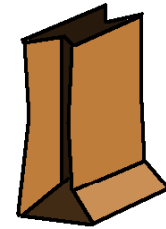
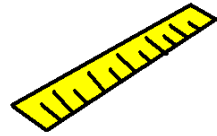


LUNCHEON LEARN

Concentricity

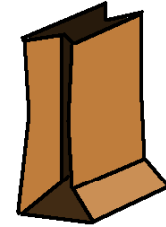
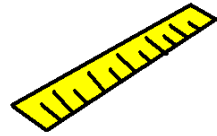
More than you ever wanted to know



LUNCHEON LEARN

**So, you need to measure
Concentricity?**

**No problem, right? Just drop
in a concentricity
characteristic and fill in the
template. You get an answer.**

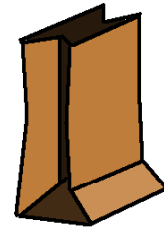
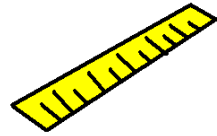


LUNCHEON LEARN

Easy.

So, what **EXACTLY** is
Calypso telling us?

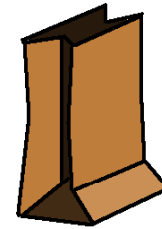
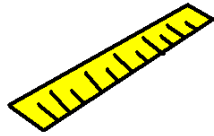
Actually, it's telling us
POSITION, not **Concentricity** as
defined in the Y14.5 standard....



LUNCHEON LEARN

You don't believe me?

Check it out:



LUNCHEON LEARN

Calypso User Desk - (C) Carl Zeiss - 1141 Fin

File Edit View Resources Features Con

Basic Status: Select function or probe

- Concentricity1
- True Position1**

True Position

True Position1 Comment

Shape Of Zone Tolerance
Diametral YZ 0.0100

Nominal Position
0.0000 X 0.0000 Y 0.0000 Z

Feature (RFS)
Bearing Journal Circle

Clear Datum Reference Datum Reference Special

Primary Datum (RFS)
Stroke Pin Bearing Cylinder

Secondary Datum

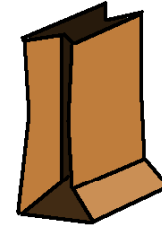
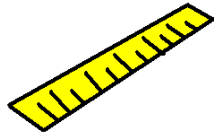
Tertiary Datum

Actual 0.0044

OK Reset

Stroke Pin Bearing Cylinder

6 mm



LUNCHEON LEARN

Concentricity

Concentricity1 Comment

0.0100 Tolerance

Feature (RFS)
 Bearing Journal Circle

Primary Datum (RFS)
 Stroke Pin Bearing Cylinder

Secondary Datum

Actual 0.0044

OK Reset

True Position

True Position1 Comment

Shape Of Zone Tolerance
 Diametral YZ 0.0100

Nominal Position
 0.0000 X 0.0000 Y 0.0000 Z

Feature (RFS)
 Bearing Journal Circle

Clear Datum Reference Datum Reference Special

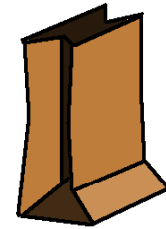
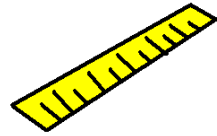
Primary Datum (RFS)
 Stroke Pin Bearing Cylinder

Secondary Datum

Tertiary Datum

Actual 0.0044

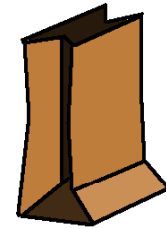
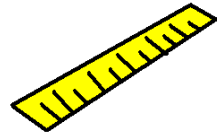
OK Reset



LUNCHEON LEARN

So is Concentricity just a special case of Position when the feature and datum happen to be on the same axis????

Great question.



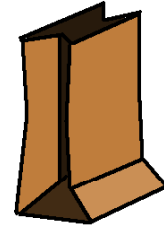
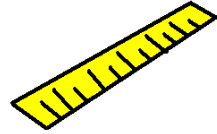
LUNCHEON LEARN Definition Time!

“Concentric
median points
elements of
corresponding
disposed feature
datum feature.
zone whose axis is
datum feature(s).
feature(s) being
concentric
tolerance zones.



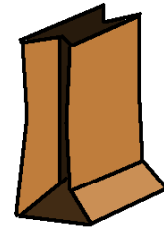
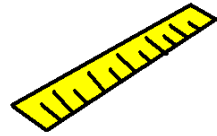
z z z
re the
sed

more radially-
center point) of a
spherical) tolerance
center point) of the
defined elements of the
cylindrical (or spherical)



LUNCHEON LEARN

**WAKE
UP!**

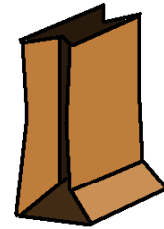
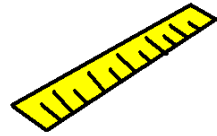


LUNCHEON LEARN

**Calypso DOES NOT do this...
easily.**

Can it be done?

Absolutely.

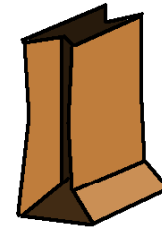
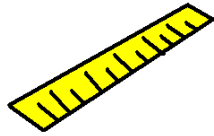


LUNCHEON LEARN

ANYTHING can be done if you
have the right resources...

In this case, **CURVE** is one of
those resources needed to pull
this off.

Here's how to do it:



LUNCHEON LEARN

Calypso User Desk - (C) Carl Zeiss - Concentricity2

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window ?

Define Nominal Geometry (Probe, Enter, or Read)

0.1000
0.0000
0.0000

Features

3-D Line1

Comment Strategy
Evaluation...

Clearance Group Nominal Definition Alignment

CP +Z Pattern (Base Alignme)

Tolerance For:

- X
- Y
- Z
- A1 Y/X
- A2 Z/X

Space Axis ±

Depth

Start Angle

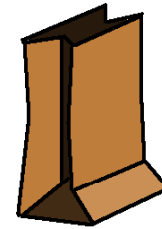
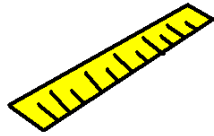
Options

- Recall
- Pattern: Rotational Pattern (use for scallop)
- Recall One Feature
- Recall Feature Points
- Theoretical Feature
- Actual To Nominal

Sigma	Form	Points
Min	Point no	Point no
		Max

OK Reset

1 mm



LUNCHEON LEARN

Calypso User Desk - (C) Carl Zeiss - Concentricity2

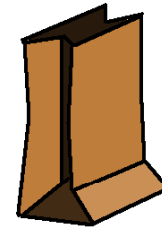
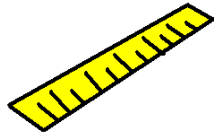
File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window ?

Basic Status: Select function or probe for surface measurement with single points

- Datum
- Feature
- Curve1
- 3-D Line1[36]
- Intersection1[36][3-D Line1,Curve1]
- Intersection2[36][3-D Line1,Curve1]
- Symmetry1[36][Intersection1,Intersection2]

X = 0.0000
Y = 0.0000
Z = 0.0200

1 mm

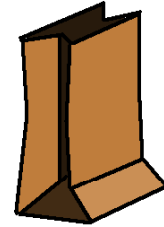
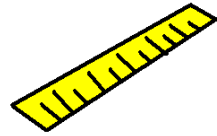


LUNCHEON LEARN

The screenshot displays the Calypso User Desktop interface. A 'Concentricity' dialog box is open, showing the following details:

- Feature:** (RFS)
- Feature:** (empty text field)
- Primary Datum:** Datum (empty text field)
- Secondary Datum:** (empty text field)
- Tolerance:** 0.0000
- Actual:** 0.3000

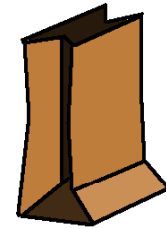
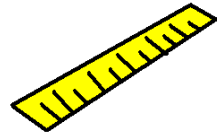
The background shows a 3D model of a part with a concentricity feature highlighted. The coordinate system (X, Y, Z) is visible, and a scale bar indicates 1 mm.



LUNCHEON LEARN

Shoooo. Lots of programming.

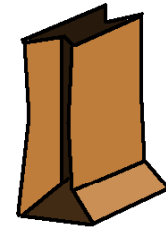
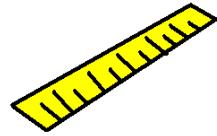
It's really not THAT bad.



LUNCHEON LEARN

You could make it a macro so you never have to program it again. Just supply feature circle coords and diameter.

Go to a training class if you want to learn about macros.

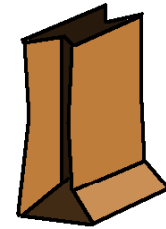
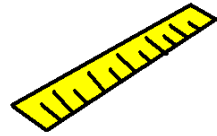


LUNCHEON LEARN

Let's test it out.

First, a theoretical example to see if it makes sense.

Let's change the FEATURE circle to $X=0$, $Y=0.05$ and run it in simulation.



LUNCHEON LEARN

YAY!

Same
Result!

The results
make sense!

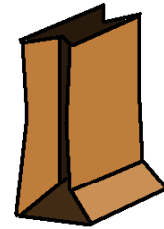
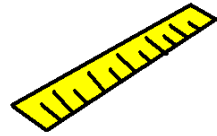
Calypso Custom Printout Concentricity1 1

Printout Display

ZEISS Calypso

Measurement Plan: Concentricity1
Date: September 7, 2011
Drawing No. *drawingno*:
Time: 3:32:32 pm
Order *order*:
Operator: Master
CMM: Simulation
Incremental Part Number: 10

	Actual	Nominal	Upper Tol.	Lower Tol.	Deviation
Overall Result					
All Characteristics:		3			
Out of tolerance:		2			
Over Warning Limit:		0			
Not Calculated:		0			
Concentricity	0.1000	0.0000	0.0500		0.0500 0.1000
Concentricity1	0.1000	0.0000	0.0500		0.0500 0.1000

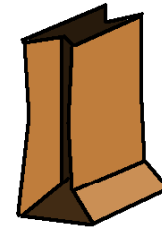
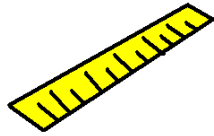


LUNCHEON LEARN

One more try...

Another theoretical example to see if it makes sense.

Let's change the FEATURE circle to $X=0.00707$, $Y=0.00707$ and run it in simulation.



LUNCHEON LEARN

YAY again!

The results
make sense!

Calypso Custom Printout Concentricity1 1

Printout Display

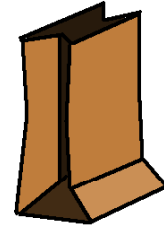
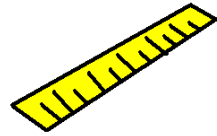
ZEISS Calypso

Measurement Plan: Concentricity1
Date: September 7, 2011

Drawing No. *drawingno*
Time: 3:38:00 pm
Order *order*

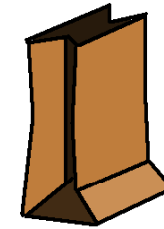
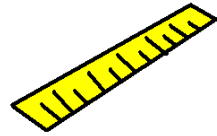
Operator: Master
CMM: Simulation
Incremental Part Number: 11

	Actual	Nominal	Upper Tol.	Lower Tol.	Deviation
Overall Result					
All Characteristics:		3			
Out of tolerance:		0			
Over Warning Limit:		0			
Not Calculated:		0			
Concentricity	0.0200	0.0000	0.0500		-- 0.0200
Concentricity1	0.0200	0.0000	0.0500		-- 0.0200



LUNCHEON LEARN

**Now a REAL program with
REAL data...**



LUNCHEON LEARN

YAY again!

The results
STILL
make sense!

Calypso Custom Printout Concenticity1 1

Printout Display

ZEISS Calypso

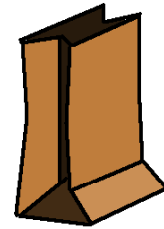
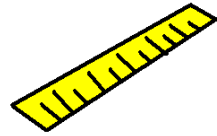
ZEISS

Measurement Plan: Concenticity1
Date: September 7, 2011

Drawing No. *drawingno*
Time: 3:46:17 pm
Order *order*

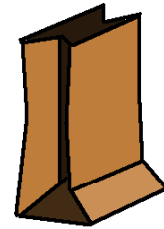
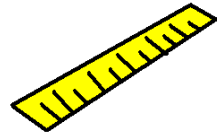
Operator: Master
CMM: Simulation
Incremental Part Number: 6

	Actual	Nominal	Upper Tol.	Lower Tol.	Deviation
Overall Result					
All Characteristics:		3			
Out of tolerance:		0			
Over Warning Limit:		0			
Not Calculated:		0			
Concenticity1	0.0041	0.0000	0.0100		- 0.0041
REAL concenticity	0.0042	0.0000	0.0100		- 0.0042



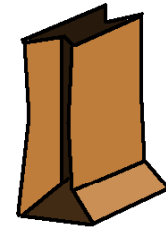
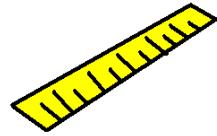
LUNCHEON LEARN

**Well, now you know how to check
“REAL” concentricity...**



LUNCHEON LEARN

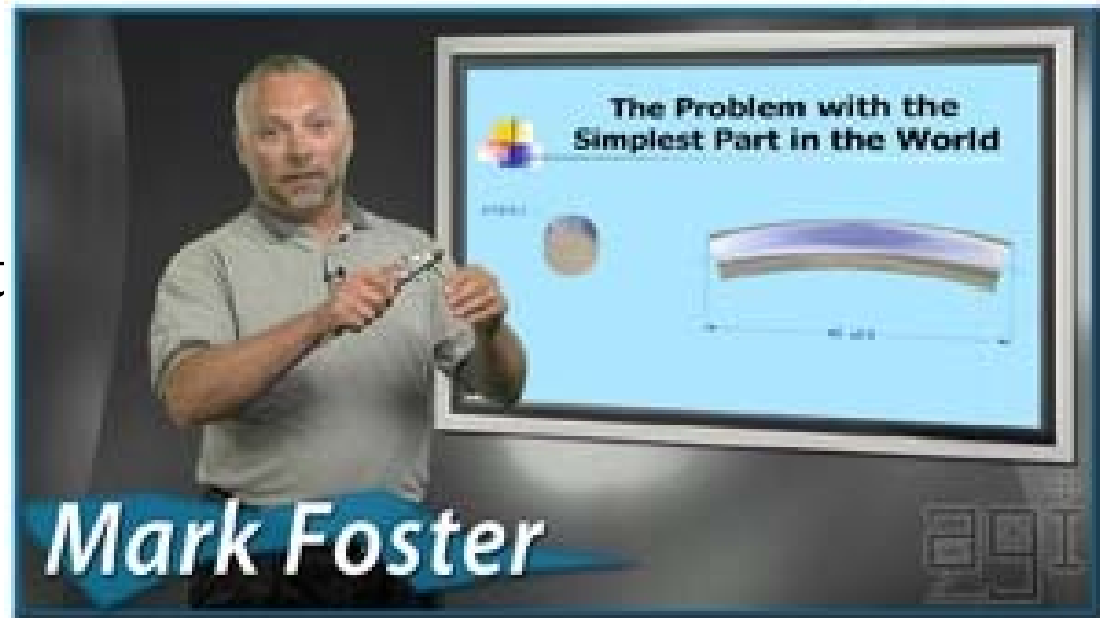
Why in the world would you ever want to do that considering the “REAL” answer is a whole 0.0001mm different than the way Calypso does it?!?!?

