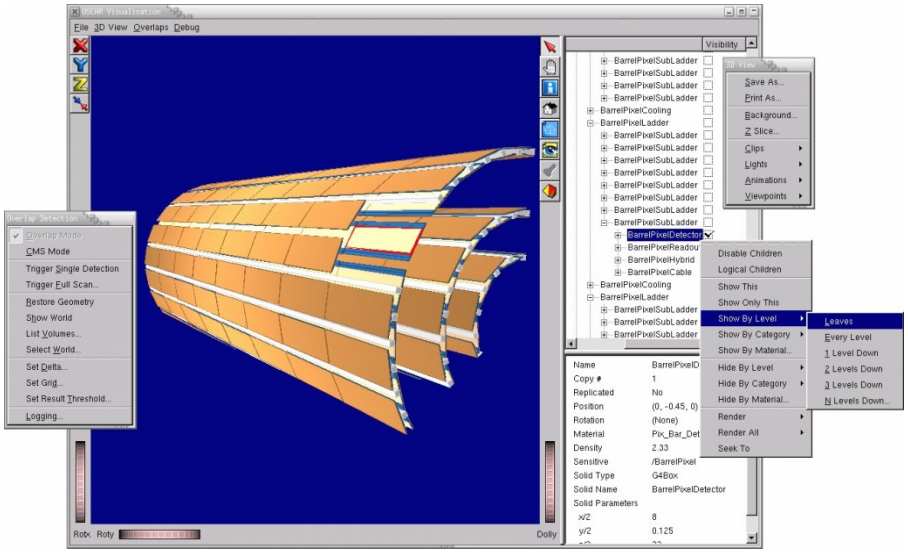
Geant4 (G)UI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CMS Mode
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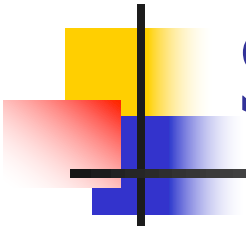


Steering the simulation - 1

- A Geant4 simulation can be **steered in three ways**:
  - everything hard-coded in the C++ source (also the number of events to be shot). You need to re-compile for any change (not very smart, actually!)
  - batch session (via an ASCII macro)
  - commands captured from an interactive session

Steering the simulation - 2

- Setting up batch mode (namely, read commands from a macro file) in the **`main()`**

```
G4UImanager* UI = G4UImanager::GetUIpointer();
G4String command = "/control/execute";
G4String fileName = argv[1];
UI->ApplyCommand(command+fileName);
```

takes the first argument after the executable as the macro name and runs it

- Your executable can be run as

```
myExecutable mymacro.mac
```

- To execute a macro interactively:

```
/control/execute mymacro.mac
```

Steering the simulation - 3

- Setting up **interactive mode** is also easy – but there are many choices of interface
  - All of them must be derived from the abstract class `G4UIsession`
  - Geant4 provides several implementations
- In the `main()`, according to the computer environments, construct a `G4UIsession` concrete class provided by Geant4 and invoke its `SessionStart()` method
  - The `G4UIExecutive` takes care of selecting the most appropriate UI given the system environment
    - GUI's are given higher priority, terminal-like lower priority

Select G(UI)

- Geant4 provides several interfaces for various (G)UI:
  - **`G4UIterminal`**: C-shell like character terminal
  - **`G4UItcsh`**: tcsh-like character terminal with command completion, history, etc
  - **`G4UIGAG`**: Java based graphic UI (GUI)
  - **`G4UIXm`**: Motif-based GUI, command completion
  - **`G4UIQt`**: GUI based on Qt libraries
- Define and invoke them like `G4UIterminal`

```
session = new G4UIGAG();
session->StartSession();
```

- Or (better) use the **`G4UIExecutive`**

An example of interactive session – let G4UIExecutive choose

- For instance: in the **`main()`**

```
G4UIExecutive* session =
  new G4UIExecutive(argc, argv);
```

Create an instance of the G4UIExecutive

```
if (argc==1)
 {
   session->SessionStart();
   delete session;
 }
```

If there are no arguments after the executable, starts an interactive session

Start the session → gives the prompt

Don't forget to delete it

On my system:

```
Available UI session types: [Qt, GAG, tcsh, csh]
```

An example of interactive session – you make the choice (v. 1)

