The Journey to Autonomous Injection Molding

From stable processing to full autonomous control – Part 1

Webinar Presented By: Bob Reese, Senior Client Solutions Consultant

A Global Company

Locations in 9 countries

80 qualified trainers worldwide

150+ employees worldwide

*To give our clients a competitive advantage by leveraging knowledge from **inside the mold**.*

CORE FOCUS

AGENDA

01 What is autonomous molding?

02 RJG's history in autonomous process control

03 Decoupled III processing

04 RJG's next phase of development to support Autonomous process control.

What is Autonomous Injection Molding?

A next generation molding process that uses real time data from both the machine and within the mold. This information is used to self adjust molding parameters maintaining quality part production without human intervention.

How Will Autonomous Molding Influence our Industry?

- **Grow your business without growing your workforce.**
- **Produce higher quality products without increasing human capitol.**
- **Leverage the ability to utilize a wider range of materials.**
  - Lower cost, wide spec. material.
  - Diversification of material supply chain
- **Increase efficiency**
  - Scrap reduction
  - Less downtime

1962 -Rod developed the first cavity pressure sensor.

1967 – Control Process Inc. Developed the first strain-gauge cavity pressure sensor for commercialization.

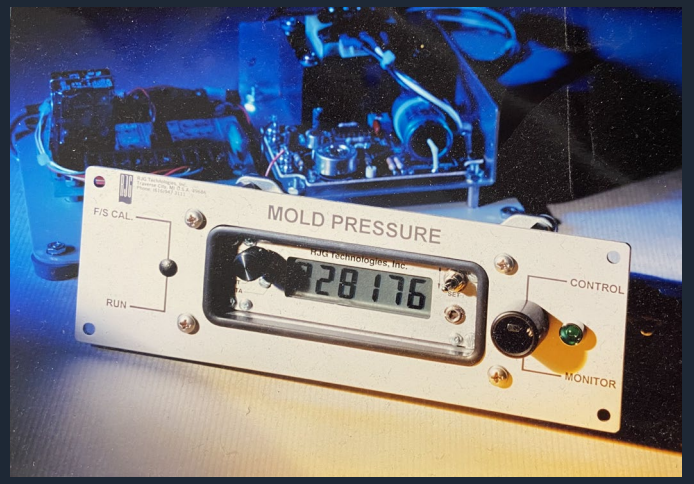
1968 – First large-scale cavity pressure application was launched at Polaroid for molding camera lenses.

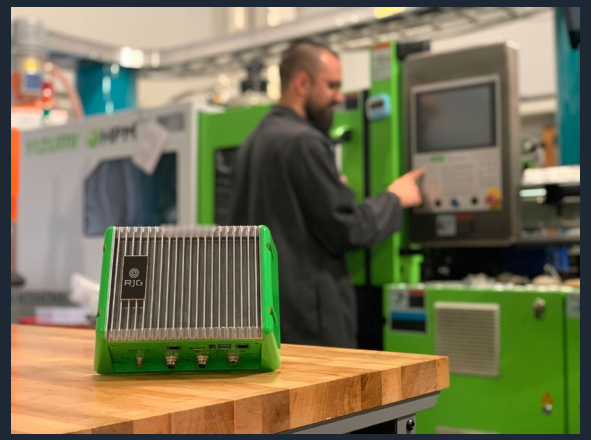
1985 – RJG Associates Inc. was founded to provide training and consulting on De-coupled molding. These training offerings were developed as a result of the knowledge gained by understanding what was happening inside the mold.

1989 – RJG Inc. was founded as an equipment, software and sensor company to provide a data acquisition package to the industry for monitoring and controlling by cavity pressure.


RJG Technologies Inc.
Traverse City, Michigan
49684 USA Ph 616-947-3111
Model DART-1002-I
Cal # NET 1
S/N 942168


DART
PAK


MOLD PRESSURE
F/S CAL
RUN
CONTROL
MONITOR




eDART

No Autonomy
(Human performs all tasks)

- Process development
- Process set-up
- Process start-up
- Process monitoring
- Process maintenance

Partial Autonomous Process Control
(Automated process control)

- Process development
- Process set-up
- Process start-up
- Process monitoring
- Process maintenance of packing phase

