# Accurate Nuclear Data for nuclear Energy Sustainability (ANDES)

ANDES Partners: CEA, CIEMAT, CNRS, GSI, IFIN-HH, INFN, ITN, JRC, JSI, JYU, NNL, NRG, PSI, SCK•CEN, TUW, UB, ULG, UPM, USC, UU

In response to the nuclear data needs associated to the new reactors and new fuel cycles supported by SNETP in its strategic research agenda and in the ESNII proposal, and taking into account the priority lists for nuclear data from NEA/OECD, FP6-EURATOM projects EUROTRANS-NUDATRA and CANDIDE, a collaboration of 20 research centers and universities prepared a proposal to the FP7-EURATOM. The proposal with title Accurate Nuclear Data for Nuclear Energy Sustainability, ANDES, has been approved and has started its activities in May 2010.
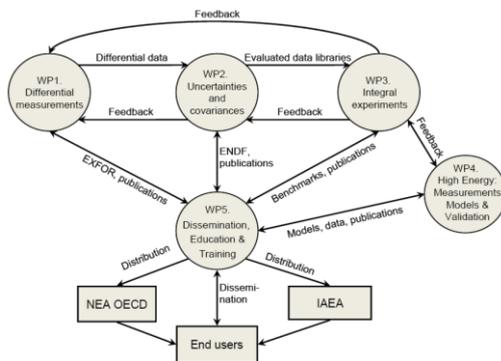
ANDES activities interrelations

IRMM in the JRC

GANIL

IFIN-HH

ANDES combines a reduced group of selected differential measurements, the improvement in uncertainties and covariance's within the evaluation process and the validation of present and new data libraries using integral experiments, to bring most critical nuclear data to the level of accuracies required by the new reactors and system promoted by ESNII and the SNETP. In addition, a specific work package will improve the prediction capabilities of high-energy transport codes for the design of ADS, developing better models and performing a few selected measurements. All this activities will be coordinated with the End Users and the main actors for nuclear data dissemination, the NEA/OECD and the IAEA.

For the measurements of low and medium energies for advanced reactor systems, a combination of the best world facilities will be used in ANDES, including: IRMM neutron sources, both the e- linear and the Van de Graaff accelerators, the n_TOF spallation facility at CERN, the Jÿvaskÿla cyclotron and the IGISOL facility, the CNRS/Orsay accelerators, and the GANIL accelerator complex. ANDES is concentrating these measurements in the following reactions and isotopes:

1. High accuracy measurements of neutron inelastic scattering cross sections of ^{238}U and isotopes of structural materials and inert fuel (^{23}Na, Zr, Mo).

2. High accuracy measurements of neutron total and capture cross sections of ^{238}U and ^{241}Am.

3. High accuracy measurements of fission cross sections several of Pu isotopes (^{238}Pu, ^{240,242}Pu), and minor actinides (^{241,243}Am and ^{245}Cm), including the fission yields for isotopes of Np, Pu and Cm by surrogate neutrons and inverse kinematics.

