MPE-PE Mini Lectures: Introduction

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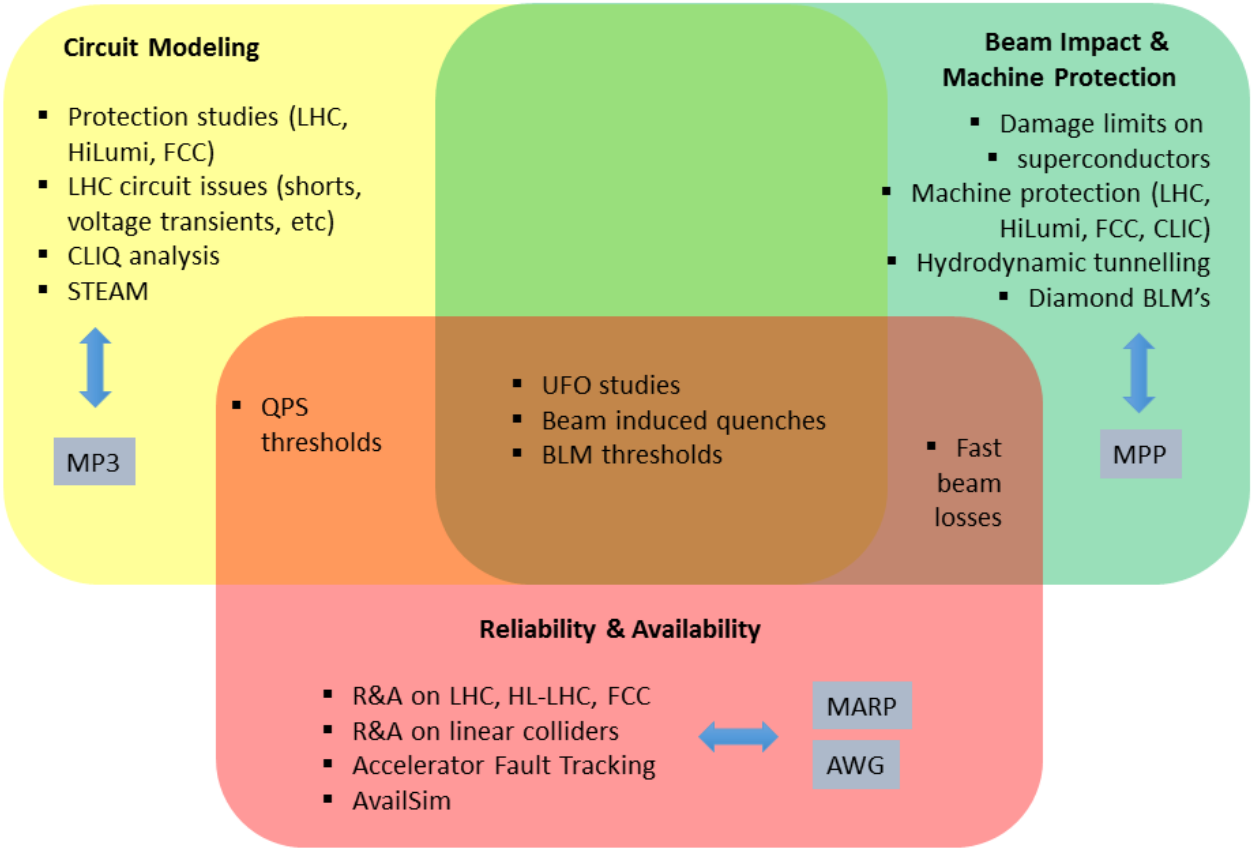
MPE-PE Section



https://twiki.cern.ch/twiki/bin/viewauth/TEMPEPE/

Mini Lectures: Topics

Beam & accelerator physics

How to describe a particle beam?

- Phase-space, Liouville theorem, emittance, optical functions (α, β, γ), σ

How do accelerators work?

- Beams production: ion sources
- Beam transport, FODO lattice
- Beam acceleration: linacs and acc. cavities
- Beam collision: synchrotron, collider, luminosity, β^*
- Acc. hardware: beam dump, cavities, …

What types of magnets do we need? And how do we get them?

- Dipoles, quadrupoles, and more: beam-dynamics and hardware realization
- Kicker and septa

Magnets

How do superconducting acc. magnets work?

- Basics of superconductivity
- Basics of superconducting magnet and cable design
- Why use superfluid helium?

Why and how to protect a s.c. magnet?

- How to quench a s.c. magnet?
- How to protect a s.c. magnet?
- Quench/damage limits

What can go wrong? Beam-related failures

- Failure classification (risk, slow/fast/ultrafast failures)
- Failure examples: magnet powering, injection/extraction failures, UFOs, QH firing
- Failure criticality for different machines

How does the CERN accelerator complex work?

- Injectors: LINACs, PSB, PS, SPS
- LHC operation and cycle
- LHC availability and faults

Reliability and availability

- Basic definitions (for CERN and other accelerators)
- Introduction to risk assessment
- Lifetime distributions and bathtub curve

Reliability & Availability

What happens if the beam is lost?

- Beam-matter interaction
- Hydrodynamic tunnelling

MP Systems

- Main MP systems at LHC (BIS, PIC, WIC, QPS, LBDS, COLL)
- Electronics for MP

Machine Protection

Special Topics… Visits…

Computational Methods

- Coding conventions and good practice / Object-oriented programming
- Basics of co-simulation
- Introduction to machine learning
- How to simulate a particle beam? How to simulate a magnetic field?

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Organization

Proposals:

- Talks should be focused on the understanding of the basics concepts and ideas
- Talks should be ~30 min + discussion
- Ask as many questions as you want!
- Thursdays, 10.30 in the week without Section Meeting (possibly with coffee/cake)?
- Start: end of April/beginning of May 2019

It’s all about the audience (i.e. about us)…