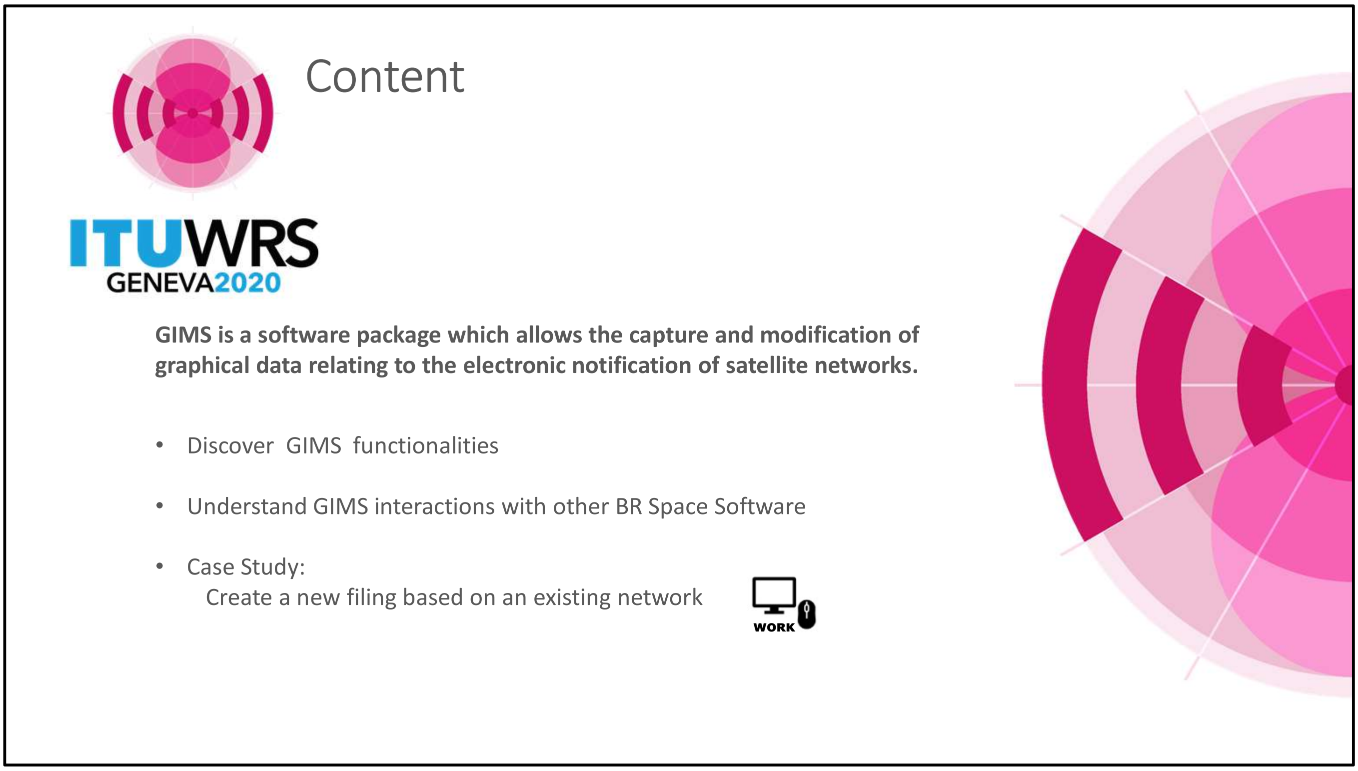
Graphical Interference Management System

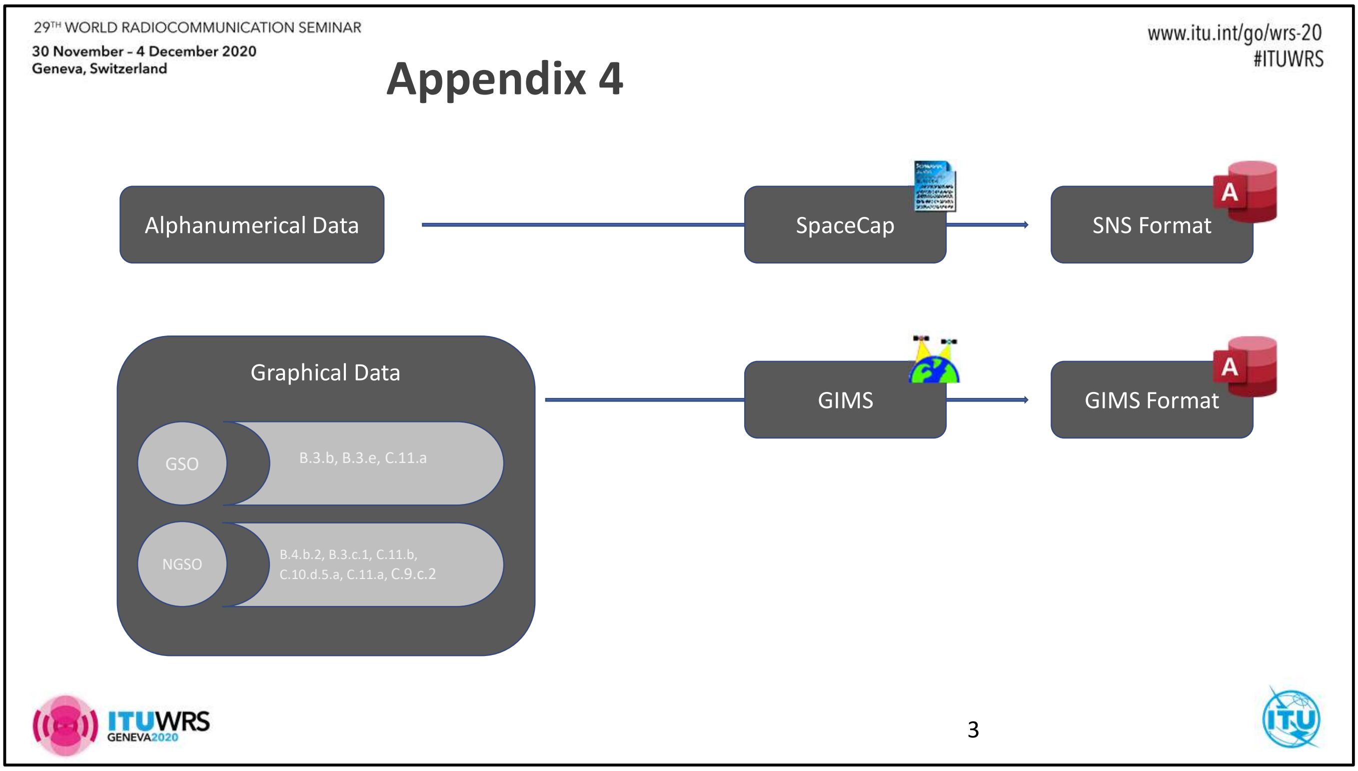
Space Software Division
ITU-R



This presentation will give you an overview of the Graphical Interference Management System (GIMS) software application's functionalities. You will also discover how other BR Space software applications relate to GIMS.

We will discover the GIMS functionalities through the scenario of creating a new satellite network filing. To do so we will not start from scratch, but we will try to reuse and modify existing data.

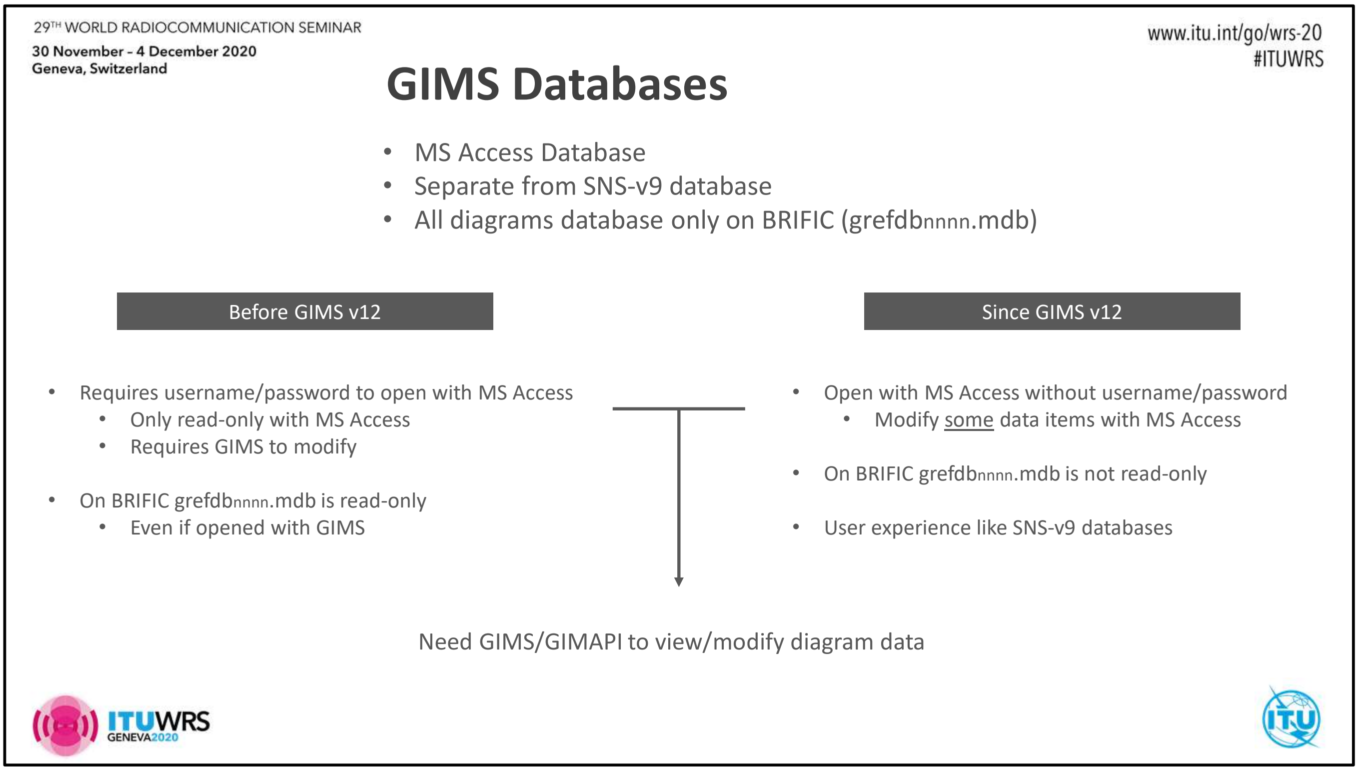
Throughout the presentation you will see "Work" images to encourage you to try by yourself what was just explained.



The Appendix 4 of the Radio Regulations (RR) describes in detail the data items to be submitted to the BR whenever you want to record a new GSO or NGSO satellite network or an earth station. The BR expects you to submit the Appendix 4 data items in two MS Access databases.

One database follows the SNS-V9 format and contains the alphanumerical data such as satellite or beam names, gain and power values. For capturing those data items you may use the SpaceCap software.

The second database is a GIMS-compatible database containing the graphical data related to GSO and NGSO satellites. The following slides will show you how GIMS can help you capturing the required graphical information.



Let’s first say a few words about GIMS databases.

The graphical data are stored in Microsoft Access databases whose format is different from the SNS-V9 format.

If you are looking for the GIMS database with all diagrams submitted so far you will find it only on the BR IFIC DVD under the name grefdb followed by the IFIC number.

There are some characteristics of the GIMS databases that have recently evolved with the release of GIMS v12.

Before that release, if you wanted to open a GIMS database with MS Access you were forced to login with a username and password and that would only give you the possibility of viewing the data. This was already good enough to create your own queries. However, any modification had to be done with GIMS (or possibly with the GIMAPI32 library).

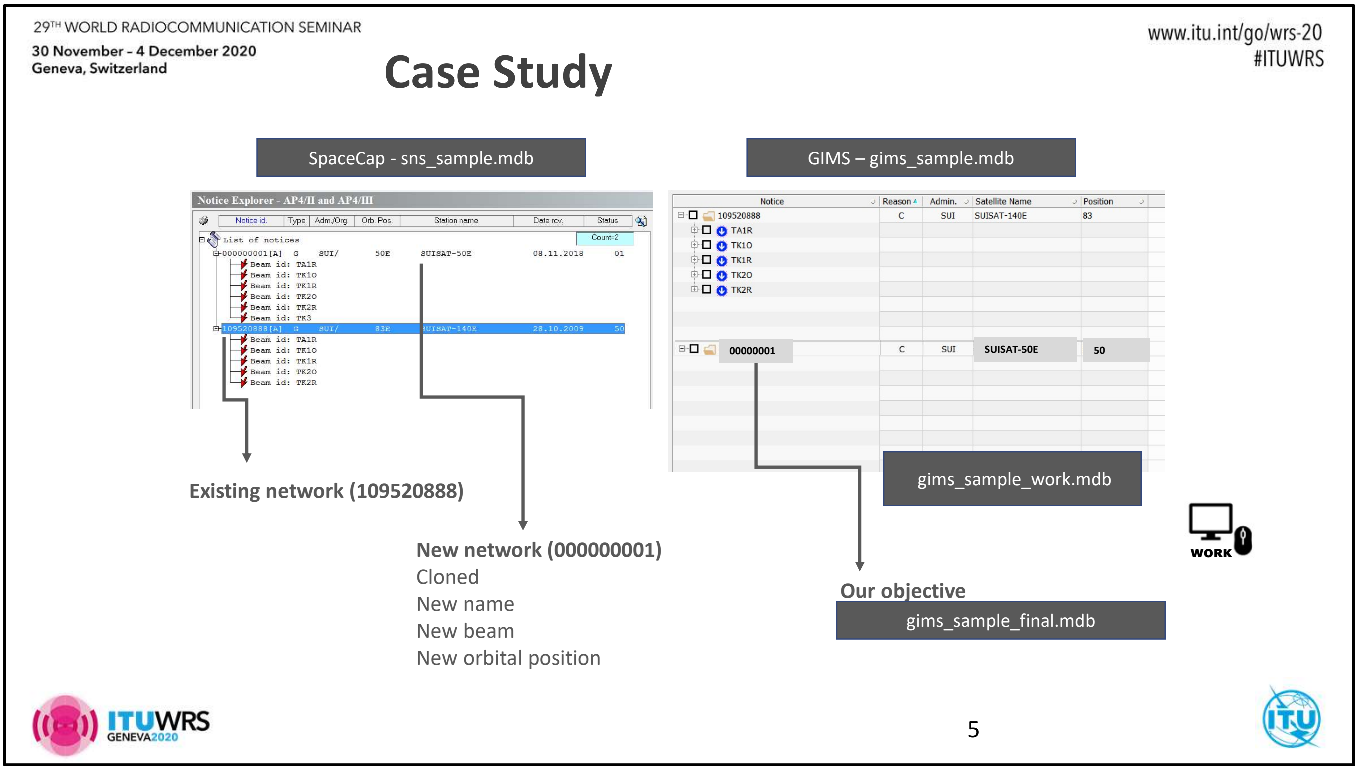
In addition the grefdb database distributed on the BRIFIC was read-only even if you opened it with GIMS.

Now, this has changed and GIMS creates databases that can be opened with MS Access without having to login and you have almost full control over the data.

Since the release of GIMSv12, grefdb databases are not read-only anymore.

These evolution was made to give you a user-experience with GIMS data that is similar to what can be done with SNS-v9 databases.

There remains, however, one limitation. By design, the actual graphical data (points coordinates for instance) are packed in a binary structure that can only be read by GIMS (or again alternatively with the GIMAPI32 library).



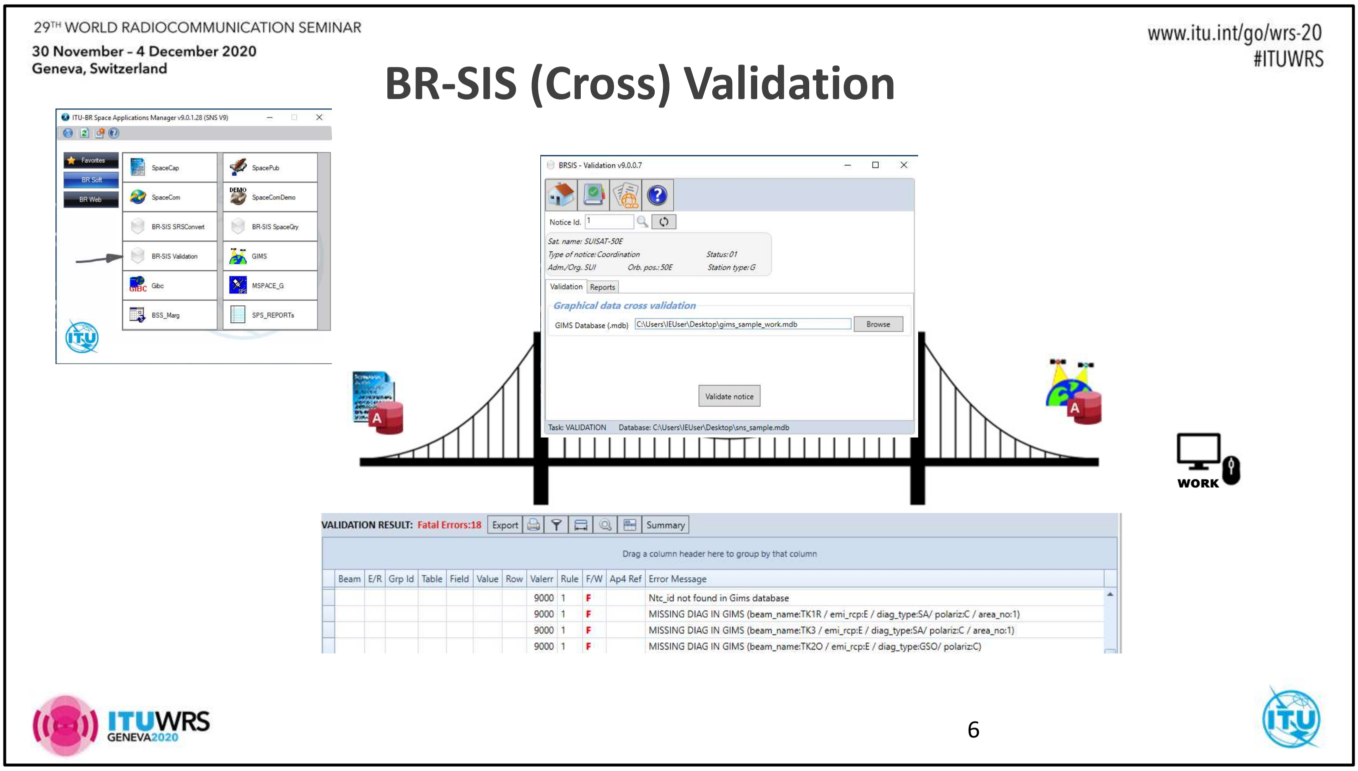
This slide describes the starting point of our scenario with which we will discover the GIMS functionalities.

The *sns_sample.mdb* database contains the data of an already notified GSO satellite registered under the ID 109520888. It was cloned to create a new network with the ID 1 that we want to submit as a new coordination request.

Other modifications were made to this new network such as the change of satellite name and nominal longitude. We also added a new beam named TK3.

The *gims_sample.mdb* database contains all diagrams for the network 109520888. At end of this presentation/workshop we aim to have created the required diagrams for network 1. The *gims_sample_work.mdb* database is at the beginning a copy of gims_sample.mdb. This is the database where we will save the newly created diagrams.

The database *gims_sample_final.mdb* is the final GIMS database that we will obtain should we have done all required data capture actions.



