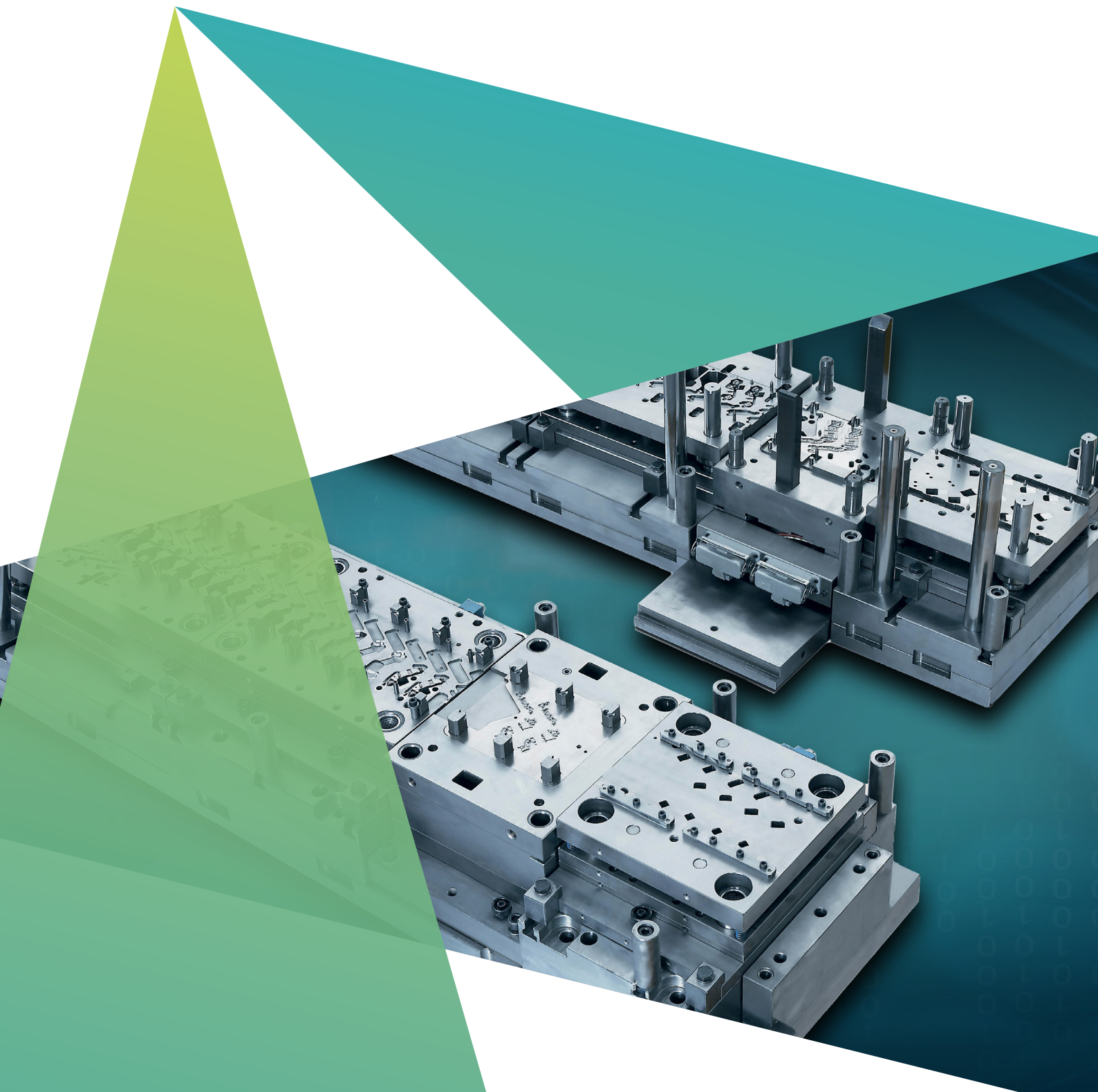


End-to-end solution for progressive dies

Creating an end-to-end smart design and manufacturing workflow for progressive dies





