Indirekte Time-of-Flight Messung

ein robustes 3D Messprinzip

Stefan.Schwope@TriDiCam.de

TriDiCam

- Gründung: 22.09.2008
- Spin-Off: des Fraunhofer Institutes für Mikroelektronische Schaltungen und Systeme, Duisburg (IMS)
- Unternehmensform: GmbH
- Geschäftsidee: Entwicklung, Produktion und Vertrieb von 3D Time-of-Flight Bildsensoren
- Vision: Die TriDiCam GmbH will in wenigen Jahren aufgrund des Technologievorsprungs zum führenden Hersteller von 3D-Sensormodulen werden
- Geschäftsführer: Dipl. Betriebswirt Jochen Noell
- Entwicklungsleiter: Dipl.-Ing. Stefan Schwope
- Mitarbeiter: Insgesamt 7 Mitarbeiter (Dipl.-Ing. und Physiker) + 200 Fraunhofer IMS Mitarbeiter

Inhalt

- 3D Systeme
- Prinzip des indirekten Time-of-Flight
- Parametrierung und Robustheit
- Fragen zum Verfahren
- Applikationsbeispiele

Inhalt

- **3D Systeme**
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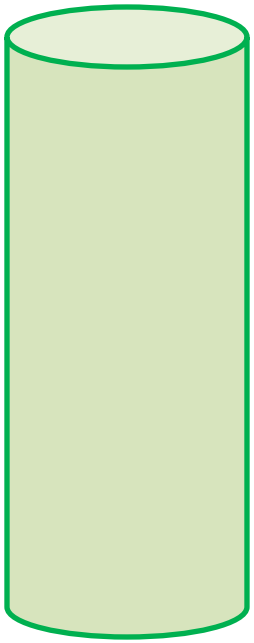
3D System

3D System

3D Scene



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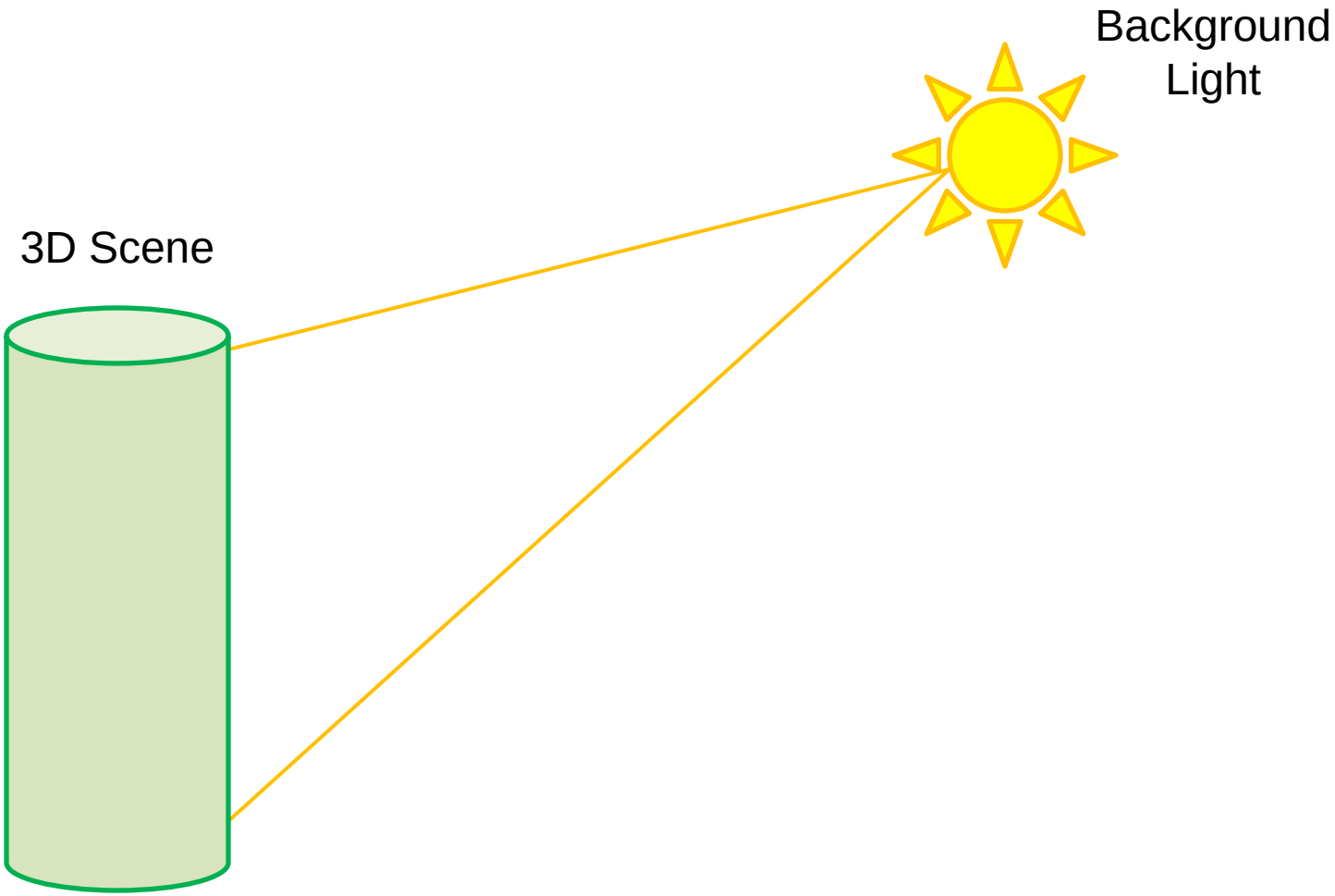

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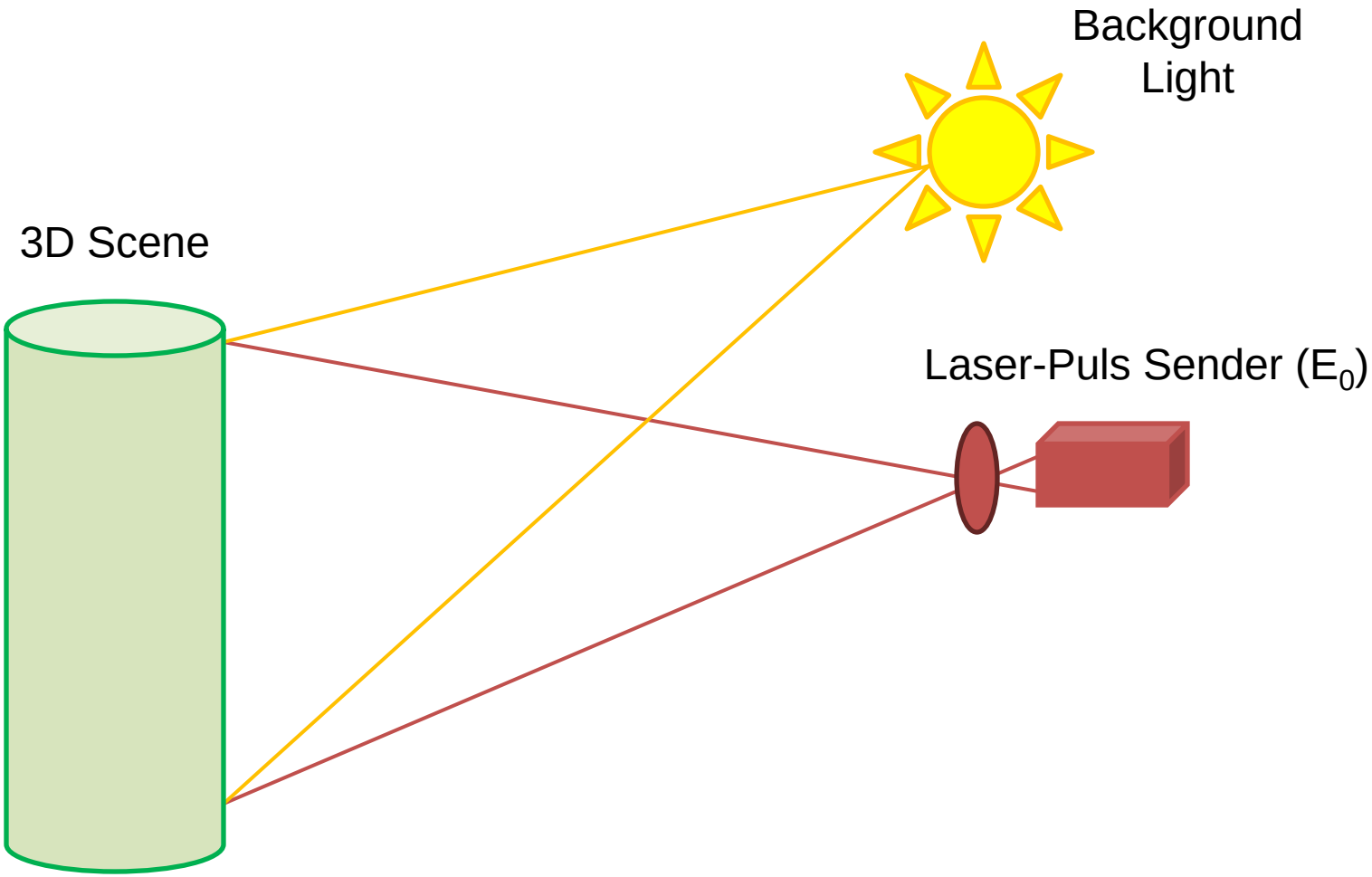

