

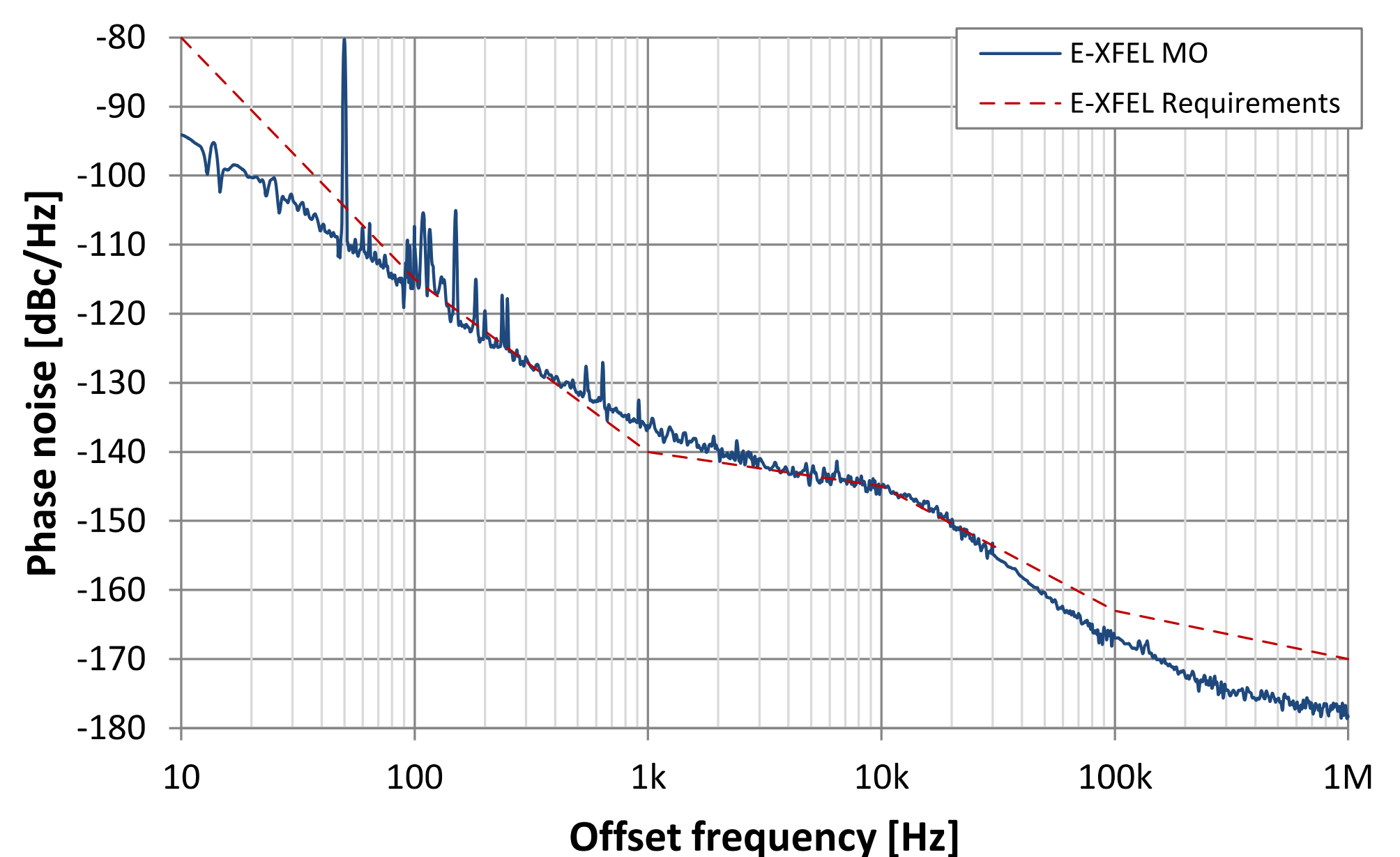
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ABSTRACT

E-XFEL's Master Oscillator (MO) as a source of the phase reference signal has to both fulfil stringent performance requirements and offer very high reliability. Since those two requirements are often contradictory, the system was partitioned in order to solve these issues separately. The signal generation part was commissioned last year and delivers an ultra high performance (< 20 fs rms jitter, $< 10^{-12}$ frequency stability, +40 dBm power) 1.3 GHz reference signal for the E-XFEL facility. A novel redundancy solution which will maintain a continuous reference signal even in case of a failure is currently in development and is planned to be in operation in early 2018.

The complete system comprises three fully independent Generation Channels (GCs), each delivering full-performance reference signal, and a Redundancy Module (REDM), which in turn includes a fast three-way RF switch, a real-time controller with diagnostics, and a dielectric-resonator filter for energy storage. We present an overview of the system, the current status of development and commissioning, as well as the achieved performance and further plans.

PHASE NOISE

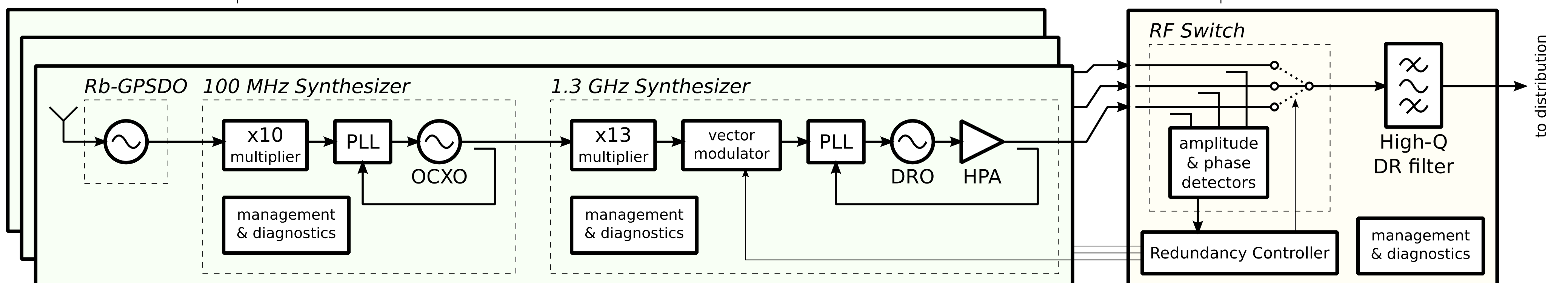


Integrated phase noise (rms jitter), 10 Hz–1 MHz:

- random: 10.3 fs
- spurious: 16.5 fs (mostly @ 50 Hz)
- total: 19.4 fs

SYSTEM BLOCK DIAGRAM

Generation Channels (x3)
 commissioned and in operation



INSTALLED MODULES



One of the three Generation Channels in its air-conditioned 19" rack (during maintenance).

FUNCTIONAL OVERVIEW

Rb-GPSDO:

stable 10 MHz frequency reference ($< 10^{-12}$)

100 MHz Synthesizer:

ultra low phase noise near carrier

1.3 GHz Synthesizer:

very low far-off phase noise, high output power (+40 dBm)

Redundancy Module:

automatic failure response for continuous reference signal

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