

Determination of the forces affecting runnability in the single-felted dryer section



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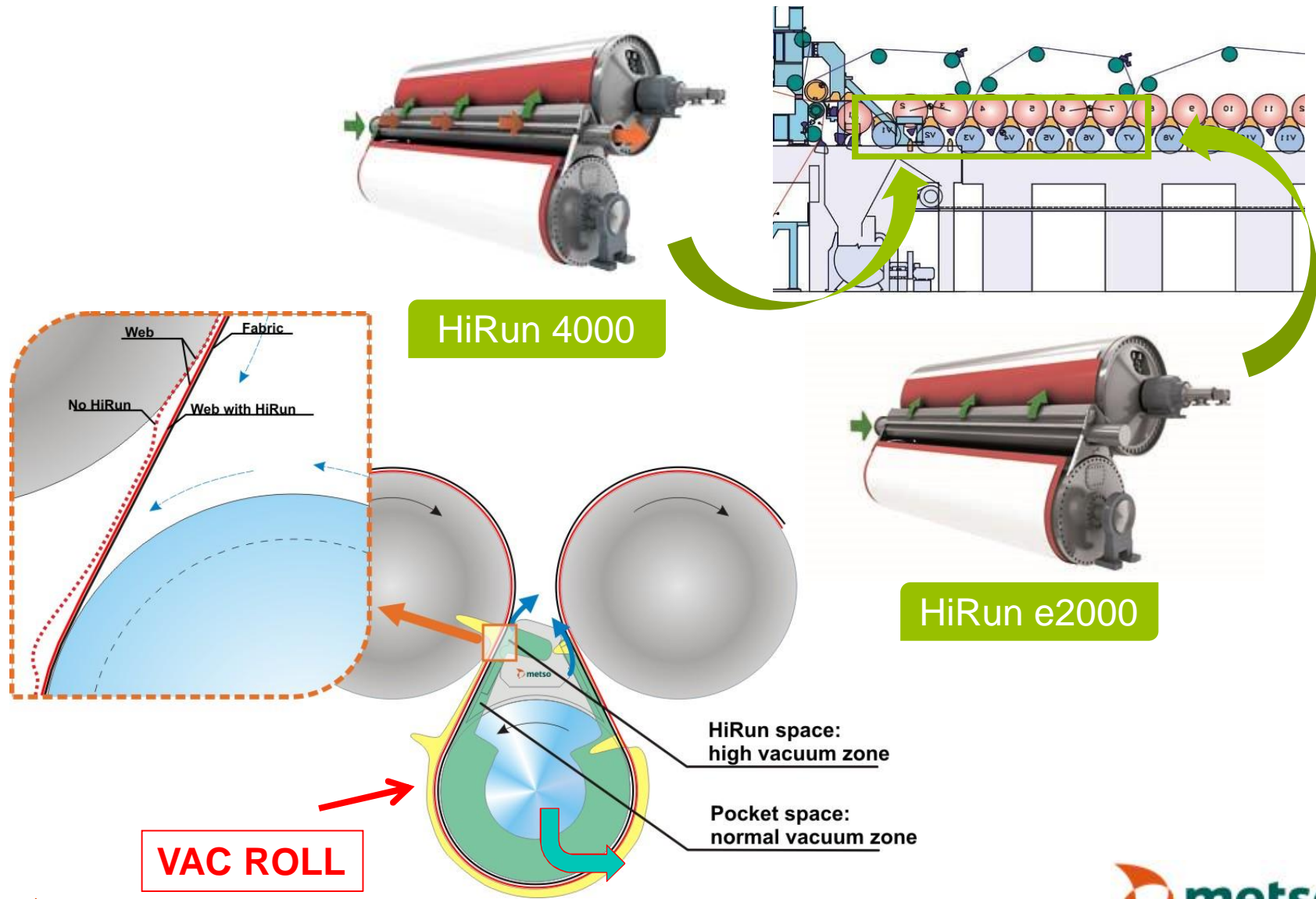
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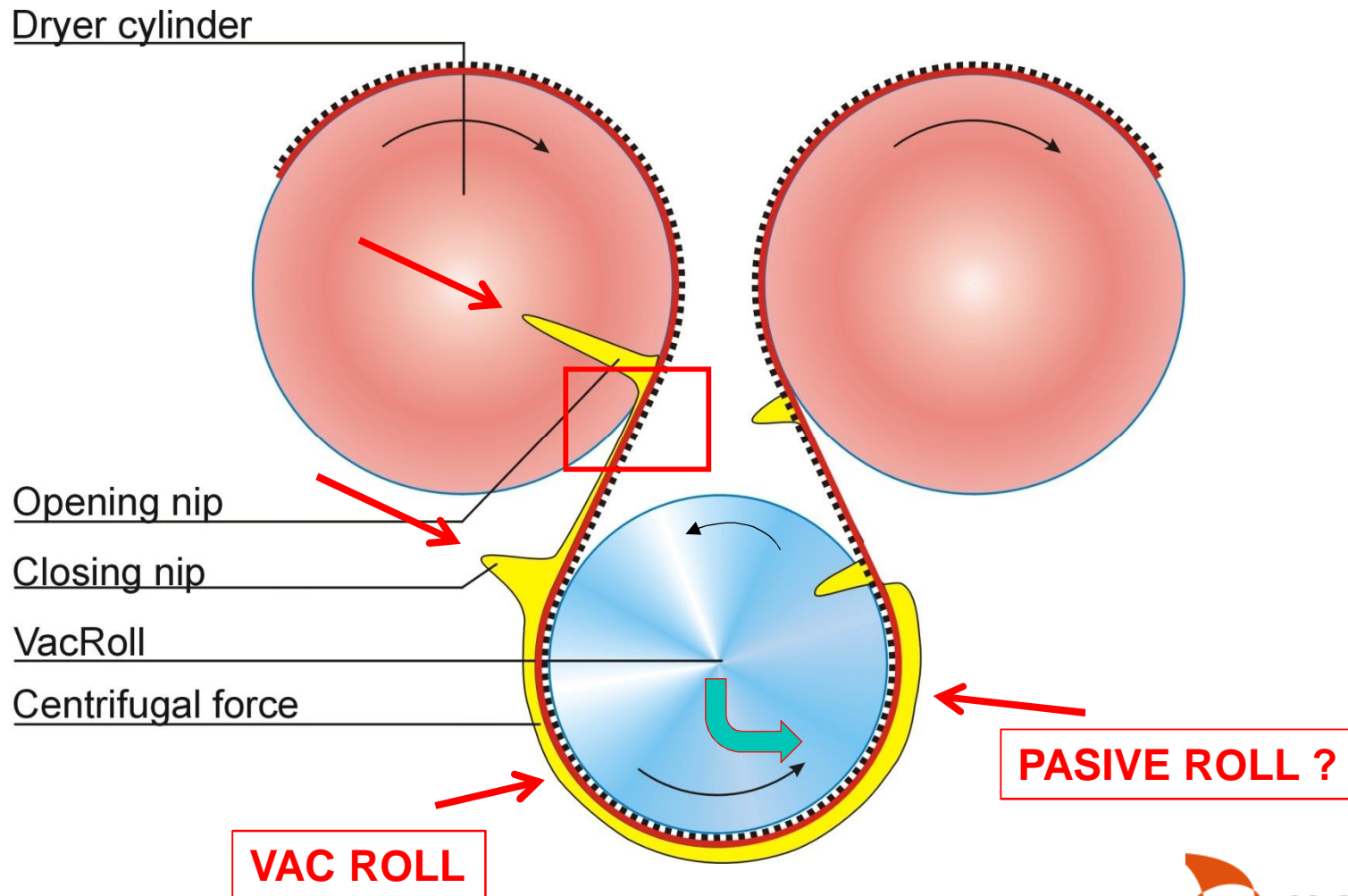
INTRODUCTION

