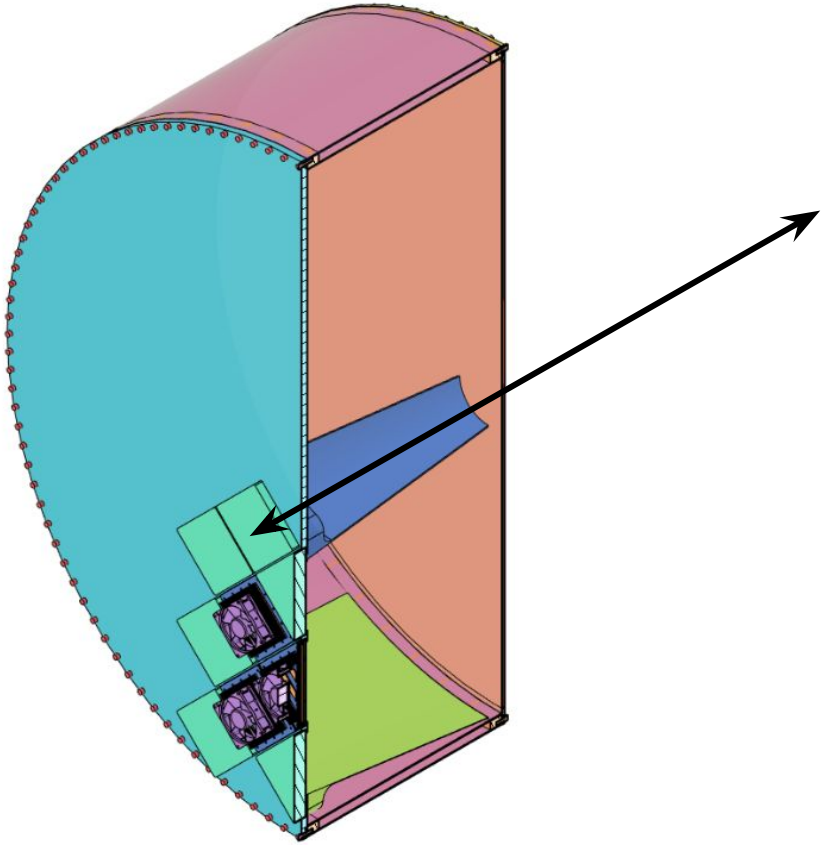
pfRICH LED/Laser Monitoring Systems

May/30/2024

Monitoring System for the Prototype monitoring system

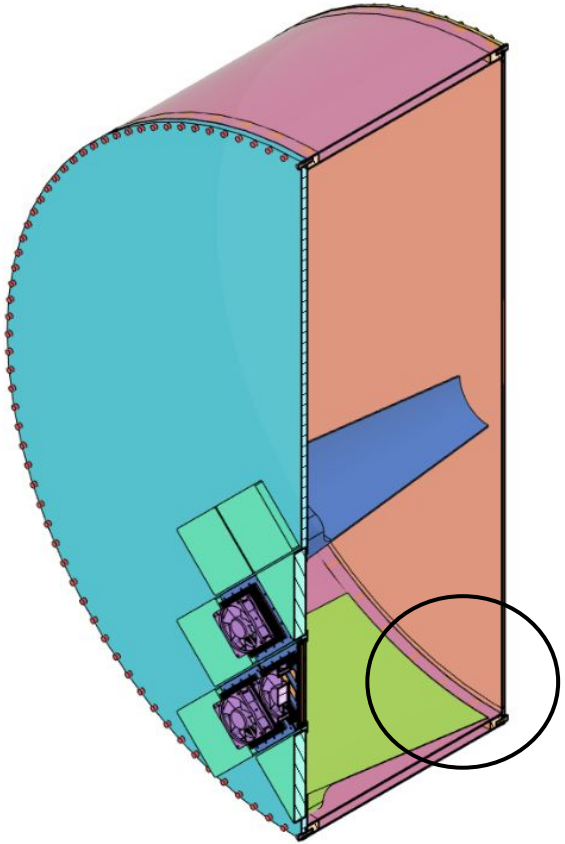


Mounting test on one of the tiles

- O-ring on flat surface.

https://www.sedi-ati.com/hermetic-fiber-optic-feedthroughs-en/m12-thread-fiber-optic-feedthrough-for-vacuum-and-pressure-up-to1000-bars/

