

Swanson School of Engineering

D5 H-9 BHG'K \pm FCH5 HCF'7 I :: H95 FG'I H=@+9 HFI B?A 7 CAD9 BG5 H C F 9 8 7 9 ; @ BC < 1 A 9 F 5 @ 9 0 J 5 H C B DC GH! 9L9F7=G9'H<9F5DM'K<9B'F957<=B; '69<=B8'H<9'657?Å @_YH"AUHUf[%]z7Ua]`Y7">c\bgcb[&]zHca <"; UY[&]z5XUa >"DcdWU_'z>Ua Yg'>"f[Ub['^{*}zÁ K]``]Ua '>"5bXYfgh^{*}zJc`_Yf Ai gU\`[&]zF]W UfX'9"8YVg_][%]



[%]8 YdUfha YbhcZ6]cYb[]bYYf]b[z̃[&]8 YdUfha YbhcZCfh\ cdUYX]WGi f[Yfmz̈/ " 8 YdUfha YbhcZD\ mg]WU H\ YfUdmÁ I b]j Yfg]mcZD]hgVi f[\

=blfcXiWicb

GiV^YWrg'k]h`fchUncf'WiZZhYUfg'\UjY'VYYb'g\ckb'nc'WcadYbgUnY'k]h`hfib_'ach]cb'Xif]b[Á dfcjcWUhjjY`HJg_g`C%QT7`]b]WU`mžh\YgY`giV^YWhg`cZhYb`YIdYf]YbWY`dU]b`k\Yb`fYUW\]b[`VY\]bX`h\YÁ VUW_`a U_]b[`dYfgcbU``\m[]YbY`cf`XfYgg]b[`X]ZZJWI`H'GhiX]Yg`\UjY`g\ckb`Ub`UjYfU[Y`cZ%)"-š`cZÁ [`Ybc\iaYfU`Y`YjUh]cb`]g`fYei]fYX`hc`fYUN(`VY\]bX`h\Y`VUV_`]b`\YU`h\migiV^YWfgžYbWcadUgg]b[Á h\Y`iddYf`fUb[Y`cZg\ci`XYf`UVXiWF]cb`k\YfY`h\Y`gidfUgd]bUhig`]g`h\Y`aU]b`UbHU[cb]gh'H\igžÁ fchUncf WizzhYUf gi V/YWng a UmiWca dYbgUnY k]h 'hfi b_'a ch]cb hc fYXi WY [`Ybc\ i a YfU Y Yj Uh]cbÁ UbX']b'h fb'dU]b"

F Ygi `hg

HUV`Y`%`AUI]aia`Hfib_`Ach]cbz;`Ybc\iaYfU`?]bYaUh]WgzUbX`AUI]aia`FYUMY`DfY`UbX`Dcgh'%&!KYY_Á 91 Yf Wjg Y'H\Yf UdmDfc [f Ua'f AYUb'-'G8Ł

CihWca Y'A YUgifY	Ú¦^	Ú[•c]
5 bhYf]cf`flŁ#DcghYf]cf`fŽŁ`@/Ub	Ë ÈGÁ Á ÈG»	ĔĖĖÁÁÈH»	N€È€Í
@UhYfU`@YUb`fHckUfXg`IbUZZYWHYX`!ž5ZZYWHYX`ŽŁ	ËÈÁÁHÈG≫	ËÈÁÁÁTÈ	N€È€Í

*"Á*Gi V^YWgʻdYfZcfa YXʻUʻVY\]bXʻl\Y`VUV<u>'</u>HJg_'VY[]bb]b['k]l\`\UbX`d`UWYX`cb`l\][\žfYUV\YXA Ug'ZJf'VY]bX'VUV

8 mbUa]WGhYfYcfUX]c[fUd\mCaQUbX'J]Wcb'Achjcb'7 UdhifY

ÁGi VYWhidfc[fYgg]cb'VUgYX'i dcb'dU]bžfUb[Y'cZa ch]cbžUbX'ghfYb[h

Á c Wig Yg. F Ub [Y'c Za ch]cb Ub X'ghf Yb [h Yb]b ['c Zf ch Uc f'WizzzzgWUdi `Uf'a i gWYg

