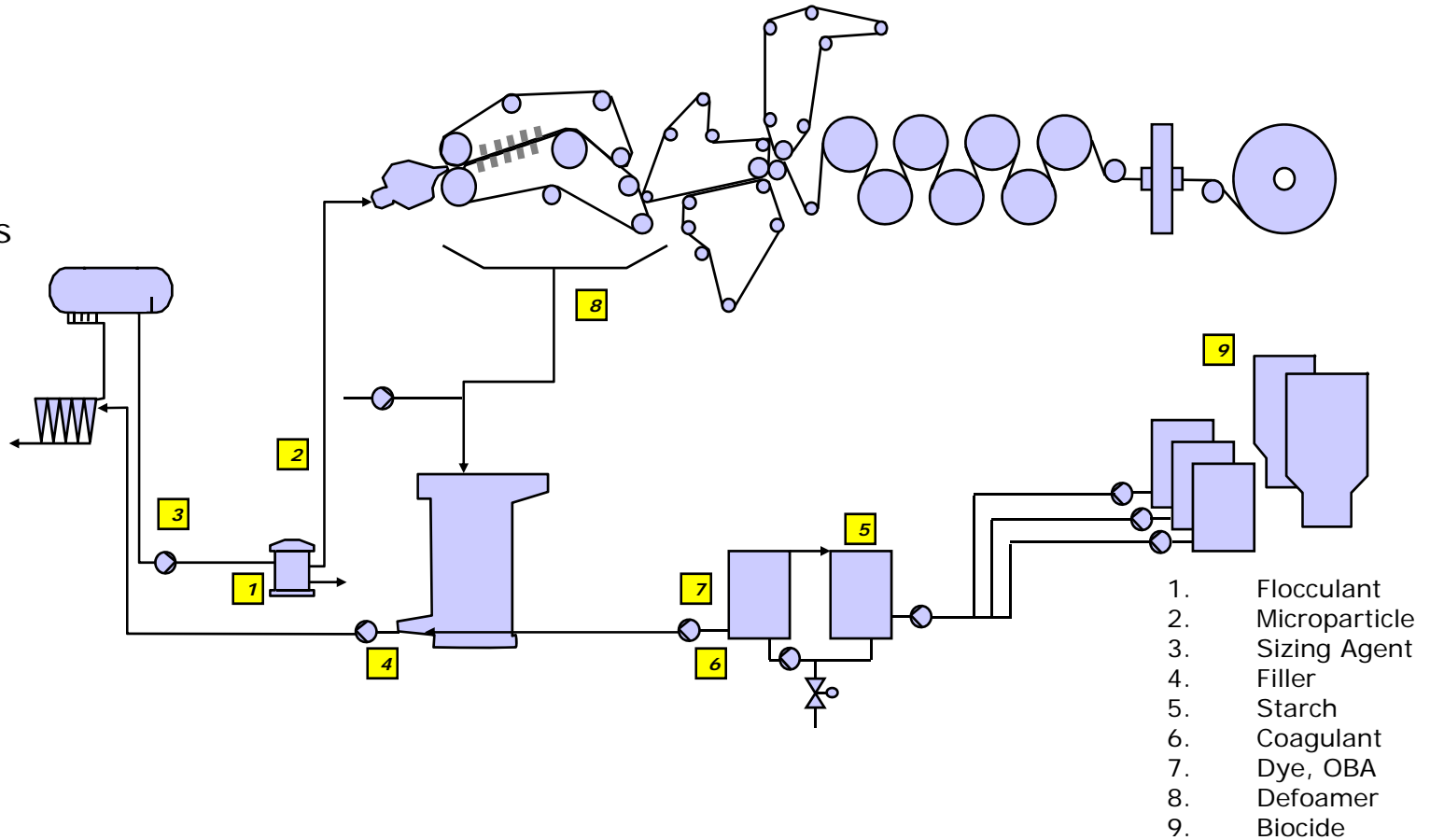
Wet-End Additives in the Approach System

Rapid Mixing

Contact Times

Chemical
Activation

Chemical
Performance

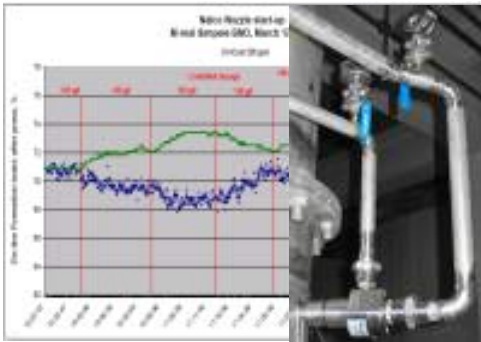


PARETO™ Wet-End Optimization Technology

Uniquely Optimized Variables

- Water management
 - Post-dilution water usage
 - Replacement of fresh water with process water for energy and water conservation efforts and environmental issues
- Chemistry
 - Molecular weight, charge, architecture etc.
 - Residence time for reaction
 - Program type (single, dual, micro particle system)
- Hydrodynamics
 - Local stoichiometrics
 - Residence times of the components
 - Shear (power, energy and type)

Use of CFD in Product Development



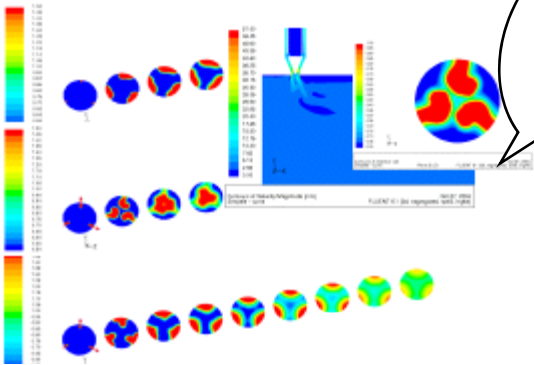
MILL TRIALS WITH SELECTED CUSTOMERS

REFERENCES

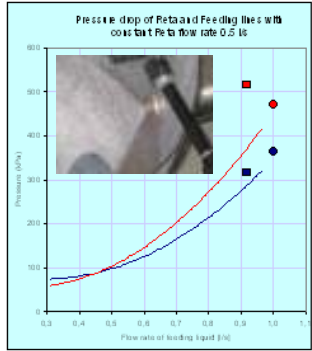


MODELLING

EXPERIMENTING



COMPUTER AIDED ENGINEERING

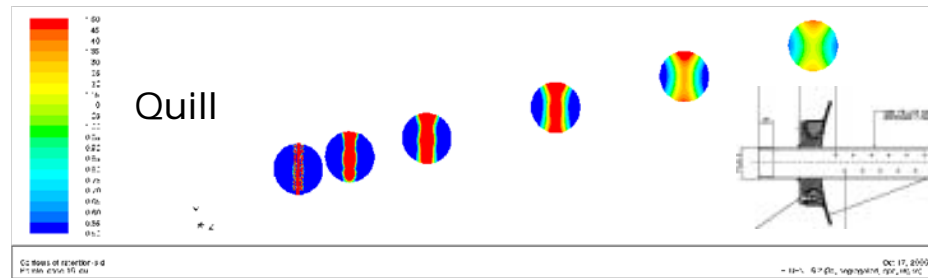
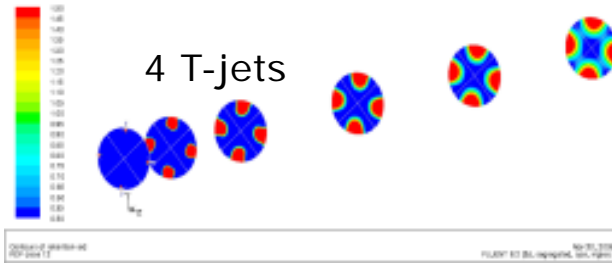


