Department of Physics
School of Applied Mathematical and Physical Sciences
NTU of Athens

Tandem Accelerator Laboratory
Institute of Nuclear and Particle Physics
NCSR - “Demokritos”

Development of a simulation code for material analysis using the PIGE technique

K. Preketes-Sigalas, A. Lagoyannis, M. Axiotis

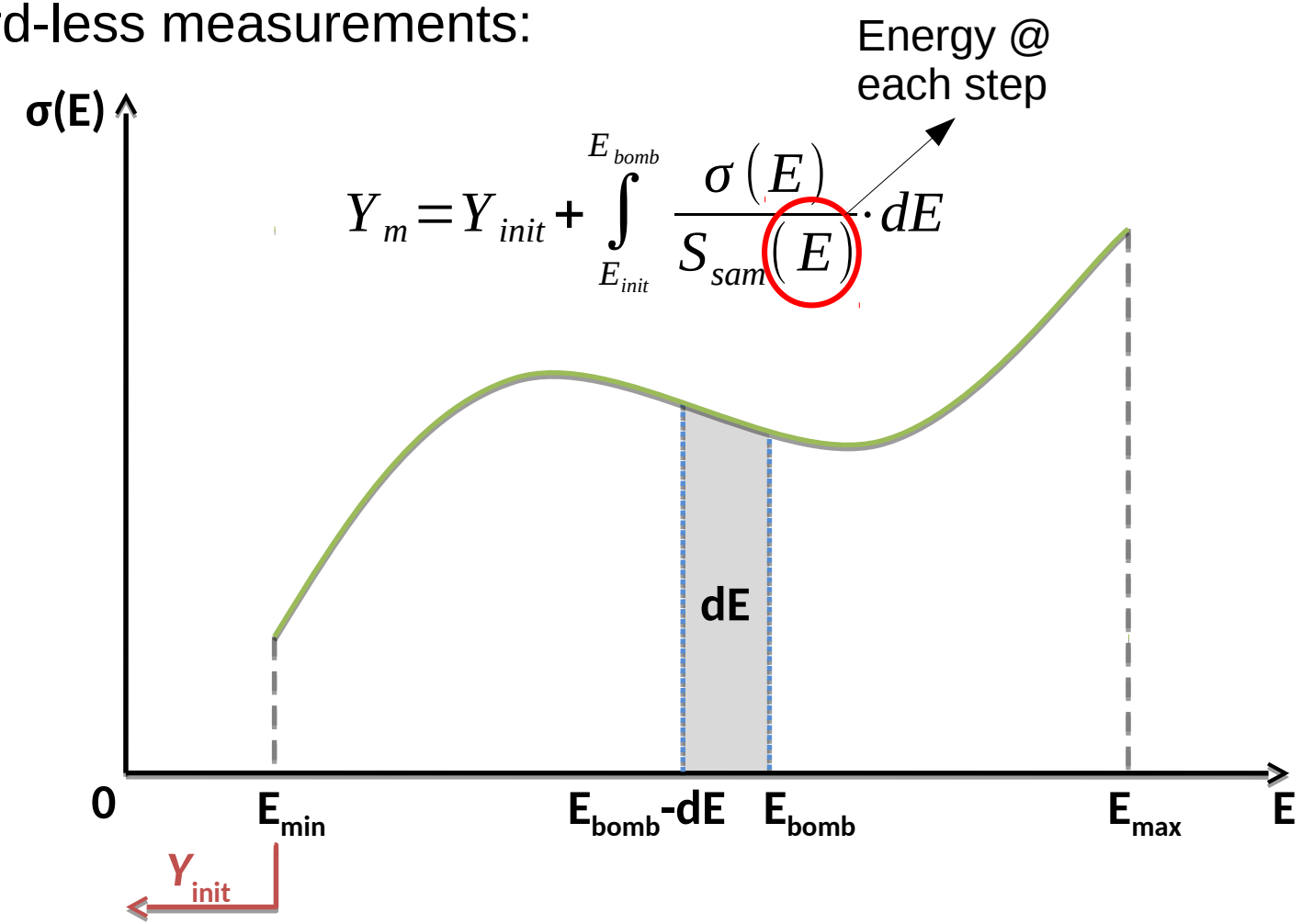
PIGE

- **P**article **I**nduced **G**amma-ray **E**mission
  - Light element analysis (e.g., Li, B, F, Mg etc.)
  - Resonant-PIGE: depth profiling
- Drawback: Use of standards
  - Stopping power → Similar-matrix standards
    → Need of several standards in each lab
- Solution: Standard-less measurements
  - Well-measured cross sections
  - Missing: Code
    - ERYA code → Windows (64-bit), LabVIEW
      → not compatible with R33 files
      → not working well

