

Compton polarimetry for SuperKEKB: ANR project plans including recent updates on laser sync'

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+ contributions from

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Funded by
the European Union

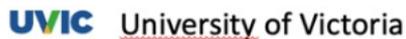
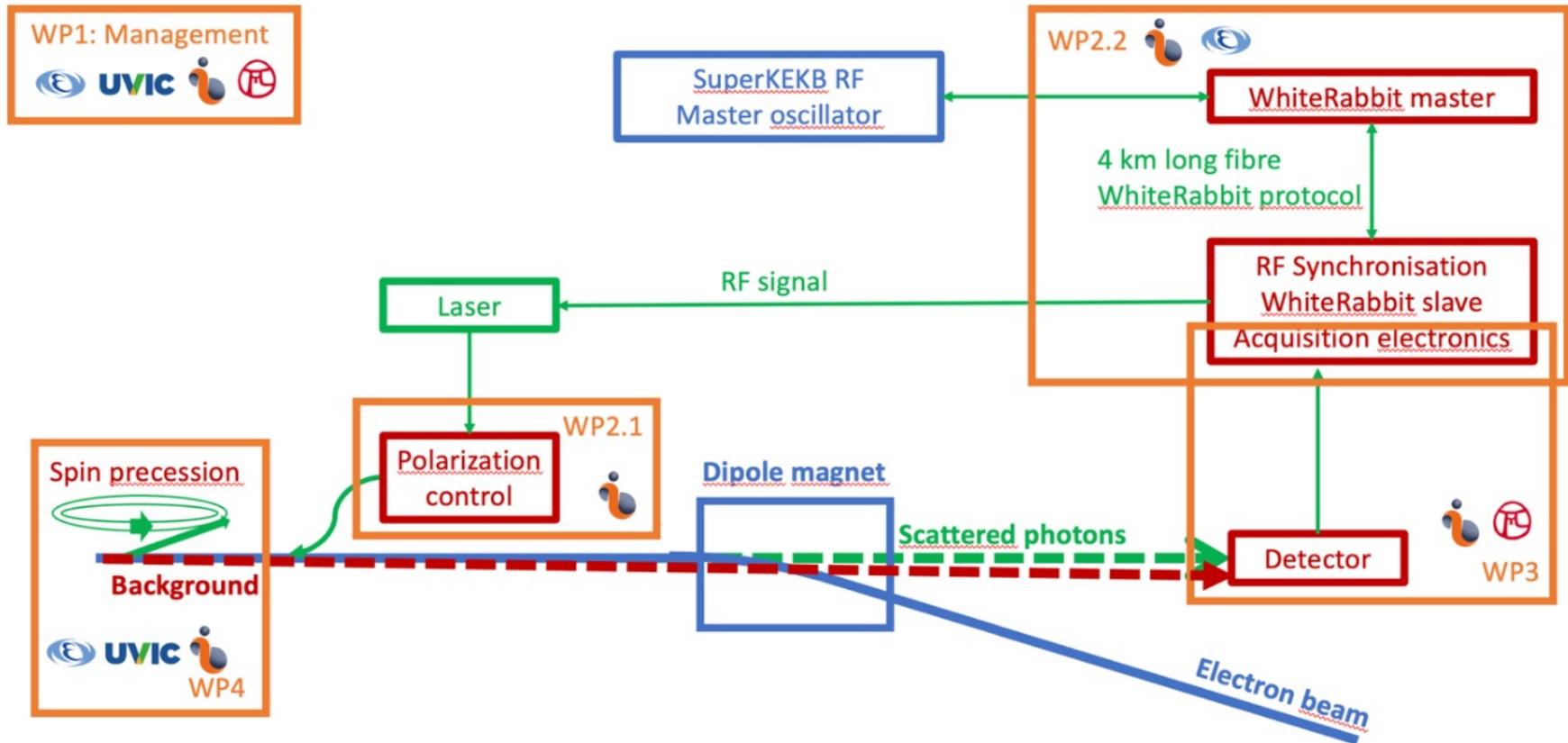