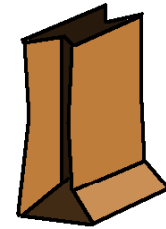
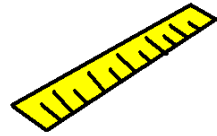


LUNCHEON LEARN

I honestly don't know considering we can use position, roundness, and runout...

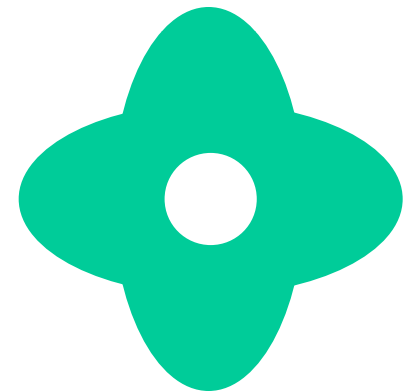
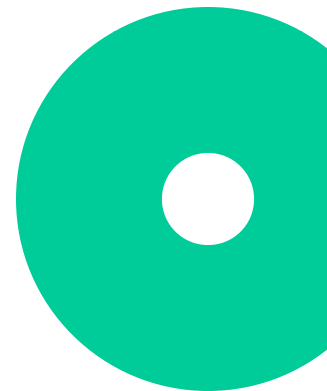
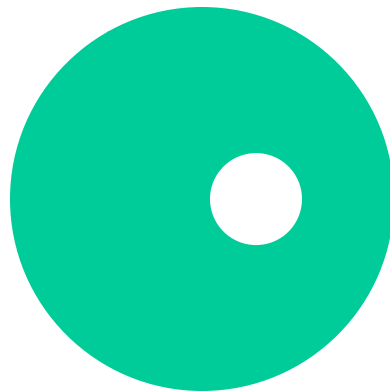
is what I said before talking to Mark Foster at Applied Geometrics, Inc. (www.gdandt.com)





LUNCHEON LEARN

Here's what's going on and WHY
"REAL" concentricity is used...



Roundness: **GOOD**

GOOD

BAD

BAD

Position: **GOOD**

BAD

GOOD

GOOD

Runout: **GOOD**

BAD

BAD

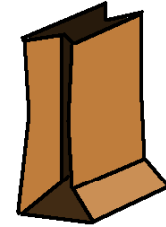
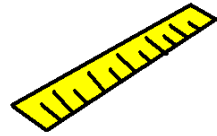
BAD

Concentricity: **GOOD**

BAD

BAD

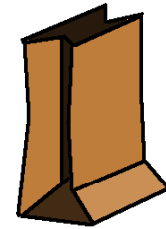
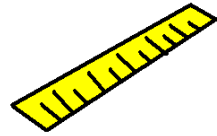
GOOD



LUNCHEON LEARN

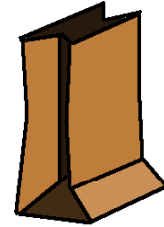
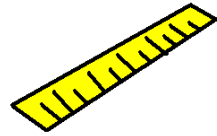
**With all that understood,
“REAL” concentricity does not
apply in MOST applications.**

The Y14.5 standard says it best...



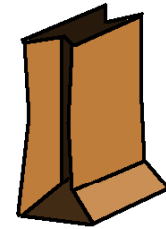
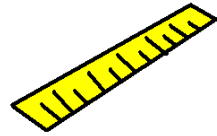
LUNCHEON LEARN

...Therefore, unless there is a definite need for the control of a feature's median points, it is recommended that a control be specified in terms of a runout tolerance or a positional tolerance.

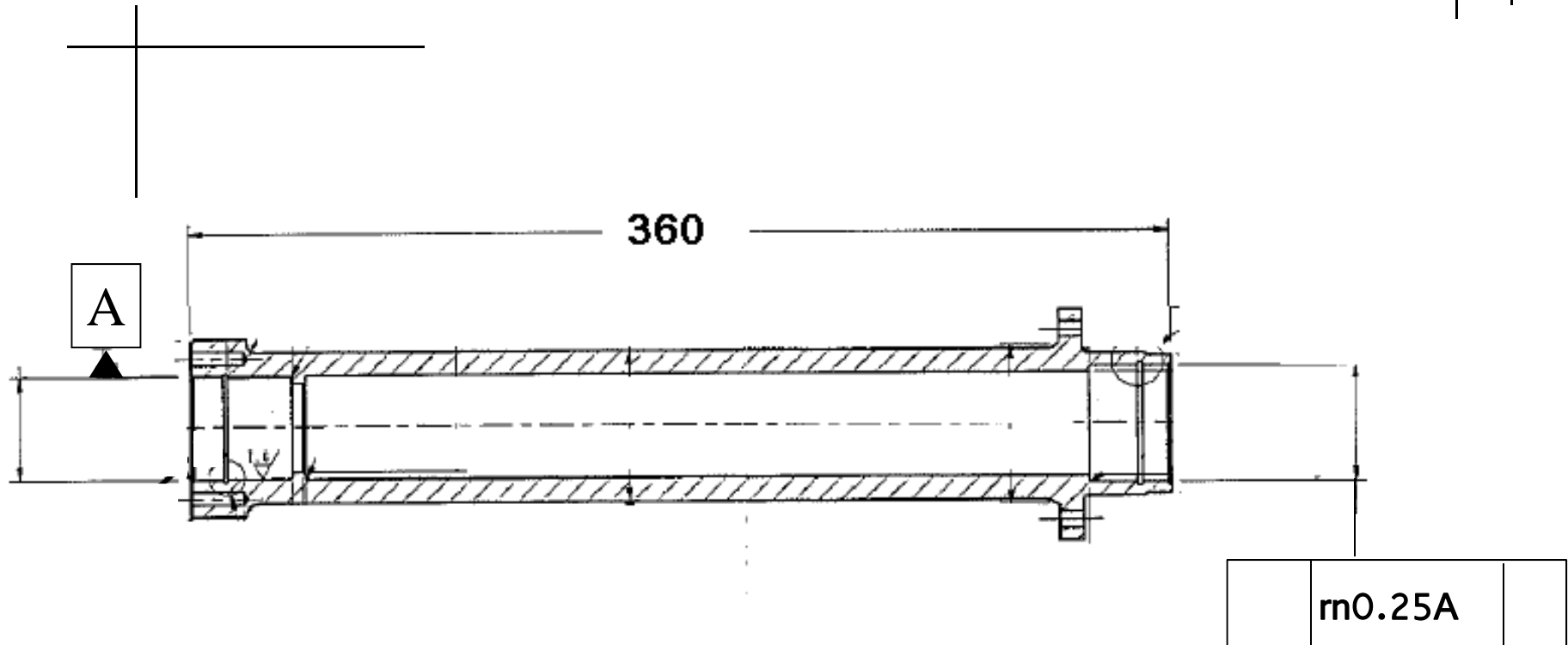


LUNCHEON LEARN

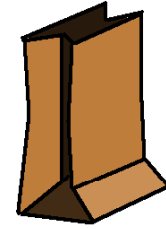
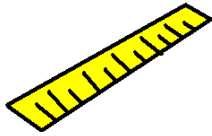
Let's take a look at a REAL part and a REAL print with a REAL bad dimension we have to check.



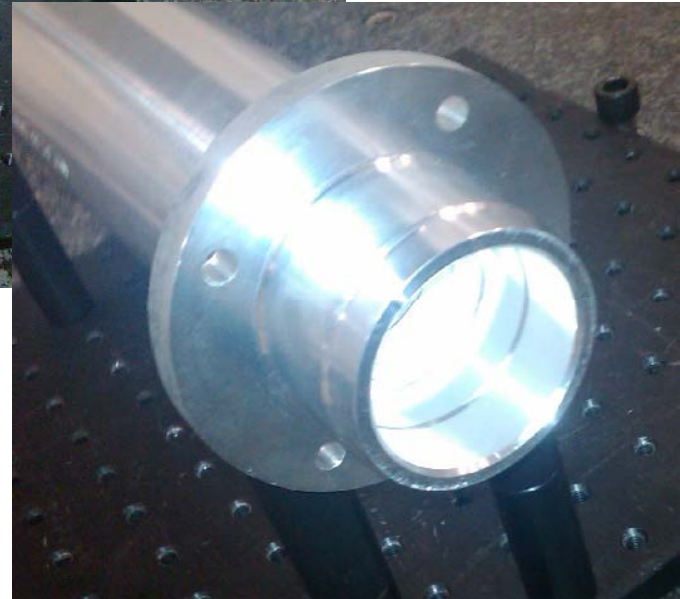
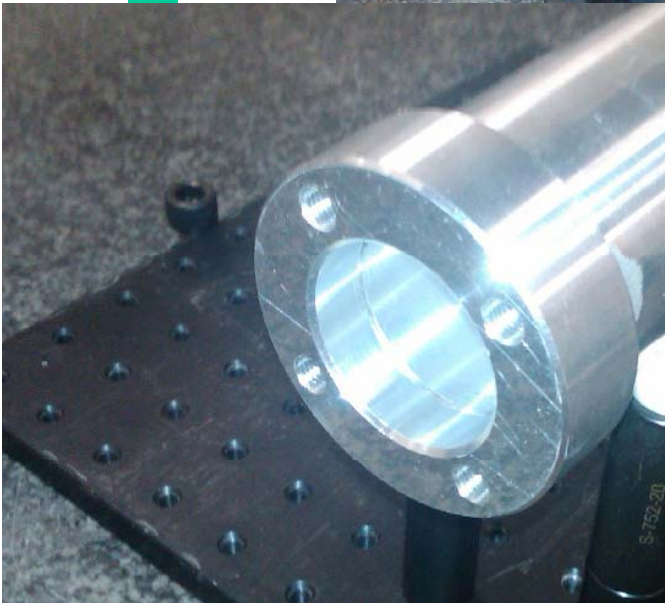
LUNCHEON LEARN

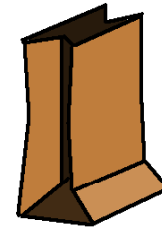
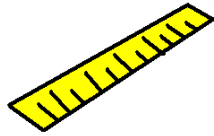


**I'm going to assume the designer meant
"Calypso Concentricity" ("Position")
and not "REAL Concentricity".**



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LUNCHEON LEARN

Calypso User Desk - (C) Carl Zeiss - Concentricity1

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window ?

Basic Status: Select function or probe for surface measurement with single points

Concentricity

Concentricity8 Comment

0.2500 Tolerance

Feature (RFS)
Circle9

Primary Datum
Cylinder1

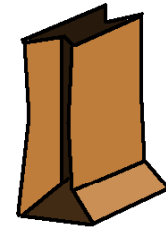
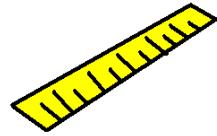
Secondary Datum

Actual 0.3082

OK Reset

“Circle 9” is the feature,
about 350mm away

“Cylinder 1” is Datum A, and is
8mm long

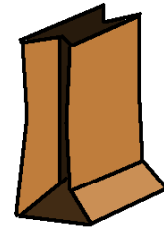
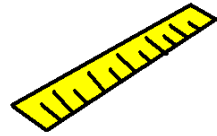


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The tolerance is 250 microns for goodness sake.

I'm using a ZEISS after all. The machine has an accuracy of 1.7 microns. PIECE OF CAKE!

What could go wrong?

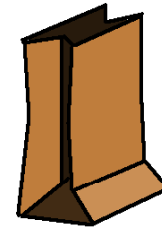
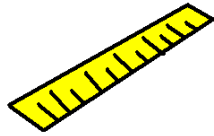


LUNCHEON LEARN

Run the part 10 times in a Loop.

Don't Touch the part.

Let's check repeatability...



LUNCHEON LEARN

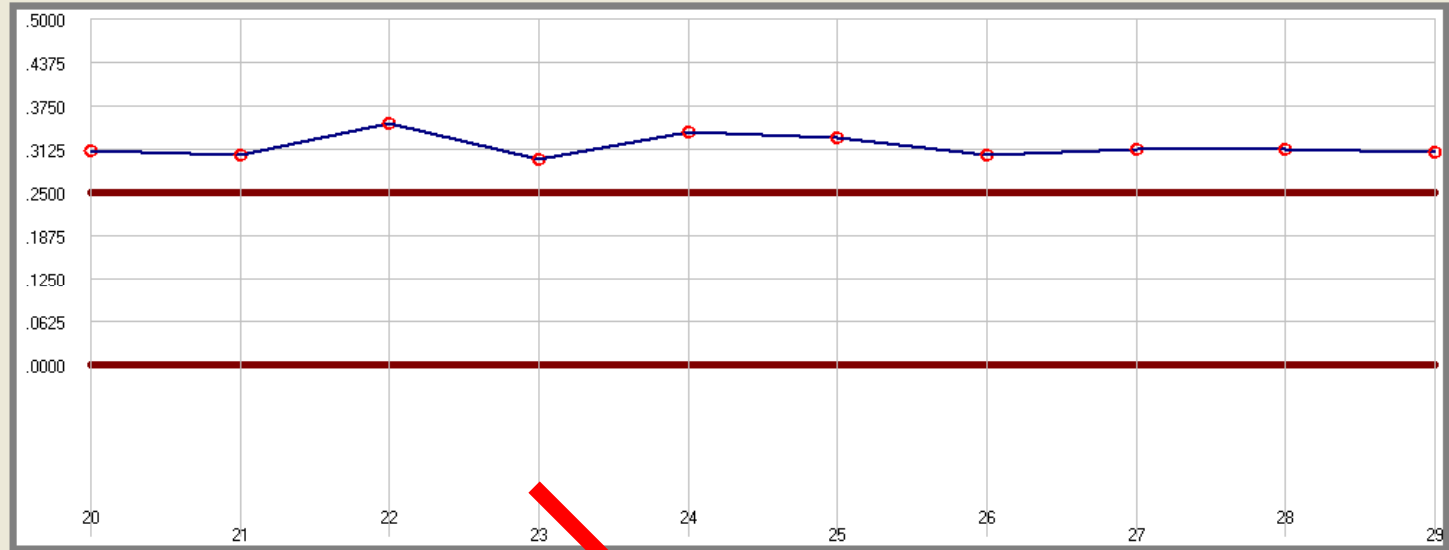
Statistical Analysis



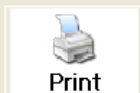
BASIC STATISTICAL ANALYSIS Concentricity8

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8**



Show True Pos. Target Charts



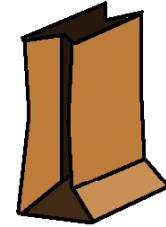
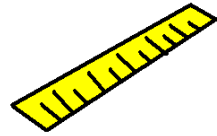
Specification Limit: —
 Average: ●
 Data Point In Tolerance: ●
 Data Point Out-of-Tolerance: ●
 Data Point off Chart Scale: ●
 Data Point Masked: ●

Upper Spec : 0.25
 Lower Spec : 0
 Average : 0.316546

Maximum : 0.35003
 Minimum : 0.29821
 Range : 0.05182

6σ/Tol : 39.84%
 Cpk : -1.339
 Total Measurements: 10
 Masked: 0

20:	.31069
21:	.30490
22:	.35003
23:	.29821
24:	.33739
25:	.32840
26:	.30421
27:	.31182
28:	.31157
29:	.30824

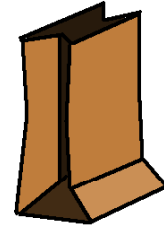
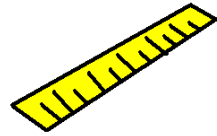


LUNCHEON LEARN

Range of 52 microns?

An estimated GR&R of 40%?

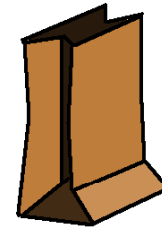
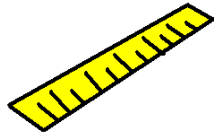
I think I need to call service...