4. State of the art decay data measurements for reactor kinetics and decay heat to improve the experimental information for the beta decay probability and strength functions and the delayed neutron emission of relevant fission fragments (^{88}Br, ^{94}Rb, ^{95}Rb and ^{137}I).
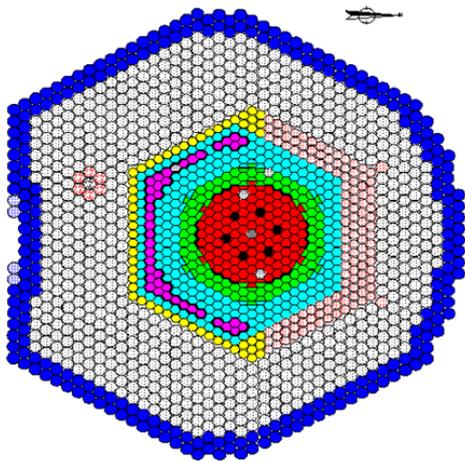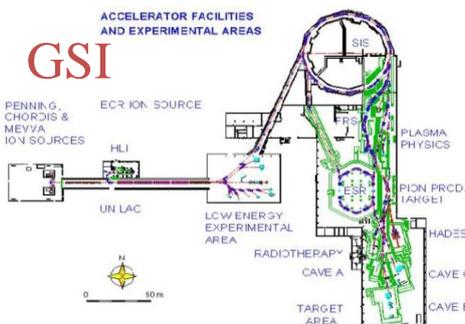
Most of these measurements are already well advanced or even completed from the point of view of data taking and at present are being analyzed, after less than a year.
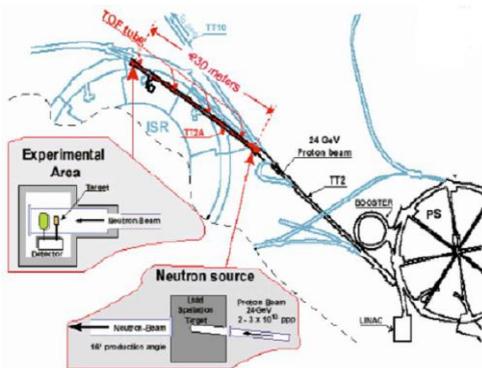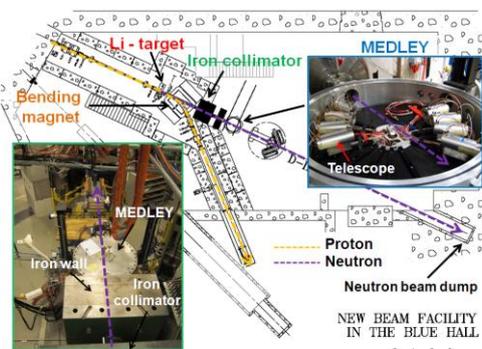
CERN n_TOF

PROFIL at PHENIX

GSI

TSL

To improve and asses the absolute accuracy of the results from computer simulations the ANDES collaboration decided to concentrate its effort in nuclear data evaluation around the data uncertainties and correlations. Special efforts will be devoted to the codes TALYS, GENEUS, CONRAD, ACAB, FISPIN. A similar effort will be made to prepare simulation programs to use covariance information. To demonstrate the performance of these tools, the covariance matrices of one major and one minor actinide (from ^{238}U/^{239}Pu, ^{241}Am) will be evaluated.

Integral experiments provide very relevant information for evaluation and validation of nuclear data. For these purpose ANDES have selected data coming from the following facilities: MUSE, GUINEVERE, PROFIL, ZPPR10A, SNEAK-7A and -7B, and the collection of international criticality benchmarks. Each of these experiment provide specific complementary information.

To provide directly useful data for the ESNII ADS demonstration facility, the main objective for ANDES in the high energy range is the model validation in the 150-600 MeV energy domain. A improving the predicting capabilities of the models in this range, and using new measurements at 500 MeV (p+Pb) and the post irradiation examination of MEGAPIE samples.

In parallel with these technical activities, ANDES will develop an intensive education and training program. ANDES is promoting that its R&D results into PhD and Master theses. In addition, one open training course specialized in Nuclear Data for Sustainable Nuclear Energy will be organized within ANDES.

To prepare the dissemination of the new measured or evaluated nuclear data ANDES has setup a close cooperation with NEA and IAEA, the two agencies coordinating the distribution of nuclear data, has been setup. Furthermore a website collects the most relevant results from ANDES, both for general public or active members of the project. In addition, ANDES is setting up an End Users group with: universities; R&D organizations; experimental reactors and nuclear facilities, international nuclear data agencies, industries involved in design or exploitation activities for Gen-IV and ADS system utilities, regulatory bodies and education representatives. Early access to the results produced in the project will be granted to the End Users group members and they are expected to provide feedback for ANDES and future nuclear data activities.

SNETP: Sustainable Nuclear Energy Technological Platform
ESNII: European Sustainable Nuclear Industrial Initiative
ADS: Accelerator Driven subcritical System