

Univerzitet u Novom Sadu
Fakultet tehničkih nauka

Predmet: 3D digitalizacija objekata

CAD INSPEKCIJA

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CAD-inspekcija – uvodne napomene

Razvoj i primena CAD-modela u inženjerskim oblastima implicirala je razvoj metoda za iskorišćavanjem najpre određenih parametara, a zatim i ukupnih CAD modela za potrebe kontrole, tj. verifikacije i inspekcije.

- Preduslov za dobar inženjerski proces jeste sprovođenje kontrole/verifikacije tokom njegove realizacije.
- Jedan od savremenih pristupa kontrole je **računarom podržana inspekcija (eng. computer-aided inspection CAI)**.
- **CAI podrazumeva komparaciju (poređenje) oblaka tačaka u odnosu na CAD model.**

CAD-inspekcija – uvodne napomene

- Specifičan oblik CAI je CAD-inspekcija.
- Rezultat ovakve analize se dobija u nekoliko oblika - od numeričkih podataka, do grafičkih u vidu mapa u boji (ili kolor mapa) kod koje svaka boja predstavlja određeni nivo odstupanja.
- Ova metoda je danas prihvaćena kao brz, efikasan i kredibilan način provere kvaliteta izrade delova različitim tehnologijama (3D štampa, rezanje, plastično deformisanje, oblikovanje plastike itd.)

CAD-inspekcija – definicije i terminologija

CAD-inspekcija podrazumeva korišćenje *CAD*-modela proizvoda, odnosno njegovih parametara, sa ciljem provere geometrijskih i dimenzionalnih odstupanja izrađenog dela ili virtuelnog modela (kreiranog na bazi rezultata 3D digitalizacije).

CAD-inspekcija je, prateći razvoj *CAD* modeliranja, najpre bila zasnovana na 2D podacima, da bi se zatim sa pojavom solid modela razvila i 3D *CAD*-inspekcija, danas poznata i pod nazivom “*CAD-to-part*” inspekcija, koja podrazumeva proveru odstupanja geometrije realnog proizvoda (na bazi njegovog digitalizovanog modela) od nominalne geometrije, definisane *CAD* modelom.

CAD-inspekcija – definicije i terminologija

Termini-sinonimi koji se upotrebljavaju za opis ovog procesa, sa manjim ili većim modifikacijama procesa su:

- Brza 3D inspekcija (eng. Rapid 3D Inspection)
- Računarom podržana verifikacija (eng. computer-aided verification CAV)
- 3D color comparison-to-CAD
- i dr.

Zahvaljujući zasnovanosti na CAD-modelu, ova vrsta inspekcije je najpoznatija pod nazivom ***CAD-inspekcija***.

CAD-inspekcija - metodologija

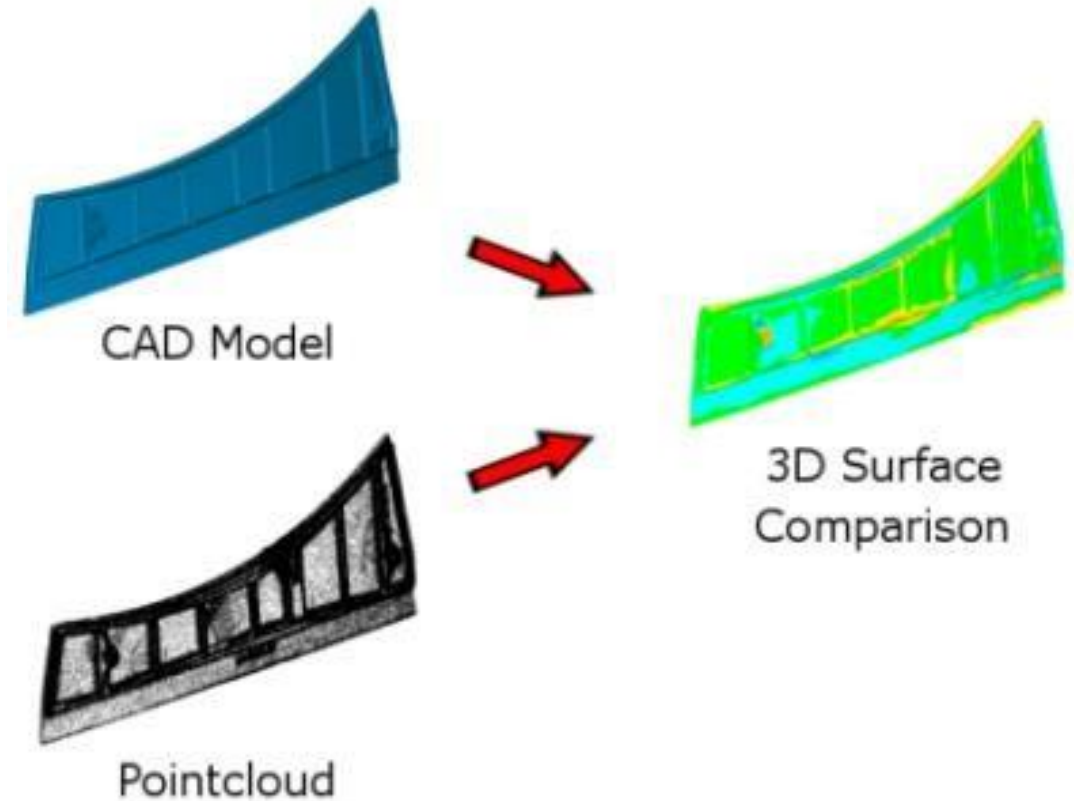
Dva osnovna segmenta *CAD*-inspekcije su:

- **3D-digitalizacija** (dominantno hardverski proces) i
- **provera odstupanja** (dominantno softverski proces).

CAD-inspekcija - metodologija

CAD inspekcija predstavlja metodu koja poredi geometriju proizvedenog dela (rezultat 3D digitalizacije) u odnosu na referentnu geometriju (originalni CAD model) i podrazumeva sledeće korake:

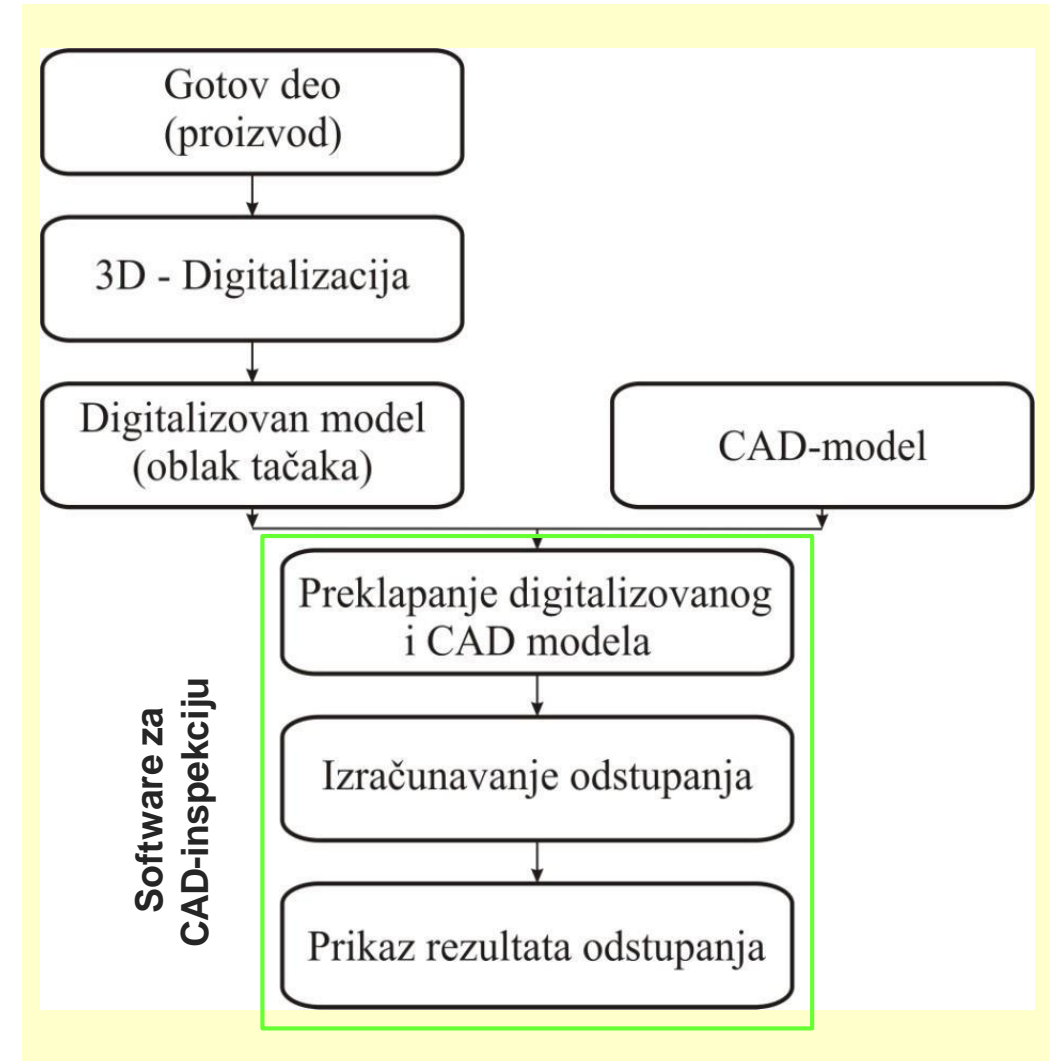
1. 3D digitalizaciju
2. Generisanje površinskog modela – opciono
3. Komparaciju sa referentnim CAD modelom



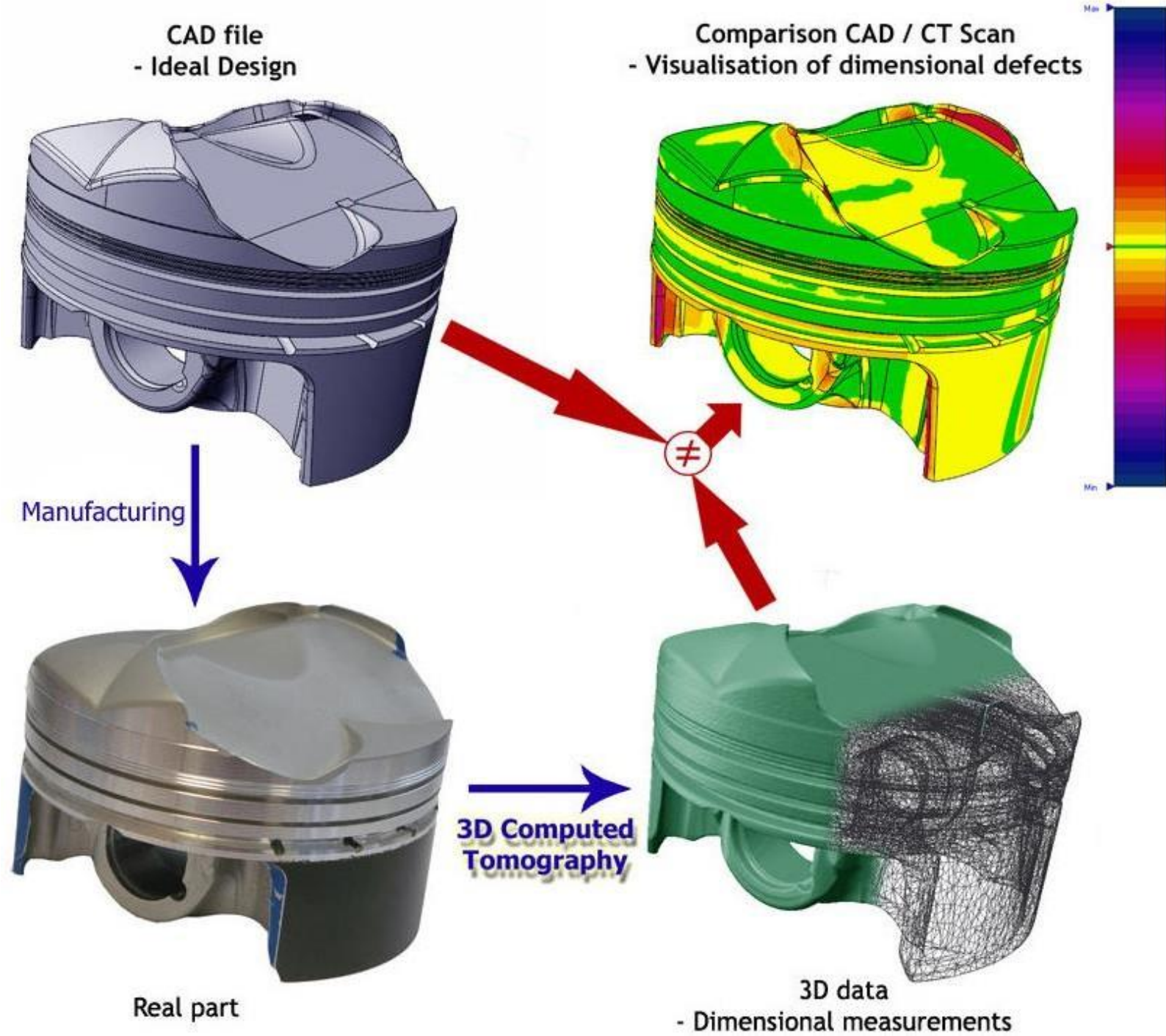
CAD-inspekcija - metodologija

Procedura provere odstupanja

- izrađen deo se digitalizuje nekom od metoda 3D-digitalizacije;
- 3D digitalizovani model (*oblak tačaka*) unosi se u neki od specijalizovanih softvera za CAD-inspekciju, zajedno sa referentnim CAD-modelom;
- sledi orijentisanje digitalizovanog modela prema CAD-modelu u cilju njihovog međusobnog preklapanja;
- potom se vrši izračunavanje nivoa odstupanja digitalizovanog modela od CAD-modela;
- prikaz rezultata odstupanja (mogu se dobiti i u grafičkom obliku radi lakše preglednosti).

