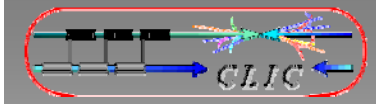
PLACET

User experiences with PLACET and examples of use for the Drive Beam

International Workshop on X-Band Structures and Beam Dynamics,

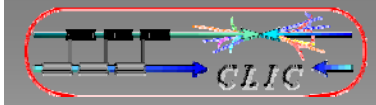
The Cockroft Institute

Erik Adli, University of Oslo and CERN, December 3rd 2008



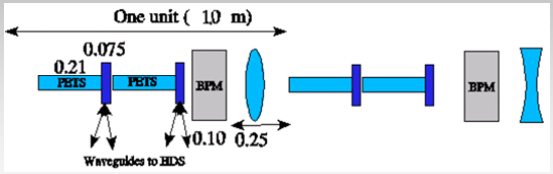
Outline

- What is PLACET?
- Personal experiences with the Drive Beam work
- Example / getting started scripts [put on CVS for future reference]:
  - **TCL**: Create a sliced beam for a FODO lattice with PETS
  - **Octave**: lattice manipulation and beam-based alignment using PLACET octave

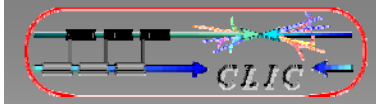


What is PLACET?

- General tracking code for non-circular machines



- Supports fast tracking of particle beams or sliced beams **(realistic beams** with large number of particles can be created and simulated easy)
- Can be used for practically all parts of the CLIC machine with the exception of the damping rings and injectors (no space-charge,v=c). Especially strong and **fast** support for **wake fields** in accelerating and decelerating structures
  - tracking through entire CLIC linac: takes few seconds with baseline setup
- Powerful build-in features for analyzing effects of misalignment and alignment/feedback schemes, automating simulation and generation of statistics for a large number of random machines
- Code used by a large part of CLIC beam dynamics team + collaborators around the world
- Command interpreter is Tcl/Tk-based + additional Octave interface



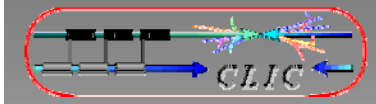
Code and development

- Written by **D. Schulte (CERN)** + major update by code keeper up to April 2008: **A. Latina (FNAL)**

https://savannah.cern.ch/projects/placet/

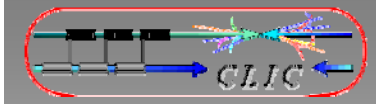
- Current code keeper **B. Dalena (CERN)**

- However, all interested collaborators are **welcome to join** as co-developers and contribute directly to the cvs-repository
  - Typically: if you have implemented a nice PLACET update, element or algorithm you think could be of general use, please consider adding it to the repository (ask to be added to "placet-developers" mailing list)



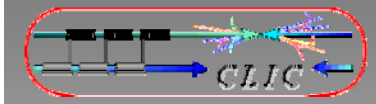
Personal start-up experiences

- Interpreter: TCL
  - I was almost blank to TCL, but much better to start with than an own-defined language like in MADX (TCL: powerful language, lot's of online help)
- Documentation: was too poor to start working alone, good examples and/or help from experts needed
  - Recently: **documentation has improved a lot**
  - And: a lot of good **example scripts** are now in CVS
- However, once I did get my hands on the interpreter and the basics: found the code very efficient



Placet-octave

- Last year a new interface added to **PLACET: Octave interface**, created by **A. Latina** (now at FNAL)
- Octave: “open source MATLAB clone” → if you know MATLAB you also know Octave
- Lattice and beam can be manipulated directly with Octave commands [**O.M. more compact code** than C for e.g. matrix-operations]
  - E.g. anywhere in your lattice definition you can insert Octave parts
- I find the Octave interface both extremely clean and powerful [I was a hard-core MATLAB user before], and it allows new and intuitive ways to perform lattice manipulation – **a GREAT addition to PLACET**
- Placet-octave seems to have reached a **mature** stage (very well working and robust) – however, it covers **only a subset of Tcl commands**



Example script

- Example shows: typical use of PLACET using both **Tcl interpreter** and **Octave interpreter**, by using a TBL-like lattice
  - Sliced Drive Beam beam
  - FODO cell with PETS
    - NB: if main linac structures shall be used, please refer to examples with Main Linac please see “example1.tcl” etc. in the same directory and this example (beams and wake fields defined in a different way for Main Linac structures)
  - "Interactive part“ using **placet-octave**
    - Beam-based alignment / dispersion calculations

http://isscvs.cern.ch/cgi-bin/viewcvs-all.cgi/placet-development/examples/clic/decelerator.tcl?root=placet&view=co