LUNCHEON LEARN

...before I do, I wonder if the distance from the Datum has anything to do with it.

Check this out:



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Statistical Analysis



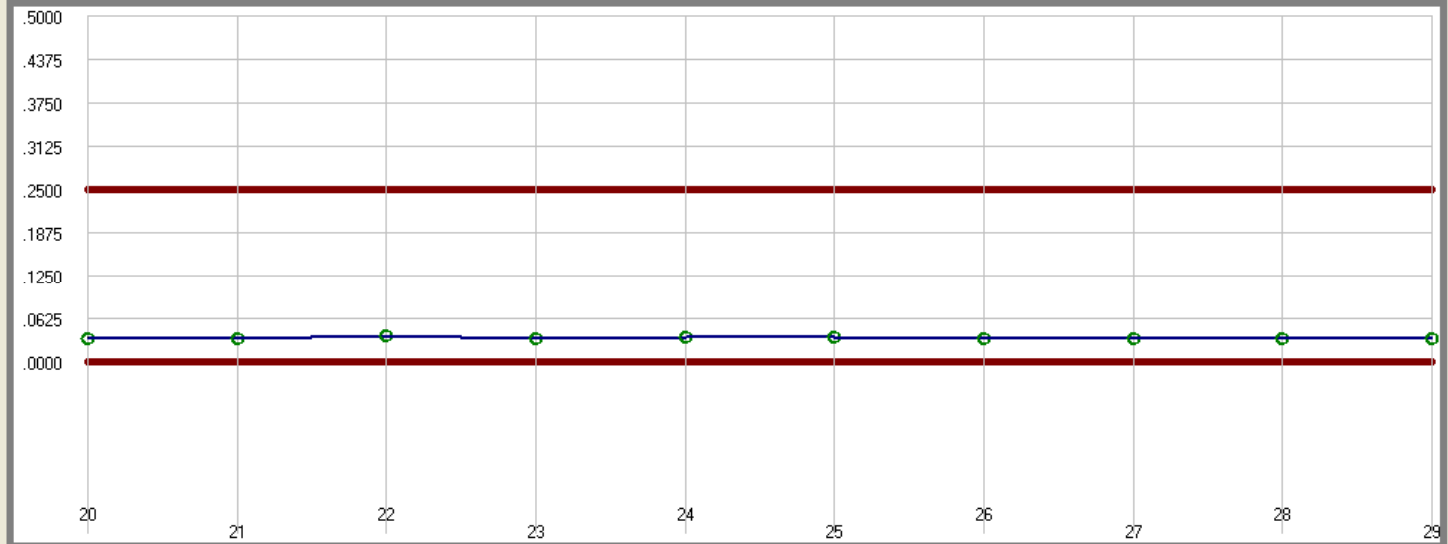
BASIC STATISTICAL ANALYSIS Concentricity1

30mm from Datum A

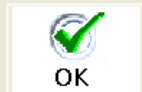
RUN CHART

Concentricity1

- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



Show True Pos. Target Charts



Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
---------------------	---------	-------------------------	-----------------------------	----------------------------	-----------------------------------

Upper Spec : 0.25

Lower Spec : 0

Average : 0.034459

Maximum : 0.0366

Minimum : 0.03338

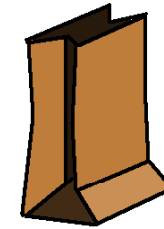
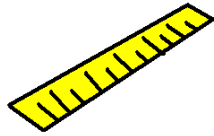
Range : 0.00322

6σ/Tol : 2.5%

Cpk : 68.890

Total Measurements: 10
Masked: 0

- 20: .03426
- 21: .03366
- 22: .03660
- 23: .03338
- 24: .03572
- 25: .03511
- 26: .03353
- 27: .03432
- 28: .03384
- 29: .03417



LUNCHEON LEARN

Statistical Analysis

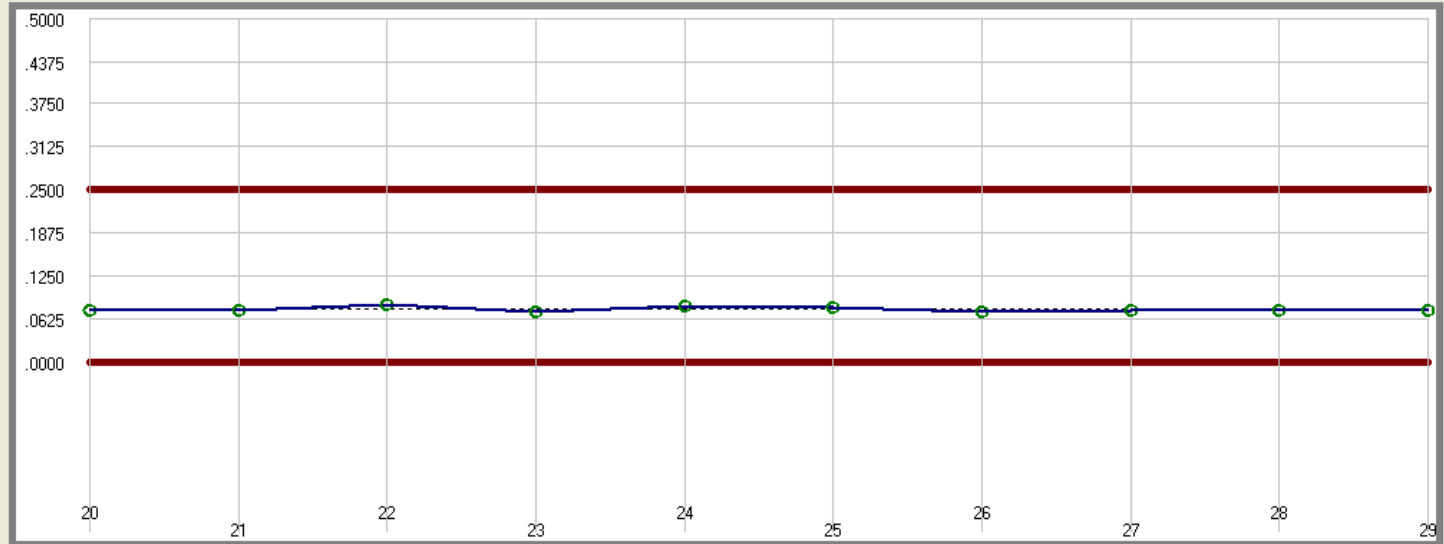


BASIC STATISTICAL ANALYSIS Concentricity2

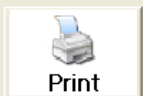
70mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2**
- Concentricity3
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



Show True Pos. Target Charts



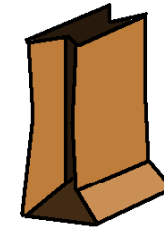
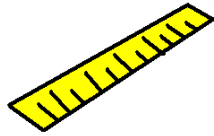
Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
---------------------	---------	-------------------------	-----------------------------	----------------------------	-----------------------------------

Upper Spec : 0.25 Maximum : 0.08263 6σ/Tol : 7.6%

Lower Spec : 0 Minimum : 0.07273 Cpk : 18.289

Average : 0.076282 Range : **0.01010** Total Measurements: 10
Masked: 0

20:	.07589
21:	.07398
22:	.08263
23:	.07273
24:	.08023
25:	.07840
26:	.07353
27:	.07560
28:	.07498
29:	.07485



LUNCHEON LEARN

Statistical Analysis

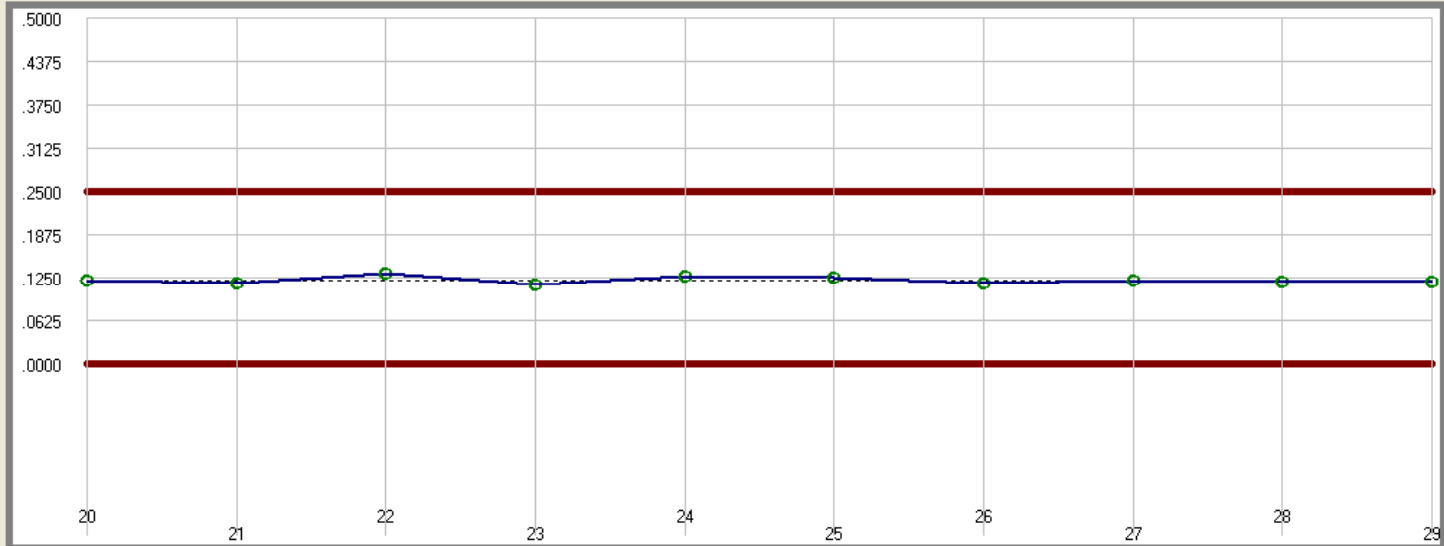


BASIC STATISTICAL ANALYSIS Concentricity3

110mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3**
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



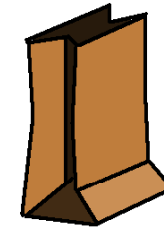
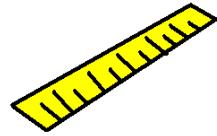
Show True Pos. Target Charts



Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
Upper Spec : 0.25	Maximum : 0.13149	6σ/Tol : 12.45%			
Lower Spec : 0	Minimum : 0.11536	Cpk : 8.278			
Average : 0.121085	Range : 0.01613	Total Measurements: 10			Masked: 0

[Click to show Percentage](#)

20: .12012
21: .11735
22: .13149
23: .11536
24: .12758
25: .12466
26: .11658
27: .11998
28: .11922
29: .11851



LUNCHEON LEARN

Statistical Analysis

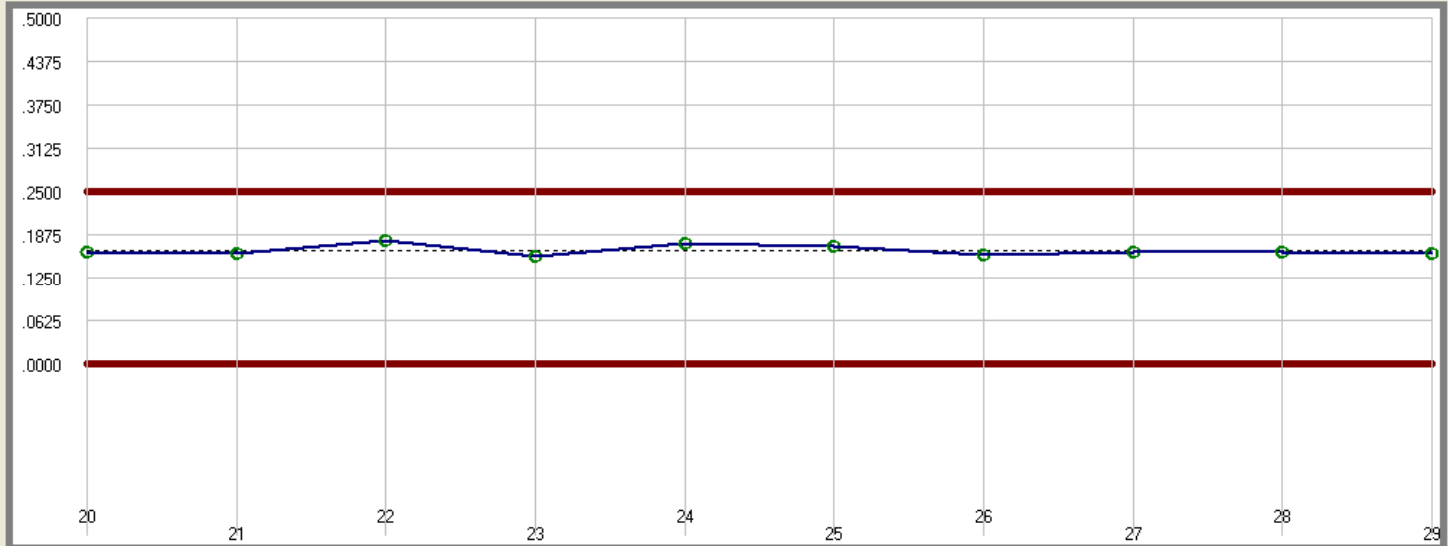


BASIC STATISTICAL ANALYSIS Concentricity4

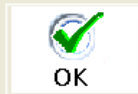
150mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4**
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



Show True Pos. Target Charts



— Specification Limit - - - - - Average ● Data Point In Tolerance ● Data Point Out-of-Tolerance ● Data Point off Chart Scale ● Data Point Masked from Statistics

Upper Spec : 0.25

Lower Spec : 0

Average : 0.165

Maximum : 0.17938

Minimum : 0.1572

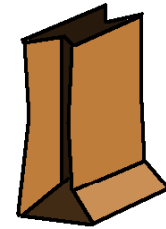
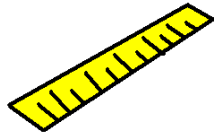
Range : 0.02218

6σ/Tol : 17.18%

Cpk : 3.957

Total Measurements: 10
Masked: 0

20: .16338
 21: .15984
 22: .17938
 23: .15720
 24: .17399
 25: .16999
 26: .15894
 27: .16338
 28: .16259
 29: .16131



LUNCHEON LEARN

Statistical Analysis

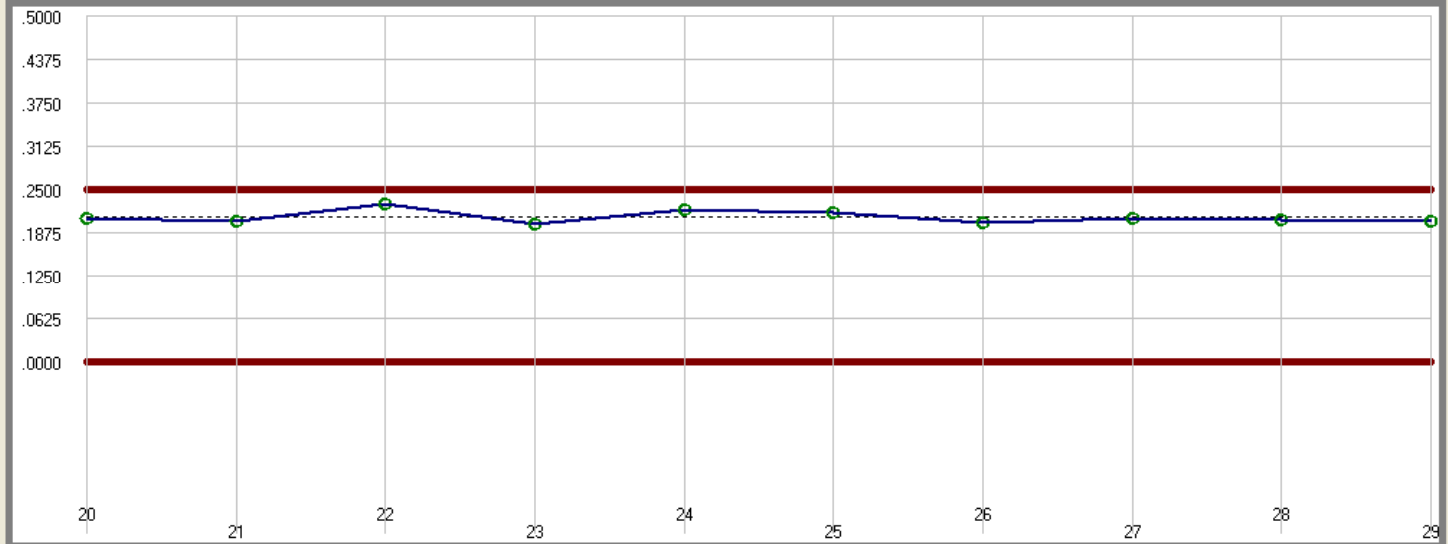


BASIC STATISTICAL ANALYSIS Concentricity5

190mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5**
- Concentricity6
- Concentricity7
- Concentricity8

