

Heat problems

(For the design of
target and decay volume)

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1. Target

Simulation of the energy deposit

Material	Carbon
Size of the target	3cm ϕ x 80cm (2 interaction length)
Beam	50GeV, 2.64MJ/pulse ($\sigma_x = \sigma_y = 5mm$)
Simulator	GEANT + GCALOR

 60.8kJ/pulse (2.3%) in total

Simulation of the heat generation at the target

Simulator

ANSYS

Material properties of Carbon

Density

2.27 g/cm³

Specific heat

1.612 J/cm³/K

Thermal conductivity

19.6 W/cm/deg

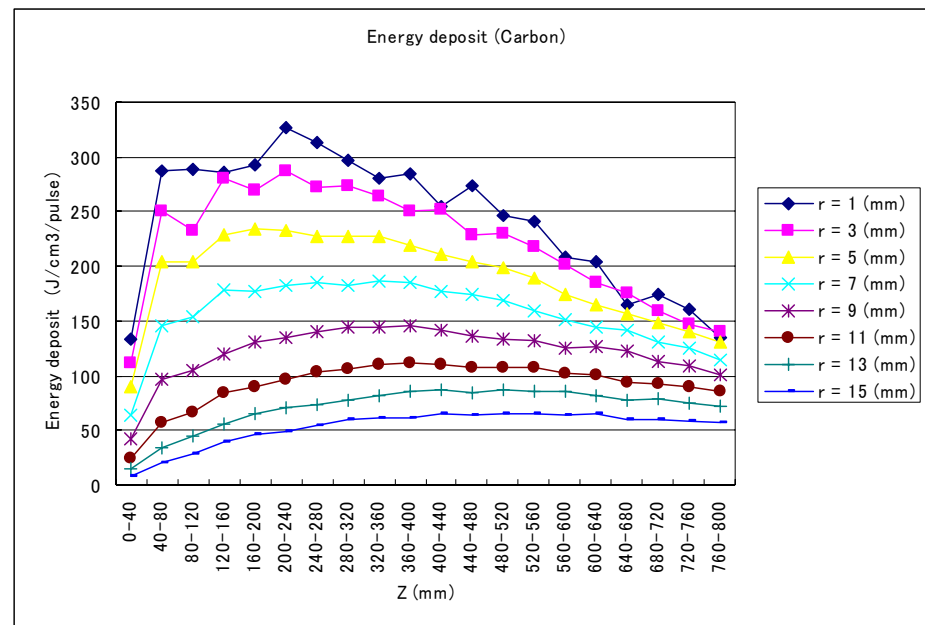
Thermal convection coeff.

7.887 kW/m²/K

Melting point

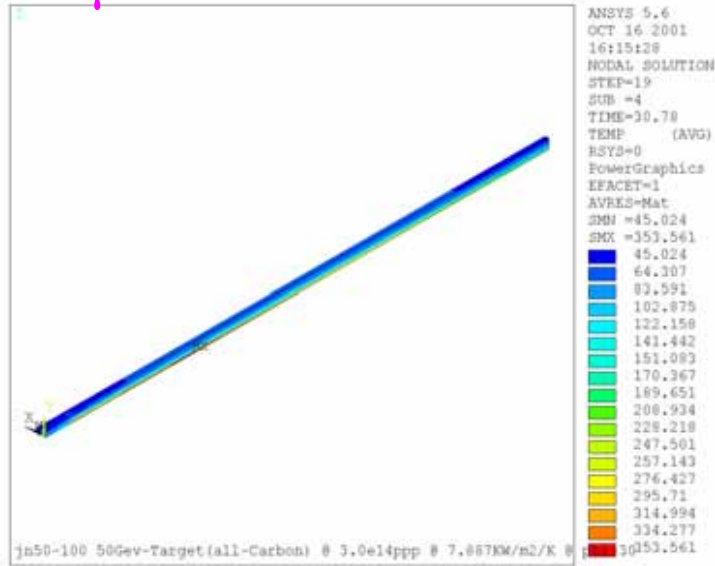
3550 °C

Energy deposit (from GEANT)

