

W. Weingarten

# **SPL Steering group meeting**

## **23 May 2008**

### **Preparatory notes**

# New simulations with lower static loss (3W/m) than before (15 W/m)

I used the numbers from V. Parma's and U. Wagner's presentation to figure out the static losses  
As "static" loss I understand all losses except the RF losses (eq. 4.5 K)

Yellow book

updated values

Table 4.26: Estimated heat loads in watts per module assuming a 6% duty cycle

Temperature	2 K		5–8 K		50–75 K	
	0.65	1.0	0.65	1.0	0.65	1.0
Cavity $\beta$						
Static loss	3.5	4.4	15.2	18.9	88.7	110.4
Beam loss	11.45	14.26	–	–	–	–
RF nom.	21.5	59.6				
HOM nom.	8.6	23.8	6.1		102	
Coupler nom.	0.64	1.79				
<b>Total dynamic nominal</b>	<b>42.2</b>	<b>99.5</b>	<b>6.1</b>		<b>102</b>	
RF ult.	51.9	144.2				
HOM ult.	20.8	57.7	6.1		102	
Coupler ult.	1.56	4.33				
<b>Total dynamic ultimate</b>	<b>85.7</b>	<b>220.5</b>	<b>6.1</b>		<b>102</b>	

		$\beta=0.65$		$\beta=1$	
		4%	8%	4%	8%
	Cryo duty cycle				
1	Static	3.50	3.50	4.40	4.40
2	Beam loss	11.50	11.50	14.30	14.30
3	Dynamic nominal	20.50	41.00	56.80	113.60
2+3	Total dynamic nominal (with beam loss)	32.00	52.50	71.10	127.90
4	Total dynamic ultimate (with beam loss)	61.00	110.50	151.80	289.30
1+2+3	Grand Total nominal	35.50	56.00	75.50	132.30
1+4	Grand Total ultimate	64.50	114.00	156.20	293.70

I concluded that the "static" losses are 13 W/m or 3 W/m in these two cases, resp.  
13 W/m are close to what I assumed up till now (15 W/m) from LEP experience.  
In addition I run some simulations with 3 W/m.