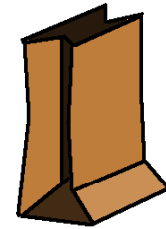
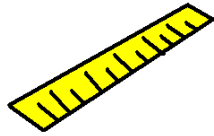


Show True Pos. Target Charts



Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
Upper Spec : 0.25	Maximum : 0.22827	6σ/Tol : 21.88%			
Lower Spec : 0	Minimum : 0.20008	Cpk : 1.466			
Average : 0.209944	Range : 0.02819	Total Measurements: 10			Masked: 0

20:	.20766
21:	.20336
22:	.22827
23:	.20008
24:	.22138
25:	.21636
26:	.20246
27:	.20783
28:	.20694
29:	.20510



LUNCHEON LEARN

Statistical Analysis

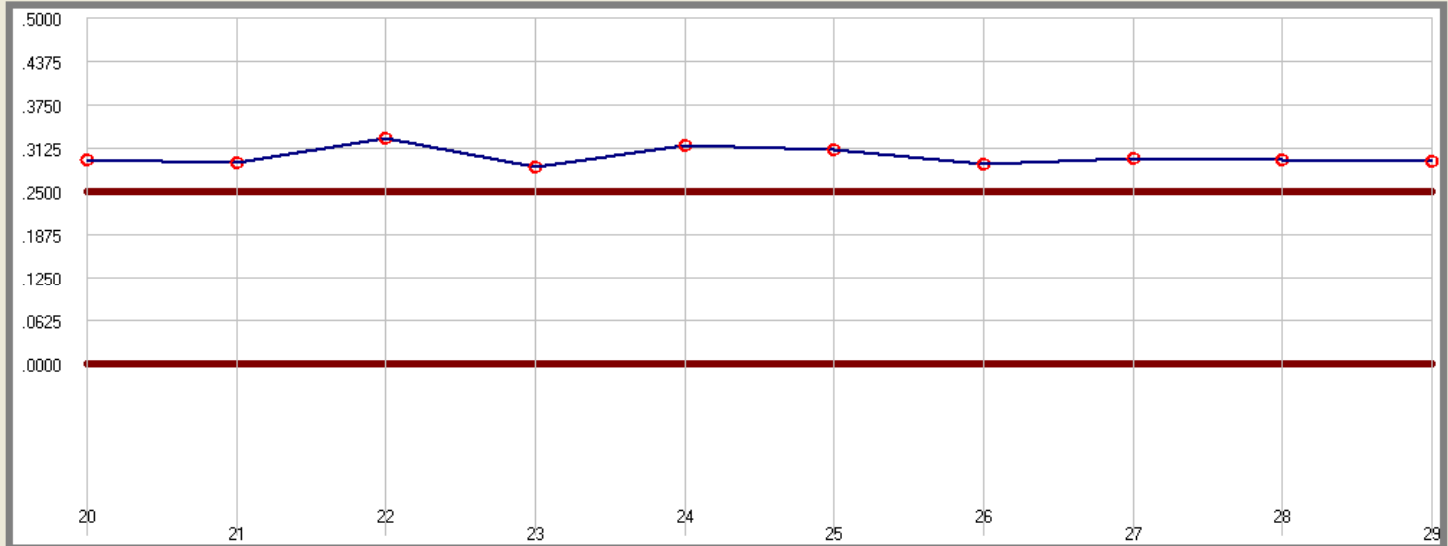


BASIC STATISTICAL ANALYSIS Concentricity7

270mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7**
- Concentricity8



Show True Pos. Target Charts



— Specification Limit
 - - - - - Average
 ● Data Point In Tolerance
 ● Data Point Out-of-Tolerance
 ● Data Point off Chart Scale
 ● Data Point Masked from Statistics

Upper Spec : 0.25

Lower Spec : 0

Average : 0.300479

Maximum : 0.32674

Minimum : 0.28604

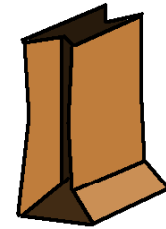
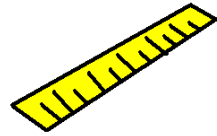
Range : 0.0407

6σ/Tol : 31.25%

Cpk : -1.293

Total Measurements: 10
Masked: 0

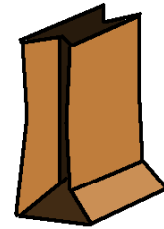
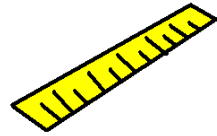
20: 29673
 21: 29107
 22: 32674
 23: 28604
 24: 31674
 25: 30963
 26: 29049
 27: 29734
 28: 29638
 29: 29357



LUNCHEON LEARN

I think I'm seeing a trend here.

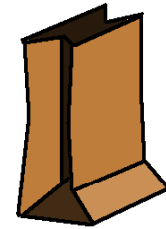
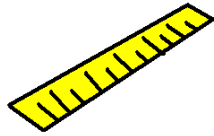
**Distance from the Datum has a
serious effect on the
Concentricity (Position) result.**



LUNCHEON LEARN

**I wonder if the length of the Datum
has anything to do with the results
as well?**

**Let's shorten a Datum a bit,
from 8mm down to 5mm and
see the effect.**



LUNCHEON LEARN

Statistical Analysis



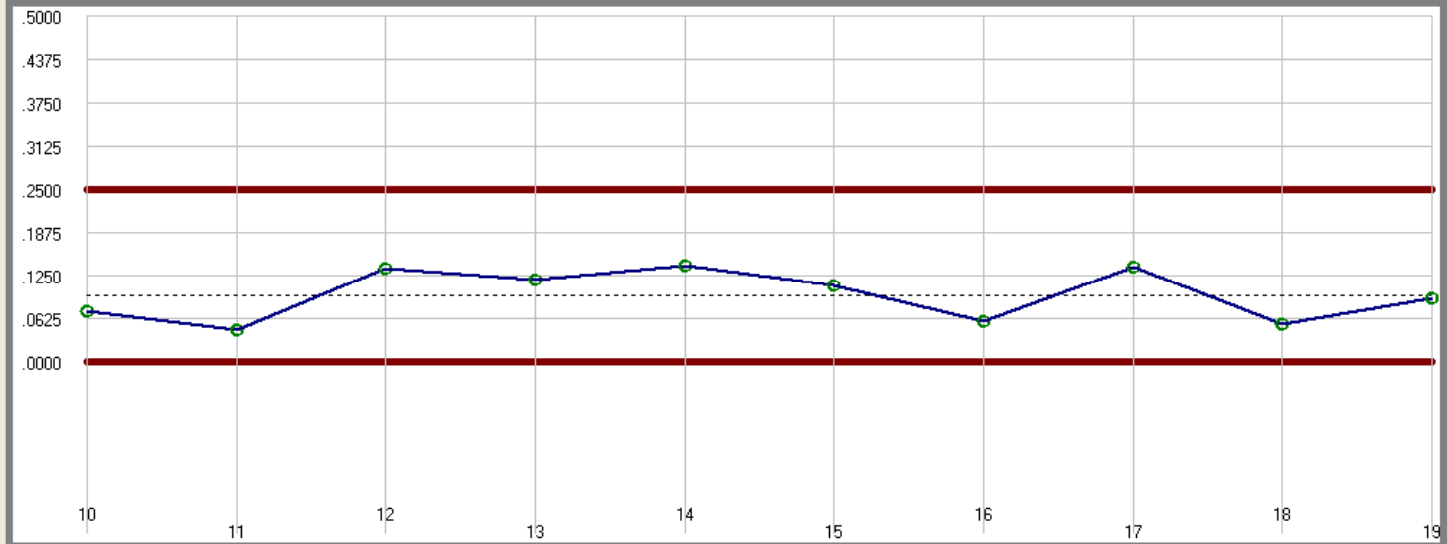
BASIC STATISTICAL ANALYSIS Concentricity1

30mm from Datum A

RUN CHART

Concentricity1

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



Show True Pos. Target Charts



Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
---------------------	---------	-------------------------	-----------------------------	----------------------------	-----------------------------------

Upper Spec : 0.25

Lower Spec : 0

Average : 0.096347

Maximum : 0.13858

Minimum : 0.04498

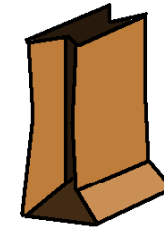
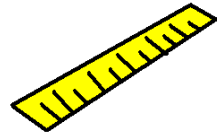
Range : 0.0936

6σ/Tol : 88.5%

Cpk : 1.393

Total Measurements: 10
Masked: 0

- 10: .07282
- 11: .04498
- 12: .13586
- 13: .11873
- 14: .13858
- 15: .11098
- 16: .05901
- 17: .13734
- 18: .05382
- 19: .09135



LUNCHEON LEARN

Statistical Analysis

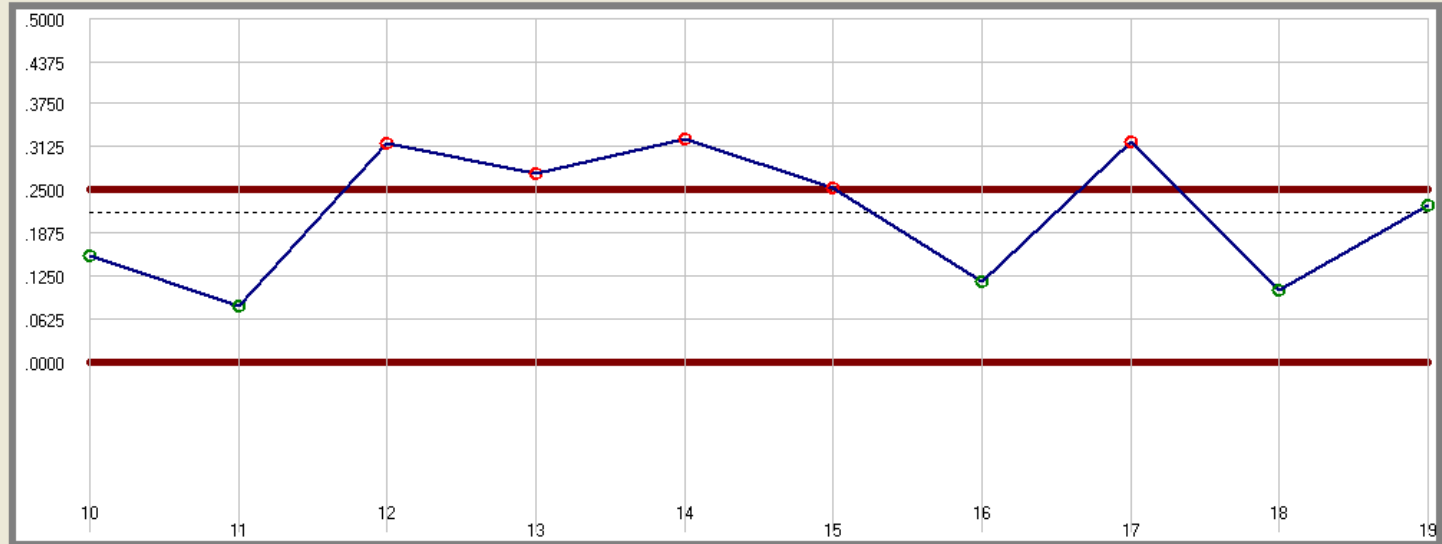


BASIC STATISTICAL ANALYSIS Concentricity2

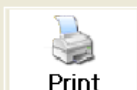
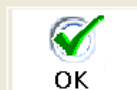
70mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



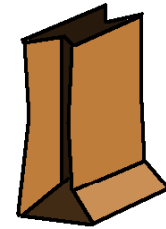
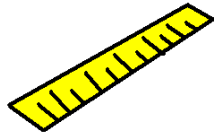
Show True Pos. Target Charts



Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
---------------------	---------	-------------------------	-----------------------------	----------------------------	-----------------------------------

Upper Spec : 0.25	Maximum : 0.3221	6 σ /Tol : 227.27%
Lower Spec : 0	Minimum : 0.08111	Cpk : .117
Average : 0.21672	Range : 0.24099	Total Measurements: 10 Masked: 0

- 10: .15387
- 11: .08111
- 12: .31676
- 13: .27235
- 14: .32210
- 15: .25279
- 16: .11757
- 17: .31960
- 18: .10460
- 19: .22645



LUNCHEON LEARN

Statistical Analysis

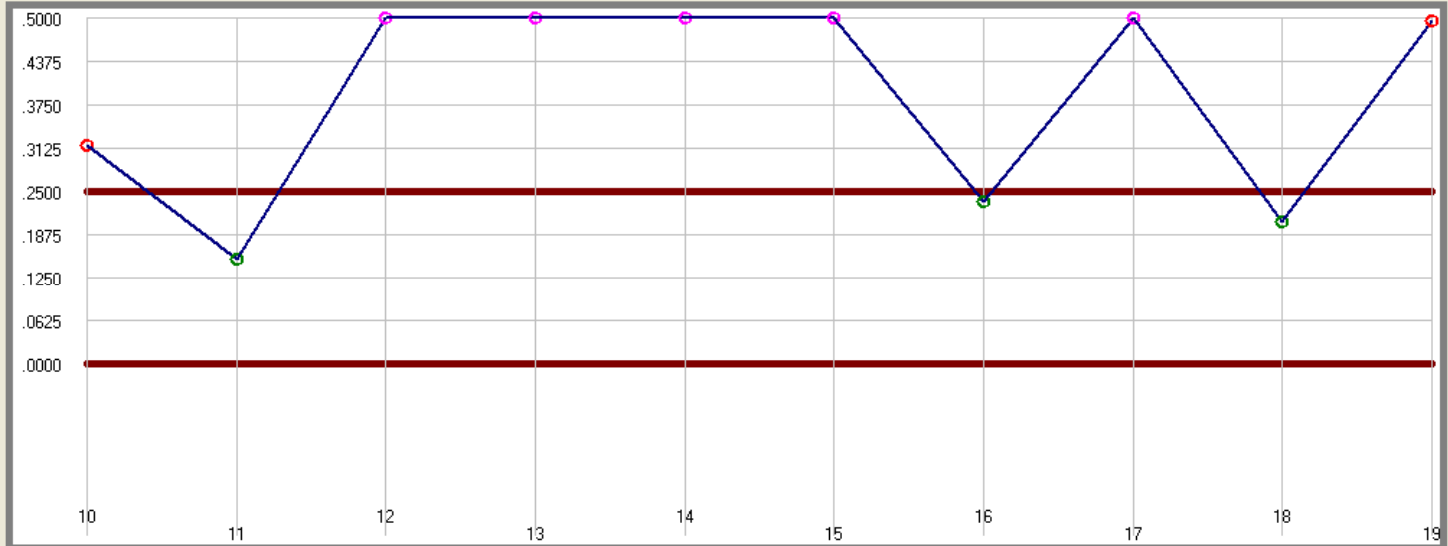


BASIC STATISTICAL ANALYSIS Concentricity4

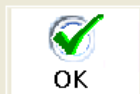
150mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4**
- Concentricity5
- Concentricity6
- Concentricity7
- Concentricity8