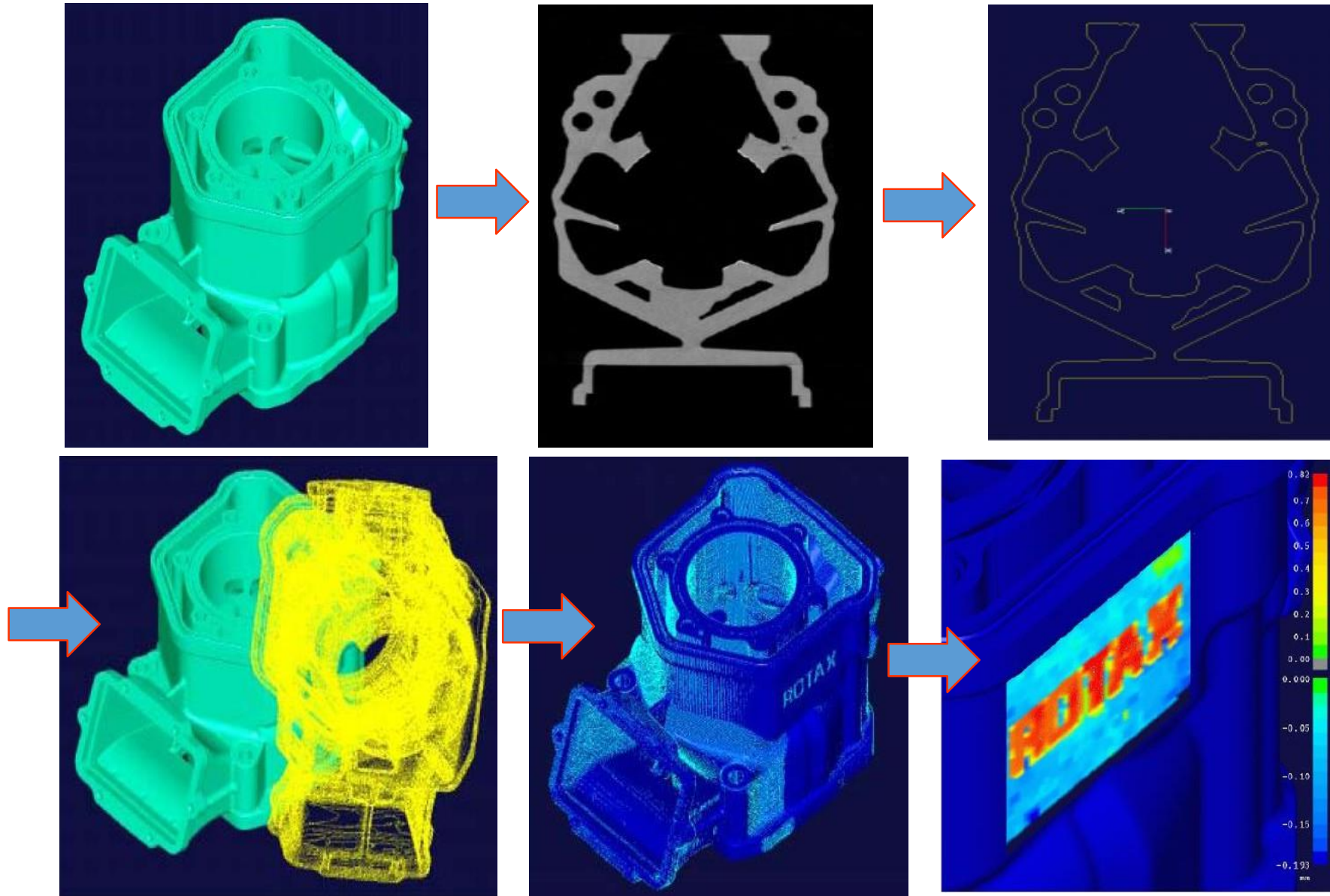


Algoritamski prikaz toka procesa



CAD-inspekcija - metodologija

Procedura provere odstupanja - primer



Primeri primene:



Qualify Report

Title: Injector Plate Inspection Report

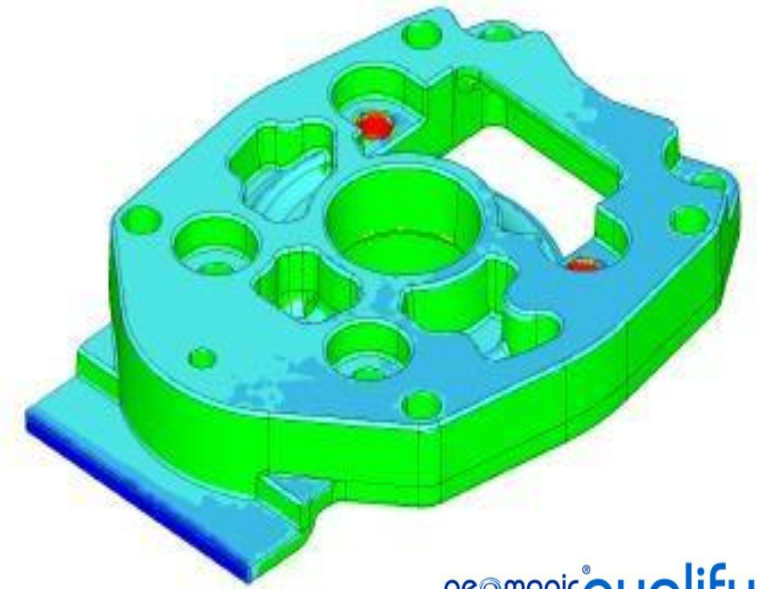
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Client: ACME Manufacturing

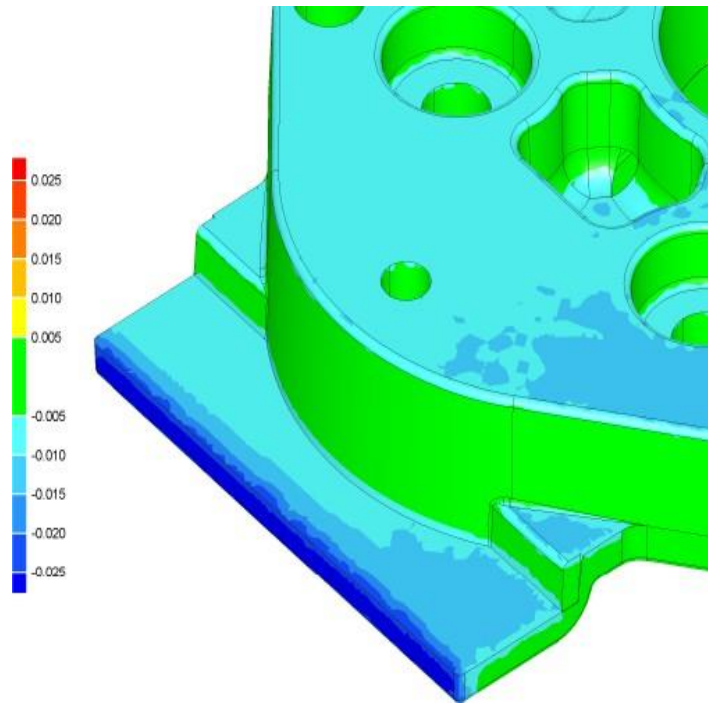
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Test: Injector_plate-SCAN

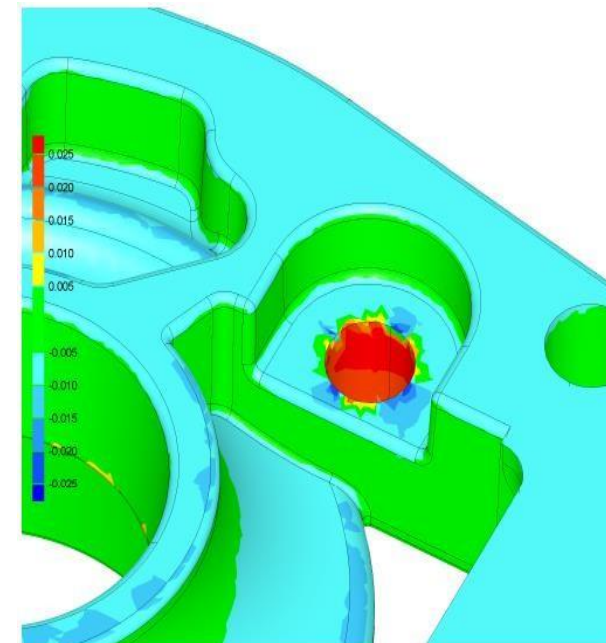
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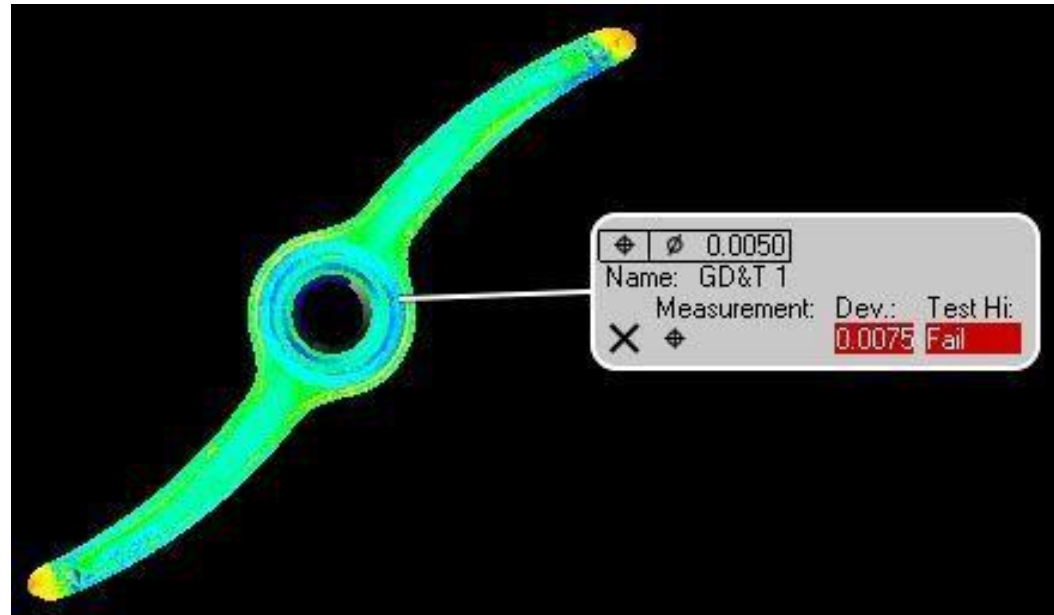
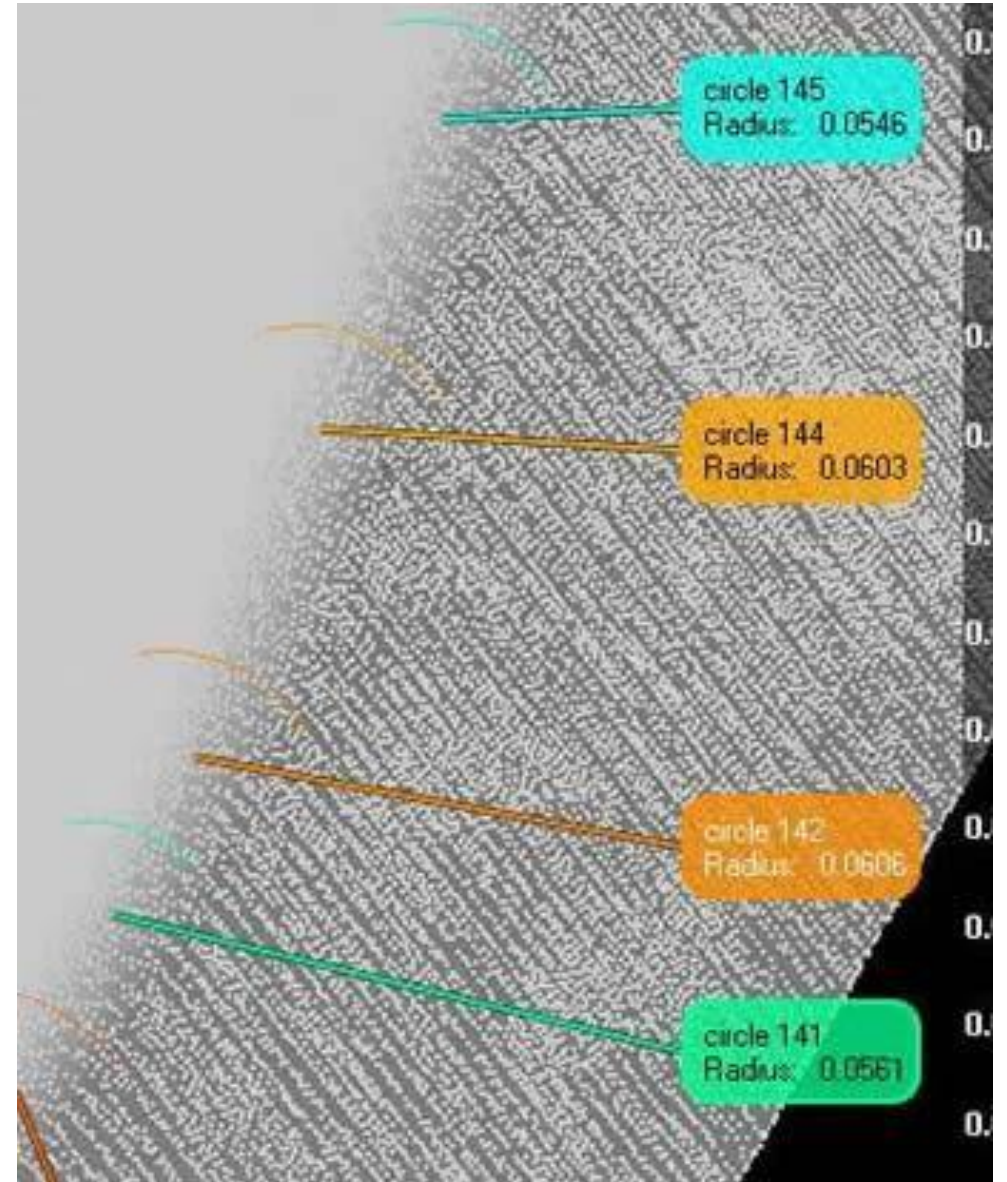
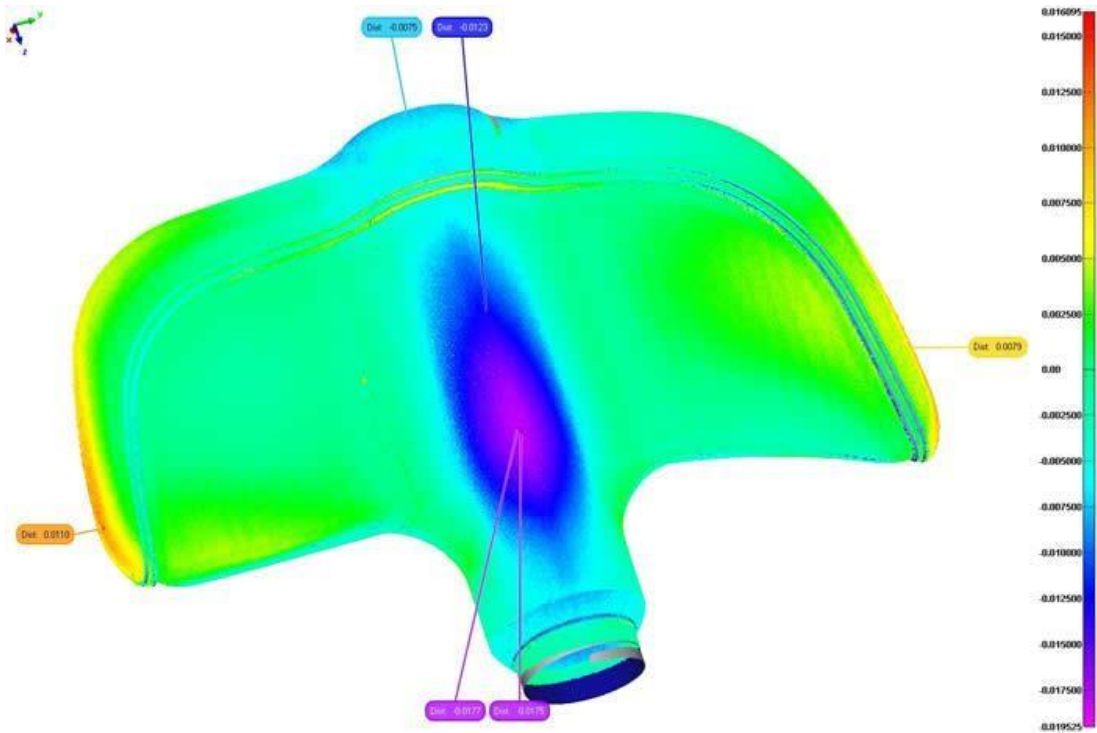