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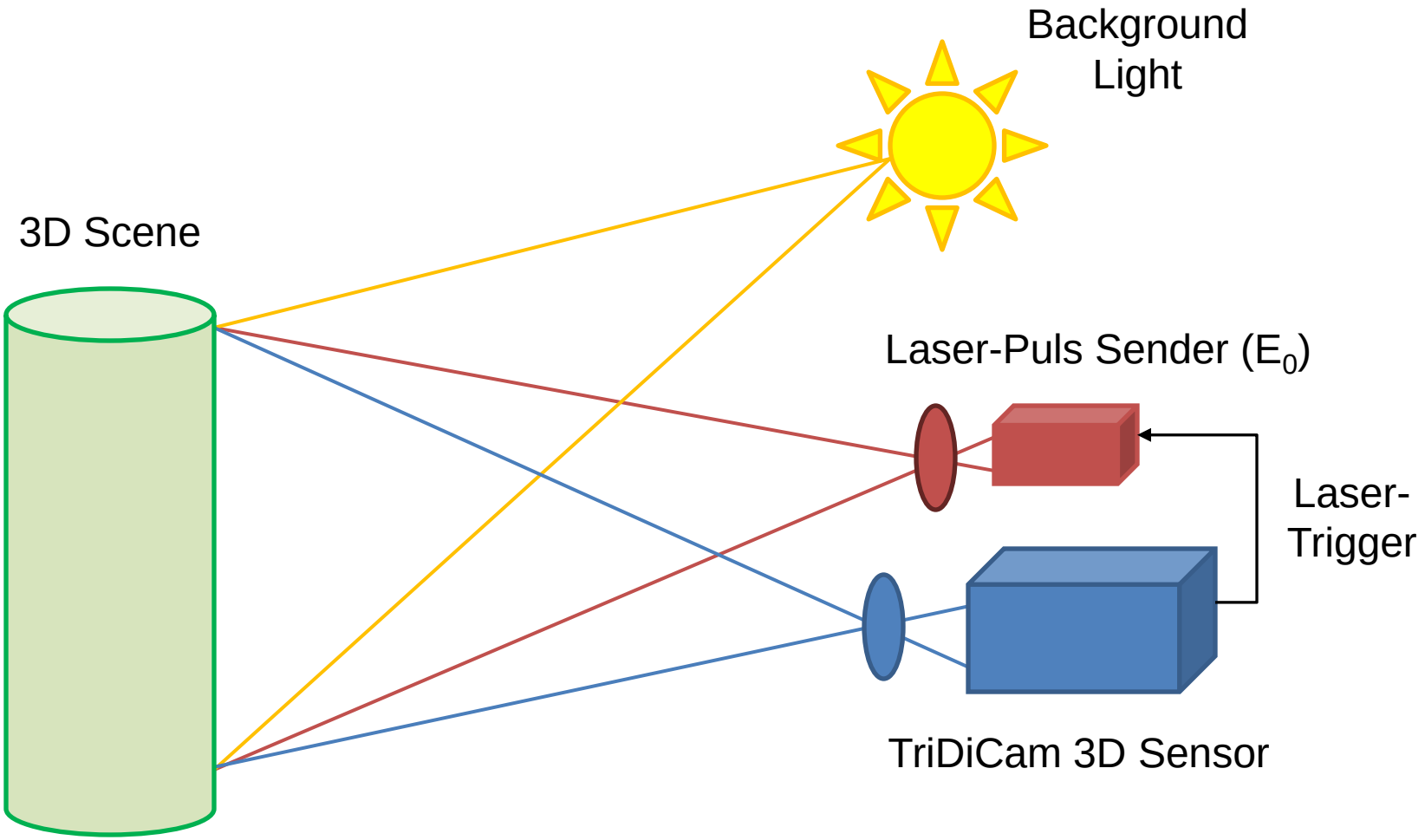
Background
Light
3D Scene
Laser-Puls Sender (E_0)
Laser-
Trigger
TriDiCam 3D Sensor

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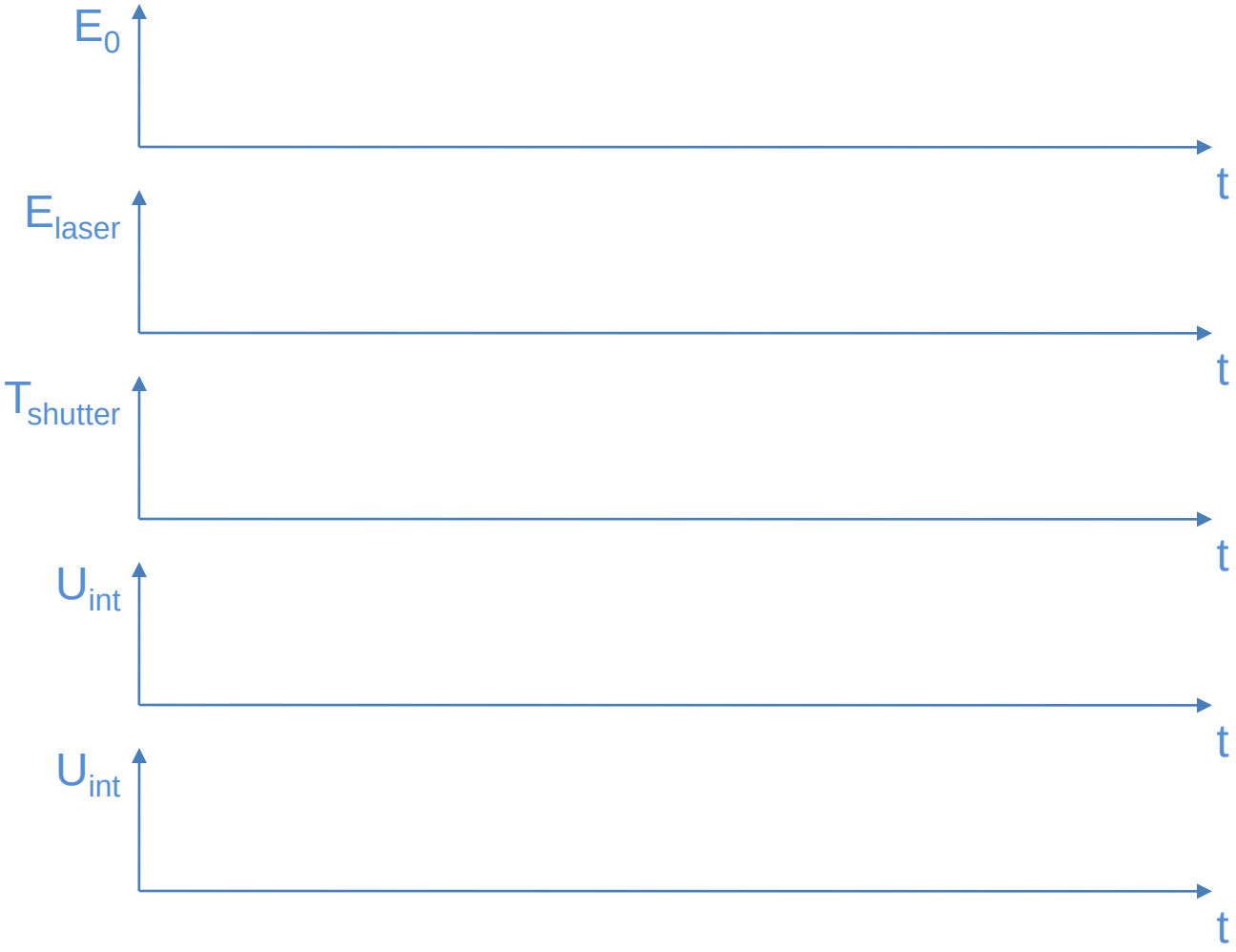
3D Principle



Prinzipskizze

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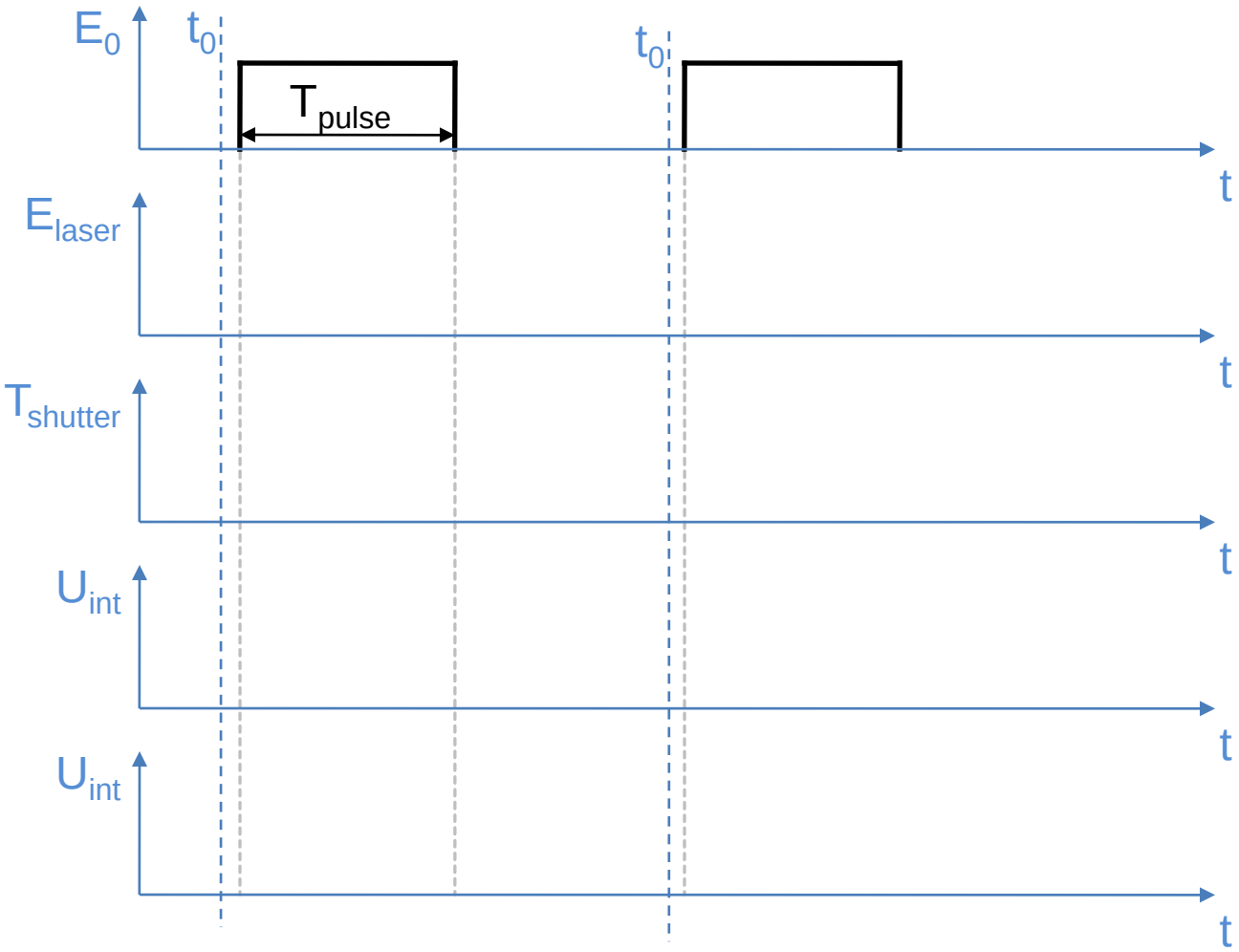