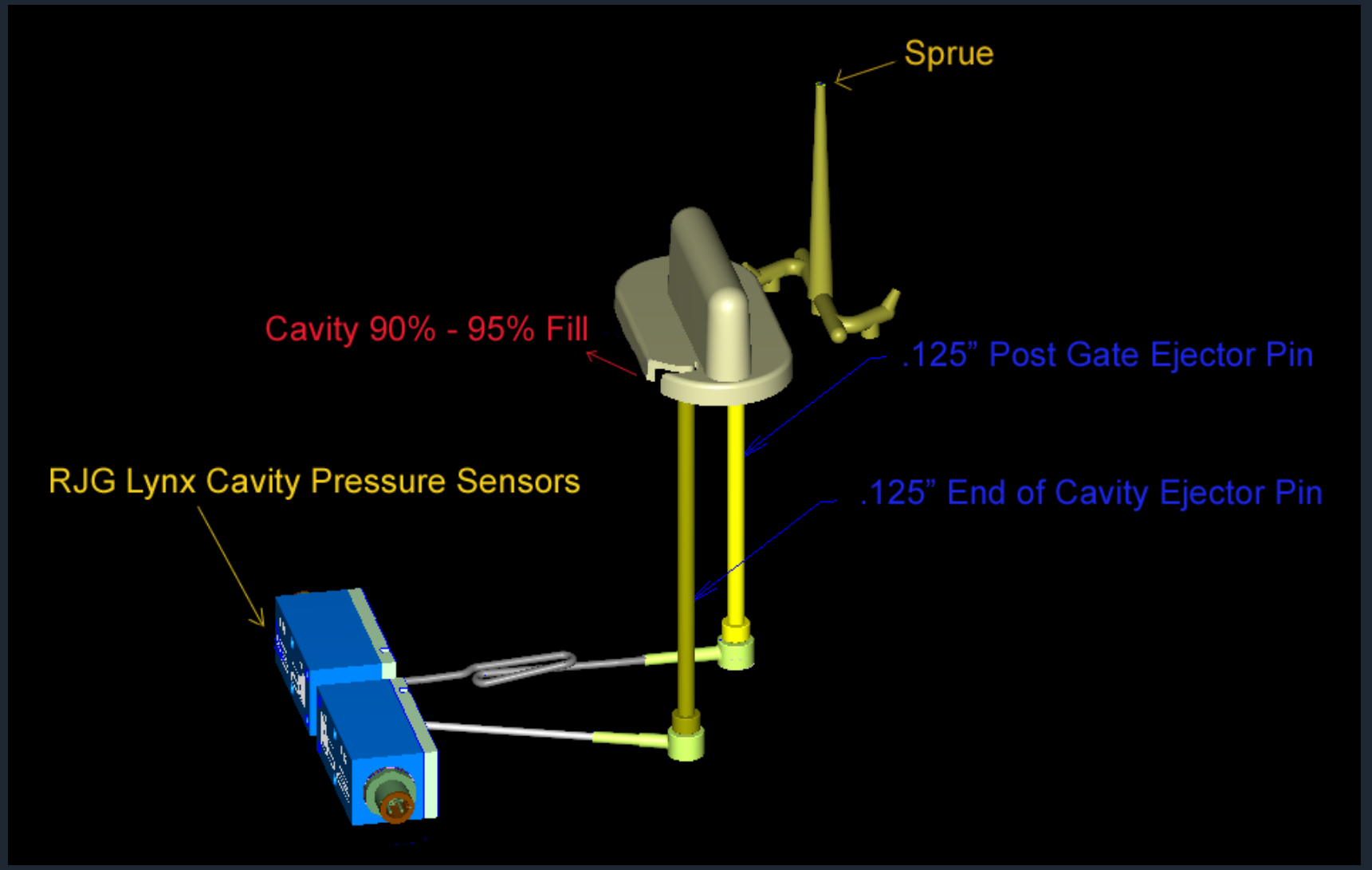
Full Autonomous Process Control

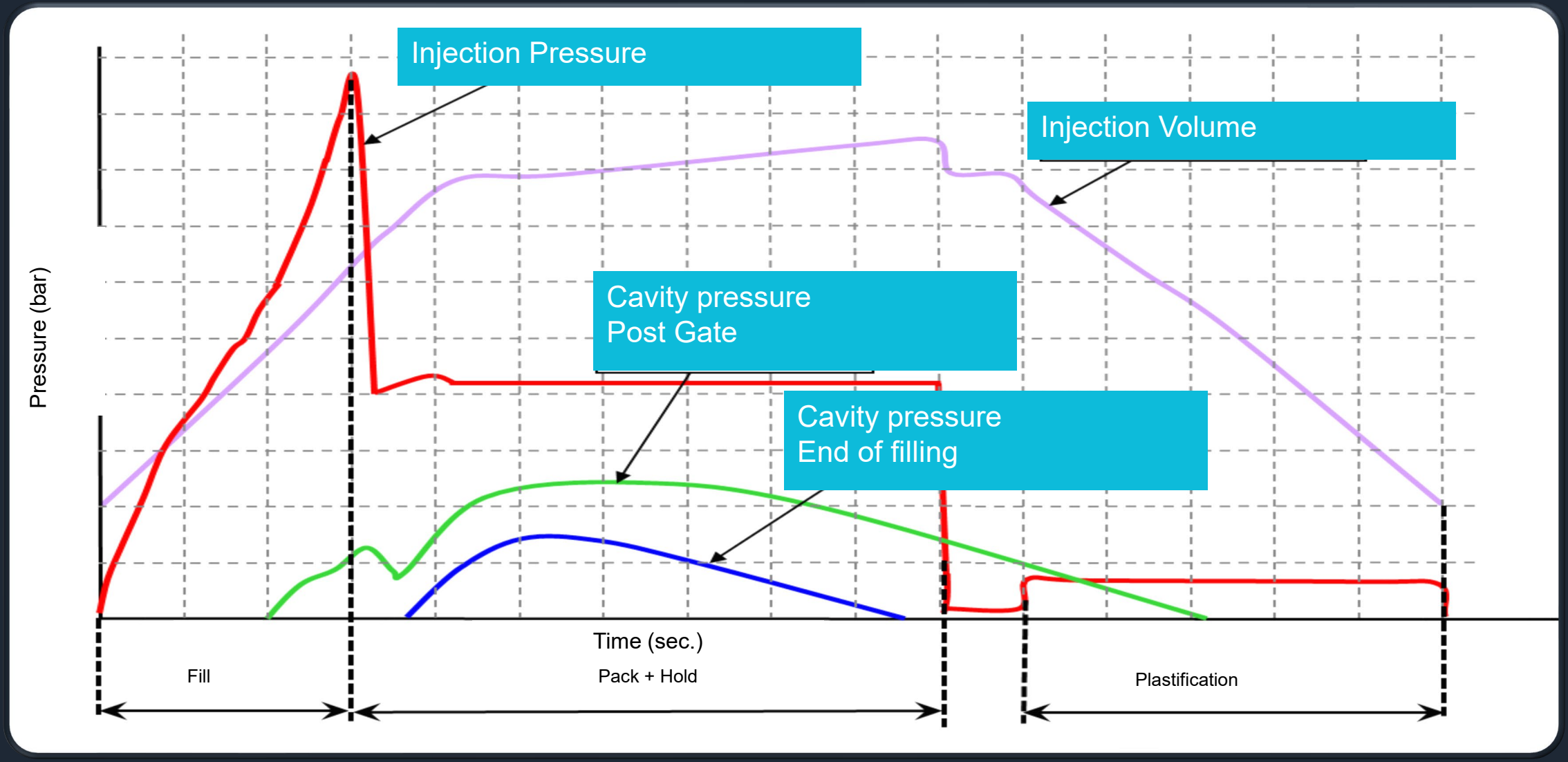
- Process development
- Process set-up
- Process start-up
- Process monitoring
- Process maintenance of filling, packing and cooling

