

# ENERGY DEPOSITION IN HORNS

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- Energy deposition in horn with integrated target
  - ⇒ single conic horn with single skin, Al and AlBeMet
  - optimal radius for joining inner (AlBeMet) and outer (Al) parts
- Energy deposition in horn
  - ⇒ single conic horn with double skin and Water channel

Energy deposition  
single conic horn  
integrated target

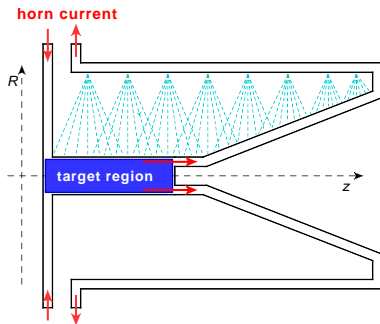
# PURPOSE

horn with integrated target

- ⇒ conducting low-Z target material: Be, Al, AlBeMet
- ⇒ thermal studies (Benjamin Lepers): rule out Al

Options:

- A) whole horn made of Be, AlBeMet
- B) only inner parts made of Be, AlBeMet and outer parts of Al

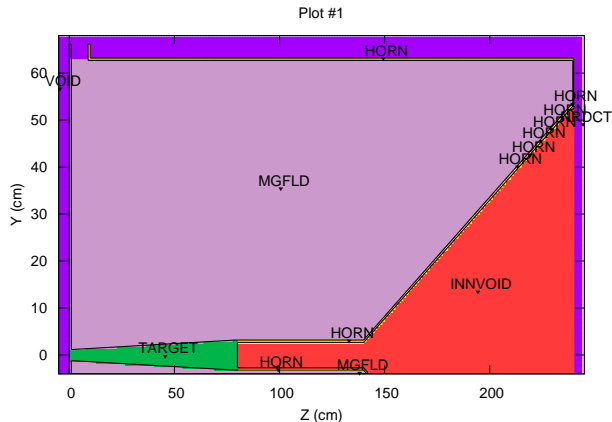


⇒ find the places (radius) where to join both pieces

→ depends on energy deposition in horn

# GEOMETRY

- dimensions taken from optimisation of single conic horns
- target has conical shape - cooling closer to the core



$$E^{kin} = 4.5 \text{ GeV}$$

$$\sigma^{bm} = 0.4 \text{ cm}$$

$$L^{tg} = 80 \text{ cm}$$

$$R_1^{tg} = 1.2 \text{ cm}$$

$$R_2^{tg} = 3.2 \text{ cm}$$

$$z^{tg} = 0 \text{ cm}$$

$$L_1^{hn} = 60 \text{ cm},$$

$$L_2^{hn} = 100 \text{ cm},$$

$$R_1^{hn} = 50 \text{ cm},$$

$$R_2^{hn} = 10 \text{ cm},$$

$$t_1 = 1.0 \text{ cm},$$

$$t_{2,3,4} = 0.5 \text{ cm},$$

$$I = 300 \text{ kA}$$

single skin, thickness: front face  $t_1$ , inner cond.  $t_2$ , exit face  $t_3$ , outer cond.  $t_4$

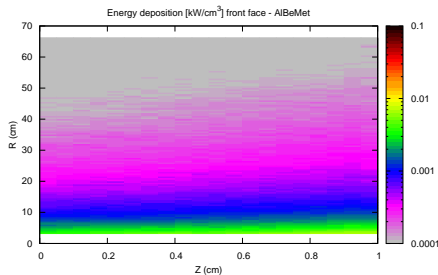
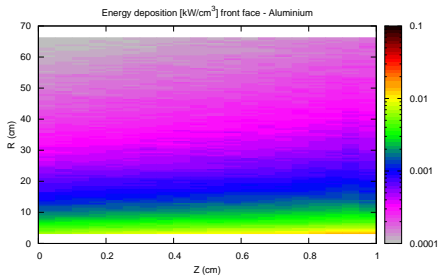
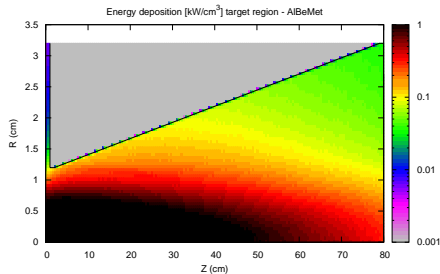
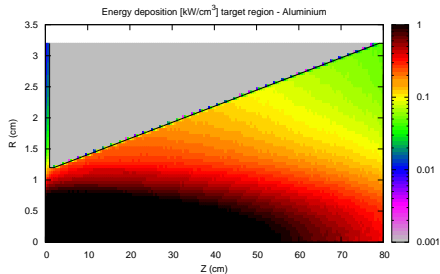
# INTEGRATED ENERGY DEPOSITION