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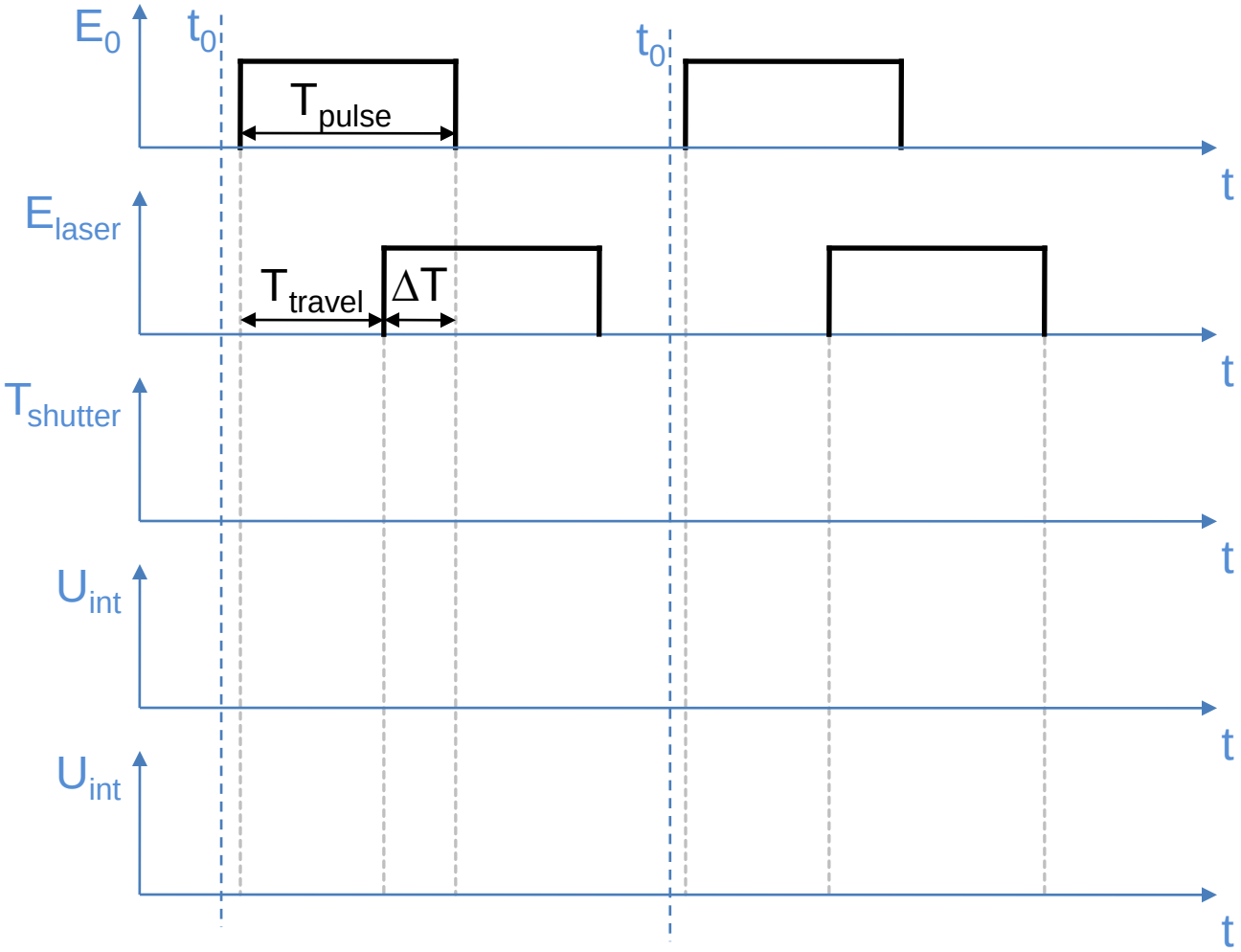

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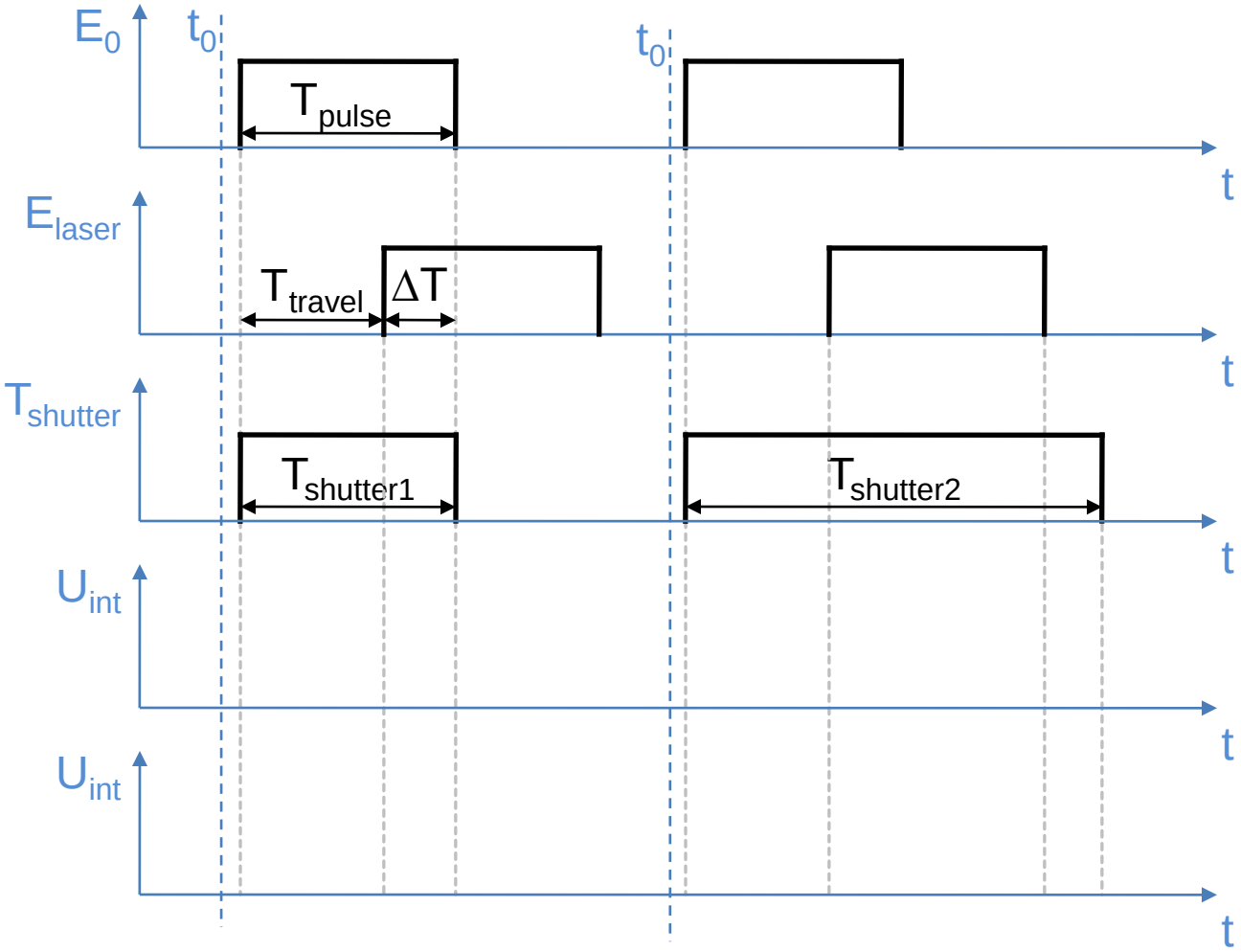

