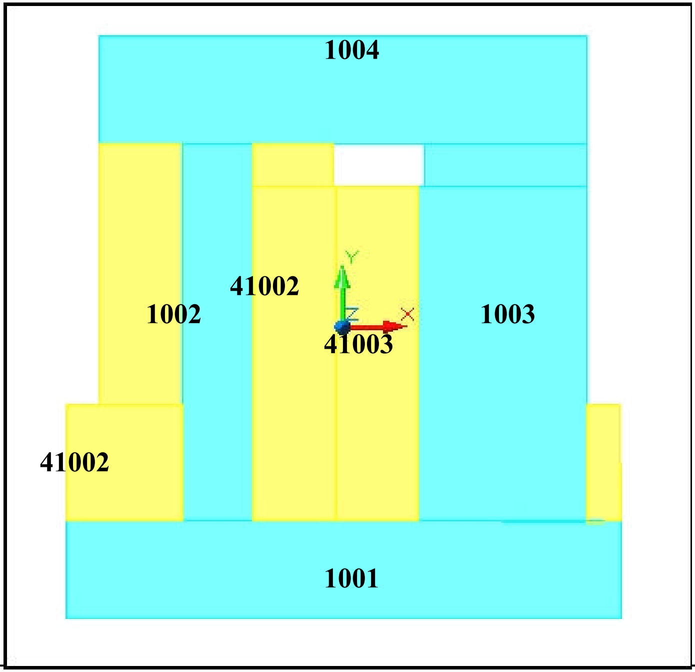
AMS 02 THERMAL CONTROL SYSTEM

Radiator and Crates thermal status

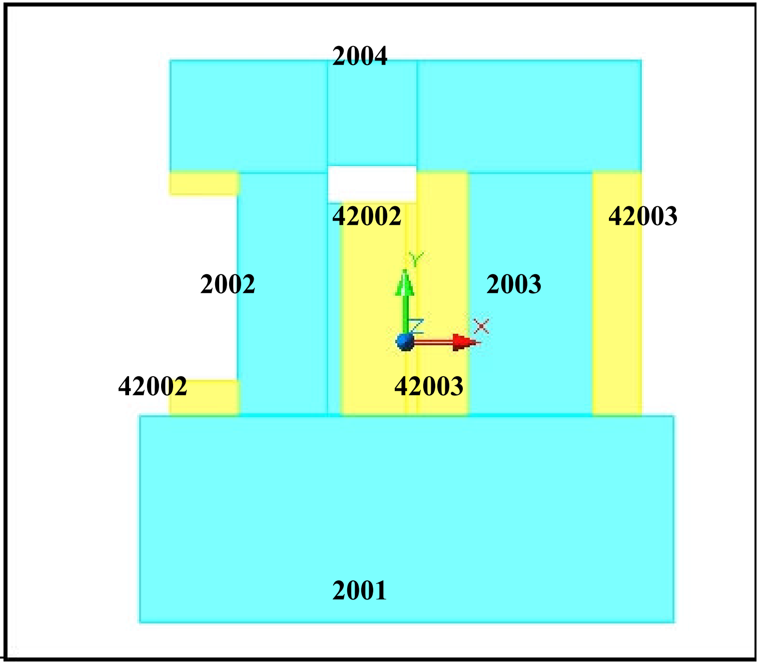
RADIATORS

Ram & Wake radiators nodalization

RAM

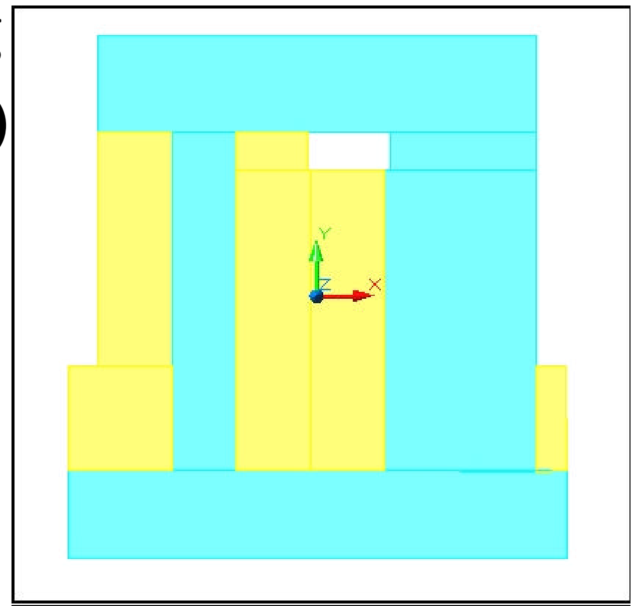


WAKE



Ram & Wake radiators Thermo-Optical properties

- Blue: Effective heat rejection surface
- Yellow: un-effective radiating area (no heat pipes embedded)
- **ALL THE SURFACE IS White Paint:**



(EOL: alpha = 0.22, eps = 0.9)

