

# Heating, Current Drive and Fast Particles Physics (1)

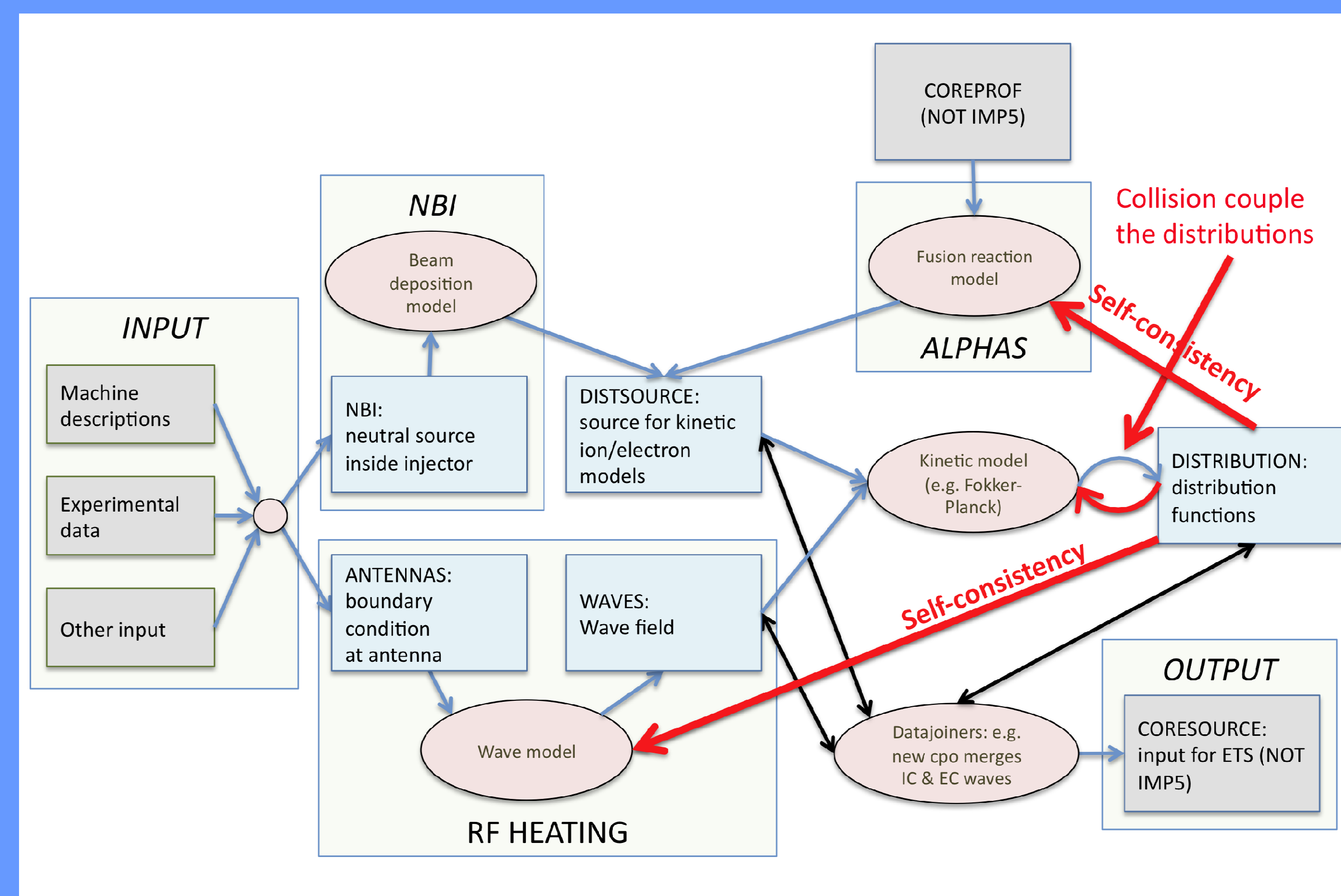
Within ITM-TF a specific Integrated Modelling project (IMP5) covers all areas in H&CD physics, e.g., EC, IC, NBI, LH, as well as alpha particles and fast particle interaction with instabilities

## Main physics issues and goals

The scope of the project is to provide a modular package of codes simulating heating, current drive and fast particle effects.

