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Manufatura de Ferramentas Assistida por Computador

Aula 2 – Fresamento

Prof. Angela Marques

asmарques@sapucaia.ifsul.edu.br

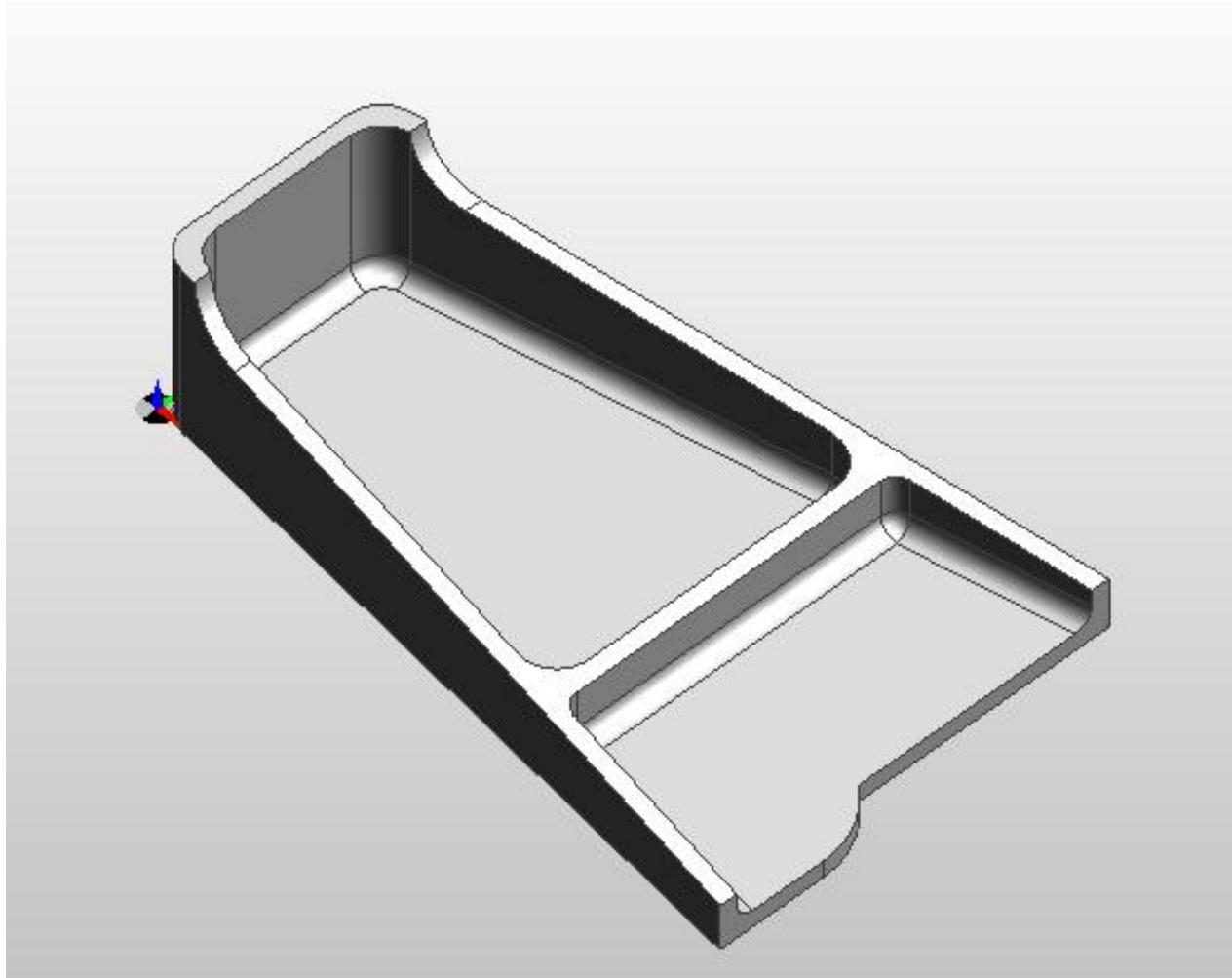
24/04/ 2012

Exercício de Fresamento

Neste exercício você aprenderá:

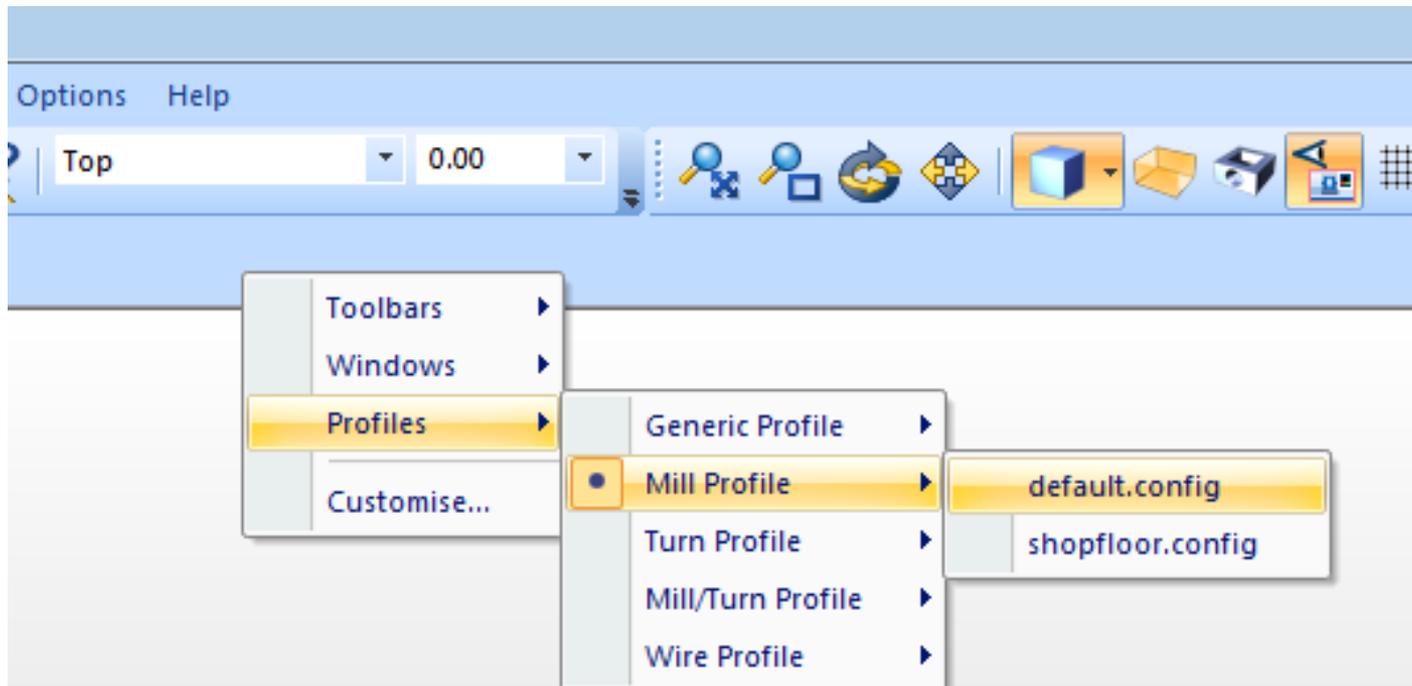
- ✓ Como abrir um modelo sólido.
- ✓ Como mudar de vista – selecionando isométrica e zoom.
- ✓ Como alinhar o corpo para o fresamento.
- ✓ Como criar um Bruto (stock).
- ✓ Características de contorno da aresta.
- ✓ Criar uma nova *Layer*.
- ✓ Extrair características da face.
- ✓ Como criar uma usinagem usando Operações (operations) e Ciclos (Cycles)
- ✓ Como simular sua usinagem.
- ✓ Como editar operações.

Modelo CAD a ser usinado:



Selecionar a Interface de Fresamento

Clicar com o Botão direito sobre a barra de ferramentas e escolher o perfil de fresamento, conforme a figura abaixo:



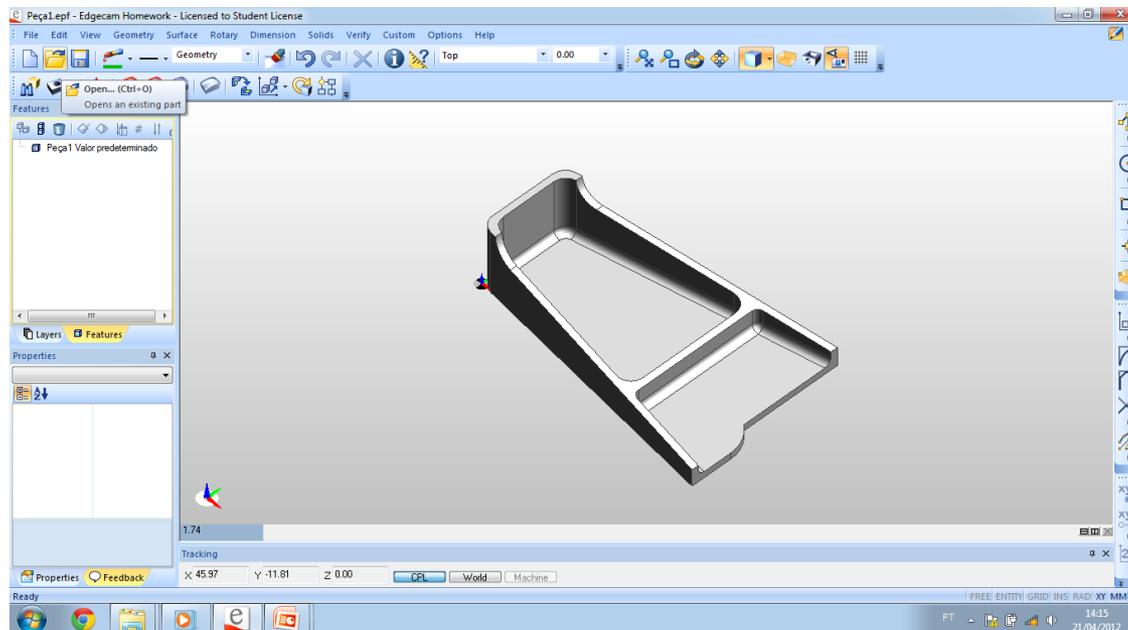
No início de toda aula é importante configurara o perfil de usinagem que desejamos trabalhar.

Abrir a peça

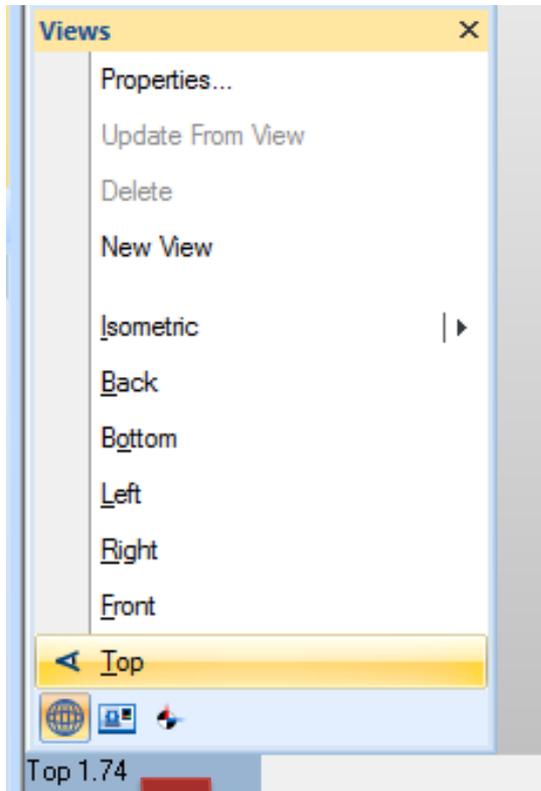
✓ Clique no botão *Open*



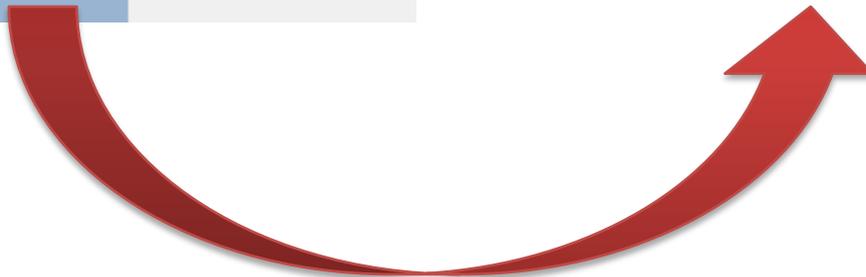
✓ Na caixa de dialogo Open que aparecer, navegue até encontrar o arquivo.



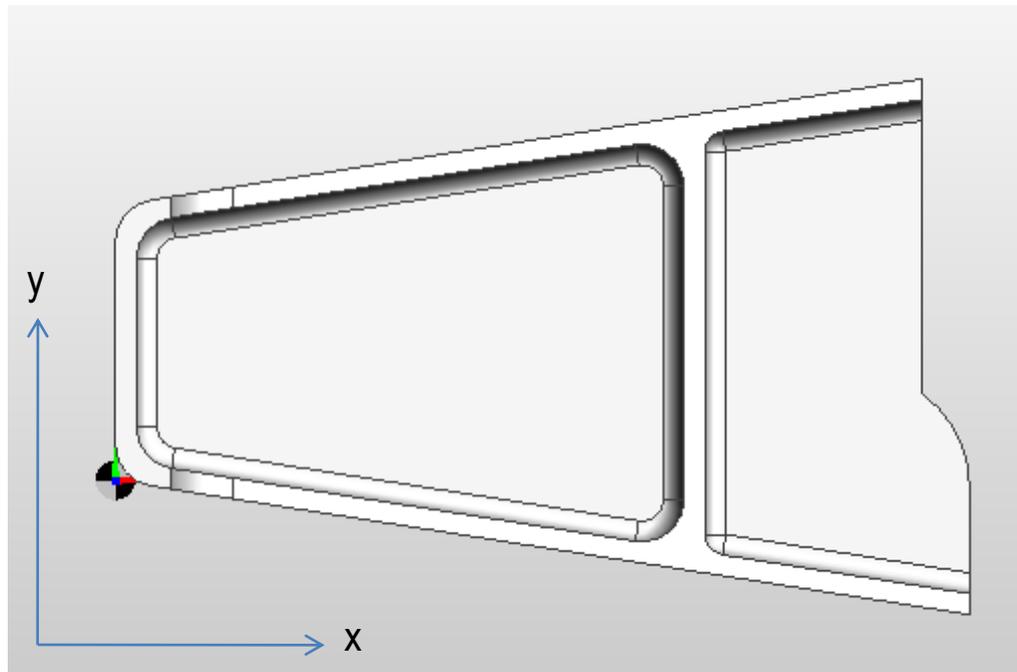
Selecionar a vista *TOP*



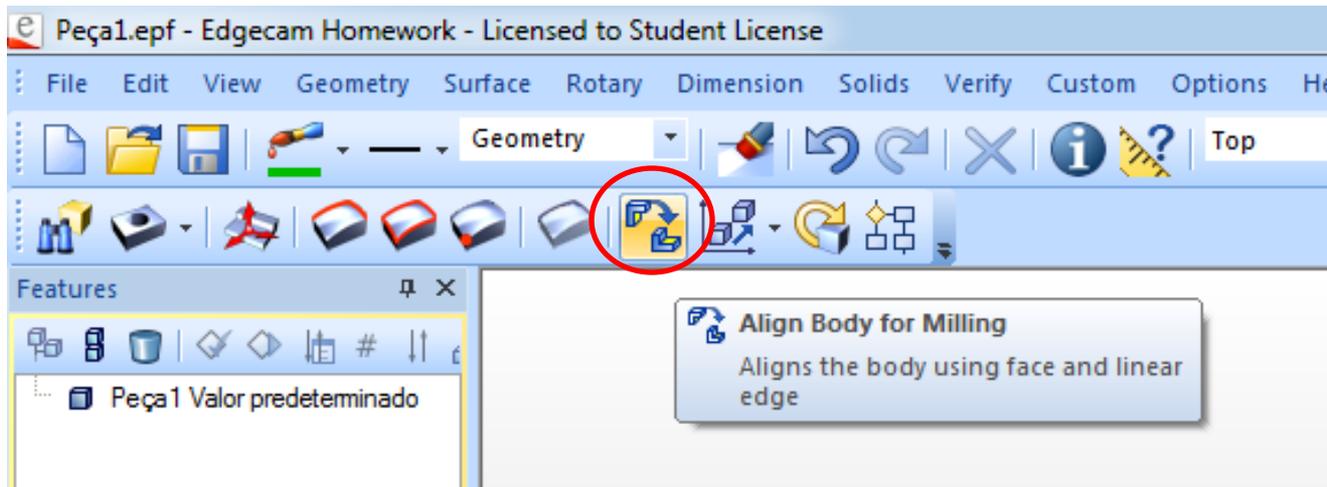
Clicar com o botão direito sobre esta área e selecionar o plano Top



Atenção: é necessário alinhar a
peça no eixo x



Alinhar o corpo para o fresamento

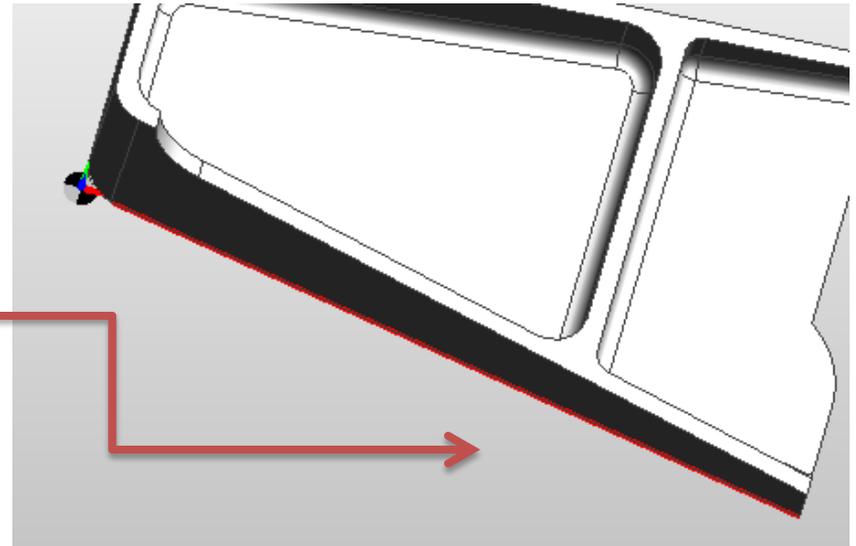


Alinhar o corpo para o fresamento

- **Selecione a face que define o plano XY** – Neste caso não há necessidade de selecionar a face, pois a peça já está na posição correta. Apenas confirme com o botão direito do mouse.

