



# Sensing Your Way Through Closed-Loop Manufacturing

Hexagon Manufacturing Intelligence

4 May, 2017

# Agenda

1. What is Closed-Loop Manufacturing?
2. Importance of Sensing in Closed-loop Manufacturing
3. Implementing The Sensing Element

# Speaker Information



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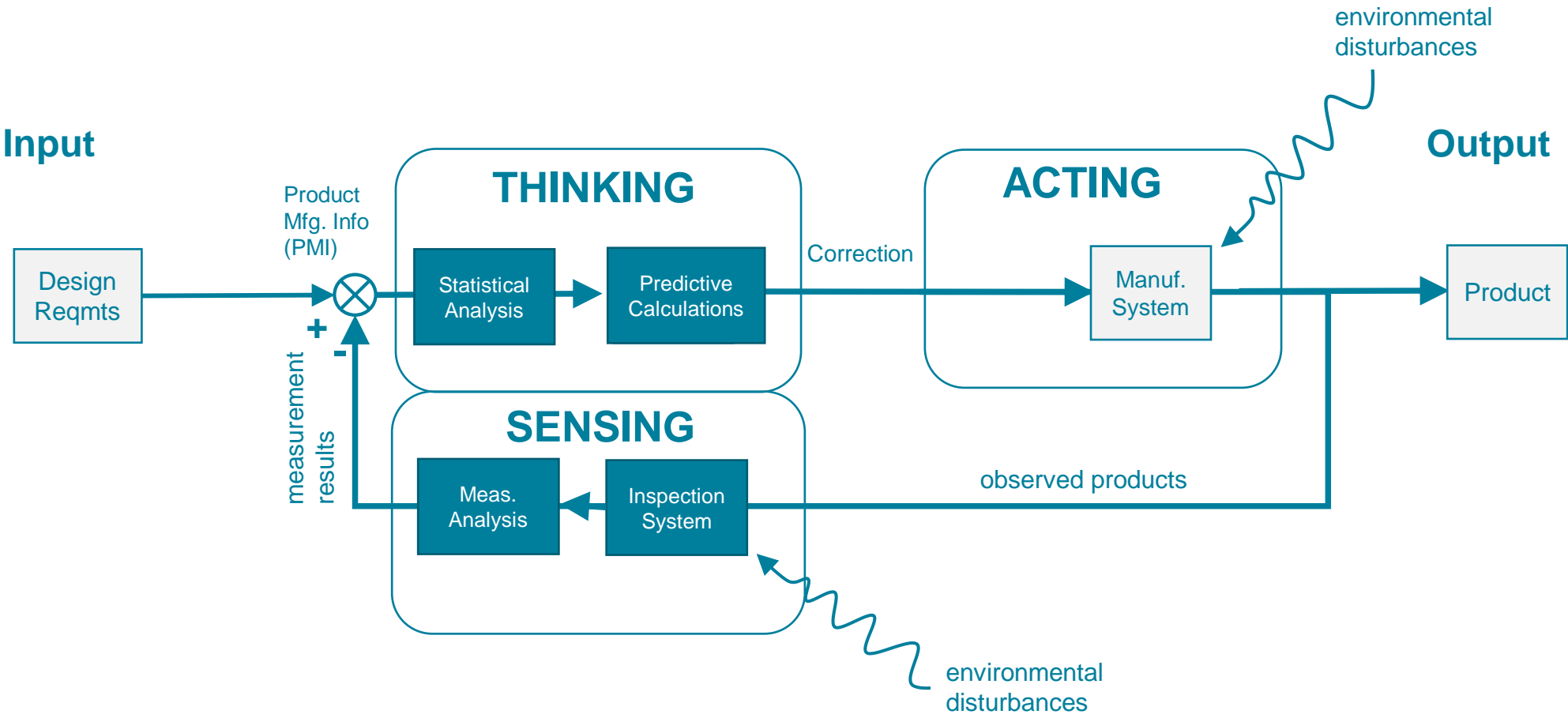
## What is Closed-Loop Manufacturing?

