Version History – CAT3D

If you are interested in versions history previous from Version 5.93 beta. (09/11/2005), please, contact Mevis.

- Correction of MLC leaf 1 and 29 in Siemens MLC with 58 leaves.
- Expanded "Open Plan" capability, previous version supported folders up to 1023 plans. New version supports up to 2047 plans per folder.
- Brush radius was not calibrated in mm, now the radius reading is correct.
- Brush content can be switched using asterisk (*) on the keyboard.
- Better treatment of sagittal and coronal re-slicing for very height scans.
- The automatic normalization option can be switched ON or OFF in the main menu, Options, "Auto Normalization".
- New parameter for RSD file : AUTO_DOSE_NORMALIZATION. Valid values for this parameter are : 0 and 1. If AUTO_DOSE_NORMALIZATION equals 0 the default condition for CAT3D will be not automatic normalization. But the user can always turn ON of OFF automatic normalization via main menu and "Options" (see previous topic).
- New: CAT3D can generate a corrected axial image set if the original image set had gantry tilt. Use OPTION and Un-Tilt.
- Bug removed: ROIs are not allowed to have empty name.
- Bug removed in ROI names after ROI Properties edition.
- If all radiation fields are set to OFF in the field editor, the dose computation switch to off state.

Version 7.11.00

New algorithm: Collapsed Cone Convolution. Only available if the the RSD has the corresponding information.

- In "Dose to POIs" there is a new table with effective radiological path length to each POI for each field.
- Set your favorite zoom factor (scale) for shield printing in RSD file. Use the keyword : ShieldZoom_Print . Example : ShieldZoom_Print = 120 .
- New: In case of non IMRT plans for isocentric cases the normalization dose is automatically adjusted to reach 100% at the isocenter or normalization POI.
- Zoom is available in BEV, use F4 or Ctrl-F4.
- BEV of dynamic (arc) fields shows all the angular directions, use PageUp or PageDown to move the point of view.
- CatShell now supports multiples backups.
- Contour , Shield and CATShell now support relative path.
- Improved Fusion Lenses: On the keyboard press <SHIFT-F5> to open the fusion lenses. The fusion lenses presents a square area with pixels from the floating or reference image. While using the fusion lense the following functions are available.

• PageUp key	• Go to next image
• PageDown key	• Go to previous image
• ESC key	• Close lense

• + key	• Increase Lense FOV
• - key	• Decrease Lense FOV
• Mouse move	• Move lense
• Mouse Left Click	• Close lense
• Mouse Right Click	• toggle between pixels from floating or reference image

Version 7.10.03

- Minor bug removed in Hot Poi search inside DVH, depending on ROIs order.

Version 7.10.01

- DVH supports up to 16 ROIs. New dialog for selecting ROIs in DVH
- DVH loads and render your favorite constrains from a file with extension ".constrains" . Click on the DVH with the right button of the mouse to load the constrains.

Version 7.10.00

- New information in protocol: The equivalent field size of the irradiated area. This information is useful when using an external independent method for checking monitor units.
- Reformat image series using CAT3D. When using MRI it is common to have primary images in sagittal or coronal planes. But, sometimes the preferred orientation for the physician is axial view. Now you can generates axial series from sagittal or coronal ones. In the main menu select "Options" and "Create Axial Serie"
- New parameter in the HEADER section of PPF files: NUMFRACTIONS, NORMALDOSE and MODALITY (CRT-3D, IMRT(mod) or IMRT(s&s)). Version PPF move to 3 .
- Zoom In and Zoom Out for BEV. Use F4 for zoom in and CTRL-F4 for zoom out.
- New dialog for ROI-Properties edition. Now it allows ROI's color edition.
- New method for ROI drawing with a circular brush. There are two brushes, one to add roi area an other to remove area. A button is used to switch between brushes.
- The path definition in CAT3D.INI now allows relative path. For example, instead of using IMAGE=c:\cat3d\rtpimg use IMAGE=rtpimg . This extension helps if you need to install CAT3D in a directory (folder) with different name, such as c:\CAT3D_718\ . If you use relative path the CAT3D.INI do not need modification after a change in the name of the instalation folder.

Version 7.09.20

- Minor bugs removed.

Version 7.09.18
- Internal data check to avoid IMRT optimization using RSD files without modulator or MLC information.

Version 7.09.17
- Bug removed that prevent some ROI segments to be retouched.

Version 7.09.16
- Magnifying Lense : Press the key + to open a magnifying lense. While using the magnifying lense no other function is available. Use mouse wheel to modify magnification. Use a mouse Click to close the magnification lense. The lense is available in the planning window, in 3D window and in mosaic window.
- Fusion Lense: On the keyboard press <SHIFT-F5> to open the fusion lense. The fusion lense presents a square area with pixels from the floating or reference image. Use a Right-click of the mouse to toggle between pixels from floating or reference image. While using the fusion lense no other function is available. Use a mouse Click to close the Fusion Lense. The fusion lense can be used only when fusion is active.
- Bug removed in IMRT optimization if a ROI with zero (0.0) volume was used as OAR or PTV. ROIs with zero volume are not allowed but now the invalid ROI is identified and removed from IMRT optimization.

Version 7.09.15
- NEW: Information regarding voxel density in ROIs . At the end of "ROI Info", the new version, shows the mean and standard deviation of of the raw voxel values. If the electron density correction is active the mean and standard deviation are also shown.
- Bug removed interpolating dose planes at the right border of the main window. That bug created small negative dose values at the border of DicomRT-Dose planes.
- The DosePlane2dcm.exe service now reads CAT3D.INI to set the axis orientation.
- If MatriXX = 1 is found the dicom RT-Dose file uses the MatriXX convention. The new DosePlane2dcm.exe does not open a console, so there is no more window blink.
- NEW: In the "Draw Shield" the user can edit (retouch) a previous shield. As the first command in the Draw Shield, press <INSERT> to enter retouch mode.
- NEW: At the end of Draw Shield the optimum collimator settings are fixed for the field. To do this two new parameters are read from the RSD : Collimator2Shield and CollimatorAsymmetric. Collimator2Shield is the distance from shield border to collimator jaws in mm [1..16]. CollimatorAsymmetric tells CAT3D if the optimum setting are for an Asymmetric collimator or not, the default is asymmetric For a symmetric collimator set zero (0) othewise set it to 1. If you want different margins in cross-plane and inplane use Collimator2ShieldInplane and Collimator2ShieldCrossplane. If you want field size rounded to 5 or 10 mm use CollimatorRoundedTo. Example of use for a symmetric collimator:

  Collimator2Shield = 5.0

CollimatorAsymmetric = 0
CollimatorRoundedTo = 10

Other Example in an asymmetric collimator:

Collimator2ShieldInplane = 2
Collimator2ShieldCrossplane = 5
CollimatorAsymmetric = 1

- Use AutoFieldSize in the .INI to set your preferences . The valid values are : YES, NO and ASK . In the case on NO, CAT3D is not going to fit the collimator to the shields. In the case of ASK CAT3D will ask if you want to fit the collimator at the end of each shield.
- To set the behavior of CAT3D Auto Field Size while using CAT3D, go to the main menu, select Options and Auto Field Settings.
- the DicomRT-Dose exported by CAT3D is generated with 1mm/pixel, approximately.
- Better rendering of 8 bits image reconstructions.
- NEW: CAT3D now is sensitive to mouse click over the auxiliary reconstructed images at the right side of the screen. This can be used in the 2D and 3D windows.
- Isodose rendering over the auxiliary reconstructed images at the right side of the screen. This feature can be set to OFF or ON in the main menu, Options and "Show Isodoses in Auxiliary".
- For better agreement with experimental data the OffAxisSoftening can be set between 0.0 and 2.0 . 0.0 means no softening, 1.0 is the standard softening as published by Taylor et. al. 0.5 means ½ of the Taylor softening, etc.
- InOutTime for Cobalt-60 machines. It is a constant of time in centi-minutes that should be added to some Cobalt-60 machines. For example InOutTime = 5.5 , in the RSD .
- Brachytherapy isodose rendering over the auxiliary reconstructed images at the right side of the screen.
- Faster gamma error analysis in densitometry, now using multithreads.

Version 7.09.10

- The main C/C++ compiler to build CAT3D was changed to INTEL ICL.
- New capabilities for the Mosaic window: rendering of ROIs and isodoses.
- The number of frames in the Mosaic can change.
- In the case of using a LINAC with MLC, there is no more warning for lack of trays.
- New matrix model for IMRT optimization allowing bigger treatment volumes in the same memory space.
- CAT3D selects the window area depending on the actual Windows resolution. Better use of the screen for 1980x1080 and 1600x900 modes.
- New parameters for RSD :
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- MLC_FACTOR
  MLC_LEAKFRONT
  MLC_LEAKLAT
  MLC_RAD_OFFSET

All of them are parameters for MLC modeling.

- Dicom filter now opens Lossy JPEG compressed images in 12 bits, volumetric multi-frame images and lossless JPEG digital X-Rays from Fuji.
- ROIExpansion now includes a parameter to keep a minimum distance to skin.
- Support to export for Varian MLC 52 leaves in revision H.
- Add Dose from External Plans allows up to 8 externals plus the active plan.
- NEW: Pencil Beam model now includes Offaxis Beam Softening. The lateral quality follows the formalism of Taylor et. al., in "A generic off-axis energy correction for linac photon beam dosimetry", Med. Phys. (25) May 1998. To activate de softening computation a new keyword is added to the RSD : **OffAxisSoftening = 1**
- Note that the softening is considered only in PencilBeam modes.

Version 7.09.6

- Support to export MLC files for Varian LINACs using Varian angle scale.
- CAT3D now detects Siemens virtual wedges and prevents computing Beam Hardening on them.
- Support for Step & Shoot delivery in IMRT.
- Bug removed in the Select Color dialog of isodose curves.
- CAT3D now prevents importing a plan into itself. Of course this was a user mistake but it destroyed the plan.
- RoiSelect.exe now follows the movement of the CAT3D window. This is specially useful in double monitor systems.
- RoiSelect : Use Right-click in a roi to go directly to Draw ROI.
- RoiSelect : Use SHIFT + Click to change the background color of RoiSelect window, this is useful for better visibility of dark colored rois .

Version 7.08.20

- NEW dialog for IMRT constrains. The maximum number of constrains now is 10.
- NEW parameter for IMRT optimization : Tolerance. Tolenrance is only checked for PTVs (equal condition).
- Bug removed when several instances of CAT3D runs 3D windows (reported by Dr. Marcos Silva).
- The maximum window size of CAT3D is limited to 1200x1000 pixels, avoiding problems with higher resolutions in new high definition monitors.
- New parameter for RSD: MLC_MODEL . If no MLC_MODEL is defined, the BEV will not show the leaves. Example of use :

- MLC_MODEL = MLC_V120

  Valid models are: MLC_V52, MLC_V80, MLC_V120, MLC_V120H,
  MLC_S58, MLC_S82,
  MLC_E80 .

- Improved rendering of PET images in fusion. Now supporting PET pixels in the range of : [0..32536].
- The fusion transparency (low and high filters) is obeyed in 3D projections.
- NEW: Draw ROI now has a circular segments mode. In Draw ROI press CTRL-C to enter or exit circle mode. When in circle mode the ring around the mouse

pointer is salmon color. Circle mode is not available in Retouch mode. Use + or – to adjust the mouse radius to fit your needs.

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- NEW: Subtract two ROI. In the example below , select “Subtract ROIs” and after that tell CAT3D to create a ROI by subtracting roi 6 minus roi 9. The new roi wil be the volume of roi 6 not overlaped by roi 9.
- NEW: CAT3D now detects if a Protocol is invoked before the CleanImage and emits a warning message. Remember that CleanImage (in mosaic) sets the border of the skin, so it is very important for source-skin-distance (SSD) computation.
- Better treatment of very elongated ROIs in IMRT, for example in some cases involving spinal cord.
- Bug removed in some cases of 3D surface smooth. This change was in i_math.dll .
- Bug removed in Mosaic, it was not showing de Z level of each frame. Now it is working properly.
- Bug removed in DVH for very complex ROIs with several polygons for axial plane. It created false HotPOIs with very high dose.
- CAT3D now updates the Window's Recent Items list with plan names. In Windows XP look in “My Recent Documents” and using Windows Vista or later look in “Recent Items”.
- Improved compatibility with Windows Vista and Windows 7.
- For MLC model MLC_E80 (Elekta 80 leaves), CAT3D saves a plan in DicomRT for Elekta WorkStation 5.0. The Plan File for this case is limited to 16 characters . The settings of backup collimators is set to the border of de MLC.
- NEW : New tool for film densitometry. Use CTRL-F8 to switch between original pixel value, hounsfield units or some options for densitometry. The film calibration file must be in a file with the name: DENSITOMETRY.TXT . CAT3D looks for the the film calibration file in the patient's folder, if it is not found it tries in CAT3D own folder. See the next example:

```
rem      DOSE    PIXEL_VALUE_FROM_SCANNER
rem
POINT =  0.0     254
POINT =  1.0     220
POINT =  25.0    88
POINT =  50.0    54.5
POINT =  75.0    38.5
POINT =  100.0   28.5
POINT =  125.0   20.5
POINT =  150.0   15.5
rem  maximum number of points 64.
rem  end of file
```

- Do not use auto-contrast when scanning the film. The first column is dose or monitor units, the second is light intensity (not density).
- Gif2Img was updated, now support TIFF files with up to 16 gray levels, this is the best choice for dosimetry.
- CAT3D now exports Varian MLC files in revision H, previous versions only created revision G of Varian specification. Starting from Varian MLC WorkStation 7.0 revision H is mandatory.
- Dose to POIs now shows dose per fraction and Total Dose. Also, Dose to POIs is

available in Add Dose Mode.

