
scale
SCOTT
SHIMANO
uci
899
grams of eXCellence

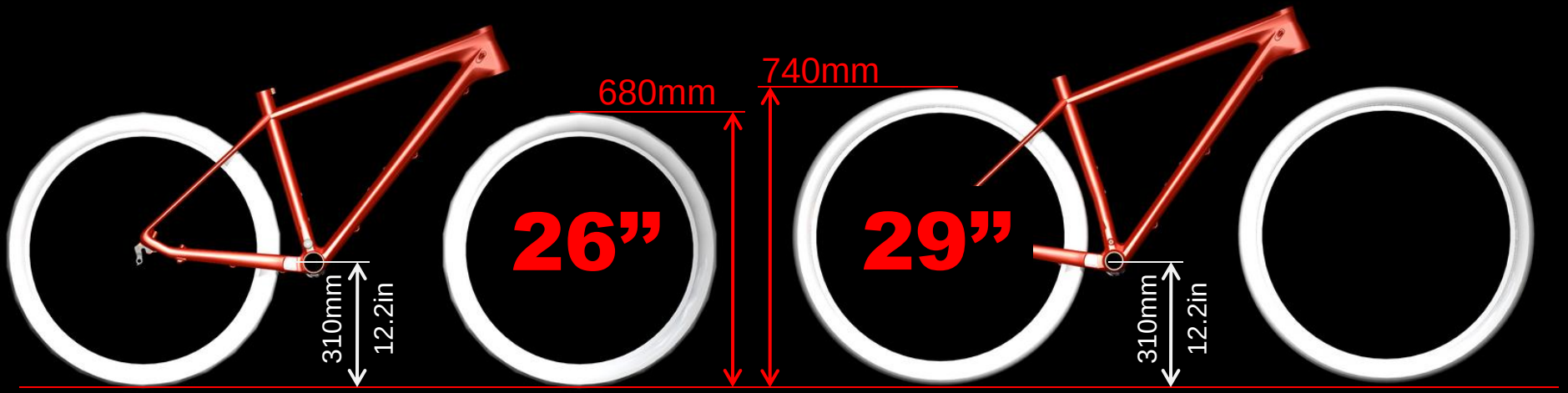
scale

SCOTT

scale

2 FRAMES

scale 29



scale

SCOTT

scale

2 FRAMES

scale 29

1 GOAL

LIGHTEST production hardtail in the world

899

949

References:

-Trek Elite 9.9 SSL	1100g.
-Specialized S-works Stumpjumper Carbon HT	1100g.
-Scott old Scale:	970g.
-Cannondale Flash:	950g.
-Merida O-Nine:	930g?
-Scott new Scale:	**899g. (max.!)**

scale

SCOTT

scale

2 FRAMES

scale 29

1 GOAL

LIGHTEST production hardtail in the world

899

949

0 COMPROMISE

Bring the **COMFORT** concept one step further

Reach the optimal **STIFFNESS**

FULL CARBON structure

R&D MEANS

Geometry
PM, Racing team, shops: feeling

Design
Designer, R&D 3D

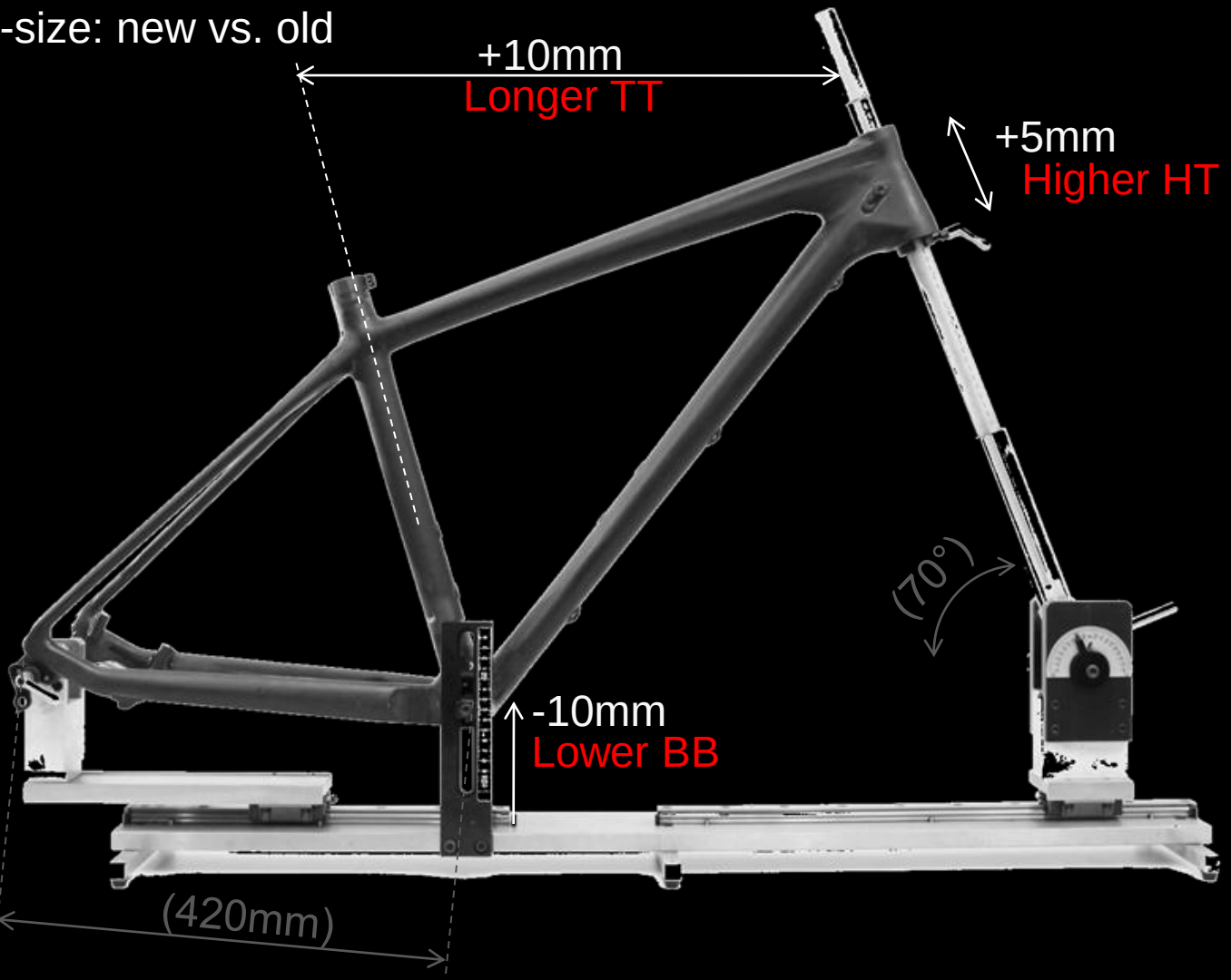
Mechanical constraints
R&D: FEA, structural calculation

