Status of implementing INCL4 and ABLA codes into Geant4

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Project outline

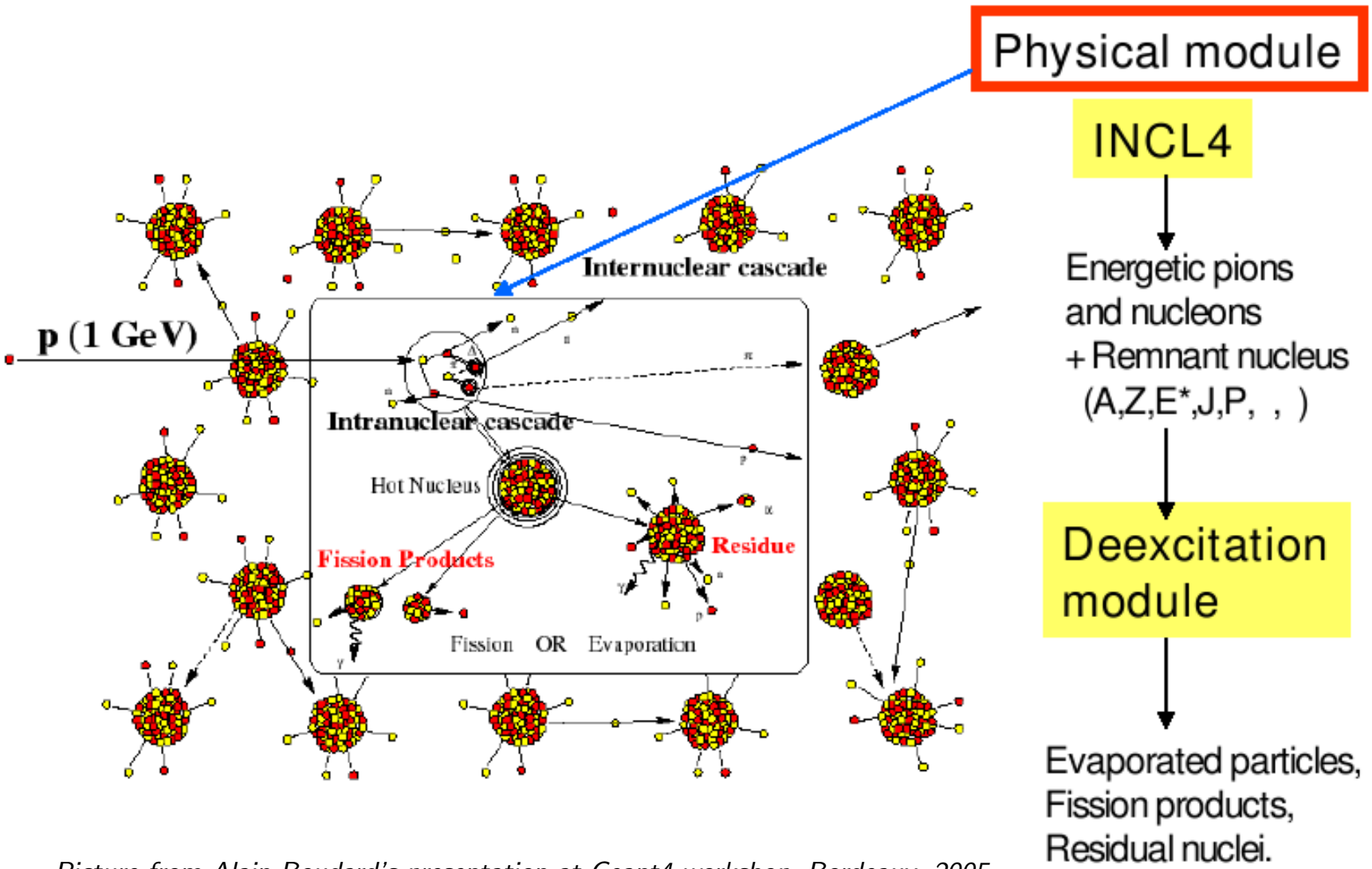
June 2006 Geant4 - INCL4 + ABLA mini-workshop:

- Agreed that INCL4 and ABLA will be translated into the Geant4
- Geant4 collaboration received FORTRAN source code (9k lines)

My Master's thesis work ,supervised by Aatos Heikkinen, is done at HIP in the Software and Physics project, together with:

- Geant4 hadronic physics working bgroup
- Original FORTRAN developers from GSI, CEA, and Liège University
  - Key contact: Alain Boudard

