

9 ANHANG: MAKRO, KS 400

```

#-----
# MACRO: CART001.MCR
# KEYWORDS: Color Field-measurement of Cartilage (Knorpel)
# ABSTRACT: Field measurement (absolut, mit ROI-Polygon)
# SYSTEM: KS400 - rel 3.0
# OPTIONS: Colour
# IMAGES: RGB-Input (3CCD-Kamera MC3254)
# LUT:
# AUTHORS: Justin M Burns, T. Betz
# USER: Dr. Bail, Charité/Virchow-Klinikum Berlin, Unfallchirurgie
# -----
-----

# Initialisierung
#-----
imgdelete "*"
Gclear 0
MSload "default"
update
showwindow "Display",1

# Datenbank Definitionen
# -----
# Eingabe, Prüfen und Setzen des Datenpfades
# -----
DATAPATH="D:/daten/cartilage"
while 1
beep 100,1100
beep 100, 990
read DATAPATH,"Geben Sie den Daten-Pfad ein: \n SYNTAX EINHALTEN !"
    if fexist (DATAPATH) != 2
        beep 300,440
        beep 300,440
        MBok "Der Pfad >> " + DATAPATH + " << existiert nicht. Korrigieren Sie Ihre Eingabe."
    else
        break
    endif
endwhile
DBsetpath DATAPATH

# Variablen für Datenbank
# -----
# APPEND wird nach der ersten Schleife auf 1 gesetzt!
APPEND=0
# Variable PRO_NR für Projektnummer
PRO_NR=001
# Variable PAT_NR für Patientenummer
PAT_NR=001
# Variable LOKAL für Lokalisation
LOKAL=1
# Variable CUT_NR für Schnittnummer
CUT_NR=001
# Variable DEFECT_AREA für Defektfläche (aufgezogenes Polygon)
DEFECT_AREA=0.0
# Variable CALLUS_AREA für Callusfläche (schwarz gefüllt)
CALLUS_AREA=0.0
# Variable KNOCHEN_AREA für Knochenfläche (schwarz ohne Füllung)
KNOCHEN_AREA=0.0
# Variable für DENS_CALLUS für Flächendichte des Callus
# (= Knochenfläche/Callusfläche * 100%)
DENS_CALLUS=0.0
# Variable KNORPEL für Knorpelfläche (blau)
KNORPEL=0.0
# Variable BINDEGEW für Bindegewebe (Rot minus Knorpel)
BINDEGEW=0.0
# Variable NONFULL für FIBROUS TISSUE
NONFULL=0.0
RES=0.0
# Eingabe des Datenbanknamens
# -----
DATABASE="Cart_001"
read DATABASE, "Geben Sie den Datenbanknamen ein!"
# Datenbankstrukturdefinition
DBnew DATABASE,13