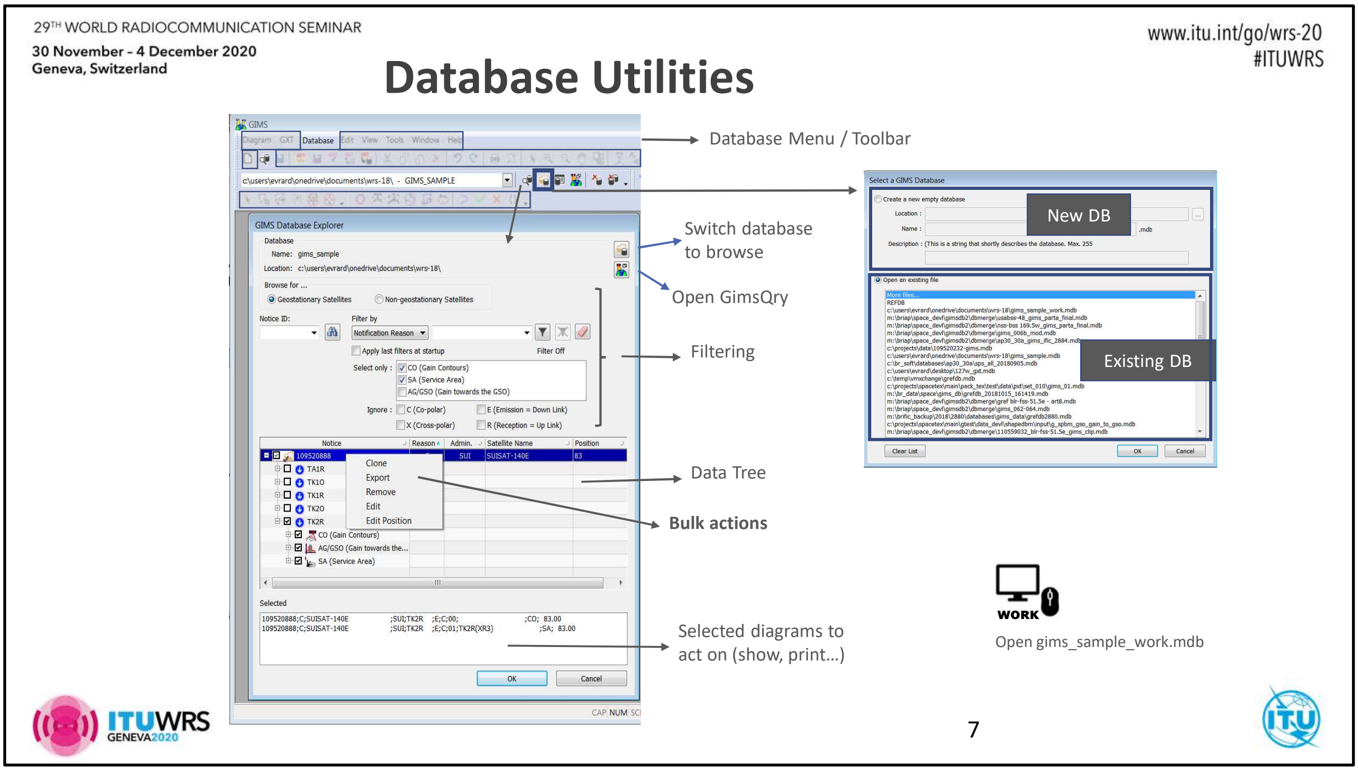
BR-SIS Validation software is certainly the most difficult to avoid using. It ensures the validity and coherence of the alphanumerical data in any SNS-V9 formatted database thereby ensuring the receivability of your submission.

In addition, since graphical data must be submitted in a GIMS database, BR-SIS Validation features a cross-validation that helps you to submit all the required diagram information.

Work

Using SAM V9.0, start BR-SIS Validation
Choose the sns_sample.mdb database and click the Start button
In the Notice ID field, type 1 and click on the Refresh button.
In the Graphical data cross validation section, click Browse and choose the database gims_sample_work.mdb
Click on Validate notice
Once the validation is completed, click on the Reports tab.

The validation report shows several fatal errors related to missing diagram data. In view of the data in the sns_sample.mdb database, BR-SIS Validation looked for graphical data in the given GIMS database and did not find them.



Before we attempt to correct the validation errors, we need to know a little bit more about how in GIMS we can manipulate databases.

The database toolbar and **Database** menu are the obvious entry points to the database access functionalities in GIMS.

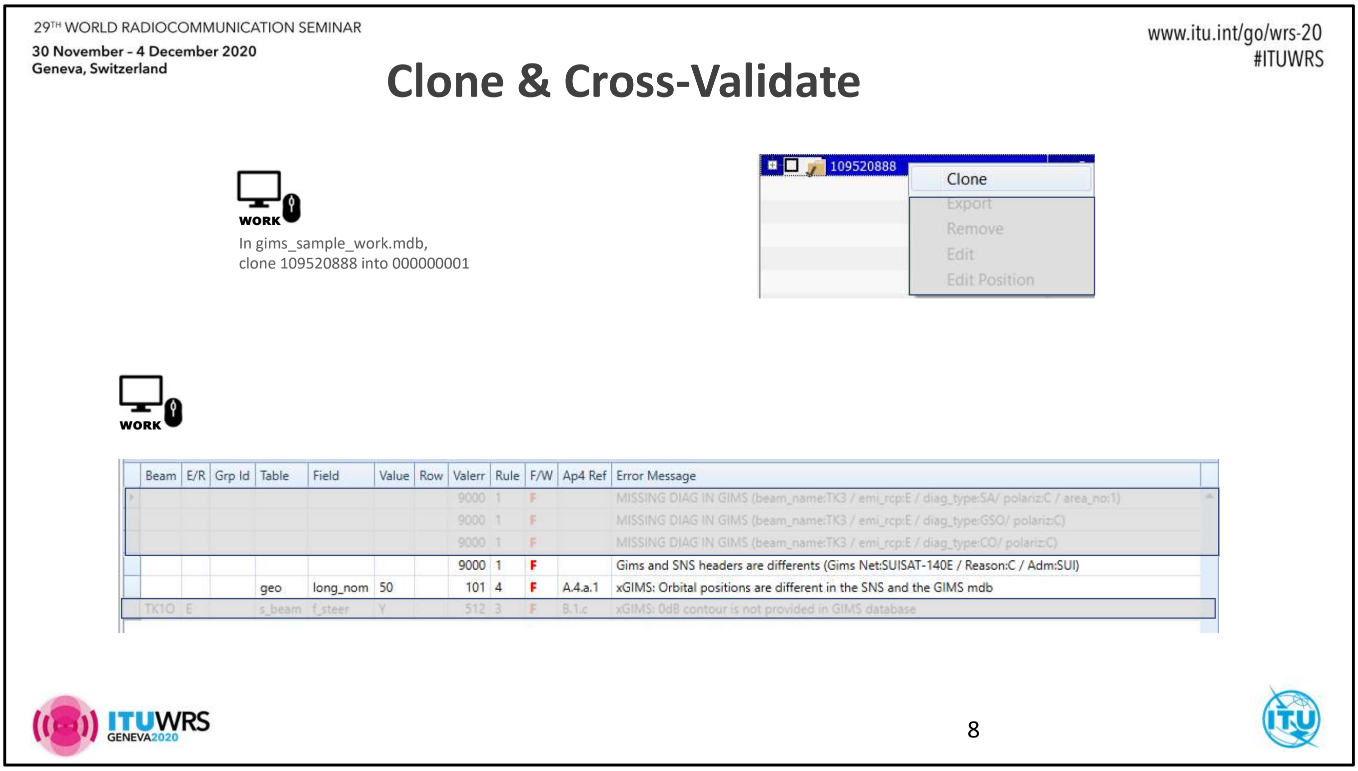
The menu items **Database | New** and **Database | Open** both open the database selector dialog box.
In the upper part of the window you can specify the name and location of an empty database that you want to create.
The lower part allows to select an existing GIMS database. You select it from a list of previously opened databases or by choosing “More files” to open a file selector window.

Once a database is opened you can view its content with the *GIMS Database Explorer*. The database content is displayed in a hierarchical form very similar to the notice explorer in SpaceCap.

Some actions to the GIMS data can already be performed in the database explorer. At each level of the hierarchy (notice, beam, diagram) one has access to actions by means of the contextual menu.

The notice level actions help manipulating all diagrams of a network. For example, **Export** copies all diagram of a network into another database.

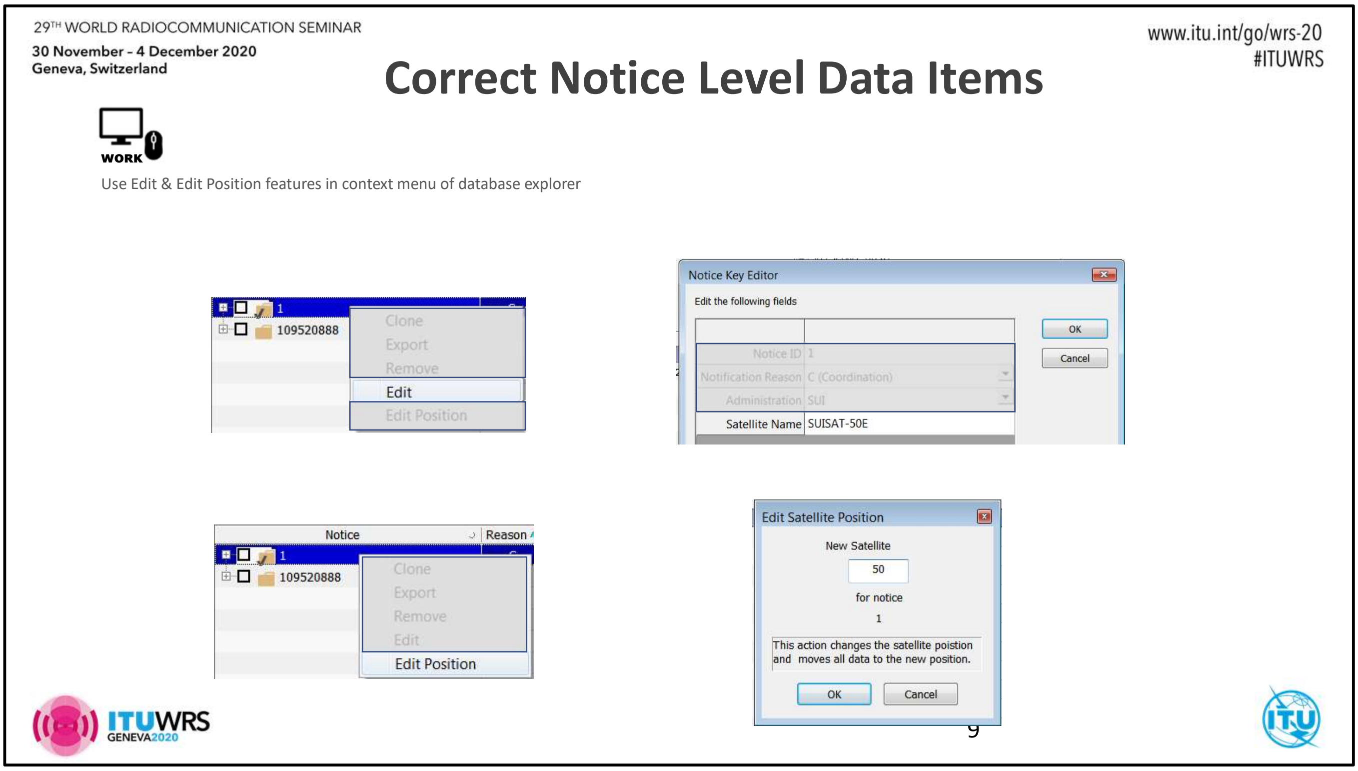
Work
Open the gims_sample_work.mdb database
View its content with database explorer.



The errors highlighted on this slide gives us a hint about what we should first do.
To solve the validation errors reported by BR-SIS Validation and as we know that the new satellite is analogous to the existing 109520888 we will first clone the graphical data of the registered network.

Work
Ensure that the GIMS Database Explorer is open and that it is showing the data of the database gims_sample_work.mdb
Select the network 109520888 by clicking on the notice ID.
*Right-click and choose **Clone** in the contextual menu.*
Enter 1 as the new notice ID.
Then go back to BR-SIS Validation, select the Validation tab and re-start the validation on the pair of databases sns_sample.mdb / gims_sample_work.mdb
The number of errors was to 4.

We will first concentrate on two of them.



BR-SIS Validation has just indicated that although it could, in the GIMS database, find a network with the ID 1 there are other network level parameters that do not match the corresponding parameters of the network 1 in the sns_sample.mdb database, namely the satellite name and the nominal longitude.

In the GIMS database explorer, the contextual menu of the notice level will help you correct those two data items.

Work

In the contextual menu of the notice 1:

- *Click **Edit** to change the satellite name to “SUISAT-50E”.*
- *Click **Edit Position** to change the nominal longitude to 50.*

29TH WORLD RADIOCOMMUNICATION SEMINAR
30 November – 4 December 2020
Geneva, Switzerland

www.itu.int/go/wrs-20
#ITUWRS

BR-SIS Cross-Validation

WORK

Beam	E/R	Grp Id	Table	Field	Value	Row	Valerr	Rule	F/W	Ap4 Ref	Error Message
							9000	1	F		MISSING DIAG IN GIMS (beam_name:TK3 / emi_rcp:E / diag_type:SA/ polariz:C / area_no:1)
							9000	1	F		MISSING DIAG IN GIMS (beam_name:TK3 / emi_rcp:E / diag_type:GSO/ polariz:C)
							9000	1	F		MISSING DIAG IN GIMS (beam_name:TK3 / emi_rcp:E / diag_type:CO/ polariz:C)
TK1O	E		s_beam	f_steer	Y		512	3	F	B.1.c	xGIMS: 0dB contour is not provided in GIMS database

ITUWRS GENEVA2020

Work

Go back to BR-SIS Validation, select the Validation tab and re-start the validation on the pair of databases sns_sample.mdb / gims_sample_work.mdb.
You should get a validation report like the one shown in the slide.

Most diagrams are already in the network 1 that was created by cloning 109520888. But as the network 1 in the SNS database contains one new beam, BR-SIS Validation correctly reports that diagrams for this new beam should be provided.

This validation report introduces us the types of GSO satellite diagrams that you can manipulate with GIMS.

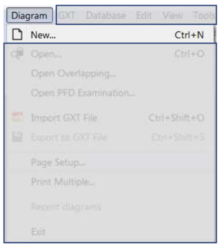
- Antenna gain contours
- Service Areas
- Gain towards the geostationary orbit

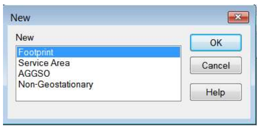
Let’s now see how GIMS can help you to create these diagrams.

29TH WORLD RADIOCOMMUNICATION SEMINAR
30 November - 4 December 2020
Geneva, Switzerland

www.itu.int/go/wrs-20
#ITUWRS

Antenna Gain Contours (CO)





- What for ?
  - Provide antenna gain
- Data Capture
  - Simple generated contours
  - Use a digitizer
  - Mouse capture tools
  - Modify existing diagram

ITUWRS GENEVA2020

11

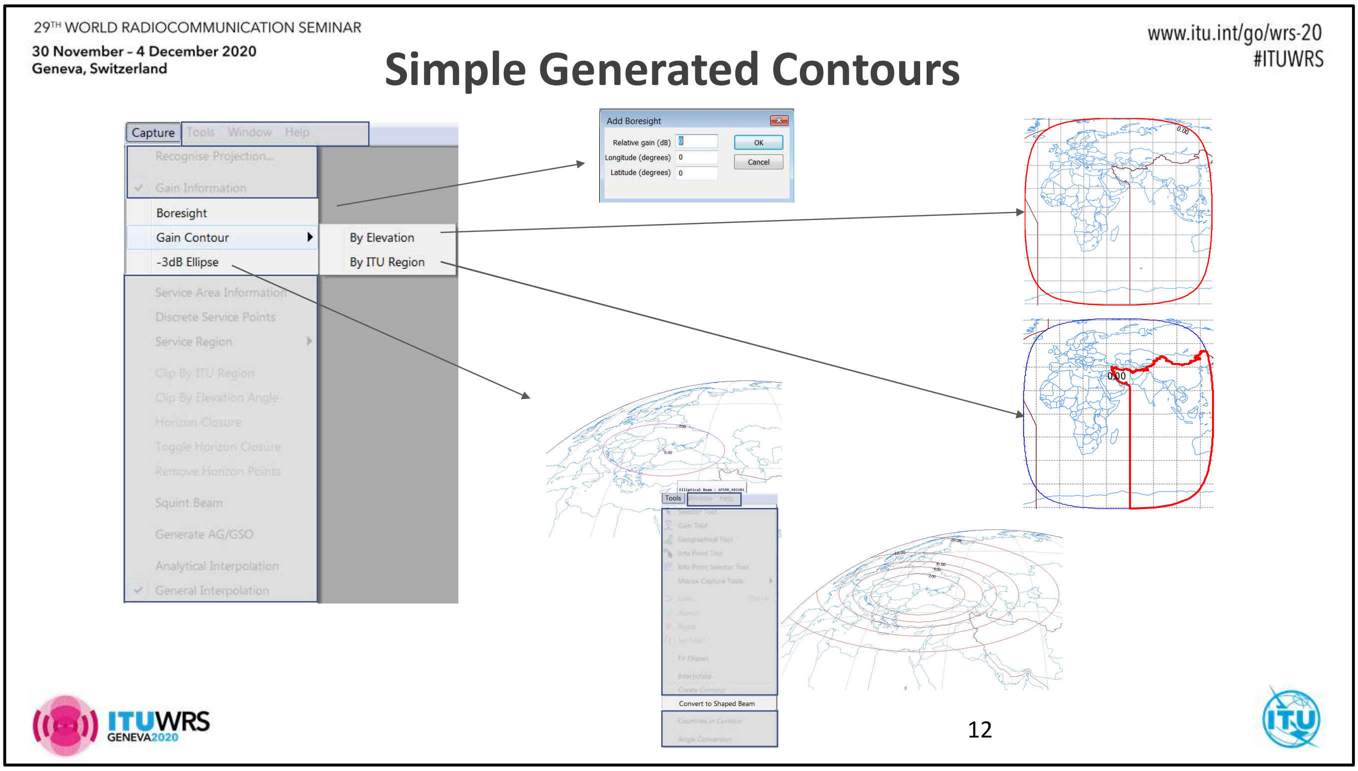
The antenna gain contours diagram provides information on how to get the antenna gain on the surface of the earth. This of course is a required value for compatibility analysis that will be introduced later.

GIMS can generate simple “calculated” contours.

With a digitizer you could transform a diagram represented on paper into the GIMS format.

Mouse capture tools allow to draw diagrams directly on a map window and to modify existing diagrams.

The first step to create a new diagram is simple : click the item **New** in the menu **Diagram** and then select GSO Footprint as the new diagram type.