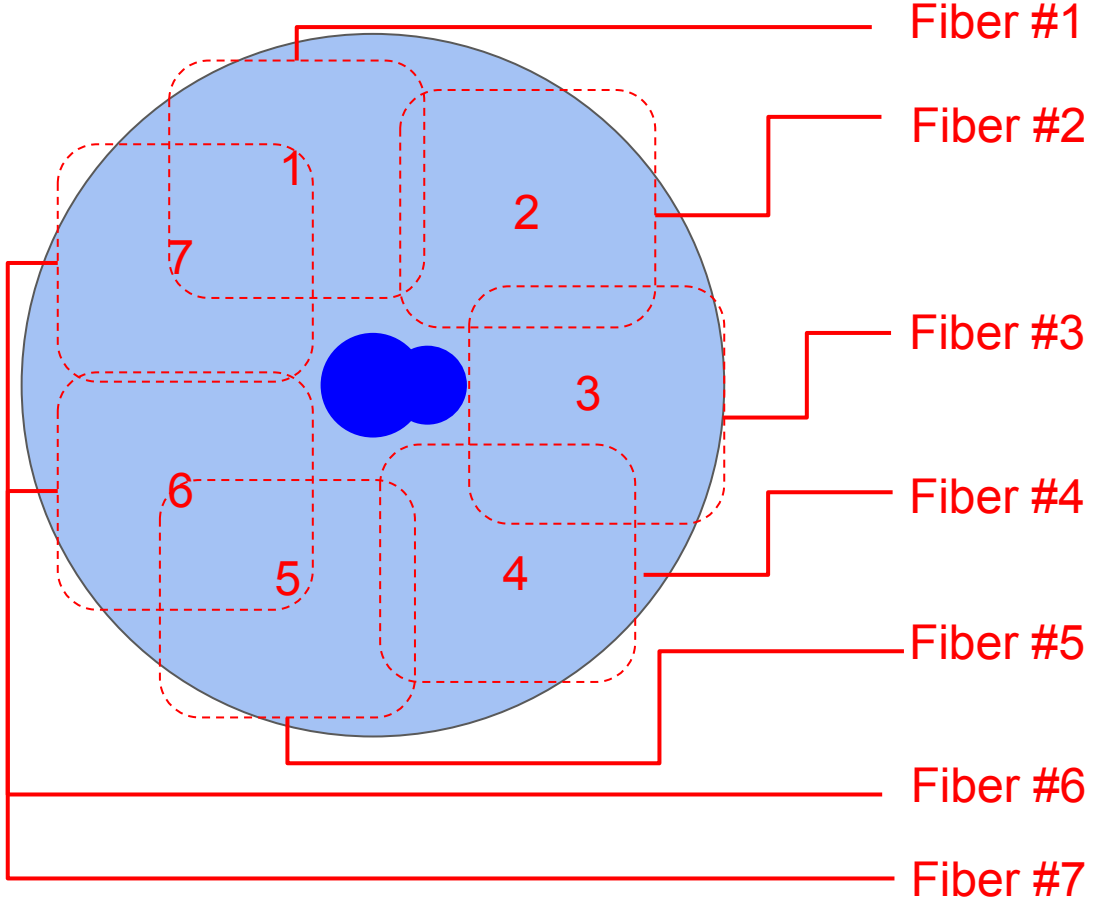
Monitoring System for pfRICH during operation