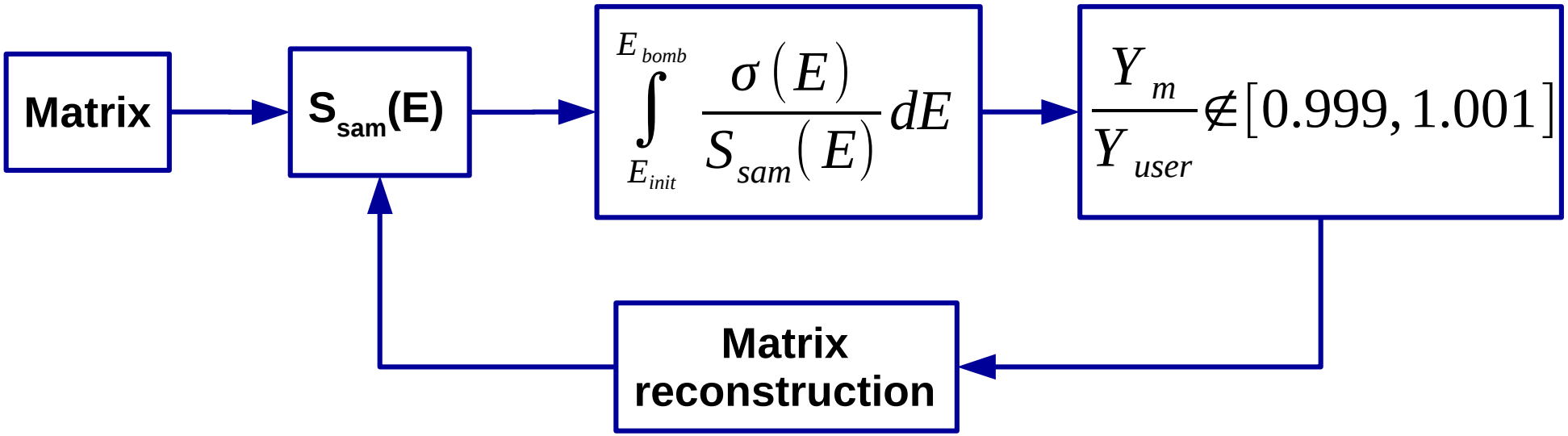
Yield calculation

- Using standards: $$Y_{sam}(E_{bomb},\varphi)=Y_{std}(E_{bomb},\varphi)\cdot\frac{C_{sam}}{C_{std}}\cdot\frac{S_{std}(E_{bomb})}{S_{sam}(E_{bomb})}$$

- Standard-less measurements:



PiGreCo program

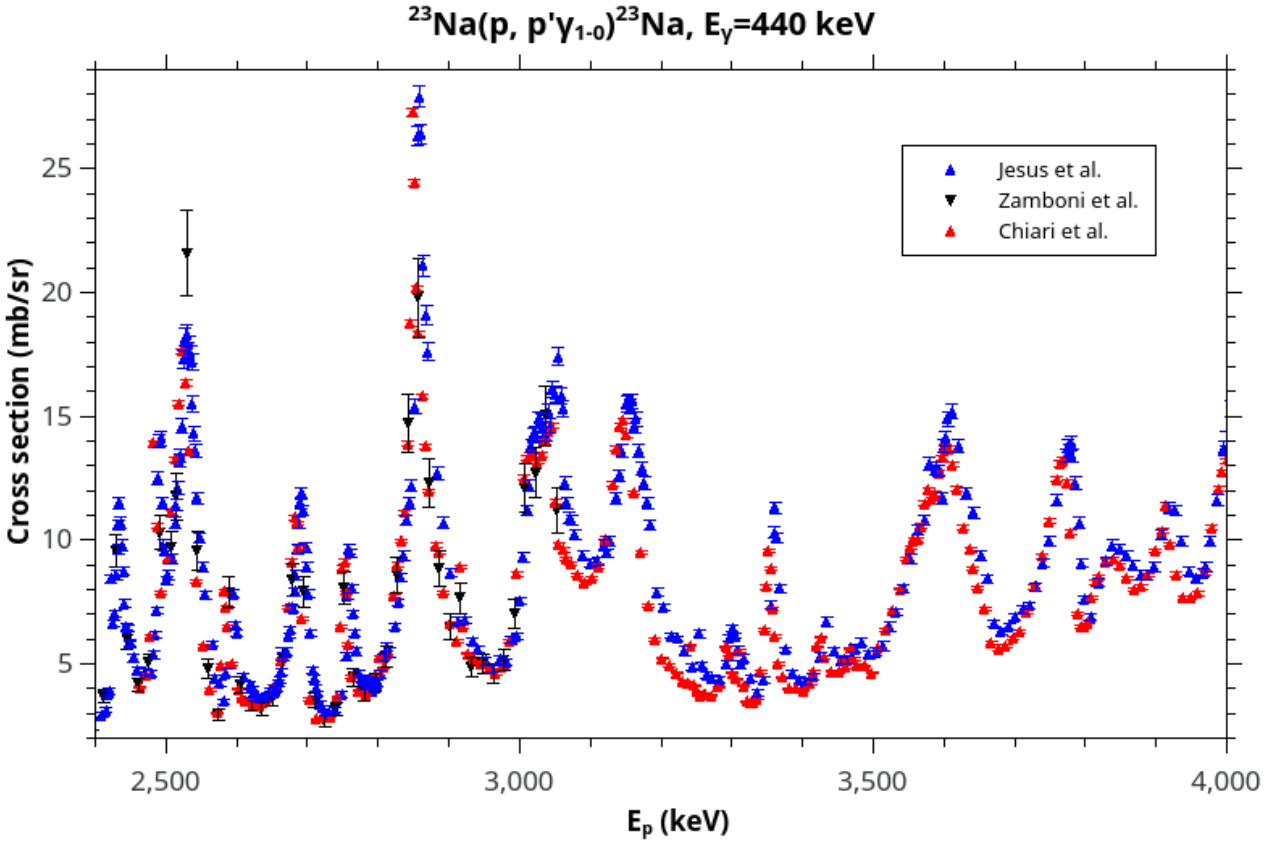


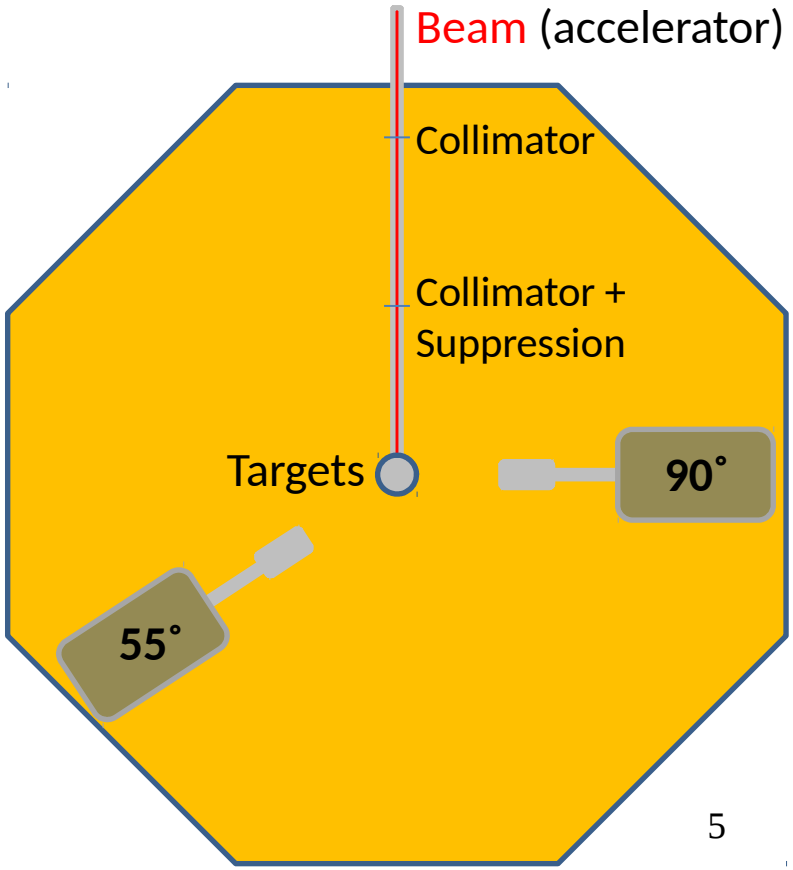
- Programmed in C++ / Qt Libraries for GUI
- Distributions for Windows/Linux/Mac
- Homogeneous monolayer matrix
- Stopping power:
  - Elemental: ZBL/SRIM compilations
  - Compound: Bragg's rule
- Cross sections: R33 files, compatibility with IBANDL