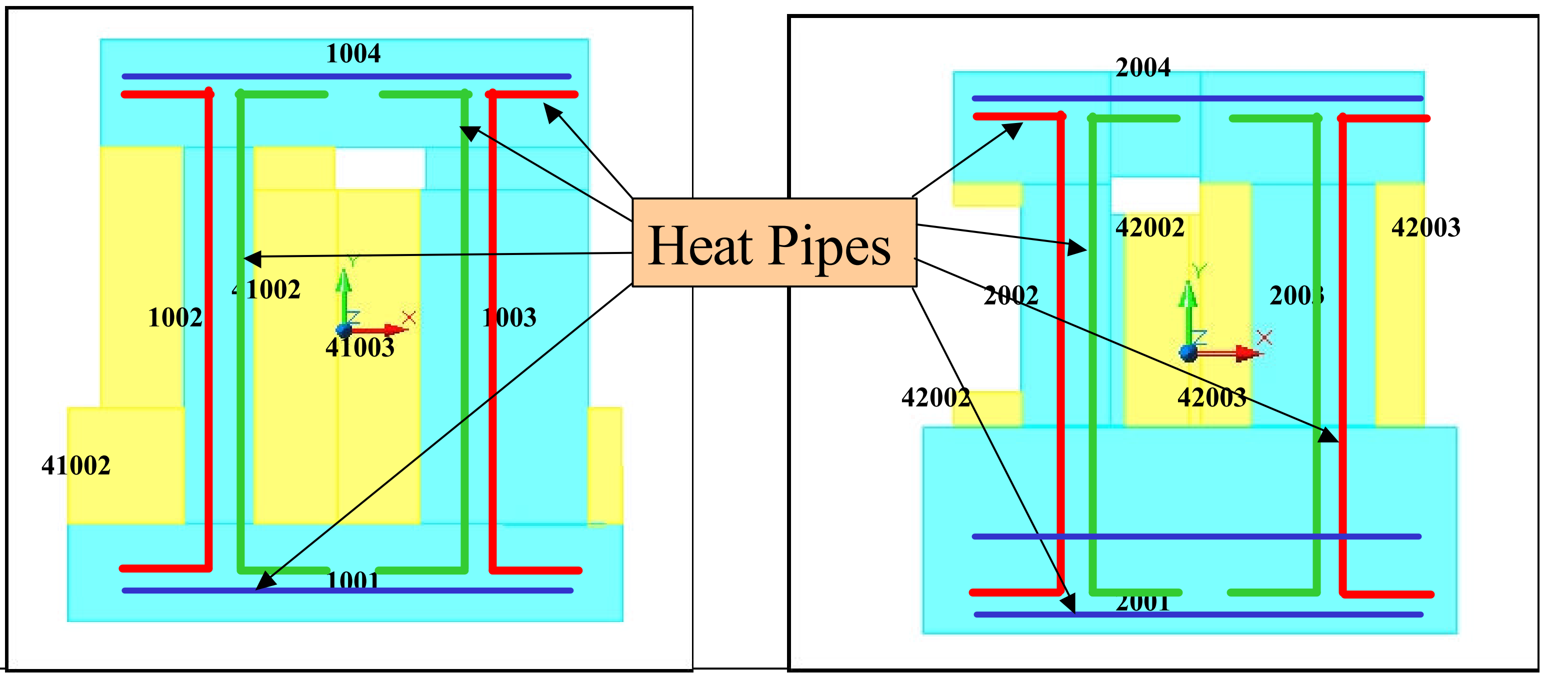
(BOL: alpha = 0.17, eps = 0.92)

Heat Pipe modelling (1)

- Heat pipes make the radiator ~"isothermal"
  - High thermal conductivity between nodes connected by HP routing
  - Skin conductivity elsewhere (provided by Aluminum 2x0.5 mm plates)

Heat Pipe modelling (2): ROUTING

RAM | WAKE



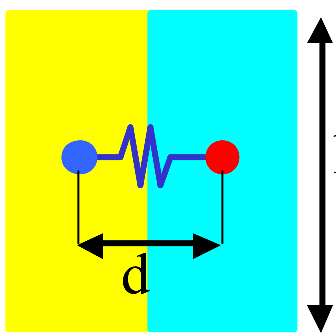
Heat Pipe Modelling (3)

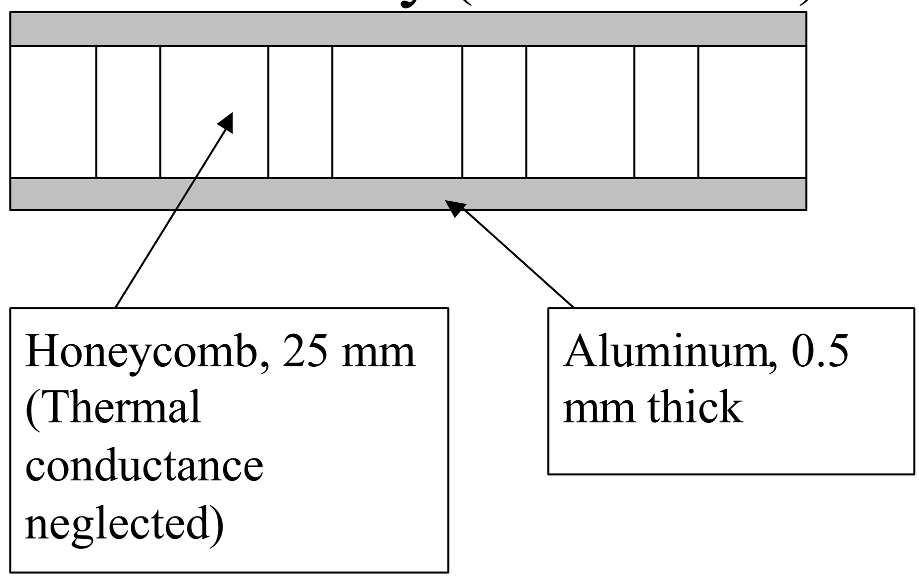
- Radiator Panel conductance:

Aluminum skins contribution only (0.5+0.5 mm)