# What is Closed-Loop Manufacturing?

- Controlled repetitive manufacturing process
- The ideal manufacturing environment
  - Continuous
  - Maintenance free
- In reality human intervention is needed
  - Optimized with quality data
  - Needs to be implemented efficiently
  - Maintained through a digital thread



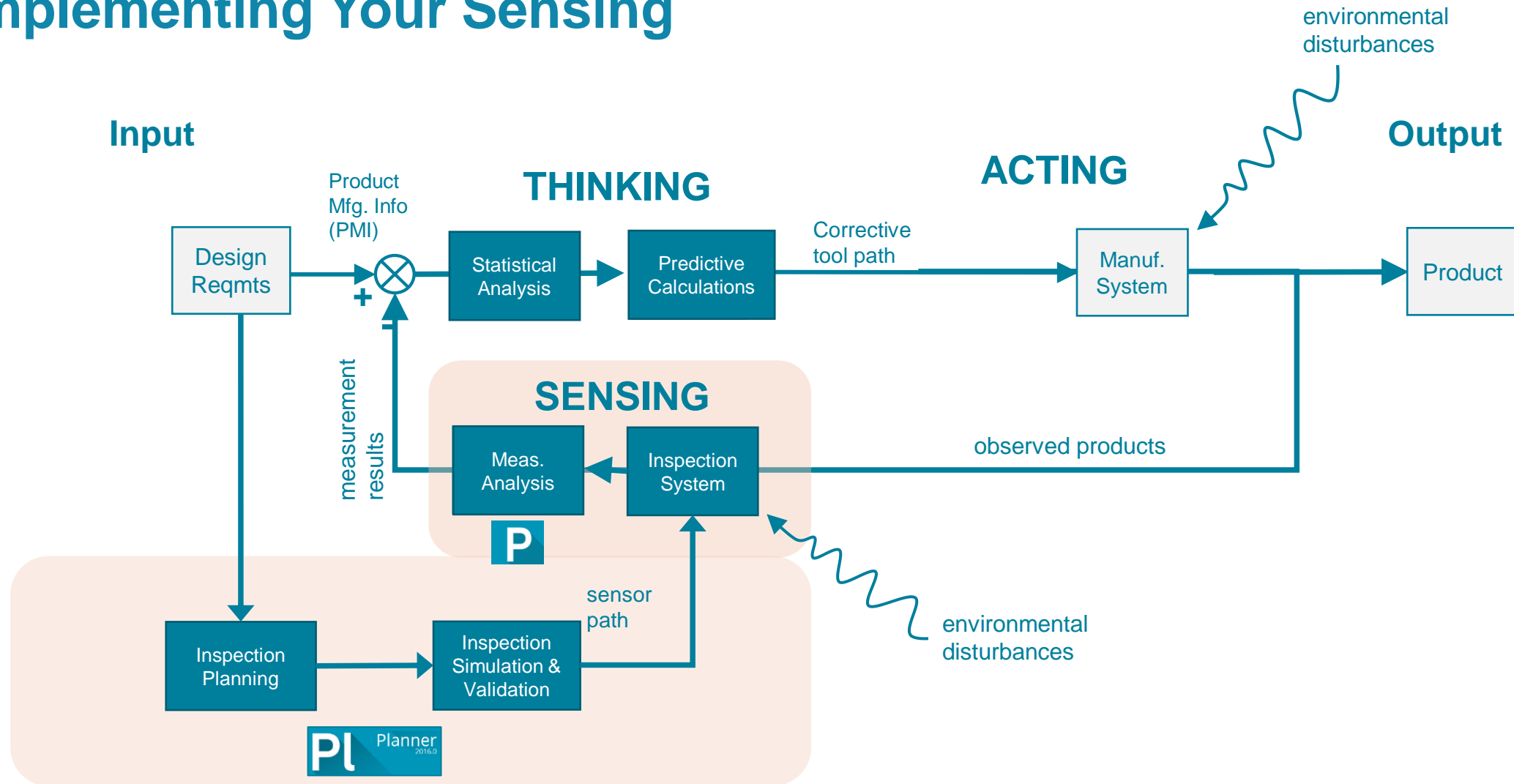
# Traditional Closed-Loop Manufacturing Process