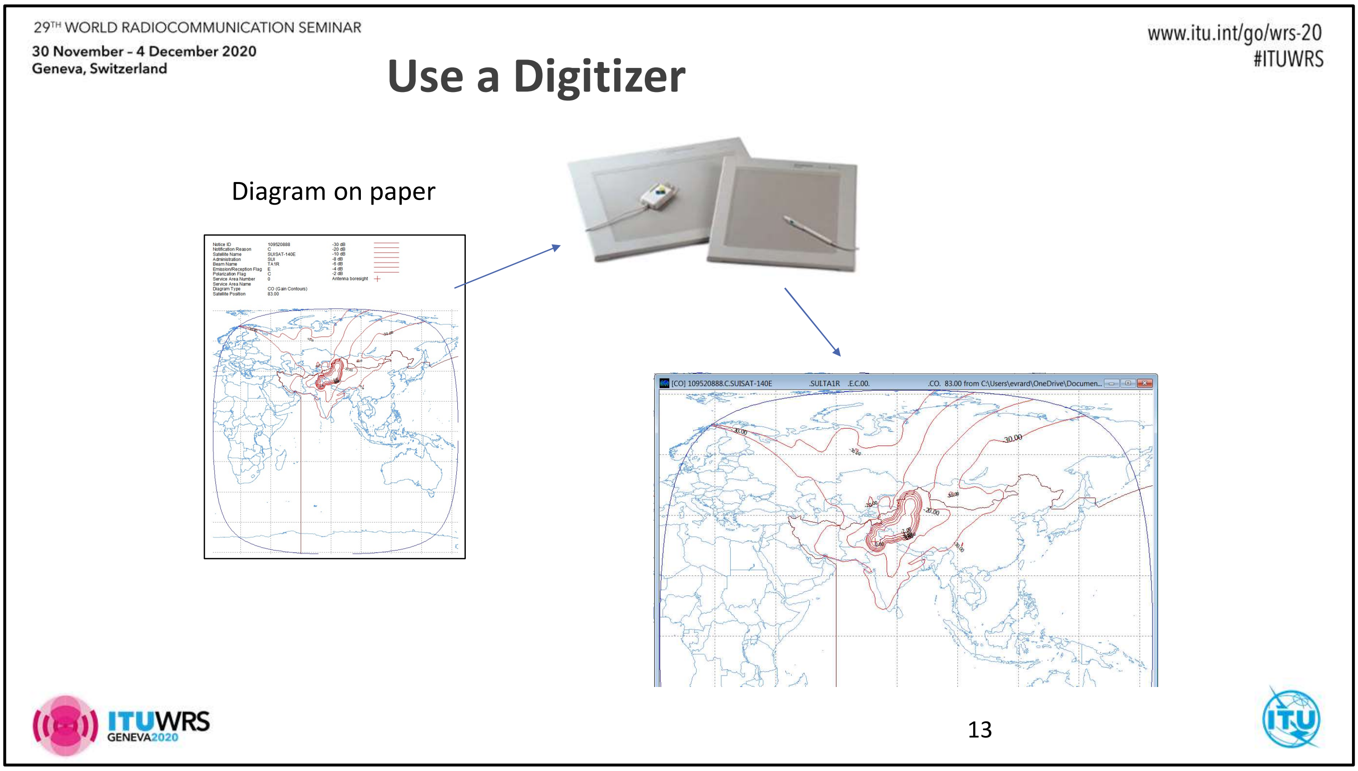
Generated contours are of three types:

1. A contour can be defined by earth station elevation angle.

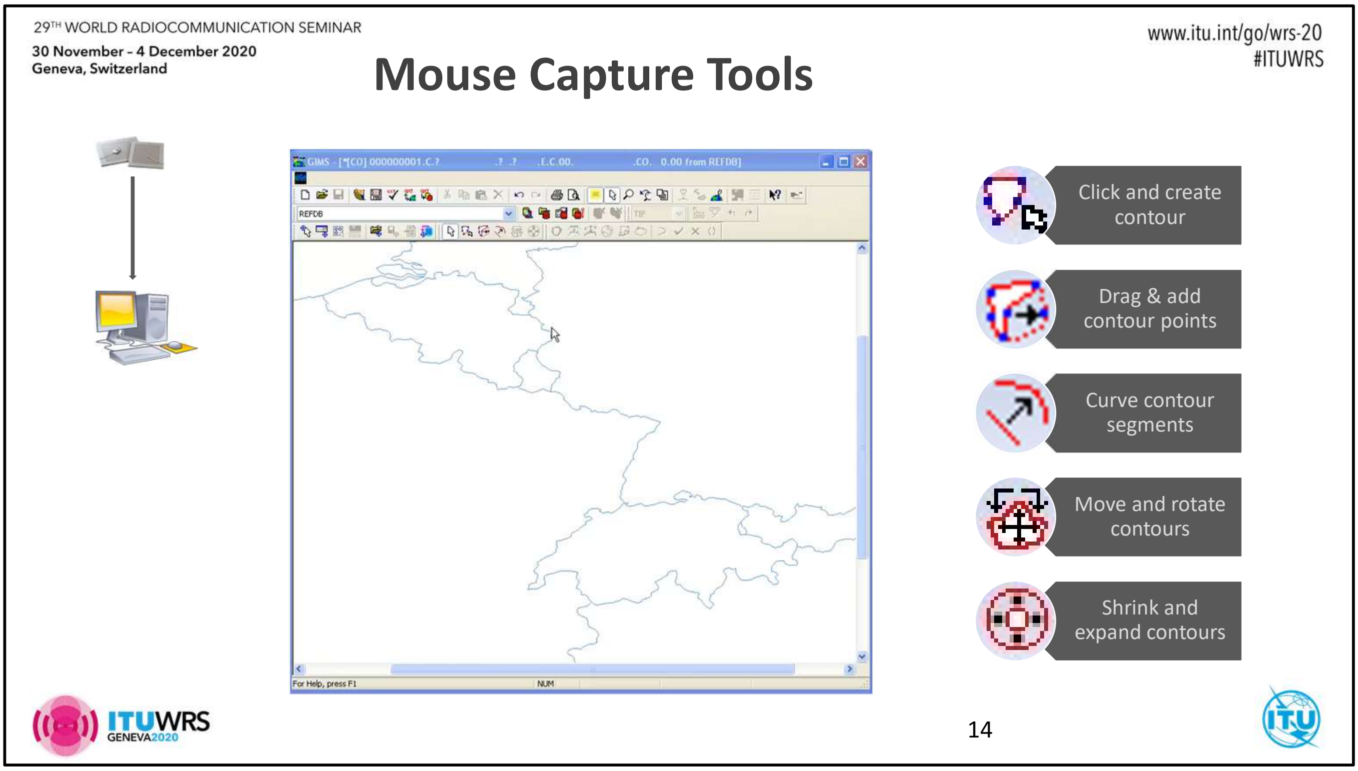
2. A contour can follow the border of an ITU region

3. A contour can be defined by ellipse parameters and then required (-2, -4, -6,-10,-20 dB) gain contours can be generated

One can also simply add a boresight by entering its coordinates.



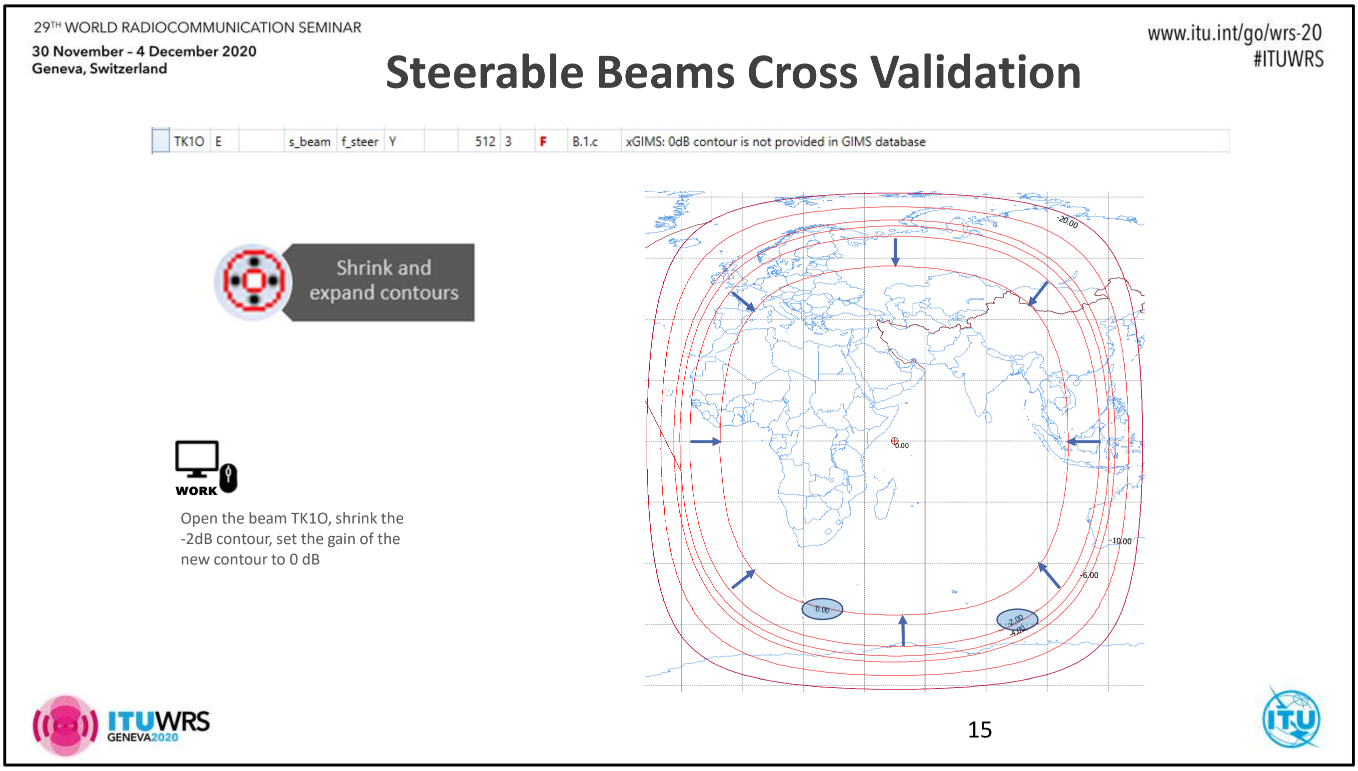
GIMS supports WinTab-compliant digitizers with which diagrams drawn on a paper map can be digitized and transferred in a GIMS database.



As the video attached to this slides shows the mouse capture tools allows drawing and manipulating antenna gain contours directly on the map window.

Refer to the GIMS help file (press F1 in GIMS or use the menu **Help | Help Topics**) to know more about the usage of these tools.

One can use the mouse capture tools to create antenna gain contours and service areas. To specify which one should be created when using a mouse tool, click either **Gain Information** or **Service Area information** in the **Capture** menu.



The “Shrink and expand contours” mouse tool could help us to fix a fatal validation error that we had so far ignored. Remember that all fatal errors should in theory be fixed before you submit a filing to the BR.

This error illustrates a type of cross-validation that BR-SIS Validation is doing. BR-SIS Validation not only ensures that you do not forget to submit diagrams but is also capable of examining the diagram data and ensures that they comply with the Appendix 4 rules. The beam TK1O in the network 1 was set to be a steerable beam. In that case, Appendix 4 requires to submit a contour of gain 0dB. We will be discussing this issue again later when discovering the GIMS validation that is not dealing with this type of errors.

Appendix 4 also requires that you provided a -2, -4, -6, -10 and -20dB contours. BR-SIS Validation will warn you if diagrams do not have the required contours.

Work

Open from the gims_sample_work.mdb database the gain contour diagram of the beam TK1O.

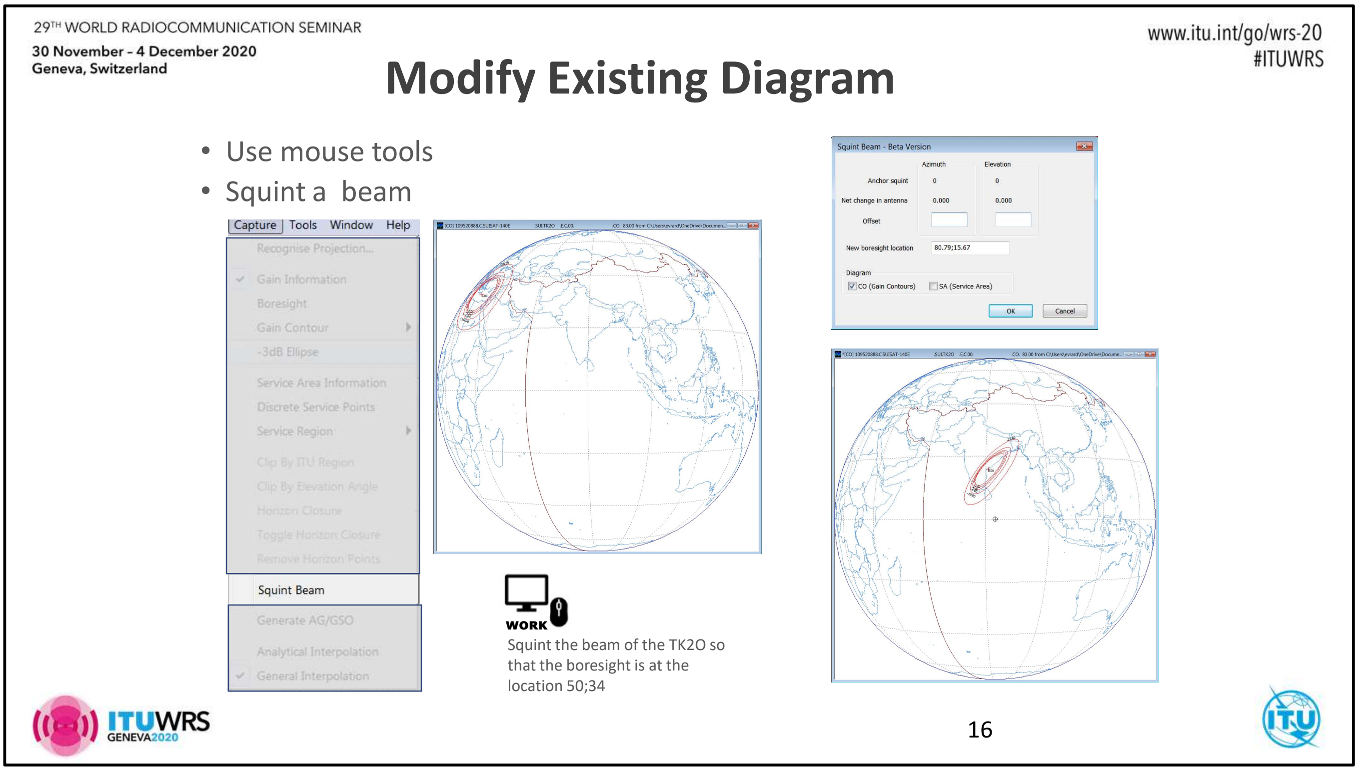
*You might want to change the projection to Plate Carrée. To do so, choose **Display Characteristics** in the **View** menu and choose the projection name in the list.*

Use the “Shrink and expand contours” tool to shrink the -2dB contour into the 0 dB contour.

Make first a copy (Ctrl + C) of the -2dB contour to add it back after it is shrinked.

Select the contour to modify
Activate the tool (Ctrl+Alt+X)
Use the mouse wheel to modify the contour
Double-click to accept the new contour

Press Esc to revert to the Selector Tool
Double-click on the new contour and change the gain to 0.



Re-using existing diagrams and tailor them to our needs is a good way to quickly get a diagram ready.

The mouse tools that allow moving contours and/or contour points are the means you could use to modify existing gain contours.

GIMS also provides the “Squint Beam” functionality to reposition gain contours. One can now reposition a beam by simply specifying a new boresight position.

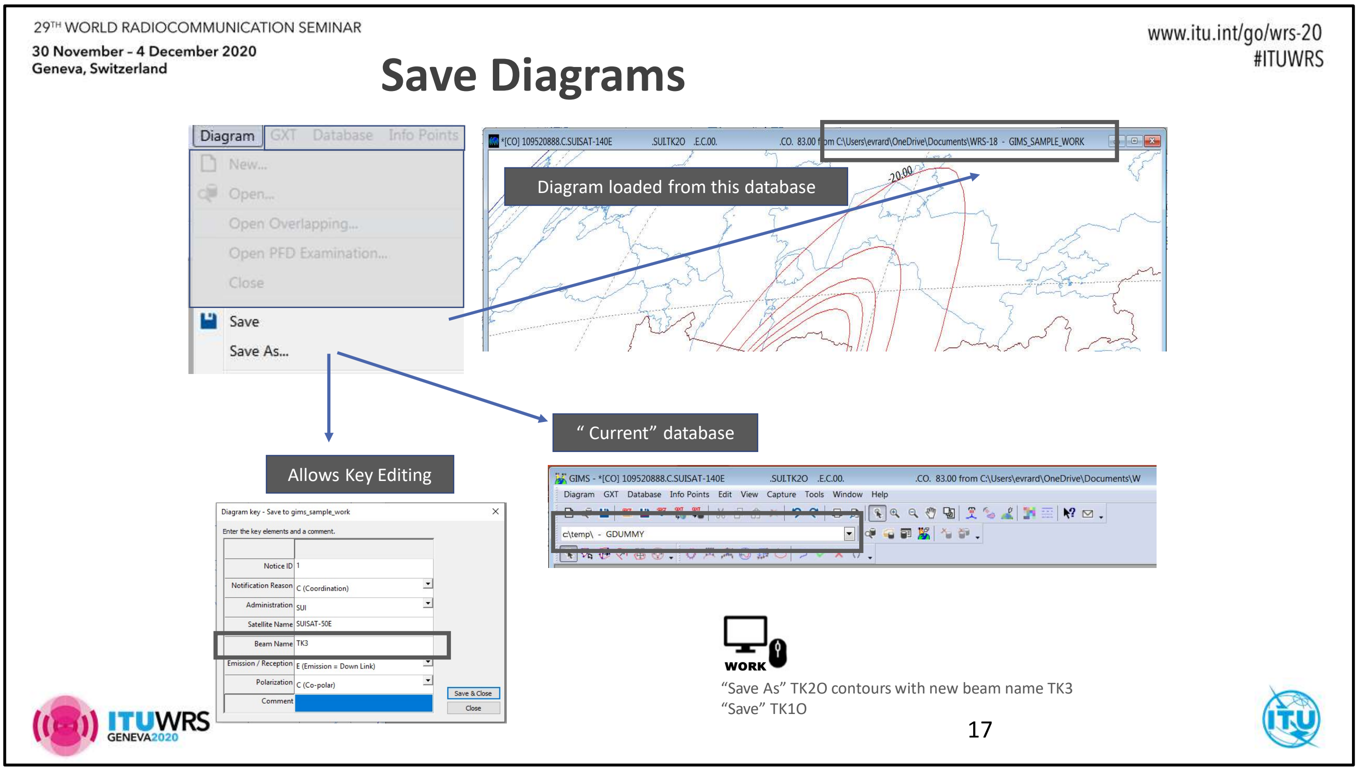
Work

From the gims_sample_work.mdb database, open the gain contour diagram of the TK2O beam.

Select the menu item ***Capture | Squint Beam***

Reposition the beam so that the new boresight position is at longitude 50 degrees and latitude 34 degrees.

In the New Boresight Location field, enter “50 ; 34”



Now that we have created two new diagrams, it is time to save them. This is a not a tremendously difficult action, but it is worth knowing a few concepts.

