

DE LA RECHERCHE À L'INDUSTRIE



CURRENT STATUS ON THE GALILÉE-1 NUCLEAR DATA PROCESSING CODE

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Wonder Workshop
Aix en Provence (France)

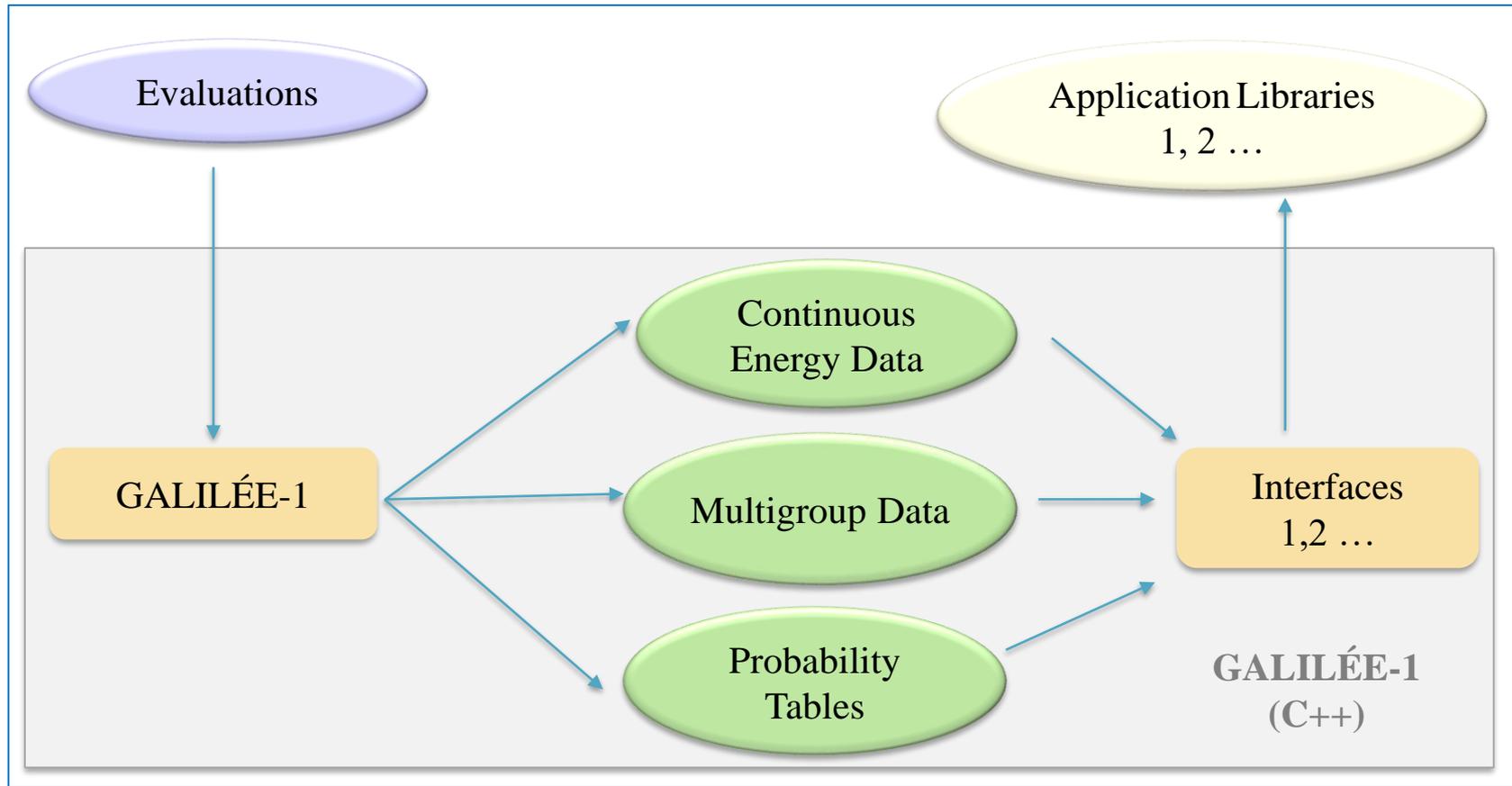
October 8-12, 2018

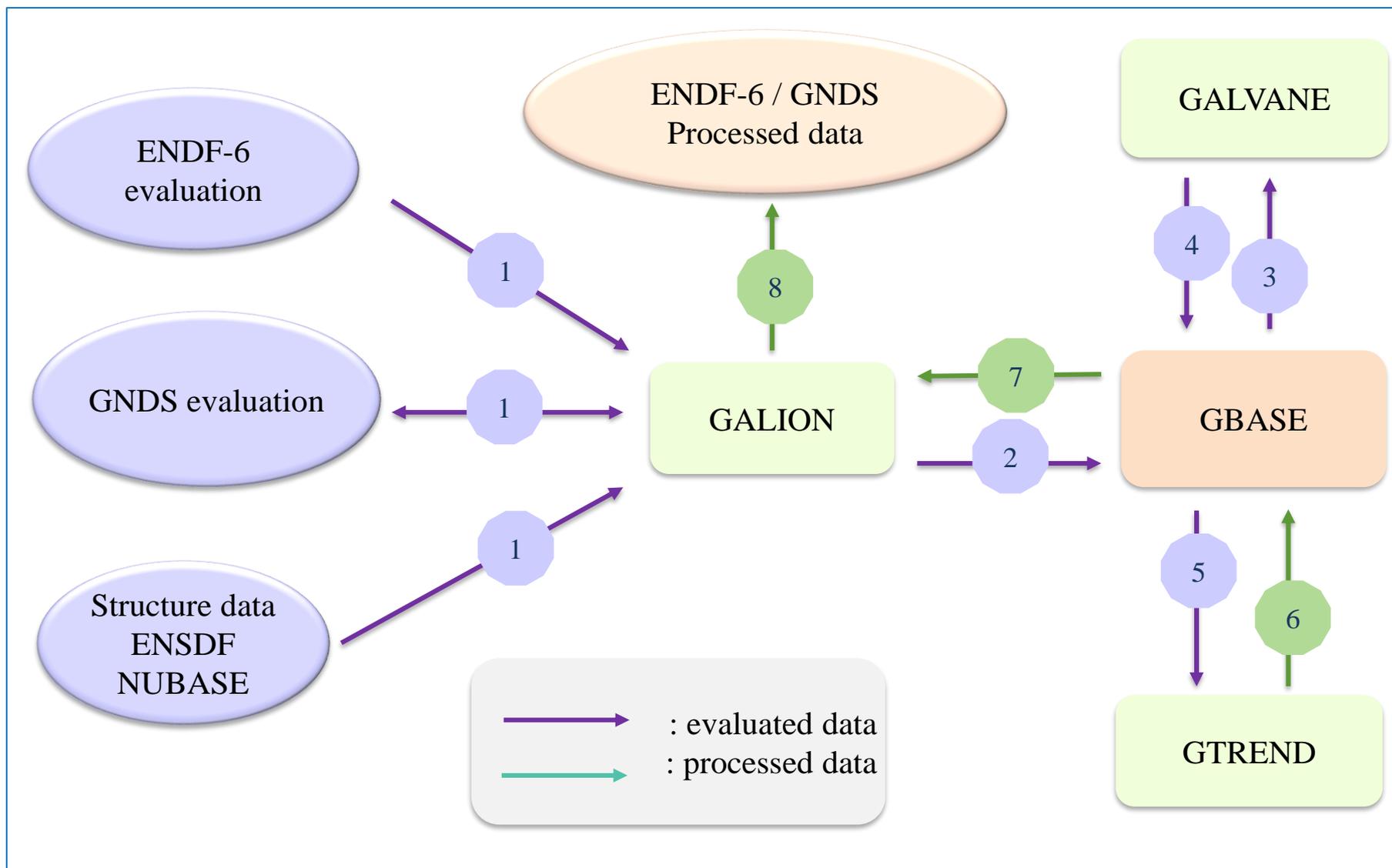
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- Motivations
- Description of the GALILEE-1 Code
- Capabilities
- RRR Reconstruction / Linearization OK
- Doppler broadening
- URR reconstruction
- Probability tables

The development of GALILÉE-1 system allows us :

- to master processing tools
- to create consistent and validated libraries for transport and depletion codes
- to provide processing tools for application codes
(Ex: Doppler broadening on the fly for Monte Carlo)
- to benefit from an enriched information coming directly from evaluation system or new format





■ Cross sections reconstruction OK in RRR

■ All nuclear formalisms

- Single-level Breit-Wigner
- Multi-level Breit-Wigner
 - simplified «NJOY-like/ENDF-6 » for elastic scattering
 - full treatment
- Breit-Wigner « multi-niveaux » (CALENDF)
- Reich-Moore
- R-Matrix limited
- URSLBW (unresolved range)

■ Exact cross sections at one energy

■ Linearization tools

■ Input

- Set of any functions with a « double » input data and a « double output »
{ $y = f(x)$, double y , double x }
- Precision criteria (ponctual, integral, mixt) according to an energy range

■ Output

- Common abscissa grid for all functions
- Values for all functions on the common abscissa grid

■ Doppler broadening

- Principle : Convolution of any kernel (Free gas, cristal lattice, ...)
with any function :

Doppler broadening could be applied on exact cross sections over the whole
energy range (no upper limit)
Doppler broadening for all partial cross sections

