

Objectives

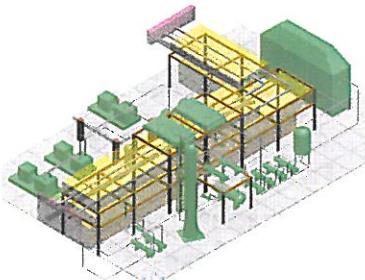
SmartPlant Layout

- Targeted at Front End Engineering Design
- Starting point
 - Process Flow Diagram
 - Plot size and shape
- Facilitate layout evolution and evaluation
 - Equipment placement
 - Pipe routes
 - Structural requirements – Pipe Racks
 - Operations
 - Maintenance
- Input to cost estimation
- Rollover into detail design

INTERGRAPH

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<u>Workshop Objectives</u>	<u>SmartPlant Layout</u>
<ul style="list-style-type: none"> ■ Explain the Layout concepts <ul style="list-style-type: none"> ▪ What it will do and what it won't do ■ Provide understanding of the reference data requirements <ul style="list-style-type: none"> ▪ Layout Equipment ▪ Piping Specs ▪ Pipe Racks ▪ Volumes ■ Provide sufficient training for a SmartPlant 3D user to be comfortable in using the layout tool. <ul style="list-style-type: none"> ▪ Placing Equipment / Pipe Racks ... ▪ Creating and Routing Pipelines ▪ Controlling Pipe Routes ■ Saving Layout cases ■ Understanding the results 	 <small>- 3 -</small>

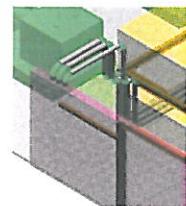
<u>Overview</u>	<u>SmartPlant Layout</u>
<ul style="list-style-type: none"> ■ SmartPlant Layout is a solution for Preliminary 3D plant layout <ul style="list-style-type: none"> ▪ Proposal development ▪ Early design estimates ▪ Plant layout optimization ▪ <u>Not a "piping design tool"</u> ■ Standalone Product <ul style="list-style-type: none"> ▪ Based on Intergraph's SmartPlant 3D ▪ Includes a full SmartPlant 3D license ▪ Concurrent user license, just like SmartPlant 3D 	 <small>- 4 -</small>

Overview

SmartPlant Layout

▪ Scope

- Layout case management
- Selected equipment, piping, structure, space management commands
- Selected local drawings and reports
- Interfaces with cost estimation
- Pipe auto-routing... *Powered by Alias I-Route*



 ALIAS  INTERGRAPH

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Overview

SmartPlant Layout

▪ Layout Evolution and Evaluation

- Place main pipe racks
- Place major equipment items
- Route some pipes
- Evaluate routes
- Optimise Layout
- Move equipment
- Add more equipment
- Add volumes
- Route more pipes

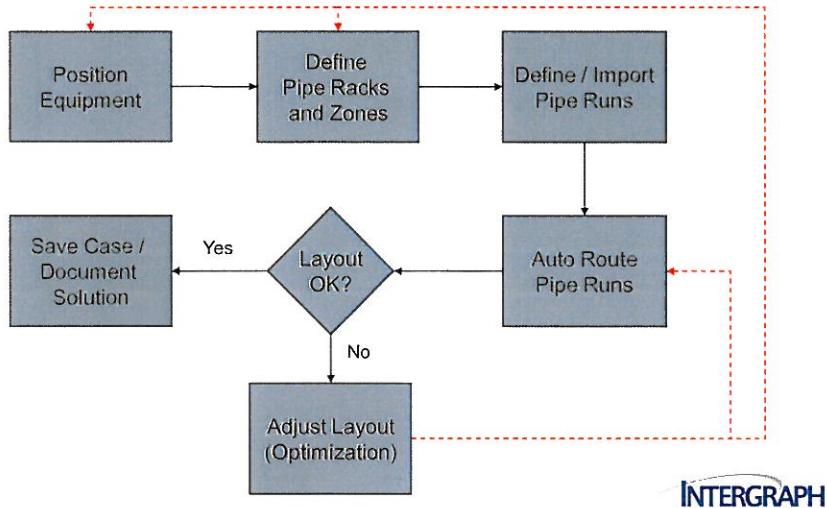
 INTERGRAPH

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Overview

SmartPlant Layout

▪ Workflow Summary



INTERGRAPH

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Reference Data

SmartPlant Layout

▪ Physical Data - Zones

- Obstruction Zones
 - An obstruction zone is an area where pipes cannot be routed.
 - Any existing item (Pipe, Equipment, Steel etc.) is automatically defined as an Obstruction.
- Avoidance Zones
 - Areas where pipe routing is to be avoided where possible.
- Rack Zones
 - Areas where routing pipes is preferred
 - Rules exist for joining, leaving and routing within Pipe Zones
- Pipe Zones
 - Area's where routing pipes is preferred.
 - Rules exist for routing within Pipe Zones.
- Connection Zones
 - Areas for routing pipes to / from
- Via Zones
 - Area's where the pipe route must pass through

INTERGRAPH

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Reference Data

SmartPlant Layout

- Physical Data - Equipment
 - SmartPlant 3D Equipment
 - Any Equipment items placed using SmartPlant 3D can be used in the layout task.
 - Additional Layout Equipment
 - This equipment is provided with the layout task, it is just like normal SmartPlant 3D equipment with the addition of piping nozzles and Pipe / Avoidance zones.
 - Pipe Racks
 - Pipe Racks are supplied as equipment items, with properties for position, length, number of bents, bent spacing etc....
 - Pipe Racks come complete with Rack, Pipe and Avoidance zones.
 - Rules exist for:
 - Joining and leaving the rack
 - Pipeline spacing on the rack.



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Reference Data

SmartPlant Layout

- Physical Data – Structure / Civil ...
 - Any Structural, Civil or other items placed using SmartPlant 3D can be used in the layout task.
 - These items will automatically become obstructions.
 - Pipe Racks
 - Racks can be created from standard catalogue steel with Rack, Pipe and Avoidance zones placed on them.
 - Existing Racks can be used, simply by placing Rack, Pipe and Avoidance zones on them.
 - Layout Racks can automatically create the supporting steel.



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<u>Reference Data</u>	<u>SmartPlant Layout</u>
<ul style="list-style-type: none"> ▪ Physical Data - Pipes <ul style="list-style-type: none"> ▪ Spec Driven <ul style="list-style-type: none"> ▪ Pipe Size ▪ Bend / Elbow Dimensions ▪ Branch / Tee Dimensions ▪ Standout Distance ▪ Shoe Height ▪ Joint Gaps ▪ Branch Gaps ▪ Air Gaps 	



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<u>Reference Data</u>	<u>SmartPlant Layout</u>
<ul style="list-style-type: none"> ▪ Evaluation Cost Data <ul style="list-style-type: none"> ▪ Linear cost of pipe <ul style="list-style-type: none"> ▪ By Bore and Spec ▪ Equivalent length of bends <ul style="list-style-type: none"> ▪ By Bore and Spec ▪ Cost Factors <ul style="list-style-type: none"> ▪ Free Space = 1 ▪ Racks / Pipe Zones < 1 ▪ Avoidance Zones > 1 	



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Reference Data

SmartPlant Layout

Lab 1. Copy Symbols and Bulkload the Layout Reference Data

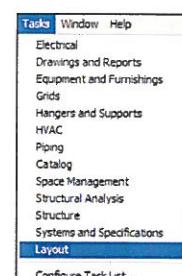
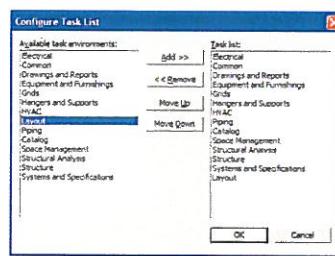
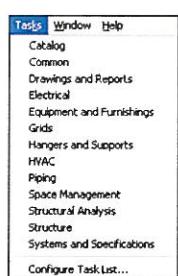


