JUNO GEANT4 SCHOOL

Beijing (北京)
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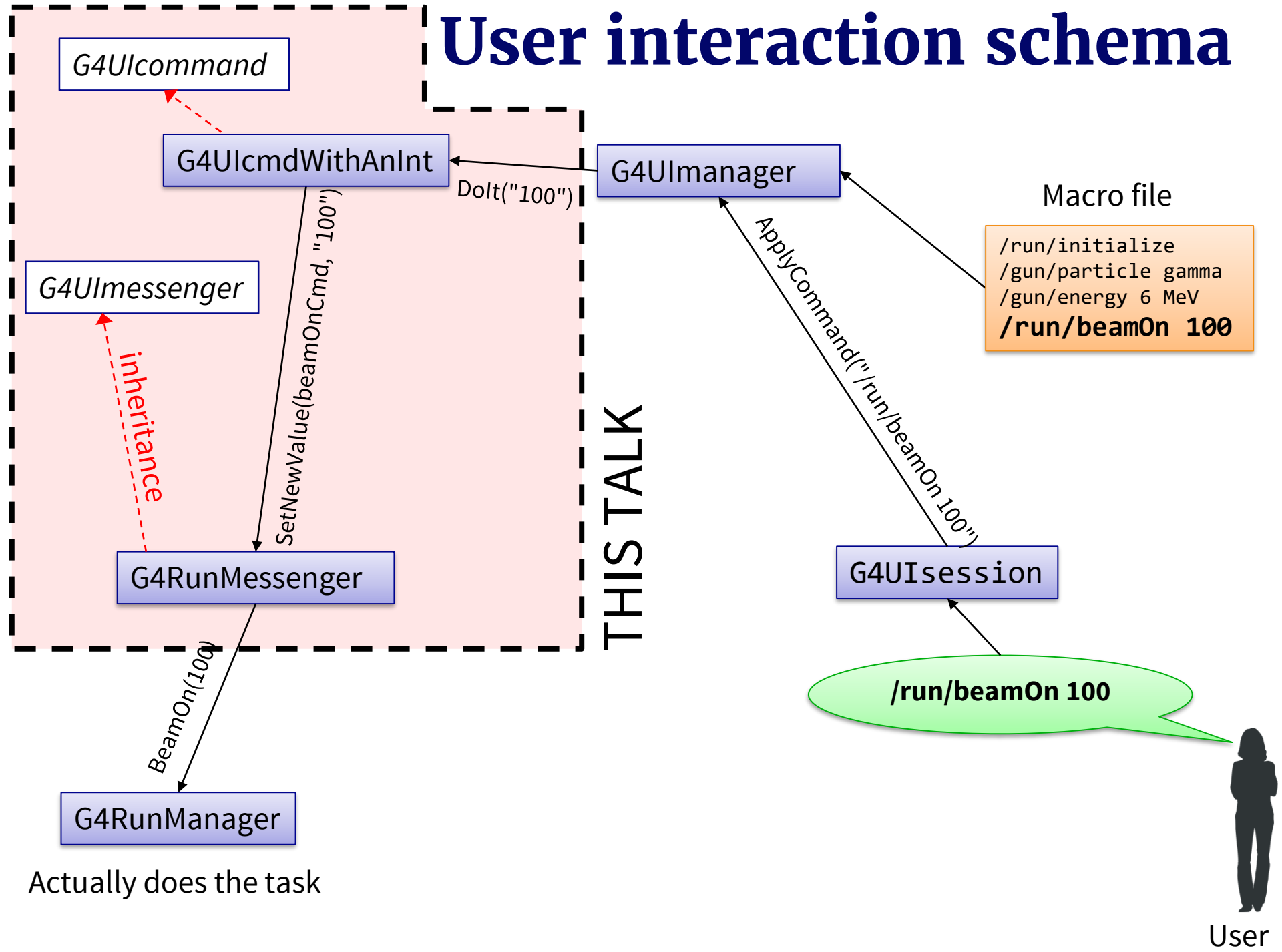
(Graphical) User Interface 2

Geant4 tutorial

User interaction schema



Example: **G4RunMessenger**

Each command results in a method call (typically) of an **associated object** (e.g. G4RunManager)

/run/beamOn 100 ⇒ runManager->BeamOn(100);

/run/verbose 1 ⇒ runManager->SetVerboseLevel(1);

/run/initialize ⇒ runManager->Initialize();

/run/physicsModified ⇒ runManager->PhysicsHasBeenModified();

...