Conductance =

$= k_{Al} \times 1mm \times h / d$

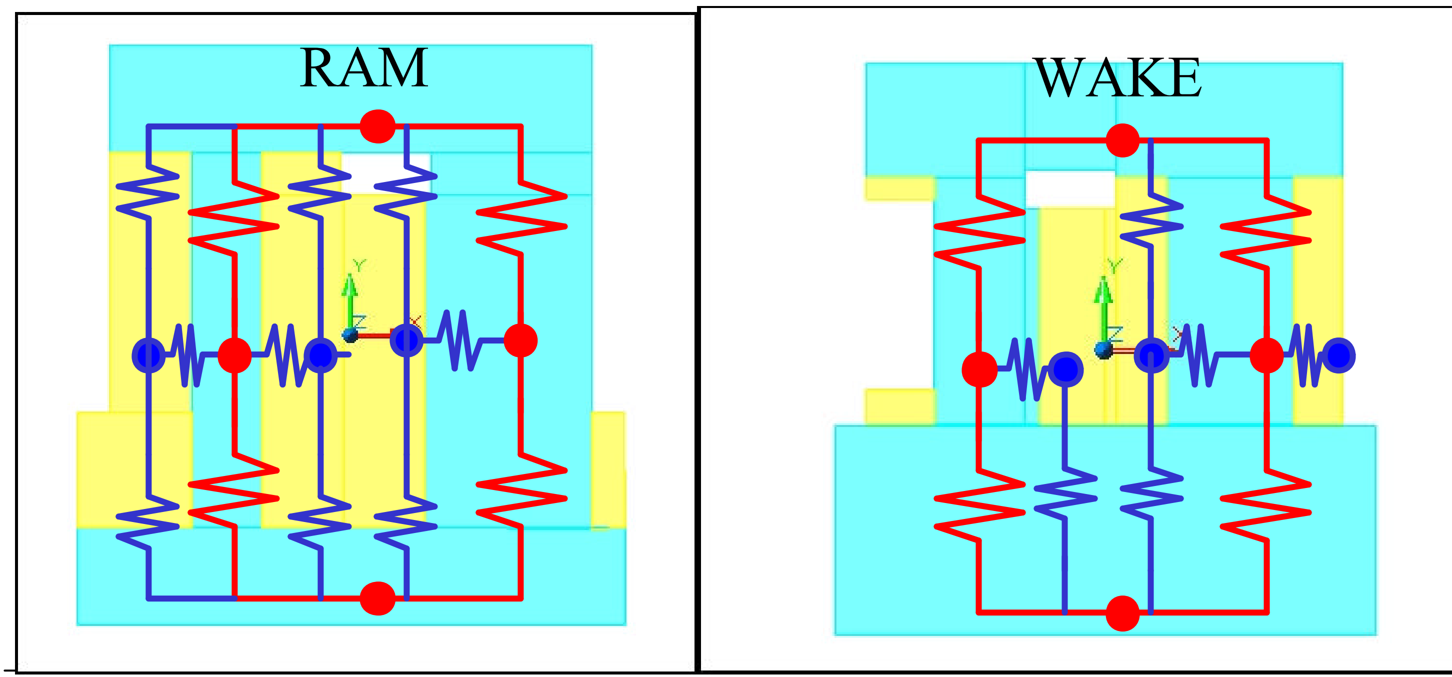




Heat Pipe Modelling (4)

300 W/K, provided by HP

In-plane skin conductance



CRATES

- Updated Crates model
- Alignment with mechanical design and latest dissipations (as per flight_design.xls, by M.Capell, 24 oct 2002)

Crates thermal status

Summary of current SINDA model:

All X-PD and VME crates are correctly modelled and included in CGS AMS02_ver1.1 model (TMM+GMM)

Name	Quantity
E	2
R	2
REPD	2
J	1
JT	1
JPD	1
M	1
MPD	1
S	4
SPD	4
T	8
TPD	8
TT	1
TTPD	1
U	2
UPD	2
UG	1
UGPD	1

NON-standard crates

Other crates/electronics currently included in ver 1.1:

- PDB (dummy)
- CAB (dummy)

Need for "realistic" reduced models

- –PDB by CGS , expected Jan 2003
- –CAB by CRISA, expected …

CRATES NOT INCLUDED

Which	by Whom	Due date
•ASTC	Tracker	TBD
•GPSA	group	
•CDD	SCL	TBD
•UGB	LMSO	Nov
•CCDB	TBD	TBD
•TTCS	NIKHEF	TBD

INFORMATION NEEDED:

- Position/attachment points
- Mounting I/F conductance
- Dimensions
- Dissipation

Crates installation on the radiators

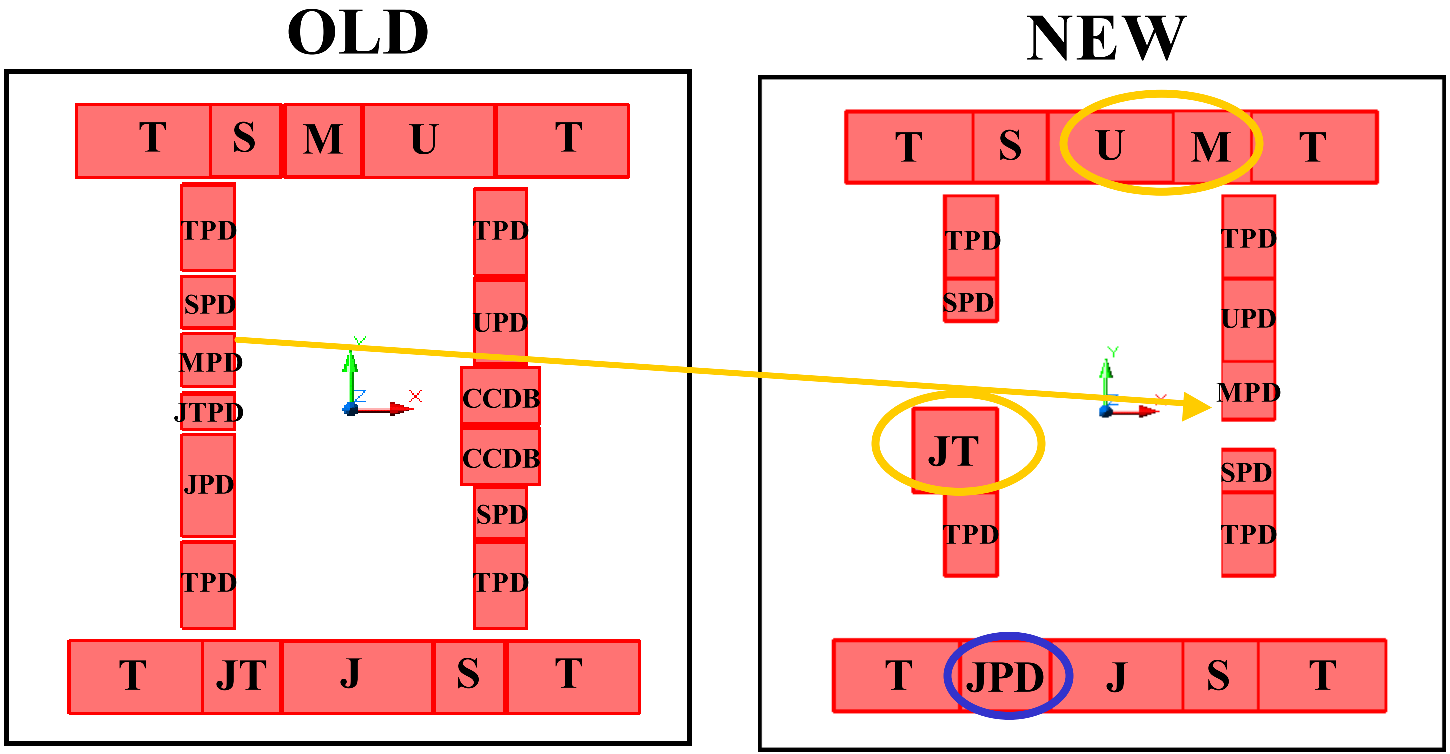
- New conductances
    - between crates walls
    - between crates and radiators