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Configure Tasks

SmartPlant Layout

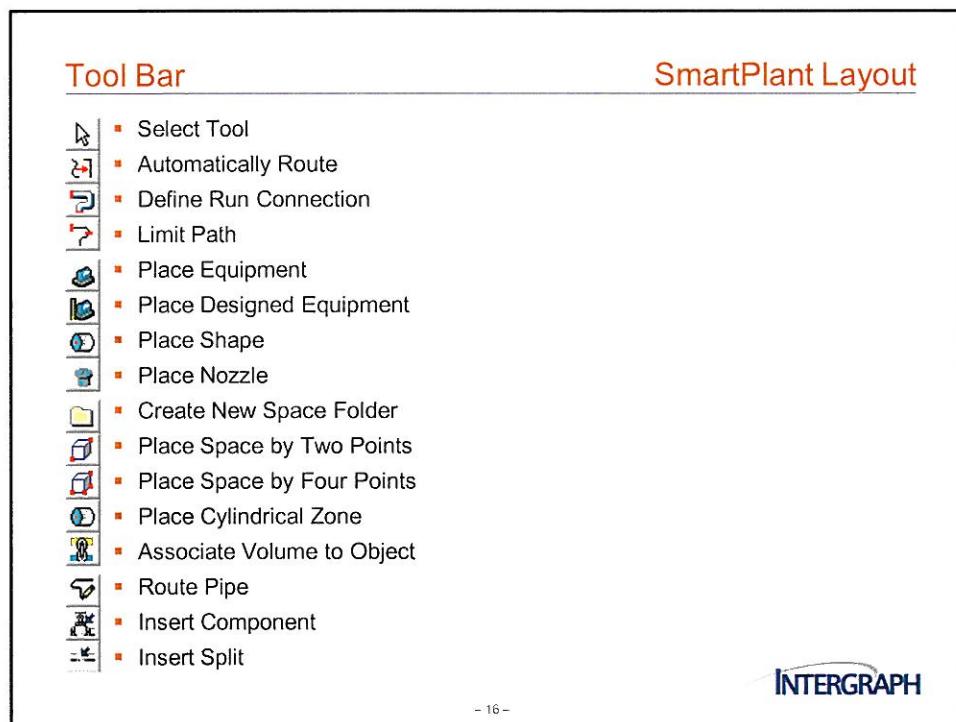
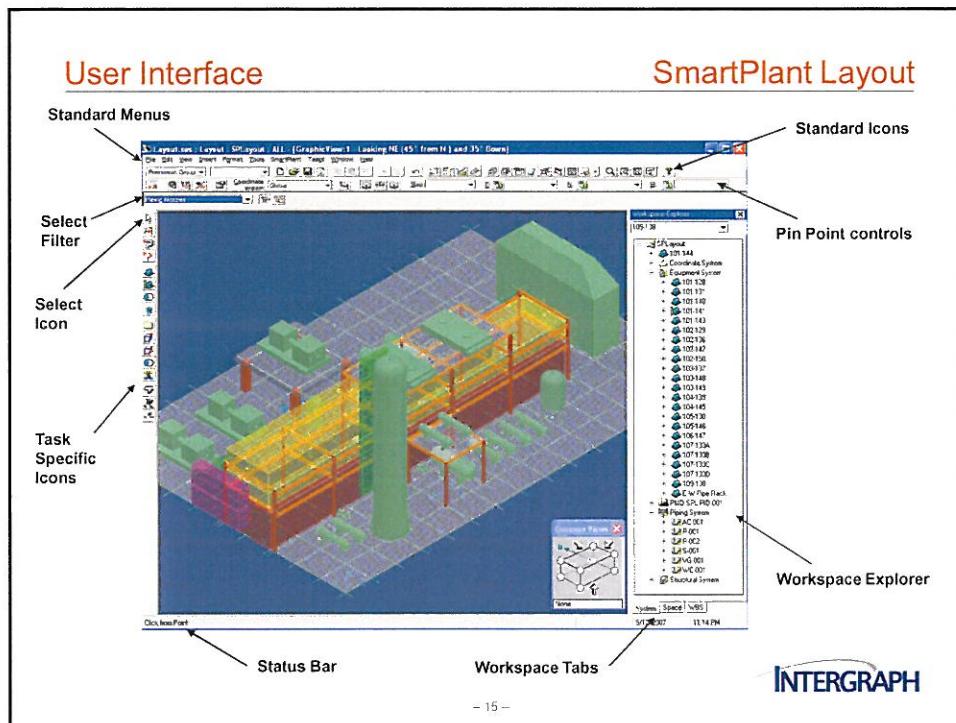
▪ Tasks – Configure Task List



Select Layout and click Add >>



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Task, Filters and Specifications

SmartPlant Layout

- Lab 2. Setting up Filters and Specifications

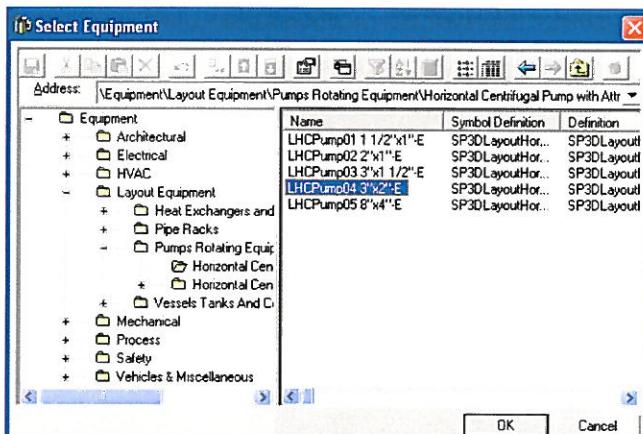
INTERGRAPH

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Placing Equipment

SmartPlant Layout

- Choose Place Equipment
 - Place the equipment as in SmartPlant 3D, you will notice the additional 'Layout Equipment'



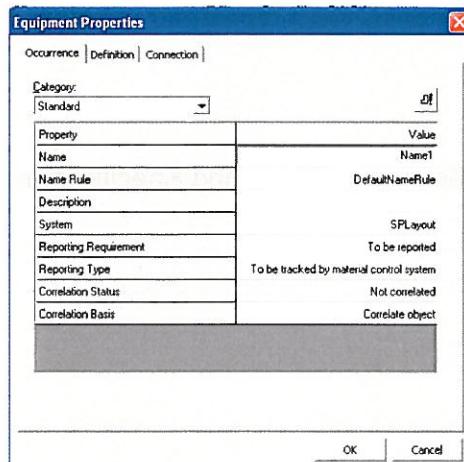
INTERGRAPH

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Placing Equipment

SmartPlant Layout

- Name the Equipment
- Change Properties as appropriate and then OK



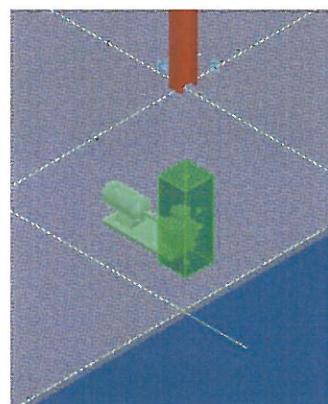
INTERGRAPH

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Placing Equipment

SmartPlant Layout

- Use Pinpoint to get accurate placement
- Use lock for Elevation or key in value
- Item is placed



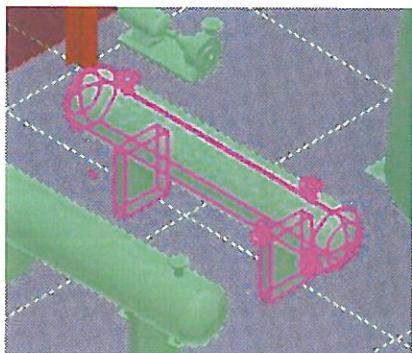
INTERGRAPH

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Placing Equipment

SmartPlant Layout

- Properties allows changing of parameters for item chosen



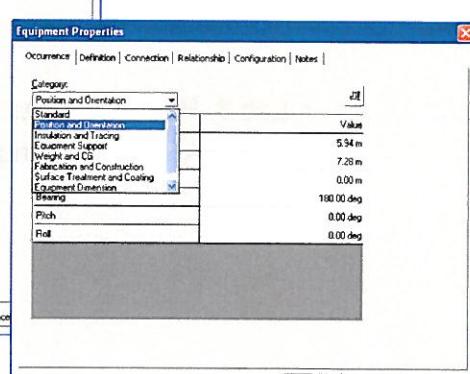
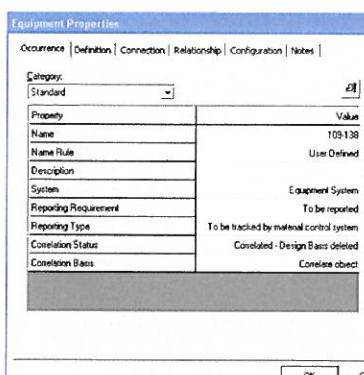
INTERGRAPH