Competing in a challenging market



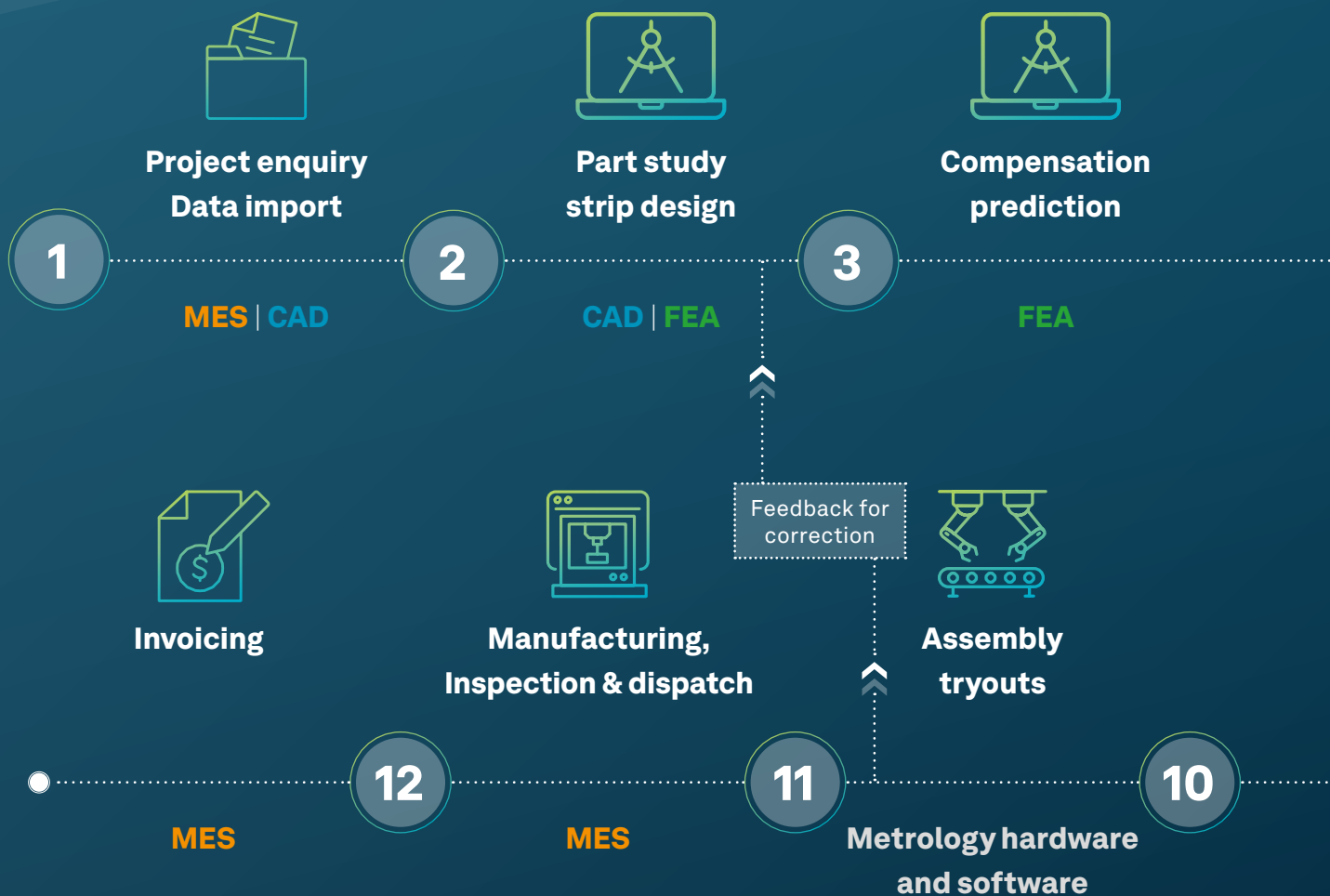
Progressive dies are essential for industry verticals including automotive, aerospace, electronics, and industrial equipment. The key challenges faced by the progressive die industry include:

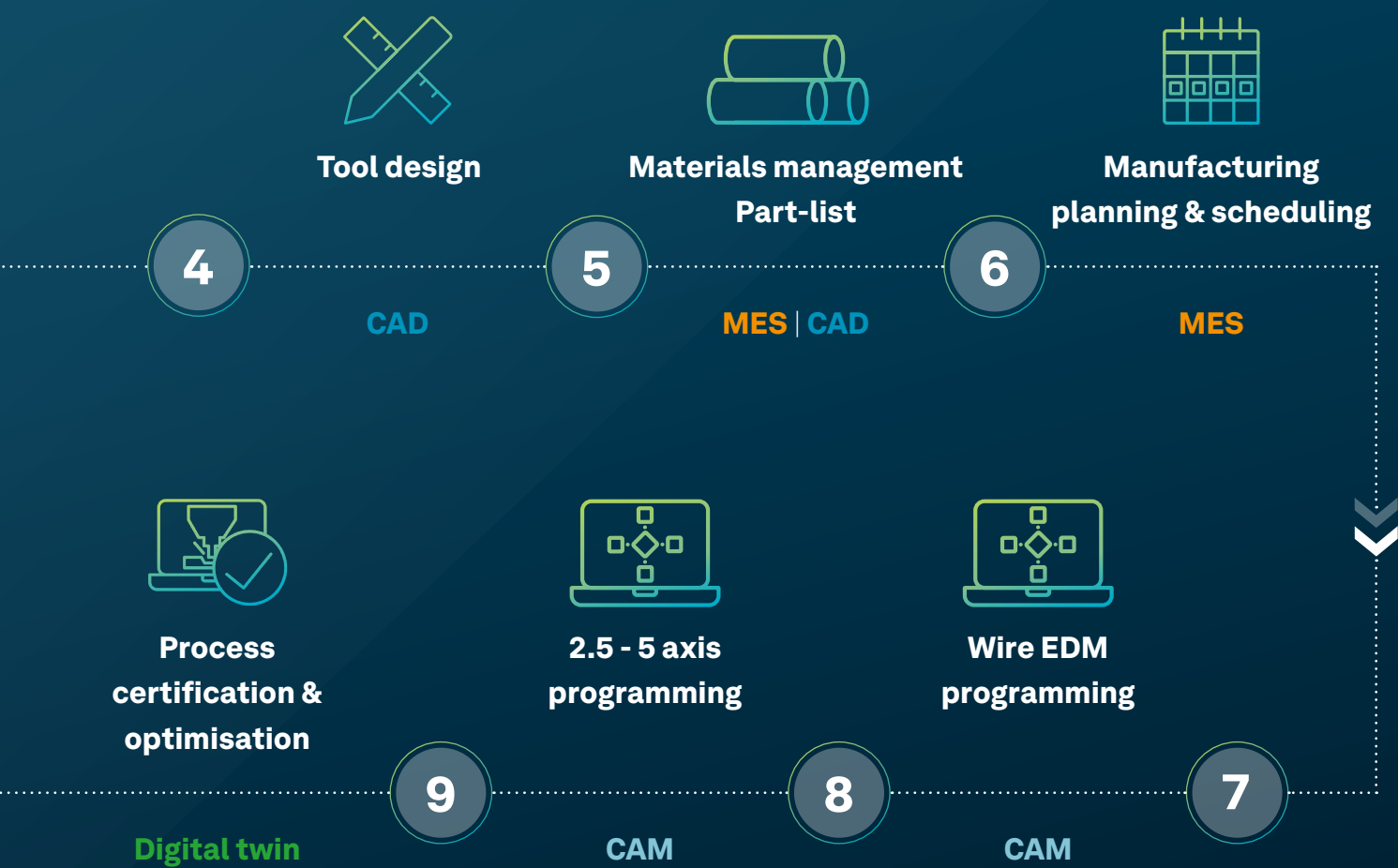
- Designing the dies faster, considering manufacturing constraints and capabilities
- Optimising the design and manufacturing cycle times
- Ensuring first time right manufacture every time and minimising rejection and rework
- Ensuring smooth execution of manufacturing activities to meet the delivery date to the end customer
- Optimising the raw material cost
- Ensuring the quality of the finished product irrespective of operators' skill levels
- Keeping track of product design revisions made by the customer
- Optimising the overall product and project cost

Hexagon's end-to-end solution for progressive die addresses these challenges at each stage of the workflow from enquiry to dispatch using a smart design and manufacturing approach based on VISI products, WORKPLAN, NCSIMUL, metrology software and hardware, and Manufacturing Asset Management software.