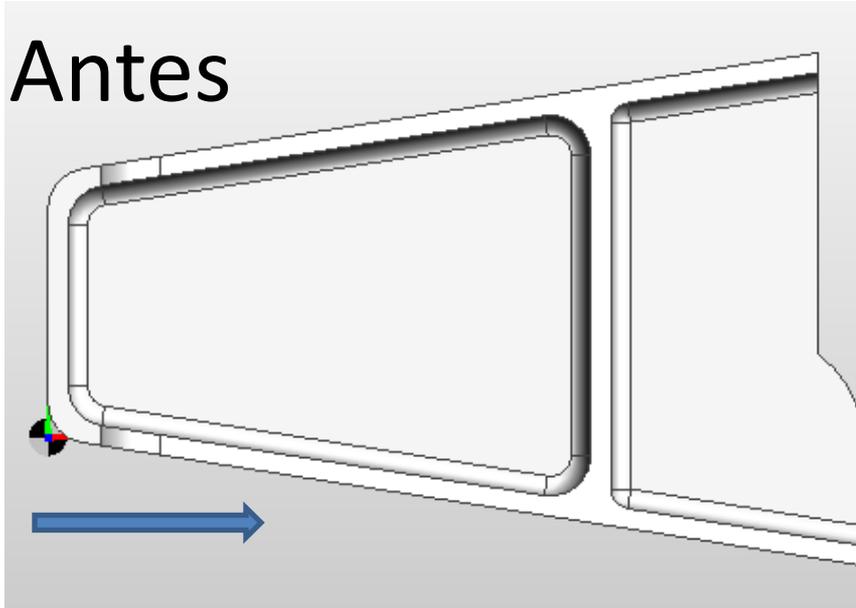


- **Selecione uma aresta linear para definir o plano do eixo da CPL** – Clicar na aresta inferior, do eixo X.
- **Selecione o ponto para mover a origem** – Neste caso não há necessidade, apenas confirme.

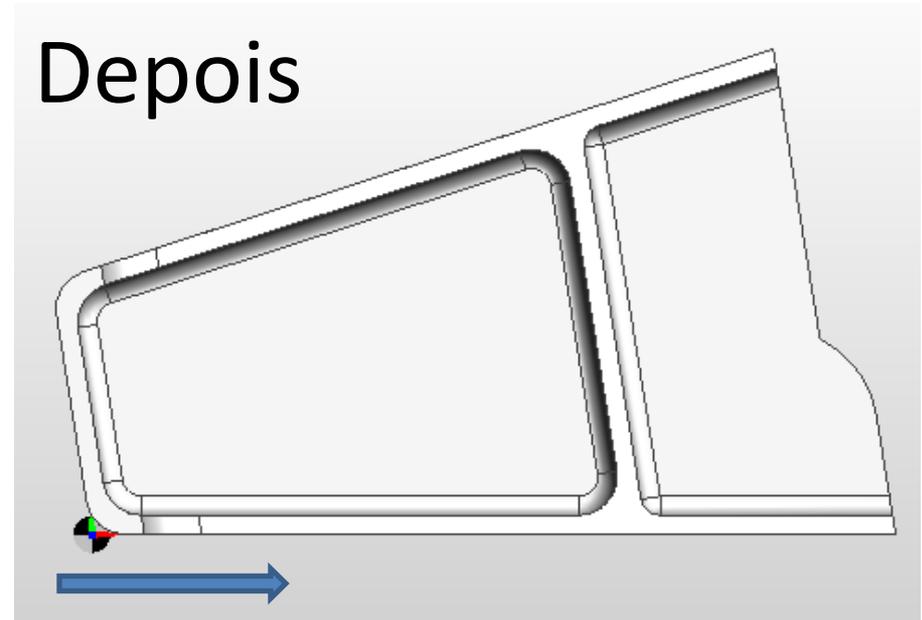


Antes & Depois

Antes



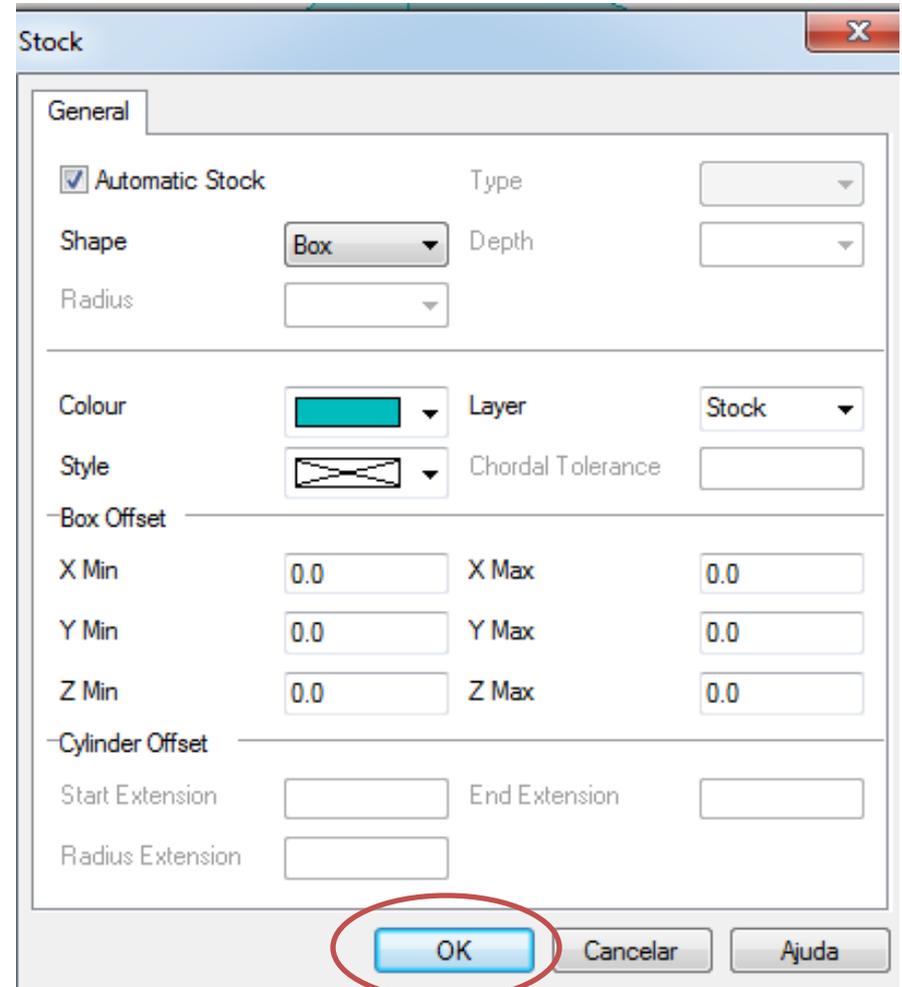
Depois



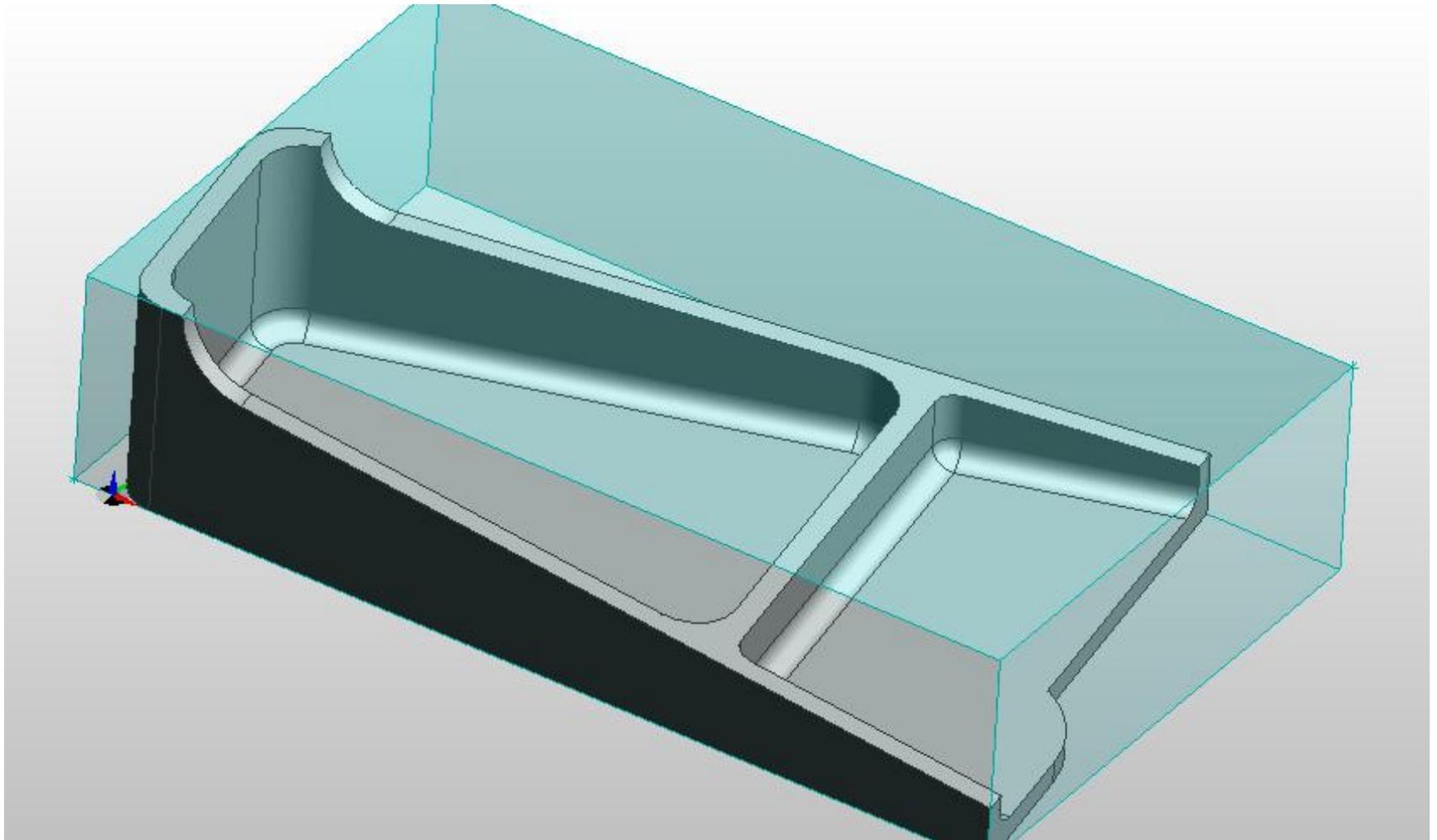
Criar o Stock

- Clique no menu **geometry** e clique em **stock/fixture**

Na caixa de diálogos faça estas configurações.

A screenshot of the "Stock" dialog box in a software application. The dialog has a title bar with "Stock" and a close button. It contains several sections: "General" with a checked "Automatic Stock" checkbox and a "Type" dropdown; "Shape" with a "Box" dropdown and a "Depth" dropdown; "Radius" with a dropdown; "Colour" with a color selection box and a "Layer" dropdown set to "Stock"; "Style" with a style selection box and a "Chordal Tolerance" input field; "Box Offset" with "X Min", "X Max", "Y Min", "Y Max", "Z Min", and "Z Max" input fields, all set to "0.0"; "Cylinder Offset" with "Start Extension", "End Extension", and "Radius Extension" input fields. At the bottom, there are "OK", "Cancelar", and "Ajuda" buttons. The "OK" button is circled in red, and a blue arrow points to it from below.

O “bruto” deverá ficar assim:

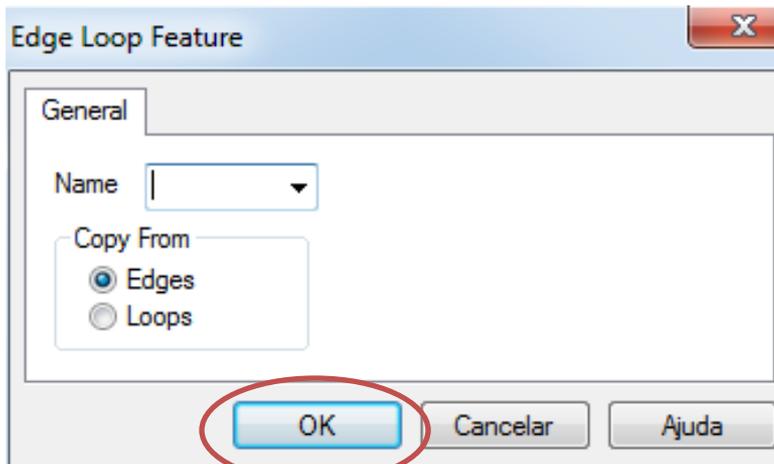


Características de contorno da aresta

1. Na barra de ferramentas clicar em *Solidus*



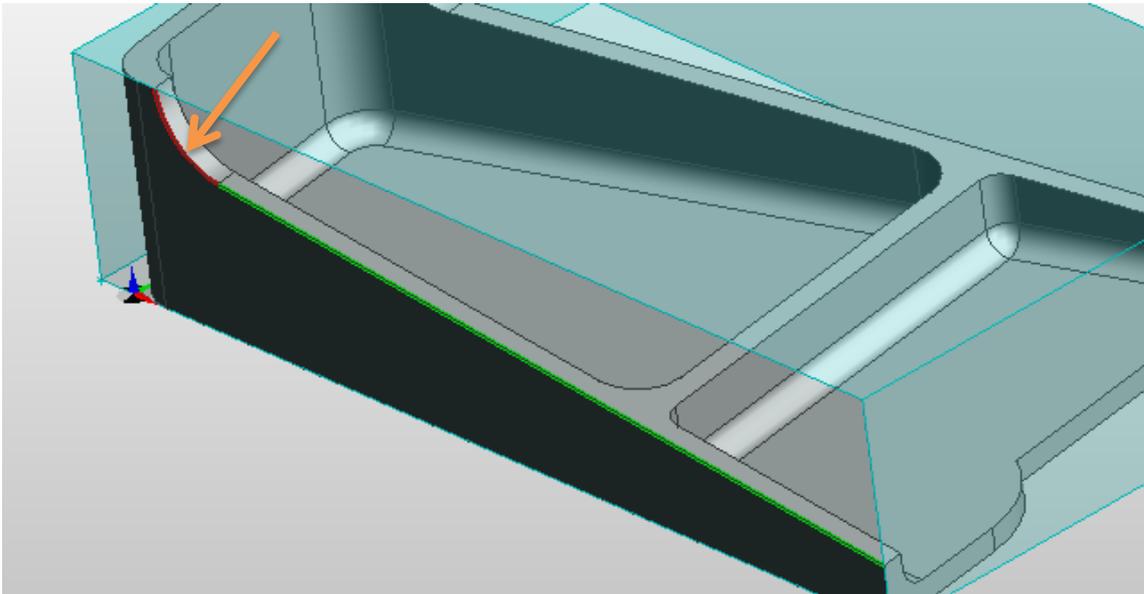
2.



3.