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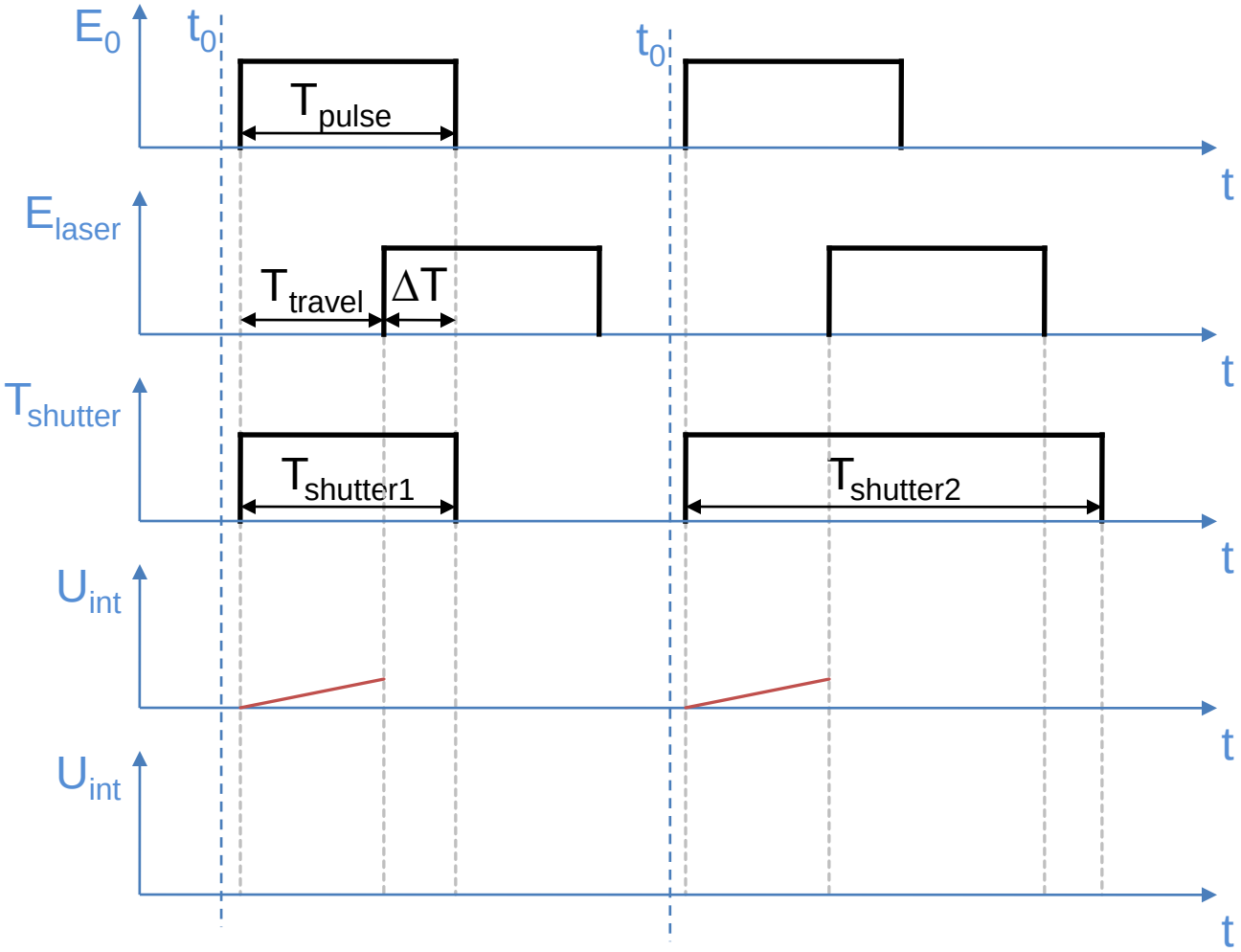

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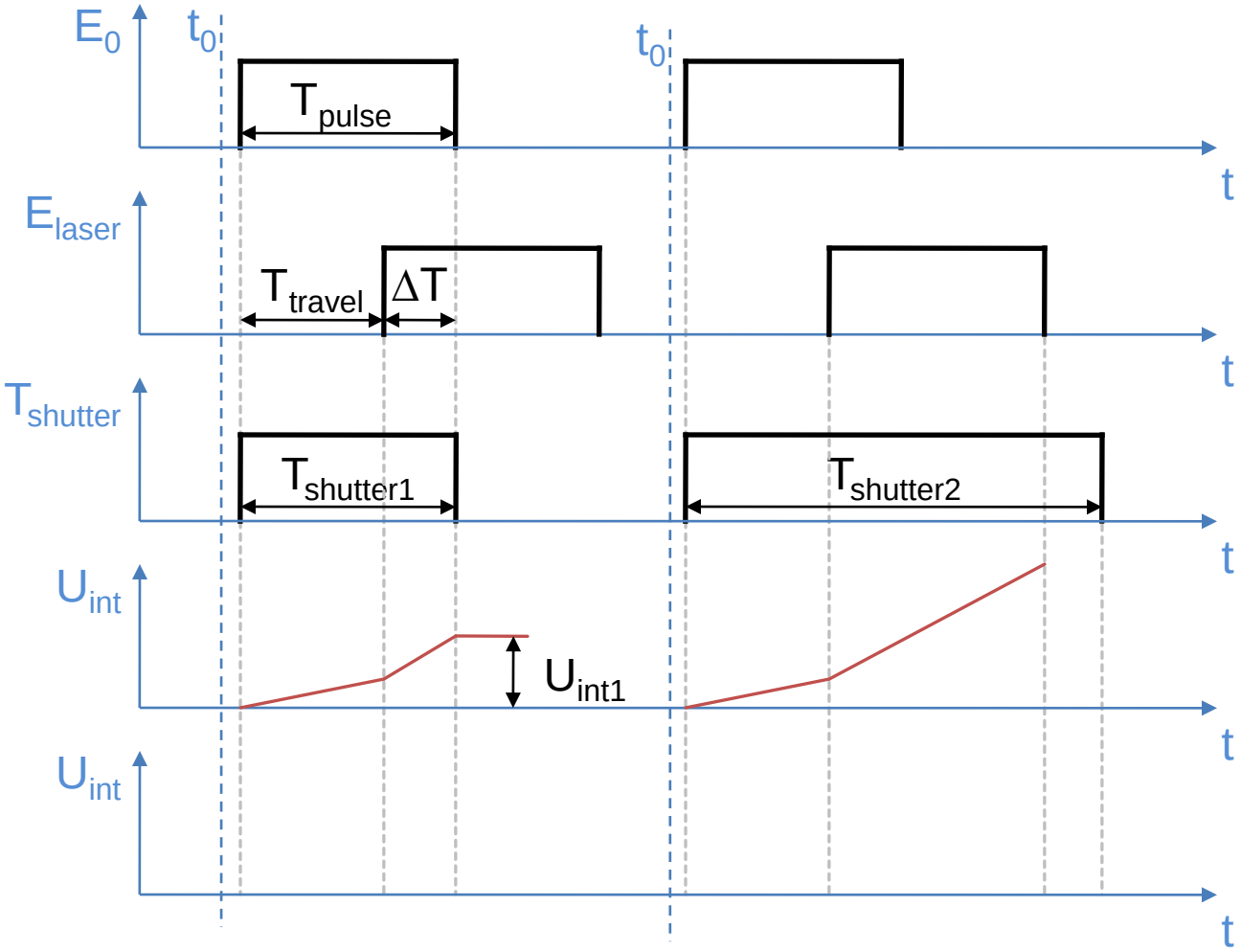

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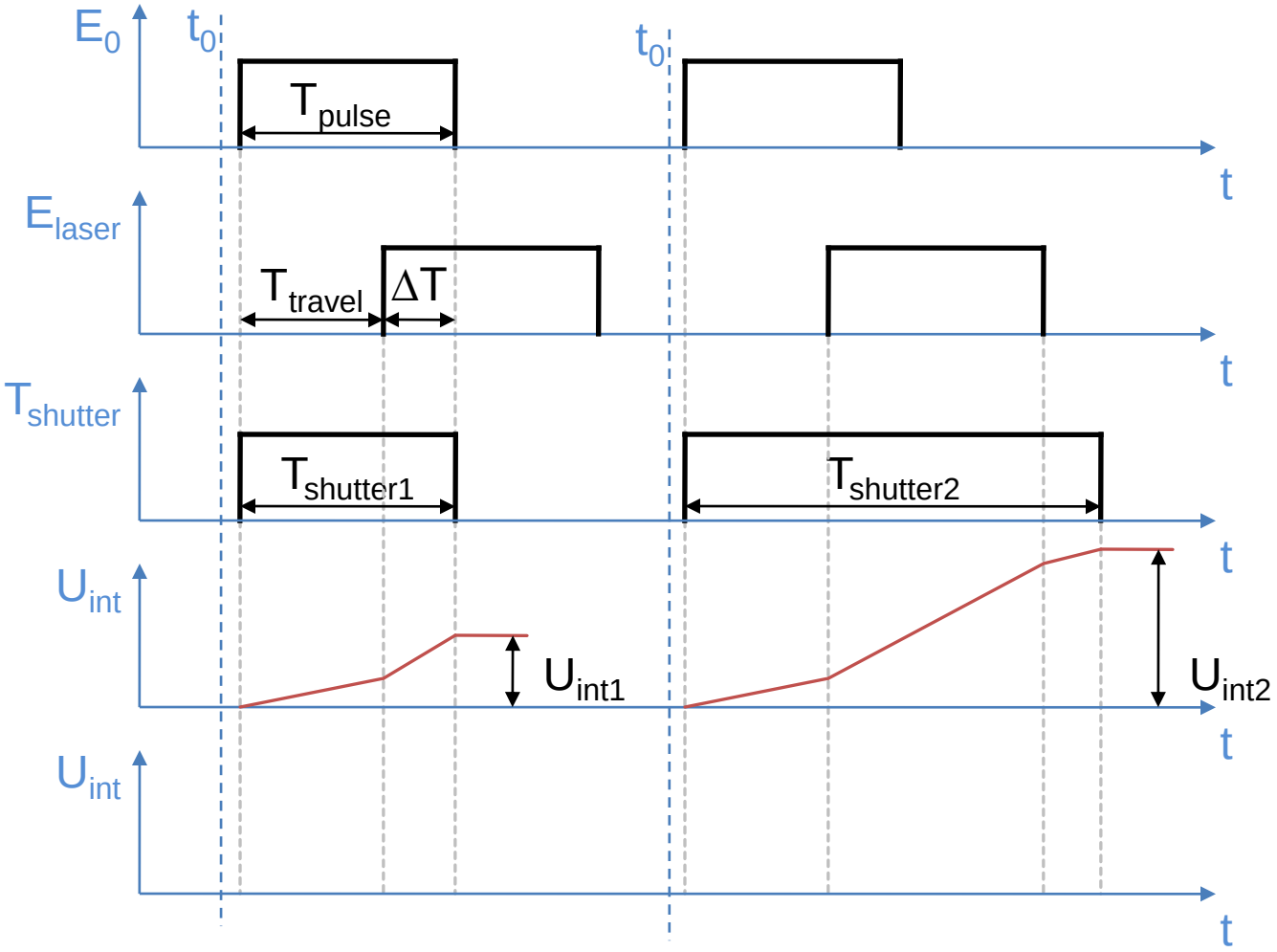