- New parameter for CAT3D.INI : VARIANMLC . Defines the path to copy each .MLC file exported by CAT3D. This option can be used to copy MLC file into a folder in the Varian MLC WorkStation or on a Shaper station.
- Bug removed in integral dose and 3D dose computation that affects PCs with I7 processors.

Version 7.07

- If the HOT_POI exist, CAT3D will search for the HOT_POI every time the plan is modified. Note that this search is non-lineal in a concave domine with multiple local maximum, so the HOT_POI found is not necessarily the absolute hot point. On the other hand, the only way to be sure that the hot point is the absolute maximum is to use a very small calculation grid which could take too much CPU time. HOT_POI is first created by the DVH. If the hot_poi is taking to much time , remove the HOT_POI .
- NEW: Shields can be exported to XYZ format. Two new parameters in the RSD file must be configured: SHIELDDISTANCE and SHIELDTHICKNESS, both in mm. SHIELDDISTANCE is the distance in mm between the source and the farthest side of the shield.
- Protocol information now include the number of fractions, so that total dose for the plan is computed and reported.
- Bug removed in the field editor page. It was a wrong initialization of float fields for edition. Not frequent.
- The isodose shadows now use a color wash style. If color wash effect is desired set the shadows to 3 or more in the isodose dialog.
- Longer edition line for the ROIs in a DVH.
- NPSF model was changed to X. Allen Li empirical formula. See: "Peak Scatter Factors for High Energy Photon Beams" , Med. Phys. June 1999. It is better that BJR supplement 25 because it takes into account the dependency on energy from Co-60 to 24 MV.
- Polygon plane equation (normal to polygons) is computed using Newell's method. It solved some problems with concave polygon interpolations and polygon sorting.
- Remove a POI using CTRL + RightClick with mouse on the poi.
- NEW: In IMRT there is a 3D visualization for Render Modulators.
- If you prefer to copy shields with CTRL_V always, not only for parallel opposed fields, include the following line in CAT3D.INI :

  CopyShieldAlways = 1;

- New module: brachytherapy templates for prostate planning.
- Better treament of some polygons while in DVH using Newell´s method.
- Render modulator with color representation intensity/flux map.
- In Render Modulator window use <PageUp> or <PageDown> to change field.

Version 7.06 .

- Better penumbra model in the corners of the fields. This improvement is only evident for low value isodoses (10.. 1%) close to the corners or diagonals of fields. The need for penumbra model modification at the corners was noted comparing the dose distribution of CAT3D´ BEV with measured distributions using MatriXX OmniPro I´mRT in CEPRO. The left image presents the result

with the previous cat3d and the right shows the new result :

- Bug removed in CleanImage with contour drawing. The bug was generated in version 7.05 due to changes in internal polygon representation (it was int and move to float). CleanImage is now compatible with the new polygon representation.
- New: In the shield file (.PB) the comment field now includes the machine name for the plan. This is safer for institutions with more than one LINAC. (recommended by Dr. Renato Ros).
- POI and POI´s name are shown in the auxiliary reconstructed images.
- New keyword in CAT3D.INI: *LANTIS* . This keyword enables the export option for LANTIS RTP Link file format. The Lantis keyword also sets the path to export/save the .RTP files. The path.
- New: Export plan to LANTIS RTP Link file format. If the Lantis path is valid, the option will be available in Teletherapy menu (open the menu with CTRL-F11).
- Bug removed in function GetDensity( ) .
- NEW: when an image fusion is active, the keys <M> and <CTRL-M> change the mixture of pixels from both image sets either in "Render as Reference" or "Render as Floating" modes. This functionality is available also while drawing ROIs.
- In fusion mode, if you use "Render as Reference" the zoom is available and ROIs drawn in this mode are parallel to internal image planes (usually CT).
- CatShell now supports drag-and-drop of files. You can drag to CatShell Dicom, Elscint, Somatom-IMA, HIS and RTP files. Drop the files into the CatShell icon in the Windows´ desktop.
- Tissue setting for BEV are now saved as user preferences.
- NEW: while drawing a ROI, a segment can be deleted using <CTRL-DEL > . CTRL-DEL can be used when you get into an image plane, but before any drawing in that image plane. The target of delete are segments of the ROI you are drawing that lay on the present image plane.
- NEW: Floating toolbar controls which ROIs are shown or hidden. This toolbar is available in the planning window, draw ROI, DVH and 3D window. With this tool, the 3D window can hide or show individuals ROIs, which is a new capability for 3D. The toolbar is implemented via and external process : RoiSelect.exe .
- Improved DVH: capacity for 8 ROIs. The ROIs can be individualy hidden using the floating ROI´s toolbar.
- DVH can switch background color between Black and White using < B > .
- DVH now searches for the point of highest dose in anatomy and creates a POI : "HOT_POI". After closing the DVH window the user can go (Goto POI , with ^G or the Goto button) to HOT_POI to investigate where the hot spot is in anatomy.
- Better check for coplanar condition for ROIs processing on DVHs.
- CAT3D removes ROI segments with area zero and perimeter below 1 mm.
- At the end of *Draw Shield* or *Auto Shield* the system ask the user to select a tray factor. (suggested by Dr. Wagner Hideo Yaegashi).
- When using copy and paste of fields, the shield definition file is only copied in case of parallel-opposed fields. This avoid the creation of not necessary and improper .PB files (suggested by Dr. Wagner Hideo Yaegashi).
- NEW: Add two ROIs and create a new one.

- NEW: Remove unused shield files. Available in the Options menu. Do not remove shield files if any other instance of CAT3D is running. This option is available when no plan is open.
- The ROI selection window now displays a color reference to each ROI.
- Support for Enhanced Dynamic Wedges manufactured by Varian. The RSD data file must contain one entry for each available wedge angle, like physical wedges. The valid names for EDW are: EDW10, EDW15, EDW20, EDW25, EDW30, EDW45, EDW60 . The wedge output factor (WOF) information use the position of the fixed jaw, either Y1 or Y2, not the field size like in physical wedges. EDW wedges can only be used in IN and OUT position, not in CW or CCW.