Características de contorno da aresta

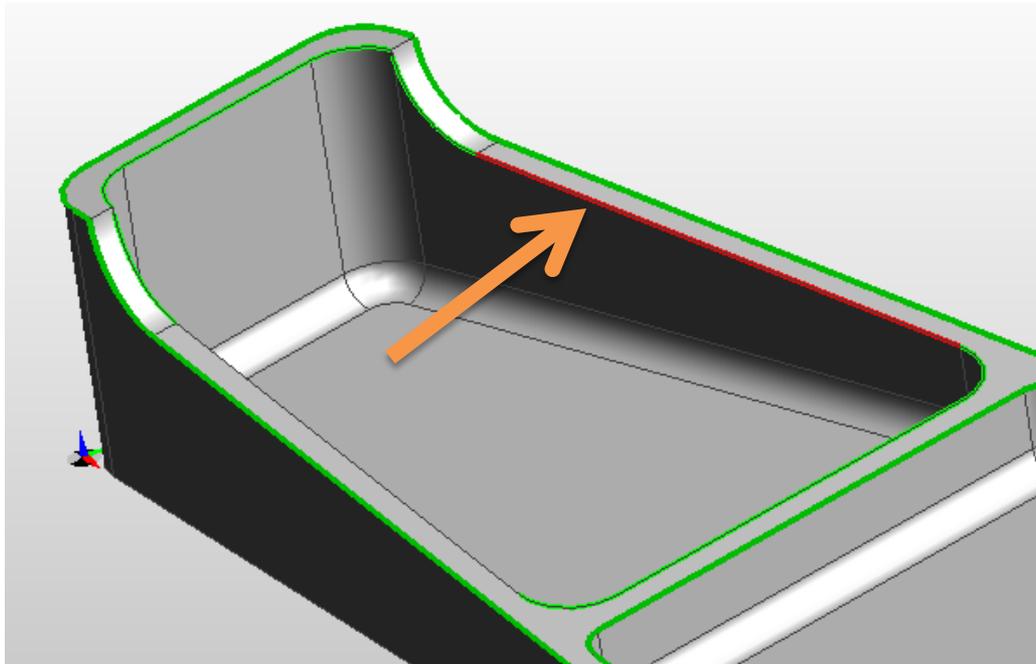
- Selecionar as arestas externas e superiores da peça.
- Selecionar todas até fechar o contorno.
- Finalizar clicando com o botão direito

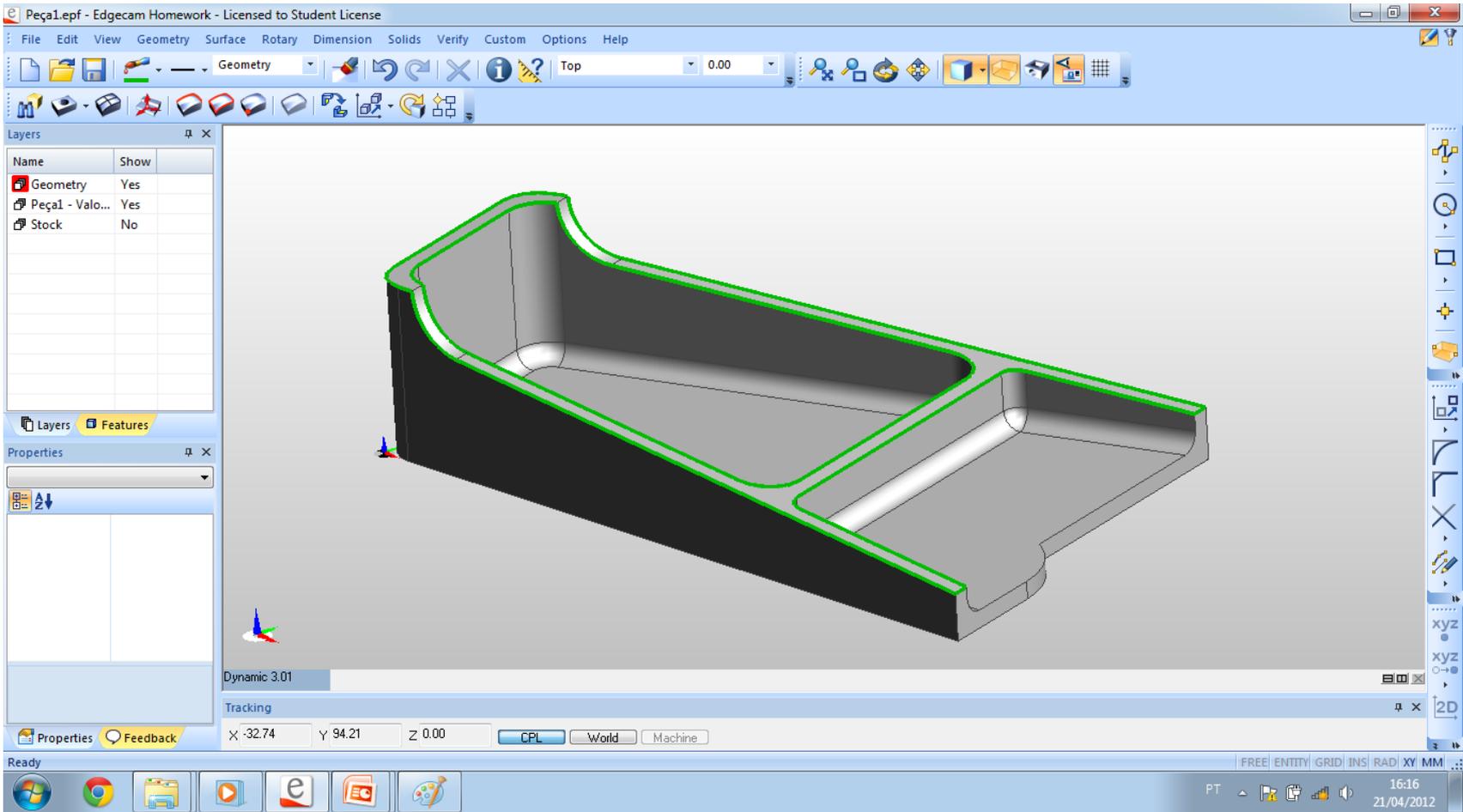


Dica: Você pode esconder o *layer stock* para facilitar a seleção das arestas!

Características de contorno da aresta

- Selecionar as arestas internas e superiores da peça.
- Selecionar todas até fechar o contorno.
- Finalizar clicando com o botão direito

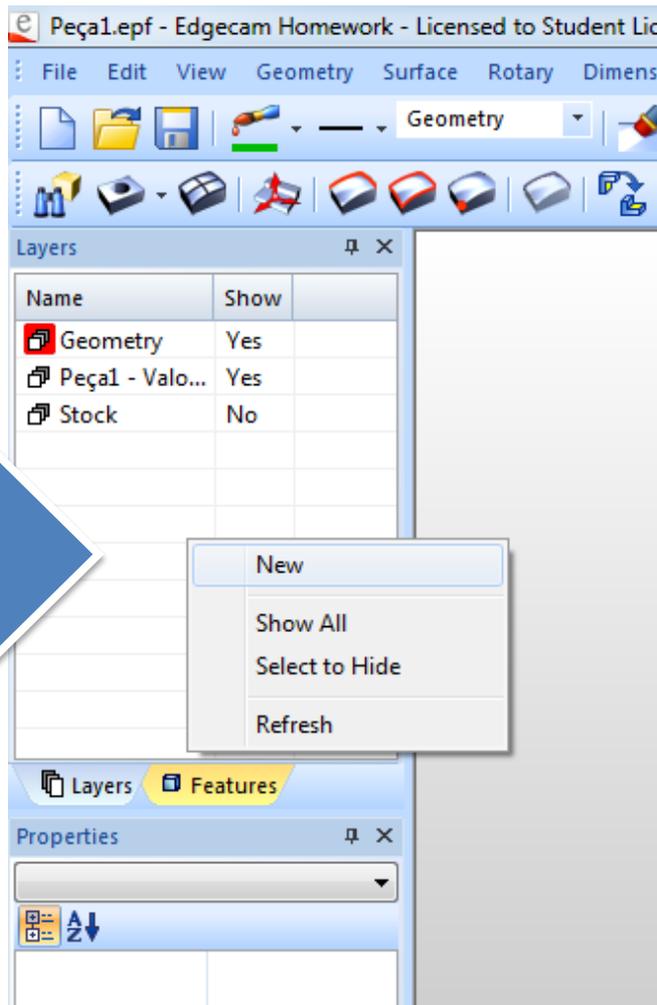




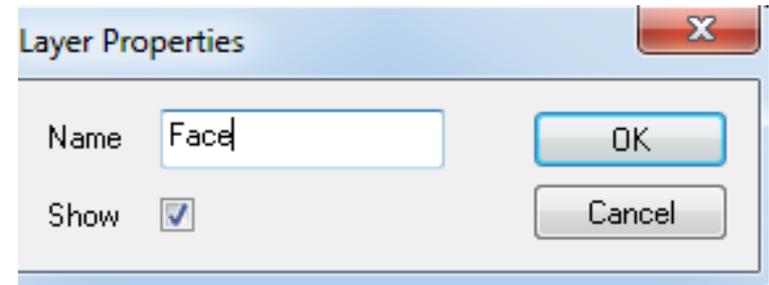
Criar uma nova *Layer*

1.

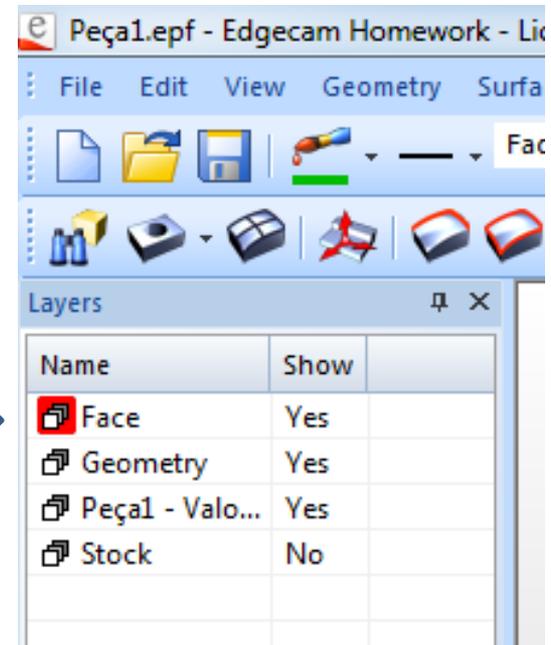
Clicar com o botão direito do mouse nesta área.



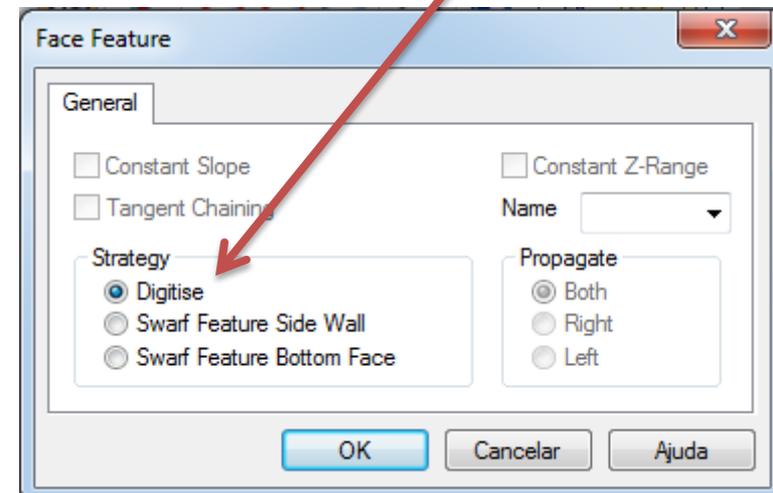
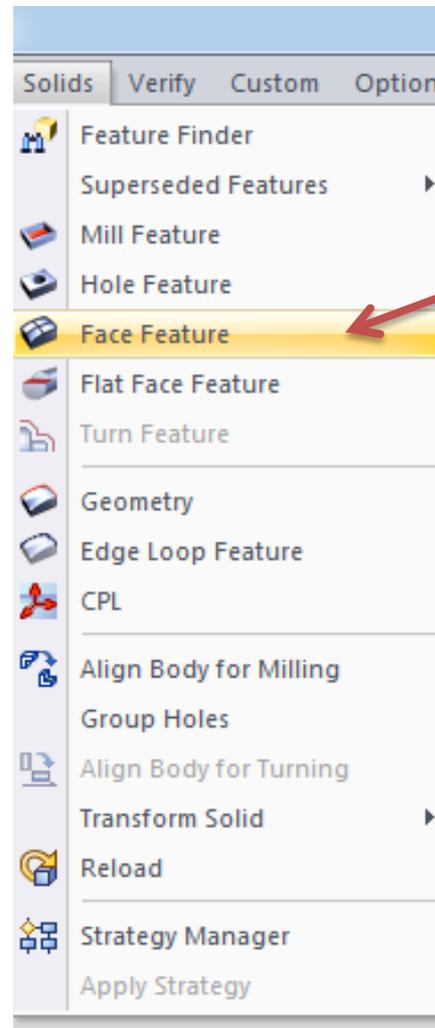
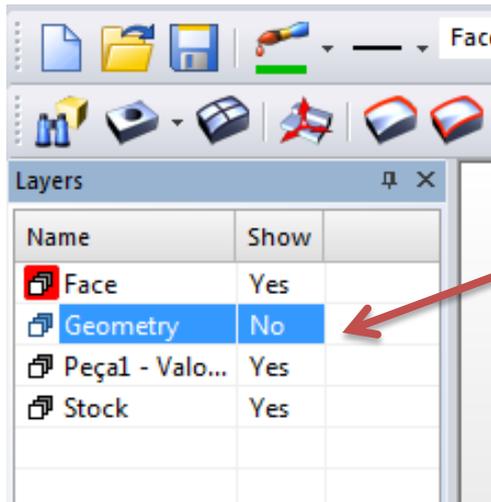
2.



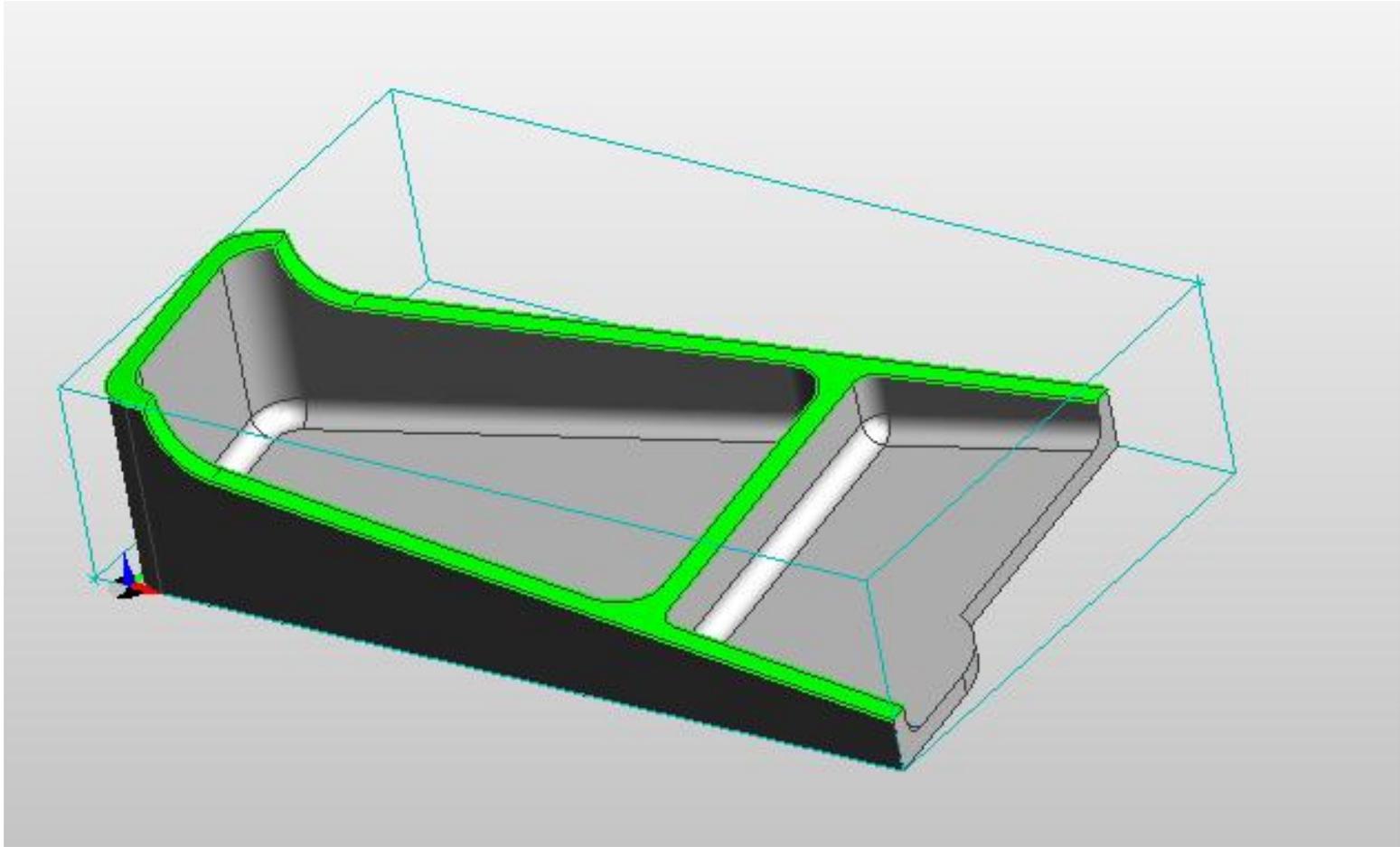
3.



Extrair características da face



Faces a serem selecionadas



Criando uma Sequência de Usinagem

- Passe para o modo de Manufatura
- Clique no ícone Manufacture no canto superior direito da janela do EdgeCAM



Criando uma Sequência de Usinagem

The image shows a software dialog box titled "Machining Sequence" with a close button (X) in the top right corner. The dialog is divided into several sections by horizontal lines. The "General" tab is selected, and other tabs include "Job Data", "Lathe Setup", "Chuck Setup", and "TailStock".

Key fields and their values are highlighted with red boxes:

- Sequence Name:** Exemplo2
- Discipline:** Mill
- Machine Tool:** training mill (indicated by a blue arrow pointing down to it)
- Initial CPL:** Top
- Output Tolerance:** 0.01
- Datum Type:** Absolute (selected with a radio button)

Other visible fields include "Choose a Code Generator", "Apply Speed Capping" (checkbox), "Mating Location" (<None>), "Mating CPL" (<None>), "Mating Offset" (checkbox), and "Machine Datum" (checkbox).

At the bottom of the dialog are three buttons: "OK", "Cancelar", and "Ajuda".

Desbastando a Peça

- Clique em **Roughing Operation**.
- Na barra de status aparece "Digitise Geometry to machine". Mova o mouse sobre peça e quando ela mudar de cor e aparecer escrito Solid..., CLIQUE.
- Confirme com o botão da direita
- Confirme novamente.



