Konference MEFANET 2009

mefanet

3. konference lékařských fakult ČR a SR s mezinárodní účastí
na téma e-learning a zdravotnická informatika ve výuce lékařských oborů
Brno, 25.-27. listopadu 2009

3D technologie ve stomatologii

D. Hrušák, L. Bolek

Lékařská fakulta v Plzni Univerzity Karlovy v Praze

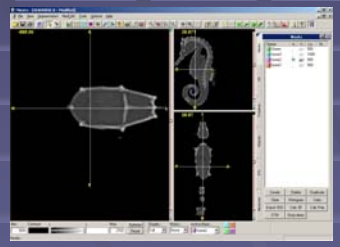
3D techniky

- Stomatologie stejně jako řada jiných oborů pracuje v trojrozměrném prostoru
- Klasické 3D postupy ve stomatologii – preparační postupy, otisky , sádrové modely, registrace postavení zubů a čelistí, korekční operace, …
- IT posouvají 3D pracovní postupy do nové dimenze,
- Stručný přehled
  - Praktické aplikace
  - Možnosti využití ve výuce
  - Směry vývoje

V prezentaci jsou kromě vlastních obrázků autorů použité jako doplňkové grafické ilustrace objekty z volně dostupných zdrojů a produktových prezentačních materiálů.

3D technologie podporované IT

- Umění
- Filmový průmysl
- Zábavní průmysl
- …
- Biologické vědy
- …
- Design
- Architektura
- Stavitelství
- Strojírenství
- Letecký průmysl
- …
- Topografie
- Archeologie



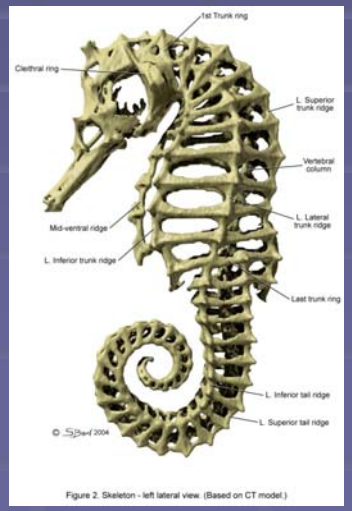
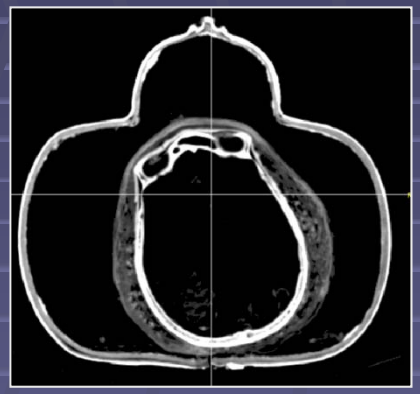
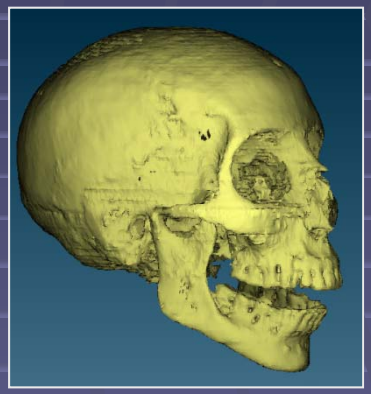
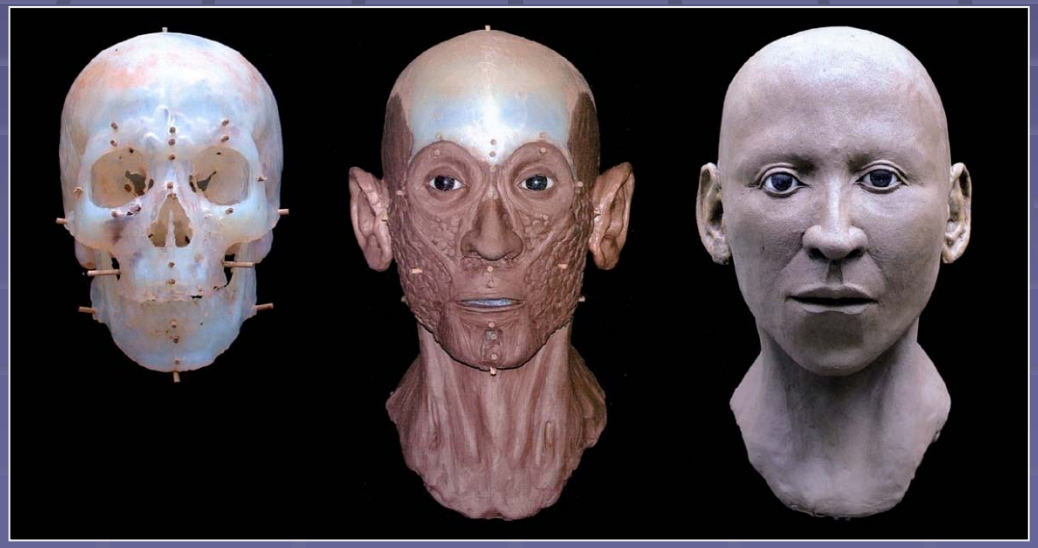


Figure 2. Skeleton - left lateral view. (Based on CT model.)

Non invasivní archeologie

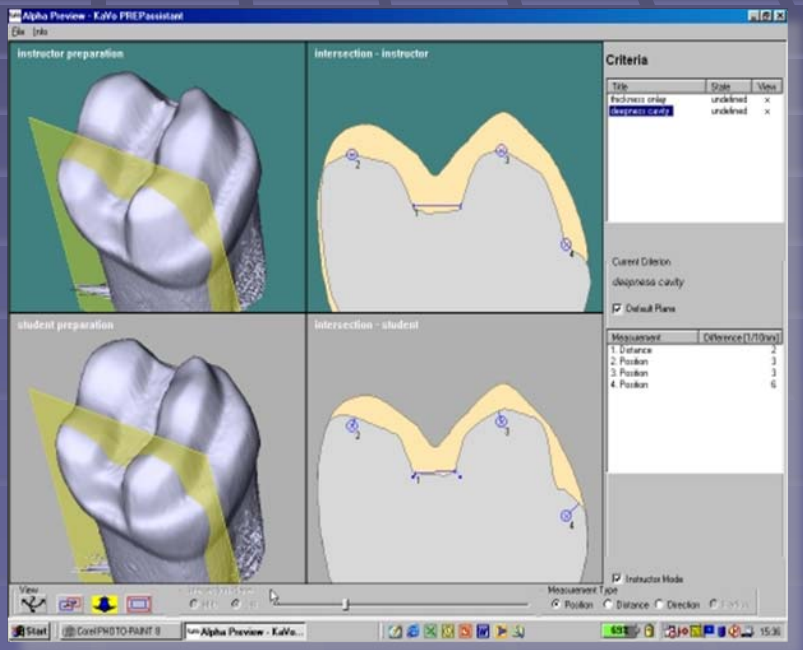


Dominic Eggbeer, The National Centre for Product Design & Development Research (PDR)

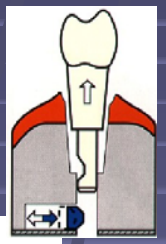
IT a 3D technologie v lékařství a stomatologii současný stav

- Výuka
  - Preklinická
    - **Elektronické publikace, animace, atlasy, ...**
    - Simulace pracovních postupů, fantomy a modely -
    - Ojedinělé použití + IT podporované 3D diagnostické a pracovní postupy – Prep-Assist
    - Klinická
    - **Závislé na možnostech přístrojového, IT a SW vybavení školicích pracovišť – klinik**
    - **Často nestíháme rychlému pokroku technologií – zpoždění cca 2-5 roky**

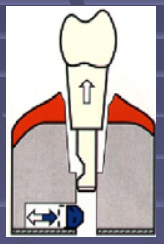
The KaVo system
for **measurement** and **evaluation**
of preparations in dental education.



