

Step by Step – Hybrid Workflow

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Step by Step – Hybrid Workflow

BENEFITS OF THE HYBRID-PROCESS

CAM

1. Save money by using only one CAM to create proper data for the SLM and MILLING process
2. Secure workflow by easy to use software without need to convert files between different CAM
3. Support knows additive but also subtractive process very well

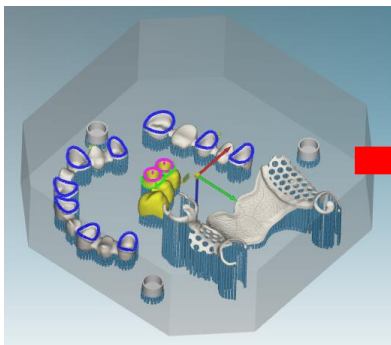
SLM

4. SLM-machine can produce autarkic and without the need to change tools
5. Cost reduction because of a minimum material investment is also a big benefit
6. Reuse powder not melted during SLM process

MILLING

7. By postmilling only special areas we save up to 70% machining-time during milling.
8. Tool-life increase a lot in terms of how many parts one milling tool can finish

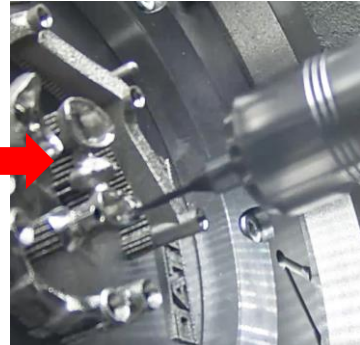
PROCESS WORKFLOW



hyperDENT (Slicing & NC-Code)



Additive Manufacturing

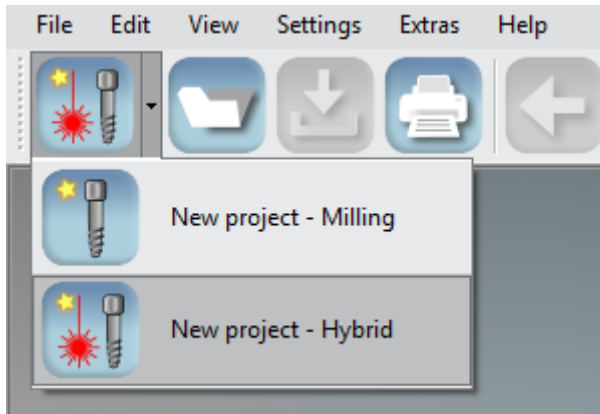


Milling

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HYBRID WORKFLOW IN HYPERDENT

