

# Program Optimization for batch production of baffle plate

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Abstract - Paper introduces programming on multiaxis VMC machine method on baffle plates production based on CIMCO automatic simulation software. For batch production of baffle plates the time required for tool change is more and corresponding code also consumes time for machining. The program functions in NC system based on mass production were studied and optimised program for the system and through the simulation of graphical software is proposed in this paper. The code is fed to the machine and program is designed so as to produce number of baffle plates in batch production in least possible time.

#### Key Words: VMC, FANUC controller, optimisation

#### **1. INTRODUCTION**

Automation is required in every field of manufacturing in batch production and mass production. Numerical Control (NC) is one in which functions and motions of machine tool are controlled by means of prepared programs containing coded alphanumeric data. NC controls the motion of workpiece and tool and input parameters such as speed, feed, depth of cut, functions such as turning spindle on/off and turning coolant on/off.

Baffle plates are used in reactors and heat exchangers. It contains tubes for carrying hot fluids and there by requires accurate machining. Modern machining focuses on quality in terms of surface finishing, material removal rate, tool and time required for production. Machine tool movements used in producing a part are of two basic types: point to point (straight line movements) and continuous path (contouring movements). Highly automated machine tools such as turning centre and machining centre will change cutting tools automatically under NC control developed program. Machining centres can use different controllers.

#### 1.1 Literature Survey

VMC is a multifunctional machine capable of performing operations of many standalone CNC machines. In papers

the various methods of performing operations are discussed i.e using 5 axis [1] for performing slant operations (i.e slant hole or slant drill). These operations can be easily and effectively performed by using 4 axis. Another aspect is to select appropriate software package depending upon requirement and type of application to be performed [3]. The other aspect while developing an efficient program for particular product will require a comparative study of program developed by personnel and program generated by CAD-CAM software packages [4]. The program generated by any software package will be more effective and free from errors than by any author. Studies showed that NX 7.5 required 11.43 minutes while PROE/EW5 required 15.11 minutes. Also studies showed that speed for different trajectories using vertical and spherical cutters the time required by various softwares were not the same [4].

Integration of CAD/CAM will offer possibility to generate NC codes of design components [2]. Hence depending on the type of operation i.e trajectory and cost associated with software balance has to be made [4].

#### 2. METHODOLOGY

#### 2.1 Blue Print Analysis

A blue print of a plate is issued by the company for its local small scale industries. After a local industry acquires a contract for the batch production of the baffle plate, the first is the analysis of the blue prints. Blue prints contain the top view, front view and side view. It also has the dimensions and material details of the baffle plate.

The co-ordinates for drilling holes in baffle plate were as follows:

Rapid traversing of tool in first position was at X-104 and Y-135.84. The circles are arranged in rhombus form and each rhombus is 16 mm. Rapid traversing is performed in positive Y direction. X co-ordinate remains constant and corresponding Y coordinates are 108.13, 80.42, 52.71, 25, -25, -52.71, -80.42 and -108.13. This way the rapid traverse G00 performed drilling operation on all holes.



Fig -1: 3 Dimensional analysis of Baffle plate

3. DEVELOPMENT OF PROGRAM

Program : The program is designed for 212 holes.

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O010(FIXTUR BAFFLE-ALL HOLES-25-11-2014) N4G0G17G40G49G80G90 S1650M3 G54 N8G0G90X103.998Y135.846 N10Z10.M8 N12G98G81Z-14.R2.F800. N14Y108.134 N16Y80.422 N18Y52.71 N20Y24.998 N22Y-24.998 N24Y-52.71 N26Y-80.422 N28Y-108.134 N30Y-135.846 N32X95.998Y149.702 N34Y121.99 N36Y94.278 N38Y66.566 N40Y38.854 N42Y-38.854 N44Y-66.566 N46Y-94.278 N48Y-121.99 N50Y-149.702 N52X87.999Y163.558 N54Y135.846 N56Y108.134 N58Y80.422 N60Y52.71 N62Y24.998 N64Y-24.998 N66Y-52.71 N68Y-80.422 N70Y-108.134 N72Y-135.846