PREPassist. 5 Steps for feedback



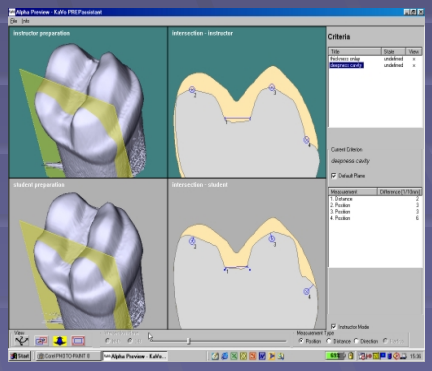
„Click“



„Click“

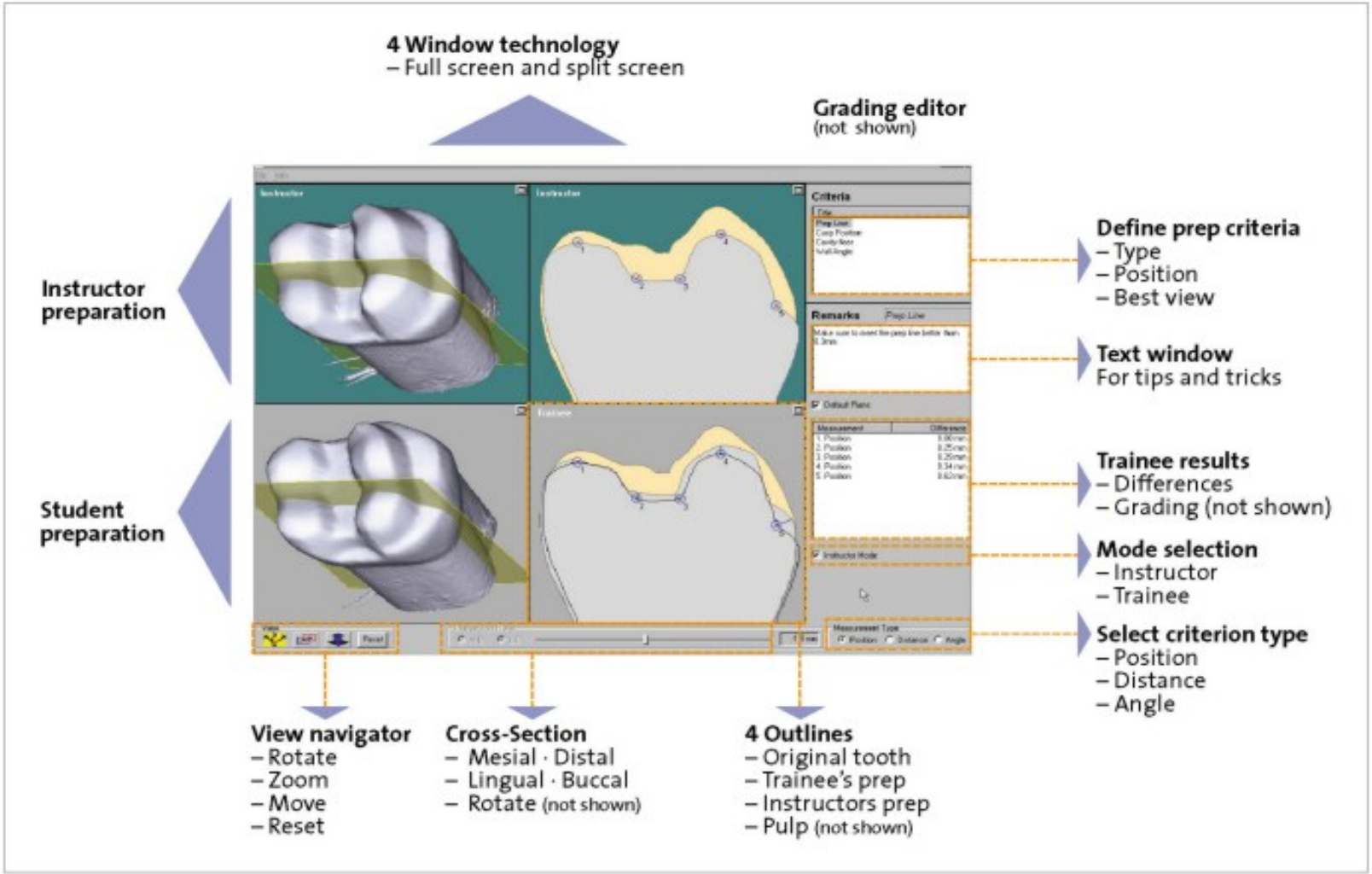
Prep at Simulator

3D Scan



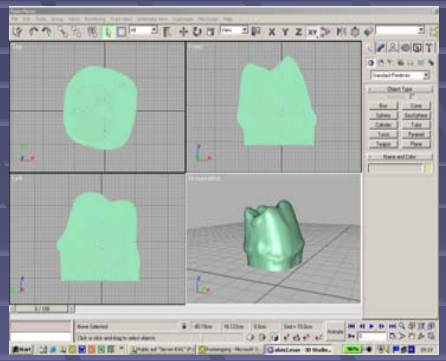
Feedback at student PC

PREPassist Evaluation Software

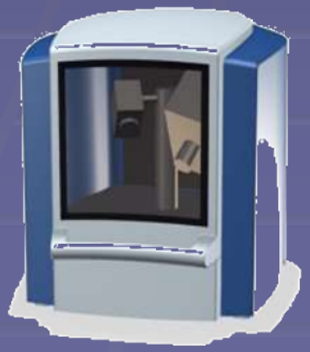


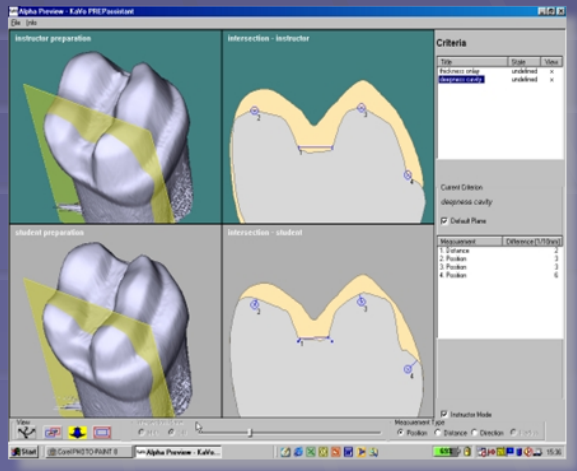
Benefits for Dental-Schools

Bold 3D Graphics enhances learning
Less complaints by objective evaluations
Teaching efficiency by self assessment
Master Preps easy generated by lecturer
Individual criteria by instructor
Upgrade existing pre-clinics
Multiple use by student groups

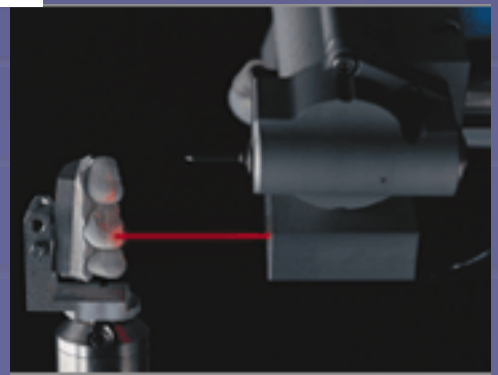


Export by stl file format





The CEREC® Acquisition CenterPowered by BluecamCAD/CAM for Everyone.



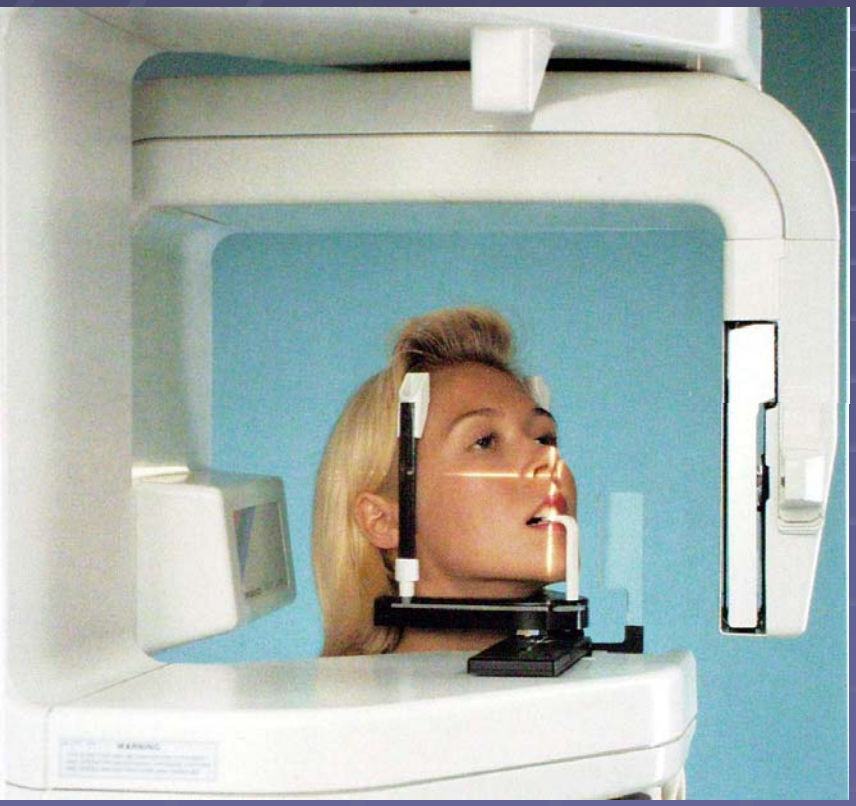
CEREC MC L

CEREC MC XL

Využití 3D zobrazení

- 3D radiologické zobrazovací metody
  - Přechod od 2D k 3D – díky snadné dostupnosti
    - CT, MRI, PET CT, USG… CBCT
  - Trend:
    decentralizace obrazových manipulací – rendering, segmantace, manipulace
  - Problém:
    kompatibilita navzdory DICOM formátům
- 3D realistické zobrazovací metody

Vyvoj rtg vyšetřovacích metod

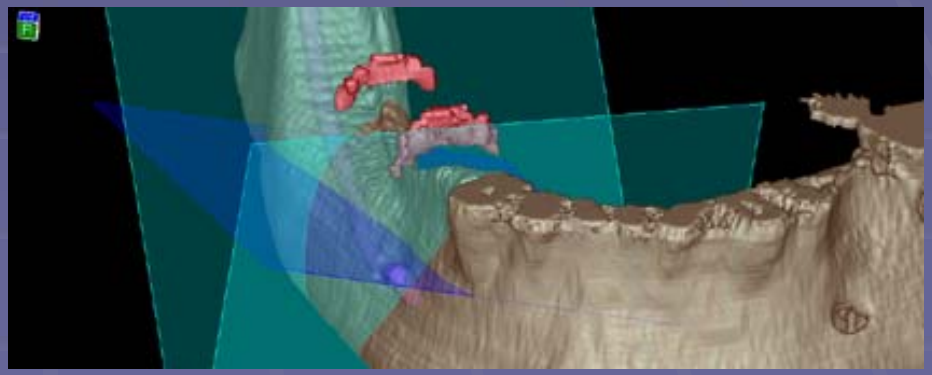


- Konvenčí radiografie – DIGI Rtg
- Intraorální snímky - RVG
- Tomografie - OPG
- Počítačová tomografie - CBCT
- 3D / 4D techniky
- ..... ???

