PROCESS CHEMISTRY CENTRE

ÅBO AKADEMI UNIVERSITY

The Effect of Fines on Dewatering, Wet and Dry Web Properties

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VTT

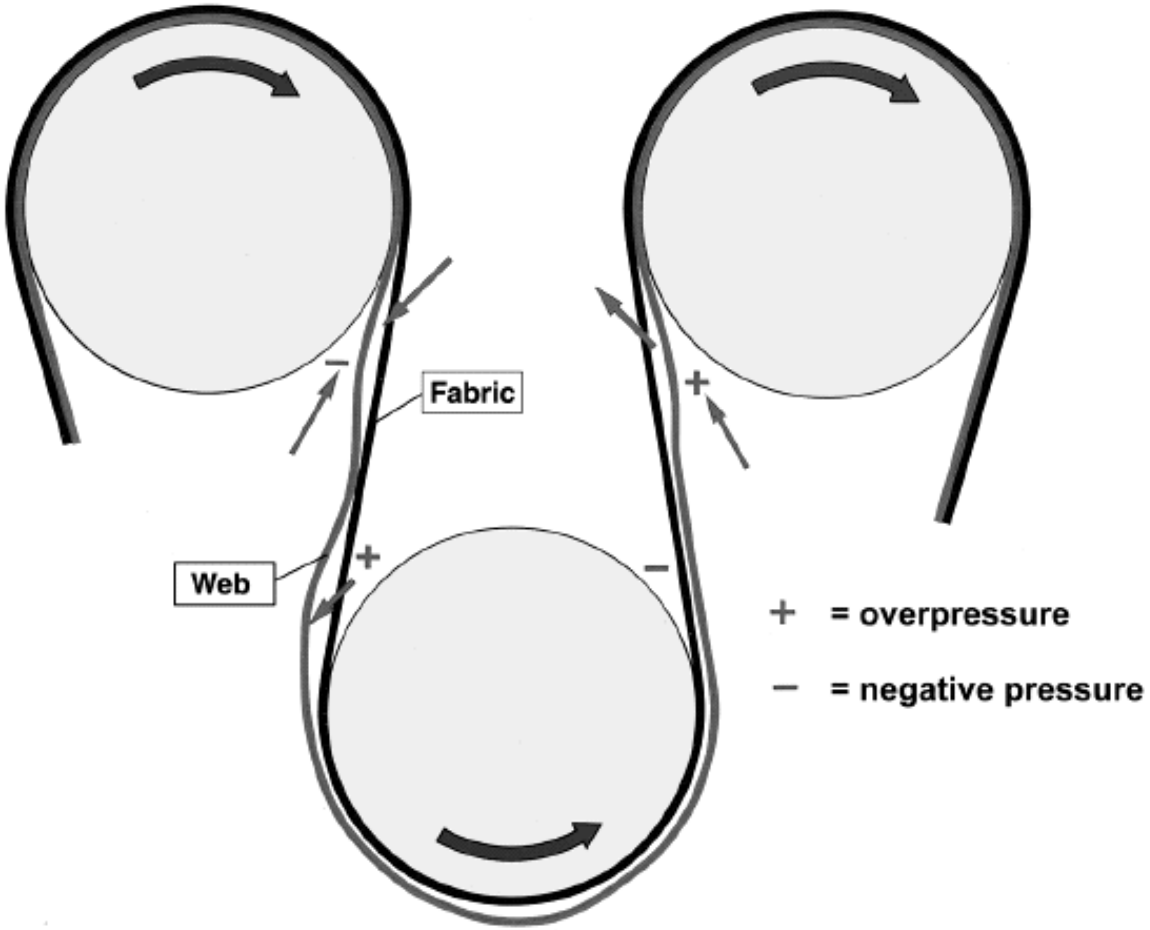
Topics

- Background
- Experimental setup
- Results:
  - Refining
  - Dewatering
  - Wet and dry web properties
- Conclusions