EAJADE
Europe-America-Japan Accelerator
Development Exchange Programme

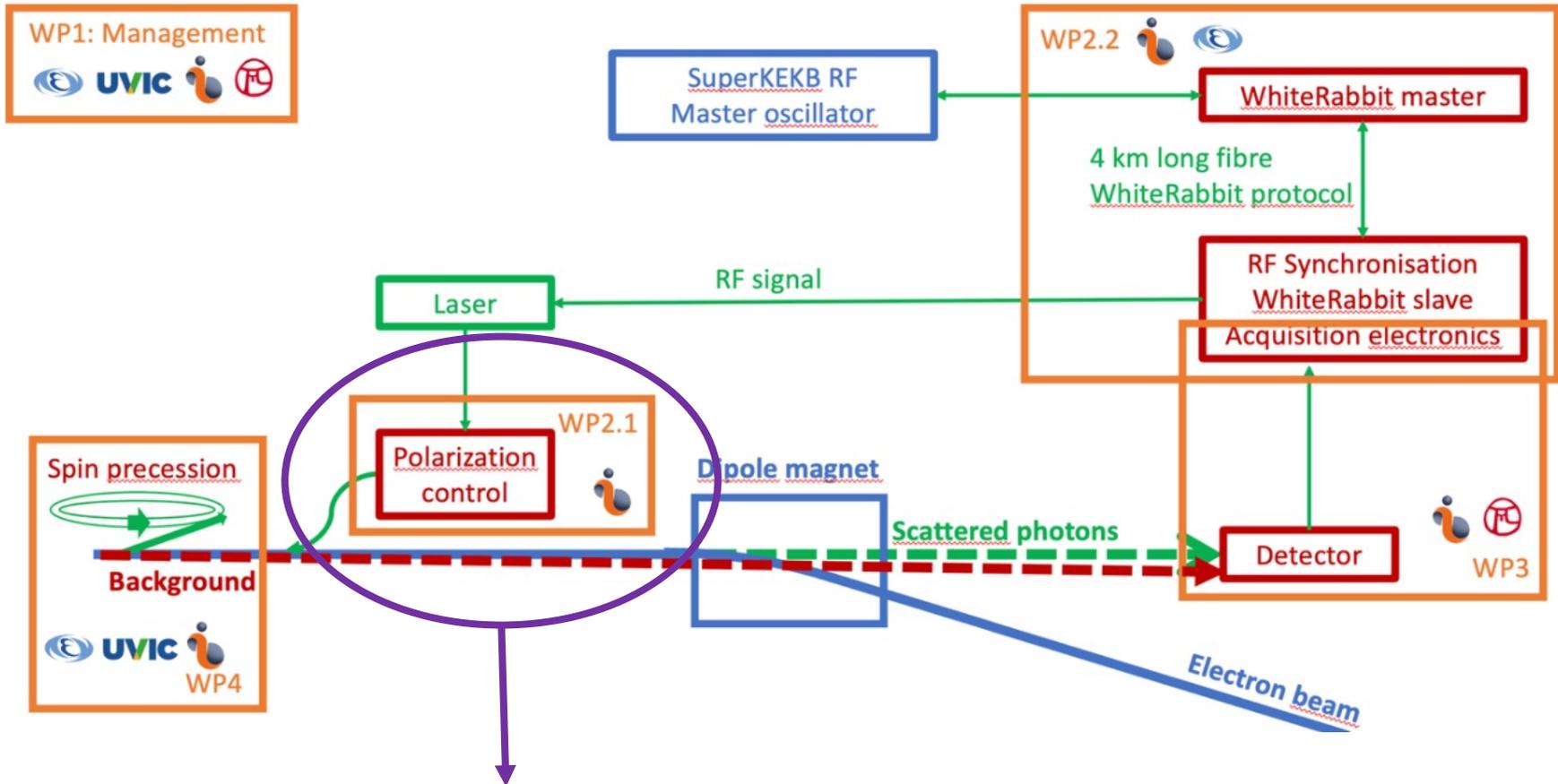
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ANR project in a nutshell