INCL4 and ABLA

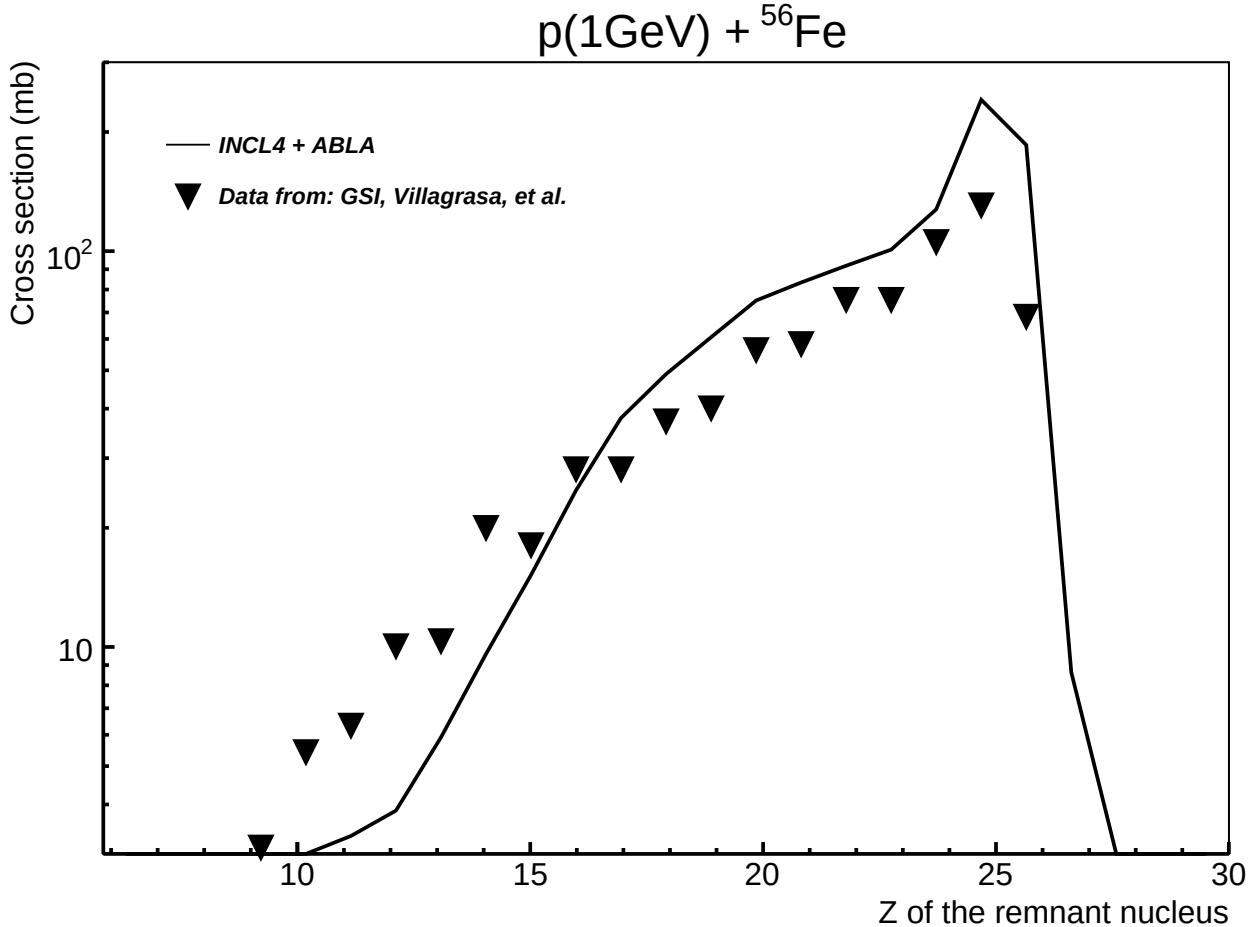


Picture from Alain Boudard's presentation at Geant4 workshop, Bordeaux, 2005.

