CRATER MODEL ASSUMPTIONS

Prepared by Bill Chang
(301)286-5703
wschang@mscmail.gsfc.nasa.gov

Introduction

- The material contained in this package represents our current understanding of your instrument from a thermal perspective. The geometry, power profiles, and temperature limits were extracted from the proposal.
- We have started building a new thermal model of the Orbiter designated as Design 'B'. The information in this package will be incorporated into the model until we receive your reduced models. Please note that Design 'B' is by no means the final configuration. It is merely a starting point for analyzing the S/C thermal control system.
- Assumptions made with respect to surface coatings, power profiles, assignment of heat dissipations locations, distribution of mass, etc. are presented as well. Information was extracted from the proposal as much as possible.
- Operational and non-operational temperature limits presented herein are assumed to be at the instrument side of the S/C interface mounts.
- Average heat dissipations used
  - 10% added for hot case analysis
  - 10% deducted for cold case analysis
- All instrument housings assumed to be Aluminum 6061. Baffles (where applicable) are assumed to be M55J composite.

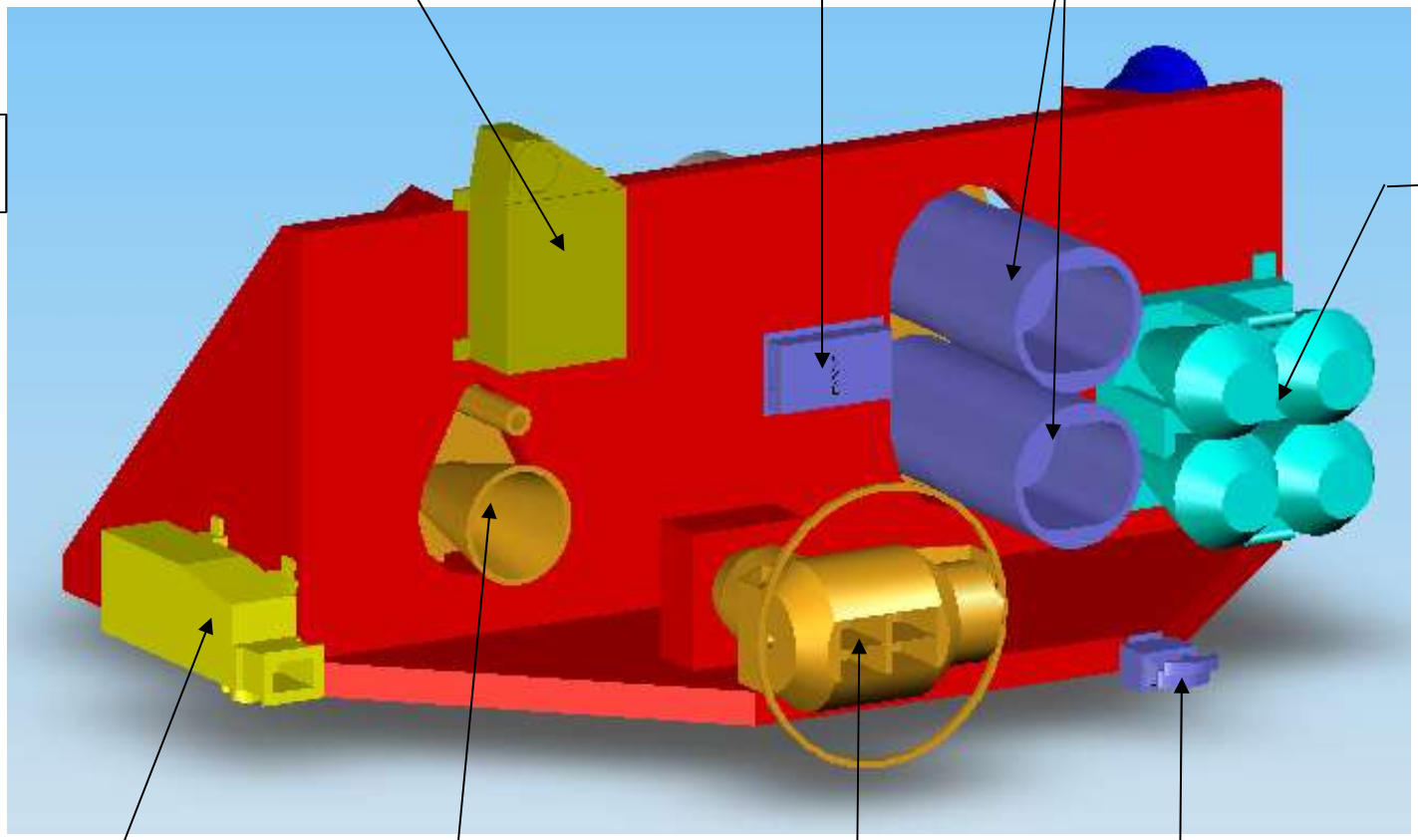
Instrument Model Usage

- For our purposes, the instrument models serve three basic functions:
  - Provide view factor blockage
  - Provide a representative heat sink or heat load at the S/C mounting interface
  - Provide a rough estimate as to instrument temperatures
- During the model exchange, we will be providing each instrument team with one of the following:
  - ***Option 1***: A reduced S/C model. Each instrument team will replace their reduced instrument model with the detailed model. At this point, it will be the responsibility of each instrument team to run their hot, cold, and survival orbital cases as well as all other cases deemed necessary.
  - ***Option 2***: GSFC can provide instrument backload data. The backload information will be referenced to the geometry currently in this package. The number of cases provided will be limited most likely to the Beta 0° hot case, Beta 90° cold case, and survival case. We do not have the time or manpower to run all the various scenarios for each instrument, therefore, if you need to run additional mission scenarios, you must elect Option 1. Since backload information will be provided referenced to the current geometry, it is critical that you review the information in this package and provide feedback ASAP.