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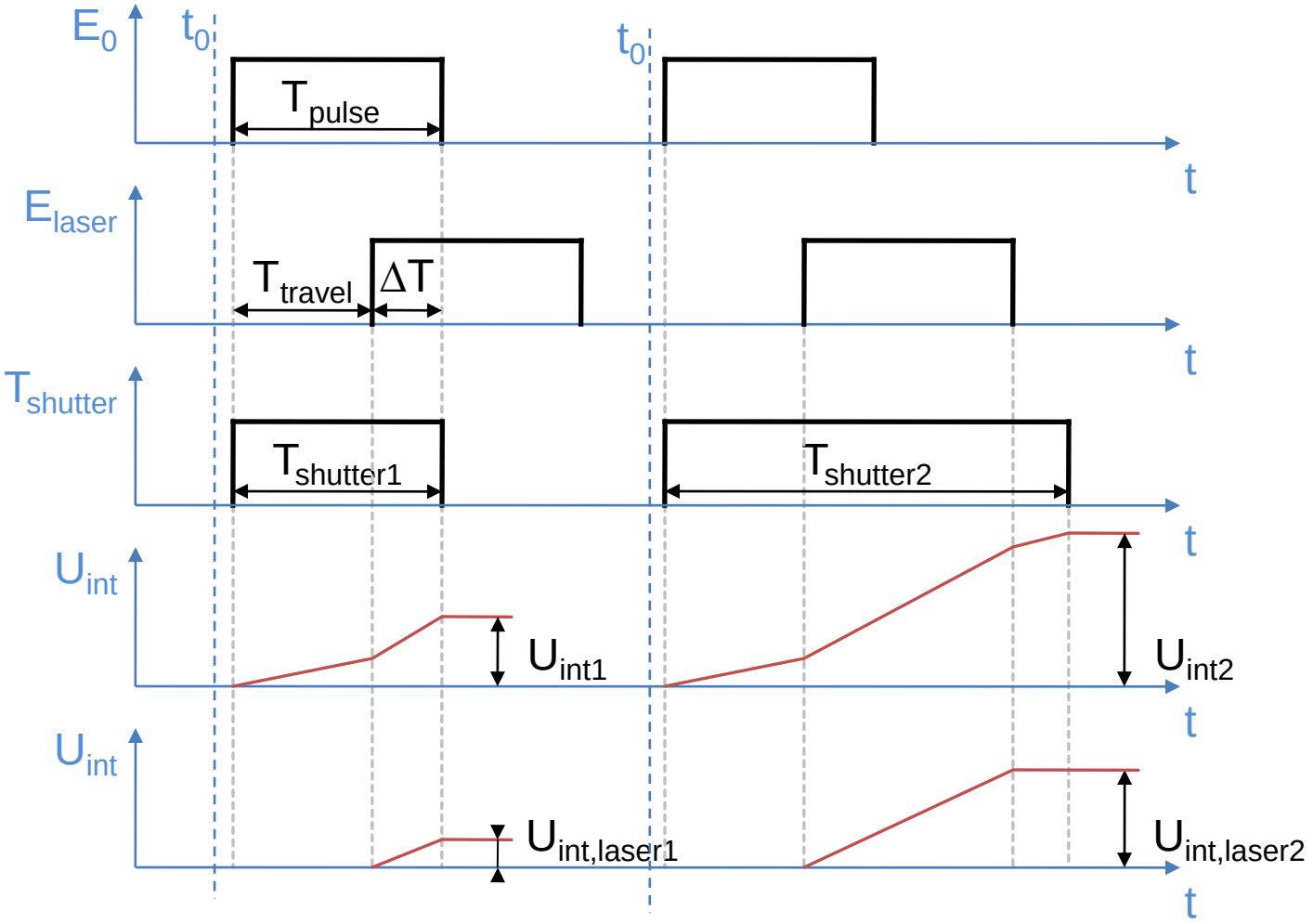

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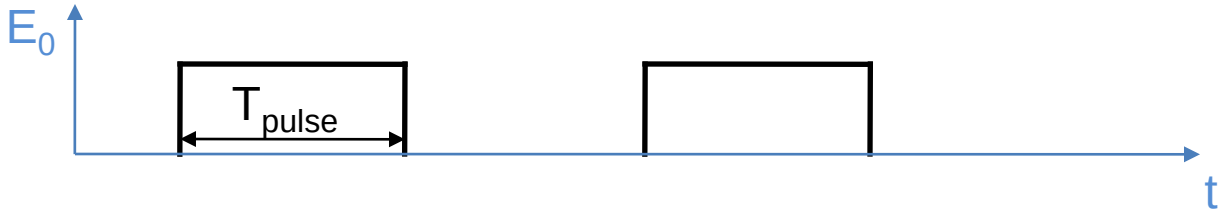
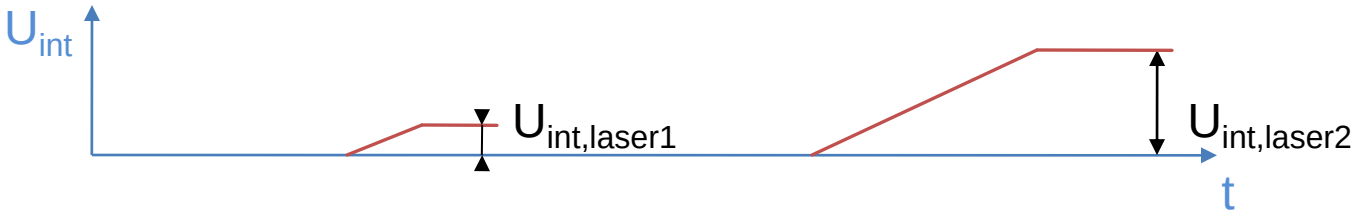


$$d = \frac{c}{2} \cdot T_{pulse} \cdot \left(1 - \frac{U_{\text{int},laser1}}{U_{\text{int},laser2}}\right)$$



Prinzipskizze

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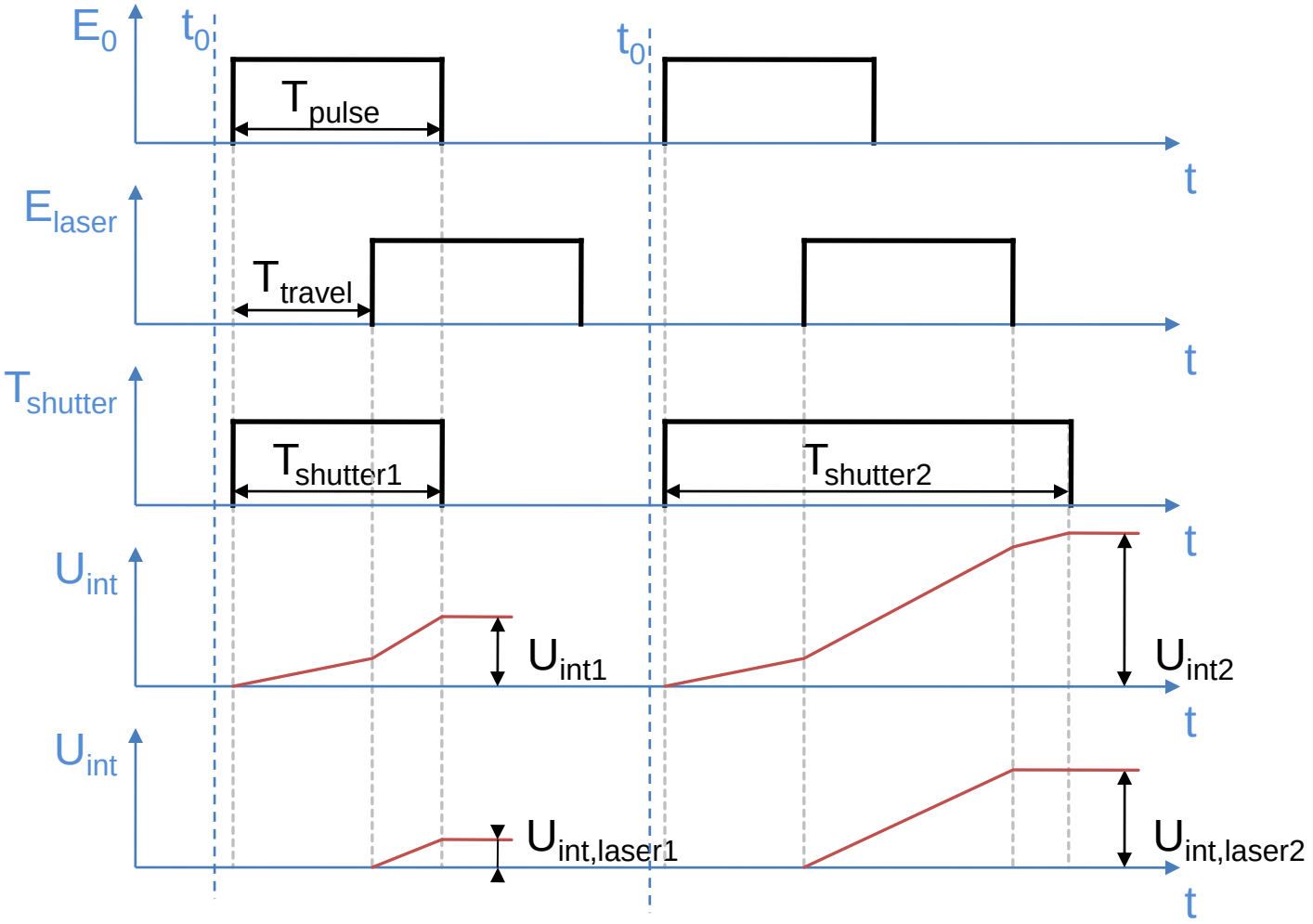