LAB & NASS TRIALS

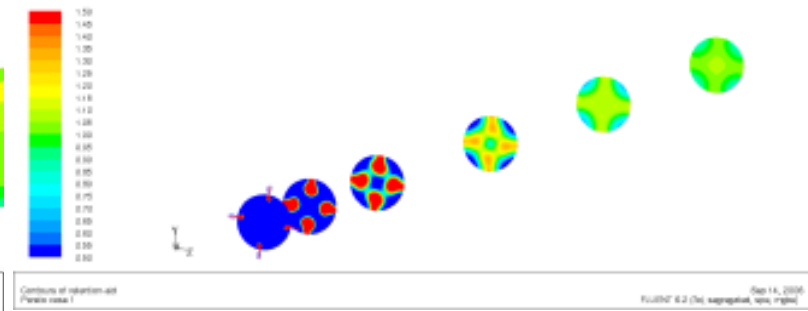
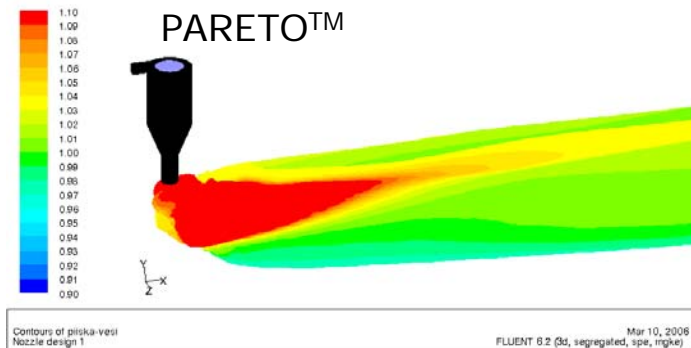
Chemical Injection Systems

Traditional Systems

- T-jet (1-6 units) Stub
- Drilled quill

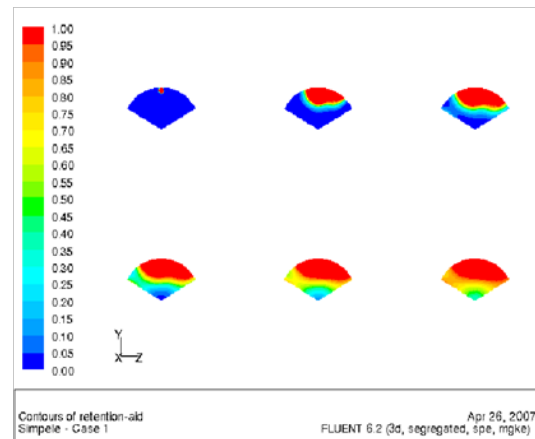
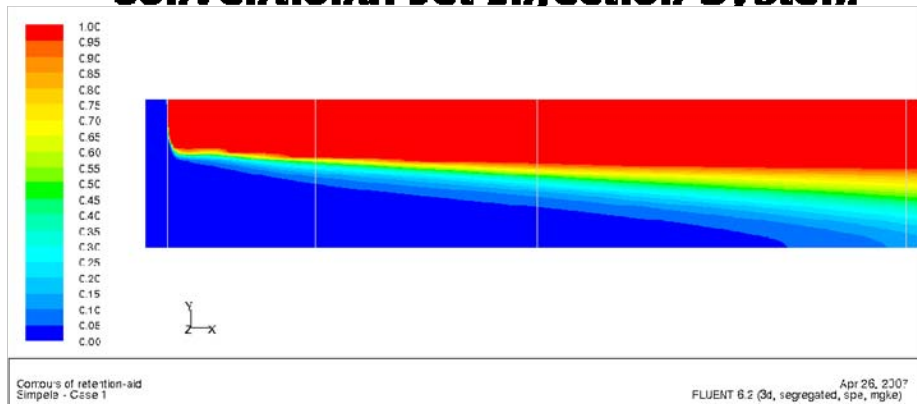


Novel methods

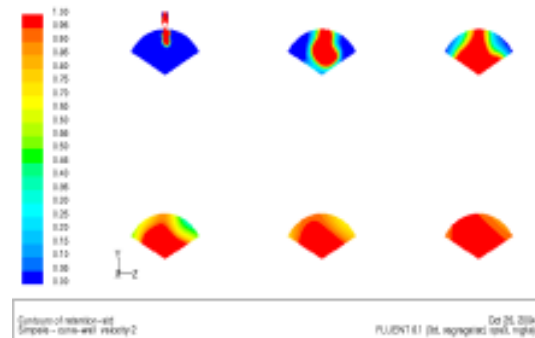
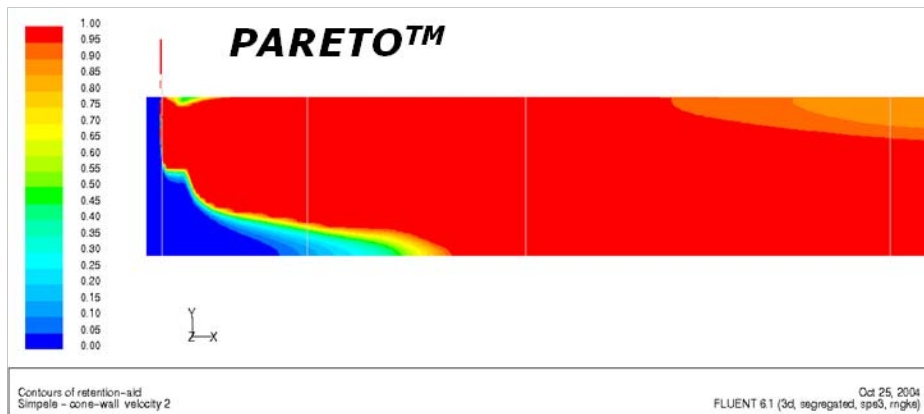


Conventional vs. PARETO™ System

Conventional Jet Injection System



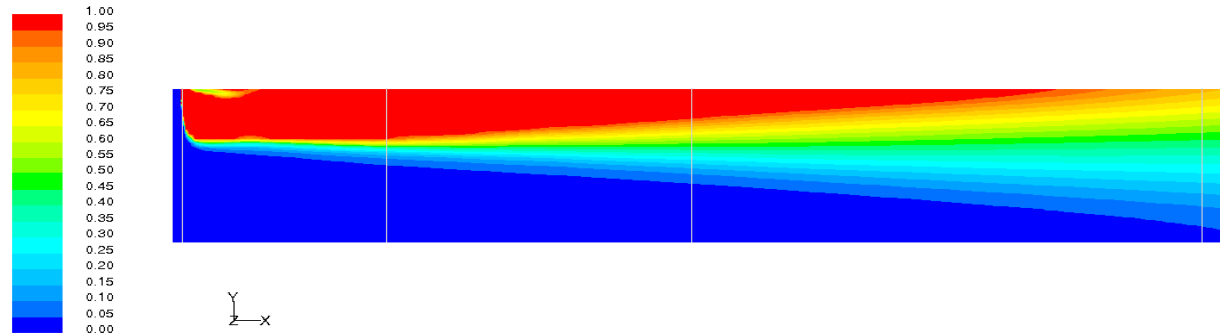
PARETO™



CFD Simulations

- Comparison of single jet to PARETO™ Mixing Technology with same mass flow and energy input
- A 10 m distance from a post-screen injection can typically be in the headbox
- Local highly concentrated areas of chemistries may result in over flocculation and/or reduced chemical efficacy due to rapid reaction rates