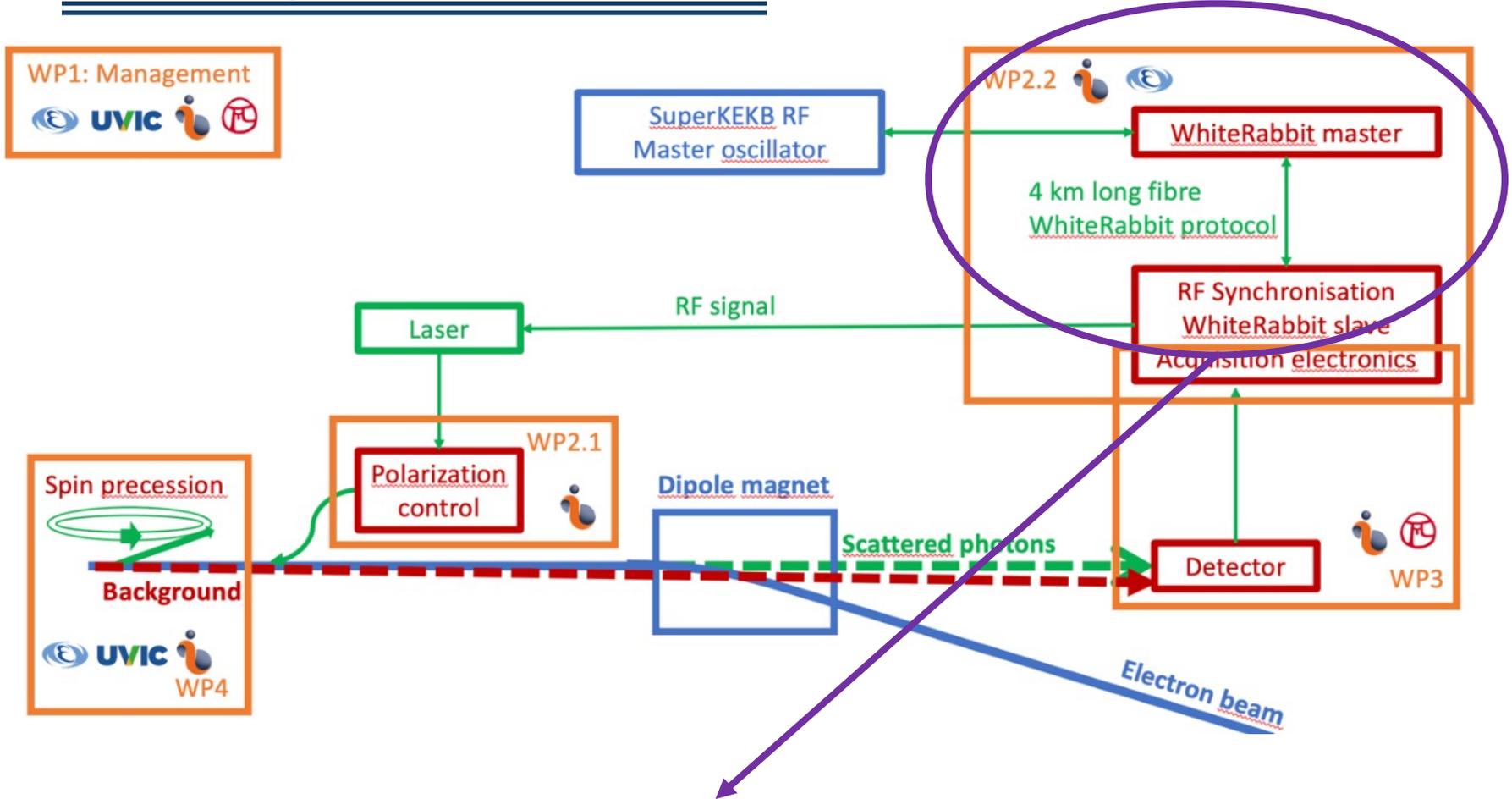
Work plans for 2026 – WP2.1



Work has recently started on a detailed modeling and will start in optical room with a CERN/IN2P3 funded PhD student in Orsay (defense expected in 2027)

→ First results expected for October

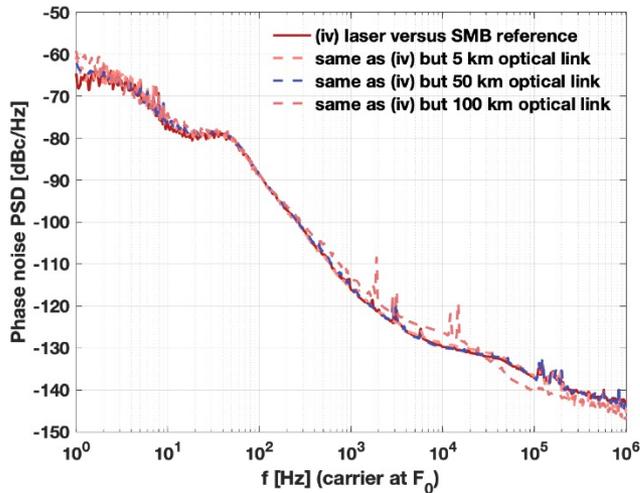
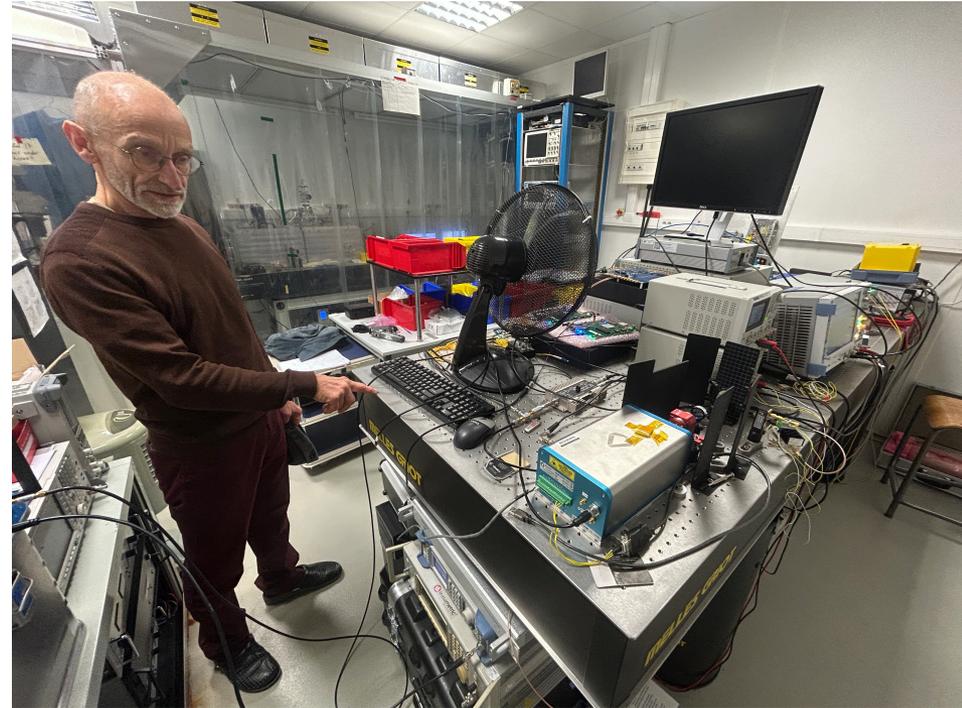
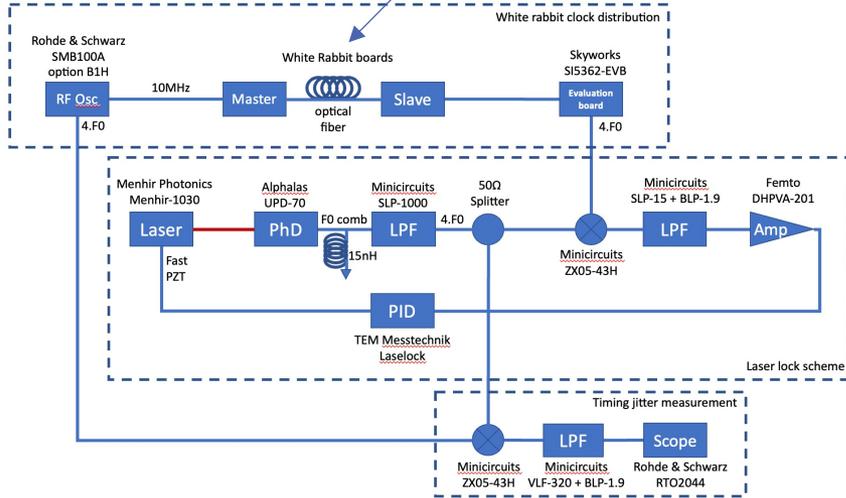
Work plans for 2026 – WP2.2