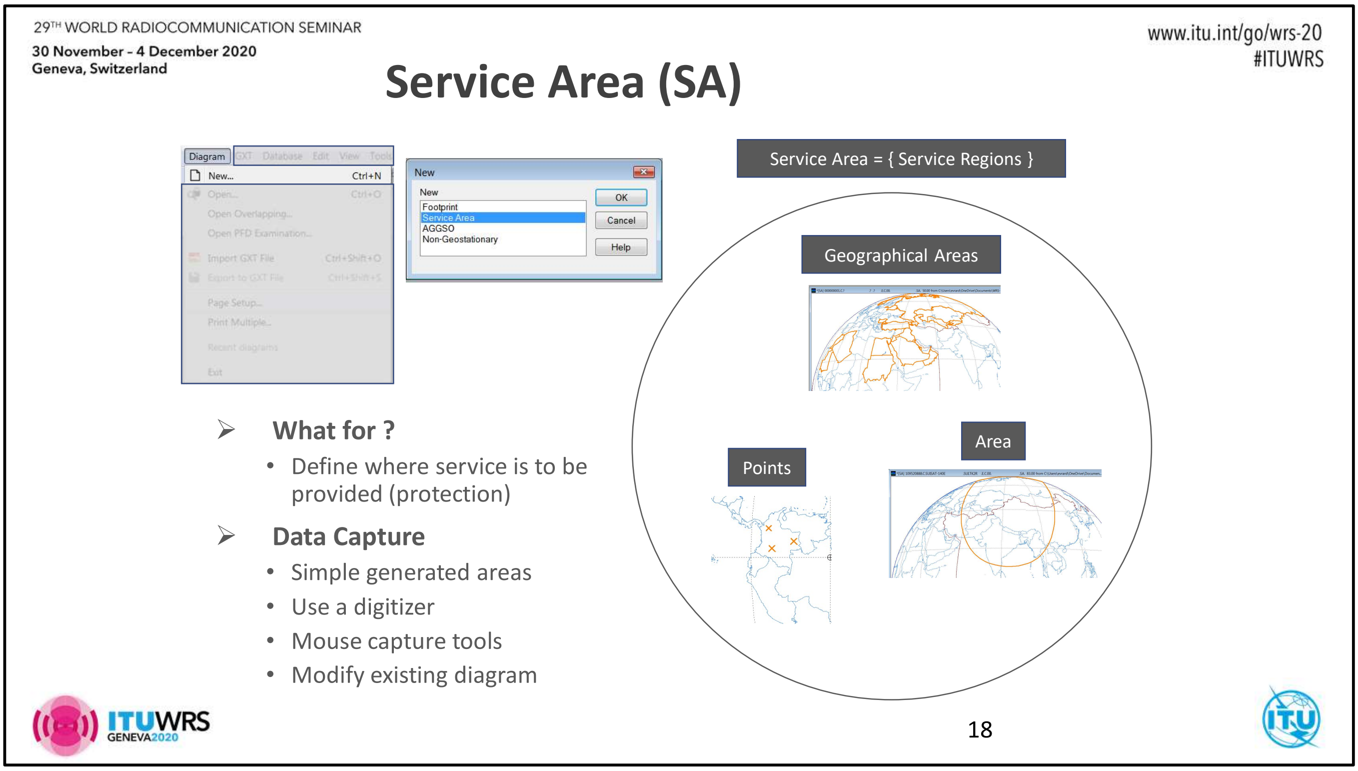
The "Current Database" is the first database of the database list in the database toolbar. By now, gims_sample_work.mdb should be your current database.

The diagram window title displays, in addition to the diagram identifiers, the parameters of database from which the diagram was loaded.

The **Save** action in the **Diagram** menu will save the diagram into the database it was loaded from (i.e. the one in the title bar).

The **Save As...** action in the **Diagram** menu will save the diagram into the current database, which allows from transferring a diagram from one database to another. In addition **Save As...** also allows for modifying the diagram identifiers.

Work
Save the gain contour diagram of the TK1O beam.
Save As ... the gain contour diagram of the TK2O beam and change the beam name to TK3.



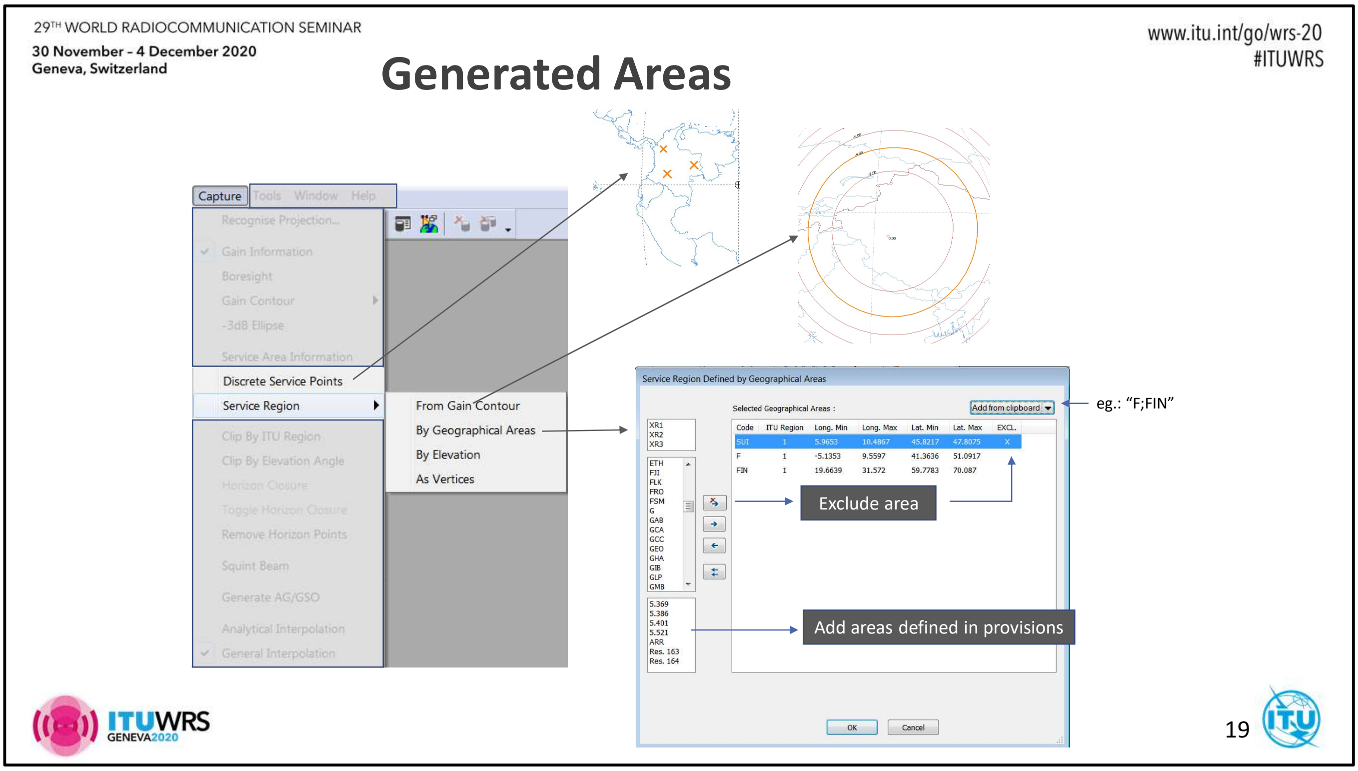
Enough of gain contours now. Let’s concentrate on the second type of diagrams, namely the service area.

A service area defines where on the earth the satellite is expected to provide its services. In many compatibility analysis there are various limits that should be met over the whole service area of other satellites to avoid interferences.

GIMS defines a service area as a set of “service regions”. This is just GIMS nomenclature. A service region may be defined in three different ways:

1. As a geographical areas, like a country code or an ITU region
2. As an area defined by a closed line.
3. As a set of points.

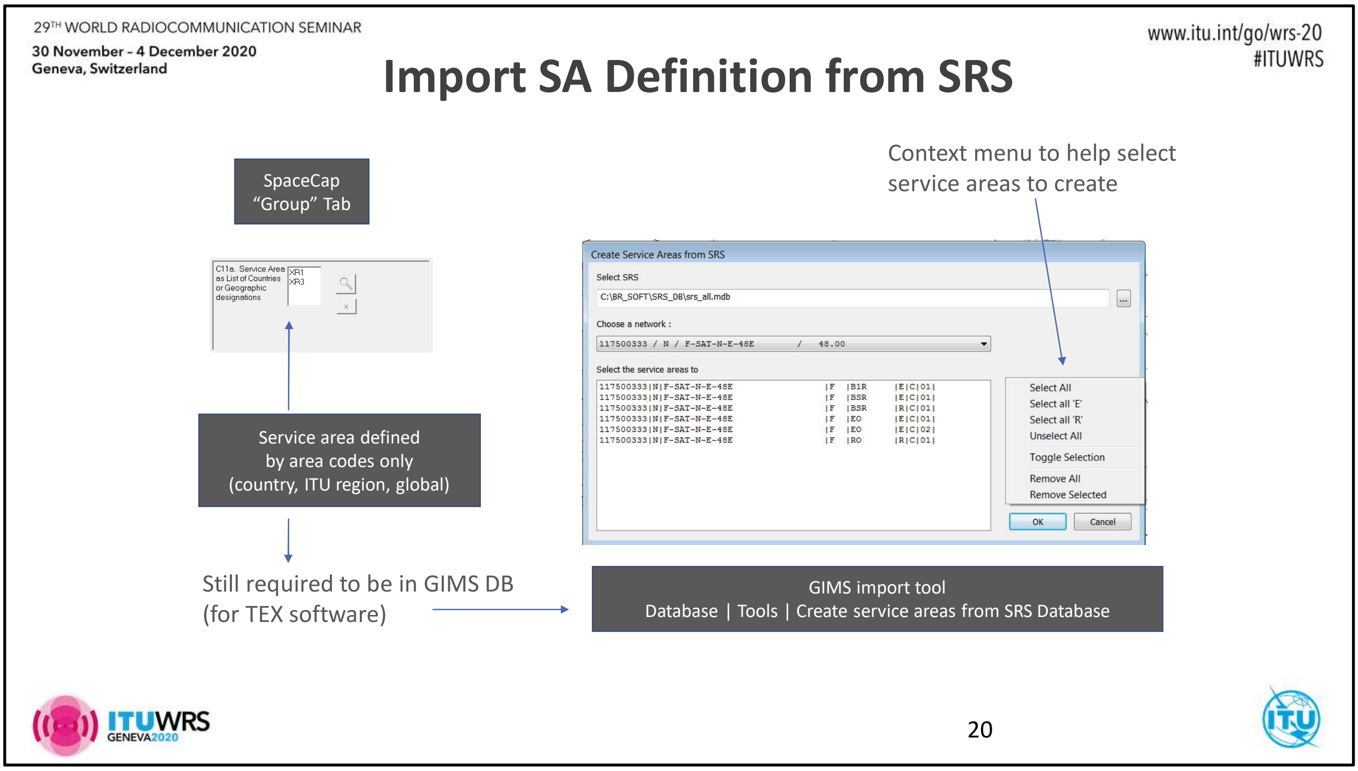
Capture-wise the situation is very similar to what GIMS offers for gain contours: generated area, complex area captured with a digitizer or the mouse capture tools.



Discrete service points may be entered one by one, like boresights, by entering their coordinates.

Generated service regions could be :

- Defined by the area where the earth station elevation angle is over a given value.
- Defined by the area inside a gain contour
- Defined by a geographical area code
    - The code could represent an ITU region or a country
    - To simplify data capture GIMS proposes predefined lists of geographical areas as they are described in some provisions of the Radio Regulations.
    - It is also possible to exclude geographical areas from the service area (<u>this of course requires that a service region has already been captured that covers the areas one wants to exclude</u>).

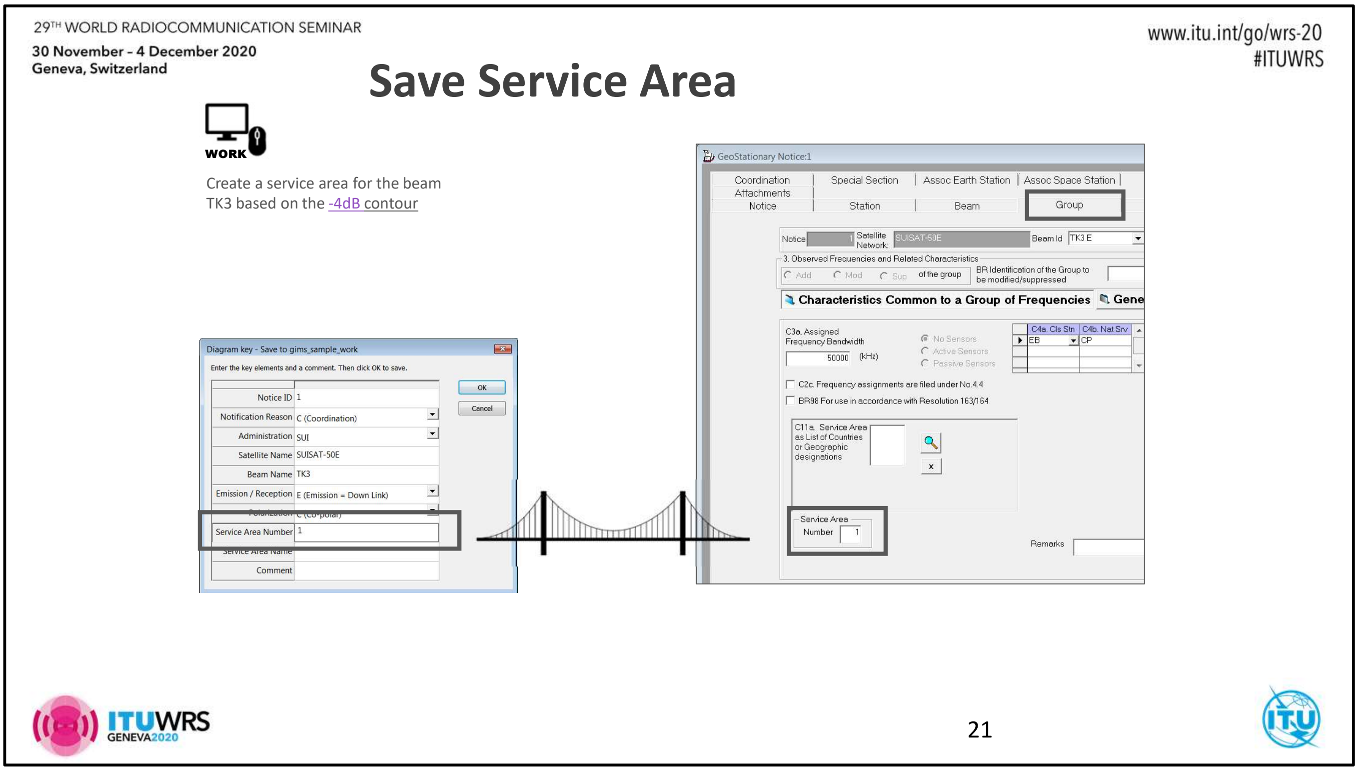


To submit service areas that are only defined by country codes you do not have to use GIMS. You can simply provide the area codes with SpaceCap. In the group-level tab you will find a list where to specify geographical area codes. Even global areas (covering the whole visible earth surface) can be set with the code "XVE".

However although it is completely valid, this information will not be used by our compatibility analysis tools that search for service areas data into GIMS databases only. Therefore, so far, BR is converting the areas defined in the SNS-V9 database into GIMS service area diagrams.

The tool that was until recently only available for ITU's internal use has been released for public usage, and you can now use it to create service area diagrams from the information found in an SNS compatible database.
You will find it under the menu **Database | Tools**. Note that the current database must be defined, and you must be allowed to modify it as this is where the tool will save the generated service areas.

We encourage you to use the tool to generate the service areas before submitting your databases to the BR. It's less work for us and your service area data will be considered when using GIBC examination programs.



Work

Create a service area for the beam TK3 that is based on the -4dB contour.

- *Select the -4 dB contour*
- *On the menu **Capture** choose **Service Region | From Gain Contour**.*

To save this service area, let’s click **Diagram | Save**. Surprisingly, you will be prompted to change the diagram identifiers.

To understand why, we must realize that the service area is attached to a group in the SNS-V9 structure. However GIMS database structure has no group concept; it is just designed to store diagrams with an identifier. The identifier allows to attach the diagram to a network (with ID, name…) then a beam (with name, direction of transmission). To attach a service area to a group (which is one level below beam) we use the service area number. The slide indicates where in SpaceCap you can set this value to indicate which service area diagram is to be used for the group being edited.

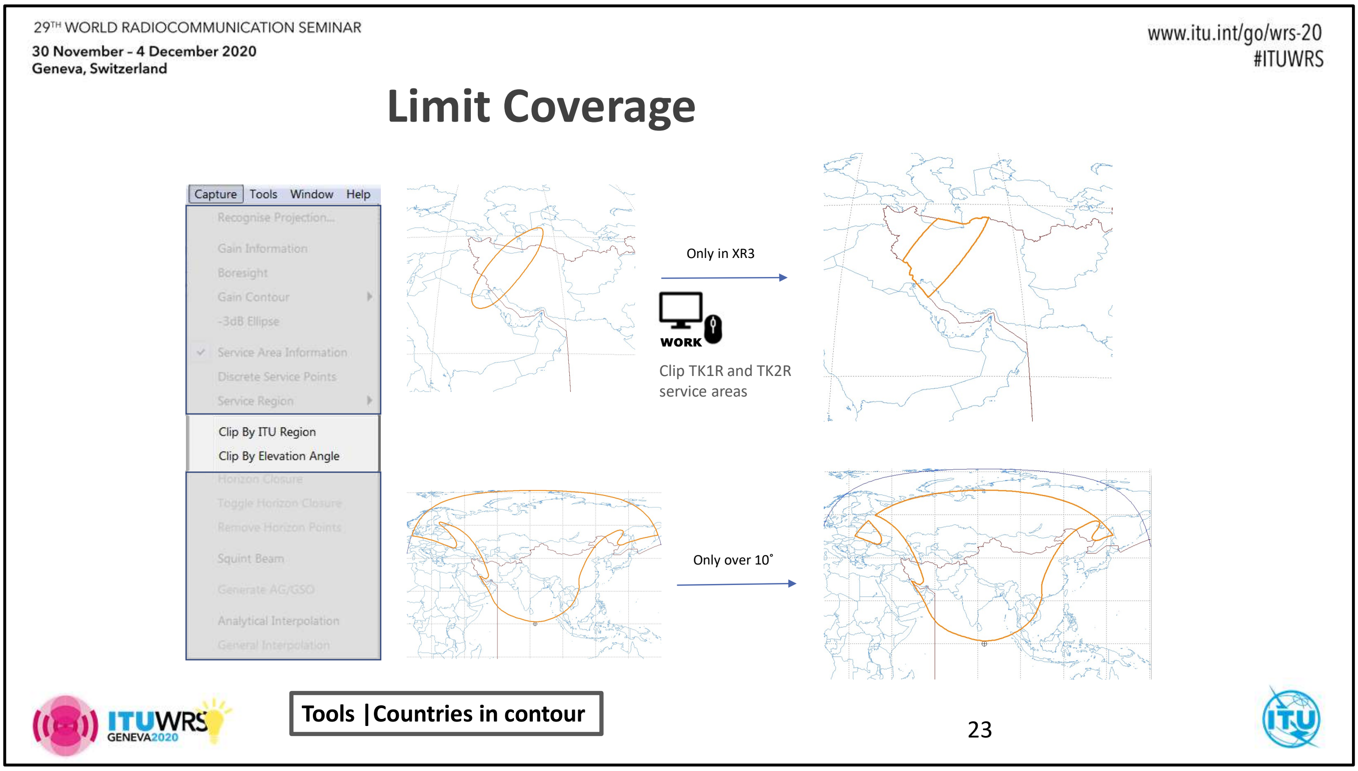
When saving the diagram, GIMS noticed that you are saving a service area and that no area number had been set yet, which is why the diagram key editor is displayed.