Production process
R&D: Molds & production line

Final assembly
PM: Specifications

GEOMETRY

Scale 26 M-size: new vs. old



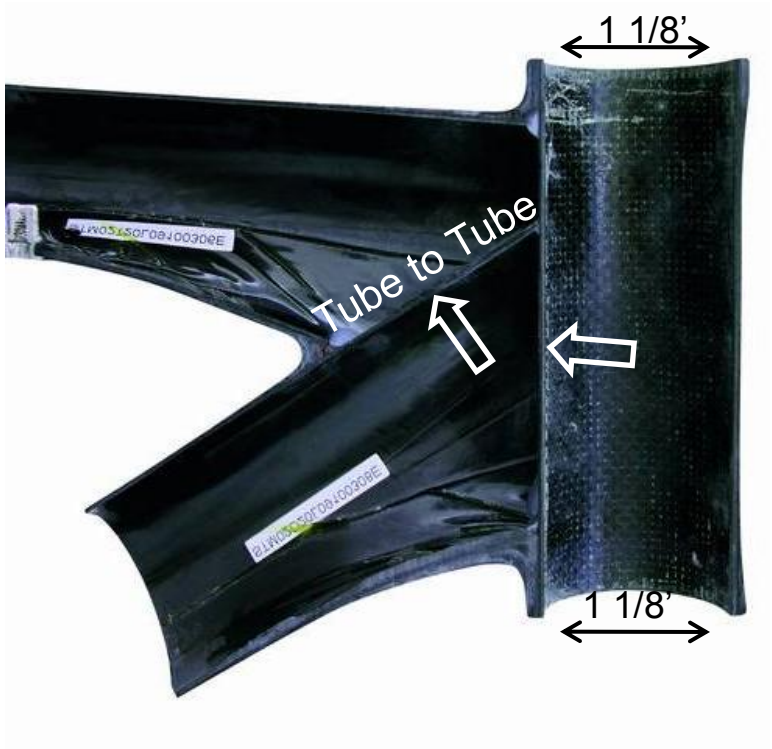
Technics

More GEOMETRY details…

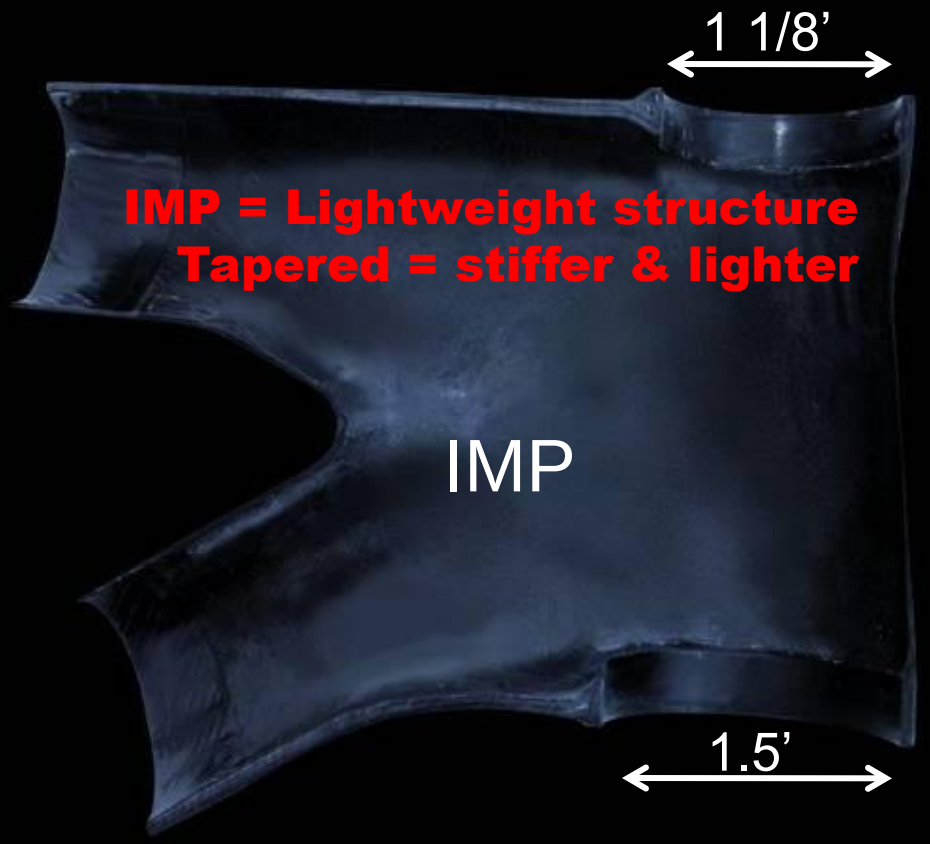
HEADTUBE

Same wall thickness, lighter, stiffer…

OLD SCALE



TUBE TO TUBE 1 1/8’ HT



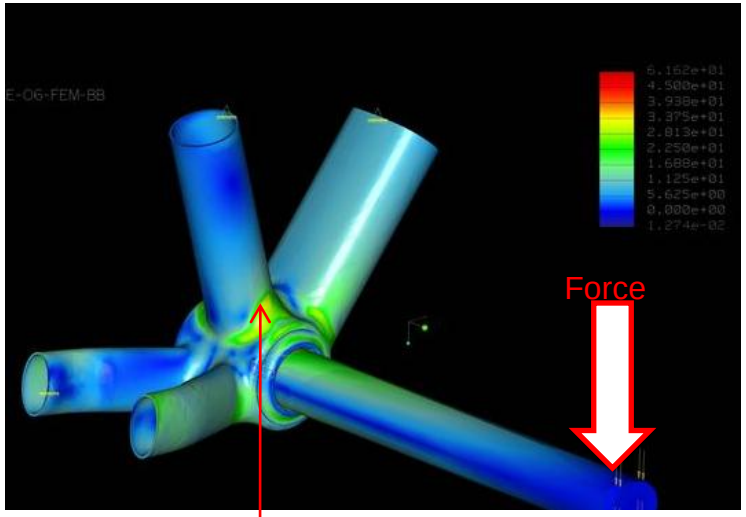
HEADTUBE

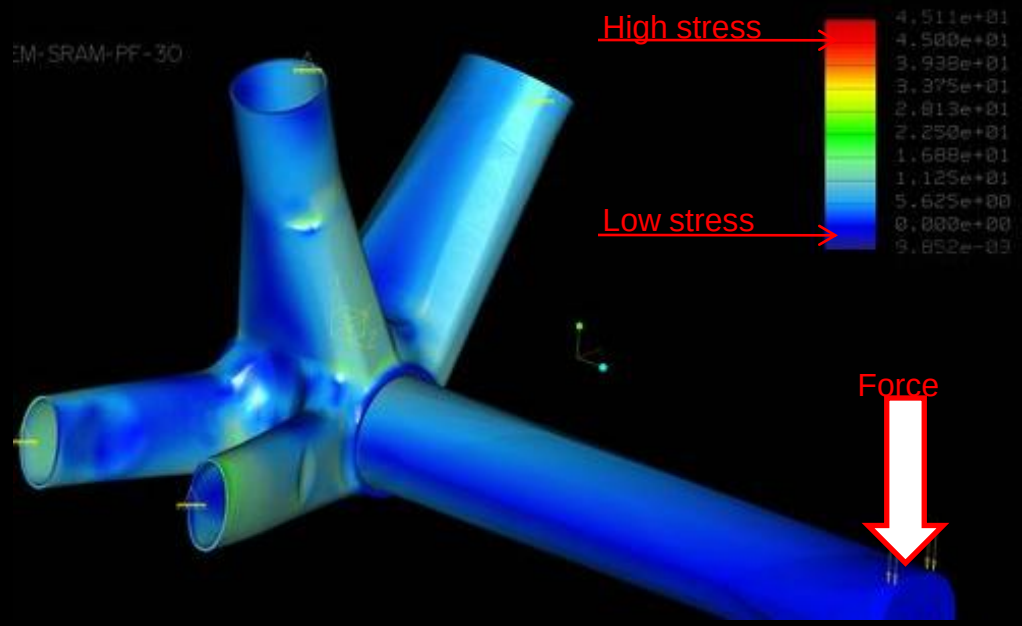
Stiffness: +10%
Weight: -15g.

BOTTOM BRACKET

Finite Elements Analysis: Stress concentration

OLD SCALE





Lower max. stress & smoother stress repartition

FEA optimisation: less stress means less reinforcement (lightweight design)

More FEA details…

Technics

IMP TECHNOLOGY

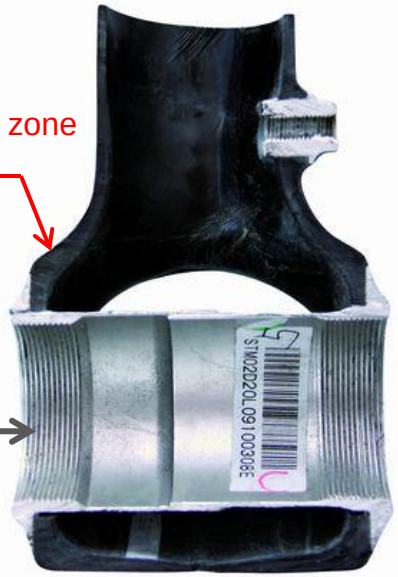
B.B 130 I.P.F.

B.B 92 I.P.F.

BOTTOM BRACKET

Press Fit BB

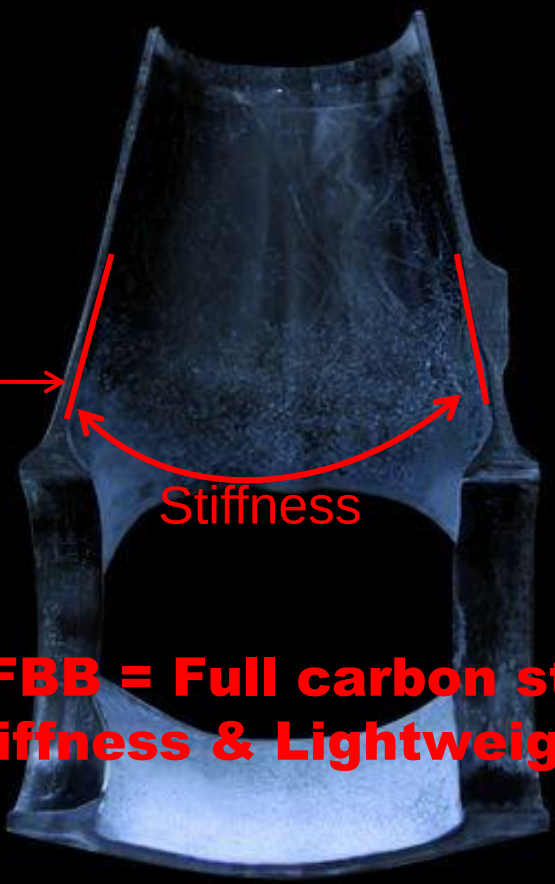
OLD SCALE



FEA High stress zone
= More material

ALLOY INSERT

THREADED BB



FEA smooth stress
transition
= Less material

Stiffness

IMP + PFBB = Full carbon structure
Stiffness & Lightweight

B.B 130 I.P.F.