Smart design and manufacturing workflow

Collaboration across departments using WORKPLAN





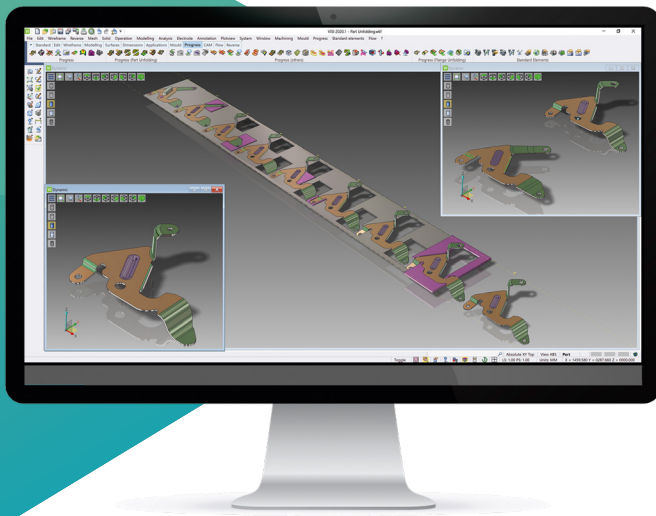
1 Project enquiry & data import

Hexagon's WORKPLAN manufacturing project management platform provides users with the ability to manage the workflow, starting with the product enquiry.

Opportunities can be created in WORKPLAN and will maintain all details related to the customer – contact details, delivery, and invoicing addresses etc. Users can then keep track of the progress of each opportunity, including various communication details for the project.

For data import, Hexagon's VISI solution can work directly with Parasolid, IGES, CATIA, Creo, UG-NX, STEP, SolidWorks, Solid Edge, Inventor, ACIS, DXF, DWG, JT Open, STL and VDA files. The extensive range of translators ensures that users can work with data from almost any supplier. The ability to skip corrupt records during the import process provides a platform from where the most inconsistent data can be managed. Very large files can be handled with ease and companies working with complex designs will benefit from the ease with which their customer's CAD data can be manipulated.





2 Part study & strip design

VISI Modelling provides a robust and powerful solid and surface hybrid modelling system that combined with Hexagon's surface technology, model analysis and 2D design, offers a complete solution to build, edit or repair complex 3D data.

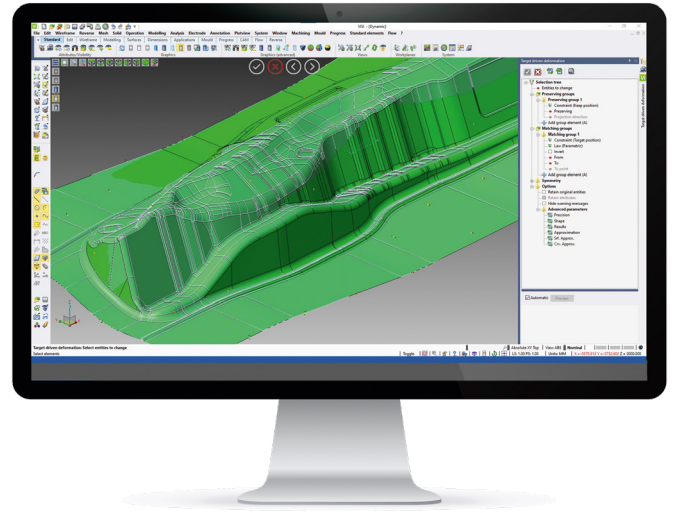
VISI Progress allows the unfolding of both surface and solid models using a powerful geometry based unfolding algorithm. The developed blank is based on a neutral fibre model calculated by choosing a standard offset ratio or using an automatic neutral axis formula. Step by step unfolding allows the designer to plan each forming stage by dynamically adjusting bend angles. It incorporates parametric features such as ribs and bosses as required at forming stage. Flexible editing allows the removal or addition of extra stages providing the user with complete freedom for unfolding experimentation.

VISI Blank is an integrated solution for the development of 2D blank shapes from complex 3D models. It is particularly useful in the generation of blank forms for the sheet metal, progressive die, press tooling and crash tooling industries. VISI Blank benefits from seamless integration with the acclaimed VISI Modelling software, using the industry standard Parasolid kernel combined with Hexagon's proprietary surface modelling and 2D design technology.