geomagic[®]qualify

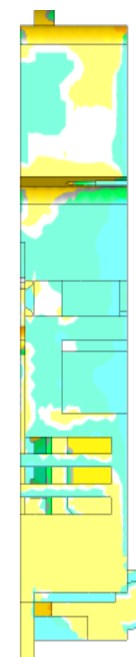
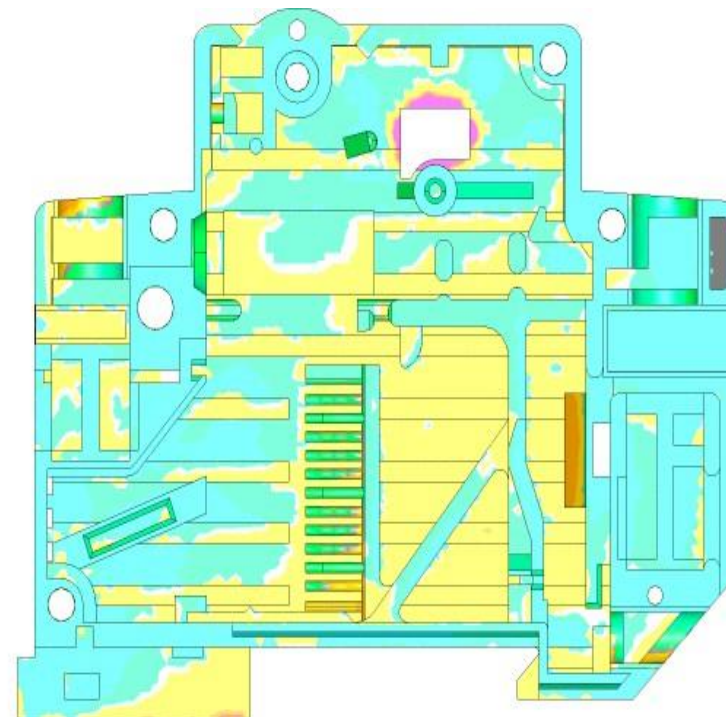
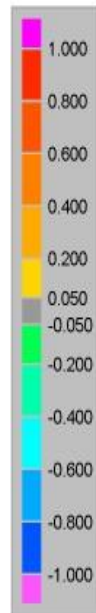
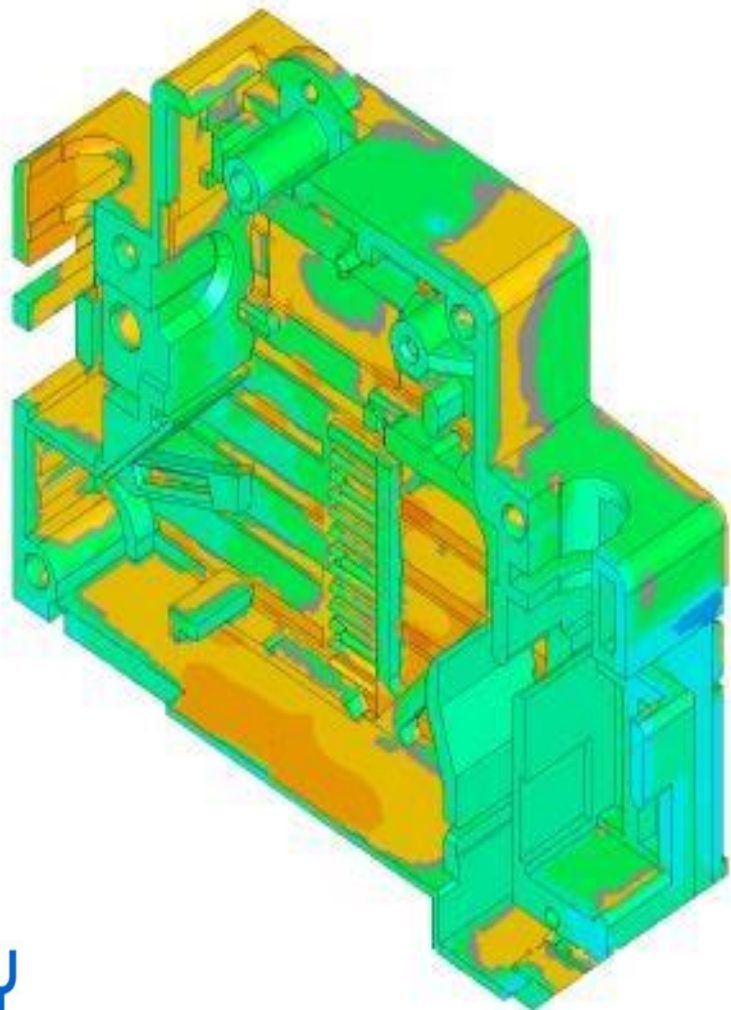
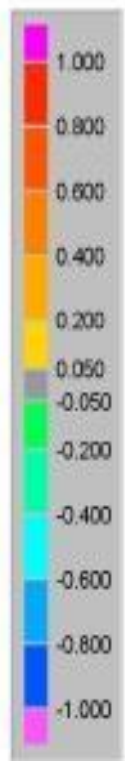


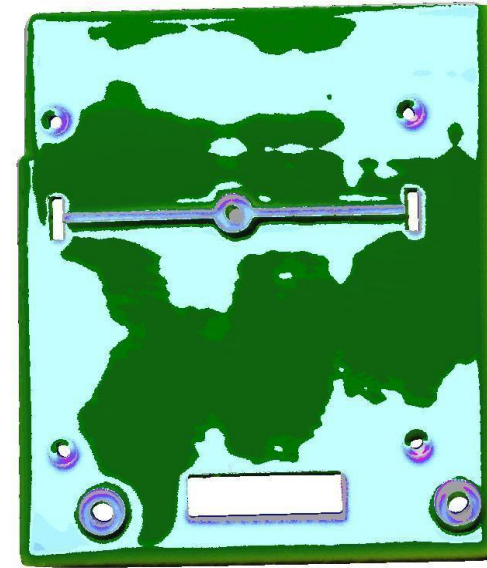
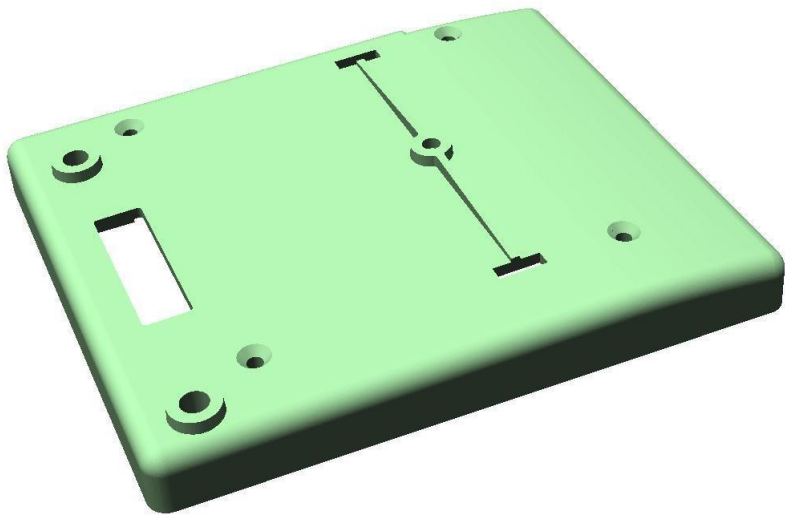
CAD-INSPEKCIJA
kod obrade rezanjem