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Placing Equipment

SmartPlant Layout

- Properties allows changing of parameters for item chosen



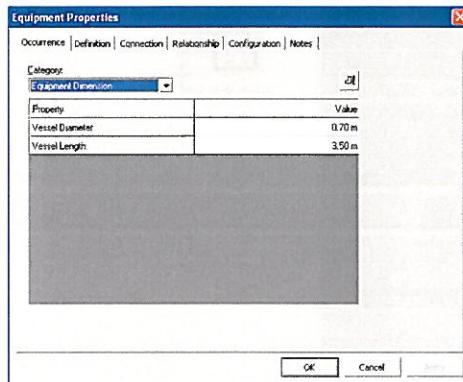
INTERGRAPH

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Placing Equipment

SmartPlant Layout

- Properties allows changing of parameters for item chosen



INTERGRAPH

- 23 -

Placing Equipment

SmartPlant Layout

- Lab 3. Placing Layout Equipment
- Lab 3A. Auto Routing Pipelines

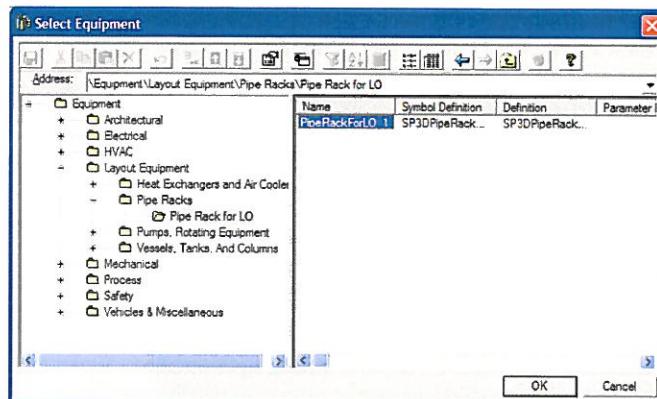
INTERGRAPH

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Placing Pipe Racks

SmartPlant Layout

- Place a Pipe Rack as an equipment item



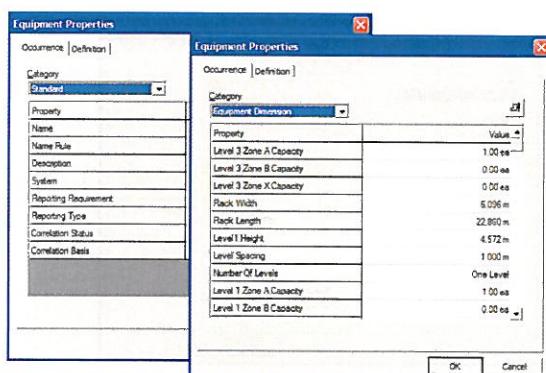
INTERGRAPH

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Placing Pipe Racks

SmartPlant Layout

- Properties



Set a Name

Dimensions / Levels

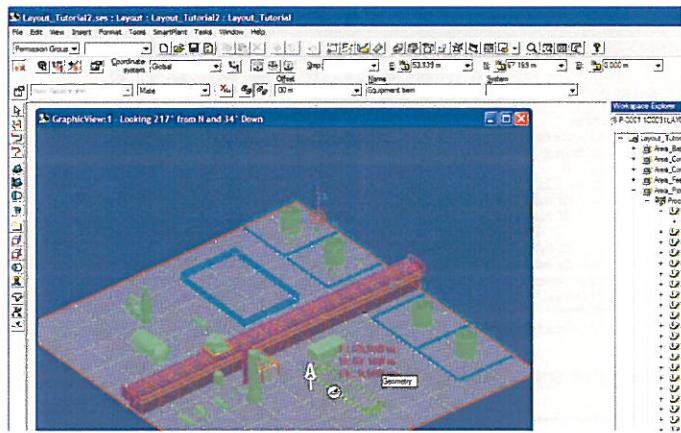
INTERGRAPH

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Placing Pipe Racks

SmartPlant Layout

■ Position the Rack



Position the Rack, use Pin Point if required.

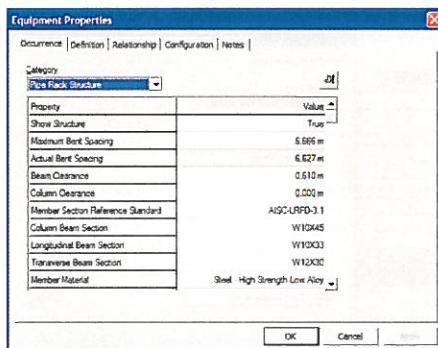
INTERGRAPH

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Placing Pipe Racks

SmartPlant Layout

■ Properties



Create the Structure if required.

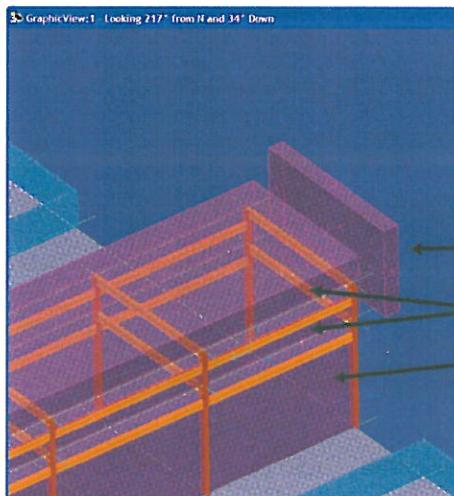
INTERGRAPH

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Placing Pipe Racks

SmartPlant Layout

- Properties



Note the zones:

- Connection Zone
- Pipe Rack Zones
- Avoidance Zone

INTERGRAPH

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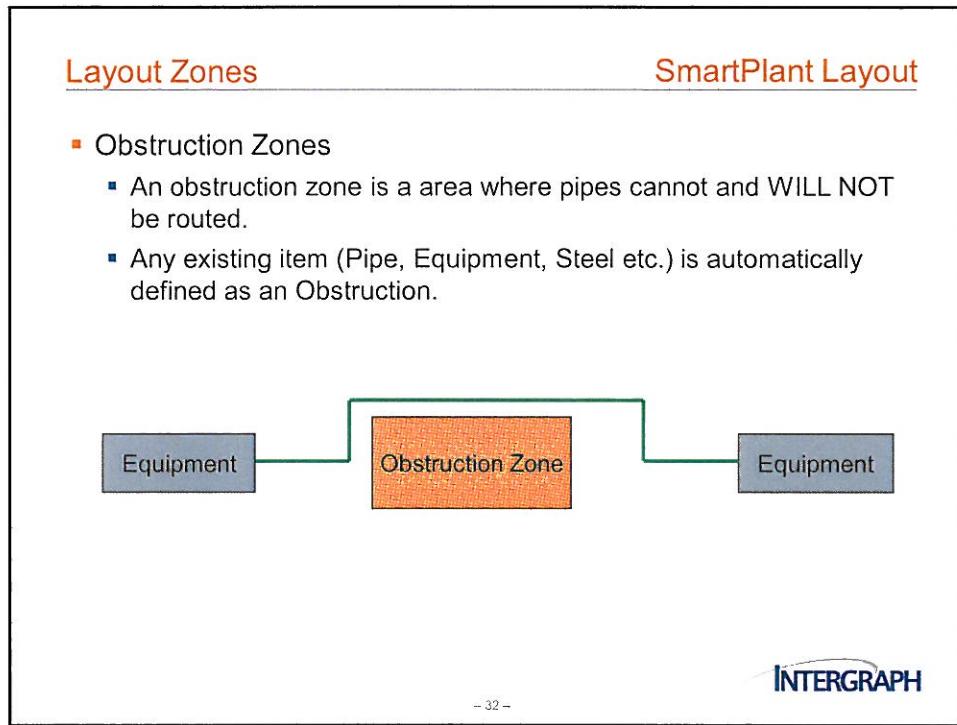
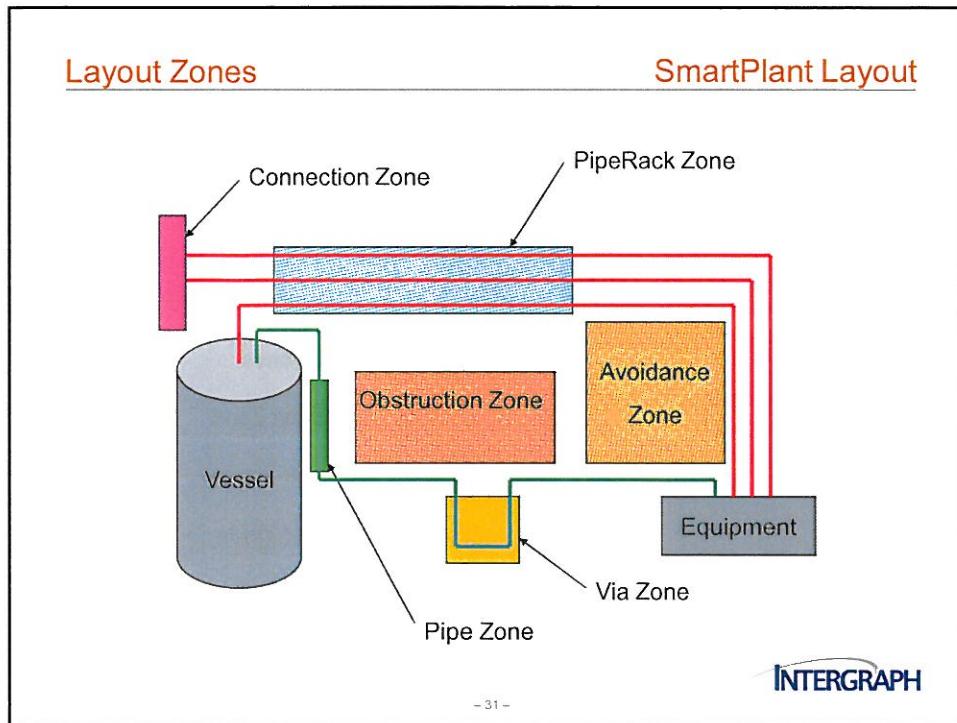
Placing Pipe Racks

