

OPTIMATION PARAMETERS OF CNC MILLING PROGRAMMING MACHINE ON THE PROCESS TIME AND ITS EFFECT ON THE EFFICIENCY

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Abstrak. Permasalahan yang diungkapkan dalam penelitian ini adalah tentang parameter Optimasi mesin pemrograman CNC milling pada waktu proses dan pengaruhnya terhadap efisiensi. Tujuan dari penelitian ini adalah untuk mengetahui pengaruh laju umpan, kedalaman potong, dan stepdown maksimum pada waktu pemrosesan dalam pemrograman milling CNC dan mencari parameter pemesinan terbaik yang menghasilkan waktu pemrosesan optimal pada pemrograman milling CNC. Hasilnya dapat berupa simulasi jarak pemesinan atau waktu operasi, panjang langkah umpan atau panjang potong umpan, dan panjang langkah tanpa pengumpanan atau panjang lintasan cepat. Data hasil percobaan digunakan untuk melihat pengaruh, dan kontribusi setiap parameter terhadap waktu proses pemesinan, juga kontribusi parameter yang dioptimalkan untuk setiap proses yang membuat waktu proses pemesinan penggilingan CNC, dan biaya akan lebih efisien.

Kata kunci. Factorial test method

***Abstract.** The problems revealed in this research is about Optimization parameters of CNC milling programing machine on the process time and its effect on the efficiency. The purpose of this research are to know the effect of feed rate, depth of cut, and maximum stepdown on processing time in CNC milling programming and searching for the best machining parameters that yield optimal processing time on CNC milling programming. The result can be in the simulation of machining distance or operation time, length of feed step or feed cut length, and length of step without feeding or fast traverse length. Experiment result data is used for see the influence, and contribution of each parameter to the machining process time, also the contribution of the optimized parameters for each process that makes the CNC milling machining process time, and cost will be more efficient.*

***Keywords.** Factorial test method*

I. PENDAHULUAN

MasterCAM adalah pemrograman cam yang digunakan untuk membangun instruksi, dan dunia yang bermanfaat, di samping industri untuk klien organisasi teknik CNC yang mewajibkan ketelitian tentang teknik manufaktur mereka. Dengan menggunakan perangkat lunak MasterCAM, seorang programmer dapat mengubah parameter pemesinan yang menghasilkan durasi persiapan ideal waktu untuk memodifikasi pemrosesan CNC. Dalam hal ini, biaya proses pemesinan penggilingan CNC selama satu jam adalah Rp. 200.000, sehingga biaya untuk 1 menit proses pemesinan mesin CNC adalah Rp.3.400, dan harga alat yang digunakan untuk setiap proses pemesinan adalah Rp.78.500

II. METODOLOGI PENELITIAN

In view of those foundation depiction of the problem, it will be referred to that the fundamental issue identified with those machining procedures of CNC processing is on the determination for machining parameters for example feed rate, maximum stepdown and depth of cut encourage rate Furthermore profundity from claiming reduced on CNC milling machining time, and machining cost.

Objectives

In accordance with the issues to be researched as formulated above, the objectives to be achieved in this study are:

1. Know the effect of feed rate on the processing time of CNC milling programming.
2. Knowing the influence of dept of cut of the processing time on CNC milling programming.
3. Knowing the effect of the maximum stepdown on the processing time on CNC milling programming.
4. Knowing machining parameters that produce optimal processing time on the CNC milling programming.
5. Calculating the most efficient machining time and machining cost.

Study literature

Calculation of the working time is the distance chisel multiplied by the frequency of feeding, divided by the speed of the feeding process times the speed [7]. Face vertical milling

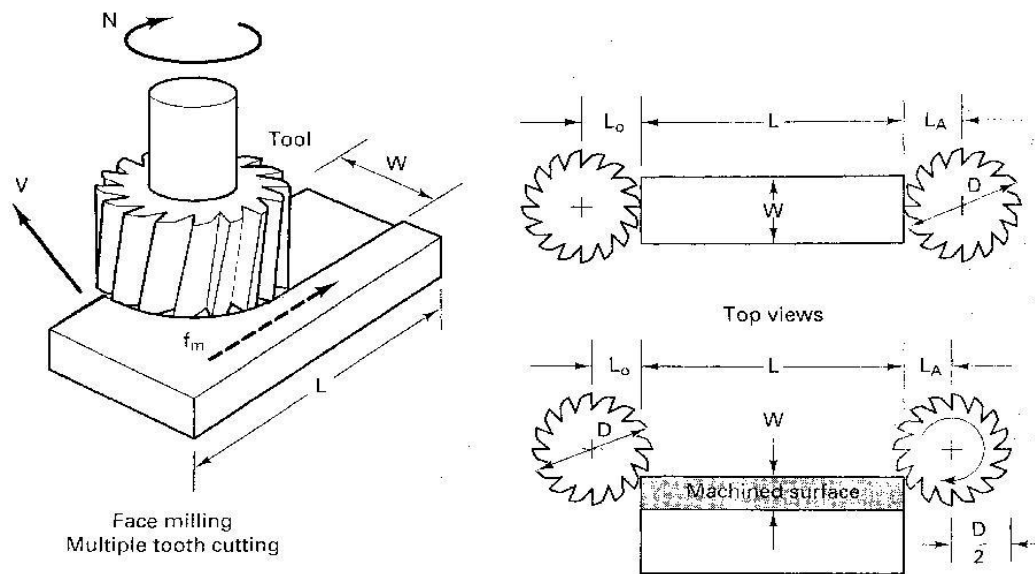


Figure 1 CNC milling process

MasterCAM 9.1 software

CAD / CAM stands for Computer-Aided Design and Computer- Aided Manufacturing. The CAD / CAM application is used to design a machine part and create a CNC program for its processing [1].

Research methodology

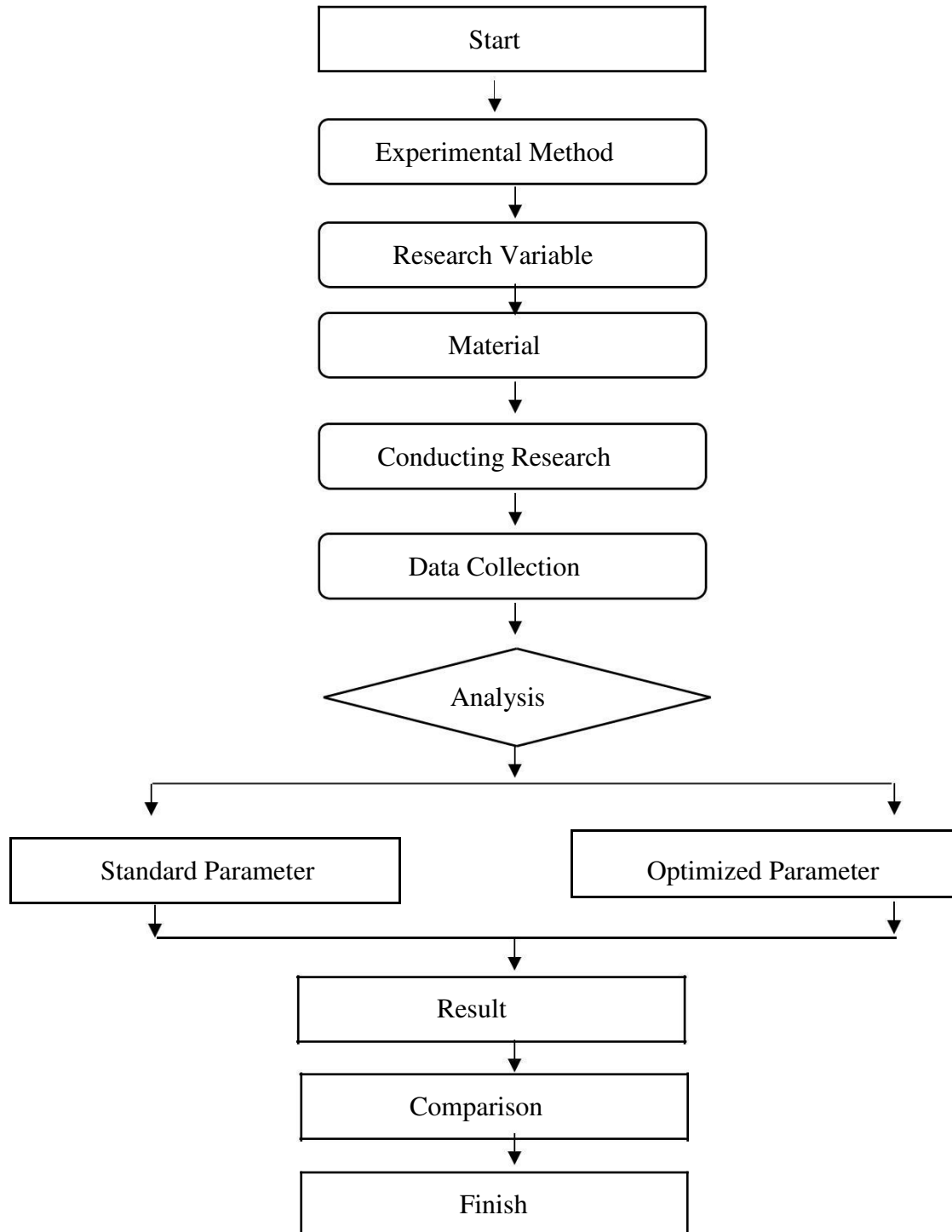


Figure 1 Flow chart diagram

III. HASIL, PEMBAHASAN DAN ANALISA

Experiment parameters data

Table 1 Drill parameters data

Feed rate (mm/rev)	Machining time (min)	Machining cost	Depth of cut (mm)
50	12	Rp 40,800	5
60	10	Rp 34,000	10
70	8	Rp 27,200	15

Table 2 Facing parameters data

Feed rate (mm/rev)	Machining time (min)	Machining cost	Max rough stepdown (mm)
1000	1.43333	Rp 4,873	2
1200	1.21667	Rp 4,137	4
1400	1.05	Rp 3,570	6

Table 3 Surface rough pocket parameters data

Feed rate (mm/rev)	Machining time (min)	Machining cost	Maximum stepdown (mm)
1500	145	Rp 493,000	0.5
1700	43	Rp 146,200	1.5
1900	23	Rp 78,200	2.5

Material and tool

Material: SKD 11

Table 1 Misumi Material Catalog [4]

Material	Heat Treatment (°C)	Hardness	Specific Gravity (at 20°C)
SKD11	Hardened 1000 - 1050 Air cooled	58 - 63 HRC	7.8
SKD11	Tempered 150 - 200 Air cooled	59 - 63 HRC	7.8

Tool: Mitsubishi Hitachi

Table 2 Mitsubishi Hitachi tool Catalog [5]