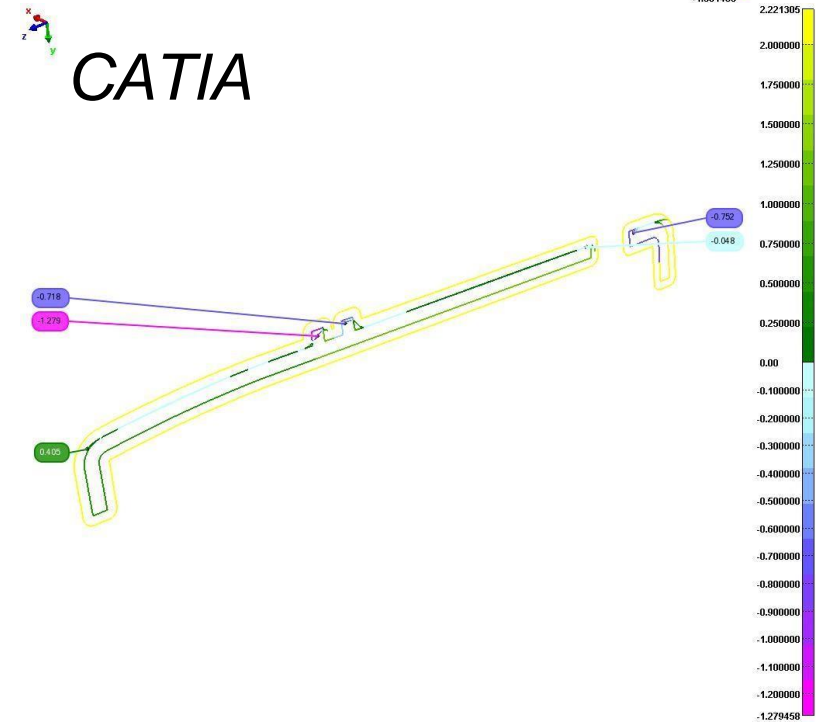


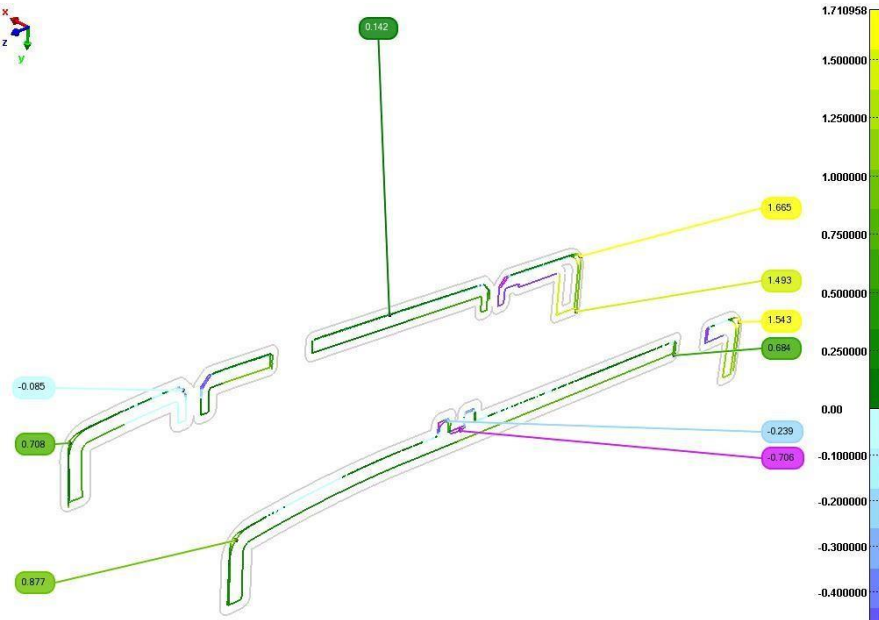
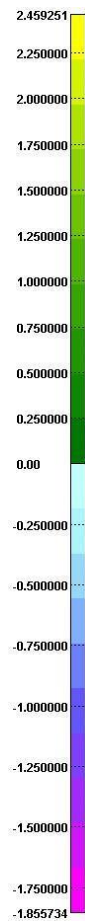
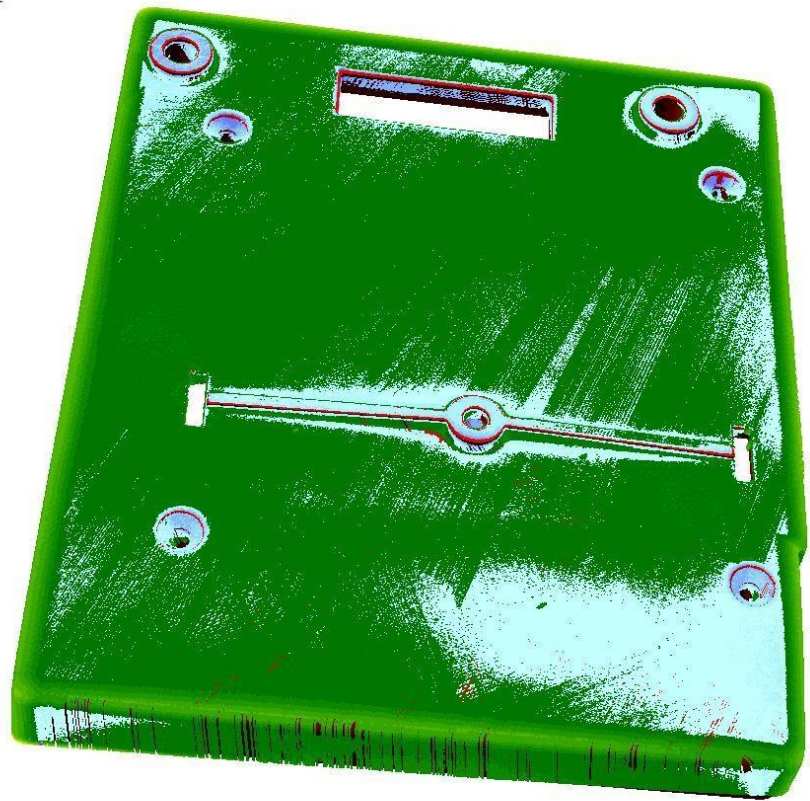
CAD-INSPEKCIJA dela brizganog od plastike



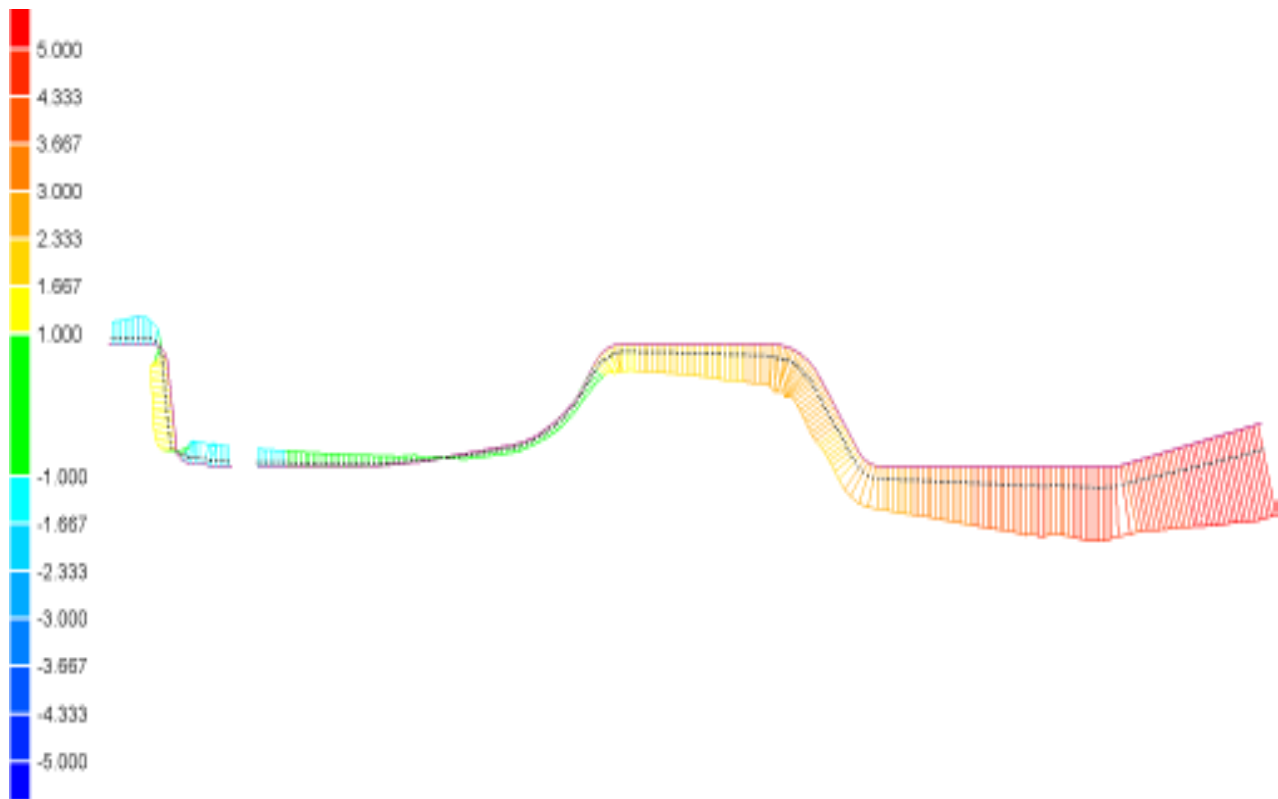


laser scanner MINOLTA VI – 900



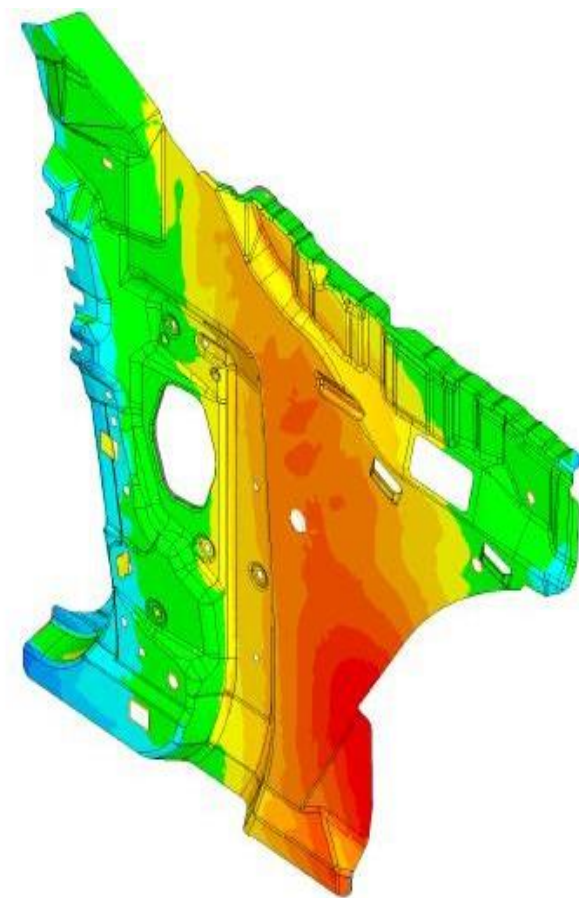
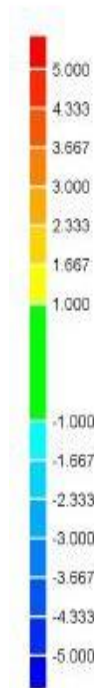


CAD-INSPEKCIJA kod obrade deformisanjem



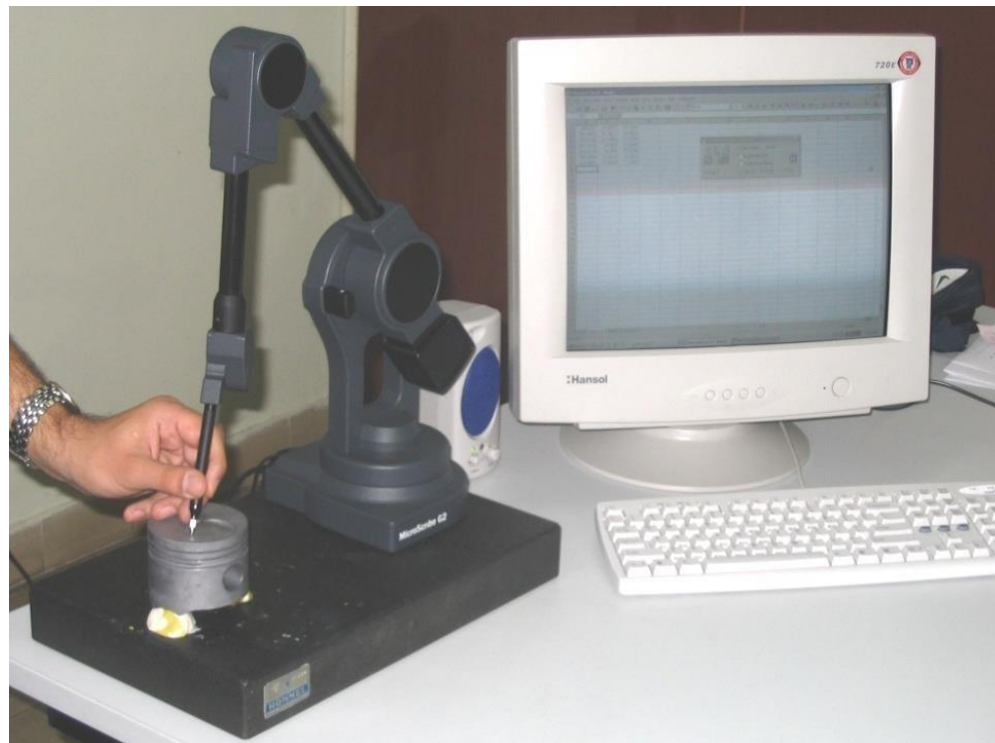
Qualify Report

Title: Sheet Metal Example Report
Author: John Smith
Client: Ford Motor Co.
Part: SM-56G
Test: Sheet Metal - Scan
4/30/2003, 5:44 pm



CAD-INSPEKCIJA

klipa "FIAT ø80"- AD "MOTINS"