# New simulation parameters

## *High Power SPL*

$$\beta = 1$$

$$E_a = 25 \text{ MV/m}$$

$$R_{\text{res}} = 24 \text{ n}\Omega$$

$$n = 5$$

$$\tau = 0.72 \text{ msec}$$

$$I_b = 40 \text{ mA}$$

$$T_{\text{in}} = 0.64 \text{ GeV}$$

$$T_{\text{out}} = 5 \text{ GeV}$$

$$\phi = 20 \text{ degrees}$$

$$r = 50 \text{ sec}^{-1}$$

$$\eta_{\text{real-estate}} = 0.5$$

$$\eta_{\text{Rf}} = 0.4$$

$$\eta_{\text{td}} = 0.2$$

$$P_{\text{cst}} = 3 \text{ W/m (equivalent 4.5 K)}$$

## *Low Power SPL*

$$\beta = 1$$

$$E_a = 25 \text{ MV/m}$$

$$R_{\text{res}} = 24 \text{ n}\Omega$$

$$n = 5$$

$$\tau = 1.2 \text{ msec}$$

$$I_b = 20 \text{ mA}$$

$$T_{\text{in}} = 0.64 \text{ GeV}$$

$$T_{\text{out}} = 4 \text{ GeV}$$

$$\phi = 20 \text{ degrees}$$

$$r = 2 \text{ sec}^{-1}$$

$$\eta_{\text{real-estate}} = 0.5$$

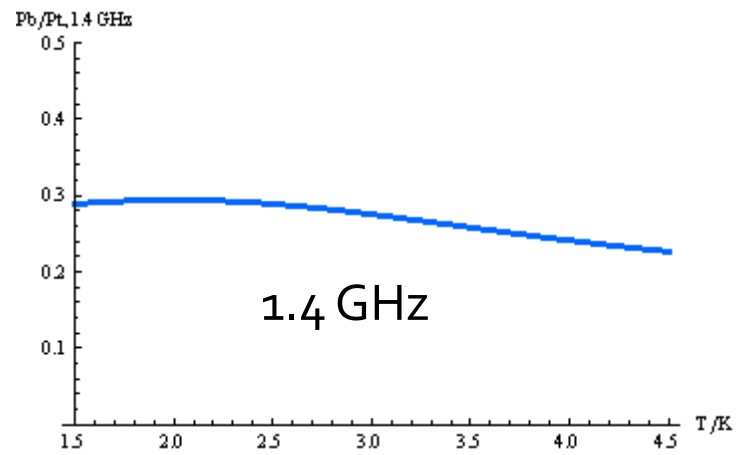
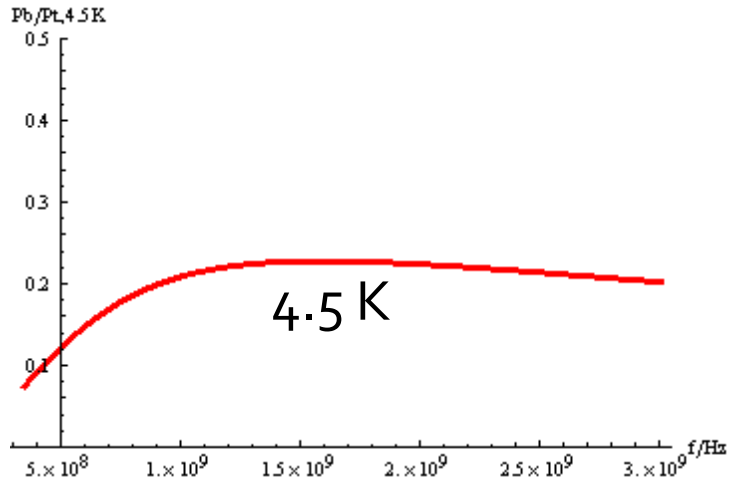
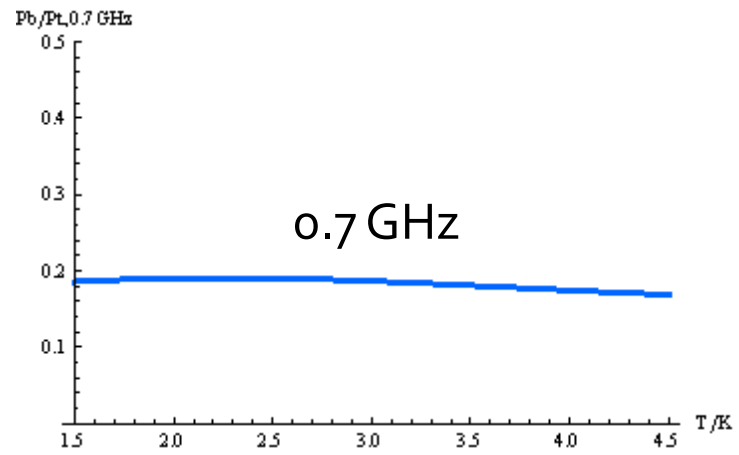
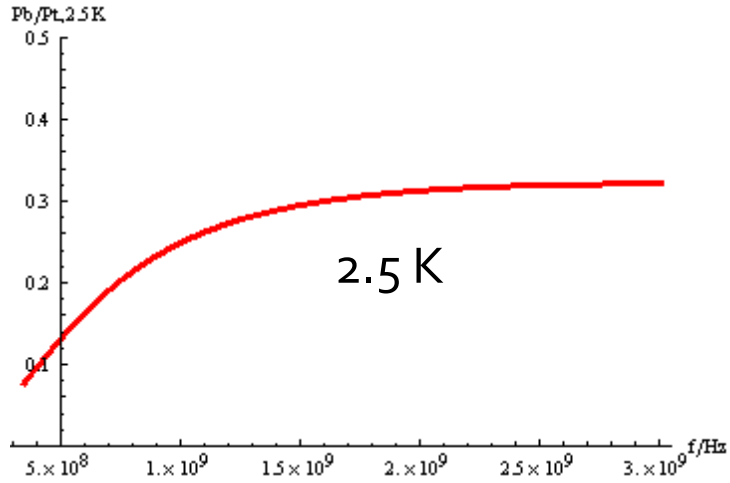
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$$P_{\text{cst}} = 3 \text{ W/m (equivalent 4.5 K)}$$