B.B 92 I.P.F.

IMP TECHNOLOGY

More BBPF details…

scale

SCOTT

BOTTOM BRACKET

Stiffness: +15%
Weight: -30g.

B.B 130 P.F.

B.B 92 P.F.

IMP TECHNOLOGY

Technics

INTEGRATED SEATCLAMP

Weight: -11g

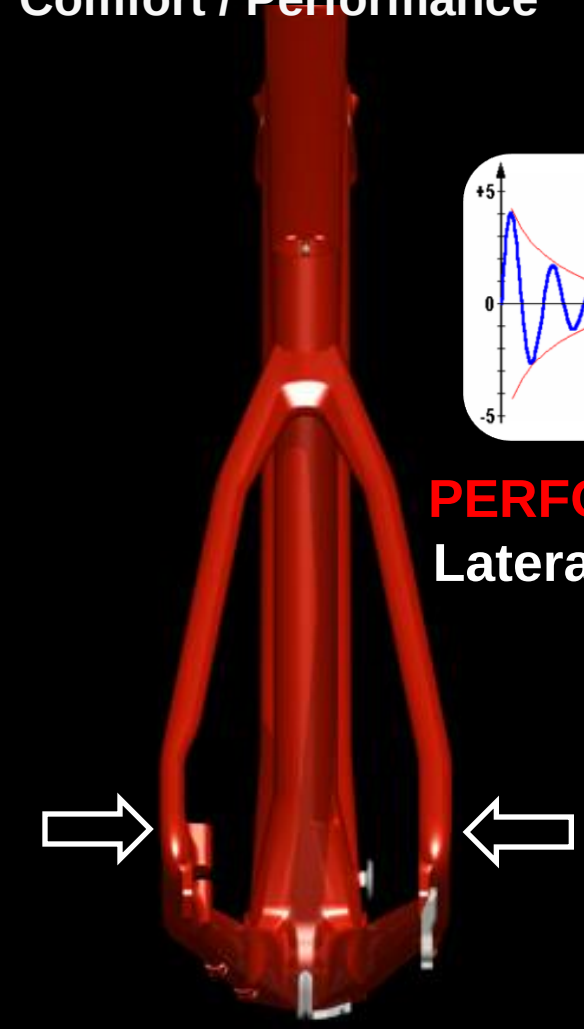
STANDARD CLAMP

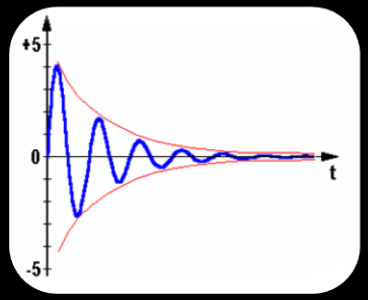
Lightweight (Ti bolt) = 16g.

Clamp = 5g!!!!

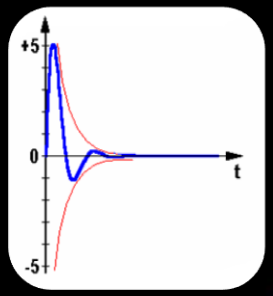
REARSTAYS

Comfort / Performance





PERFORMANCE
Lateral stiffness



COMFORT
Vertical compliance

REARSTAYS

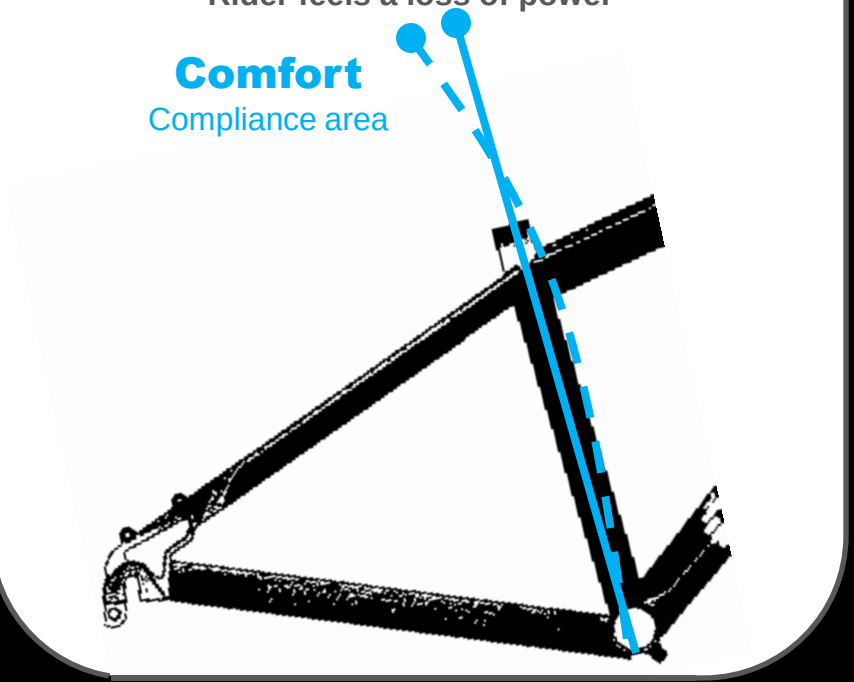
Comfort / Performance

STANDARD Concept

Most of the competition focuses on the comfort benefits of the seatpost… **BUT**

-Descending while standing on the pedals = Rider receives no comfort benefit

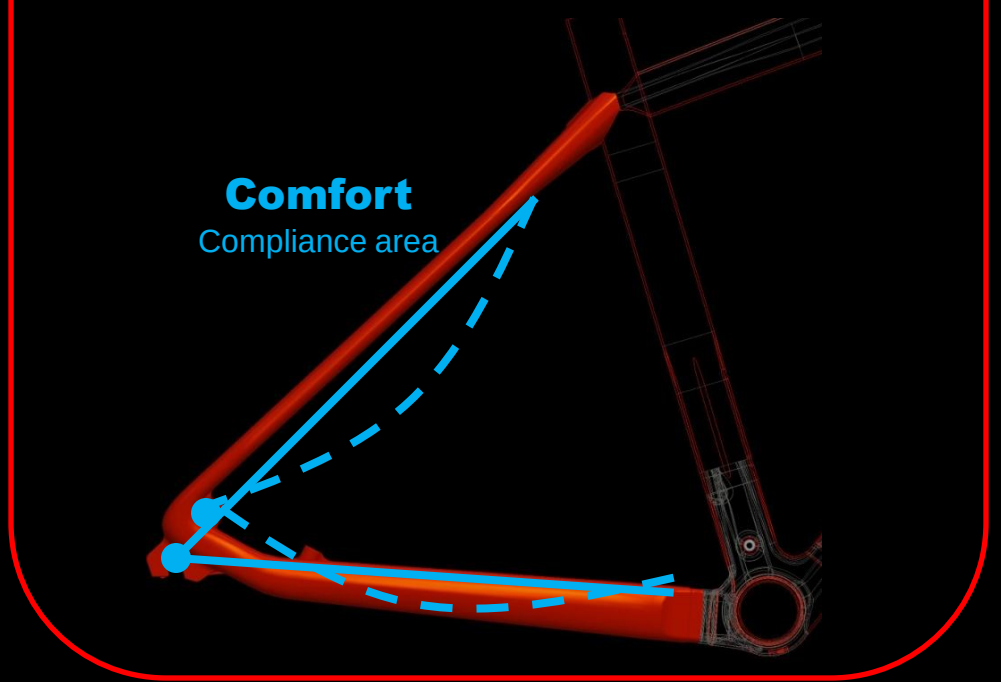
-High deformation of the seatpost = Rider feels a loss of power