N74Y-163.558 N76X79.999Y177.414 N78Y149.702 N80Y121.99 N82Y94.278 N84Y66.566 N86Y38.854 N88Y-38.854 N90Y-66.566 N92Y-94.278 N94Y-121.99 N96Y-149.702 N98Y-177.414 N100X71.999Y163.558 N102Y135.846 N104Y108.134 N106Y80.422 N108Y52.71 N110Y24.998 N112Y-24.998 N114Y-52.71 N116Y-80.422 N118Y-108.134 N120Y-135.846 N122Y-163.558 N124X63.999Y177.414 N126Y149.702 N128Y121.99 N130Y94.278 N132Y66.566 N134Y38.854 N136Y-38.854 N138Y-66.566 N140Y-94.278 N142Y-121.99 N144Y-149.702 N146Y-177.414 N148X56.Y163.558 N150Y135.846 N152Y108.134 N154Y80.422 N156Y52.71 N158Y24.998 N160Y-24.998 N162Y-52.71 N164Y-80.422 N166Y-108.134 N168Y-135.846 N170Y-163.558 N172X48.Y177.414 N174Y149.702 N176Y121.99 N178Y94.278 N180Y66.566 N182Y38.854 N184Y-38.854 N186Y-66.566

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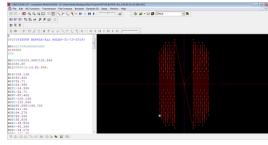


