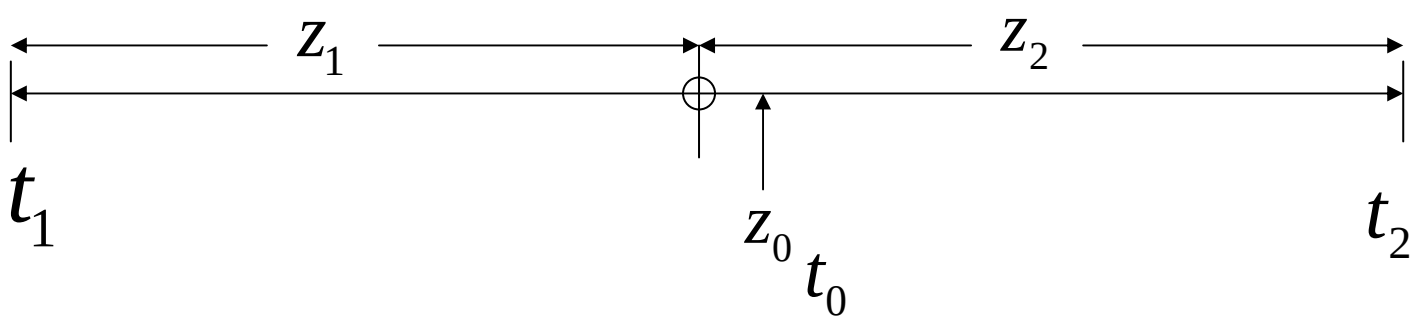
Reference Timing for FP420



$$t_1 - t_0 = \frac{c}{|z_1| + z_0}; \quad t_2 - t_0 = \frac{c}{|z_2| - z_0}$$

($|z_i|$ are distances but z_0 is signed)

Stating the obvious, but → $$z_0 = \left(\frac{c}{2}\right) \times \left(\frac{1}{t_1 - t_0} + \frac{1}{t_2 - t_0}\right)$$

