

INCL++ development for Geant4 10.0

Daide Mancusi

Geant4 collaboration meeting
Seville, 24th September 2013

technical developments

physics developments

- nucleus-nucleus extension

- validation

- few-nucleon removal

- multipion extension

conclusions

CTest-CDash-based unit testing

The screenshot displays the CDash web interface for the INCL++ project. The browser address bar shows the URL: `my.cdash.org/index.php?project=INCL%2B%2B#`. The page header includes navigation links for Dashboard, Calendar, Previous, Current, and Project. A status bar indicates the last file change on Tuesday, September 17, 2013, at 19:00 EDT. The main content area is titled "Nightly" and contains a table of test results for the site "dapint".

Site	Build Name	Update		Configure			Build		Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass			
dapint	linux-g++-default-DebugWithCoverage	0	0	0	0	50	0	0	63		11 hours ago	

Below the test results table, there is a "Coverage" section with a table showing 82.98% coverage for 5929 LOC tested and 1216 LOC untested. A "Dynamic Analysis" section shows 100 defects detected by Valgrind. The footer includes the Kitware logo and CDashPro 2.1.0.0 version information.

`http://my.cdash.org/index.php?project=INCL%2B%2B`

CTest-CDash-based unit testing

The screenshot shows the CDash web interface for the INCL++ project. The browser address bar shows the URL `my.cdash.org/index.php?project=INCL%2B%2B#`. The page header includes navigation links like 'Dashboard', 'Calendar', 'Previous', 'Current', and 'Project'. A status bar indicates 'No file changed as of Tuesday, September 17 2013 - 19:00 EDT'. The main content area is divided into several sections:

- Nightly**: A table showing build details for site 'dapint' and build name 'linux-g++-default-DebugWithCoverage'. The 'Build' section shows 50 errors (highlighted in orange), 0 warnings, 0 not run, 0 fails, and 63 passes.
- Coverage**: A table showing 82.98% coverage for 5929 LOC tested and 1216 LOC untested.
- Dynamic Analysis**: A table showing 100 defects found by Valgrind.

Two red arrows point from the text below to the '50' error count and the '100' defect count in the tables. The footer includes the Kitware logo and version information 'CDashPro 2.100 © Kitware | Report problems | Privacy Policy | 0.244s'.

this is due to Boost

this is due to ROOT

INCL++ is free from memory leaks

CTest-CDash-based unit testing

CDash - INCL++

my.cdash.org/index.php?project=INCL%2B%2B#

Google Maps Il P... R La Republic... C Corriere della S... CEA webmail Other Bookmarks

Login All Dashboards Buy Wednesday, September 18 2013 06:06:01 EDT

INCL++

Dashboard Calendar Previous Current Project

No file changed as of **Tuesday, September 17 2013 - 19:00 EDT** Show Filters Advanced View Auto-refresh Help

Nightly

Site	Build Name	Update			Configure		Build		Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass			
dapint	linux-g++-default-DebugWithCoverage	0	0	0	0	0	50	0	0	63	11 hours ago	

Coverage

Site	Build Name	Percentage	LOC Tested	LOC Untested	Date
dapint	linux-g++-default-DebugWithCoverage	82.98%	5929	1216	11 hours ago

Dynamic Analysis

Site	Build Name	Checker	Defect Count	Date
dapint	linux-g++-default-DebugWithCoverage	Valgrind	100	11 hours ago

Kitware CDashPro 2.1.0 © Kitware | Report problems | Privacy Policy | 0.244s

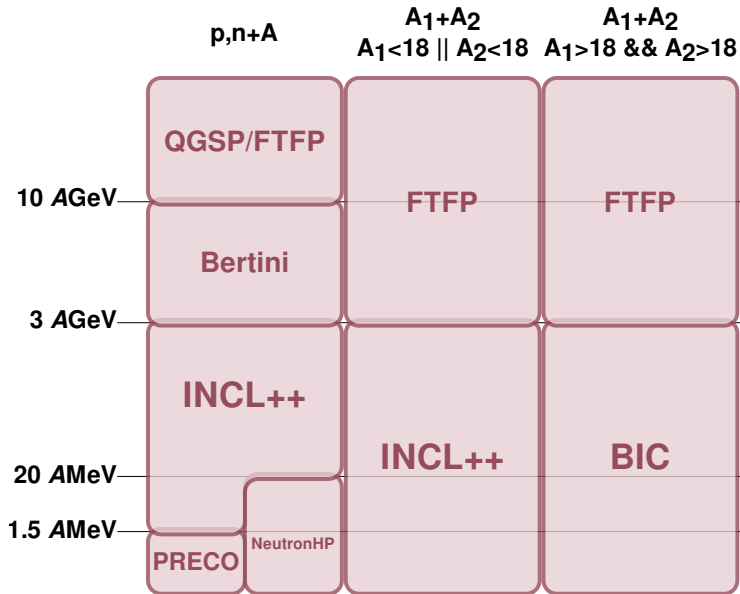
"technical" unit tests

physics tests to be included soon

- ▶ QGSP_INCLXX
- ▶ QGSP_INCLXX_HP
- ▶ FTFP_INCLXX
- ▶ FTFP_INCLXX_HP

- ▶ involve them in **testing/profiling**?
 - ▶ please?!