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N212Y-52.71     N326Y135.846       N214Y-80.422     N328Y108.134       N216Y-108.134     N330Y80.422       N218Y-135.846     N332Y22.71       N220Y-161.558     N334Y24.998       N222Y-191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N239Y108.134     N344Y-135.846       N232Y80.422     N346Y-63.558       N234Y2.08.134     N346Y-63.558       N234Y2.07     N355Y66.566       N234Y2.4998     N350Y149.702       N236Y2.4998     N350Y149.702       N234Y2.4998     N350Y149.702       N244Y-80.422     N356Y66.566       N244Y-80.422     N356Y66.566       N244Y-80.834     N358Y38.854       N244Y-80.834     N358Y38.854       N244Y-80.422     N364Y-42.78       N252X-48.Y177.414     N364Y-42.78       N252X-48.Y177.414     N364Y-419.702       N254Y149.702     N364Y-419.702       N254Y149.702     N364Y-419.702       N254Y149.702     N364Y-419.702       N254Y149.702     N364Y-419.702		
N214Y-80.422     N328Y108.134       N216Y-108.134     N330Y80.422       N218Y-135.846     N332Y25.71       N220Y-163.558     N334Y24.998       N222Y-191.27     N336Y-24.998       N224X-40.Y191.27     N336Y-24.998       N224X-40.Y191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N348X-79.999/117.414       N236Y24.998     N352Y121.99       N244Y-108.134     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N362Y-121.99       N242Y-80.422     N366Y-121.99       N254Y149.702     N368Y-149.702       N254Y149.702     N368Y-149.702       N254Y149.702     N368Y-149.702       N254Y149.702     N368Y-149.702       N254Y149.702     N368Y-149.702       N254Y149.702     N368Y-149.702       N256Y-6566     N	N210Y-24.998	N324X-71.999Y163.558
N216Y-108.134     N330Y80.422       N218Y-135.846     N332Y52.71       N220Y-163.558     N336Y24.998       N222Y-191.27     N336Y-24.998       N224X-40.Y191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N346Y-163.558       N234Y52.71     N352Y121.99       N240Y-52.71     N354Y49.4278       N242Y-80.422     N356Y66.566       N244Y-108.134     N356Y38.854       N244Y-135.846     N362Y-66.566       N244Y-135.846     N362Y-66.566       N244Y-135.846     N362Y-66.566       N252X-84Y177.414     N364Y-94.278       N252X-84Y177.414     N364Y-121.99       N254Y149.702     N364Y-94.278       N264Y135.846     N374Y135.846       N264Y149.702     N364Y-94.278       N264Y149.702     N364Y-94.278       N264Y149.702     N364Y-94.278       N264Y149.702     N364Y-94.278       N264Y149.703     N372Y171<	N212Y-52.71	N326Y135.846
N218Y-135.846     N332Y52.71       N220Y-163.558     N334Y24.998       N222Y-101.27     N336Y-24.998       N224X-40.Y191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N346Y-79.999Y177.414       N236Y24.998     N350Y149.702       N238Y-24.998     N350Y149.702       N238Y-24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N360Y-42.78       N254Y149.702     N364Y-94.278       N254Y149.702     N364Y-44.9702       N256Y121.99     N370Y-177.414       N266Y-6566     N374Y135.846       N262Y38.854     N374Y135.846       N262Y38.854     N374Y135.846       N264Y-42.78     N382Y24.998       N272Y-149.702     N384Y-24.998       N262Y38.854     N374Y135.846	N214Y-80.422	N328Y108.134
N218Y-135.846     N332Y52.71       N220Y-163.558     N334Y24.998       N222Y-101.27     N336Y-24.998       N224X-40.Y191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N346Y-79.999Y177.414       N236Y24.998     N350Y149.702       N238Y-24.998     N350Y149.702       N238Y-24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N360Y-42.78       N254Y149.702     N364Y-94.278       N254Y149.702     N364Y-44.9702       N256Y121.99     N370Y-177.414       N266Y-6566     N374Y135.846       N262Y38.854     N374Y135.846       N262Y38.854     N374Y135.846       N264Y-42.78     N382Y24.998       N272Y-149.702     N384Y-24.998       N262Y38.854     N374Y135.846	N216Y-108.134	N330Y80.422
N220Y-163.558     N334Y24.998       N222X-191.27     N336Y-24.998       N224X-40.Y191.27     N336Y-2.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232W0.422     N346Y-163.558       N234Y52.71     N348X-79.999Y177.414       N236Y24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y6.566       N244Y-108.134     N358Y38.854       N244Y-108.134     N358Y38.854       N244Y-108.134     N366Y-42.78       N244Y-108.134     N364Y-42.78       N244Y-108.134     N364Y-42.78       N244Y-108.134     N364Y-42.78       N244Y-108.134     N364Y-14.702       N244Y-108.134     N364Y-14.702       N252X-48.Y177.414     N364Y-14.702       N252X-48.Y177.414     N364Y-14.702       N252Y-48.Y177.414     N364Y-14.702       N252Y-48.Y173.884     N376Y108.134       N264Y-38.854     N376Y108.134       N264Y-38.854     N376Y108.134       N264Y-38.854		