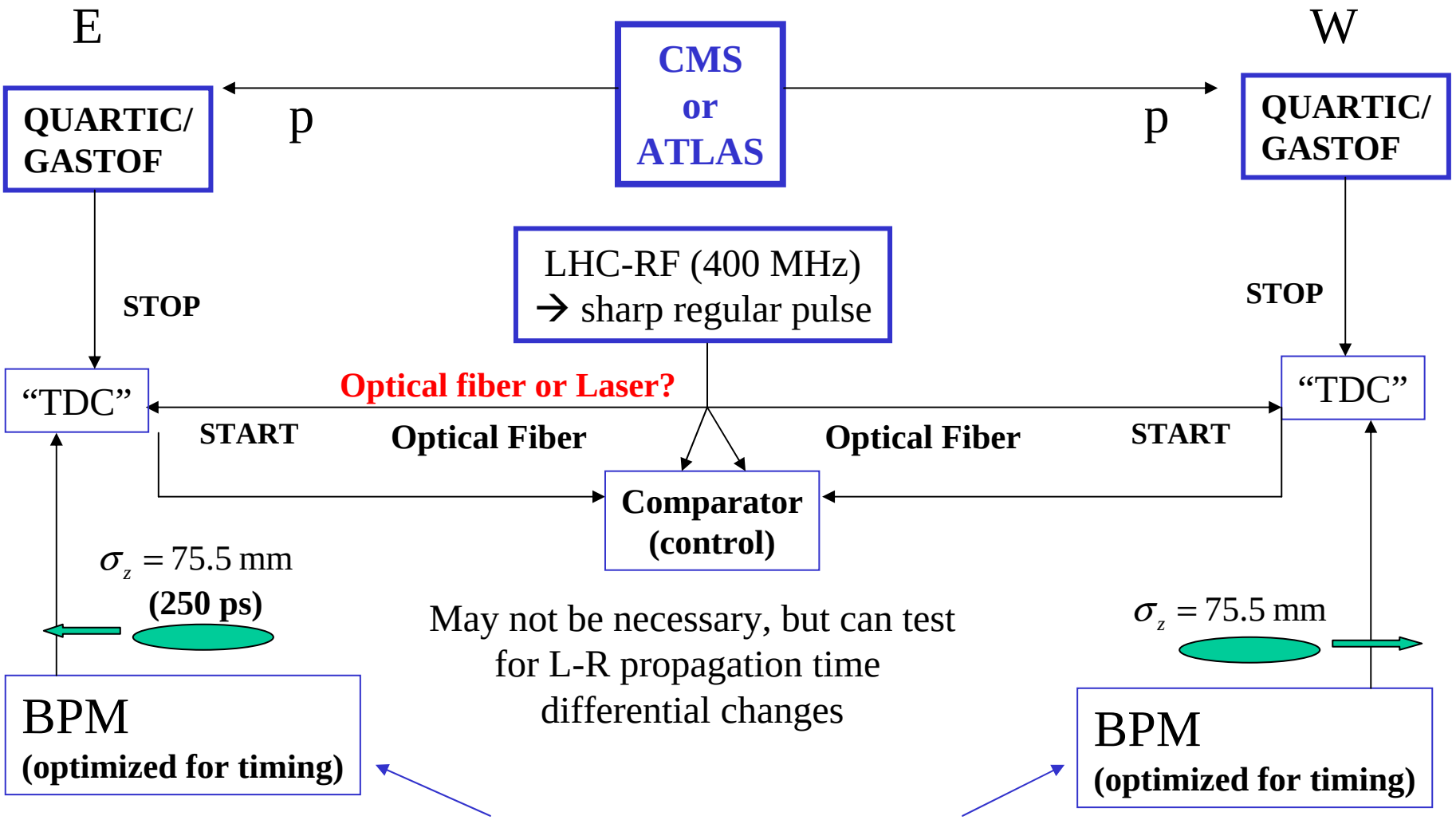
if $z_1 = z_2$

The reference time, given by a local (to FP420) "clock" must

(a) have no differential jitter (at few ps level) between L and R stations

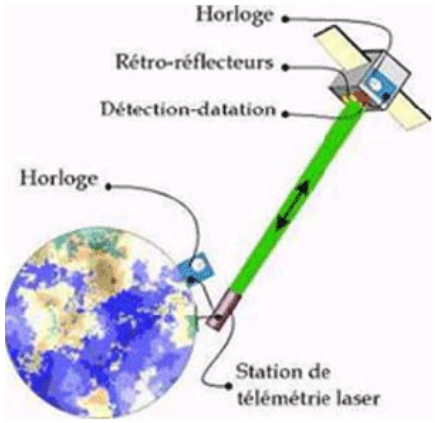
(b) be calibrate-able → fix $z_0 = 0$ and $\left(\frac{dz_0}{d - TDC}\right)$

A possible scheme:



Tell where p is w.r.t. bunch centroid. (few mm/70mm)
Fine correction on p_incident. Compare with sum time from $t_E + t_W$

r&d m : T2L2



Learn from space physics?

TIME TRANSFER BY LASER LINK T2L2

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The T2L2 experiment allows the synchronisation of remote clocks on Earth, and the monitoring of a satellite clock, with a time stability of the order of 1 ps over 1000s and a time accuracy better than 100 ps. The principle is based on the propagation of light pulses between the clocks to synchronise. The ground segment is a satellite laser ranging station with a special instrumentation able to time light pulses accurately as compared to the ground clock to synchronize. The satellite payload comprises an optical package, and a time tagging unit connected to the space clock.

elements :

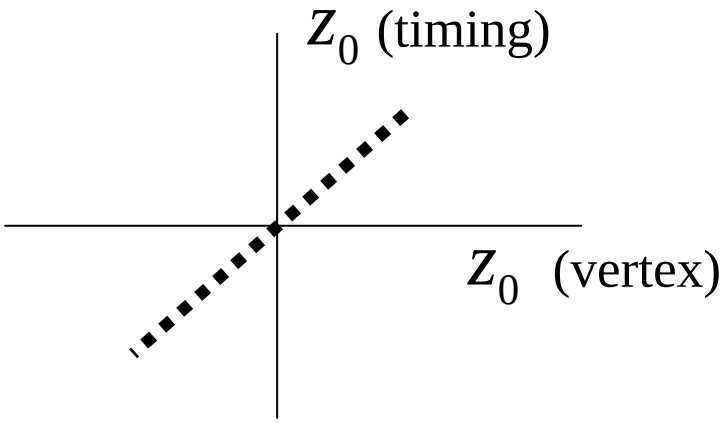
A detection unit based on an avalanche photo-diode working in a Geiger mode.
A time tagging unit able to time the photo-diode output in the satellite clock time scale with a precision better than 3 ps.
A high index corner cube (100mm diameter) having a large field of view.

Assuming jitter problem solved,
Calibrate with real DPE events.

Want low-ish Lum, enough single interactions $L \leq\sim 5\times10^{32} cm^{-2}s^{-1}$
(maybe want a special low-L bunch crossing later)

Trigger on two forward rap gaps - needs better coverage $6.5 < |\eta| < 9.5$
plus central state (could be dijets, or just ΣE_T)

"Know" central vertex and z_0



Ambiguities give much background if do not select single interactions. Could require (e.g.): $\xi_1\xi_2 > \left(\frac{M_{JJ}^2}{\sqrt{s}}\right)$

→ We must have a good reference signal free of jitter between E and W stations. This is as important as the detectors themselves. Temperature control? Return path control?

→To use 220m stations together with 420m, these need timing too.

→ Position of interaction in bunch: tight (?) correlation with position in time of p wrt bunch center at 420, because no RF cavities intervene.

→ Need to discuss with LHC RF/clock experts.