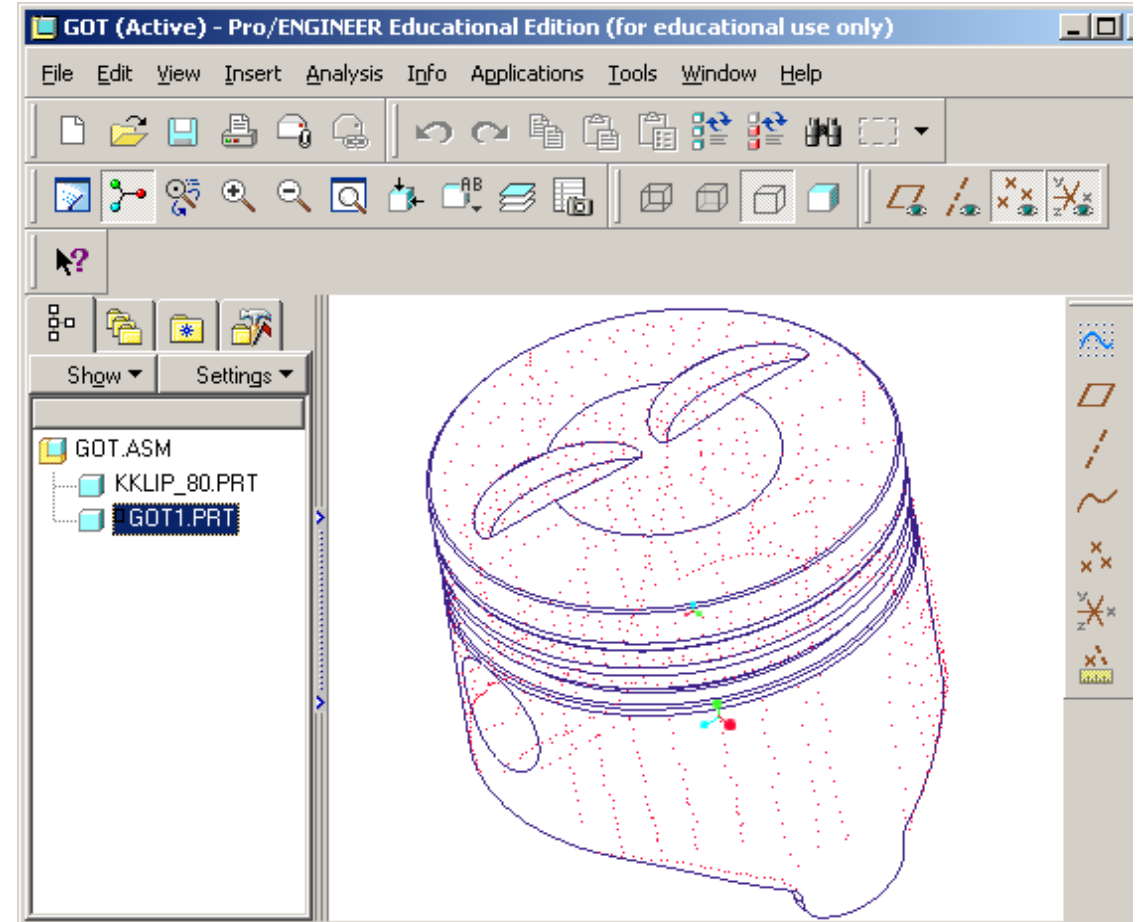
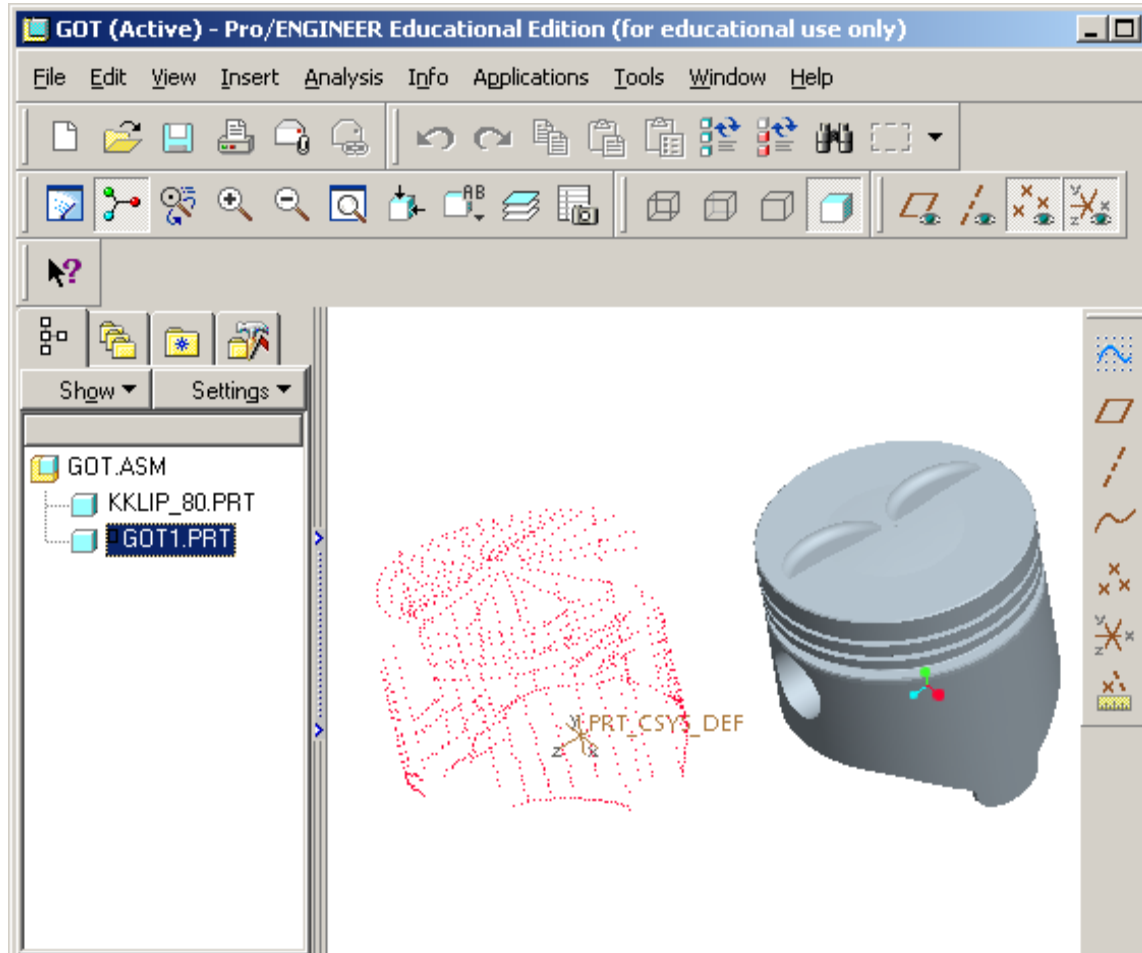
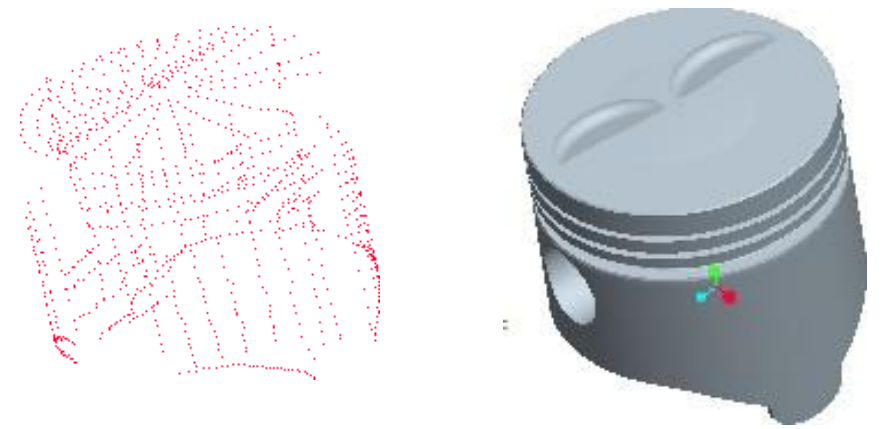
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3	243.0531	1.5321	73.7754	
4	239.0477	1.4409	73.6719	
5	234.9048	1.1252	73.4697	
6	231.6157	0.7576	73.3151	
7	228.0757	0.6151	73.3829	
8	225.3286	0.3371	73.4046	
9	222.3197	-0.0416	73.3383	
10	219.3237	-0.2625	73.3978	
11	216.773	-0.408	73.3606	
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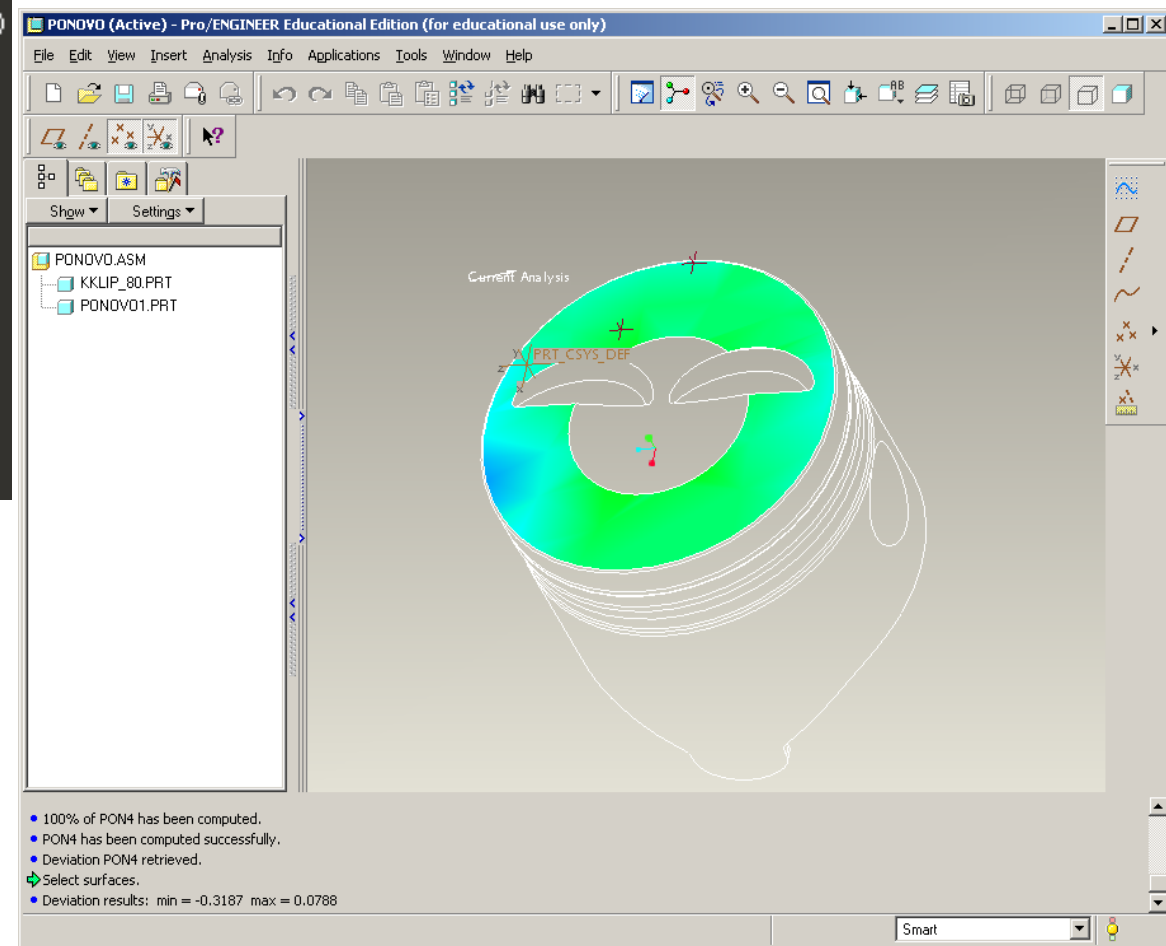
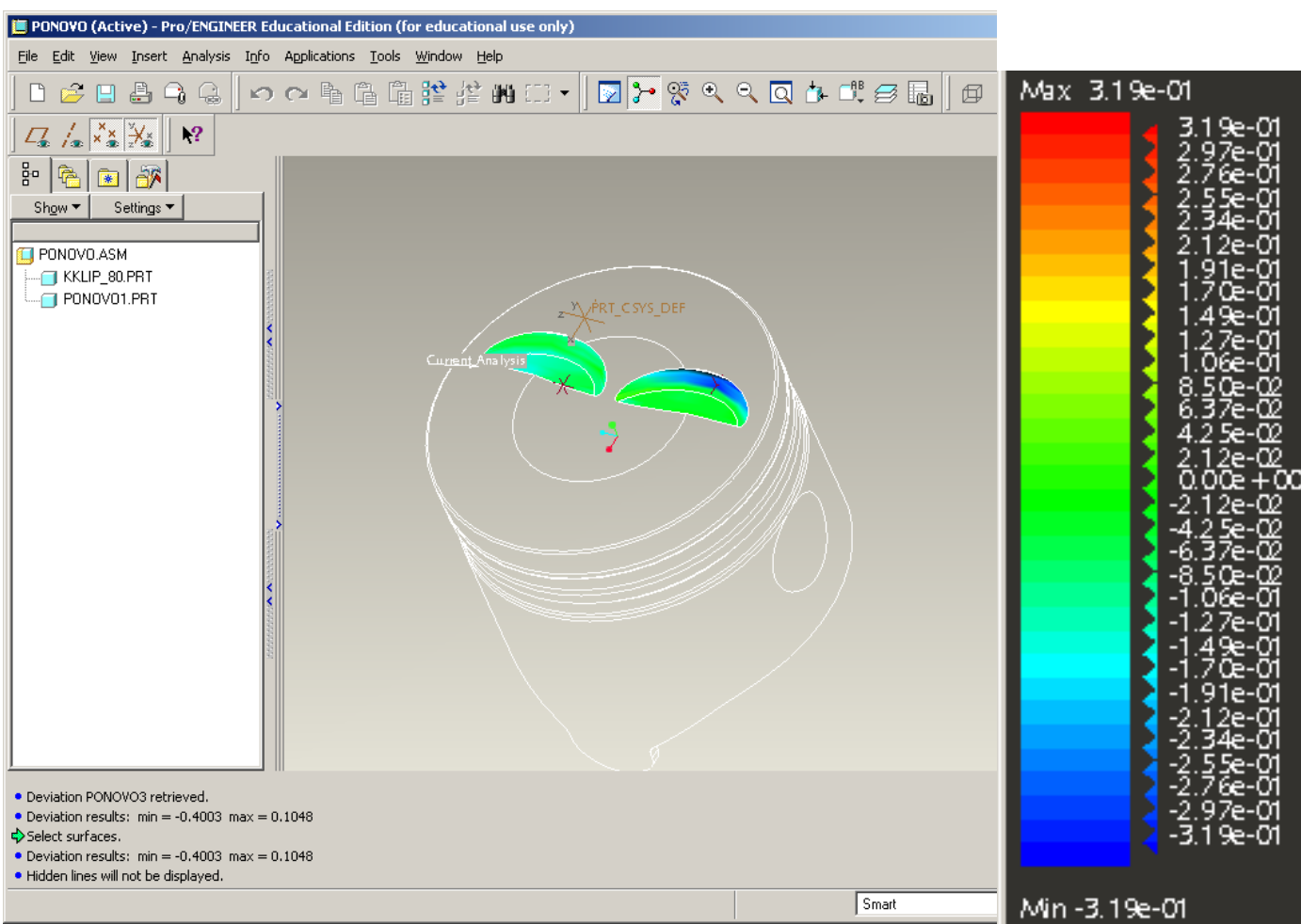
3D-digitalizacija na 3D-digitajzeru MicroScribe G2X (1093 tačke)