have been implemented , according to the new crates dimensions

- Validated figures are expected from NSPO

New crates accomodation

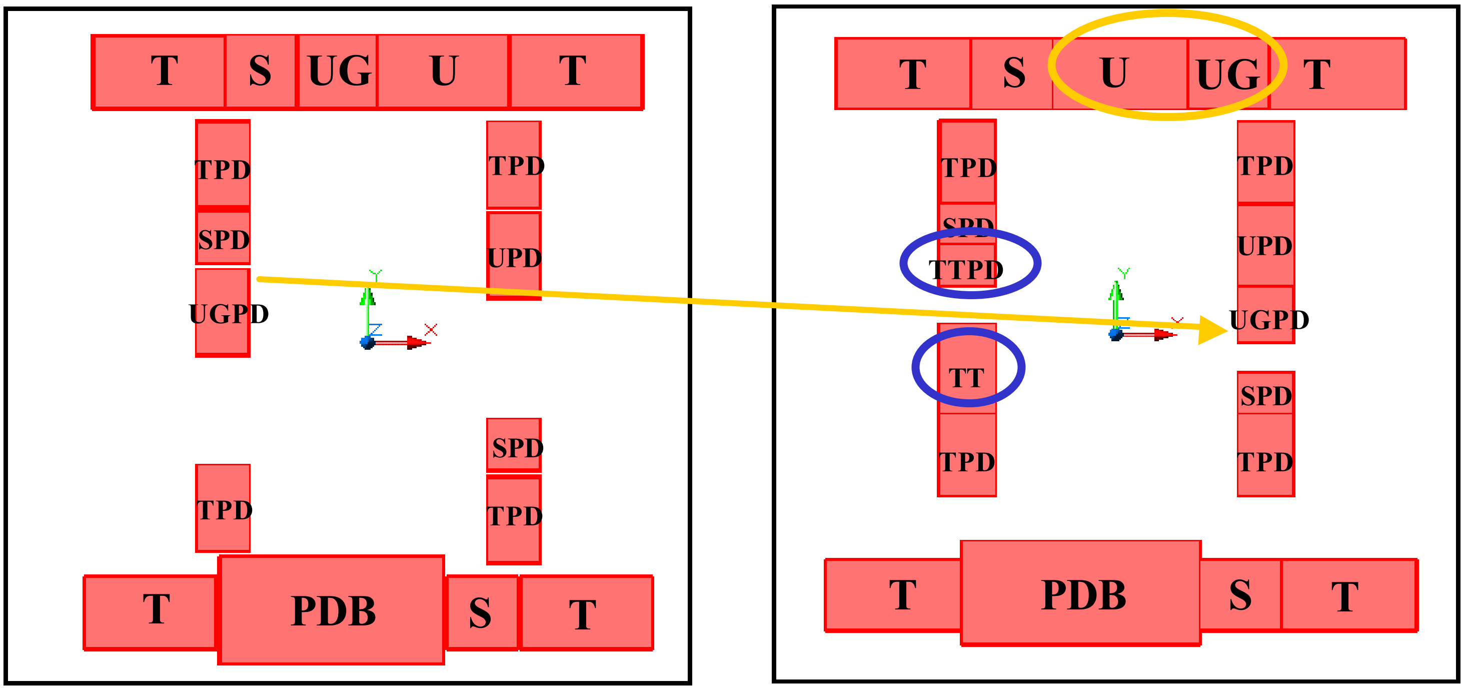
RAM



New crates accomodation

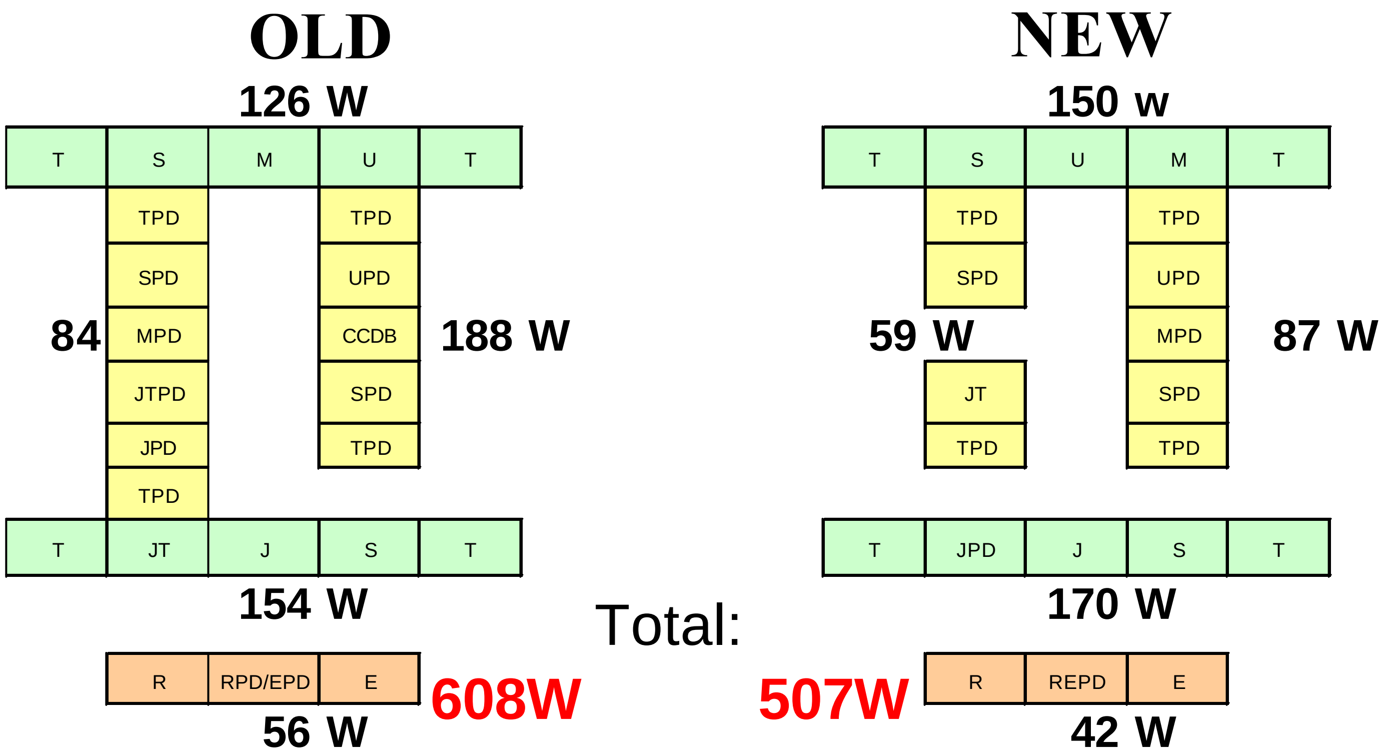
WAKE

OLD **NEW**



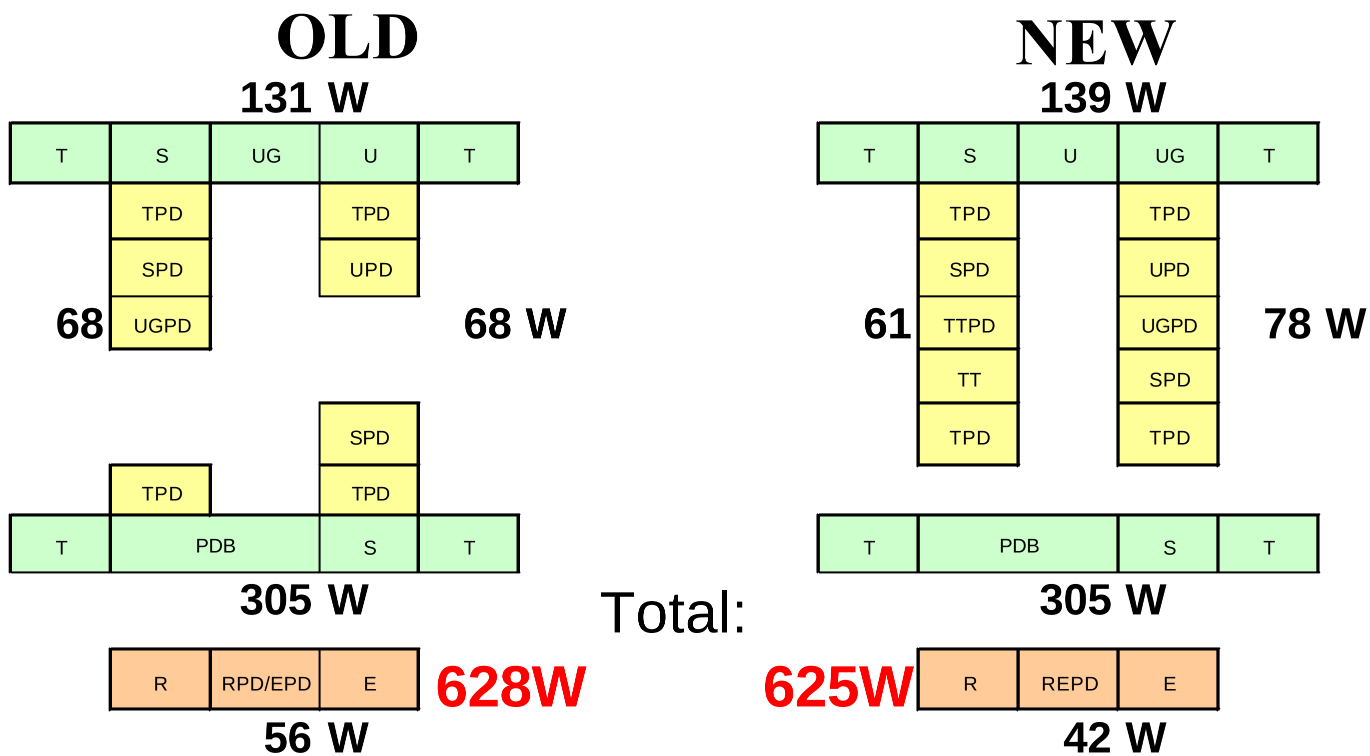
