Start-to-End Simulations

TTF1, TTF2 and XFEL

**TTF1**
- Start-to-End Simulations of SASE FEL at the TESLA Test Facility, Phase 1.

**TTF2**
- Optimized version (6.4 mm, 1 GeV)
- Operation without 3.9 GHz cavity: Case 0.5 nC, 4 ps sigma, magnetic compression
- Operation without 3.9 GHz cavity: Case 1.0 nC, 4 ps sigma, velocity bunching
- Operation without 3.9 GHz cavity: Case 1.0 nC, 20 ps flat top, velocity bunching

**XFEL**
- Benchmark S2E workshop, August 2003 (20.5 GeV, 3 chicanes, 12 kA peak)
- ESFRI XFEL workshop, October 2003 (20.0 GeV, double chicane, 5 kA)

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**XFEL S2E Files**

Case 20 ps laser flat top, with 3.6 GHz cavity, double chicane, 20 GeV

(Y. Kim Optimization)

**Schematic Layout of the XFEL (Double Chicane, 40 MV/m Cathode)**

**injector** (up to Z=12.00 m, between the 5th and 6th cavity inside ACC1)

- Input Files for ASTRA: aperture, solenoids, rf gun, q-cell structure, half module
- Input Files for Particle: solenoids, rf gun, q-cell structure

**Astra Injector Simulations Output Files**

- Output Files
  - Astra Files
  - Astra.log
  - Astra.in
  - Astra.out
  - Astra.pdf

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**Long. Phase Space**

- Linear vs. Nonlinear Behavior
- Low Emittance Configuration
- High Emittance Configuration

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**Diagram**

- Schematic diagram of long. phase space
- Graph showing phase space distribution
- Axes labeled: linear, non-linear, beam position, beam momentum
Kinetic Energy Vs \( Z \) / 1 nC Case

long. phase space

long. phase space

rf extracted
long. Density + wake fields:
4 TESLA modules
3rd harmonic cavities: 8m active length

with cavity wakes (without rf)
working point with $V(3^{rd}) = 100$ MV
working point with $e'''=0$