SCOTT Concept

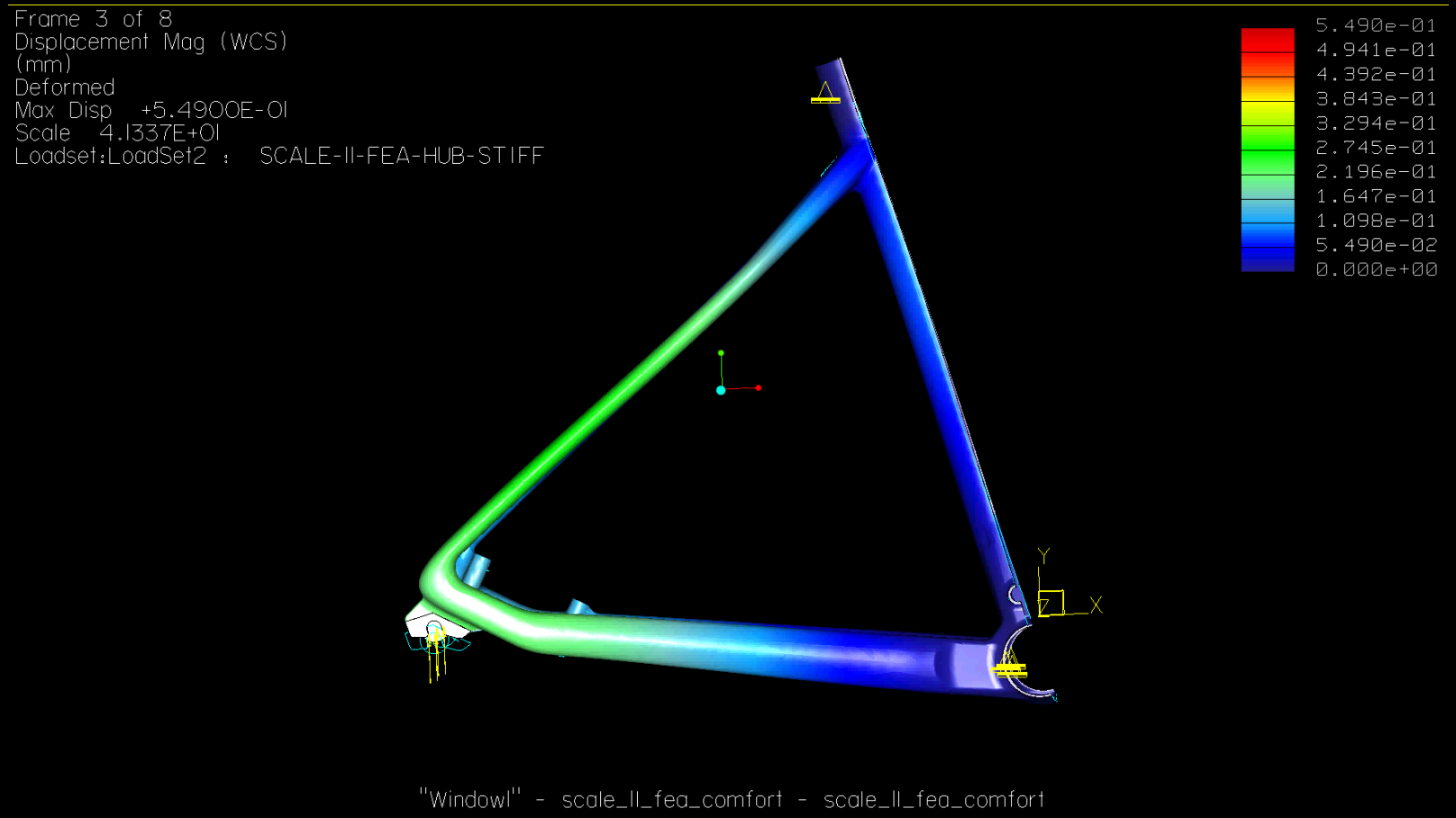
80% of the comfort must come from the frame rear triangle

= Rider receives maximum comfort benefit regardless of body position



REARSTAYS

Finite Elements Analysis: Vertical compliance (comfort)

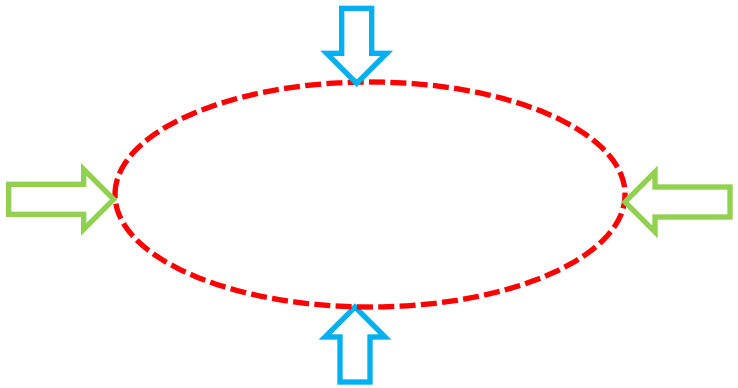


REARSTAYS

Comfort / Performance

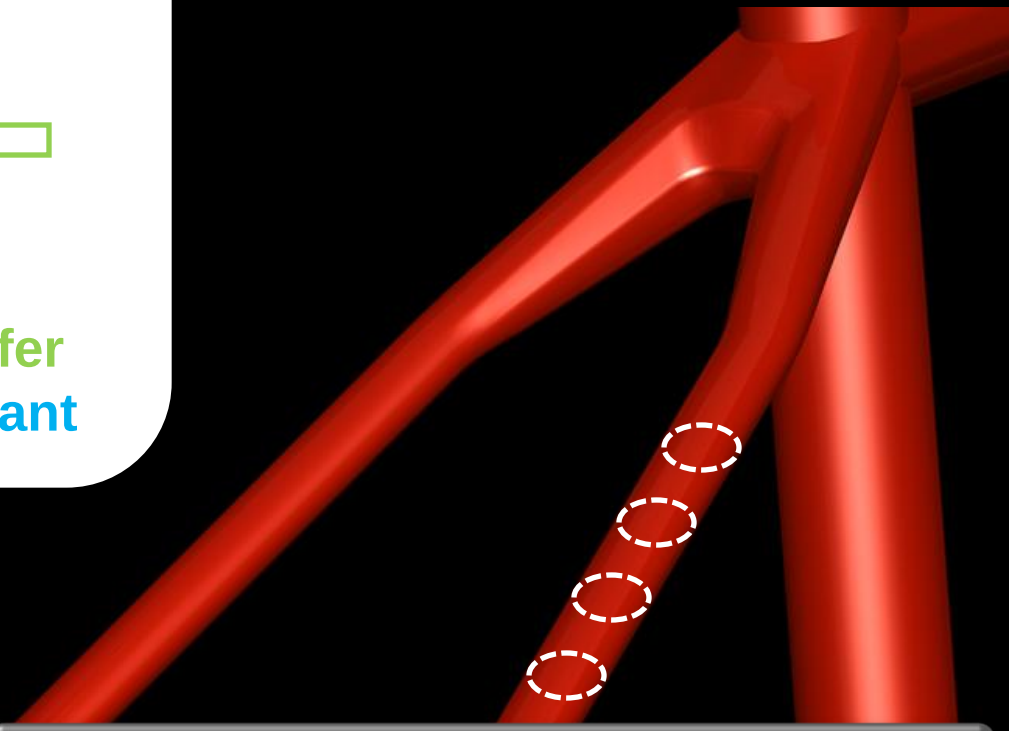
1- Frame design:

Seatstays Section



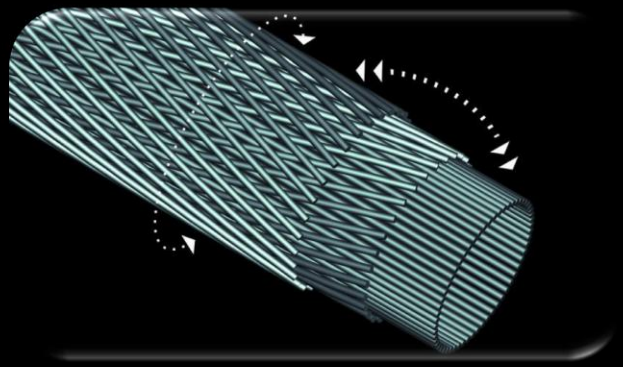
Performance: wider = stiffer

Comfort: thinner = compliant

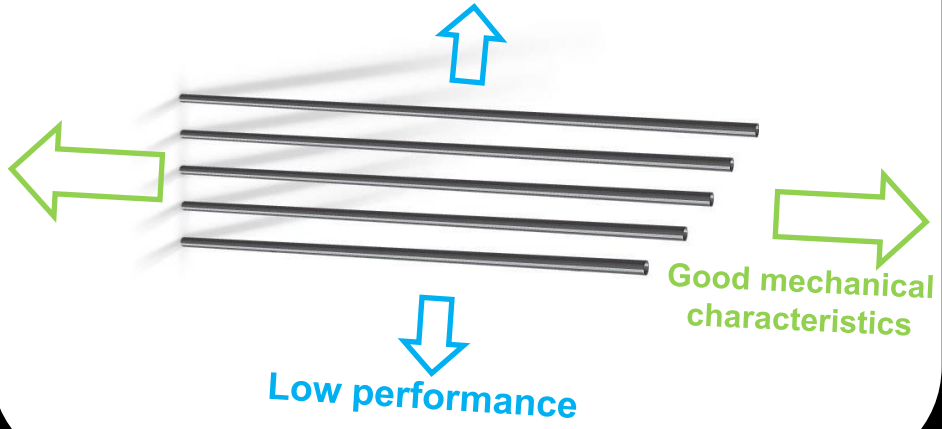


REARSTAYS
Comfort / Performance

2- Material: (Fibers orientation and wall tickness)