- Already done: convolution with linear function

Ag109 / JEFF32

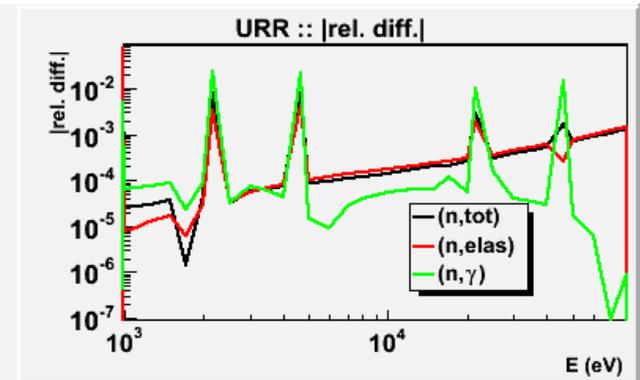
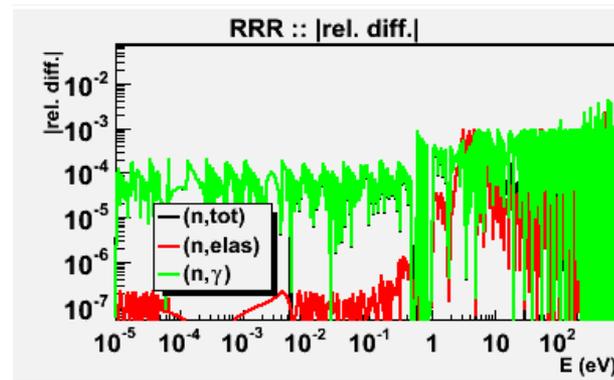
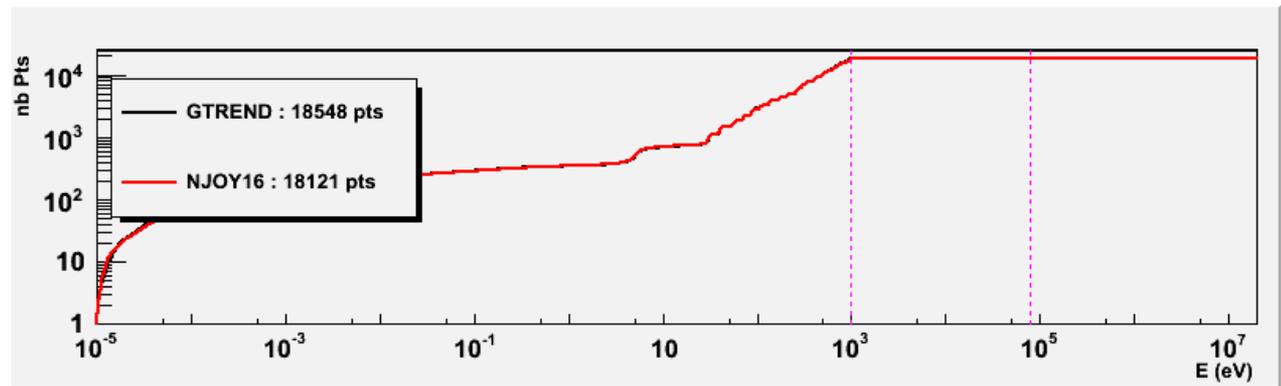
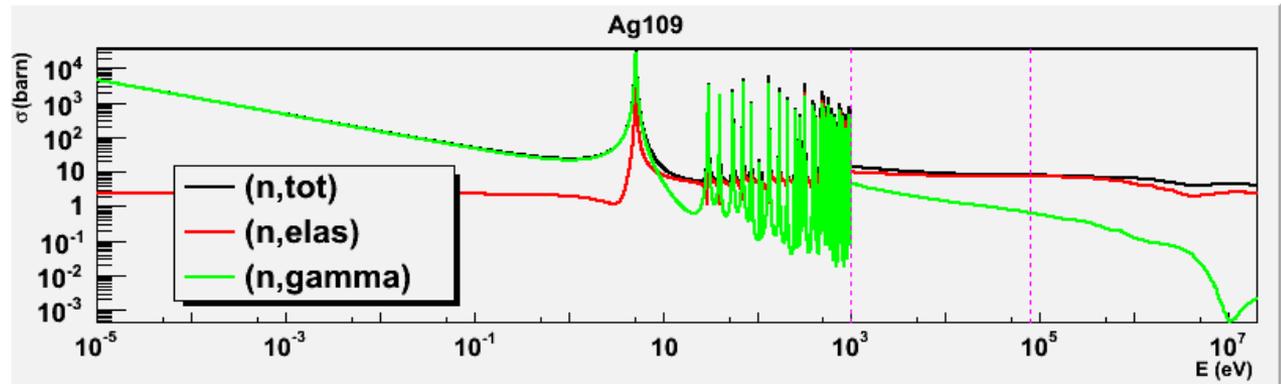
Comparison between

NJOY16 and GTREND

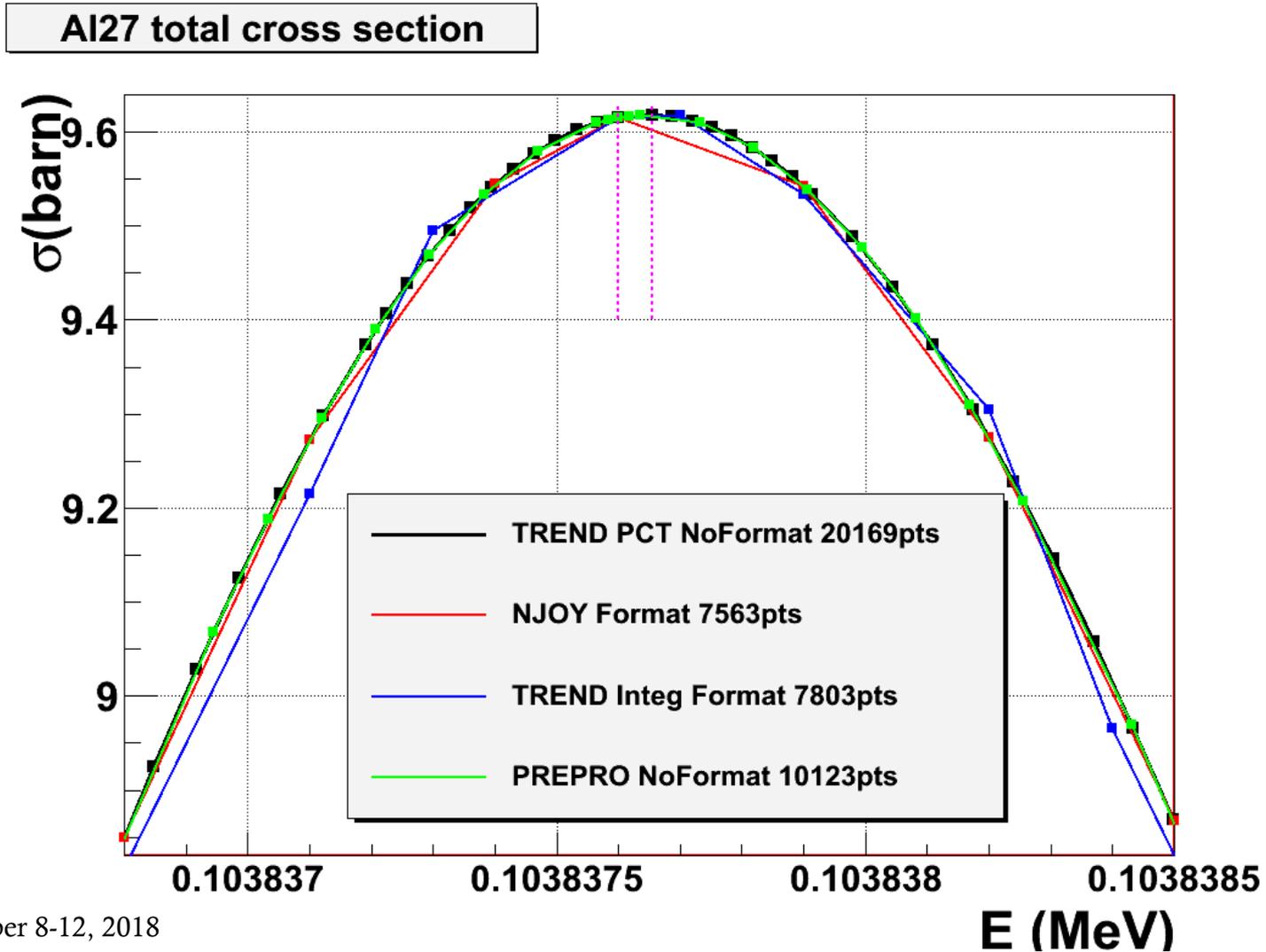
Cross sections (RRR)

Cross sections (URR)