N222Y-191.27     N336Y-24.998       N224X-40,Y191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-165.568       N234Y52.71     N348X-79.999Y177.414       N236Y24.998     N350Y149.702       N234Y24.998     N350Y149.702       N234Y24.80.422     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N246Y-135.846     N362Y-66.566       N244Y-108.134     N36Y38.854       N246Y-135.846     N364Y-94.278       N256Y14.9702     N364Y-94.278       N256Y121.99     N370Y-177.414       N258Y94.278     N372X-87.999Y163.558       N260Y66.566     N374Y135.846       N262Y38.854     N376Y108.134       N264Y-38.854     N376Y18.846       N260Y66.566     N380Y52.71       N268Y94.278     N382Y24.998       N260Y66.566     N380Y52.71       N268Y94.278     N382Y24.998       N270Y-121.99     N384Y-24.998 </td <td></td> <td></td>		
N224X-40,Y191.27     N338Y-52.71       N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N348Y-79.999Y177.414       N236Y24.998     N350Y149.702       N238Y-24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N244Y-108.134     N358Y38.854       N244Y-108.134     N360Y-36.856       N244Y-108.1558     N360Y-38.854       N244Y-108.154     N360Y-38.854       N244Y-108.1558     N360Y-38.854       N244Y-108.121     N364Y-94.278       N252X-48.Y177.414     N366Y-121.99       N254Y149.702     N364Y-94.278       N252Y4149.702     N364Y-94.278       N262Y38.854     N374Y135.846       N262Y38.854     N376Y108.134       N264Y-48.854     N378Y80.422       N264Y-48.558     N390Y-108.134       N264Y-48.558     N390Y-108.134       N264Y-49.278		
N226Y163.558     N340Y-80.422       N228Y135.846     N342Y-135.846       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N348X-79.999Y177.414       N236Y24.998     N350Y149.702       N234Y52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N244Y-108.134     N358Y38.854       N244Y-103.558     N360Y-38.854       N244Y-103.558     N362Y-66.566       N250Y-191.27     N364Y-94.278       N252Y149.702     N364Y-142.199       N254Y149.702     N364Y-142.199       N254Y149.702     N364Y-142.199       N256Y121.99     N370Y-177.414       N256Y121.99     N370Y-177.414       N258Y94.278     N372X-87.999Y163.558       N260Y66.566     N374Y135.846       N262Y38.854     N376Y108.134       N264Y-38.854     N376Y108.134       N264Y-38.854     N378Y80.422       N264Y-49.81     N382Y24.998       N270Y-121.99     N384Y-24.998       N270Y-121.99     N384Y-24		
N228Y135.846     N342Y-108.134       N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-163.558       N234Y52.71     N346X-79.999Y177.414       N236Y24.998     N350Y149.702       N234Y24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N360Y-49.278       N250Y-191.27     N364Y-94.278       N252X-48.Y177.414     N366Y-121.99       N252X-48.Y177.414     N366Y-121.99       N254Y149.702     N368Y-149.702       N256Y121.99     N370Y-177.414       N258Y94.278     N372X-87.999Y163.558       N260Y-66.566     N378Y180.422       N264Y-38.854     N378Y80.422       N264Y-49.278     N382Y24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702	N224X-40.Y191.27	N338Y-52.71
N230Y108.134     N344Y-135.846       N232Y80.422     N346Y-135.846       N234Y52.71     N348X-79.999Y177.414       N236Y24.998     N350Y149.702       N238Y-24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N358Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N360Y-38.854       N248Y-163.558     N362Y-66.566       N250Y-191.27     N364Y-94.278       N252X-48.Y177.414     N366Y-121.99       N254Y149.702     N368Y-149.702       N256Y121.99     N370Y177.414       N256Y121.99     N370Y177.414       N256Y121.99     N372X-87.999Y163.558       N260Y66.566     N376Y108.134       N262Y38.854     N376Y108.134       N262Y4.6566     N380Y52.71       N268Y-94.278     N382Y24.998       N270Y-121.99     N384Y-24.998       N270Y-121.99     N384Y-24.998       N270Y-121.99     N384Y-24.998       N270Y-121.99     N384Y-24.998       N270Y-135.846     N390Y-1	N226Y163.558	N340Y-80.422
