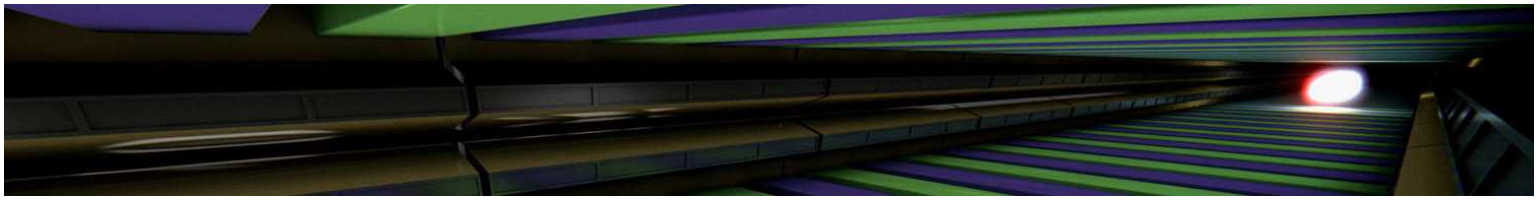


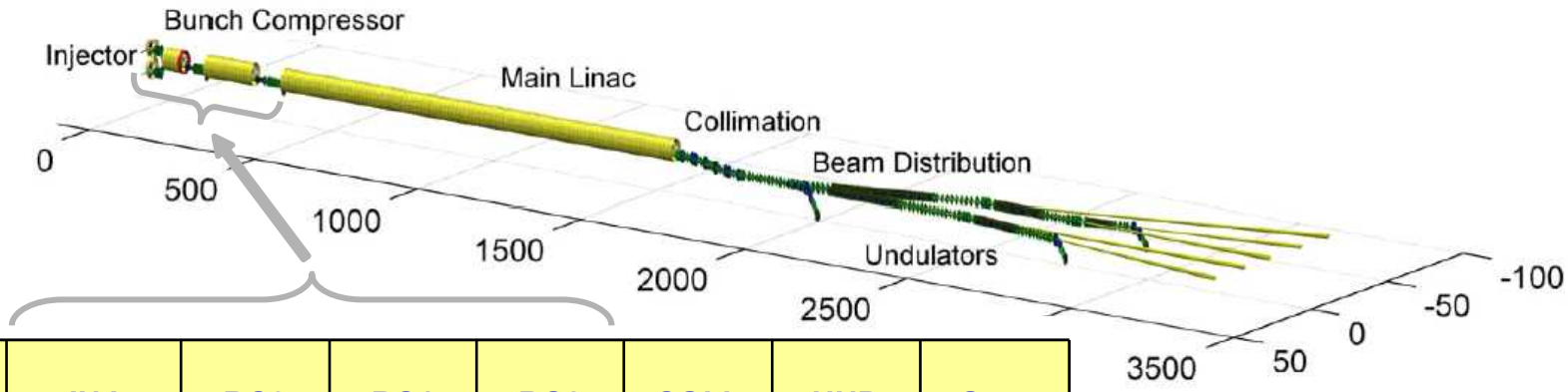
RF Synchronization Requirements

WP18 „Special Diagnostic“

Matthias Hoffmann DESY

European XFEL

Overview – Locations of Diagnostic Devices



	INJ	BC0	BC1	BC2	COLL	UND	Sum	
BAM	1	-	2	2	-	2	7	LB synchronization
EOD	1	1	1	-	-	-	3	RF synchronization
CRD	-	-	1	1	1	-	3	
SRM	-	1	1	1	-	-	3	
TDS	1	-	1	1	-	-	3	RF synchronization
EBPM	-	1	1	1	-	-	3	RF synchronization
Sum	3	3	7	6	1	2	22	

