FFA23 – OPAL tutorial

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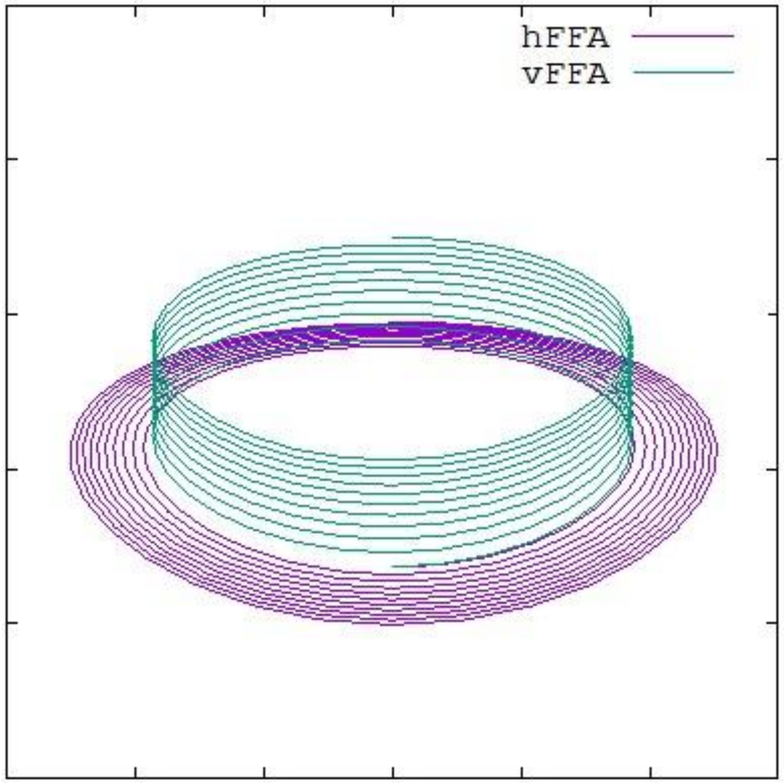
Intro

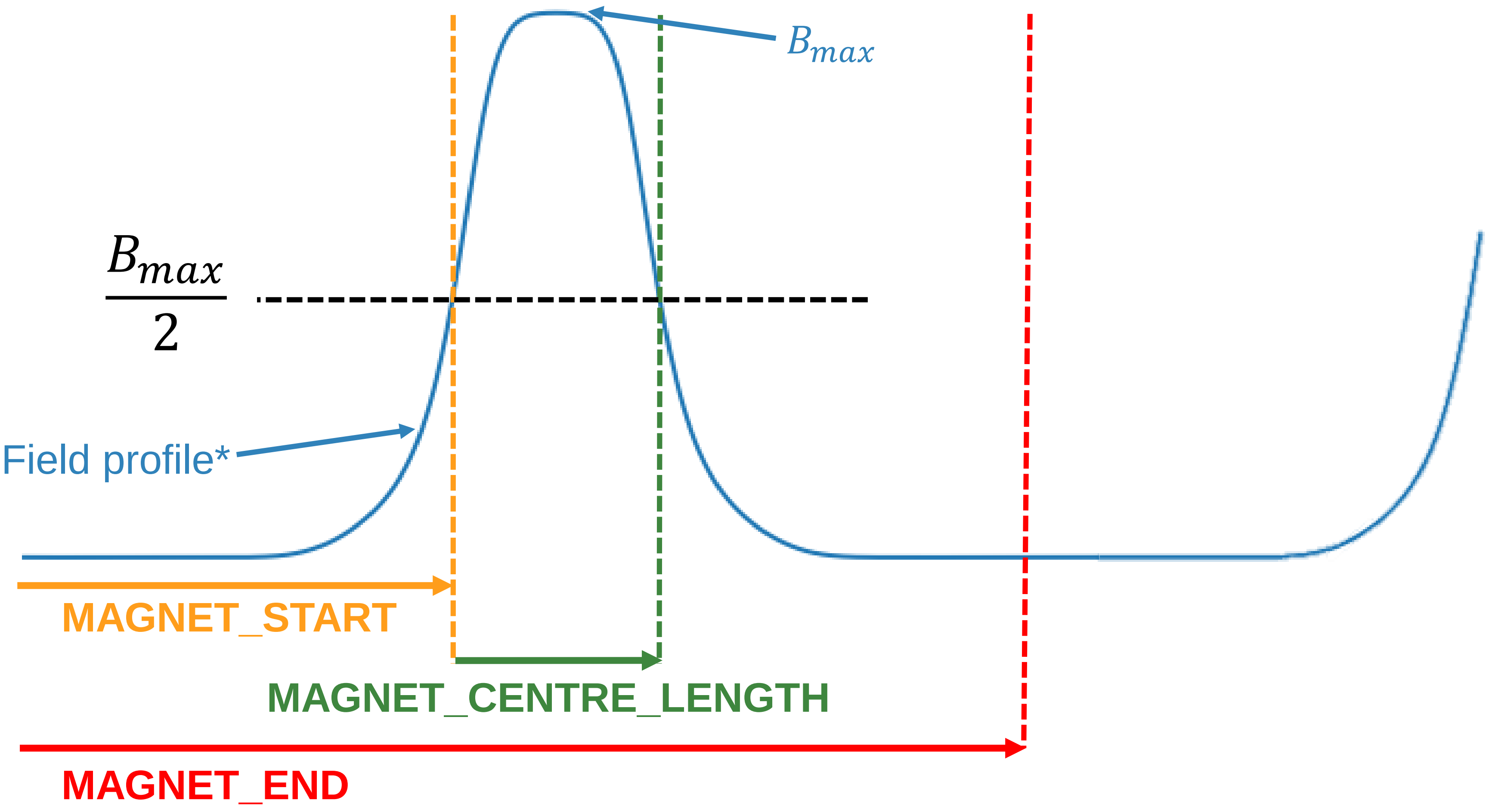
- Open source code for simulating FFAs, cyclotrons, linacs and rings including 3D space charge, written in C++.
- OPAL comes in two flavours – **OPAL-cyc (cyclotrons/FFAs/rings)** and OPAL-t (linacs, photo injectors, XFELs).
- OPAL tracks particles using 4^{th} order Runge-Kutta with *time* as the independent variable.
- OPAL is designed to run massively parallel on HPC machines.