Tool	Drill
Revolution	950 rpm
Drilling depth	16 mm max
Feed rate	100 mm/ rev max

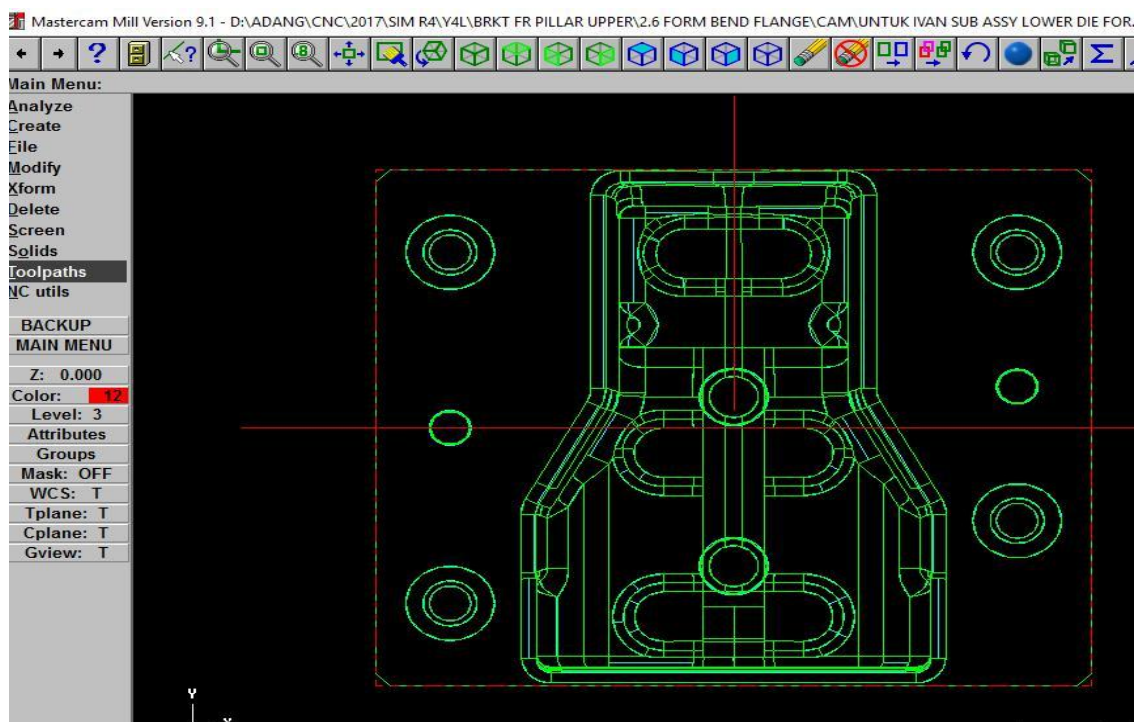
Table 3 Mitsubishi Hitachi tool Catalog [5]

Tool	End Mill
Revolution	1000 rpm
Drilling depth	15 mm max
Feed rate	1800 mm/ rev max

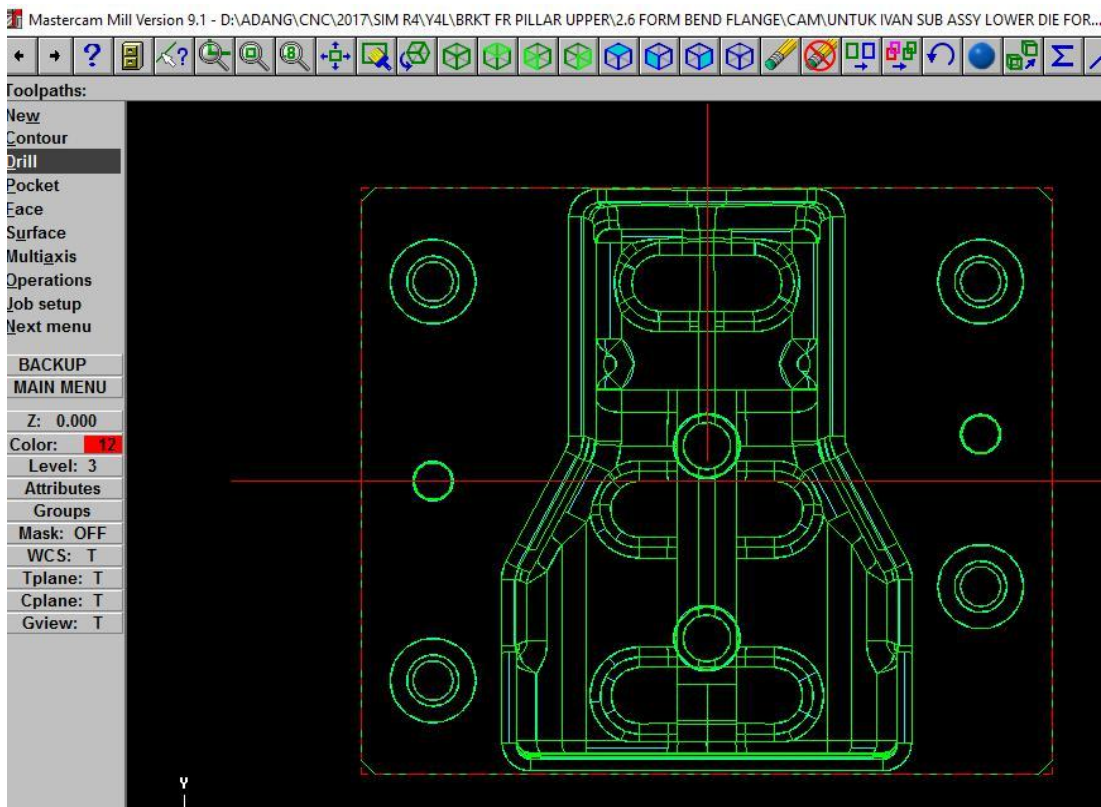
Conducting research

Drill process

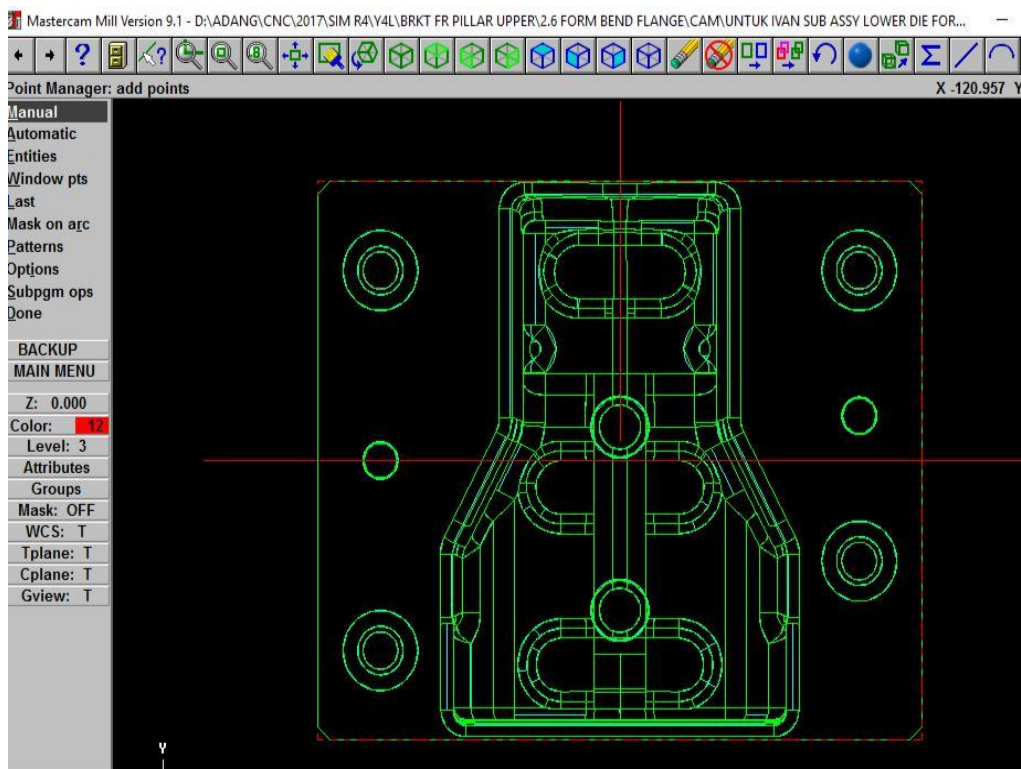
- a. Start master cam v9 lathe
- b. Open the design picture
- c. Choose the toolpaths (the path through space that the tip of a cutting tool follows on its way to producing the desired geometry of the workpiece).



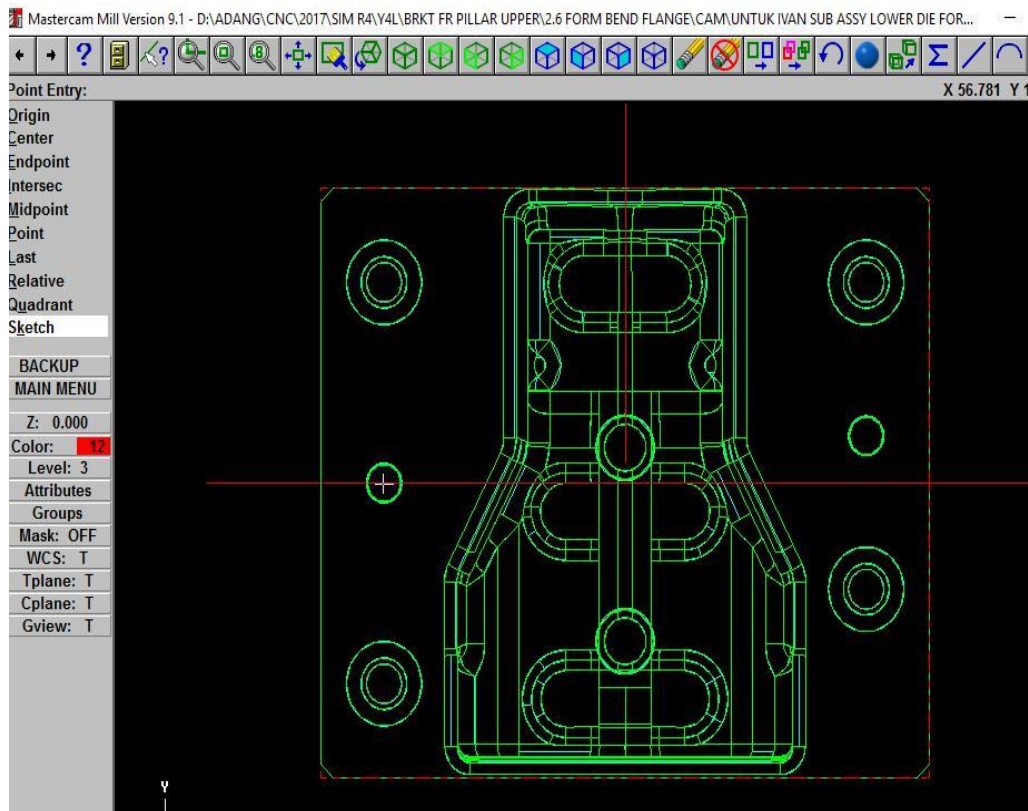
d. Choose drill option for machining process