- “ Runnability through the press and dryer section has always been an important issue for papermakers
- “ Air flow and boundary layer disturbances reveal themselves in many different types of runnability problems
- “ Some common problems that are observed are: difficult tail threading, edge fluttering, wrinkles, unnecessarily high draws, curling or edge flutterõ õ
- “ In particular, due to the natural vacuum effect in the opening dryer nip and the high adhesion forces of wet paper on the dryer surface, the paper web strongly tends to follow the cylinder rather than the dryer fabric.
- “ In order to resolve those runnability problems, it is necessary to understand, measure and determine forces that affecting paper in single felted section

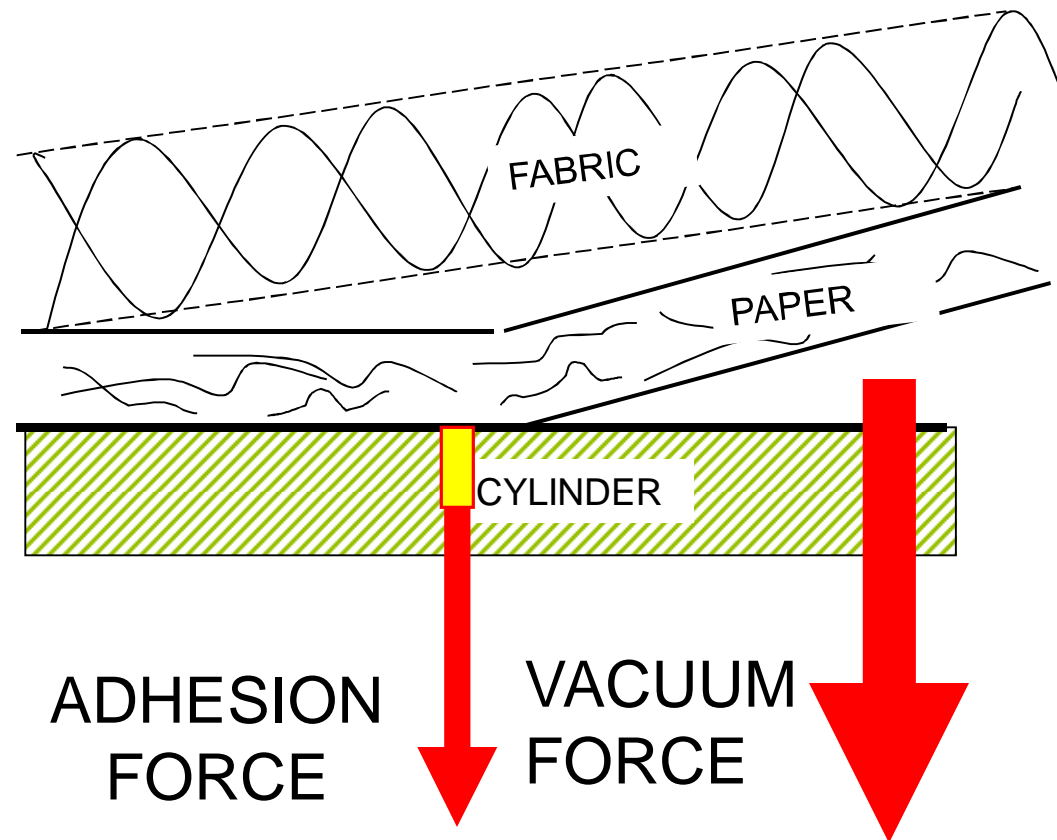
Paper Machine runnability (HiRun System)