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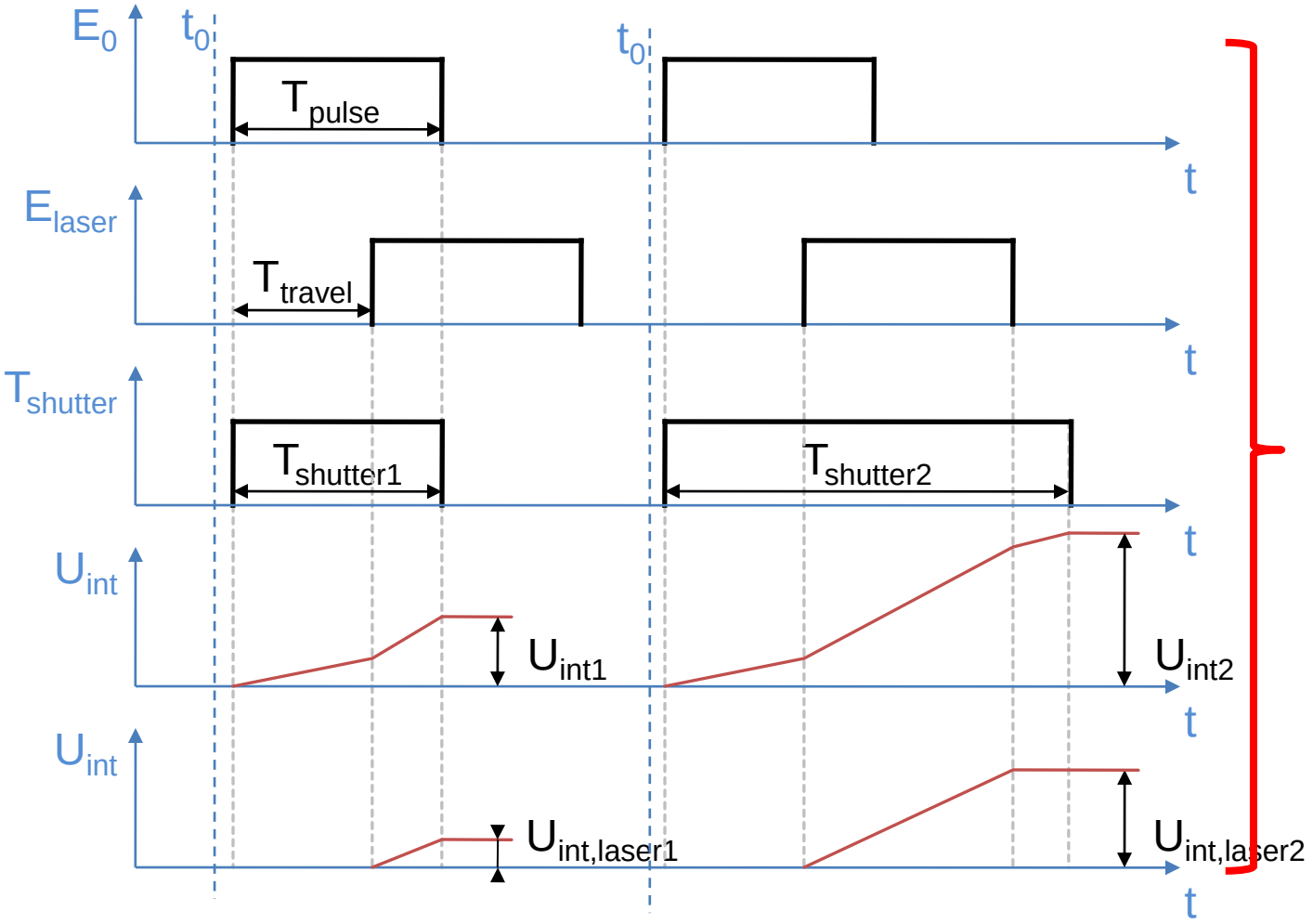

Done inside every Pixel

Prinzipskizze

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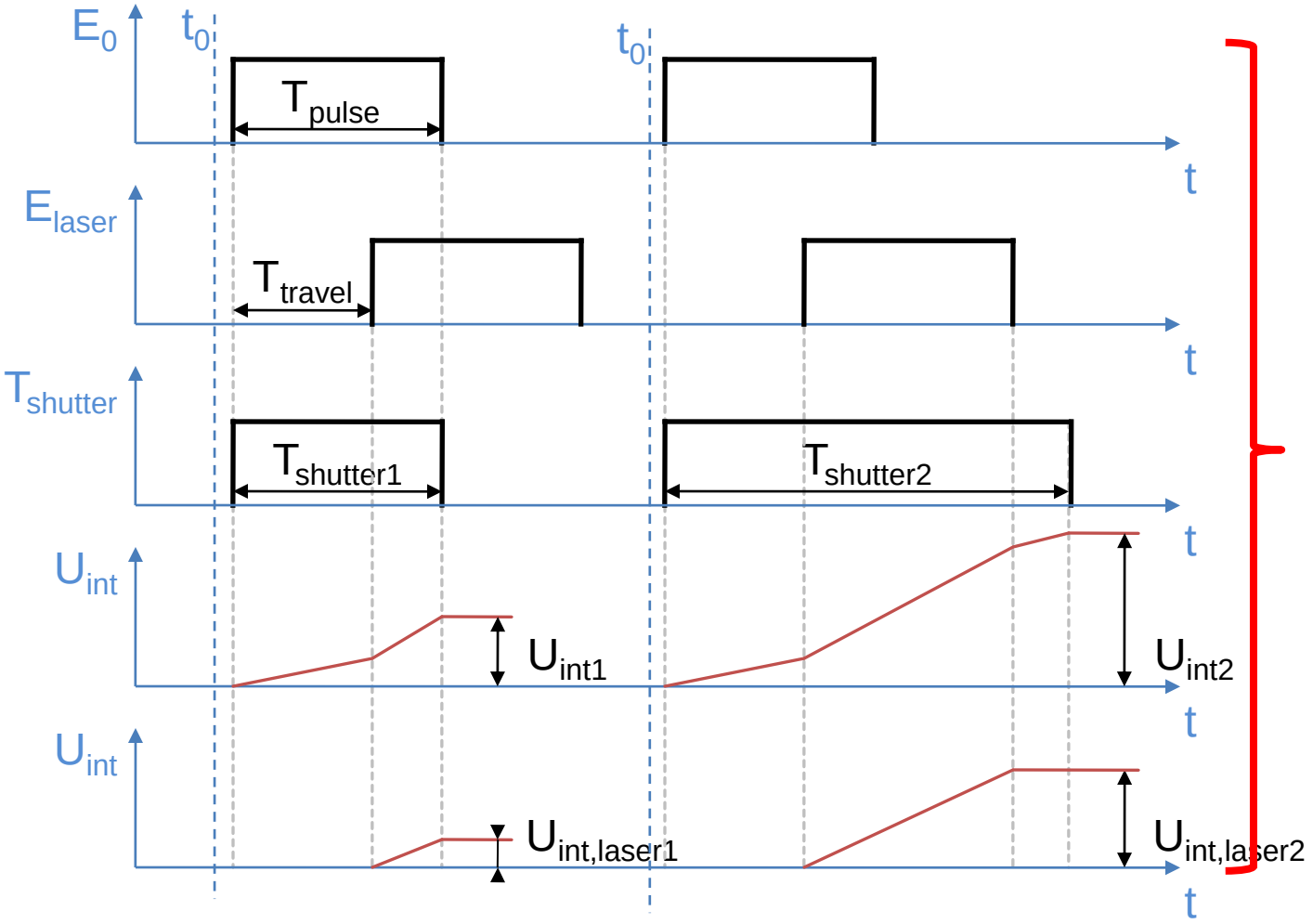