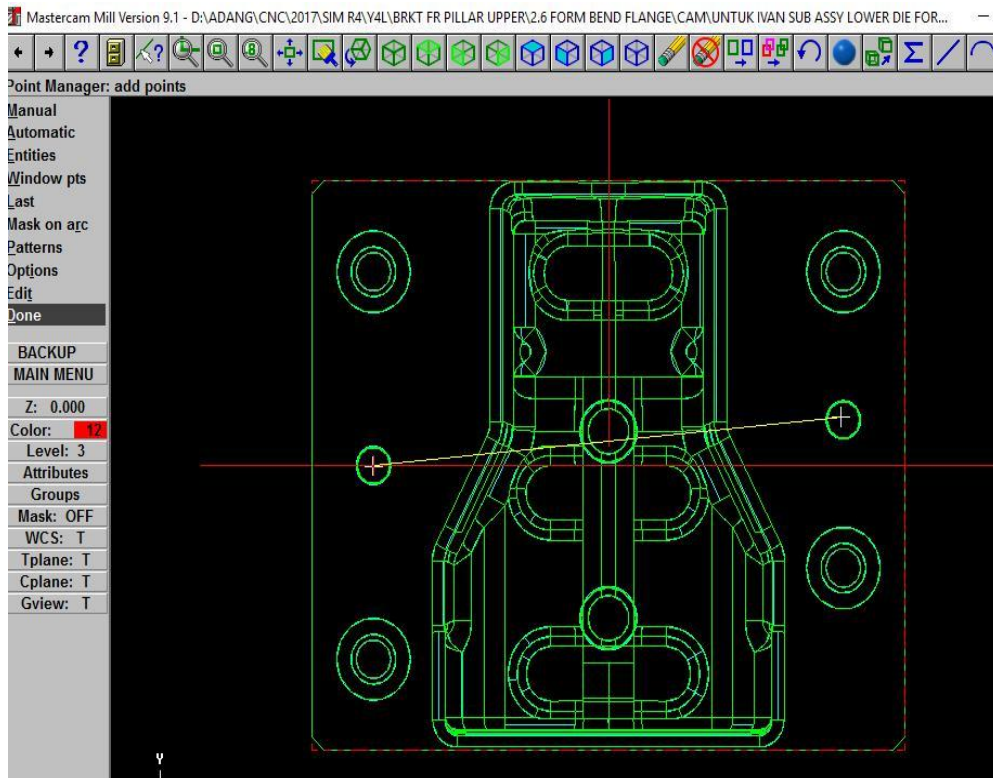
e. Click on the manual option



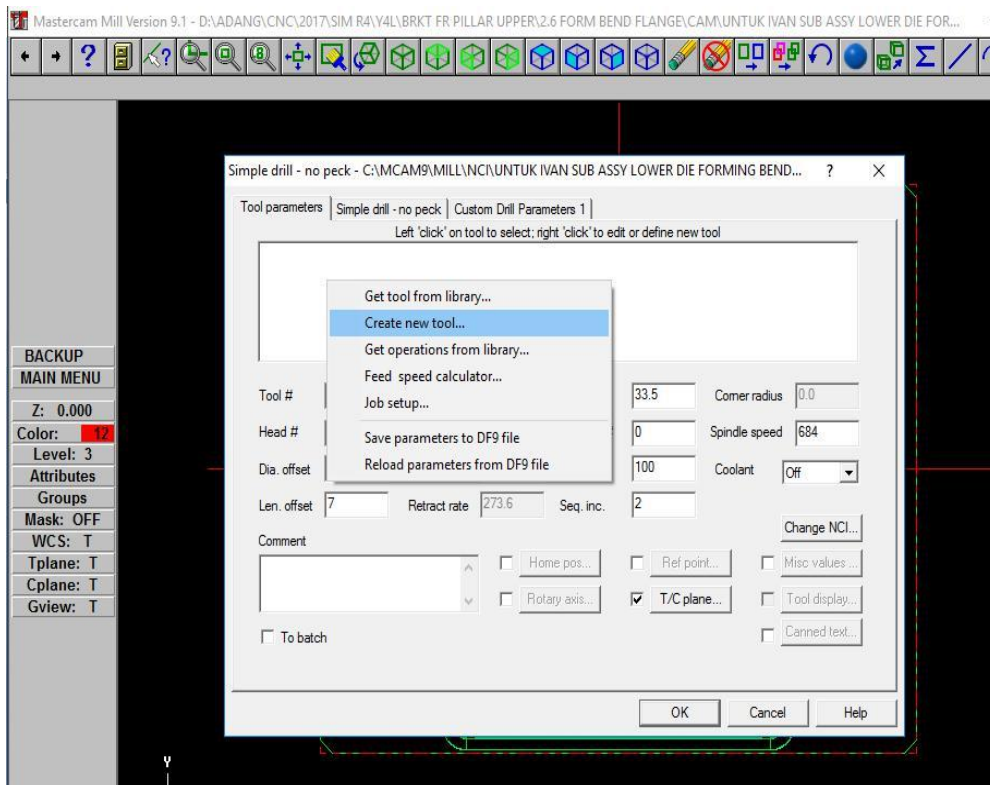
f. Choose the hole on the design picture sketch



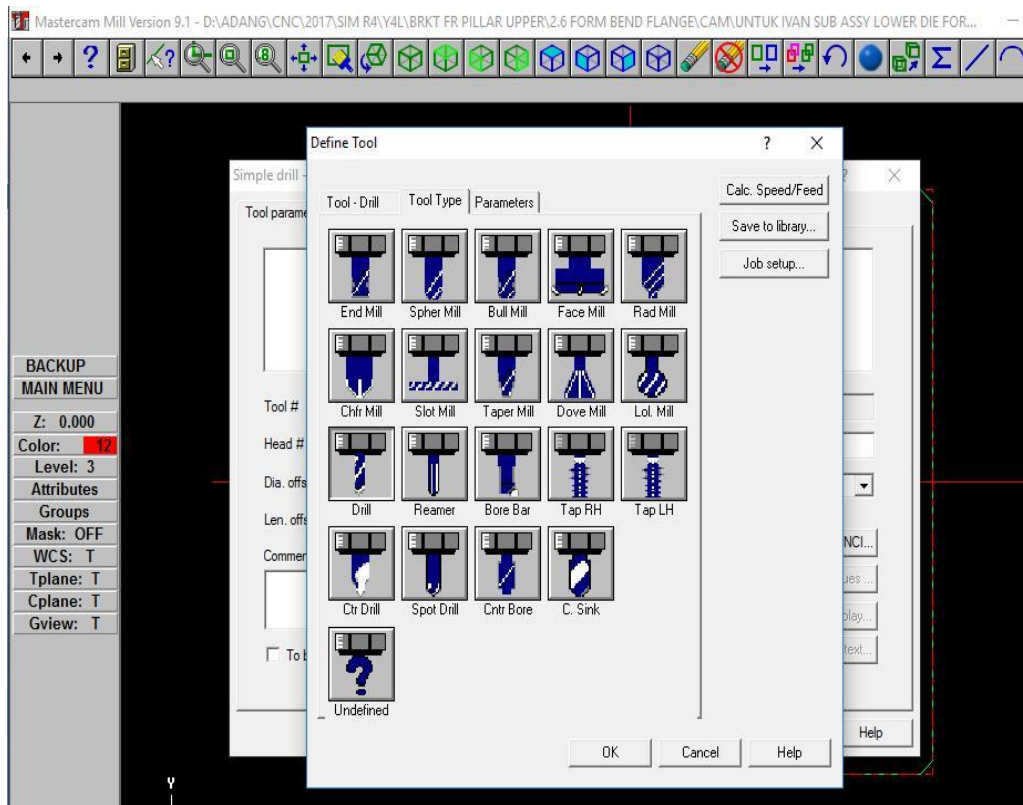
g. Click done



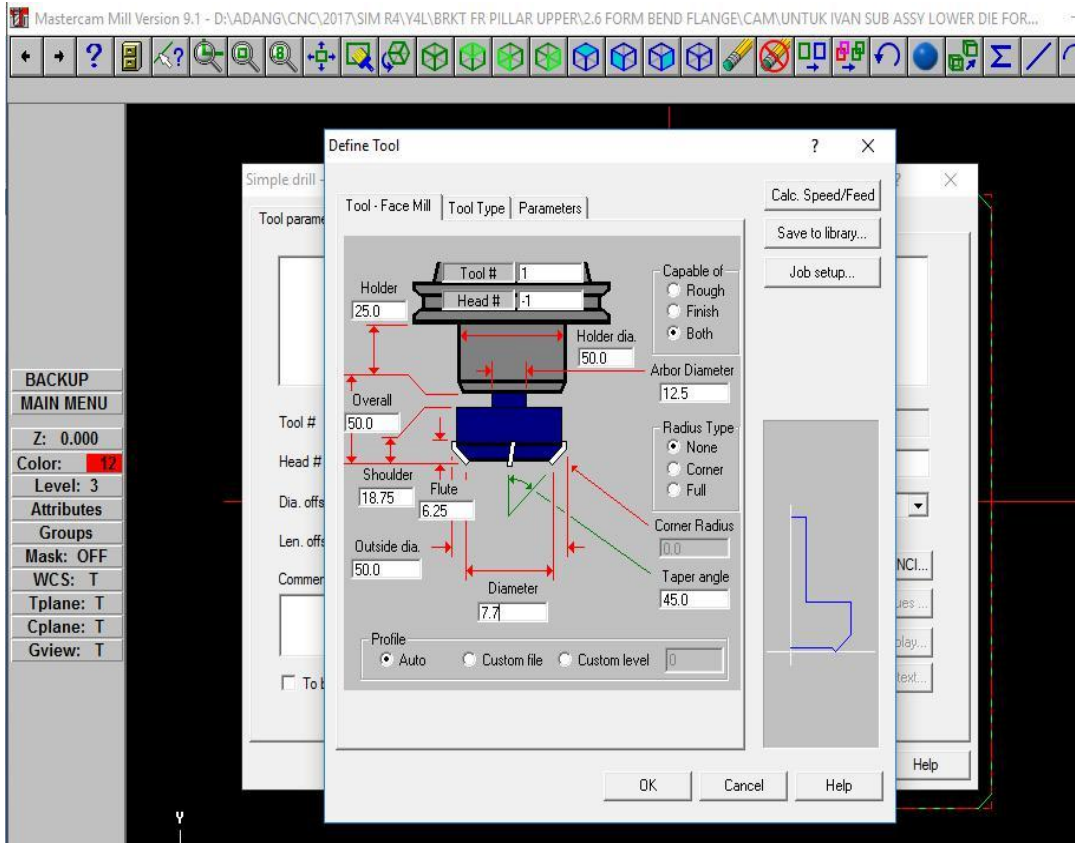
h. Create new tool for the machining process