synchronisation tests were already conducted over the past year. Very recent result obtained (see next slides). Work with beam at KEK ATF being planned again due to ATF staff change. Minor impact on project, as collaboration continues with SuperKEKB team.

WP2.2 : Laser synchronisation

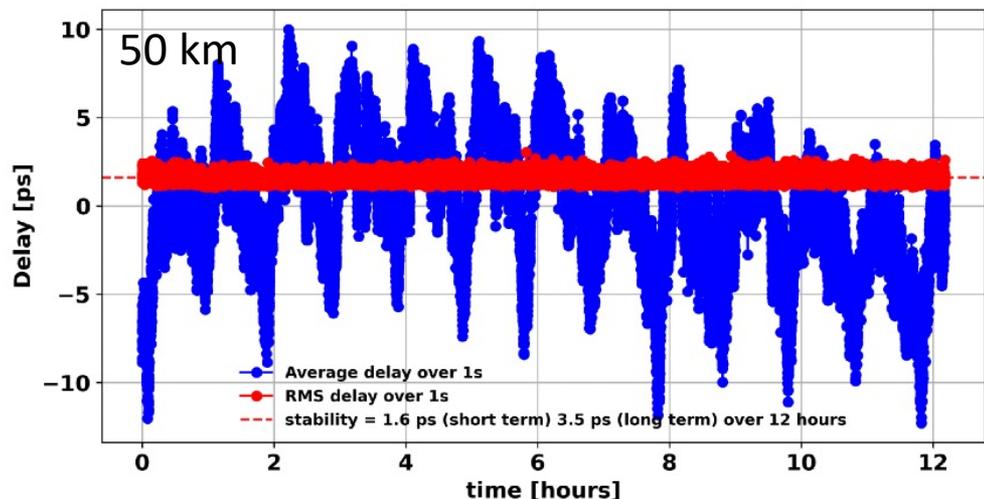
Fibre link 10m, 5km, 50km, 100km



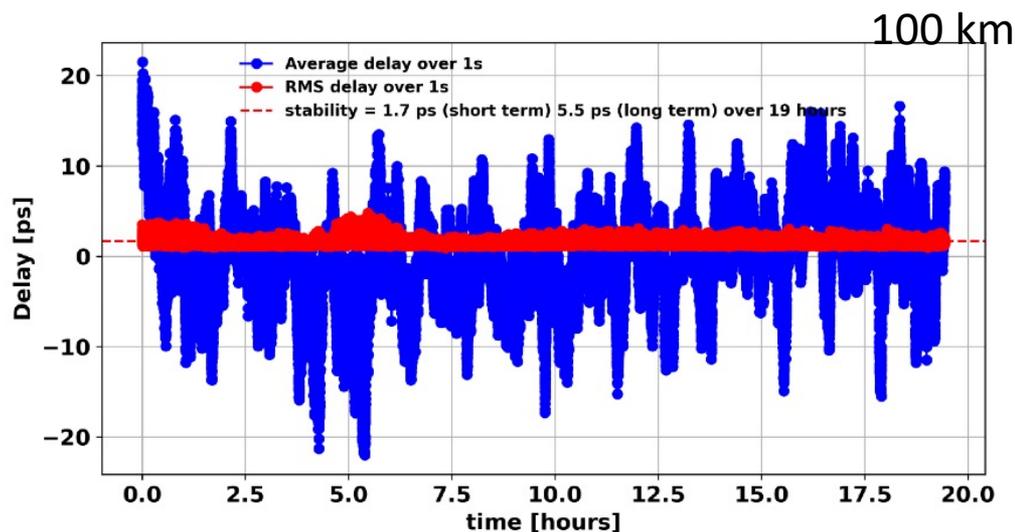
Commercial PID system used
 Could be implemented in board FPGA at later stage

