

LHC Collimators

- For TCP and TCS collimators
 - - Material choice
 - - Collimator concept
 - - Dimensions

Material choice

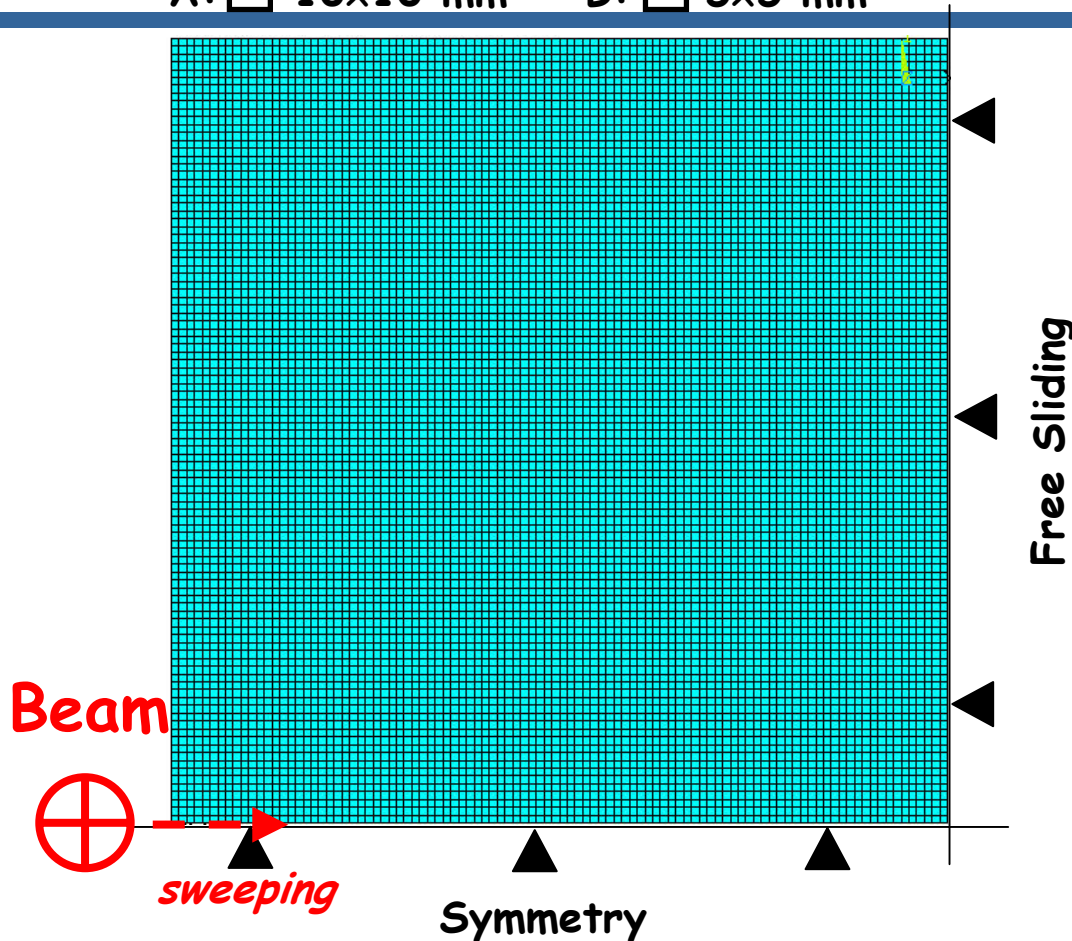
- Which material withstands the different LHC beam scenarios?

Material choice

- Has to withstand 3 major scenarios:
 - Proton beam at 7 TeV
 - Beam at Injection (450 GeV)
 - Ion beam (e.g. Pb)
- Other demands
 - Vacuum
 - Impedance

Material choice

A: \square 10x10 mm B: \square 5x5 mm



Finite Element Model

2D MESH

10^4 parabolic elements

$3 \cdot 10^4$ nodes

0.05x0.05 mm mesh size

MATERIALS

Graphite

Beryllium

3D CFC

Graphite matrix with:

27 % in x direction

4 % in y and z direction

Elastic linear law

Small deformations

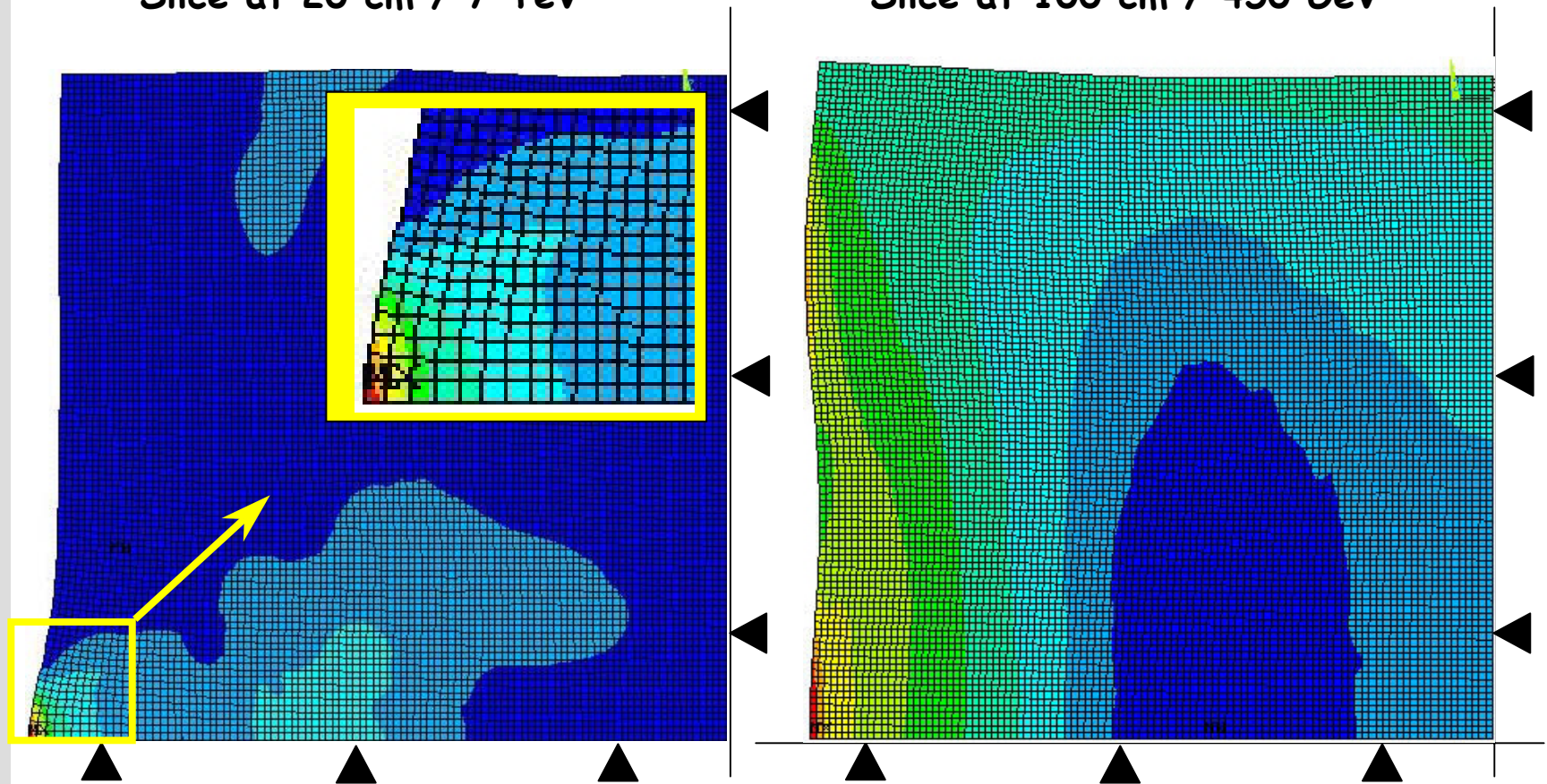
Anslys results

Graphite

CFC

Slice at 20 cm / 7 TeV

Slice at 100 cm / 450 GeV



Ansys results

Stress values for different proton load cases

Maximum stress values

	Injection			
		T [°C]	σ_{VM} [MPa]	σ_{VM}/σ_y
C-C	20 cm	335.4	4.4	0.03
	100 cm	344.6	12.7	0.10
Graphite	20 cm	335.4	3.1	0.11
	100 cm	344.6	6.2	0.23
Beryllium	20 cm	168	334	1.45
	100 cm	200	440	1.91
Asynchronous beam abort at 7 TeV scaled with factor 2.5				
C-C	20 cm	211.6	20.8	0.16
	100 cm	550.8	82.0	0.63
Graphite	20 cm	211.6	4.4	0.16
	100 cm	550.8	17.8	0.66
Beryllium	20 cm	116	584	2.54
	100 cm	168	1248	5.43