Show True Pos. Target Charts



Specification Limit	Average	Data Point In Tolerance	Data Point Out-of-Tolerance	Data Point off Chart Scale	Data Point Masked from Statistics
---------------------	---------	-------------------------	-----------------------------	----------------------------	-----------------------------------

Upper Spec : 0.25

Maximum : 0.6901

Cp : .197

Lower Spec : 0

Minimum : 0.15309

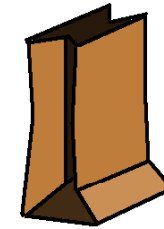
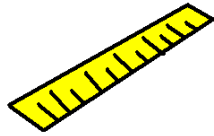
Cpk : -.328

Average : 0.458054

Range : 0.53701

Total Measurements: 10
Masked: 0

- 10: .31695
- 11: .15309
- 12: .67938
- 13: .58082
- 14: .69010
- 15: .53705
- 16: .23538
- 17: .68495
- 18: .20628
- 19: .49654



LUNCHEON LEARN

Statistical Analysis

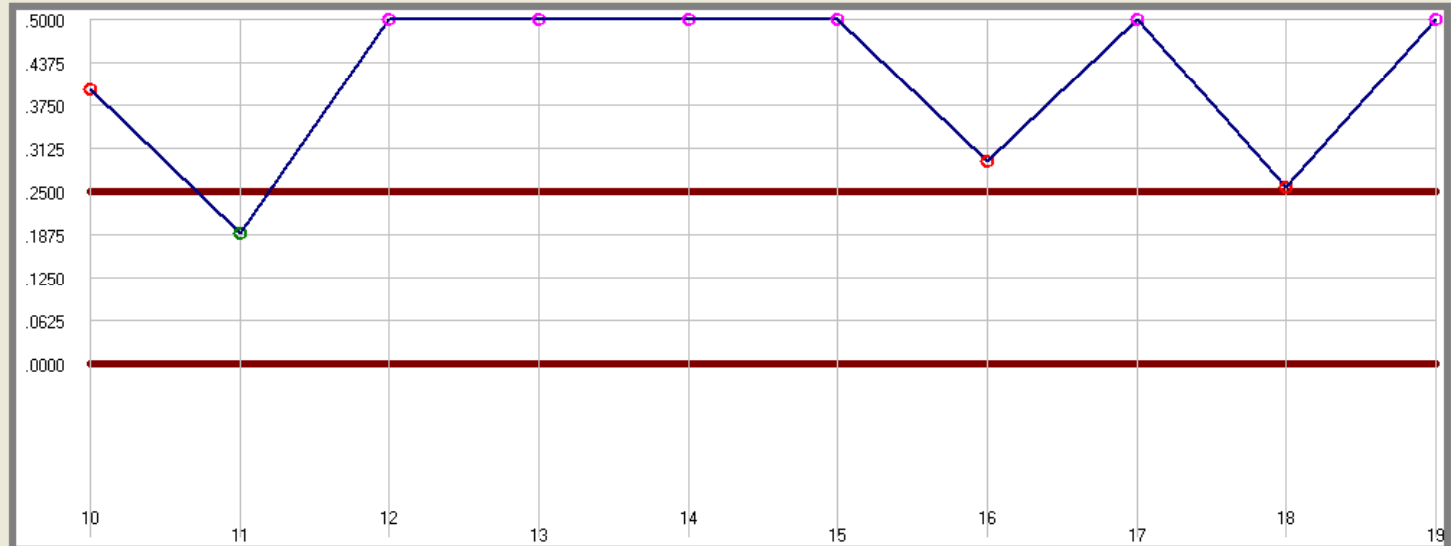


BASIC STATISTICAL ANALYSIS Concentricity5

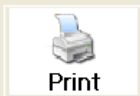
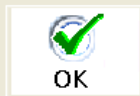
190mm from Datum A

RUN CHART

- Concentricity1
- Concentricity2
- Concentricity3
- Concentricity4
- Concentricity5**
- Concentricity6
- Concentricity7
- Concentricity8



Show True Pos. Target Charts



— Specification Limit
 - - - - - Average
 ● Data Point In Tolerance
 ● Data Point Out-of-Tolerance
 ● Data Point off Chart Scale
 ● Data Point Masked from Statistics

Upper Spec : 0.25

Lower Spec : 0

Average : 0.578671

Maximum : 0.87406

Minimum : 0.18899

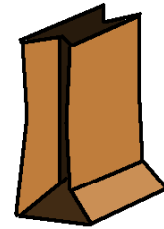
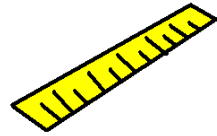
Range : 0.68507

Cp : .154

Cpk : -.406

Total Measurements: 10
Masked: 0

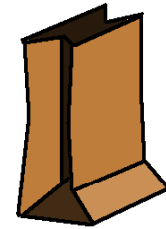
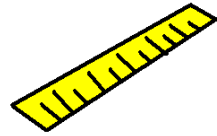
10: .39852
 11: .18899
 12: .86088
 13: .73502
 14: .87406
 15: .67905
 16: .29427
 17: .86764
 18: .25704
 19: .63124



LUNCHEON LEARN

WOW!

**A 3mm difference in Datum Length
had a HUUUGE difference in
results.**

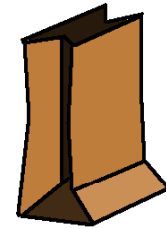
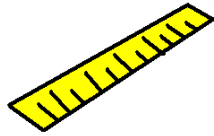


LUNCHEON LEARN

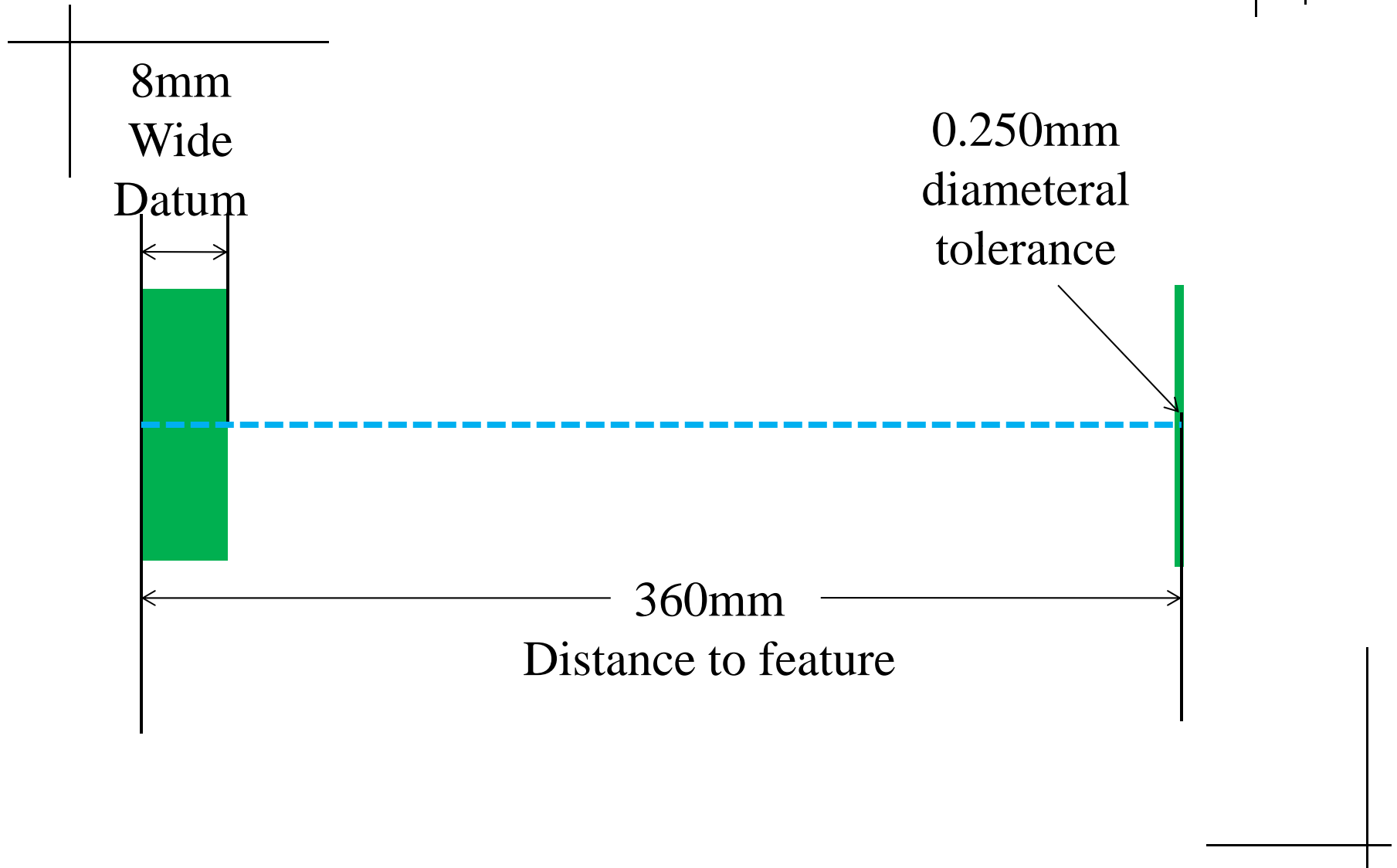
So, we have two problems here:

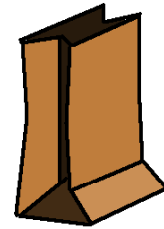
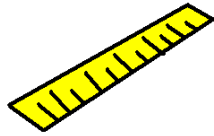
- **Feature located a long way from Datum**
- **Short, Unstable Datum**

Let's think about what we
are trying to do...

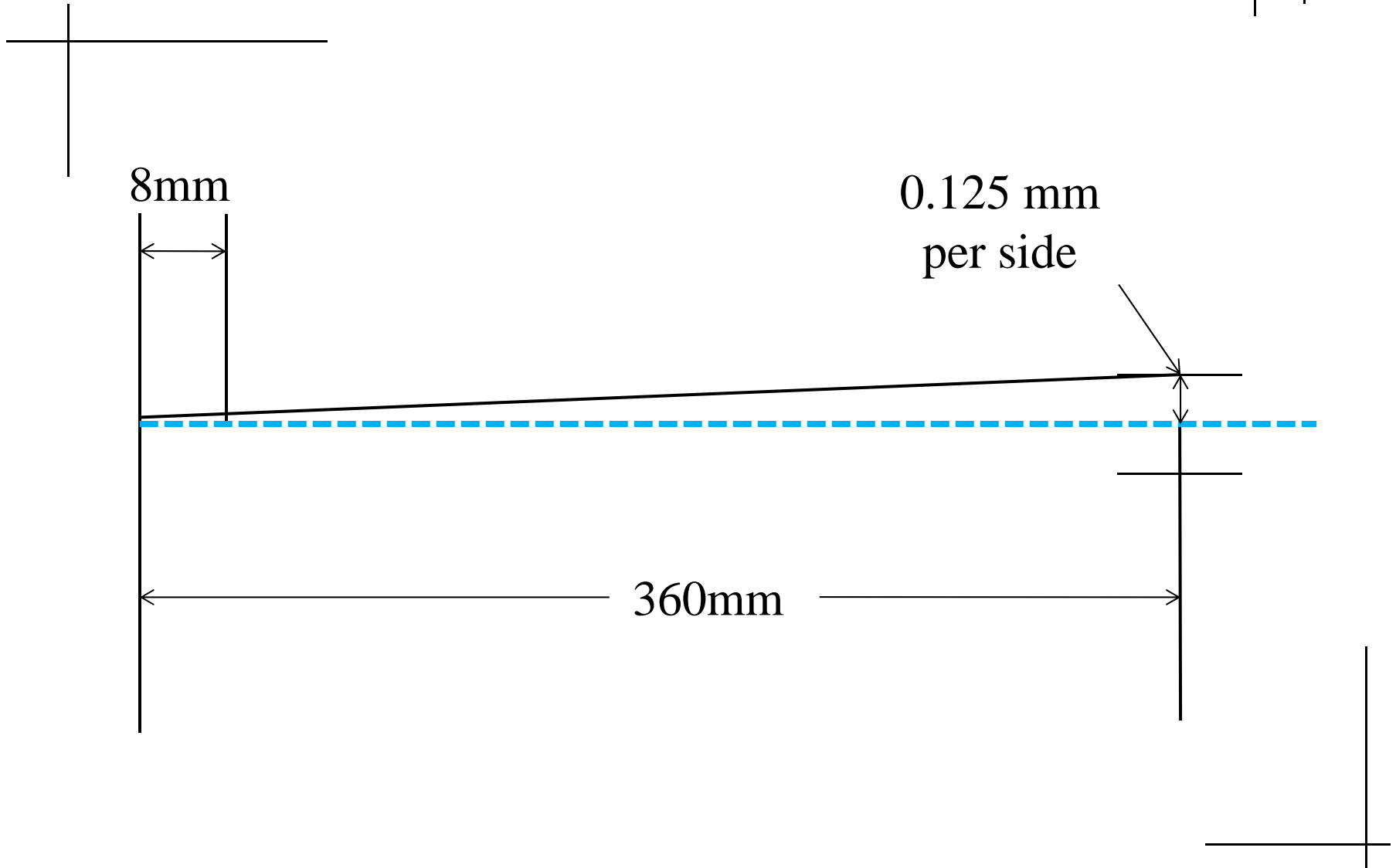


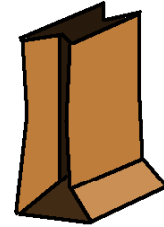
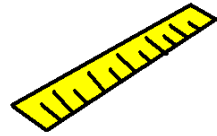
LUNCHEON LEARN





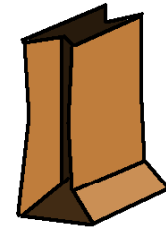
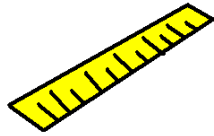
LUNCHEON LEARN