N232Y80.422     N346Y-163.558       N234Y52.71     N348X-79.999Y177.414       N236Y24.998     N350Y149.702       N238Y-24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N364Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N362Y-66.566       N259Y-191.27     N364Y-94.278       N252X-48.Y177.414     N366Y-149.702       N256Y121.99     N370Y-177.414       N258Y94.278     N372X-87.999Y163.558       N260Y65.566     N374Y135.846       N264Y-38.854     N372X-87.999Y163.558       N264Y-38.854     N376Y108.134       N264Y-38.854     N378Y80.422       N266Y-66.566     N380Y52.71       N266Y-66.566     N380Y52.71       N264Y-38.854     N36Y-188.34       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702	N228Y135.846	N342Y-108.134
N232Y80.422     N346Y-163.558       N234Y52.71     N348X-79.999Y177.414       N236Y24.998     N350Y149.702       N238Y-24.998     N352Y121.99       N240Y-52.71     N354Y94.278       N242Y-80.422     N356Y66.566       N244Y-108.134     N364Y38.854       N246Y-135.846     N360Y-38.854       N246Y-135.846     N362Y-66.566       N259Y-191.27     N364Y-94.278       N252X-48.Y177.414     N366Y-149.702       N256Y121.99     N370Y-177.414       N258Y94.278     N372X-87.999Y163.558       N260Y65.566     N374Y135.846       N264Y-38.854     N372X-87.999Y163.558       N264Y-38.854     N376Y108.134       N264Y-38.854     N378Y80.422       N266Y-66.566     N380Y52.71       N266Y-66.566     N380Y52.71       N264Y-38.854     N36Y-188.34       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702     N384Y-24.998       N272Y-149.702	N230Y108.134	N344Y-135.846
N234Y52.71N348X-79.999Y177.414N236Y24.998N350Y149.702N238Y-24.998N352Y121.99N240Y-52.71N354Y94.278N242Y-80.422N356Y66.566N244Y-108.134N358Y38.854N246Y-135.846N360Y-38.854N249Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N260Y66.566N374Y135.846N264Y-38.854N376Y108.134N264Y-38.854N378Y80.422N266Y66.566N380Y52.71N264Y-38.854N378Y80.422N266Y-64.2738N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N282Y80.422N396X-95.998Y149.702N284Y5.271N396X-95.998Y149.702N284Y5.271N396X-95.998Y149.702N284Y5.271N396X-95.998Y149.702N284Y5.271N396X-95.998Y149.702N284Y5.271N396X-95.998Y149.702N284Y5.271N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854<		
N236Y24.998N350Y149.702N238Y-24.998N352Y121.99N240Y-52.71N354Y94.278N242Y-80.422N356Y66.566N244Y-108.134N358Y38.854N246Y-135.846N360Y-38.854N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N256Y4.278N370Y-177.414N256Y4.278N370Y-177.414N256Y4.278N370Y-177.414N266Y-6.566N370Y108.134N264Y-6.566N376Y108.134N264Y-38.854N376Y108.134N264Y-6.566N380Y52.71N268Y-4.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N274Y-177.414N388Y-80.422N274Y-177.414N388Y-80.422N274Y-177.414N388Y-80.422N274Y-177.414N388Y-80.422N274Y-177.414N398Y-108.134N278Y135.846N390Y-108.134N288Y2.24.998N400Y94.278N288Y2.24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854<		
N238Y-24.998N352Y121.99N240Y-52.71N354Y94.278N242Y-80.422N356Y66.566N244Y-108.134N358Y38.854N246Y-135.846N360Y-38.854N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N370Y-177.414N258Y94.278N376Y108.134N264Y-38.854N376Y108.134N264Y-38.854N376Y108.134N264Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N28Y20.422N396Y-103.558N282Y80.422N396Y-103.558N282Y80.422N396Y-103.558N284Y-24.998N400Y94.278N284Y-24.998N400Y94.278N284Y-24.998N400Y4.278N284Y-24.998N400Y4.278N284Y-24.998N400Y4.278N284Y-24.998N400Y4.278N294Y-108.134N406Y-65.66N290Y-135.846N410Y-94.278N298Y-163.558N410Y-94.278		
N240Y-52.71N354Y94.278N242Y-80.422N356Y66.566N244Y-108.134N356Y66.566N246Y-135.846N360Y-38.854N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48,Y177.414N366Y-121.99N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N262Y38.854N376Y108.134N264Y-94.278N380Y52.71N264Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N268Y-94.278N390Y-108.134N278Y135.846N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N280Y24.998N400Y94.278N284Y52.71N398Y121.99N284Y52.71N398Y121.99N284Y24.998N400Y94.278N284Y-24.998N400Y94.278N284Y-24.998N400Y4.278N284Y-24.998N400Y94.278N284Y-24.998N400Y94.278N298Y-21.5586N410Y-94.278N298Y-163.558N410Y-94.278N298Y-163.558N410Y-94.278N298Y-163.558N410Y-94.278		