# The Role of Sensing In Closed-Loop Manufacturing

- Necessary to provide quality data for feedback
- Needed to validate the first part before production
- Needed to close the loop for continuous process control
- Requirements
  - Accurate and transferrable data
  - Efficiently Implemented
  - Easily Maintained

# Implementing Your Sensing

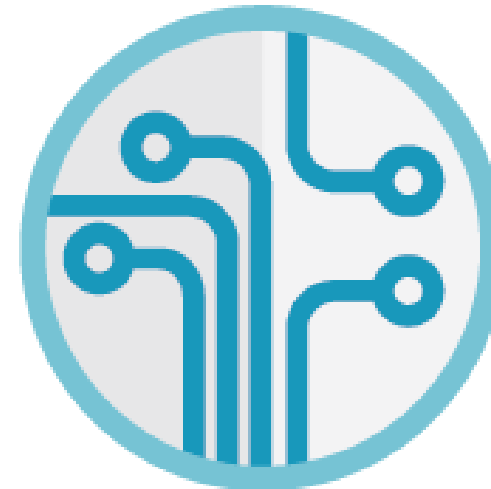




# Implementing The Sensing Element

A good process starts with a good plan...

- 1) Design requirements must be defined
- 2) Design requirements must be validated
- 3) Inspection plan must created
  - 1) Probe path
  - 2) Measurement calculations
  - 3) Report methods
- 4) Inspection plan then validated
  - 1) CMM simulation and inspection plan testing
  - 2) Before you execute on machine / go live
- 5) Execute the inspection plan
- 6) Communicate data for plan maintenance