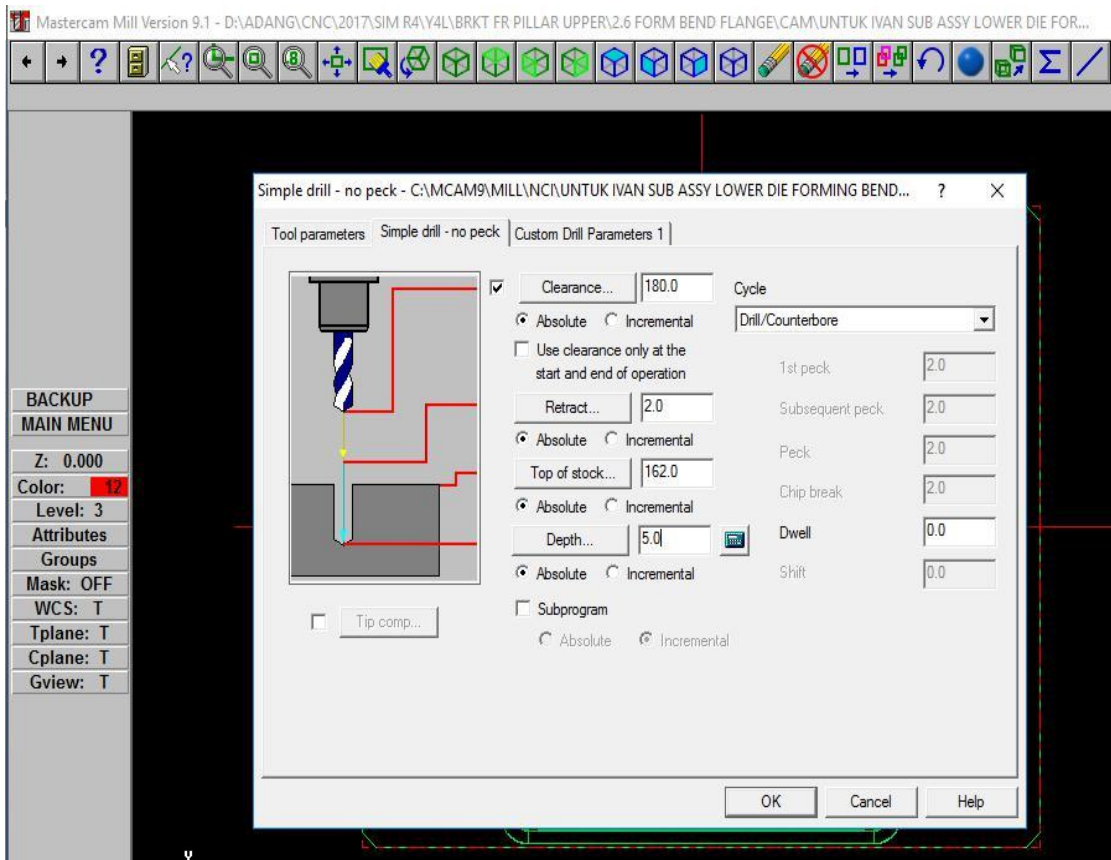
i. Define the tool type that want to be used for machining process



j. Set the diameter of the tool that needed for the tool that used

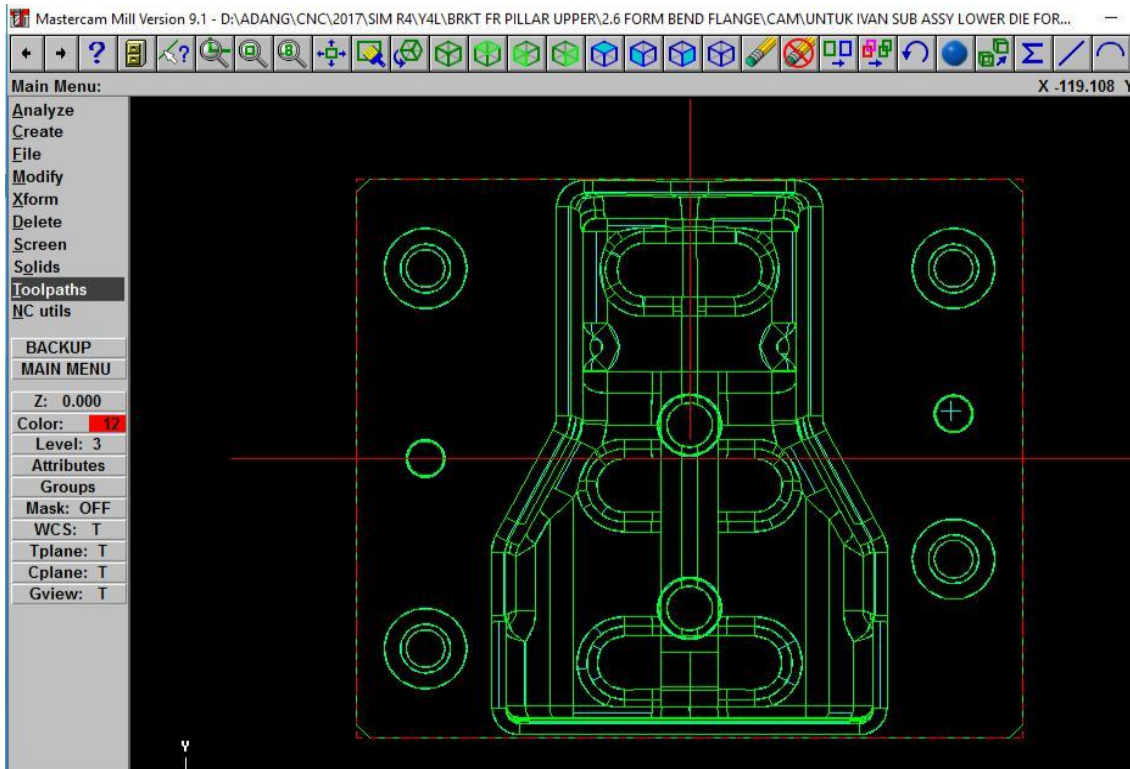


k. Set the clearance, absolute top of stock, and depth of cut

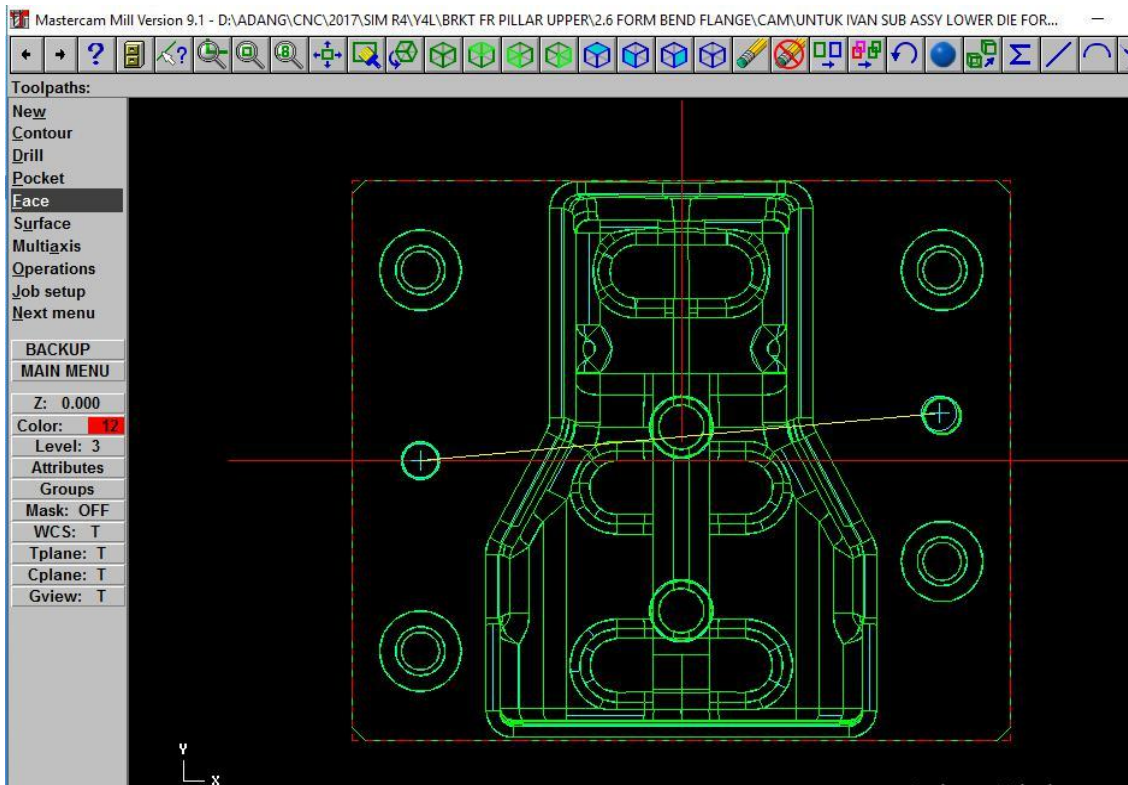


Facing

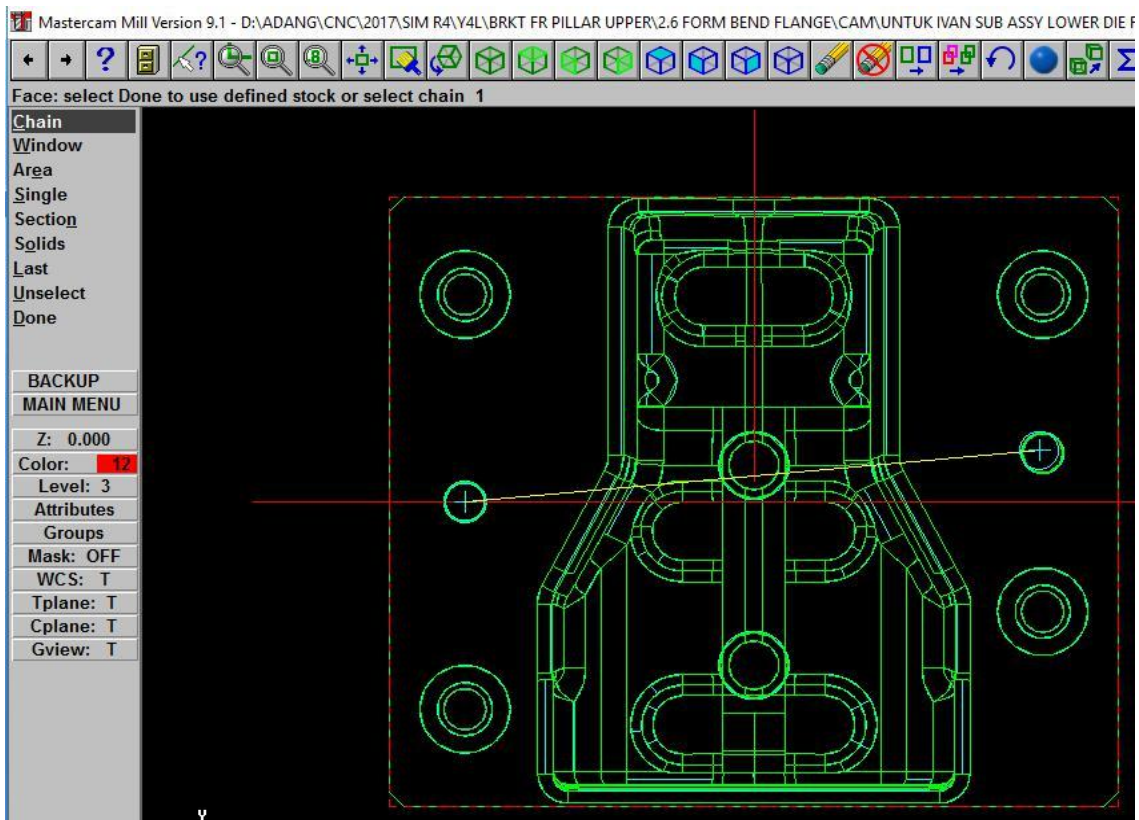
- a. Start master cam v9 lathe
- b. Open the design picture
- c. Choose the toolpaths (the path through space that the tip of a cutting tool follows on its way to producing the desired geometry of the workpiece)