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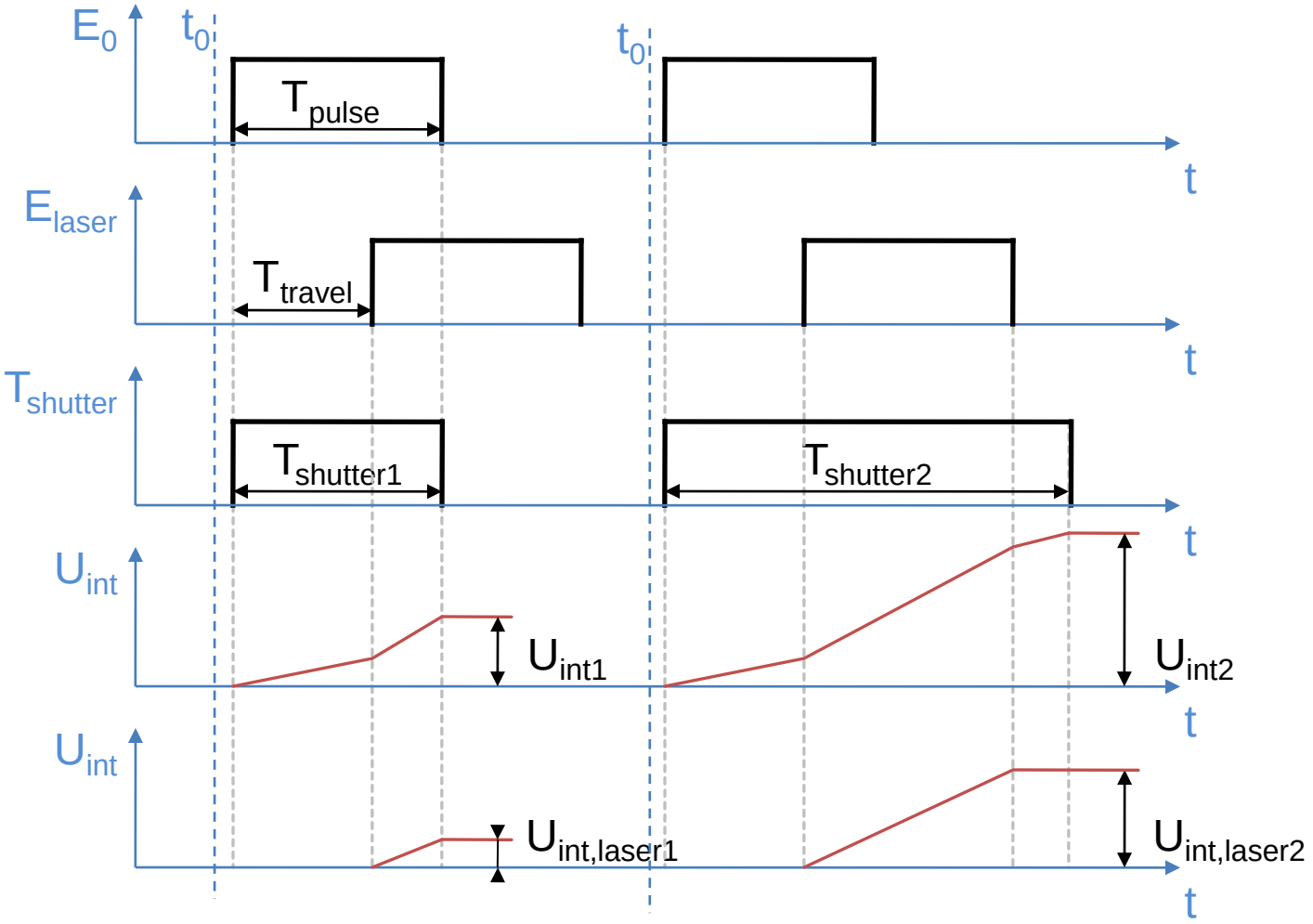

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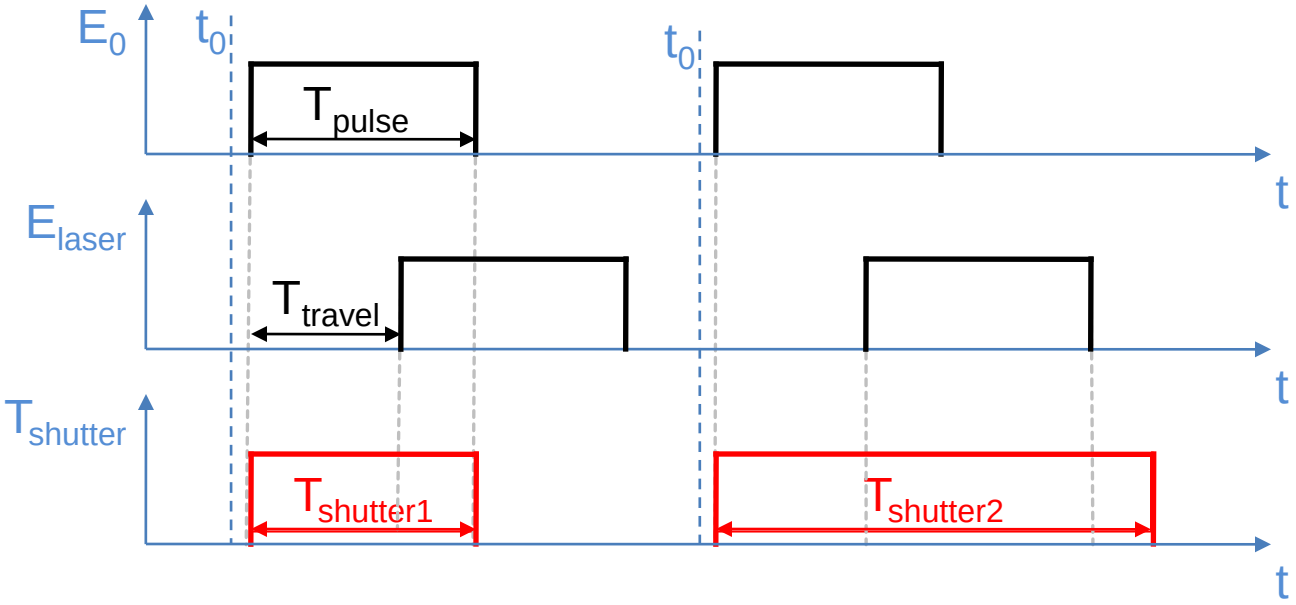

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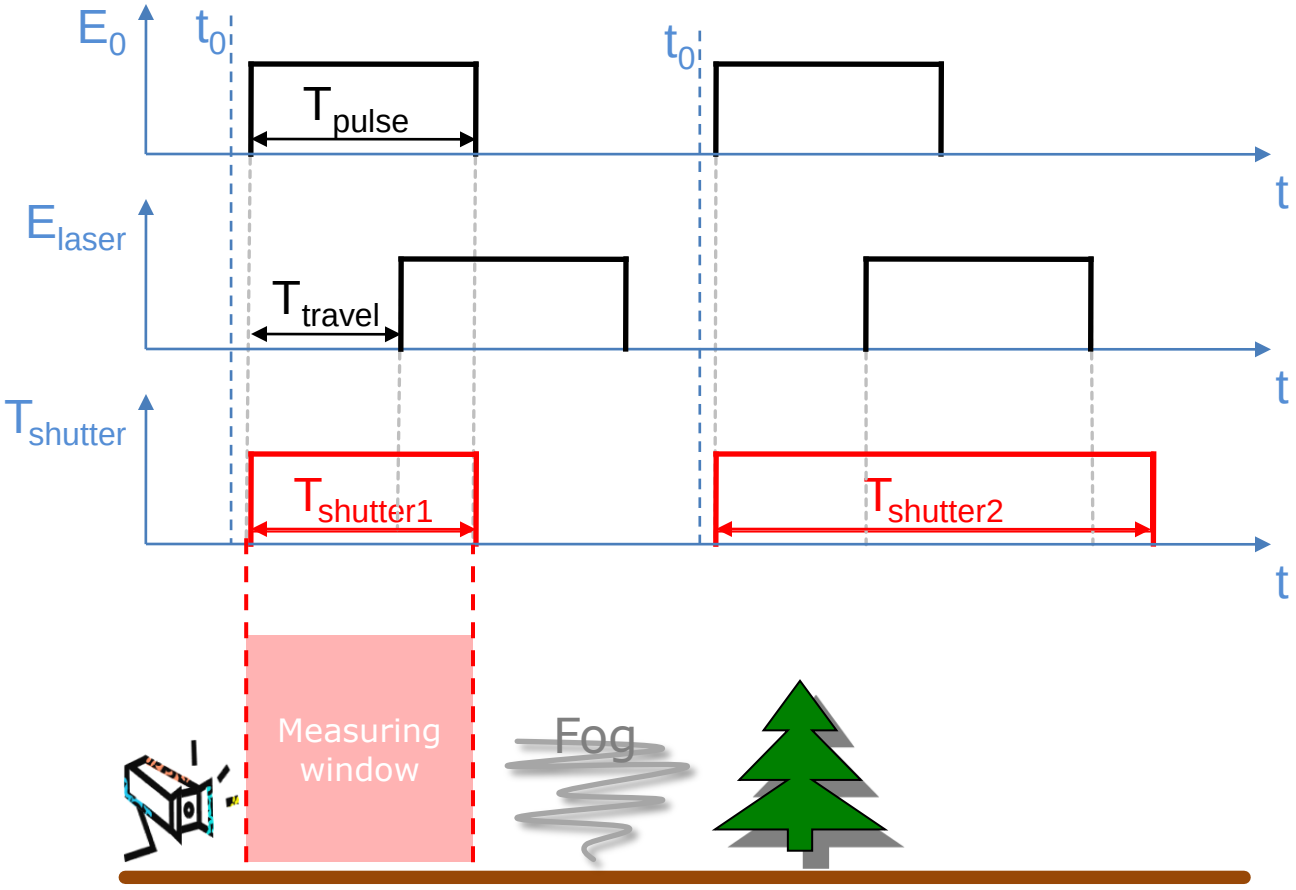