3

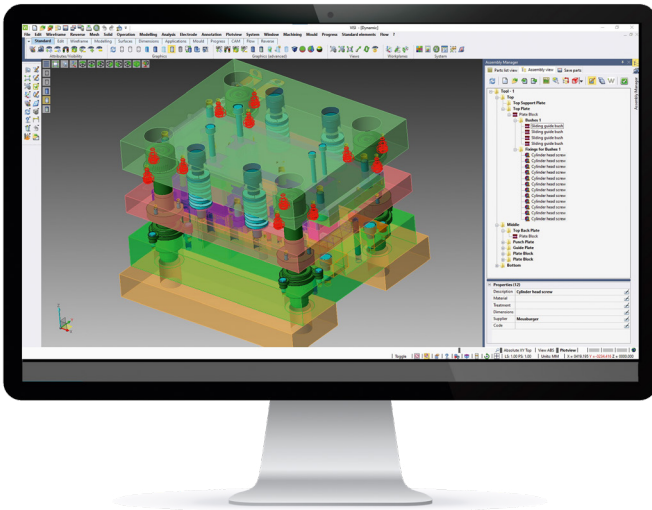
Compensation prediction

The springback prediction tool uses the starting nominal part, material data and blank calculation to generate a second mesh of the product geometry including springback adjustments. The designer can then use the relative compensation tool to achieve a morphing on the original surface set to generate the compensated surfaces to produce an accurate sheet metal part. This will provide major benefits to the die market by reducing the time of the 'design to manufacturing' process and by reducing the cost of a typical trial and error approach to solving this longstanding industry issue.



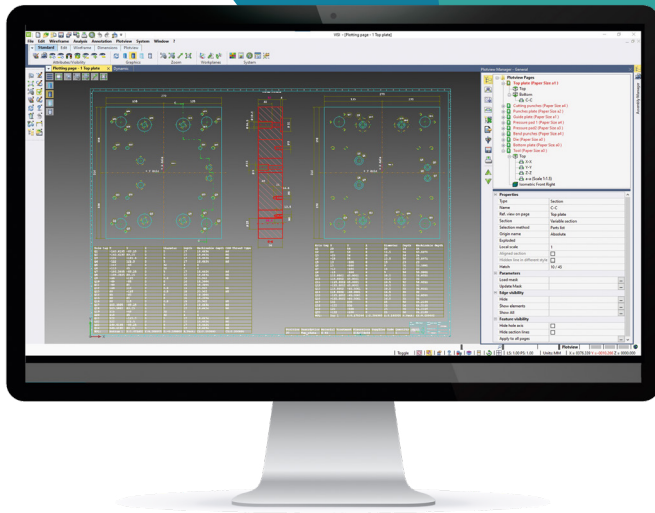
4

Tool design



The tool assembly allows the designer to quickly construct a solid based layout of the required bolster plates along with the necessary pillar and bush arrangements. Access to the parameters of each individual plate ensures that modification of the tool layout is quick and efficient. The tool assembly will typically include all the critical data required for correct operation of the press tool, including press stroke, strip stroke, punch height and tool stroke information.

VISI Progress supports standard parts libraries from all leading suppliers of Progressive Die Tooling components.



5 Materials management and part-list

WORKPLAN provides all the necessary features for the management of the complete purchasing process. This includes the purchasing budget requirements, the RFQs and stock management, purchase order receipts and supplier billing check and control functions. Reports are available in real time for stock on hand for projects and trace stock items in the system.

WORKPLAN automates the budget request and approval for raw materials, standard components, composed components, all the stock reservation and availability are checked in progress. Automatic import of detailed Bill of Materials (BOM) information from popular CAD systems is a time saver and helps minimise mistakes.

Using this module of WORKPLAN, manufacturers can ensure that all the required raw material and bought-out items are made available on time to meet the delivery date to the end customer. This also helps optimise the inventory carrying cost.

Using VISI CAD, user can create complete set of 2D detailed drawings generated directly from the 3D model. Any standard catalogue component will have the correct detail representation within a section view. Changes to the 3D model will result in modifications to the 2D view along with any fully associative dimensions. Part-list table items and their respective balloon references can be added to the drawing using dedicated assembly management tools.

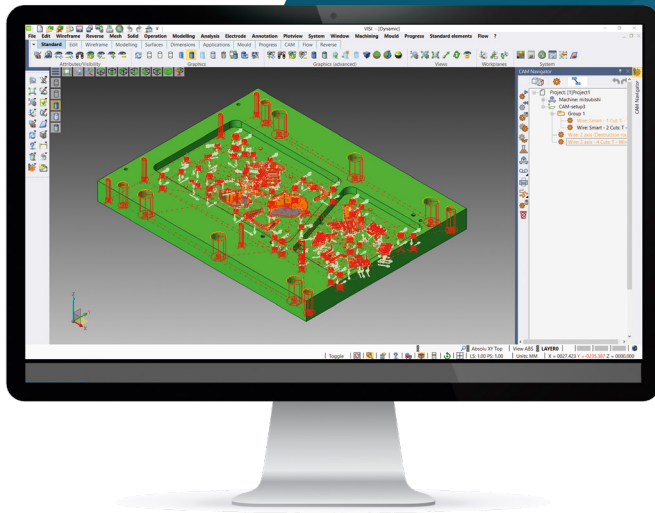
6 Manufacturing planning and scheduling

WORKPLAN schedules projects and jobs based on set priorities and availability of resources. It supports forward looking simulations. Manufacturers can use WORKPLAN's GANTT charting to optimise workload, reduce bottlenecks, control milestones, and meet due dates.