Integrated energy deposition in parts of the horn

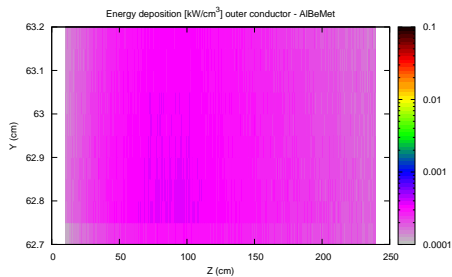
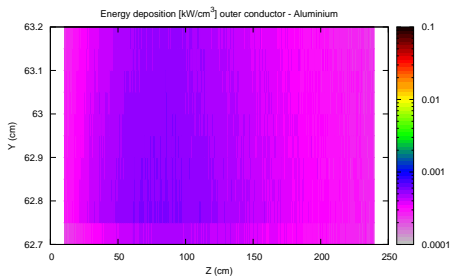
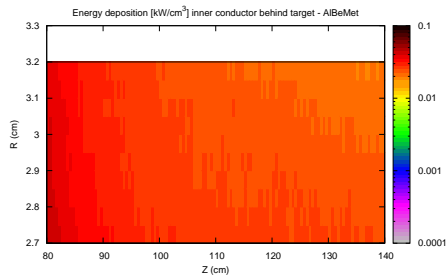
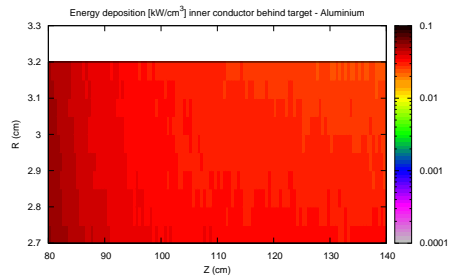
@ 4 MW,  $E^{kin} = 4.5$  GeV

region	Al [kW]	AlBeMet [kW]
target	369	262
front face	5.67	3.05
exit face	0.50	0.35
inner cond - straight section	16.53	13.10
inner cond - conic section	10.34	7.33
outer conductor	18.55	12.03
total	420.59	297.86

# ENERGY DEPOSITION - DENSITY I



# ENERGY DEPOSITION - DENSITY II

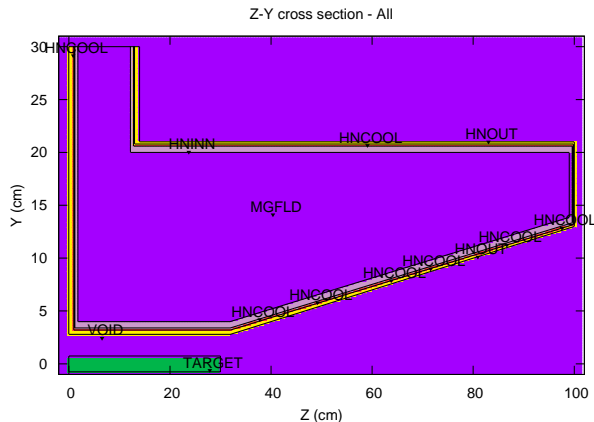




Energy deposition  
single conic horn  
double skin

# GEOMETRY

- compare with previous results for NuFact horn
- omitted glass insulator and other details



