Dot Configuration with the Dot Cockpit

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Introduction
Traditionally, protocols for patient examinations were mostly based on the expected pathology, for example in the brain: standard, MS, trauma, tumor and so on. There was a similar approach to the other body parts. Hence the protocols for each pathology were stored in a folder, in a more or less ‘tree-like’ structure. The image quality could be greatly hampered if patient movements were substantial, as with Parkinson’s patients, or those with claustrophobia. It was up to the user to find appropriate protocols, to adjust the protocol or to find alternatives. In 2009 Siemens introduced a whole new approach to scanning patients with the release of the syngo MR D11 software for the MAGNETOM Aera and Skyra systems. This was the 3rd generation of automation in scanning software (see Fig. 1).

This also introduced a new way of configuring patient examinations. Before the syngo MR D11 software release, the set of protocols (program) used to examine a patient was solely based on the expected pathology, without taking into account the patient’s condition, like level of cooperation or claustrophobia. With the introduction of Dot engines, the examination could be customized (personalized) based also on, for example, the patient’s condition. With ‘the flick of a switch’ you could change, for example, from the standard to an uncooperative examination strategy. By using strategies within a Dot engine the exam could be easily tailored to the patient’s condition if required. Furthermore, additional functionalities were introduced, such as AutoAlign in several body regions, or Auto Bolus detection. The main goals shared by the Dot engines are standardization, consistency and efficiency. All tools included in the Dot engines are designed to streamline the workflow throughout an examination.

DotGO
DotGO has been introduced in the latest release of the syngo MR E11 software and is based on the experiences of our customers with the Exam Explorer in the syngo MR software and in particular with the Dot engines in the previous software versions (D11 and D13). Standard now with the E11 software is the Dot Cockpit, which replaces the Exam Explorer. The Dot Cockpit overcomes the existing limitations of configuring patient examinations and Dot engines.

Because the initial release of the Dot engines was built on the existing Exam Explorer, there were some limitations/restrictions in the way we...
could configure Dot engines. For many users this meant that their configuration was quite complicated and/or time consuming. Both the complexity and the time aspect have been addressed in the syngo MR E11 software. This article describes the way we configure Dot engines in the new E11 software as compared to the D13 software.

### Dot Cockpit
The new Dot Cockpit is your central interface for all protocol management tasks. This includes flexible configuration of all Dot engines, according to your standards of care. The Dot Cockpit replaces the Exam Explorer and enables you to configure all of your MRI protocols – Dot or non-Dot protocols alike – and all of your Dot engines. You can create a Dot engine within minutes, with simple drag & drop. In the section headed “Dot configuration with syngo MR E11” we explain how to create a Dot engine step-by-step. But first let’s briefly discuss how Dot engines were created with the syngo MR D13 software.

### Dot Configuration with syngo MR D13
The steps describe the creation of the standard Brain Dot Engine as came with the 1.5T MAGNETOM Aera and 3T MAGNETOM Skyra scanners on the syngo MR D13 software. This standard Brain Dot Engine uses four different strategies and one patient context decision for contrast. Table 1 shows the different protocols per strategy.

These are the steps required to create such a Dot engine from the start:

1. Insert a Neuro patient view (creates the four strategies and patient context decision as described in table 1)
2. Add a Clinical Decision point called ‘MPR Planning’
3. Insert six strategy branches for each protocol pre contrast (protocol 1–6)
4. Insert a Patient Context Decision for contrast administration
5. Insert a strategy branch for protocol 7–8
6. Insert a Clinical Decision called MPR Planning and attach the Dot AddIn ‘MPR Planning’ to it for the 3D protocols in the Resolution Focus strategy
7. Now copy all the different protocols in the respective folders
8. Attach a Generic View AddIn to all the protocols and make sure they are configured properly
9. As for the 3D protocols, make sure the MPR planning is configured properly and then assign the MPR assignment to the 3D protocols selecting the correct orientations
10. Test all the protocols in the ‘simulation mode’

### Table 1

<table>
<thead>
<tr>
<th>Standard</th>
<th>Resolution Focus</th>
<th>Speed Focus</th>
<th>Motion-insensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAHead Scout</td>
<td>AAHead Scout</td>
<td>AAHead Scout</td>
<td>AAHead Scout</td>
</tr>
<tr>
<td>t1_se_sag_320</td>
<td>t1_space_sag_iso</td>
<td>t1_fl2d_sag</td>
<td>t1_blade_sag_dark-fluid</td>
</tr>
<tr>
<td>t2_tse_tra_p2</td>
<td>t2_spc_sag_p2_iso</td>
<td>t2_haste_tra_p2</td>
<td>t2_blade_tra_p2</td>
</tr>
<tr>
<td>t2_tirm_tra_dark-fluid</td>
<td>t2_spc_da-fl_sag_p2_iso</td>
<td>t3_tirm_tra_dark-fluid_p3</td>
<td>t2_blade_tra_dark-fluid</td>
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<tr>
<td>ep2d_diff_3scan_trace_p2</td>
<td>ep2d_diff_3scan_trace_p2</td>
<td>ep2d_diff_3scan_trace_p2</td>
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</tr>
<tr>
<td>t1_se_tra_320</td>
<td>Mpr planning for 3D</td>
<td>t1_fl2d_tria</td>
<td>t1_blade_tria_dark-fluid</td>
</tr>
<tr>
<td>contrast agent</td>
<td>contrast agent</td>
<td>contrast agent</td>
<td>contrast agent</td>
</tr>
<tr>
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<td>t1_space_sag_iso</td>
<td>t1_fl2d_tria</td>
<td>t1_blade_tria_dark-fluid</td>
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<tr>
<td>t1_se_cor_320</td>
<td>t1_fl2d_cor</td>
<td>t1_blade_tria_dark-fluid</td>
<td></td>
</tr>
</tbody>
</table>

Overview protocols of the Dot engine.
Figure 2 shows how the configuration would look like in the syngo MR D13 software.