It is also encouraged to give a name to the service area that helps to quickly identify the area coverage when browsing with the database explorer. Apart from that usage the area name is not really a member of the diagram key and could be changed at a later stage without any impact on the linking between a group and a service area diagram.

Appendix 4 is only one side of the story as far as data submission is concerned. Article 5 is the other side, and it tells us that we cannot use whatever frequencies and whatever service in whatever region of the world. Therefore BR-SIS Validation can also cross-check that information using both the SNS-V9 and GIMS databases that you submitted.

This validation is so far only for internal use. But if you could use them you would see the messages shown in the slide. This is a cross-validation because based on the frequencies and services captured in the sns_sample.mdb BR-SIS Validation could find out that the allocation is only valid in ITU region 3. Then inspecting the service area diagrams that were linked to the corresponding groups it could detect that they were covering other regions.

On your side, you must master the intricacies of Article 5 to detect that problem. Then, GIMS can help to correct the invasive areas.



GIMS provides two ways for constraining a service area coverage.

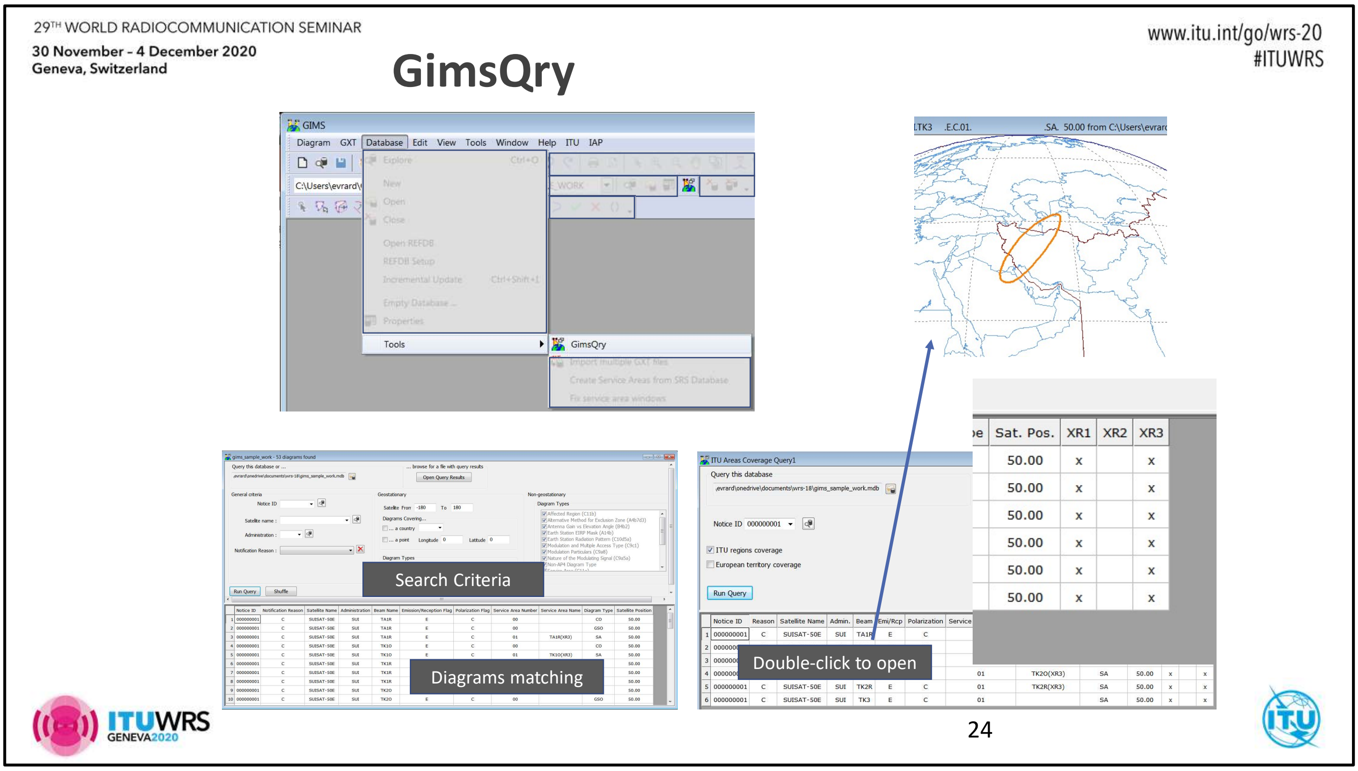
An existing service area border may be limited

1. To cover only areas where the earth station elevation angle is over some given value.
2. To cover only areas inside given ITU regions.

Work

Open the service area diagram of the beam TK3 that we created previously
*Select the area contour and use the **Clip by ITU Region** item of the menu **Capture***
Add XR3 to the list of geographical area
Then save the diagram in the gims_sample_work.mdb database

Note that the can you get the list of countries covered by an area: select a contour/area and click **Countries in *Contours*** *in the **Tools** menu.*



Another way to retrieve service area coverage information is to use GimsQry.

GimsQry is a general purpose GIMS database query tool. You specify search criteria and GimsQry returns the list of all matching diagrams.

Simple search criteria are based on the diagram identifier items (satellite name, nominal longitude…)

Other criteria allows to search for service areas covering a country or a given location (this could take some time so it’s good to combine the coverage criteria with diagram identifier criteria to limit the number of diagram to be tested for coverage).

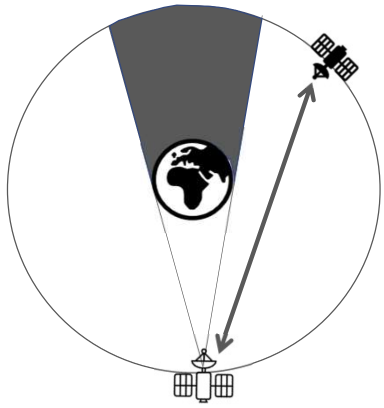
ITU region coverage is a separate query type that lists the ITU regions covered by all service areas of a network.

From the diagrams result list you can open diagrams in GIMS or save them into a GIMS database.

Antenna Gain towards GSO (GSO)

- What for ?
  - Used for AP8 ($^{\Delta T}/_{T}$) calculation
  - Only required for bi-directional bands
    (see Appendix 4 of Satellite Validation Rules)

- Capture
  - Simple generated contours
  - Use a digitizer
  - Mouse capture tools
  - Modify existing diagram

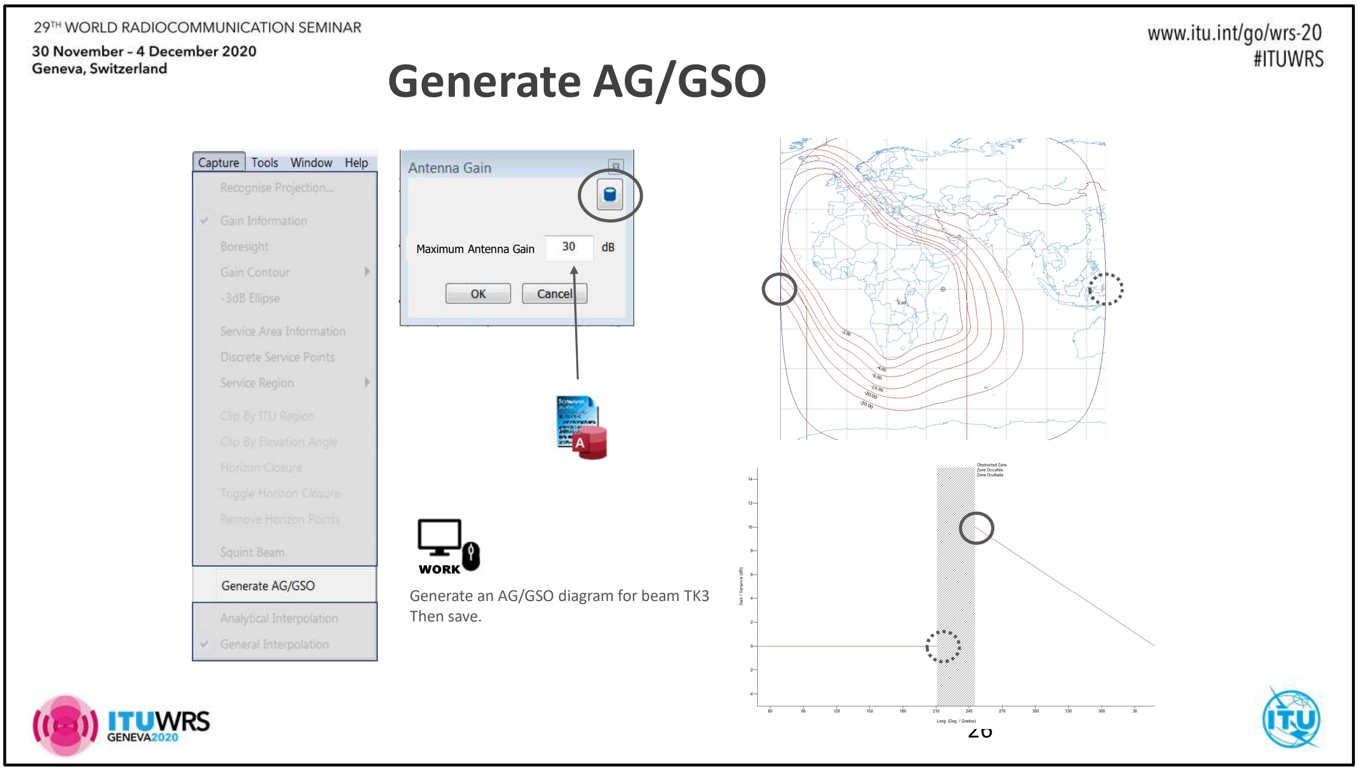


ITUWRS GENEVA2020

The last diagram that we must create to satisfy the cross-validation rules is a bit different : it represents the gain of the satellite antenna towards the geostationary orbit.

It is only required when the frequency bands you captured in the SNS database are for bi-directional use. Eventually this diagram will be used by the GIBC/Appendix 8 software.

AG/GSO diagram capture follows the usual schema already presented for gain contours and service areas.



There is one tool provided by GIMS to generate an AG/GSO diagram.

Based on the gain contour diagram and the value of the antenna gain at the edges of the visible area GIMS generates a very simple diagram. As the gain values in the diagram are absolute gain values GIMS first asks to provide the maximum antenna gain. Clicking the little database icon allows to retrieve it from an SNS database.

> **Work**
> *Open the antenna gain contour diagram for the beam TK3 from the gims_sample_work.mdb database*
> *Select the menu item* ***Capture | Generate AG/GSO***
> *If you ask for the gain to be retrieved from an SNS database, you will surely be prompted to specify the database to be used. Choose sns_sample.mdb.*

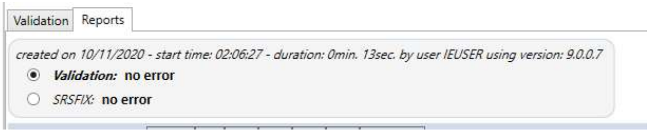
29TH WORLD RADIOCOMMUNICATION SEMINAR
30 November – 4 December 2020
Geneva, Switzerland

www.itu.int/go/wrs-20
#ITUWRS

BR-SIS Cross-Validation

WORK

Last BR-SIS Validation run to confirm the data are now correct



Diagrams ready to be used

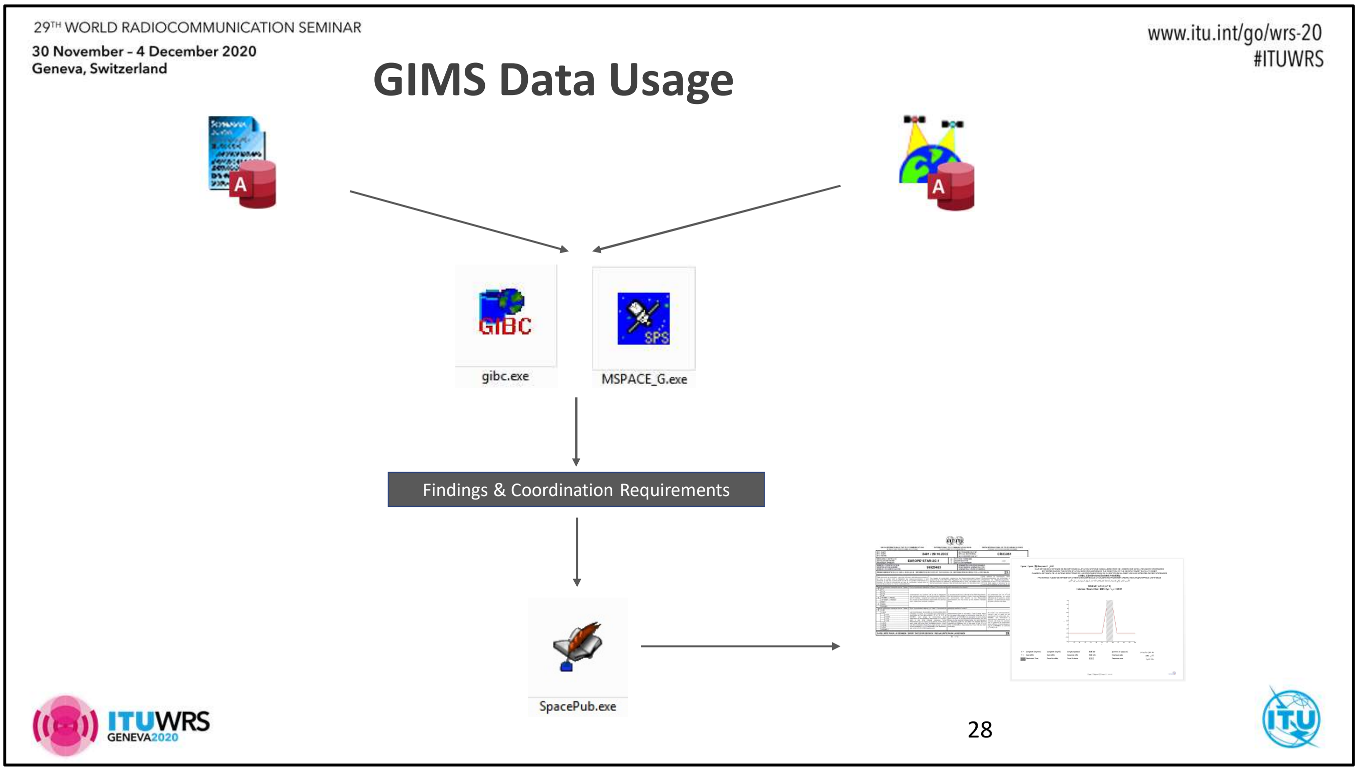
ITUWRS GENEVA2020

27

Work

Run the last cross-validation using the databases sns_sample.mdb and gims_sample_work.mdb

*Do you see "**Validation: no error**"? Congratulations ! Your data are ready to be submitted.*



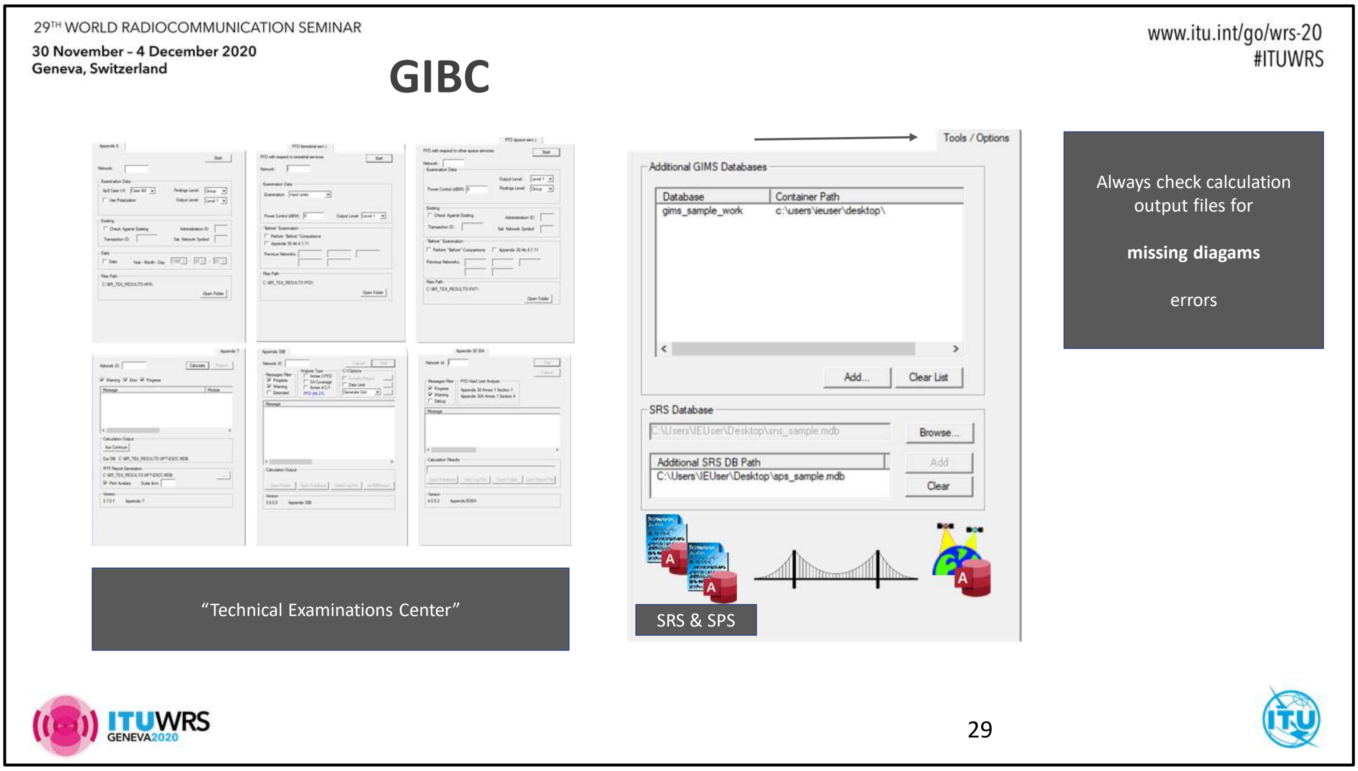
Your data are ready to be submitted… really ?

Now that they pass the basic and not so basic validation it's time to look at how the graphical data are being used by the BR and discover other software and GIMS features to help you get even more confidence about your data.

Once received, your data will be transferred in our master databases. They will be further validated with hidden BR-SIS Validation rules like the one described earlier. Finally they will go through various compatibility analysis software like GIBC and MSPACEg.

These *technical examination software*, as we use to call them, are designed to verify that your data do not exceed various limits defined in the RR. If the limits are exceeded and depending on the type of limit, "hard" or "trigger" limit, your network (or part of it) will be rejected or simply obliged to coordinate with a potentially long list of other administrations before you can go the notification stage.

The conclusions will be processed by SpacePub and published in Special Sections of the BR IFIC.



The technical examinations software that we use internally are made available as part of the Space Software suite.

