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Ingenuity for life

电子企业生产过程中的流程仿真与优化

SEWC applications by PlantSimulation

 Realize innovation.

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Agenda

- SEWC- Digital Factory
- Practice 1:
  Process simulaton&optimization
- Practice 2:
  Material flow simulation
- Practice 3:
  Factory layout simulation

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SEWC – general information
西门子工业自动化产品(成都)有限公司

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Products:

Highlights:

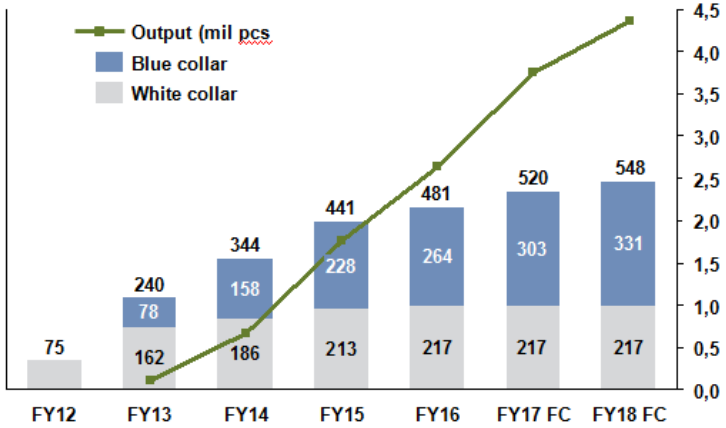
§ **12,000+ products / day**

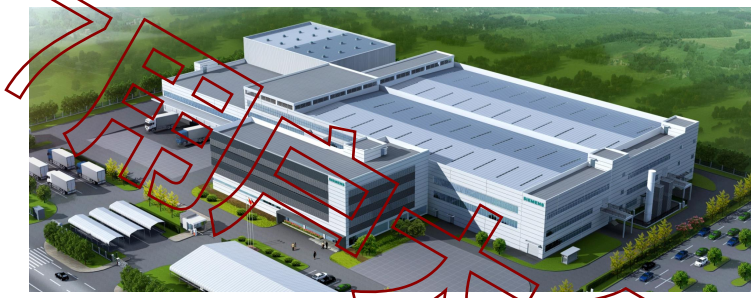
§ **500 MLFBs**

§ **3000 material parts**

§ **3.5 million components / day**

§ **Global delivery, 2 DC**





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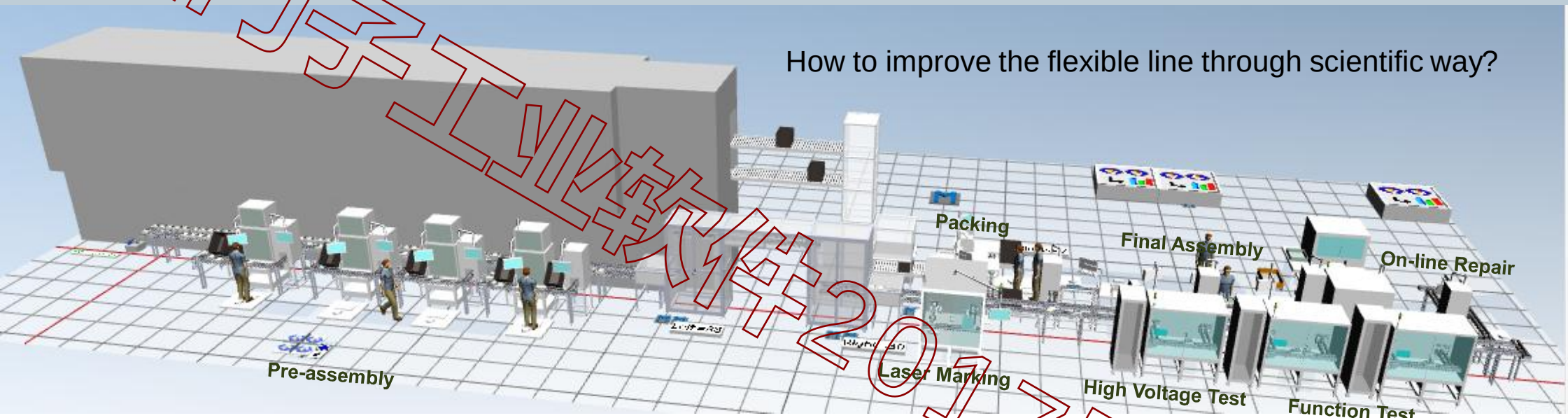
Automated assembly line



