



3DCS
VARIATION ANALYST

Training programs

Hands-on instructor-led courses covering GD&T fundamentals, 3D tolerance analysis modeling, and advanced add-on modules. Available in-person and virtual for all skill levels.

3DCS-TRG-01 — Foundations

GD&T basic

Geometric dimensioning & tolerancing — foundations

Training plan

Introduction to GD&T & dimensional engineering

- Purpose and advantages of GD&T
- Goals of Dimensional Engineering

Lesson 1 — Datums

- Role of Datums in GD&T
- Datum Reference Frame (DRF)
- Reading Feature Control Frames

Lesson 2 — Surface profile

- Profile callout tolerance zone
- Applicable feature types

Lesson 3 — True position

- Tolerance zone geometry
- MMC and LMC modifiers impact

Lesson 4 — Orientation callouts

- Perpendicularity, Parallelism, Angularity
- Surface vs. axis applications

Lesson 5 — Form callouts

- Flatness, Circularity, Cylindricity, Straightness
- Form vs. Location vs. Orientation zones

Lesson 6 — Additional content

- Combining multiple callouts on one feature
- MMB and LMB modifiers in the DRF

Duration & format


In-person

8 hours — 1 day


Virtual

8 hours — 2 sessions

Learning objectives

- Understand the purpose and advantages of GD&T over linear dimensioning
- Read and interpret engineering drawings containing GD&T callouts
- Apply Datums, Feature Control Frames, and tolerance zones correctly
- Recognize and distinguish Location, Orientation, and Form tolerances

Prerequisites

- None — open to all participants

Evaluation

- Practical drawing interpretation exercises during the session

France

26 Avenue Jean Kuntzmann,
Campus Pré-Mayen – Inovallée
38330 Montbonnot-Saint-Martin
+33 (0) 476 043 030

North America

North American Innovation Center
28064 Center Oaks Ct A
Wixom, MI 48393
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3DCS-TRG-02 — Foundations

Advanced GD&T

Geometric dimensioning & tolerancing — ASME
Y14.5 in depth

Training plan

Day 1 — Introduction to GD&T

- What is variation and why control it?
- GD&T purpose vs. linear dimensioning
- Feature Control Frames and how to read them
- Lesson 1: Datums and Datum Reference Frames

Day 2 — Form, orientation & profile

- Lesson 2: Material Modifiers (Rule #1, MMC, LMC)
- Lesson 3: Form Tolerances (Flatness, Circularity, Cylindricity, Straightness)
- Lesson 4: Orientation Tolerances (Perpendicularity, Parallelism, Angularity)
- Lesson 5: Profile Tolerances — Surface and Line Profile
- Composite Profile application

Day 3 — Location, runout & bonus

- Lesson 6: Location Tolerances (True Position, Concentricity, Symmetry)
- Lesson 7: Runout Tolerances (Circular & Total Runout)
- Bonus: Combining callouts, MMB/LMB in the DRF

Duration & format



In-person

24 hours — 3 days



Virtual

24 hours — 6 sessions

Learning objectives

- Master all GD&T symbol types per the ASME Y14.5 2009 standard
- Interpret complex engineering drawings with advanced tolerancing
- Apply Material Modifiers (MMC, LMC) and boundary conditions (MMB, LMB)
- Understand Form, Orientation, Profile, Location, and Runout tolerances in depth

Prerequisites

- Optional: GD&T Basic training recommended
- Customer drawings can be provided for tailored exercises (additional fees may apply)

Evaluation

- Drawing interpretation exercises — company-specific drawings can be used

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3DCS-TRG-03 — Core module

3DCS Variation Analyst

3D tolerance analysis — core training

Training plan

Day 1 — The basics

- Introduction to Dimensional Engineering (RSS vs. Worst Case, 1D vs. 3D)
- Lesson 1: Reviewing an existing 3DCS model
- Lesson 2: Starting a new model from scratch
- Lesson 3: Modeling Features

Day 2 — The core of a 3DCS model

- Lesson 4: Creating Moves to locate parts
- Lesson 5: Creating GD&T (part variation)
- Lesson 6: Creating Measures (outputs)
- Lesson 7: Running Monte Carlo and Contributor Analysis
- Lesson 8: Model Validation