WORKPLAN includes an easy to use drag and drop graphical tool to set routing order and create workflows. These workflows can be simulated for a set period, based on project due dates. Users can also set various internal due dates, to ensure tighter management and provide a buffer in the workflow. WORKPLAN automatically generates a resource load planning schedule, which considers existing available capacities.

Using these modules of WORKPLAN, various manufacturing activities can be planned, resources optimised, and progress tracked against the plan to ensure that the project is delivered on time as per the customer requirement.





7 Wire EDM Programming

2- and 4-axis machining operations give the user a choice of parameters such as machining direction, auto offsetting, lead on/off radius, tag distance, lead off distance, and lead on/off technology to name just a few. Each parameter is accompanied by a bitmap giving the user additional information on how it will affect the resulting toolpath.

It is possible to select from several different methods of unattended machining. If the machine is equipped with automatic wire threading, then users will want to run unattended as long and as often as possible. Unattended machining is performed by leaving the slugs attached while all the preliminary cuts are taken. This module supports a comprehensive range of EDM machines from leading machine tool manufacturers.

8

2.5 - 5-axis programming

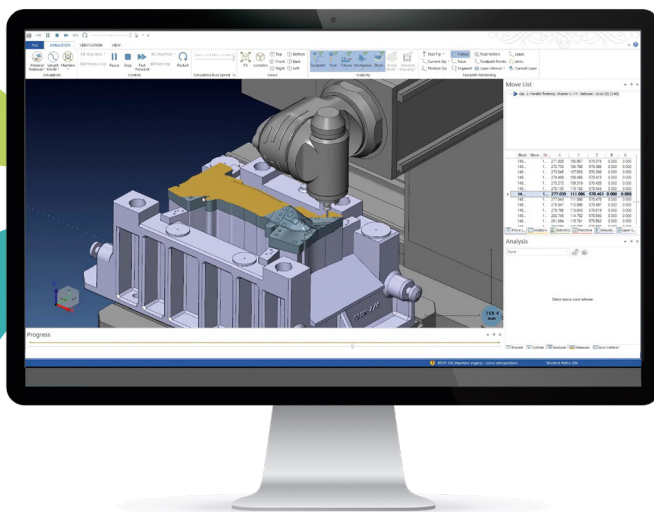
VISI Machining 2D provides a practical, intuitive, and simple solution for CNC programming including 4- and 5-axis indexing. Knowledge based feature recognition will automatically select features directly on the solid geometry and create reliable milling and drill cycle toolpaths.

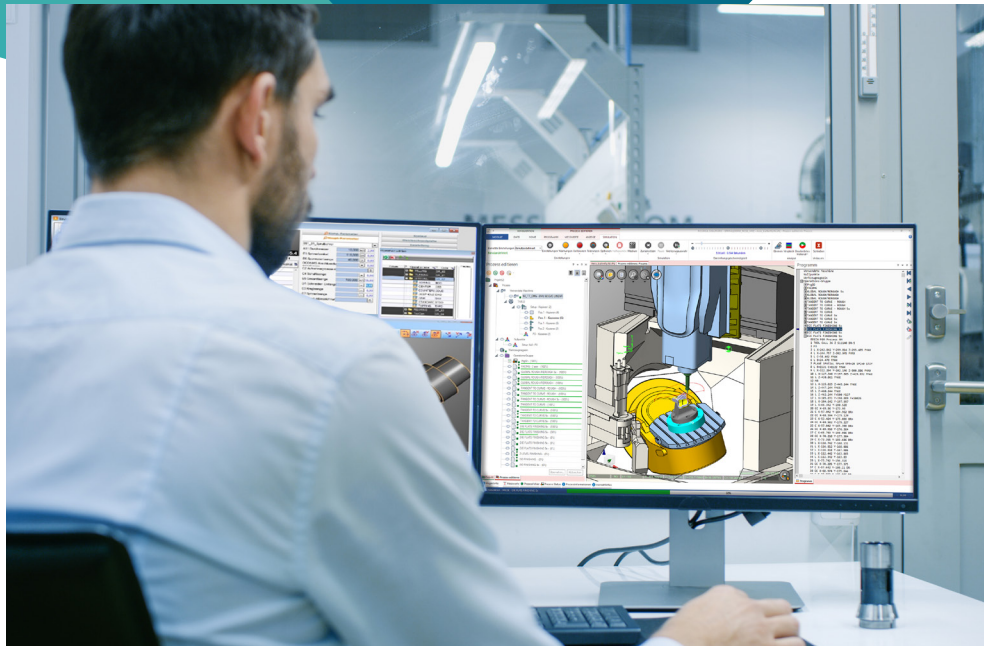
VISI Machining 3D creates intelligent toolpaths on the most complex 3D parts. Dedicated high speed milling techniques and built-in smoothing algorithms create highly efficient NC code. Intelligent toolpaths will reduce cycle times on the machine, improve productivity and continuously produce high quality components.