Most diagnostics in Injector and BC areas: ‘tailoring’ of long bunch profile

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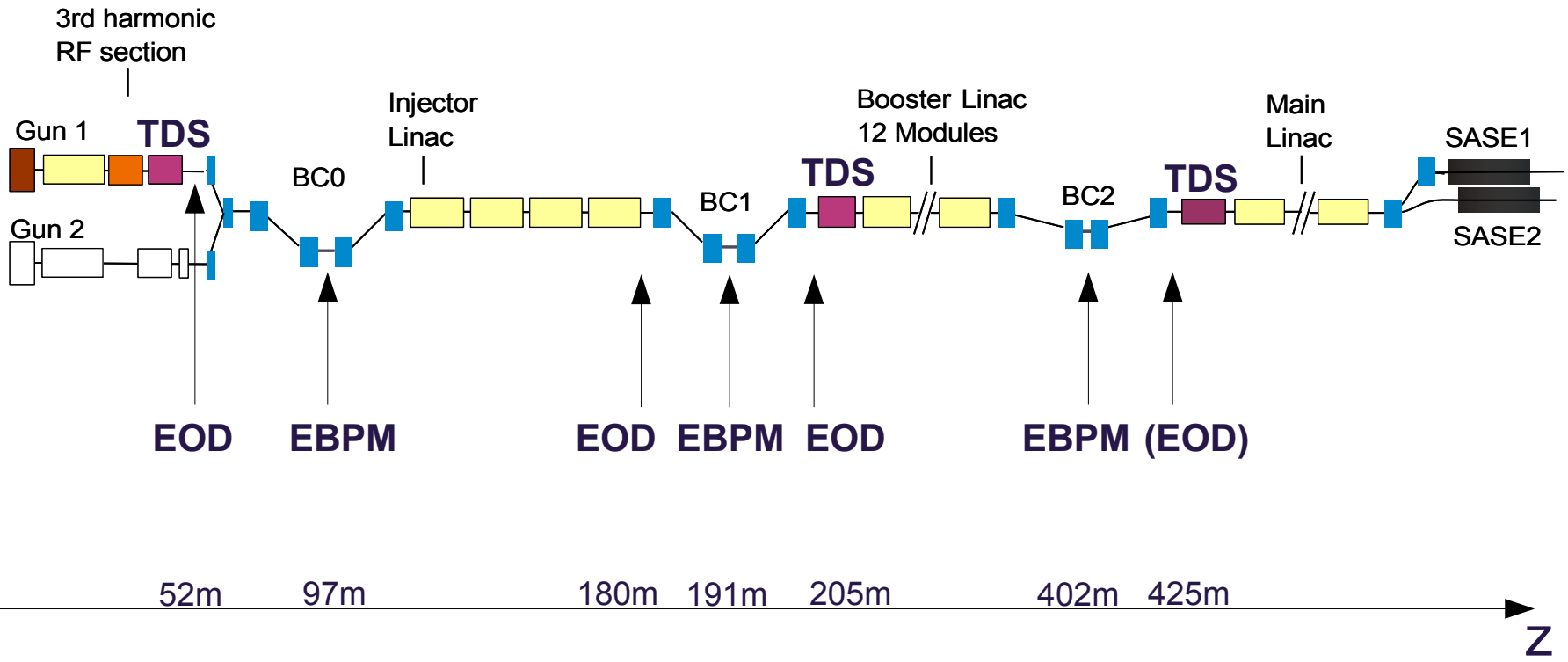
Overview – Distances

- Energy Beam Position Monitor (EBPM)
- Electro-Optical Diagnostics (EOD)
- Transverse Deflecting System (TDS)



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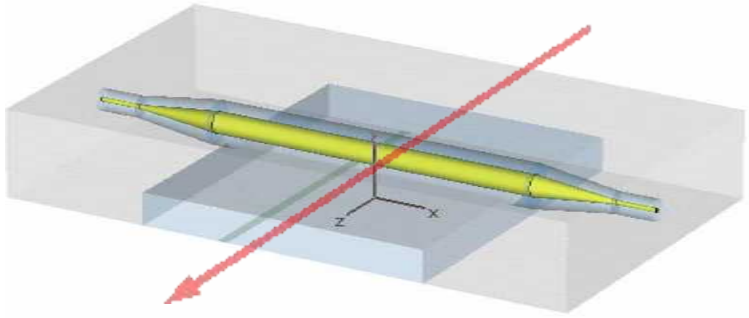
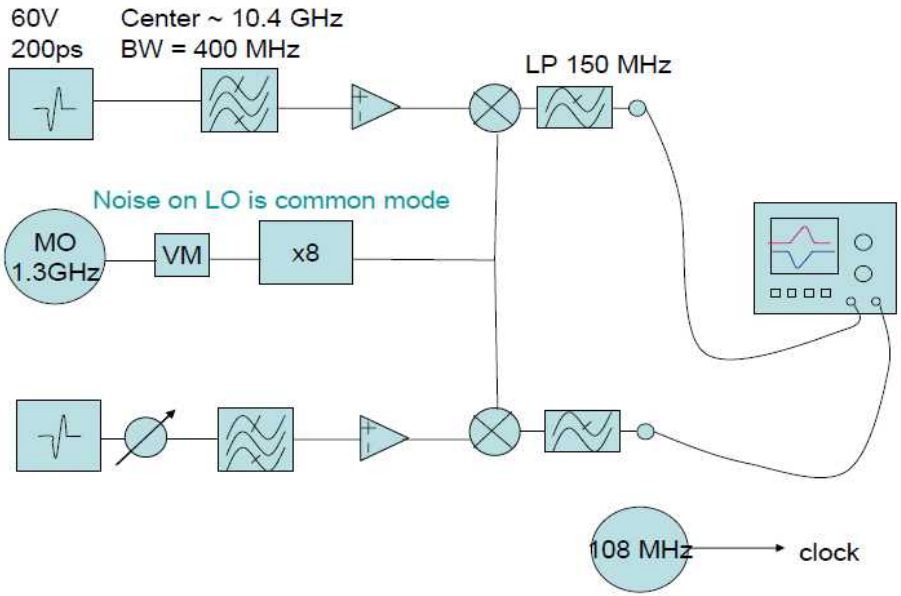
Energy Beam Position Monitor