Model Assumptions

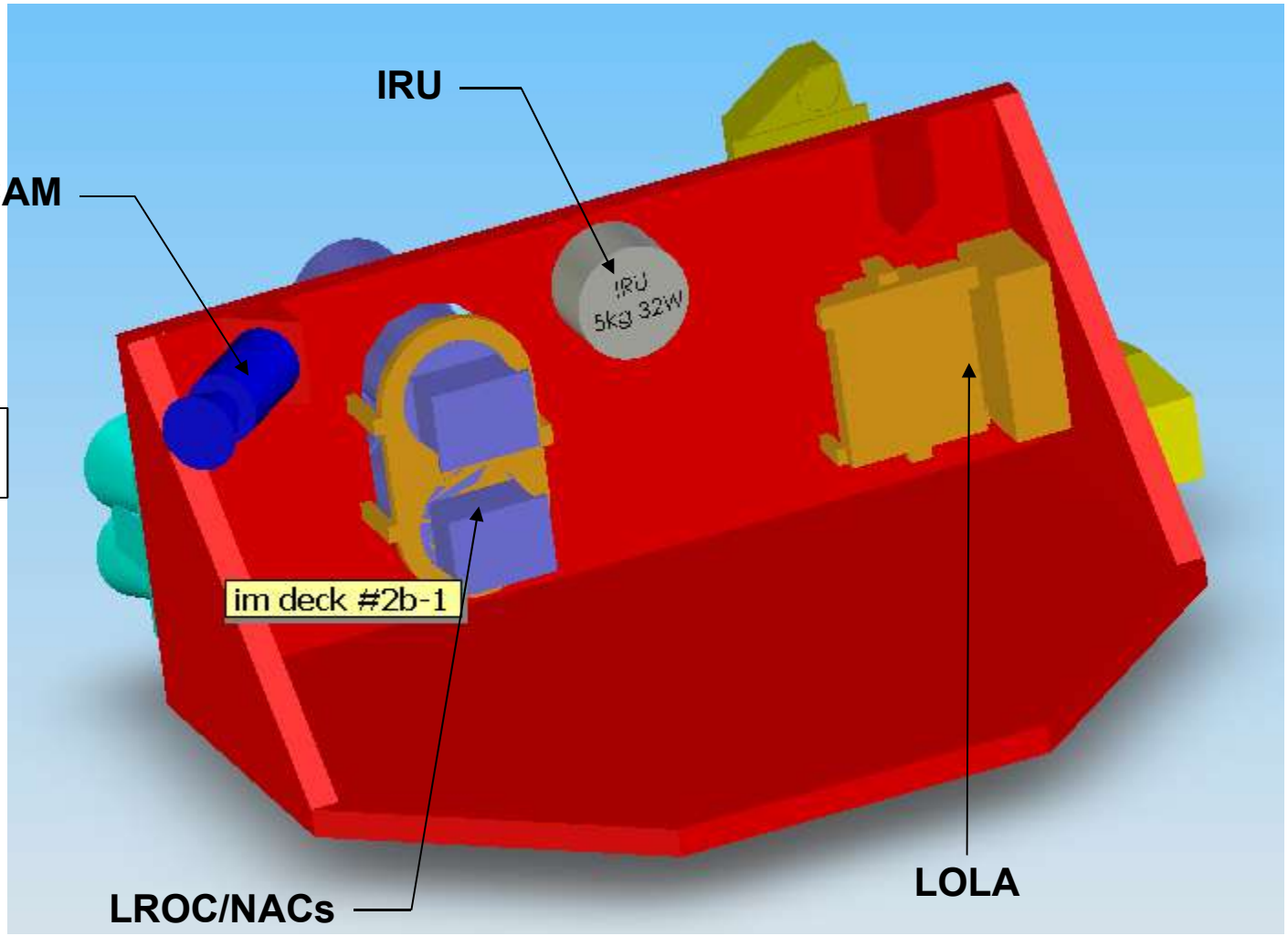
- External geometry information estimated from proposal (refer to following slides for geometry info.)
- Instrument power profile from proposal
  - Peak operational power
    - 9.0W with 30% reserve during brief periods of data transmission
    - 6.4W standby
  - Average operational power
    - 6.0W with 30% reserve constant throughout the orbit
    - 3.4W standby
- Temperature limits:
  - Operational: -30°C to +35°C
  - Survival: -40°C to +50°C
- Housing and mounts assumed to be Aluminum 6061
- Instrument is conductively coupled to OB at 4 mount locations. I/F thermal gasket material is Cho-Therm (current baseline).
- Only external geometry and underlying housing structure are modeled. Internal details are not modeled.
- Based on the arrangement of PCB in the instrument, we assume that 6W average operational power dissipation is applied as follows:
  - 50% at node 10 = 3W (see following figure for location)
  - 25% at node 1 = 1.5W
  - 25% at node 7 = 1.5W
- Mass = 4.3 kg + 1.3 kg reserve = 5.6 kg total
- Instrument is fully blanketed
  - Outer layer of MLI is Kapton. Using the following a/e properties per GSFC coatings committee:
    - BOL = 0.44 / 0.80
    - EOL = 0.55 / 0.76
  - Aperture nodes (20 & 30) assume covered with Black Germanium Kapton. Using the following a/e properties per GSFC coatings committee:
    - BOL = 0.49 / 0.81
    - EOL = 0.51 / 0.78
  - MLI e* value utilized is 0.005 to 0.03.