Desbastando a Peça

Roughing Operation

General Tooling Depth

Rest Rough

Mill Type Optimised

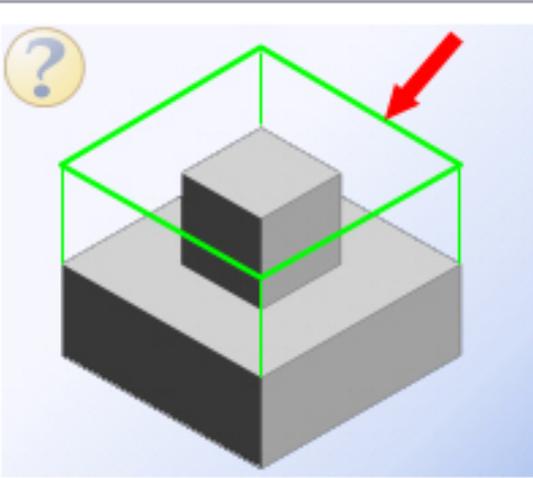
% Stepover 80

Offset 0.2

Z Offset

Tolerance 0.01

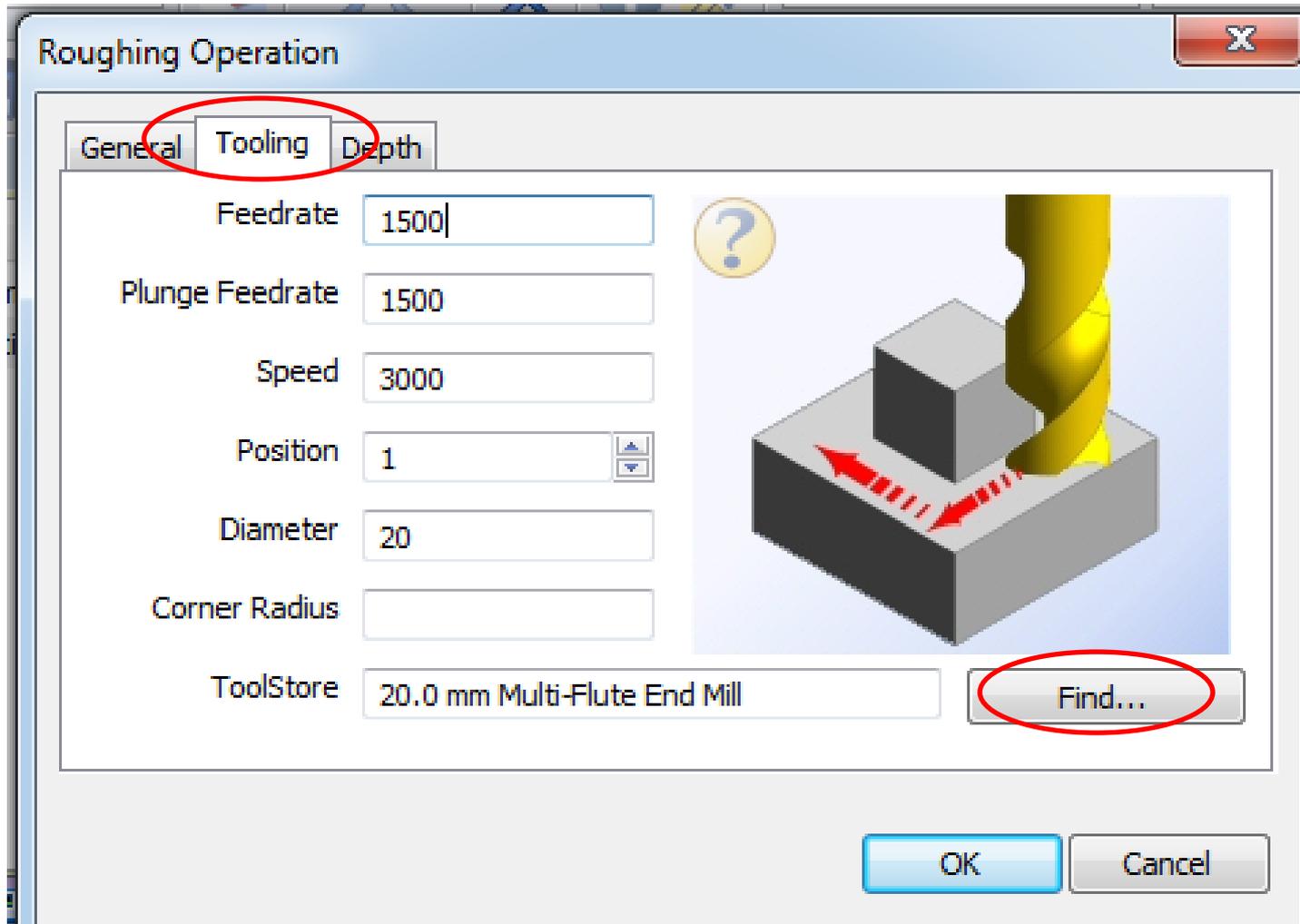
Digitise Stock



OK Cancel

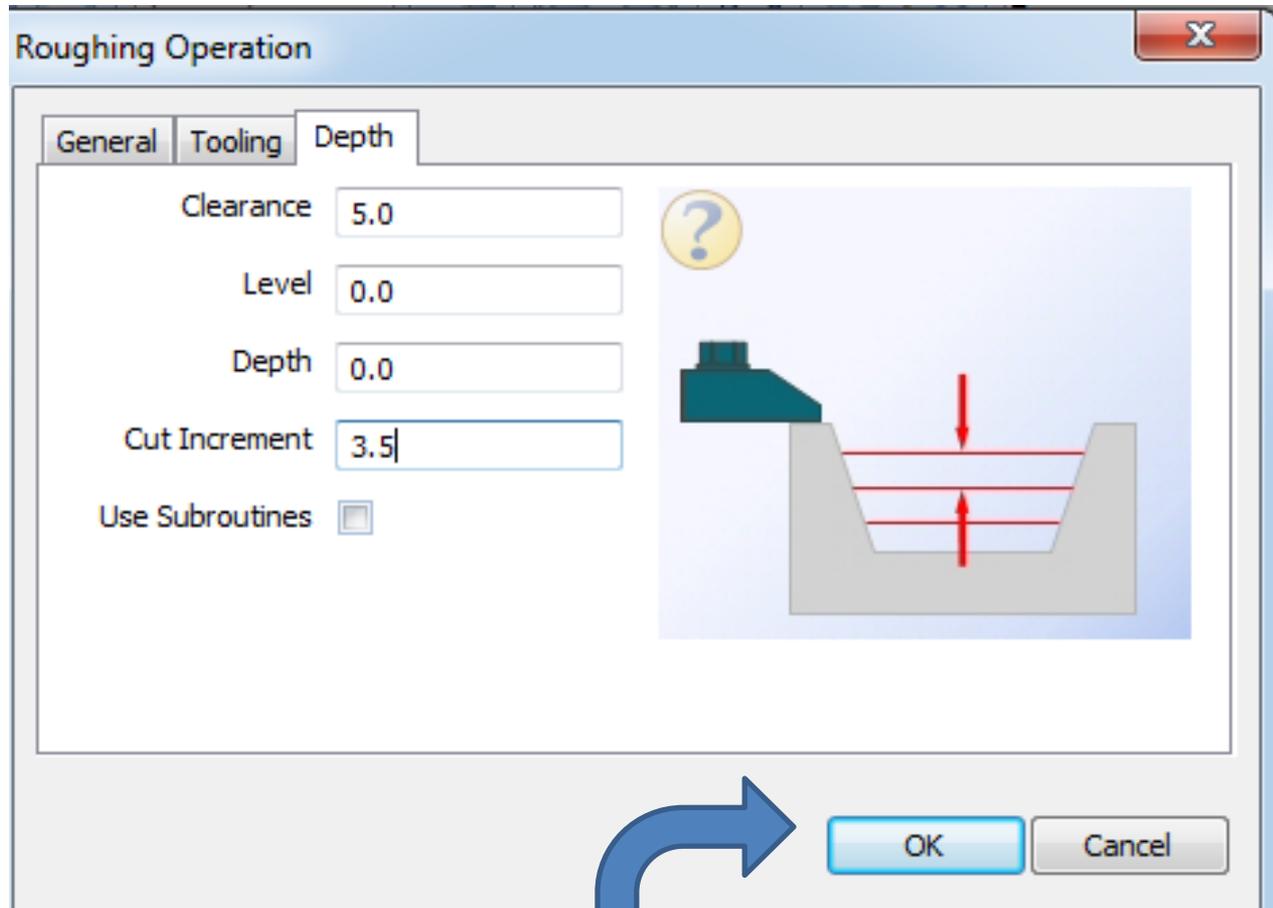
Preencher os dados conforme a imagem

Escolha a ferramenta para o desbaste

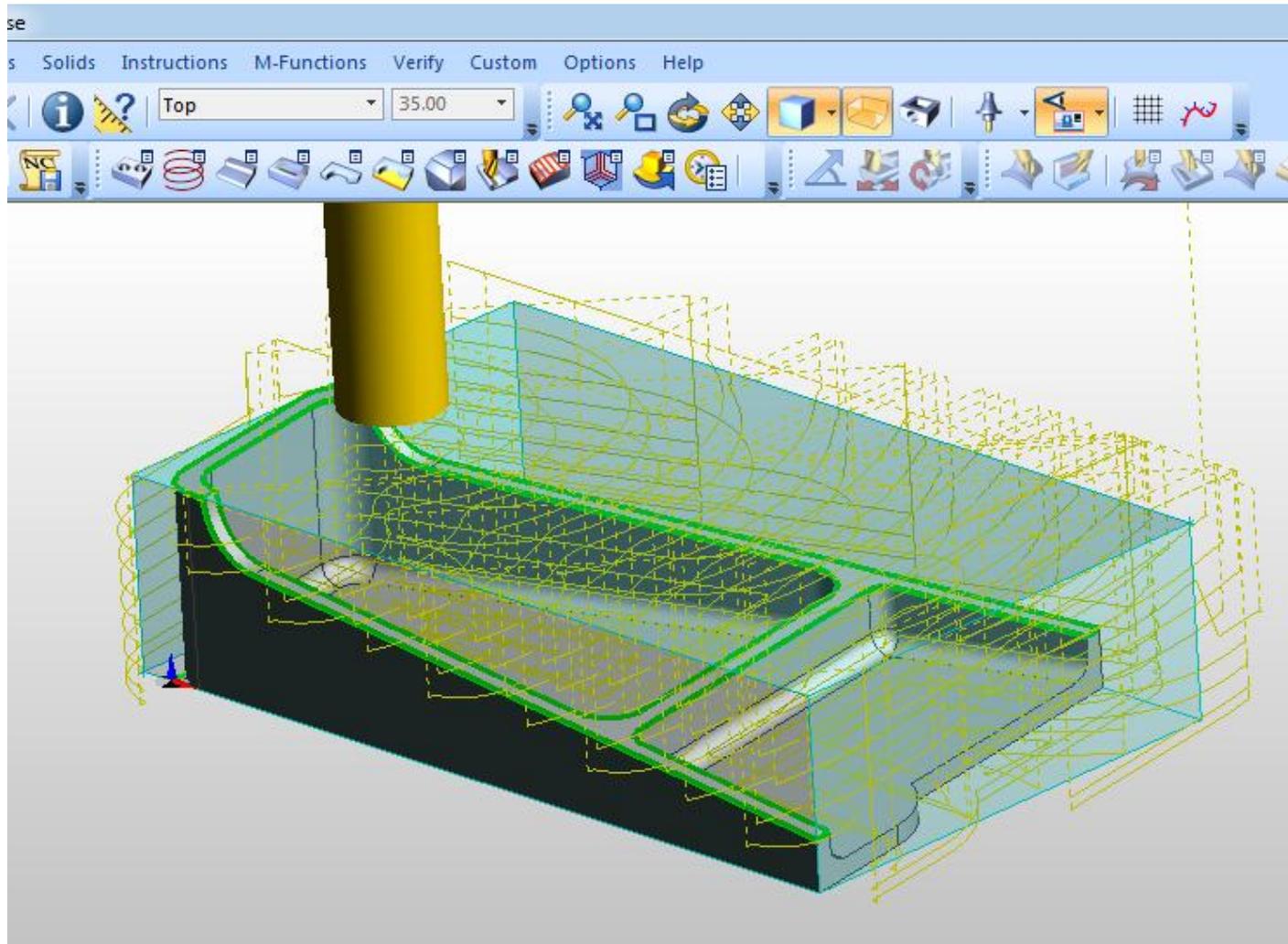


Altura de segurança...

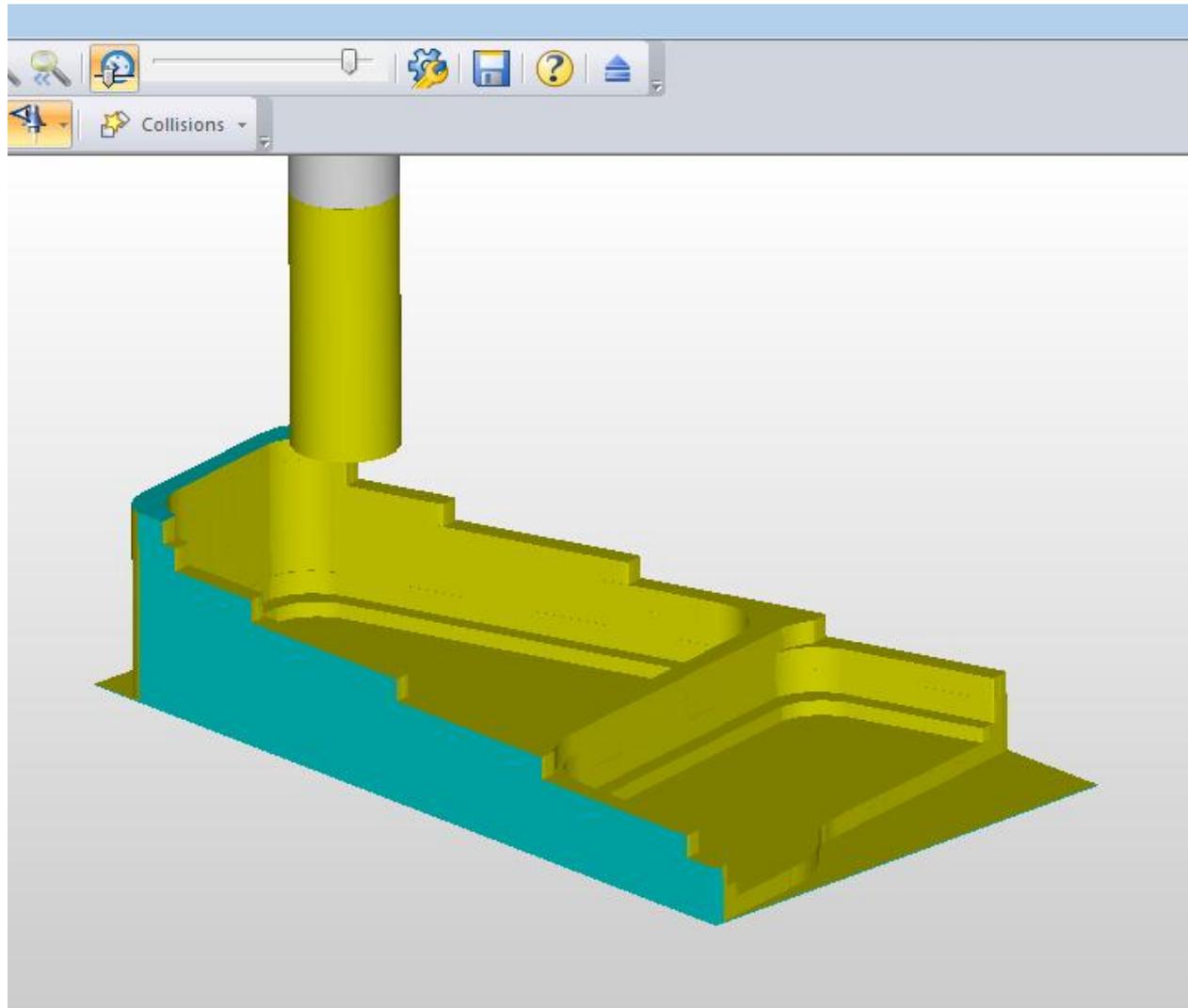
Incremento de corte...



Caminhos da ferramenta

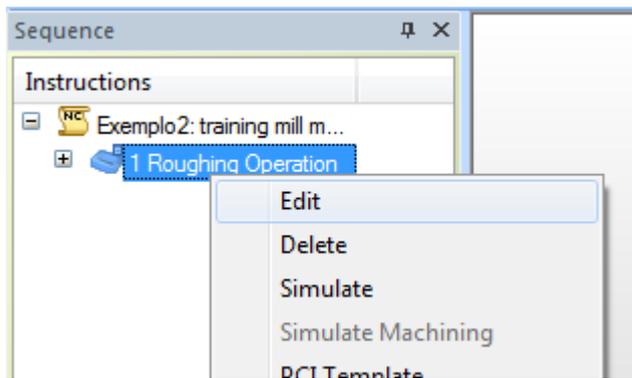


Simulação do desbaste



Editar a “*Operation*”

- Existem duas formas para se fazer isso:
 1. Clicar com o BD em cima da *Operation* e selecionar *Edit*
 2. *Dar dois cliques rápidos no caminho da ferramenta que aparece na tela em amarelo.*