Trojrozměrné zobrazovací metody

(1979, Godfrey Newbolg Hounsfield + Allan McLeod Cormack)

- CT, MRI, PET CT, 3d Sonografie, Skenování, volumetrické analýzy,…
- Začátek 3D modelací - před cca 12 lety
- S překotným rozvojem IT technologií i rozvoj 3D virtuálních technik
- CBCT v oblasti hlavy představuje novou modalitu pro široké použití

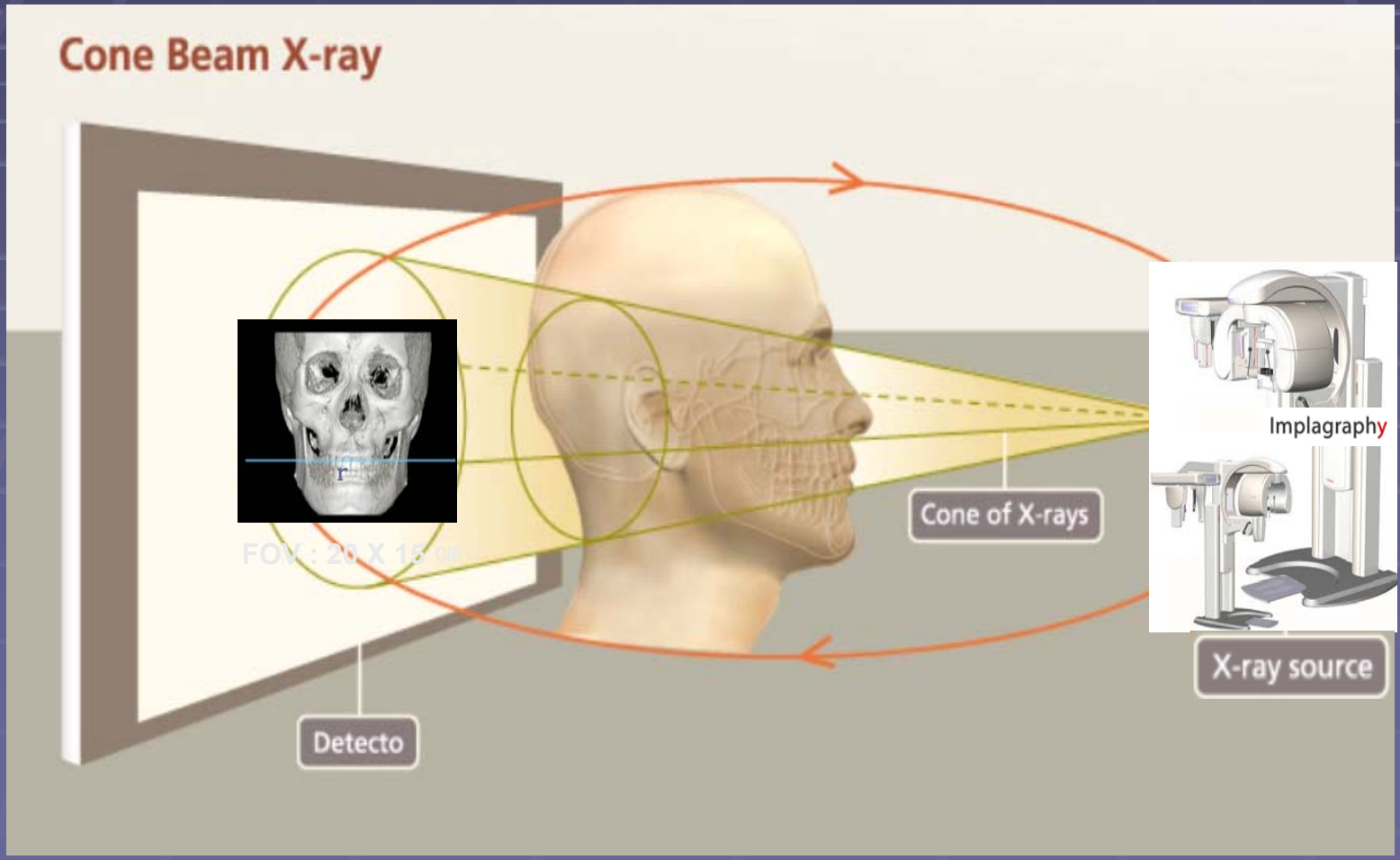


VoNaviX®

1. Computed Tomography

1-1. Cone Beam CT?

- Applied with **Cone Beam** Technology for the next generation



Využití 3D zobrazení

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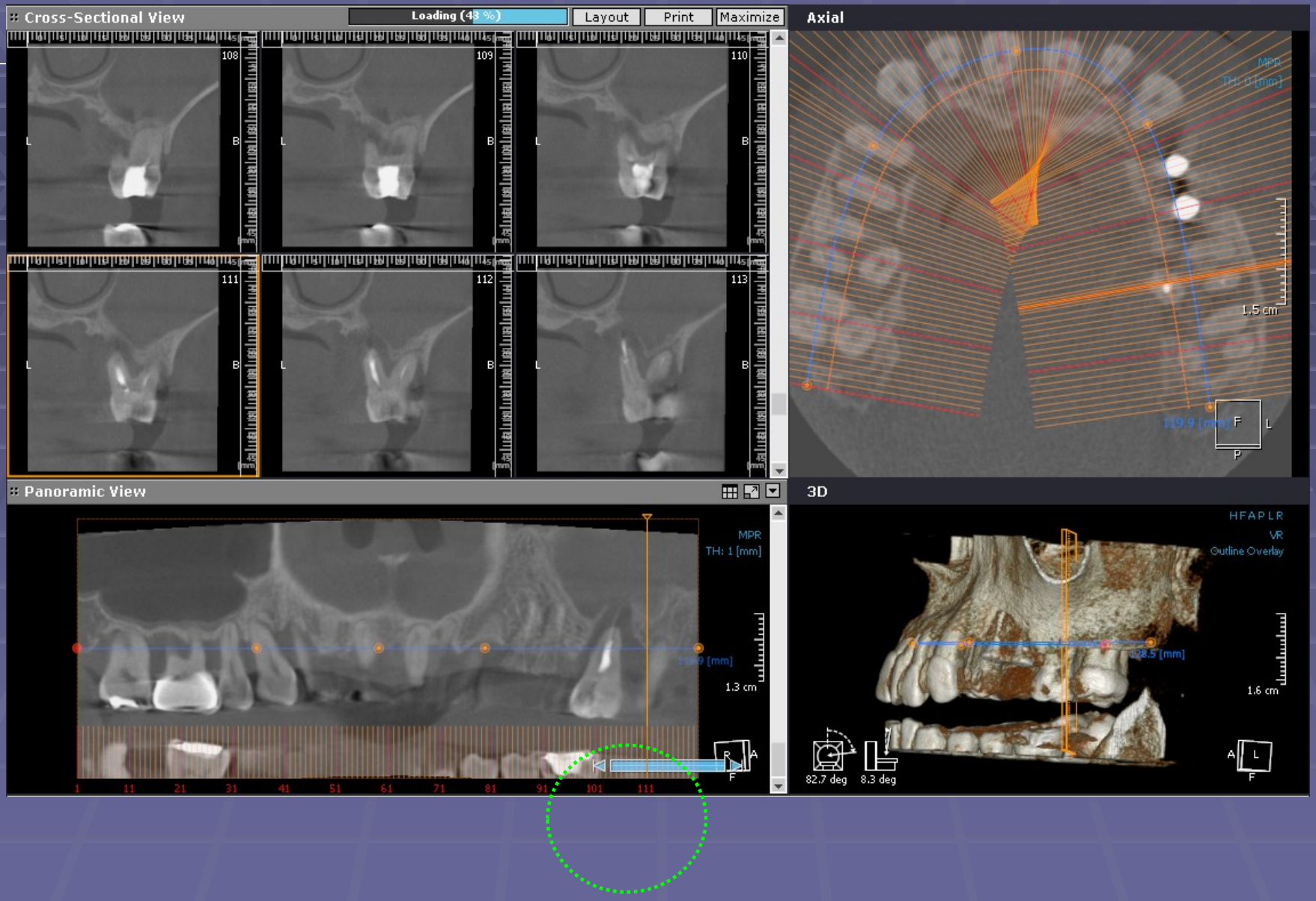
    - CT, MRI, PET CT, USG… CBCT
  - Trend:
    decentralizace obrazových manipulací – rendering, segmantace, manipulace v rukou klinika
  - Problém:
    kompatibilita navzdory DICOM formátům
    SW závislý na HW
  - Perspektiva:
    sjednocení datových formátů, vytváření společných výukových databází


Cross-Sectional View
Loading (43 %)
Layout
Print
Maximize
108
109
110
111
112
113
Axial
MPR
1.5 cm
F
L
P
Panoramic View
MPR
TH: 1 [mm]
1.3 cm
1 11 21 31 41 51 61 71 81 91 101 111
3D
HFAP LR
VR
Outline Overlay
1.6 cm
82.7 deg
8.3 deg

SurgiCase

SurgiCase CMF

INSTALL

SurgiCase CMF

The installation file contains SurgiCase CMF and some demo cases

SurgiCase CMF

SurgiCase CMF is a highly accurate, powerful **3D simulation environment** for cranio-maxillofacial surgeries. It offers detailed pre-surgical information, in both 3D and 2D, allowing you to:

- accurately evaluate the patient's anatomy
- perform cephalometric analyses
- plan reconstructive surgeries
- plan osteotomies and distractions
- relocate bone parts
- simulate soft tissue outcome

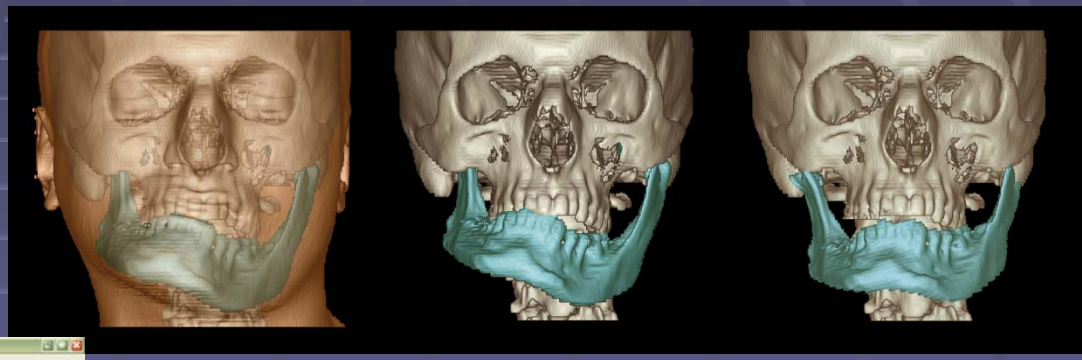
SurgiCase CMF is the most accurate 3D simulation software available in the CMF market. It enables you to try out different surgical approaches, show virtual post-op results (including photo mapping) and improve communication with your patient. What you see is what you get.

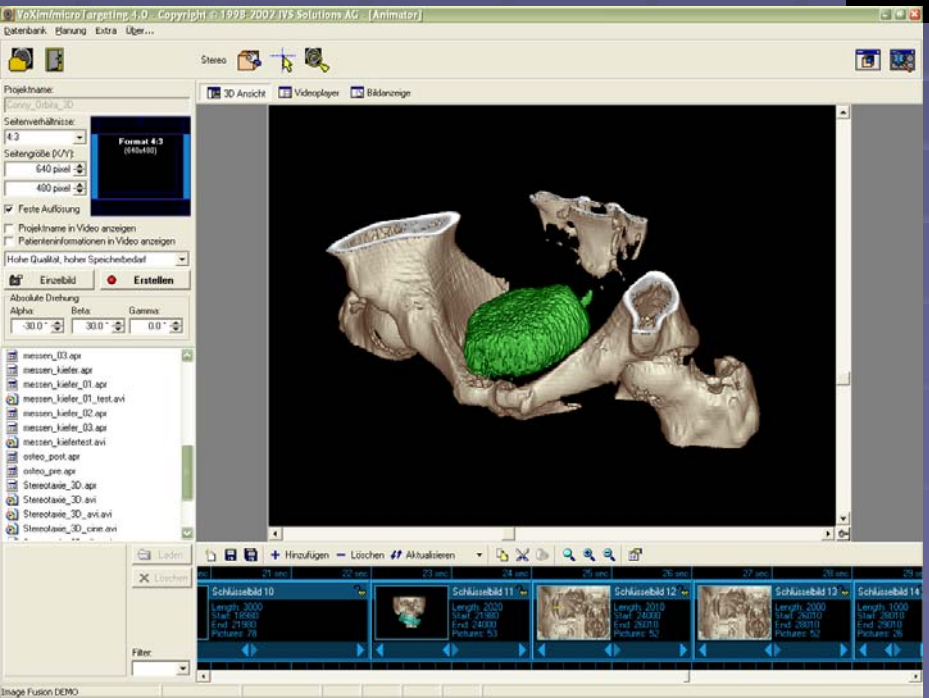
Once the surgery planning in SurgiCase CMF is completed, **custom made surgical guides** can be produced using additive fabrication technologies. These guides accurately transfer the planned treatment to the patient at the time of the surgery. These patient-specific, intra-operative guidance systems aid you in accurately positioning bone segments or distraction devices according to the pre-operative plan.

Based on computerized patient data from the SurgiCase software, Materialise can easily manufacture accurate **physical 3D models**. Precise anatomical models developed from scanning input deliver essential information for diagnostic, therapeutic and didactic purposes. Surgeons who use 3D models are convinced that these models enable them to make important discoveries about the anatomy, which are not apparent from X-rays or CT and MRI scans.

Modules for the use in the area of Cranio Maxillofacial Surgery:

- *VoXim*® Osteotomy
- *VoXim*® Image Fusion
- *VoXim*® Modelling
- *VoXim*® Animation





VoXim® Animation

Využití 3D zobrazení

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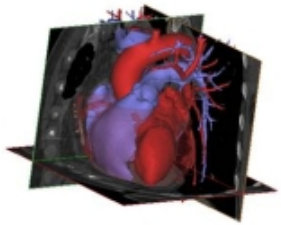
Mimics

Medical solutions

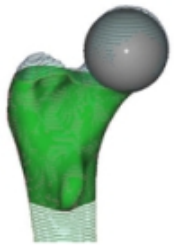
Mimics

The standard for 3D image processing and editing based on scanner data.



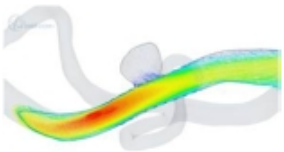
3D Visualization

RP Models



Traditional CAD

Device and Implant Design



Computer Aided Engineering

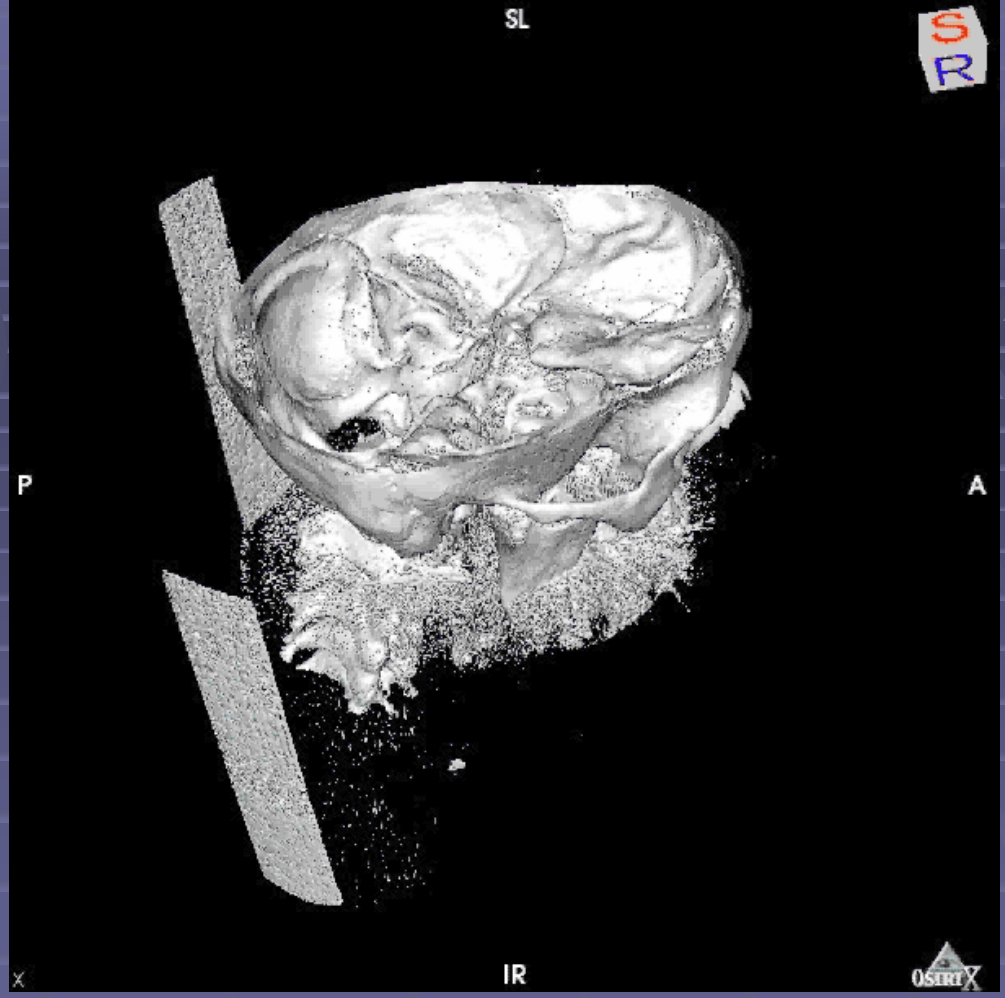
Surgical Simulation

Verification and Measuring

Arts and Natural Sciences

Mimics 12.1

Existují kvalitní opensource SW nástroje pro práci s 3D daty



3DSlicer

OsiriX Imaging Software

Advanced Open-Source PACS Workstation

DICOM Viewer

News | About | Screenshots | Downloads | Roadmap | Plug-ins | Learning | Users | Partners | Store | PACS | Links | Contact

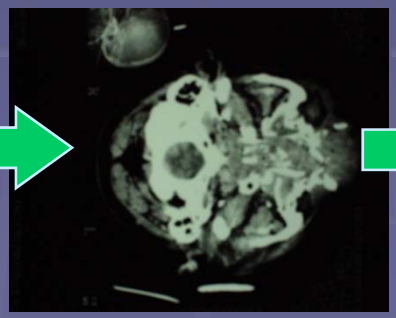
Co dělá Mimics SurgiCase, Voxim…

Umožňuje:

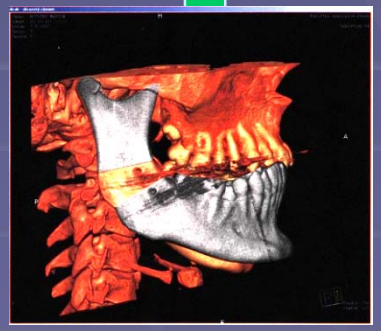
- import skenovaných dat „obrazů“
- Výběr určitých struktur v daném zobrazení
- Využití těchto dat pro další aplikace

3D Model

CT or MRI Scan



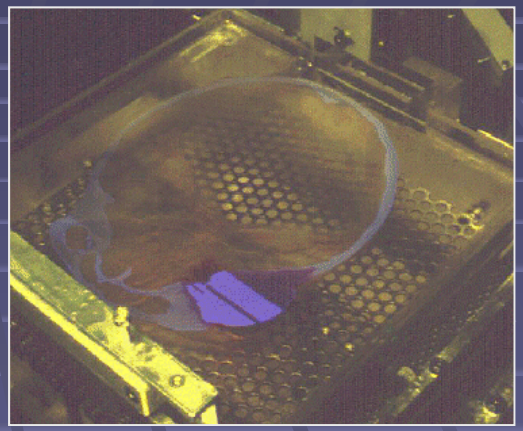
2-D Cross Sections

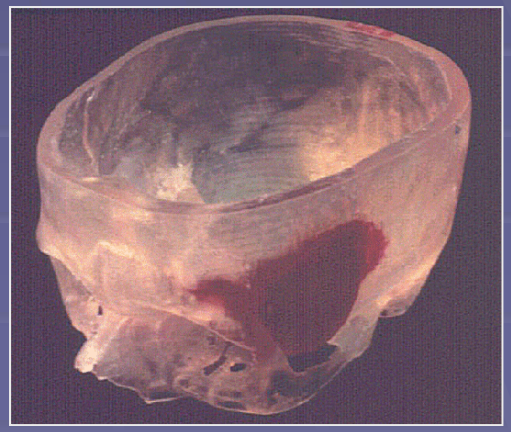


Software

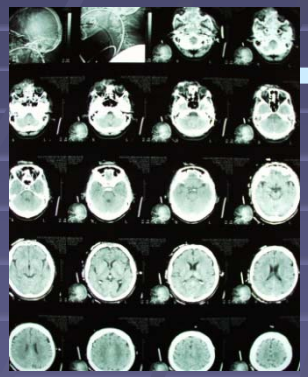
Rapid Prototyping

- Možnost barevného značení:
  - Označení tumoru
  - Resekce
  - osteotomie
  - Kořenů zubů …
  -

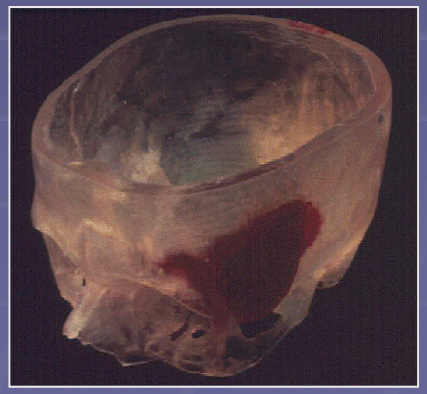


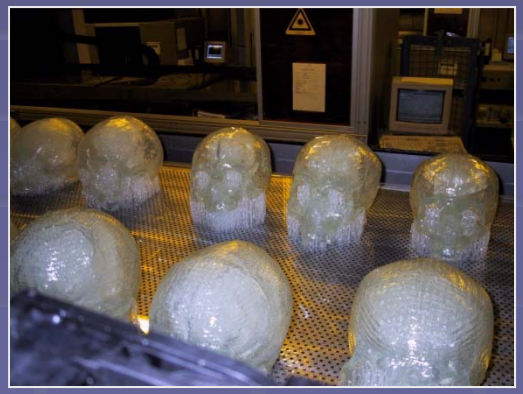


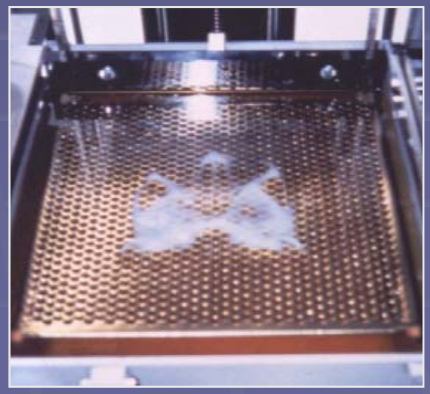
SW PROPOJENÍ mezi obrazovými daty a dalšími fázemí zpracování obrazových dat:



- Rapid Prototyping
- CAD
- Finite Element Analysis
- Surgical Procedure Simulation
- Other application domains







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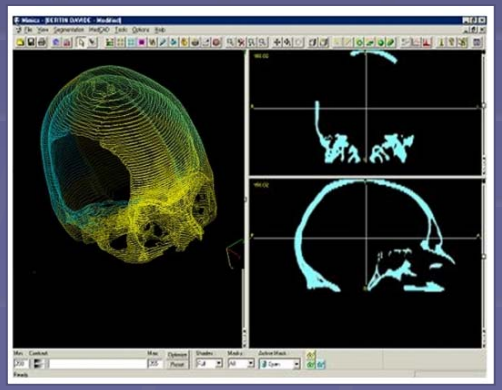
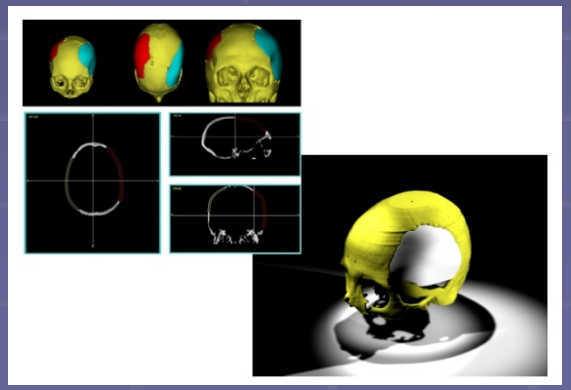
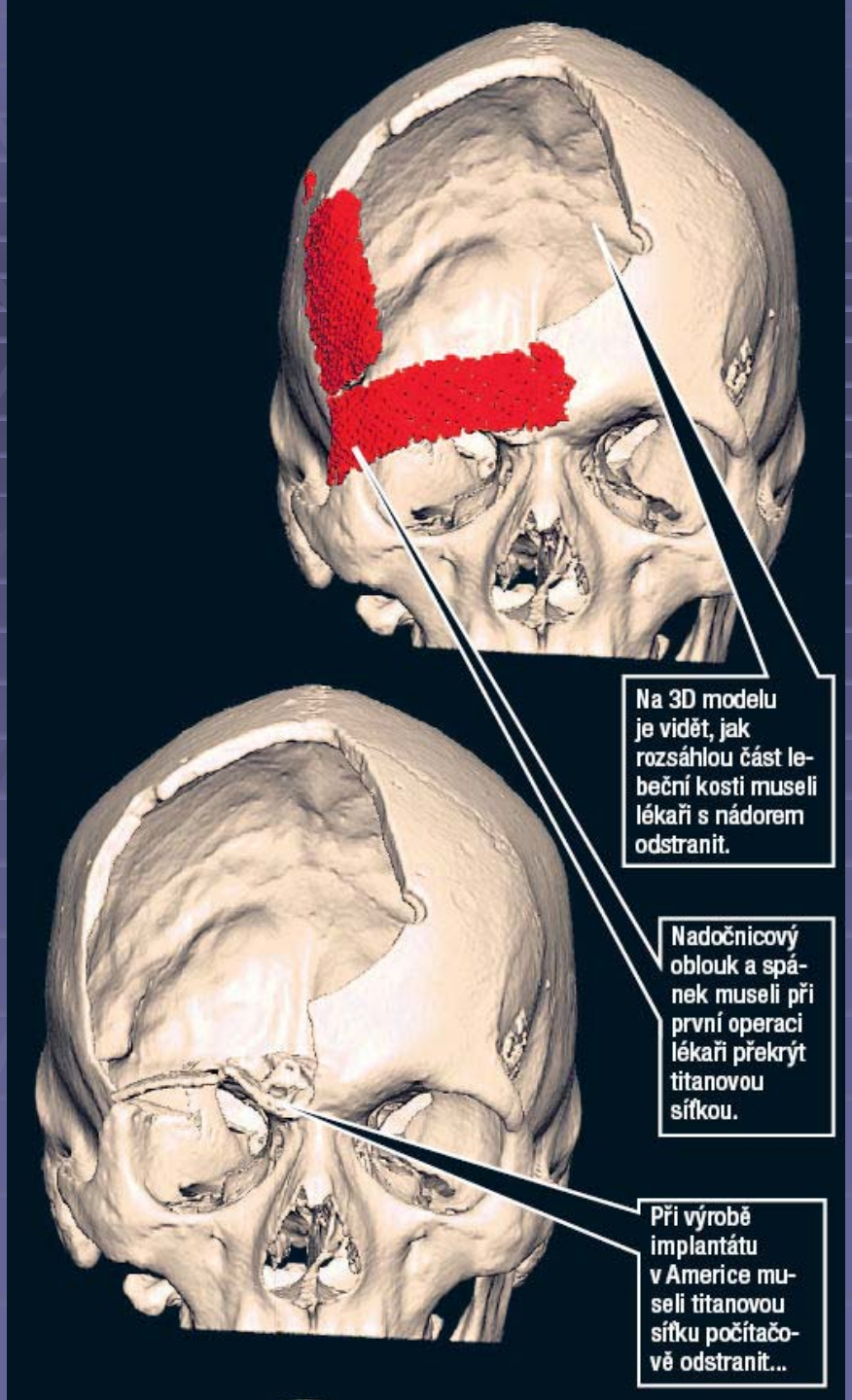
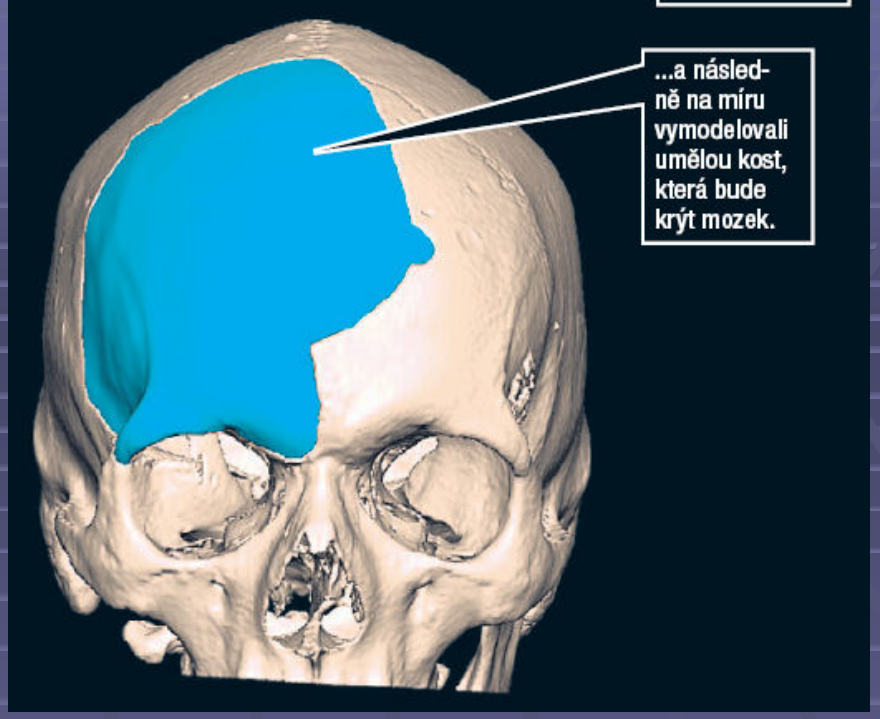