Key Factors:
- Flexible production line
- Total 72 MLFBs are produced in this line
- 2-3 MLFBs can be mix produced at the same time
- Different MLFB has different processing time
- Different MLFB combination group create different output

Processes:
- Pre-assembly*3
- Laser Marking*1
- High Voltage Test*1
- Function Test*2
- Analog Function Test*1
- Final Assembly*1
- Packing*2
- On-line Repair*1

We use Tecnomatix to simulate:
How the WorkPieceCarrier quantity impact the maximum output

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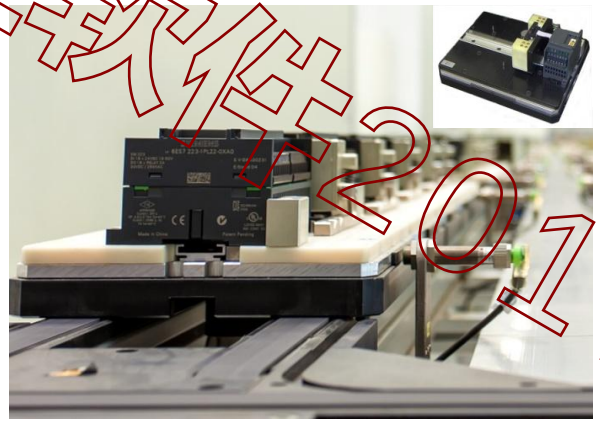
Simulation:

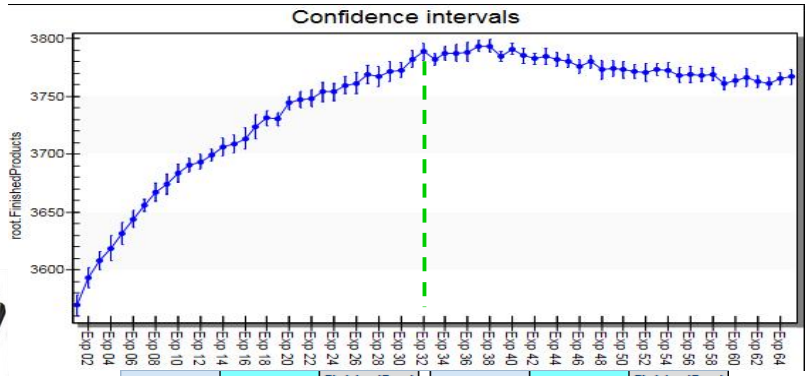
Process the experiment simulation by changing the WorkPieceCarrier quantity from 80pcs to 120pcs

Result:

After a certain level, more WorkPieceCarrier can't get obvious improvement on output.

Reference quantity: 87pcs





Exp	WT QTY	FinishedProducts	Exp	WT QTY	FinishedProducts
Exp 01	56	3570	Exp 34	89	3787
Exp 02	57	3594	Exp 35	90	3787
Exp 03	58	3609	Exp 36	91	3788
Exp 04	59	3619	Exp 37	92	3794
Exp 05	60	3632	Exp 38	93	3794
Exp 06	61	3644	Exp 39	94	3785
Exp 07	62	3656	Exp 40	95	3791
Exp 08	63	3667	Exp 41	96	3785
Exp 09	64	3674	Exp 42	97	3783
Exp 10	65	3684	Exp 43	98	3785
Exp 11	66	3691	Exp 44	99	3782
Exp 12	67	3694	Exp 45	100	3781
Exp 13	68	3700	Exp 46	101	3776
Exp 14	69	3706	Exp 47	102	3780
Exp 15	70	3709	Exp 48	103	3773
Exp 16	71	3714	Exp 49	104	3775
Exp 17	72	3724	Exp 50	105	3773
Exp 18	73	3731	Exp 51	106	3772
Exp 19	74	3730	Exp 52	107	3771
Exp 20	75	3735	Exp 53	108	3774
Exp 21	76	3747	Exp 54	109	3773
Exp 22	77	3748	Exp 55	110	3768
Exp 23	78	3754	Exp 56	111	3769
Exp 24	79	3754	Exp 57	112	3769
Exp 25	80	3760	Exp 58	113	3769
Exp 26	81	3761	Exp 59	114	3761
Exp 27	82	3759	Exp 60	115	3764
Exp 28	83	3768	Exp 61	116	3766
Exp 29	84	3772	Exp 62	117	3763
Exp 30	85	3773	Exp 63	118	3761
Exp 31	86	3782	Exp 64	119	3766
Exp 32	87	3789	Exp 65	120	3767
Exp 33	88	3782			