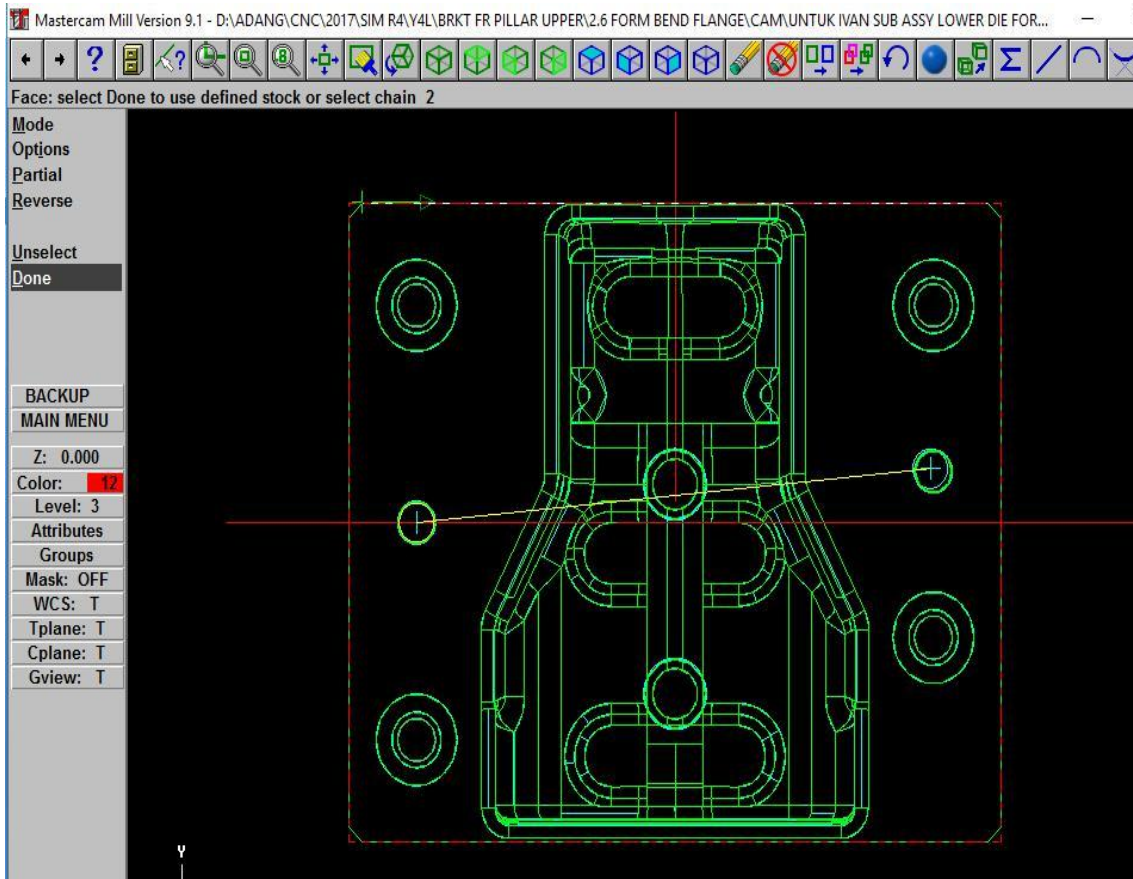
d. Click face option for the facing machining process