Sensor strategy is paramount in successful autonomous molding development

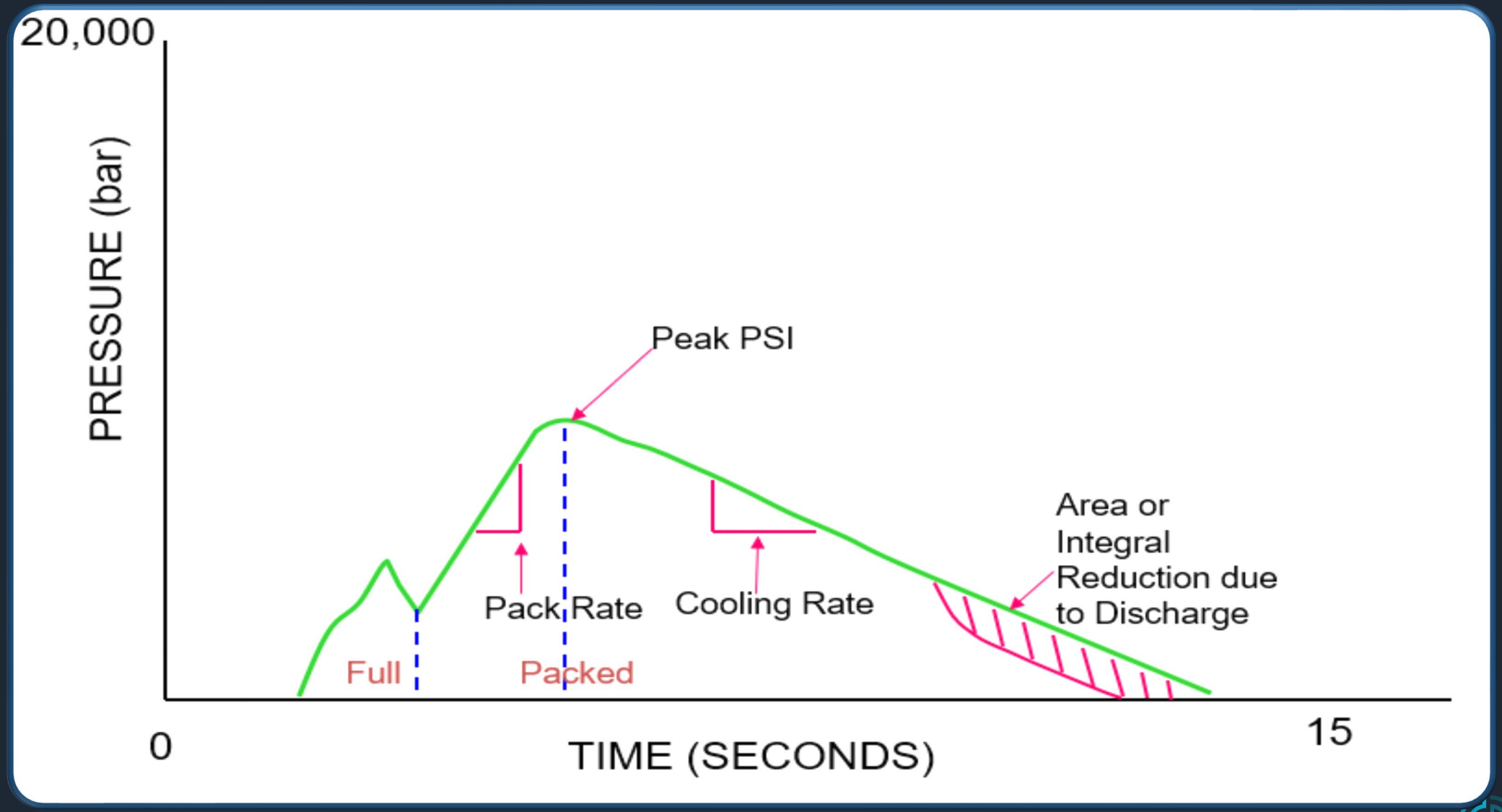
- **Algorithms and accuracy of AI engines are only as good as the input data.**
- **Machine input data is not enough. Too many variables downstream of the nozzle.**
- **Many are attempting Autonomy without in-cavity sensors but with limited success.**

Typical sensor installation

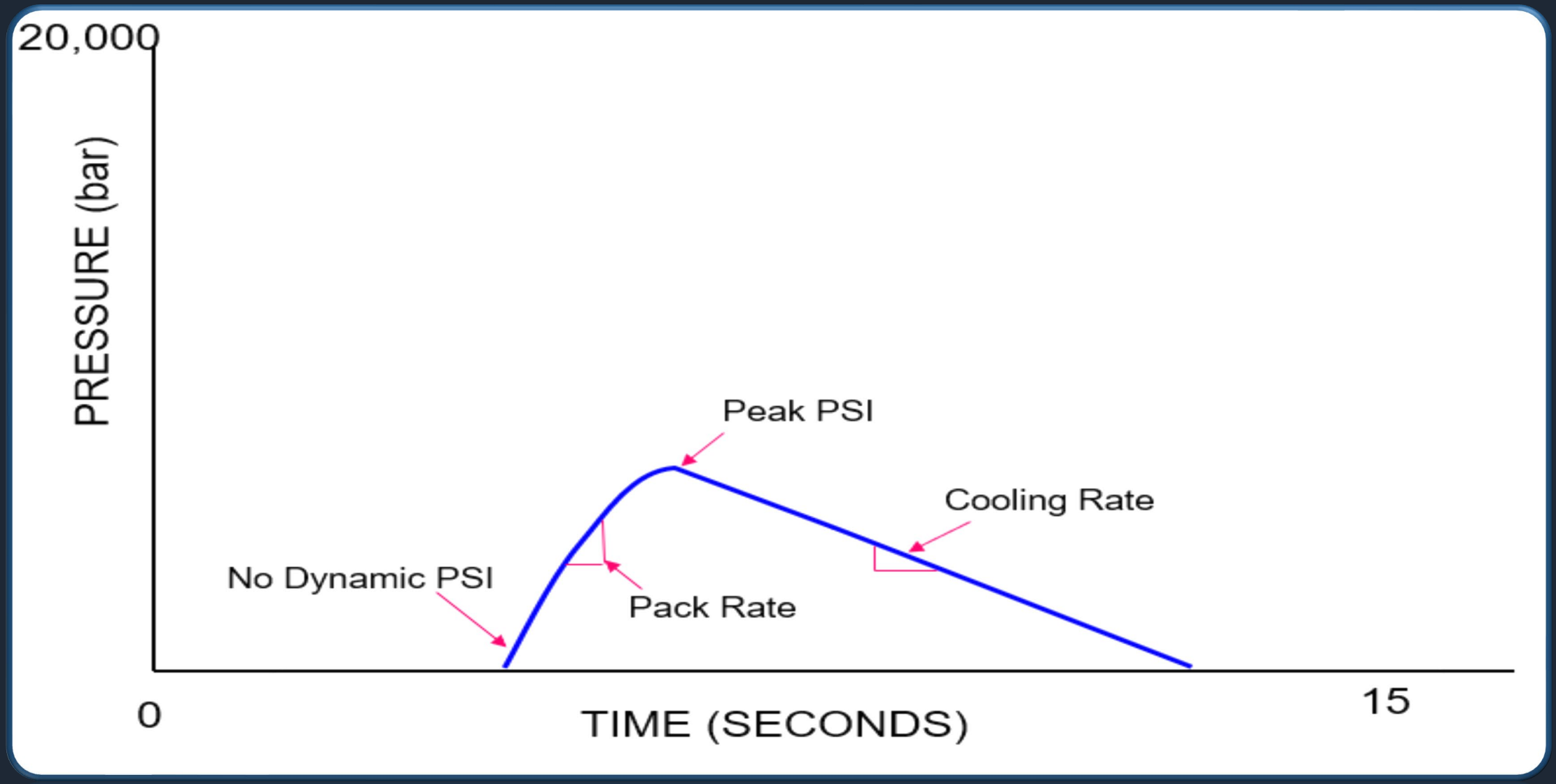



Injection Pressure
Injection Volume
Cavity pressure
Post Gate
Cavity pressure
End of filling
Pressure (bar)
Time (sec.)
Fill
Pack + Hold
Plastification