Example script

Example script: minimal self-consistent Drive Beam decelerator (code is divided into parts and well-commented for your reference)

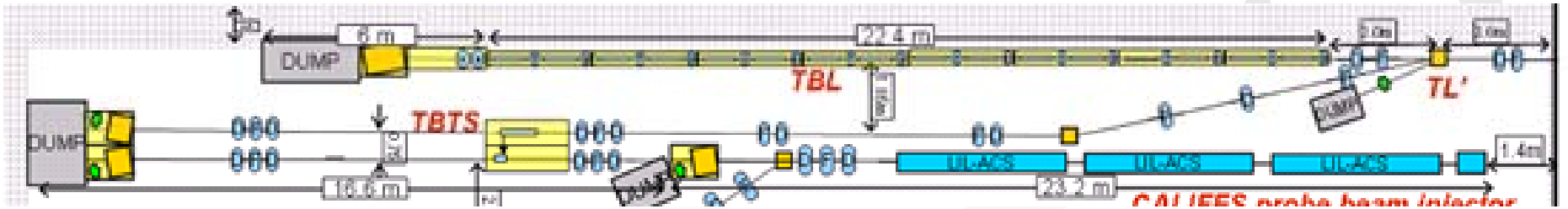
Tcl-interface :

- **Part 1: Define the beam**
- **Part 2: Define lattice component parameters (e.g. Cavities)**
- **Part 3: Define the lattice**
- **Part 4: Track**
- **Part 5: Data processing**

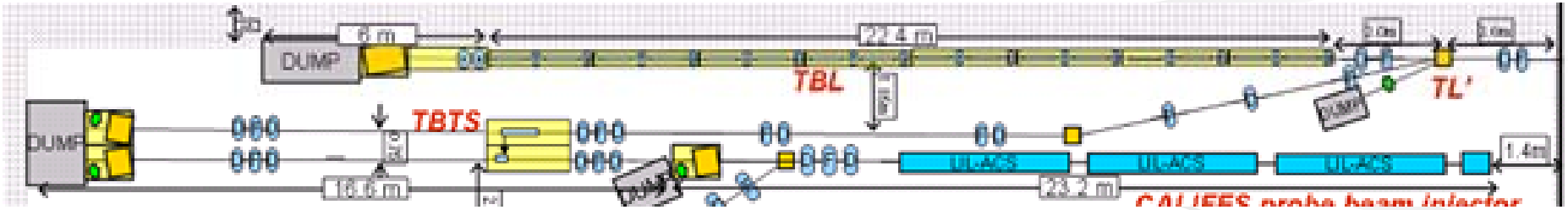
Octave-interface :

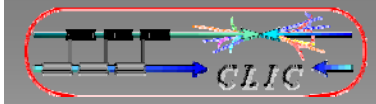
- **Part 6: Beam-based alignment and lattice manipulation**

This last part will be shown "interactively" – to show the ease of use of the Octave interface. For the rest: please download and read the (well-commented) example



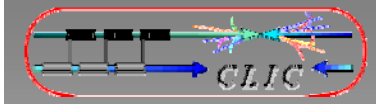
(max 5. minutes demo session)





Conclusions

- My opinion: PLACET has classical “power versus learning curve” issue
- For using PLACET most efficiently one need to know two languages (TCL and Octave)
  - But: BIG advantage that languages are main stream computer languages, with well-defined behaviour and lot’s of online help (unlike e.g. MAD scripting language)
  - Some many purposes: only the Tcl interface will be of needed
  - For code modification: C and basic C++ skills needed
- To get started with PLACET: I would advice to start with a simple example from the example folder, understand it, and build-on from there



Some examples to get started

- I recommend the following examples for people who wants to start using PLACET :

For a minimal generic beam generation and tracking example w/o wake fields :

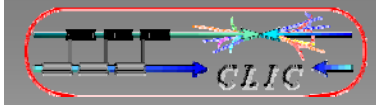
http://isscvs.cern.ch/cgi-bin/viewcvs-all.cgi/placet-development/examples/Placet_BC2_Example/

Tracking through full CLIC linac (30 GHz), including wake fields :

http://isscvs.cern.ch/cgi-bin/viewcvs-all.cgi/placet-development/examples/clic/example1.tcl

For example of Octave-interface and Beam-Based Alignment :

http://isscvs.cern.ch/cgi-bin/viewcvs-all.cgi/placet-development/examples/clic/decelerator.tcl



PLACET contact point

- PLACET download:

  https://savannah.cern.ch/projects/placet/

- The current PLACET code keeper (from July 2008): Barbara Dalena (CERN)

  Barbara.Dalena@cern.ch

  - general questions about PLACET (installation etc.) can be sent here

- For questions about the example shown and related issues please feel free to also contact me:

  Erik.Adli@cern.ch