← Reproducible phase noise power spectral density

WP2.2: long term tests



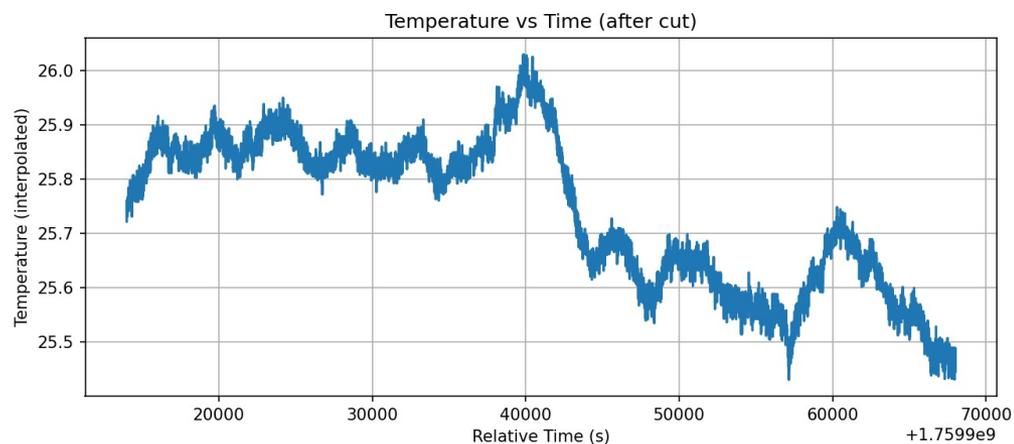
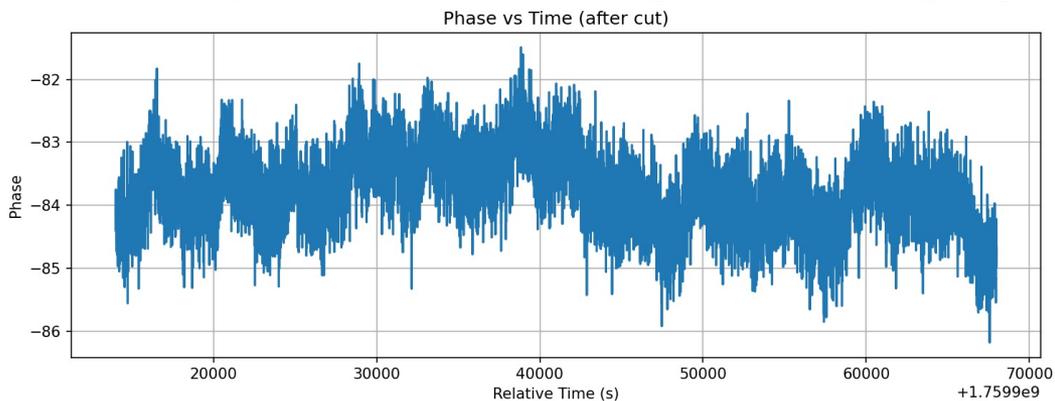
- Half-day or day-long tests
- Laser frequency PZT gets out of range after long time
- Peak-peak time jitter of ± 10 ps
- Very likely dominated by thermal drifts (see the ~ 1 h periodicity related to air conditioning)



Long term measurements at SKB

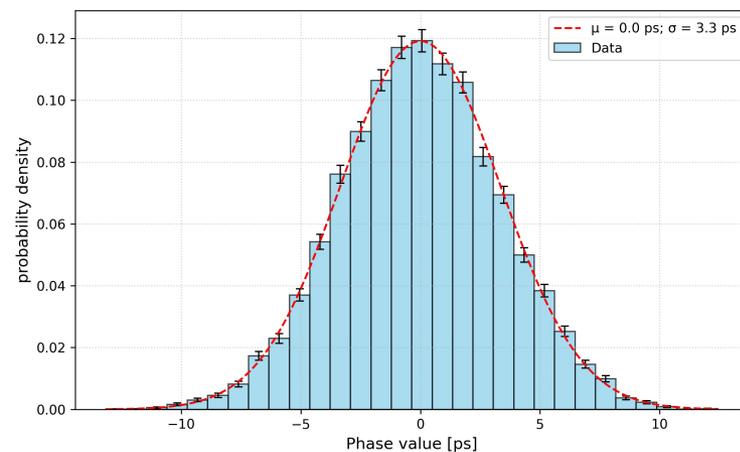
Tests at the board level with SKB reference, while accelerator operations are stopped

Plan to reproduce in the coming weeks during regular ops.



3.3ps RMS over 18h

Great similarity of results wrt those obtained in Orsay



WP2.2: conclusion/outlook

- Conclusion:
 - Proof of concept OK (5 km perfect for SuperKEKB, also OK for larger scale projects...)
 - Improvements related to thermal handling being planned : housing of boards
 - Laser control feedback could be implemented in FPGA (→ long term out of scope of this ANR project)

LCWS proceedings of tests at ATF
<https://arxiv.org/abs/2512.21212>

Study of laser-beam arrival time synchronization towards sub-picosecond stability level

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Paper submission in preparation

A Low Cost Picoseconds Precision Timing and Synchronization Over

A Hundred Kilometer

Alice P...*, Aurélien Martens*, Antoine Back*, Paul-Eric Pottie[†], and Daniel Charlet*