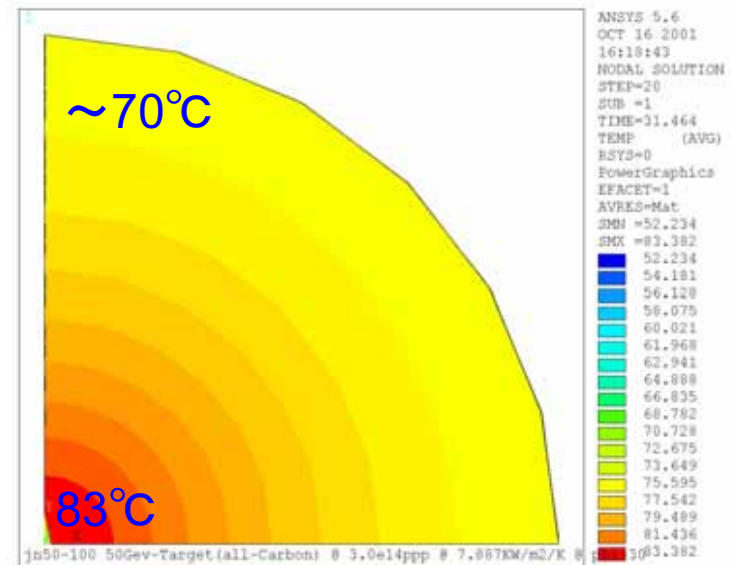
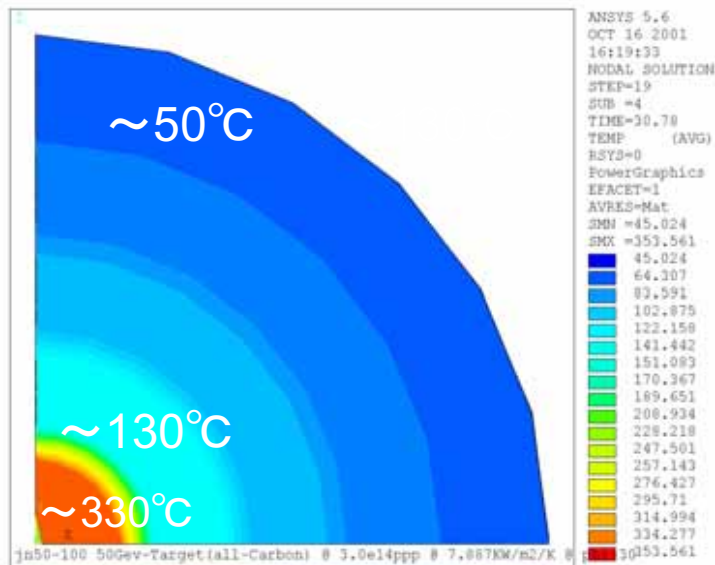
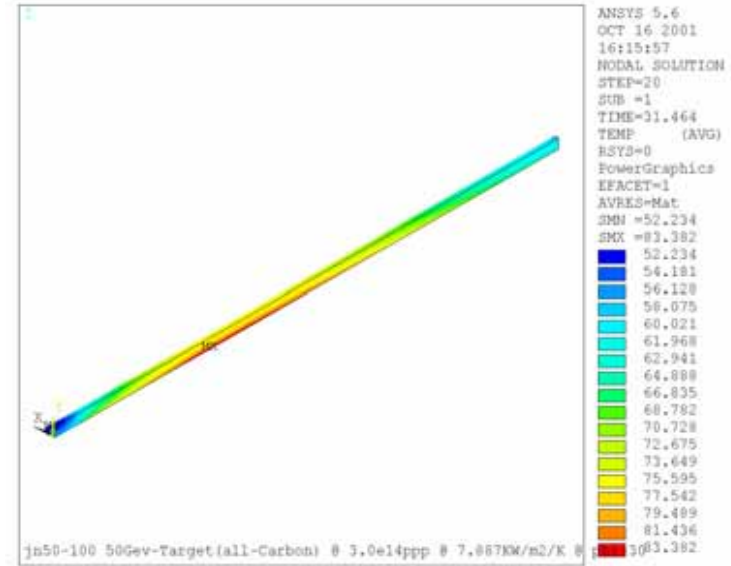


Results (1)