CAD-INSPEKCIJA

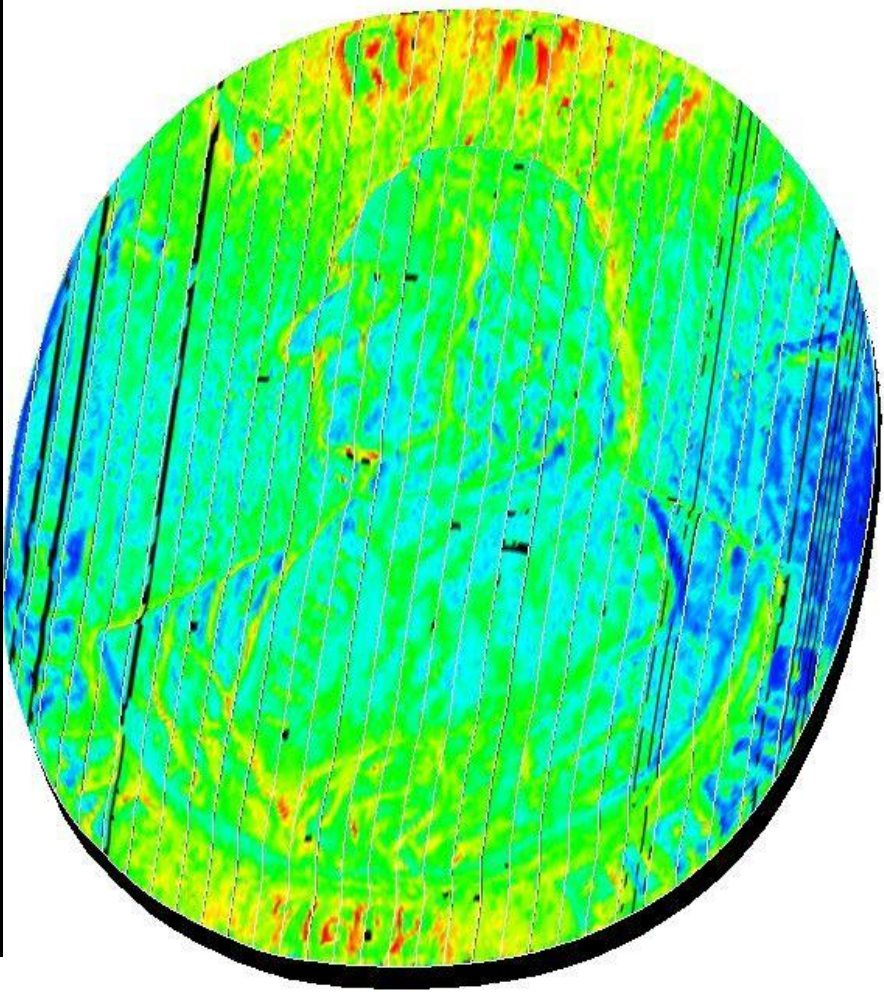
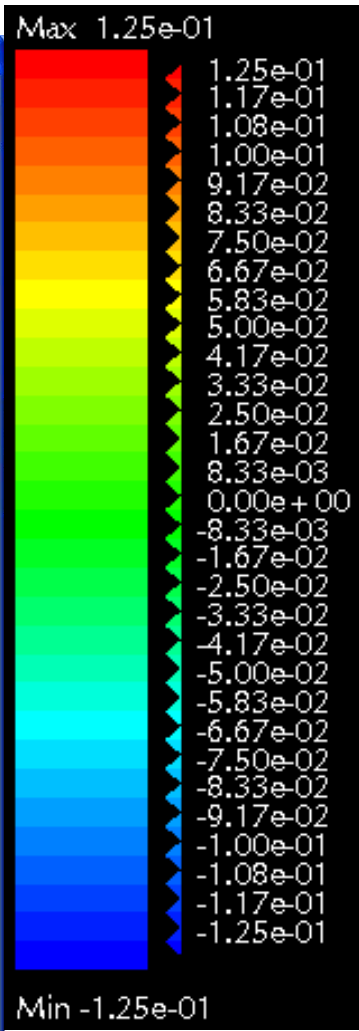
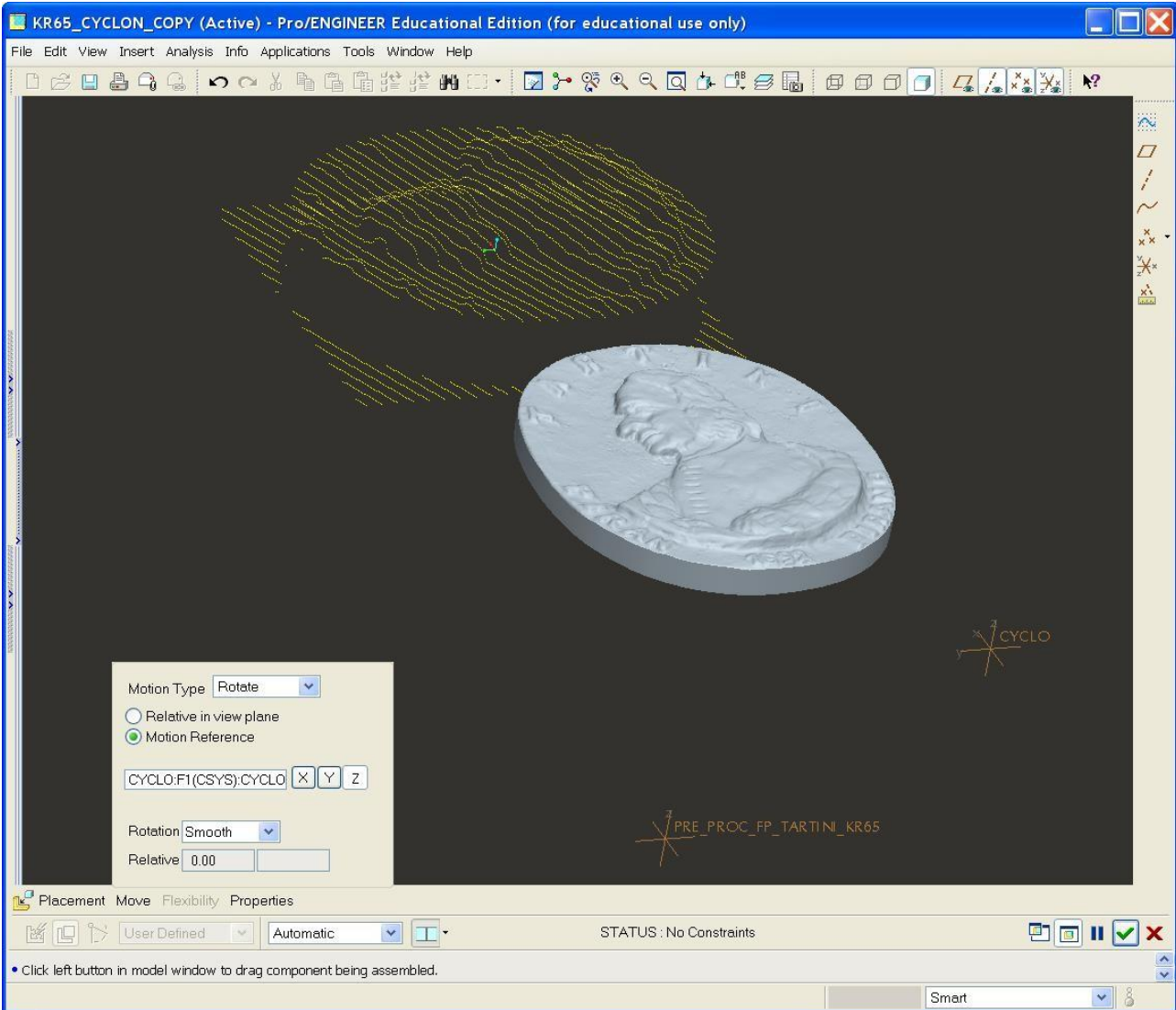
klipa "FIAT ø80"- AD "MOTINS"

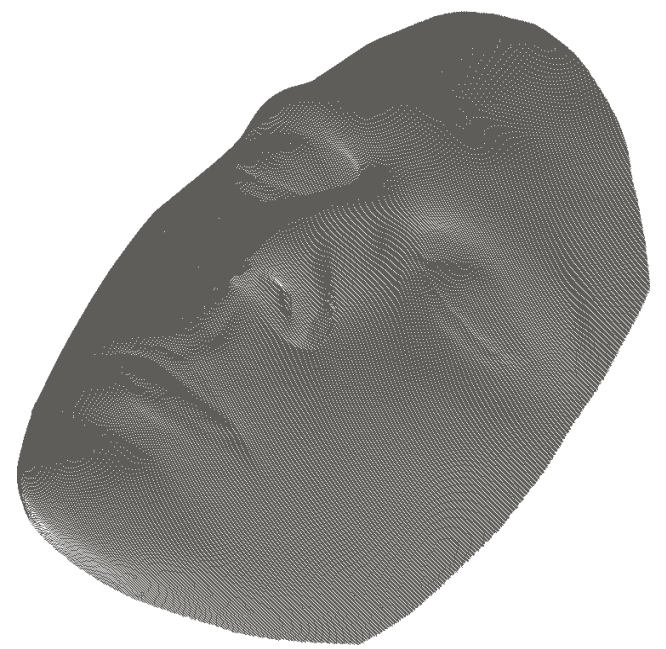
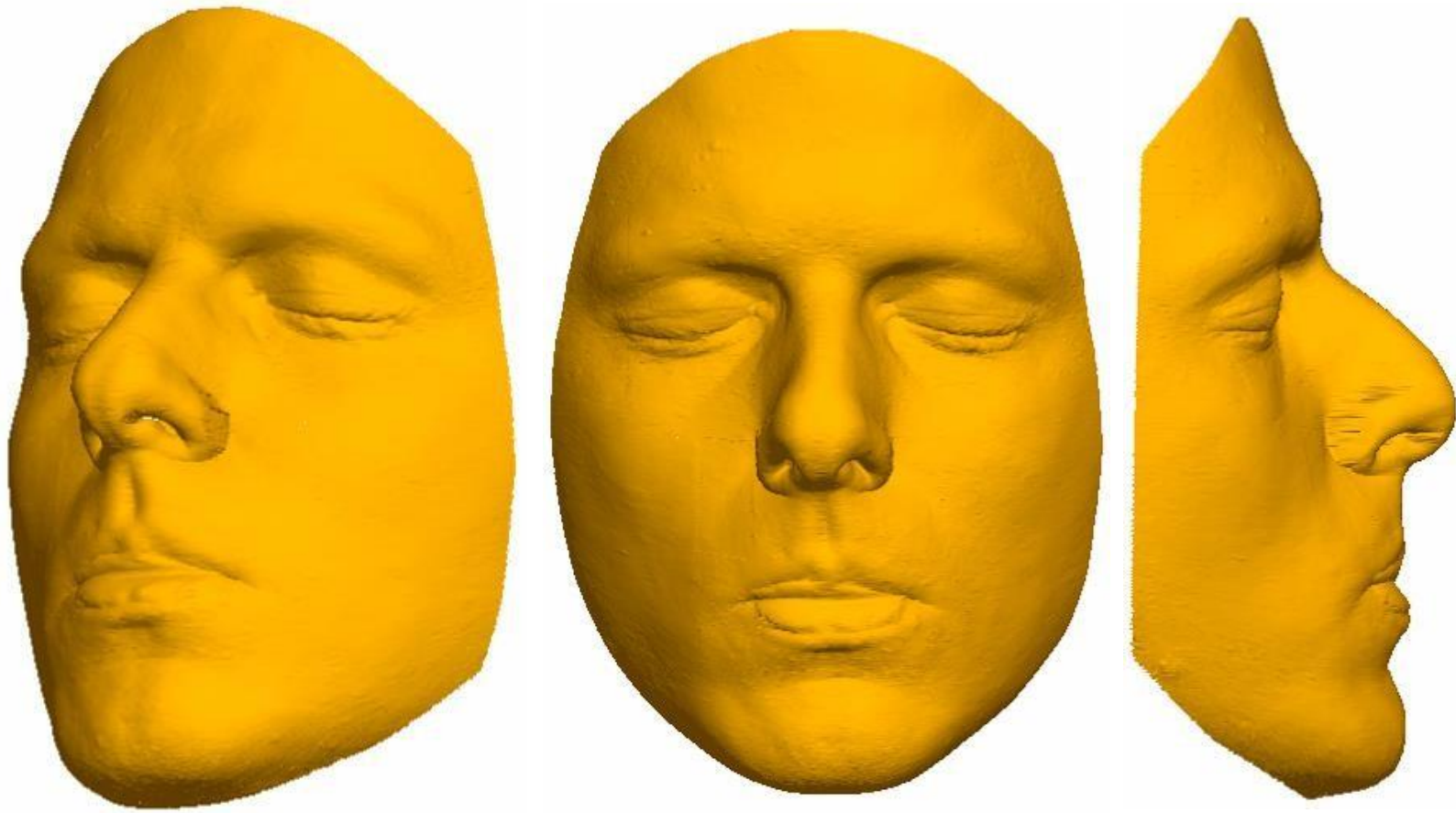
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modulu Pro/VERIFY