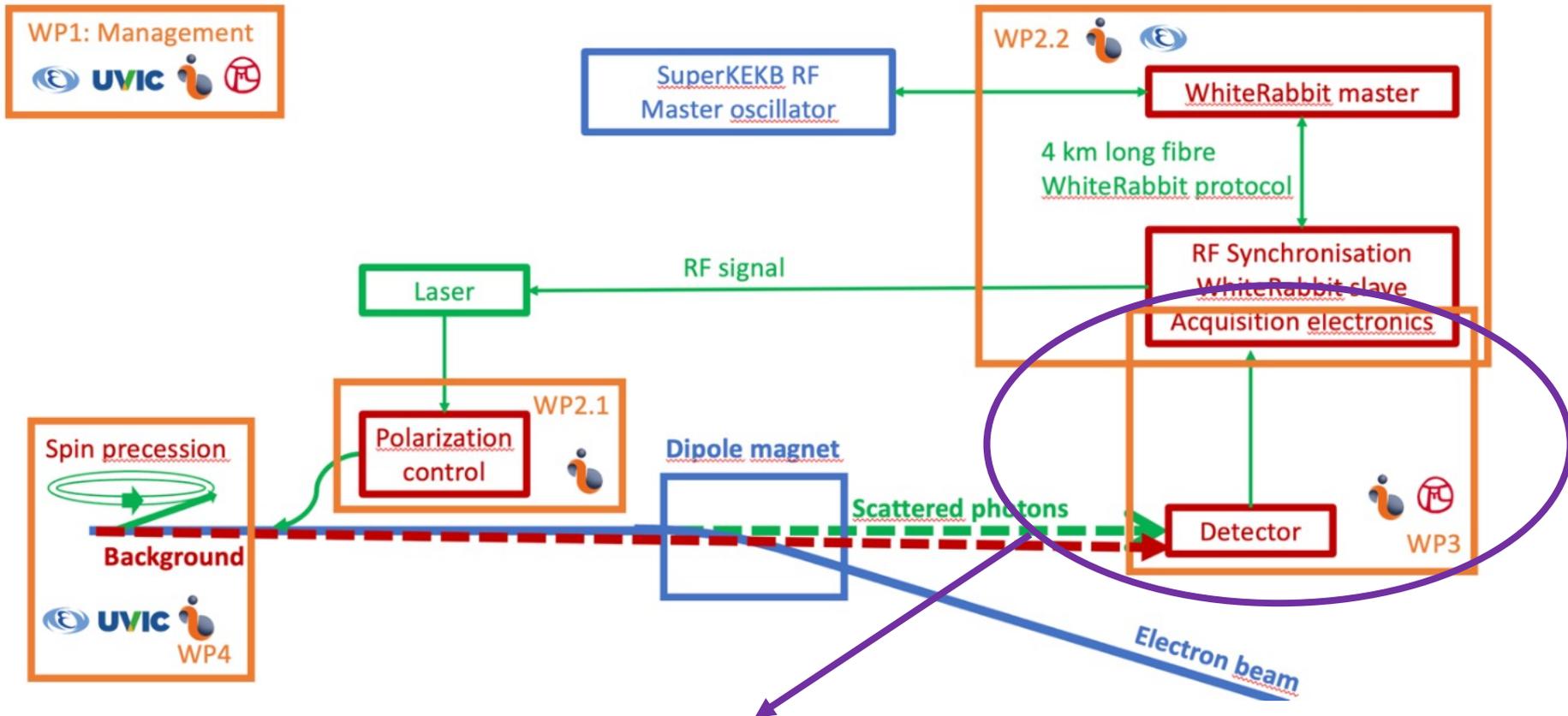
* Laboratoire de physique des 2 Infinis Irène Joliot-Curie (IJCLab), Université Paris-Saclay, CNRS/IN2P3 Orsay, France

[†] Laboratoire Temps Espace (LTE), Observatoire de Paris, Université PSL, Sorbonne Université, Université de Lille, LNE, CNRS Paris, France