hadronic model map



technical developments

physics developments

- nucleus-nucleus extension

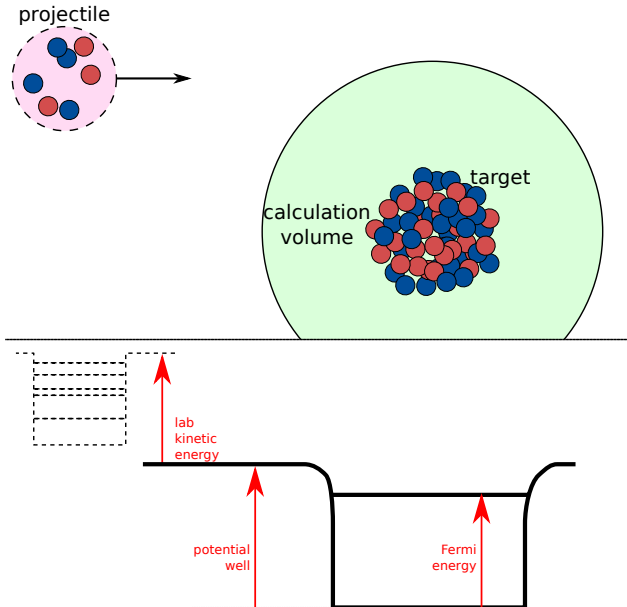
- validation

- few-nucleon removal

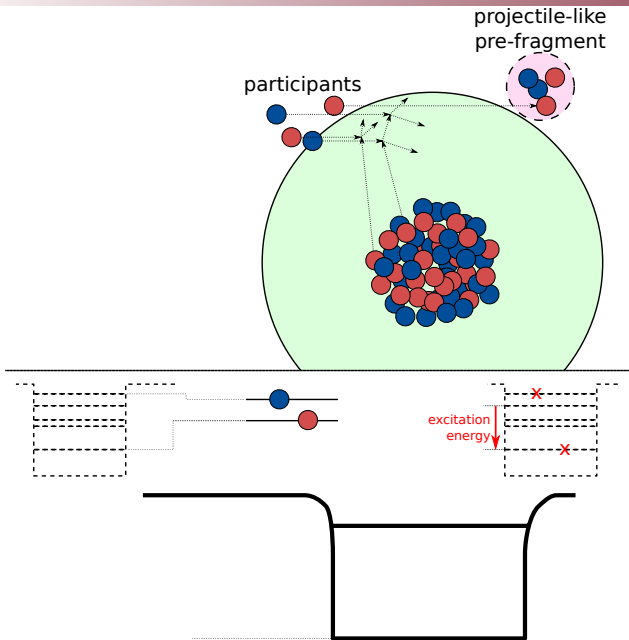
- multipion extension

conclusions

nucleus-nucleus extension: scheme



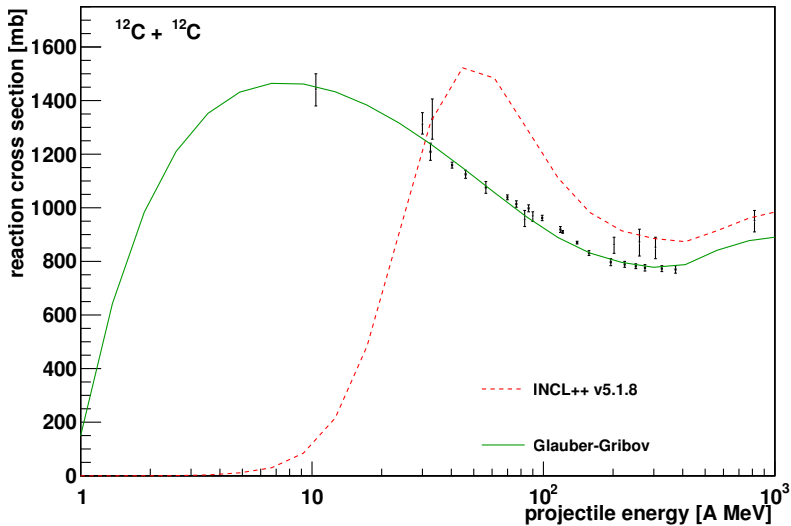
nucleus-nucleus extension: scheme



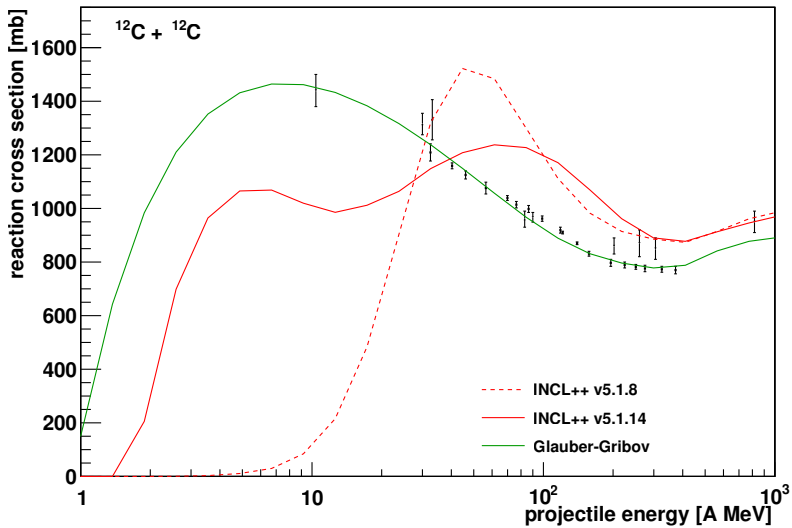
