

**ENGINEERING NOTE**

Engineering Division

Cat. Code: LH 1001

LBL Serial #: M 7801

DOC#:

Page 1 of 4

Author(s): Egon Hoyer

Date: 10/13/99

Checked by:

MAC

First Line:

US - LHC COLLABORATION

Second Line:

1.1.4 - ABSORBERS - TAS

Title:

AMBIENT COOLING CALCULATIONS FOR CMS TAS - SUMMARY

Ambient cooling calculations were carried out for the TAS installed in the CMS Shield Rotating System in the absence of forced air cooling. The detailed calculations are documented in Engineering Note M 7800. Here the input power, thermal model & cooling assumptions and time - temperature results are summarized.

Input Power:

Absorber collision power at $1.0 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ luminosity	219 W
24 hour average absorber collision power at design luminosity (peak luminosity = $1.0 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ )	131 W
24 hour average absorber collision power at ultimate luminosity (peak luminosity = $2.5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ )	329 W
Power used in calculations for design luminosity	160 W
Power used in calculations for ultimate luminosity	400 W

Thermal Model:

A thermal model was used where heat travels from the TAS to the central steel shielding. From the central steel shielding it travels in two different paths. One is radially outward thru the concrete and polyethylene to the ambient air. The other is forward to the forward steel shielding and radially outward thru the concrete and polyethylene to the ambient air.

Layout:

Shield Rotating System – Elevation LHCTX55\_0006

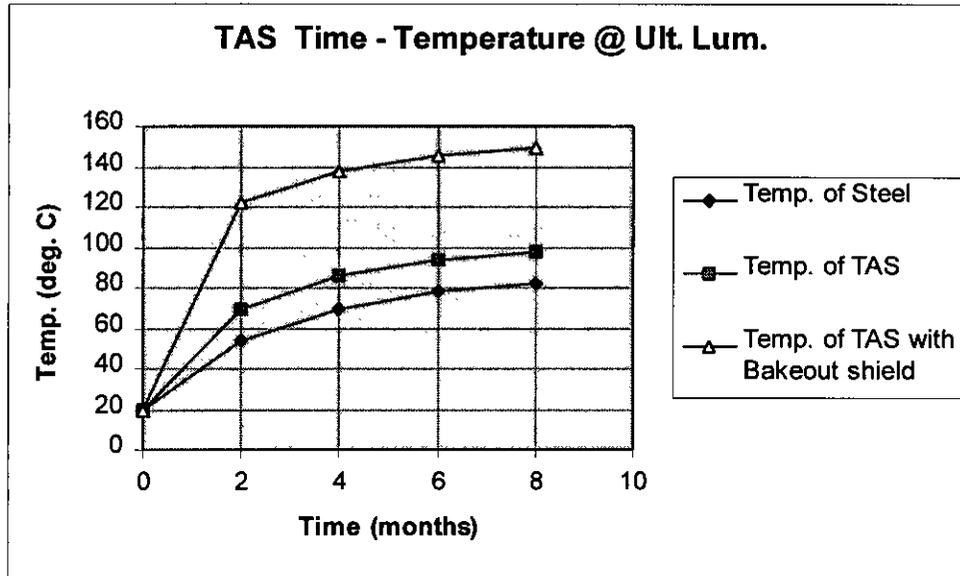
Assumptions:

- No heat flow along the vacuum pipe
- No heat flow out the front end of the forward rotating shielding
- No heat flow into the fixed shield region

Time-Temperature Results:

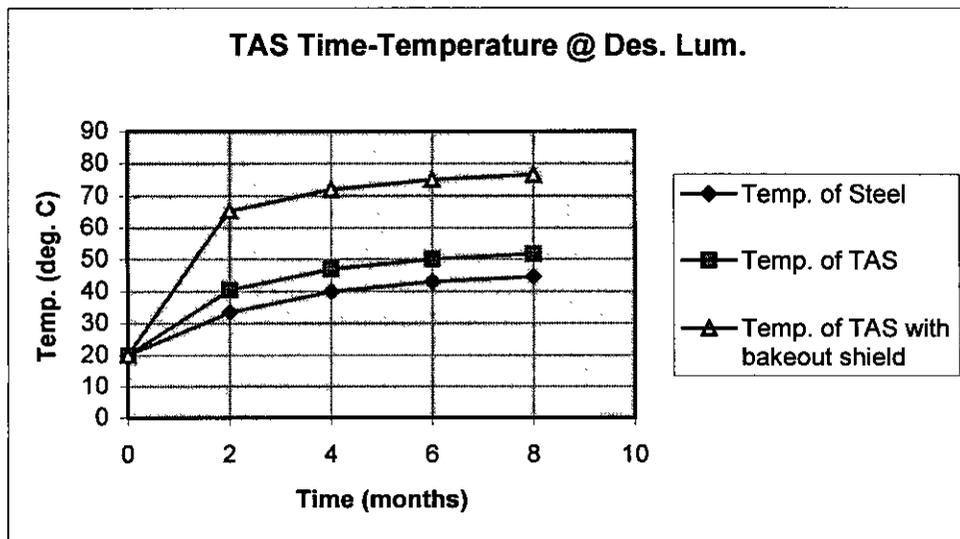
Ultimate Luminosity - Input power to the TAS = 400 W

Calculations are done for the TAS with and without a bakeout shield



Design Luminosity - Input Power to the TAS = 160 W

Calculations are done for the TAS with and without a bakeout shield



Cat. Code:	LBL Serial #: M 7801	DOC#:	Page 4 of 4
Author(s): Egon Hoyer			Date: 10/13/99

Summary:

With a 75 degree C limit placed on the TAS vacuum chamber (TAS Functional Specification – Draft):

With Ultimate Luminosity the TAS, without a bakeout shield, will reach the 75 degree C limit in about 2 1/2 months. If the bakeout shield is added to the TAS, then the limit will be reached in about 1 month.

With Design Luminosity the TAS, without a bakeout shield, will not reach the 75 degree C limit. If the bakeout shield is added to the TAS, then the limit will be reached in about 6 months.

Issues:

With just ambient cooling of the TAS in the CMS, the issues are:

1. Is the higher beam tube temperature acceptable?
2. Is the increase in temperature of the surrounding shielding acceptable?