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preliminary

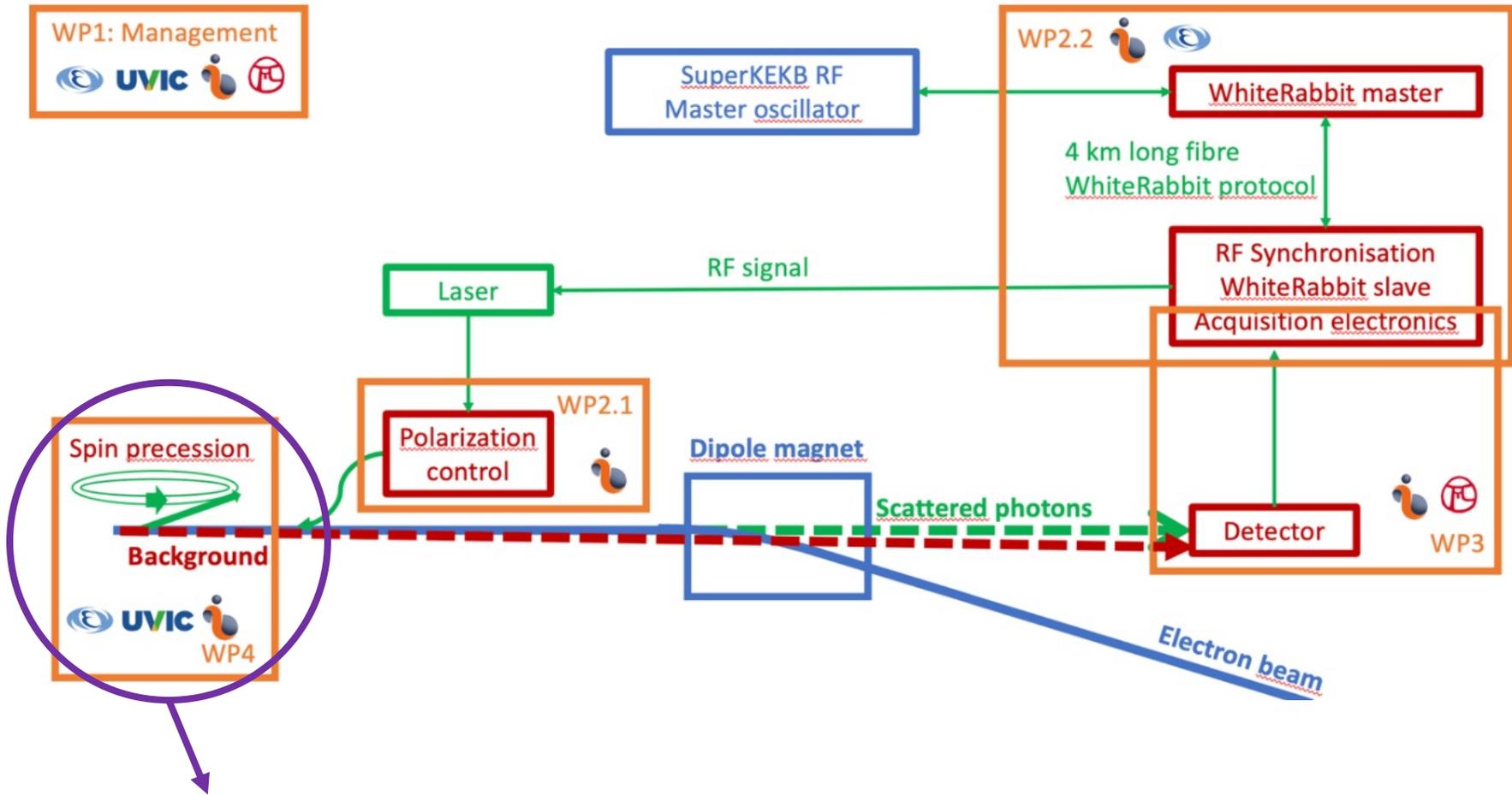
Work plans for 2026 – WP3



2 engineers started to work on this topic, good progress on the specifications of hardware (BaF2 crystal, optical filter, PMT, DAQ). Goal: order in the coming weeks, to allow first tests in september. → more news at the next B2GM

Master intern (to continue in PhD thesis) found. PostDoc offer available (deadline 10th Feb). <https://inspirehep.net/jobs/3083338>

Work plans for 2026 – WP4

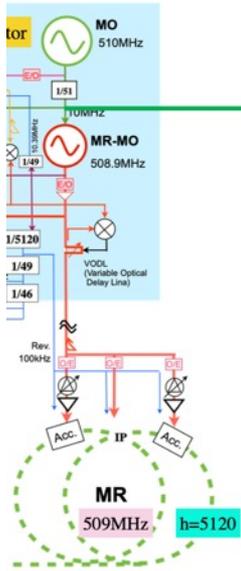


Depending on profile of PostDoc, expect contribution to Touschek lifetime data taking and analysis → I assume personnel is needed on time, timeline to be discussed

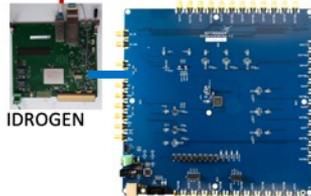
Conclusion / outlook

- Status: ANR project well on track so far
 - Detector engineering design well engaged, close to procurement phase.
 - Laser polarisation work started.
 - Laser synchronisation proof of concept validated
- Plans:
 - Detector assembly and test started by september
 - Laser polarisation modeling and first hardware tests before summer
 - Laser synchronisation improvements will take more time (high load of engineering team) but current results are sufficient at this stage
 - Further joint tests with SKB team planned : behaviour of system during regular SKB operation, results of acquisition of Beam loss monitors
- Contribution to Touschek lifetime measurements well possible → when/how/work load to be discussed.

Final goal



Regular optical link,



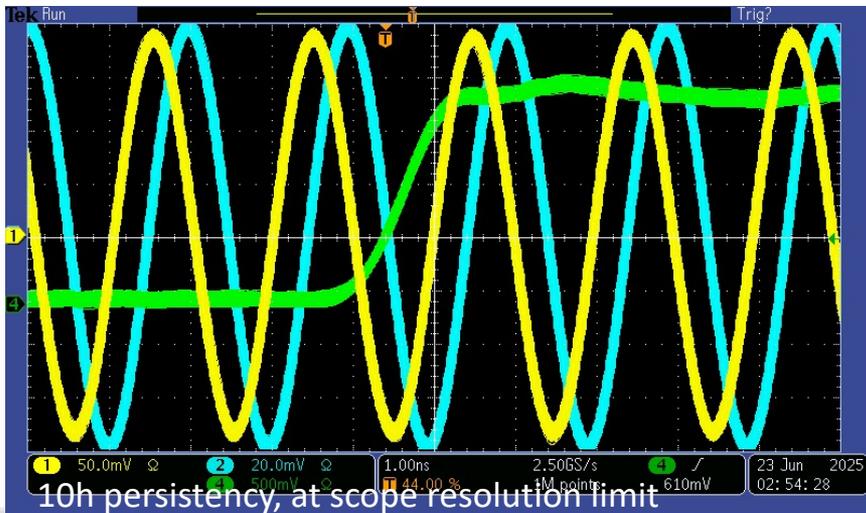
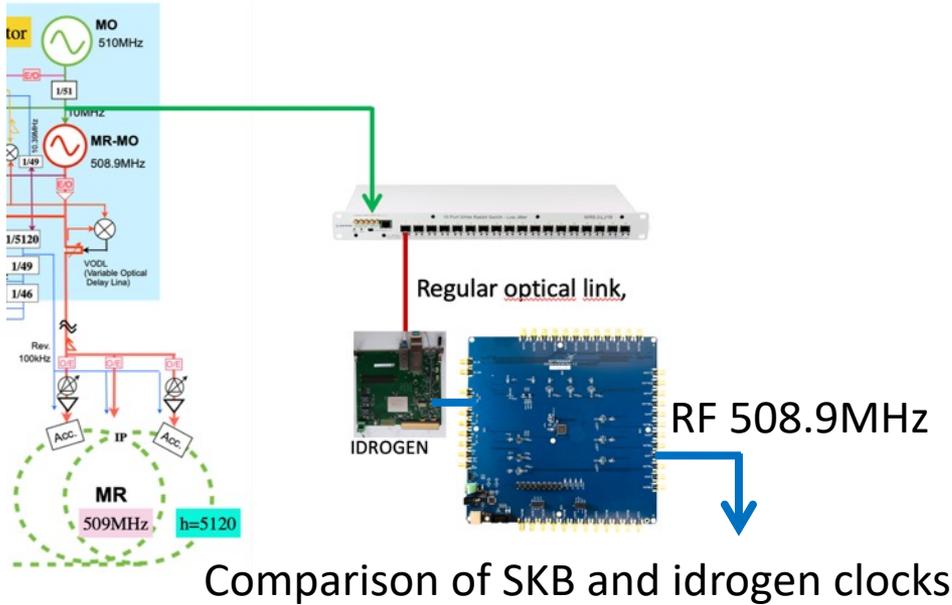
IDROGEN