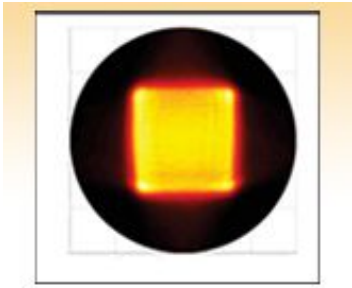


Suggested mounting point/points

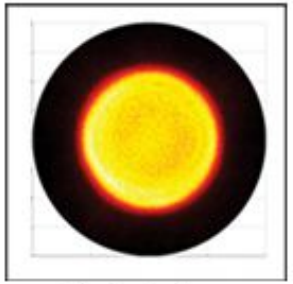
Laser coverage

https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_ID=1660





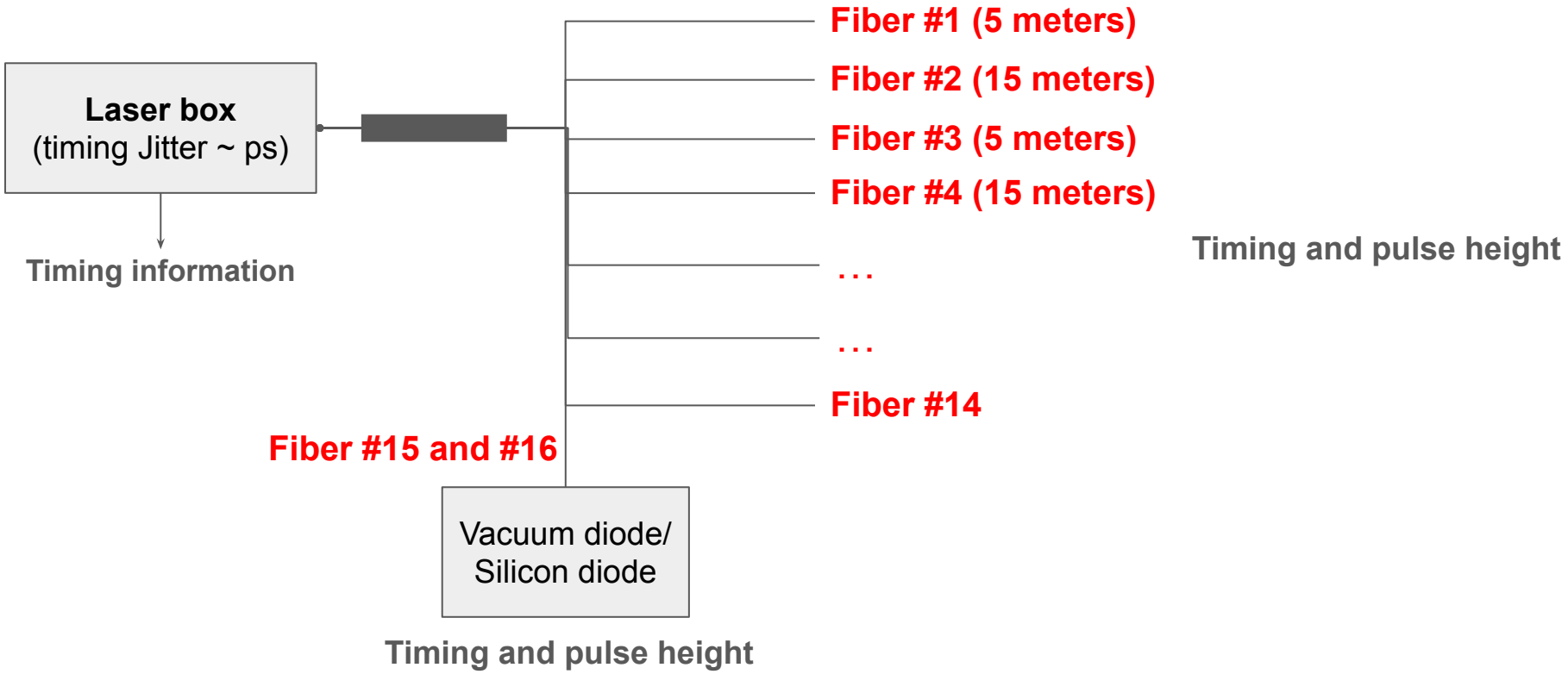
Square Pattern



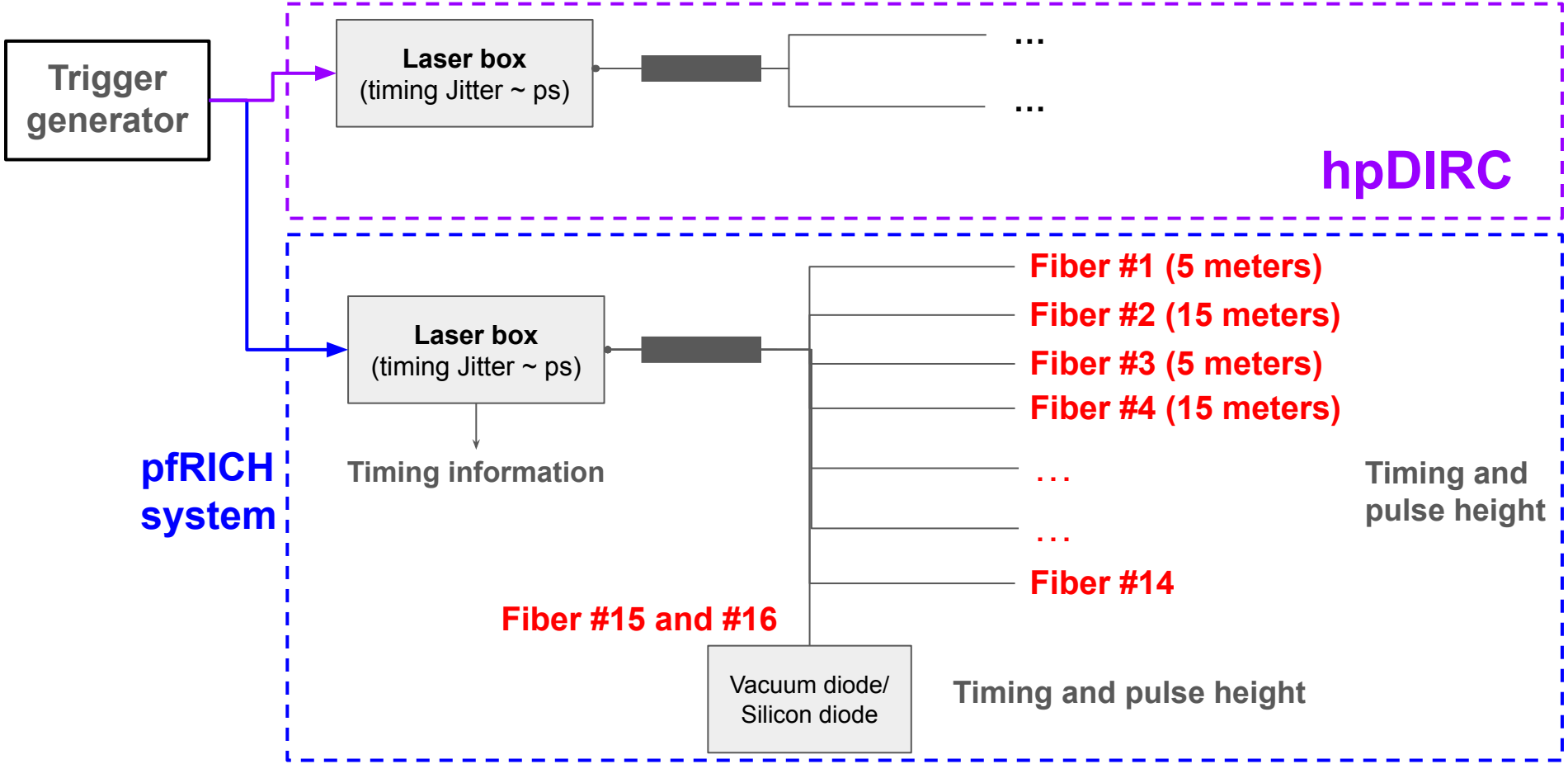
Circle Pattern

- 40 cm coverage
  - 50 degree square diffuser
- 7 fibers needed to cover the entire area
  - Square engineering diffuser.
  - Each are separated by 10 ns (different fiber length)
- 1 additional fiber to monitoring pulse integrity.
- Pulsed at 1-10 Hz
  - Phenix Nd:Yag Laser is pulsed at few Hz

Laser Jitter Monitoring



Integrated monitoring system pfRICH + hpDIRC



Estimated cost laser system

PILAS – picosecond pulsed diode lasers

Our PILAS picosecond pulsed diode lasers are designed for industrial as well as scientific applications. Get a flexible system to fit any application.