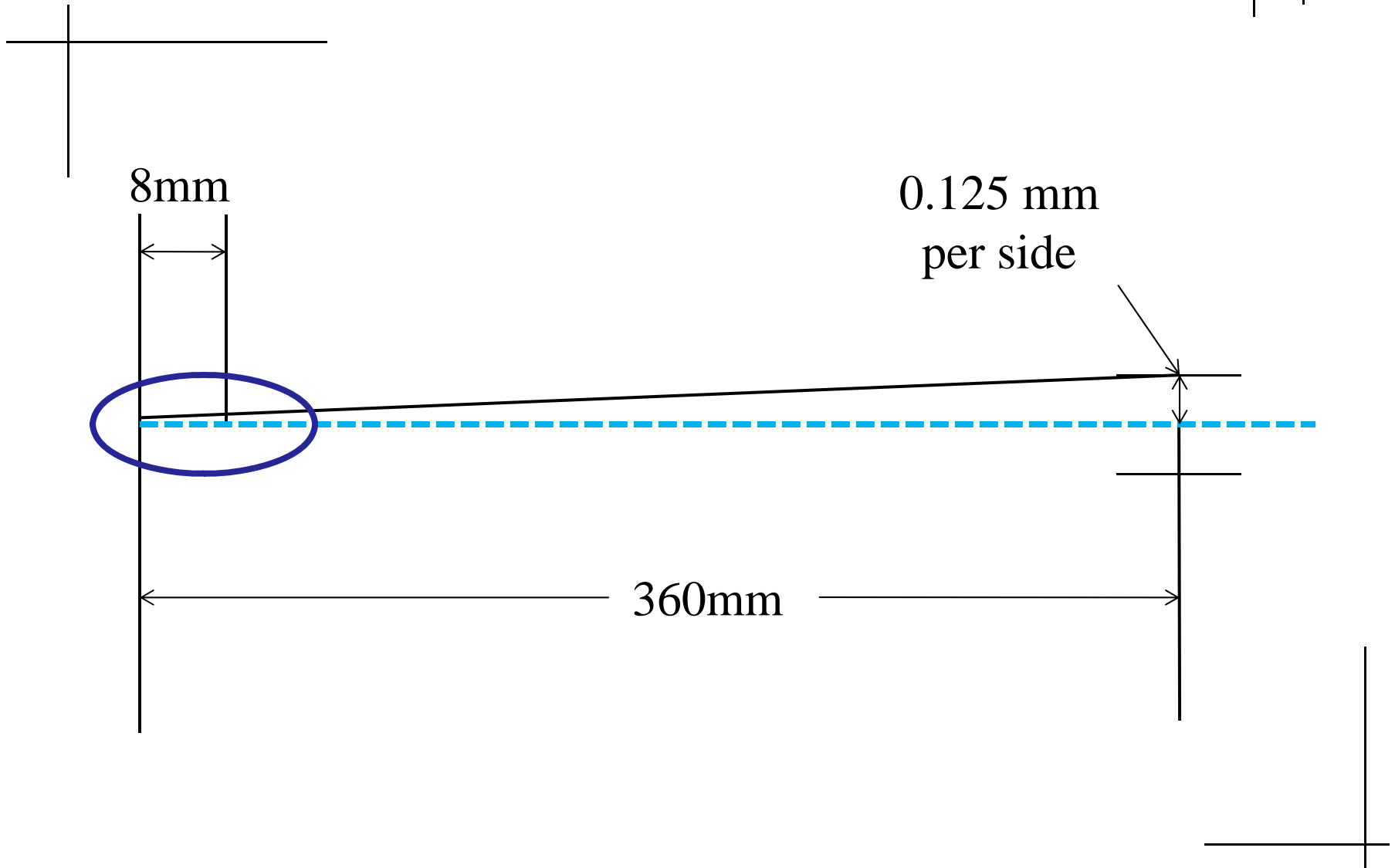


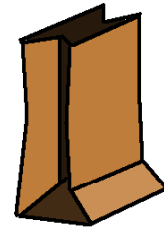
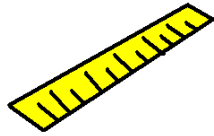
LUNCHEON LEARN

**Assuming we hold the feature
left side of the datum and the
feature still, what tolerance is on
the right side of the datum?**

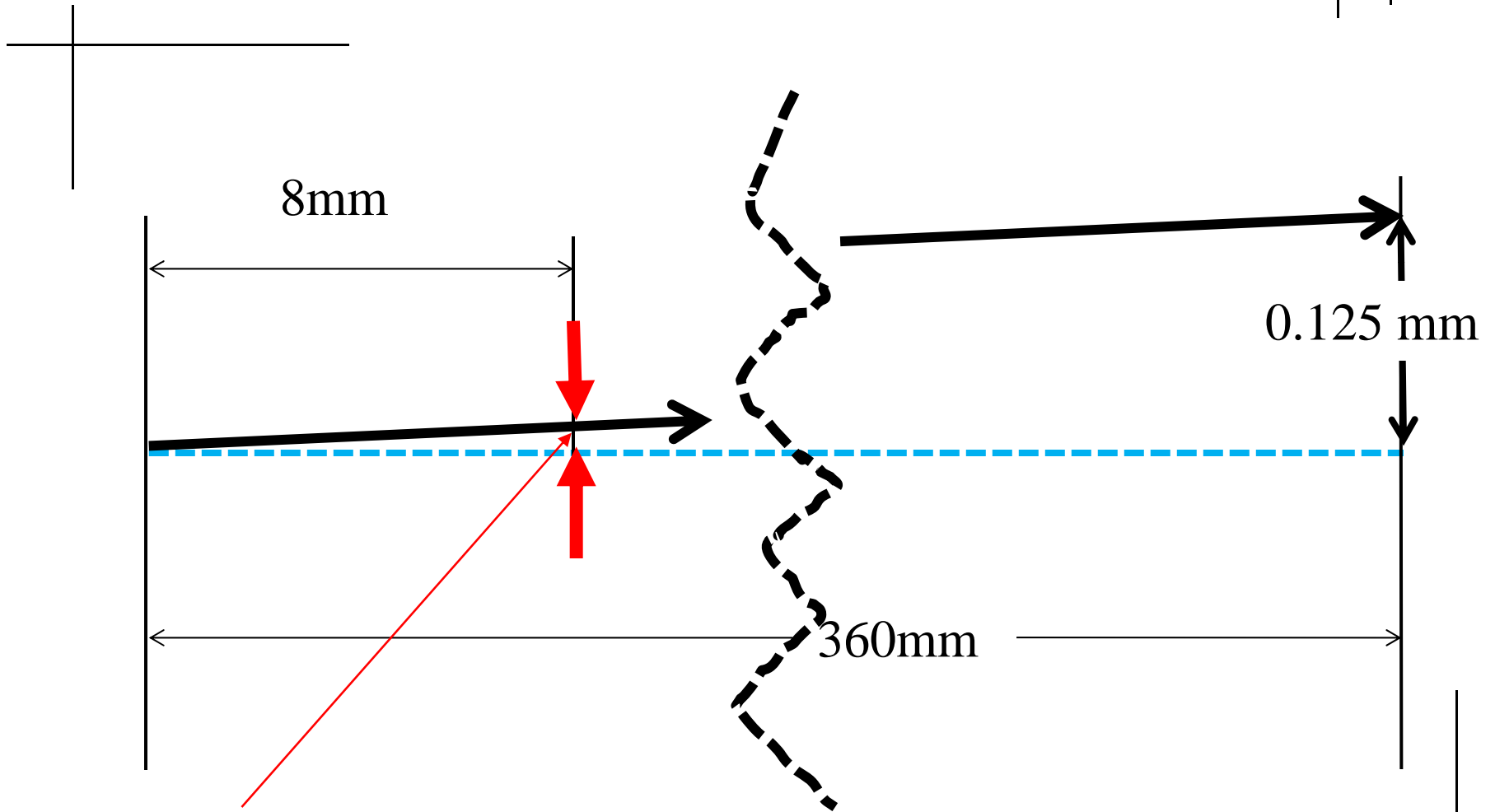


LUNCHEON LEARN

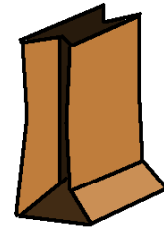
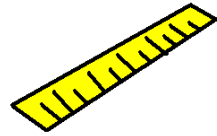




LUNCHEON LEARN



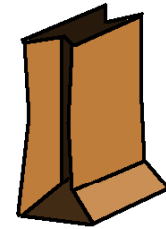
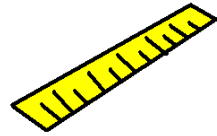
$$0.125/360 * 8 = 0.0028 \text{ mm!}$$



LUNCHEON LEARN

**So, in this case, a tolerance of
250 microns is REALLY a
tolerance of 2.8 microns.**

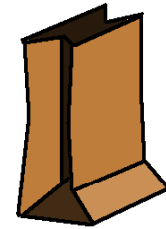
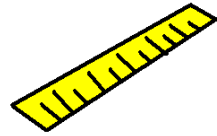
**YIKES! No wonder we are
having problems!**



LUNCHEON LEARN

**Time to go buy a
UPMC ultra with
an accuracy spec
of 0.4 microns!**



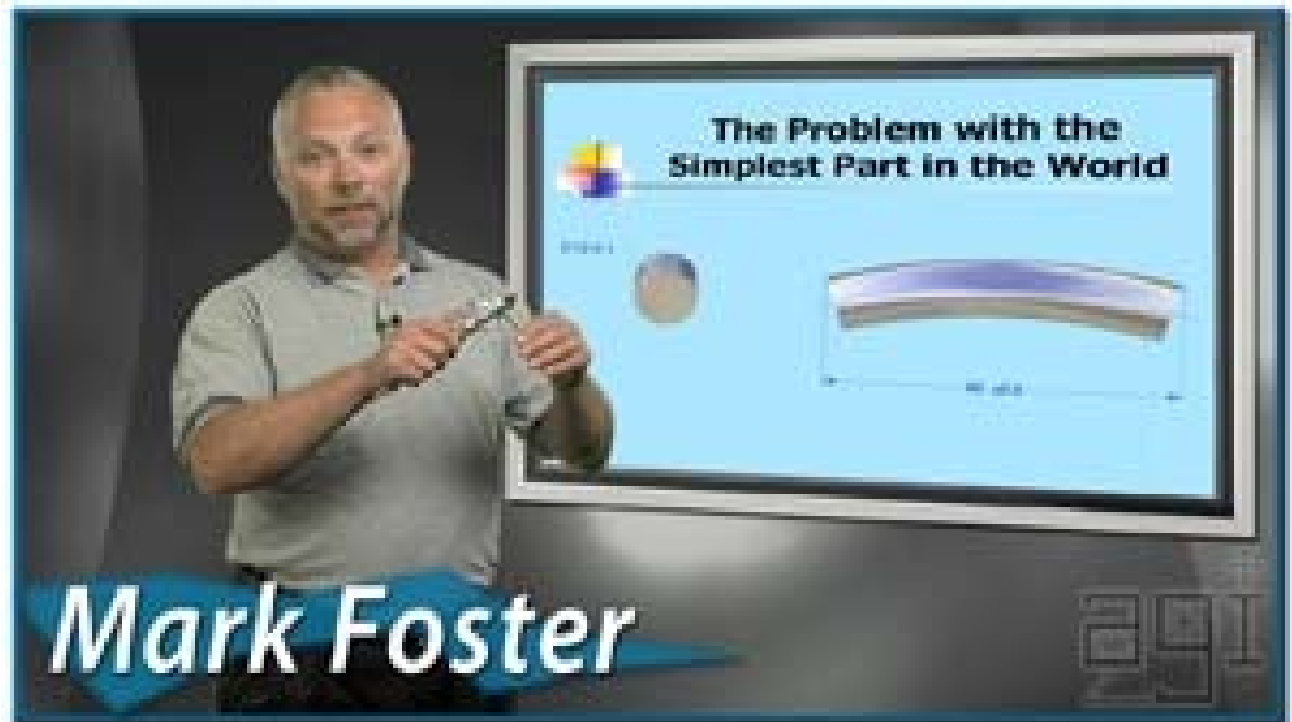


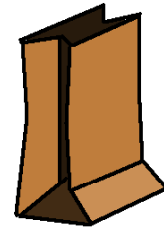
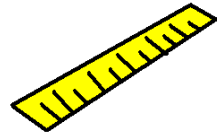
LUNCHEON LEARN

I can't buy a UPMC ultra right now...

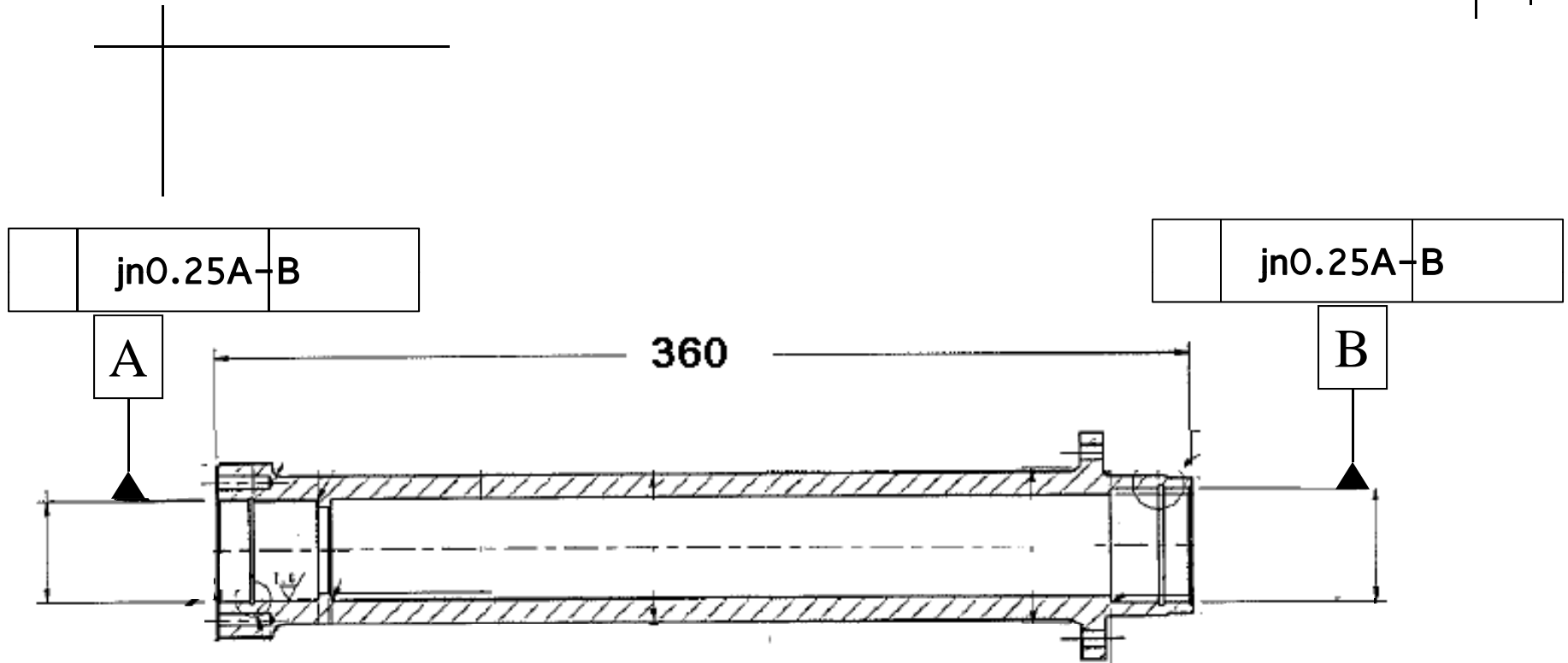
So I ask myself "WWMFD"?