New power dissipation

RAM



New power dissipation

WAKE



Radiators MLI

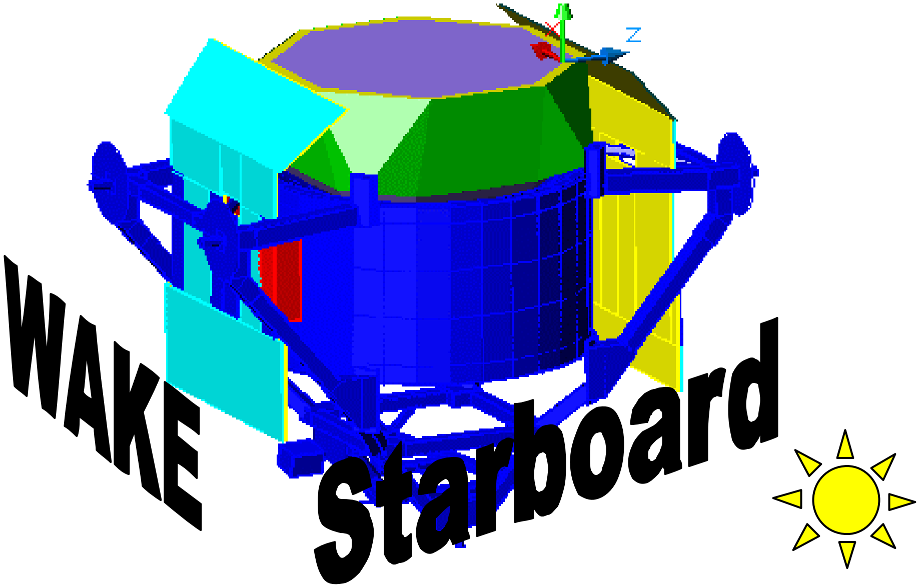
Understanding of the problem

- MLI installation on crates walls may be difficult due to
  - cabling
  - reduced clearance during integration.
- A study is needed to assess the need for MLI on crates walls.