"P/&!k YY_'ghfi Whi fYX'dfc[fUa

91 Yf WgY'H Yf UdmDf chc Wc`

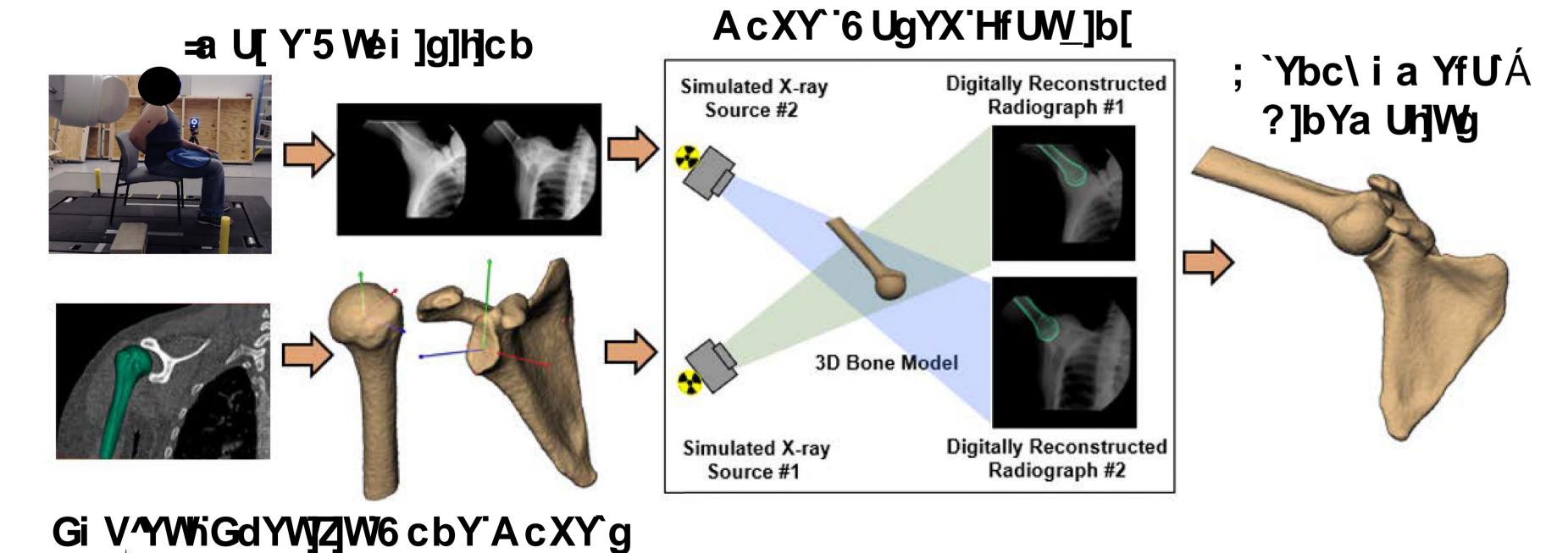
AGma dhca UhjWfchUhcf'W ZZhYUf']gc`UhYX'hc'gi dfUgd]bUhi g

A Yh c Xg ″A&\$`giV^YWrg`fU[Yg`()!+\$ŁfYWri]hYX`UZhYf`dfcj]X]b[`=F6!UddfcjYX`kf]hhYb`]bZcfaYX`WcbgYbhA

8 YhYfa]bY`W(Ub[Yg`]b`lfib_`ach]cbžaU(]aia`fYUN(žUbX`[`Ybc\iaYfU`Y`YjUh]cb`UbX`h\YA fY`Uhjcbg\]d`VYhk YYb`hfi b_`a chjcb`UbX`[`Ybc\i a YfU`Y`Yj Uhjcb`Xi f]b[`U`VY\]bX`h`Y`VUV_`HUg_A Zc``ck]b['U'%&!kYY_'ghfiWhifYX'YIYfW]gY'h\YfUdmidfc[fUa'

fBY[fYYgŁ :][i fY'& FY'Uh]cbg\]d'6 Yhk YYb'7 \ Ub[Yg']b'Hfi b_A $FchUhjcb'UbX'7 \setminus Ub[Yg']b'; Ybc \setminus i a YfU''9 YjUhjcb$

Hfib_`FchUhjcb`flbUZZYWHYX`ZcfkUfX`!ž5ZZYWHYXÁ :cfkUfX`ŽŁ	€ËÁÁÈ»	GÌŦÁ ÁHË »	N€È€Í
AUI]aiaˈFYUW(Ë€ÈÁ€ÈH	Ë€ÈÁ€È	N€È€Í
; `Ybc\ i a YfƯ '9`Yj Uh]cb	ÌÈ€ÁÁÁJÈ »	ÎĒÁÂÈF»	N€È€Í
Bc`X]ZZYfYbWYg`]b`Hfib_'ach]cbžÁ aUI]aia`fYUWYžcf'[`Ybc\iaYfUÁ Y`YjUh]cb`dcgHYIYfW]gY`h\YfUdm ÁbWYUgYX`Hfib_`fcHUh]cb`hckUfXgÁ UZZYWNX`g]XY `XYWYUgYXÁ [`Ybc\iaYfU`Y`YjUh]cb`UhÁ aUI]aia`fYUWY`fl][ifY`&L Ád0\$'\$)žF %1\$"&+žF1!\$")&	Elevation (15.0 10.0 5.0 -3.0 -5.0 -10.0 -15.0 -20.0 -25.0 ge in Maximum Trunk	7.0 12.0



:][ifY`%`CjYfj]Yk`cZ]aU[Y`UWei]g]h]cb`UbX`dfcWYXifYg`Zcf`_]bYaUhJWUbU`mg]gA

7 ca dUf]gcbg'a UXY'i g]b['dfY!'UbX'dcgHYI YfW]gY'N YfUdmHf]U'g'WcbHJ]b]b['N Y'a U]a i a À