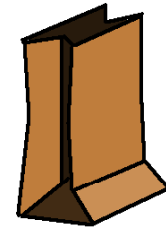
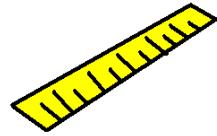
**What
Would
Mark
Foster
Do?**





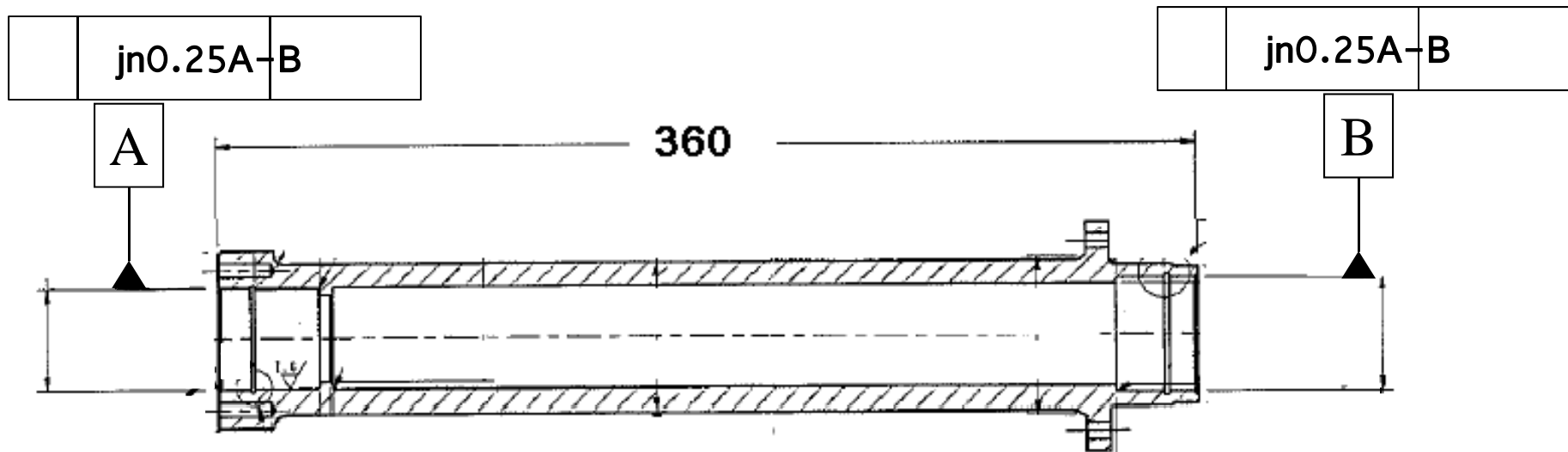
LUNCHEON LEARN

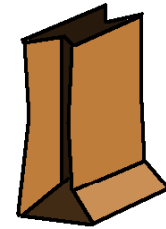
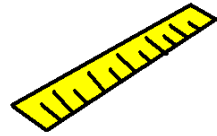




LUNCHEON LEARN

That makes sense! Functionally, -A- does not 100% control how a shaft fits through there!

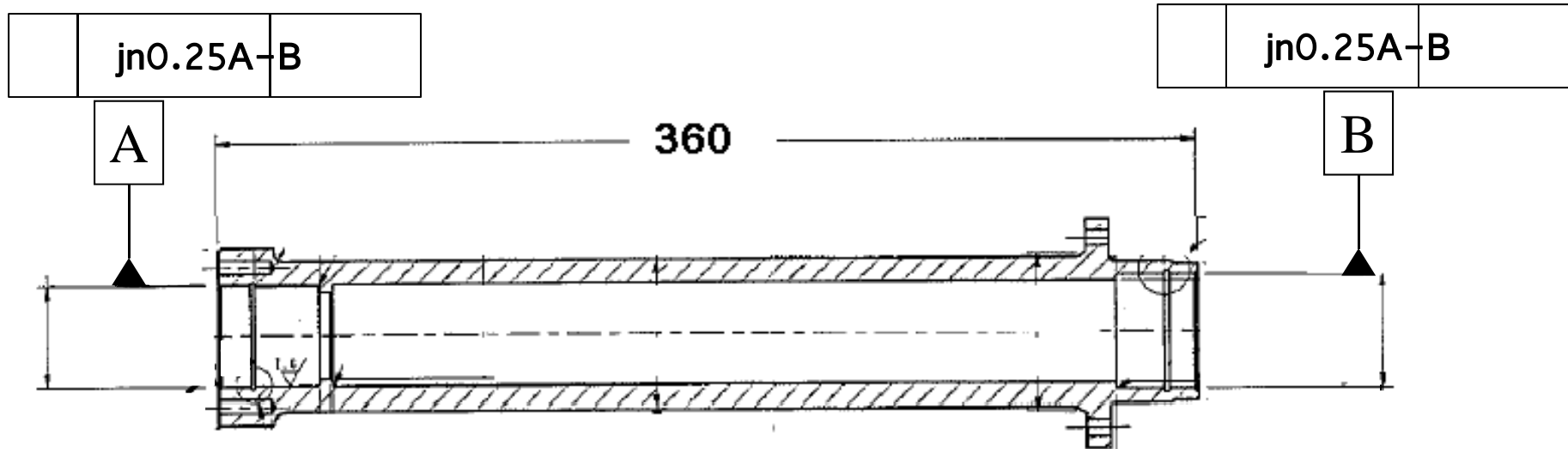


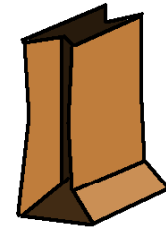
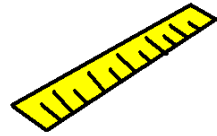


LUNCHEON LEARN

-A- and -B- equally control things.

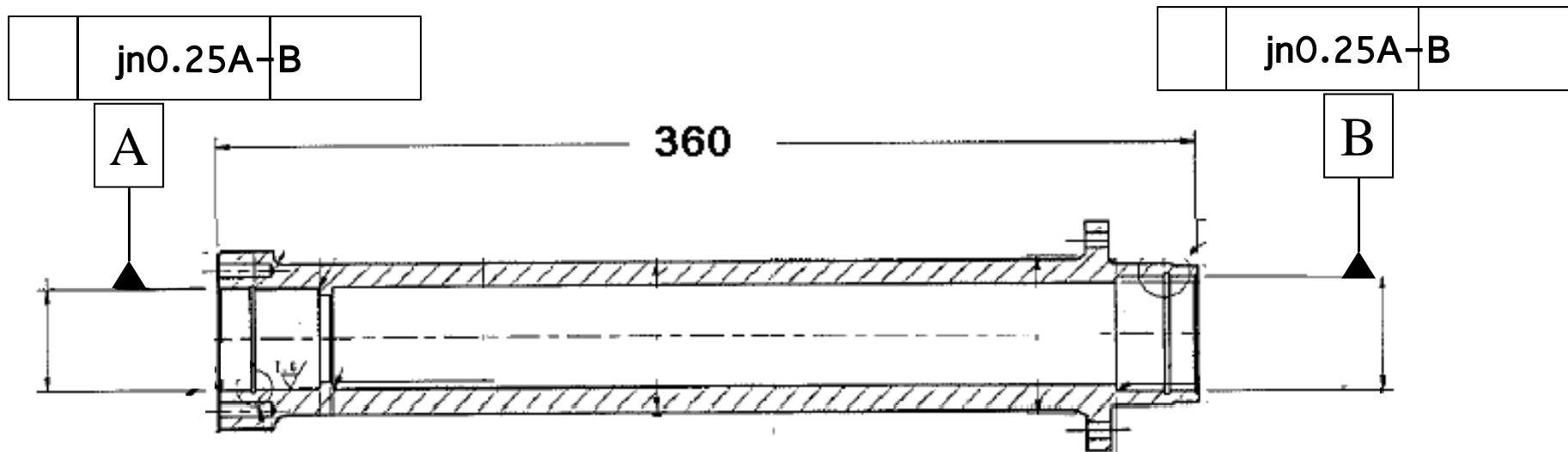
An axis created through -A- and -B- is now Datum A-B.

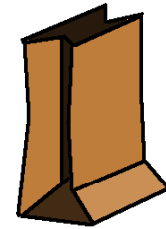
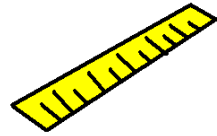




LUNCHEON LEARN

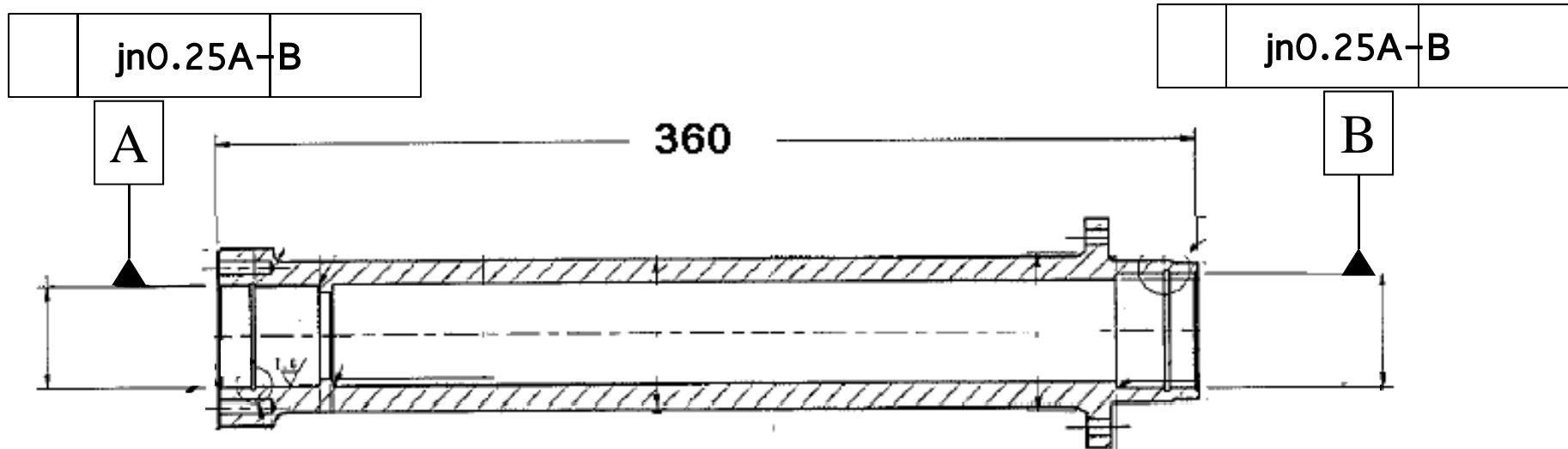
We are trying to make sure –A- and –B- are positioned the same way on the same axis so nothing gets bound up.

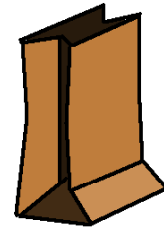
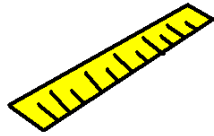




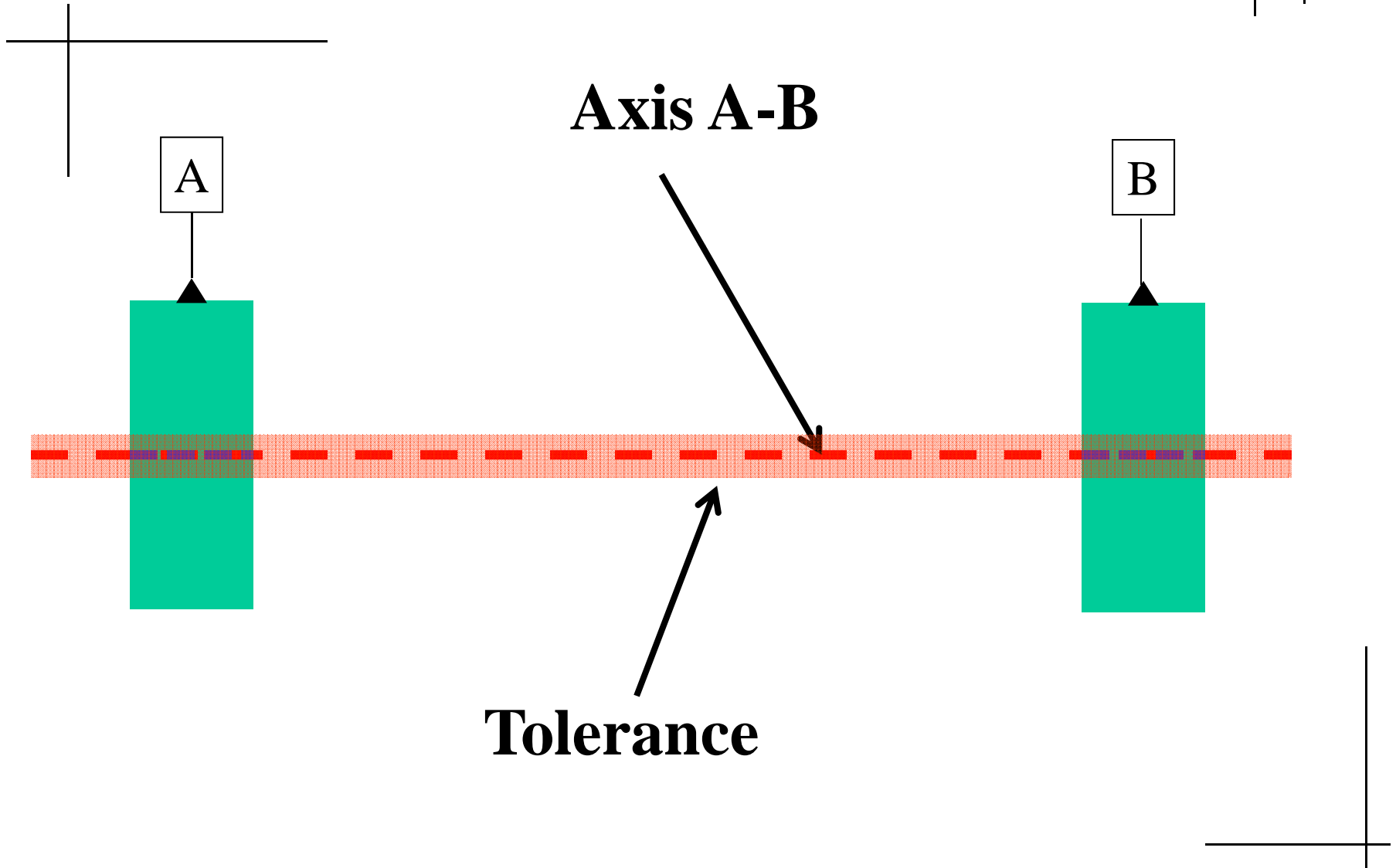
LUNCHEON LEARN

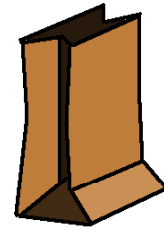
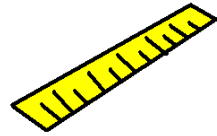
The individual axes of the cylinders of A and B need to be within a cylindrical zone centered on A-B.