SmartPlant Layout

- Lab 4. Place a Pipe Rack
- Lab 4A. Auto Routing Pipelines

INTERGRAPH

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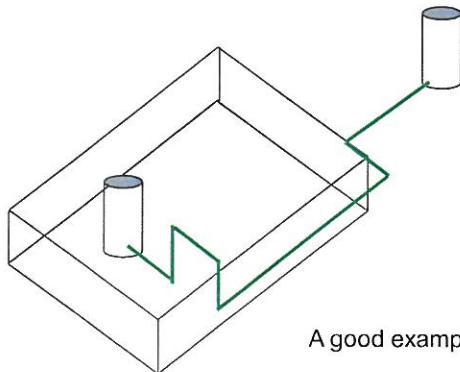


Layout Zones

SmartPlant Layout

■ Avoidance Zones

- Area's where pipe routing is to be avoided where possible.
- Area's that can be entered if essential.



A good example here may be a vessel bund.

INTERGRAPH

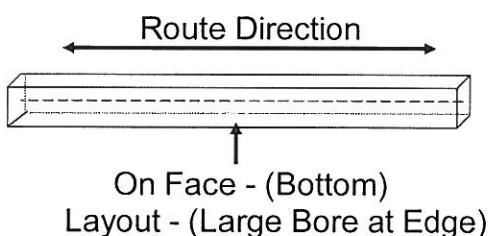
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Layout Zones

SmartPlant Layout

■ Rack Zones

- Area's where routing pipes is preferred.
- Rules for pipe layout.
- Rules for pipe as it joins / leaves.
- Pipes can be placed on levels according to fluid code.



INTERGRAPH

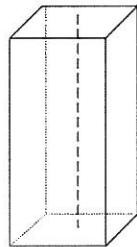
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Layout Zones

SmartPlant Layout

▪ Pipe Zones

- Area's where routing pipes is preferred.
- Often adjacent to a piece of equipment or structure with pipe support potential.
- Layout less constrained than a rack.
- Rules exist for routing within Pipe Zones.



Route Direction

On Face - only obeyed if no extra cost

INTERGRAPH

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Layout Zones

SmartPlant Layout

▪ Rack Zones and Pipe Zones

- Important Note.
 - Initial characterisation is by the end co-ordinates of the longest axis.
 - These must not be within an obstruction.

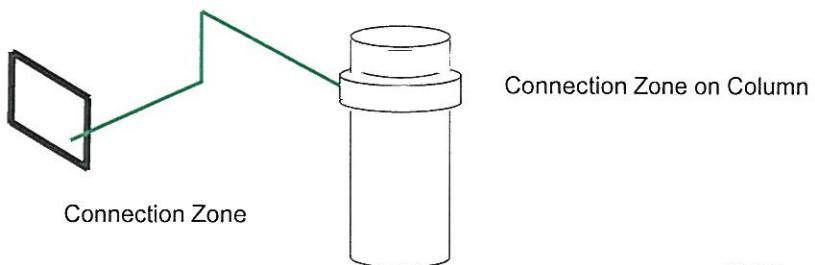
INTERGRAPH

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Layout Zones

SmartPlant Layout

- Connection Zones
 - Area's for routing pipes to / from
 - Box or Cylinder
 - Pipes will be attached to nearest point on surface



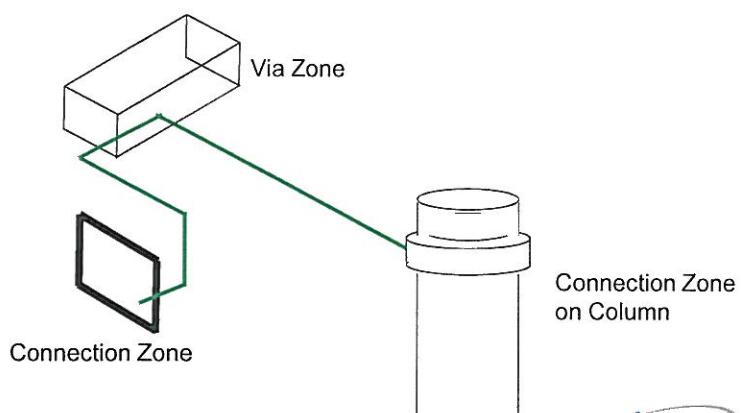
INTERGRAPH

Layout Zones

SmartPlant Layout

Via Zones

- Area's where the pipe route must pass through
- Used to control / force the routing



INTERGRAPH

Layout Zones

SmartPlant Layout

- Zone Precedence
 - Racks
 - will penetrate
 - Obstructions
 - will penetrate
 - Pipe Zones
 - will penetrate
 - Avoidance Zones

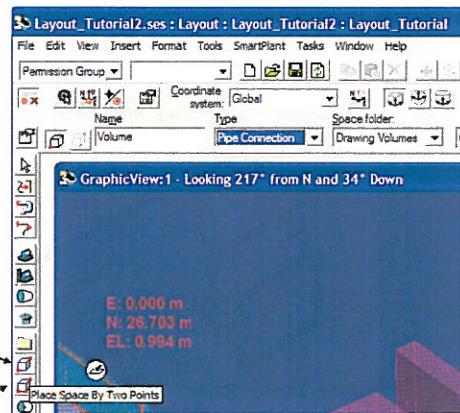
INTERGRAPH

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Placing / Modifying Zones

SmartPlant Layout

- Use the 'Place Space' icons
 - Set the name
 - Specify the type
 - Specify the space folder
 - Use Pin Point if required



INTERGRAPH

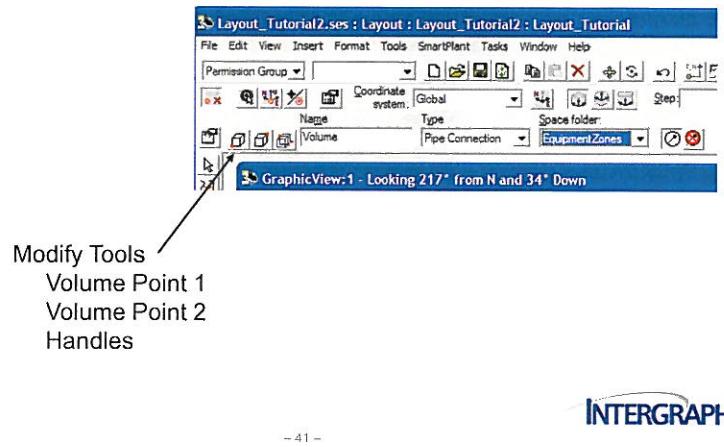
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Placing / Modifying Zones

SmartPlant Layout

- Select the Zone

- Modify the name, type, space folder and size as required.