Codes are being integrated in workflows to address different physics problems, as e.g., provide heating and current sources for transport simulations (ETS) and MHD instability control simulations.

The ultimate goal is to enable self-consistent simulation of heating and current drive in the presence of fast particle instabilities, especially for ITER



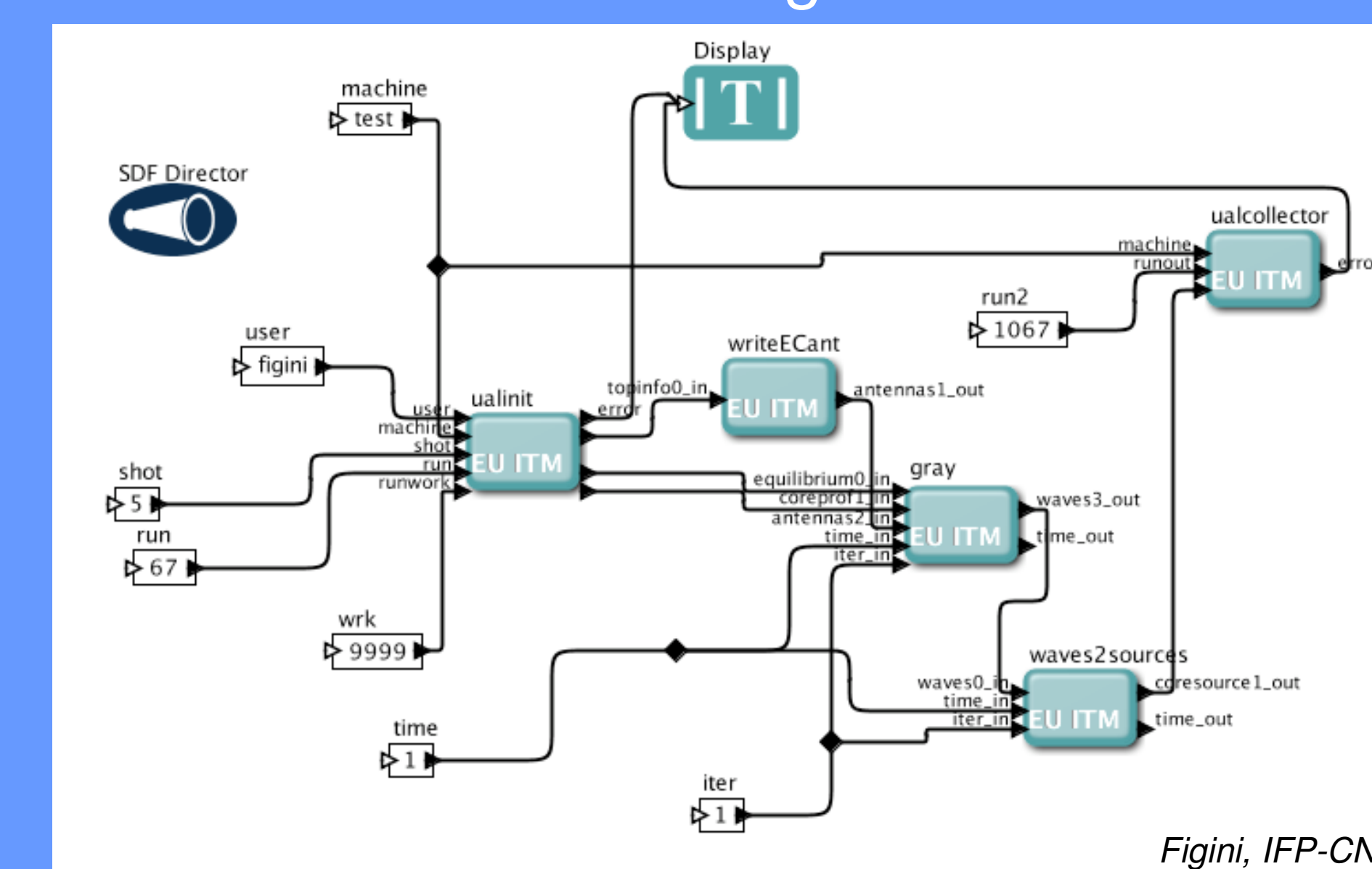
## EC & LH physics

Electron Cyclotron (ECRH&CD) and Lower Hybrid (LHCD) codes ported to ITM deal with a variety of models, as, e.g., optical and quasi-optical ray-tracing codes, beam tracing codes, as well as different current drive (CD) models.