Energy grid

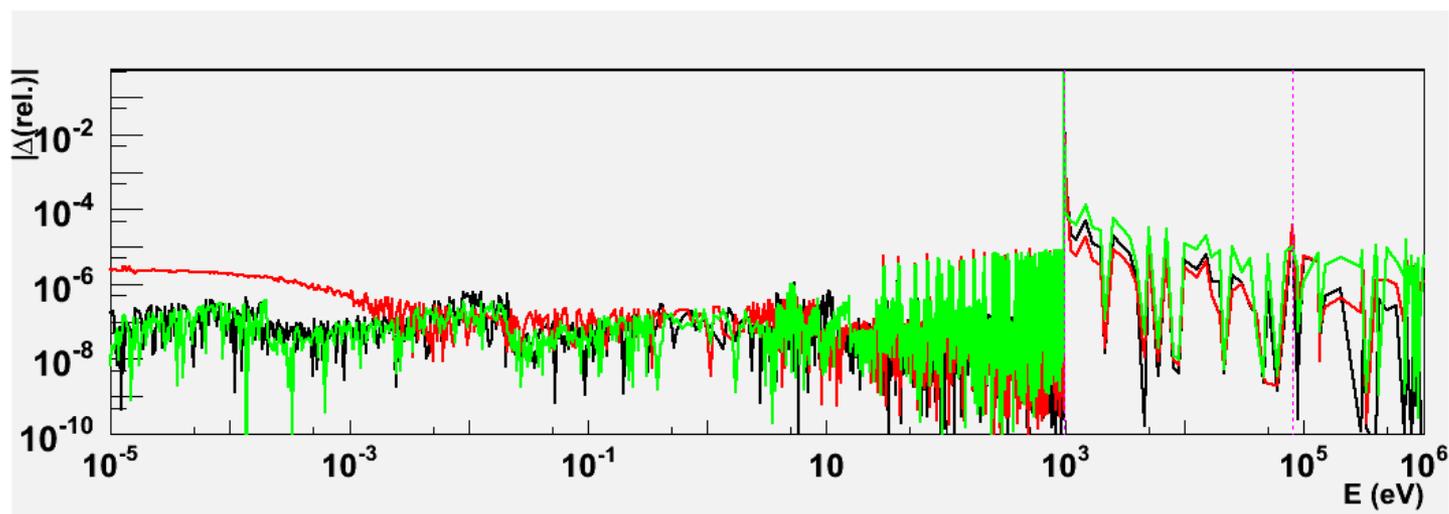
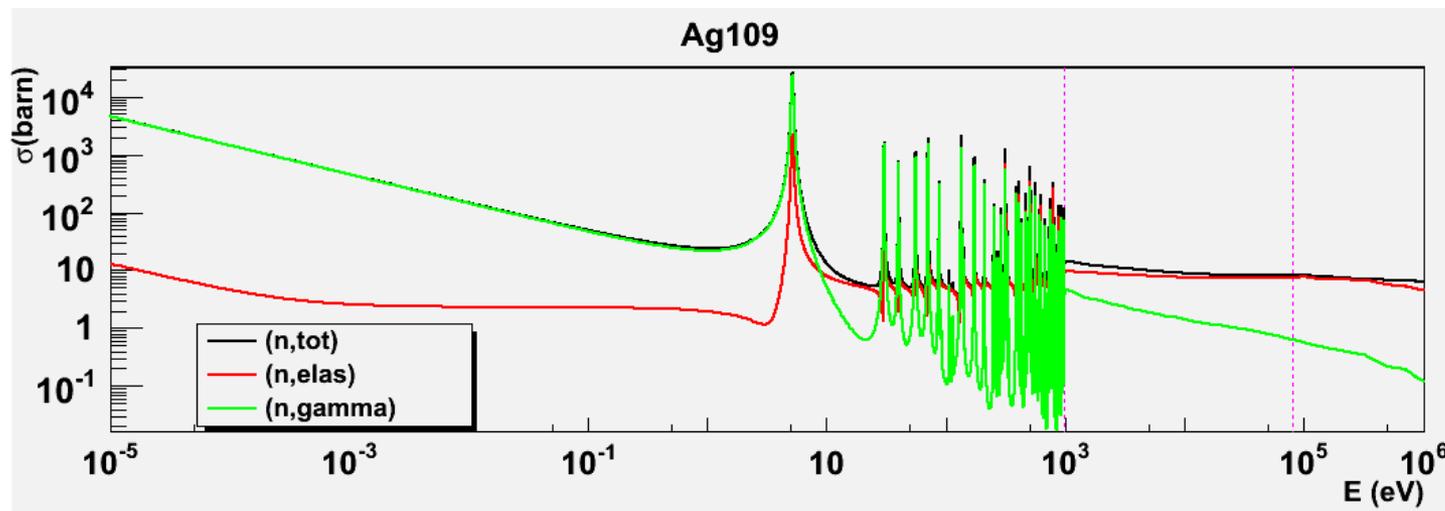


Various Criteria used for cross section linearization

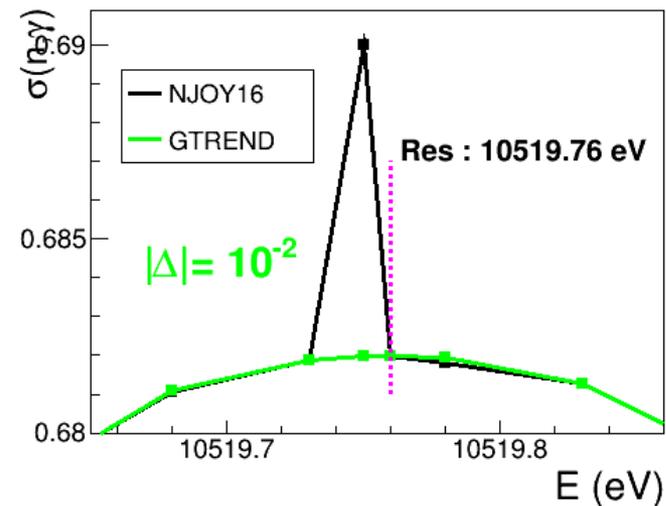
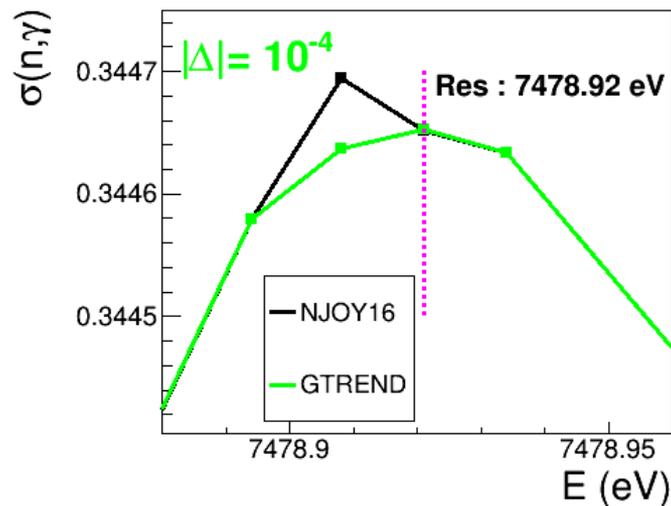
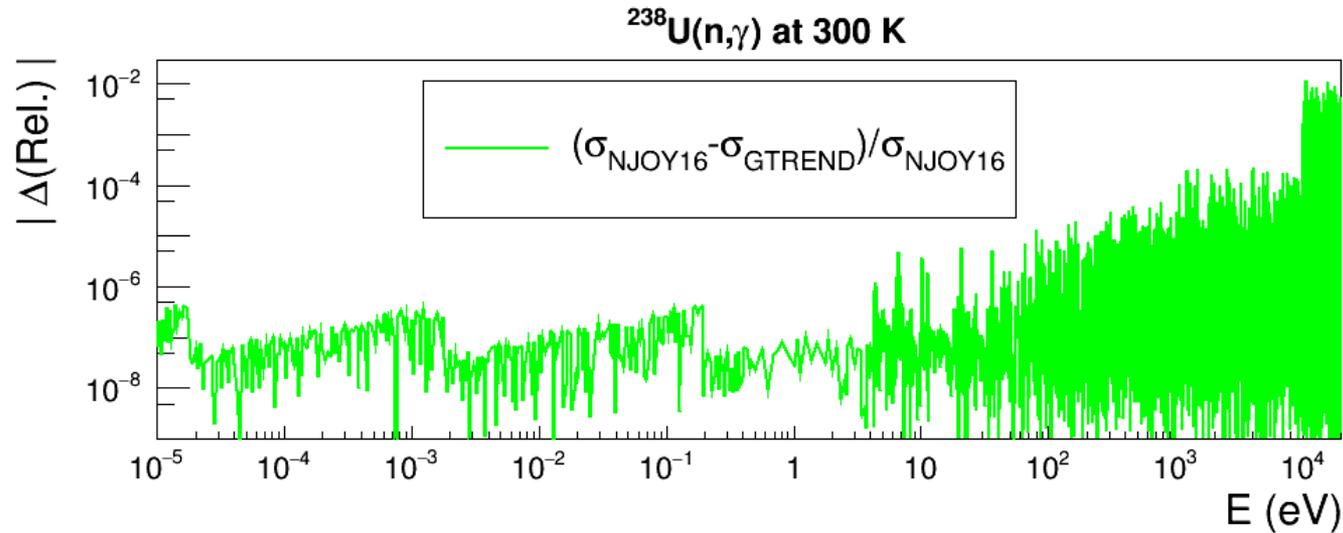


DOPPLER BROADENING / BROADR (300K)

XS Doppler : GTREND Doppler broadening cross section on NJOY2016 Energy grid
PENDF / NJOY 0K used