Benefit:

- Cost saving to avoid unnecessary investment for current line
- Scientific reference for new line development

We use Tecnomatix to simulate:
How the WorkPieceCarrier quantity impact the maximum output

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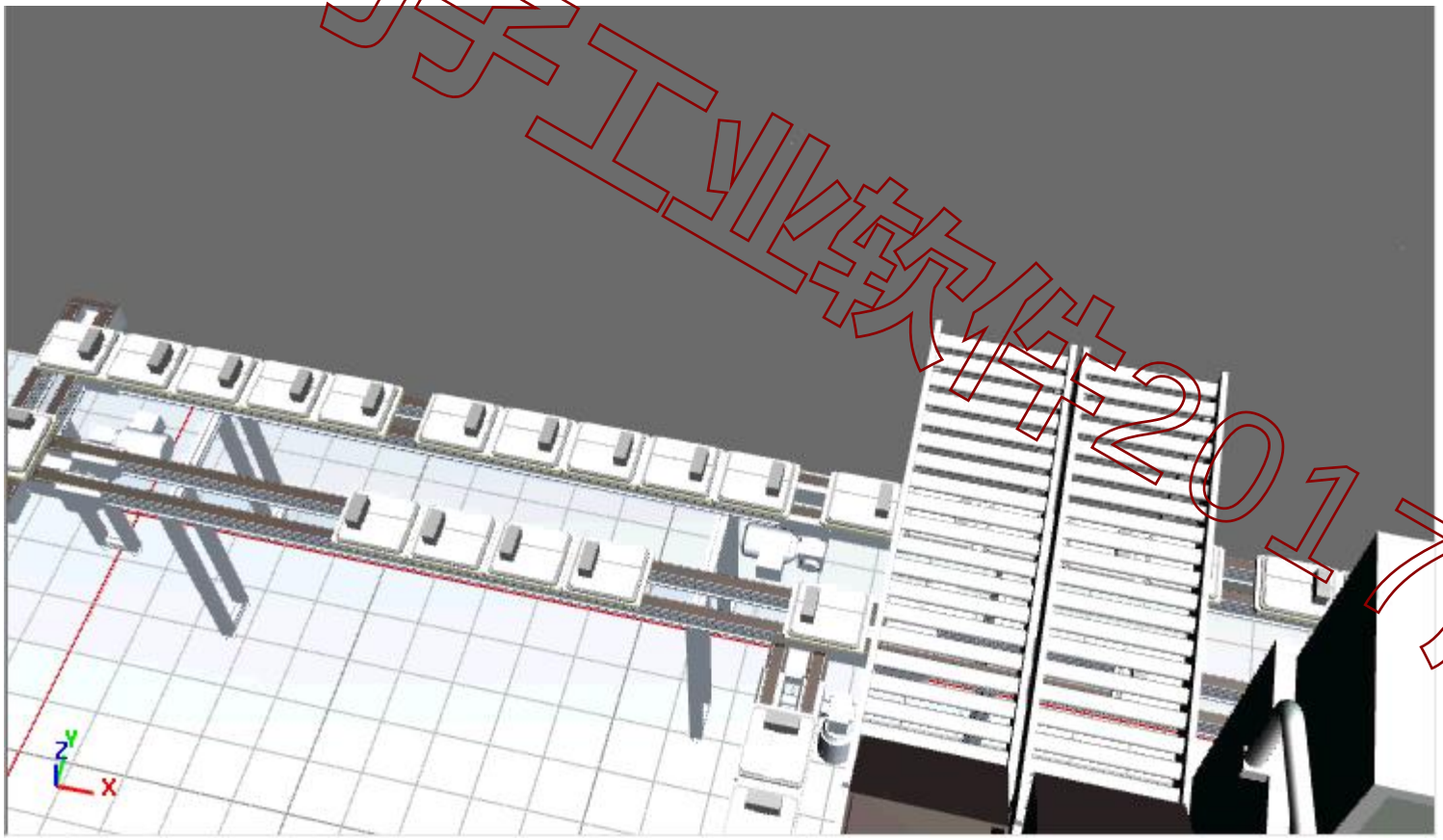