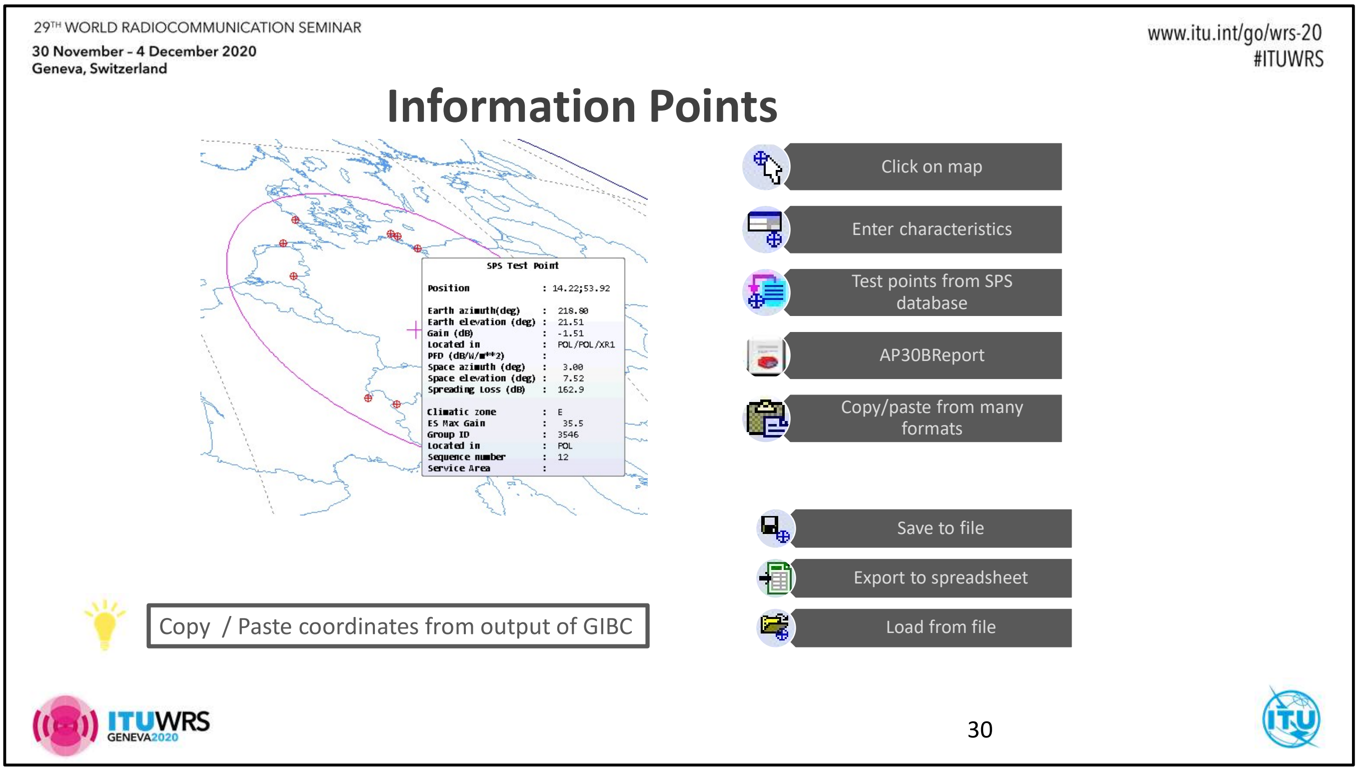
GIBC is really the “technical examination center” software from where most calculations may be performed. Only Mspaceg that is specific to the examinations of networks submitted in the planned bands of Appendices 30/30A is still a separate software.

This is not the purpose of this presentation to go into the details of the GIBC usage. However it is useful to talk about the interaction between GIBC and GIMS , which can at times bring its peculiarities.

Most GIBC tools need to have access to alphanumerical and graphical data. The **Tools/Options** tab of GIBC is where all databases are configured. Some examinations software will read alphanumerical data from both the SRS database (for non-planned bands data) and the SPS database (for planned bands data in AP30/30A). Hence the two database fields at the bottom of the screen. The top part is devoted to GIMS databases.

If you do not specify any GIMS database, Appendix 8 and both PFD calculations could report that they could not load diagram data required for their respective calculations. Make sure to **review the result files for such messages**.

You may provide several GIMS databases. Calculation programs look for the diagrams they need in each of them until one is found.
This mechanism was put in place to support reference GIMS databases (grefdbnnnn.mdb) that used to be read-only. Therefore the only way you could instruct the program to use diagrams that were not already in this master database was to store them in another database and add it to the list of additional databases.



Showing points on a GIMS map is the job of the Information Points feature. GIMS has a toolbar dedicated to information points actions. The slide shows the purpose of each of its buttons.

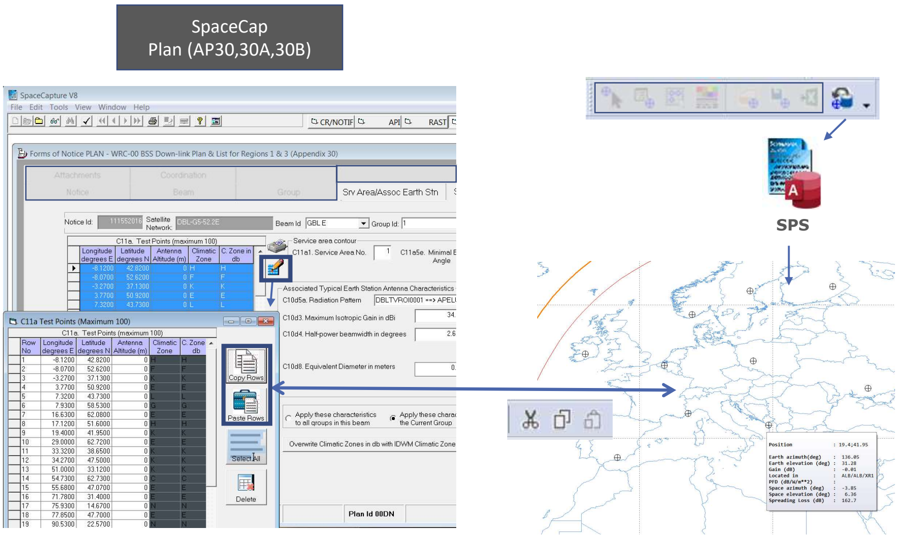
An information point can also be simply created by pasting a text representation of a coordinate copied from another source. A possible source could be the output files and databases of GIBC programs.

Test points from an SPS database can also be imported as information points. AP30BReport, which is the software you can use for querying AP30B analysis results, also makes use of information points.

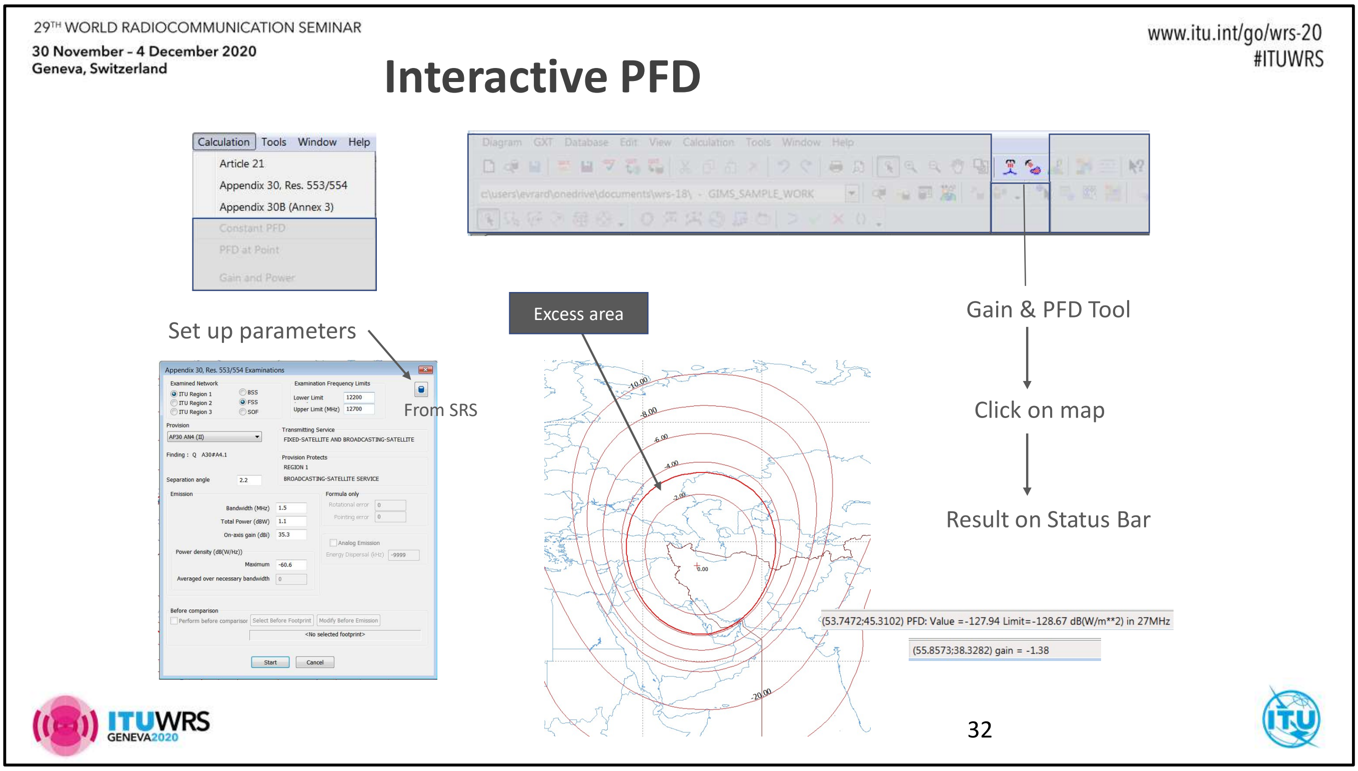
29TH WORLD RADIOCOMMUNICATION SEMINAR
30 November – 4 December 2020
Geneva, Switzerland

www.itu.int/go/wrs-20
#ITUWRS

Information Points & SpaceCap



You can copy test points captured in SpaceCap and paste them in GIMS. They will automatically be displayed as information points. The reverse is also possible and might be a handy way of creating your test points to be saved in an SPS database.

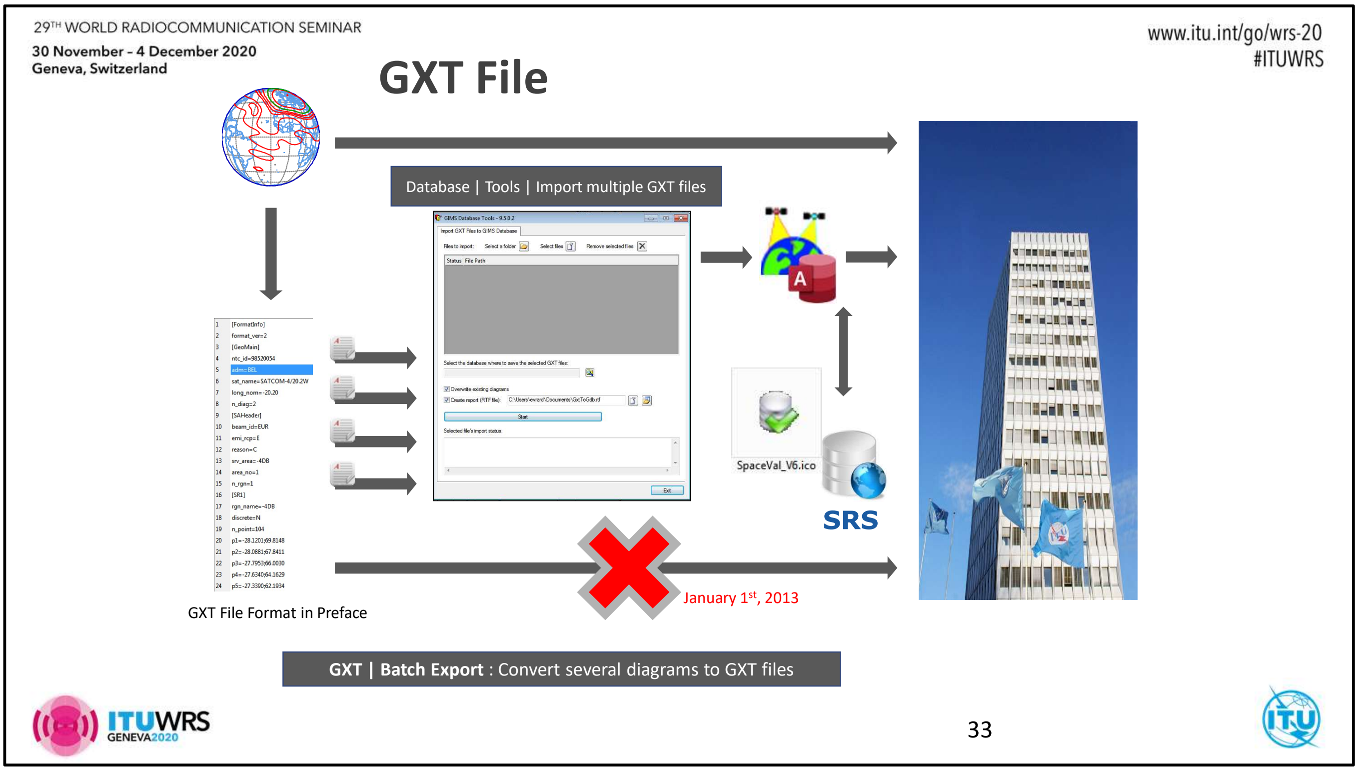


The PFD tools integrated in GIMS may be used to reproduce the PFD excess that was highlighted by the PFD analysis in GIBC. GIBC analyses all possible emissions of your network whereas you will use the GIMS PFD tool to show you the PFD produced by one emission.

Once all the emission parameters are set (some PFD tools allows for retrieving them automatically from SNS-V9 database), GIMS calculates the PFD values over the whole visible earth and shows the excess area. This might be a handy way of tailoring your beam to solve PFD excess.

The **Article 21** PFD tool corresponds to the GIBC/PFD(terrestrial serv.) analysis.
The **Appendix 30 Res 553/554** tool is the counterpart of the GIBC/PFD (space serv.) analysis.
The **Appendix 30B (Annex 3)** tool implements the limit of PFD of the Appendix 30B that are accessible in GIBC under the AP30B tab.

The gain and PFD mouse tools that can be activated in the GIMS main toolbar allows for clicking on the map and get the antenna gain or PFD value displayed in the status bar at the bottom-right of the screen.



We switch now to a different subject that will bring us back to validation issues.

Before 2013, the electronic submission of GIMS diagrams was done with GXT files. GXT files are text files containing the diagram data. The format is defined in the Chapter 2 of Section III of the Preface of the BR IFIC (https://www.itu.int/en/ITU-R/space/Pages/prefaceMain.aspx).

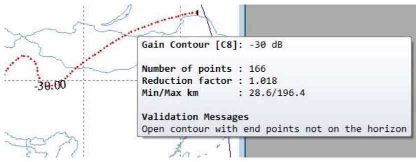
Now GIMS data must be submitted in a GIMS database. This allows us to implement a safe cross-validation. However it may sometimes be useful to work with GXT files especially because they are easy to generate programmatically and allow to edit graphical data in a simple text editor.

The screenshot in this slide shows the main window of a tool integrated in GIMS that helps you to import a set of GXT files into a GIMS database.

You might also be exposed to the GXT format when your diagrams are not valid.

GIMS Validation

- Integrated and invoked before diagram is saved
  - Diagrams in GIMS DB are valid
- Ensure correctness of diagrams
  - No looping/crossing gain contours
  - Visibility of points
- Ensure gain can be calculated
- Rules evolution
  - *Old diagrams might not pass but considered valid when saved without modification*
- Valid in GIMS – Fatal in BR-SIS Validation



TK1O	E		s_beam	f_steer	Y		512	3	F	B.1.C	xGIMS: 0dB contour is not provided in GIMS database

GIMS does not let you save diagrams without applying some validations.

Not all lines are eligible to be valid gain contours: they'd better not cross another gain contour or contain loops before they can be saved.

Other rules ensure the gain can be safely calculated. There is limit on the size of the diagrams in terms of number of points and number of contours over which the gain interpolation algorithm will not produce any value.

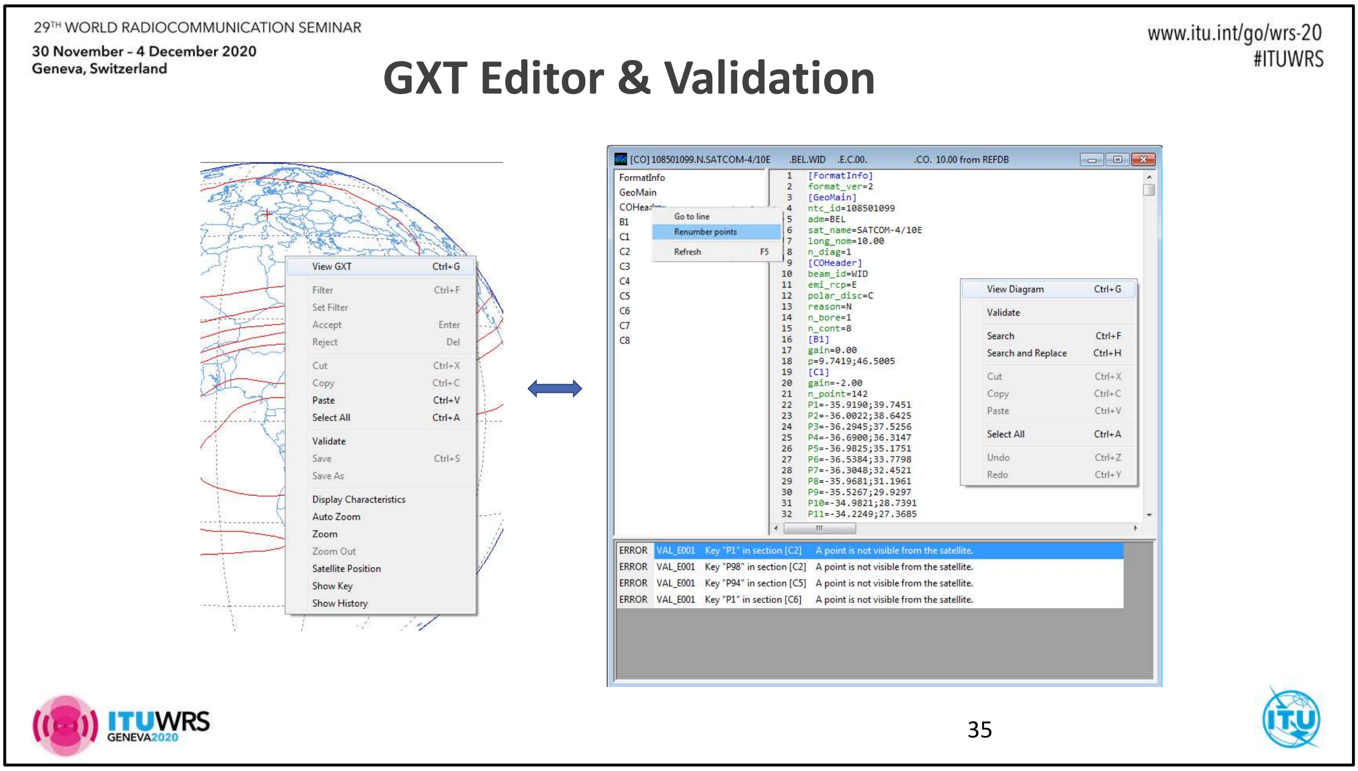
The GIMS validation, automatically triggered whenever one attempts to save a diagram ensures the integrity of the data in any GIMS database.

