VIRTUALIZATION OF FLOATING-POINT COMPUTATION

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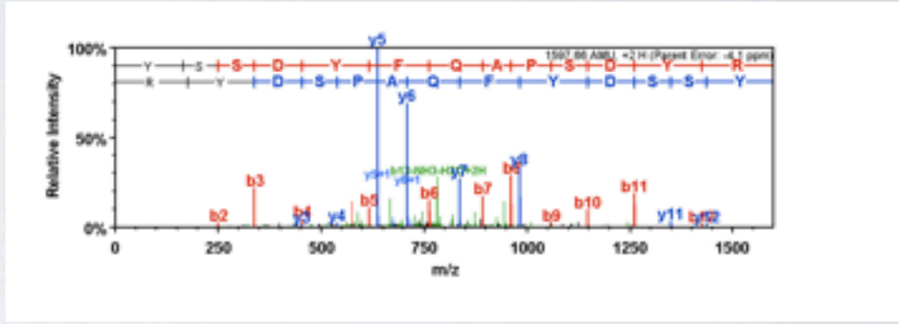
WHAT IS SO SPECIAL ABOUT FP ?

- 3 fields with 3 differents meaning:
  - Sign: Positive/Negative
  - Exponent: Do we deal with big/small number ?
  - Mantissa: What accuracy

- Various format to adress it (IEEE754 2008)
  - Binary32
  - Binary64
  - Binary16, Binary128 ...

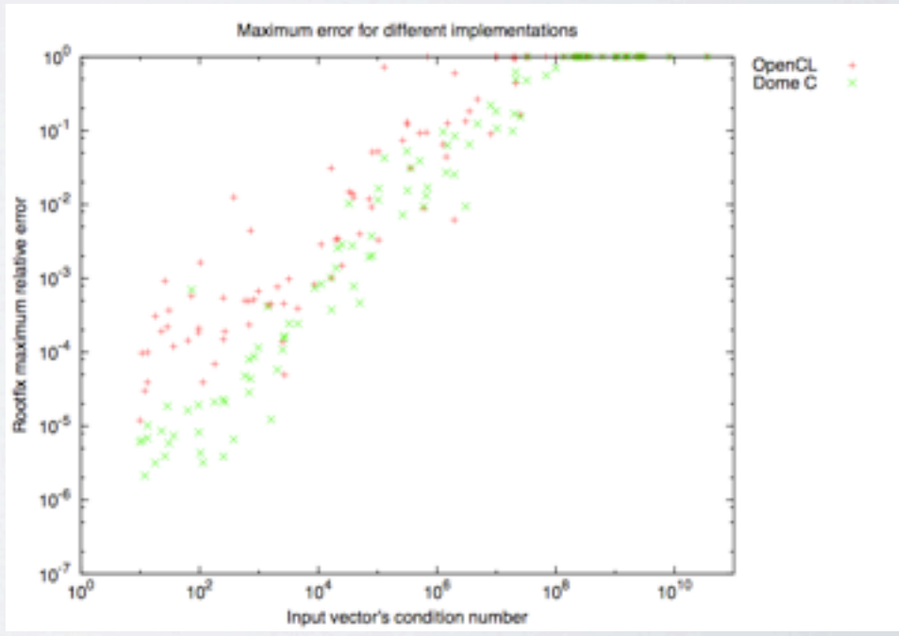
EXAMPLES OF FP MISSUSE

- **Biology**: Data produced by MS/MS machine
  - Binary64 but analysis shows that binary32 is enough (divide storage & data transfert by 2)



Joint work with Y. S. Dandass, MSU

- **Physics**: Power Flow Analysis
  - Fast simulation with low accuracy (eliminate irrelevant solution)
  - Accurate simulation to differenciate the remaining one
  - Accuracy depend on problem size



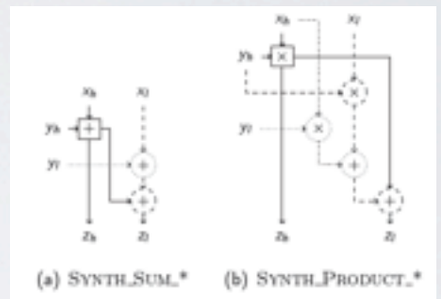
Joint work with M. Marin, UPVD

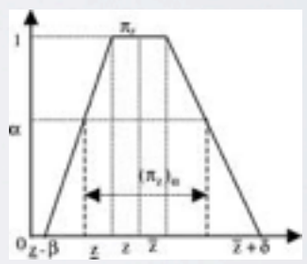
SOLUTIONS

- **real** format exposed to the programmer, transformed to one of the available format according to
  - Static program analysis
  - Statistical FP analysis
  - Computational time available
  - Free ressources

EXAMPLES OF WORK DONE AT PERPIGNAN

- RangeLab
    - Static analysis of FP expression
- Error Free Transformation (+, x, -, /)
    - Same results in the same amount of time
    - Plus corrective terms if enough time/ressource is given
- Fuzzy Arithmetic on GPU
    - Quickly gather informations on FP distribution
- On the fly FP compression
    - Reduce data transfert without sacrificing precision





AEM: VIRTUALIZATION OF FP

- Master thesis subject:
  - Static translation of a generic FP format to IEEE-754 formats
  - Work plan:
    - Propose different strategies (computation, allocated memory, mixed, ...)
    - Evaluate the impact of such modifications (Accuracy, Data transfert, Execution time, ...)
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