Version 7.05 (23/12/2008)

- CAT3D reads new IMG format for sub-mm images. The support for sub-mm images started with Dicom filter 5.10.
- Maximum number of original images increased to 1022 (was 256).
- Maximum number of floating images for fusion increased to 1024 (was 256).
- Maximum number of roi segments increased to 2048 (was 1024).
- A linear model for Beam Hardening Factor (BHF) with field size at any fixed depth was introduced. The model was created by Lic. Andrés Bruna. There is a paramter to adjust in the RSD : BHFvsFieldSize . A frequently found value is 0.005 . The valid range for the parameter is 0.0...0.009 . Example of use:

  BHFvsFieldSize = 0.004

  If the RSD does not have the parameter CAT3D assumes 0.0 which is equivalent to previous versions of CAT3D.
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- New solid IMRT modulators can be exported in .decimal format.
- Improved monitor unit calculation for electron beams with pencil beam models.
- NEW: DVHs are saved to files . Each time a DVH is computed a file is generated with the same name of the plan file followed by the number of the ROIs. The file extension is .DVH . This file is ASCII, delimited by tabs and character strings are delimited with " " . The decimal separator is the point (.) . Is is very ease to import these files into Excel or OpenOffice, other external tools can be used also.

Version 7.04 (03/09/2008)

- Automatic ROI expansion and Automatic Shield generation can avoid growing outside patient skin. When the expansion is limited into the patient tissue the process takes longer time because more conditions have to be checked.
- Better dialog for ROI expansion and Automatic Shield.
- New toolbar for the 3D window.

Version 7.04.7beta (01/07/2008)

- New buttons for the X-ray window. Most of the buttons are known for CAT3D users but the symbols with numbers from 1 to 4. They represent the first brachytherapy source data in CAT3D.INI file. These four sources are consider frequently used and as such have a shortcut to put them in the plan. The

number of the source is automatically generated by CAT3D as a counter. All the buttons have associated tooltips.

Version 7.04.5beta (24/06/2008)

- Cat3d menus now respond to one mouse click.
- Default Beam Eye View quality is High.
- Drag a POI with mouse. Move the mouse cursor to the POI you want to drag. When the shape of the cursor turns into a white cross, pressing the CTRL key, Click and held the left button and drag de POI to the desired place over the image, the release the mouse buttom. *Be careful not moving an isocenter POI to open air outside patient tissue because the ray tracer could get lost finding the entry point in skin !.*
- Default dose computation mode changed to "Pencil Beam 8x8" . Due to the availability of very fast CPUs like Pentium D, Core 2 Duo, Core 2 Quad and the new algorithms for multi-thread dose computation this method became very efficient and it is a much better model than "Fast".

Version 7.04.4beta (2/06/2008)

- Clean-Image now shows a gray representation of the anatomy while adjusting the cutting level. (subjested by Dr. Rogerio Sanchez, Radioterapia Santana , São Paulo).
- Better mouse control for 3D orientation (in the 3D window).
- The auxiliar reconstructed images now rendered in the 3D window. The center of the reconstructed images is driven with CTRL-G (Goto POI).
- Better blinking cursor for edition.

Version 7.04.1beta (14/05/2008)

- Improved kinematic for Orion Linacs or any other with CollimatorZero = 90 or CollimatorZero = 270. problem reported by Cr. Márcio Tokarski – Campinas SP .
- CAT3D supports a new command line parameter: -N . It is used to create a new plan for a set of images (.IMG) . The sintax is:
- CAT3D.exe -N image_file_name.img
- DICOM filter now can call MNPS or CAT3D after exporting the IMGs.
- Improved floating image renderization in 3D perspective.

Version 7.03a (02/05/2008)

- Correction to 7.03: when a saved plan was opened the volumes of ROIs were not re-calculated . (reported by Dra. Raquel - Pelotas, RS - and Dr. Renato Ros - CEPRO).
- Better initial setting for the first window-resize.

Version 7.03 (20/04/2008)

Several CAT3D's algorithms were parallelized: Due to the multicore trend in the CPU market, parallelization strategy seems very promissory for math intensive tasks. Some time-consuming functions were recoded to allow a multi-thread approach :

- Dose computation.
- DRR / BEV generation.

- Mutual information computation for image matching.

  In all cases the improvement were impressive, mainly if a Core 2 Quad is used to run CAT3D. The future CAT3D strategy for optimization should be based in parallelization, so users are encourage to upgrade their workstations with multi-cores CPU.

- Collimator angle is properly set when a field is copied to parallel opposed position.
- Asymmetry is properly set when a field is copied to parallel opposed position.
- DRR / BEV do not rotate with collimator angle.
- Bug removed in Auto Shield : affecting fields number 5 or above when no volume recalculation was needed (when volume was in cache). It was a hard to find bug, because it mainly showed in systems with low memory or field number above 14 (pointed out by Dra. Monica Brunetto, Dra. Marcela Setti and Dr. Anderson Cruz).
- Better treatment of ROI (volume) expansion with concave surface. In particular for ROIs with more than one polygon in an axial plane. For example, the top planes with seminal vesicles. (problem pointed out by Dr. Gustavo Sanchez and Lic. Diego Dodad, from ITR – La Plata).
- Faster representation of field entries and wedges.
- 3D representation of field entries. It is a transparent surface few mm above the skin. To hide/show the entries press CTRL-A.
- Brighter color for DRR/BEV axis and scale.
- Bug removed: ROI names were not cleaned when the plan was changed, only evident when the new plan had less ROIs than the old and you enter the DVH dialog (reported by Dr. Renato Ros)
- When a ROI is being drawn the pen color is the the same of the ROI color (recommended by Dr. Carlos Pereira , CLINIRAD , Hosp. Angelina Caron).
- Images produced by image matching (fusion) can be exported as a secondary image set in IMG format. The secondary image set can be use by CAT3D or MNPS as a primary image set. To export the secondary image set, go to Fusion Menu (via ALT-F5) and select "Export as Secondary IMGs".

Version 7.02 (06/02/2008)

- IMRT matrix generation can be aborted with <ESC>.
- The maximum number of control voxels was increased for better optimization of PTVs up to 2000 ml.
- The orientation mark on the modulator 3D model (XYZ or DXF) is deeper toward the gantry in the inplane axis.
- A field with modulator in OFF state keeps it modulation data.
- Image matching without POIs : CAT3D will try to make an automatic image matching if there are less than four common POIs between the fixed and floating image set. The automatic matching is based on Mutual Information Maximization and the optimization algorithm is a Simulated annealing. The optimization stops when the user press <ESC> . CAT3D shows a split image at the left of the screen to follow the evolution of matching improvement.
- New options and render capabilities to image fusion. In the fusion menu you can select “Render as Reference image” and “Recon. As floating view” .
- Faster mutual information maximization on multicore processors like Pentium D, Core 2 Duo and Core 2 Quad, using 2 threads for MI computation.