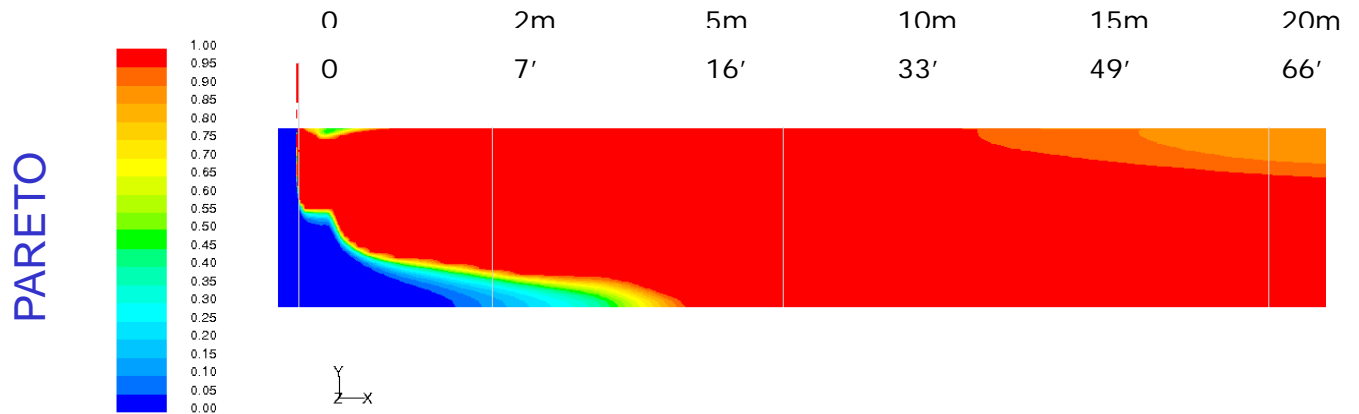
SINGLE JET



Contours of retention-aid
Simple6 - current design

Oct 25, 2004
FLUENT 6.1 (3d, segregated, spe3, rngke)

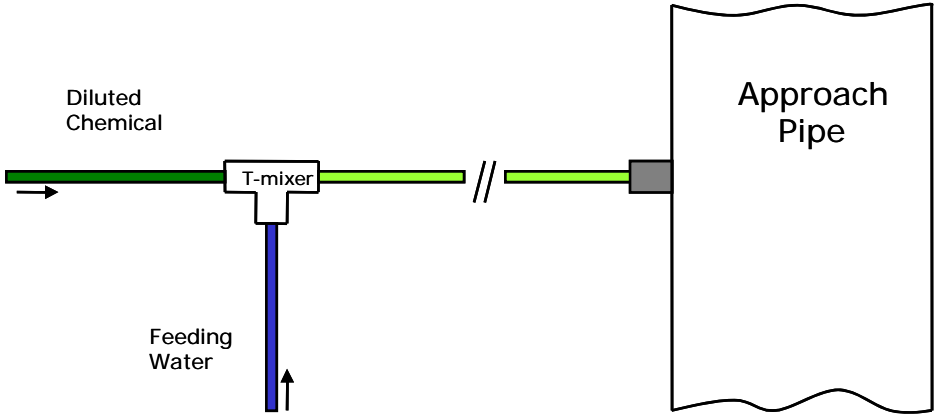
Distance Downstream →



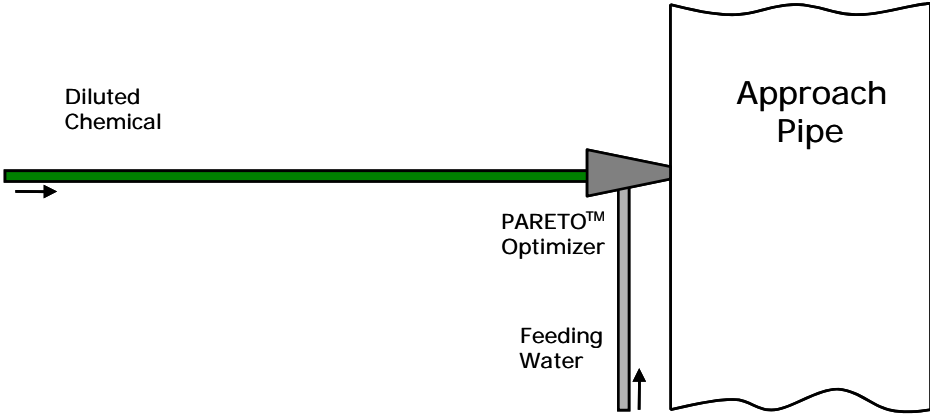
Contours of retention-aid
Simple6 - cone-wall velocity 2

Oct 25, 2004
FLUENT 6.1 (3d, segregated, spe3, rngke)

Conventional



PARETO™



Pareto Optimizer Technical Description

Chemical in

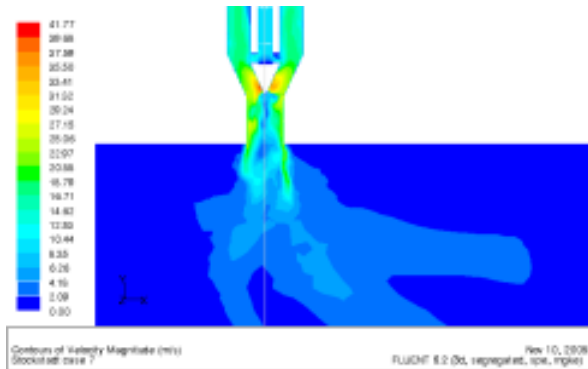
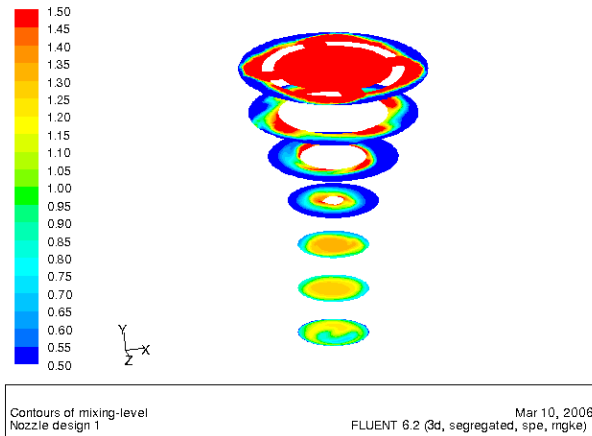


Feeding
liquid in



Discharge conical jet pattern

Mixing profiles in the PCR

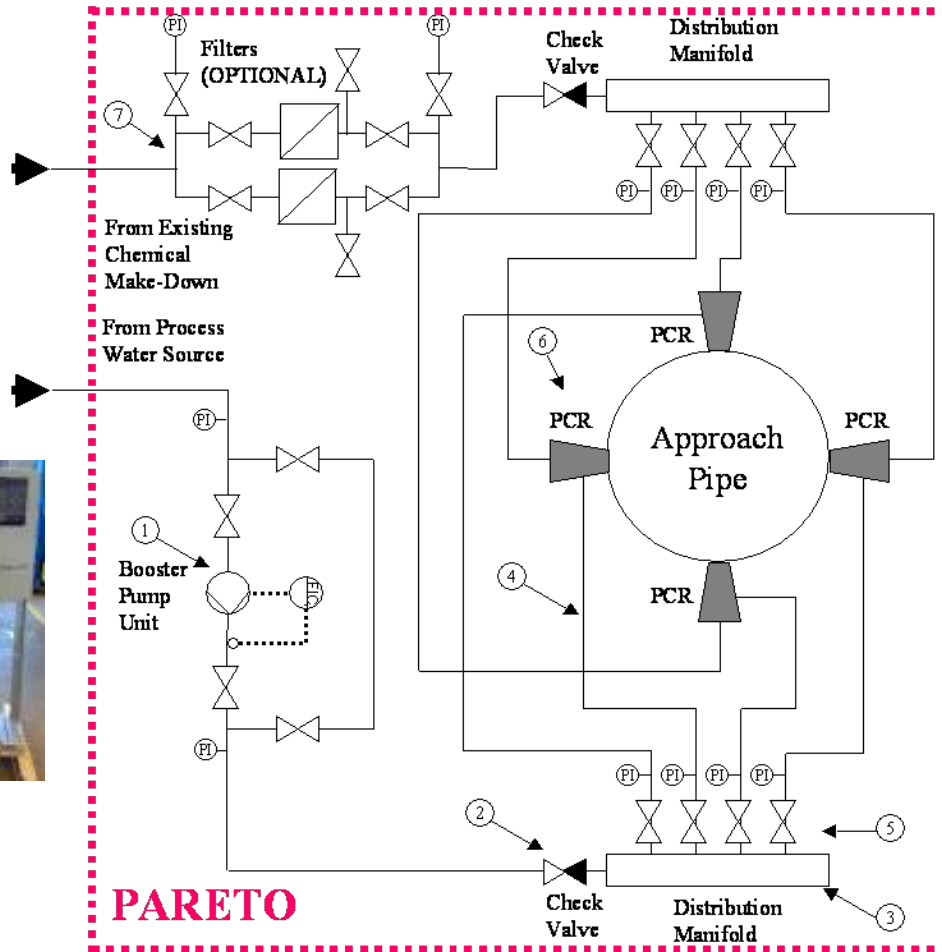


Contour of velocity magnitude

MECHANISMS:

- Chemical kinetics
- Shear & Turbulence
- Mixing
- Penetration
- Spreading

PARETO™ System Components

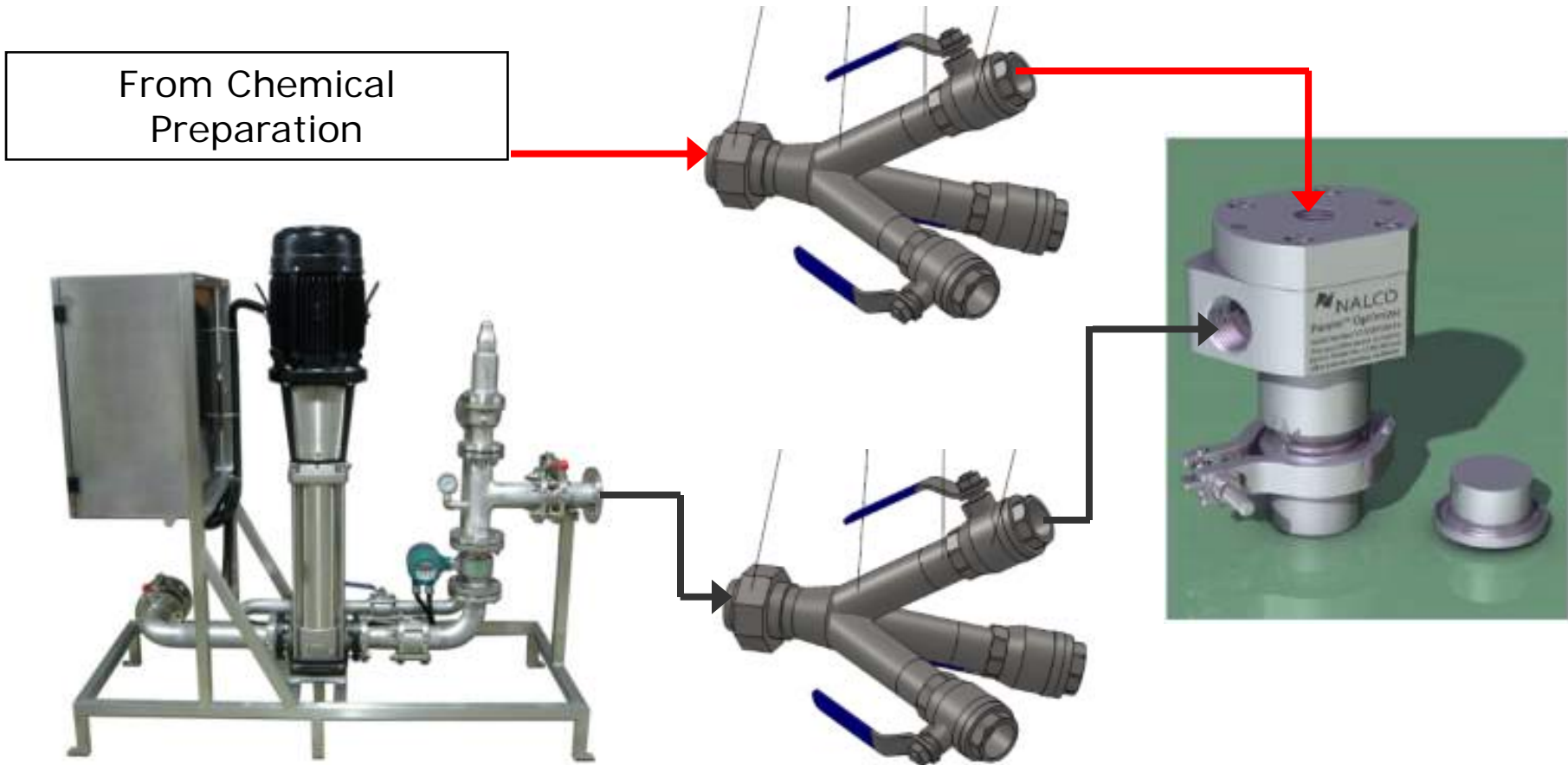


MAIN COMPONENTS:

- (1) Booster pump unit for feeding water with flow rate control and control panel
- (2) Check valves
- (3) Distribution headers
- (4) Stainless steel braided hoses to connect to the respective PCR
- (5) Each hose has a pressure gauge and handvalve before connection to the braided hose
- (6) PCRs with adapters for connection to the approach pipe
- (7) Filters for the chemical dosing line before the distribution manifold (OPTION).

PARETO™ System Components

From Chemical Preparation



- Optimized water usage and type for energy and water conservation efforts
- Wet-end additive efficacy improvement
- Improved on-machine efficiency via reduced web-breaks and improved process stability
- Improved cleanliness in the short circulation system
- Improved moisture and basis weight web profiles by improved mixing efficiency
- Improved paper properties including formation

PARETO™ Case Study-Client A

MILL OVERVIEW:

*Paper Grade:
Coated Board*

*Production:
215,000 t/y*

*Operating
Speed:
600/min
(1,968 fpm)*

*Wire Width:
4,500 mm
(177 inches)*

*Furnish:
Kraft,
Mechanical*



1st PARETO™ Installation in March 2005

PARETO™ Case Study-Client A

Before



After



FRESH WATER SAVINGS:
>200 000 m³/y

ESTIMATED ENERGY SAVINGS:
>7.6 MM kWh

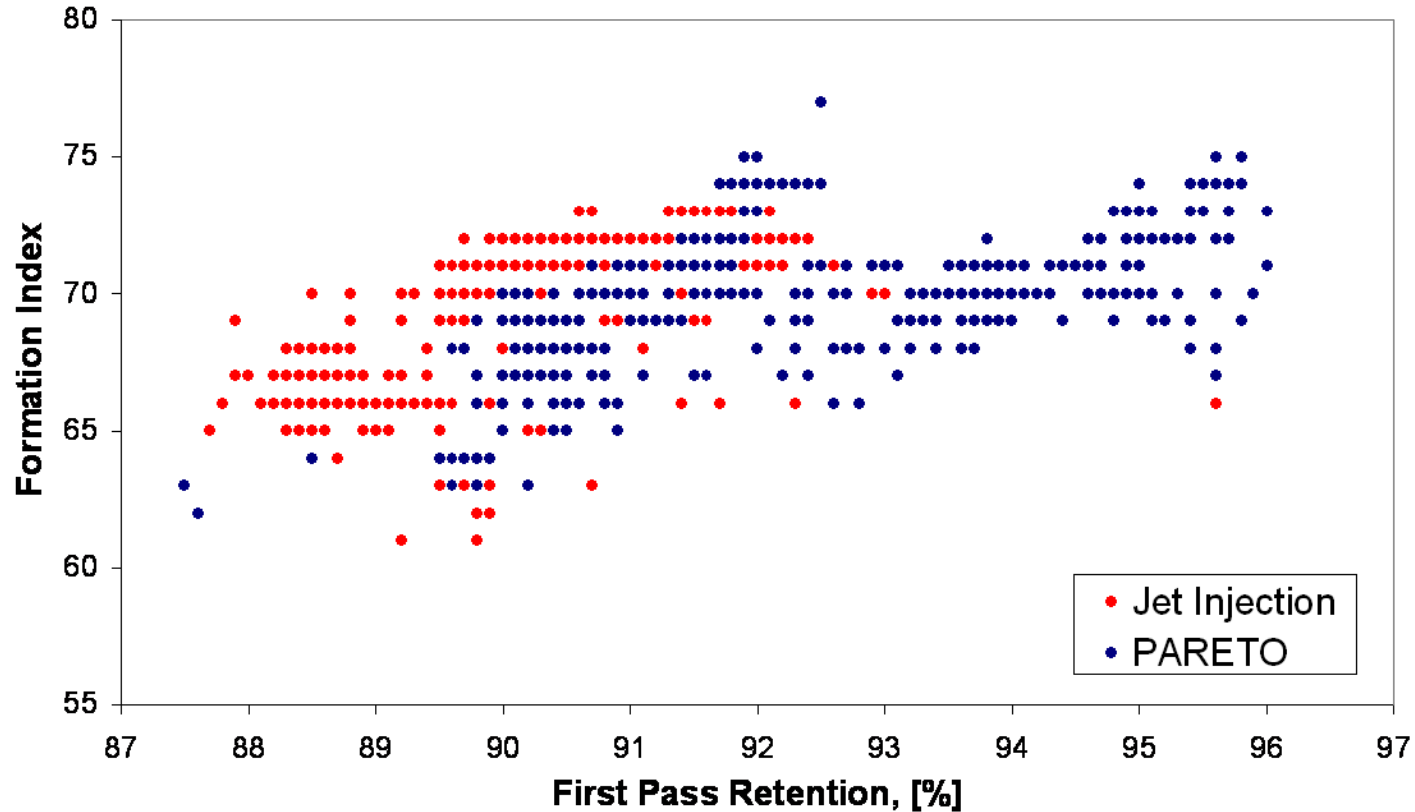
- Replaced conventional jet injection system with PARETO™
- PARETO™ in middle-ply approach pipe
- Post-screen and 5 meters from headbox
- The customer later upgraded all flocculant and microparticle feeding locations for all three plies in December 2005
- Fresh water replaced with white water in March 2006