FFAs in OPAL

- OPAL is capable of simulating both horizontal and vertical FFA magnets.
- Spiral or Sector horizontal magnets
- Allows for lots of freedom with the fringe field model.
- Full 3D space charge – good for small bunches



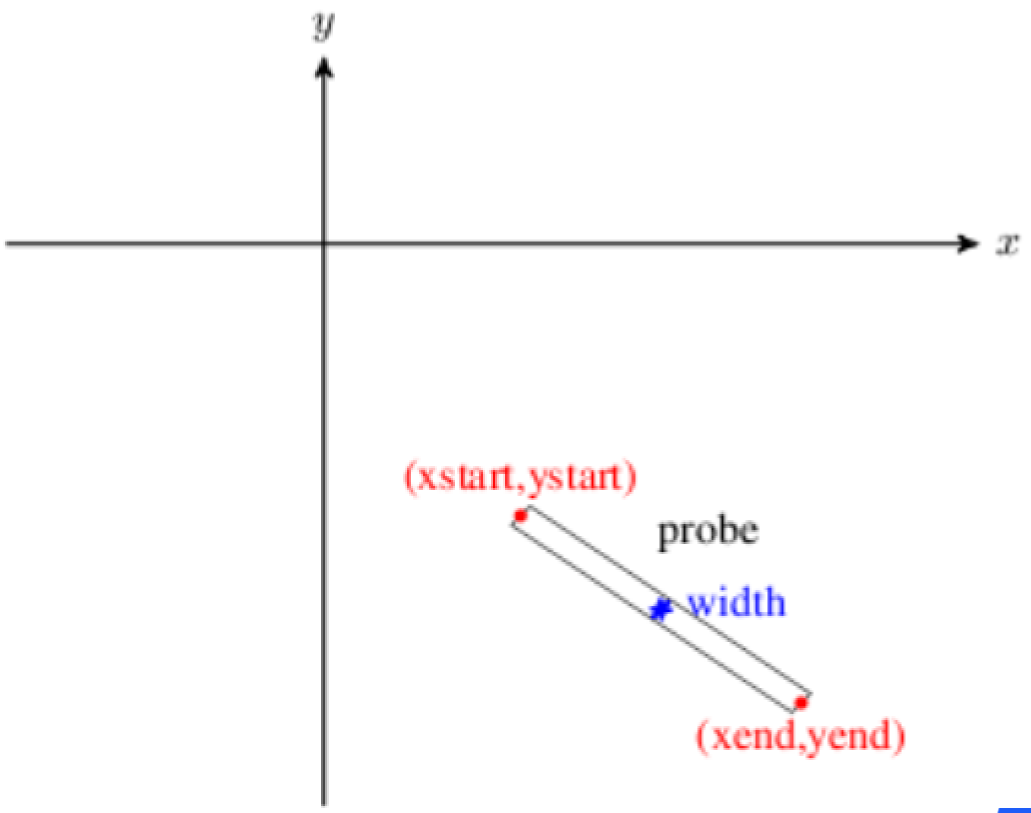
Placing magnets



* Field profile at a constant radius

Output from OPAL

- There are 3 main outputs from OPAL.
- PROBE.loss file from the PROBE element.
- trackOrbit.dat files
- Fieldmaps



Tutorial GitHub repo

- https://github.com/carl-jolly/FFA23-school/tree/main

- Jupyter notebook

- git clone https://github.com/carl-jolly/FFA23-school.git

Future of OPAL

- PyOPAL
- OPAL on GPUs – OPAL X
- New solvers specifically for FFAs/ synchrotrons
- More utility for simulating synchrotrons