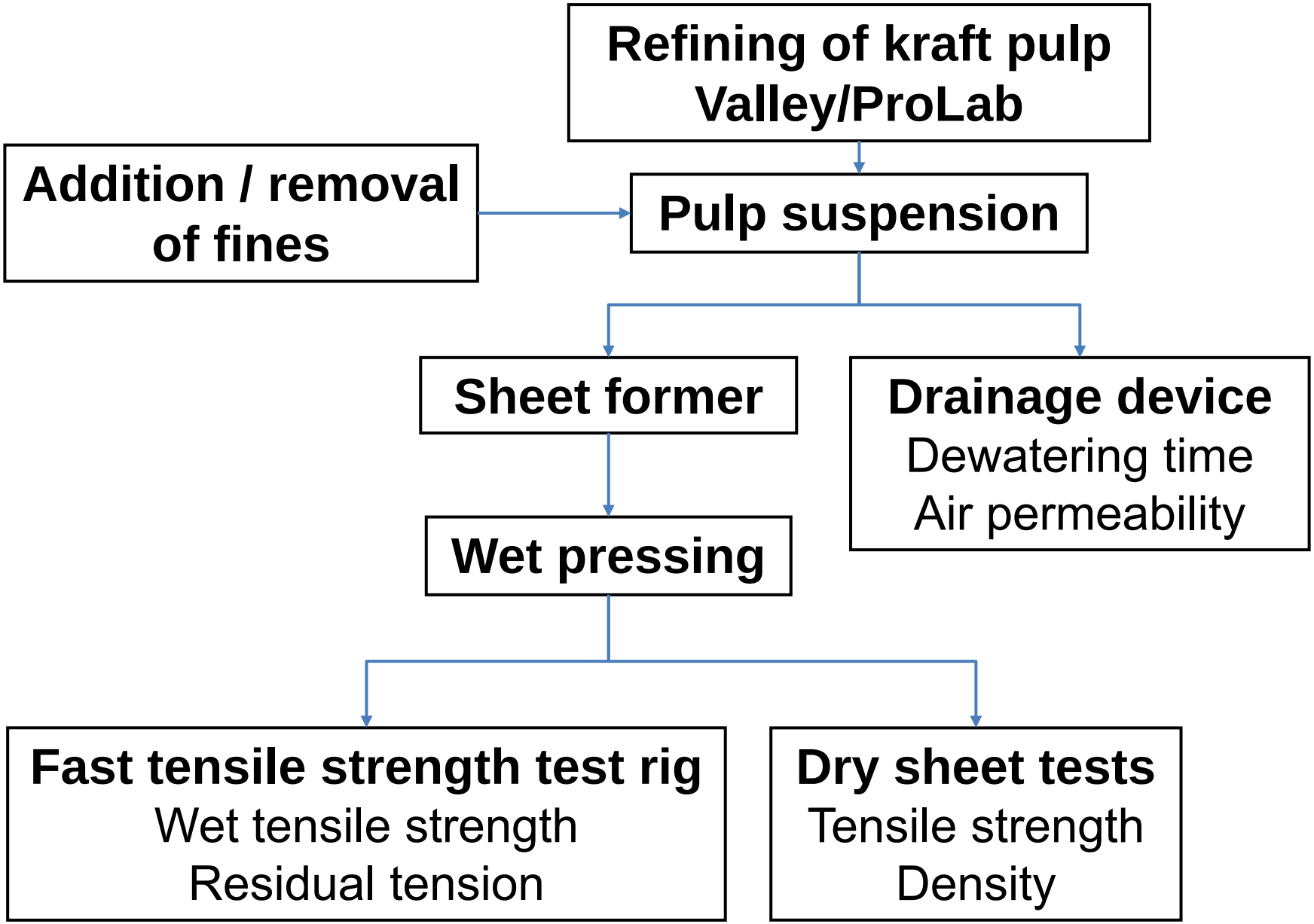
Background

- Tension and relaxation properties of wet web → critical for runnability
- Runnability can be controlled through tailored wet-end chemistry
- Low solids content: network strength dependent on interfibre friction
- Refining: Improves bonding ability of fibres → strong and smooth dry paper

Relaxation of wet web causes slackness and serious runnability problems

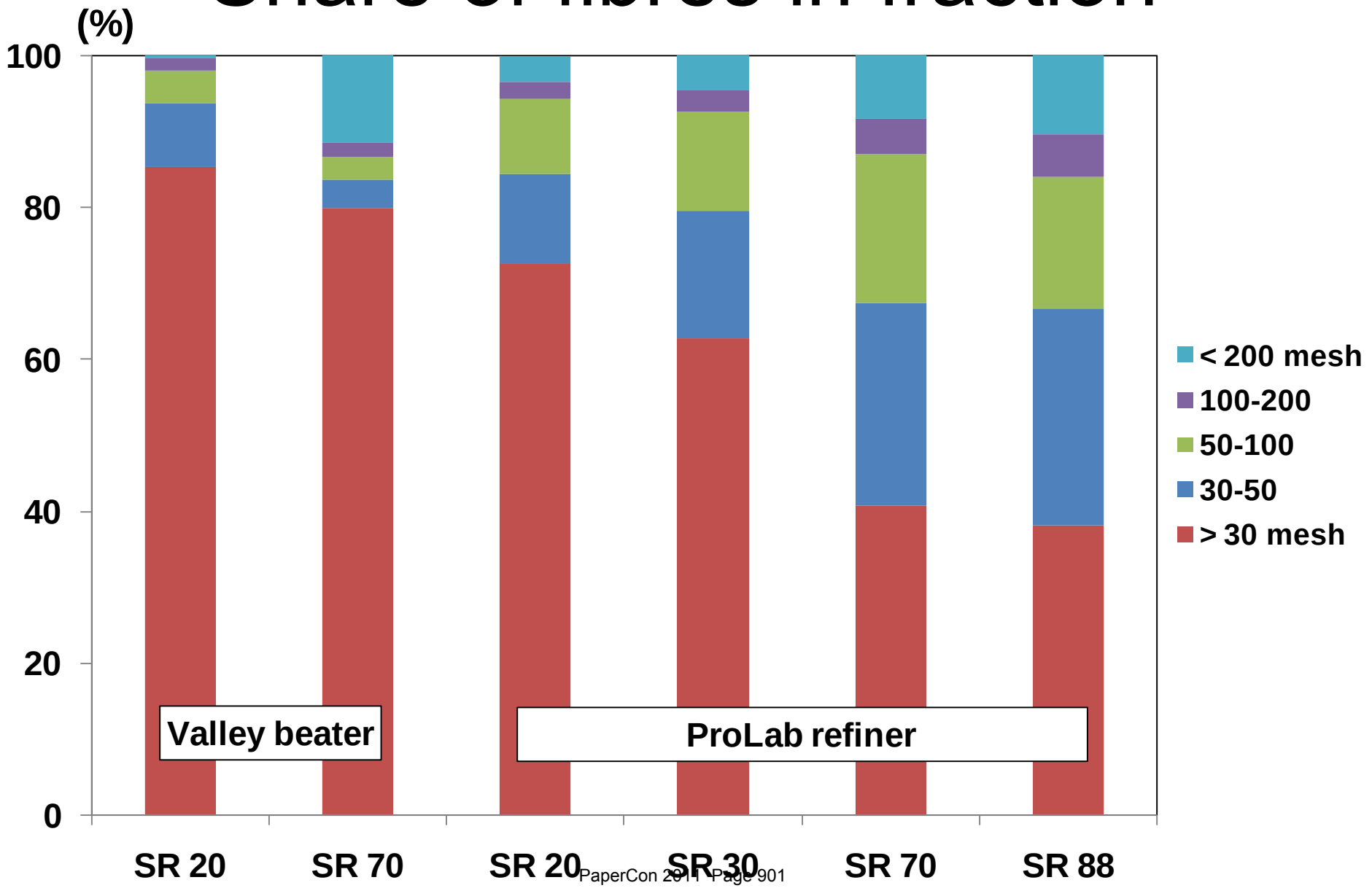


Kuhasalo et al. in: Papermaking Part 2, Drying, ed. H. Paulapuro, Fapet Oy, 2000.