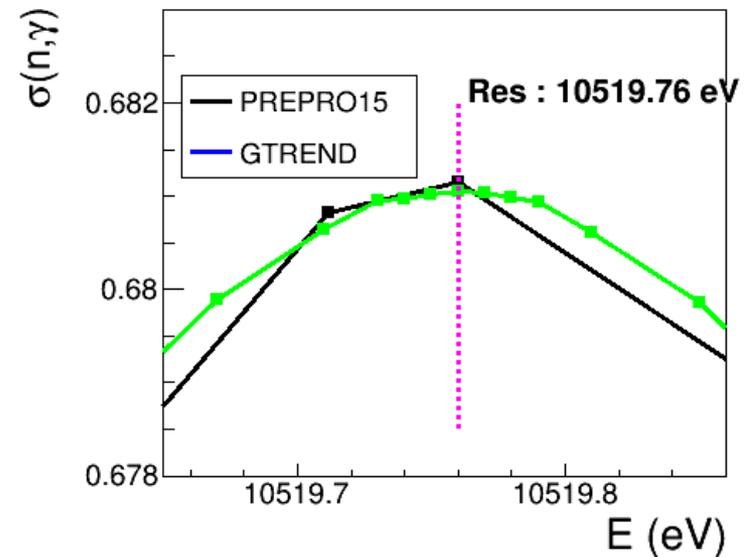
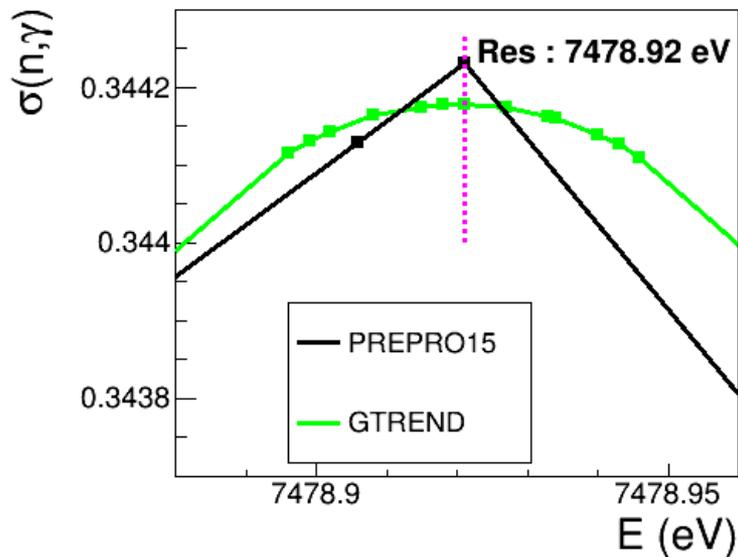
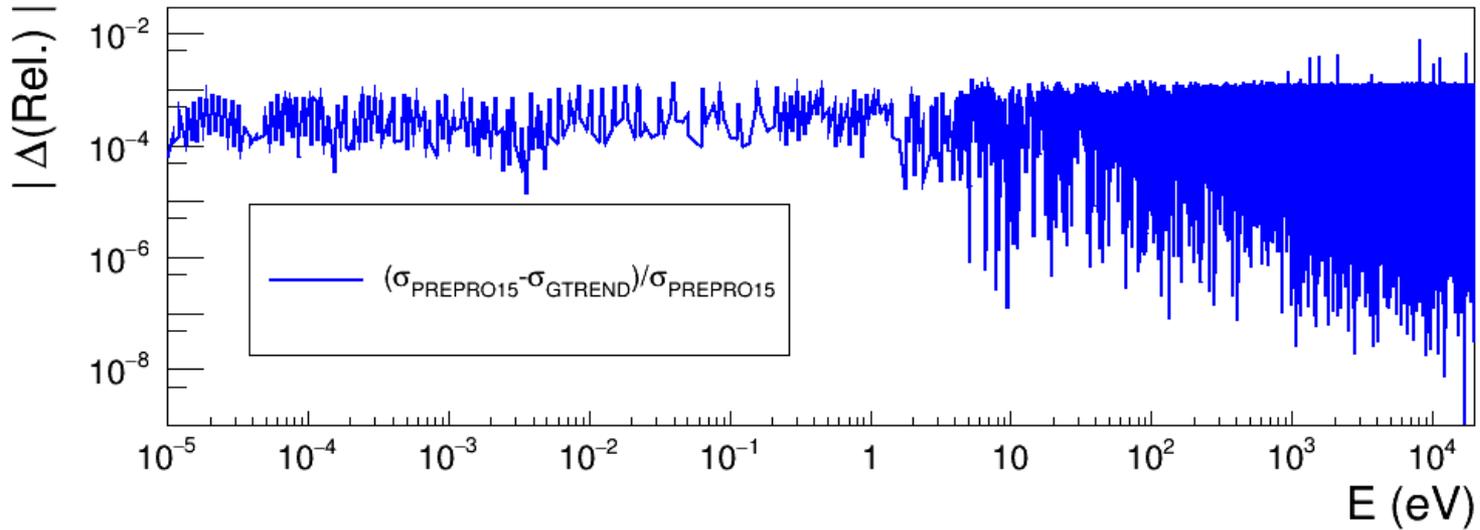
GLITCHES ON NJOY16 DOPPLER BROADENING



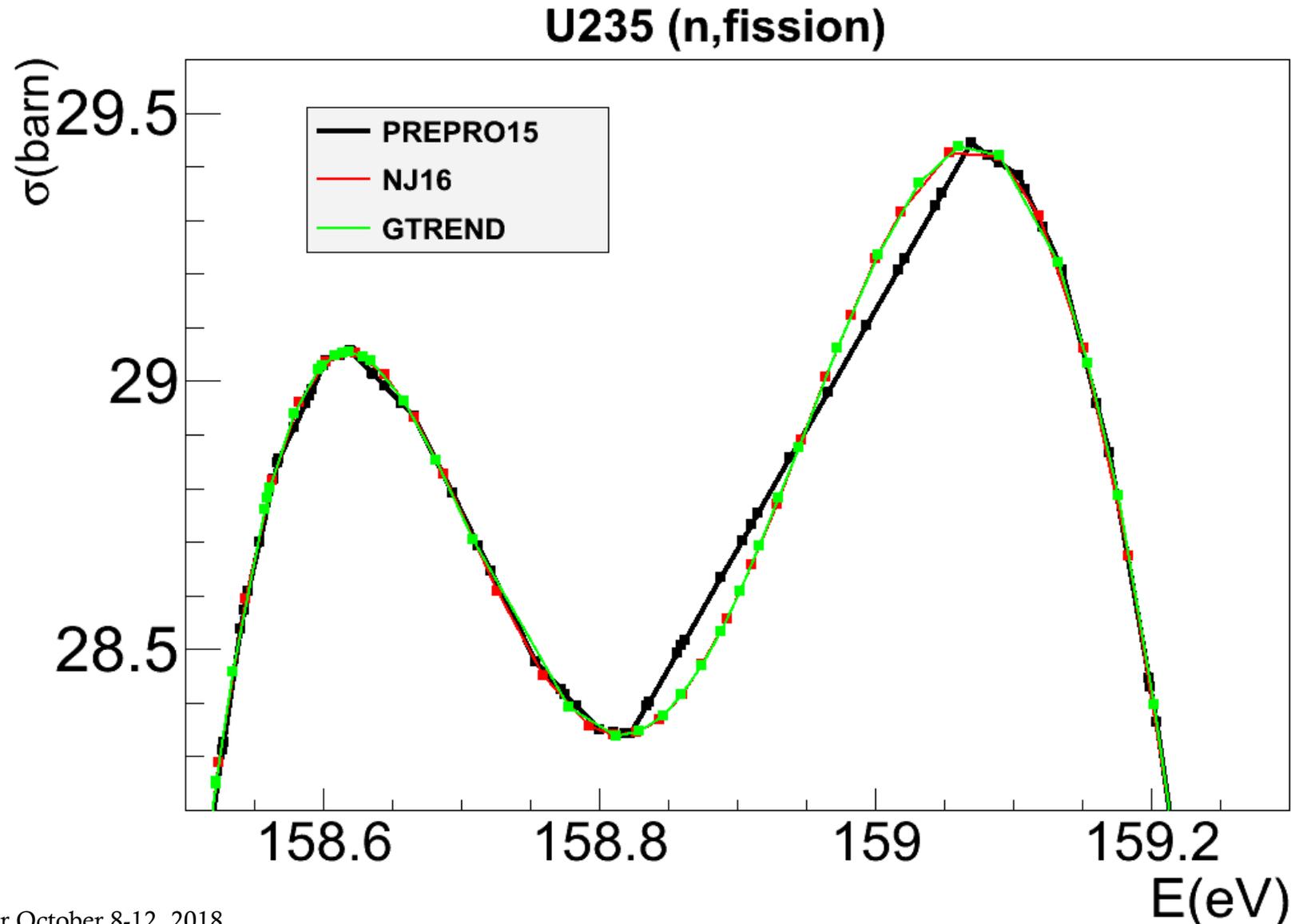
No major impact on macroscopic calculations

DOPPLER BROADENING / PREPRO

$^{238}\text{U}(n,\gamma)$ at 300 K



RECONSTRUCTION + DOPPLER BROADENING : NJOY / PREPRO / GTREND



URR RECONSTRUCTION (AVERAGE XS LSSF=0)

URR reconstruction

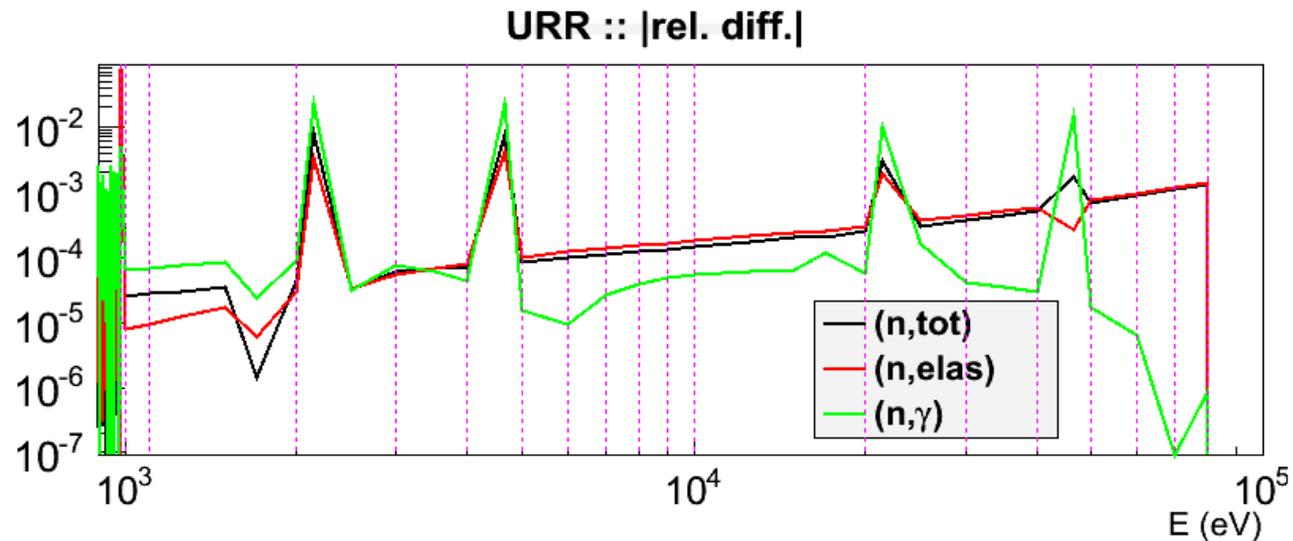
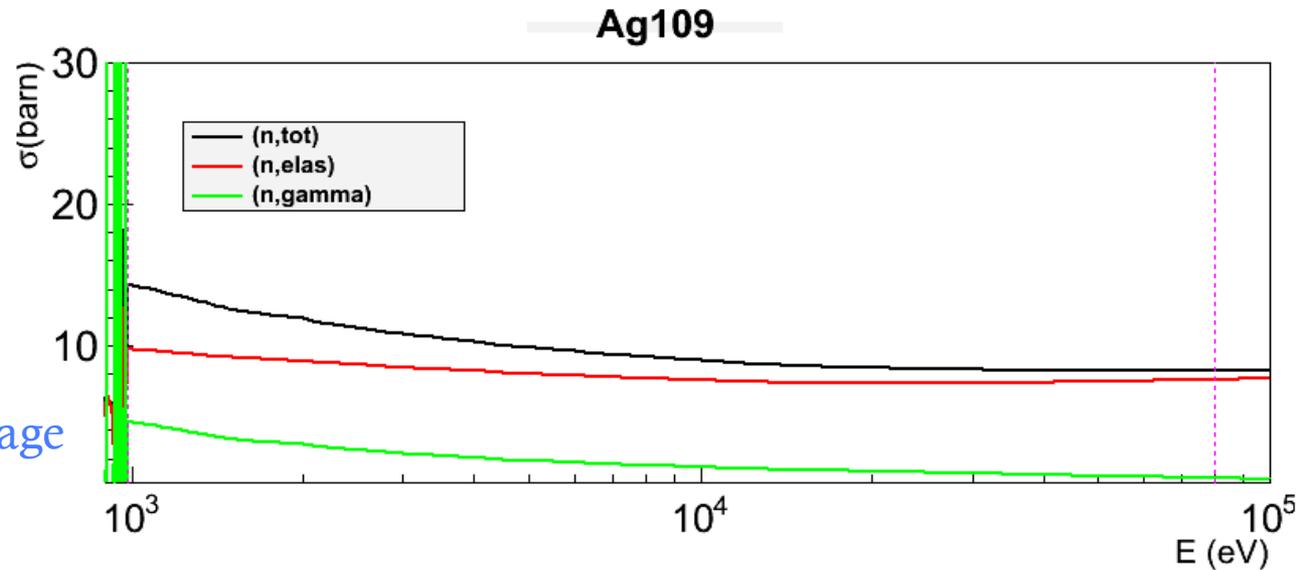
Evaluation : interpolation mode for average parameters