Day 3 — Advanced topics

- Lesson 9: Modifying and refining the model
- Lesson 10: Creating a checking fixture
- Lesson 11: Parts with Embedded GD&T
- Lesson 12: Automated Reporting
- Lesson 13: Additional learning resources

Duration & format


In-person

24 hours — 3 days


Virtual

24 hours — 6 sessions

Learning objectives

- Build complete 3D tolerance analysis models from scratch in 3DCS VA
- Create Moves, Measures, and GD&T to define assembly variation
- Run Monte Carlo simulations and interpret Contributor Analysis results
- Generate automated reports and validate model assumptions

Prerequisites

- Basic CAD platform skills (exploded views, cross-sections, navigation)
- Understanding of GD&T Basics

Evaluation

- Hands-on model creation and analysis on a DCS-provided example assembly

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3DCS-TRG-04 — Standalone

Design Variation Modeler

3D tolerance analysis — DVM platform

Training plan

Introduction to dimensional engineering

- Why Dimensional Engineering matters
- RSS vs. Worst Case — 1D vs. 3D analysis

Lesson 1 — Reviewing an existing model

- First look at 3DCS DVM using a completed model

Lesson 2 — Starting a new model

- Create a model from an empty file
- How 3DCS stores data and CAD integration

Lessons 3–5 — Moves, measures & GD&T

- Lesson 3: Creating Moves to locate parts
- Lesson 4: Creating Measures (key outputs)
- Lesson 5: Creating GD&T (part variation)

Lessons 6–9 — Analysis & automation

- Lesson 6: Running and interpreting analysis results
- Lesson 7: Automated reporting
- Lesson 8: Extracting Moves, Measures & GD&T from CAD
- Lesson 9: Additional resources

Duration & format


In-person

8 hours — 1 day


Virtual

8 hours — 2 sessions

Learning objectives

- Create a complete 3D tolerance analysis model in 3DCS DVM
- Define Moves, Measures, and GD&T within the DVM environment
- Run analysis and interpret results to assess design performance
- Automate the modeling process by extracting data directly from CAD

Prerequisites

- Basic CAD platform skills (exploded views, cross-sections, navigation)
- Understanding of GD&T Basics

Evaluation

- Hands-on model completion using a DCS-provided example assembly

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3DCS-TRG-05 — Standalone

Mechanical Variation Modeler

3D tolerance analysis — MVM platform

Training plan

Introduction to dimensional engineering

- Why Dimensional Engineering matters
- RSS vs. Worst Case — 1D vs. 3D analysis

Lesson 1 — Reviewing an existing model

- First look at 3DCS MVM using a completed model

Lessons 2–3 — Starting the model

- Lesson 2: Create a model from an empty file
- Lesson 3: Creating Measures

Lessons 4–6 — Moves, variants & GD&T

- Lesson 4: Creating Moves to locate parts
- Lesson 5: Creating Model Variants
- Lesson 6: Creating GD&T

Lessons 7–10 — Validation & reporting

- Lesson 7: Results Validation (Monte Carlo, Contributor Analysis)
- Lesson 8: Embedded GD&T and Constraints
- Lesson 9: Automated Reporting
- Lesson 10: Additional resources

Duration & format


In-person

8 hours — 1 day


Virtual

8 hours — 2 sessions

Learning objectives

- Create a full 3D tolerance analysis model in 3DCS MVM
- Define Moves, Measures, GD&T, and Model Variants
- Extract GD&T and Constraints directly from CAD part files
- Run Monte Carlo and Contributor Analysis to validate design performance

Prerequisites

- Basic CAD platform skills (exploded views, cross-sections, navigation)
- Understanding of GD&T Basics

Evaluation

- Hands-on model creation using a DCS-provided example assembly

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3DCS-TRG-06 — Add-on module

Compliant Modeler add-on

FEA-based flexible part & weld sequence analysis

Training plan

Day 1 — The basics (CM rail assembly)

- Introduction: Rigid Body limitations and Compliant inputs
- Lesson 1: Review an existing Compliant Model
- Lesson 2: Load FEA data — link 3DCS points to FEA mesh nodes
- Lesson 3: Adding the Force Measure
- Lesson 4: Creating Clamp Moves
- Lesson 5: Creating Gravity Moves
- Lesson 6: Creating Join Moves (welding simulation)
- Lesson 7: Analyzing and comparing Rail model results