```

```

DBsetcolumn DATABASE,1,"Projekt_Nr","Int","<none>"
DBsetcolumn DATABASE,2,"Patient_Nr","Int","<none>"
DBsetcolumn DATABASE,3,"Lokalisation","Int","<none>"
DBsetcolumn DATABASE,4,"Schnitt_Nr","Int","<none>"
DBsetcolumn DATABASE,5,"Defektfläche","Float","mm²"
DBsetcolumn DATABASE,6,"Callusfläche","Float","mm²"
DBsetcolumn DATABASE,7,"Knochenfläche","Float","mm²"
DBsetcolumn DATABASE,8,"Callusdichte","Float","%"
DBsetcolumn DATABASE,9,"Knorpel","Float","mm²"
DBsetcolumn DATABASE,10,"Bindegewebe","Float","mm²"
DBsetcolumn DATABASE,11,"Nichtfüllung","Float","mm²"
DBsetcolumn DATABASE,12,"Fib_Tiss","Float","mm²"
DBsetcolumn DATABASE,13,"Resorption","Float","mm²"
datalist DATABASE,0,0
update

# Initialisierung der Meßparameter
# -----
MSload "default"
MSsetprop "REGIONFEAT","AREA"
MSsetprop "FIELDFEAT","Flaeche[UNIT^2]=SUM(AREA)"
MSsetprop "DRAWFEAT","DRCONTOUR"
# diese Scalierung paßt zum Objektiv 1.6 und Zoom 0.55
MSsetprop "SCALEX",0.0093633
MSsetprop "SCALEY",0.0093633
MSsetprop "UNIT","millimeter"

# Berechnen des Rectangle 6 x 1,5 mm²
# -----
RECTX=6/0.0093633
RECTY=1.5/0.0093633
# write RECTX
# write RECTY
# Generieren 641 x 160 Pixel !
SIZEX=int(RECTX)
SIZEY=int(RECTY)
# write SIZEX
# write SIZEY

beep 100,660
showwindow "Messages",1
write "@"
write "Stellen Sie das Mikroskop wie folgt ein!"
write "Objektiv 1,6x, TV-Zoom: 0,55x"
write "Tubus auf 50/50 stellen!"
write "Beleuchtung auf 7 V , Graufilter ON"
write "Leuchtfeld- und Aperturblende voll auf!!!"
write "Neutralfilter 0.4 + 16 im Durchlichtstrahlengang rein"
write "Kamera MC 3254 auf Normalwerte : Gain=0 ...."
beep 100,1000
MBok "Haben Sie alles eingestellt ?"
showwindow "Messages",0
# -----
----
# Meßschleife
while 1
# das Macro ist so aufgebaut, daß alle Schnitte in einer
# Datenbank gemessen werden!
# deshalb werden erst hier die allgemeinen
# Parameter abgefragt
# -----
# neue Zeile in Datenbank nicht vergessen!
DBaddline DATABASE
#
read PRO_NR,"Geben Sie die Projekt-Nummer ein: \n SYNTAX EINHALTEN !"
DBsetvalue DATABASE,"Projekt_Nr",PRO_NR
read PAT_NR,"Geben Sie die Patienten-Nummer ein: \n SYNTAX EINHALTEN !"
DBsetvalue DATABASE,"Patient_Nr",PAT_NR
read LOKAL,"Geben Sie die Lokalisation ein: \n SYNTAX EINHALTEN !"
DBsetvalue DATABASE,"Lokalisation",LOKAL
read CUT_NR,"Geben Sie die Schnitt-Nummer ein: \n SYNTAX EINHALTEN !"
DBsetvalue DATABASE,"Schnitt_Nr",CUT_NR
#

while 1
#Bildaufnahme
imgdelete "*"

```

```

Gclear 0
update
# Anlegen eines Hilfsbildes für Wincopy
imgnew "FRAME",758,572,1,"Colour"
beep 100,880
beep 150,660
pause "Stellen Sie das nächste Bildfeld ein!",2000
# pause "Laden des Beispielbildes von der Harddisk!",2000

! tvinput "INPUT"
# !imgload "k:\bail\cartilage\cart_02.tif","INPUT"
imgdisplay "INPUT"
# Shading-Korrektur (bei unbedingter Notwendigkeit)
lowpass "INPUT","SHAD_REF",49,5
shadcorr "INPUT","SHAD_REF","INP_GOOD",2,0
# Enhancement
#-----
normalize "INPUT","ENH_NORM",5
# Kopieren des Bildes in das FRAME-Hilfsbild
wincopy "ENH_NORM","FRAME",6,4,758,572,0,0
while 1
  Gclear 0
  imgdelete "RECT"
  imgdisplay "FRAME"
  # Maskierung erzeugen für Defektfläche
  # -----
  beep 100,880
  beep 150,660
  pause "Verschieben Sie das Rechteck und \n ziehen Sie den oberen Rand bei Bedarf
auf!",0
  SIZEX=int(RECTX)
  SIZEY=int(RECTY)
  STARTX=50
  STARTY=250
  ! Grectg STARTX,STARTY,SIZEX,SIZEY,14,0
  Gmerge "RECT",255
  MByesno "Do you need to correct the rectangle image?"
  if _STATUS!=1:break
  _APPEND=1
endwhile

MByesno "Do you need to correct the tv image?"
  if _STATUS!=1:break
  _APPEND=1
endwhile

dislevrgb "RECT",21,0,0,255,255,255,0,0,10,"RGB"
binfill 21,29

# Erzeugen des Meßbildes (Maskierung)
# -----
Gclear 0
imgnew "MEAS_SM",SIZEX,SIZEY,1,"Colour"
wincopy "FRAME","MEAS_SM",STARTX,STARTY,SIZEX,SIZEY,0,0
imgdisplay "MEAS_SM"

MByesno "Do you need to correct the defect area?"
if _STATUS == 1
  while 1
    Gclear 0
    imgdelete 1
    imgdelete "MASK1"
    imgdelete "MASKFILL"
    imgdelete 20
    pause "Outline the defect area with a polygon, pensize 2, and light green. Do not go
off the screen",0
    imgcopy "MEAS_SM",1
    imgedit 1
    Gmerge "MASK1",255
    binfill "MASK1","MASKFILL"
    imgcopy "MASKFILL",20
    imgdisplay 20