nucleus-nucleus extension: scheme

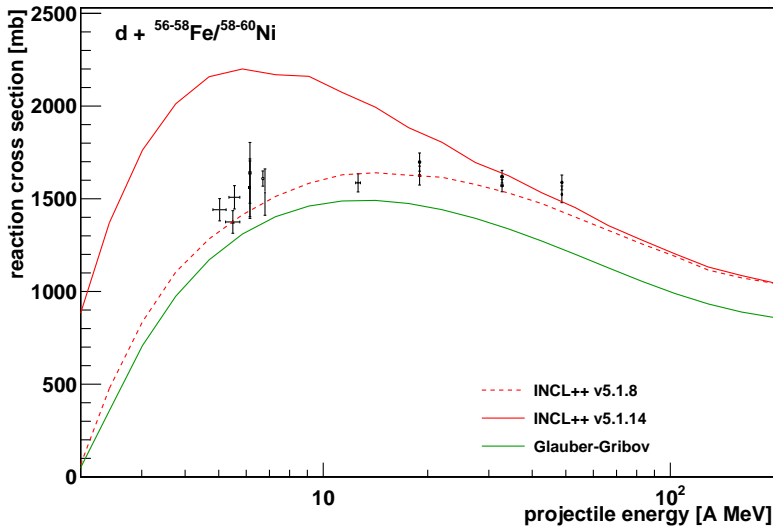
- ▶ **fusion** model at low energy
 - ▶ nucleons trying to enter below **Fermi energy**
- ▶ **smooth** transition between fusion and cascade
- ▶ but. . .

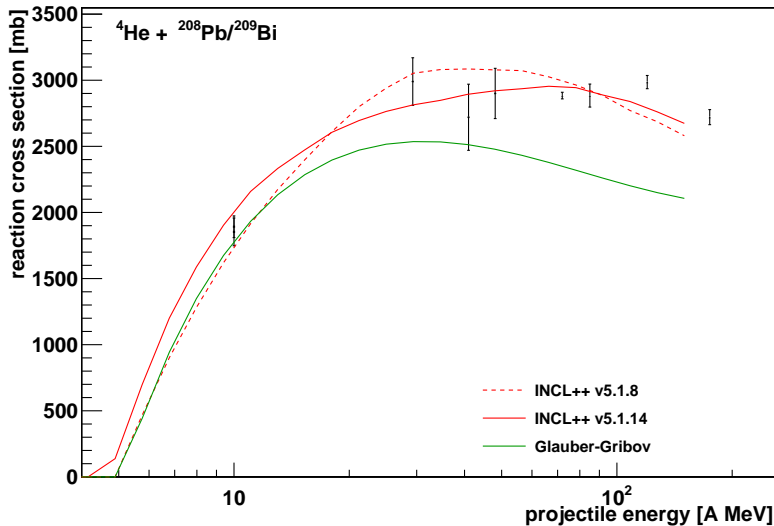
problem in low-energy fusion



unsatisfactory fusion **parameters** (tuned for light charged particles)