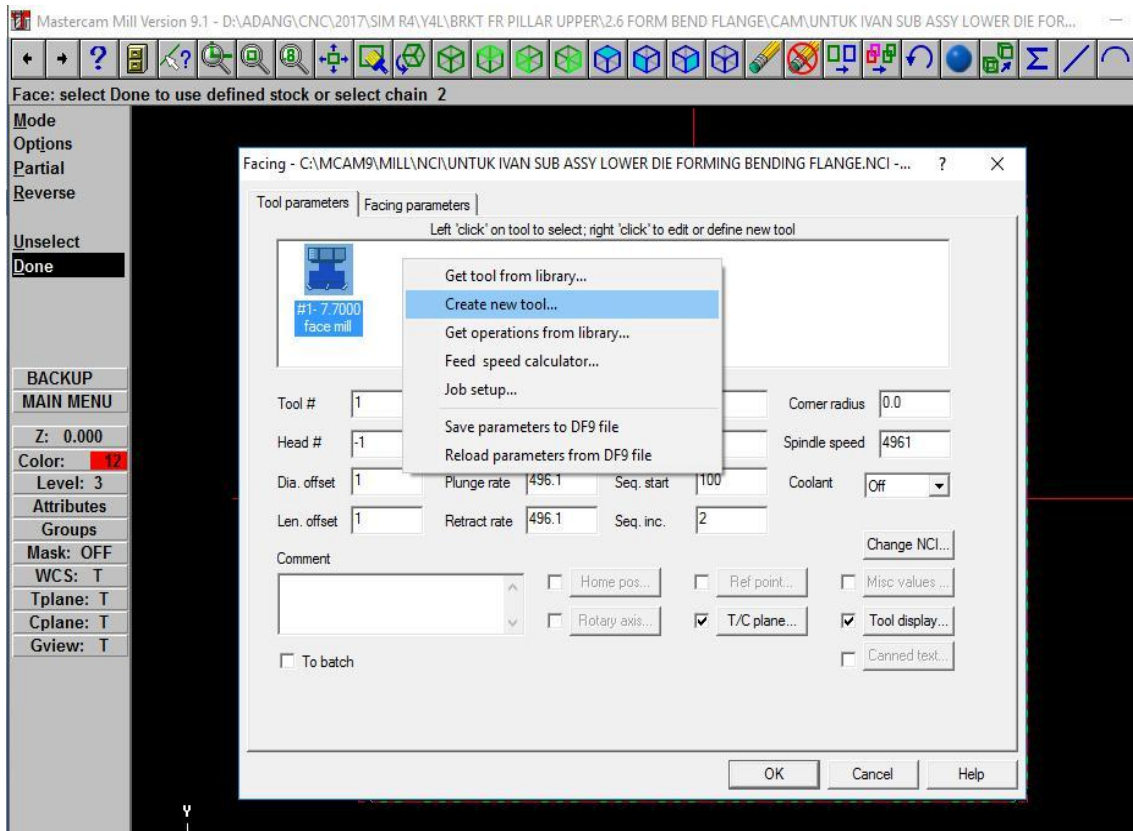
e. Choose on the chain option



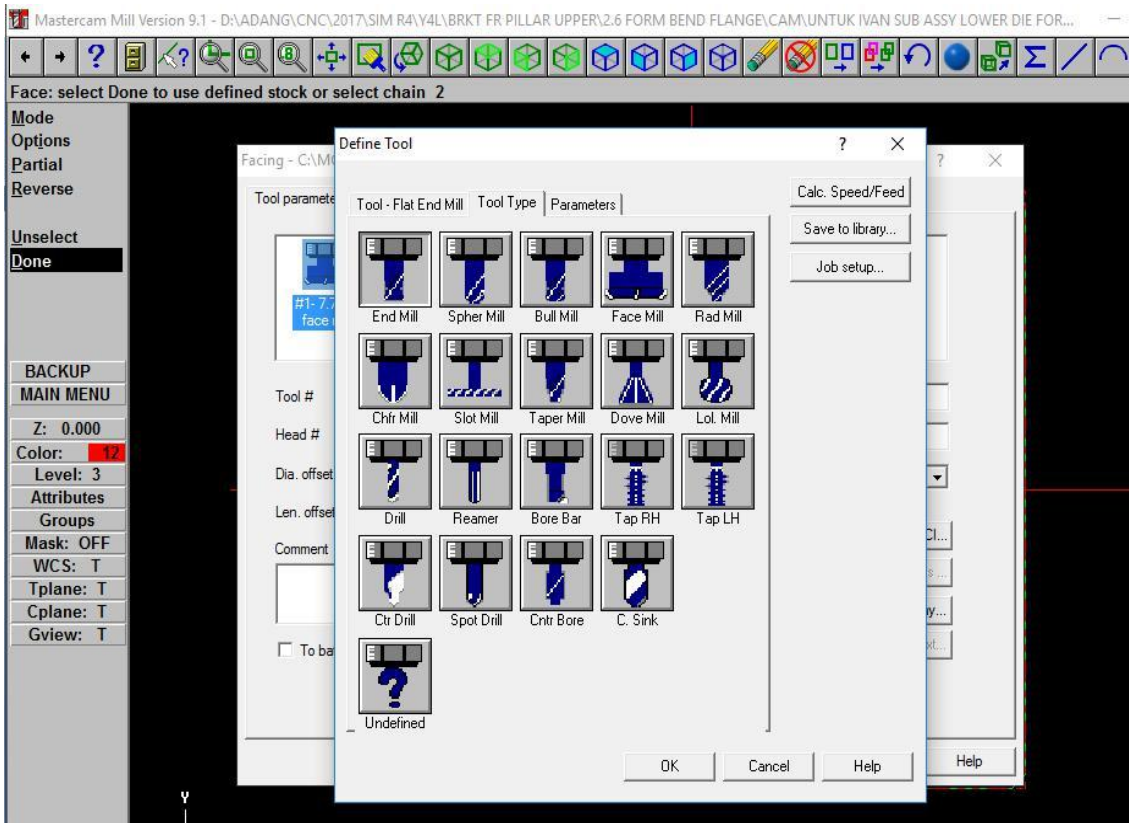
f. Click done



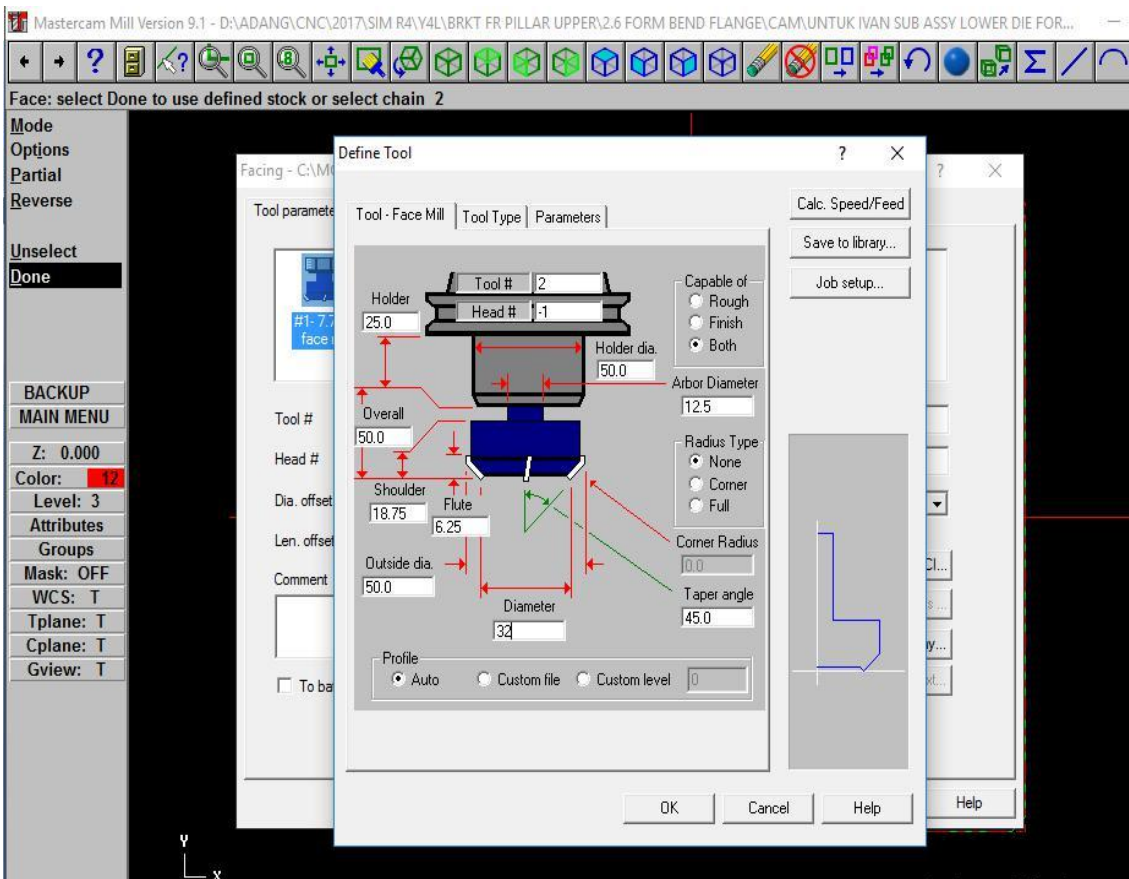
g. Create new tool for the machining process



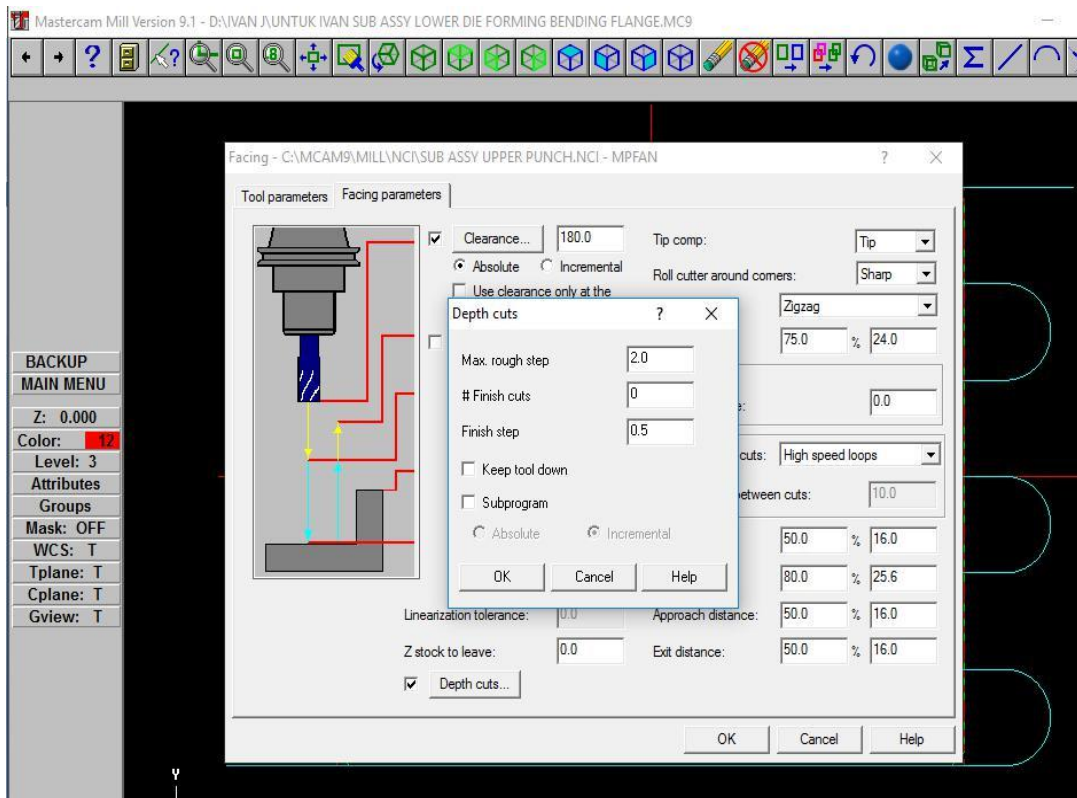
h. Define the tool type that want to be used for machining process