Forces Affecting the Web in Single-Felting



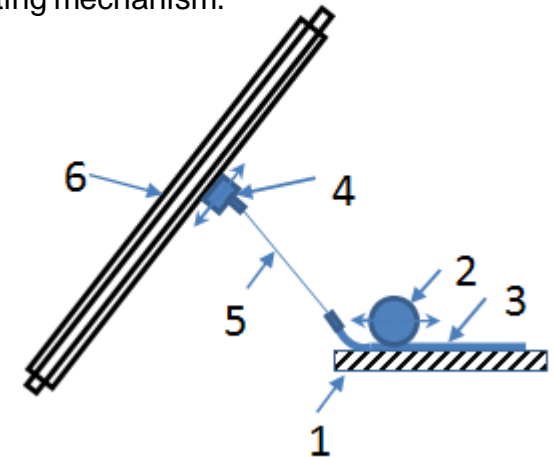
FORCES AFFECTING ON THE WET PAPER WEB IN THE OPENING NIP



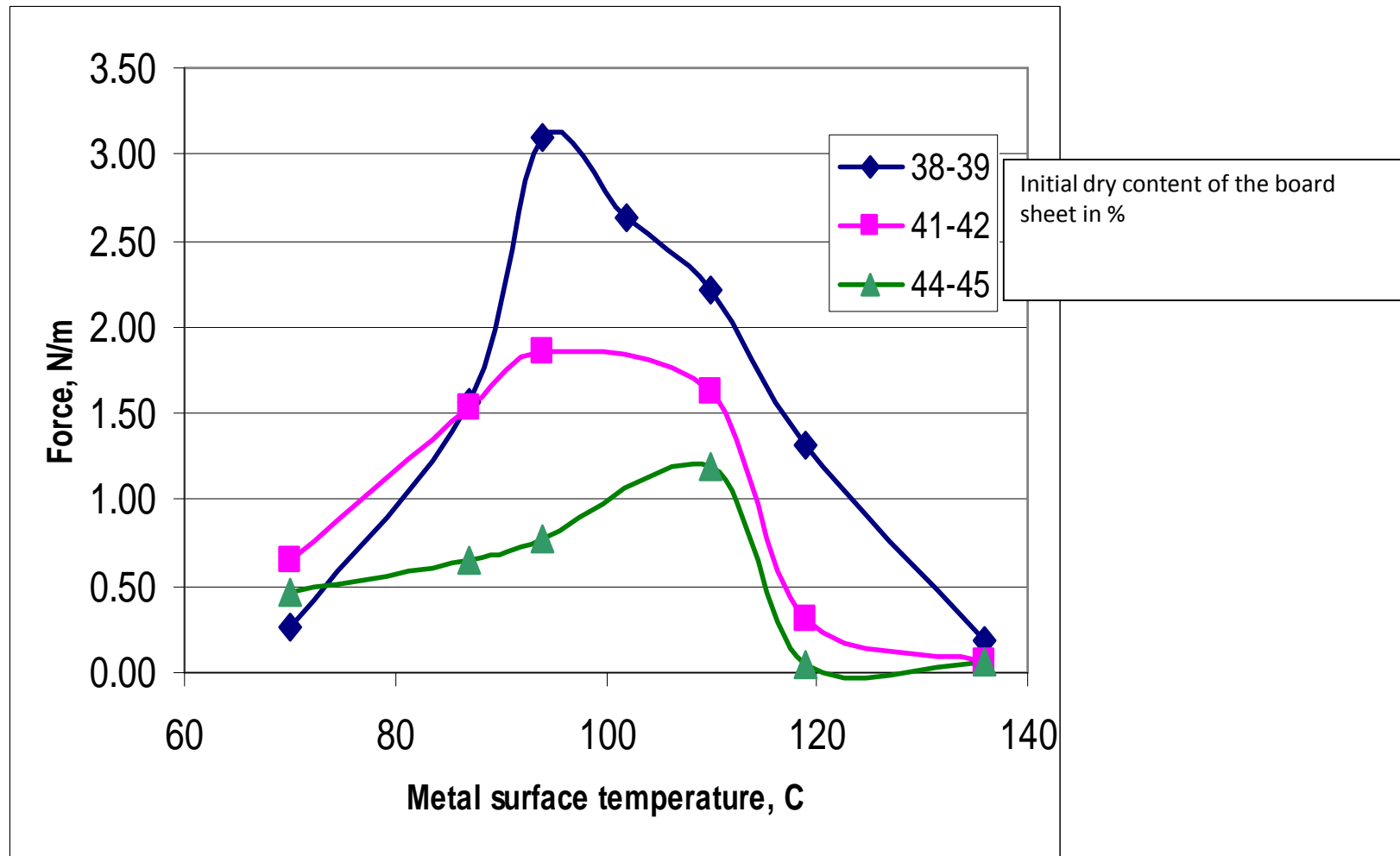
Adhesion test rig at Technical Research Center of Finland (VTT)



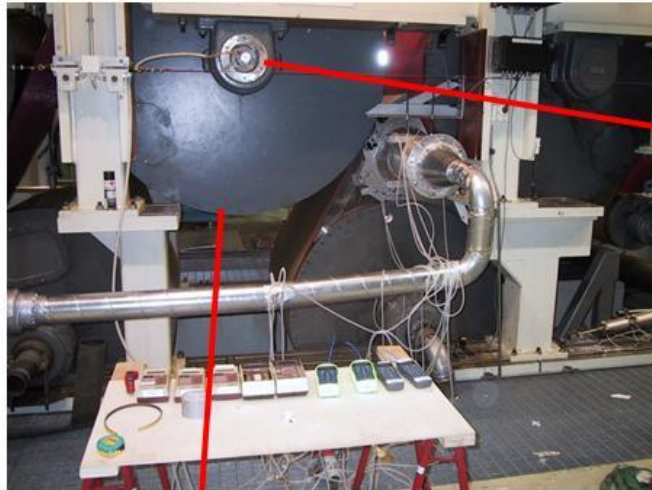
1-heated plate; 2-pressing roll; 3-board sample; 4-force sensor; 5-thread, connecting board sample with force sensor; 6-frame with lifting mechanism.