Post Gate Data

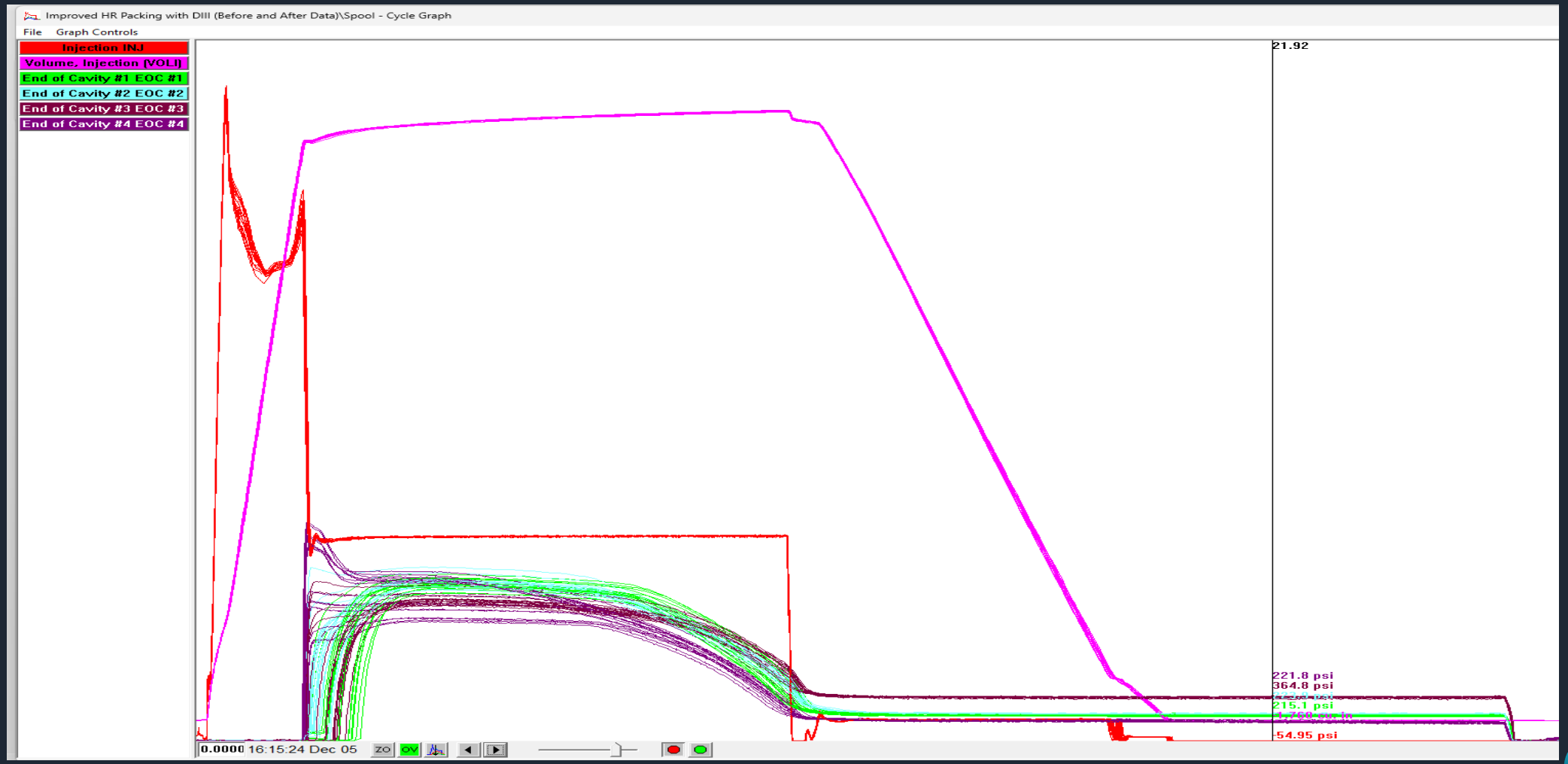


End of Cavity Data

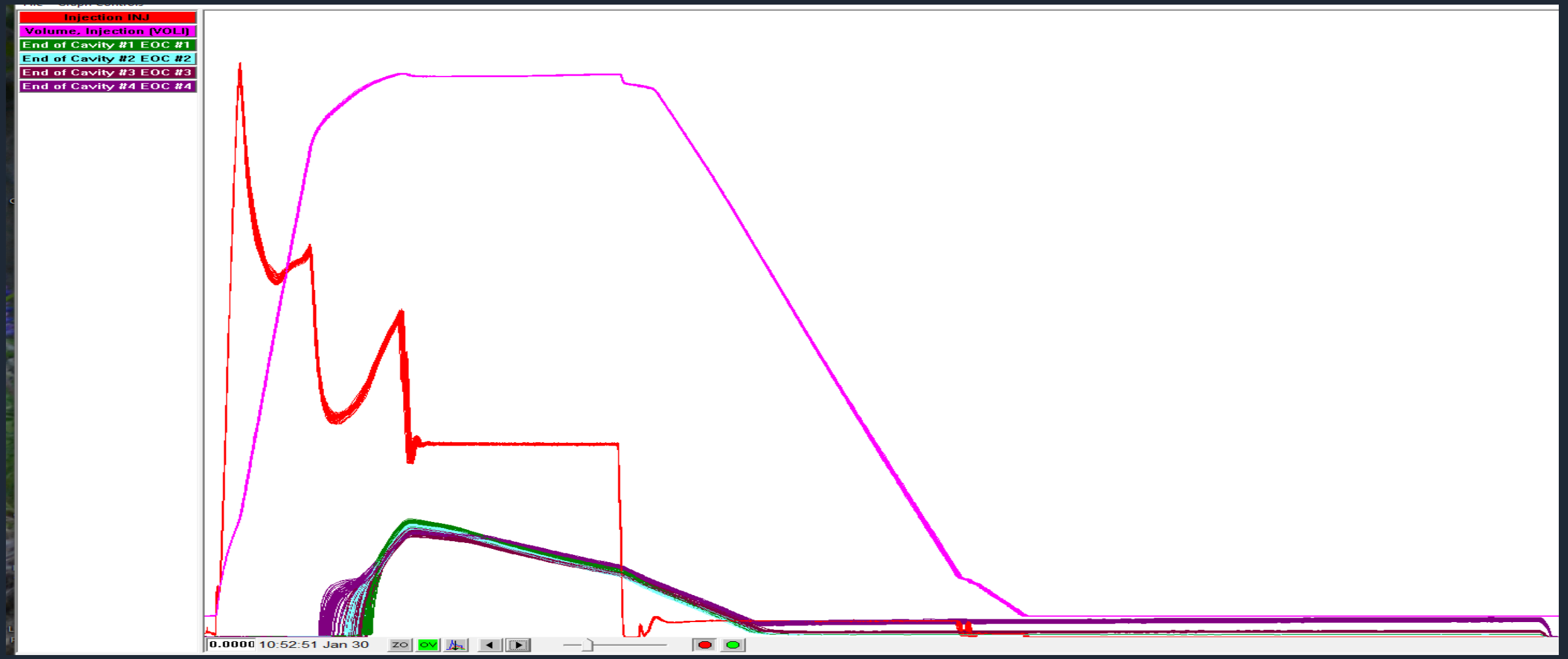


30 shots overlayed – Machine only information.