Design ‘B’ Configuration

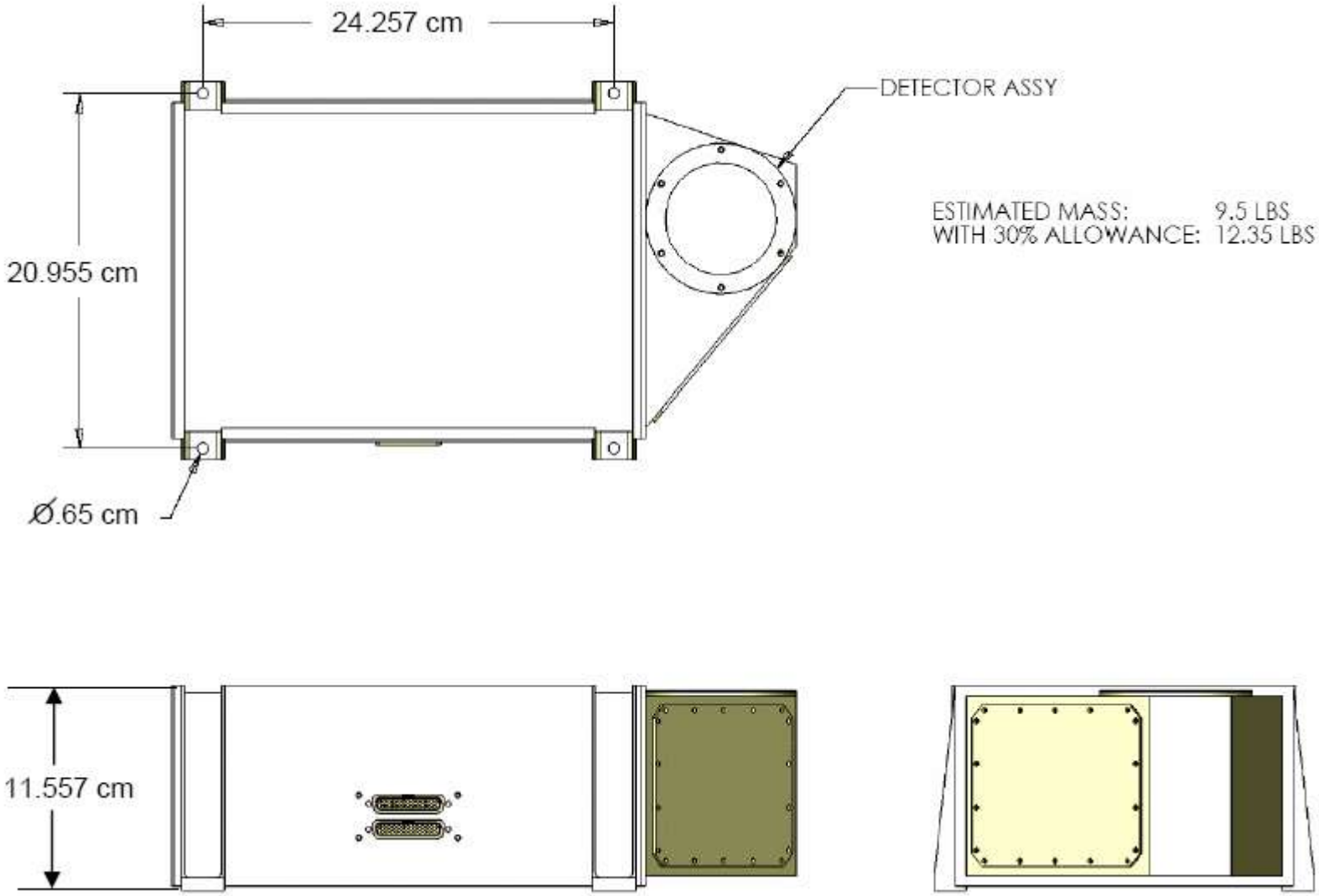


TBR