Validation rules evolved, and old diagrams may not necessarily pass the current rules. However as these diagrams were at some point in time considered valid, you may save them unchanged (for instance to transfer them from the master database to another personal database). But as soon as you change such a diagram, the validation is triggered, and you would have to correct it before it can be saved.

Some validation rules are shared between GIMS and the BR-SIS Validation cross-validation. However what BR-SIS Validation considers as a fatal error might not be noticed by the GIMS validation.

A typical example is the steerable beam related error that we encountered previously.

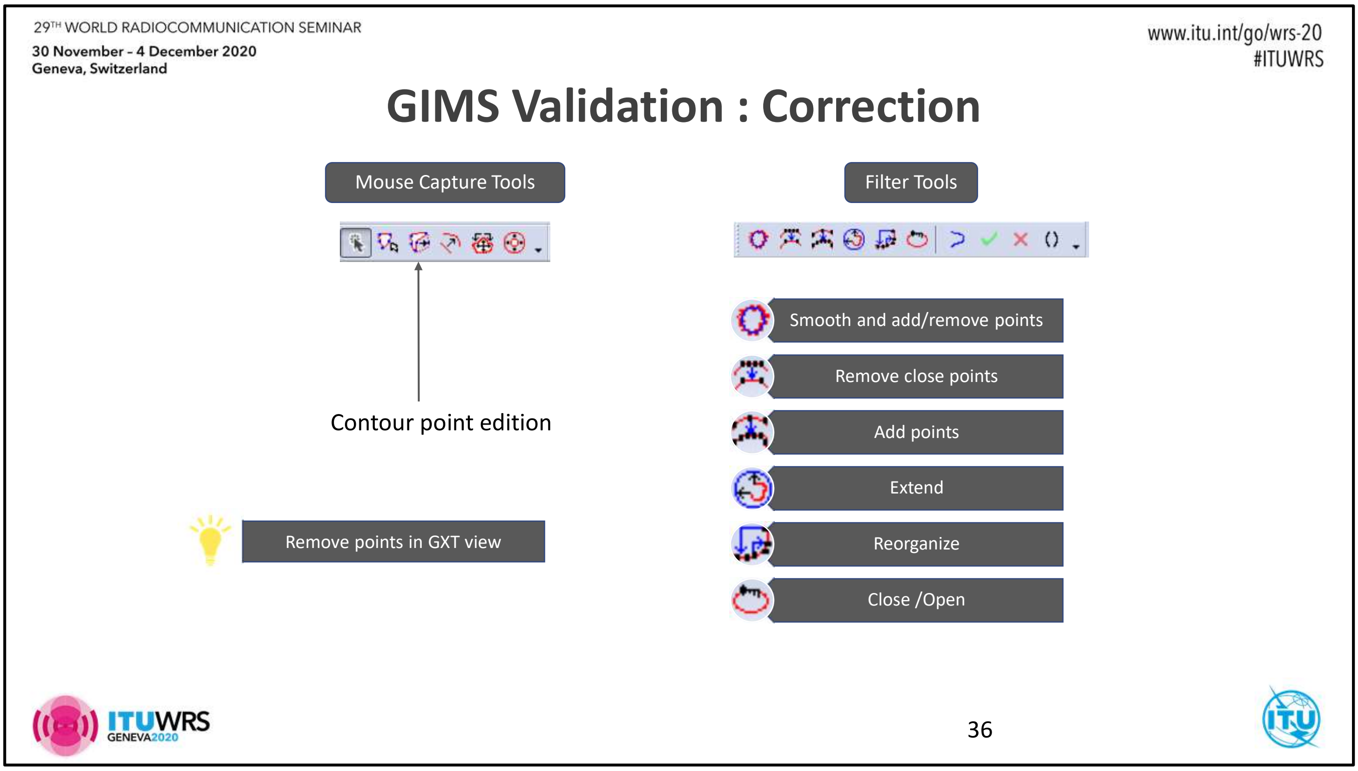
In GIMS there is no concept of steerable beam and as such , the diagram that triggered the fatal cross-validation error was a perfectly valid diagram (gain could be calculated). BR-SIS Validation knows that this beam was flagged as steerable in the SNS database and it can therefore add an extra validation layer to the GIMS diagram and report it as invalid.



Some validation errors are interactively displayed on the diagram window; the wrong contours are displayed with a different line style and the error message is displayed in the contour tooltip.

The integrated GXT editor is also used to show all validation messages and can be used to change the diagram's points to correct errors.

The way points are described in the GXT format, with the initial point index "Pi=", is not always very practical to add or remove points as we should renumber all points below. The "COHeader" section on the left windowpane has a context menu with the "Renumber points" item. This allows you to add/remove points without take care of setting the right point index value. Then, in the end just "Renumber points".



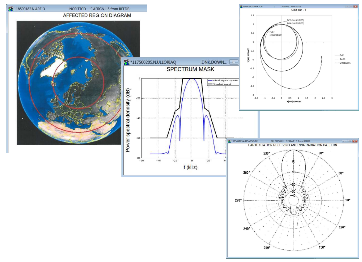
To correct validation errors the filter tools may often be helpful and of course the mouse capture tools that allow to change contours shape can help as well.

29TH WORLD RADIOCOMMUNICATION SEMINAR
30 November - 4 December 2020
Geneva, Switzerland

www.itu.int/go/wrs-20
#ITUWRS

NGSO Diagrams

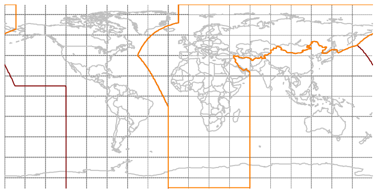
Stored as pictures



- Space Station Radiation Pattern (B3c1)
- Earth Station Radiation Pattern (C10d5a)
- Antenna Gain vs Elevation Angle (B4b2)
- Service Area (C11a)
- Spectrum Mask Diagram (C9c2)
- Affected Region (C11b)

In GIMS 13

Service areas
defined by
geographical areas
may be captured



- Publication automation
- But not useable by other software

ITUWRC SHARM EL-SHEIKH2019

Mandatory electronic submission

ITUWRS GENEVA2020

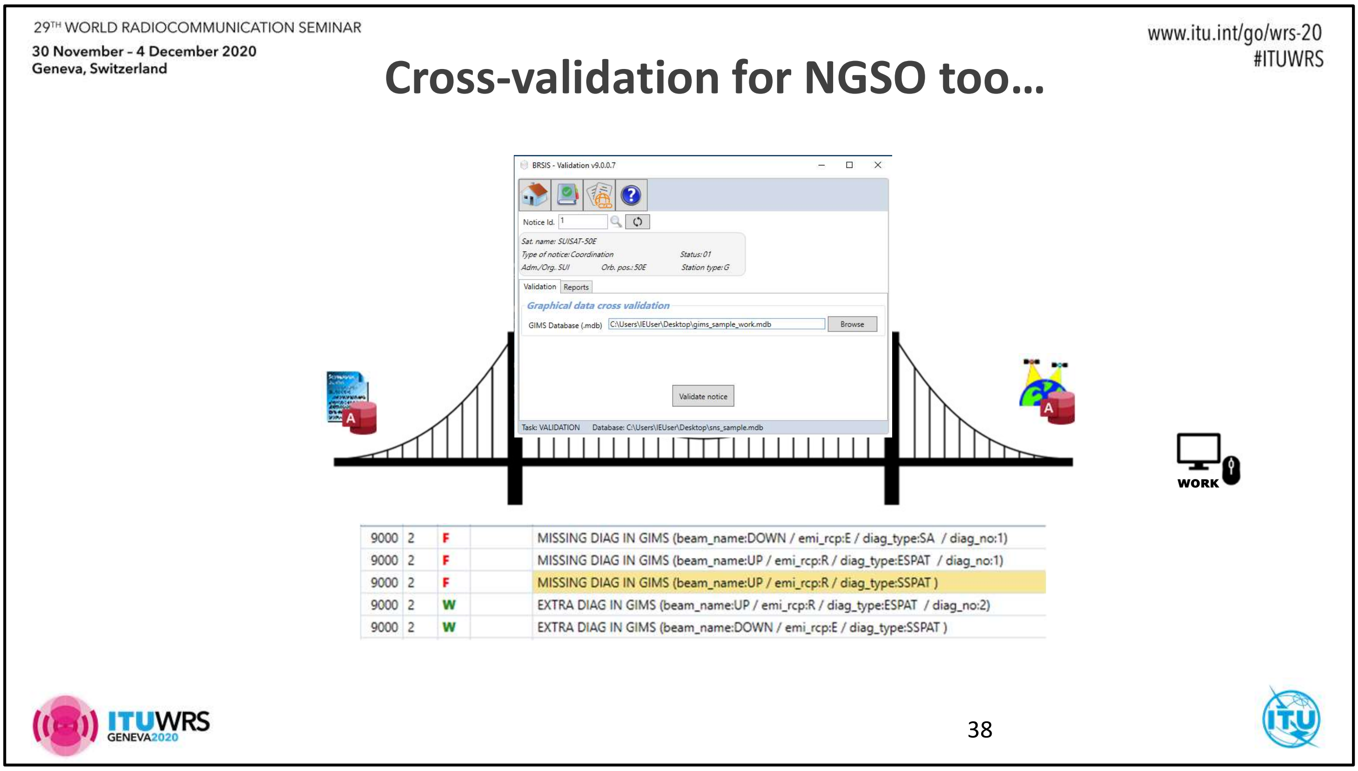
37

For the past few years, diagrams related to NGSO satellites have also been stored in the GIMS database. Most of them are saved as pictures. This was helpful for us to automate the integration of these diagrams into the publications. But as pictures, this was pretty much their only use.

Since WRC-19 made it mandatory to submit all diagrams electronically with GIMS, having them stored as pictures allows to easily fulfill this recent requirement.

Little by little we will provide the possibility to capture NGSO diagrams as “real” diagrams whose data could then be re-used by other software components. The most important ones being the technical examinations software.

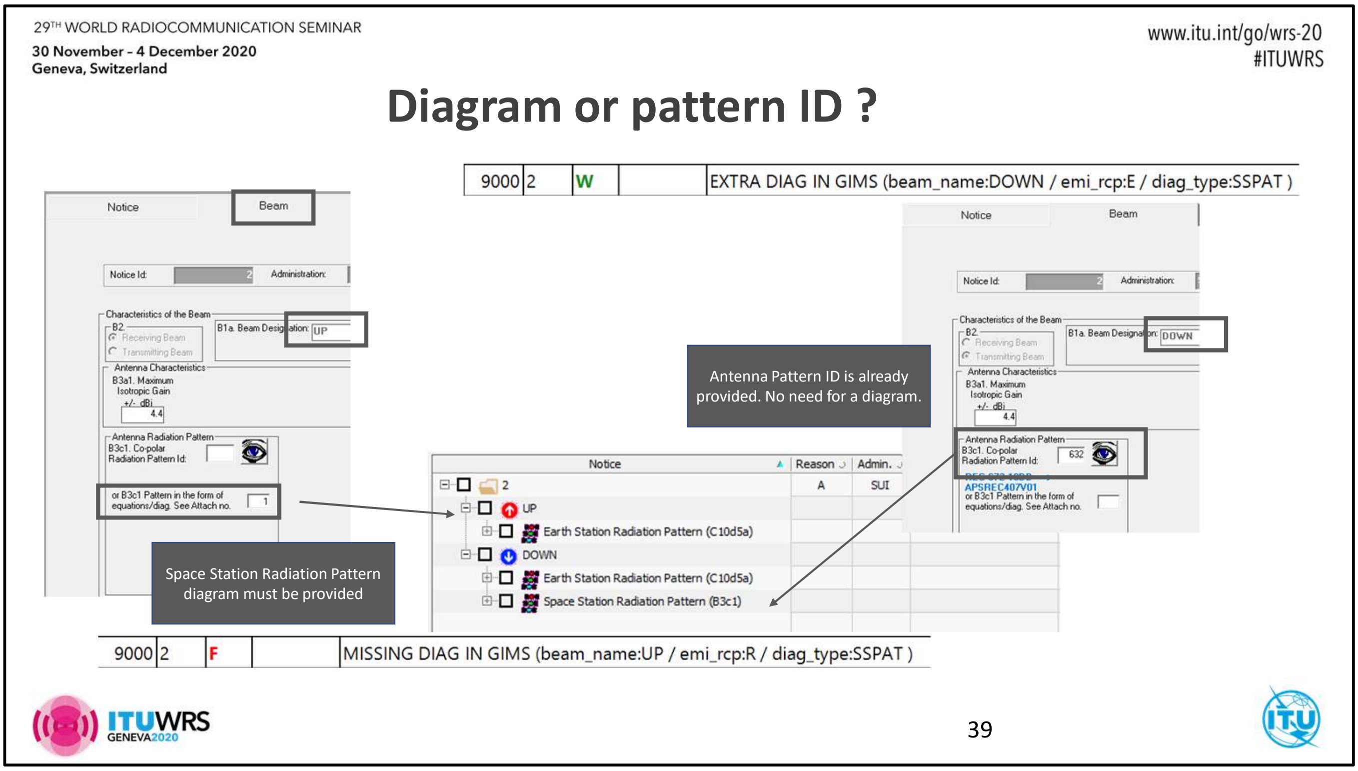
The first NGSO “real” diagram was introduced with GIMS v13: service areas, defined by geographical areas, can now be captured.



Since it is now mandatory to submit NGSO diagrams in a GIMS database, BRSIS-Validation needed to be ready to run cross-validation for NGSO diagram data item. Guess what? It is ready.

Work

The sns_sample.mdb contains an NGSO network with notice ID 2.
Use BR-SIS Validation to cross-validate this network with gims_sample_work.mdb.
As a result, you should get 4 messages related to diagram data



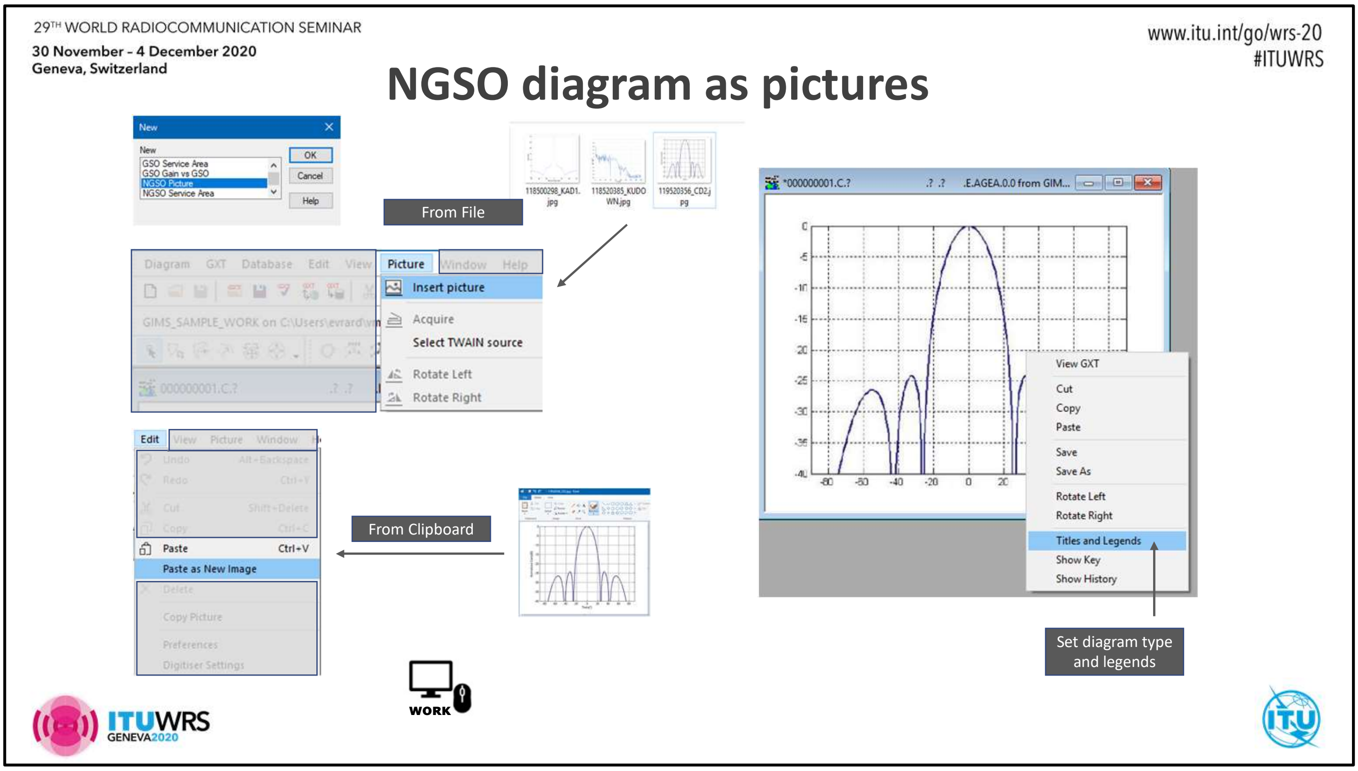
Let’s first discuss the validation message related to space station radiation pattern (SSPAT) diagram.

In SpaceCap, to fill the Antenna Radiation Pattern field at the beam level, we have two possibilities.

1. Provide the ID of a pattern by choosing it from a list of a “standard” patterns.
2. Provide the number of the attachment containing the description of the pattern.

If we choose a pattern ID then there is no need to provide a diagram. This is the cause of the warning message for the beam DOWN.

If you specify an attachment number, it should now refer to a GIMS database and therefore a corresponding diagram should exist. As you can see, there is no SSPAT diagram attached to the beam UP in the GIMS database, hence the fatal error message.



To fix the validation errors related to SSPAT diagram let's capture such a diagram in the form of a picture.