Dr. Villiam Dallolio, Dr. Massimo Orsi, Dr. Enrico De Micheli, Ing. Samuele Puricelli, Ing. Francesco Davolio, Dr. Luigi Monolo



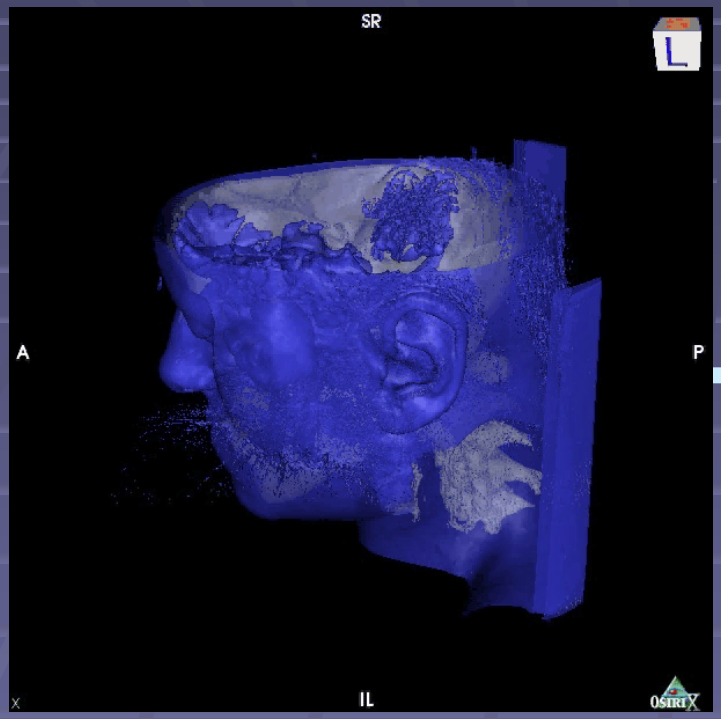


Zdroj: deník Aha ! 13.11.2009

Laciná výroba studijních a operačních modelů

┬http:\d-anatomystore.com

SW PROPOJENÍ mezi obrazovými daty a dalšími fázemí zpracování obrazových dat:



- Rapid Prototyping
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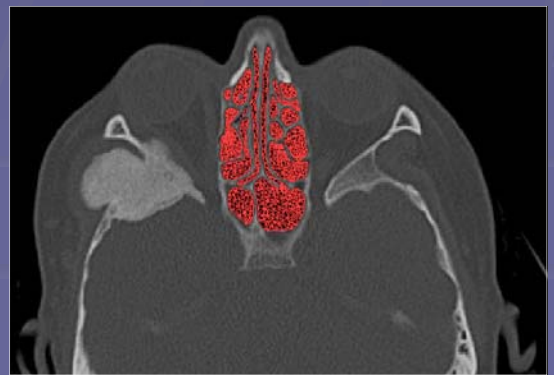
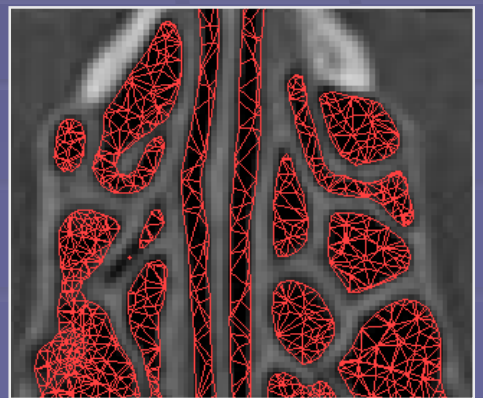
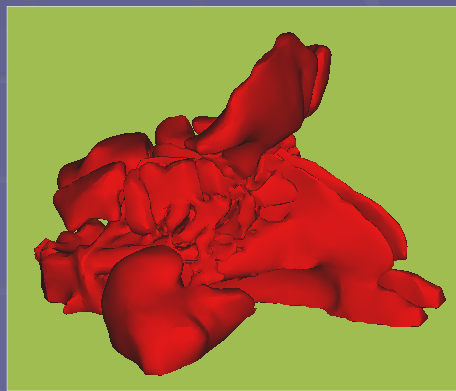
- Other application domains







SW PROPOJENÍ mezi obrazovými daty a dalšími fázemí zpracování obrazových dat:

- Rapid Prototyping
- CAD
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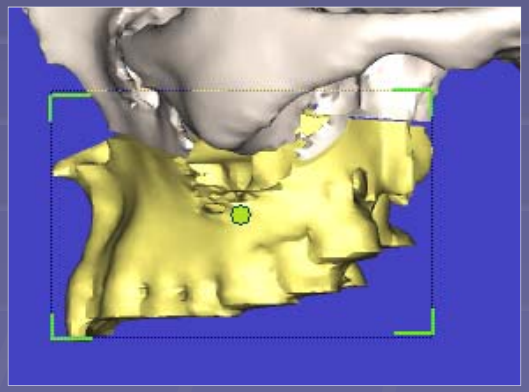
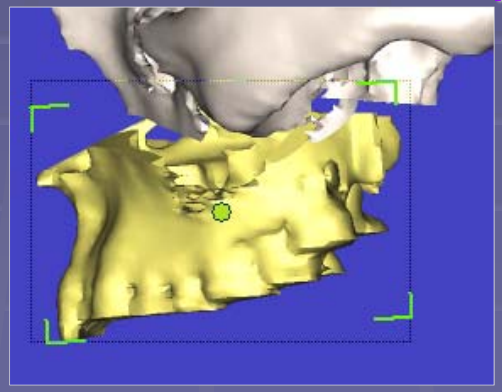
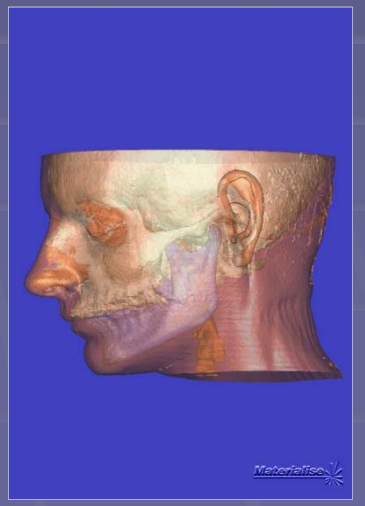
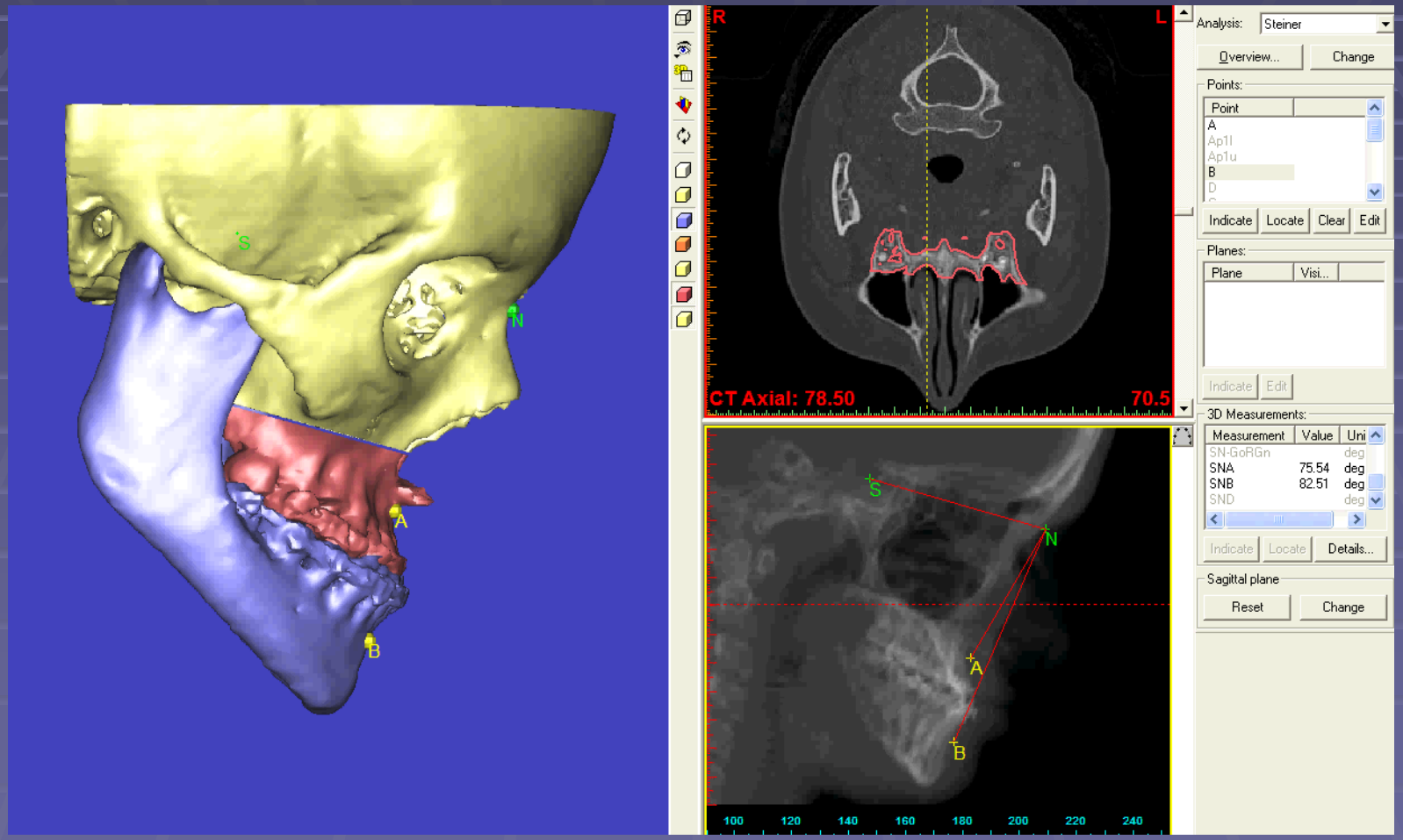
- Surgical Procedure Simulation
- Other application domains





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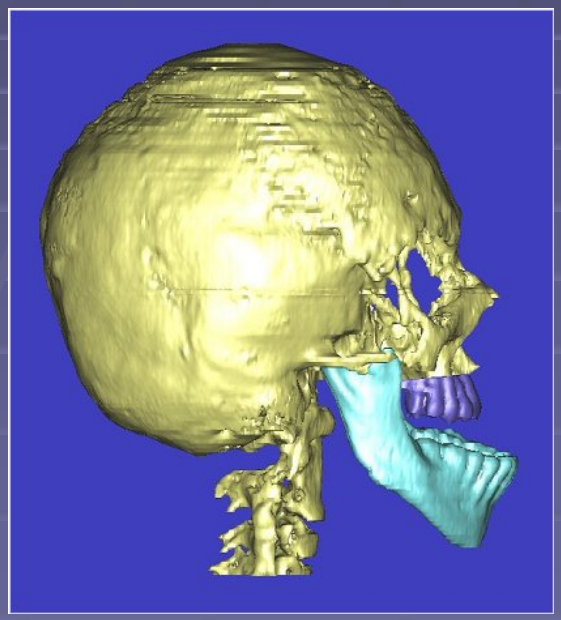
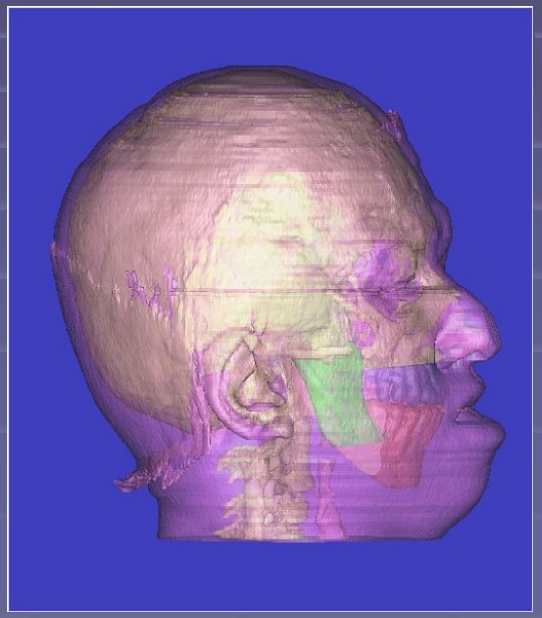
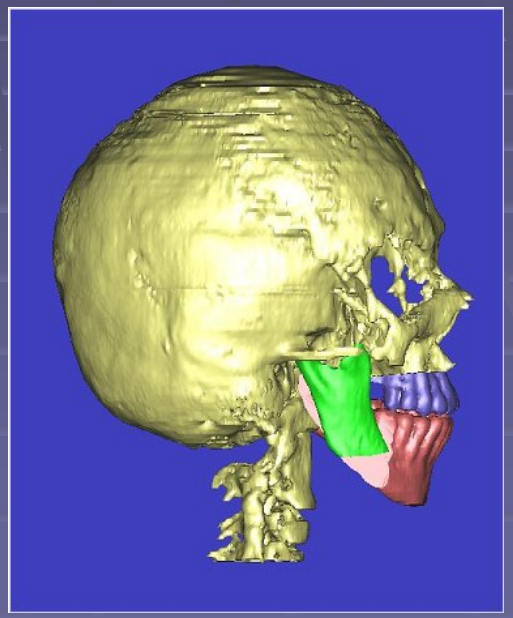
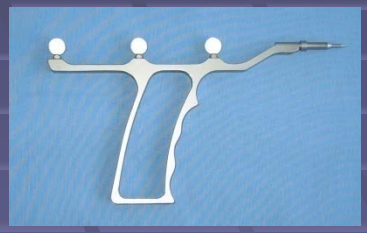




Co k tomu potřebujeme?

- 3D Data – CT
- Výkonný počítač ?
- Adekvátní SW
- Znalosti anatomie, operačních postupů a chirurgických technik, ….
- Virtuální realita – nic není nemožné…

- Možnost opakovaných pokusů , „oprav“ …
- Výsledek zpracovatelný do fyzického „hardcopy modelu“ - „výtisk prostorového modelu“ – ověření operačního proveditelnosti a přesnosti postupu
- Didaktická hodnota cvičné operace na skutečných datech

Navigace



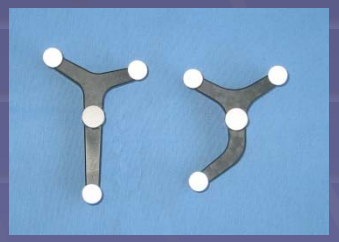
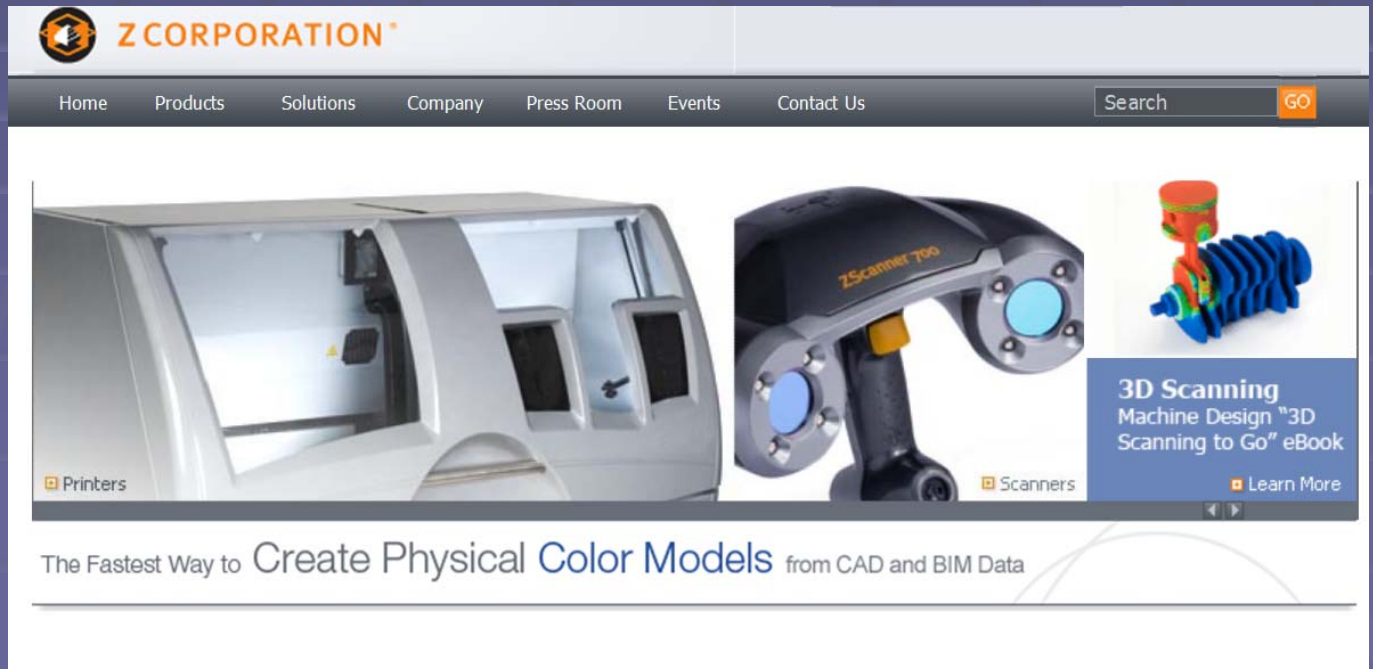