De-coupling Formation and Retention

Coated FBB 270
gsm

Results:

- Improved Retention at equal or better formation
- Improved system stability and cleanliness
- Partial decoupling of retention and formation



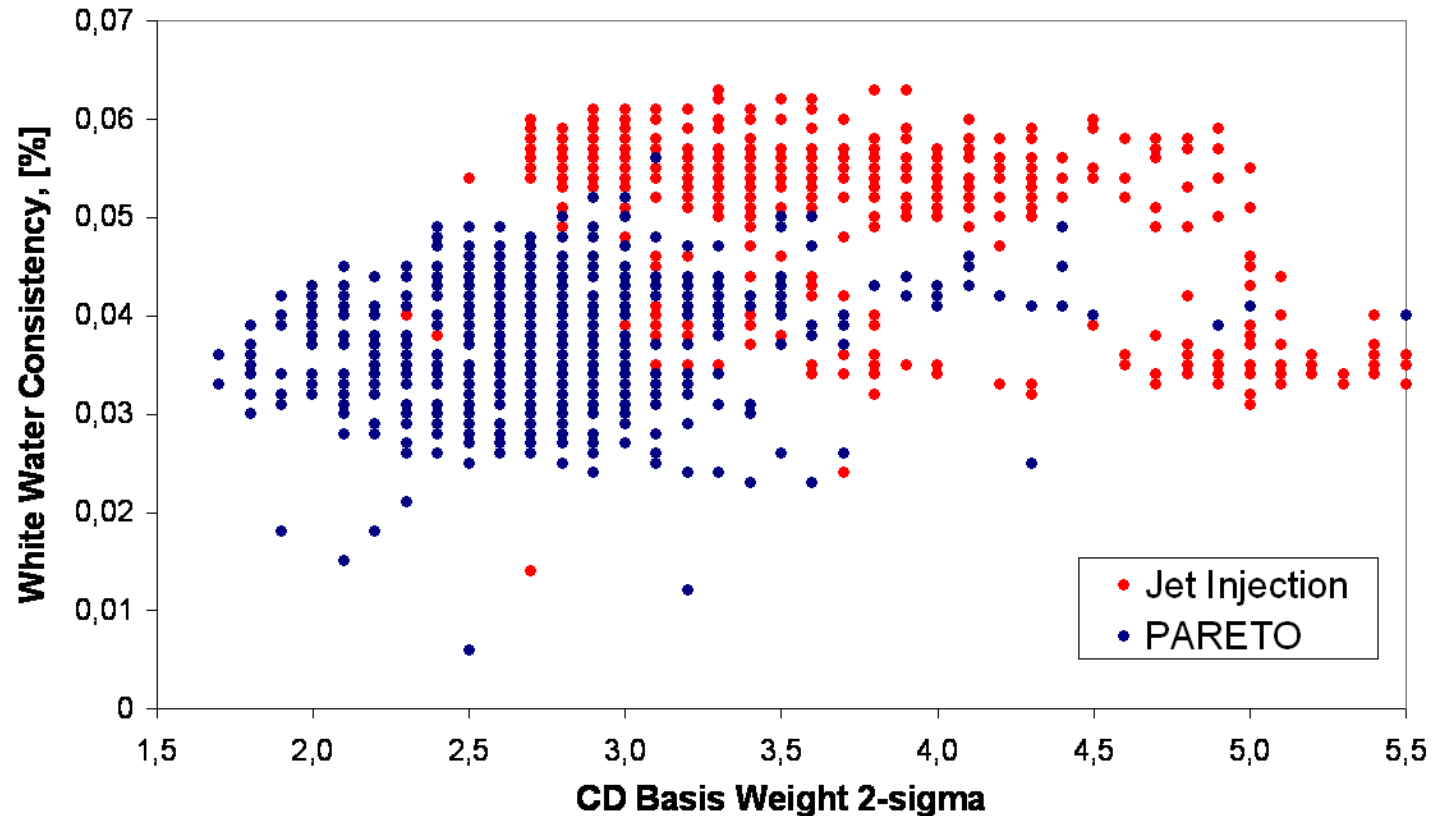


Improved Web Profiles

Paper Grade:
Coated FBB 295
gsm

Results:

- Improvement in basis weight and moisture profiles and associated operational benefits
- Better edge rolls