/random/setSeeds 8 8 888 ⇒ G4Random::setTheSeeds({8, 88, 888});

Add new macro commands

1) Create a **messenger class** for the commands
2) Create an instance of **command directory** in the messenger constructor
3) Create the **command instances** inside the messenger constructor
   - optionally create a custom command class*
4) Write the code that responds to the commands in the messenger SetNewValue method
5) Create an **messenger instance** at an appropriate place (ideally the associated object's constructor)

***Note:** Too advanced topic for this course.

Built-in command types

with examples

- **G4UIcmdWithoutParameter**: /run/initialize
- **G4UIcmdWithAnInteger**: /run/beamOn 10
- **G4UIcmdWithABool**: /process/em/auger true*
- **G4UIcmdWithADouble**: /particle/property/decay/br 0.5
- **G4UIcmdWithADoubleAndUnit**: /gps/time 1.5 us
- **G4UIcmdWithAString**: /gps/particle e-
- **G4UIcmdWith3Vector**: /gps/direction 0.707 0.707 0.0
- **G4UIcmdWith3VectorAndUnit**:
  /gps/position 0.0 0.0 0.0 m

***Note:** The **true** values are **t**, **true**, **y**, **yes** and **1** (case insensitive); everything else is **false**.

New messenger: header

MyClassMessenger.hh

```
#include <G4UImessenger.hh>
#include <G4UIdirectory.hh>
#include <G4UIcmdWithADouble.hh>
#include <G4UIcmdWithoutParameters.hh>

#include "MyClass.hh"

class MyClassMessenger : public G4UImessenger
{
public:
    MyClassMessenger(MyClass* myObject);

    ~MyClassMessenger();

    void SetNewValue(G4UIcommand* command, G4String newValue) override;

private:

    MyClass* fObject;
    G4UIdirectory* fDirectory;
    G4UIcmdWithADouble* fSomeParameterCommand;
    G4UIcmdWithoutParameters* fDoSomethingCommand;
};
```

Necessary Geant4 headers

Header to the class to manage

Inherit from G4UImessenger

Commands defined in constructor

Method reacting to all command call managed by this messenger

New messenger: source...

MyClassMessenger.cc

```
#include "MyClassMessenger.hh"

MyClassMessenger::~MyClassMessenger() {
    delete fSomeParameterCommand;
    delete fDoSomethingCommand;
    delete fDirectory;
}

MyClassMessenger::MyClassMessenger(MyClass* myObject)
    : fObject(myObject) {
    fDirectory = new G4UIdirectory("/myClass/");
    fDirectory->SetGuidance("Commands for MyClass");

    fSomeParameterCommand =
    // ...
```

Include the header

UI command and directory pointers should be deleted!

Assign the pointer to the associated object

Create the command directory (with description)

To be continued in the next slide...

New messenger: ...source

MyClassMessenger.cc

```
    // ...
    fSomeParameterCommand = new G4UIcmdWithADouble("/myClass/setParameter", this);
    fSomeParameterCommand->SetGuidance("Set some parameter");
    fSomeParameterCommand->AvailableForStates(G4State_PreInit, G4State_Idle);
    // ... More details

    fDoSomethingCommand = new G4UIcmdWithoutParameters("/myClass/do", this);
}

void MyClassMessenger::SetNewValue(G4UIcommand* command, G4String newValue) {
    if (cmd == fDoSomethingCommand) { fObject->DoSomething(); }
    else if (cmd == fSomeParameterCommand) {
        G4double value = fSomeParameterCommand->GetNewDoubleValue(newValue);
        fObject->SetParameter(newValue);
    }
}
```

Create a new command with description

Enable only in certain state(s)

Method reacting to command calls

Which command is it?

What are the command‘s parameters?

Simple reaction

It is necessary to parse the parameters string!

Use the parsed value

G4GenericMessenger

Good news: we have alternative!

- no need to implement a new class ☺
- no need to instantiate a UI directory ☺
- no need to declare the comand objects ☺
- no need to parse values end write conditions ☺
- no need to delete so many pointers ☺
- without support for more complex commands ☹

It's the **G4GenericMessenger** class.

G4GenericMessenger – use

MyClass.hh

```
// ...
#include <G4GenericMessenger.hh>

class MyClass {
// ...
G4GenericMessenger* fMessenger;
};
```

MyClass.cc

```
// ...
MyClass::MyClass() {
    // ...
    fMessenger = new G4GenericMessenger("/myClass/", this);
    fMessenger->SetGuidance("Commands for MyClass");
    fMessenger->DeclareMethod("setParameter", &MyClass::SetParameter)
        .SetStates(G4State_PreInit, G4State_Idle)
        .SetGuidance("Set some parameter");
    fMessenger->DeclareMethod("do", &MyClass::DoIt);
}

MyClass::~MyClass() {
    // ...
    delete fMessenger;
}
```

These few lines do exactly the same as previously defined MyClassMmessenger. **Simpler?** ☺

Conclusion

- Defining new user commands is possible using one of the ways:
  - **more general** and **complex**: G4UImessenger, G4UIdirectory, G4UIcommand, ...
  - **easier** but perhaps **less flexible**: G4GenericMessenger