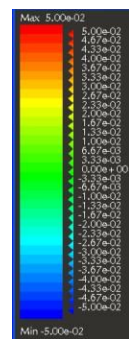
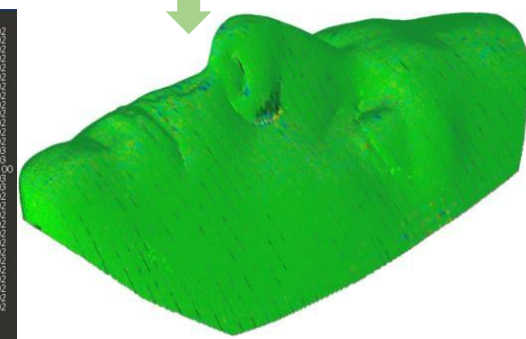
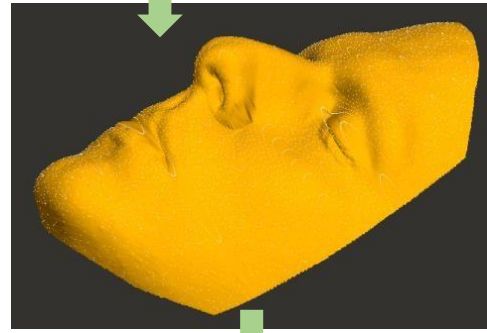
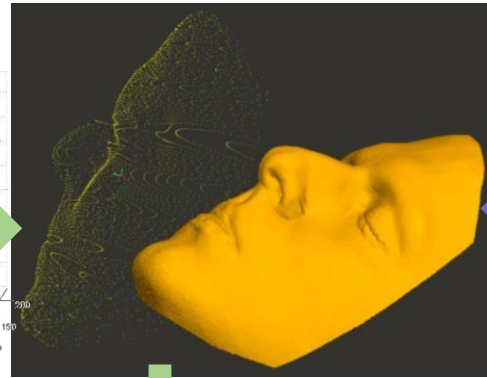
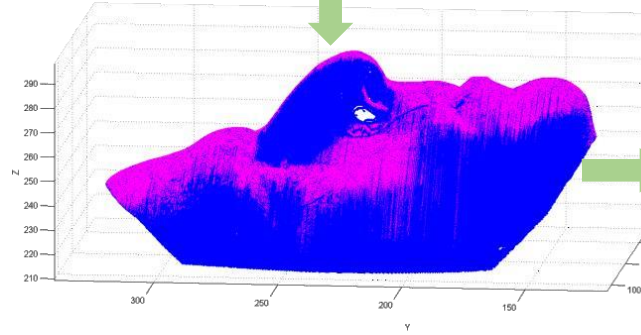




CAD-INSPEKCIJA
 klipa "FIAT ø80"- AD
 "MOTINS"
 Rezultat odstupanja
 u Pro/VERIFY







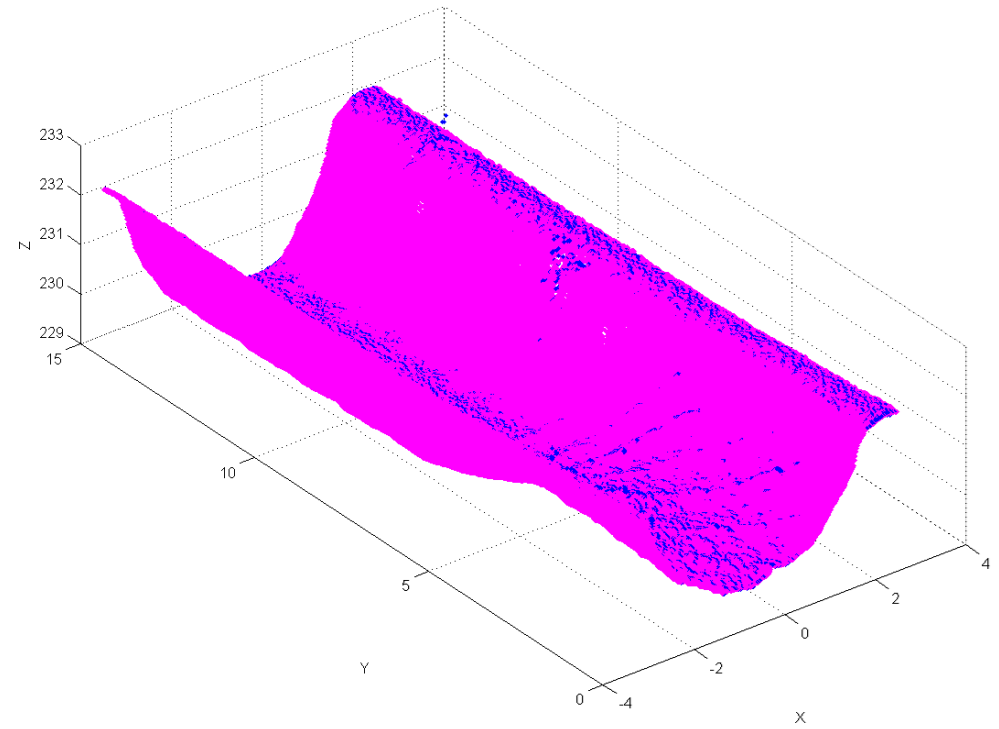
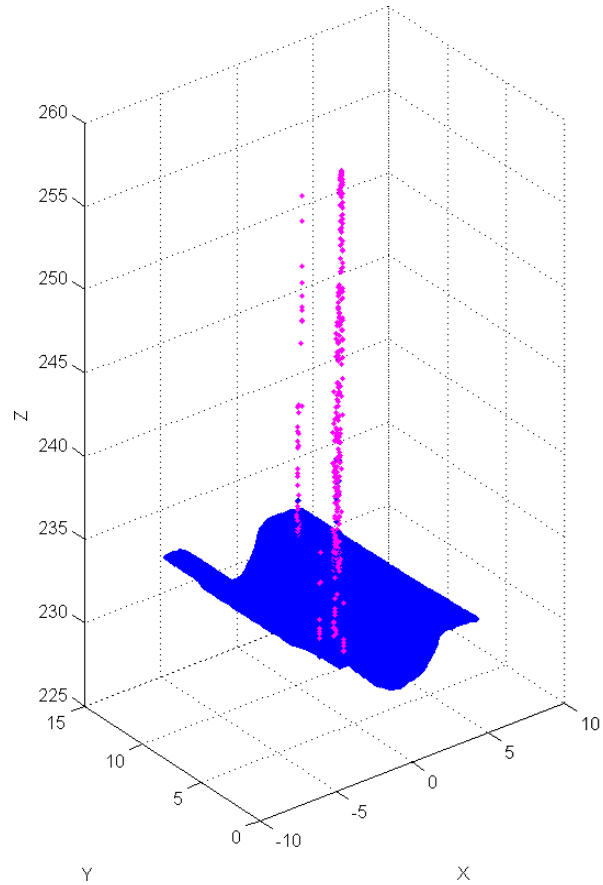
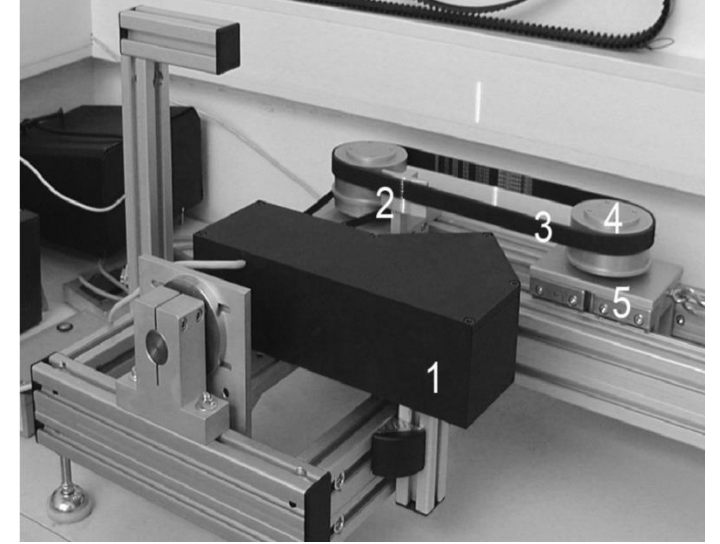
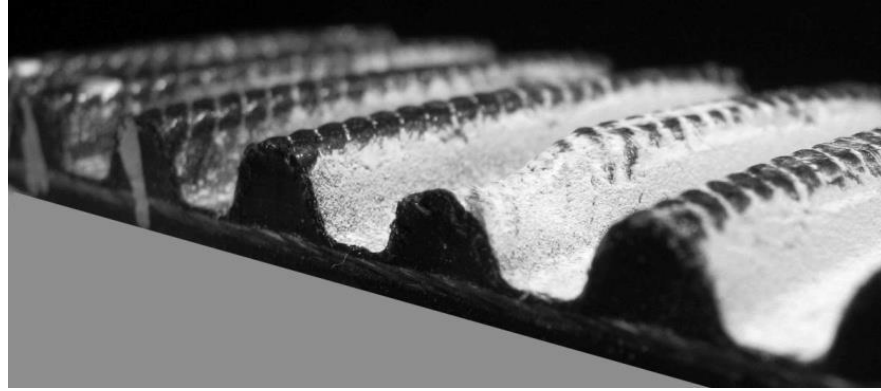
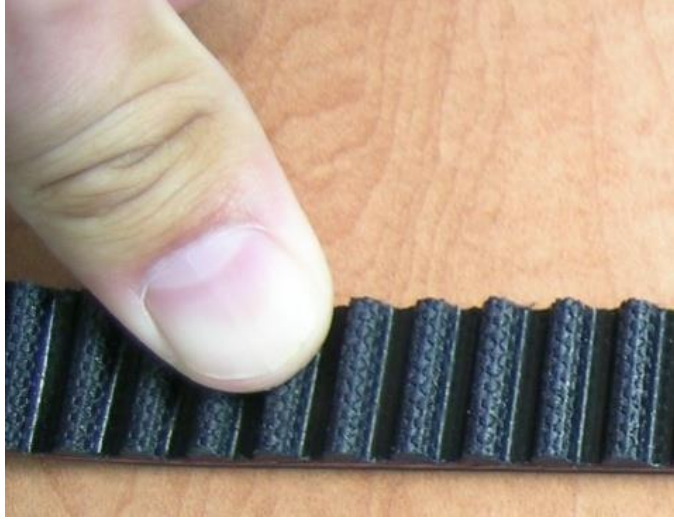
ASMO001 (Active) - Pro/ENGINEER Educational Edition (for educational use only)