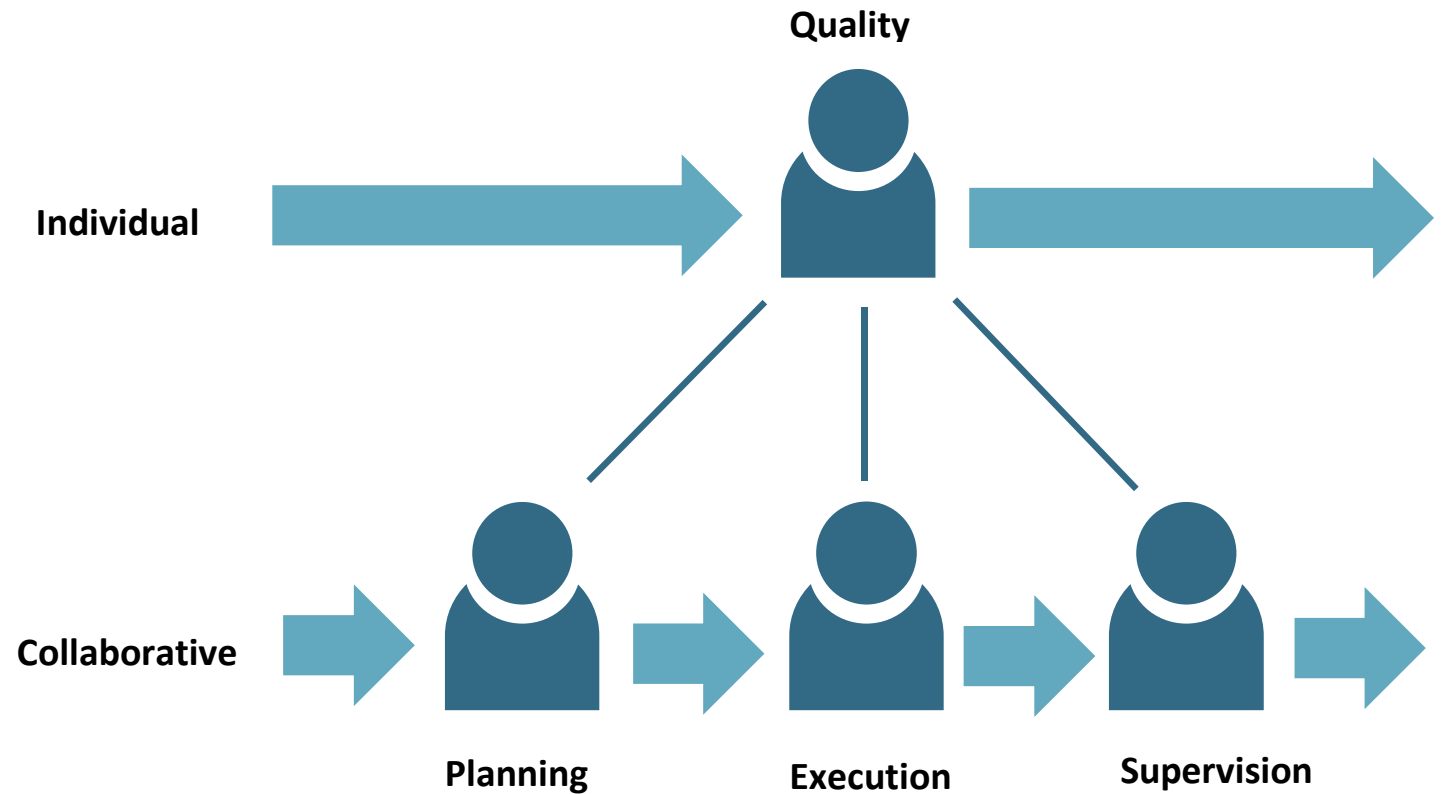


# How We Can Make Implementation Easier?

Two aspects of this:

- 1) Workflow Efficiency
- 2) Technical Tools

## New Software Environments for a Collaborative Workflow



# Workflow Efficiency:

Plan

Execute

Report

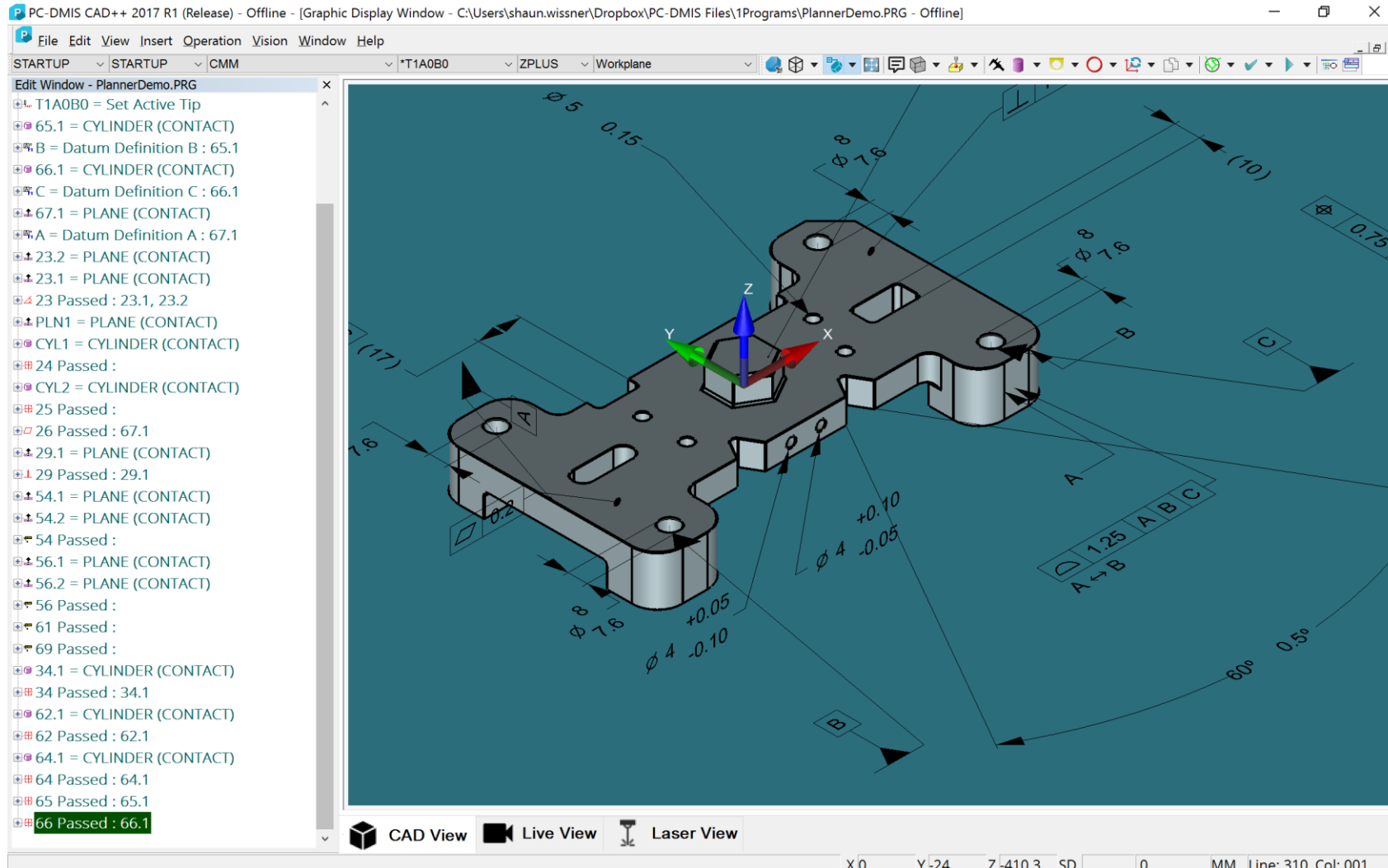


**Do it the way you want to do it!**

# Technical Tools

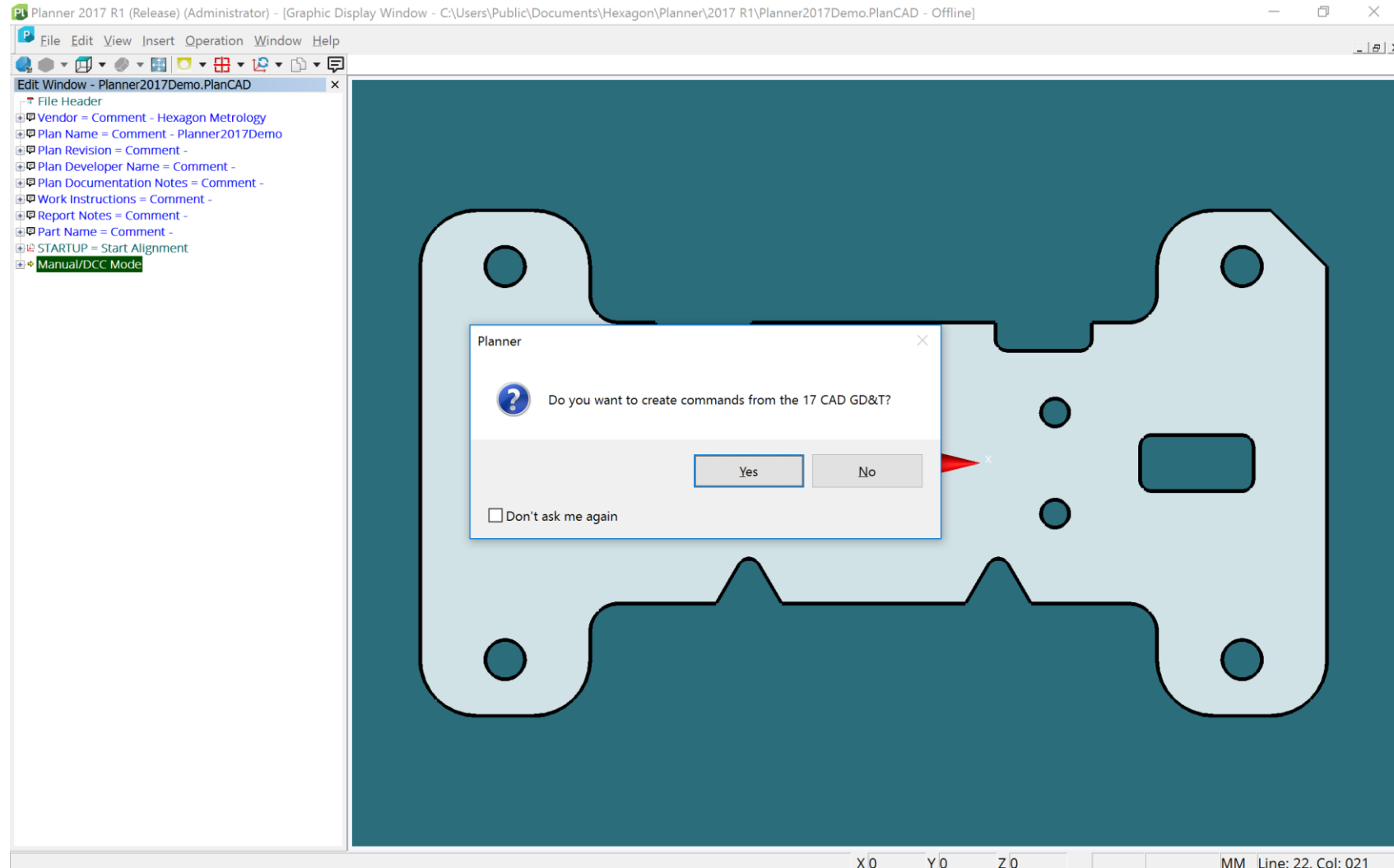
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# Embedded GD&T