```

```

        MByesno "Do you need to correct this image?"
        if _STATUS!=1:break
            APPEND=1
        endwhile
else
    displevrgb "MEAS_SM","MASK1",0,0,255,255,255,255,0,0,10,"RGB"
    binnot "MASK1","MASK1"
    binfill "MASK1","MASKFILL"
    imgcopy "MASKFILL",20

endif

    # Messen der Defektfläche
wait 1500
update
MSmeasmask "MASKFILL","FRAME","MASKFILL",0,1,10
DBgetvalue "MASKFILL","AREA",MASKAREA
# write MASKAREA
DBsetvalue DATABASE,"Defektfläche",MASKAREA
wait 1000

# Segmentieren der Knochenfläche
# -----
while 1
    imgdisplay "MEAS_SM"
    Gclear 0
    imgdelete "MEASKN1"
    imgdelete "MEASKN2"
    showwindow "Messages",1
    write "@"
    write "You are now measuring the"
    write "bone area"
    beep 100,880
    beep 150,660
    wait 1500
    ! displevrgb "MEAS_SM","MEASKN1",1,0,0,255,11,101,0,123,10,"HLS"
    binscrap "MEASKN1","MEASKN2",0,30,0
    binnot "MEASKN2","MEASKN2"
    binfill "MEASKN2","MEASKN2"
    binnot "MEASKN2","MEASKN2"
    imgdisplay "MEASKN2"
    MByesno "This is the measurement image. Does it need to be corrected?"
        if _STATUS!=1:break
            APPEND=1
        endwhile
    # Messen der Knochenfläche (schwarz)
    # -----
    MSmeasmask "MEASKN2","FRAME","KNOCHEN",0,2,10
    DBgetvalue "KNOCHEN","Flaeche",KNAREA
    # write KNAREA
    DBsetvalue DATABASE,"Knochenfläche",KNAREA
    # Ermittlung der Callusfläche durch interaktives Schließen
    # -----
    while 1
        imgdelete "MEASKN3"
        imgdelete "MEASKN4"
        imgdelete "MEASKN5"
        imgdelete "MEASKN6"
    while 1
        Gclear 0
        imgdelete "MEASKN21"
        imgcopy "MEAS_SM",1
        imgdisplay 1
        beep 100,880
        beep 150,660
        pause "Schließen Sie die Knochenfläche mit dem Stift \n in Stärke 2 und mit der
hellgrünen Farbe!",0
        imgedit 1
        Gmerge "MEASKN21",255
        imgdisplay "MEAS_SM"
        MByesno "Do you need to correct this image?"
            if _STATUS!=1:break
                APPEND=1
            endwhile
        Gclear 0

```

```

binor "MEASKN21","MEASKN2","MEASKN21"
binclose "MEASKN21","MEASKN21",7,1
binfill "MEASKN21","MEASKN3"
Gmerge "MEASKN3",255
Gclear 0
binnot "MEASKN3","MEASKN4"
binscrap "MEASKN4","MEASKN5",0,10000,0
binnot "MEASKN5","MEASKN6"
imgdisplay "MEASKN6"
wait 1000
    MByesno "This is the image to be measured. Does it need to be corrected?"
    if _STATUS!=1:break
        APPEND=1
    endwhile

MSmeasmask "MEASKN6","FRAME","CALLUS",0,2,10
DBgetvalue "CALLUS","Flaeche",CALAREA
DBsetvalue DATABASE,"Callusfläche",CALAREA

DENS_CALLUS=KNAREA/CALAREA*100
DBsetvalue DATABASE,"Callusdichte",DENS_CALLUS
Gclear 0

# Measuring the Nichtfüllung
while 1
    Gclear 0
    imgdelete "REST"
    imgdisplay "MEAS_SM"
    beep 100,660
    showwindow "Messages",1
    write "@"
    write "You are now measuring the"
    write "Nichtfüllung"
    wait 1500
    ! dislevrgb "MEAS_SM","REST",1,0,0,108,77,255,0,255,10,"HLS"
    binscrap "REST","REST",0,2000,0
    binfill "REST","REST"
    binnot "REST","REST"
    binscrap "REST","REST",0,200,0
    binnot "REST","REST"
    binand "REST",20,"REST"
    imgdisplay "REST"
    MByesno "This is the measurement image. Does it need to be corrected?"
    if _STATUS!=1:break
        APPEND=1
    endwhile

MSdrawmask "REST","FRAME"
Gmerge 3,255
imgdisplay "MEAS_SM"
MSmeasmask "REST","FRAME","REST",0,2,10
DBgetvalue "REST","Flaeche",REST
DBsetvalue DATABASE,"Nichtfüllung",REST
Gclear 0

# Measuring the Bindegewebe
binor "REST","MEASKN6","BG"
binnot "BG","BG"
MSdrawmask "BG","FRAME"
Gmerge 4,255
imgdisplay "MEAS_SM"
MSmeasmask "BG","FRAME","BG",0,2,10
DBgetvalue "BG","Flaeche",BG
DBsetvalue DATABASE,"Bindegewebe",BG
Gclear 0
update

# Bone Resorption
imgdisplay "ENH_NORM"
MByesno "Do you need to measure the bone resorption?"
if _STATUS == 1
    while 1
        Gclear 0
        imgdelete "POLY1"
        imgdelete "21"
        beep 100,660
        showwindow "Messages",1