Raw material : UniDirectional (UD) Prepreg



Each tube/area of the frame is a combination of different layers, with different orientations, helping to deliver the optimal characteristics

More CARBON details…

REARSTAYS
Structure

STANDARD Construction

Seatstays, chainstays and solid dropout are bonded together:

= Complicated structure (bonding, overlaps, heavy)

New TUBULAR STRUCTURE

One piece tubular seatstay, chainstay & dropout

= Homogeneous structure (less material, optimized performance, less weight)

Technics

More IMP details…

TUBULAR STRUCTURE

REARSTAYS

Comfort: +20%
Lateral stiffness: +10%
Weight: -25g.

Comfort measurement (deformation with 200kg on seatpost (measured @ dropout):
-Old Scale: 3.70mm
-New Scale: 4.66mm

IMP TECHNOLOGY

Technics

SDS shock damping system

TUBULAR STRUCTURE

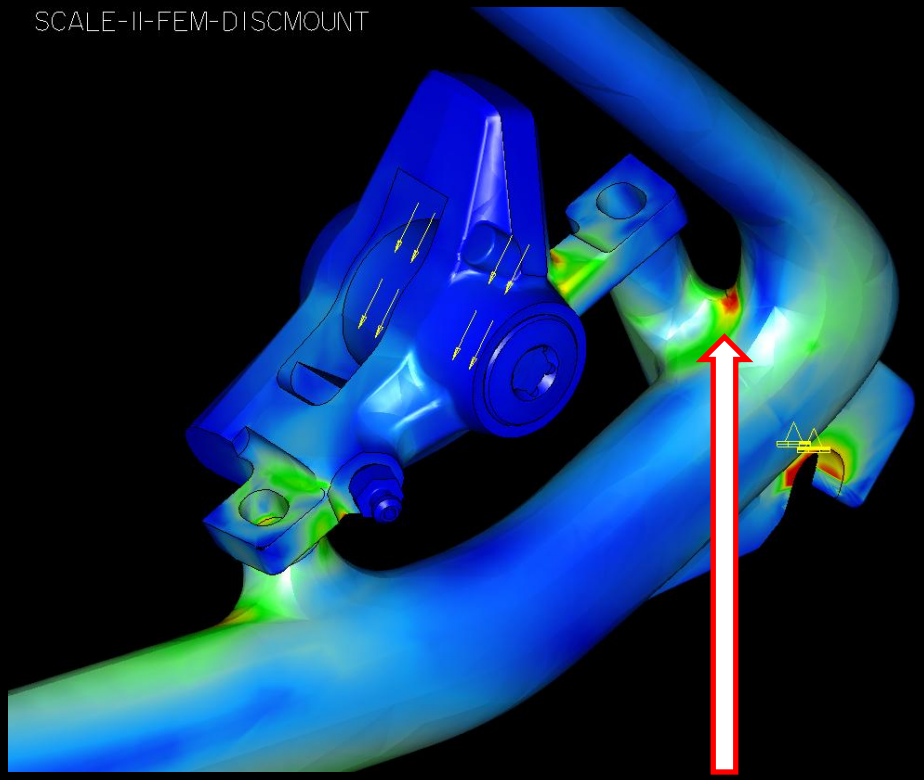
REARSTAYS: DISCMOUNT

Comfort = seatstay deformation

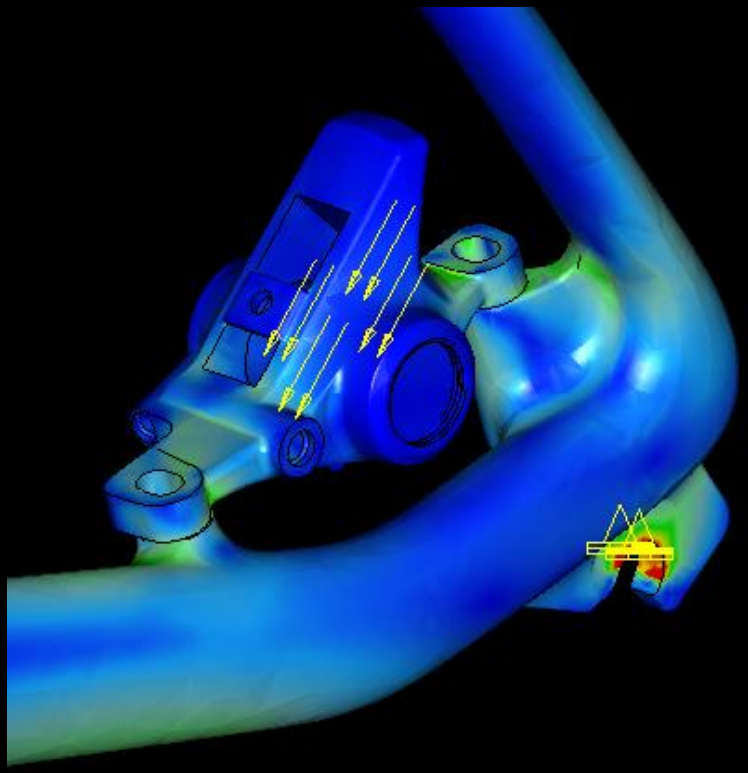
The disc is fixed on the chainstay to avoid seatstay vibration during braking.

REARSTAYS: DISCMOUNT

Finite Elements Analysis: Stress concentration example



Version1: max. stress concentration



Version2: better stress repartition, lower max. stress

REARSTAYS: DROPOUTS

Carbon dropouts

Replaceable hanger
Same as Genius & Spark

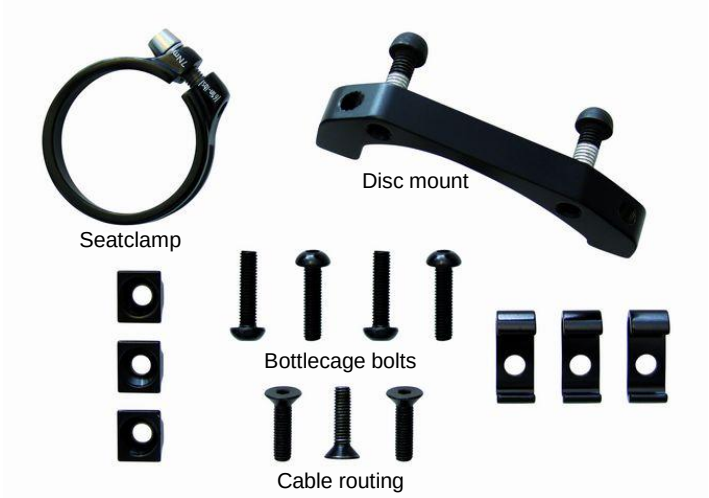
ASSEMBLY

ADDITIONNAL PARTS:

Discmount
Cablerouting
Seatclamp
Bottlecage bolts

Weight: -47g!

OLD SCALE **1 Set = 63g.**



1 Set = 16g.

ASSEMBLY

FD GUIDE (Only delivered with all HMX frames)

FINAL WEIGHT COMPARISON

	OLD SCALE		NEW SCALE
FRAME			
Headtube	970g.	-15g	880g.
Bottom Bracket		-30g	
Rearstays		-25g	
Structure		-20g	
ELEMENTS			
Cable routing	27g.	-5g	11g.
Seatclamp		-11g	
	997g. Average weight (+/-25g.)		**<899g!** MAXIMUM weight !
ASSEMBLY			
Discmount	direct mount (35g.)	-35g	post mount (0g.)
Bottom Bracket	threaded (100g.)	-20g	press fit (80g.)