- Measurement of beam energy (via beam position)
- Using transversly mounted stripline pickup
- 1.3GHz from MO for RF front-end



- **Frequency:** 1300MHz from MO
- **Power level:** +10dBm
- **Connector:** N-type
- **RMS phase jitter:**
  - @BC0 <150fs
  - @BC1 <150fs
  - @BC2 <150fs
- **Short term drifts:** 200fs (0.1 – 100s)
- **Long term drifts:** 1..2ps
- **z Locations:** 97m, 191m, and 402m



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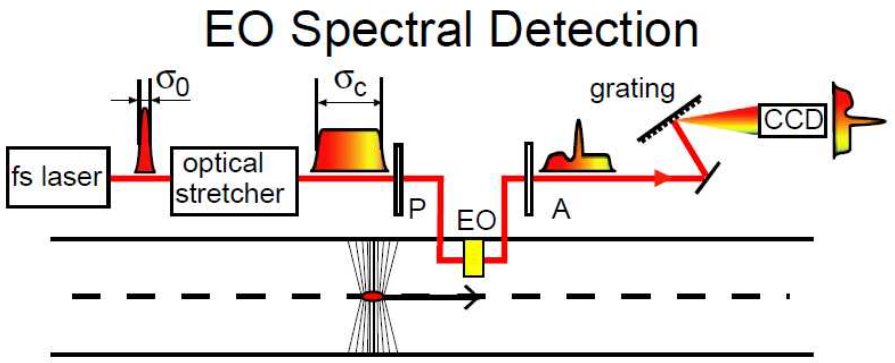
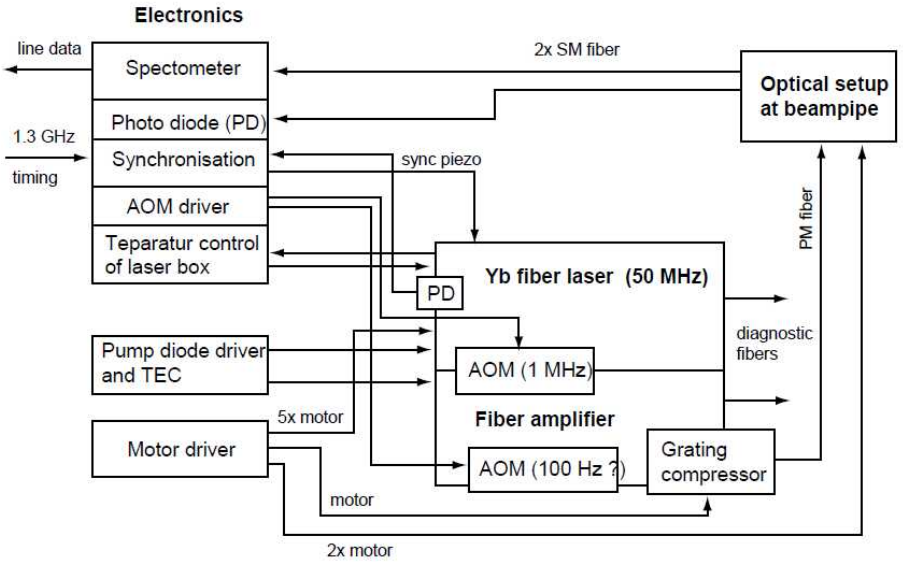
Electro-Optical Diagnostic

- Measurement of longitudinal bunch profile
- Method of spectral decoding
- fs-Laser locked to 1.3GHz (MO)

- **Frequency:** 1300MHz from MO
- **Power level:** +10dBm
- **Connector:** N-type
- **RMS phase jitter:**
  - @INJ <300fs
  - @UBC1 <50fs
  - @DBC1 <50fs
  - @BC2 <50fs (optional)
- **Short term drifts:** 150fs (0.1 – 100s)
- **Long term drifts:** 1..2ps
- **z Locations:** 51m (XSE 5th floor), 180m, and 425m





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Transverse Deflecting System

- Measurement of the longitudinal phasespace/energy distribution within the bunch
- TDS translates longitudinal coordinate into transverse
- Variation of the RF phase – variation of the screen position
- Acceptable jitter: single rms bunch length

- **Frequency:** 1300MHz from MO
- **Power level:** +10dBm
- **Connector:** N-type
- **RMS phase jitter:**
  - @INJ <100fs
  - @BC1 <50fs
  - @BC2 <30fs
- **Short term drifts:** 300fs (0.1 – 100s)
- **Long term drifts:** 2..3ps
- **z Locations:** 52m (XSE 5th floor), 207m, and 427m