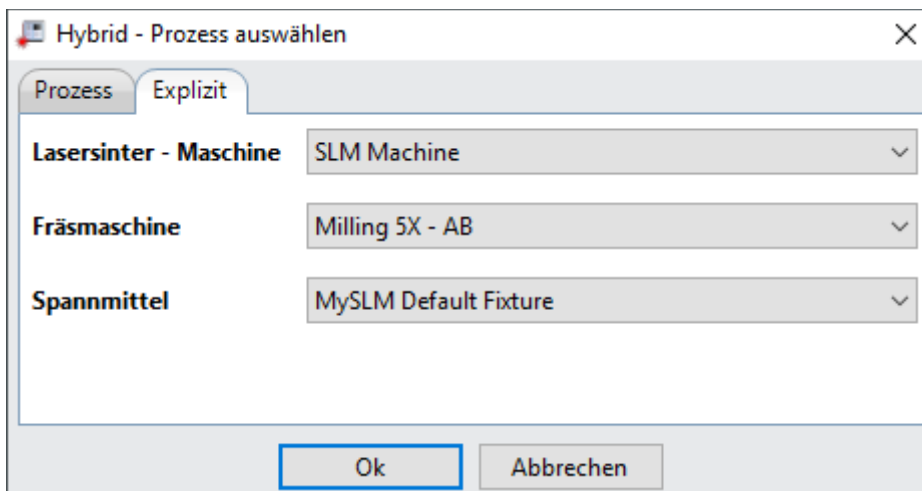
CHOOSE HYBRID-PROCESS



CHOOSE MACHINE-COMBINATION



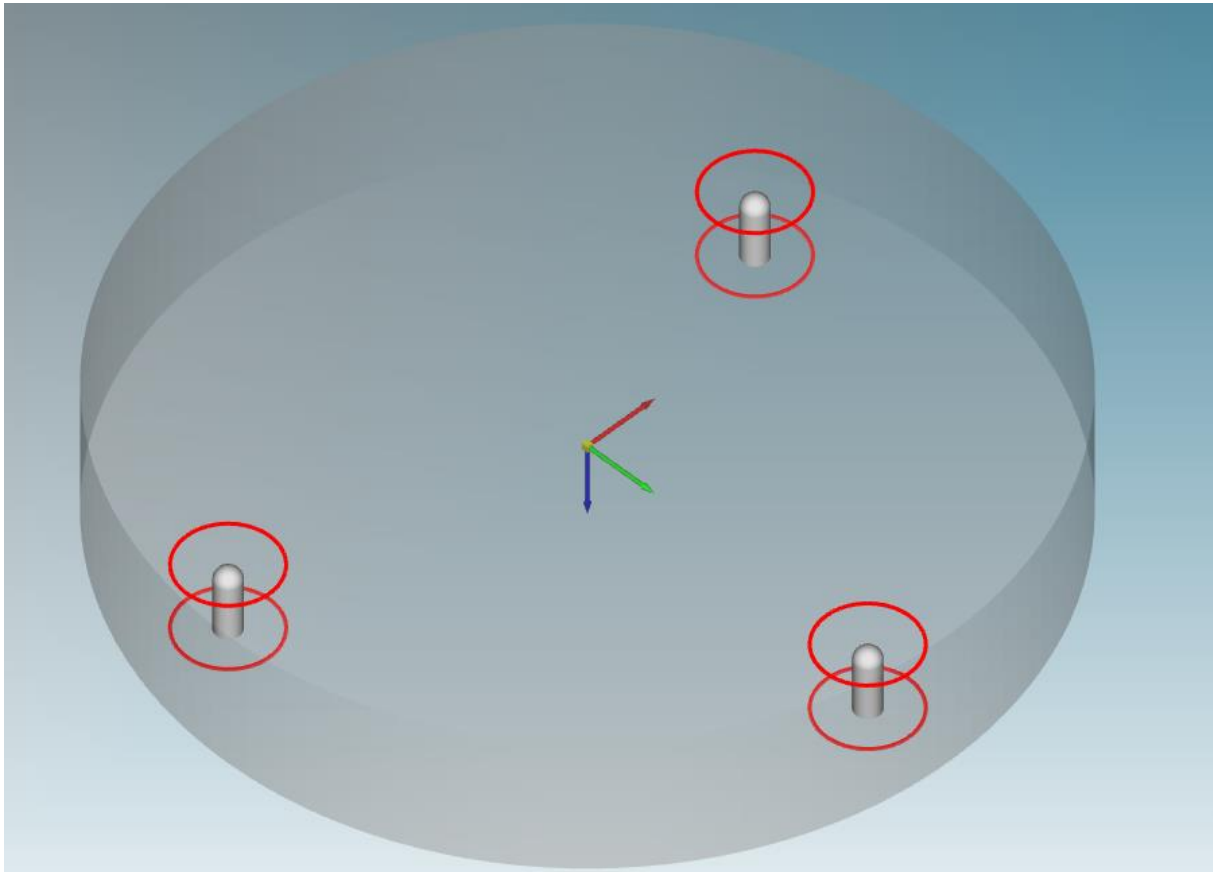
There you have to choose the laser-melting machine, milling machine and corresponding fixture.