NJOY : Interpolation on average cross sections calculated on MF2 energy grid

GTREND :

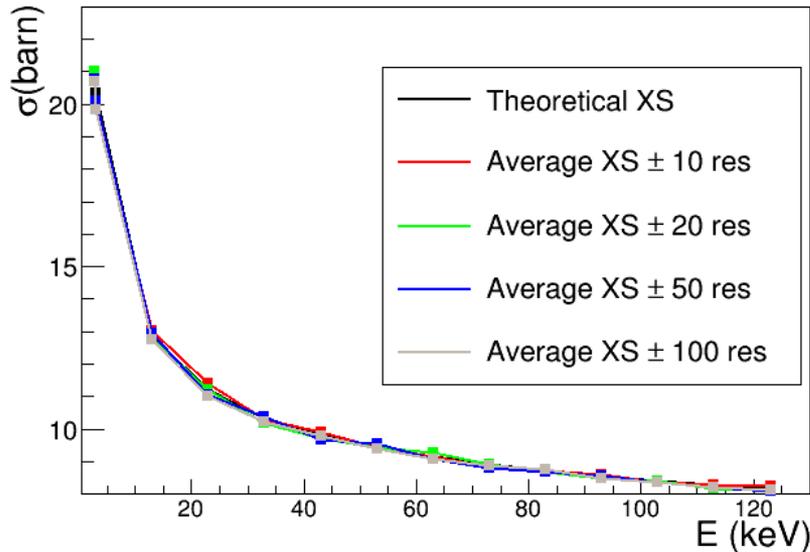
Cross sections calculations from interpolated average parameters.

Interpolation on XS or on parameters ?



URR SAMPLING → POINTWISE PROBABILITY TABLES

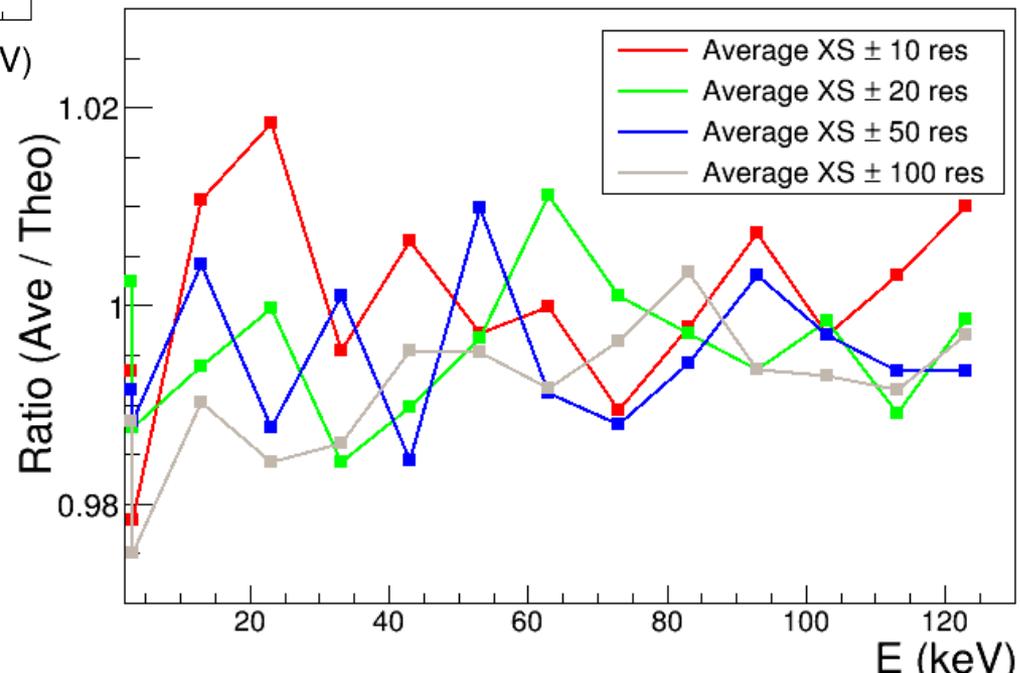
average XS Tot Gd154



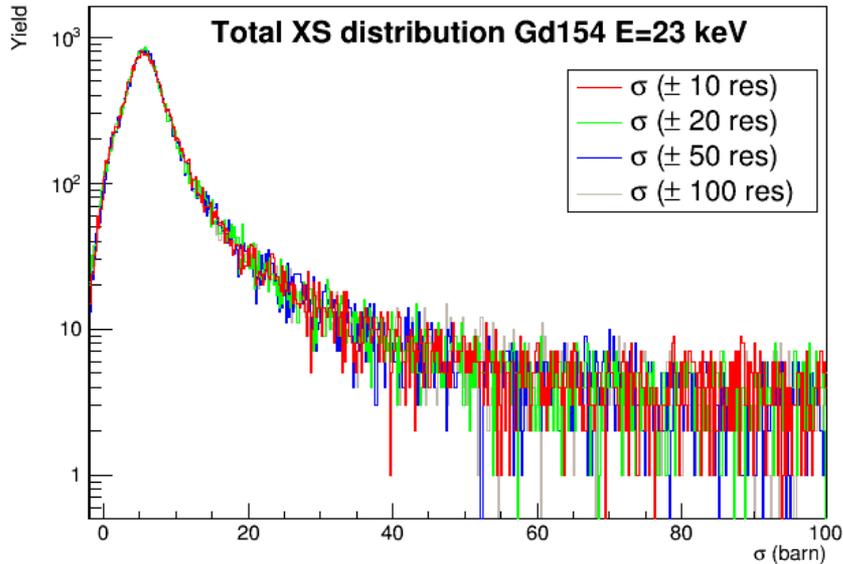
Dependance to number of resonances for average total cross section

Gd154 JEFF-3.2
URR 2.7 keV to 123 keV
URR Type C
30 000 samplings
SLBW in URR
How many resonances ?