Same 30 shots overlayed showing the variation in the cavity.

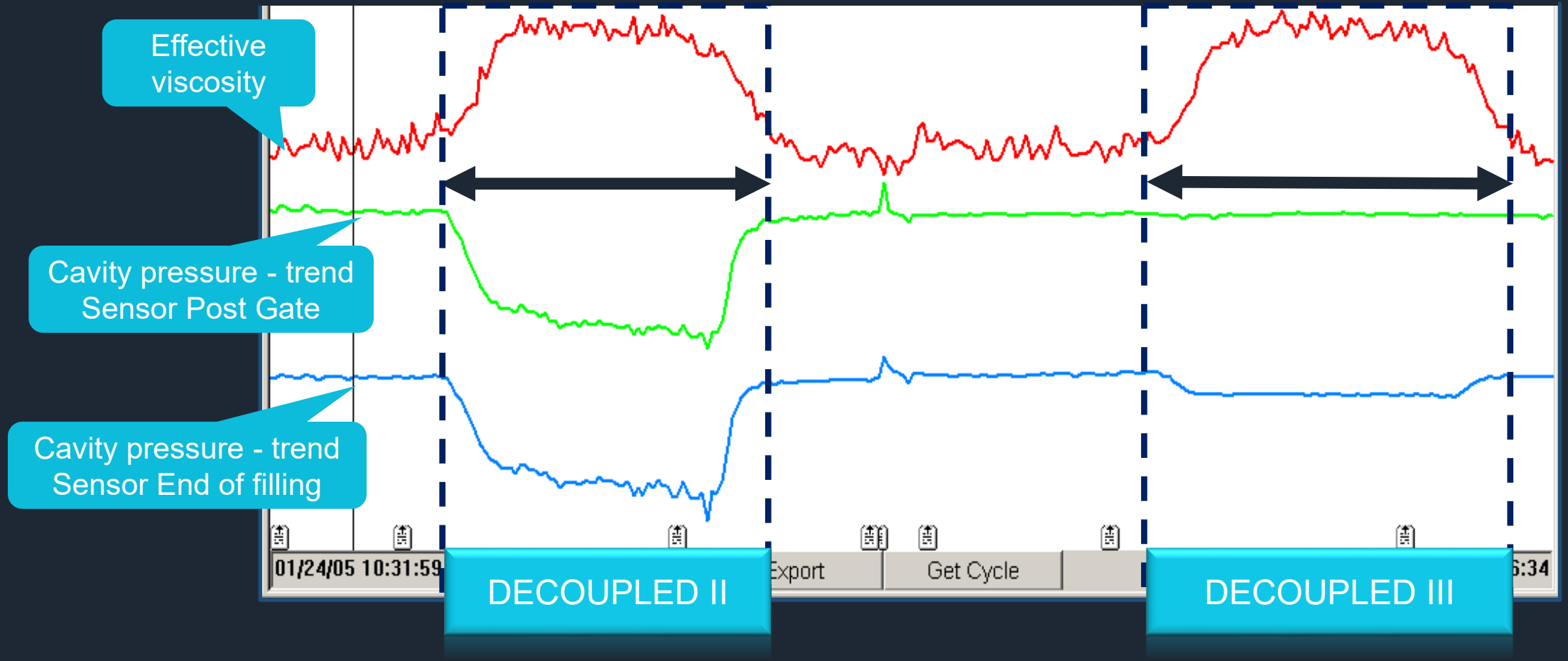


DECOUPLED III Cavity Pressure Control



Why use DECOUPLED MOLDING®

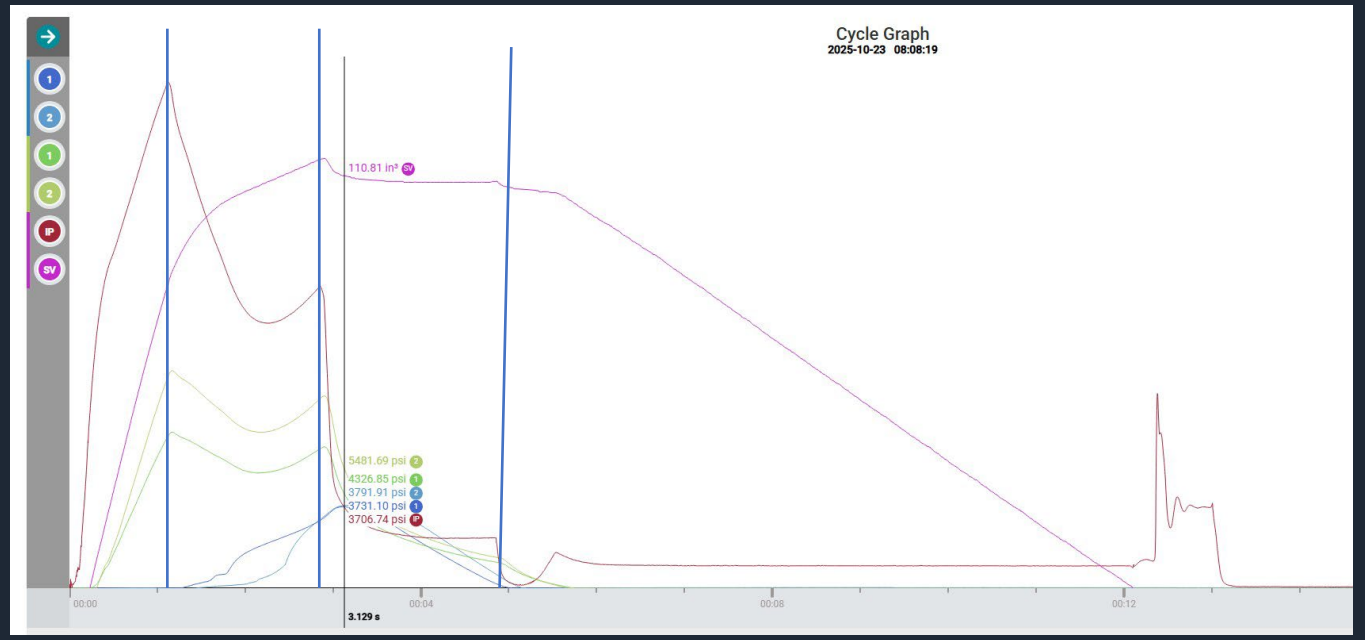
Process simulation with 11% viscosity increase



Stage 1 – First-Stage Fill (Velocity Control):
The screw moves forward at a controlled velocity to fill approximately 95–98% of the cavity with plastic. This stage is controlled by injection velocity, not pressure. Its end is pre-determined by a set screw position ensuring a consistent fill only part volume.