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After this choice had been done you see the build-platform. The pins are used by the probing-tool to generate corresponding workcoordinatesystem at milling machine.

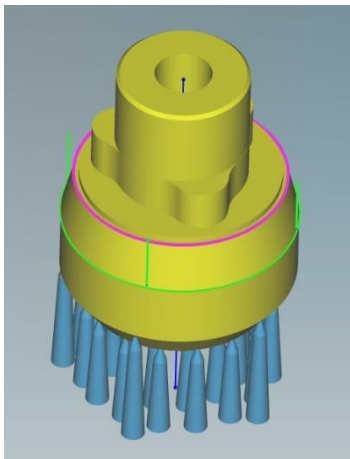
The red circles are a safety-areas for the probing tool.



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FILE PREPARATION

If that is done you can import corresponding STL-files



After file-import supports are generated automatically based on user-defined parameters.

Supports can be adjusted everytime also after they have been generated automatically.

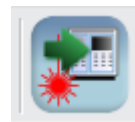
If you use META-Data from CAD-System you get also:

- Emergence-profile (Green)
- Abutment-base (Purpel)
- Screw-Channel (Blue line in the center)

Without META-Data you can generate the different elements in hyperDENT.

SLICE FILE AND CALCULATE TOOLPATH

After all preparation had been done we can start slicing



process and create the nc-file



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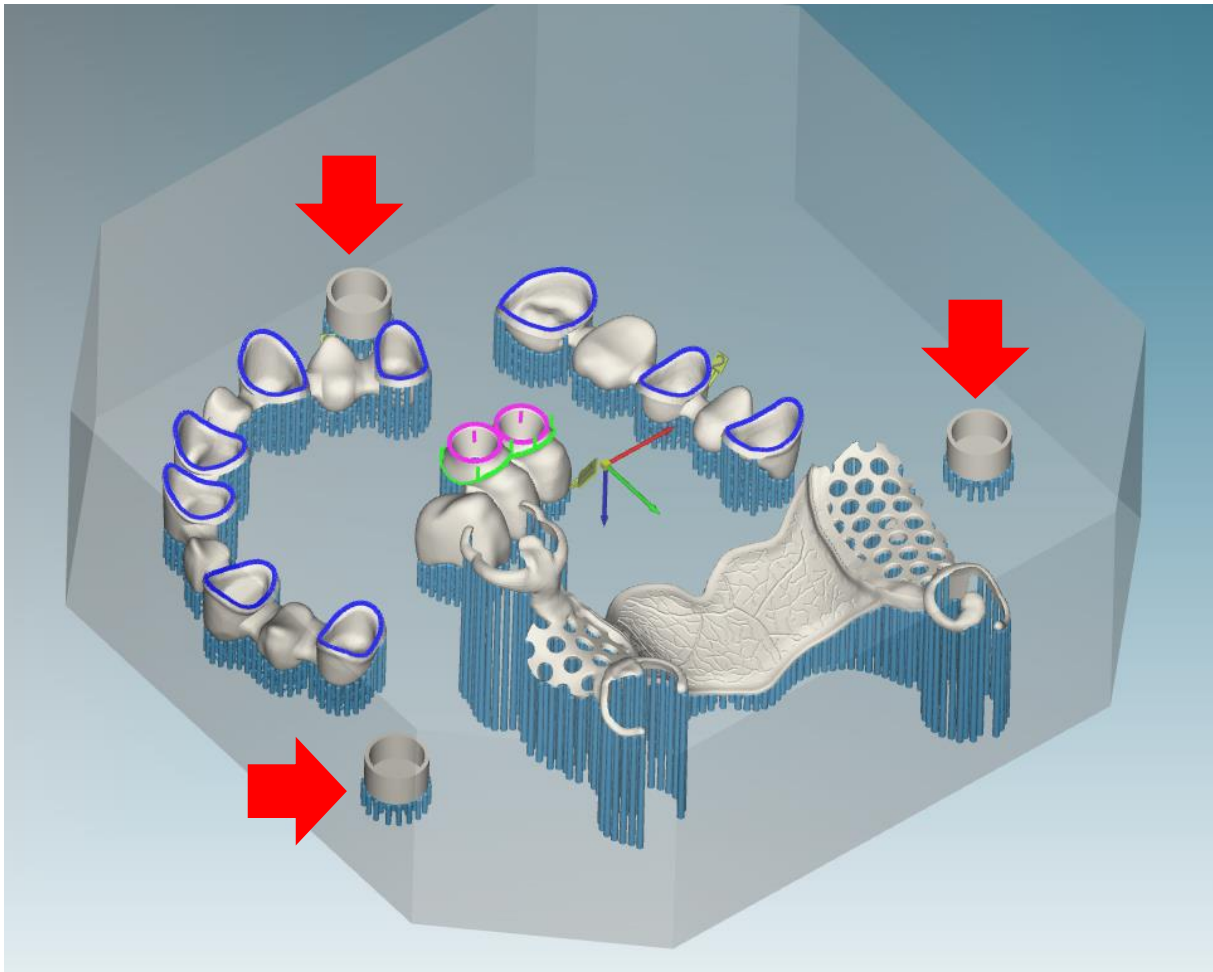
HYBRID WORKFLOW AT MILLING MACHINE