- Add dose distributions from up to 5 plans. Each time you compute the integral dose of a plan, the 3D dose distribution is saved with extension ".DOSE3D". After DOSE3D is computed you should close the plan because if any change is made, the DOSE3D file is removed. Open a second plan that use the same image set. Select "Add dose from external Plans" in the teletherapy menu. You can add up to 4 external plans with the active plan.
- CAT3D checks screen resolution at start time and stop running if resolution is too low. CAT3D needs a Windows screen mode of 1024x768 or higher. Consider using 1152x864 for better rendering.

Version 7.01 (01/12/2007)
- If image fusion is active, the 2D planes projected into the 3D window are taken from the external (floating) image set.
- In the 3D window the density surface has a new parameter: Smooth.
- Bug removed: alt-c followed by alt-c aborted CAT3D.
- New interface for CTRL-D in the 3D window.
- About now shows license limit and CAT3D configuration (if IMRT is included, if Virtual Simulator, etc).
- In DVH, if the user includes a hidden ROI for computation, CAT3D will remove the hidden attribute to that ROI .
- Bug removed in cursor movement while working with orthogonal x-rays
- CTRL-S now save inside orthogonal x-rays mode.
- default isodose shading was set to 1.
- Two quality index are shown when the TMR table is generated: TPR20/10 and D10.

Version 7.00 (26/09/2007)

Version 7.0X.16 beta (16/09/2007)
- Faster 3D rendering using "back-fase culling" .
- Main menu responds to <ALT – F4> .

Version 7.0X.15beta
- New main menu style with some buttons for fast access.
- Automatic grays optimization: use the first button in the grays tool bar. Any other gray buttom remove automatic gray level optimization. Automatic gray level optimization is based in histogram equalization which is a non linear map between pixel values and available gray levels.

Version 7.0X.12beta
- When typing a float value the ',' is translated to '.' . On the brasilian ABNT2 numeric keypad the ',' is now accepted.
- The blinking rate on the edition cursor was set to 0.7 seconds.

Version 7.0X.11beta
- Access to teletherapy Field Editor from inside 3D window.
- Options to change density and teletherapy 3D reconstructions from inside 3D window. Use < ^D > and < ^I > .
- Default 3D rendering mode changed to SOLID .
- Each instance of CAT3D creates unique files por 3D volumes. Previous versions of

CAT3D had problems with more than one CAT3D using 3D rendering. Now 3D rendering supports up to 20 CAT3D running simultaneously in the same working path.

- The printer server "WPRINT.EXE" move to version 1.09. Now, there is no need to enter <OK> at the end of WPRINT .
- Faster representation of wedge filters .
- Bug removed in the treatment of ROIs that includes complex polygons (self intersecting contours) as segments. Reported by Dr. Edilson Pelosi – IAVC – São Paulo.
- The maximum number of ROIs (volumes) used as conditions for IMRT optimization increased from 5 to 8.
- The concept of priority was incorporated to the ROIs (volumes) used as optimization conditions in IMRT. The priority should be used when volumes are overlaped. The region of overlap is considered as optimization condition only with the volume of higher priority. Priority is an integral number, the greater the number the higher the priority.
- The user can change the margin of compensator material exceeding the field size in IMRT plans. Use the new RSD keyword: "CompensatorMargin" . This parameter is used by CAT3D to export compensator's geometry in XYZ or DXF files. The default value is 15 mm. The valid range for the parameter is [5..50] mm. Example of use :
- CompensatorMargin = 12
- New: DVH now computes and displays mean dose (or mean pdd) to each ROI . Previous versions of CAT3D computes minimum, maximum and most frequent dose (also known as "mode" in statistics).
- NEW: Automatic Shield generation. Being in a BEV window the ROI menu now shows a new option "Auto Shield" . The shield need some margin in the range [0.5 .. 50] mm. The margin can be isotropic or not. A shield can be generated from one or two ROIs . Two ROIs can be used if they are overlapped or in close contact.
- New: Transparency for 3D volumes .
- New: Bolus . The user can create up to 4 ROIs that allows the modification of the pixel values of the images (CT, RM, contours). These ROIs have reserved names:
- **bolus-1 , bolus-2 , bolus-3** and **bolus-4**
- The names are not case sensitive. Bolus ROIs have two properties: pixel value and priority.
- The pixel value is the value than CAT3D dosimetry is going to receive if the voxel/pixel under consideration is bolus. Priority is use to tell CAT3D that the bolus is more important than the image pixel even if the pixel under consideration is not air. In regions with air, the bolus is always more important. If you want to add bolus outside patient skin use priority OFF (default). Use priority ON if you want a ROI that overwrite the pixel value (density) of the image for heterogeneities correction. To add bolus you only have to draw a ROI which one of the four reserved names. To edit the bolus properties open the Roi Menu and select "Edit Bolus Properties" .

Version 7.0X.1 (beta) (09/07/2007).

- **DirectDraw** is no longer the supporting platform or hardware abstraction layer. Cat3D 7.00 move to **SDL** (**Simple DirectMedia Layer** from http://www.libsdl.org/). All previous versions of CAT3D were full screen non cooperative, from now on CAT3D is a windowed application. CAT3D 7.00 is optimized for 32 bits per pixels screen modes, if the Windows desktop is not in 32 bits/pixel, SDL will emulate the mode but this is not optimum. CAT3D 7.00 should be executed in screen resolutions above 1024x768; a very good choice is 1280x1024, 32 bits/pixel. CAT3D 7.0X needs more system and video memory now, each window allocates four times the memory of an equivalent window in version 6.xx .
- NEW: Dose to POIs information.
- Bug removed: ray tracing returning depth with negative value in the range of ±Voxel size. It created a problem with the Maximum Precision Convolution method.
- Better evaluation o maximum attenuation constrains for IMRT with solid modulators.
- The Beam Hardening Factor model (BHF) was modified to allows variations along different wedge thickness, following a model proposed by Lic. Andres Bruna.
- New isodose shading in 2D and 3D using "alpha blending". The alpha blending control is inside "Set isodose" window with a valid range between 0 and 10.
- Solid IMRT modulator can be exported to Autodesk DXF directly. Two additional files are needed: "xyz_2_dxf.exe" and "at3dx.dll", so if you plan to do this, check if both files are inside CAT3D's directory.