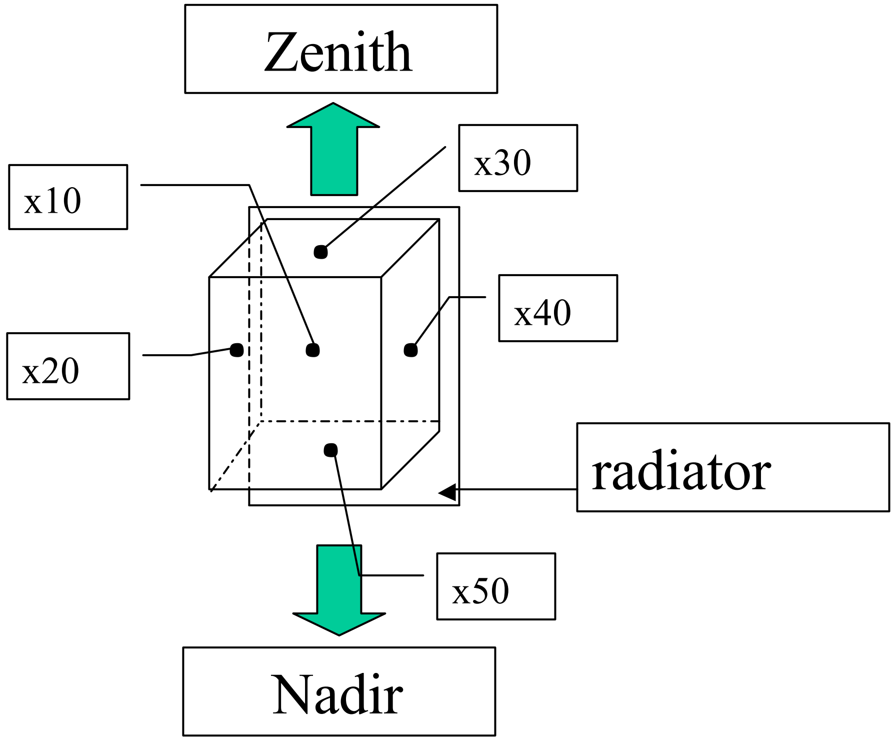
Model modifications

- No MLI on crates surfaces => thermo-optical properties for crates surfaces : **anodized aluminum:** a **= 0.38,** e **= 0.83**.

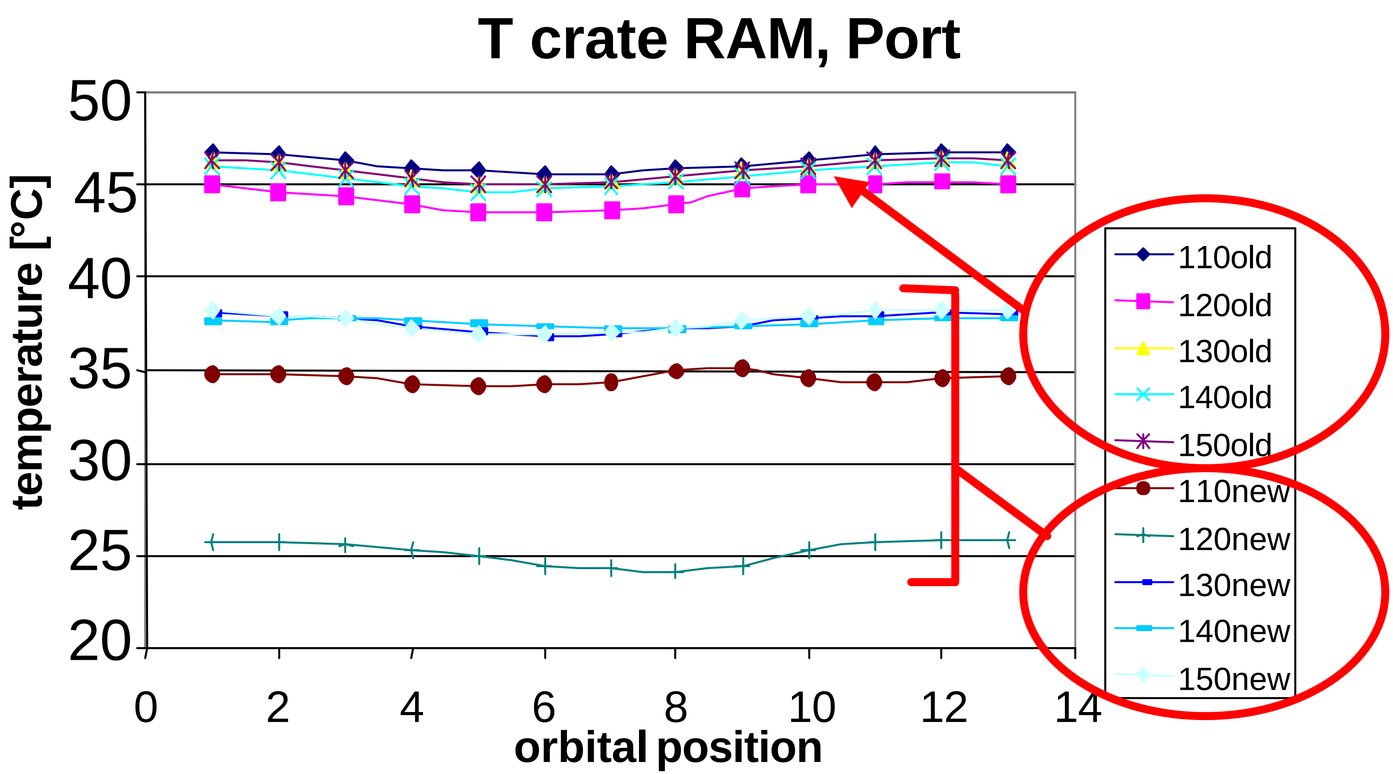
Analysis done with Beta=-75° orbital loads