VISI Auto Tilting capability converts traditional 3-axis toolpath to 5-axis operations which

dramatically increases the number of strategies available to cover any scenario. This approach applies high speed machining technology to 5-axis toolpaths providing intelligent collision detection. Benefits include faster cutting speed, increased rigidity (less vibrations) and better finishing quality.

5-axis machining has traditionally been regarded as advanced technology best suited to the aerospace and automotive industry. 5-axis machining offers many advantages, all of which are now being applied to the mould and die sector. VISI Machining provides the operator with a productive solution for creating highly efficient toolpaths with advanced collision control for the most complex 3D data.



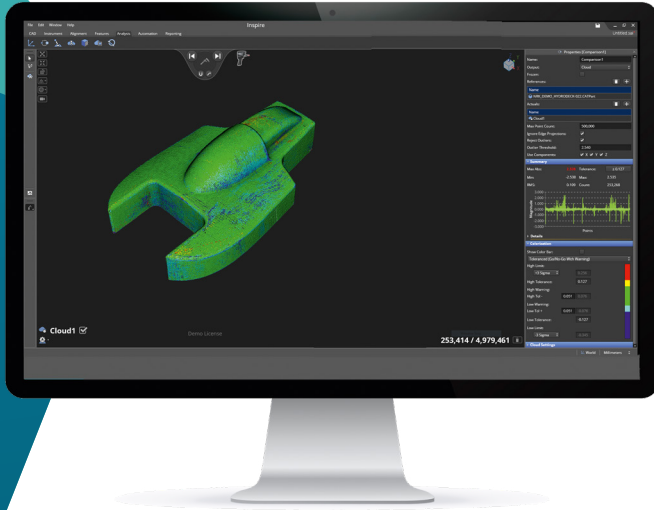


9 Process certification and optimisation

NCSIMUL manages the complete machining process from the NC program to the machined part. Its capabilities allow users to fully master the shop floor and include automatic G-code reprogramming and G-code simulation. NCSIMUL virtually builds the real-life machining environment to eliminate errors, decrease set-up times, reduce manufacturing costs, and increase shop floor productivity.

NCSIMUL Machine is a high-end CNC simulation software for G-code verification, machine simulation and tool optimisation. It detects programming errors and any potential collision from the same NC code that drives the CNC machine.

NCSIMUL Optitool analyses cutting conditions, dramatically reduces “air cutting”, optimises feed rates and allows users to create better cutting strategies. The overall benefits are a reduction in the production cycle times, enhancement of cutting operations and fast development of new G-code optimised files for future applications. This module allows users to optimise the tool lengths, air cutting and cutting conditions of NC programs (from 3- to 5-axis simulation software) and globally increase the quality of machining operations.



10 Assembly try-outs

After manufacturing of the progressive die, the first sample press part produced can be scanned using Hexagon's Absolute Scanner AS1, and 3D point cloud data corresponding to the actual geometry of the part produced is collected. This set of data can be compared with a 3D model of the part to ensure that the actual part produced is within the acceptable tolerance limits using Inspire metrology software. If there are any major dimensional deviations

observed for the first press part produced, then the necessary corrections can be made in the progressive die design.

Intuitive and easy to use, Inspire is a comprehensive solution that makes measurement simple, saves time, and ultimately improves productivity. With one simple interface, Inspire works with any portable measuring arm or laser tracker for probing and scanning applications.

11a Manufacturing operations

Using time management functionalities within WORKPLAN, users can manage, and track time spent on all the projects. Data can be entered through touchscreens, workstations, barcode readers or timecards. This functionality can also help track and report on unproductive tasks, employee hours, time spent correcting problems or other quality issues, overtime, leaves, holidays and more.