Version 6.00 (19/02/2007)
- Better check for the SSE2 and SSE3 capabilities and the number of
- threads supported by the CPU.

Version 5.99.9b (14/02/2007)
- NEW: The machine or energy of a saved plan can only be changed explicitly via <CTRL F11> and "Select a machine or energy".

Version 5.99.9 (06/02/2007)
- Security issue: if you had a BEV and the coordinates of the active isocenter were changed using <CTRL END> or <HOME> or <END> the BEV was not re-computed and any shield drawn in that obsolete BEV were shifted. Now, any change in the coordinates of the active isocenter (isocenter supporting the BEV) will force a refresh of the BEV. (reported by Lic. Diego Dodat, ITR - La Plata, Argentina).

Version 5.99.8 (03/02/2007)
- Better interaction between the Proteq hard lock and the Windows printing services. Dr. Renato Ros reported an error condition when Windows is printing and CAT3D try to access the proteq hard lock. We hope that the problem has being avoided (03/02/2007)

Version 5.99.7 (30/01/2007)

Minor adjustments :
- DrawROI starts with 3 planes views, DrawShield only with the main view, because most of the time shield need to use cursor's radius information.

(recommended by Dr. Renato Ros).

NEW:

- Support for 3 planes view for 512x512 pixels images while in 1024x768 Windows resolution. Now CAT3D resize on the fly the lateral images to 360x360 if the screen resolution is 1024x768 and to 512x512 if screen resolution is higher.

Version 5.99.6 (28/01/2007)

- NEW: Predefined gray windows to assist bright and contrast adjust.

Predefined combinations are stored in CAT3D.INI. The syntax is as follow

```
GRAY_XXXX   =   lowpixelvalue   highpixelvalue  comment_for_help
```

where GRAY_XXXX is one of the keywords representing entries for different type of tissues. See the following example, that you can copy and paste into your CAT3D.INI :

```
GRAY_BRAIN  =  1000   1090   CT Brain soft tissue
GRAY_SKULL  =  1050   1800   CT Skull soft window
GRAY_ABDOMEN = 886    1132   CT abdomen
GRAY_LUNGS   = 200    1100   CT lungs
GRAY_BONES   = 1050   2500   CT bones
GRAY_BEV     = 200    3500   DRR BEV
GRAY_BEV_DARK = 500   4094   DRR BEV Dark
GRAY_USER1   =  40    1100   CT user lung
GRAY_USER2   =  900   3000   CT user bone
GRAY_USER3   =  40    1200   not used
GRAY_USER4   =  50    1300   not used
GRAY_USER5   =  60    1400   not used
GRAY_USER6   =  70    1500   not used
GRAY_USER7   =  80    1600   not used
GRAY_USER8   =  90    1700   not used
GRAY_USER9   =  4     200    Atlas and Contours
```

Remember that good setting for a CT scanner are not necessary good for other machine. (recommended by Lic. Andrés Bruna - Argentina).

Version 5.99.5 (28/01/2007)

- NEW: Dynamic actualization of the screen image when gray window levels are moved with mouse o arrow keys (recommended by Lic. Andrés Bruna – Argentina). The user does not need to press ENTER to see the change in image bright and contrast.

Version 5.99.4 (26/01/2007)

- NEW: Tooltips: The user hovers the cursor over an item in a tool bar, without clicking it, and a small box appears with supplementary information regarding the item being hovered over.
- NEW: Grays window control while drawing a ROI, using the right mouse button over the image.
- NEW: Show or hide isodoses while drawing a ROI, using <CTRL I> .

Version 5.99.3 (22/01/2007)

- NEW: When the three planes view is active, ROIs are rendered in all of them, the main windows and the auxiliary views.
- Default state for ROI drawing was changed to three planes view. (recommended by Lic. Andrés Bruna - Argentina and Dr. Marcos A. Silva - Maringá e

Londrina, Paraná, BR).

- NEW: Two levels of quality for Beam Eye View (BEV). The default level is the faster, with lower quality. The BEV dialog window allows the user to select a high quality BEV . (recommended by Lic. Andrés Bruna - Argentina). (21/01/2007)
- NEW icons in the tool bar. In non BEV images : show or hide ROIs and background color. In BEV images : show or hide ROIs, show or hide isodoses and show or hide the axis scale. (21/01/2007)

Version 5.99.2 (19/01/2007)

- NEW: <CTRL I> has three states:
  - with isodoses and field borders
  - with field border and no isodoses
  - with isodoses and no field borders
- NEW: When a radiation field is copied using <CTRL C> and <CTRL V> a new shield is created for the new field. The new ROI has a better comment showing the gantry angle of the new field. This has other beneficial side effects and avoid inconsistencies.
- NEW: Axis and scale are rendered over Beam Eye Views. <CTRL I> also hide this axis. (recommended by Dr. Renato Ros, Edilson Pelosi and the staff of IAVC).
- NEW: The shield (PB) is projected into the BEV, not only the original ROI. With this solution, PBs created by Shield.exe are rendered into BEV. Previous versions of CAT3D did not show PB's files generated by the program Shield.exe.

Version 5.99.1 (15/01/2007)

- Bug removed in MLC and Shape export to Varian Shaper (29/11/2006)
- Better polygon clipping using Vatti's method (Bala R. Vatti, "A generic solution to polygon clipping", Communications of the ACM, v.35 n.7, p.56-63, July 1992). This is used in FillPoly and is of importance to DVH computation.
- ROIs used for shield drawing (32 to 63) are not rendered in 3D any more.
- ROI information now shows the perimeter of each segment including segments used for shield. Using the area and perimeter of a shield the user could compute an approximated equivalent square side for independent hand check. (10/01/2007)

- Bug removed: When the electron density correction (EDC) table was changed, the old dose cache was not invalidated. Now a change in EDC force CAT3D to re-compute all dose distributions. (bug reported by : Lic. Andrés Bruna and Bio Eng. Victor Bahamonde, from CABIN, Argentina). (12/01/2007)
- NEW: Pixel range for electron density correction now goes up to 8192. Previous version was limited to 4096. The new range can be useful for some prosthetic material. (12/01/2007)
- Improved ROI rendering over non axial images. Most ROIs are drawn on axial views but could be observed in sagital, coronal or oblique view. The new algorithm presents a better picture of a ROI when it is cut by any reformatted image plane (14/01/2007).

Version 5.99 (24/11/2006)

- In 3D, when you enter de number of nodes in the X axis, CAT3D makes a proposition for the number of nodes in Y and Z. It computes ny and nz in such a way that the resulting voxels are cubes (have same size in each axis or close to that).
- NEW: CAT3D shows the borders of each field in any axial, coronal or sagittal plane.
- Bug removed in some DVH (new FillPloy() with window clipping).
- NEW: when drawing a shield inside CAT3D, there is no more need to enter roi number or roi name.