2nd stage Pack - Transfer from velocity 1 (fill) to velocity 2 (packing velocity):
Pack at that pre-determined velocity until the control sensor in the cavity reaches a pre-determined pressure. The goal is to pack out the part and compensate for material shrinkage as the polymer cools, without overpacking or distorting the cavity

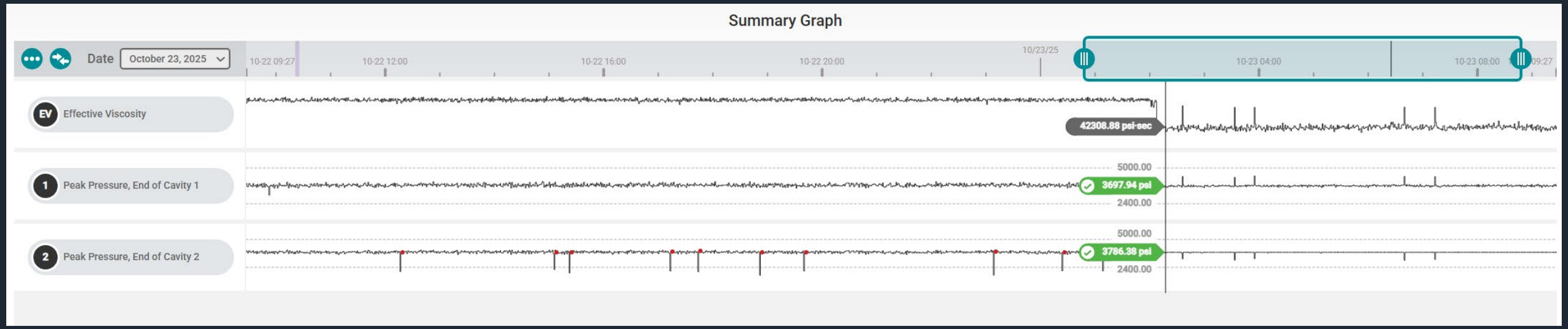
3rd stage - Hold (Pressure):
The third stage maintains sufficient pressure to keep material in the cavity until the gate freezes. This ensures dimensional stability and consistent part weight.



1st stage Velocity controlled to a pre-set screw position

2nd stage Velocity controlled to a pre-set cavity pressure

3rd stage Pressure limited hold pressure for a pre-determind time



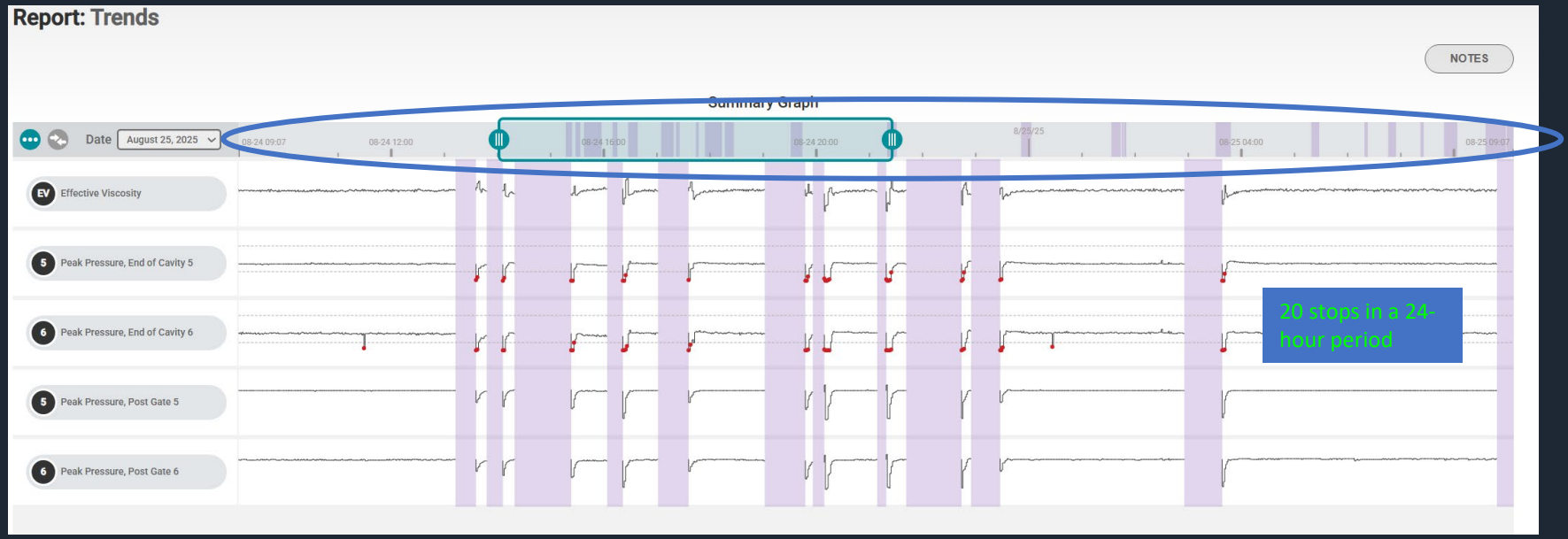
Viscosity changes as a new lot of material is introduced but the end of cavity pressure remains the same.

These summary graphs are the same. The cursor is highlighting the cavity pressure before and after the viscosity change.

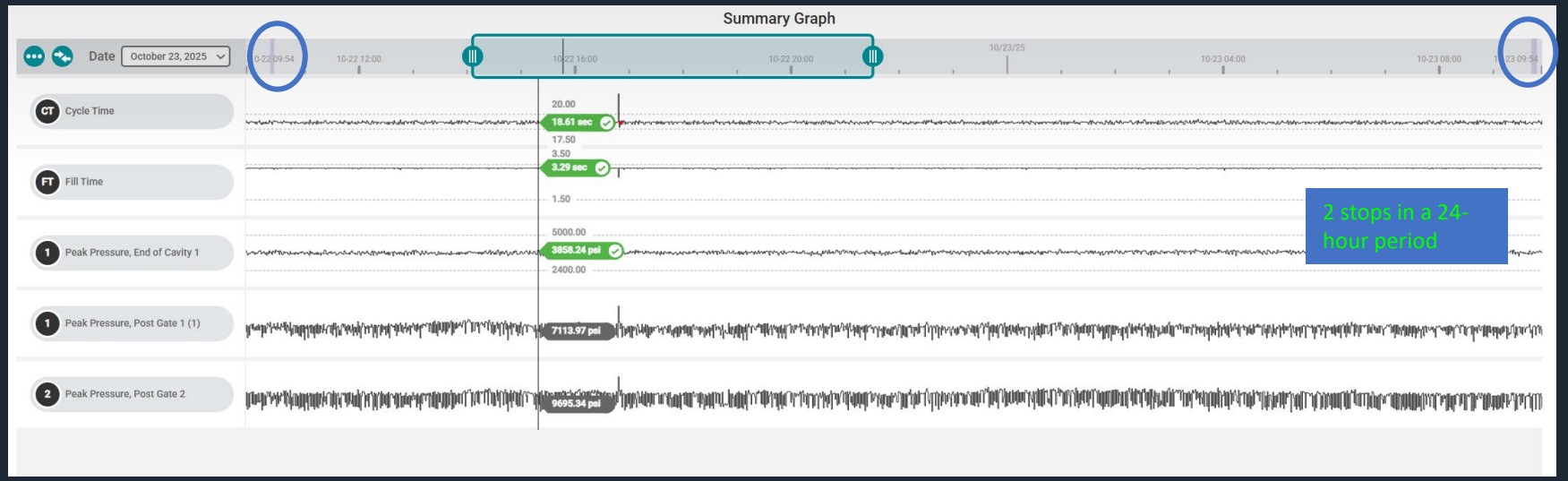
Up-time is a major factor in profitability