i. Set the diameter of the tool that needed for machining process

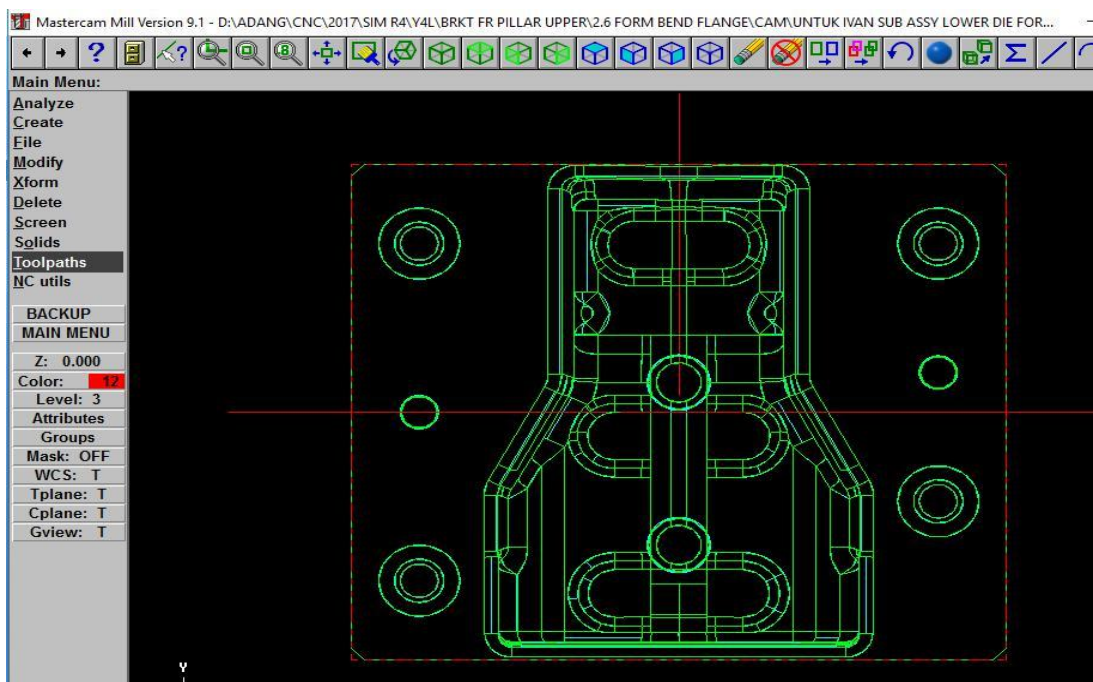


j. Set the clearance, and depth of cut on the maximum rough step

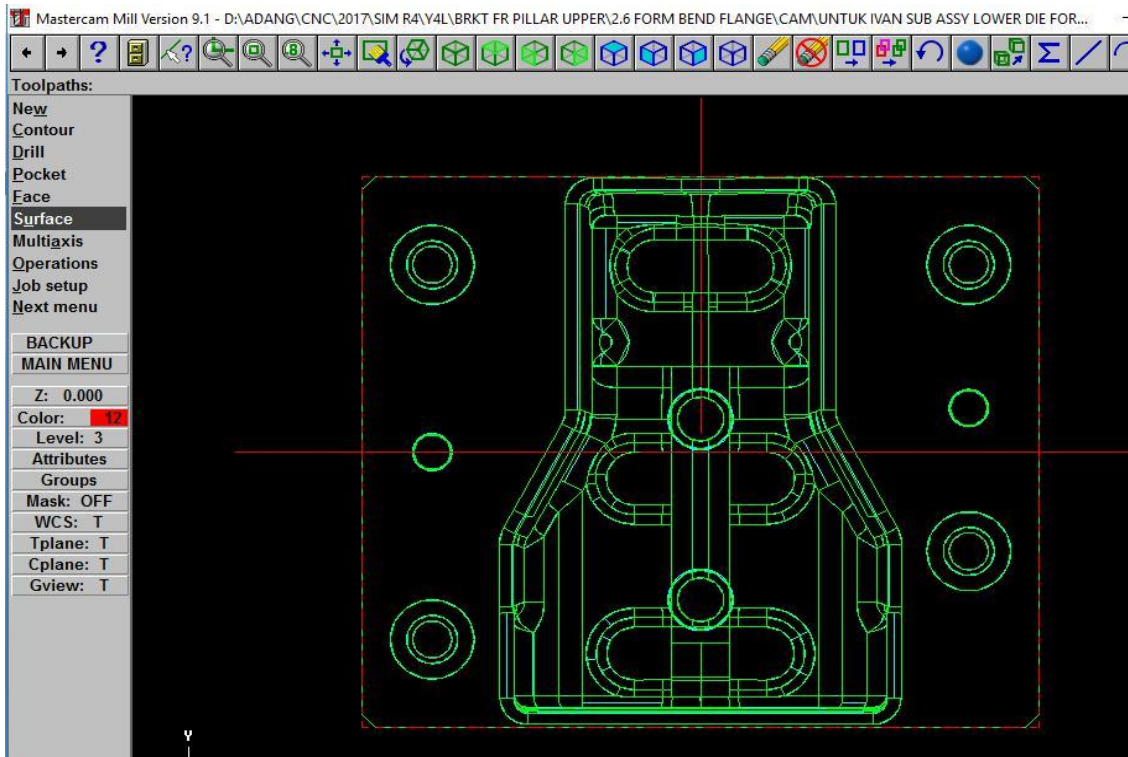


Surface rough pocket

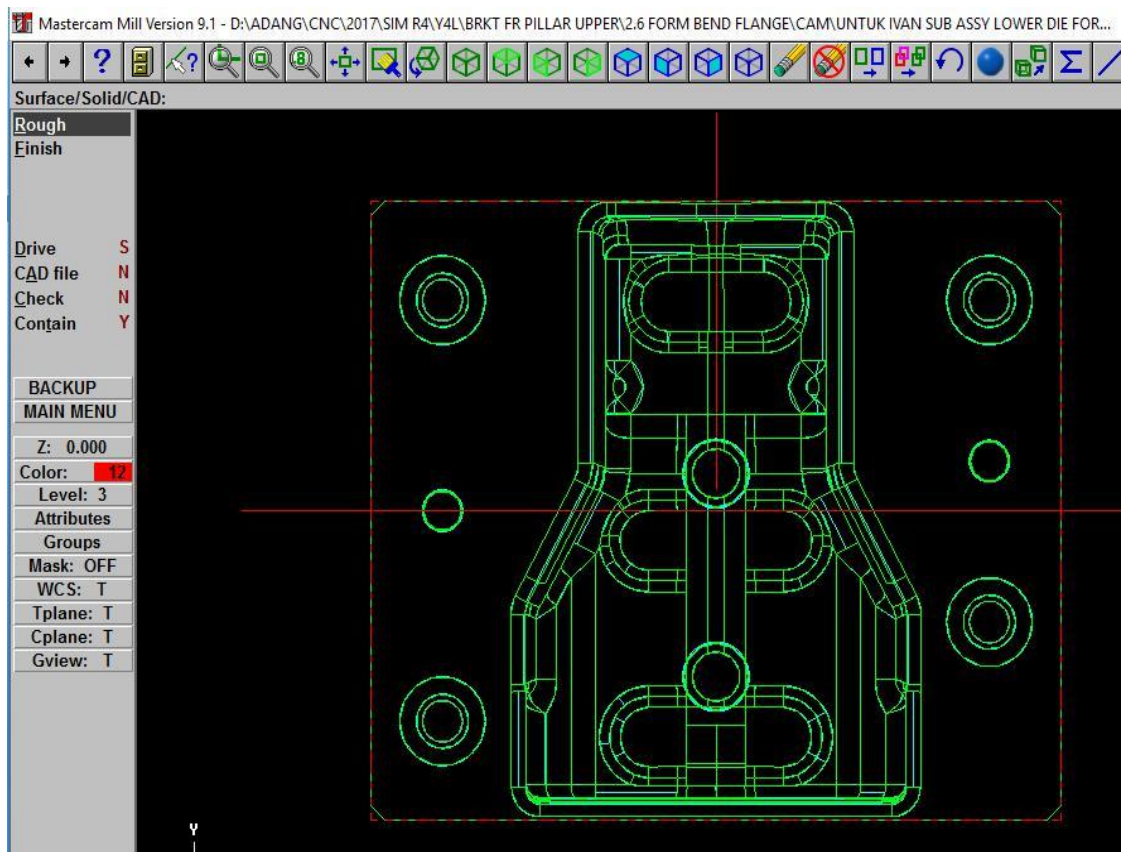
- Start master cam v9 lathe
- Open the design picture
- Choose the toolpaths (the path through space that the tip of a cutting tool follows on its way to producing the desired geometry of the workpiece)



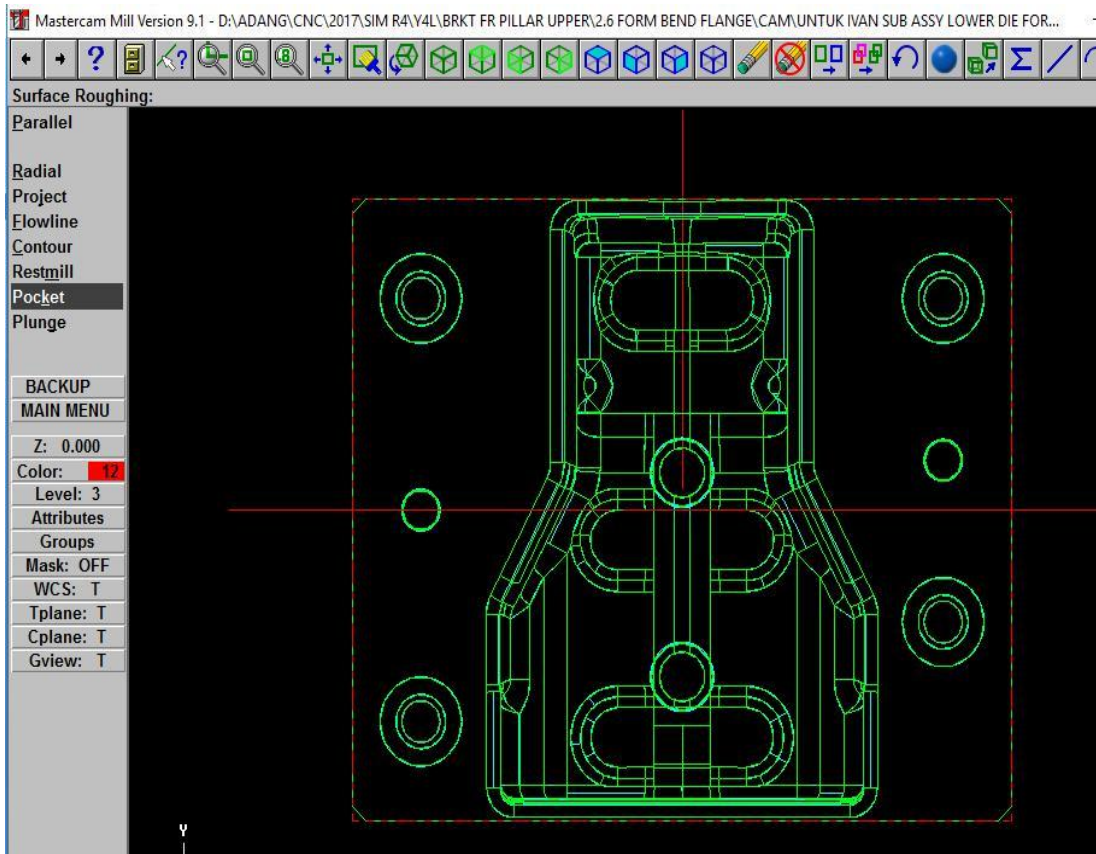
d. Choose the surface that want to be proceed



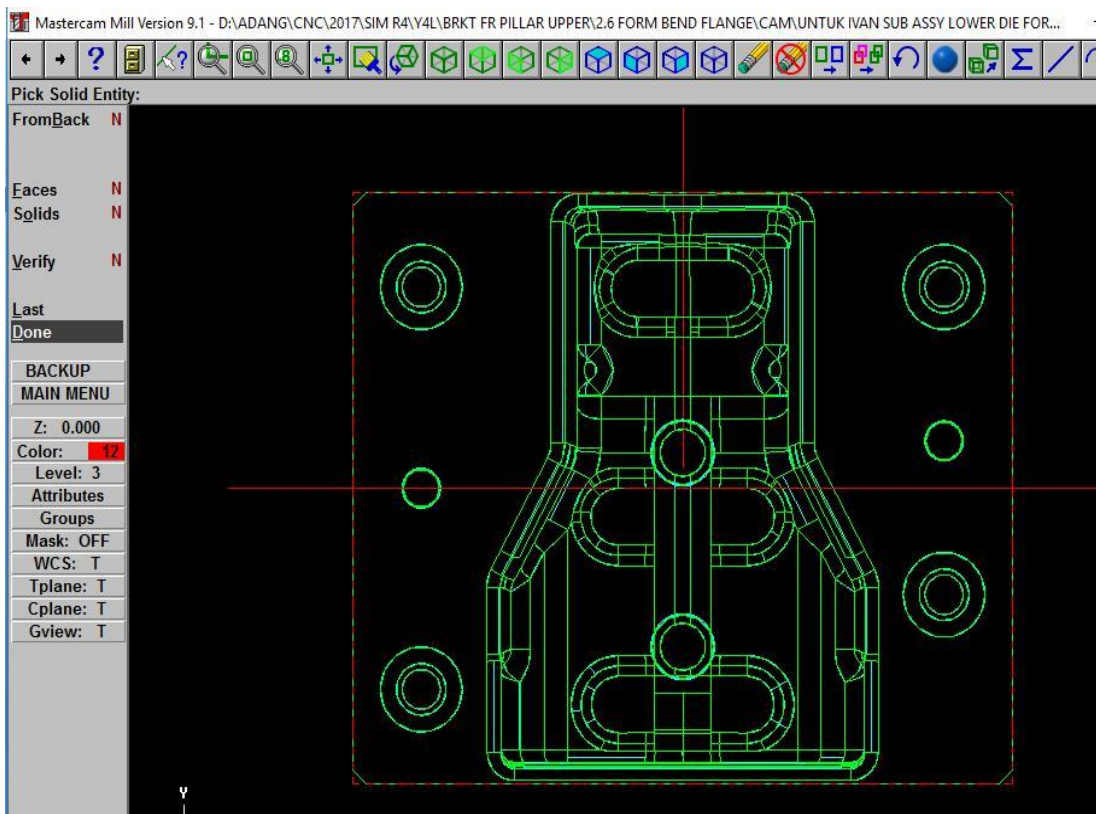
e. Click on the rough option



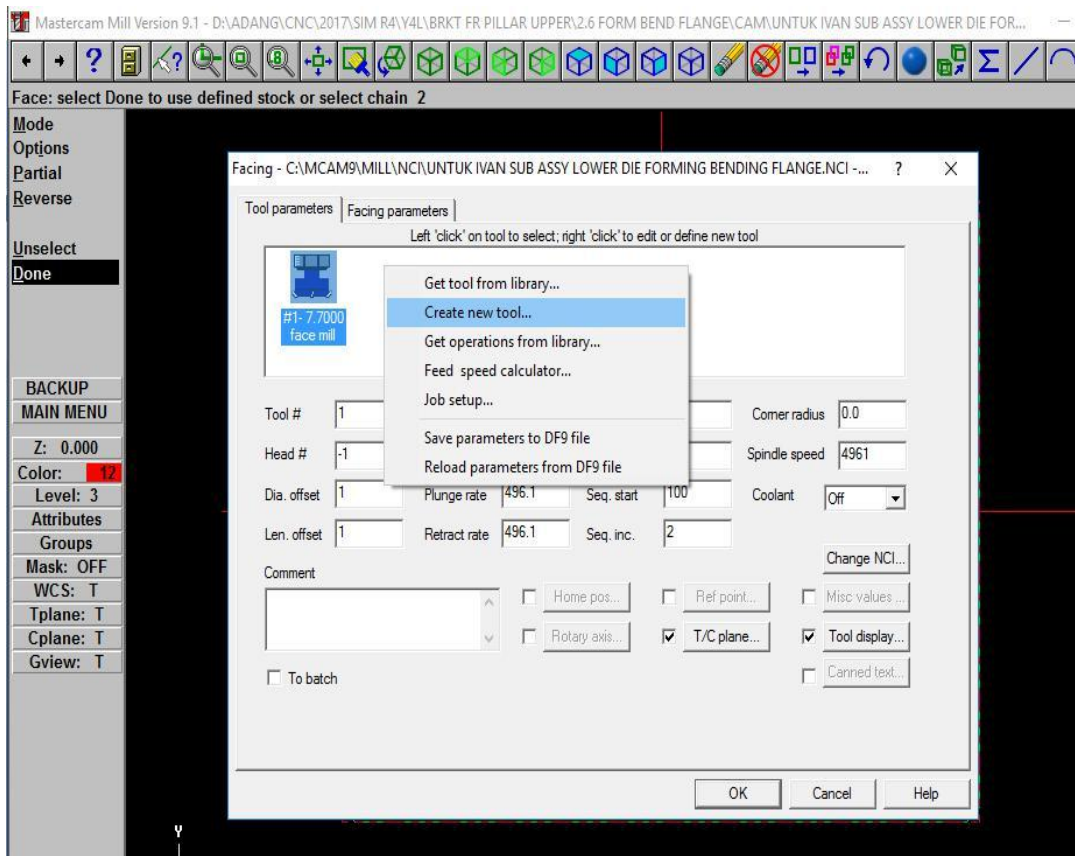
f. Choose pocket option and choose the line that want to be proceed