- You can drive the choice of the **`G4UIExecutive`** at run-time

```
Available UI session types: [GAG, tcsh, csh]
```

- If you do not want GAG (highest priority) and you want TCSH:

```
unset G4UI_GAG_USE
export G4UI_TCSH_USE=1
```

An example of interactive session – you make the choice (v. 2)

- For instance: in the `main()`

```
G4UIsession* session=0;
```

Create a (null) pointer to the base session class

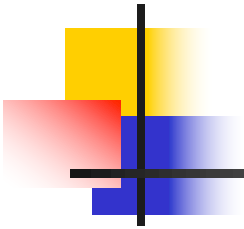
```
if (argc==1)
 {
    session = new G4UIterminal;
    session->SessionStart();
    delete session;
 }
```

If there are no arguments after the executable, starts an interactive session

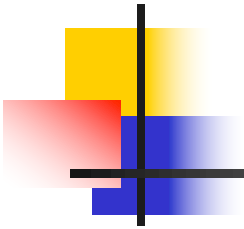
Define the session as a dumb terminal, and **starts** it

Don't forget to delete it

User Interface Choices



- `G4UIterminal` – C-shell-like character terminal
  - runs on all Geant4-supported platforms
- `G4UItcsh` – tcsh-like character terminal with command completion, history, etc.
  - runs only on Solaris and Linux
- `G4UIXm, G4UIXaw, G4UIXWin32` – G4UIterminal implemented over Motif, Athena and WIN32 libraries
  - runs on Unix/Linux and Windows, respectively
- `G4UIGAG` – Java-based GUI
  - runs on all Geant4 platforms



Built-in user commands

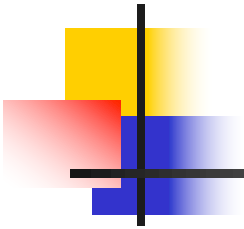
- Geant4 provides a number of general-purpose user interface commands which can be used:
  - interactively via a (G)UI

    ```
    Idle> /run/setCut [value] [unit]
    ```

  - in a macro file
- Within C++ code using the `ApplyCommand()` method of `G4UImanager`

  ```
  G4UImanager::GetUIpointer()
  ->ApplyCommand("/run/setCut 1 cm");
  ```

- A complete list of built-in commands is available in the Geant4 Application Developers Guide, Chapter 7.1



User-defined commands (1)

- If built-in commands are not enough, you can make your own (e.g. change at run-time parameters of primary generator, etc.)
- Geant4 provides several command classes, all derived from **`G4UIcommand`**, according to the type of argument they take
  - **`G4UIcmdWithoutParameter`**
  - **`G4UIcmdWithABool`**
  - **`G4UIcmdWithADouble`**
  - **`G4UIcmdWithADoubleAndUnit`**
  - `...`

User-defined commands (2)

- Commands have to be defined in messenger classes, that **inherit from G4UImessenger**
- Define the command in the constructor:

```
G4UIcmdWithADoubleAndUnit* fThetaCmd =
  new G4UIcmdWithADoubleAndUnit
    ("/prim/angle",this);
```

Command taking as argument a double and a unit, called /prim/angle

```
fThetaCmd->SetGuidance("Opening angle of source");
fThetaCmd->SetDefaultUnit("deg");
fThetaCmd->SetUnitCandidates("deg rad");
```

Sets guidance, default unit, etc.

- Delete the command in the destructor

User-defined commands (3)

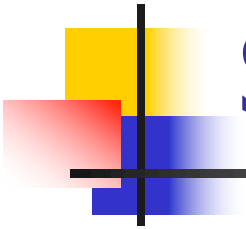
- Define the action of the command in the **`SetNewValue()`** method of the messenger:

```
void MyMessenger::SetNewValue
   (G4UIcommand* cmd,G4String string)
{
  if (cmd == fThetaCmd)
  {
    G4double value = fThetaCmd
    ->GetNewDoubleValue(string);

    ...->DoSomething(value);
  }
}
```

Retrieve a G4double value from the **(string)** argument given to the command

Use the value in the way it is needed (e.g. pass it to other classes: opening angle for primary generator)



Summary

- Interactive sessions where user can give commands by keyboard can be used (from dumb terminals to graphic interfaces)

- A number of general-purpose commands are provided by Geant4, but **users can define more**, according to their needs → flexibility!