CRATES NODALIZATION

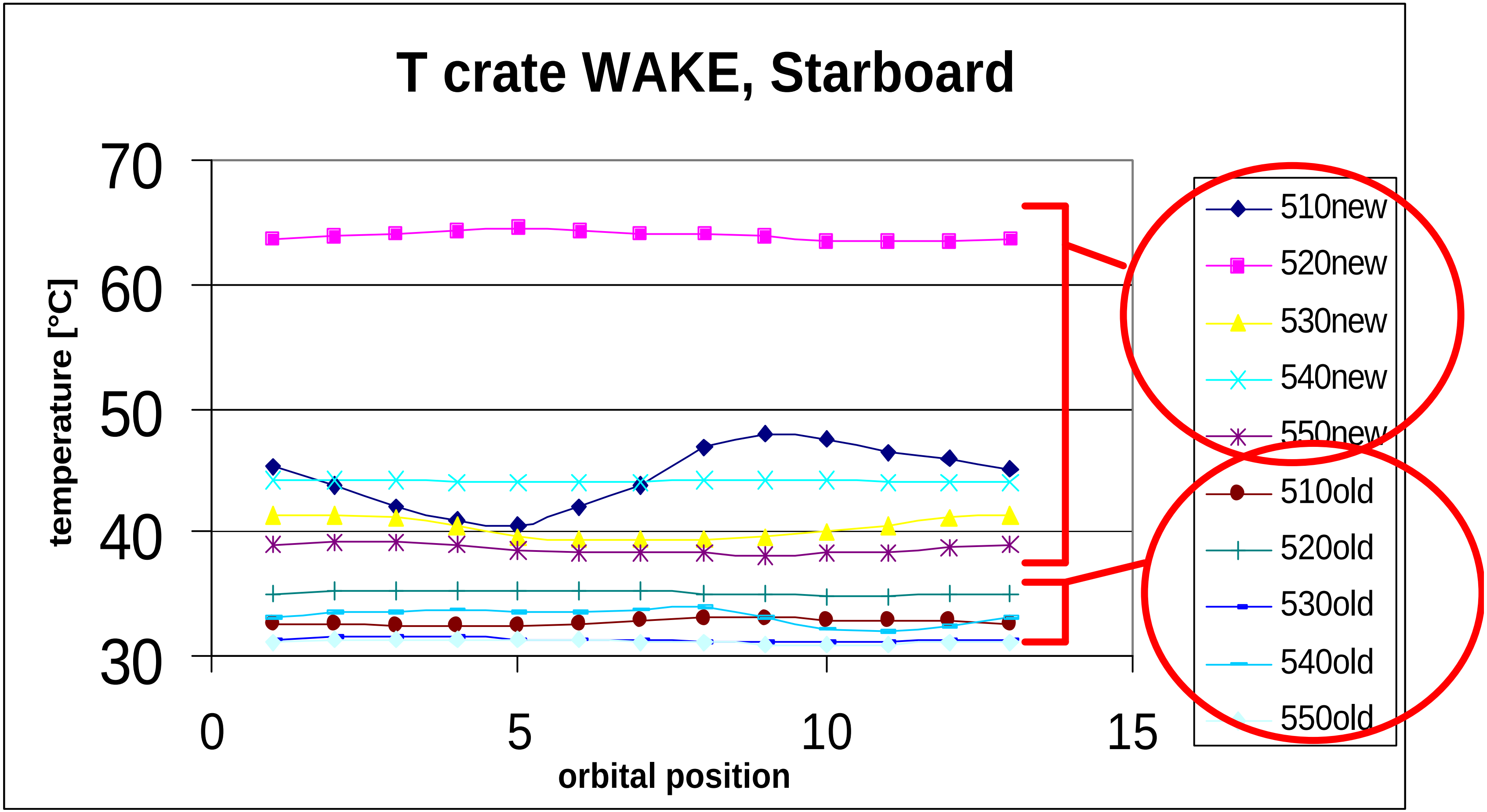


T – Crate walls temperature



Effects on PORT side

- Temperature decrease (7-20 °C)
- Greater gradients among walls on the same crate (from ~ 2 to ~ 17°C)