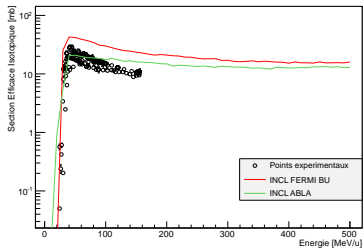




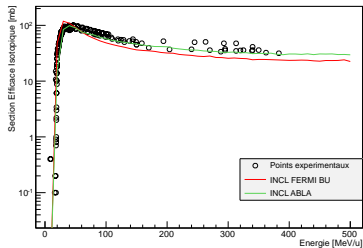


light-ion reactions (hadrontherapy)

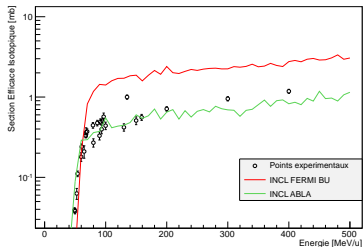
C12(p,X)Be7



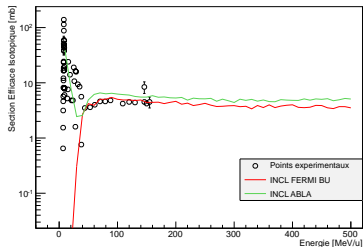
C12(p,X)C11



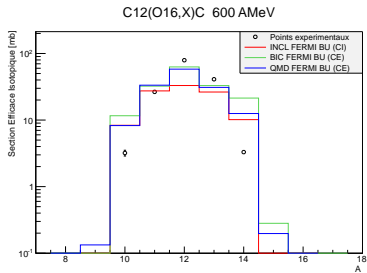
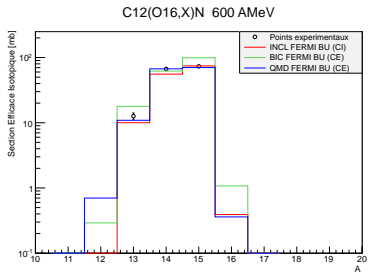
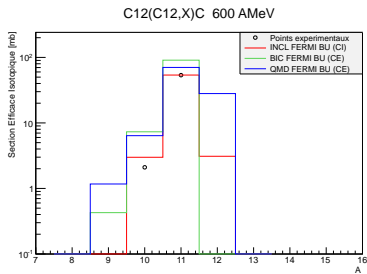
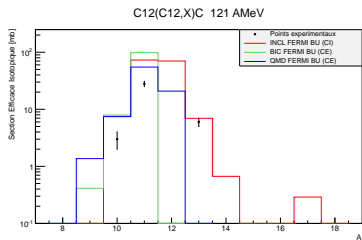
O16(p,X)Be10



O16(p,X)N13



light-ion reactions (hadrontherapy)

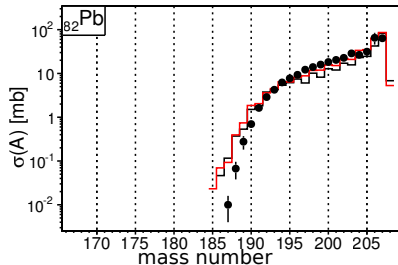
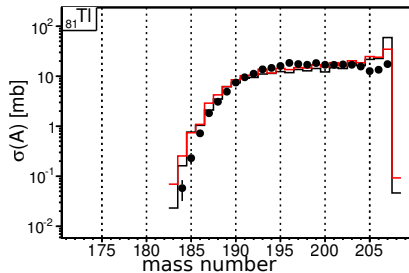


internship work by M. Delerín

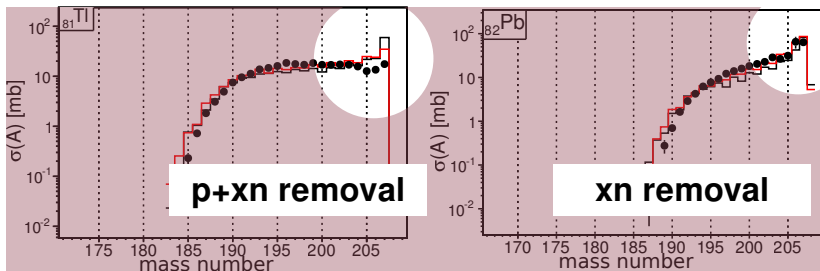
- ▶ **sensitivity** to de-excitation
 - ▶ ABLA07 better for $p + A$
- ▶ **general agreement**: QMD > INCL++ > BIC
 - ▶ CPU time: INCL++ \simeq BIC \simeq 0.01 \times QMD!