IDROGEN
w/ SI5362 chip

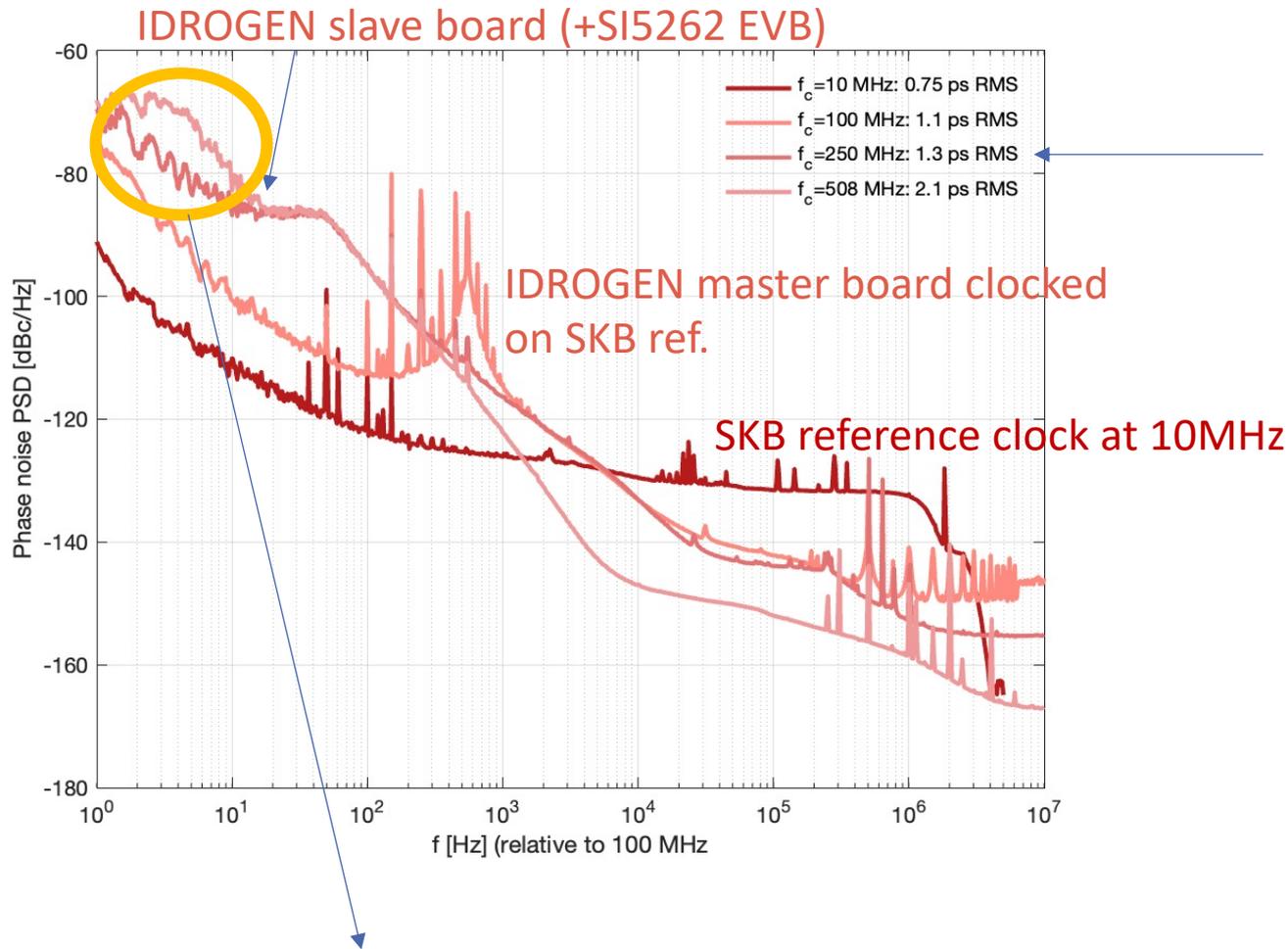
RF 508.9MHz

To laser synchro input

First validation test at SKB (oct'25)



Phase noise measurements @SKB



Was 2.0ps in June'25
Improvement: use of
master idrogen instead of
commercial switch

Overshoot related to SI5362 chip, to be improved in the future.

Phase noise measurements @ATF

Less spurs → improved Phase Noise