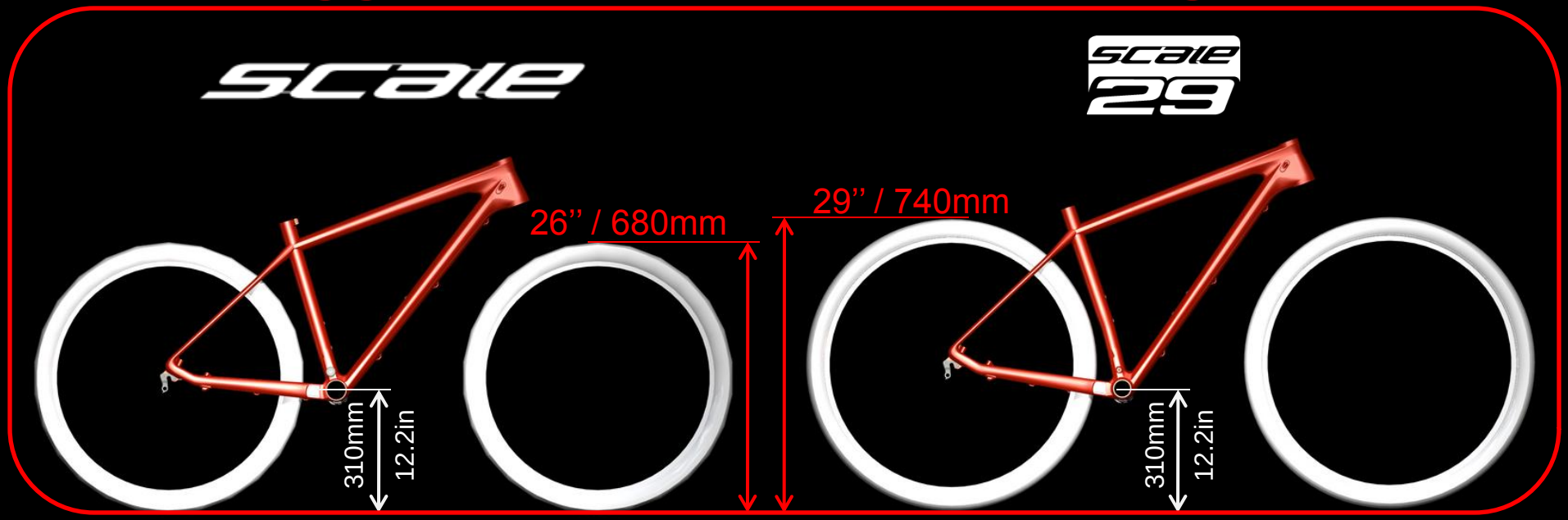
Technics

More STRUCTURE Weight Saving details…

WHAT's 29"?

Geometry:

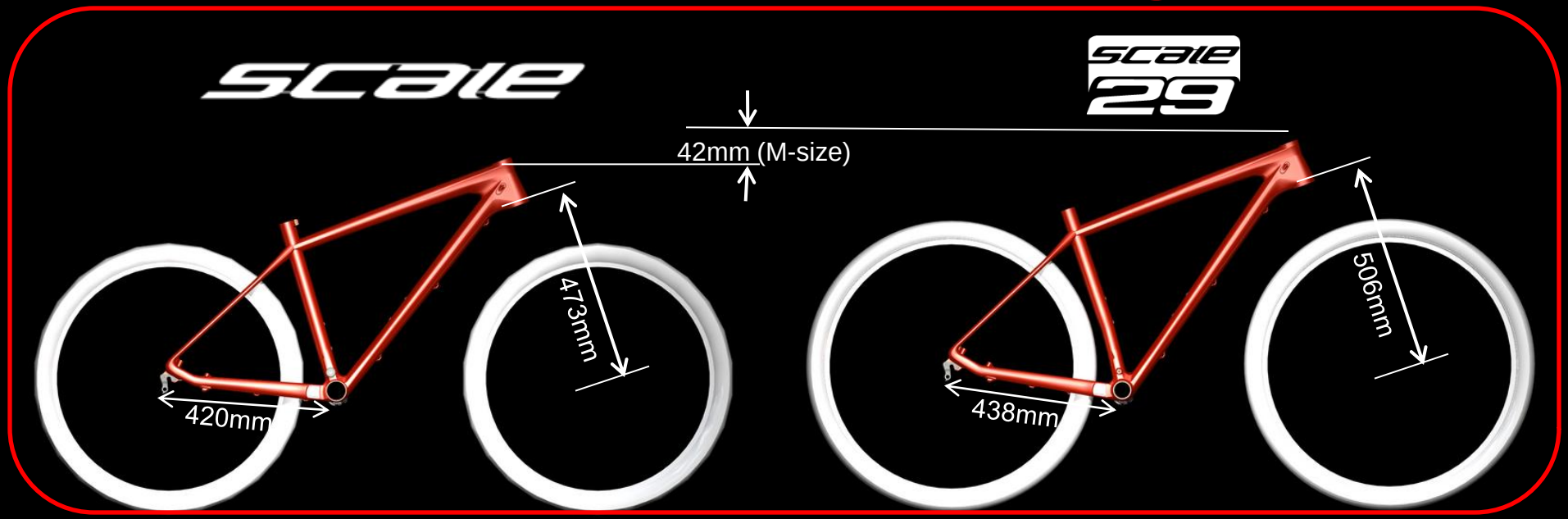
Bigger wheels, same BB height



WHAT's 29'?

Geometry:

Different position and riding skills



WHAT's 29"?

Frame detail (FD mount)

WHAT's 29"?

29" vs 26"

Weight:	Complete 29" bike has a slight weight penalty compared to a 26" with the same specs.
Advantages:	faster rolling on smooth terrain smoother ride on rough terrain better cornering traction good geometry for XL sizes
Disadvantages:	weight compromised handling due to the big wheels compromised geometry for S sizes

scale

SCOTT

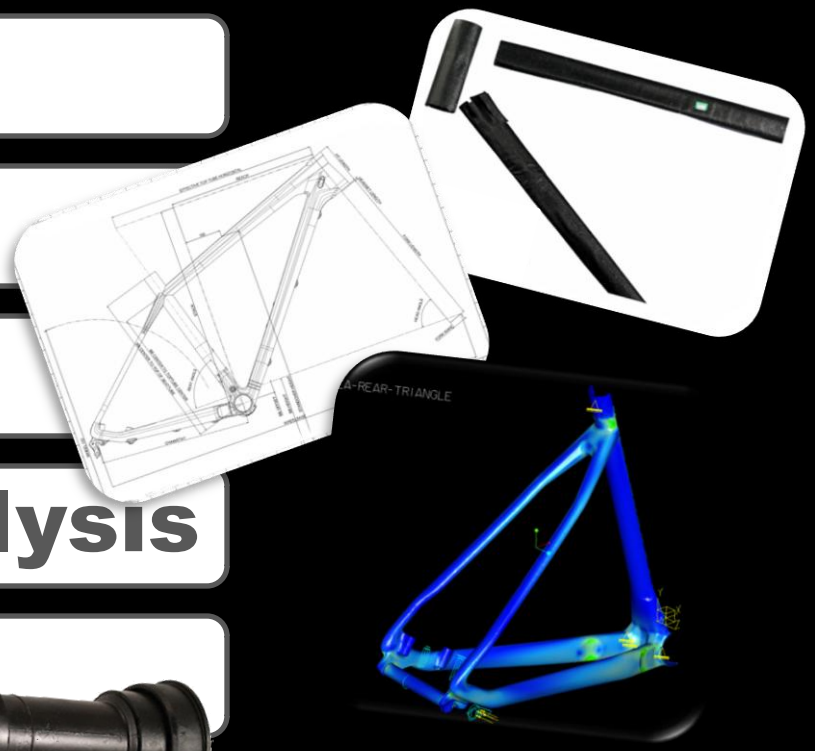
Thanks for your attention!

scale

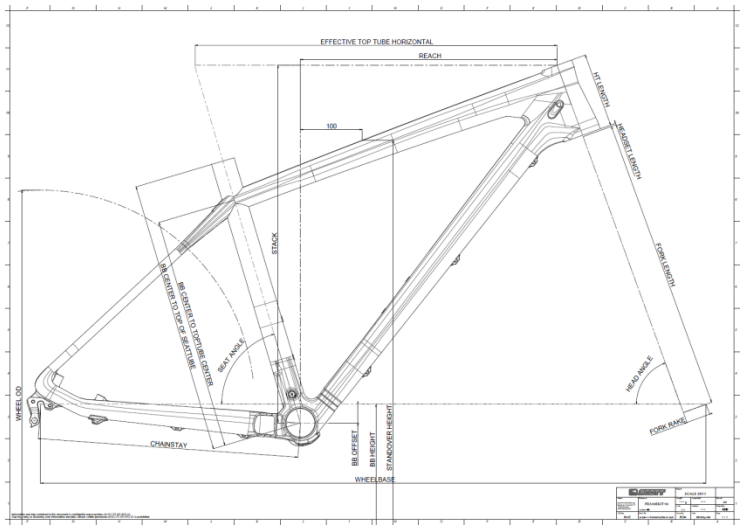
SCOTT

MORE DETAILS

- Geometry
- IMP / Tube to Tube
- Raw material
- Finite Elements Analysis
- Press Fit BB
- Frame structure