Placing / Modifying Zones

SmartPlant Layout

- Lab 5. Place an Obstruction Volume
 - Lab 5A. Auto Routing Pipelines

INTERGRAPH

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Format View Styles

SmartPlant Layout

- Changing the look of the data
 - Surface Style Rules



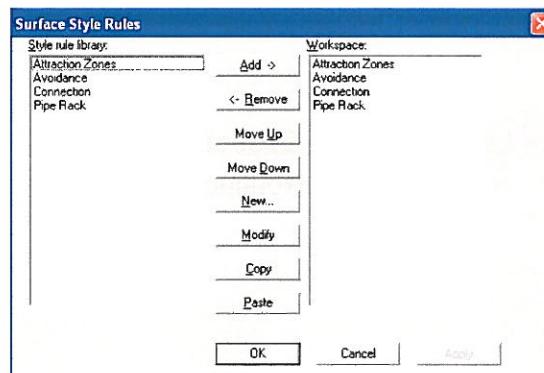
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INTERGRAPH

Format View Styles

SmartPlant Layout

- Changing the look of the data
 - Surface Style Rules



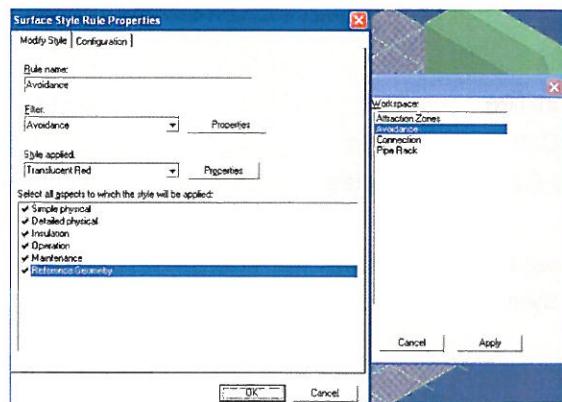
- 44 -

INTERGRAPH

Format View Styles

SmartPlant Layout

- Changing the look of the data
 - Surface Style Rules



The Object Type filters for Zones can be found in;

SP3D\Space\Space Entities\zones

Use translucent Colours to display the zones



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Format View Styles

SmartPlant Layout

- Lab 6. Surface Styles



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Auto Route Concepts

SmartPlant Layout

- Pipes can be routed between the following items:
 - Nozzle to Nozzle
 - Nozzle to Branch/Tee
 - Branch/Tee to Nozzle
 - Branch/Tee to Branch/Tee
 - Any of the above to Connection Zones
 - Connection Zones to Connection Zones
- Using physical and cost reference data, the cheapest route is determined and displayed.

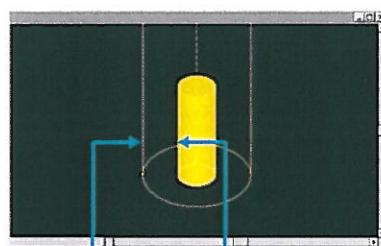
INTERGRAPH

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Auto Route Concepts

SmartPlant Layout

- Pipe Envelope
 - Each pipe carries a radial clearance envelope
 - Pipe spacing is a consequence of the envelopes



Pipe + Air Gap = Routing Diameter

- Properties are defined by Pipe Spec and Size and can be over ridden by the user.

INTERGRAPH

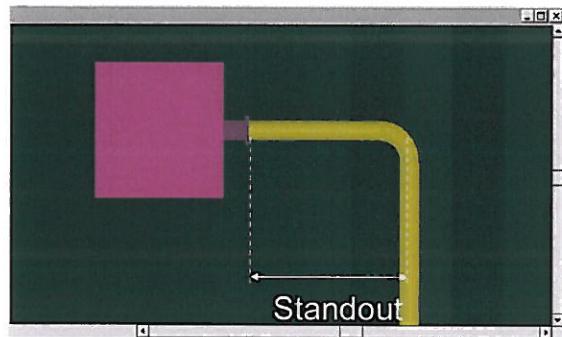
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Auto Routing Concepts

SmartPlant Layout

- Flexibility

- Properties are defined by Pipe Spec and Size and can be over ridden by the user.



INTERGRAPH

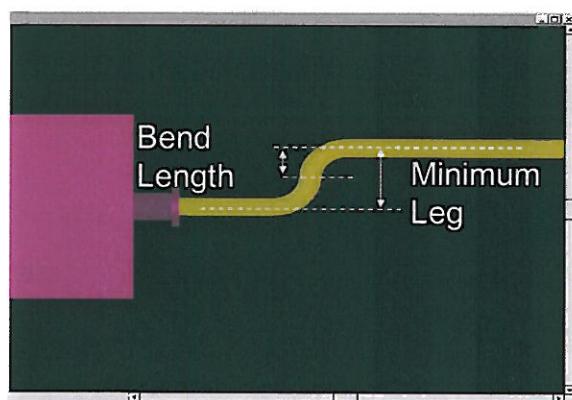
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Auto Routing Concepts

SmartPlant Layout

- Minimum Legs

- Properties are defined by Pipe Spec and Size and can be over ridden by the user.



INTERGRAPH

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Auto Routing Concepts

SmartPlant Layout

- Cost Data
 - Linear cost of pipe
 - By Bore and Spec
 - Equivalent length of bends
 - By Bore and Spec
- Cost Factors
 - Free Space = 1
 - Racks / Pipe Zones < 1
 - Avoidance Zones > 1

INTERGRAPH

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Auto Routing Concepts

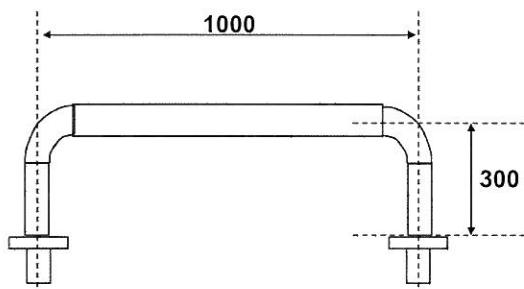
SmartPlant Layout

- Routing in Free Space

Linear Cost = 1

Bend Cost = 100

Evaluation Cost = $1000 + 300 + 300 + (2 \times 100) = 1800$



INTERGRAPH

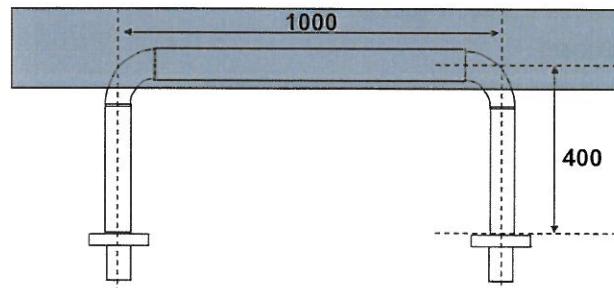
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Auto Routing Concepts

SmartPlant Layout

- Routing using Racks

Rack Cost Factor = 0.2
Evaluation Cost = $(1000 * 0.2) + 400 + 400 + (2*100) = 1200$



INTERGRAPH

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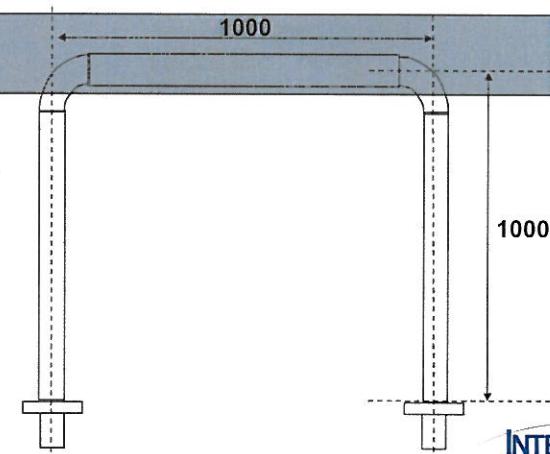
Auto Routing Concepts

SmartPlant Layout

- Forcing the use of Racks

Evaluation Cost = $(1000 * 0.2) + 1000 + 1000 + (2*100) = 2400$

Specify the Rack as
a 'Via' Volume



INTERGRAPH

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Auto Routing Concepts

SmartPlant Layout

- Routing Features
 - Orthogonal routes by default.
 - Skews.
 - Nozzles.
 - Racks & Zones.
 - Tee Directions.
 - Can be specified if required.
 - Reducers.
 - Will be automatically inserted where required.
 - Pre-Routed Pipe.
 - As with Equipment, Civil and Steel etc. existing pipe will automatically become an obstruction.