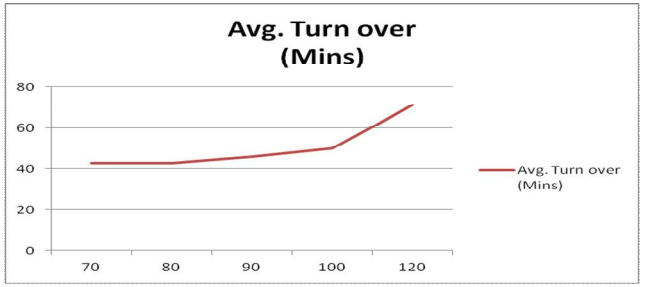

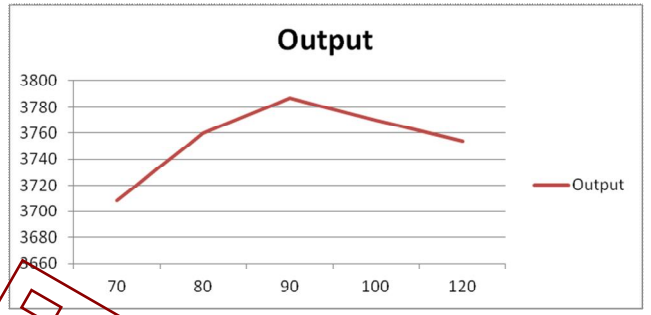

WT QTY	Avg. Turn over (Mins)	Output
120	71	3754
100	50	3770
90	46	3787
80	43	3760
70	43	3709

Reality

We use Tecnomatix to simulate:
Order combination to create best output

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Simulation:

Use Genetic Algorithm to simulate all the possible order combinations, find the best combination group to guide production

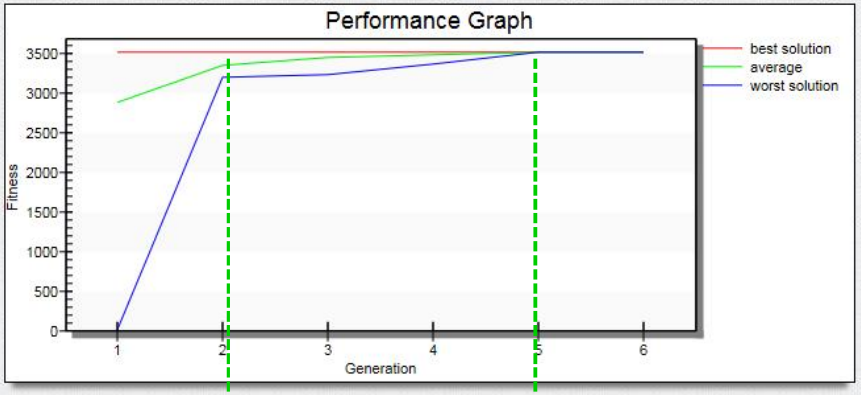
Result:

- Get the analysis result of 450 groups
- Each combination group get the best configuration to achieve maximum output

• The best 10 individuals

Individual	Fitness	ID	Chromosomes ->
Gen 1 Ind 1	3513	1	Chrom 1
Gen 6 Ind 1	3513	91	Chrom 1
Gen 2 Ind 18	3439	28	Chrom 1
Gen 5 Ind 4	3430	74	Chrom 1
Gen 4 Ind 10	3429	60	Chrom 1
Gen 3 Ind 12	3391	42	Chrom 1
Gen 4 Ind 12	3380	62	Chrom 1
Gen 2 Ind 10	3366	20	Chrom 1
Gen 3 Ind 10	3361	40	Chrom 1
Gen 2 Ind 20	3318	30	Chrom 1