Roughing X

General Control **Depth** Contouring Approach

Clearance 5.0 Associative

Level 0.0 Associative

Depth 0.0 Associative

Cut Increment 3.5 Technology

Use Subroutines

Finish At
 Depth
 Clearance

Intermediate Slices

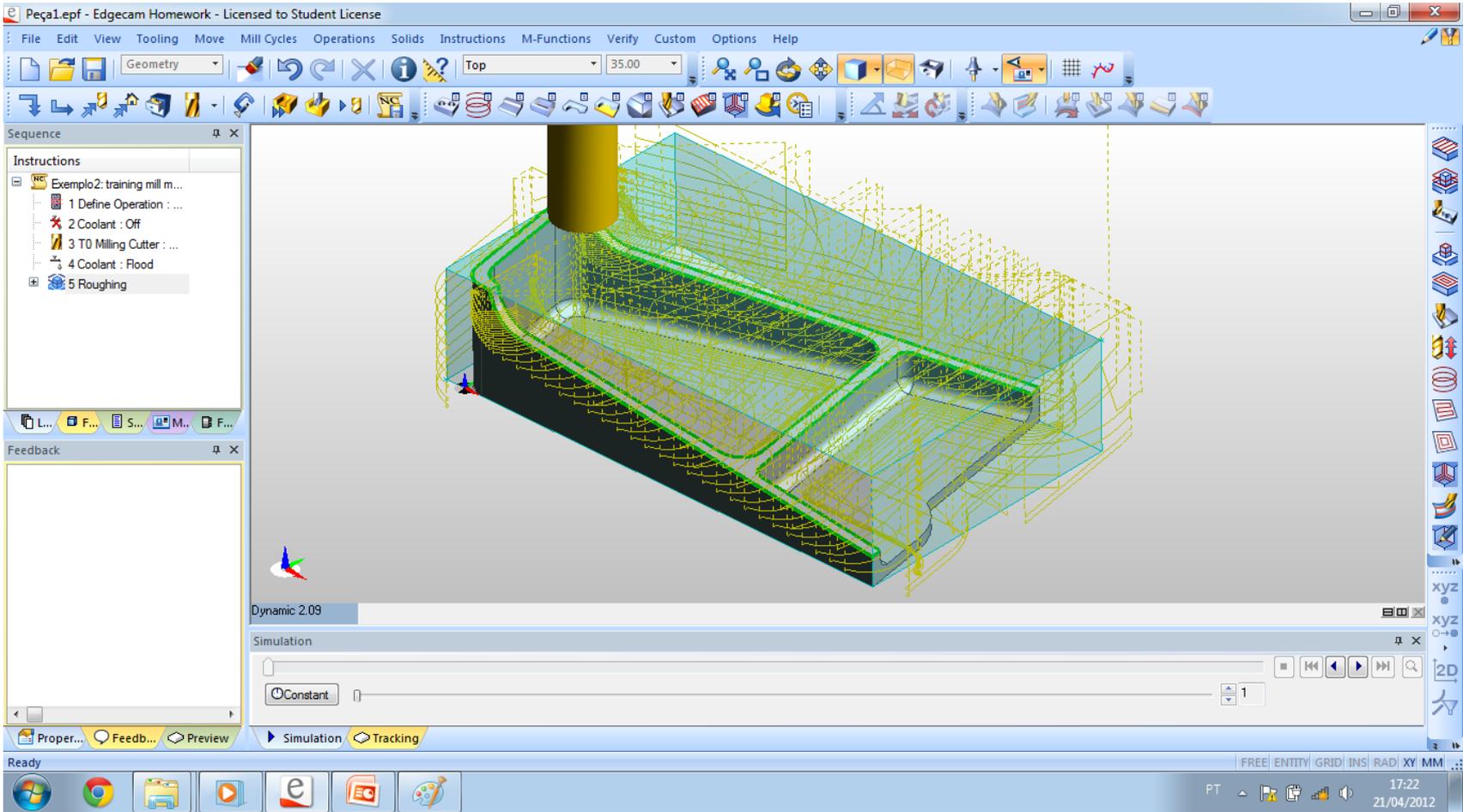
% Stepover 80 Cut Increment .5

Percentage Feed 100

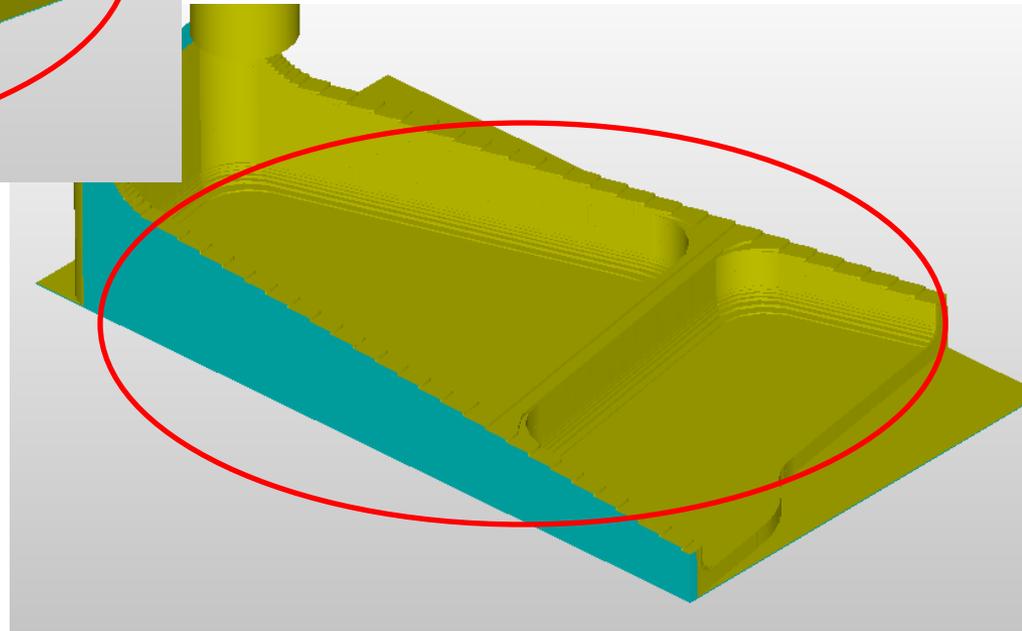
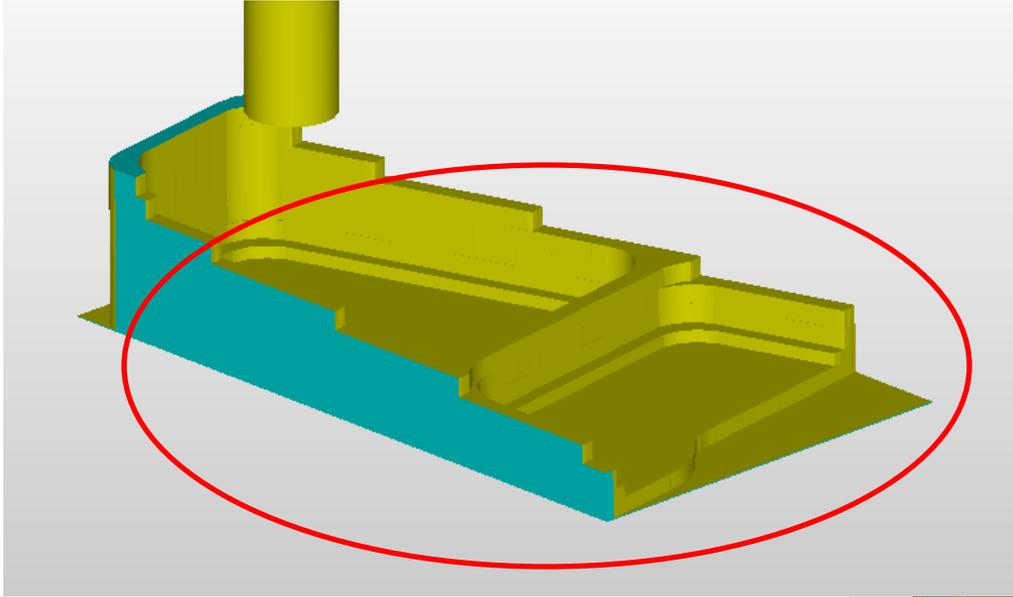
Flat Land

Detect Flat Land Minimum Width

OK Cancelar Ajuda



Antes & Depois



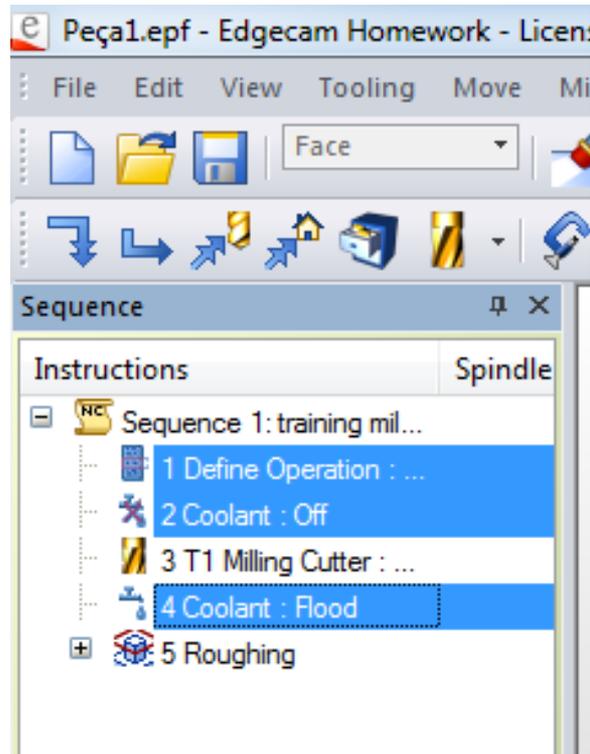
Ciclos de Usinagem

O que vamos fazer agora é a programação da usinagem sem usar as “*Operations*”

Para tanto é necessário seguir os seguintes passos:

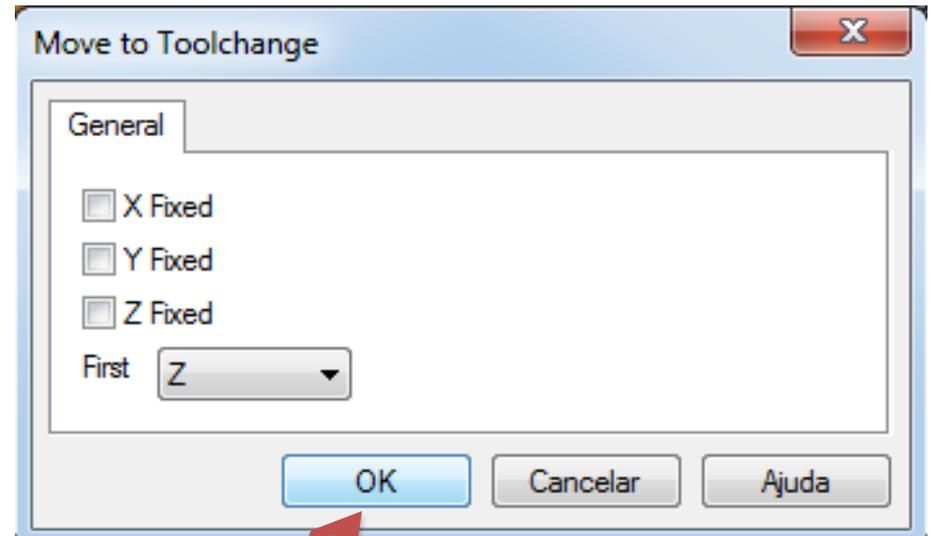
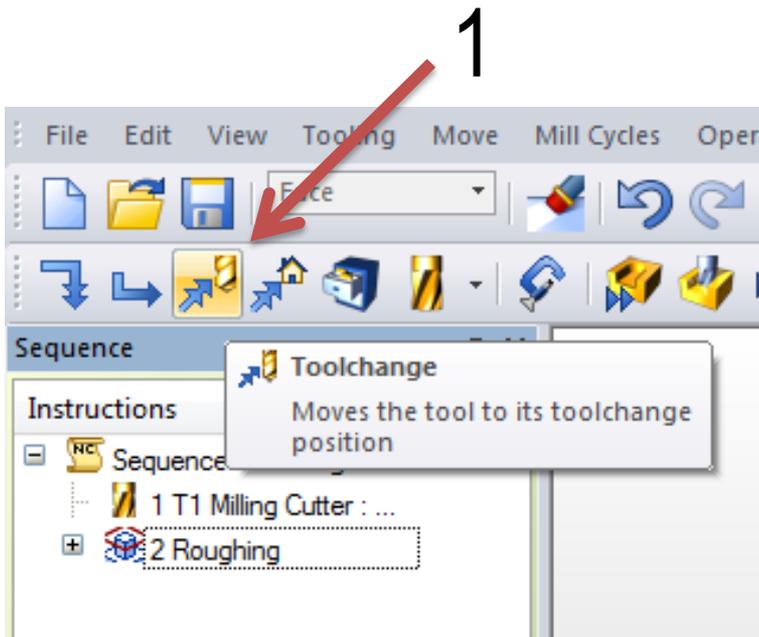
- *Mover a ferramenta para o ponto de troca*
- *Escolher uma ferramenta*
- *Selecionar a estratégia de usinagem*

Passo 1:

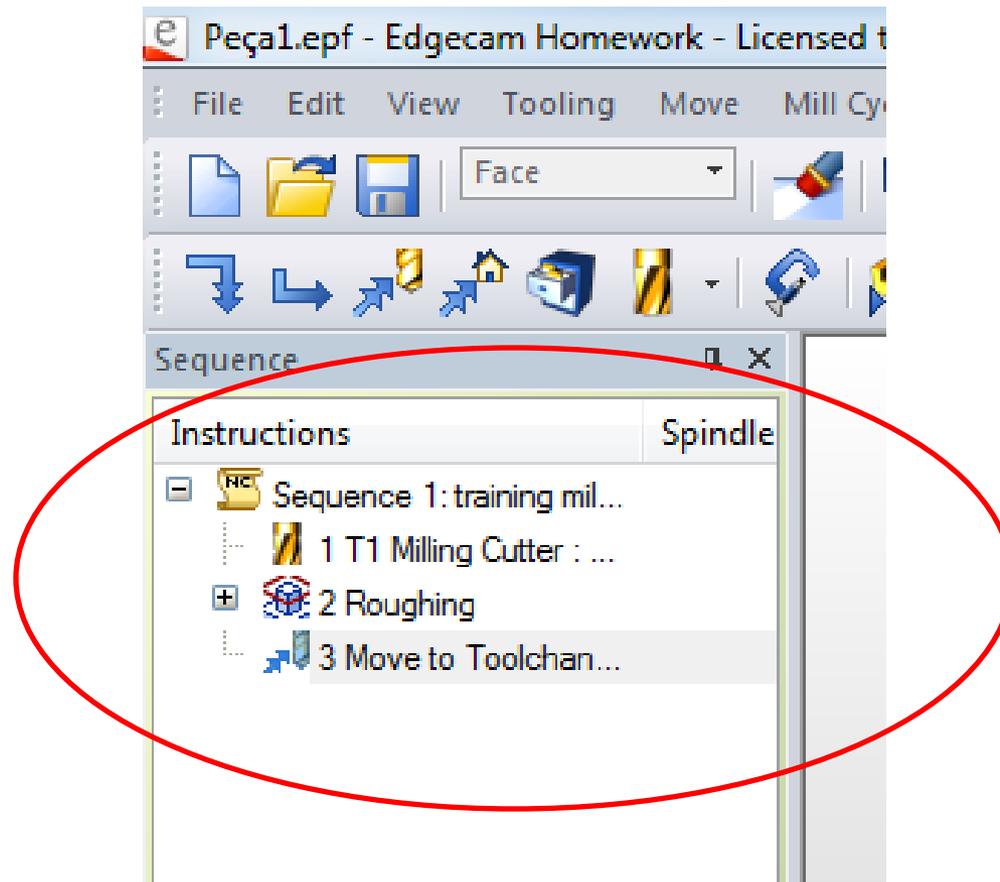


Deletar, se houver...

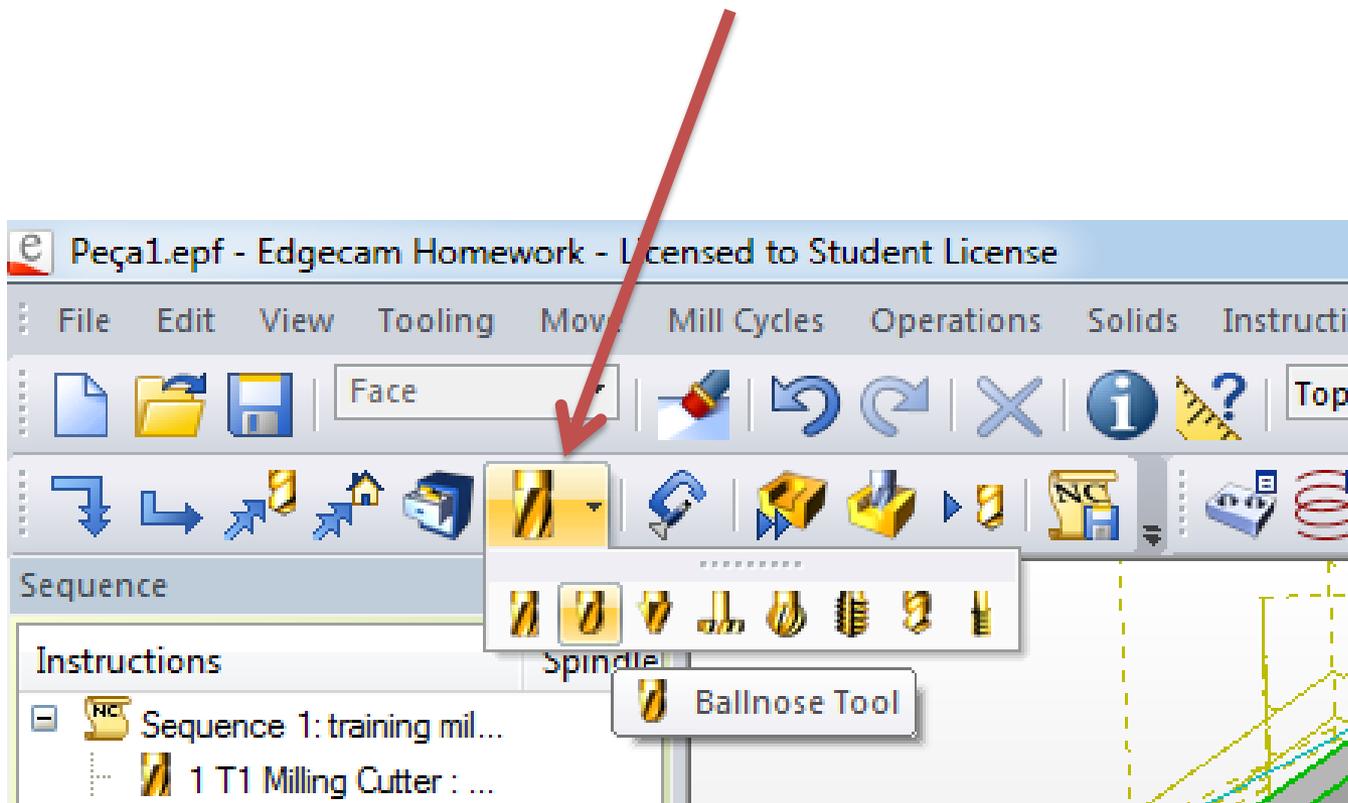
Mover a ferramenta para a troca



Observer



Escolher a ferramenta



Milling Cutter

General More... Loading Toolstore Spindle Angled Head

ToolStore Find...