Refining of kraft pulp
Valley/ProLab
Addition / removal of fines
Pulp suspension
Sheet former
Drainage device
Dewatering time
Air permeability
Wet pressing
Fast tensile strength test rig
Wet tensile strength
Residual tension
Dry sheet tests
Tensile strength
Density

Refining

Share of fibres in fraction

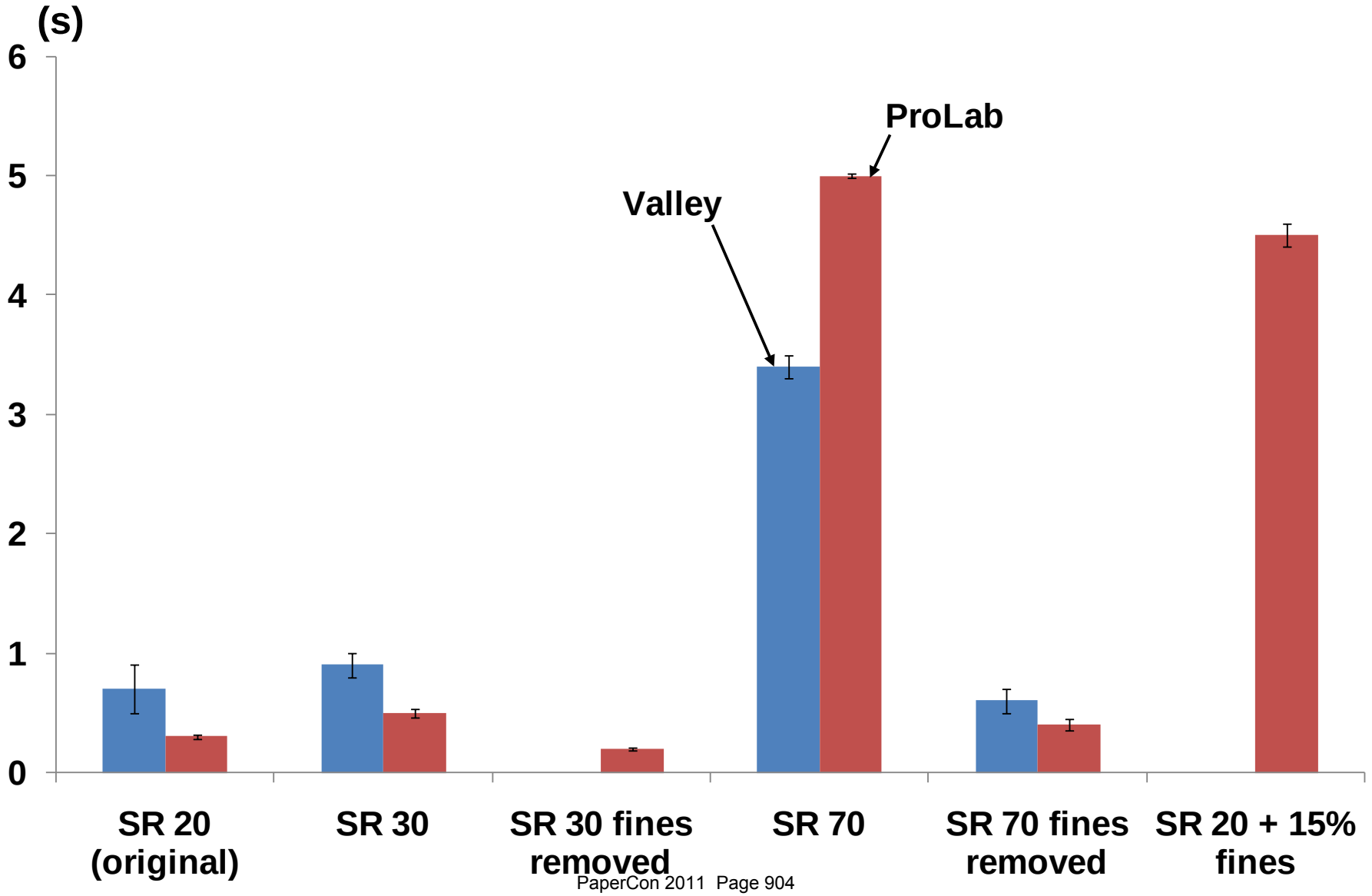


Summary: Refining

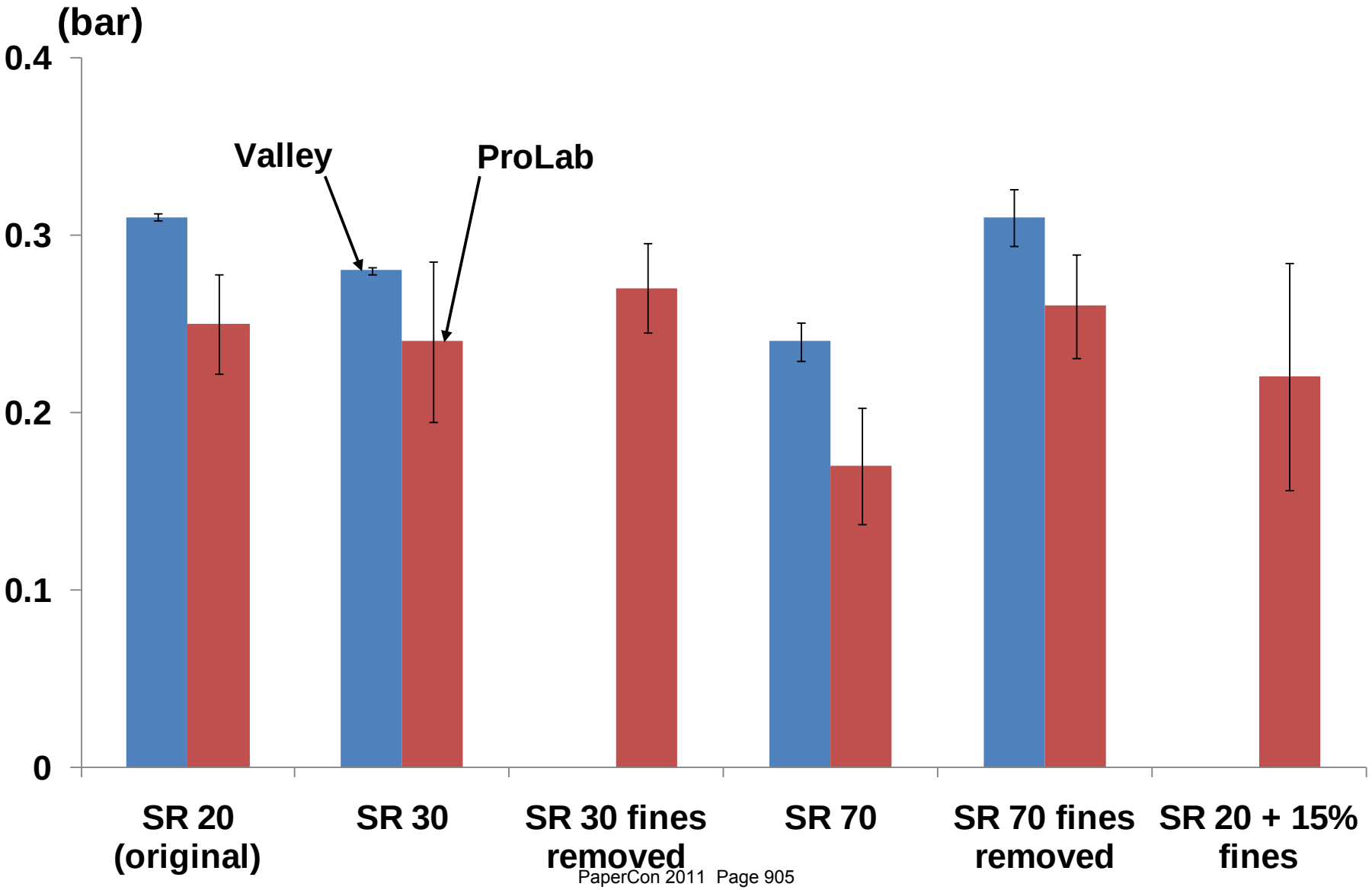
- Valley beater:
  - High amount of fines
  - Small change in share of long fibres
  - → Milder treatment
- ProLab refiner:
  - High amount of fines
  - Less long fibres
  - → More fibre cutting