Part has to be mounted into special fixture for the corresponding slm-platform.

Shape of the fixture is based on platform-geometry of slm-machine.

You can contact Follow-ME! to ask for existing solutions for your machine!

START PROBING-CYCLE TO CREATE WORKCOORDINATESYSTEM



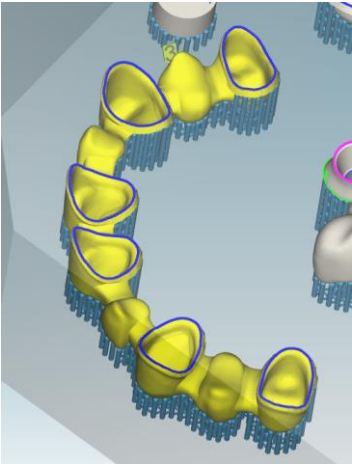
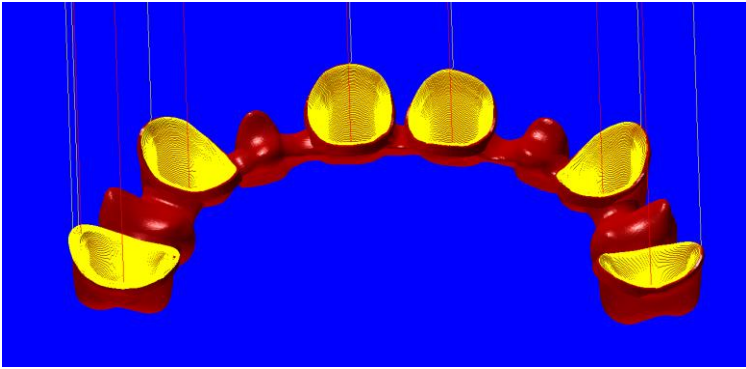
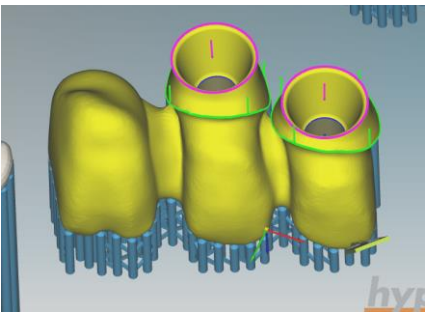
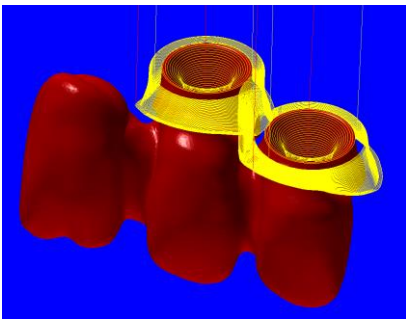
Based on the probing-pins (red arrows) the coordinate-system at machine-tool will be generated due to a special probing-cycle running on machine-tool. Probing-cycle could be adjusted individually to customer needs and is implemented into the normal nc-program for the milling-machine.