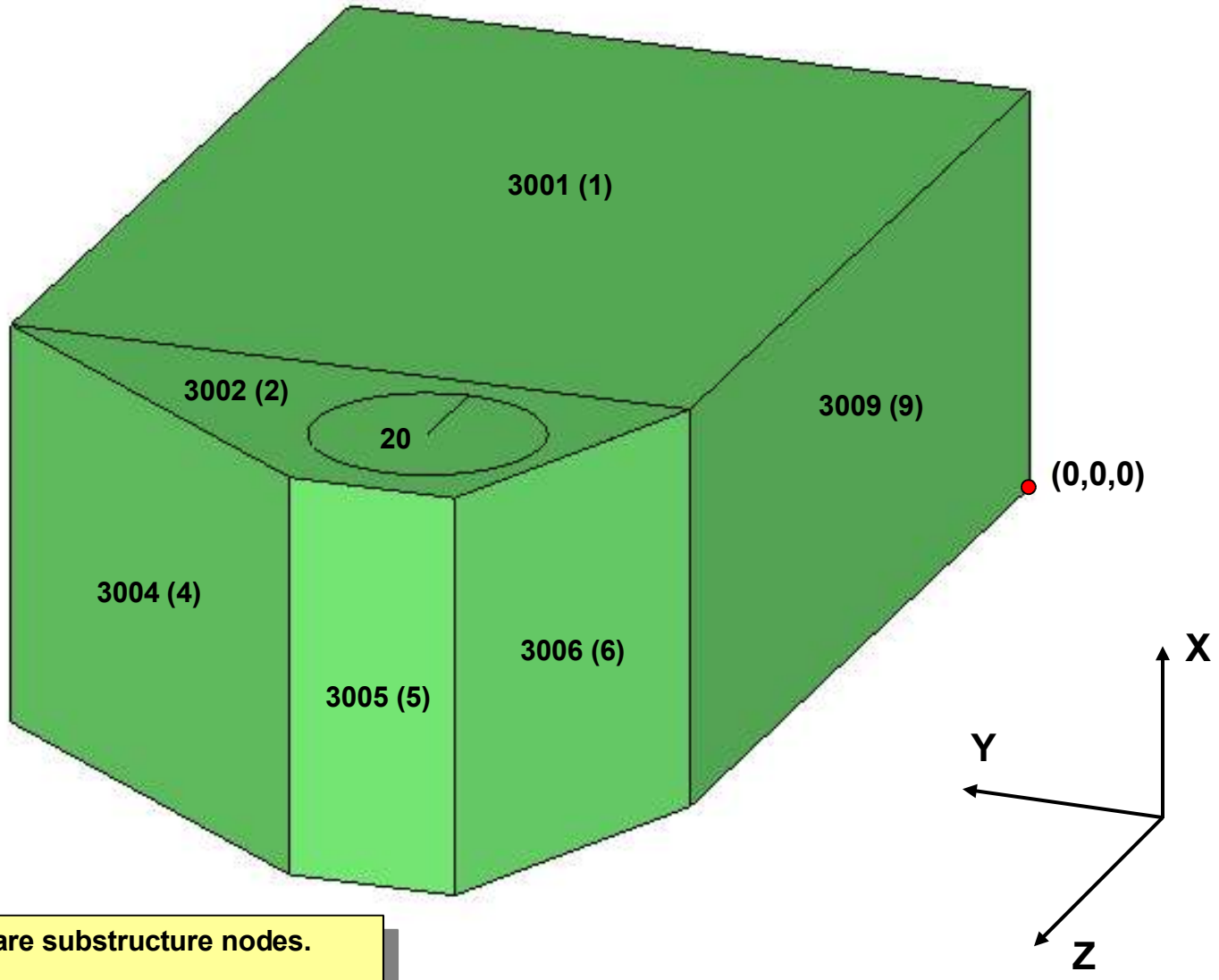
Design ‘B’ Configuration (con’t)