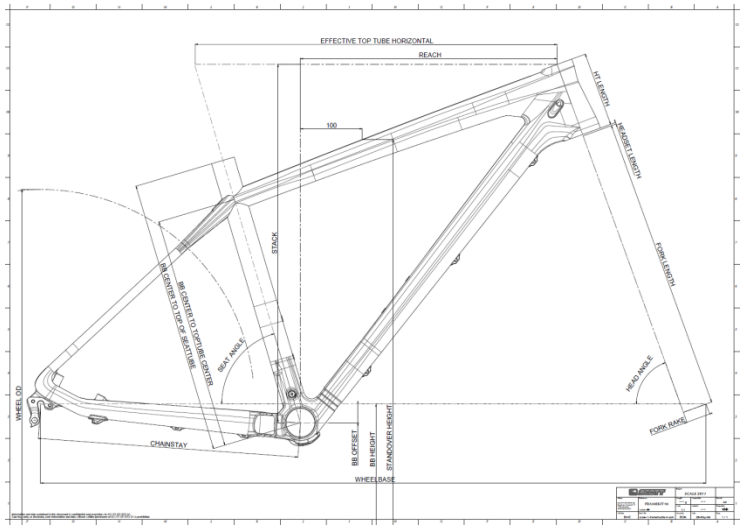
GEOMETRY SCALE26



		S	M	L	XL
fork rake	mm	39.0	39.0	39.0	39.0
A/ head angle	°	70.0	70.0	70.0	70.0
fork length	mm	473.0	473.0	473.0	473.0
headset length	mm	2.5	2.5	2.5	2.5
B/ head tube	mm	110.0	120.0	135.0	160.0
C/ top tube horizontal	mm	555.0	585.0	610.0	640.0
D/ actual top tube	mm	496.0	518.0	541.0	570.0
E/ seat angle	°	73.5	73.5	73.5	73.5
F/ BB center to top of seattube	mm	390.0	440.0	480.0	530.0
G/ BB center to toptube center	mm	324.0	374.0	414.0	464.0
H/ chainstay	mm	420.0	420.0	420.0	420.0
I/ BB offset	mm	-30.0	-30.0	-30.0	-30.0
J/ BB height	mm	310.0	310.0	310.0	310.0
G/ standover height	mm	733.0	765.0	792.0	830.0
L/ wheel base	mm	1043.0	1073.5	1099.5	1131.0
wheel OD (tire:xxxx)	mm	680.0	680.0	680.0	680.0
M/ reach	mm	387.1	414.3	435.1	458.2
N/ stack	mm	566.8	576.3	590.3	613.8
stem length	mm	90.0	90.0	100.0	110.0
cockpit length	mm	645.0	675.0	710.0	750.0

		S	M	L	XL
fork rake	in	1.5	1.5	1.5	1.5
A/ head angle	°	70.0	70.0	70.0	70.0
fork length	in	18.6	18.6	18.6	18.6
headset length	in	0.1	0.1	0.1	0.1
B/ head tube	in	4.3	4.7	5.3	6.3
C/ top tube horizontal	in	21.9	23.0	24.0	25.2
D/ actual top tube	in	19.5	20.4	21.3	22.4
E/ seat angle	°	73.5	73.5	73.5	73.5
F/ BB center to top of seattube	in	15.4	17.3	18.9	20.9
G/ BB center to toptube center	in	12.8	14.7	16.3	18.3
H/ chainstay	in	16.5	16.5	16.5	16.5
I/ BB offset	in	-1.2	-1.2	-1.2	-1.2
J/ BB height	in	12.2	12.2	12.2	12.2
G/ standover height	in	28.9	30.1	31.2	32.7
L/ wheel base	in	41.1	42.3	43.3	44.5
wheel OD (tire:xxxx)	in	26.8	26.8	26.8	26.8
M/ reach	in	15.2	16.3	17.1	18.0
N/ stack	in	22.3	22.7	23.2	24.2
stem length	in	3.5	3.5	3.9	4.3
cockpit length	in	25.4	26.6	28.0	29.5

GEOMETRY SCALE29



		M	L	XL
fork rake	mm	46.0	46.0	46.0
A/ head angle	°	69.5	69.5	69.5
fork length	mm	506.0	506.0	506.0
headset length	mm	2.5	2.5	2.5
B/ head tube	mm	105.0	115.0	125.0
C/ top tube horizontal	mm	600.0	620.0	640.0
D/ actual top tube	mm	526.0	542.0	560.0
E/ seat angle	°	72.5	72.5	72.5
F/ BB center to top of seattube	mm	440.0	480.0	530.0
G/ BB center to toptube center	mm	375.0	415.0	465.0
H/ chainstay	mm	438.0	438.0	438.0
I/ BB offset	mm	-60.0	-60.0	-60.0
J/ BB height	mm	310.0	310.0	310.0
G/ standover height	mm	783.0	810.0	842.0
L/ wheel base	mm	1096.8	1117.0	1137.9
wheel OD (tire:xxxx)	mm	740.0	740.0	740.0
M/ reach	mm	405.0	422.0	439.0
N/ stack	mm	618.0	628.0	637.0
stem length	mm	90.0	100.0	110.0
cockpit length	mm	690.0	720.0	750.0

		M	L	XL
fork rake	in	1.8	1.8	1.8
A/ head angle	°	69.5	69.5	69.5
fork length	in	19.9	19.9	19.9
headset length	in	0.1	0.1	0.1
B/ head tube	in	4.1	4.5	4.9
C/ top tube horizontal	in	23.6	24.4	25.2
D/ actual top tube	in	20.7	21.3	22.0
E/ seat angle	°	72.5	72.5	72.5
F/ BB center to top of seattube	in	17.3	18.9	20.9
G/ BB center to toptube center	in	14.8	16.3	18.3
H/ chainstay	in	17.2	17.2	17.2
I/ BB offset	in	-2.4	-2.4	-2.4
J/ BB height	in	12.2	12.2	12.2
G/ standover height	in	30.8	31.9	33.1
L/ wheel base	in	43.2	44.0	44.8
wheel OD (tire:xxxx)	in	29.1	29.1	29.1
M/ reach	in	15.9	16.6	17.3
N/ stack	in	24.3	24.7	25.1
stem length	in	3.5	3.9	4.3
cockpit length	in	27.2	28.3	29.5

Back to presentation : GEOMETRY

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IMP / TUBE TO TUBE

Carbon process

TUBE TO TUBE

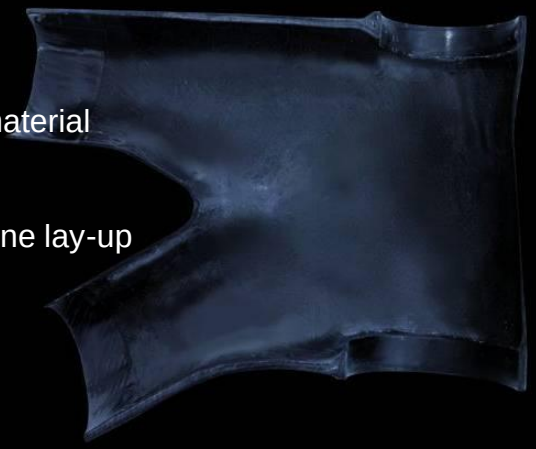
The tubes are produces separately, and then bonded together.
Advantage: easy production (8 years ago...).
Disadvantage: discontinuity of the strucure in the joints area.

IMP

All tubes are produced in one piece at the same time.
Difference to standard monocoque: IMP solid core is used continously from raw material preforming until removal after curing.

Advantage: this ensures homogeneous structure and accurate adherence to the fine lay-up schedule.

Disadvantage: process requiring experience and know how.



Back to presentation: HEADTUBE

Back to presentation: REARSTAYS

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RAW MATERIAL

SCOTT COMPOSITE FIBER HMF

SCOTT COMPOSITE FIBER HMX

While we already use the proven HMF composite fiber on all of our composite high-end bike models, we have improved upon conventional HMF material. This new fiber, which is produced exclusively for Scott, offers 20% more stiffness and is employed on all the areas that need additional rigidity. This new material also allows us to reduce weight and improve riding characteristics. NET stands for Naked External Tubeset, and the LTD model sheds its exterior cosmetic layer, which saves even more weight.