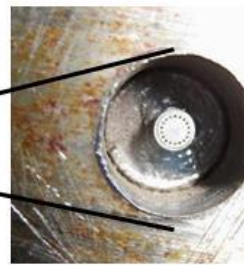
Adhesion forces as function of surface temperature and paper dry content



The circulation pressure measurement at pilot machine



Pressure sensor



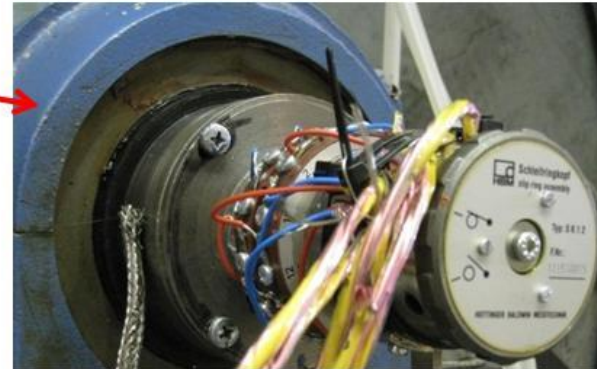
8 mm



Amplifier



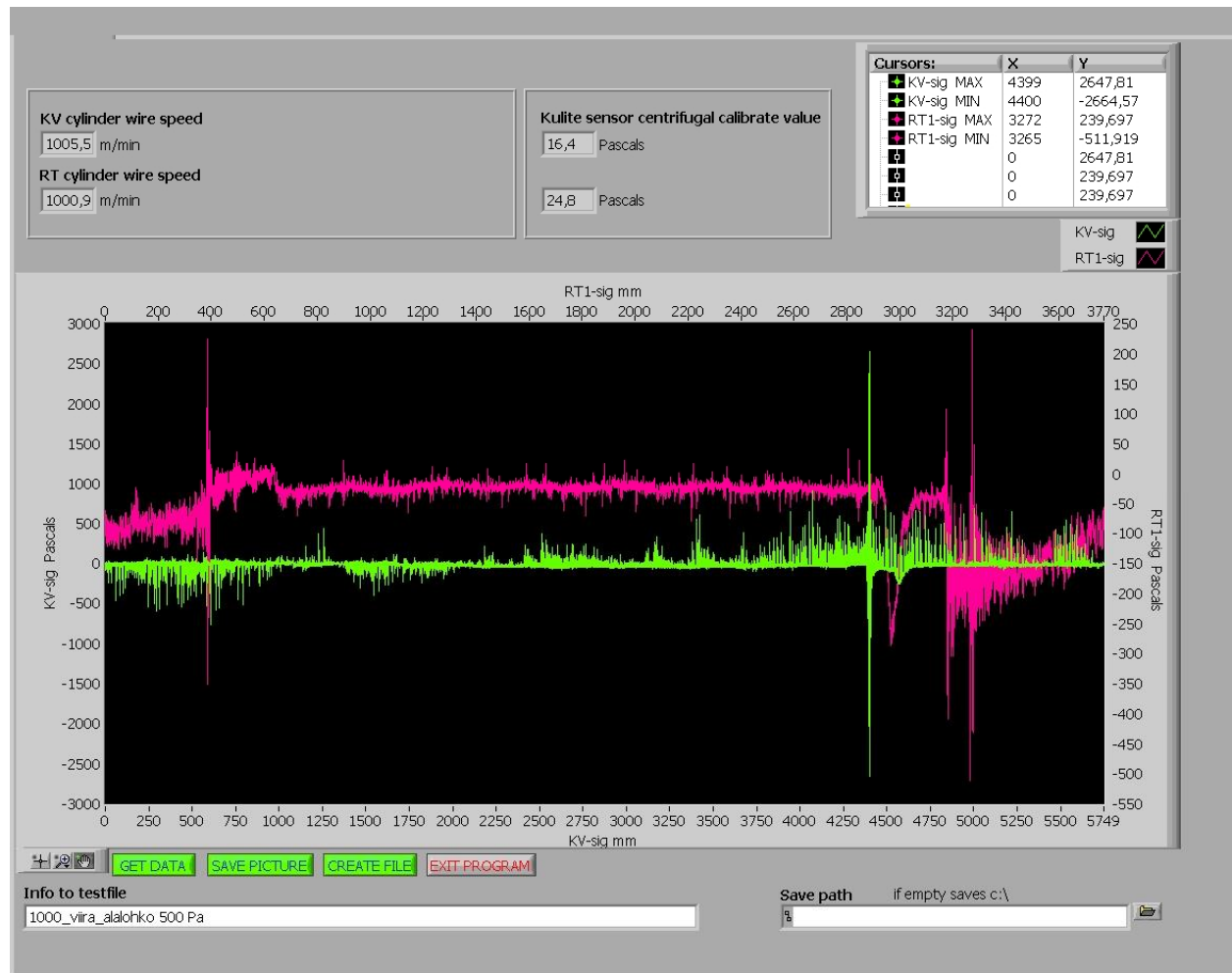
Slide device



Oscilloscope



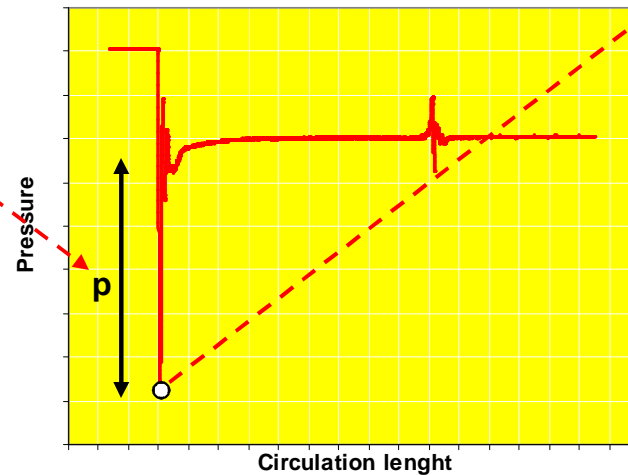
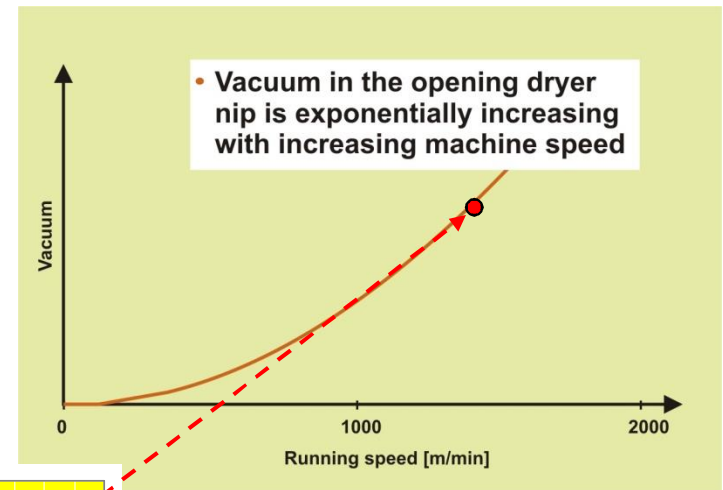
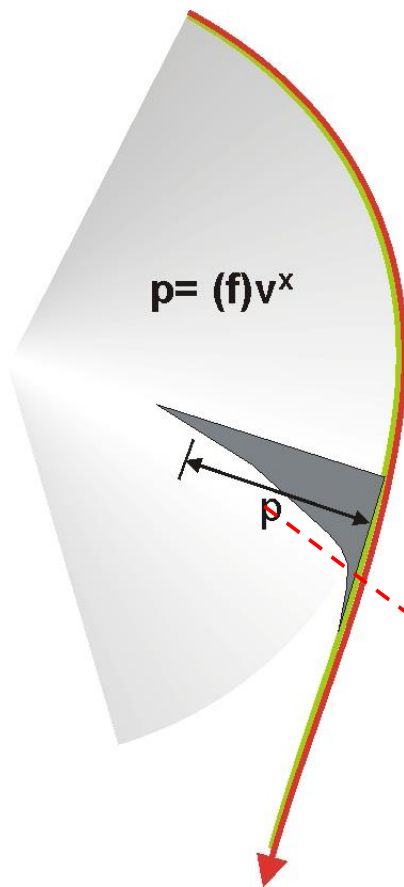
The circulation pressure measurement at pilot machine