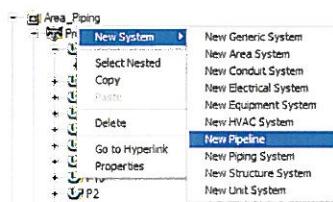


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Creating Pipelines

SmartPlant Layout

- Whilst in the layout task, a right mouse click in the Workspace explorer (System tab) will allow the creation of a pipeline.



- Enter a name for the pipeline and a owning system.

This is identical to creating Pipelines in SmartPlant 3D

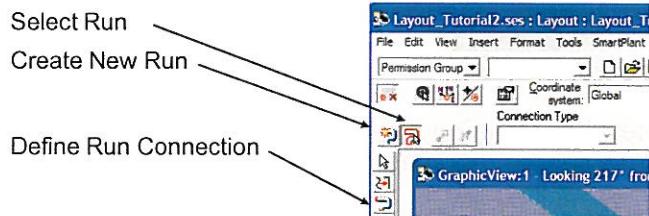


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Creating Pipe Runs

SmartPlant Layout

- Pipe runs can be created in the conventional SmartPlant 3D manner if desired.
- Use the 'Define Run Connection' icon to create runs and set the to / from information.



- When defining Runs, ensure that the nominal size, pipe spec and optionally, the fluid code are specified.

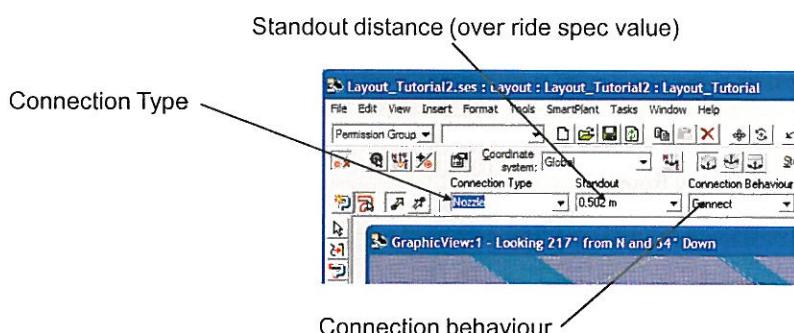
INTERGRAPH

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Creating Pipe Runs

SmartPlant Layout

- Following creation / selection of the run, the start type and start point should be specified.



- Dependent on connection type, options will vary

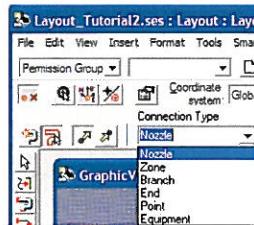
INTERGRAPH

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Creating Pipe Runs

SmartPlant Layout

- Connection Types.



- Settings made when defining connections are stored on the Pipe Run, these can be modified from the property dialogues if required.
- Continue to create / define runs as required.
- The auto routed pipe nominal size is taken from the Run Properties.

INTERGRAPH

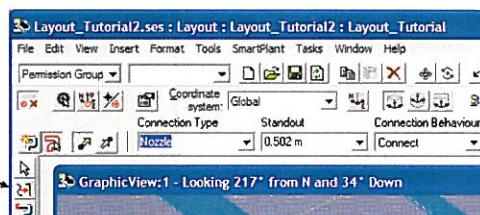
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Auto Routing Pipelines

SmartPlant Layout

- Use the 'Automatically Route' icon.

Automatically Route



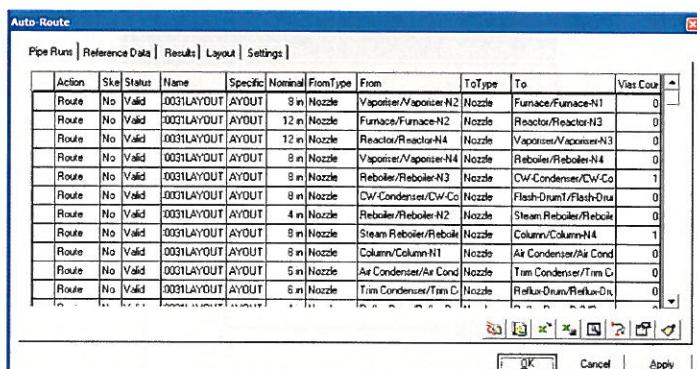
INTERGRAPH

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Auto Routing Pipelines

SmartPlant Layout

- Use the 'Automatically Route' icon.



- All defined runs will be displayed with nominal sizes, to and from connections and the number of via's etc.

INTERGRAPH

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Auto Routing Pipelines

SmartPlant Layout

- The Auto-Route icons.



Add Runs to the form
 Add Runs From a P&ID
 Add Runs From a Spreadsheet
 Save Runs to a Spreadsheet
 Preview Routes
 Automatically Route Pipes
 View / Change properties of the selected run
 Clear one or more runs

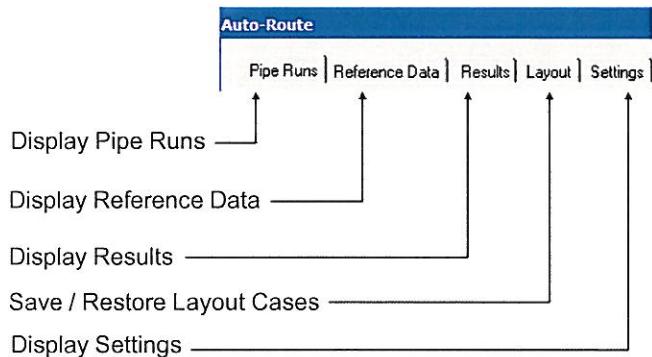
INTERGRAPH

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Auto Routing Pipelines

SmartPlant Layout

- The Auto-Route Tabs.



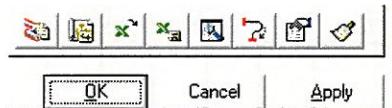
INTERGRAPH

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Auto Routing Pipelines

SmartPlant Layout

- The Auto-Route Buttons.



OK – Accept all changes and close the Dialogue

Cancel – Cancel all changes and close the dialogue

Apply – Accept the changes, leave the dialogue open.

INTERGRAPH

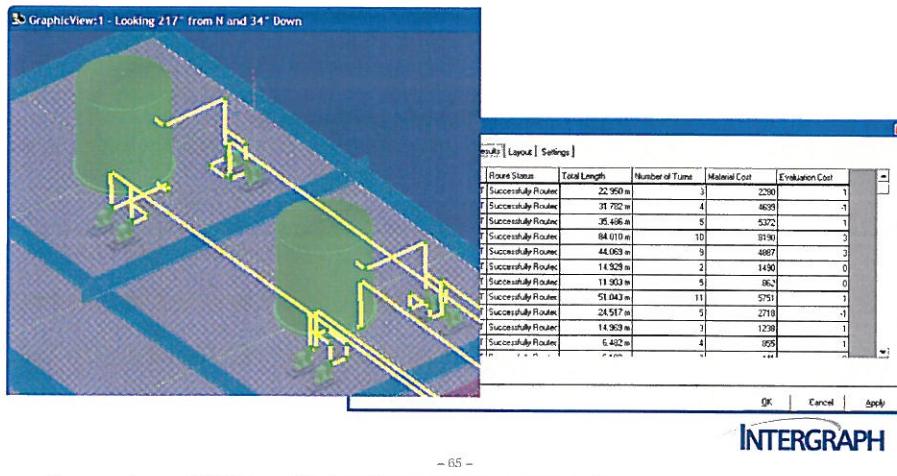
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Auto Routing Pipelines

SmartPlant Layout

- Preview the auto routing.

- Using the 'Preview' icon, the routes will be displayed in the model, the results will also be displayed on the 'Results' tab.