Day 2 — Advanced application (CM exhaust assembly)

- Lesson 8: Review a Rigid Body model
- Lesson 9: Adding Compliant Moves to the Exhaust Assembly
- Lesson 10: Using the Thermal Move (localized temperature deformation)
- Lesson 11: Analyzing and comparing Exhaust model results

Duration & format



In-person

16 hours — 2 days



Virtual

16 hours — 4 sessions

Learning objectives

- Enhance a 3DCS Variation Analyst model with Compliant Modeler features
- Load FEA data and simulate flexible part deformation (gravity, clamping, joining)
- Create Clamp, Gravity, Join, and Thermal Moves
- Compare results with and without compliant modeling to quantify impact

Prerequisites

- Completion of 3DCS Variation Analyst (VA) training
- Experience using VA on Rigid Body assemblies
- Basic CAD platform skills — GD&T Basics

Evaluation

- Two complete compliant models built during training (Rail & Exhaust assemblies)

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3DCS-TRG-07 — Add-on module

Mechanical Modeler add-on

Kinematic & mechanism variation analysis

Training plan

Introduction to Mechanical Modeler

- Which models benefit most from 3DCS MM
- Required inputs for an MM analysis
- How a VA model can be enhanced with MM

Lesson 1 — Reviewing an existing MM model

- First look at a completed 3DCS MM model

Lessons 2–3 — Starting the model

- Lesson 2: Set up model for MM analysis
- Lesson 3: Creating Measures

Lessons 4–6 — Moves, variants & GD&T

- Lesson 4: Creating Joints, Constraints and Motion
- Lesson 5: Creating Model Variants
- Lesson 6: Creating GD&T

Lessons 7–10 — Validation & reporting

- Lesson 7: Monte Carlo, Contributor Analysis, Kinematic Simulation
- Lesson 8: Embedded GD&T and Constraints
- Lesson 9: Automated Reporting
- Lesson 10: Additional resources

Duration & format



In-person

8 hours — 1 day



Virtual

8 hours — 2 sessions

Learning objectives

- Extend a 3DCS VA model with Mechanical Modeler kinematic analysis
- Create Joints, Constraints, and Motion to simulate mechanical assemblies
- Run Monte Carlo analysis and Kinematic Simulations
- Extract GD&T and Constraints directly from CAD files

Prerequisites

- Completion of 3DCS Variation Analyst (VA) training
- Experience using VA on Rigid Body assemblies
- Basic CAD platform skills — GD&T Basics

Evaluation

- Hands-on model creation with kinematic simulation on a DCS example

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3DCS-TRG-08 — Add-on module

Advanced Analyzer & Optimizer

Deep analysis & tolerance optimization tools

Training plan

Introduction to AAO

- Additional analysis tools and extra insights from existing models
- AAO setup and Preferences

Lesson 1 — GeoFactor Analyzer (GFA)

- Accessing the GeoFactor Matrix
- Instant feedback from input changes

Lesson 2 — Critical Tolerance Identifier (CTI)

- Interpreting CTI outputs
- Identifying the most impactful inputs across all results

Lesson 3 — Tolerance Optimizer (TO)

- Optimizing inputs based on requirements
- Experimenting with different optimization controls

Lesson 4 — Simulation Based Sensitivity (SBS)

- Difference between basic Contributor Analysis and SBS
- Understanding interaction effects between inputs

Lessons 5–6 — Sequence & datum optimizers

- Lesson 5: Sequence Optimizer — optimize weld sequence for minimal variation (CM only)
- Lesson 6: Datum Optimizer — choosing the best locators

Duration & format



In-person

8 hours — 1 day



Virtual

8 hours — 2 sessions

Learning objectives

- Use AAO tools to gain deeper insight from existing 3DCS models
- Identify the most impactful tolerances with GeoFactor Analyzer and CTI
- Optimize tolerances and weld sequences using dedicated optimizers
- Understand interaction effects with Simulation Based Sensitivity analysis

Prerequisites

- Completion of 3DCS Variation Analyst (VA) training
- Experience using VA on Rigid Body assemblies
- 3DCS Compliant Modeler training (required for Sequence Optimizer only)
- Basic CAD platform skills — GD&T Basics

Evaluation

- Hands-on AAO exercises using a DCS-provided tolerance model

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