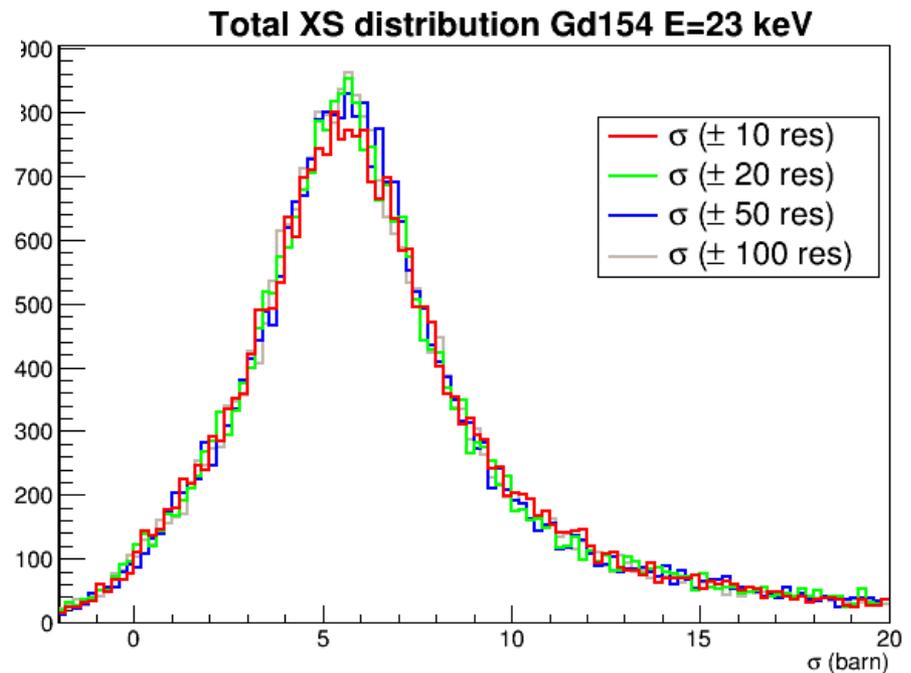
ratio average XS Tot Gd154



URR SAMPLING → POINTWISE PROBABILITY TABLES

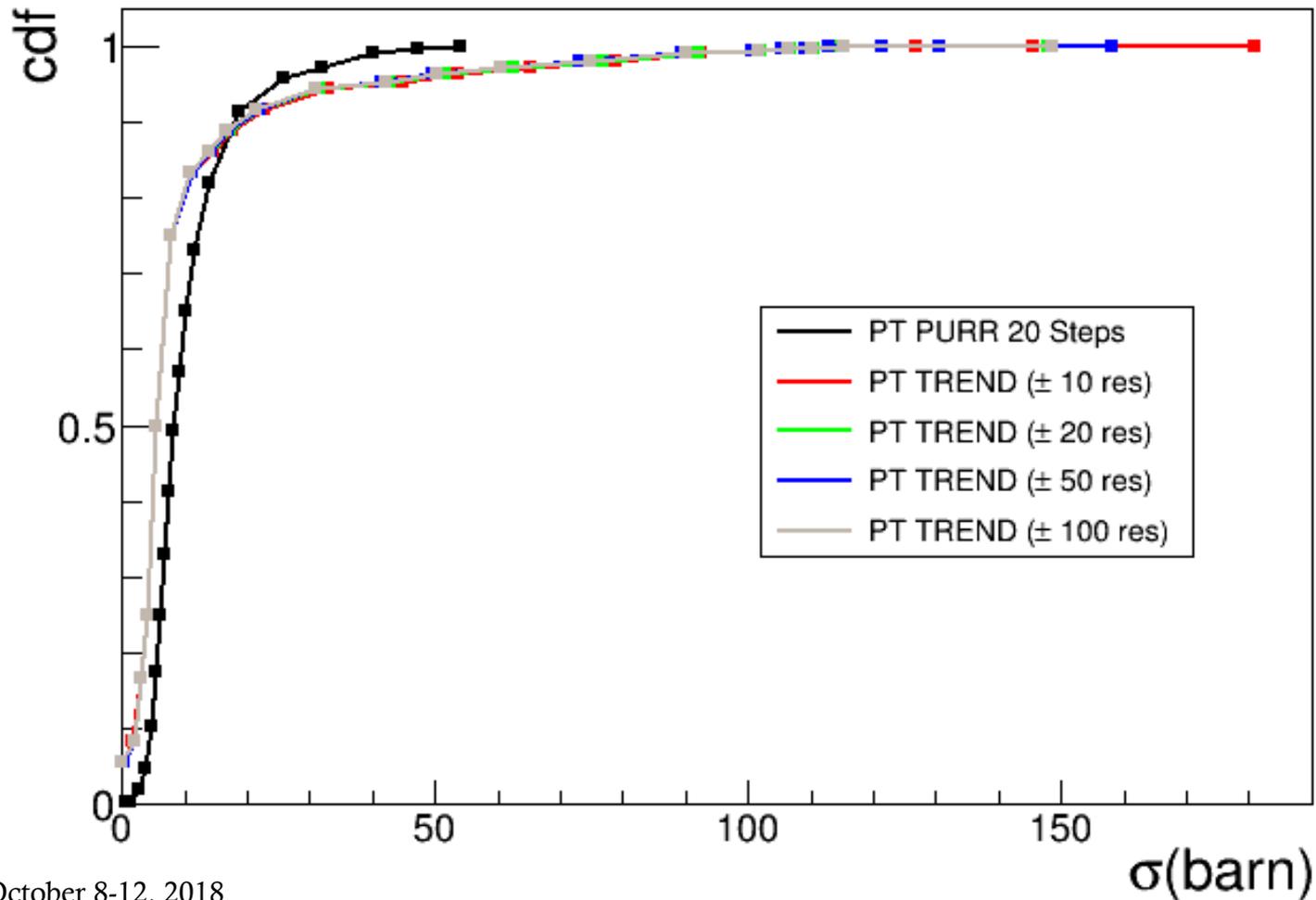


Dependance to number of resonances for total cross section distribution



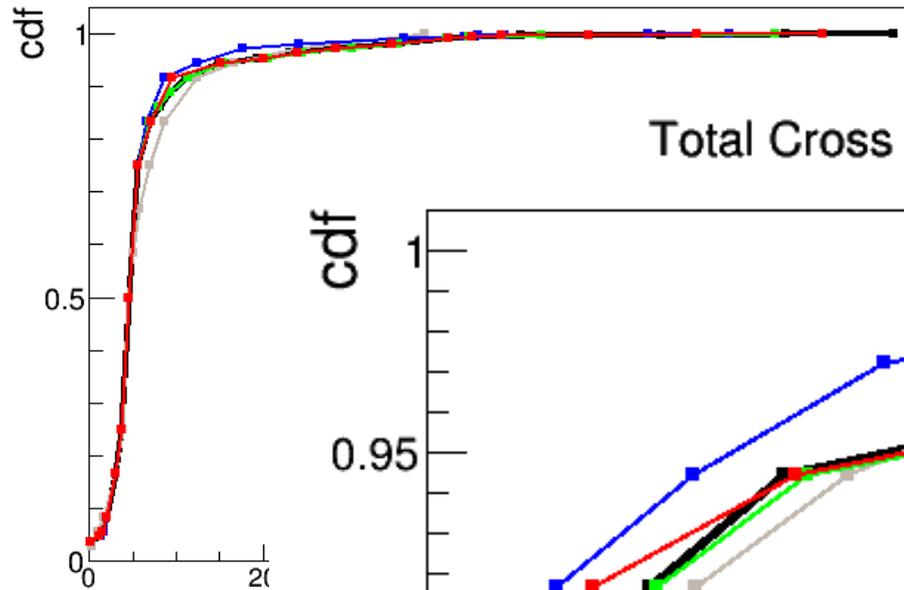
Probability table : comparison to PURR PT