Opening nip vacuum forces

Speed

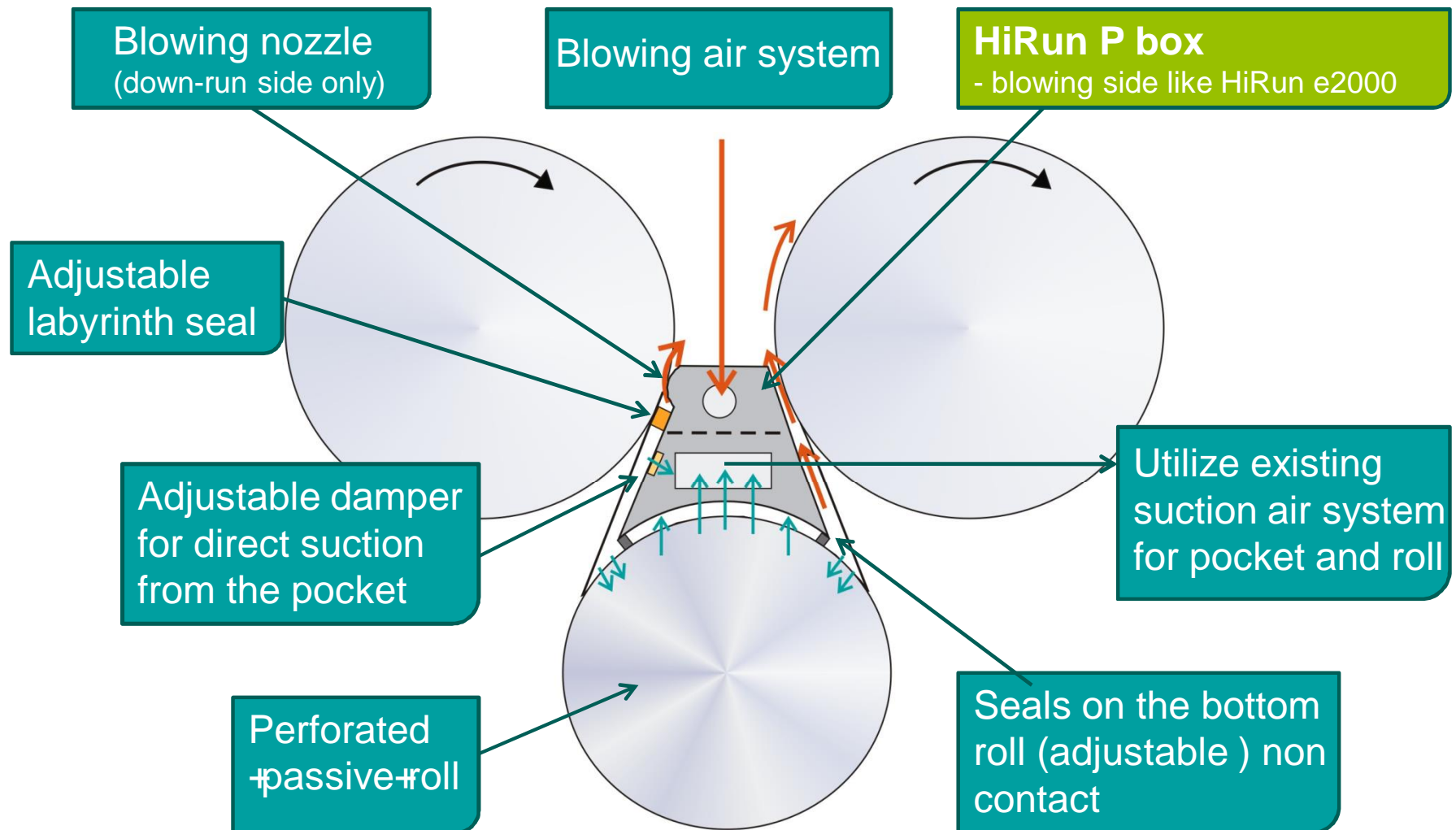
“ At higher speeds sheet tends to follow the dryer cylinder surface due to **adhesion and vacuum forces**