5 μ s

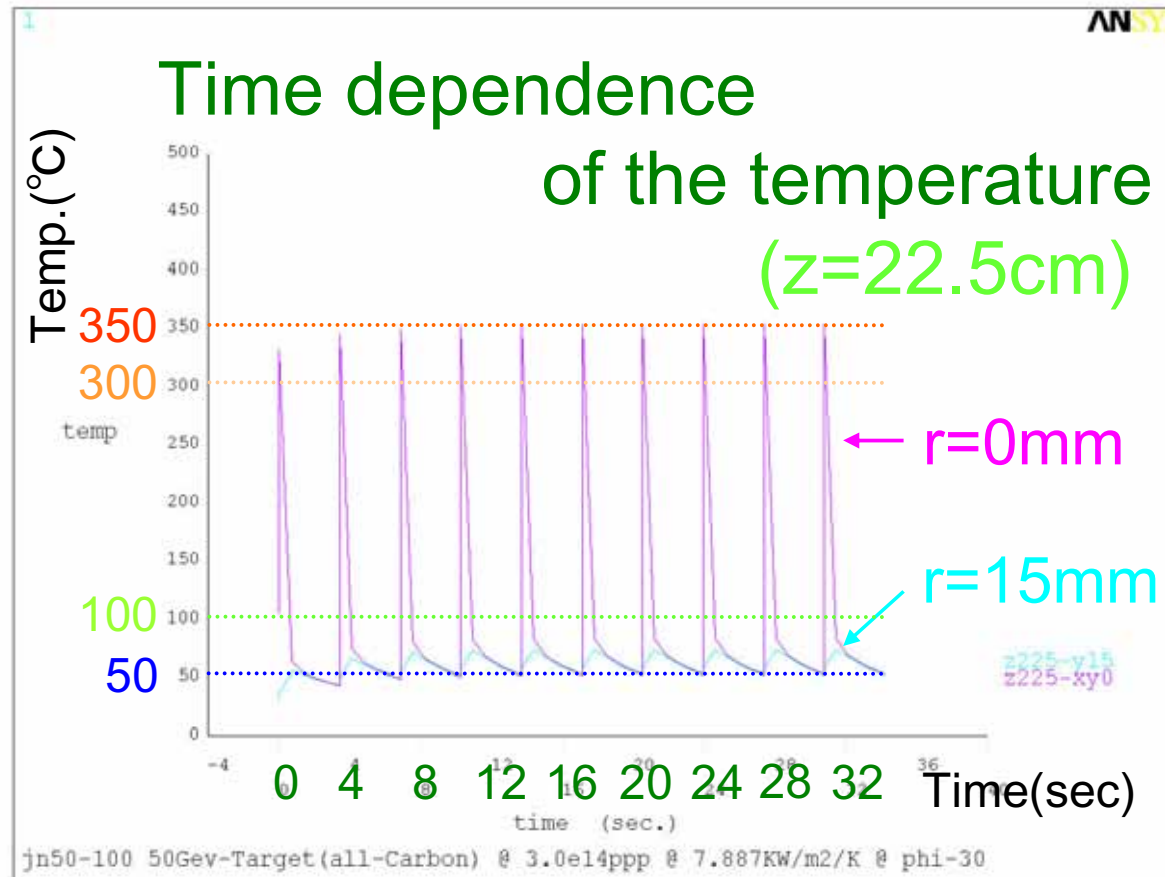


0.684s



By M.Minakawa

Results (2)