Dewatering and air permeability

Dewatering time



Air permeability

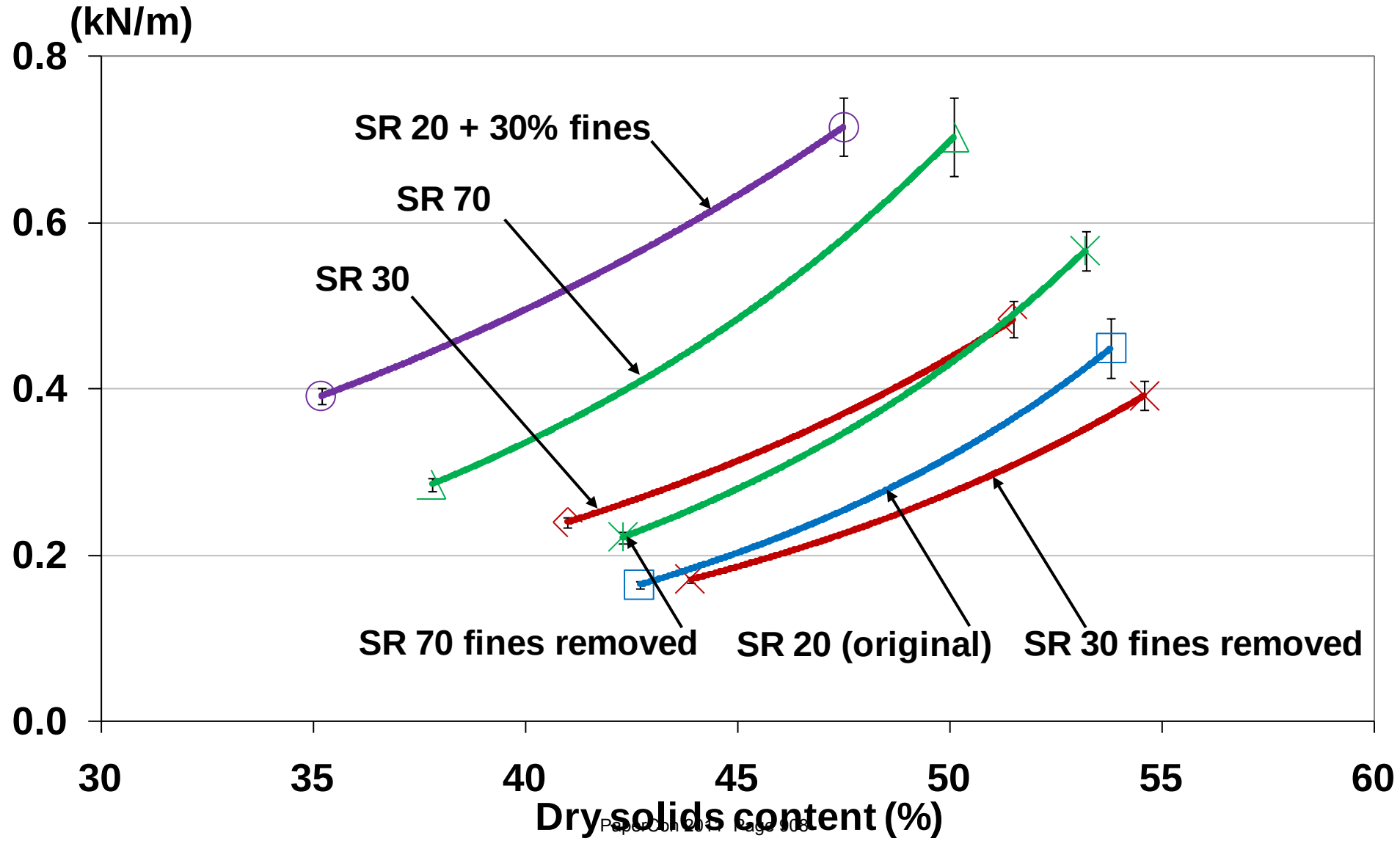


Summary: Dewatering and air permeability

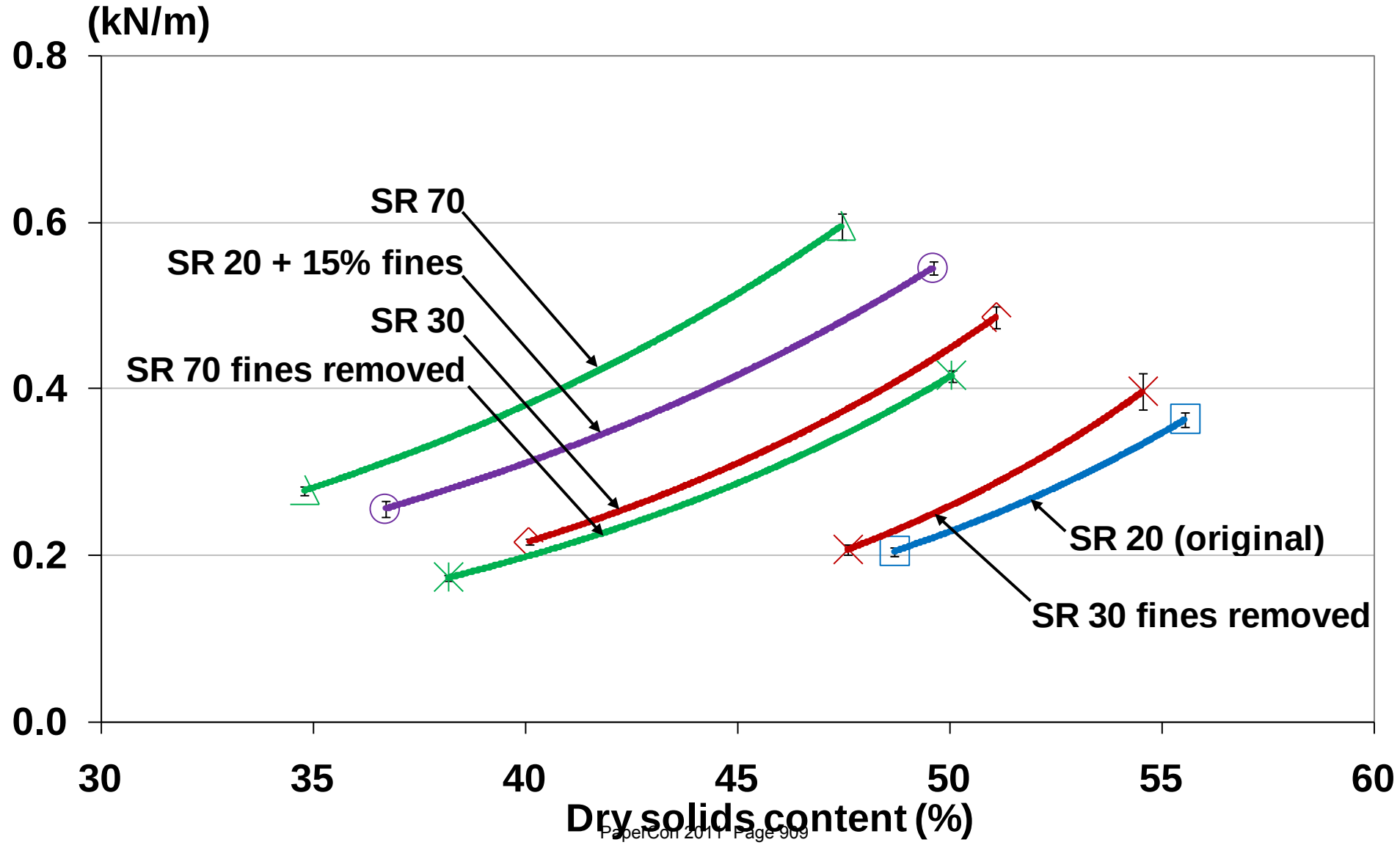
- Refining: Increased dewatering time and decreased air permeability
- Removal of fines: dewatering time and air permeability close to original
- Addition of fines: increased dewatering time and decreased air permeability
- Valley vs. ProLab:
  - Shorter dewatering times at higher refining using Valley → denser sheets when using ProLab