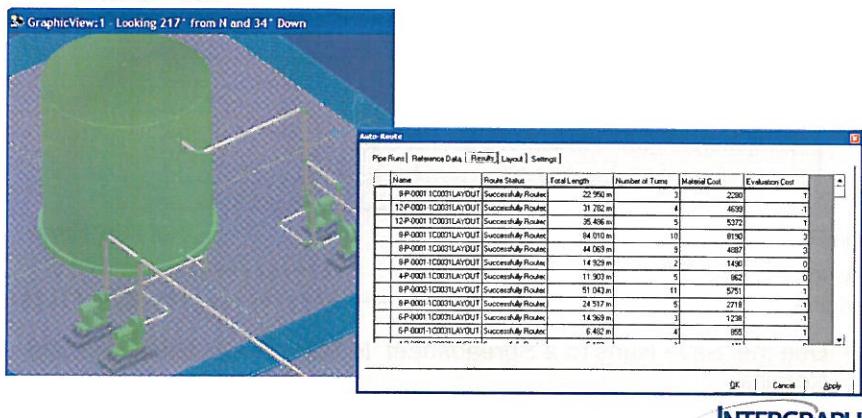
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Auto Routing Pipelines

SmartPlant Layout

- Auto Route the Pipelines.

- Using the 'Automatically Route Pipes' icon, the routes will be created in the model, the results will also be displayed on the 'Results' tab.



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Auto Routing Pipelines

SmartPlant Layout

- Lab 7. Auto Routing Pipelines

INTERGRAPH

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Understanding the Results

SmartPlant Layout

- The Results display.

Name	Route Status	Total Length	Number of Turns	Material Cost	Evaluation Cost
B-P-0001-1C0031LAYOUT	Successfully Routed	22.350 m	3	2260	1
12-P-0001-1C0031LAYOUT	Successfully Routed	31.782 m	4	4589	-1
12-P-0001-1C0031LAYOUT	Successfully Routed	35.496 m	5	5372	1
9-P-0001-1C0031LAYOUT	Successfully Routed	64.010 m	10	8190	2
8-P-0001-1C0031LAYOUT	Successfully Routed	44.069 m	9	4867	3
8-P-0001-1C0031LAYOUT	Successfully Routed	14.929 m	2	1450	0
4-P-0001-1C0031LAYOUT	Successfully Routed	11.903 m	5	962	0
8-P-0002-1C0031LAYOUT	Successfully Routed	51.043 m	11	5751	-1
8-P-0001-1C0031LAYOUT	Successfully Routed	24.517 m	5	2718	-1
6-P-0001-1C0031LAYOUT	Successfully Routed	14.363 m	9	1238	-1
6-P-0001-1C0031LAYOUT	Successfully Routed	8.482 m	4	695	1

Pipe Run Name

Routing Status

Length of Pipe

Not Functional

Material Cost

Number of Turns

- Use the 'Save Runs to a Spreadsheet' to Save Route definitions and Results.

INTERGRAPH

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Understanding the Results **SmartPlant Layout**

- The Run Spreadsheet.
- Run Information.

Head	Action	Pipeline	Run Name	Pipe Spec	NPD	NPD UnitType	From Type	From Item	To Type
Start	Route	P6	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Vaporiser/Vapouriser-H2	Nozzle	F	
	Route	P7	12-P-0001-IC0031L1C0031LAYOUT	12 in	Nozzle	Furnace/Furnace-H2	Nozzle	F	
	Route	P8	12-P-0001-IC0031L1C0031LAYOUT	12 in	Nozzle	Reactor/Reactor-H2	Nozzle	S	
	Route	P9	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Vapouriser/Vapouriser-H2	Nozzle	F	
	Route	P10	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Reboiler/Reboiler-H3	Nozzle	C	
	Route	P11	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	CIV/Condenser/CIV-Condenser Nozzle	Nozzle	F	
	Route	P12	4-P-0001-IC0031L1C0031LAYOUT	4 in	Nozzle	Reboiler/Reboiler-H2	Nozzle	S	
	Route	P13	12-P-0001-IC0031L1C0031LAYOUT	12 in	Nozzle	Steam/Steam-Generator-H1-Nozzle	Nozzle	C	
	Route	P14	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Compressor/Compressor-H1-Nozzle	Nozzle	A	
	Route	P15	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Compressor/Compressor-H1-Nozzle	Nozzle	A	
	Route	P16	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Compressor/Compressor-H1-Nozzle	Nozzle	A	
	Route	P17	SP-0001-IC0031L1C0031LAYOUT	8 in	Nozzle	Air Condenser/Air Condenser-Nozzle	Nozzle	T	
	Route	P18	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Titan Condenser/Titan Condenser-Nozzle	Nozzle	F	
	Route	P19	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Reflux/Drum/Reflux-Drum-H1-Nozzle	Nozzle	F	
	Route	P20	4-P-0001-IC0031L1C0031LAYOUT	4 in	Nozzle	Product Pump-1/Pump-1-Branch	Nozzle	A	
	Route	P21	4-P-0002-IC0031L1C0031LAYOUT	4 in	Nozzle	Product Pump-2/Pump-2-Branch	Nozzle	A	
	Route	P22	4-P-0002-IC0031L1C0031LAYOUT	4 in	Nozzle	Reflux Pump-P-1/Pump-P-1-Branch	Nozzle	A	
	Route	P23	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Flash Drum/F Flash Drum-TA-Nozzle	Nozzle	C	
	Route	P24	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	12-P-0001-IC0031LAYOUT Zone	Nozzle	F	
	Route	P25	4-P-0002-IC0031L1C0031LAYOUT	4 in	Nozzle	Feed Pump-A-1PumpA-1-Nozzle	Nozzle	F	
	Route	P26	4-P-0002-IC0031L1C0031LAYOUT	4 in	Nozzle	Feed Pump-A-2PumpA-2-Nozzle	Nozzle	A	
	Route	P27	4-P-0101-IC0031L1C0031LAYOUT	4 in	Nozzle	Feed PumpA-3PumpA-3-Nozzle	Nozzle	A	
	Route	P28	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Feed PumpA-4PumpA-4-Nozzle	Nozzle	A	
	Route	P29	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Feed PumpB-1PumpB-1-Or Branch	Nozzle	E	
	Route	P30	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Feed PumpB-2PumpB-2-Or branch	Nozzle	E	
	Route	P31	6-P-0001-IC0031L1C0031LAYOUT	6 in	Nozzle	Compressor/Compressor-H1-Branch	Nozzle	G	
	Route	P32	4-P-0001-IC0031L1C0031LAYOUT	4 in	Nozzle	Feed PumpB-3PumpB-3-Nozzle	Nozzle	F	

INTERGRAPH

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Understanding the Results **SmartPlant Layout**

- The Run Spreadsheet.
- Via Volumes

Head	Run Name	VolumeName/DB Identifier...
Start	B-P-0001-IC0031LAYOUT	
	12-P-0001-IC0031LAYOUT	
	12-P-0001-IC0031LAYOUT	
	8-P-0001-IC0031LAYOUT	
	8-P-0001-IC0031LAYOUT	
	8-P-0001-IC0031LAYOUT PipeRack-1A/[00011176-0000-0000-3510-6F0A92461F04]	
	8-P-0001-IC0031LAYOUT	
	4-P-0001-IC0031LAYOUT	
	8-P-0002-IC0031LAYOUT PipeRack-1A/[00011176-0000-0000-3510-6F0A92461F04]	
	8-P-0001-IC0031LAYOUT	
	6-P-0001-IC0031LAYOUT	
	6-P-0001-IC0031LAYOUT	
	4-P-0001-IC0031LAYOUT	
	4-P-0001-IC0031LAYOUT	
	4-P-0002-IC0031LAYOUT	
	12-P-0001-IC0031LAYOUT	
	12-P-0001-IC0031LAYOUT	
	4-P-0001-IC0031LAYOUT	
	4-P-0102-IC0031LAYOUT	
	6-P-0001-IC0031LAYOUT PipeRack-1A/[00011176-0000-0000-3510-6F0A92461F04]	
	6-P-0101-IC0031LAYOUT	
	6-P-0001-IC0031LAYOUT	
	6-P-0001-IC0031LAYOUT	
	6-P-0001-IC0031LAYOUT	
	4-P-0001-IC0031LAYOUT	

INTERGRAPH

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Understanding the Results

SmartPlant Layout

- The Run Spreadsheet.
 - Reference Data.

INTERGRAPH

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Understanding the Results

SmartPlant Layout

- The Run Spreadsheet.
 - Results.