• Evolution of the fitness values of the generations



Define GA fitness (Finishedproducts) → Define variable inputs (Worker qty, WT distr. Order pool…) → Start Gen1 GA calculation → Gen2 ~Gen5 (inherit last Gen result) → Stable result

Benefit:

- Use the result to guide production selecting the right order to produce.
- Maximum output improved ~9%

We use Tecnomatix to simulate:
Optimize the worker configuration during soft loading time

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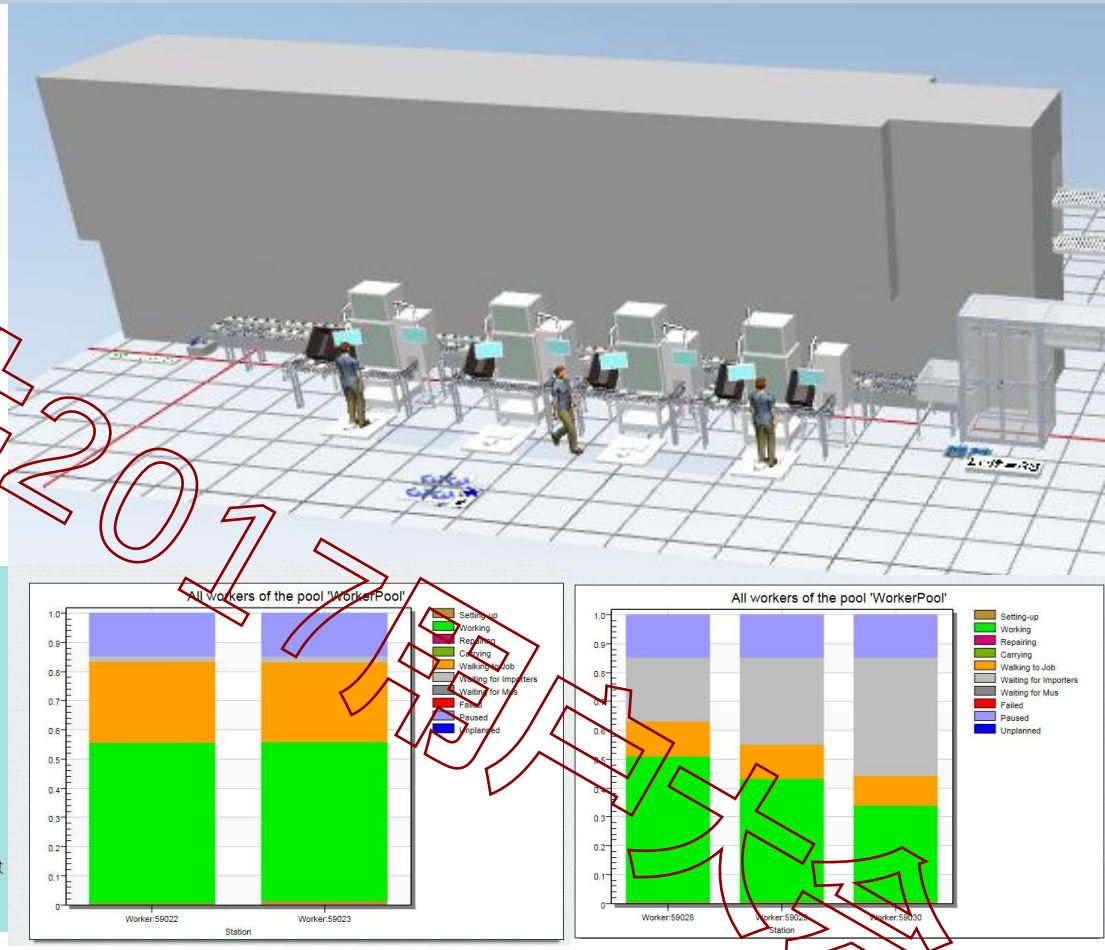
Simulation:

- Scenario 1: **2** workers in pre-assembly process
- Scenario 2: **3** workers in pre-assembly process