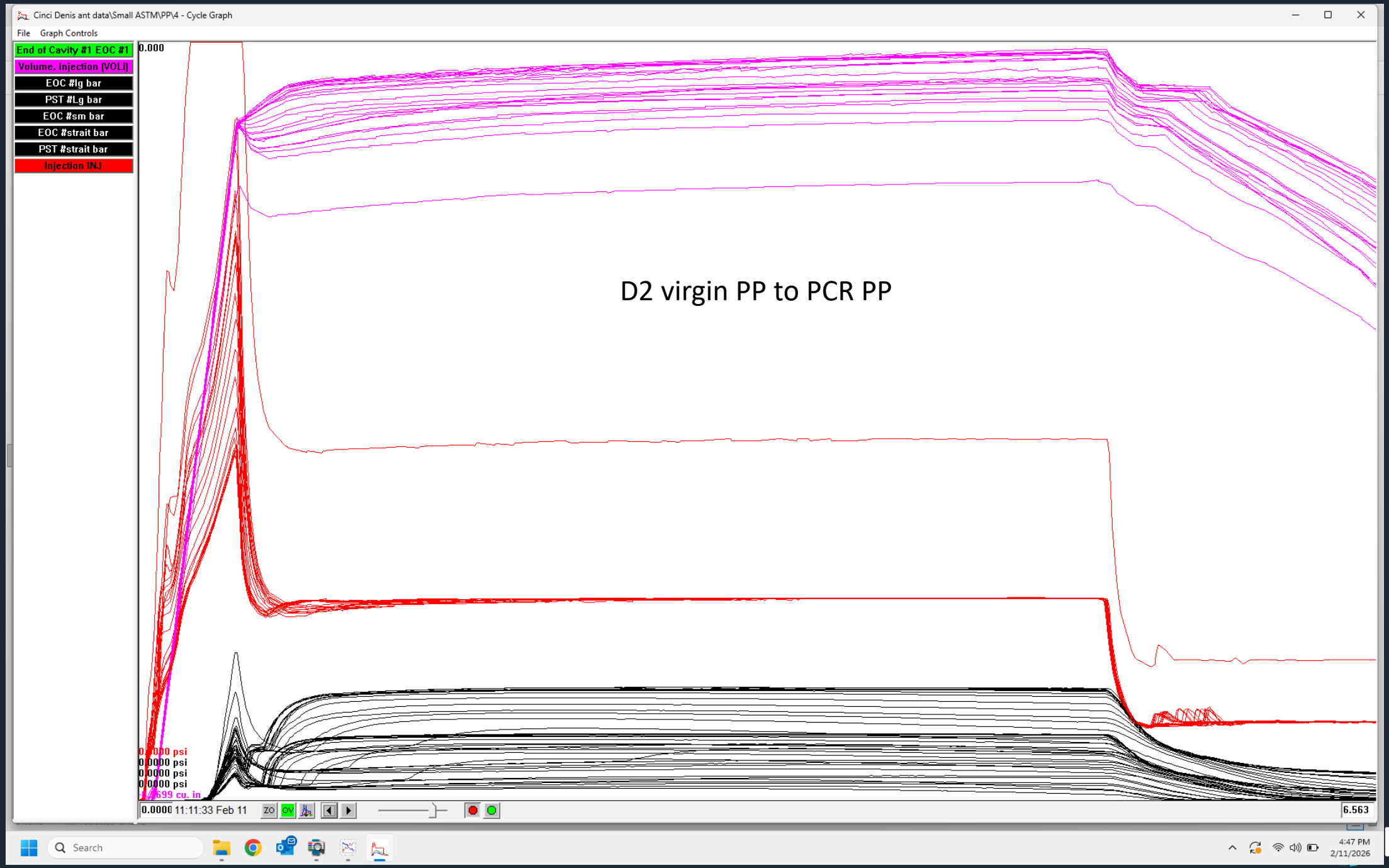
- Machines running good products at the fastest possible cycle time is in most cases the largest factor in molding profitability.
- If machines break cycle multiple times a day for things like stuck parts, robot missing parts, short shots, quality confirmation etc. it takes longer to run the order quantity.
- This along with the re-start of the machine requires lost productive labor.
- There is also additional scrap that can be generated at start-up.

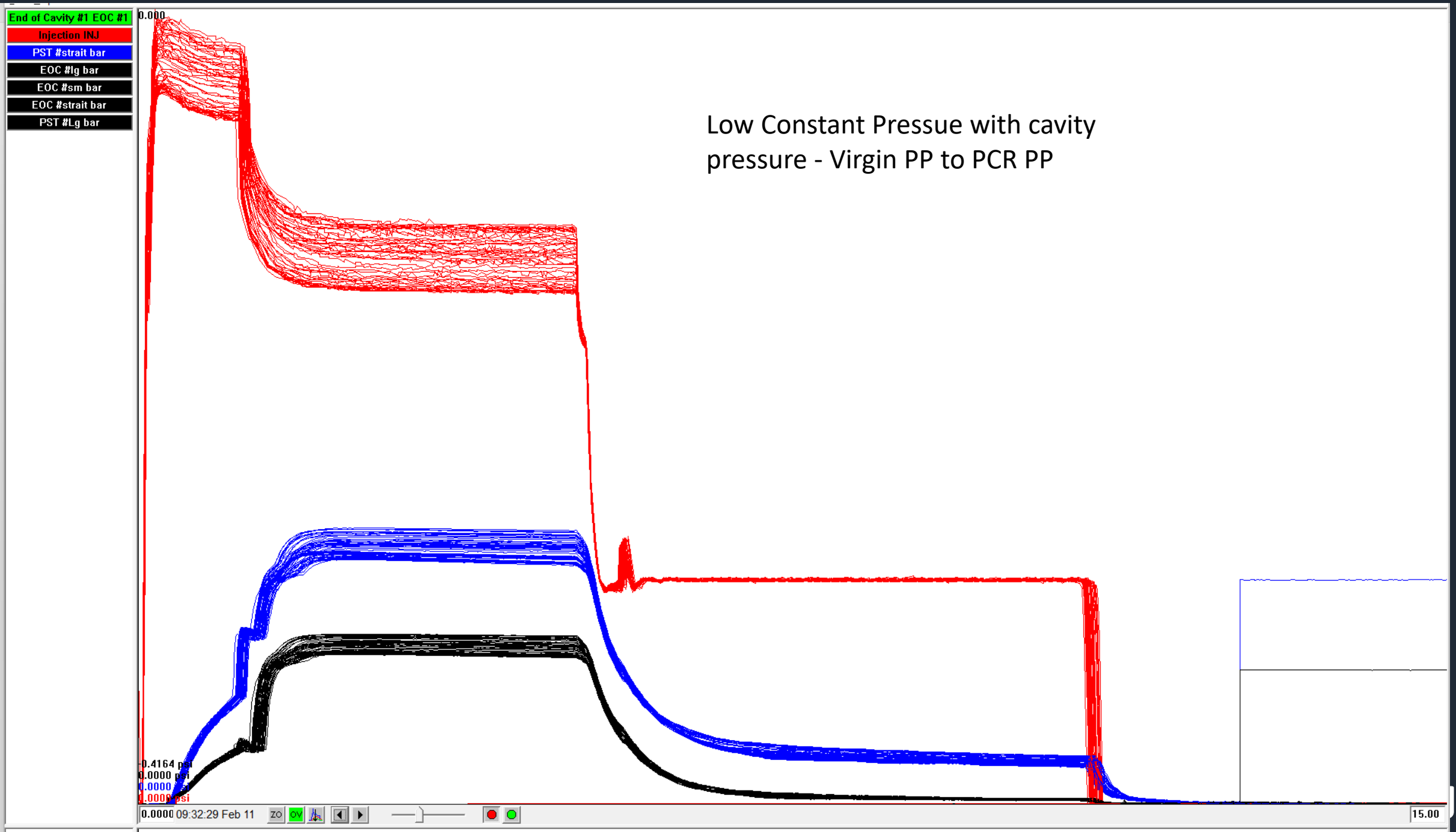
Downtime recorded for a conventional D2 process over a 24-hour period