Foto: Daniel Hrušák – AO kurs Hanover 2008

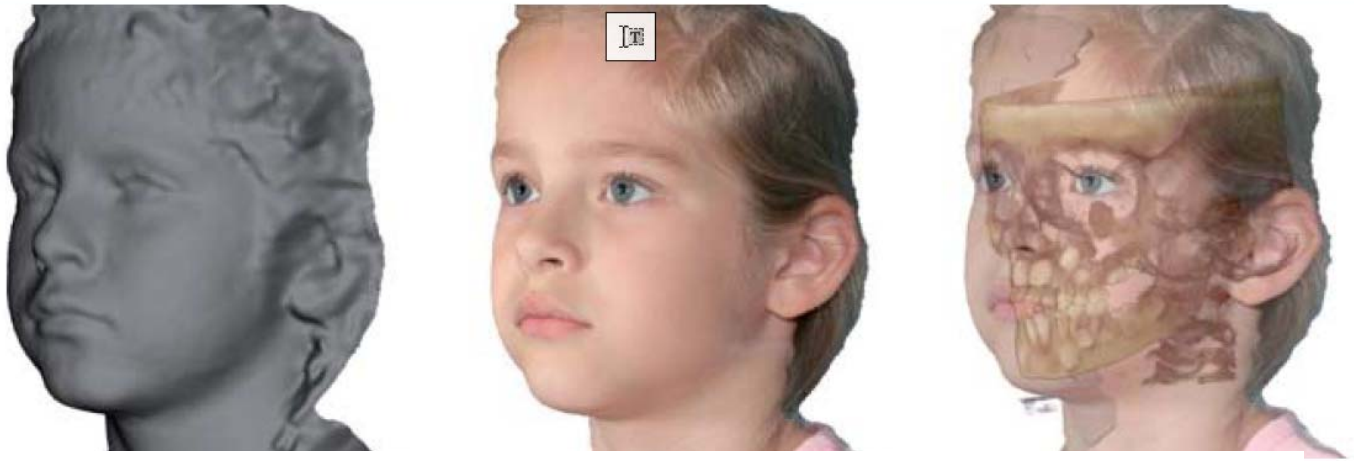
Prostorové zobrazení 3D a 4D objektů s analýzou povrchů a tvarů

- Použití 3D Scanerů
- Laserové techniky
- Fotografické techniky
- Počítačové zpracování výsledného obrazu
- Propojení s CT daty – superimpozice obrazů
- Čtvrtý rozměr – Čas (zachytit dynamiku procesů)



dimensional imaging

WORLD LEADING 3D SURFACE IMAGING //



Di3D™ Facial Capture System with new V4 Di3Dcapture™ software.

3D facial surface image capture, viewing, analysis and storage on a standard PC;

- Instantaneous capture
- Photo-quality 3D surface image
- Up to 24 megapixel color resolution
- Versatile meshing options
- 3D soft tissue overlay onto cone beam CT for improved patient communication using third party applications
- **New Di3Dcapture™ V4** software now available with single button capture and build, accelerated image processing and easy-to-use visual file management tools.

The Di3D™ Facial Capture System is the system of choice for researchers pioneering the latest advances in many areas including orthodontics, oral and maxillofacial surgery and plastic surgery.

Examples of recent publications include;

- Technical validation of the Di3D™ stereophotogrammetry surface imaging system *1
- Towards building a photo-realistic virtual human face for craniomaxillofacial diagnosis and treatment planning *2
- Validation and reproducibility of a high-resolution three-dimensional facial imaging system *3

World Leading 3D & 4D Surface Imaging //

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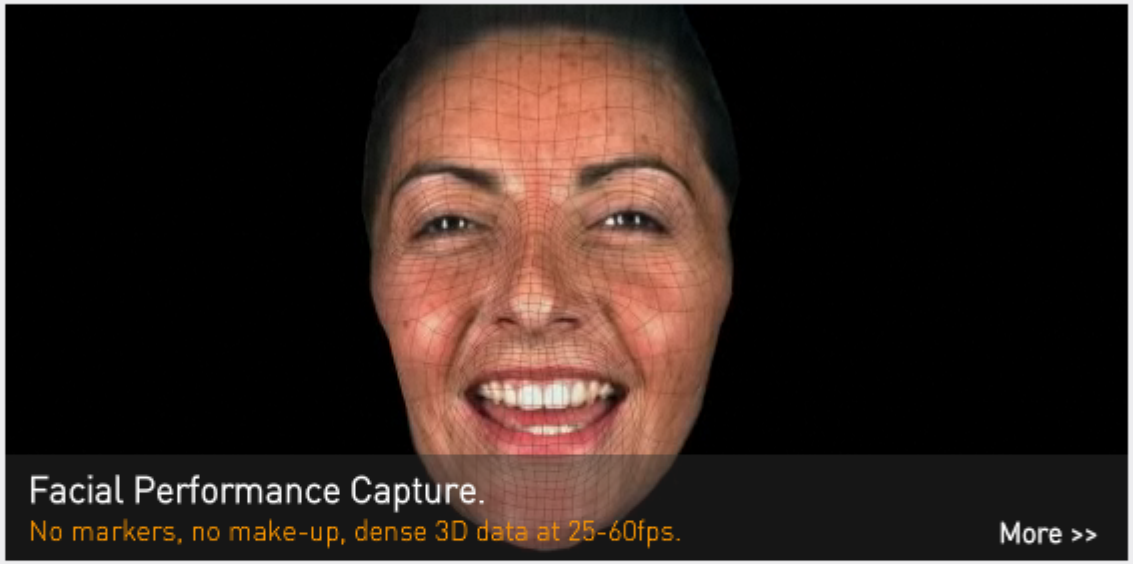

YOUR BUSINESS

What is your business?

- Entertainment
- Life Sciences
- Psychology

MORE

HIGHLIGHTS

Highlights

Dimensional Imaging will be at SIGGRAPH 2008.
Booth #1523.

MORE

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Passive Stereo Photogrammetry

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CONTACT US //

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GLASGOW, SCOTLAND
UK G52 4RU

TEL: +44 141 585 6481
EMAIL: INFO@DI3D.COM

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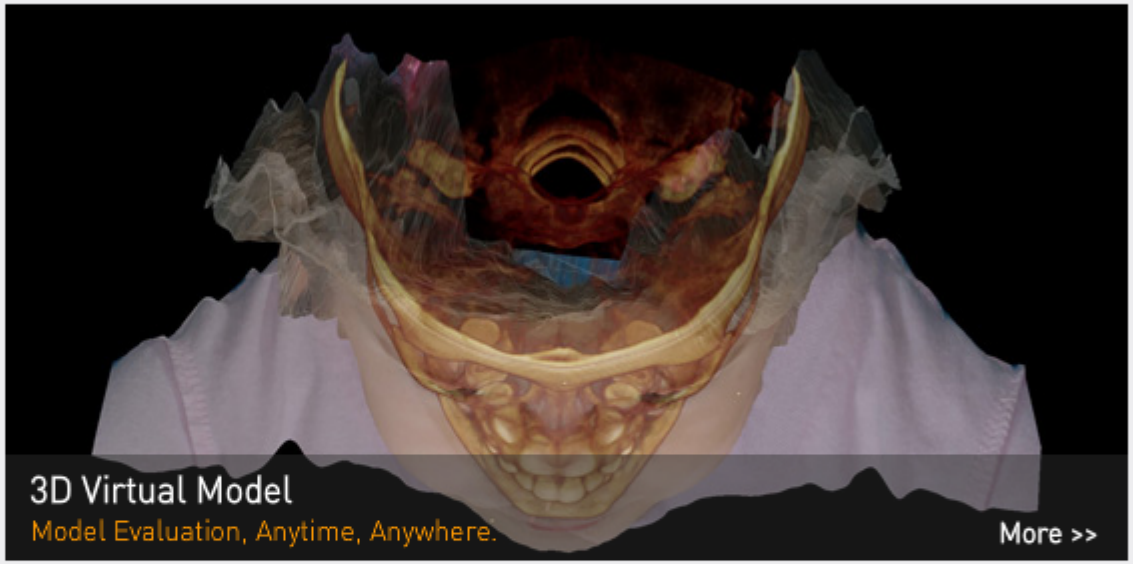

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Využití 3D technologií

- Virtuální nácvik chirurgických technik
  „Od virtuální reality k REALITĚ !!!“
- Dokumentace komplexních případů k „ohmatání“
- Plánování složitých a rozsáhlých operací
- Individuální implantáty
- Výukové modely pro studenty

Děkuji za pozornost

Foto: Daniel Hrušák – Hlu-Hluwe NP Santa Lucia South Africa 2008