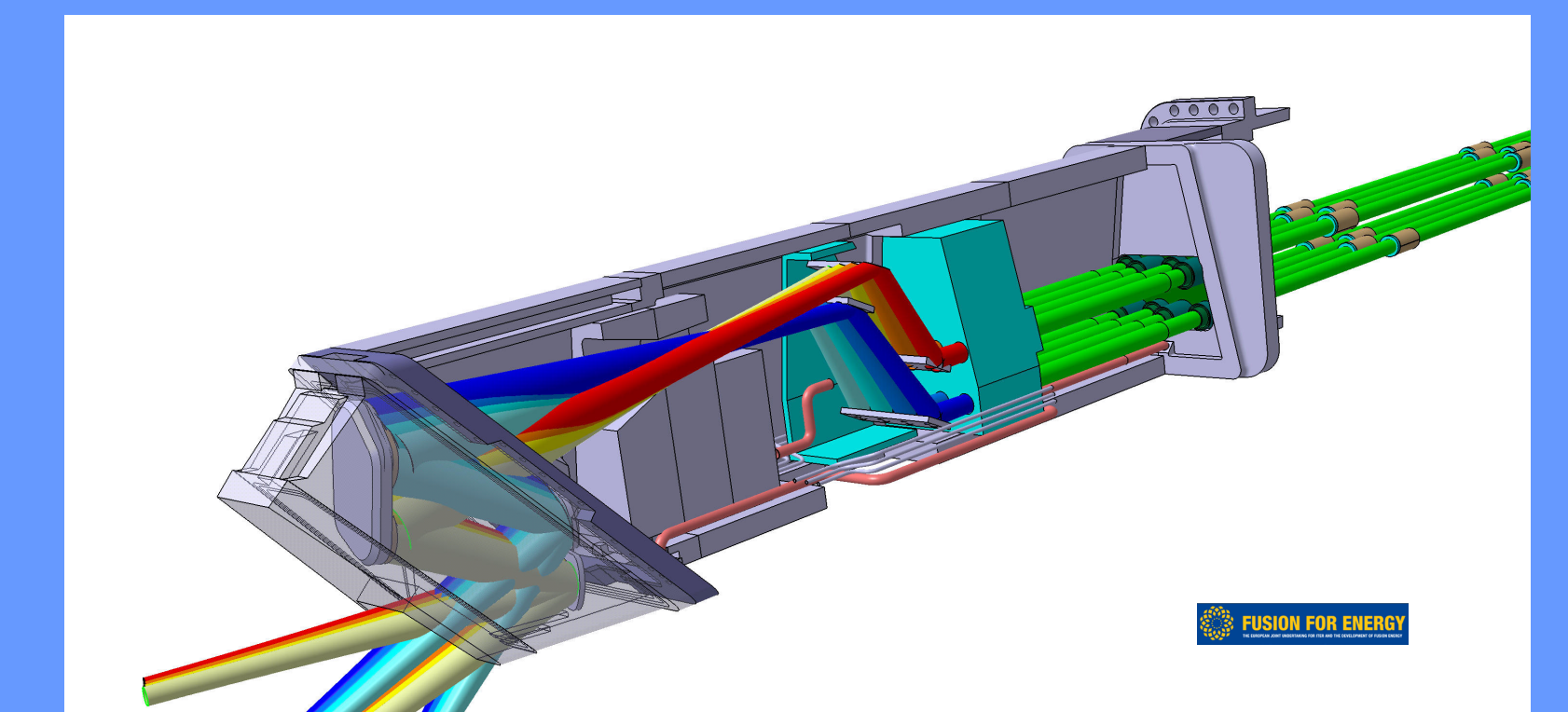
Fokker-Planck codes (RELAX, LUKE) with different levels of complexity are also available.

The codes TORBEAM, GRAY, TRAVIS, TORAY-FOM, C3PO, RAYLH are well suited to estimate ECCD/LHCD capabilities in present tokamak plasmas as well as in ITER.

### EC beam tracing workflow



**ITER EC Upper Launcher**  
main goal : control of MHD instabilities (neoclassical tearing mode / sawtooth)



ITER EC beams aiming at  $q=2$  and at  $q=1$  surfaces