Choose from more than 10 different wavelengths in the range from 375-1550 nm, repetition rates from single-shot to 40 MHz pulse trains, internal or external trigger. With PILAS you get alignment and maintenance-free 24/7 operation.

- Pilas Laser: $15K
- Fibers: $600 x 16 = $9.6k
- Splitter: 5 x 1-4 splitters, 5 x $1.5k = $7.5k
- $25K (other ancillary items): Feedthrough x 16, diffusers x 16.
- $20K(contingency).
- **1-16 port fiber splitters:** https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=13963
- Total: **$77k**

Open question

- **LED vs Laser**
  - **Timing resolution, LED ~ 0.5-1 ns, laser <100ps**

- **Does the pulse laser light generate too much photons per pulse?**
  - **Can we tune the intensity? Yes, ~10 photons / pulse**

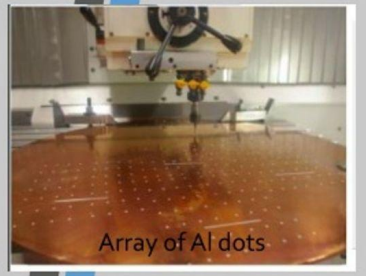
- **Signal splitter and diffusers, would they jitter the signal and smear the timing resolution?**

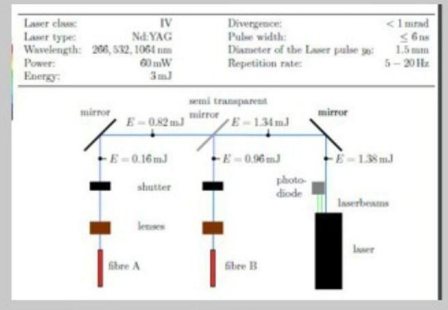
- **Recommandation:** we need to purchase a set of equipment immediately to ensure the proposed strategy is feasible.