Version 5.98 (26/10/2006)

- Open Watcom C/C++ 1.6 release 1 had a bug in code generation, so we had to return to version 1.5.
- NEW: In the "Integral Dose" option, a report of the volume inside several isodoses was included.
- Bug removed: 2D isodose level contouring algorithm more stable on several field topographies, in this case for constant dose regions. A new check against zero division was introduced. The rare cases showing the bug were sent by Dr. Wagner Hideo Yaegashi from "Clinica Memorial".

Version 5.98.4 beta (09/10/2006)

- Correction: the solid model of the modulator is exported with the same orientation of the beam eye view (the XYZ file).
- Better ray tracing algorimth supporting a tissue volume that do not form a simply connected space (volume). The algorimth is slower but safer for some exotic conditions. The test case probing the previous method was kindly sent by Lic. Gustavo Sanchez, from ITR de La Plata, Argentina.
- Open Watcom C/C++ compiler upgrade to version 1.6 release 1. The generated code is smaller and slightly more efficient for floating point computation because the generation of FWAIT instruction was removed.

Version 5.98.3 beta (05/10/2006)

- NEW: CAT3D exports the dose distribution of the active image plane when the user activates the profile (F8). The dose distribution goes to a file inside CAT3D directory :

```
Plane_TeleDose.txt
```

It is an ASCII file. Each line ends with two characters: CR LF (0x0D 0x0A).

The structure of the file is:

```
      Line 1:  string comment
      Line 2:  string , planfile name
      Line 3:  reserved, it is empty so far
      Line 4:  x1   y1   z1 (coordinates of the upper left corner of
plane/screen)
      Line 5:  x2   y2   z2 (coordinates of the upper right corner of
plane/screen)
      Line 6:  x3   y3   z3 (coordinates of the lower left corner of
plane/screen)
      Line 7:  x4   y4   z4 (coordinates of the lower right corner of
```

```
plane/screen)
      Line 8:  v11  v12  v13....v1n
      .
      .
      .
      Line 8:  vm1  vm2  vm3... vmn
```

This is for a matrix with n columns and m rows. Each dose value (vij) is represented by a float. Each row ends with the end of line marker (CR LF).

- In <ALT-C> the frame selection now has red border.

Version 5.98.2 beta (17/09/2006)
- Improved ROI selection dialog for "Draw ROI".

Version 5.98.1 beta
- NEW: DVH with absolute total dose. Use <^D> or < % > to switch between absolute or relative dose.
- Better scale in the DVH dose axis.
- Improved IMRT :
  a) Dose transmission is equal to maximum modulation limit for far beamlets.
  b) Render Modulator now shows field limits.

Version 5.97 (31/07/2006)
- Some minor bugs removed.

Version 5.97.4 beta (8/07/2006)
- NEW: ROI segment retouch. When in "Draw ROI", at the very beginning of a new plane, if a previous segment of the ROI exist, you can retouch by pressing the INSERT key . The retouch was aimed to add or remove small areas of an existing segment, it creates a bypass between two points in the previous segment, so the retouch segment is an open polygon. (Suggestion by Lic. Andres Bruna).

Version 5.97.3 beta (28/06/2006)
- Better computation of ROI volumes when several segments of one ROI have overlapped areas and for non axial ROIs. For some complex ROIs with lot of vertex it is a time consuming task. In case of several segments in one plane, CAT3D checks for each point of the domain if it is inside or outside each segment (closed polygon) using the Jordan Curve Theorem as criterion (Haines, Eric, "Point in Polygon Strategies," Graphics Gems IV, ed. Paul Heckbert, Academic Press, p. 24-46, 1994).
- Implant time was included in the brachytherapy dose to POIs report. A brief dose-volume report was also included (only if there is a dose prescription to a given POI).

Version 5.97.2 beta (28/06/2006)
- NEW: Non axial ROIs are suitable for DVH computation. Non axial ROIs are frequently found when they are imported from image fusion.

Version 5.97.1 beta (24/06/2006)

- Bug removed: In the option "Reference to Isocenter". In some conditions the selected POIs were scrambled by CAT3D. It was an improper access to the index of POIs. (Reported by Bioing. Victor Bahamonde, from CABIN, Argentina).
- The internal gray table for CT pixel (or RM or PET, etc) translation in screen rendering was grown from 16384 to 32768 intensity levels. PET images have pixels with internal values as high as 2^15, so we increased the pixel range to accomodate such values.
- New: Dose Prescription in brachytherapy planning. Now you can select a POI and ask CAT3D for the necessary implant time to achieve a desired prescribed dose to that point. Source decay is taken into consideration.
- New: Dose to POIs report in brachytherapy plans. If there was a previous dose prescription to a POI, a report of the volume inside several isodoses will be presented.
- New: Use of mouse to move the cursor in X-Ray views. Mouse left click is used and you have to click over the same point in both views.
  IMPORTANT : one click is not enough, you have to click both X-Ray views !

- New: Distance tool for X-ray view. Using double-click or enter you fix one end point, the other is the position of the red cursor. Ctrl-D also works in X-ray views.
- Improved Table Editor : The table editor is the editor used to open and modify the POI table, electrons density table, ROI hiding, etc. Now you can select a cell by clicking with the left button of the mouse, move through a column with the mouse wheel. From the keyboard the new valid keys are:

```
TAB       - move to next cell
HOME      - move to first column, first row
PAGE UP   - move several rows up in the table
PAGE DOWN - move several rows down in the table
```

  As usual, F10 and ESC close the table editor, the first accepting the changes the later discarding any change. The buttons <OK> and <CANCEL> can be clicked with the mouse giving the same results of <F10> and <CANCEL> respectively.

Version 5.96 (16/05/2006)

- NEW: The Dicom filter emits a warning for repeated slices (slices with same Z , if axial, or X if sagittal, or Y if coronal) and mark those slices with a red cross, to assist the user in the appropriate slice selection. Please select only one slice for each value of Z in axial views. Dicom move to version 3.66 (24/04/2006).
- Improved attenuation model for IMRT compensators :
  The attenuation properties of the compensator material must be defined in the RSD file for each energy. The attenuation equation is as follows:

```
I = I0 * exp(- u * t )                    (equ. 2006.1)
```

  where

```
u = u0  +   c1 * t  +  c2 * r + c3 * S   (equ. 2006.2)
```

  The second term in the equation 2006.2 represent "beam hardening" of the

pencil beam traveling through the compensator material. r represent the off-axis distance at the plane of the isocenter. The fourth term depends on scattered radiation inside the modulator material and S is equivalent square for the field size, at isocenter level.