Mount Description Associative

Position Offset

Group Code Code ID

Comment

Diameter Corner Radius

Tool Type Mill Hole Probe

Sub Type Angle

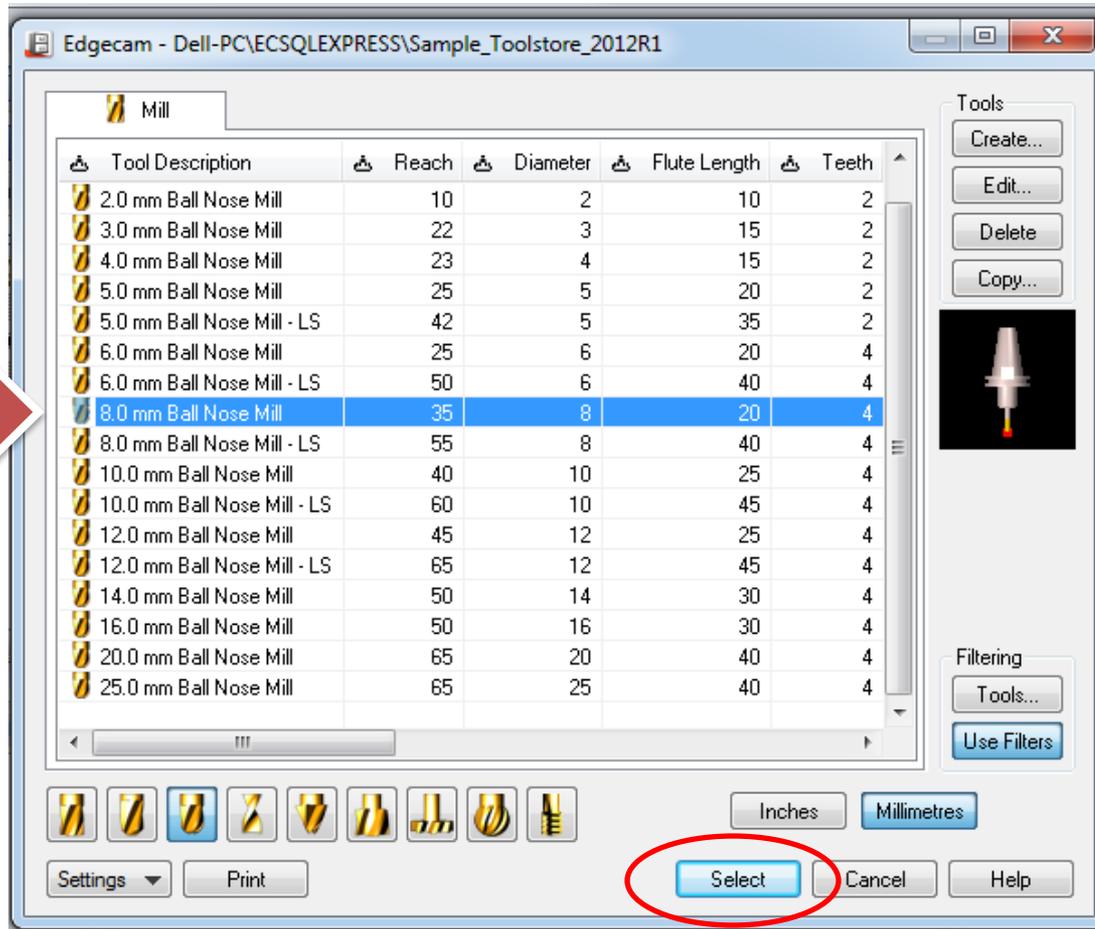
Tap Taper Angle

Small Diameter Units

Feed Type

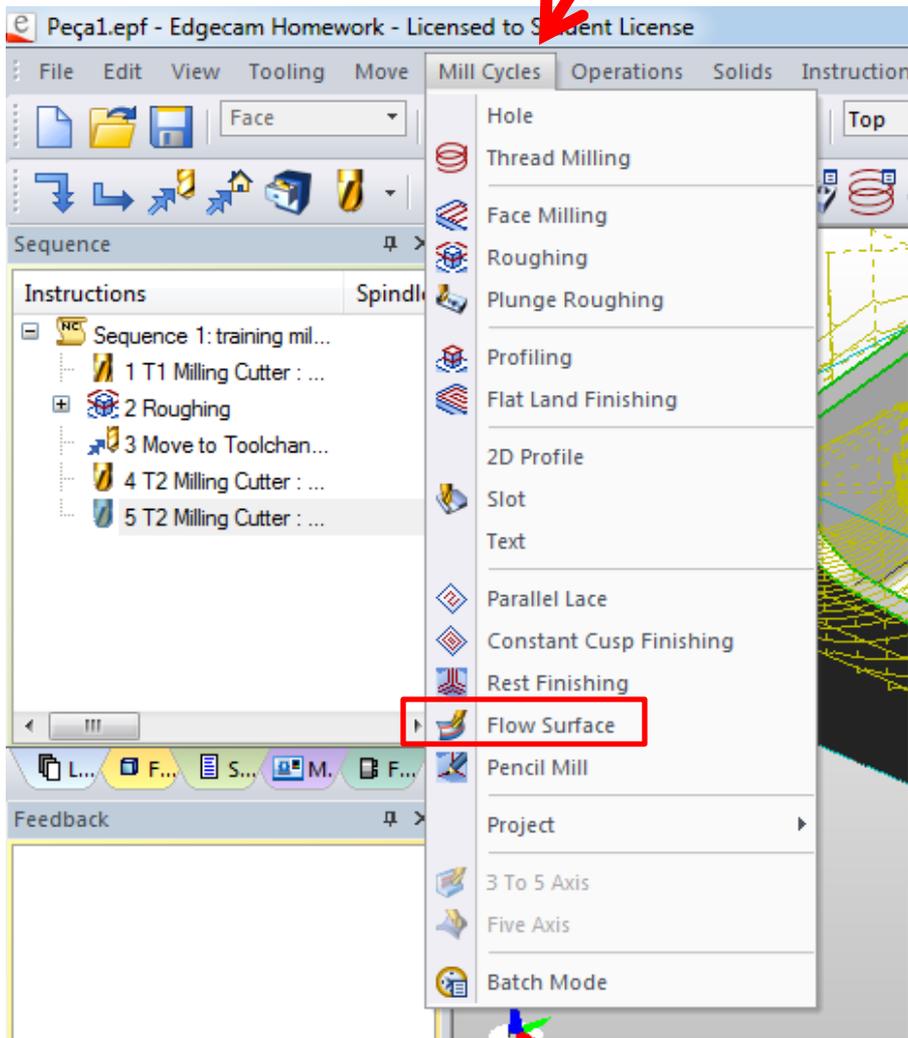
OK Cancelar Ajuda

Escolher a ferramenta



**8.0mm Ball
Nose Mill**

Secionar o ciclo de usinagem:



Flow Surface Cycle

Flow Surface Cycle

General | Depth | Leads | Links

Strategy

- Blend between Two Curves
- Blend between Two Surfaces

Mill Type

- Climb
- Conventional
- Optimised

Number of Cuts:

Cut Order: Standard

Reverse Cuts

Enforce Closed Contour

Start Position

Helical

Check Surface Standoff:

Offset:

Tolerance: 0.05

% Stepover: 50

Cusp Height:

Feed Rate (mm/min): 1500

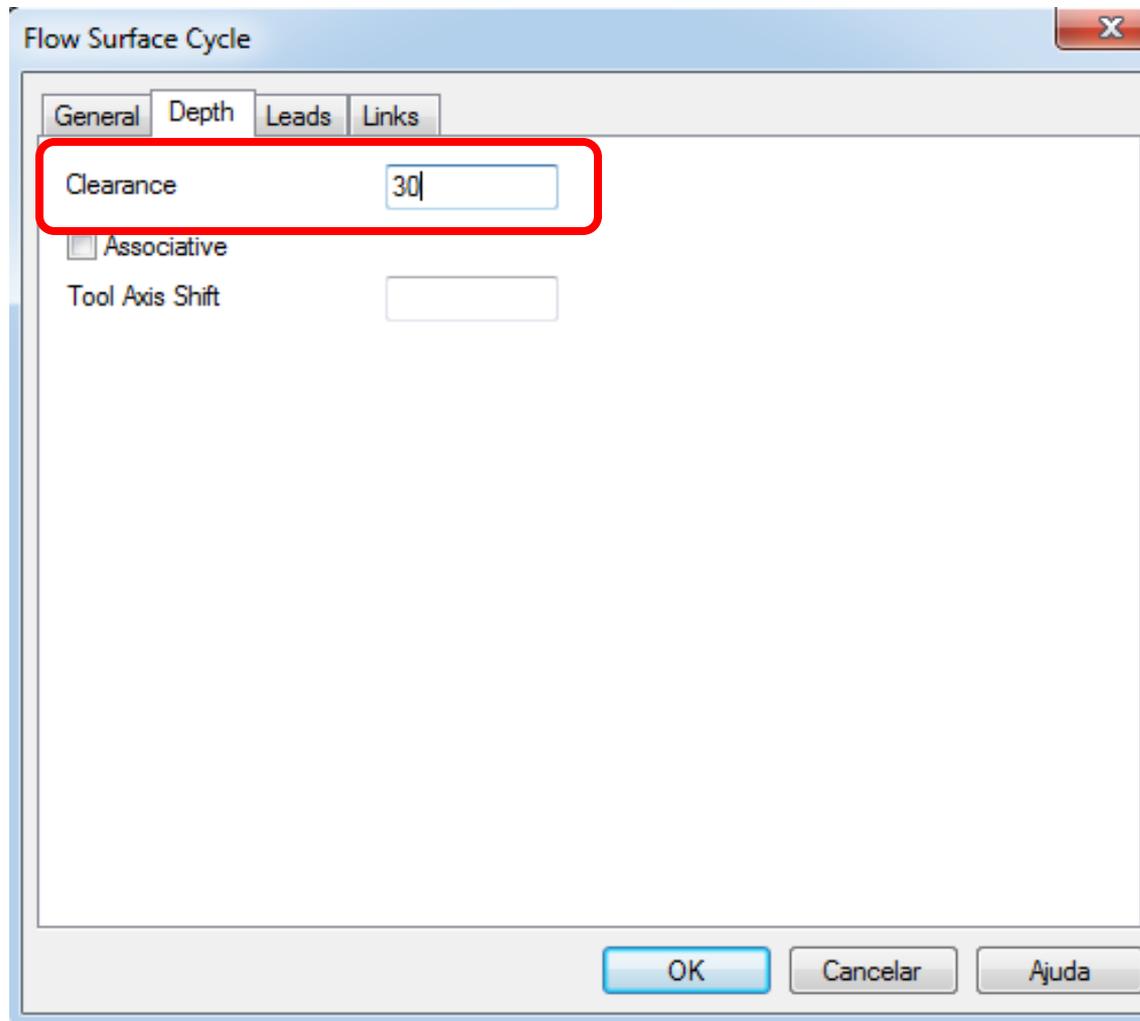
Plunge Feed Rate (mm/min): 1500

Speed (RPM): 3000

Technology:

OK Cancelar Ajuda

Aba "Depth"



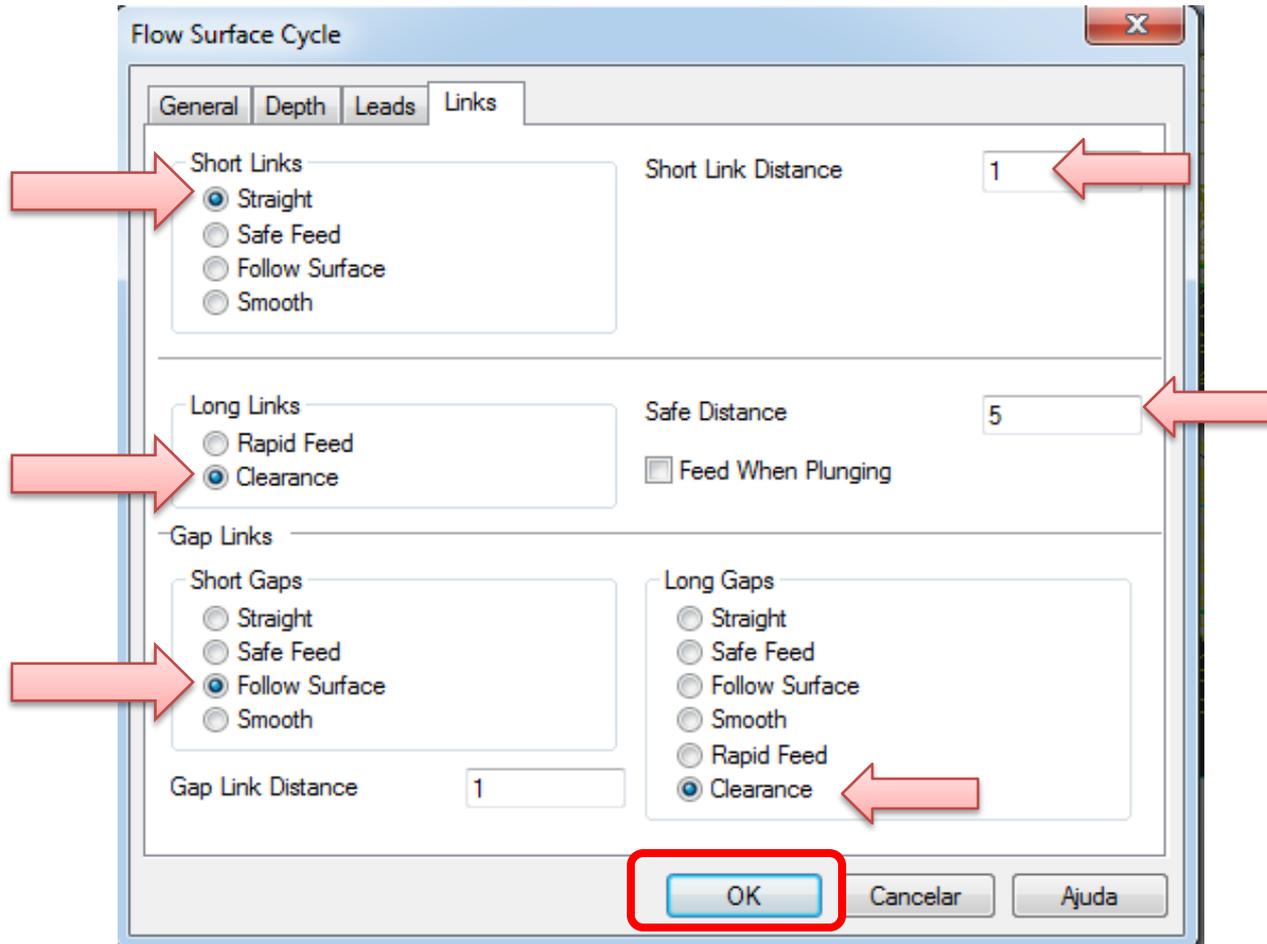
Na aba “Leads”

The image shows a software dialog box titled "Flow Surface Cycle" with a close button (X) in the top right corner. The dialog has four tabs: "General", "Depth", "Leads", and "Links". The "Leads" tab is currently selected. Inside the dialog, there are several sections for configuring lead parameters:

- Type:** A group box containing five radio buttons: "None", "Horizontal" (selected), "Tangential", "Vertical", and "Normal".
- Percentage Feed:** A text input field containing the value "100".
- Equal Lead Moves:** A checked checkbox.
- Lead In:** A section with four input fields: "Angle" (90), "Lead Radius" (0.0), "Length" (empty), and "Height" (0.0).
- Lead Out:** A section with four input fields: "Angle" (empty), "Lead Radius" (empty), "Length" (empty), and "Height" (empty).
- Start Extension:** An input field (empty).
- End Extension:** An input field (empty).

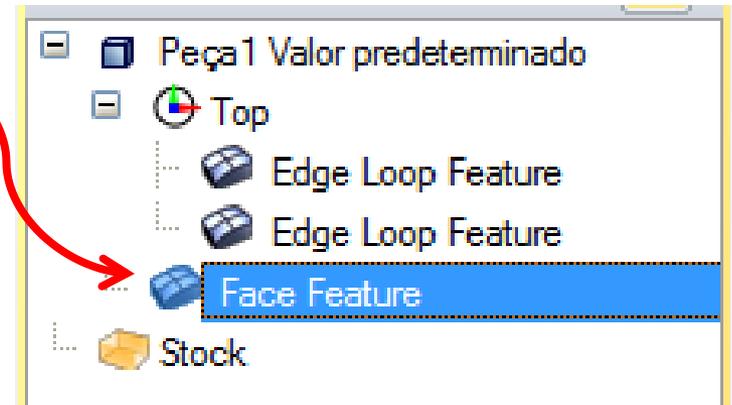
At the bottom of the dialog, there are three buttons: "OK", "Cancelar", and "Ajuda".