N242Y-80.422N356Y66.566N244Y-108.134N358Y38.854N246Y-135.846N360Y-38.854N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N376Y108.134N264Y-38.854N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N386Y-50.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N28Y135.846N392Y-135.846N28Y135.846N392Y-135.846N28Y2135.846N394Y-163.558N28QY108.134N400Y94.278N284Y-24.998N400Y94.278N284Y-24.998N400Y94.278N284Y-25.71N404Y38.854N292Y-80.422N400Y4.278N284Y-24.998N400Y94.278N284Y-26.511N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N294Y-108.134N408Y-66.566N296Y-135.846N410Y-94.		
N244Y-108.134N358Y38.854N246Y-135.846N360Y-38.854N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N376Y108.134N264Y-38.854N380Y52.71N266Y-66.566N380Y52.71N264Y-38.854N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N284Y52.71N398Y121.99N284Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N298Y-163.558N410Y-94.278N298Y-163.558N410Y-94.278N298Y-163.558N410Y-	N240Y-52.71	N354Y94.278
N246Y-135.846N360Y-38.854N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N28Y80.422N390Y-108.134N28Y135.846N399Y-103.558N28Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.558N410	N242Y-80.422	N356Y66.566
N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N26X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y43.854N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99	N244Y-108.134	N358Y38.854
N248Y-163.558N362Y-66.566N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N26X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y43.854N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99	N246Y-135.846	N360Y-38.854
N250Y-191.27N364Y-94.278N252X-48.Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N264Y-38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N272Y-149.702N384Y-24.998N274Y-177.414N388Y-80.422N26XY38.546N390Y-108.134N28W108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y94.278N290Y-52.71N404Y38.854N290Y-52.71N404Y38.854N290Y-52.71N406Y-38.854N290Y-135.846N410Y-94.278N296Y-135.846N410Y-94.278N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99		
N252X-48,Y177.414N366Y-121.99N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N400Y4.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N294Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N410Y-94.278N298Y-163.558N412Y-121.99		
N254Y149.702N368Y-149.702N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N280Y108.134N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99		
N256Y121.99N370Y-177.414N258Y94.278N372X-87.999Y163.558N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N294Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99		
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N260Y66.566N374Y135.846N262Y38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N292Y-108.134N408Y-66.566N292Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N410Y-94.278N298Y-163.558N412Y-121.99	N256Y121.99	
N262Y38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99	N258Y94.278	N372X-87.999Y163.558
N262Y38.854N376Y108.134N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-80.422N406Y-38.854N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99	N260Y66.566	N374Y135.846
N264Y-38.854N378Y80.422N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-64.566N294Y-108.134N408Y-64.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99	N262Y38.854	
N266Y-66.566N380Y52.71N268Y-94.278N382Y24.998N270Y-121.99N384Y-24.998N272Y-149.702N386Y-52.71N274Y-177.414N388Y-80.422N276X-56.Y163.558N390Y-108.134N278Y135.846N392Y-135.846N280Y108.134N394Y-163.558N282Y80.422N396X-95.998Y149.702N284Y52.71N398Y121.99N286Y24.998N400Y94.278N288Y-24.998N400Y94.278N288Y-24.998N402Y66.566N290Y-52.71N404Y38.854N292Y-80.422N406Y-38.854N292Y-135.846N402Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N294Y-108.134N408Y-66.566N296Y-135.846N410Y-94.278N298Y-163.558N412Y-121.99		
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## 3. CIMCO SIMULATION



## 4. CONCLUSION

The time required for performing one operation is 5 hours. Previously the tool was brought from its home position(Z=0) to Z=50 and then operation was started. Then it was observed that if tool was brought to Z=10 then time was reduced by 18 minutes per piece. It could be inferred that significant time reduction could not be achieved considering that batch production was to be done. But had it been used for mass production, significant time reduction could be expected.

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