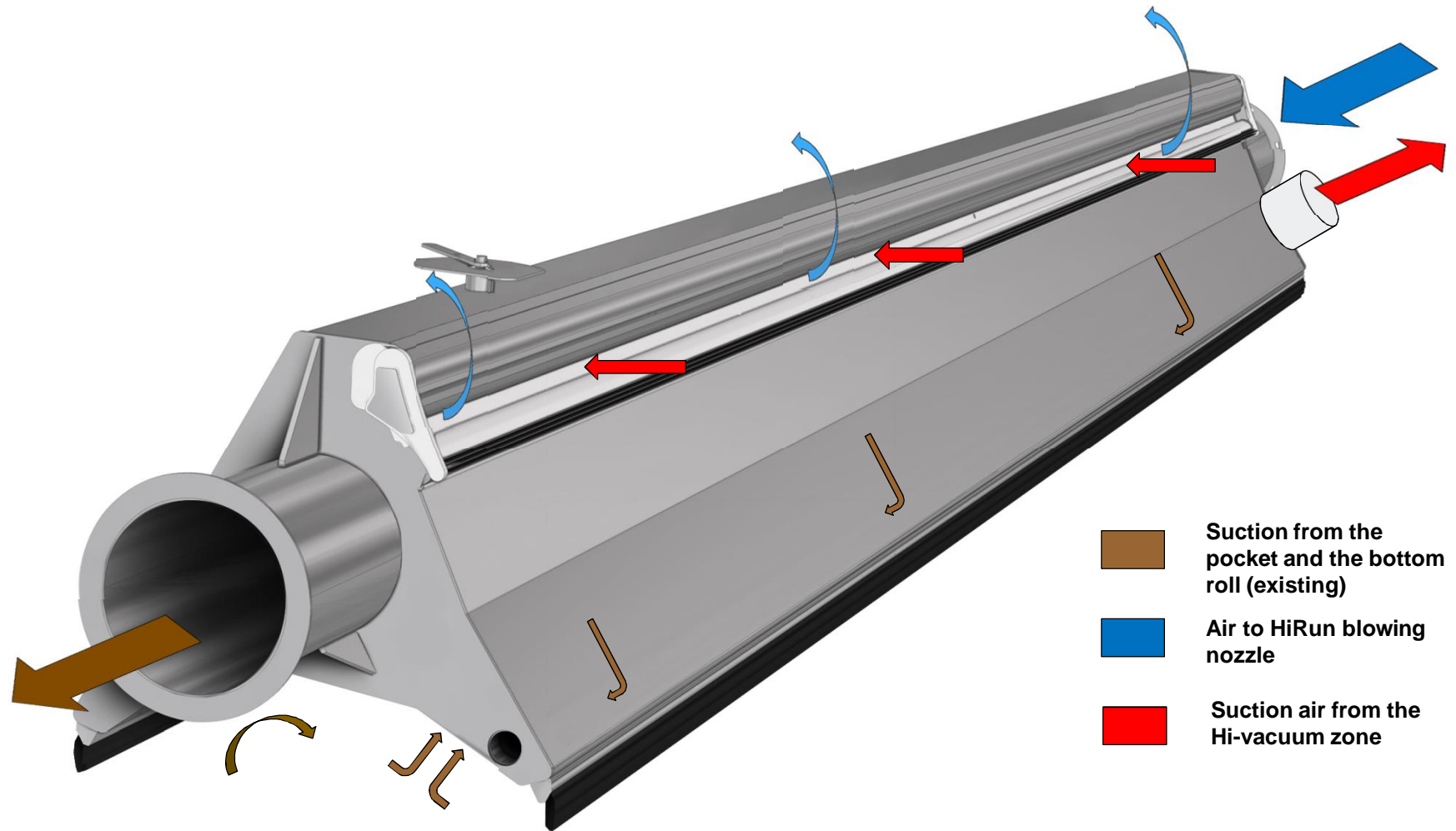
HiRun P for passive, perforated bottom rolls

- “ HiRun P stabilizer was specially developed for perforated bottom rolls in single-felting. The new concept utilizes the proven and well-functioning high-pressure blowing principle - technology which is used in all other HiRun installations all over the world.
- “ Now this same technology is available also for the perforated bottom rolls which are not having any direct suction connected to the roll itself.
- “ High vacuum level is created at the opening dryer nip area by high-pressure blowing resulting in excellent sheet runnability and effective tail threading.
- “ The vacuum to the pocket area and to the roll is created by suction from the HiRun P box . The stabilizer is equipped with good adjusting possibilities of the air flow and seal distances in order to optimize vacuums in each part of the pocket.

HiRun P for perforated rolls



HiRun P4000 for perforated rolls, Latest development to create 3000Pa vacuum!



Conclusions

- “Lack of exact data of the opening nip underpressure and the adhesion with wet web has been a problem in the analysis of the runnability problems
- “A method and equipment have been developed to measure the adhesion.
- “Maximum adhesion forces in both static and dynamic conditions were observed at hot surface temperature between 80-120 C.
- “The opening nip pressure distribution is determined with sophisticated measuring instruments for different PM speeds and conditions
- “New SymRun E blow box concept is saving up to 50 % of fan energy
- “New runnability solution Hirun P for drying section with perforated passive rolls is developed and delivered for the first 2 references.