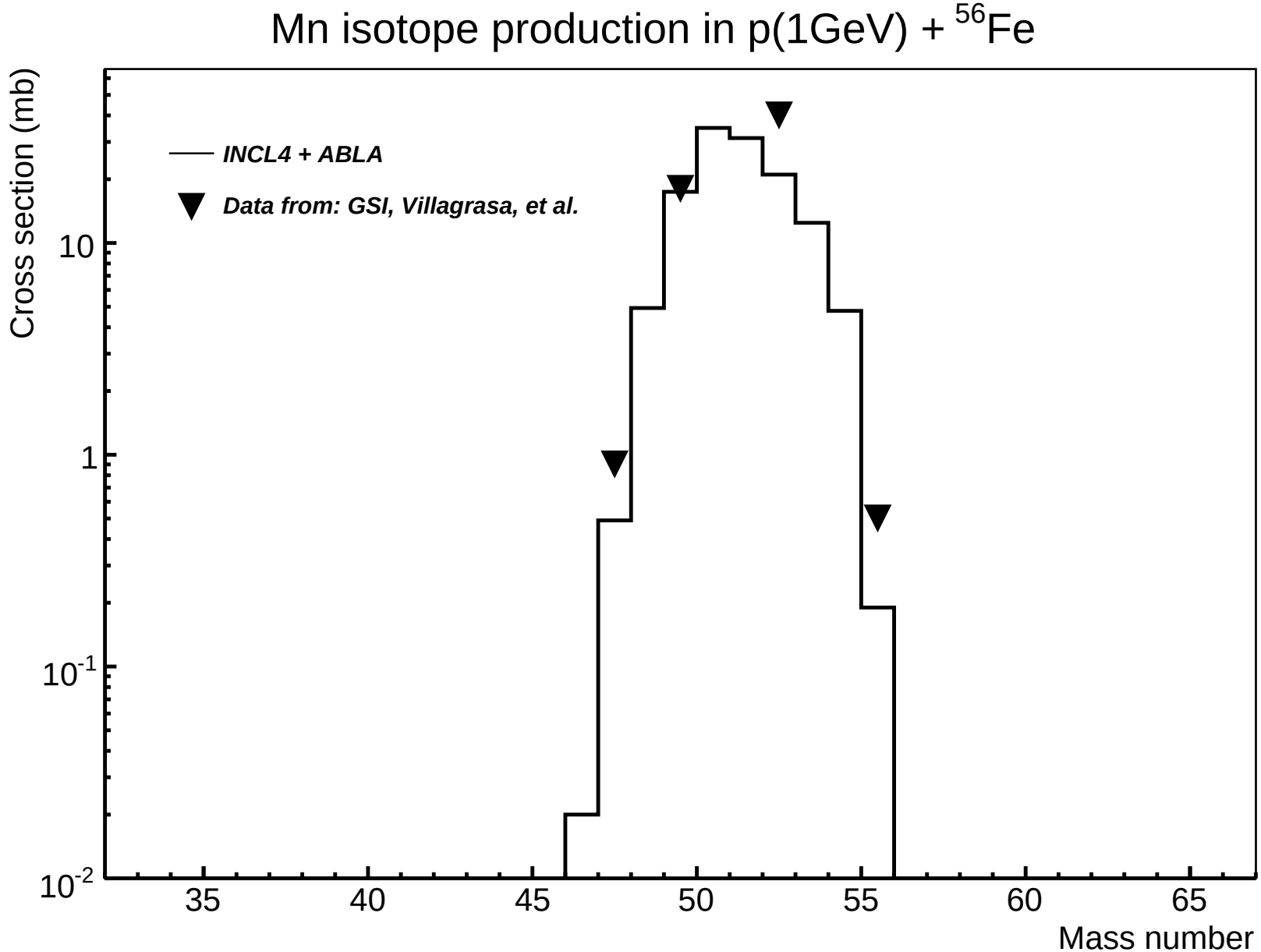
Remnant nuclei from p(1 GeV) + ^{56}Fe

As an exercise, to familiarise myself with stand-alone INCL4 and ABLA, I have reproduced some of A. Boudard's plots.