CRATER Design from Proposal



CRATER Geometry



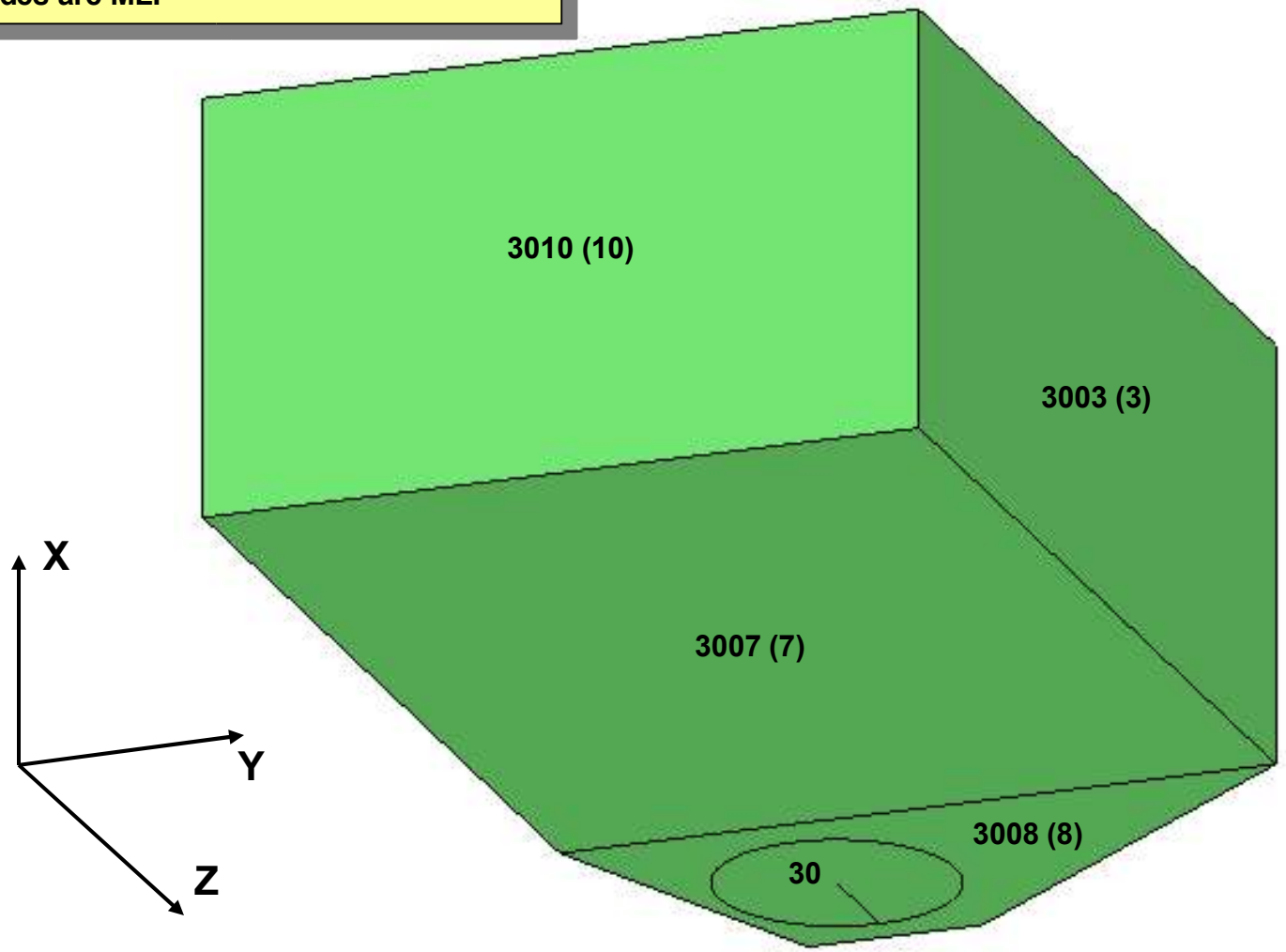
Nodes shown in () are substructure nodes.

3xxx nodes are MLI

CRATER Geometry (con't)

Nodes shown in () are substructure nodes.

3xxx nodes are MLI



CRATER Dimensions