The coordinate-system is important to give machine proper information about origin of the milling-code.

Step by Step – Hybrid Workflow

CREATE TOOLPATH BASED ON PREDEFINED TEMPLATES

After this had been done we can machine all parts based on predefined strategies. Compared to the milling parts out of blanks we only have to postmill areas for which we need high accuracy. E.g. inside of coping or crowns, emergence-profile and of course implant-geometries.

Part to be machined	Corresponding milling strategy
	
	

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GENERATE OFFSET

OFFSET FOR IMPLANT-GEOMETRY

The interface-geometry must have an offset for postmilling already during import into hyperDENT.

The offset for the emergence-profile can be generated inside of hyperDENT directly.

Also we can generate offset for the inside of the cavity side in hyperDENT.

The customer need to use inside CAD-software implant-geometries which have already an offset.

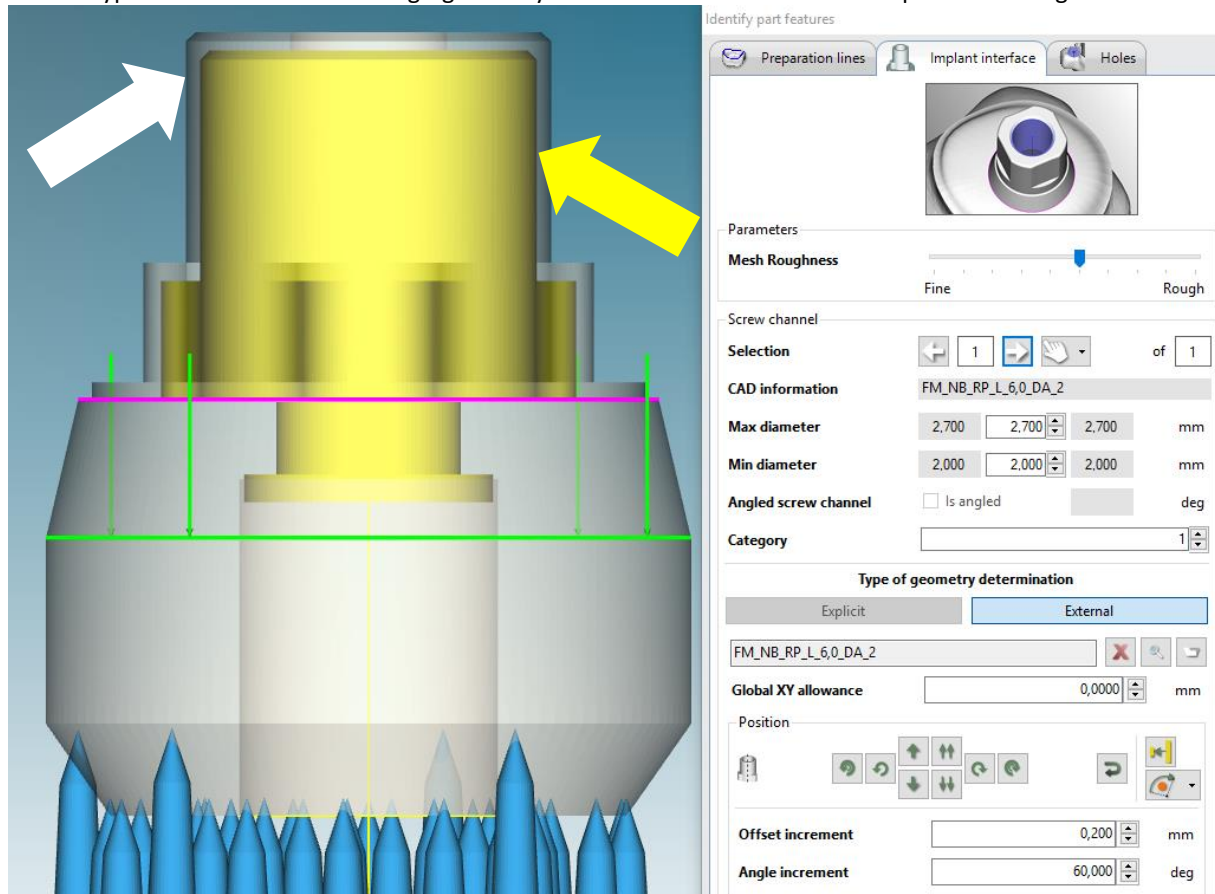
➔ The geometry with offset is later used for the SLM-process.