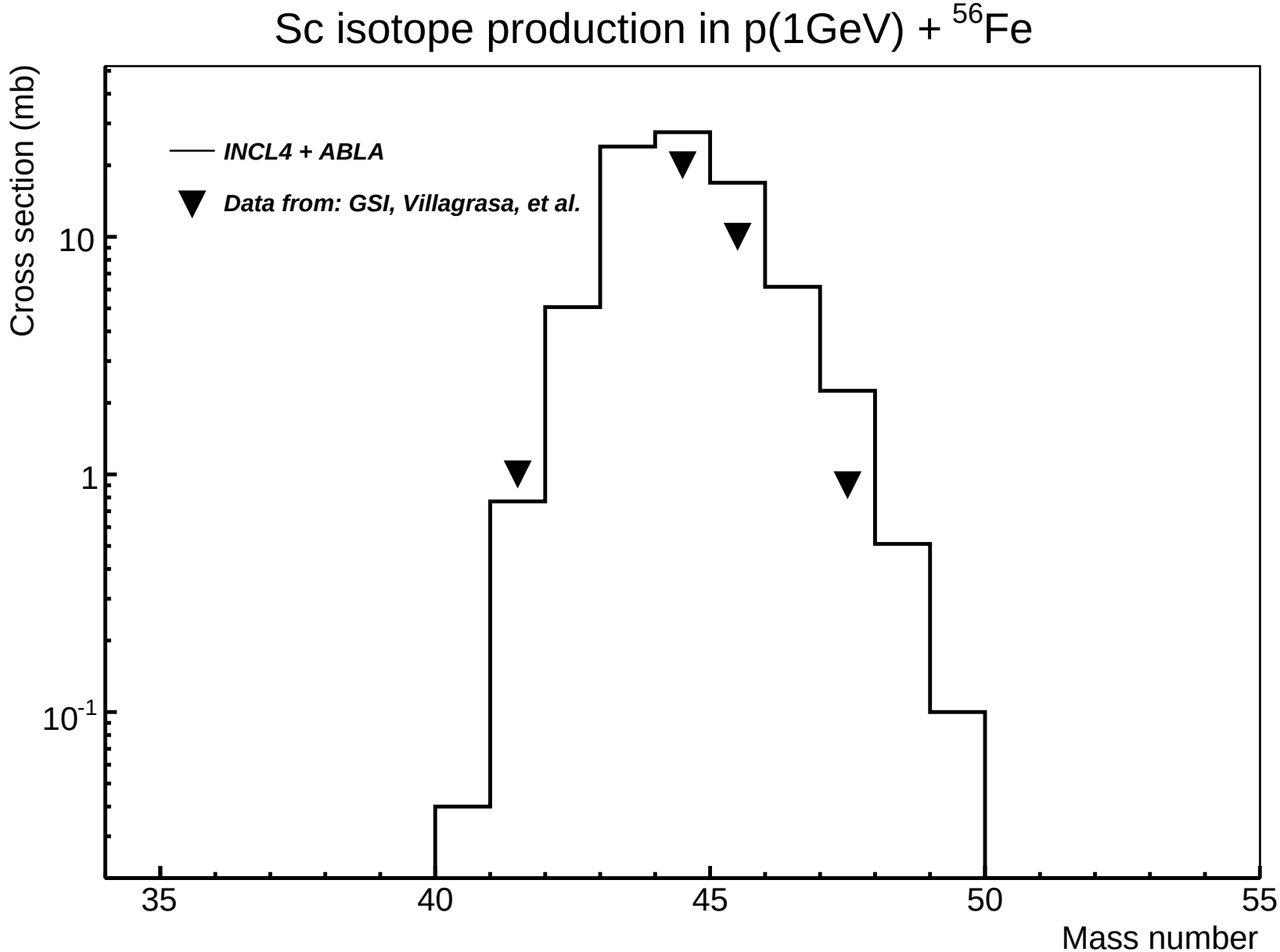
(See his Geant4 workshop 2005 slides.)



Manganese isotopes produced in p(1 GeV) + ^{56}Fe



Scandium isotopes produced in p(1 GeV) + ^{56}Fe



Wrapping INCL4 + ABLA key functionalities

I have made C++ wrapper providing following **functions**:

- `initincl4_()` - initialize the INCL4 cascade code
- `ablainitinterface_()` - initialize ABLA evaporation code
- `processevent()_` - produce one event (INCL4 and ABLA)

Input and output **structs**:

- `calincl_` - passing bullet type, energy and target nucleus mass and proton numbers to the INCL4 and ABLA
- `varntp_` - outputting particle types, momenta, and energies after each event

Preliminary hybrid C++-Fortran interface to Geant4 will be released for collaboration in November 2006.

Test driver (as it is now)

1. Accepts command line parameters:
   - `cpptestdriver 208 82 1 1000 100000 outputFile.out`
   - *A, Z, bullet type, kinetic energy (MeV), number of events*
2. Calls INCL4 and ABLA models
3. Produces plain ASCII text file containing INCL4 and ABLA output

ROOT provides:

- Scripting
- Run control
- Data analysis (ROOT databases built from ASCII files)
- Visualisation

Note: We dont't create any ROOT dependency for Geant4 and INCL4 + ABLA.

Translation status and outlook

Done:

- Basic INCL4 and ABLA structure:
  - Common blocks → C++ structs
  - FORTRAN subroutines and functions → C++ function definitions
- Makefile for compiling the system
- First draft of test framework

To be done:

- FORTRAN subroutine and function implementation
- First draft of C++ class design based on INCL4 and ABLA C++ interfaces
  - We follow the Geant4 Bertini cascade implementation
- First release Apr. 2007
- INCL5 to be translated in due time. (See Alain Boudard's talk.)