Chemical Efficiency Improved by 30%

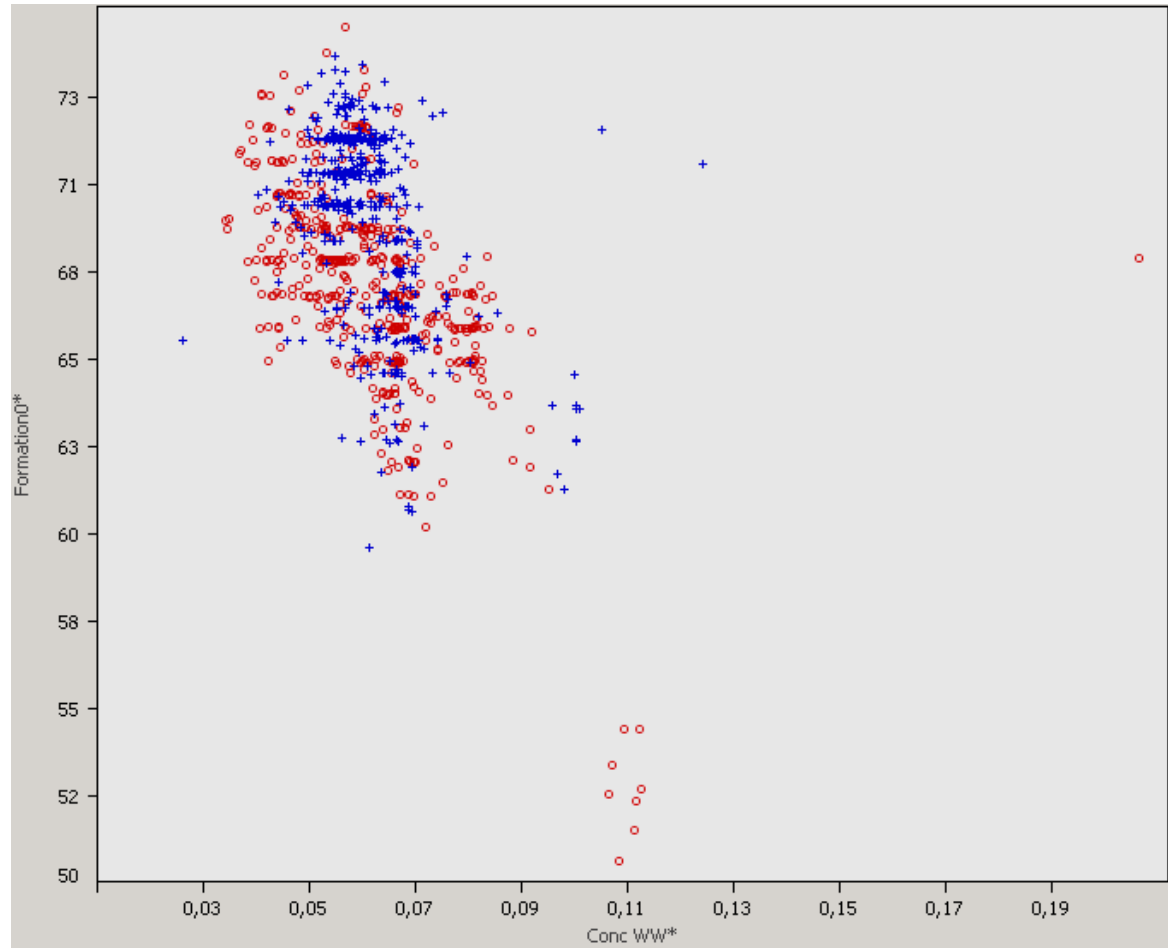
Paper Grade:
Coated FBB 295
gsm

Results:

- Same Retention at reduced chemical dosage

+ *Jet Injection*

● *PARETO™*



PARETO™ Case Study-Client B

MILL OVERVIEW:

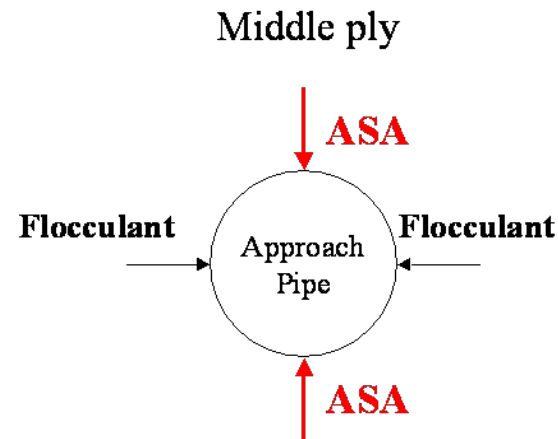
*Paper Grade:
Coated Board*

*Production:
140,000 t/y*

*Operating Speed:
500/min
(1,640 fpm)*

*Wire Width:
3,400 mm
(134 inches)*

*Furnish:
Kraft,
Mechanical*



PARETO™ Installation in June 2007

PARETO™ Case Study-Client B

**FRESH
WATER
SAVINGS:**

**>44 000
m³/y**

**ESTIMATED
ENERGY
SAVINGS:**

>3 MM kWh

Before

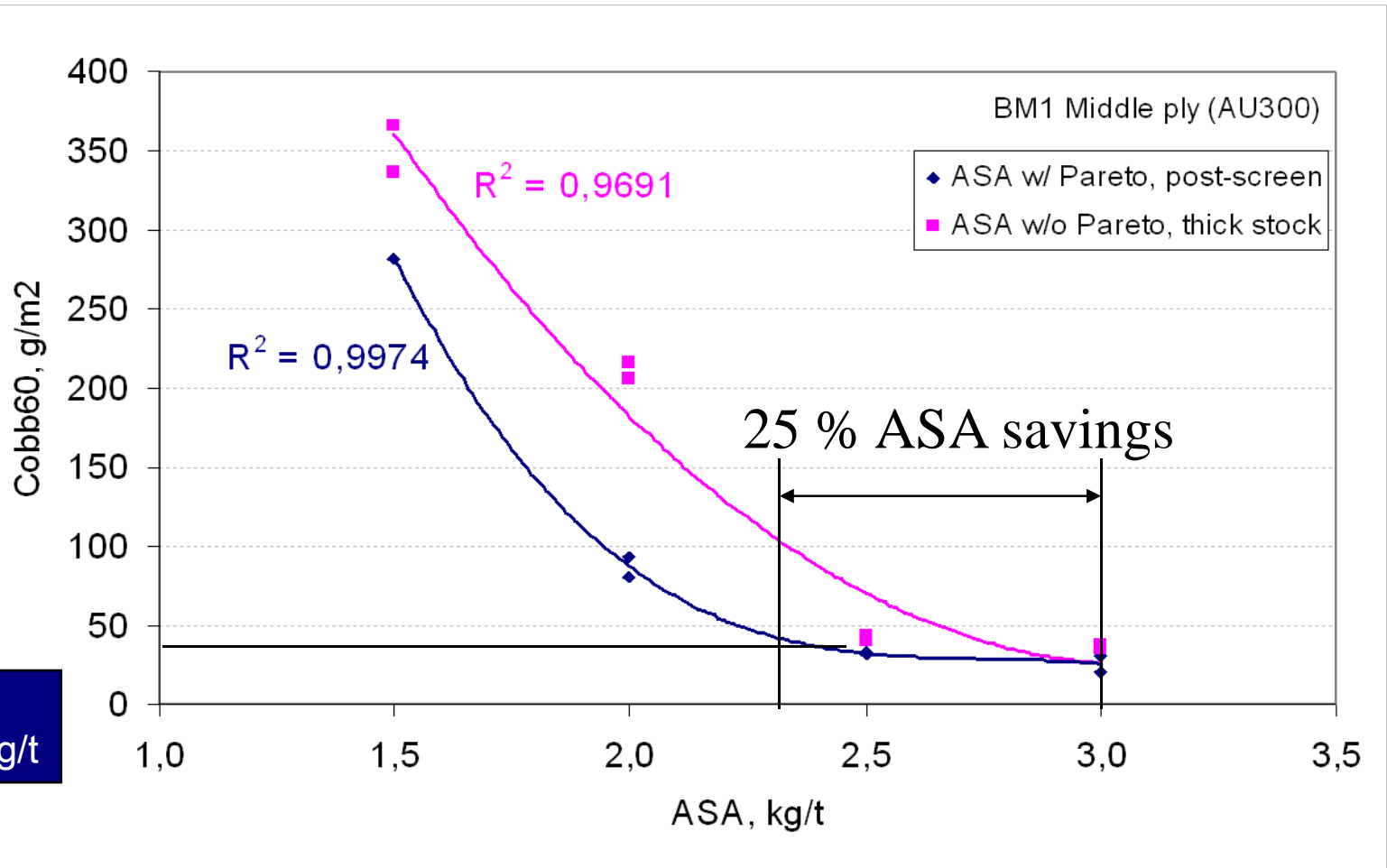


After

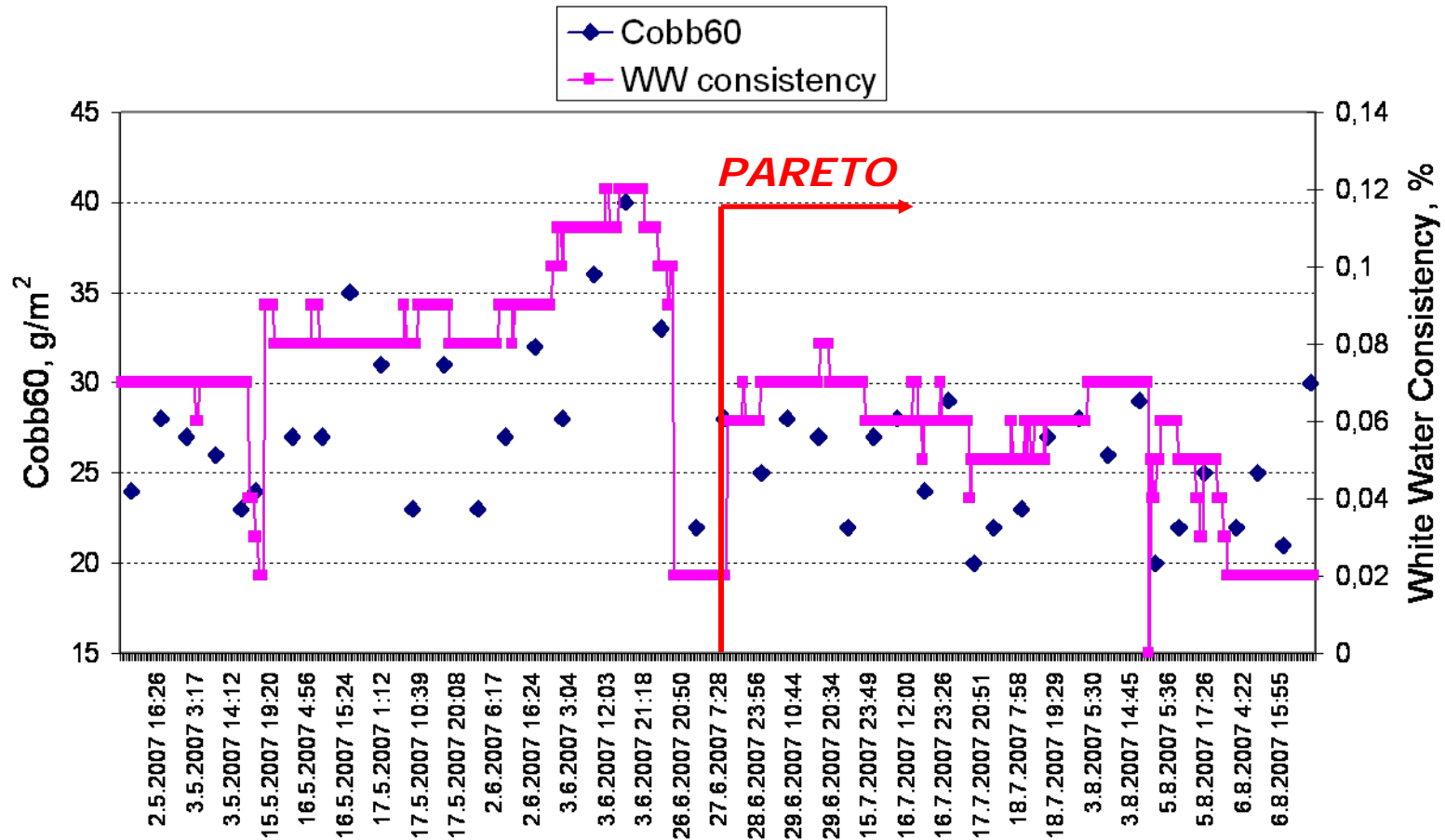


- Replaced conventional jet injection system with PARETO™
- PARETO™ in middle-ply approach pipe
- Post-screen and 15 meters from headbox
- Action plan to install Pareto in the back-ply by end 2007