Work

*Click the menu item **Diagram | New** and choose "NGSO Picture". Click the OK button.*

*In the **Picture** menu choose **Insert Picture**.*

Select the file sspat.jpg

*Right-click the diagram and choose the menu item **Titles and Legends**.*

Select the Diagram Type : Space Station Radiation Pattern (B3c1)

Type in this title : SPACE STATION TRANSMITTING ANTENNA RADIATION PATTERN

Set X Axis Legend to : Phi (deg)

Set the Y Axis Legend to: Gain (dBi)

Click OK

Ensure that gims_sample_work is the current database (i.e. the one selected in the database list of the database toolbar)

*Select **Diagram | Save As** and enter the following diagram key elements:*

Notice ID : 2

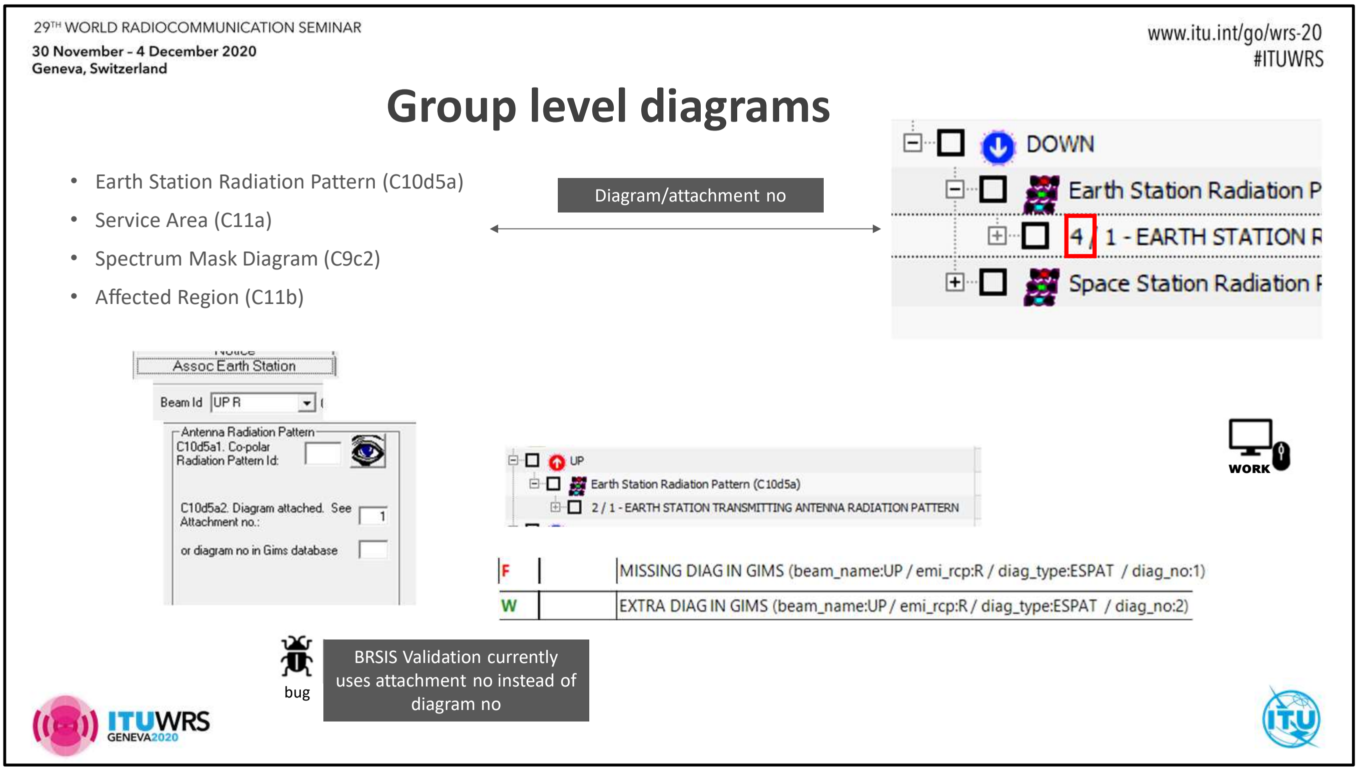
Notification Reason : A (Advanced Publication)

Administration : SUI

Satellite Name : SUISAT-NGSO
Beam Name : UP
Emission/Reception : R
Sequence Number : 1
Click the Save & Close button.

Note that as this is a beam level diagram, you were not asked to provide a diagram number.
The sequence number allows to save several pictures for representing one diagram.

Work
Let's now delete the extra SSPAT diagram.
Ensure that gims_sample_work is the current database
*Select **Database | Explore***
Expand the notice number 2 branch and then the DOWN beam branch.
Select "Space Station Radiation Pattern" and right-click.
*Choose **Remove** and confirm the removal.*
Run again the validation using sns_sample.mdb and gims_sample_work.mdb and verify that the messages related to SSPAT diagram have disappeared.



In the SNS-V9 structure, some diagram data items are attached to a group “below” the beam level, or to a group related table. Earth associated stations (in the table e_as_stn) are linked to a group. We have already mentioned that since GIMS has no concept of groups we must use a diagram number to properly link the diagram to its group.

The validation messages related to Earth Station Radiation Pattern (ESPAT) diagram illustrate this issue.

It is important to note that as this is written BRSIS Validation WRONGLY uses the attachment number to validate the relation between SNS-V9 database and GIMS. This should be fixed.
Furthermore, since the attachment should always be a GIMS database, the attachment number now becomes useless and will be removed in SNS-V9.1 to only leave the diagram number.

Like for SSPAT diagrams, you may also choose to define the Antenna Radiation Pattern with a built-in antenna pattern, and you will then set the pattern ID field. In that case you should not provide any diagrams.

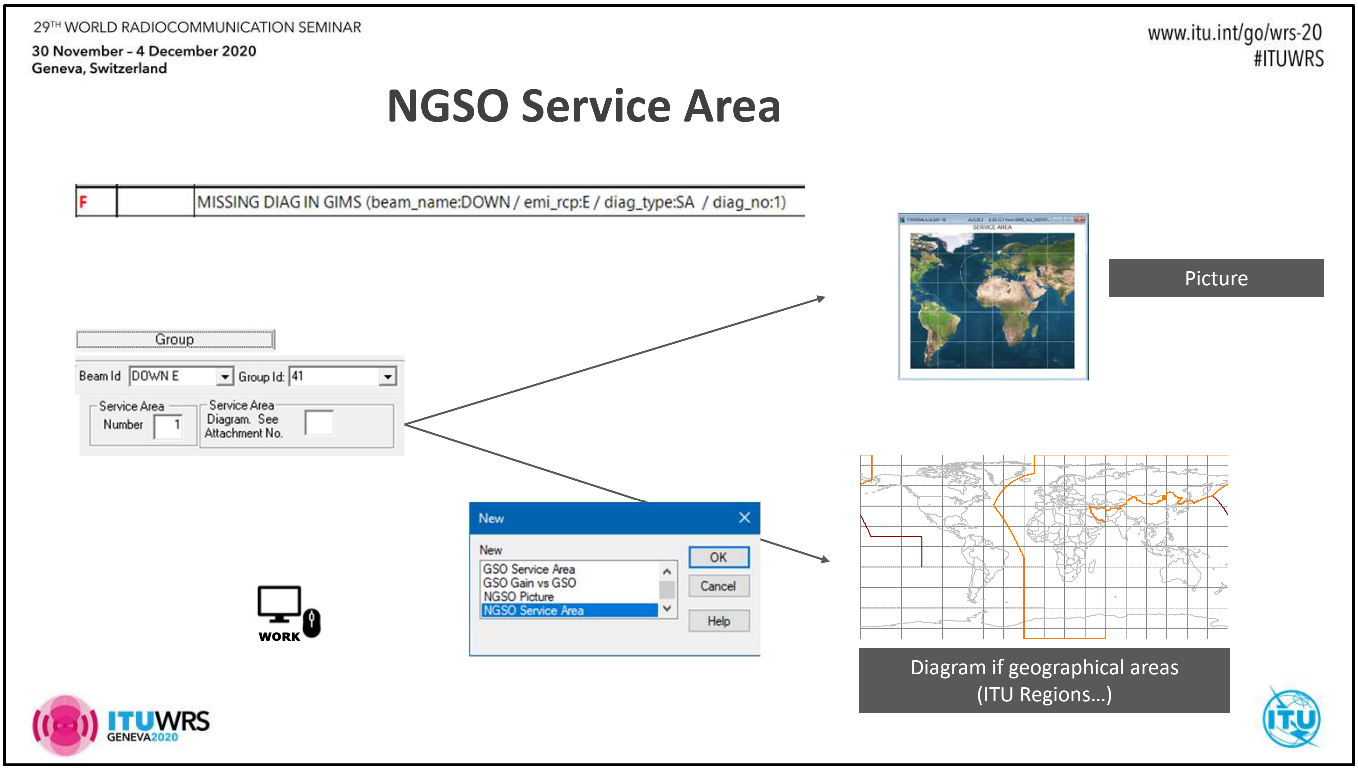
Work
Let’s change the diagram number of the ESPAT diagram of the UP beam

*Open the database explorer and open the earth station pattern diagram of the UP beam (menu **Database | Explore**, check the box on the left of the item "2/1-EARTH STATION….", click OK)*
*Select the menu item **Diagram | Save As**.*
Set the Diagram Number field to 1 and click the button "Save & Close"

Re-open the database explorer.

Select the item "2/1-EARTH STATION…." of the UP beam
*Right-click and choose **Remove**. Confirm the Removal.*

Run again the validation using sns_sample.mdb and gims_sample_work.mdb and verify that the messages related to ESPAT diagram have disappeared.



In the group 41 of the DOWN beam we set the service area number to 1. This implies that one should have provided a service area diagram for this beam. Therefore let's see how to capture a service area defined by gepgraphical areas.

Work

*In the **Diagram** menu select **New** and choose "NGSO Service Area". Click the OK button.*

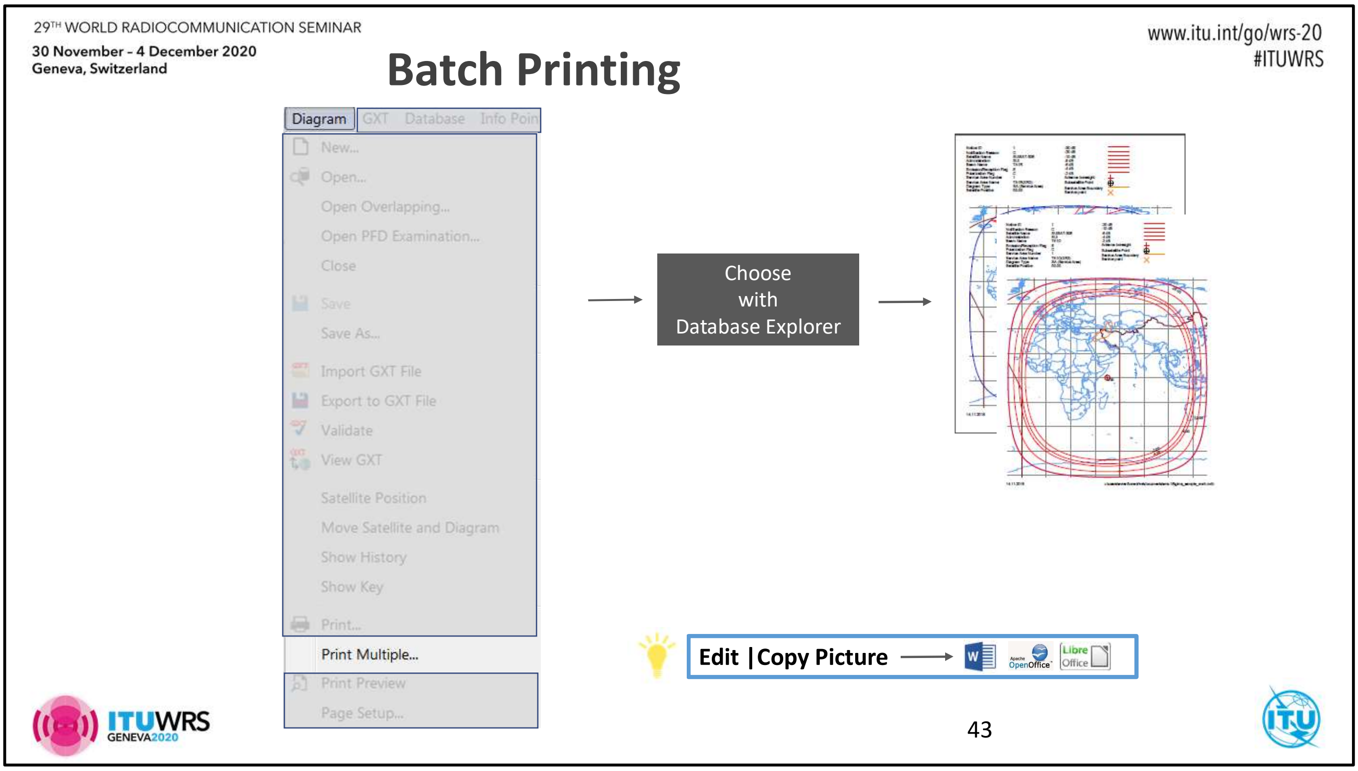
*In the **Capture** menu, select **Service Region | As worldwide area.** Choose the XAA and click OK.*

*In the **Capture** menu, select **Service Region | By Geographical Areas**.*

> *Select country codes and click on **the right arrow with the red cross to exclude** the selected countries from the service area.*

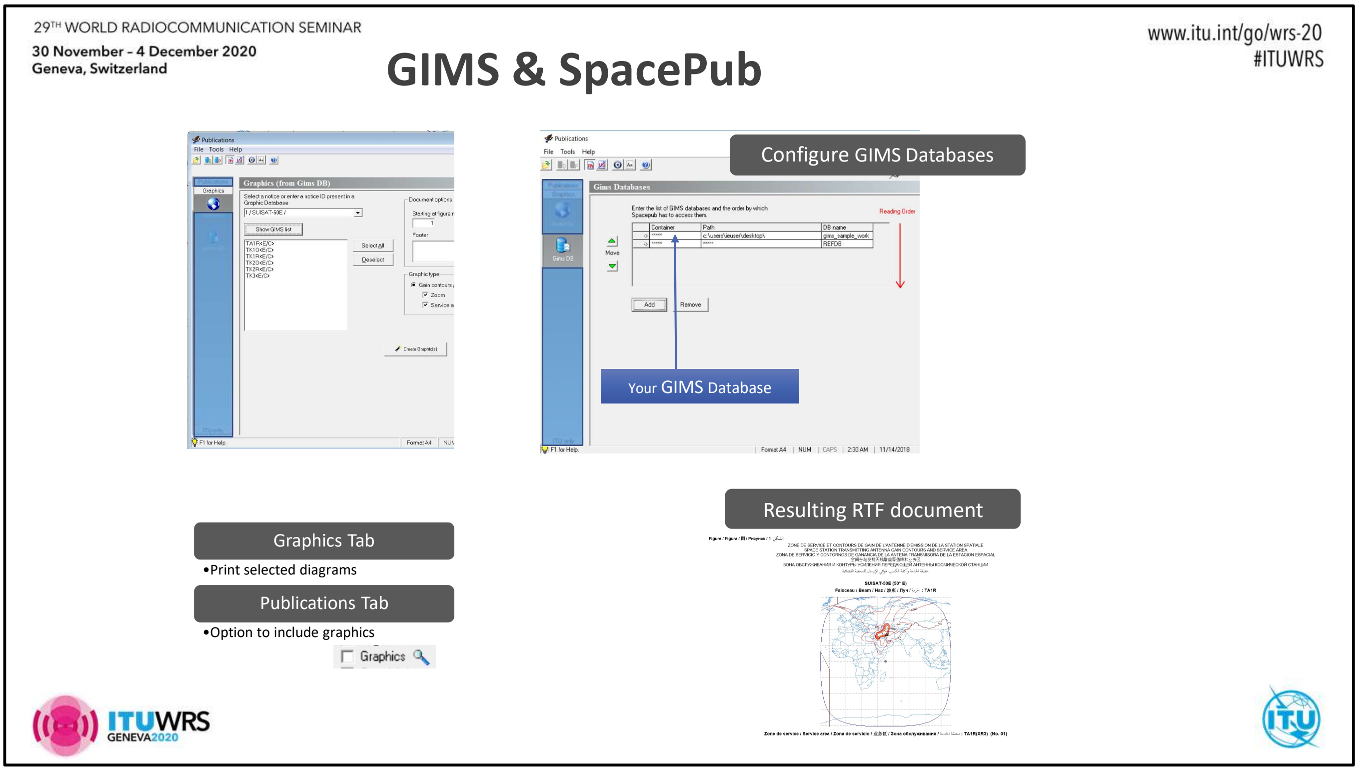
Save the diagram with a diagram number set to 1.

Run again the validation using sns_sample.mdb and gims_sample_work.mdb and verify that the messages related to the cross-validation have disappeared.



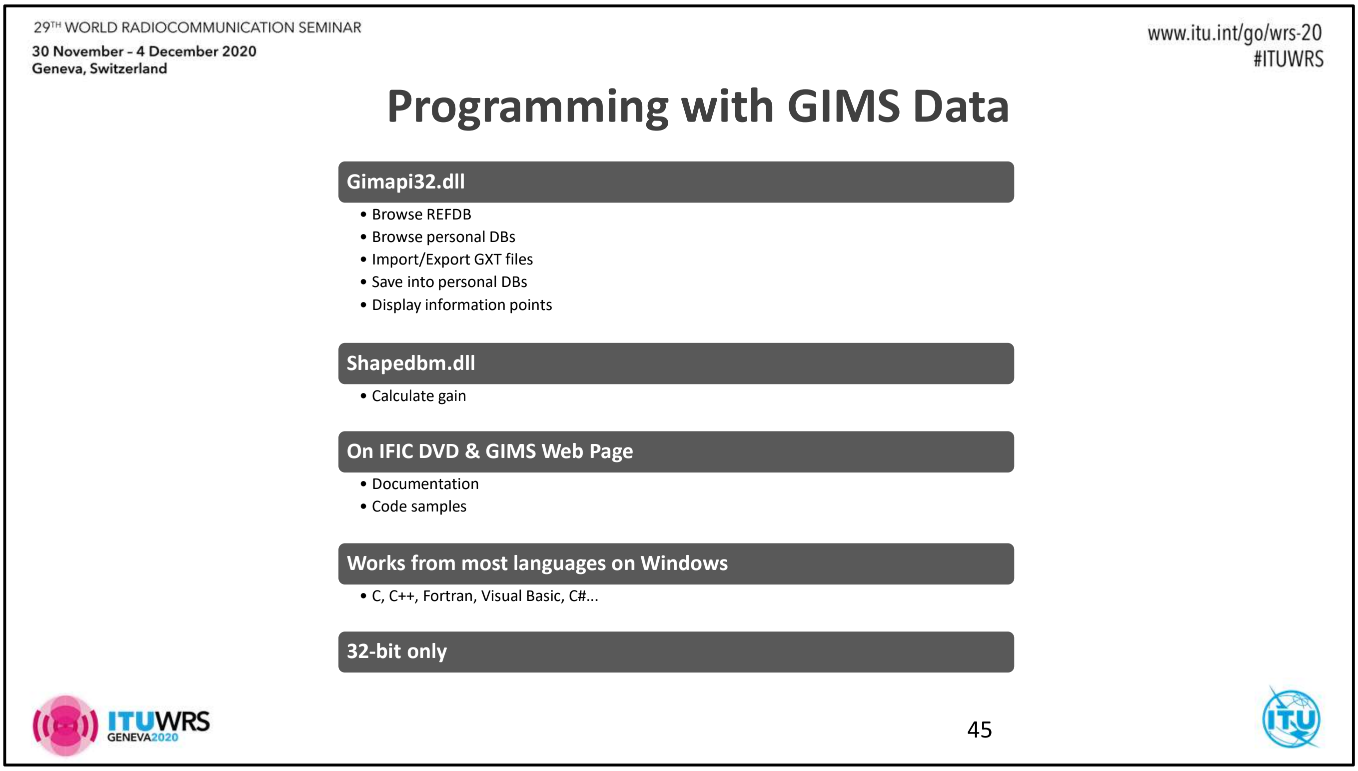
If diagrams can of course individually be printed, the **Print Multiple** feature under the **Diagram** menu allows for selecting several diagrams that will be printed in batch.

To insert a diagram's picture into another document you can use the **Copy Picture** facility under the **Edit** menu.



Printing of diagrams may also be done with SpacePub. The **Graphics** tab allows for selecting diagrams of a particular network and create an RTF document.

The **GIMS DB** tab allows for adding your personal GIMS databases for printing diagrams that would not already be in grefdbnnnn.mdb as distributed on the BRIFIC.



We provide two libraries for working with GIMS data.

The GIMAPI32 library exposes functions for browsing the database and import/export GXT files.

The SHAPEDBM library can be used to get access to the GIMS interpolated gain values.

More information…

ITUWRS
GENEVA2020

- **Download**
  https://www.itu.int/en/ITU-R/software/Pages/space-network-software.aspx
- **Tutorial**
  https://www.itu.int/en/ITU-R/software/Pages/gims_tutorial.aspx

brsas@itu.int