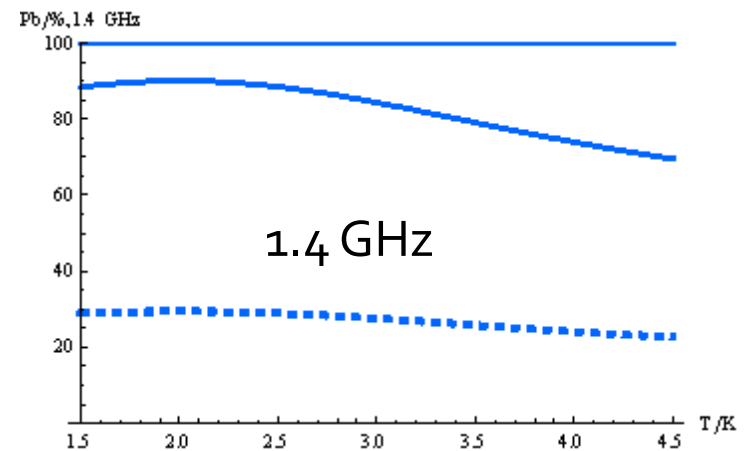
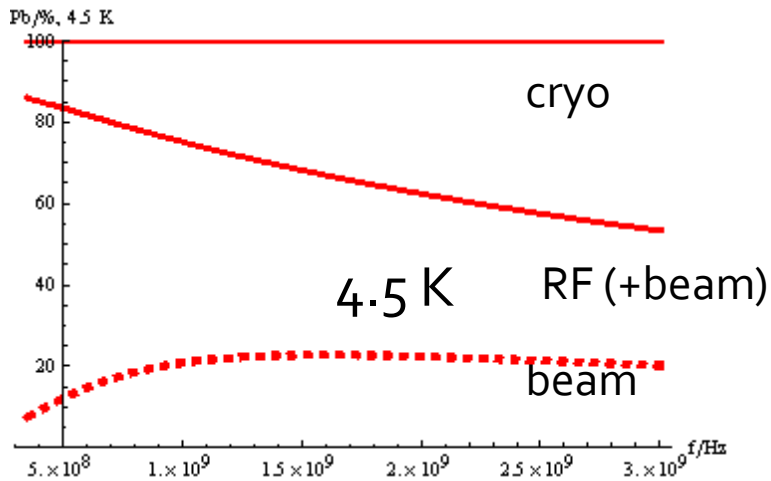
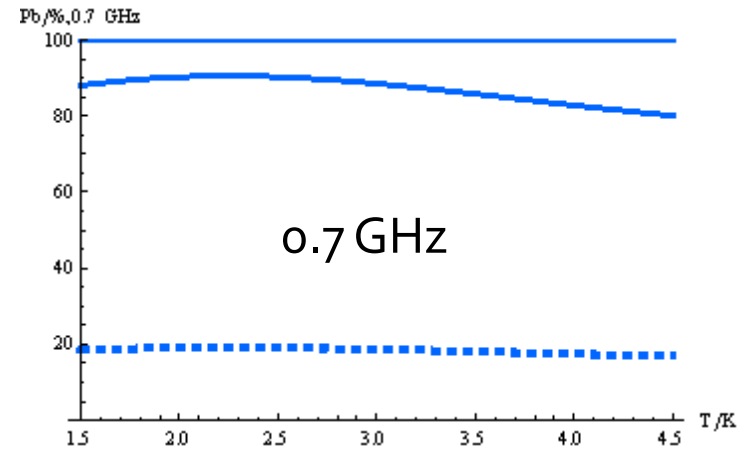
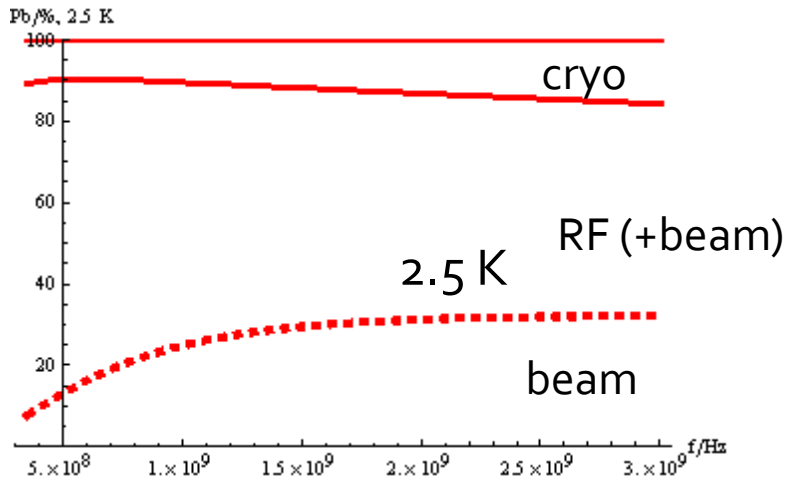
# Power grid – beam transfer efficiency ( $T_b, \omega$ )