A	B	C	D	E	F	G	H	I
1	Plant Name : Layout_Tutorial2		Version : -	.07/00				
2	User Name : @SRSNE\Pothekar		Date & Time : -	11/12/2007 13:34				
AutoRoute Results								
3	Head	Run Name	Route Status	Total Length	Number of Turns	Material Cost	Evaluation Cost	
4	Start							
5	8-P-0001	1C031LAYOU	Successfully Routed	22 950 m	3	2290	1	
6	12-P-0001	1C031LAYOU	Successfully Routed	31 782 m	4	4699	1	
7	10-P-0001	1C031LAYOU	Successfully Routed	35 267 m	5	5372	1	
8	8-P-0001	1C031LAYOU	Successfully Routed	35 019 m	10	8190	2	
9	8-P-0001	1C031LAYOU	Successfully Routed	44 069 m	9	4887	3	
10	8-P-0001	1C031LAYOU	Successfully Routed	14 929 m	2	1490	0	
11	4-P-0001	1C031LAYOU	Successfully Routed	11 303 m	5	862	0	
12	8-P-0001	1C031LAYOU	Successfully Routed	49 160 m	13	5999	2	
13	8-P-0001	1C031LAYOU	Successfully Routed	51 610 m	9	3875	1	
14	6-P-0001	1C031LAYOU	Successfully Routed	14 969 m	3	1238	1	
15	6-P-0001	1C031LAYOU	Successfully Routed	6 481 m	4	855	1	
16	4-P-0001	1C031LAYOU	Successfully Routed	5 192 m	3	441	0	
17	1-P-0001	1C031LAYOU	Successfully Routed	6 037 m	1	330	0	
18	4-P-0002	1C031LAYOU	Successfully Routed	2 287 m	2	208	0	
19	4-P-0002	1C031LAYOU	Successfully Routed	2 892 m	3	350	0	
20	12-P-0001	1C031LAYOU	Successfully Routed	49 570 m	9	7981	2	
21	12-P-0001	1C031LAYOU	Successfully Routed	33 785 m	3	4699	0	
22	4-P-0001	1C031LAYOU	Successfully Routed	6 229 m	2	405	0	
23	4-P-0002	1C031LAYOU	Successfully Routed	3 233 m	1	203	0	
24	6-P-0001	1C031LAYOU	Successfully Routed	103 745 m	8	7072	-6	
25	4-P-0101	1C031LAYOU	Successfully Routed	2 496 m	0	147	0	
26	4-P-0001	1C031LAYOU	Successfully Routed	2 496 m	0	147	0	
27	4-P-0001	1C031LAYOU	Successfully Routed	2 496 m	1	105	0	
28	6-P-0001	1C031LAYOU	Successfully Routed	15 392 m	3	1263	0	
29	4-P-0001	1C031LAYOU	Successfully Routed	6 043 m	2	395	0	

INTERGRAPH

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Controlling Routing

SmartPlant Layout

- Pipe routing can be influenced by:
 - Placing Zones.
 - Racks, Pipe, Obstruction and Avoidance.
 - Setting Via's.
 - Selecting an existing zone to go via.
 - Creating a new zone to go via.
 - Runs can have more than one via. setting.
 - Changing Cost Factors on Zones.
 - <1 Attract, > 1 Avoid.
 - Changing Run properties.
 - Standout distance.
 - Air Gap, Branch Gap, Joint Gap
 - Linear Cost , Bend Cost.
 -
 - Routing in stages
 - Routed pipes become obstructions for the next batch

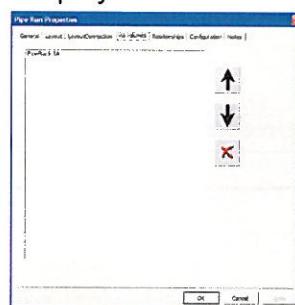


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Controlling Routing

SmartPlant Layout

- Limit Path Command
 - Select the 'Limit Path' icon
 - If the current selection is not a run, Select the run to limit
 - Select the volume to route via.
- Via volumes are displayed on the 'Run Properties' dialogue.



- Via. Settings can be ordered and deleted from this dialogue.

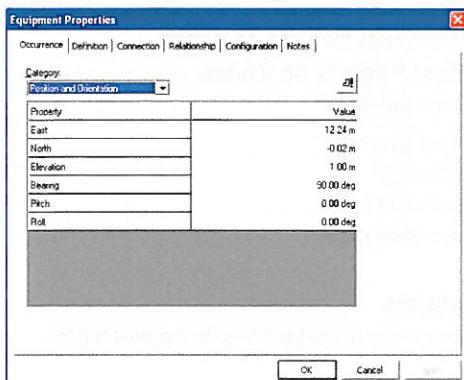


- 74 -

Modifying Equipment

SmartPlant Layout

- Choose Equipment with Select option
- Choose Move 
- Locate equipment in new position
- NOTE: can also be changed through individual equipment properties



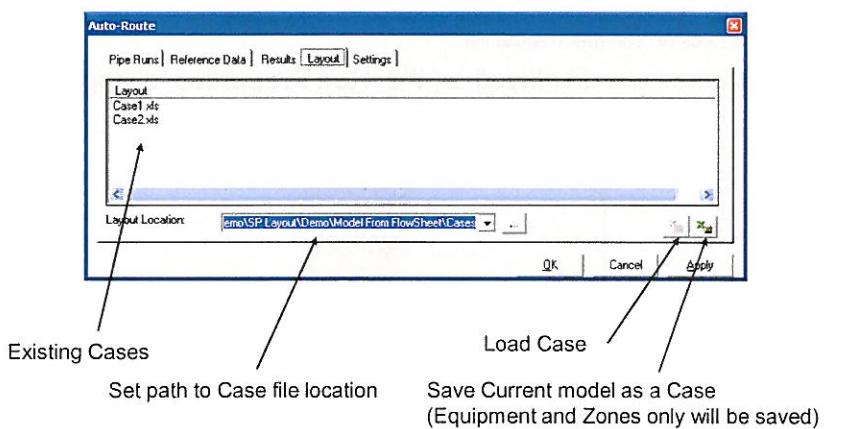
INTERGRAPH

- 75 -

Saving Cases

SmartPlant Layout

- Using the Auto-Route Dialogue
 - Select the Layout tab



INTERGRAPH

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Saving Cases

SmartPlant Layout

The Case File

		Status	System	Name	Part Name	GUID
3						
4						
5	Head					
6						
7	Start					
8	M			Feed_Equipment	Feed_PumpB-2	PumpAsmCPump002A8d [0004E2E-0000-0000-4604-0391A8461F04]
9	M			Feed_Equipment	Feed_PumpA-1	PumpAsmCPump002A8d [0004E2E-0000-0000-4604-0391A8461F04]
10	M			Feed_Equipment	Feed_PumpB-1	PumpAsmCPump002A8d [0004E2E-0000-0000-4604-0391A8461F04]
11	M			Feed_Equipment	FeedB	VTankLayVTankLag
12	M			Product_Equipment	Product	VTankLayVTankLag
13	M			Product_Equipment	ByProduct	VTankLayVTankLag
14	M			Feed_Equipment	FeedA	VTankLayVTankLag
15	M			Feed_Equipment	FeedA	PipeRack
16	M			Area_Reactor	HeaterStack	CoolerAasmHEC1H01A
17	M			Area_Reactor	HeVaporizer	CoolerAasmHEC1H01A
18	M			Area_Separation	Column	LayoutColumnColumn.wrd
19	M			Area_Compressor	Compressor	HorRackPdXAreaHorRe
20	M			Area_Reactor	HeCv-Candenser	HorRackPdXAreaHorRe
21	M			Area_Separation	Reboiler	CoolerAasmHEC1H01A
22	M			Area_Sep	Reboiler	CoolerAasmHEC1H01A
23	M			Area_Separation	FlashDrum1	HorRackSuppAasm
24	M			Area_Product	Trim Condenser	HorRackSuppAasm
25	M			Feed_Equipment	FeedPumpA-3	VTankLayVTankLag
26	M			Feed_Equipment	Feed_PumpA-4	VTankLayVTankLag
27	M			Feed_Equipment	Feed_PumpB-4	VTankLayVTankLag
28	M			Feed_Equipment	Feed_PumpB-3	VTankLayVTankLag
29	M			Feed_Equipment	Feed_PumpA-2	VTankLayVTankLag
30	M			Area_Reactor	HeFlame	CoolerAasmCoolsAasm
31	M			Area_Separation	1Steam Reboiler	KettleFchInletAasmKet
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- Lab 8. Saving Cases



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- Lab 9. Practical Exercise



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