

# astroid Dosimetry App User Guide

## Overview



The .decimal astroid Dosimetry App device is used to aid planning and analysis of proton radiation therapy treatments. The astroid Dosimetry App device is not an interactive end user application and is not intended to perform all the functions of a typical radiation treatment planning system. Users of the system will write scripts or use a fully interactive software program that makes calls to the functions provided by the astroid Dosimetry App. In essence, this device serves as a foundational proton dosimetry calculation library that greatly reduces the burden and time required to develop treatment planning and plan analysis software by making readily available much of the core functionality common to these types of applications. This core functionality includes various CT image processing tools, structure and contour modification operators, proton dose calculations, proton aperture and range compensator device design algorithms, and many other radiotherapy specific calculation functions. Since this application does not include a graphical user interface, much of the usability and plan approval tools are not applicable or available herein, and it is expected that derived treatment planning applications follow the guidelines set forth in IEC 62803 and IEC 62366 to make sure all such features are included in final end user applications.

Access to the astroid Dosimetry App is provided by the thinknode™ framework using http json formatted requests. thinknode™ provides the 'backbone' used to send and receive requests, maintain users, realms and organizations, and provide data storage and management.

The [Dosimetry Manifest Guide](#) contains a complete list of all functions and types supported by the astroid Dicom App through API calls.

## Purpose

The purpose of this document is to provide guidance on the setup, access, and usage of the astroid Dicom app.

## Getting Started



The primary purpose of the astroid Dosimetry App is to provide a library of efficient and easily accessible proton dosimetry functions which can serve as the foundational tools for developing higher level radiation treatment planning and analysis software programs. The Dosimetry App is not intended to be an interactive end-user application; instead it will serve as a source of tested and validated calculation functions which software developers can utilize in other end-user applications. The astroid Dosimetry App provides access to these calculation functions through the thinknode™ framework

which is accessible over the internet and performs all calculations in a cloud based environment. thinknode provides robust, redundant data storage, ensuring industry leading data integrity as well as stable software version management and release process.

## Connecting to thinknode™

The Dicom App, and all its released versions live on thinknode™ hosted on the Amazon S3 service. Communication with the App is performed over the internet through thinknode https requests which are password protected per user and permission based by thinknode organization administrators. The thinknode startup procedure includes full installation of the appropriate application environment onto the virtual servers, which includes hardware and performance checks to ensure sufficient resources are available for the requested application. A full thinknode™ userguide is found at <https://developers.thinknode.com>.

Basic information needed to communicate with the Dosimetry App through thinknode™ :

- thinknode™ user name and password as a base64 encoded blob (e.g.: `userName:PassW0rd1 → dXNlck5hbWU6UGFzc1cwcmQx`)
- thinknode™ api url (e.g.: `https://api.thinknode.com`)
- thinknode™ version the application is released on (e.g.: `v1.0`)
- application name (e.g.: `Dosimetry`)
- realm name

See [thinknode™ Examples](#) for sample code projects for connecting to the Dicom App.

## Precautions



It is the responsibility of those utilizing this application to ensure all that all usages of this product relating to patient treatments are performed by trained and qualified personnel only and that such personnel is aware that the quality of any generated treatment plans is highly dependent on the quality and correctness of the input data; therefore if any questions or uncertainties exist regarding the quality, units, or identification of input data arise, they must be investigated and resolved before the data are used.

## Functions



The Dosimetry App exposes three primary classes of functions through its API: dose calculation functions (DCF), design task functions (DTF), and radiotherapy support functions (RSF). Each function has its own type of input argument specifications and output results specifications. It is worthy of pointing out the interdependence of these function classes upon one another. Specifically, the DCFs rely heavy on the use of the RSFs and may take as input, the output devices produced by the DTFs.

The DTF are typically higher level functions that will modify data parameters and make repeated use of the various DCFs and RSFs to accomplish some type of “optimal” device or plan design.

- Details of each function, argument parameters, and return values are provided at the [Dosimetry Manifest Guide](#).
- Notes about manifest documentation:
  1. Previous versions of the dosimetry documentation can be found at the [Dosimetry Versions](#) page.
  2. If a manifest is manually pulled down from the thinknode framework, that manifest will not match the one outlined in the [Dosimetry Manifest Guide](#). Only the functions and types detailed in the dosimetry manifest guide have been tested and approved for release for customer use (use of any other functions is beyond the intend scope of this product and is done at your own risk).

## Data Types

Details of each datatype used by the Dosimetry App can be found at the [Dicom Manifest Guide](#).

## Examples

### thinknode™

Official thinknode™ user guide documentation can be found at <https://developers.thinknode.com>. Below are basic examples of communicating with thinknode™ calculation providers.

- **Python:** Sample Python project (note: this example requires third party libraries) that details the following thinknode™ api functions:
  - [Python: Post to Immutable Storage](#)
  - [Python: Post a Calculation Request](#)

## Dicom App Functions

Refer to the [Functions](#) section for explanation and usages for each function type.

## System Usage

Normal system usage requires following the specifications for functions and data types as detailed by the [Dicom App Manifest Guide](#). Making correct calls to the calculation provider requires following the specifications for api requests as detailed by the [thinknode™ API guide](#). Additionally, as most large data structures are returned in base64 encoded format, users can and should perform error checking during decoding to be certain data was not lost or corrupted during transmission.

Details about the intended use of the functions can be found at the [Functions](#) section.

## Improper System Usage

When using the astroid Dicom App, as with any complex program, there is the potential for misuse. The thinknode™ framework and Dicom App limit most of the potential misuse of exposed functions and data types, but there's still a potential for misinterpretation of the results provided by the app. Below are a few examples of topics that are easily confused or overlooked when performing even basic tasks.

## Known Application Limitations

Below are listed the known application limitations, defects, or inconsistencies.

1. None at this time

Should you discover or suspect any additional errors or limitations not noted above, please contact the .decimal astroid Dicom App development lead, Kevin, Erhart, at [kerhart@dotdecimal.com](mailto:kerhart@dotdecimal.com) with details of your concerns. All concerns will be addressed as quickly as possible and follow up with the submitter will occur throughout the inquire and correction process.

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