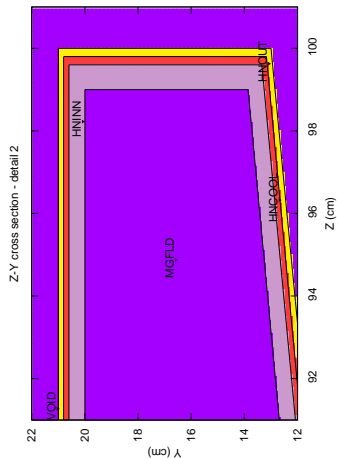
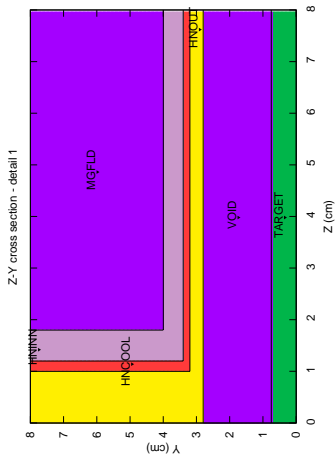
$E^{kin} = 2.2 \text{ GeV}$   
 $\sigma^{bm} = 0.2 \text{ cm}$   
 $L^{tg} = 30 \text{ cm}$   
 $R^{tg} = 0.75 \text{ cm}$   
 $\text{Material}^{tg} = \text{Hg}$   
 $z^{tg} = 0 \text{ cm}$

$L_1^{hn} = 32.0 \text{ cm},$   
 $L_2^{hn} = 68.0 \text{ cm},$   
 $R_1^{hn} = 2.8 \text{ cm},$   
 $R_2^{hn} = 13.0 \text{ cm},$   
 $R_3^{hn} = 21.0 \text{ cm}$   
 $t_1 = 1.0 \text{ cm},$   
 $t_2 = 0.4 \text{ cm},$   
 $t_{3,4,5} = 0.2 \text{ cm},$   
 $t_6 = 0.6 \text{ cm},$   
 $I = 300 \text{ kA},$

$\text{Material}^{hn} = \text{Al}$   
 $\text{Material}^{cool} = \text{H}_2\text{O},$

outer skin, thickness: front face  $t_1$ , inner cond.  $t_2$ , exit face  $t_3$ , outer cond.  $t_4$   
 water channel  $t_5$ , inner skin  $t_6$

# GEOMETRY - DETAILS



double skin of horn (HNOUT, HNINN) with water cooling channel HNCOOL

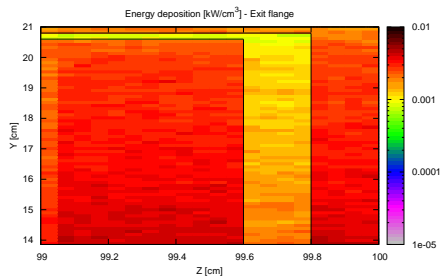
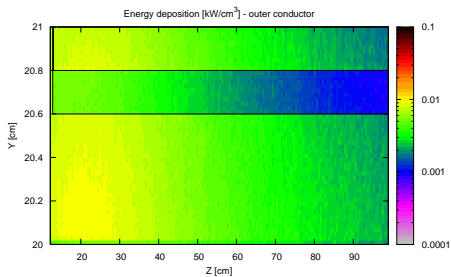
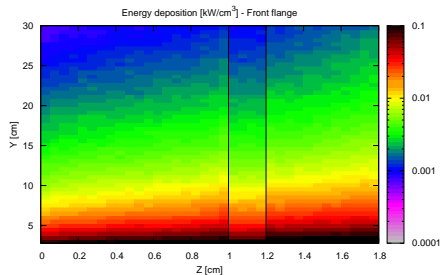
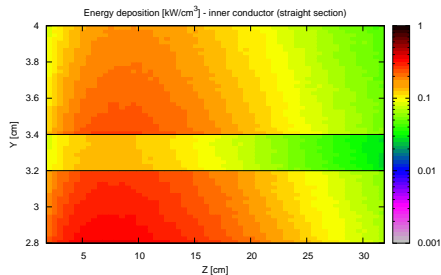
# ENERGY DEPOSITION

Integrated energy deposition in parts of the horn

@ 4 MW,  $E^{kin} = 2.2$  GeV

region	FLUKA results [kW]	old results [kW]
target	793	
front face	25.8	67
exit face	1.90	
inner cond - straight section	105.4	78.7
inner cond - conic section	33.2	14.9
outer conductor	51.2	48.2
total	217.5	208.8
water channel total	23.4	
inner skin total	123.2	
outer skin total	80.6	

# ENERGY DEPOSITION - DENSITY I



# ENERGY DEPOSITION - DENSITY II