Temperature at the center

~350°C at the maximum

No Problem

By M.Minakawa

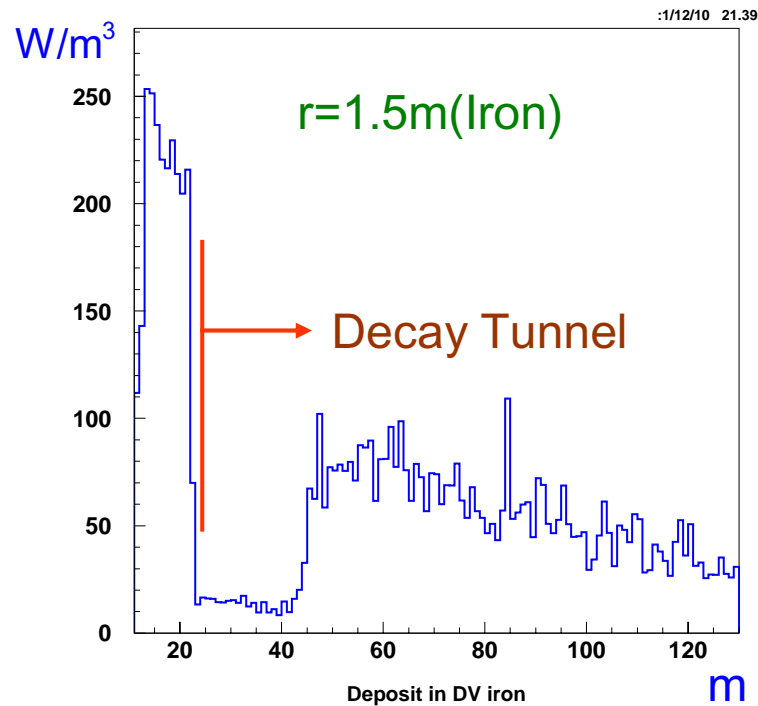
2. Decay Tunnel

Simulation of the energy deposit

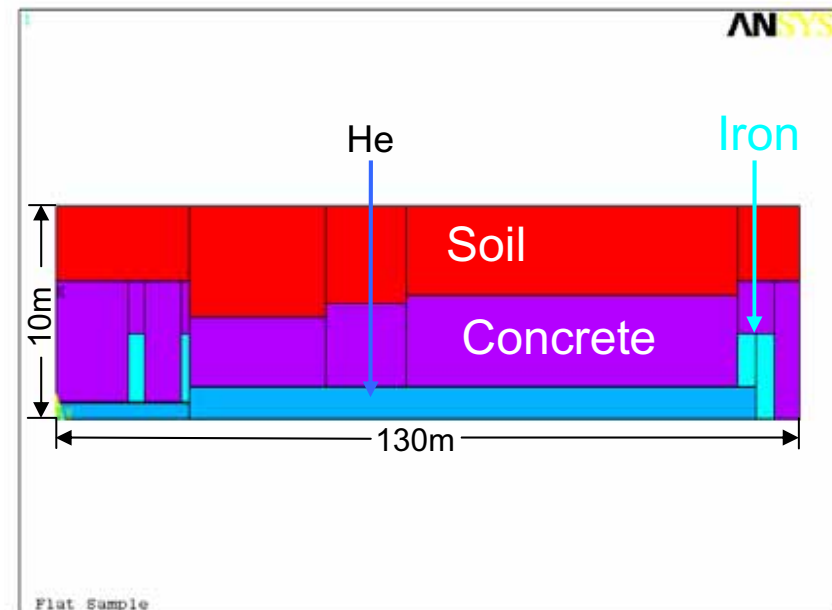
Material	
(Wall & Shield)	Iron + concrete
Size of the tunnel	3m ϕ
Thickness of the wall	16mm of Iron
Beam	50GeV, 2.64MJ/pulse
Target	Sapphire
Simulator	GEANT + GCALOR

Simulation of the heat generation in the decay tunnel

Energy deposit
(from GEANT)



Shape of the decay tunnel
and the shield



Result

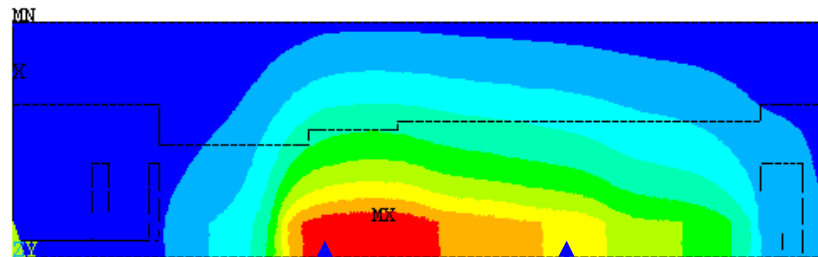
1

Maximum Temperature

~300°C

→ Need Cooling

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DEC 10 2001  
23:53:07  
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SUB =1  
TIME=1  
TEMP (AVG)  
RSYS=0  
PowerGraphics  
EFACET=1  
AVRES=Mat  
SMN =27.09  
SMX =296.866  
27.09  
57.065  
87.04  
117.015  
146.99  
176.966  
206.941  
236.916  
266.891  
296.866
```



300°C

220°C

Possible solutions:

Water cooling of the wall of the decay tunnel

Circulation of He in the decay volume

etc...

Summary

Target

Carbon Target

Maximum Temperature

~350°C

No problem

**(Effective cooling methods of target
and stress from the shockwaves
have to be studied)**

Decay Tunnel

Maximum Temperature

~300°C

Need Cooling

**(Necessary to search for
the effective cooling methods)**