# Results high power SPL (3 W/m)



Results high power SPL

# Total power sharing [%] ( $3 \text{ W/m}$ )



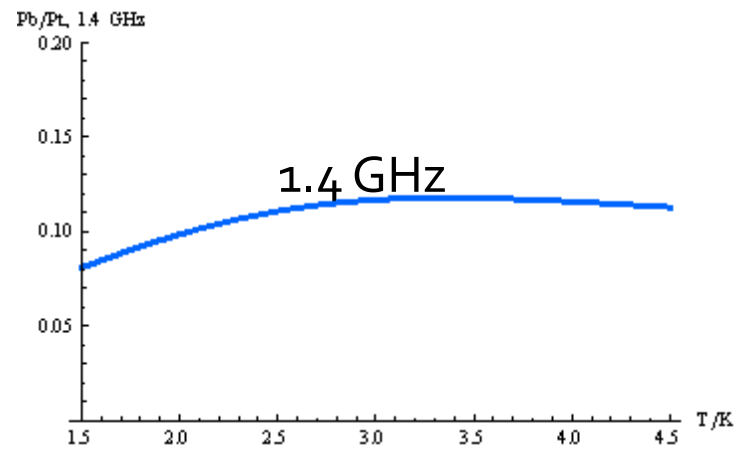
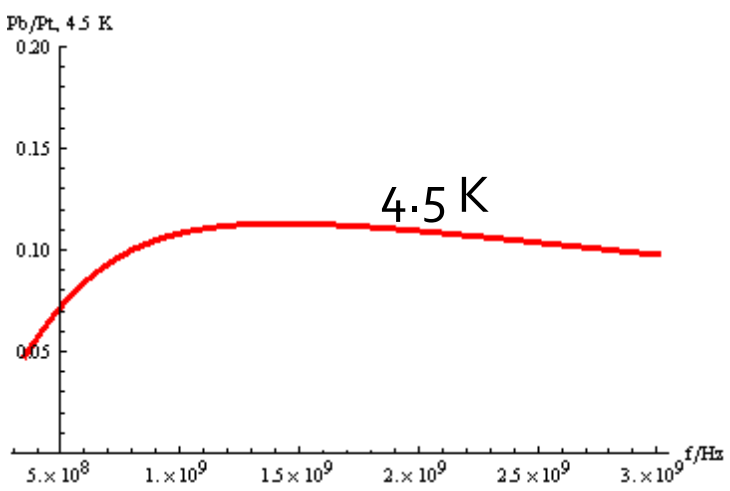
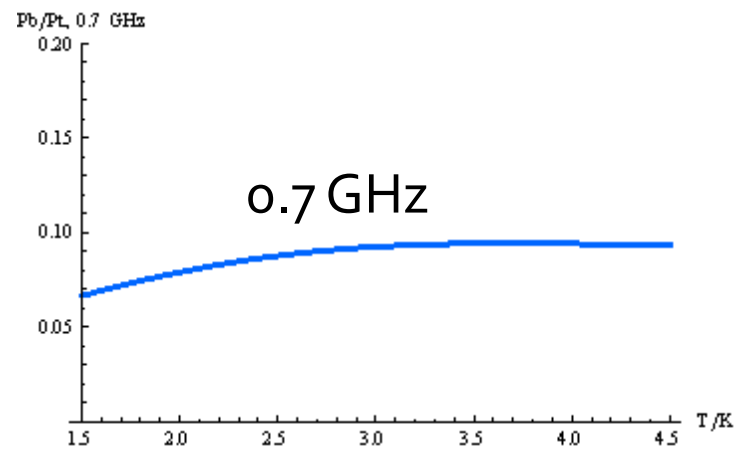
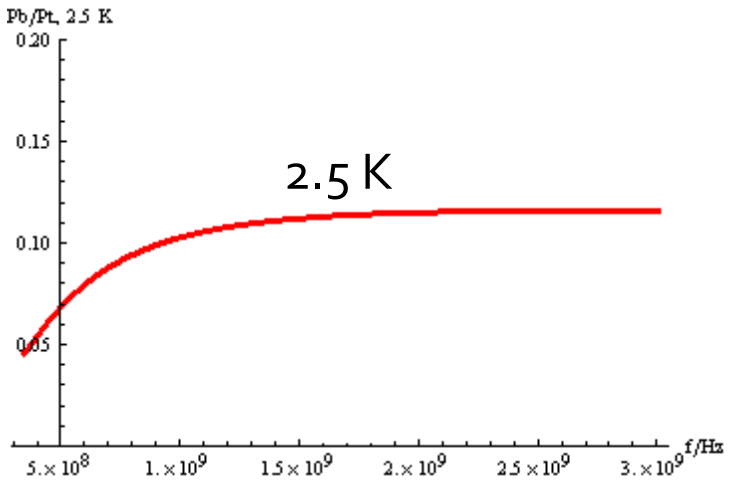
# Capacities at 4.5 K and 2.0 K