Na aba “Links”



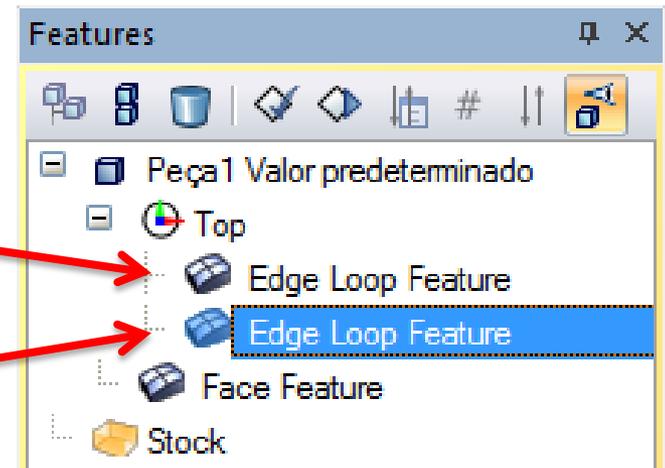
O software solicita as seguintes informações:

- Selecionar a superfície
- Clicar na primeira curva
- Confirmar com o botão direito
- Clicar na segunda curva

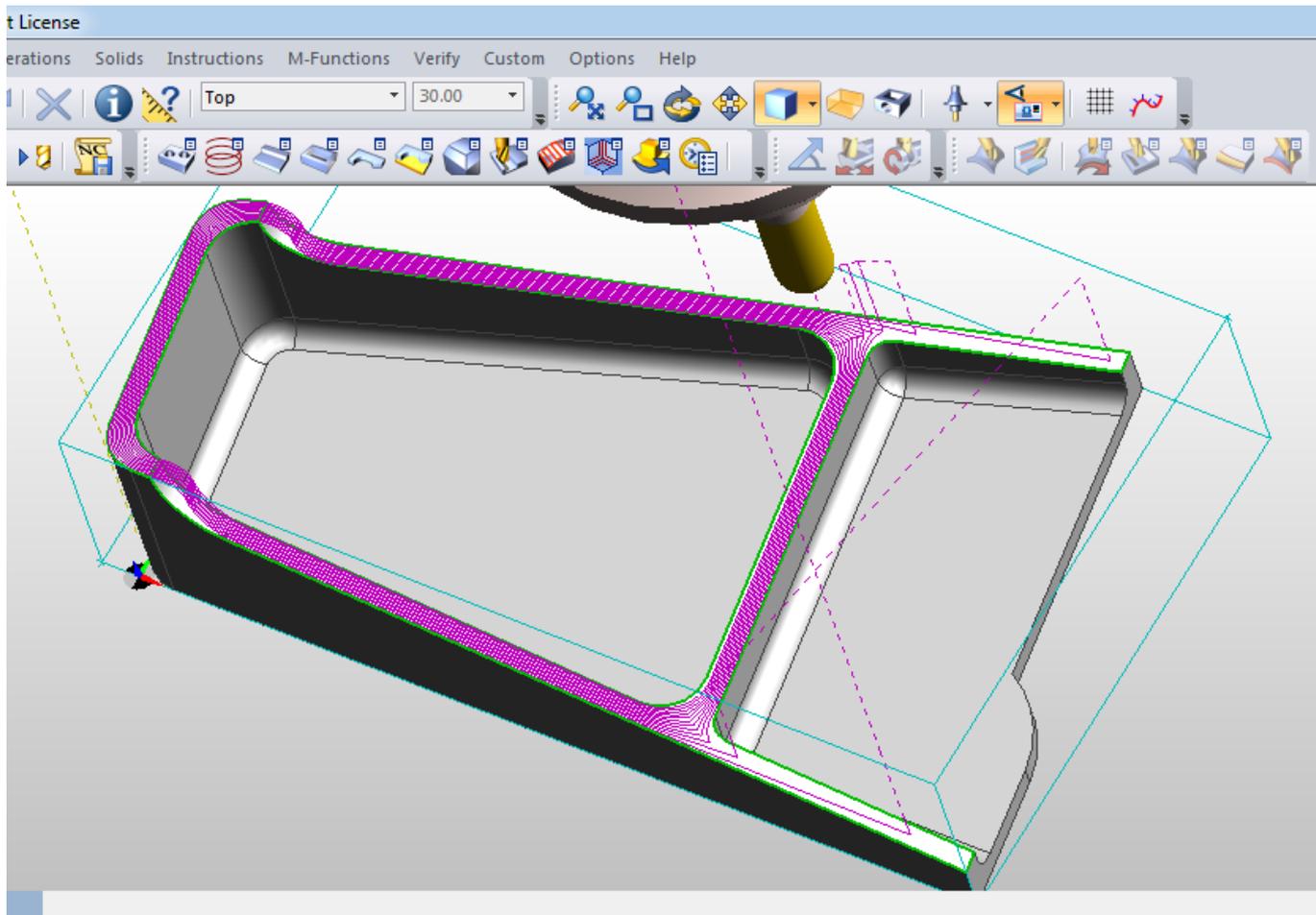


Curva 1

Curva 2



A estratégia programada apresenta o seguinte resultado:

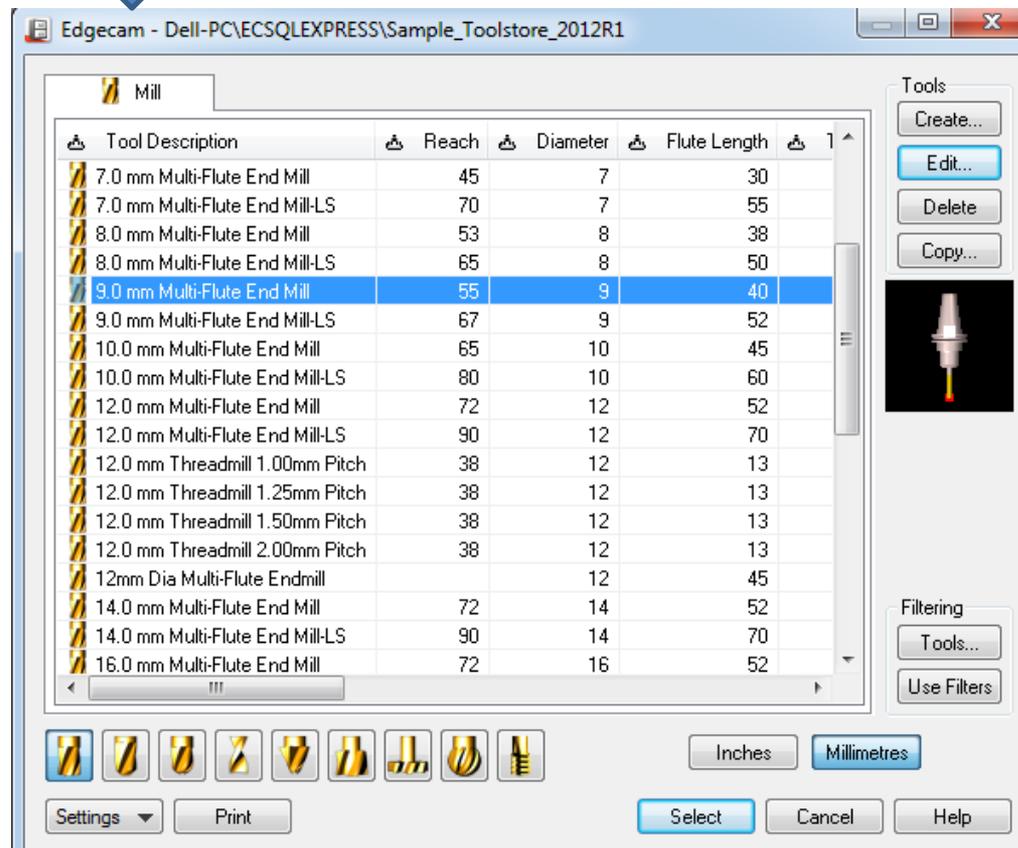


Redesbaste

- Para esta estratégia de usinagem, faremos um novo desbaste, porém com uma ferramenta menor.
- Repita os passos anteriores:
 - Mover a ferramenta para o ponto de troca;
 - Escolher uma nova ferramenta;

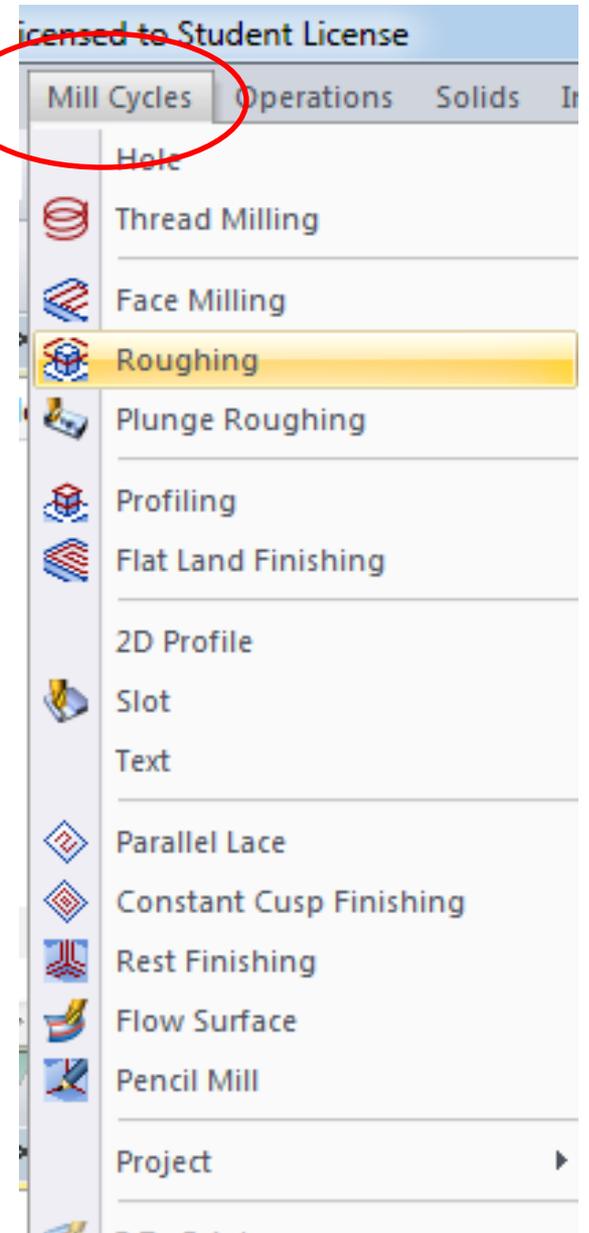
A ferramenta a ser escolhida é a seguinte:

8.0 mm Multi-Flute End Mill-LS



Ciclo de Redesbaste

Clicar aqui



Na aba **General**,
configurar os
dados conforme a
imagem ao lado

Roughing

General Control Depth Contouring Approach

Model Type

- Wireframe
- Surface
- Solid

Mill Type

- Climb
- Conventional
- Optimised

Rest Rough

Digitise Roughing

Strategy

- Concentric
- Lace
- Spiral
- Waveform

Offset

Z Offset

XY Offset

% Stepover

Tolerance

Lace Angle

Clean Up % Stepover

Stock

Stock Type

Stock Offset

Feed

Feedrate (mm/min)

Plunge Feedrate (mm/min)

Speed (RPM)

Technology

OK Cancelar Ajuda

Na aba **Control**,
configurar os dados
conforme a imagem
ao lado

Roughing

General Control Depth Contouring Approach

Prismatic Geometry

High Speed Cornering

Cut by Region

Close Open Pockets

Minimum Radius

NC Output Smoothing

None

Line Arc

Spline

Waveform Options

High Feed On Back Passes

Smoothing Radius

Back Pass Retract

Full Width Cut Moves

Use Trochoidal

% Trochoid Stepper

Min Trochoid Diameter(%)

Max Trochoid Diameter(%)

Check Fixtures

Use Check Fixtures

Fixture Offset

Fixture Z Offset

Fixture XY Offset

Boundary Control

Tool Control

Tool Centre

Tool Inside

Tool Outside

Offset

OK Cancelar Ajuda

Na aba *Depth*,
configurar os dados
conforme a imagem ao
lado

Roughing

General Control **Depth** Contouring Approach

Clearance 5 Associative

Level 0 Associative

Depth 0 Associative

Cut Increment 2 Technology None

Use Subroutines

Finish At
 Depth
 Clearance

Intermediate Slices

% Stepover Cut Increment

Percentage Feed

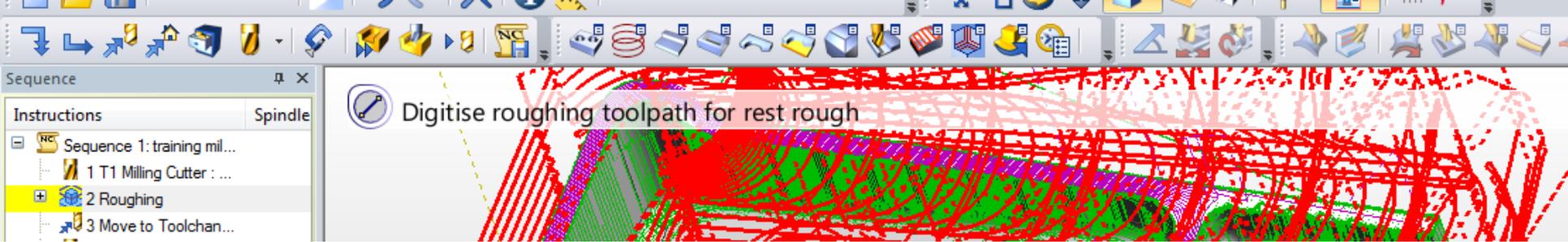
Flat Land

Detect Flat Land Minimum Width

OK Cancelar Ajuda

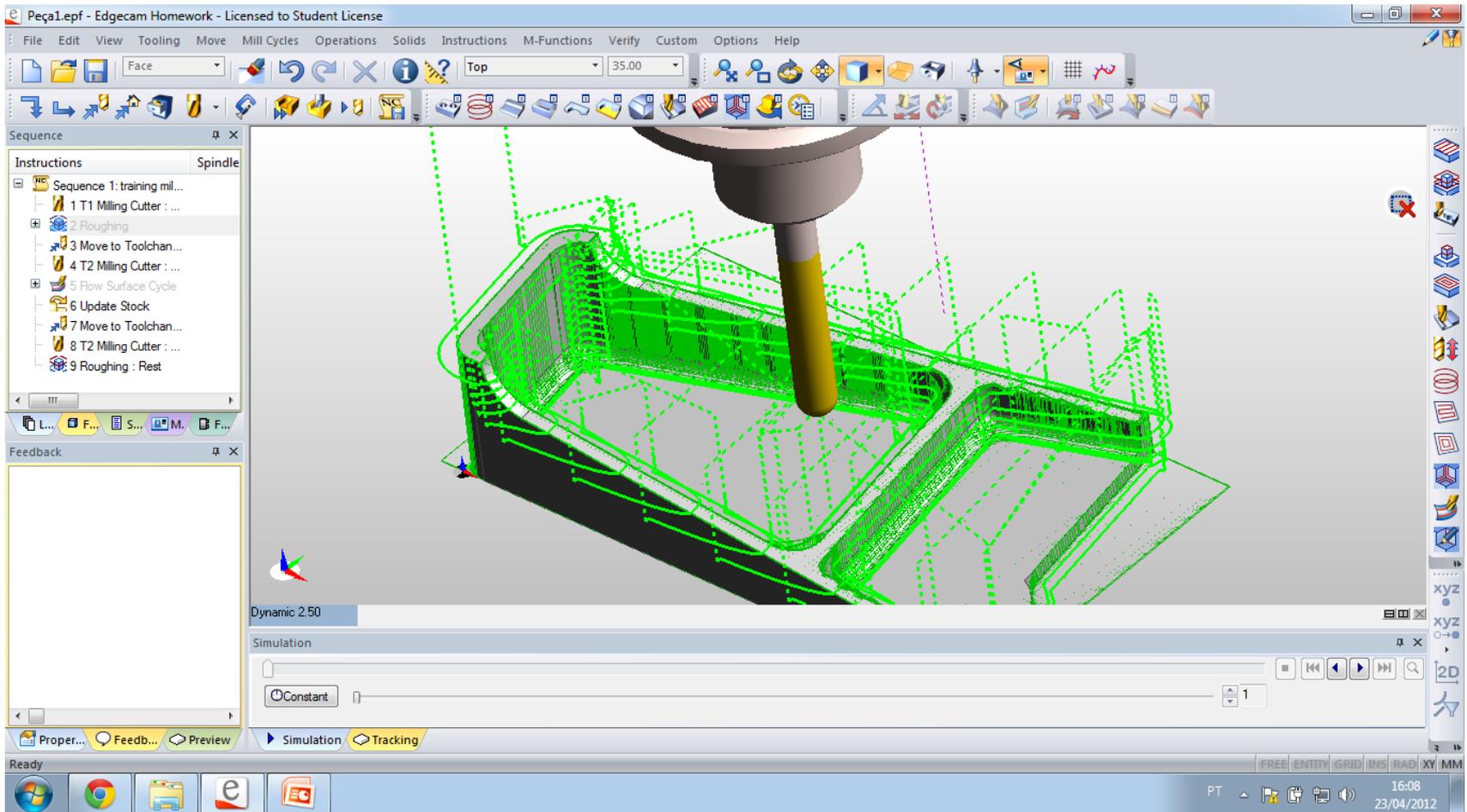
Ciclo de Redesbaste

- Nesta etapa percebemos a grande diferença deste desbaste...
- O software nos pede para indicar (selecionar) o desbaste anterior, ou seja, aquele em que faremos o redesbaste.



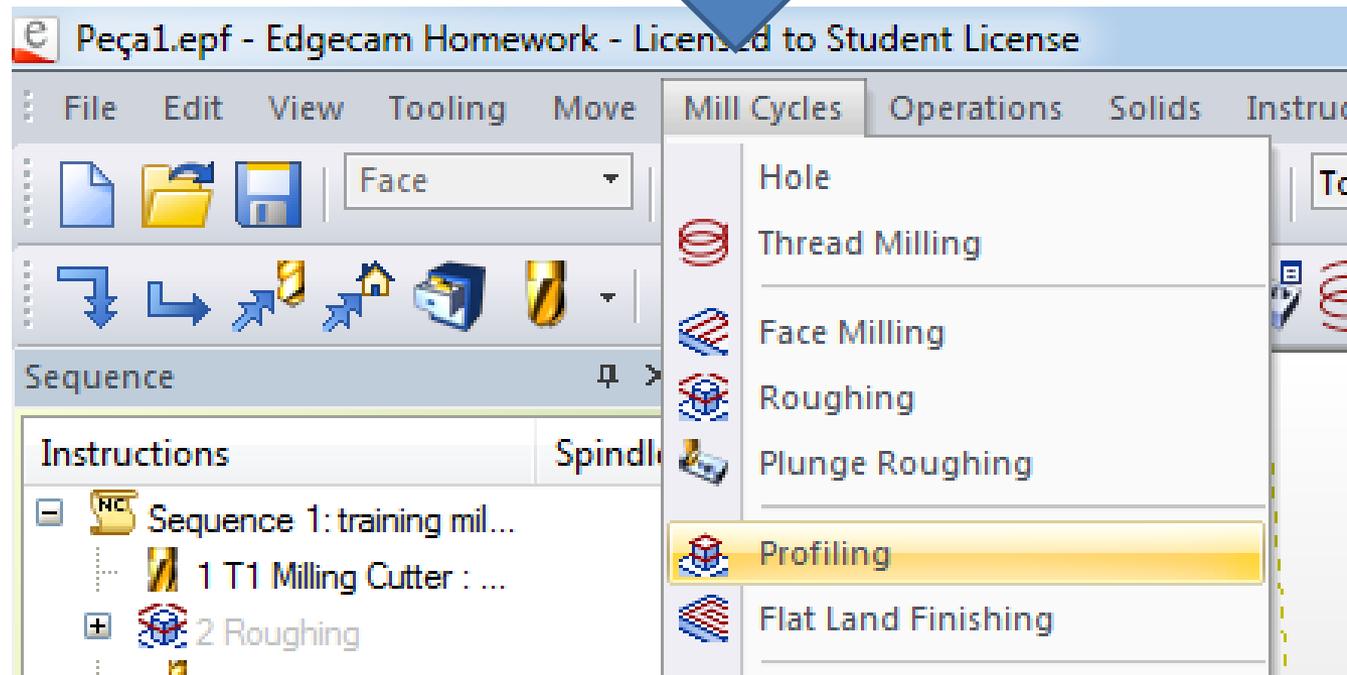
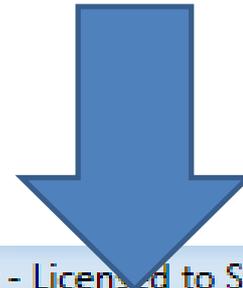
- ✓ Observar que ao colocarmos o mouse sobre o caminho da ferramenta, ela fica em vermelho e na janela de instruções a estratégia fica em amarelo. Depois de selecioná-la, confirmar com o botão direito.
- ✓ A próxima solicitação é selecionar o limite, se houver, neste caso confirmar com o botão direito, pois não há limites.