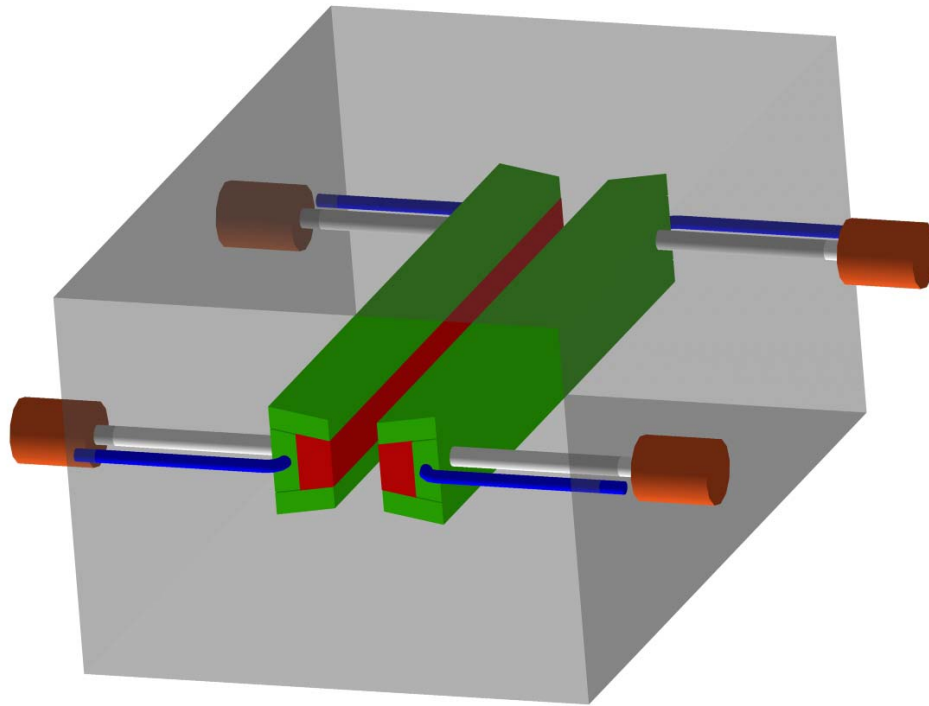
Maximum allowable value for the ratio σ_{VM}/σ_y is usually 0.66.

Material Choice

- Graphite or Carbon-carbon (very similar robustness?!)
- 10 times more robust than next best material (Be)
- Beryllium does not withstand the expected beam impact at injection and 7 TeV (Ok for slow losses)

LHC Collimator concept

■ Main characteristics

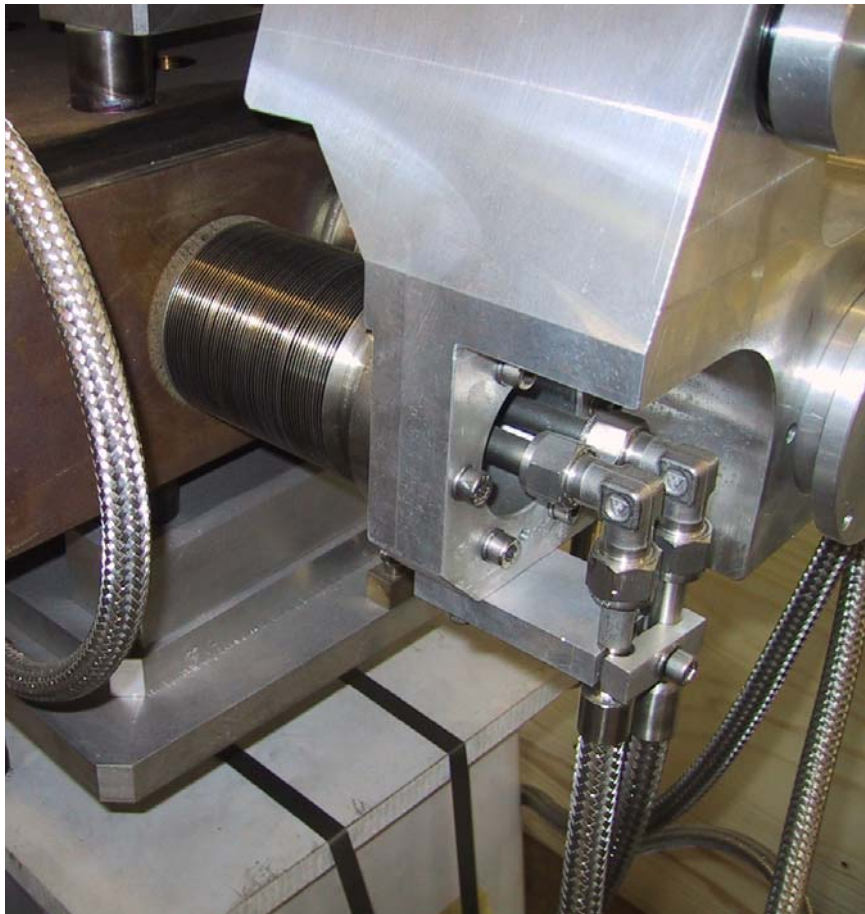


-2 Motors on each jaw

-Jaw cooling included in housing.

-Vacuum Feed through via isolated bellows

LEP Collimator concept



- Two cooling connections with flexible tubes
- Vacuum Feed through via bellows
- High precision guiding

Technical reference values

Space requirement flange to flange:

- TCP: 620 mm
TCS: 1420 mm
- Two motor per jaw, two per vacuum tank
- Cooling and measurements through isolated feed through