There is no possibility at the moment to create offset on implant-geometry within hyperDENT!

For this purpose, Follow-ME! offers their own validated CAD-Library for the implant-systems of your choice.

Those geometries have already an offset. Furthermore, we have validated milling strategies as well.

Within hyperDENT we use an exchange-geometry without offset to create the toolpath for milling machine.



White Arrow = Geometry with offset for slicing process

Yellow Arrow = Final geometry without offset for milling process

Step by Step – Hybrid Workflow

Summary:

1. Define your implant-type inside of the CAD system
➔ You must define an offset for implant geometry of the STL-model in CAD
2. Import the STL (with Meta-Data if available) into hyperDENT
3. Exchange-geometry (implant geometry without offset) will be defined in hyperDENT
4. Start slicing-process which gets done on original STL-model defined in step #1.
5. Start nc-program generation which gets done on exchange-geometry defined in step #3

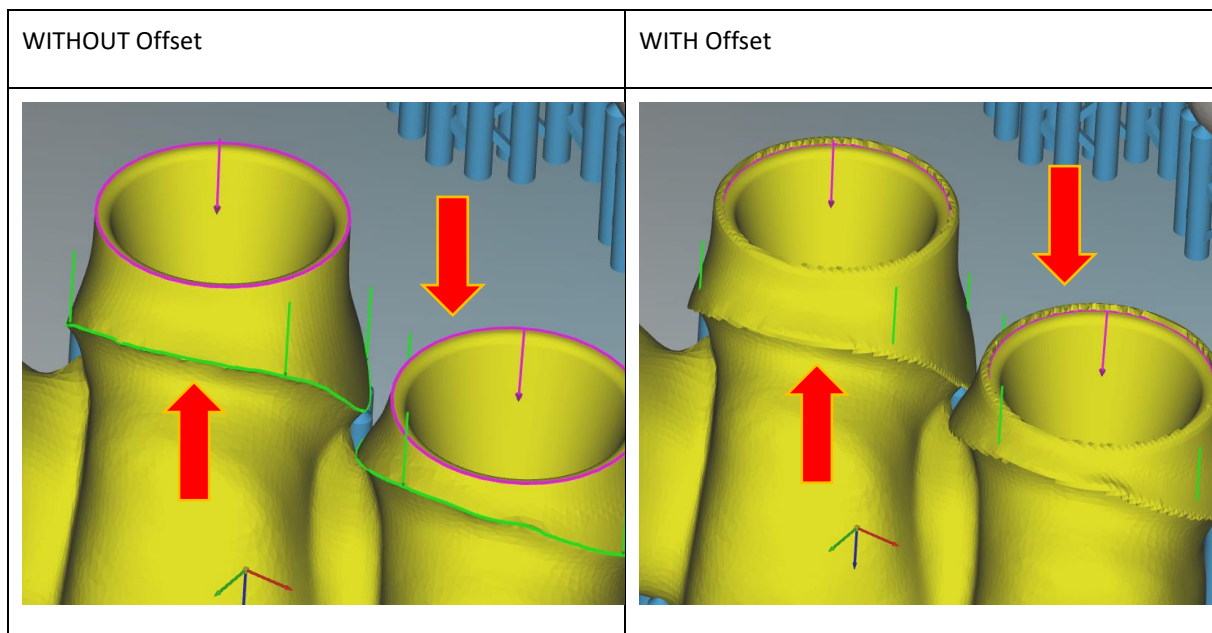
Beside the CAD-Library from Follow-ME! the customer can use also their own CAD-Library.