Even for this relatively simple Dot engine it is difficult to present an easy overview of the complete Dot engine. In the next section we describe the configuration using the Dot Cockpit of software syngo MR E11.

Dot configuration with syngo MR E11

The new structogram view of the Dot Cockpit enables you to see the whole exam workflow. The different strategies, decisions, the branches and protocols are shown in a similar way as in table 1. Let’s create the same Dot engine with syngo MR E11 as discussed in the previous section with syngo MR D13.

As a start we create four strategies by dragging a strategy into the program (Fig. 3), and rename the strategies ‘Standard’, ‘Resolution focus’, ‘Speed focus’ and ‘Motion-insensitive (BLADE)’.

We need to insert the AAHead_Scout protocol, which can be found easily by using the built-in search functionality (Fig. 4). You can type in any string for the protocol you are looking for and it will show all protocols matching the keywords in the tree (SIEMENS) we are searching in. It will show also the program name where this protocol has been found. In this case it is AAHead for finding all the Auto Align scouts.

Now we can drag-and-drop this AAHead_Scout into the Standard strategy (Fig. 5).
Since this is a protocol that we want to run in any of the strategies, we could use the Expand option (under the right mouse button) rather than copy the AAHead_Scout in each strategy (Fig. 6). This reduces the number of protocols in the Dot engine. The result is shown in figure 7. The AAHead_Scout is now a single protocol for all strategies. Now we can add all the other protocols (prior to contrast) into the respective strategies. This is achieved very quickly using the search option on the right side. Just by typing a few keywords, we can find the protocols that we need (Fig. 8).

After we have added all of the protocols the Dot engine looks like figure 9. Please note that the ep2d_diff_3scan_tra_p2 is also expanded since this protocol is used in all strategies just like the AAHead_Scout. In the ‘Resolution focus’ strategy an MPR planning has also been added. The MPR planning can be found using the Search functionality as well.

The next step in configuring the Dot engine is to configure the contrast agent administration. In syngo MR E11 we can also drag-and-drop decisions from another Dot engine by searching for the keywords ‘head dot con’, see figure 10. This contrast decision is then added to all four strategies.

After we have added the contrast decision in all four strategies, the Dot engine would look like what is shown in figure 11.
Now that we have a contrast decision in all of the strategies, we put in the additional pre-contrast protocols, the ‘inject contrast agent’ pause and the post contrast protocols (Fig. 12). Please note that we leave empty ‘cells’ where there is no equivalent for a protocol in certain strategies, like MPR planning in the Resolution focus, but not in any of the others. Or the pre contrast t1 is not available (needed) in the ‘Resolution focus’ strategy, whereas there is one in all other strategies. This enables us to keep a clear overview of the Dot engine and identify the differences between the strategies.

What’s left is to configure the MPR planning to have the presets that we normally want to have there, like FOV, slice thickness, spacing and the use of AutoAlign (Fig. 13).

Next, we need to select in the MPR Assignment of the 3D protocols the reconstruction that we require, in this case tra, cor or both (Fig. 14).

Now that we have configured everything we can switch to the simulation mode and see how everything will work when we select different strategies, without or with contrast selected. This can be easily controlled and viewed on the right side of the window or by selecting the strategy in the structogram including the contrast agent decision. Figure 15 shows the simulation mode for the Speed focus strategy and no contrast selected and figure 16 shows the same strategy (Speed focus) but now with the contrast selected. The structogram shows the selected strategy and protocols in a slightly brighter color than the others, whereas the right side of the screen shows which protocols would be visible in the queue, including the total time for the program.

One other feature to point out is that the Dot Cockpit recognizes which protocols have exactly the same configuration as the one we are editing. This is indicated by the “8 identical” in this case: Even if the name is different, identical protocols are found (Fig. 17). When we select this, a window on the right will appear with not only the
identical protocols (first column with checkboxes), but also the identical Dot AddIns (second column with checkboxes). It could also be that whilst the protocol is identical, the Dot AddIn is not, or the protocol is different and the AddIn configuration is identical. By selecting the protocols or AddIns on the right, any changes that we make to either the protocol or the AddIn will also be applied to the selected protocols. This makes protocol management much easier and faster. Here we need to change just one protocol in order for eight other protocols and eight AddIns to be changed automatically.

Conclusion

In this article we have shown how the Dot Cockpit helps you to configure Dot engines in a much easier and faster way than before. The new Dot Cockpit allows for the creation of Dot engines within minutes. This would even allow for the creation or adjustment of Dot engines in between patients. The new structure overview gives a comprehensive overview of the complete Dot engine. In figure 18 it is shown how easy it is to obtain an overview of the entire Dot engine in syngo MR E11 as compared to syngo MR D13 (Fig. 19).