AUI]aia'UbhYf]cf!dcghYf]cf'UbX``UhYfU'lfib_``YUbžaUI]aia'lfib_'fchUh]cb'fKY[fYYgžÁ

G][b]ZWUbWY

8]gW gg]cb

Yj U i UHYX 'XYHYfa]bY']Za chjcb'ghfUHY[mXYWYUgYg'X]gWca ZcfhfYUW[]b['VY\]bX'h Y'VUV 9 j U i UhY W Ub[Yg']b a U]a i a 'f YUW ']b gi d Yf]cf!]bZYf]cf X]f YWf]cb dcgh Yl Yf Wgy'h Yf Udm

FY`Uhjcbg\]d`VYhk YYb`hYUf`g]nY`UbX`dUhjYbh`fYdcfhYX`ci hWca Yg`k]h`hfi b_`Wca dYbgUhjcb`k]``VYA

: i h fY'8]fYWjcbg

Á, `Ybc\ i a YfƯ Y Yj Uhjcb'a YUgi fYX']b'\ YƯN mgi VYWg'Uha U]a i a 'fYUN 'VY\]bX'N Y'VUV<u>A</u>Á k Ug %) "- š O Q & (\$ \` \][\ Yf h Ub W ff YbhW c \ cfh

[`Ybc\iaYfU'YYjUh]cb'fYei]fYX

*"A*FY`Uhjcbg\]d`VYhkYYb`W{Ub[Yg`]b`aU|]aia`hfib_`fchUhjcb`UbX`[`Ybc\iaYfU`Y`YjUhjcb`UhA a U]a i a 'fYUN' 'jbX]WUhjjY'cZW Ub[Yg']b a chjcb ghfUhY[m ÁDcg]h]cb]b[`UZZYWHYX`g]XY`a cfY`Zcfk UfX `]bWYUgY`WYUfUbWY`k]h``UhYfU`hcfgc`a]b]a]n]b[Á

*"Á*Bc'W(Ub[Yg']b'a U]aia'fYUN(']b'A@X]fYWF]cb' 'YlYfW]gY'N YfUdmaUmbchUZZYWhfYUN(]b[Á VY]bX'h Y'VUV

*"*AJ]Wcb'i gYX'hc'hfUW_'UbUhca]WU'a Uf_Yfg'hc'ei UbhjZmhfi b_'a chjcb'UbX'fYUW

/G][b]Z]WUbWY`k Ug`gYhUhd`0`\$'\$)

DfY!'j g"DcgH9I YfWgY'H YfUdm

Ci hhica Y DUf Ua Yhifg

fYUW]b'a YX]U!`UHYfU fA @LX]fYW]cb

DYUfgcbBg cf GdYUfa UbBg WcffY Uhjcbg hc XYhYfa]bY fY Uhjcbg\]dg VYhk YYb W Ub[Yg]b hfi b_A a chjcb[·]UbX[·][`Ybc\ i a YfU[·]Y[·]Yj Uhjcb[·]dcgHYI YfWjgY[·]h YfUdm

DUJfYX`HhYghcf`WJfW``Uf`gHUhJghJWg`cb`ci hWca Y`dUfUa YhYfg`dfY!`jg"dcgHYI YfWJgY`h YfUdm

GHJhjghjWg

; `Ybc\ i a YfU`Y`Yj Uhjcb`Uha U]a i a 'fYUN 'fKY[fYYgž8 mbUa]WGhYfYcfUX]c[fUd\ mL

AUI]aia'fYUNY 'VY\]bX'h\Y'VUW_']b'A@X]fYWF]cbžbcfaU']nYX'hc'ghYfbia'aUf_Yf'UbX``ckYfÁ Ufa `Yb[h fJ]WcbŁ

5 W_bck `YX[Ya Ybhg GiddcfhiZica ĥ Y`BUhjcbU`=bghjhihYg`cZ<YUĥ Á [fUbh)F\$%5F\$*-)\$'`]g`[fUhYZi``mÁ UW_bck`YX[YX"

FYZYfYbW/g **G/Q@/Z**Yj f Y!7 c`Ui `YhU"5 bb D\ **ng F Y\ UV]**`A YX &\$% Ž&Q6 YmA 'YhU'' > '6]ca YWY '9 b['&\$\$* OQ?c`n`YhU"CFG&\$%



″Ä/CadYbgUhjcbʻj]Uʻlfib_ʻfcHUhjcbʻaUmUjXʻjbʻXYjY`cdaYbhcZUʻdfYX]WhjjY`acXY`hcʻXYhYfa]bYA h YYZYWrgʻcZYI YfWjgY'h YfUdmicbʻ[`Ybc\ia YfU`Y`YjUhjcb'Xifjb['U'VY\jbX'h Y'VUV_'HUg_

″AXYbhjZnjb[ˈ<u>a_chicbˈghfUhY[]Ygˈi hj</u>`]nYX'VmdUhjYbhgˈk]h\ˈfchUhcf'W ZZhYUfgʻa Um\ Y`d']XYbhjZmÁ **Z** b**Wj**cb**U**⁻]a dfcj Ya Ybhg

J]WcbŁ