To enter u0, c1, c2 and c3 in the RSD file, use the keyword CompensatorCoeff. Example :

```
CompensatorCoeff = 0.0435   -0.0001    0.000012  -0.00000031
```

The values of u0, c1, c2 and c3 must be stablished for each energy and material.
The extended model was due to experimental result from Lic. Leopoldo Mazzucco, Rio Cuarto, Argentina.

Version 5.95.6beta (24/04/2006)

- NEW : Improved management of conformal shields: Following the kind advices of some users (Lic. Graciela Vélez, Lic. Gustavo Sánchez and Lic. Andrés Bruna), the following modifications were introduced :
  a) Shields must be drawn over Beam Eye View (BEV) images.
  b) CAT3D automatically sets the beam axis of the shield from BEV data.
  c) CAT3D automatically generates an optional comment string with the field number and gantry angle. The user can edit the proposed comment.
  d) CAT3D generates a shield file name proposition. The user press ENTER to accept the proposition. The user can edit the proposed file name.
  e) CAT3D automatically links the shield file with the proper field that generated the BEV.
- Improved ROI volume calculation: The volume calculation could go wrong if there are repeated CT slices (same Z) and the ROI `interpolation` generates the same ROI for each one of the redundant slices. It was fixed.
  NOTE: It is not advised the use of redundant slices in a plan !

Version 5.95.4beta (17/04/2006)

- Shield exported to Multicut in normal or mirror condition. Bug removed that generated a wrong vertex in the main axis of the field. (thanks to the advice and collaboration of Lic. Gustavo Sánchez, from ITR de La Plata -Argentina).

Version 5.95.3beta (27/03/2006)

- The internal gray table for CT pixel (or RM or PET, etc) translation in screen rendering was grown from 4096 to 16384 intensity levels. The results is that pixels with intensities above 4096 are rendered in white , because there is no saturation, as it happened in previous versions.
- Screen mode of 1280x1024 is also accepted by CAT3D. This is the optimum resolution for 19" LCD monitors. If you use a resolution above 1024x768, consider using PLATES = 512 in CAT3D.INI .
- Shield exported to Multicut now with the external border of the shield. A scale problem was also fixed (thanks to the advice and collaboration of Lic. Gustavo Sánchez and Eng. Marcelo Martínez, from ITR de La Plata - Argentina).

Version 5.95.2beta (17/03/2006).

- New affordable version: A new version of CAT3D which only supports Co-60

teletheraphy units was created for clinics without LINACs. The restricted version is not able to work with high energy photons or electrons.
- Clean Image was modified to preserve the values of pixels if they are not zero.

Version 5.95.1beta (08/03/2006)
- Security issue: when the user changes the "Dose Computation Mode", CAT3D now forces a new computation of dose distribution.
- Conformal Shield (apertures) exported to MultiCut (is a computer-controlled hardware unit that creates Styrofoam molds for the purposes of beam modification), manufactured by Multidata Systems International Corporation.

Version 5.94 (08/02/2006)
- Interface Library: bug removed in SelectPath() , very sparse, only critical for the filter "Gif2Img". A local variable was not properly inicialized.

Version 5.94.2beta (23/01/2006)
- Optimized algorithm for shield's penumbra generation. CAT3D generates the appropriated penumbra using the mathematical model only ones and save the result to a temporary file, any future call to the shield uses the stored penumbra.

Version 5.94.1beta (17/01/2006)
- Bug removed : Another condition of sparce crashes of solid 3D rendering, not frequently. It was generated by the MOVUPS instruction (SSE) reading a last float from a memory mapped file, trying to read in a not legal region.(Reported by Lic. Erick Hernandez, La Asunción, Guatemala). (05/01/2006)
- NEW: Penumbra model for shields. With the new penumbra model CAT3D accepts a parameter in the RSD file to adjust the width of shield's penumbra at the level of the isocenter. The parameter is "ShieldPenumbra" and it is the width of the penumbra, considering width the distance between 80 and 20% decrement lines.
  See the following example:
  ShieldPenumbra = 5.6 (distance from 80% to 20% in mm, at isocenter level.)
  The valid range for field penumbra is : 2.0 to 12.4 mm .
  Note: The penumbra region for shields is very narrow, because they are closer to isocenter than LINAC collimation system, so if you want to measure that penumbra use a micro-chamber, a diode or film dosimetry. Regular ionization chambers are to big for that narrow penumbra and they magnify the penumbra. (Collaborator: Lic. Andres Bruna).
- NEW: If the active RSD file is modified with an open plan and the user close and open the teletherapy planning, CAT3D checks for modifications and flushes the dosimetry cache. This is useful for RSD edition and beam modeling. The check for modification is made using the CRC-CCITT, with 32 bits (cyclic redundancy check with 32 bits, from the Consultative Committee for Telephone and Telegraph (CCITT)).

Version 5.93.7 (18/12/2005).
Version 5.93.6 beta (08/12/2005).
- Bug removed: a problem was detected when unused lines in the RSD file had

several TAB characters. Detected by Armando - Mevis.
- NEW: Saving the optimizations conditions used for IMRT.

Version 5.93.4 beta. (29/11/2005).
- Improved implementation of the contouring routine for isodose drawing, with better responses in singularities.
- Higher resolution of the dose matrix for 2D isodose rendering.

Version 5.93.3 beta. (28/11/2005).
- Bug removed: Definition of the modulation limits when attenuation coefficients were dependent on off-axis was wrong. (reported by Leopoldo Mazzuco)
- Bug removed: Density correction menu remained active when you changed a plan, without closing CAT3D. If the first plan used CT images and the second contour images, the electron density table for the second plan was wrong, because it keeps the first table. Now, every time you close or change a plan, the electron density correction is switched off. (reported by Instituto de Terapia Radiante, La Plata, AR)

Version 5.93.2 beta (21/11/2005).
- Bug removed: Sparce crashes of solid 3D rendering, not frequently. It was generated by the MOVUPS instruction (SSE) reading a last float from a memory mapped file, trying to read in a not legal region.

Version 5.93 beta. (09/11/2005)
- NEW : Volume (ROI) expansion in 3D, including aniostropic and isotropic expansion. The user draws the GTV manually and the expansion tool creates the
- PTV using a GTV expansion. In the isotropic case the margin is the same in all directions. For the anisotropic expansion the user has to set the margins for anterior, posterior, right, left, cranial and caudal directions. The legal margin value is from 0.5 to 50 mm.
- Bug removed: Better renderization of solid 3D ROIs when they are small. The previous implementation creates some holes inside small ROIs in 3D rendering.