Back to presentation: REARSTAYS

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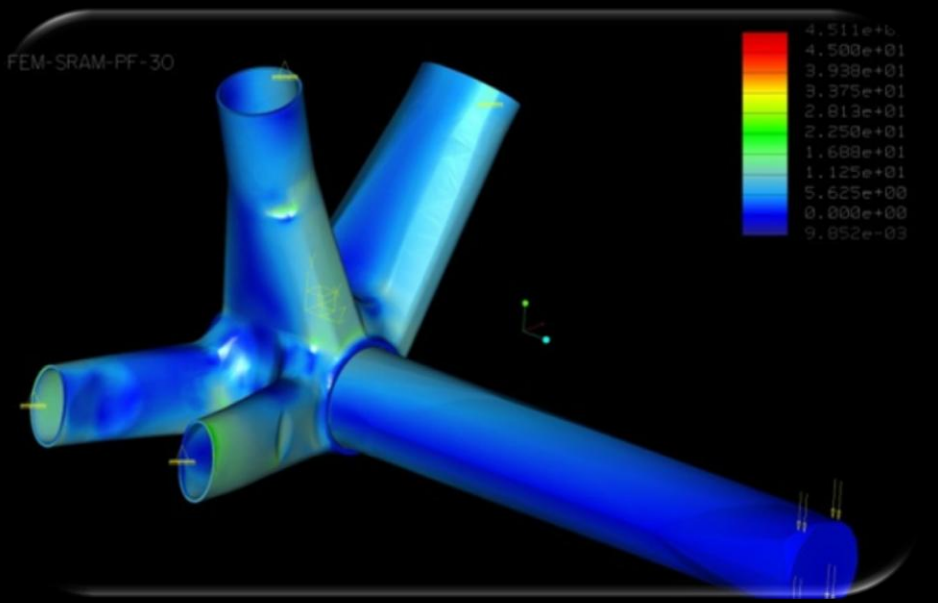
FINITE ELEMENTS ANALYSIS

We always measure and test all our frames in our laboratories. This data base has been used to validate the computer analysis, which was a key point to optimize the new Scale by:

- reducing the maximum stress in the material
- having fewer and smoother stress concentrations
- evaluating the stiffness and deformation

The Finite Elements Analysis (FEA) reproduces the different tests made in laboratories. Thanks to this we can

reduce the weight AND increase the stiffness!



Back to presentation: BOTTOM BRACKET

Back to presentation: REARSTAYS

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PRESS FIT BB

Scott Standards

OLD BB: threaded

The frame has to be threaded, which requires alloy material
(= bonding and non homogeneous materials).
The Bottom bracket weighs 100g.

SCOTT BB STANDARDS: PRESS FIT ONLY (PF)

The goal is to have an homogeneous structure and, for this, to delete all alloy parts on the frame.
The press fit does not require any alloy part anymore!
Advantages:

- weight reduction of 25g on the frame by eliminating threaded BB shell (full carbon structure)
- weight reduction on the BB (the BB weighs 80g)

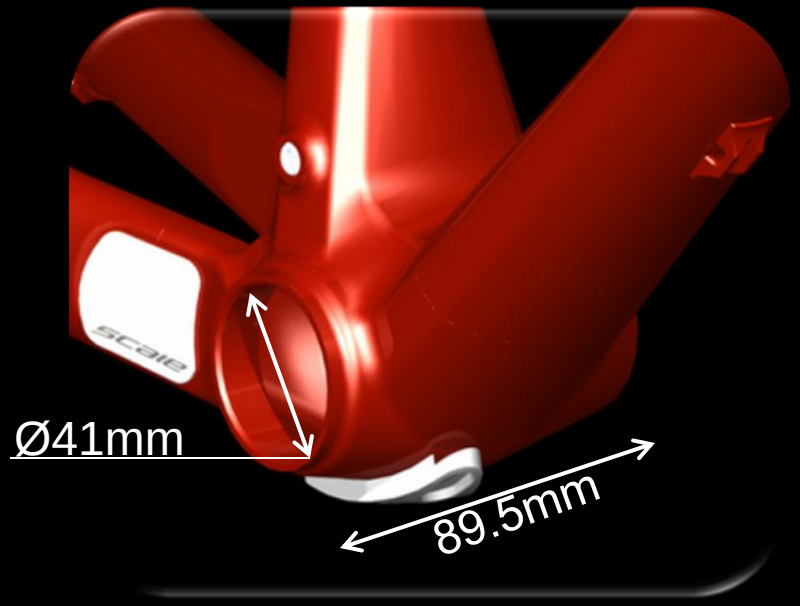
PRESS FIT BB

Scott Standards

BBPF92

BB Cups Ø41mm

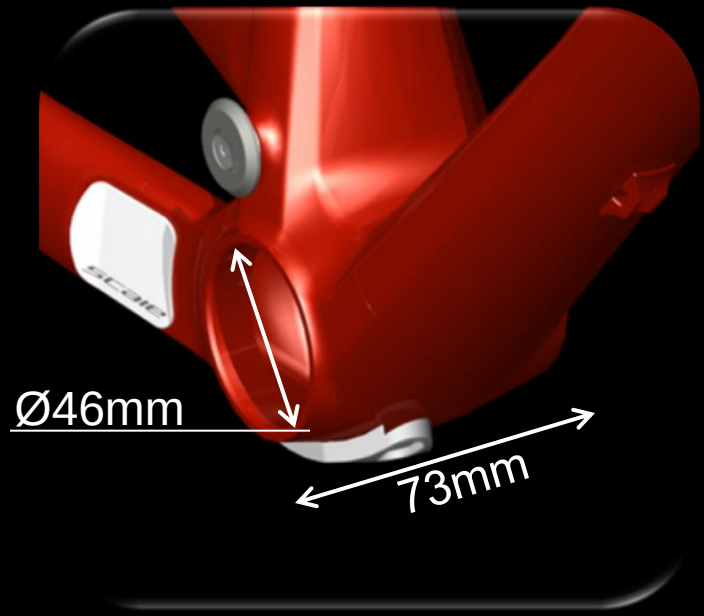
Compatible with all standards cranksets



BBPF30

BB Cups Ø46mm

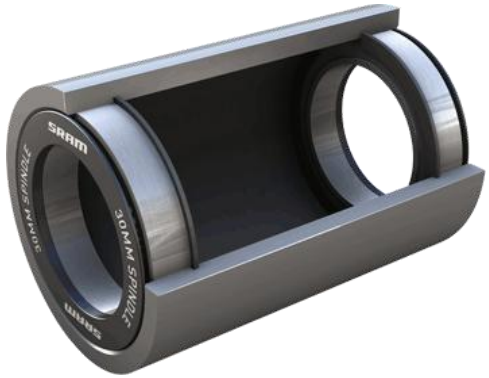
Compatible with SRAM oversized cranksets
Lighter and stiffer final assembly.
Reduced Q-factor



PRESS FIT BB

BBPF30 vs. BB30

BB30



The bearings are directly pressed in the frame

-the frame needs an alloy part to respect the tolerances
-if the bearing wears out or is pressed in a wrong direction, the frame is definetly damaged

BBPF30

Approved by Scott!

The bearings are assembled in plastic cups. The plastic cups are pressed in the frame

-the frame can have a full carbon structure (due to the plastic cups interface)
-the plastic cup interface avoids to damage the frame during assembly and if the bearing wears out.

= LIGHTER AND SAFER

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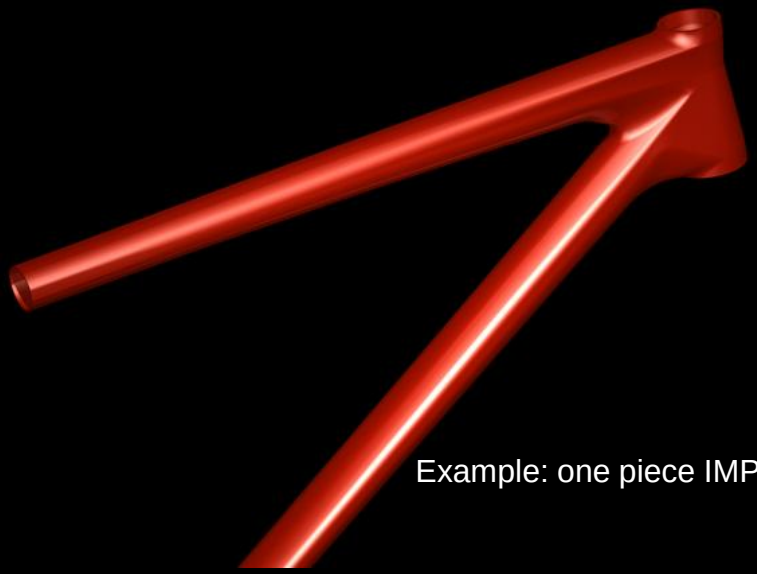
STRUCTURE

A lightweight frame construction starts from the definition of the molds and the joints between each molded element.



Example: one piece IMP front triangle

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