Wet web properties

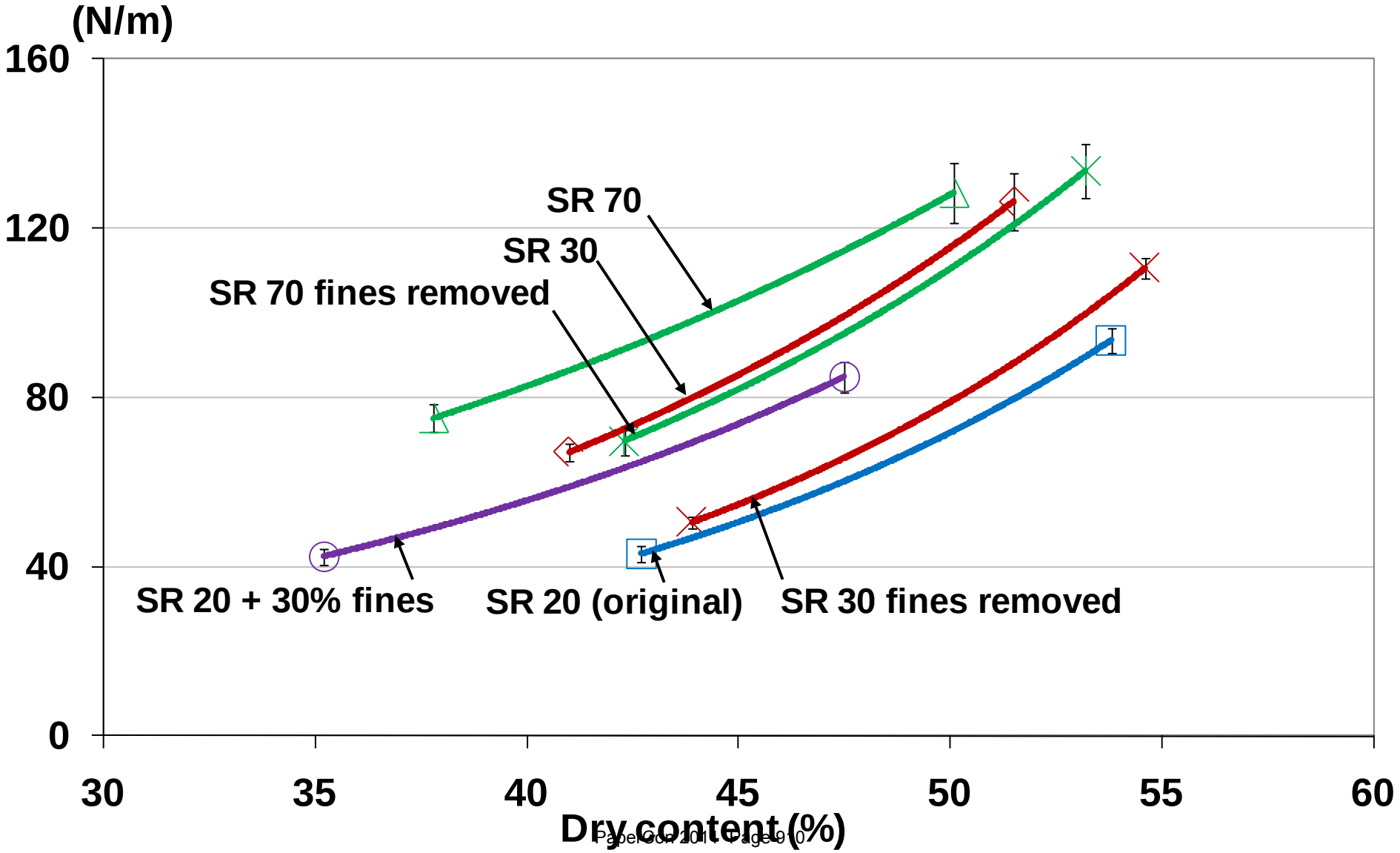
Valley: Tensile strength



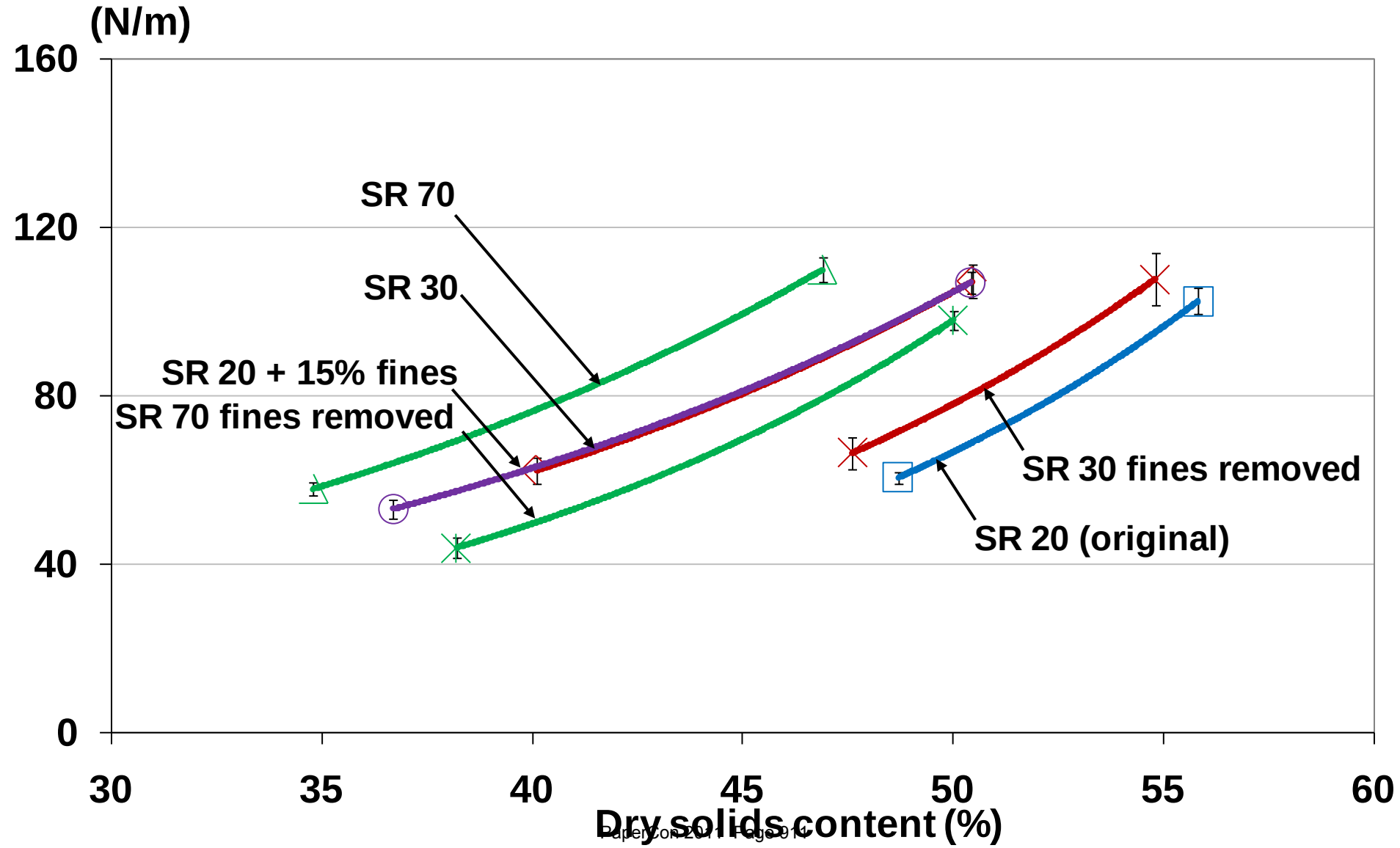
ProLab: Tensile strength



Valley: Residual tension after 0.475 s at 2% strain



ProLab: Residual tension after 0.475 s at 2% strain



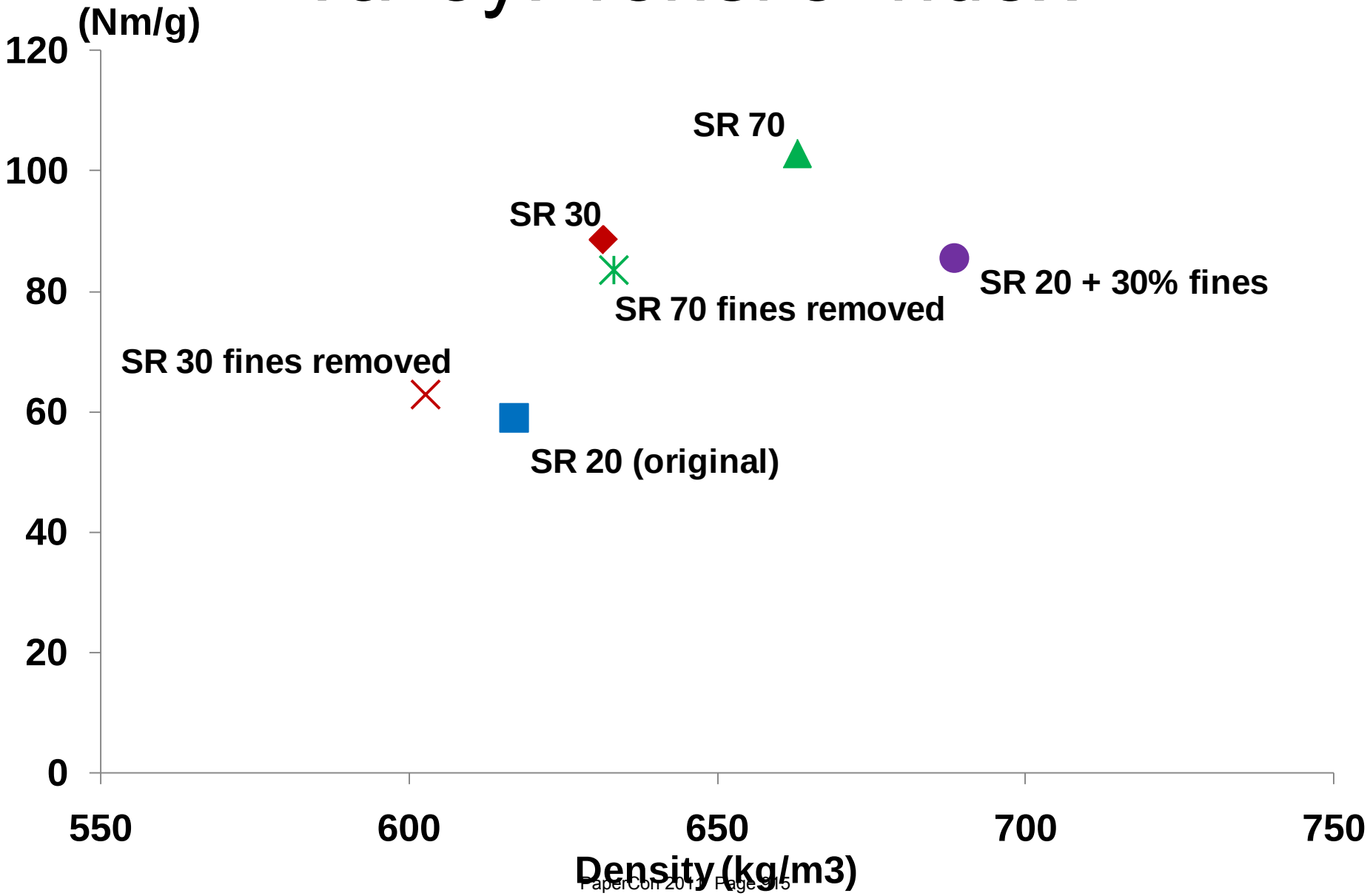
Summary: Wet web properties

- Refining and addition of fines:
  - Decreased dry content after wet pressing
  - Increased wet tensile strength and residual tension
- Removal of fines: Decreased wet tensile strength and residual tension