25 % ASA Savings

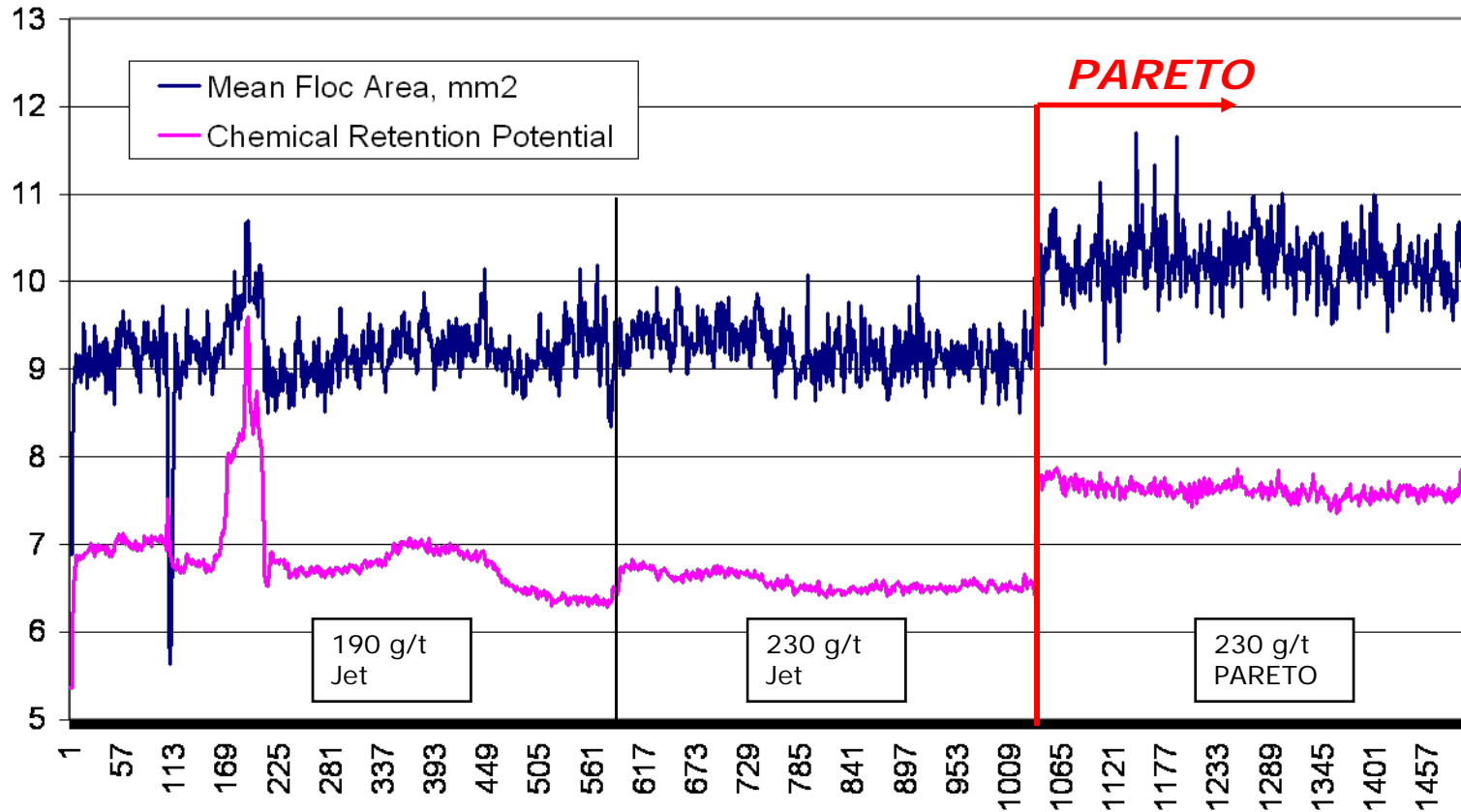


Improved Retention and Sizing Effect



PARETO Value Added

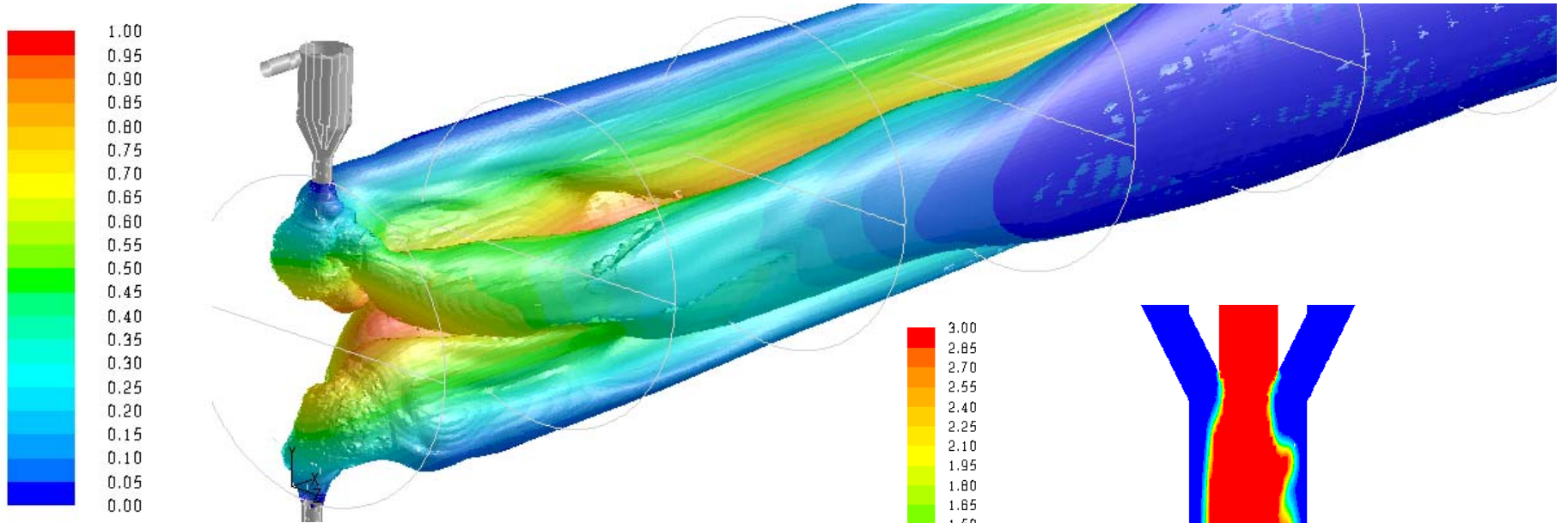
Highlighted with ONASS



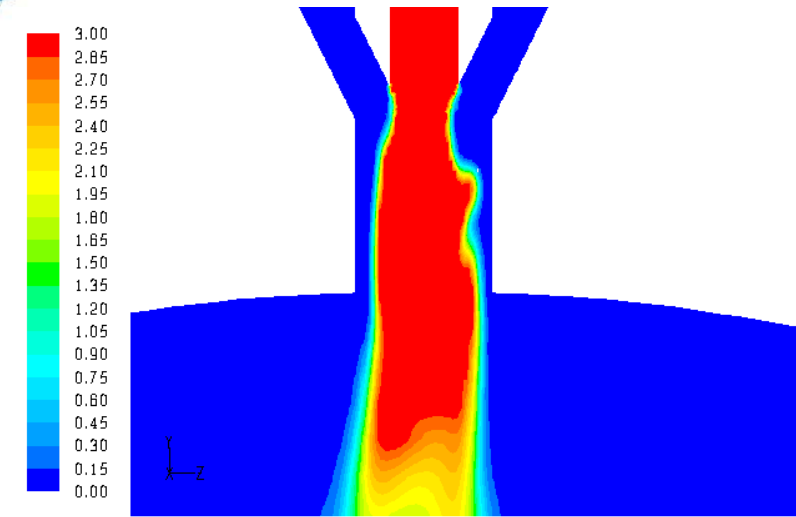
Improvement in flocculant performance at constant dosage (230 g/t)

PARETO for Wet-Strength Aid

CFD Simulations

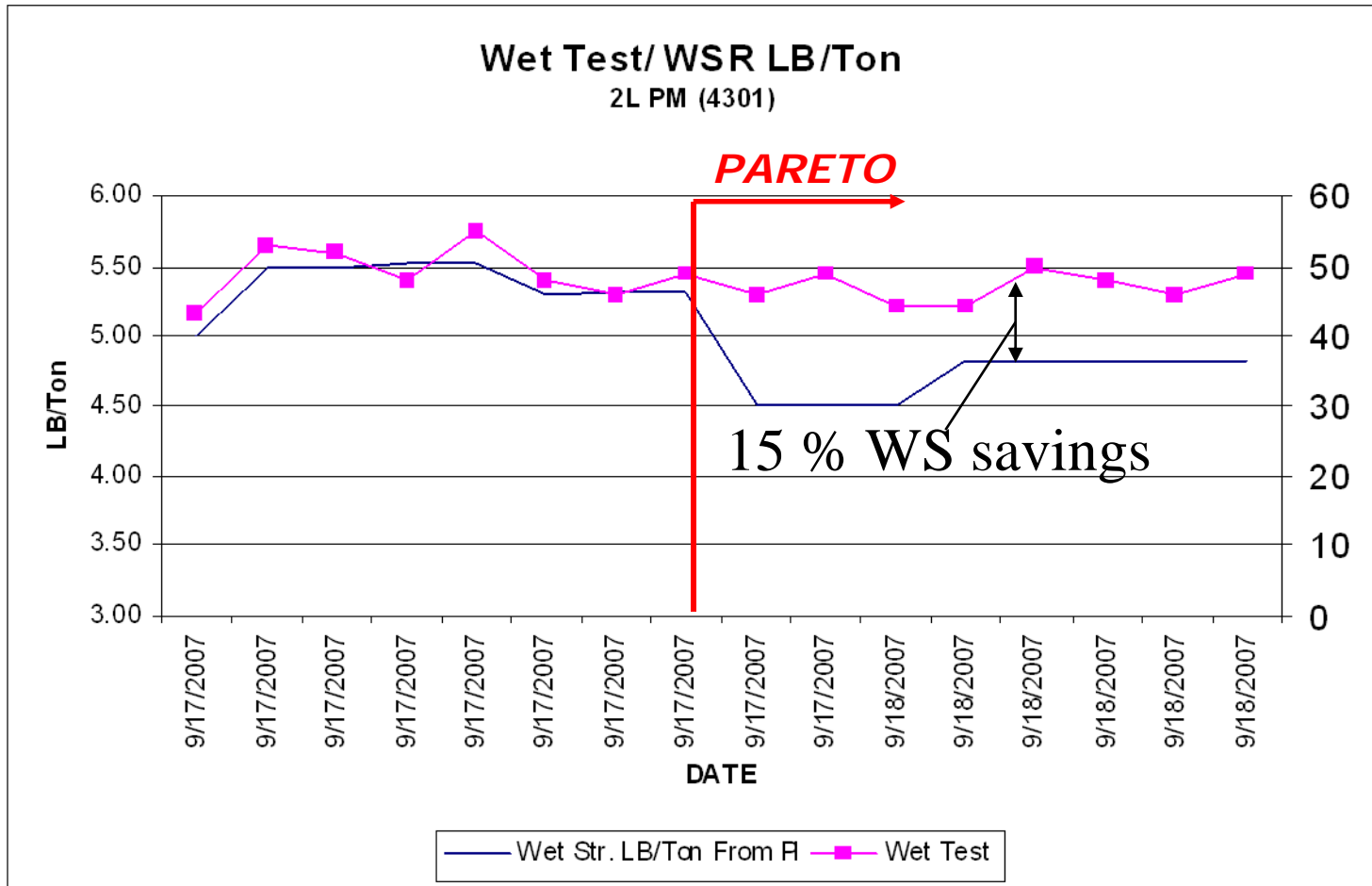


Iso-surface of chemical
coloured by radial distance
from the pipe wall



Mixing level within the Optimizer

15 % Wet-Strength Savings



Technology Definition

- Nalco's **patented** technology to optimize the injection of chemical additives into process streams.
- It is a Nalco global best practice for **flocculant** addition.
- The technology and underlying principles apply to **flush** mounted injection ports.
- The technology has been proven superior to injection technologies such as quills, stubs and other competitive offers.

- Nalco always retains ownership of the PARETO Optimizer.
- Competitive chemistry is ***NOT*** allowed to pump through the PARETO Optimizer.

***Over 70 installations worldwide
and growing !!***

- For more information on PARETO™ please contact:
 - Email sram@nalco.com / +919840755307
 - Visit our website at www.nalco.com/pareto
 - Contact your local Nalco Sales Account Manager.

Thank You!

Questions?