Result:

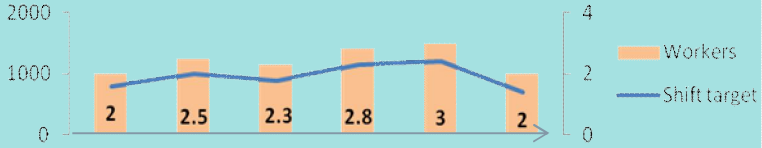
- Avg. efficiency of 2 workers: 90% output/shift: 853pcs
- Avg. efficiency of 3 workers: 63% output/shift: 1192pcs (tester bottleneck)

* Calculate the efficiency with available working time



Benefit:

Guide production to arrange the workers based on shift production target.



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We use Tecnomatix to simulate: Material flow

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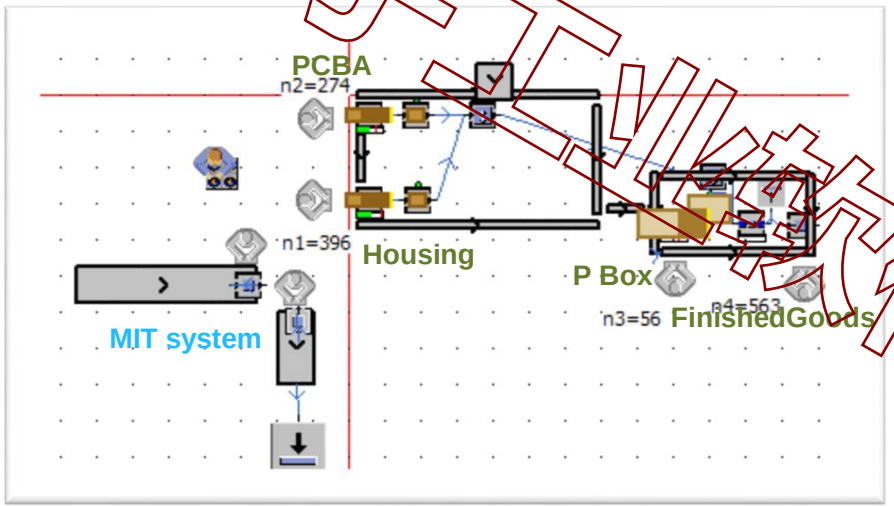
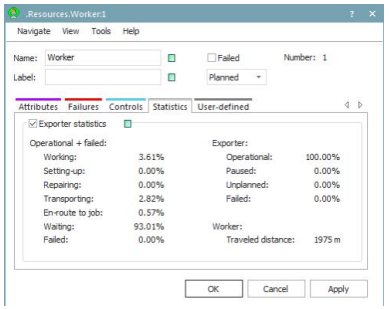
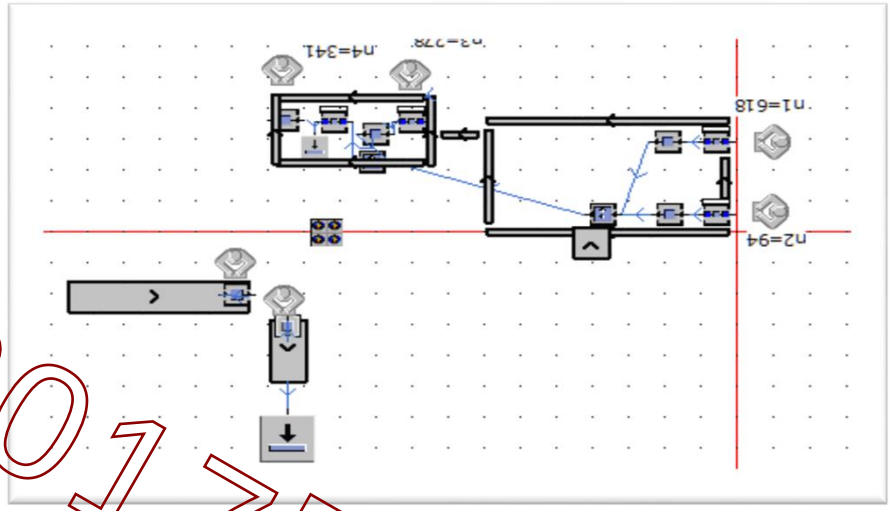
Option 1