O resultado:



Perfilar

- Clicar em:
 - My cycles
 - Profiling



Na aba **General**,
configurar os dados
conforme a imagem ao
lado

The screenshot shows the 'Profiling' dialog box with the 'General' tab selected. The 'Model Type' section has 'Solid' selected. The 'Mill Type' section has 'Optimised' selected. The 'NC Output Smoothing' section has 'Line Arc' selected. The 'Tolerance' field is set to '0.05'. The 'Feedrate (mm/min)' field is set to '2801.13' and 'Plunge Feed (mm/min)' is also set to '2801.13'. The 'Speed (RPM)' field is set to '8753.52'. The 'Technology' dropdown is set to 'None'. The 'Compensation' section has 'None' selected. The 'CRC Register' field is empty. At the bottom, there are 'OK', 'Cancelar', and 'Ajuda' buttons.

General | Depth | Control | Start/End | Lead | Links | Rest Profiling | Contouring

Model Type
 Wireframe
 Surface
 Solid

Mill Type
 Climb
 Conventional
 Optimised

3D Profiling
 Prismatic Geometry
 Undercut

Offset
Z Offset XY Offset
Tolerance Minimum Radius

Multiple Passes

Start Offset Offset Increment

Feed

Feedrate (mm/min) Plunge Feed (mm/min)
Speed (RPM) Technology

CRC

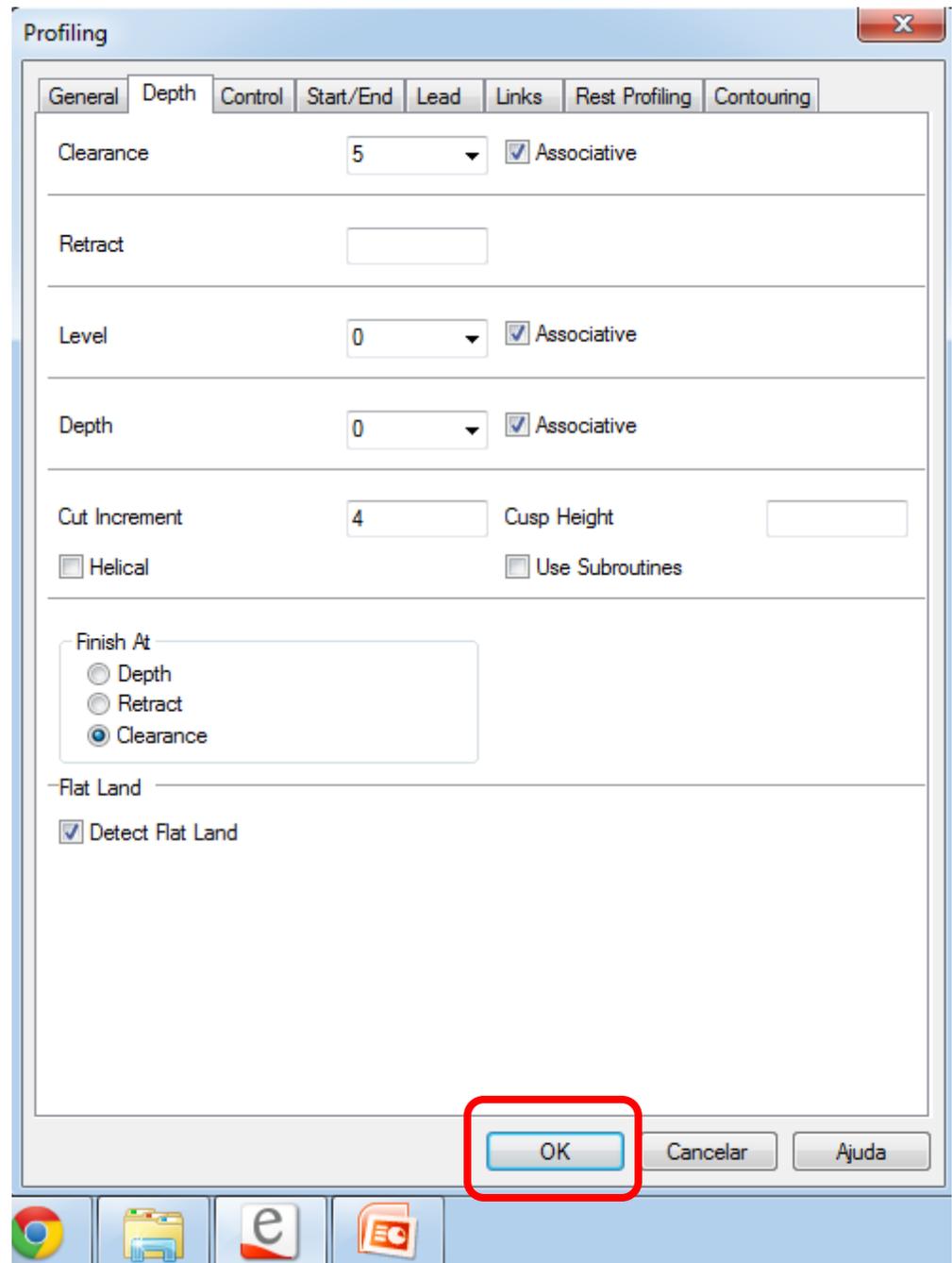
Compensation
 None
 Centre Line
 Geometry

CRC Register

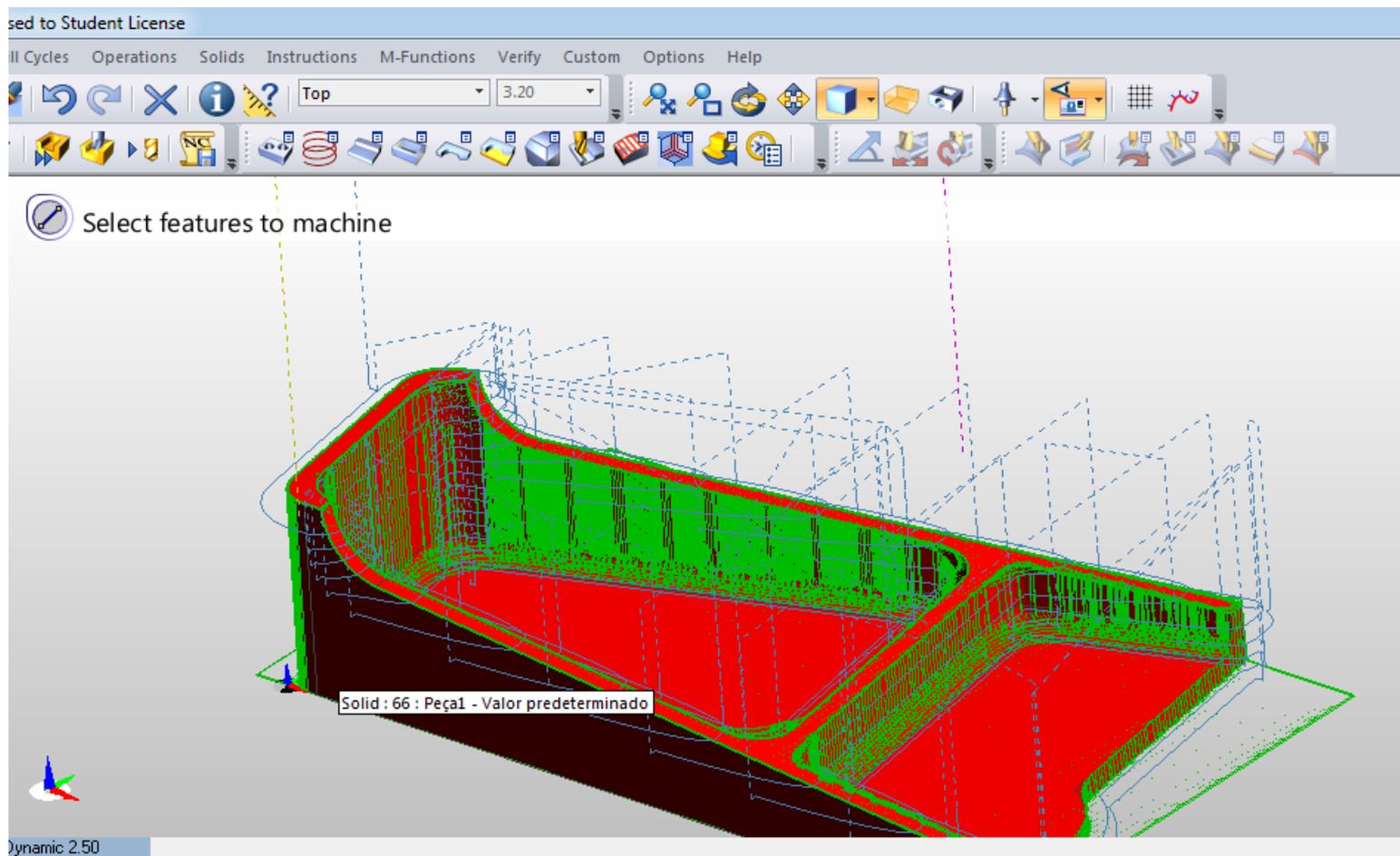
OK Cancelar Ajuda

Na aba *Depth*,
configurar os dados
conforme a imagem ao
lado

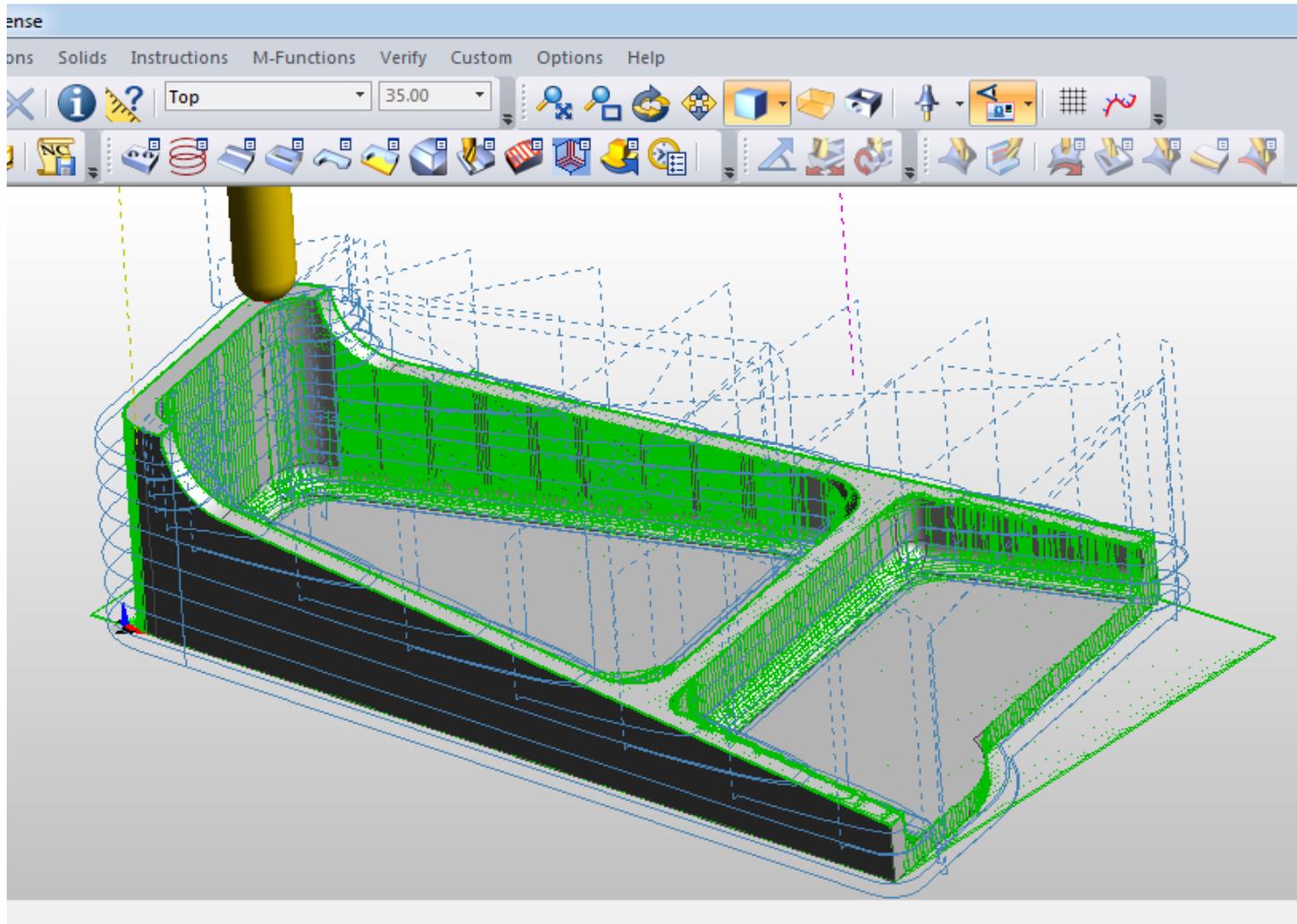
Obs: todos são associativos



➤ Selecionar o modelo a ser usinado e confirmar com o BD

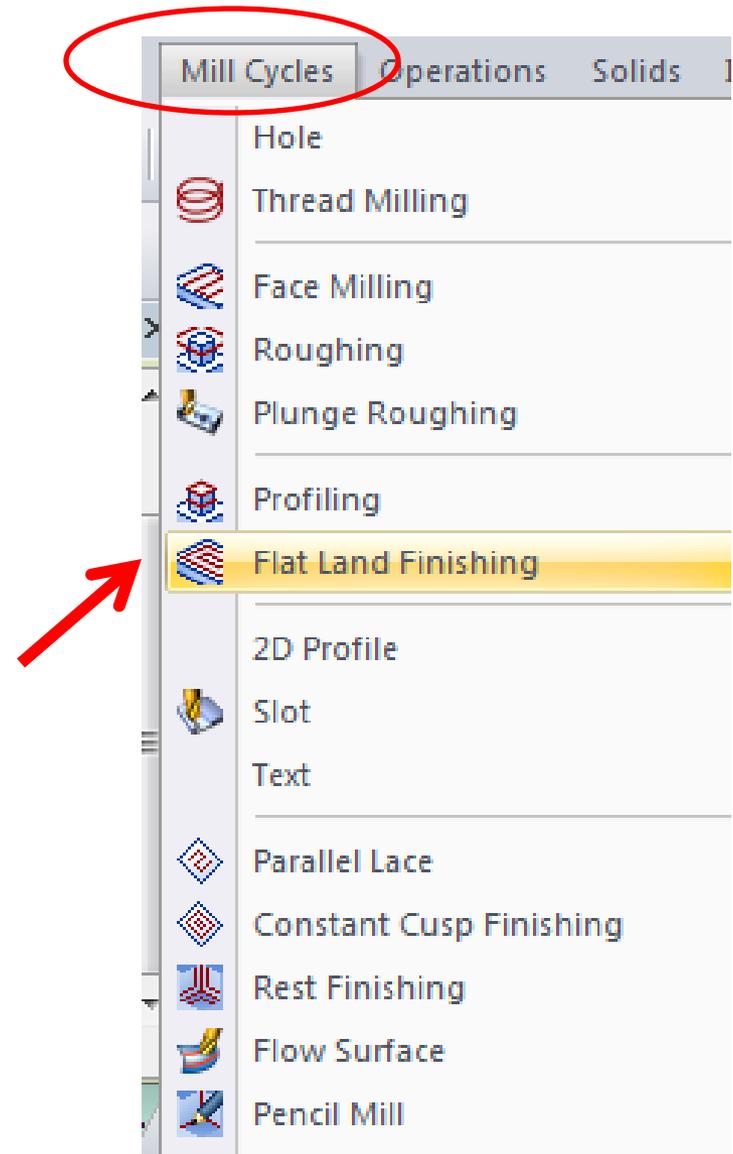


Resultado da usinagem do Perfil



Acabamento das áreas planas

- Clicar em:
 - My cycles
 - Flat Land Finishing



Na aba **General**,
configurar os dados
conforme a imagem ao
lado

The image shows a software dialog box titled "Flat Land Finishing" with a close button (X) in the top right corner. The "General" tab is selected, and the following settings are visible:

- Model Type:** Wireframe, Surface, Solid
- Strategy:** Concentric, Lace, Finish Pass
- Close Open Pockets
- Add Finish Pass
- Boss
- Mill Type:** Climb, Conventional, Optimised
- NC Output Smoothing:** None, Line Arc, Spline
- % Stepover:** 80
- Stand Off Distance:** 6
- Minimum Width:** (empty)
- Offset:** (empty)
- Tolerance:** 0.05
- Angle:** (empty)
- Feed:**
- Feedrate (mm/min):** 2801.13
- Plunge Feed (mm/min):** 2801.13
- Speed (RPM):** 8753.52
- Technology:** None
- Boundary Control:**
- Tool Control:** Tool Centre, Tool Inside, Tool Outside
- Offset:** (empty)

Buttons at the bottom: OK, Cancelar, Ajuda.

Este é o caminho percorrido pela ferramenta.