Total Cross section PT Gd154 / 23keV

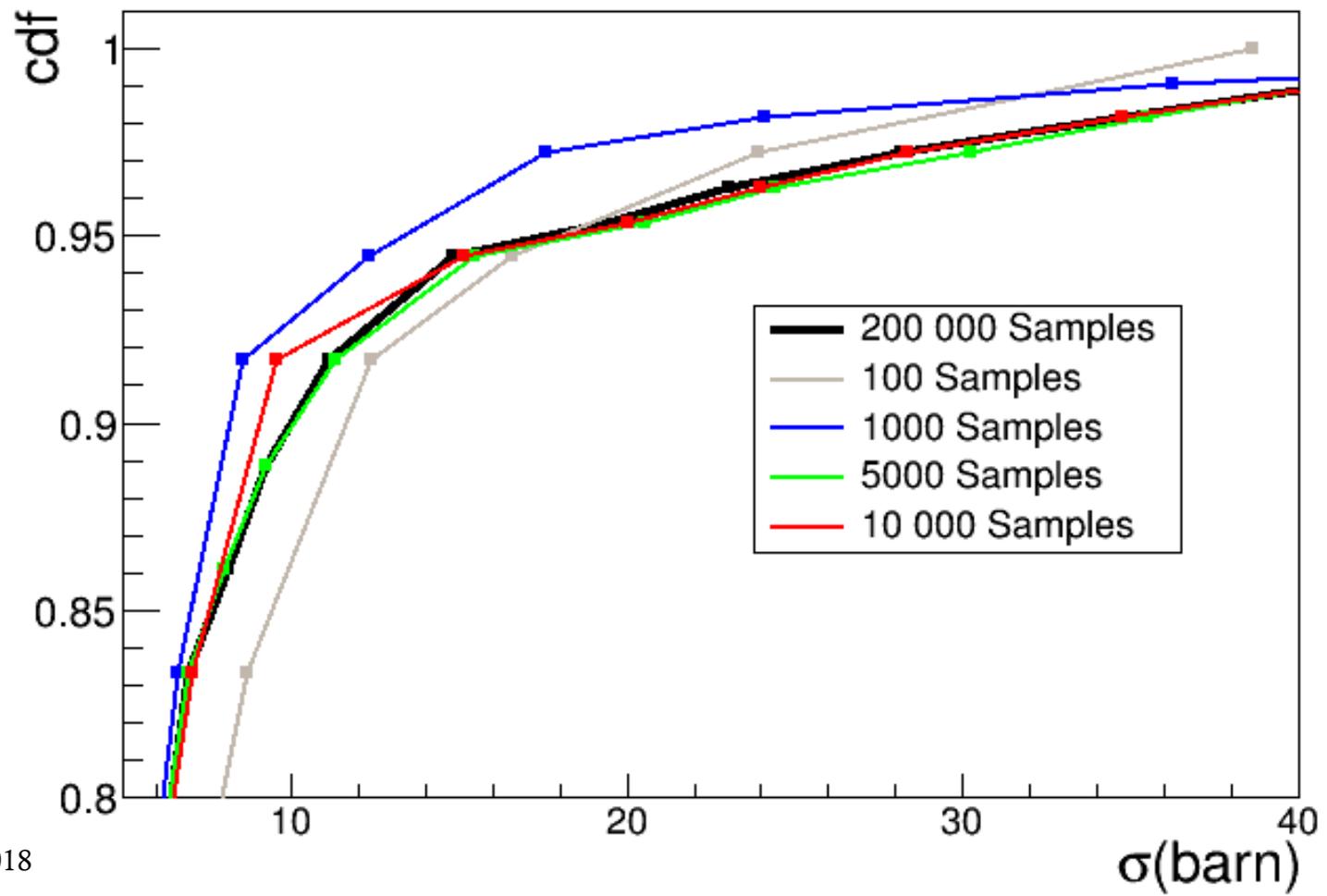


PT CONSTRUCTION : SENSITIVITY TO SAMPLES NUMBER

Total Cross section PT Ba140 / 60keV

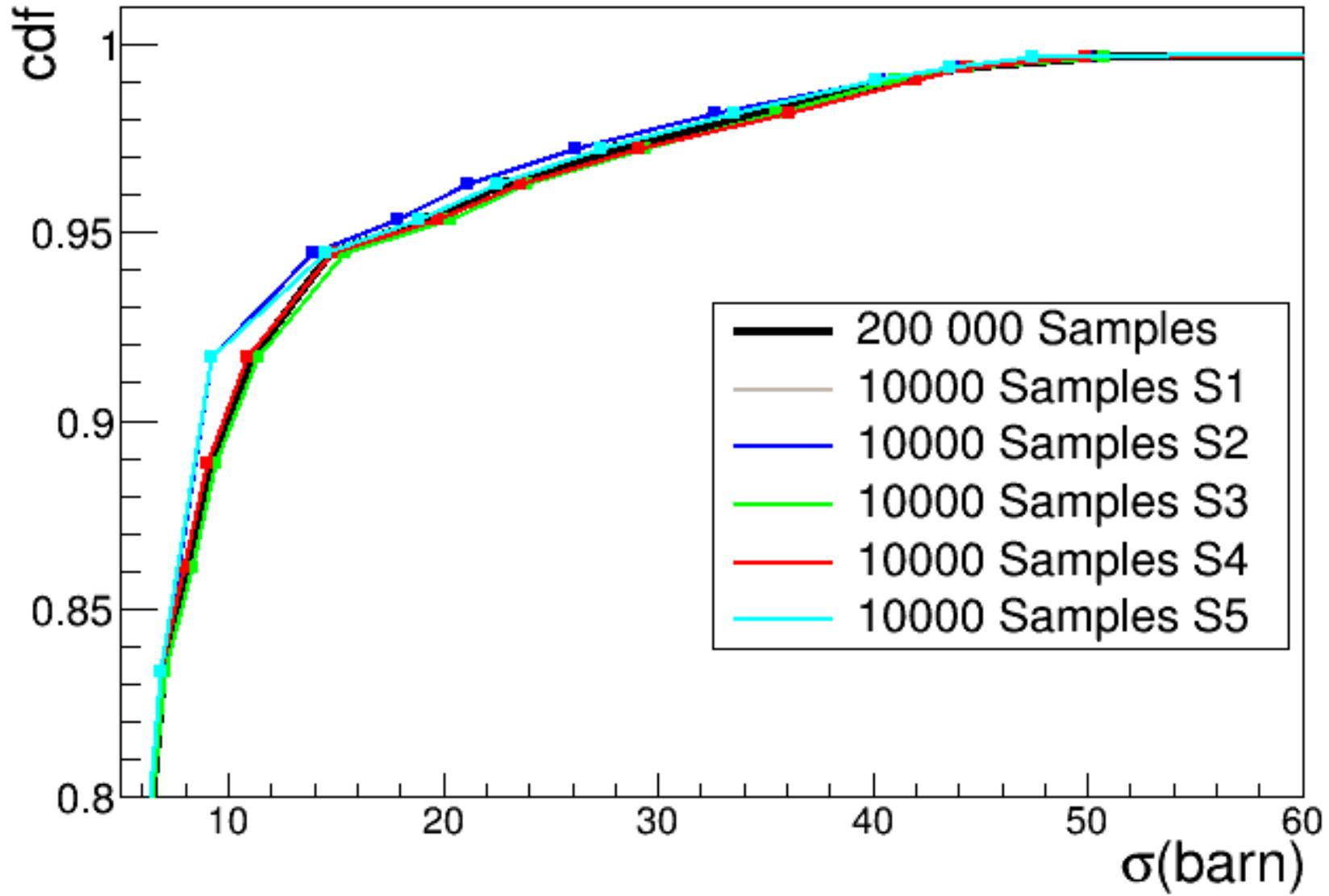


Total Cross section PT Ba140 / 60keV



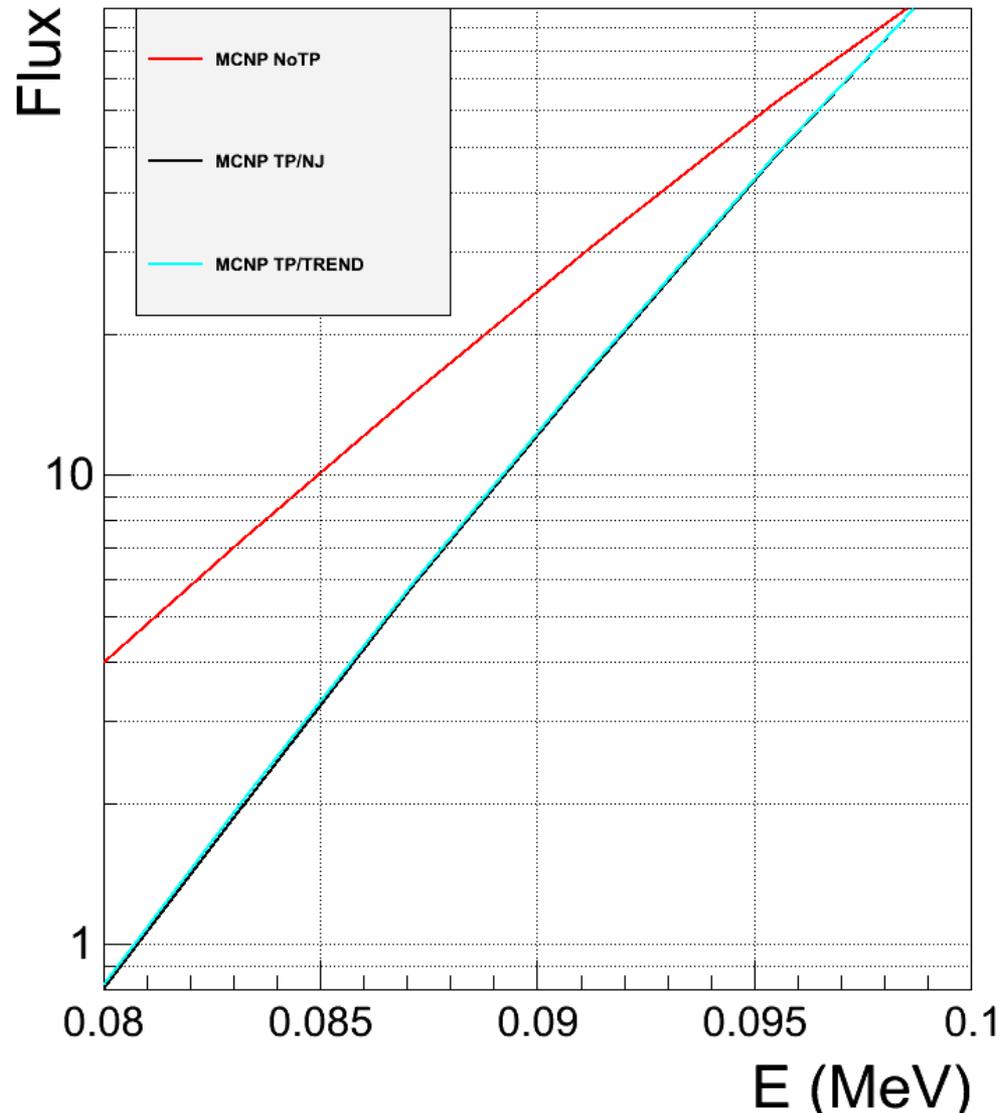
PT CONSTRUCTION : SENSITIVITY TO SAMPLES NUMBER (50 RESONANCES)