However to verify the process and make it working it is up to him.

Of course we could give him most important parameters (offset-specifications).

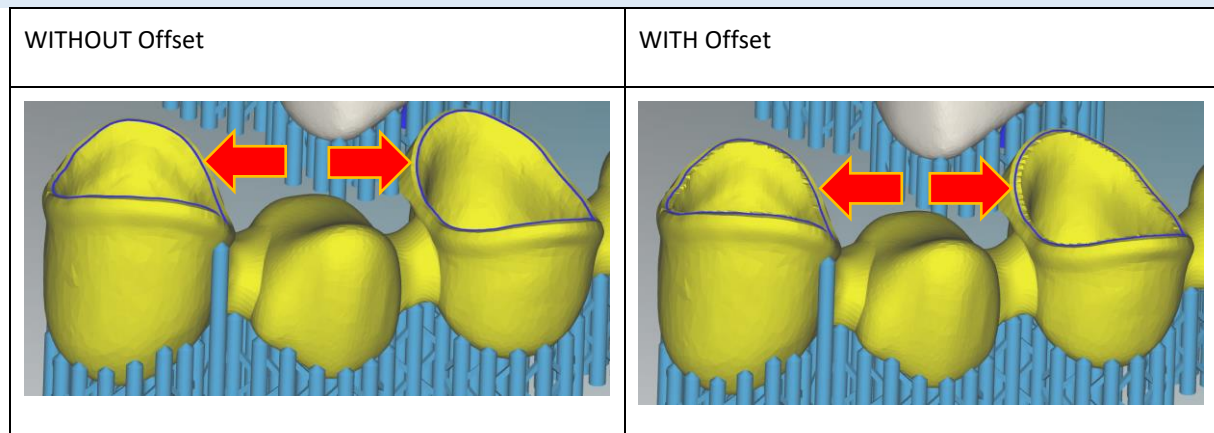
OFFSET FOR EMERGENCE-PROFILE

As described above we have the possibility to define the offset for emergence-profile within hyperDENT. The value of the offset is variable.



Step by Step – Hybrid Workflow

OFFSET FOR INSIDE COPINGS, CROWNS AND BRIDGES



Step by Step – Hybrid Workflow

SALES RELEVANT INFORMATION

GENERAL INFORMATION

Milling Machine

Brand:

Type:

Control:

SLM-Maschine

Brand:

Type:

Fixture availability

Is a fixture for milling machine available to clamp buildplatform:

YES/NO

Customer Data

Company:

Contact:

Address:

Country:

Current Software

CAD:

CAM:

3D-Printing:



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IMPLANTSYSTEMS FROM FOLLOW-ME!

For further information about implant-workflow please check also chapter [Generate Offset](#)

Which Implant-Systems are needed:

Which amount of Scanbodies is needed for each system?

Implantgeometry	Amount

Current Available Systems:

Biomet 3I Certain
Nobel Biocare Active
Nobel Biocare Branemark
Nobel Biocare Replace
Camlog Screwline
Dentsply Frialit Xive
Straumann SynOcta
Straumann Bonelevel

Priority of not available geometries (still to develop):

Please ask license-department for a list of all geometries you can order

1.	
2.	
3.	

If you choose implant-systems you should question if you really need them for Hybrid-Process.

E.g. if you produce just a small amount of a specific implant-system it's maybe not worth to by for Hybrid.