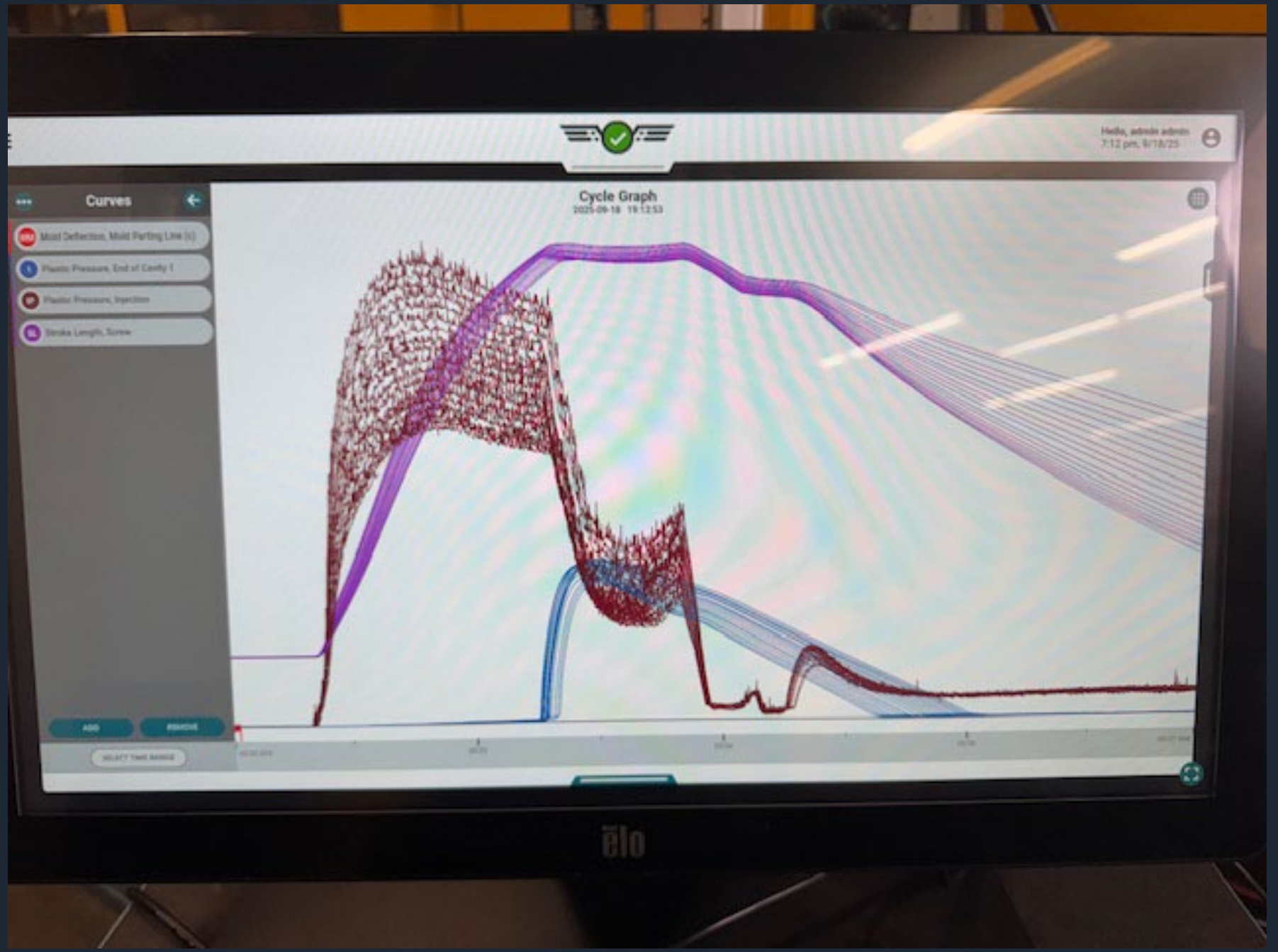


Downtime recorded for a Decoupled 3 process over a 24-hour period




Cinci Denis ant data\Small ASTM\PP\4 - Cycle Graph
File
Graph Controls
End of Cavity #1 EOC #1
Volume, Injection (VOLI)
EOC #lg bar
PST #Lg bar
EOC #sm bar
EOC #strait bar
PST #strait bar
Injection INJ
0.000
D2 virgin PP to PCR PP
0.0000 psi
0.0000 psi
0.0000 psi
0.0000 psi
0.0000 11:11:33 Feb 11
6.563
Search
4:47 PM
2/11/2026


End of Cavity #1 EOC #1
Injection INJ
PST #strait bar
EOC #lg bar
EOC #sm bar
EOC #strait bar
PST #Lg bar
0.000
Low Constant Pressue with cavity pressure - Virgin PP to PCR PP
-0.4164 psi
0.0000 psi
0.0000 psi
0.0000 psi
0.0000 09:32:29 Feb 11
ZO
OV
15.00


Curves
Cycle Graph
ADD
REMOVE
elo

Thank you!

Want to go from 20 stops to 2 stops
in a 24-hour period?

rjginc.com/contact-us