Total Cross section PT Ba140 / 60keV



Ba140 Sphere
Source 101 keV
Neutron flux in sphere

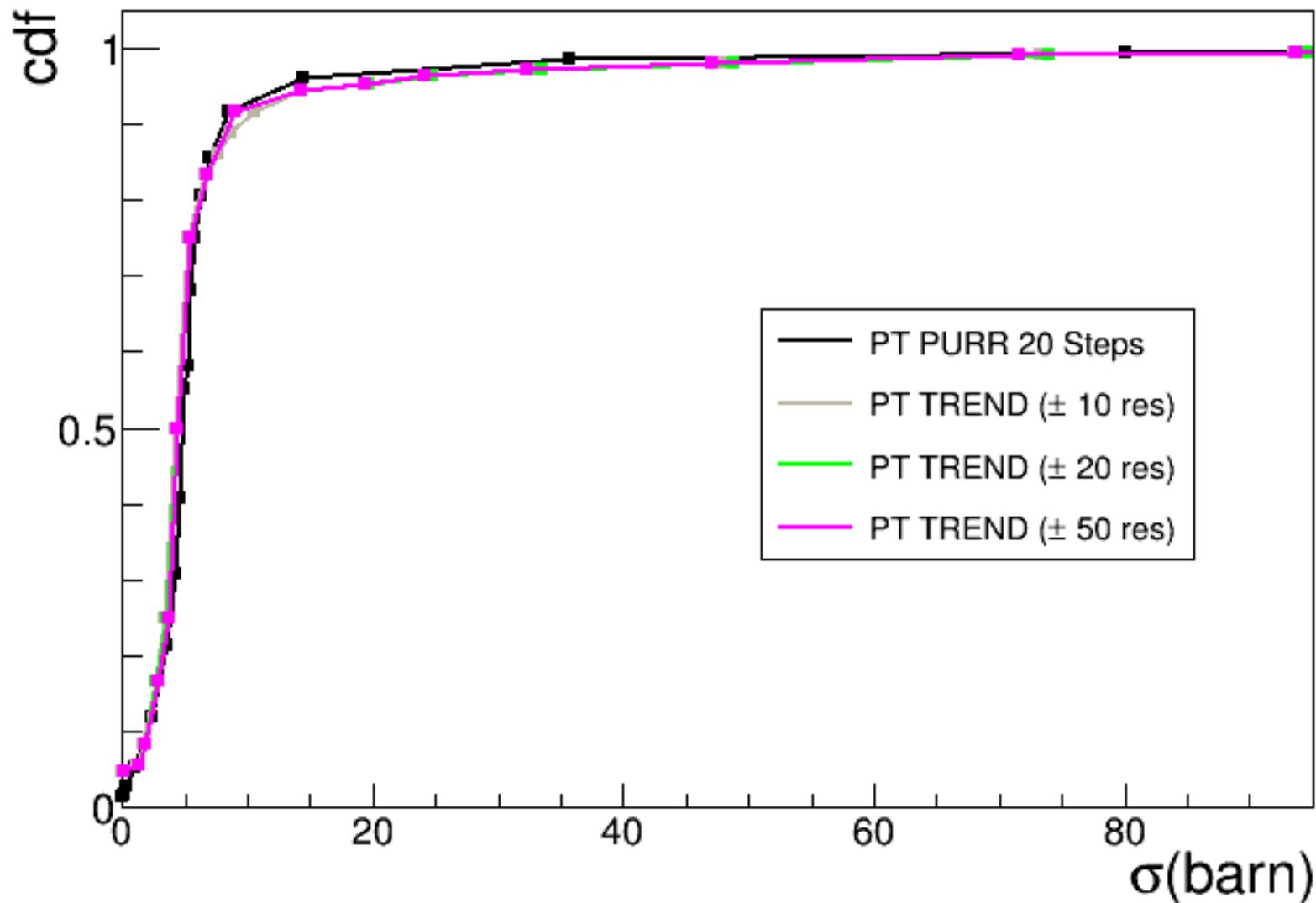
Ba140



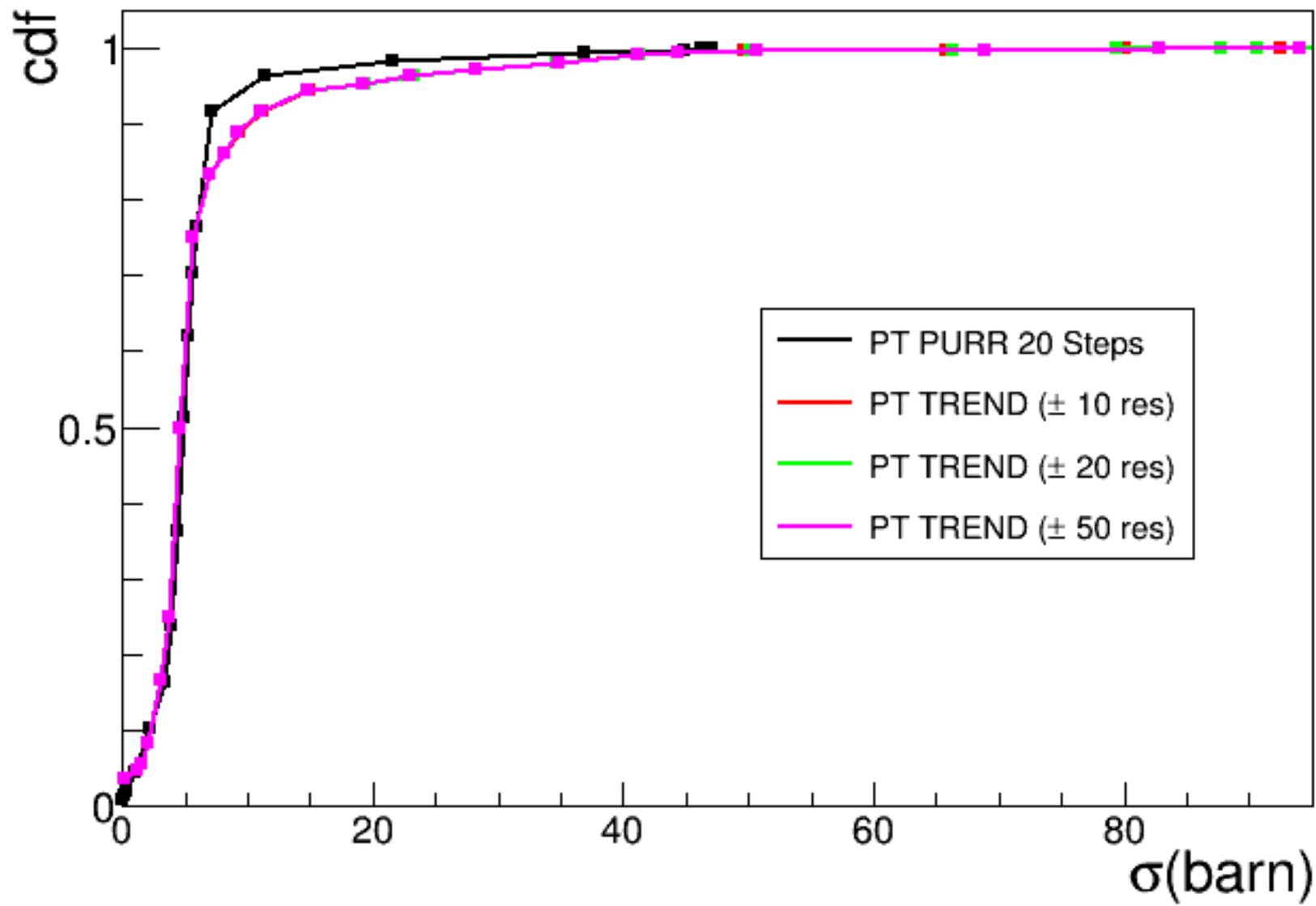
- Reconstruction RRR 0K (all formalisms) : done
- Doppler Broadening (various criteria) : done
- URR average cross sections : done
- URR pointwise Probability Tables : in progress
- URR multigroup Probabality Tables : in progress
- Thermal treatment : in progress



Total Cross section PT Ba140 / 25keV

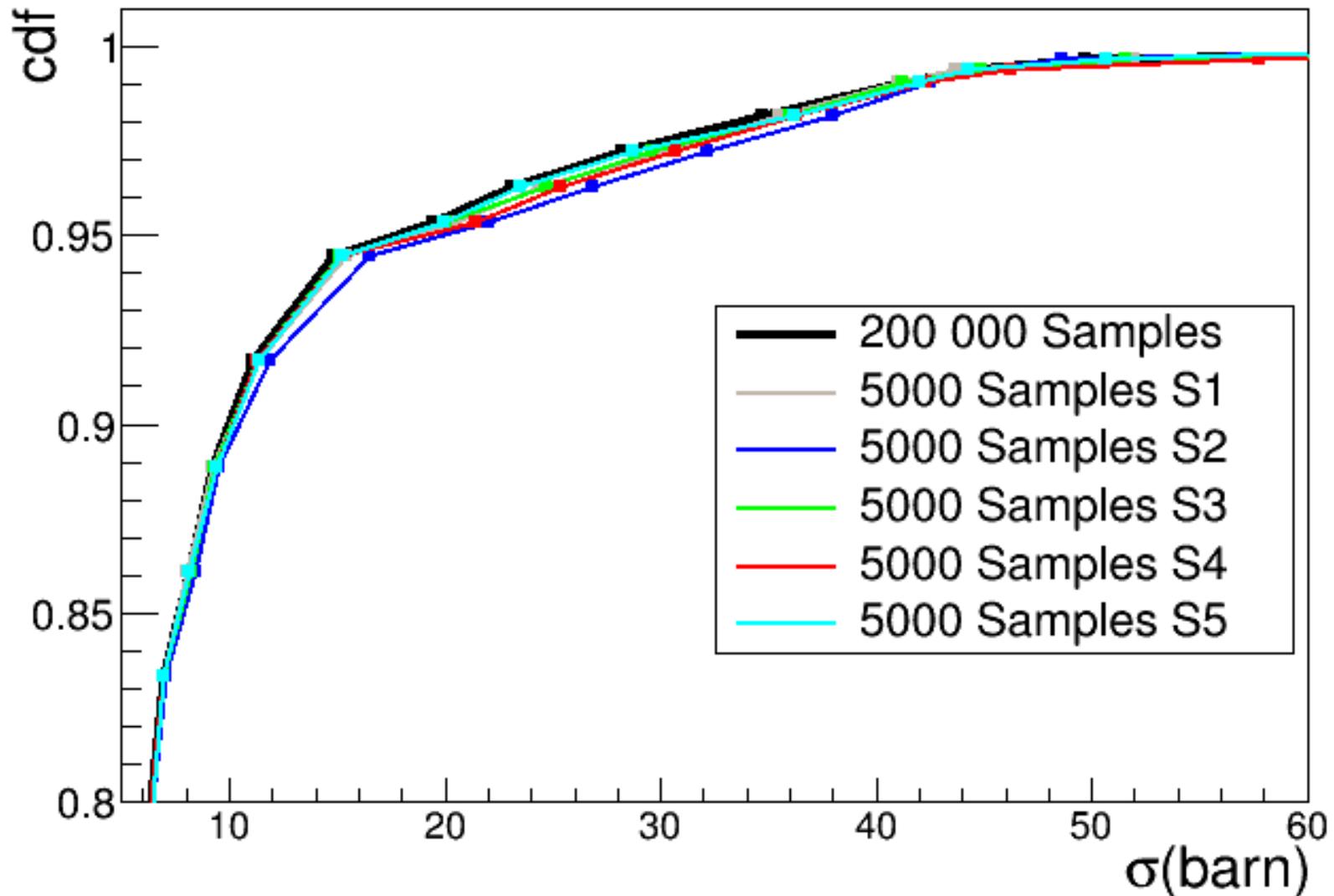


Total Cross section PT Ba140 / 60keV



PT CONSTRUCTION : SENSITIVITY TO SAMPLES NUMBER (10 RESONANCES)

Total Cross section PT Ba140 / 60keV



PT CONSTRUCTION : SENSITIVITY TO SAMPLES NUMBER (10 RESONANCES)

Total Cross section PT Ba140 / 60keV