In case implantat-systems are not available right now we need approx. 4 weeks for delivery.

Delivery time is due to create library, print and mill testplatforms.

Step by Step – Hybrid Workflow

WHAT IS INSIDE LICENSE

- 3X/5X Modul (Depands on machine)
- Implant Modul (Depands on part-types customer wants to do)
- Implant Library (Depands on implant-geo's customer wants to manufacture)
- Hybrid Modul

DELIVERY PACKAGE

Database

- Milling database (dbconfig) (Default database which need to be adjusted for machine type)
- Fixture
- Implantinterface-Database (CAD + CAM)
- SLM-Machine-Database

Technical Documentation

- Hybrid Manual (included in hyperDENT Help-File)

hyperDENT Installationsdateien

- hyperDENT Installation
- hyperVIEW Installation
- Ticket ID (Inclusive Hybrid-Modul und ordered Implant-Interface Geometries)
- Postprocessor
- MDF

CAD-Bibliothek

- Exocad
- 3Shape
- DentalWings

Scanbodies: Amount and type as ordered

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TECHNICAL RELEVANT INFORMATION

Does milling machine have RTCP: YES/NO

Does milling machine support probing cycle

- If yes is it possible to rotate coordinate-system only in XY-Plane (around Z) or is it possible to rotate Z as well?
- What's the diameter of probing-tool?
- How many clearance is need between probing tool and geometry to measure?

Fixture

To be able to create a proper fixture it's important to have the CAD-drawing of the build-platform from SLM machine. You can ask you local dealer.

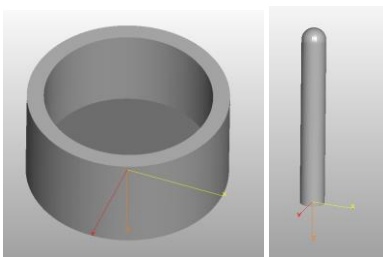
- Is a fixture available?
- Do you have a CAD/STL file of the fixture?
- Whats the tolerance of the fixture?
- Where is the origin?
- How the platform gets clamped?

Probing Geometry

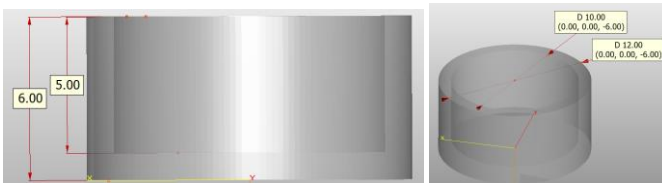
After the printing process of the part we need a possibility to create a proper workcoordinatesystem for the milling machine. For this we build some probing-elements onto the platform.

Based on them the probing-cycle at milling machine can generate WCS.

- Geometry: Cylinder, Pins, etc...

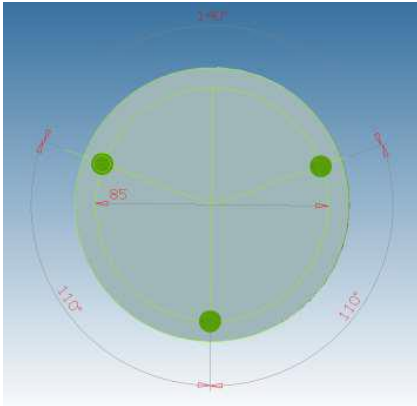


- Measurement: Size of the geometry



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- Position of probing geometry on the platform



-> Ones you know about the geometry shape and slm-machine-type please contact FM-Support for further details.

Probing Cycle

It would be important to know how the probing-cycle looks like.

This is necessary to know what need to be adjusted in milling-pp.

Usually the probing-cycle gets developed first. Afterwards tests are done by implementing probing-cycle into standard-milling program manually.

Once that is working well we need sample nc-code to be able to implement into PP.

Tools

T-Slots are needed to mill undercut in screwchannel from cavity side.

For further information about tools please contact FM support.