## Table from Parma-Wagner presentation

HP SPL	T operation	Equiv. capacity at 4.5 K	El. power	Simulation El. power 3 W/m (15 W/m)
	[K]	[kW]	[MW]	[MW]
Yellow Book	2.0	15.8	4.0	-
HP SPL 4% duty	2.0	15.8	4.0	3.3 (8.5)
HP SPL 4% duty	4.5	47.2	10.3	7.5 (10)
HP SPL 8% duty	2.0	27.8	6.5	-
HP SPL 8% duty	4.5	88.0	18.6	-

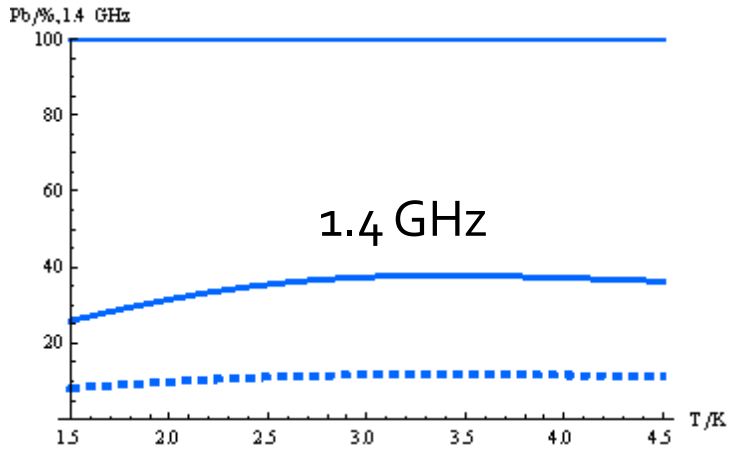
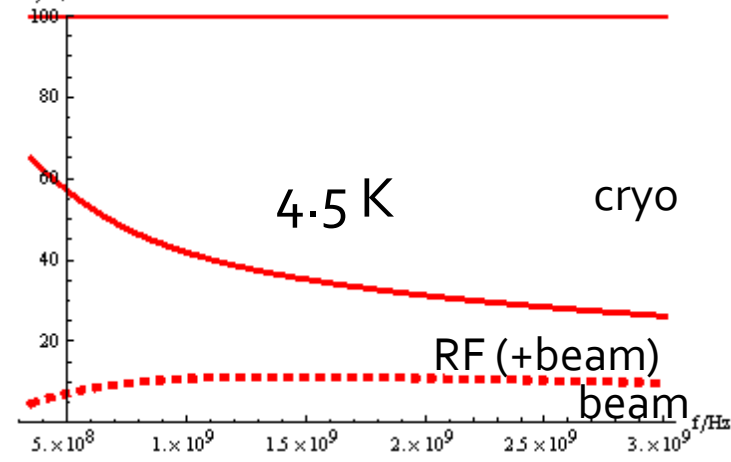
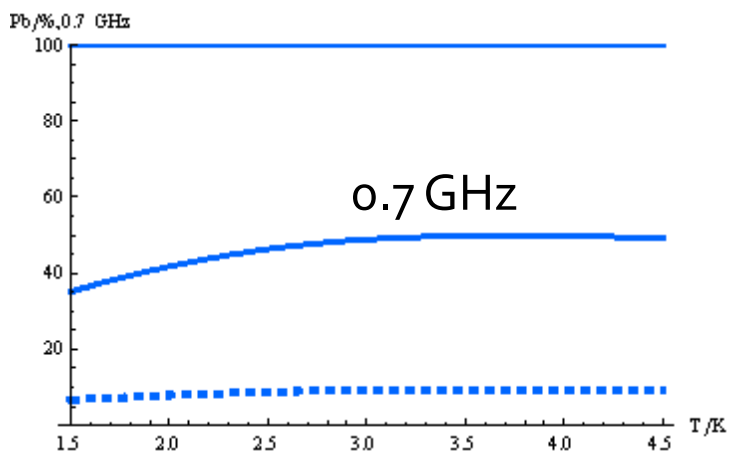
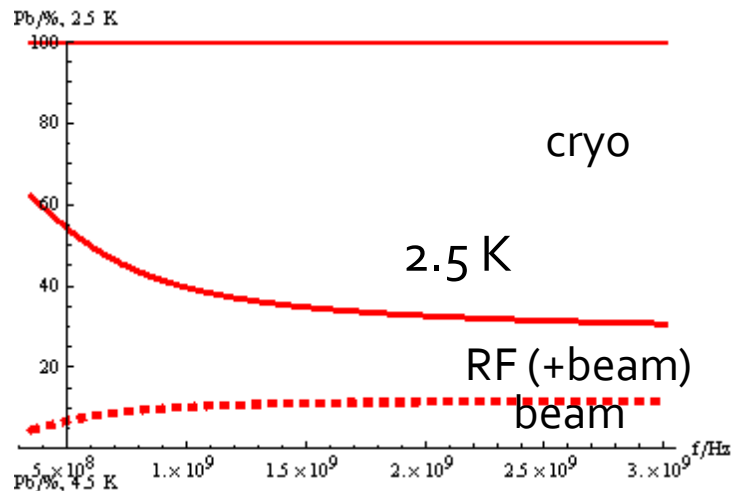
# Power grid – beam transfer efficiency ( $T_{b, \omega}$ )

## Results low power SPL (3 W/m)



# Results low power SPL

## Total power sharing [%] ( $3 \text{ W/m}$ )





# Capacities at 4.5 K and 2.0 K

## Table from Parma-Wagner presentation

LP SPL	T operation	Equiv. capacity at 4.5 K	El. power	Simulation El. power 3 W/m (15 W/m)
	[K]	[kW]	[MW]	[MW]
Old data 2007	2.0	2.1	0.8	-
Old data 2007	4.5	3.1	1.0	-
Actual data	2.0	4.8	1.3	1.2 (5.5)
Actual data	4.5	9.1	2.5	1.0 (3.0)