```

```

write "@"
write "Select the polygon, 2, and light green"
write "Position the polygon so that the bone resorption"
write "area is enclosed with in."
wait 1500
imgdisplay "ENH_NORM"
imgcopy "ENH_NORM",21
imgedit 21
Gmerge "POLY1",255
imgdisplay "ENH_NORM"
MByesno "Do you need to correct this image?"
if _STATUS!=1:break
    APPEND=1
endwhile
Gclear 0
binfill "POLY1",22
dislelrgb "ENH_NORM",23,1,0,68,52,3,255,0,171,10,"HLS"
binscrap 23,24,0,70,0
binfill 24,24
binnot 24,24
binmask 22,24,26
subtract 26,29,27,2

else
    imgdisplay "ENH_NORM"
    Gmerge "POLY2",255
    Gclear 0
    binfill "POLY2",27
endif

imgdisplay "ENH_NORM"
MSmeasmask 27,"FRAMEB",27,0,2,10
DBgetvalue 27,"Flaeche",RES
DBsetvalue DATABASE,"Resorption",RES
update
wait 1000

# Green
beep 100,880
beep 200,990
pause "Insert Safranin-O/ Light green image",0
Gclear 0
! tvinput "INPUT"
imgcopy "INPUT","INPUTB"
# !imgload "k:\bail\cartilage\cart_02B.tif","INPUTB"
imgdisplay "INPUTB"
# Enhancement
#-----
normalize "INPUTB","ENH_NORB",5
# Anlegen eines Hilfsbildes für Wincopy
imgnew "FRAMEB",758,572,1,"Colour"
# Kopieren des Bildes in das FRAME-Hilfsbild
wincopy "ENH_NORB","FRAMEB",6,4,758,572,0,0
Gclear 0

! dislelrgb "FRAMEB","CART",1,0,184,255,61,189,65,255,10,"HLS"
binscrap "CART",11,0,20,0
binfill 11,11

while 1
    Gclear 0
    imgdelete "CARTEND"
    imgdelete "POLY"
    imgdelete "MASK200"
    beep 100,660
    showwindow "Messages",1
    write "@"
    write "Now you must outline the new cartilage!"
    write "Select the polygon, 2, and light green"
    write "Position the polygon so that the"
    write " new cartilage area is enclosed with in."
    wait 1500
    imgcopy "FRAMEB",1
    imgedit 1

```

```
Gmerge "POLY",255
MSdrawmask "POLY","FRAMEB"
imgdisplay "FRAMEB"
MByesno "Do you need to correct this image?"
if _STATUS!=1:break
  APPEND=1
endwhile
  Gclear 0
  binfill "POLY","MASK200"
  binand "MASK200",11,"CARTEND"
  imgdisplay "FRAMEB"
  MSmeasmask "CARTEND","FRAMEB",11,0,2,10
  DBgetvalue 11,"Flaeche",CART
  DBsetvalue DATABASE,"Knorpel",CART
  Gclear 0
  update
# Fibrous Tissue Measurement

DBgetvalue DATABASE,"Knorpel",CART
DBgetvalue DATABASE,"Bindegewebe",BG
BINDEGEW=BG
KNORPEL=CART
NONFULL=BINDEGEW-KNORPEL
wait 2000
DBsetvalue DATABASE,"Fib_Tiss",NONFULL
update
wait 2000
# Erzeugen des Meßbildes für rotes Bindegewebe
  update
  MByesno "Wollen Sie ein weiteres Bildfeld vermessen?"
  if _STATUS!=1:break
  APPEND=1
endwhile
beep 100,880
beep 200,990
showwindow "Messages",1
write "@"
write "Ende des Macros"
write "Exportieren Sie die Daten!"
wait 2000
stop
```