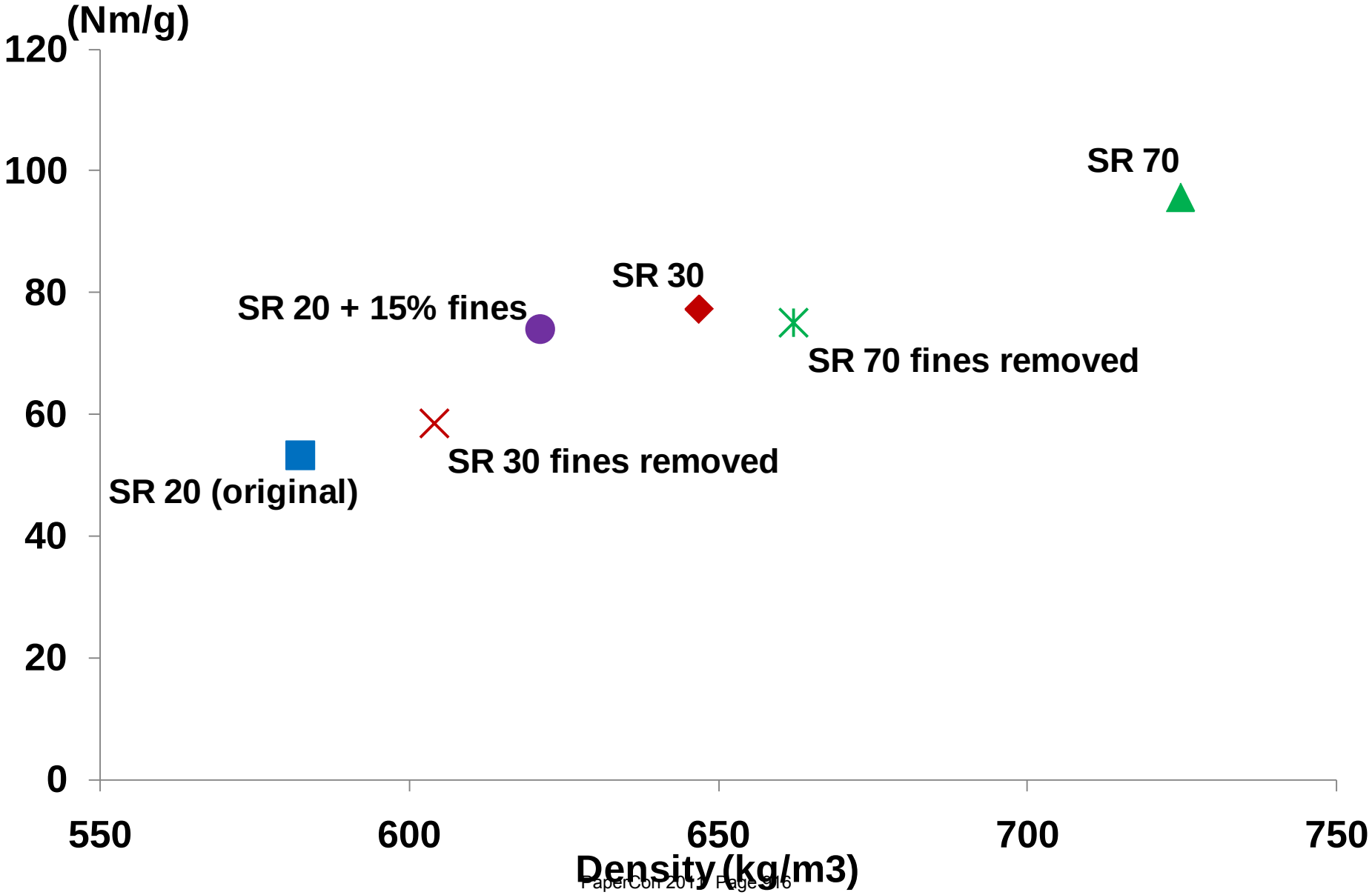
- Valley vs. ProLab:
  - Refining using Valley beater resulted in higher dry content after wet pressing
  - Slightly higher wet tensile strength at constant dry content
  - Slightly higher residual tension at constant dry content
- Fines important for wet tensile strength
- Fibre properties more important for residual tension

Dry web properties

Valley: Tensile Index



ProLab: Tensile index



Summary: Dry web properties

- Refining: Increased density and dry tensile strength
- Removal of fines: Decreased density and tensile strength
- Addition of fines: Increased density and tensile strength
- Valley vs. ProLab:
  - External fibrillation when Valley was used → slightly higher tensile strength than for ProLab
  - Shorter fibres when ProLab was used → higher density than Valley

Conclusions

- Refining important for the mechanical properties of paper
- Fines were important for the wet tensile strength
- Fibre properties more important for the residual tension
- Drawback: longer dewatering → further investigation needed