Testing the code

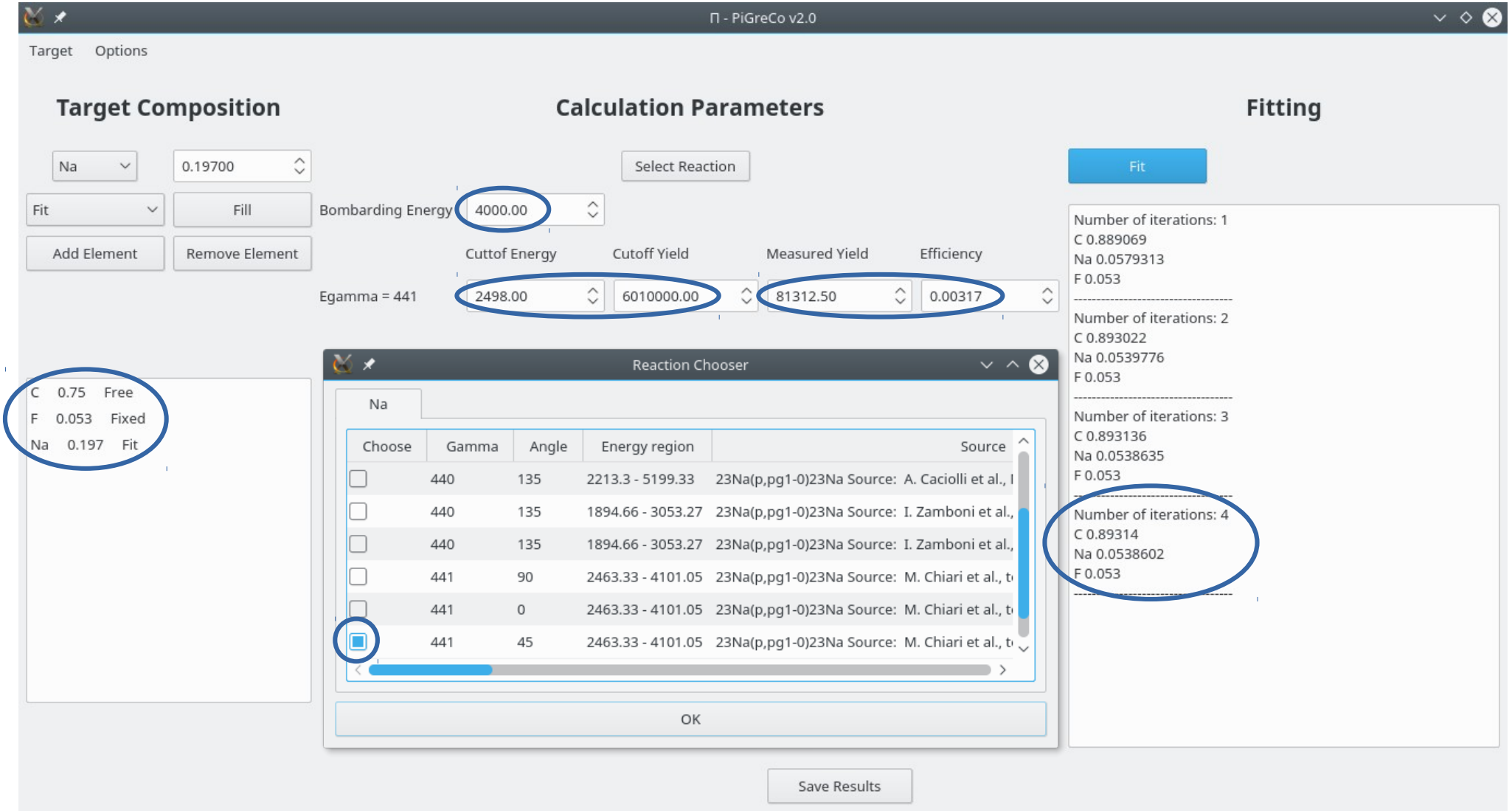
- 3 standard samples
  - Phosphate rock (NIST, SRM 120b)
  - Multicomponent glass (NIST, SRM 1412)
  - ST NaF (5.3% Na, 5.3% F in C)
- E_p = 1.5 – 4.0 MeV (variable steps)