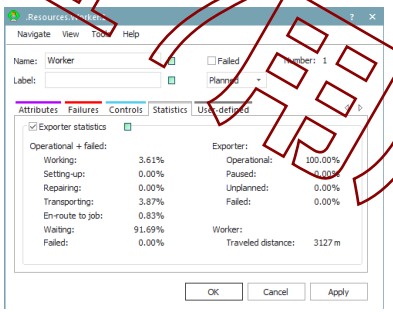




Walking distance: 1975m

Option 2





Walking distance: 3127m

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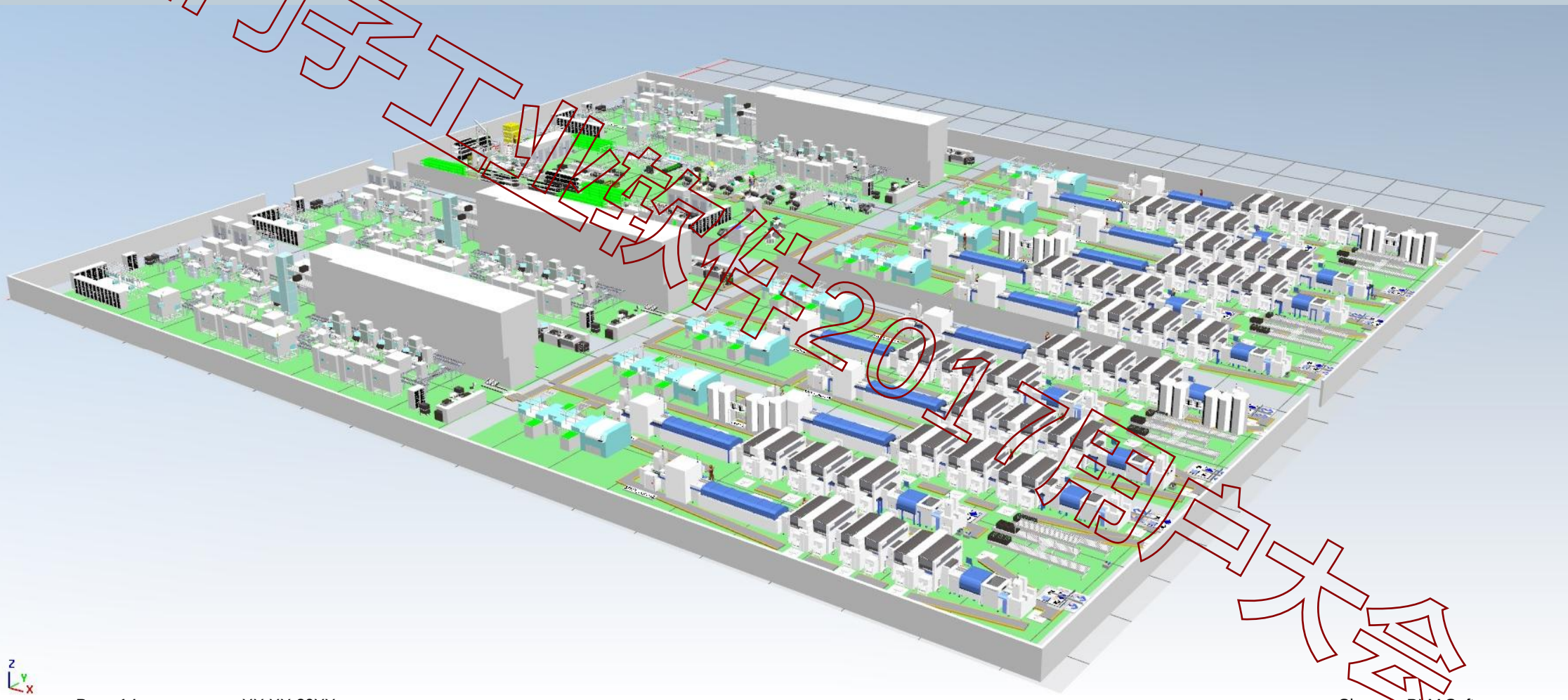
Factory layout



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