# Planner Software for Design Professionals: Automatic Planning



# Planner tools for PC-DMIS

PC-DMIS 2017 R1 (Release) - [Graphic Display Window - C:\Users\shaun.wissner\Dropbox\PC-DMIS Files\1Programs\PlannerDemo.PRG - Offline]

File Edit View Insert Operation Vision Window Help

RESET CMM T1A0B0 ZPLUS Workplane

Edit Window - Planner2017Demo.PlanCAD

- File Header
- STARTUP = Start Alignment
- Manual/DCC Mode
- Dimension Format
- Load Probe - CMM
- T1A0B0 = Set Active Tip

Feature - Sensor Mapping

19 All Features ✓ 0 Unassigned

ID	Sensor	Strategy
66.1	CMM	TTP Strategy
67.1	CMM	TTP Strategy
23.2	CMM	TTP Strategy
23.1	CMM	TTP Strategy
PLN1	CMM	TTP Strategy
ARM1_2_200_1		
Arm2_200		
CAM		
CENTER_REFERENCE_PROBE		TTP Strategy
CMM		TTP Strategy
CMS LASER2		TTP Strategy
CMS_0		TTP Strategy
CP		TTP Strategy
Crank		TTP Strategy
CRANKCAP		TTP Strategy
CMS LASER2		TTP Strategy

Select All Features Deselect All Features Done

CAD View Live View Laser View

Fit the graphics to the view screen X0 Y-12 Z-205.15 SD 0 0 MM Line:13.Col:050





# GLOBAL PC-DMIS USERS' FORUM *AT HxGN LIVE 2017*



## USER GROUP SESSIONS:

- Reporting – a tips and tricks session to help users unleash the full power of PC-DMIS reporting
- Motion – getting the best from clear planes, clear cubes, auto path, path from feature and other PC-DMIS motion tools

## TECHNICAL SESSIONS:

- PC-DMIS Application Improvements and Measurement Routine Optimization
  - Shop Floor – PC-DMIS Optimization Workshop
- Live User Echo Session – user ideas that influence PC-DMIS development
  - PC-DMIS Power Users

## METROLOGY LOUNGE WALK-IN SESSIONS:

- Drop-in clinic
- Speak one-on-one with a PC-DMIS expert
  - Ask us anything!



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# Questions?