@ Tandem Accelerator Laboratory - “Demokritos”

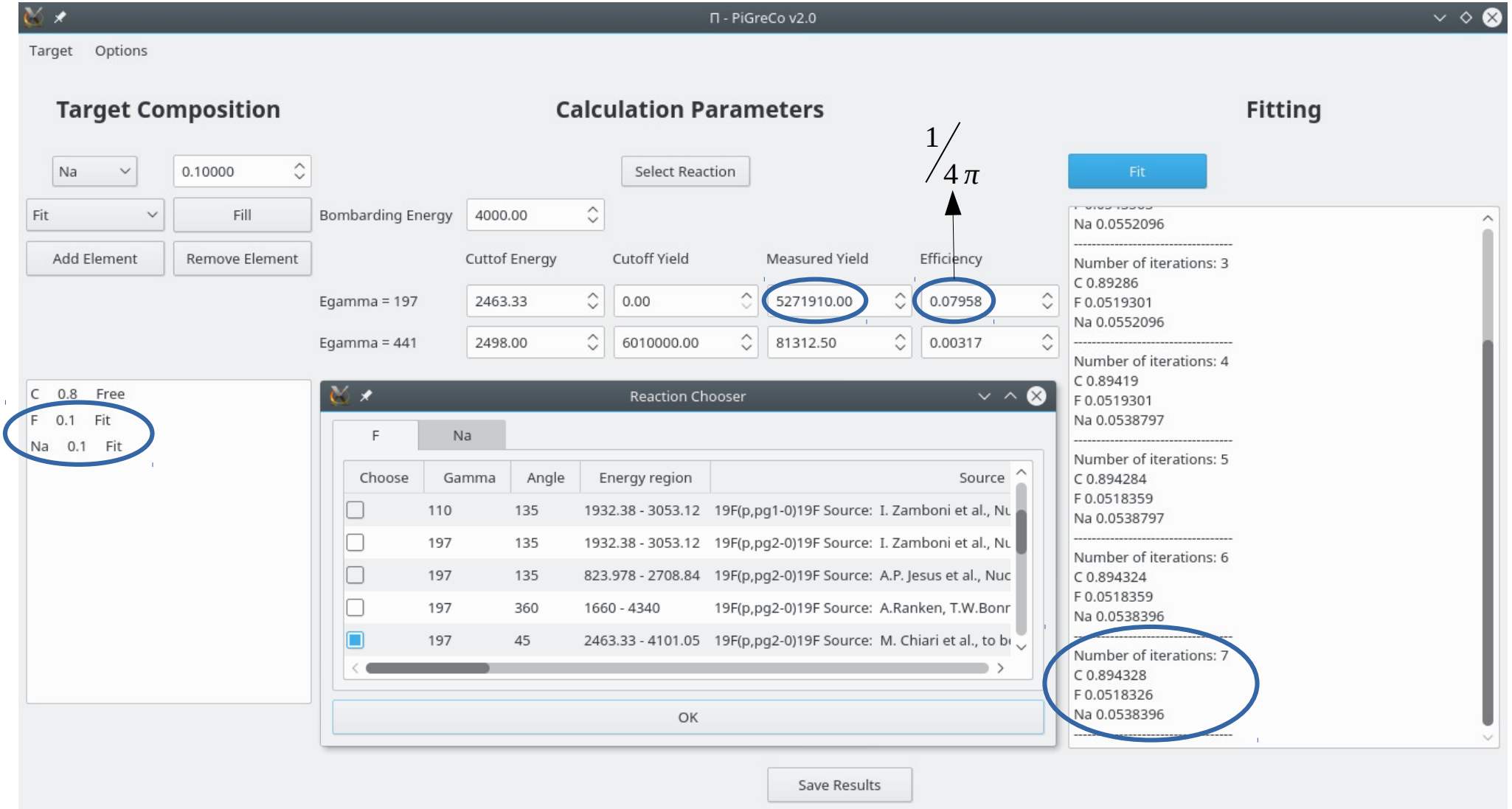




ST NaF (one fitting element)



ST NaF (two fitting elements)



To do list...

- Near future
  - Fixing of possible bugs
  - Analysis of the other two standards
  - Up to 5 fitting elements
  - Adding straggling
- Distant future
  - Extra features on demand
  - Weight percentage ← → Atomic percentage
  - Multilayer targets (resonant-PIGE) / ill-posed problem…

Thank you for your attention!