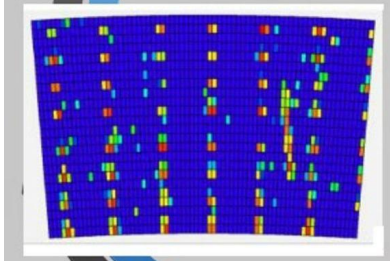
Backup slides

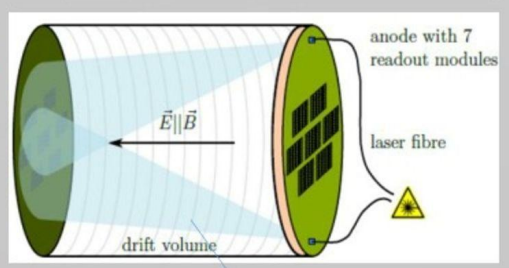
Laser vs LED System

ILC Prototype TPC Laser calibration system









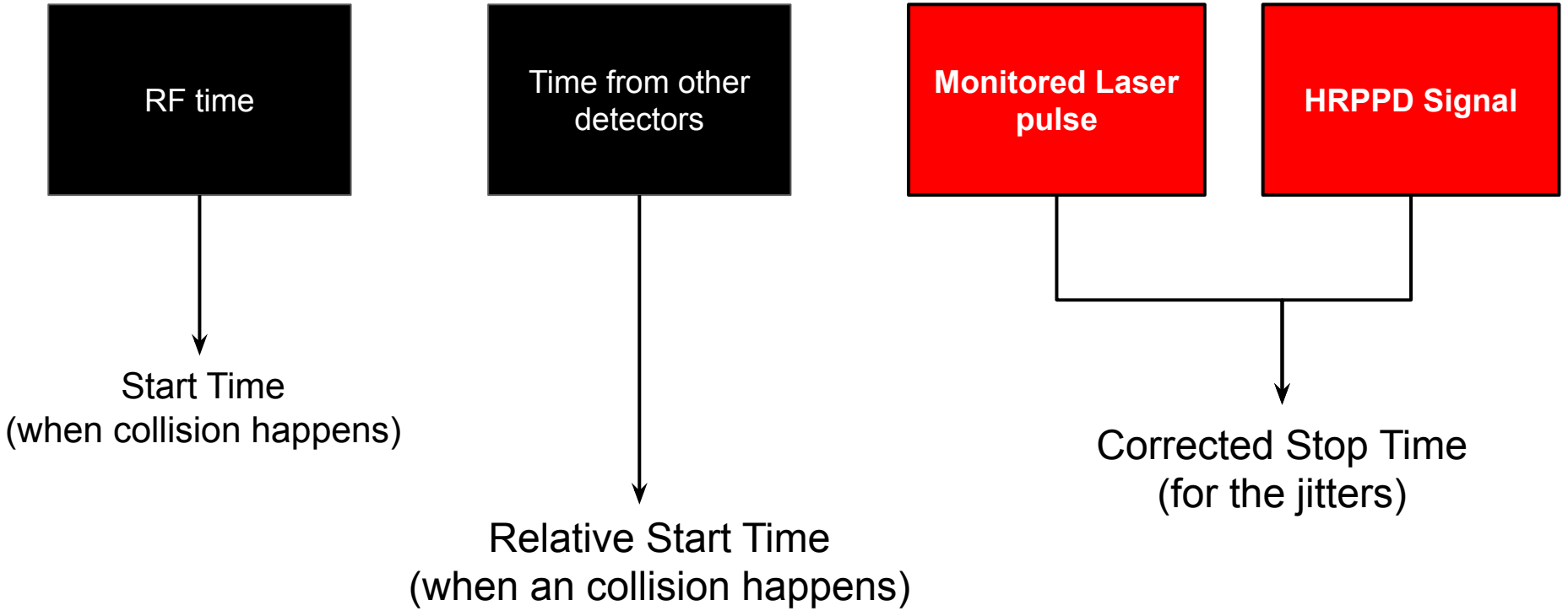
Diffuse laser light

Reconstructed position after drift, which integrates all distortions and misalignments

- Rely on pattern of small Al dots (not lines) on membrane to carry information (integrated along full drift) about distortions on small volume element
- No Z-information, however this may be Ok for relatively small TPC's with short drift lengths, where space charge is not as big an issue

B.Azmoun, BNL

Time


RF time
Time from other detectors
Monitored Laser pulse
HRPPD Signal
Start Time
(when collision happens)
Relative Start Time
(when an collision happens)
Corrected Stop Time
(for the jitters)