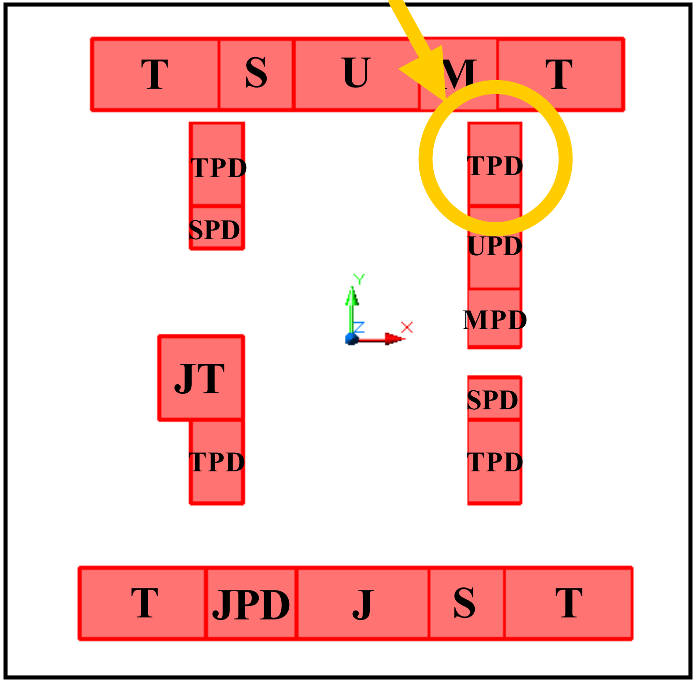

T crate WAKE, Starboard
temperature [°C]
70
60
50
40
30
0
5
10
15
orbital position
510new
520new
530new
540new
550new
510old
520old
530old
540old
550old

Effects on Starboard side

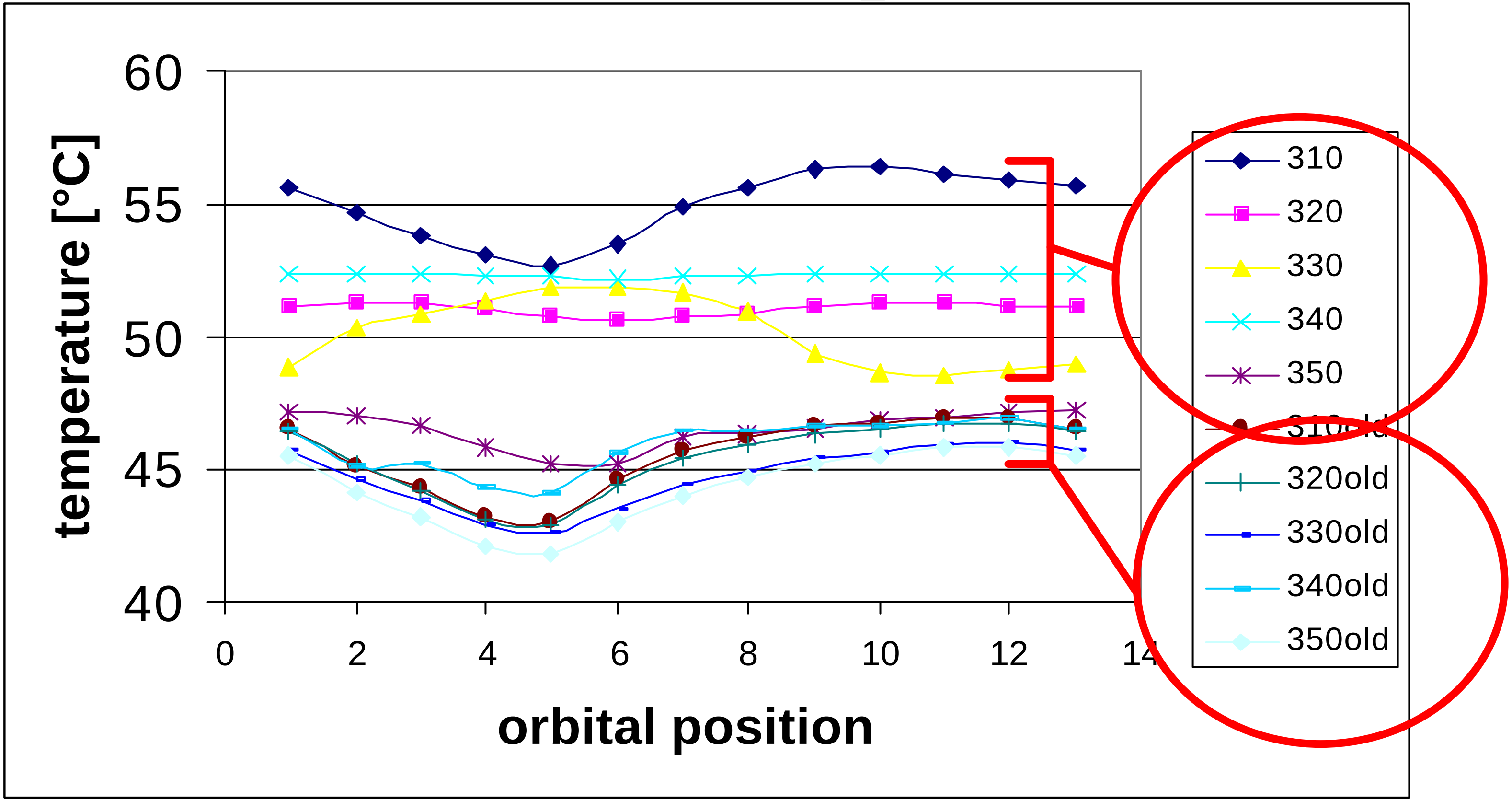
- Temperature increase (10-30 °C)
- Greater gradients among walls on the same crate (from ~ 4 to ~ 30°C)

TPD walls temperature

- TPD location: Ram, starboard side
- TPD is the highest dissipating crate in the column: 24.55 W



TPD walls temperature



CONCLUSIONS

- MLI is foreseen on the most critical crates walls, namely:
  - Starboard and port
  - Boards thermal interfaces for VME crates
  - XPD walls facing the vacuum case.
- MLI in the inner radiator area: TBD