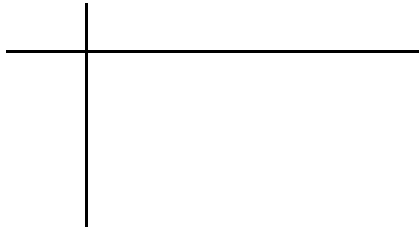


LUNCHEON LEARN

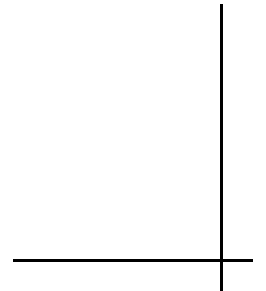
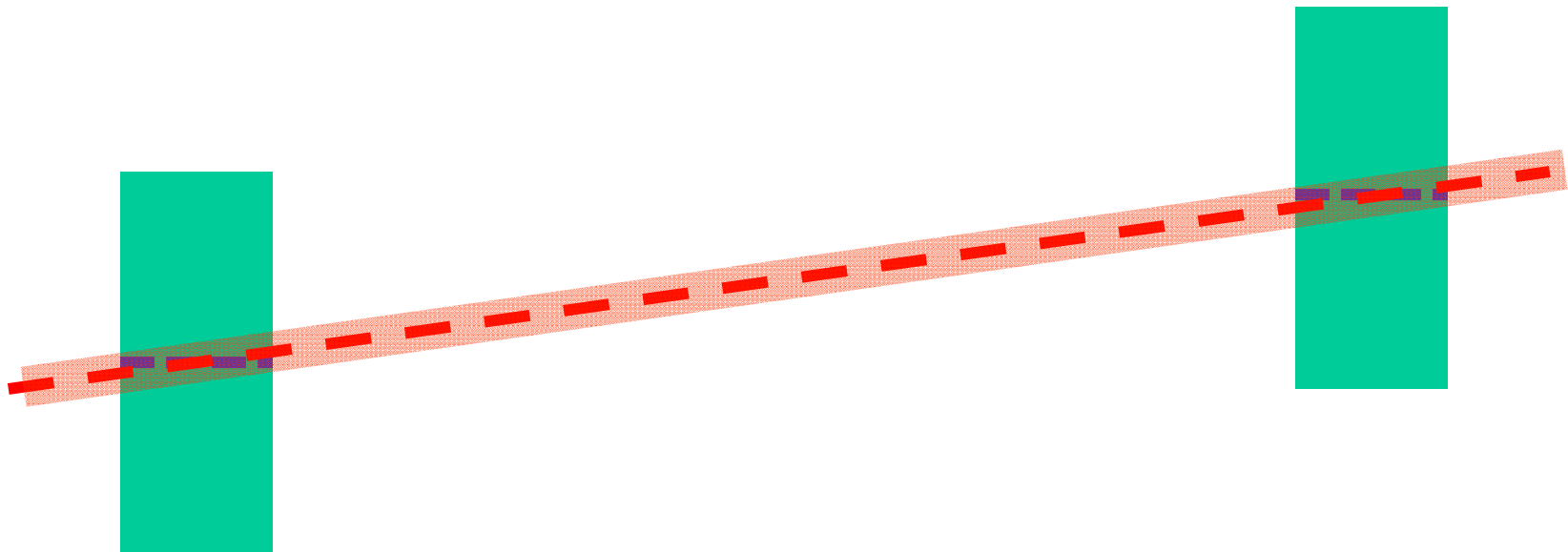
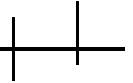


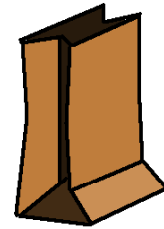
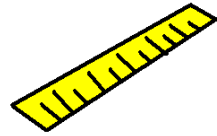


LUNCHEON LEARN



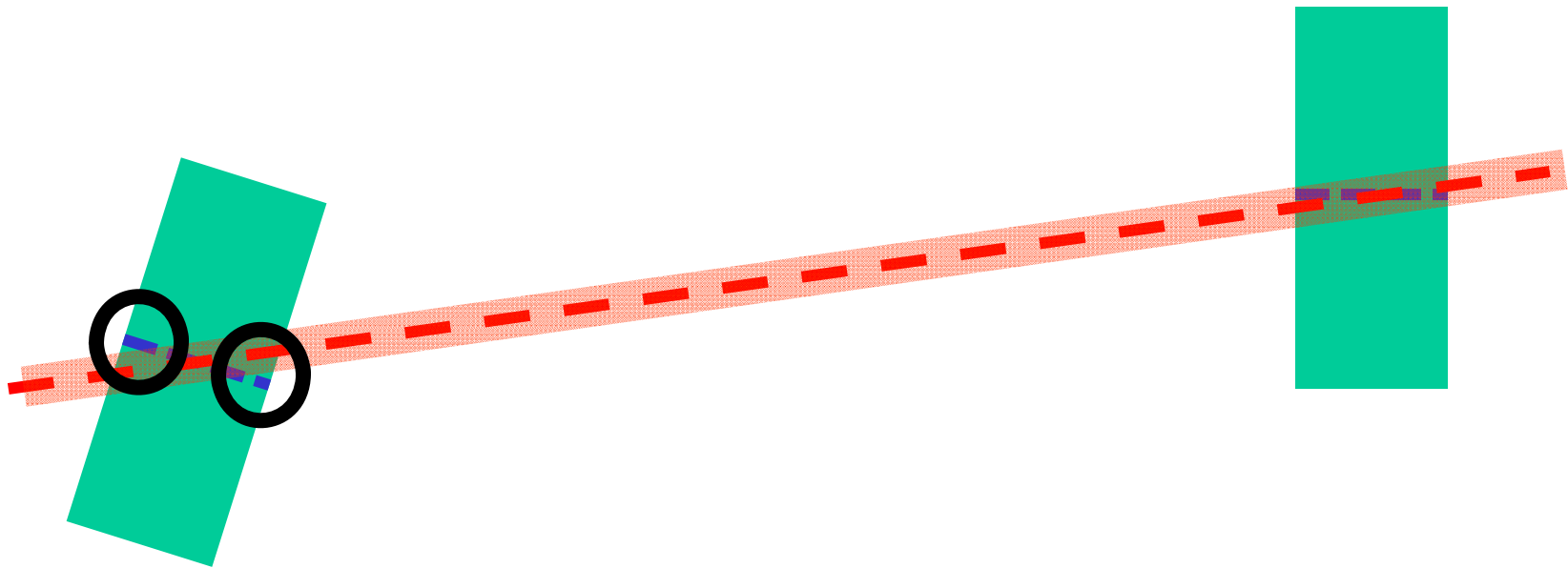
OK

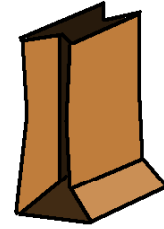
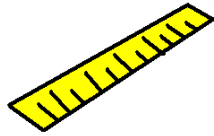




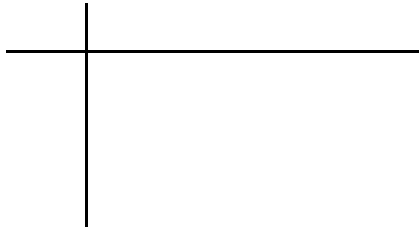
LUNCHEON LEARN

NOT OK

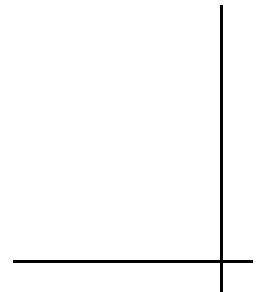
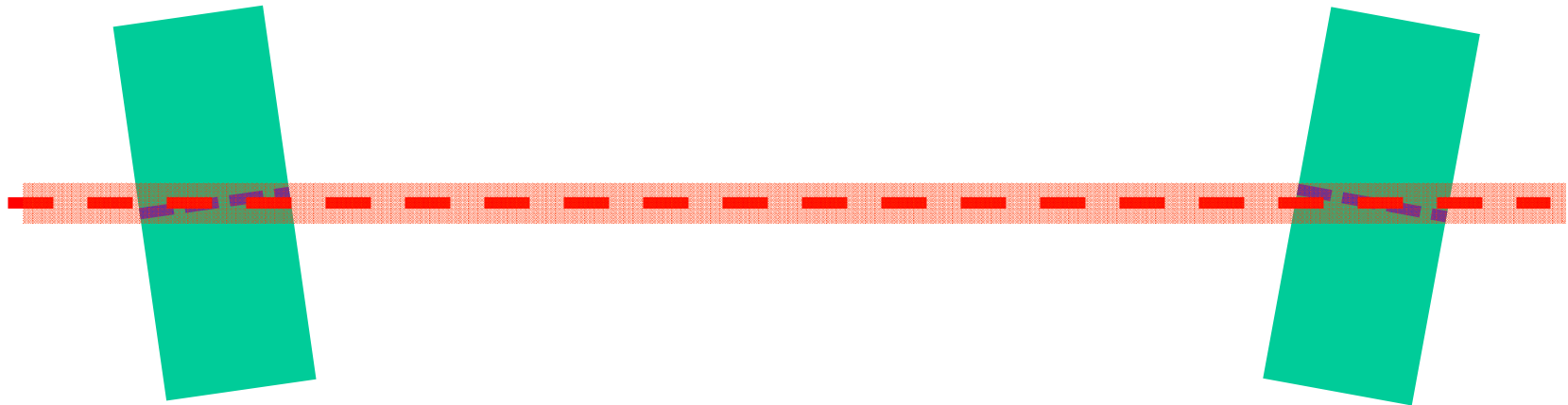
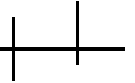


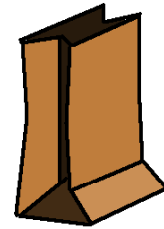
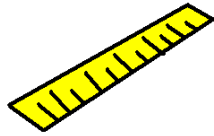


LUNCHEON LEARN



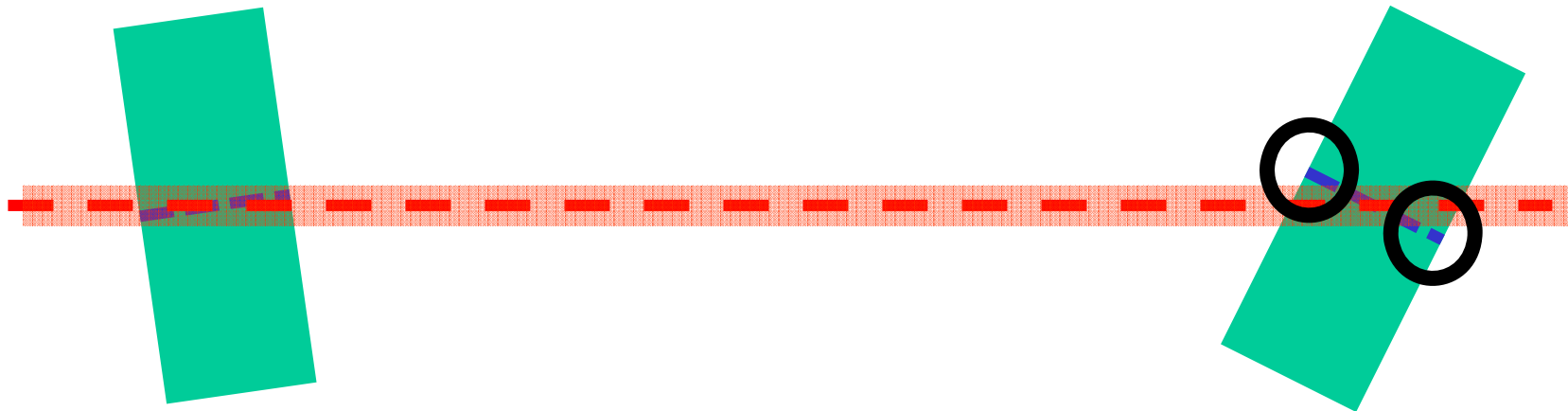
OK

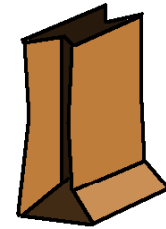
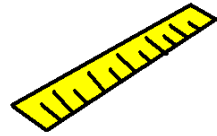




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NOT OK

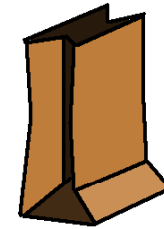
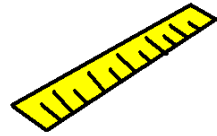




LUNCHEON LEARN

Let's do this in Calypso.

**Fortunately, this is MUCH
easier than trying to figure
out "REAL" Concentricity!!!!**



LUNCHEON LEARN

Calypso User Desk - (C) Carl Zeiss - Stepped Cyl

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window ?

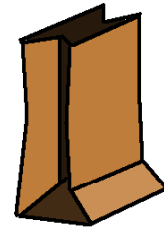
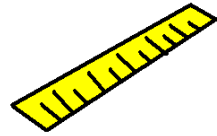
Basic Status: Select function or probe for surface measurement with single points

Cylinder1
Cylinder2
3-D Line1[Cylinder1,Cylinder2]

X = 2.5500
Y = 0.1044
Z = -0.0044

Cylinder1
Cylinder2

7 mm

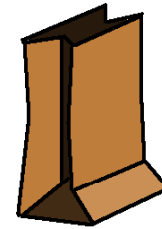
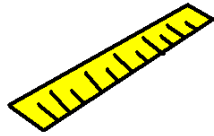


LUNCHEON LEARN

NOTE:

Using a 3-D line with RECALL creates a line between the CENTERS of the two cylinders selected.

Make sure LSQ is selected in the feature window for each cylinder.



LUNCHEON LEARN

Calypso User Desk - (C) Carl Zeiss - Stepped Cyl

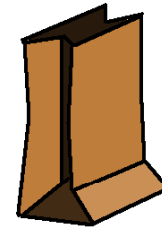
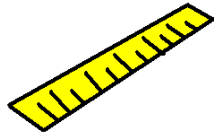
File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window 2

Basic Status: Select function or probe for surface measurement with single points

- True Position1
- True Position2
- Coaxiality1**

7 mm

Fit



LUNCHEON LEARN

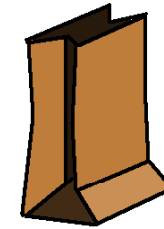
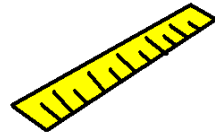
Calypso User Desk - (C) Carl Zeiss - Stepped Cyl

File Edit View Resources Features Construction Size Form and Location Plan CAD Extras Planner Window ?

Basic Status: Select function or probe for surface measurement with single points

- True Position1
- True Position2
- Coaxiality1
- True Position3

7 mm



LUNCHEON LEARN

WOW!

That's a big difference.

Maybe our part isn't as bad as I thought after all!

Calypso Custom Printout Stepped Cyl 1

Printout Display

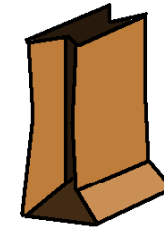
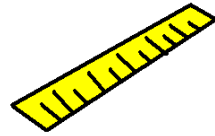
ZEISS Calypso

Measurement Plan: Stepped Cyl Date: September 9, 2011

Drawing No. *drawingno* Time: 11:35:50 am Order * order *

Operator: Master CMM: Simulation Incremental Part Number: 1

	Actual	Nominal	Upper Tol.	Lower Tol.	Deviation
Overall Result					
All Characteristics:		4			
Out of tolerance:		2			
Over Warning Limit:		0			
Not Calculated:		0			
True Position1	0.0065	0.0000	0.2500		0.0065
True Position2	0.0298	0.0000	0.2500		0.0298
Coaxiality1	0.9661	0.0000	0.2500		0.7161 0.9661
True Position3	0.9661	0.0000	0.2500		0.7161 0.9661



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Coaxiality is the same as True Position of a Cylinder when the Feature Nominals are zeroed on the datum.

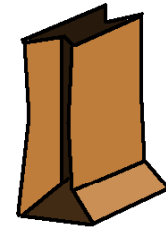
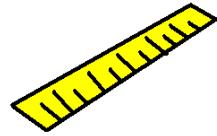
Calypso Custom Printout Stepped Cyl 1

Printout Display

ZEISS Calypso

Measurement Plan: Stepped Cyl
Date: September 9, 2011
Drawing No. *drawingno*
Time: 11:35:50 am
Operator: Master
CMM: Simulation
Order * order *
Incremental Part Number: 1

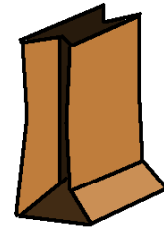
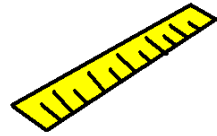
	Actual	Nominal	Upper Tol.	Lower Tol.	Deviation
Overall Result					
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Coaxiality1	0.9661	0.0000	0.2500		0.7161 0.9661
True Position3	0.9661	0.0000	0.2500		0.7161 0.9661



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We suggest reporting both results and document WHY you did what you did:

- 1) You reported “concentricity/coaxiality” as the print states, however that was probably not the design intent.**
 - 2) You reported Position to A to A-B and B to A-B because functionally, that is what the part really “sees” and you presume that was the design intent.**
-



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Concentricity

More than you ever wanted to know

Questions?