- ▶ de-excitation is **important**
- ▶ INCL++ good compromise between **accuracy** and **CPU time**

1-GeV $p+^{208}\text{Pb}$

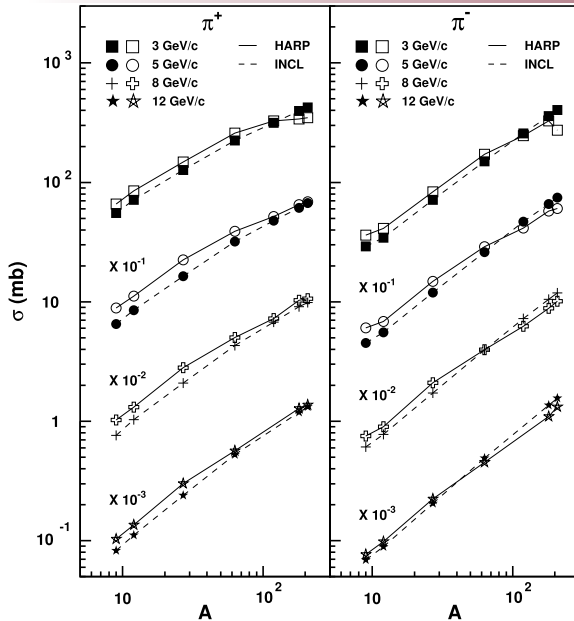


1-GeV $p+^{208}\text{Pb}$



- ▶ common defect of **all** INC/QMD models
- ▶ connected with the **energy content** of the nuclear surface
- ▶ improvement **under way**

extension to 10–15 GeV

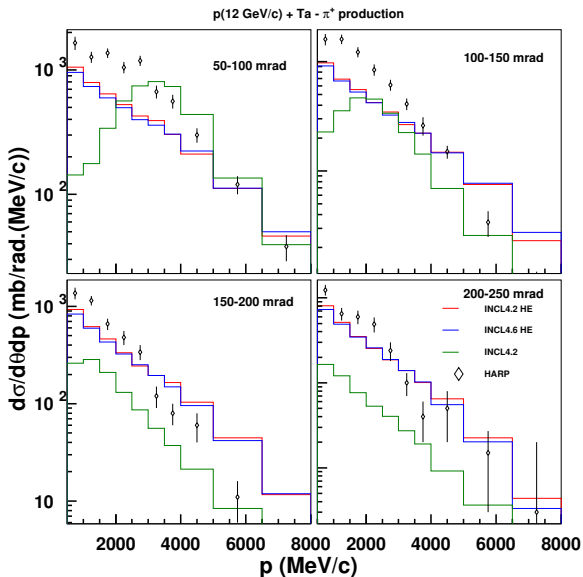


HARP
collaboration
Phys. Rev.
C77 (2008)
055207



Pedoux and
Cugnon
Nucl. Phys.
A866 (2011)
16

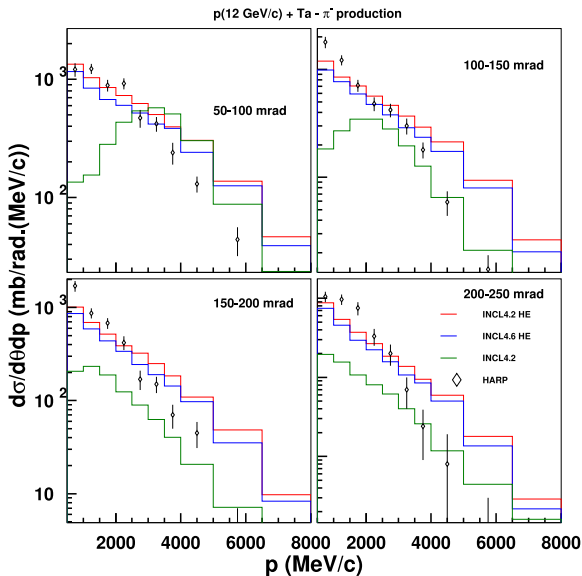
extension to 10–15 GeV



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conclusions

in INCL++:

- ▶ low-energy fusion **retuned**
- ▶ extensive validation on **nucleus-nucleus** data
- ▶ a bunch of **fixes**

in INCL4.6 (soon in INCL++):

- ▶ improved cross sections for **few-nucleon** removal
- ▶ extension up to **10–15 GeV**

future plans:

1. port **high-energy** extension to INCL++
2. **strangeness** production
3. automate **physics** testing
4. bring **ABLA++** back to life

... hopefully **3.** and **4.** by the end of 2013

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