Hallo Team Eratz,

Please refer to attached VeraCAD settings, rolling die 3D model and the pictures of actual parts.
During manufacturing process, excess burr was found at the 4th rolling process which is not desirable, since the preset geometry after 4th rolling is what we need.
Could you check the attachment and advise
-if there is any wrong with the settings?
-or possible causes to inconsistence between settings and real parts made.
The raw material used was diameter Ø58mm and length 380mm.
Thank you for your kind assistance.

Answers to your Project.

Golden Rule 1)
Number of passes = 4.
4 Passes is okay, because maximum total Reduction = 77.6 %. This will require 4 passes.
2 Passes can do up to 55 %.
3 Passes can do 70 %
4 Passes can do 78 %
5 passes can do 86 %.

Golden Rule 2)
Calibration sequence.
Cross-section 1,2,3,4,5 are okay. Calibration sequence follows standard rules.

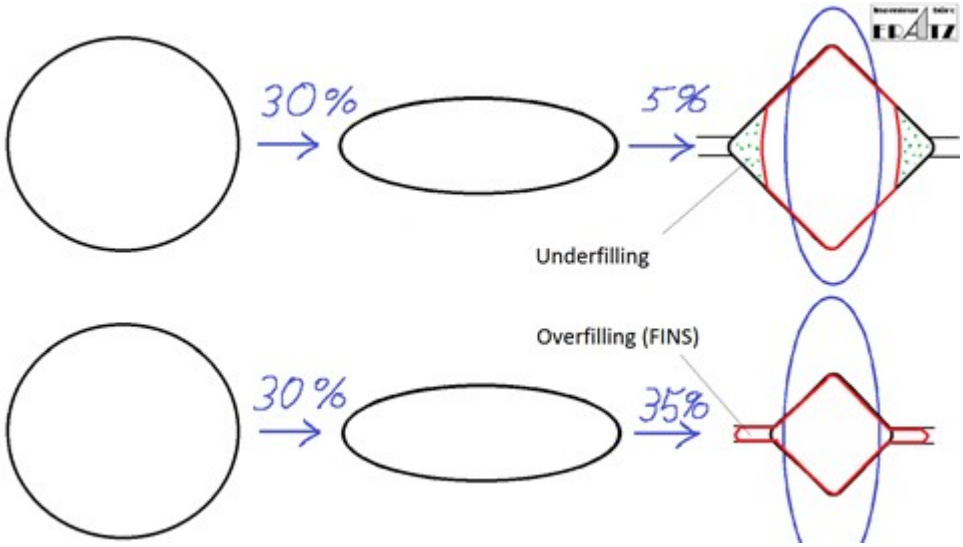
Cross-section 6, 7, 8, 9 can also be done with CIRCLE- CIRCLE- CIRCLE- CIRCLE, because
CIRCLE-CIRCLE can be used with 5 % reduction.
But the CIRCLE-OVAL-CIRCLE-OVAL-CIRCLE is also okay and sometimes has advantages.
This is because the pass get an unique shape from the front end to rear end.

Cross-section 10,11 are okay. Calibration sequence follows standard rules.

Cross-section 12,13 are okay. There is no reduction rate or near to zero reduction rate. If so we cannot change the shape. It must be done with CIRCLE-CIRCLE-CIRCLE in all passes.

Summary golden rule 2.
Calibration sequence is okay.

Golden Rule 3)
Reduction rates.



Explanation:
In the above picture we have CIRCLE to OVAL with 30 % of Reduction. The Oval will get a certain shape Width / Height. This shape was analyzed by a diploma worker in 2012 and the data from this diploma work is included in VeraCAD 3.79 and later. It is used by VeraCAD automatically.
If we put this Oval into the next pass – a square in the example – we are not completely free in choosing the pass 2 reduction rate. From the picture you will see, if we do it with 5 % reduction, we will get strong under-filling. If we do it with 35 % we will get overfilling, this is called fins. The necessary reduction rate is somewhere between 5 % and 35 %. The same principle is also true for Calibration sequence CIRLCE-OVAL-CIRCLE. I do not have such a picture available.
The major question is, if we do reduction in CIRCLE to OVAL with 38 % (Your cross-section 3 and 4), what is the reduction rate in pass 2 for OVAL to CIRCLE, in order to have 100 % filling degree for the CIRCLE (100 means no under-filling and no overfilling(fins)). This question originally was determined by the old EUMUCO database, which no is about 40 years old and I do not trust. Therefore I developed new rules base on my many years of experience with reducer rolling projects. This rules say:

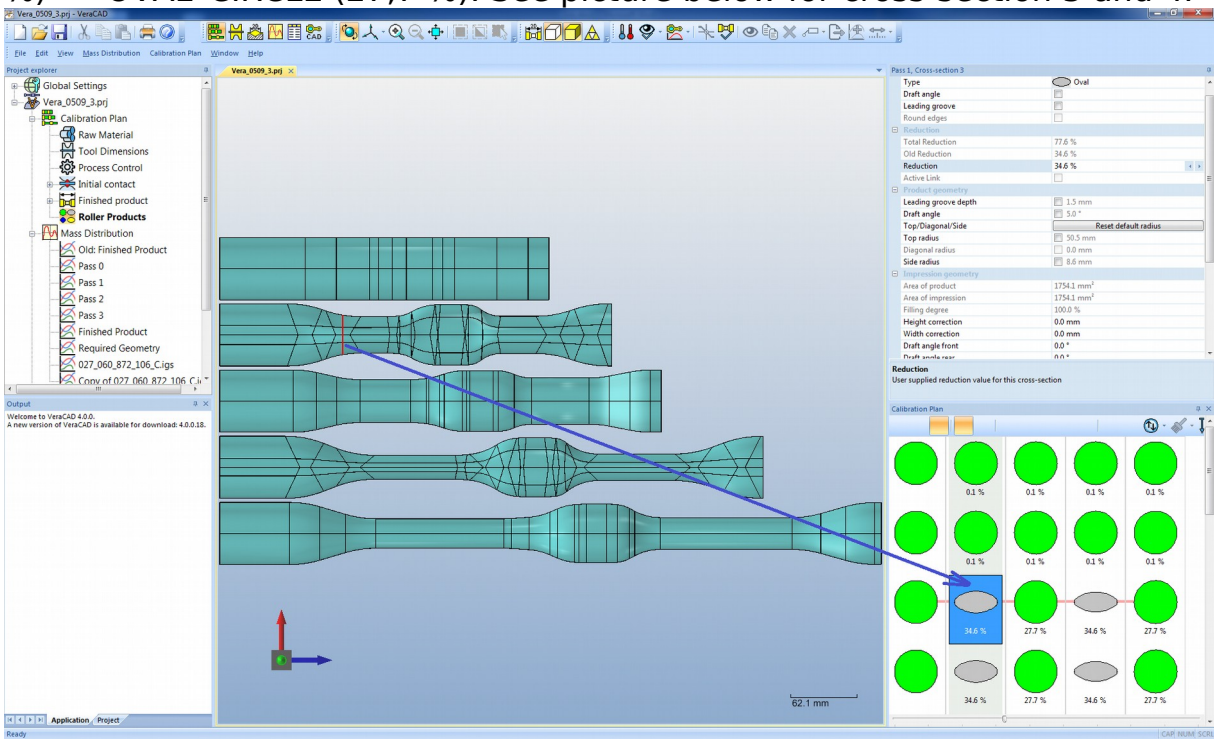
Reduction rate CIRCLE to OVAL	Reduction rate (100 % Filling) for OVAL to CIRCLE	Reduction rate (100 % Filling) for OVAL to SQUARE
1	0,8	0,85
2	1,6	1,7
3	2,4	2,55
4	3,2	3,4
5	4	4,25

We can express this simple rule as
P1 = reduction CIRCLE - OVAL
P2cc = reduction OVAL - CIRCLE
P2sq = reduction OVAL - SQUARE

P2cc = 0,8 * P1
P2sq = 0,85 * P1

If we hold this relationship between a pass that does spreading (OVAL) and the next pass that is CIRCLE or SQUARE, we can expect a 100 % filling.
I am not sure, if I teached this knowledge in the same way when I was at Alfot and did the training, but I train this rules since many years.

In your project you this rule is violated.
In cross-section 3 and 4 the current reduction rate is
CIRCLE-OVAL (37 %) -> OVAL – CIRCLE (21 %) -> CIRCLE-OVAL (37 %) -> OVAL–CIRCLE (21 %).
But it should be:
CIRCLE-OVAL (34,6 %) -> OVAL–CIRCLE (27,7 %) -> CIRCLE-OVAL (34,6 %) -> OVAL–CIRCLE (27,7 %). See picture below for cross-section 3 and 4.



This will help to fill CIRCLE cross-section in pass 2 and in pass 4.
In order to do so, you have to switch of the active link. If the link is active, the old EUMUCO database is in effect and you cannot modify the reduction rates.
What you also have to do is, use the above rule with P2 = 0.8 * P1 or P4 = 0.8 * P3 for all other cross-sections with CIRCLE-OVAL-CIRCLE-OVAL-CIRCLE calibration sequence.

This mismatch in reduction rate will produce the underfilling. If we do have underfilling, the volume in one section is not constant throughout the pass passes. VeraCAD calculates the volume and volume constancy under the condition, that each cross-section is filled by 100 %.
If this condition is not matched a length defect will be the consequence without doubt. If we have length defect in one pass, the next pass tool will hit the workpiece at wrong position and will produce heavy fins.

As a summary the correct filling of cross-section is a key point in reducer rolling. It should be managed at first priority.

Golden Rule 4)
Leading grooves.
It looks like there is no problem with twisting in pass 1 and 2, because the workpiece is short.
It also looks like no problem with twisting in pass 4.
Therefore Leading grooves are not necessary.

Golden Rule 5)
Draft Angles
You did not apply draft angle. Golden rule no 5 says:
30° draft angle (impression) to all CIRCLES
30° draft angle (impression) to all Full size Ovals (Thick Ovals)
In you case, because of the big flash corner radius, the effect of draft angle 30° is would be very small. Therefore the not providing the draft angles does not cause the rolling defects.
In future I recommend to apply the draft angles and may be a flash corner radius of 15 mm. But this is not a must, you can follow company rule if you have good experience with that.

Golden Rule 6)
You have made the Flash Corner radius 20 mm in all cross-sections. This helps to avoid the fins and rolling defects. I personally would not make it so big, but I have seen many customers who make a big flash corner radius like you.
Therefore it is okay. In addition, because you are rolling Aluminum it help to keep the workpiece clean and the tool surface smooth.
The 20 mm is okay.

Golden Rule 7)
Relative Motion
You applied the Relative Motion based on VeraCAD Proposal Button. This is okay.

Summary
The Reduction rates, set in Golden Rule no 3 will cause the rolling defect in this project.