WORKPLAN's Time Management module is an easy to use, all-in-one tool to manage employees' attendance, hours and track their progress on tasks. WORKPLAN helps check the times spent at each scheduled work centre on the project. Data can be entered from a computer terminal, touch screen, barcode readers or via manual input and timecards.

Using WORKPLAN, users can track the progress of various manufacturing activities and take corrective measures, if required, to complete the manufacturing activities as planned. The actual manufacturing cost of the project can also be monitored.

Hexagon's solution for industrial IoT device monitoring enables you to monitor the performance, availability, and health of your manufacturing assets through the SFX platform. Manufacturing Asset Management is designed to maximise overall equipment effectiveness (OEE) and operational excellence indicators, either for

a single device or for a set of systems, whether in real time or reporting over a period of time.

The solution offers data and metrics including:

- Real-time asset dashboard showing machine status
- Real-time notifications of critical events
- Real-time and historic event logging
- Availability = Operating time / Scheduled time
- Performance = (Programs executed x Ideal execution time) / Operating time
- Quality = Programs successfully executed / Total programs executed
- Quality = Acceptable jobs / Total jobs done



11_b Inspection and dispatch

The quality module within WORKPLAN enables separate tracking of time and costs associated with non-conformities – the cost of poor quality.

This module is not only a great help to get the ISO certifications and meet ISO standard requirements mentioned in the quality management system (QMS), but it will manage supplier evaluation and give access to cross-functional features to improve quality and meet internal policies.

Additionally, the maintenance of measuring devices used in quality assurance, quality indicators and KPI analysis are key to achieving ISO Certificates.

Delivery notes can also be created once the project is ready to dispatch.





12

Invoicing

WORKPLAN issues invoice and manages the invoicing process.

Additional modules offer a view on cash inflow and outflow based on scheduled payments, as well as creating invoices for accounts receivable and ordered materials from accounts payable.

WORKPLAN performs detailed analysis specific to quotes, jobs, times, costs, and other metrics with a few simple mouse clicks to improve the estimating and planning processes. It also enables comparison of the planned versus actual project cost and its components.

Seamless integrated workflow

Using Hexagon solutions – VISI products, WORKPLAN, NCSIMUL, metrology hardware and software, and Manufacturing Asset Management software, progressive die customers will have a seamless integrated workflow from the enquiry stage through to dispatch due to seamless exchange of data in terms of CAD CAM files and project related information, without any losses.

Integration between VISI and WORKPLAN

Integration between VISI and WORKPLAN allows bills of materials from VISI Progress to be imported directly into WORKPLAN solutions, ensuring that WORKPLAN can produce accurate, competitive quotations. WORKPLAN configures an import model in correlation with the file exported from VISI Progress, automatically importing the bill of materials.

The BOM import of VISI is done intuitively as the design progresses, making it possible to update the WORKPLAN project with a single click from the Assembly Manager. A synchronisation log makes it possible to follow the evolution of imports and to limit re-entries, which are always a significant risk of error.

Data can be sent from DESIGNER, which is Hexagon's CAD application for smarter manufacturing, to RADAN for CAM programming

Headline features include:

- Customised settings based on VISI configuration
- Import and automatic construction of technical breakdown from VISI native files as the project progresses
- Dynamic synchronisation with a single button click
- Synchronisation of standard components in common with the databases
- Synchronisation log
- Automatic production process creation based on keywords

The integration means users save time and can give a quicker response to customers, especially regarding raw materials, standard elements and stock supply management. Projects and their costs can be fully controlled, thanks to the import of the complete bill of materials tree structure.

The integration between above mentioned Hexagon products limits the risk of data input errors, guaranteeing reliability and accuracy when information is passed between them with just a few clicks.

Key benefits

Key benefits of Hexagon's end-to-end solution for progressive dies include:



Optimisation of overall product and project cost



Better control over the quality of the product



Optimisation of raw material cost



Seamless integrated workflow for ease of use and faster training



Better resource utilisation for equipment and operators



Faster time to market, ensuring on-time deliveries to the end customer



Optimisation of manufacturing cycle times



Optimisation of design cycle time



Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Manufacturing Intelligence division provides solutions that utilise data from design and engineering, production and metrology to make manufacturing smarter. For more information, visit hexagonmi.com.

Learn more about Hexagon (Nasdaq Stockholm: HEXA B) at hexagon.com and follow us [@HexagonAB](https://twitter.com/HexagonAB).