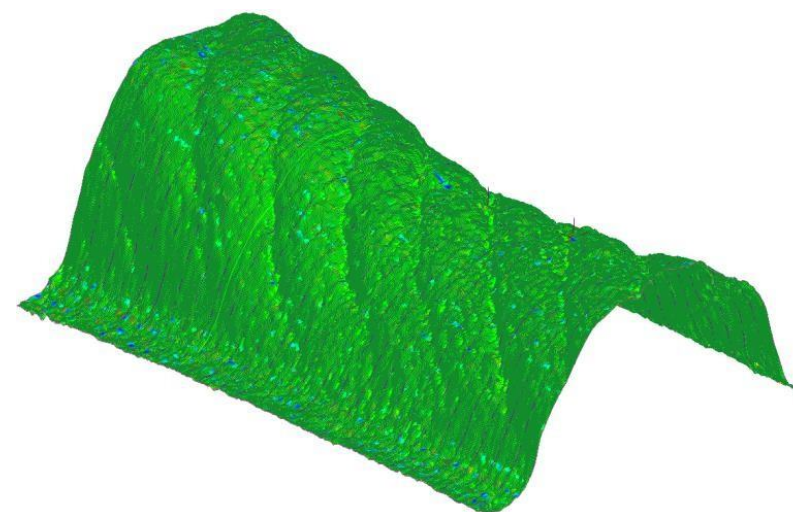
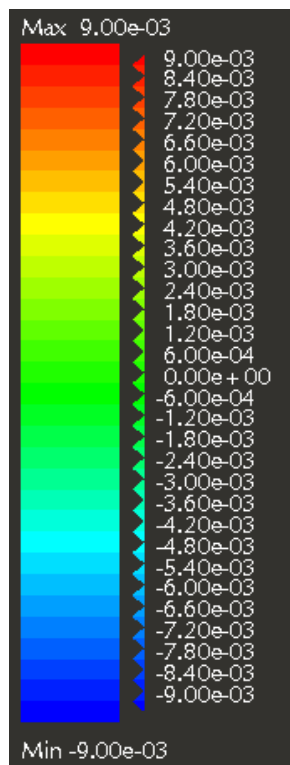
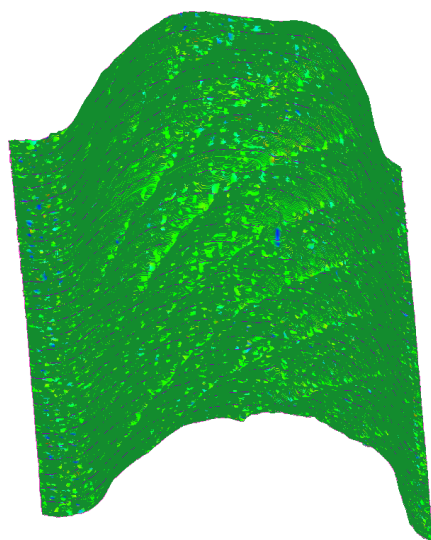
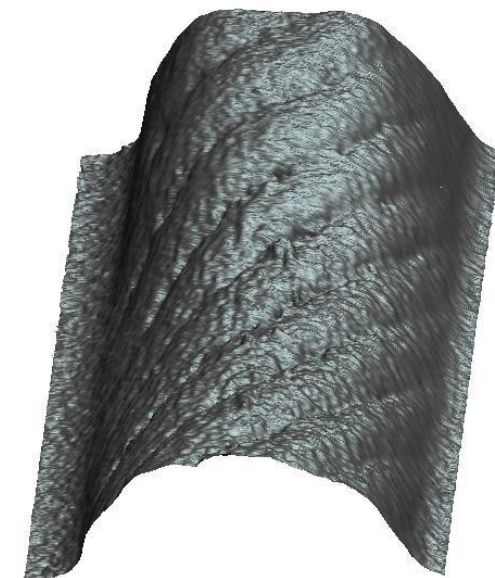
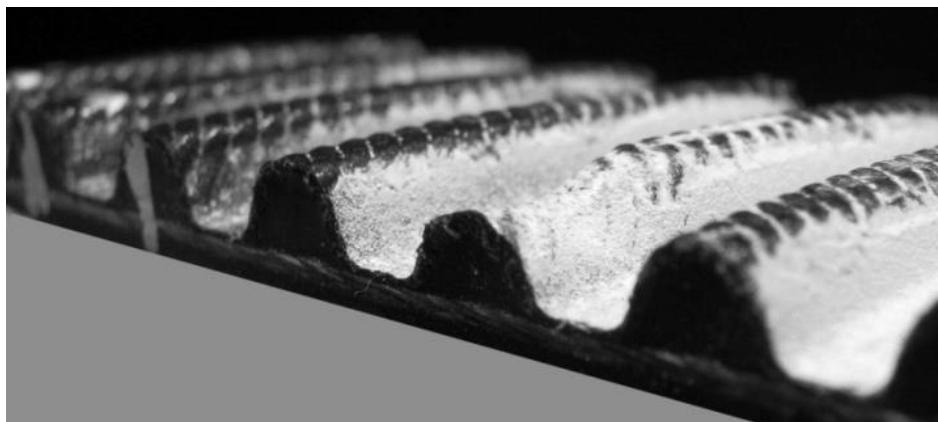
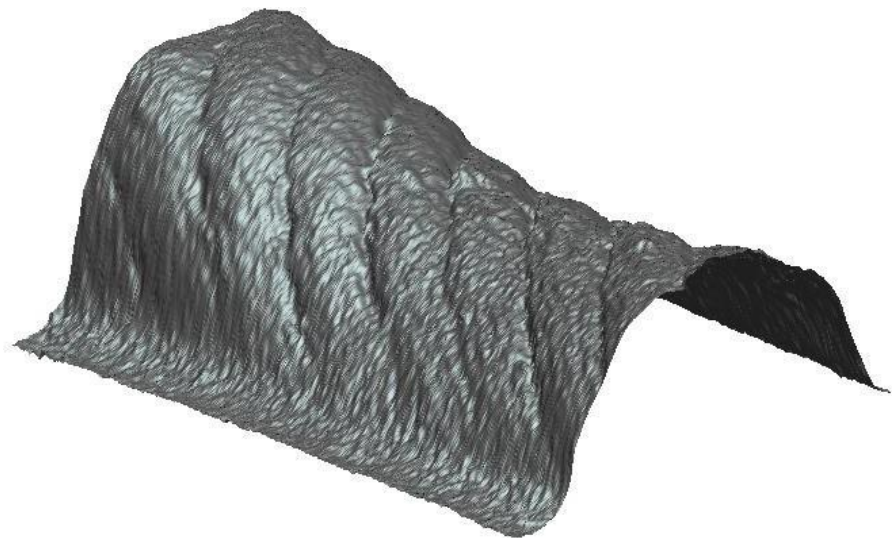
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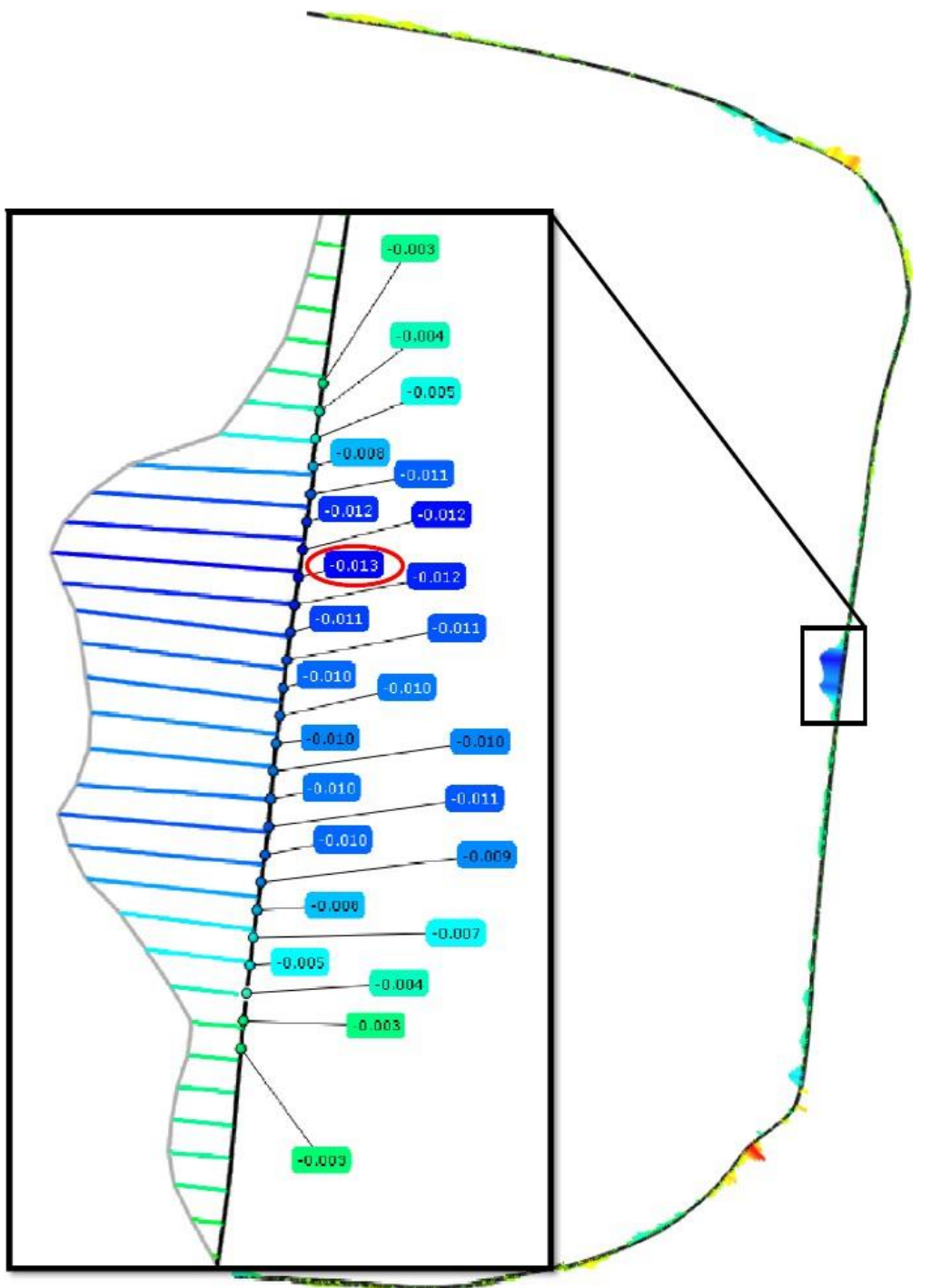
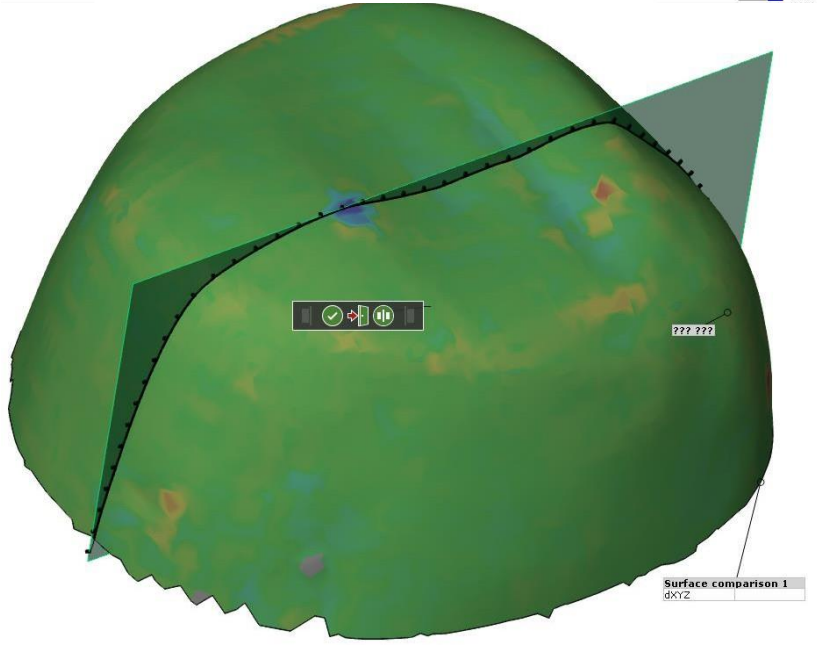
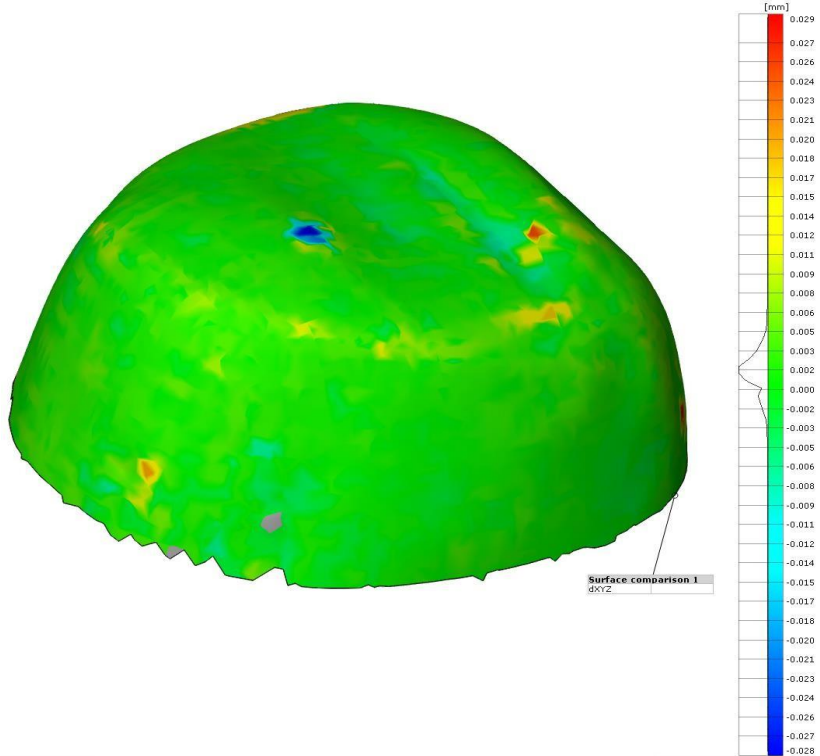
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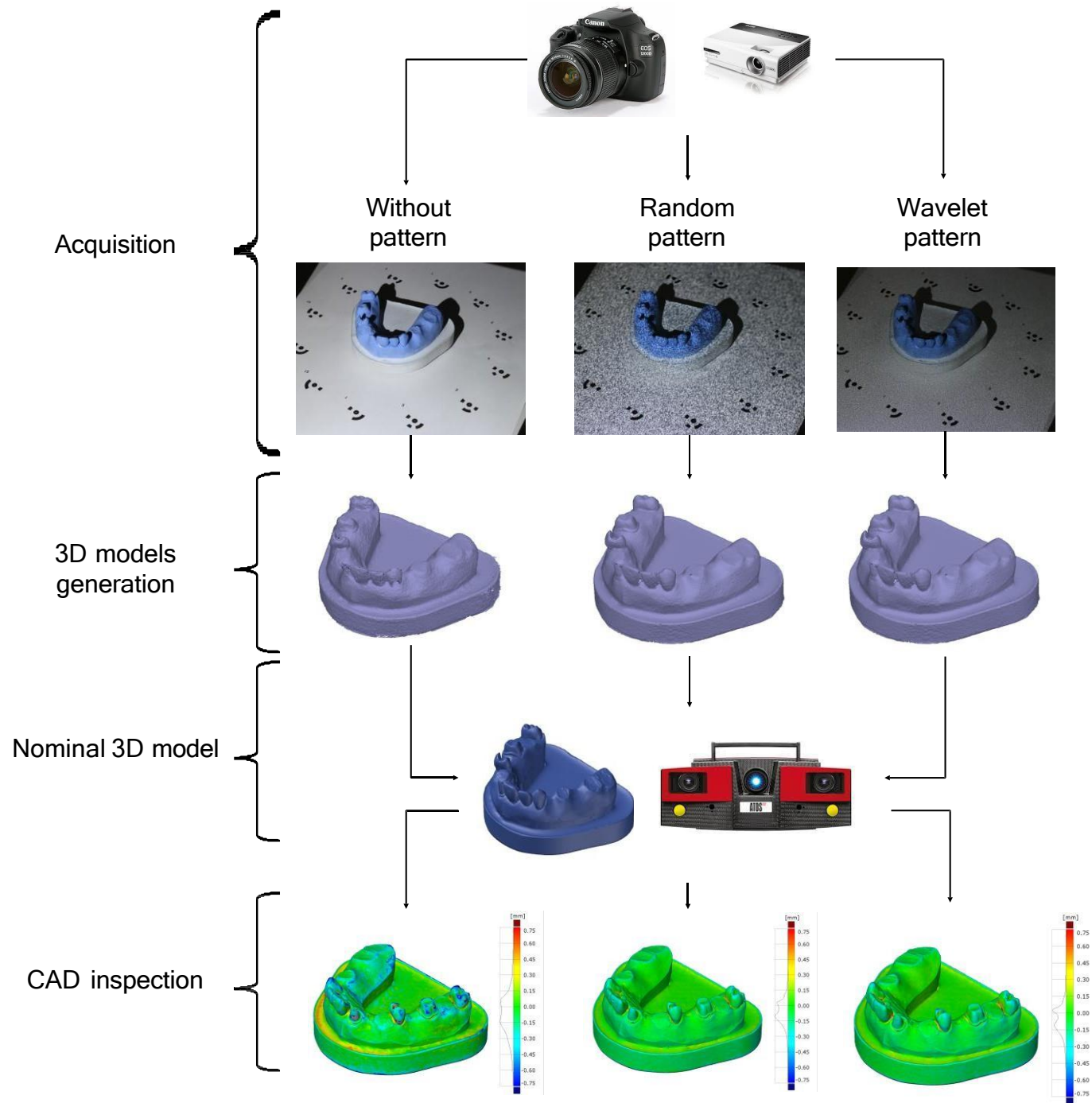
- VERIFICATION
- Results
- VER RESULTS
- Compute
- Display
- Tabulate
- Export
- Done/Return

Deviation results: min = -0.0940 max = 0.0940









HVALA NA PAŽNJI!