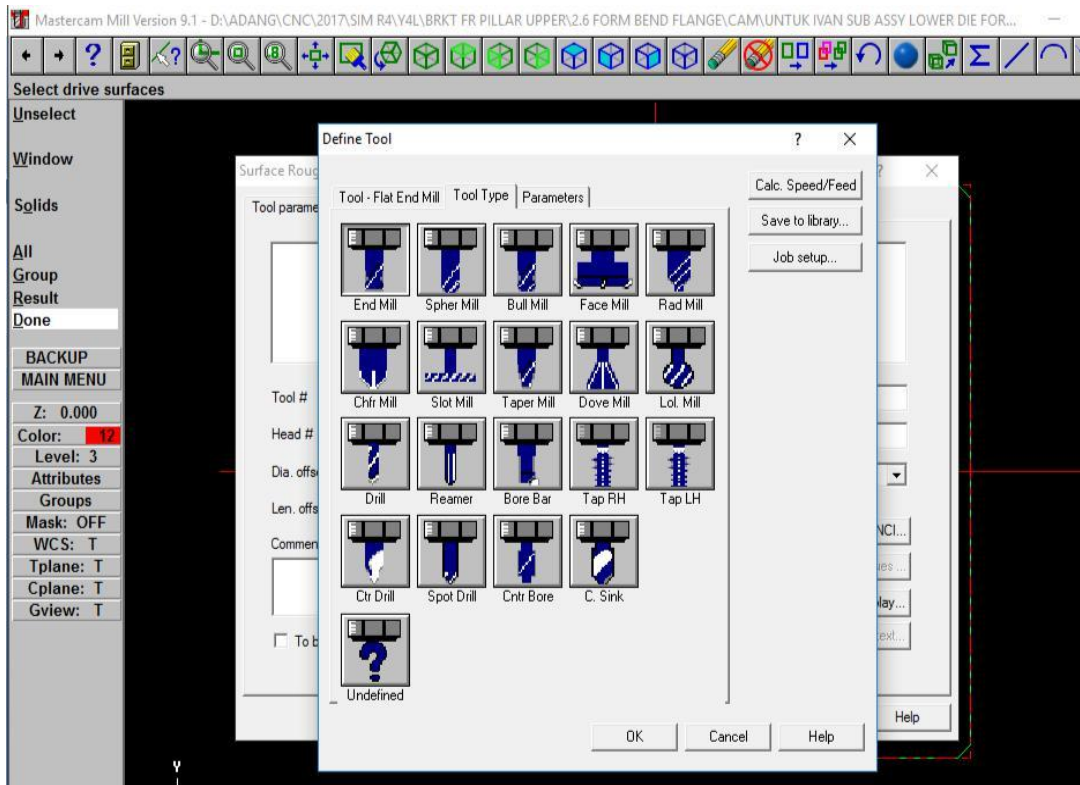
g. Click done



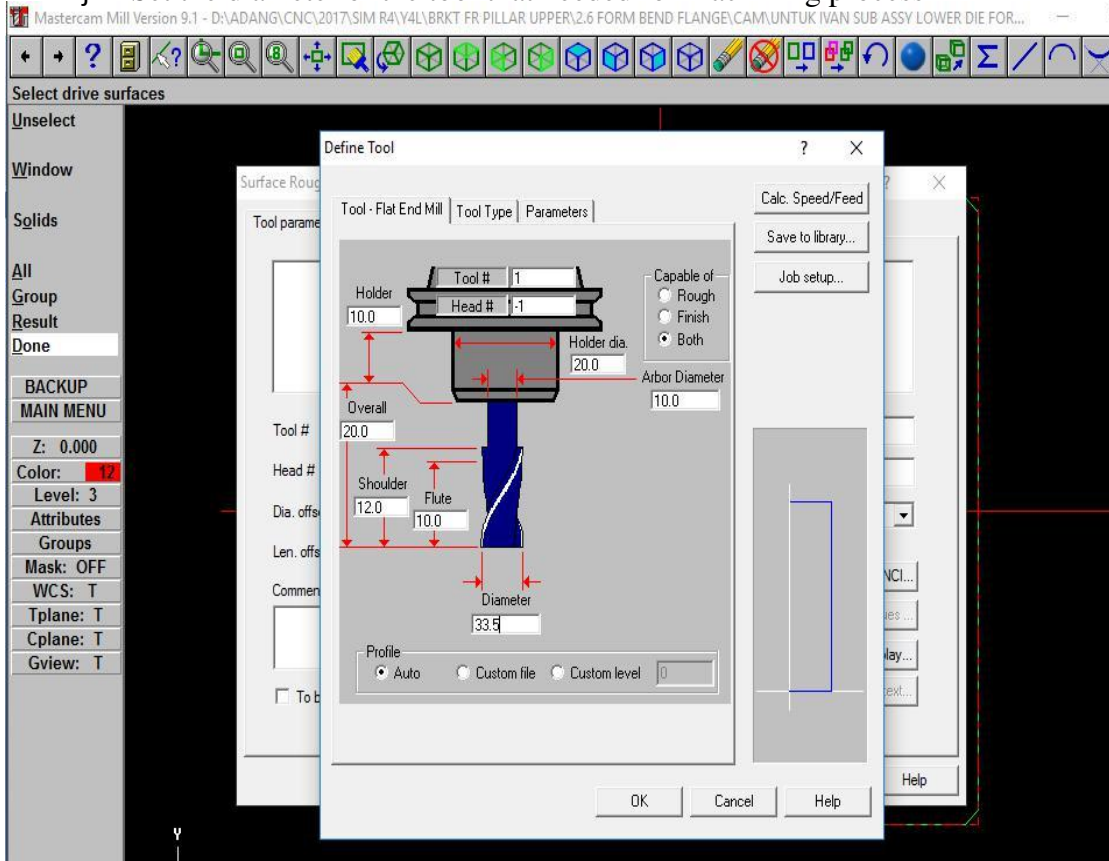
h. Create new tool for the machining process



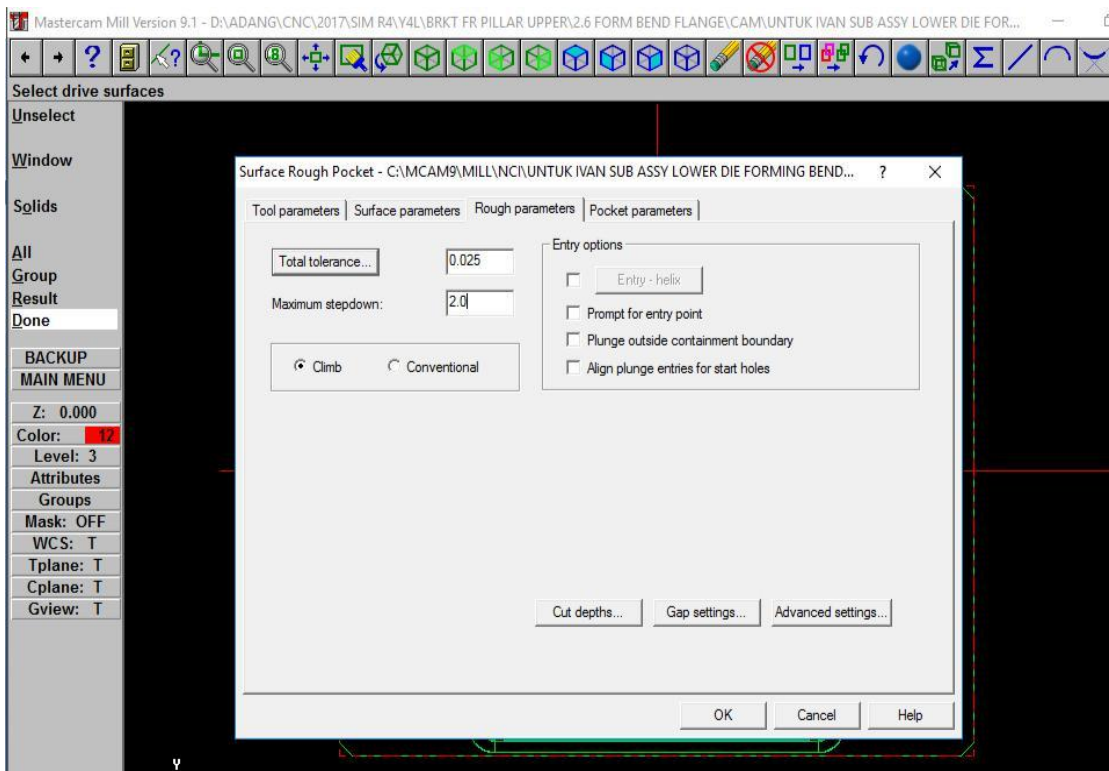
i. Define the tool type that want to be used for machining process



j. Set the diameter of the tool that needed for machining process



k. Set the total tolerance and maximum stepdown, then click ok



Data collection and analysis

Parameters Data

Peck drill – full retract

Table 1 Drill Parameters Data

(n)Spindle speed (rpm)	Feed rate (mm/rev)	Tool dia	Clearance	Retract	Depth of cut (mm)	Top of stock	Machining time process (min)
900	50	7.7	180	2	5	162	12
900	60	7.7	180	2	10	162	10
900	70	7.7	180	2	15	162	8

Facing

Table 2 Facing Parameters Data

(n) Spindle speed (rpm)	Feed rate (mm/rev)	Tool dia	Retract rate	Clearance	Depth	depth of cut (mm)	Machining time process (min)
1000	1000	32	1500	180	161.2	2	1.43333
1000	1200	32	1500	180	161.2	4	1.21667
1000	1400	32	1500	180	161.2	6	1.05

Surface rough pocket

Table 3 Surface Rough Pocket Parameters Data

(n) Spindle speed (rpm)	Feed rate (mm/rev)	Clearance	Feed plane	Total tolerance	Maximum stepdown (mm)	Machining process time (min)	Tool dia
650	1500	180	2	0.025	0.5	145	33.5
650	1700	180	2	0.025	1.5	43	33.5
650	1900	180	2	0.025	2.5	23	33.5

Summary

Advantages:

1. The CNC machining cost will be more efficient.

Table 1 lowest machining cost

Machining process	Lowest machining cost
Drill process	Rp 105,700

Facing process	Rp 82,070
Surface rough pocket process	Rp 313,700

2. The CNC machining process will take less time to finish.

Table 2 Best machining time

Machining Process	Best Machining Time (min)
Drill process	8
Facing process	1.05
Surface rough pocket process	23

3. The surface of the material that proceed with the fast machining time will be smoother.

Based on the results of data and experimental analysis with reference to the formulation of the problem, this study can be summarized as follows:

1. There is a significant influence on variation of feed rate variation, maximum stepdown variation, and depth of cut variation on the processing time on CNC milling programming by using MasterCAM software.
2. The cost for the machining process on the CNC milling machine have become more efficient from the effect of the optimized feed rate, maximum stepdown, and the consideration of the tool life time.
3. The result from using the variation of feed rate, maximum stepdown, and depth of cut on the processing time on CNC milling programming variation are resulting good parameters choice for each machining process by using the optimized feed rate, maximum stepdown, and the consideration of the tool life time.

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