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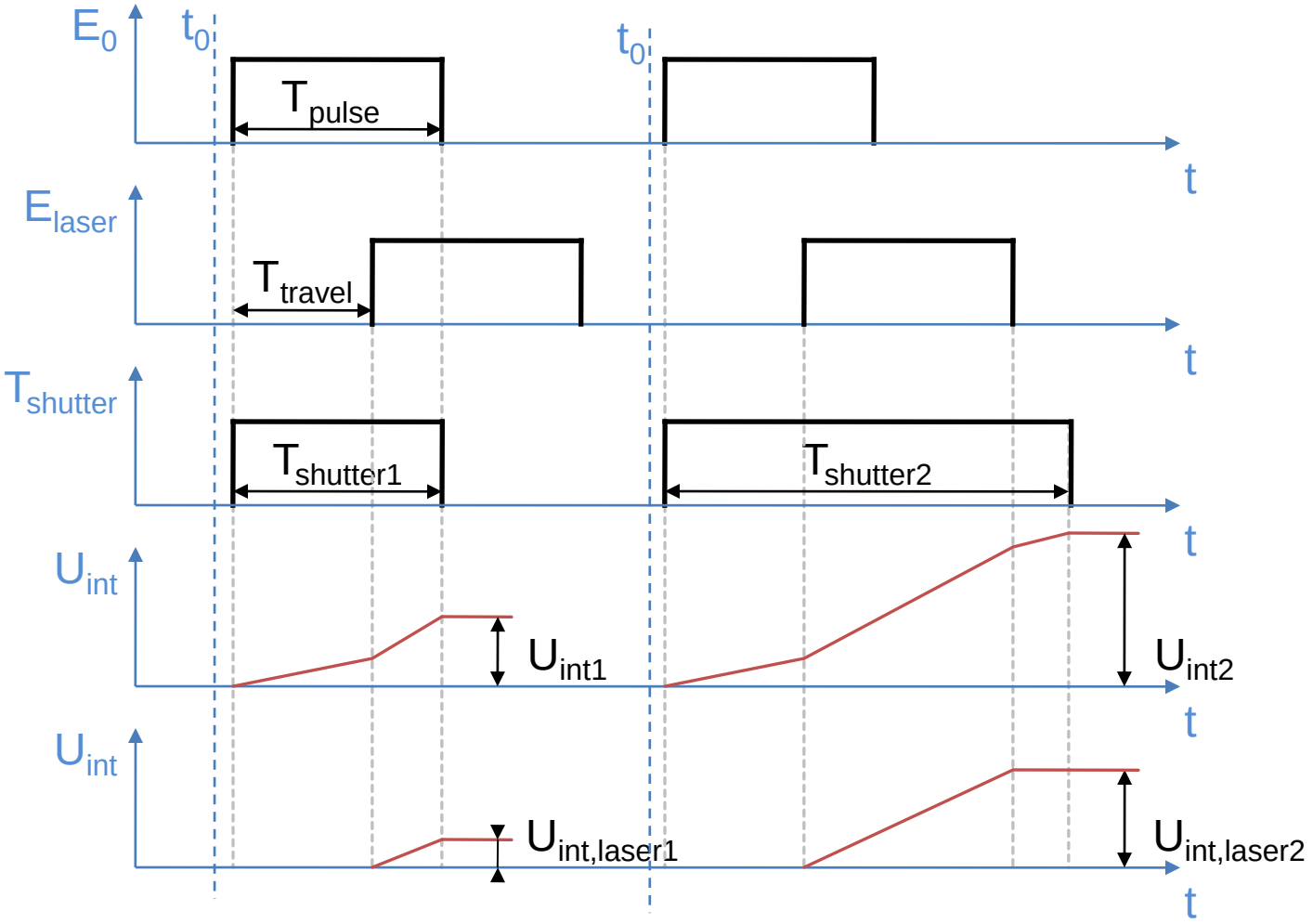

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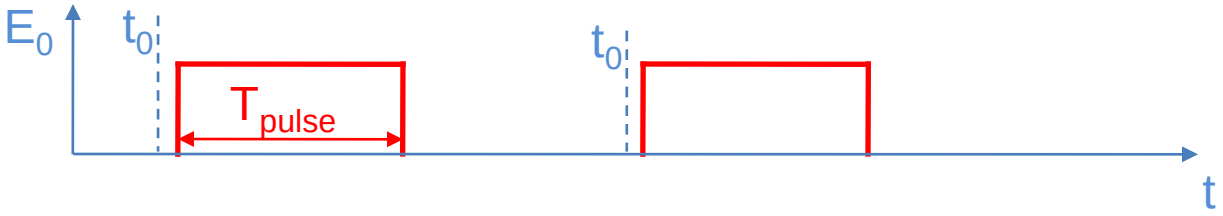

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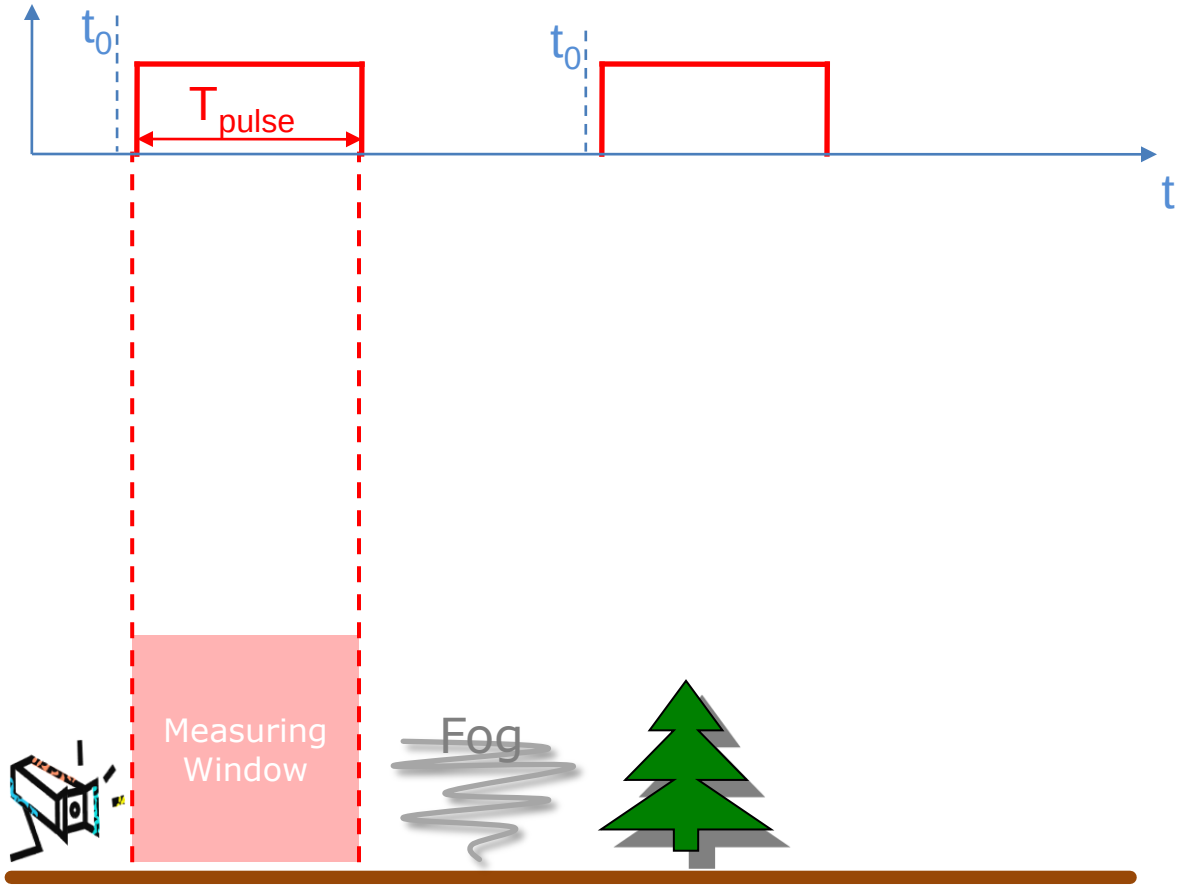

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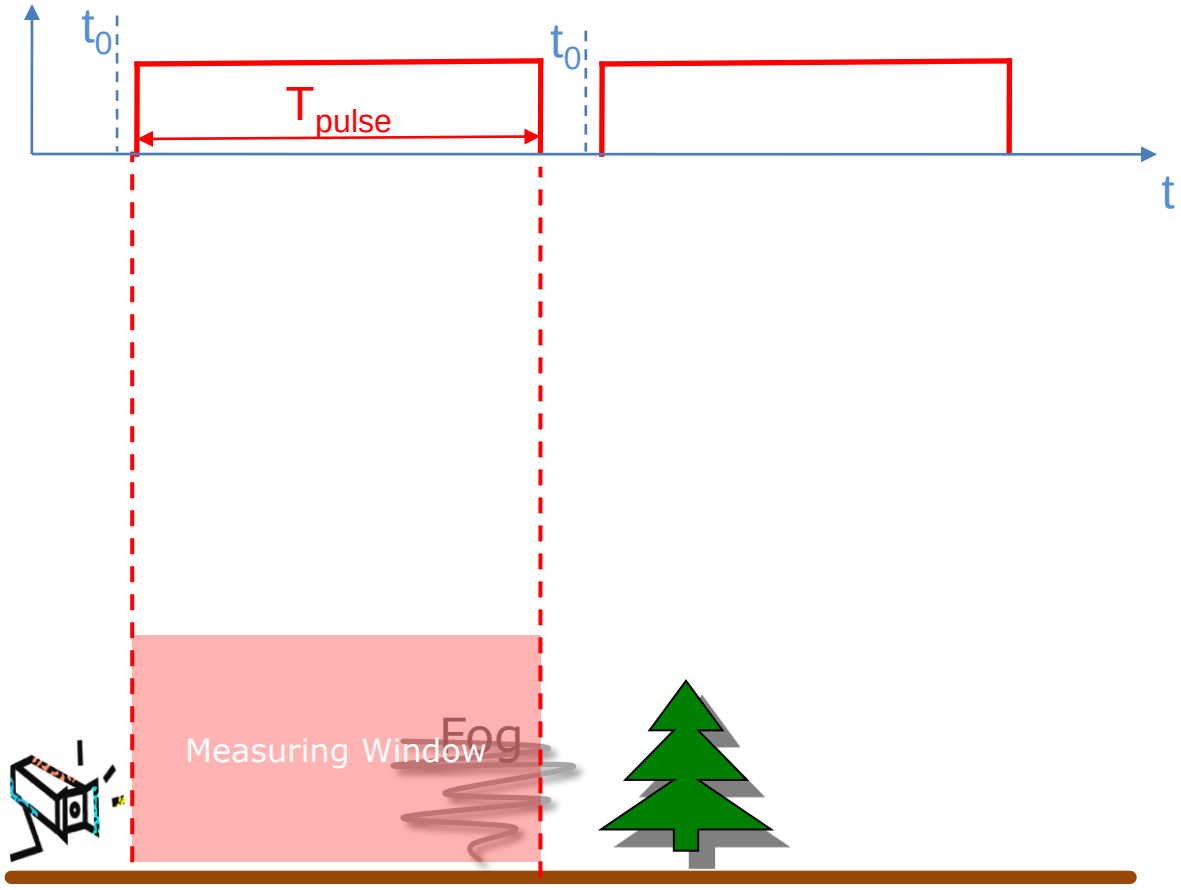

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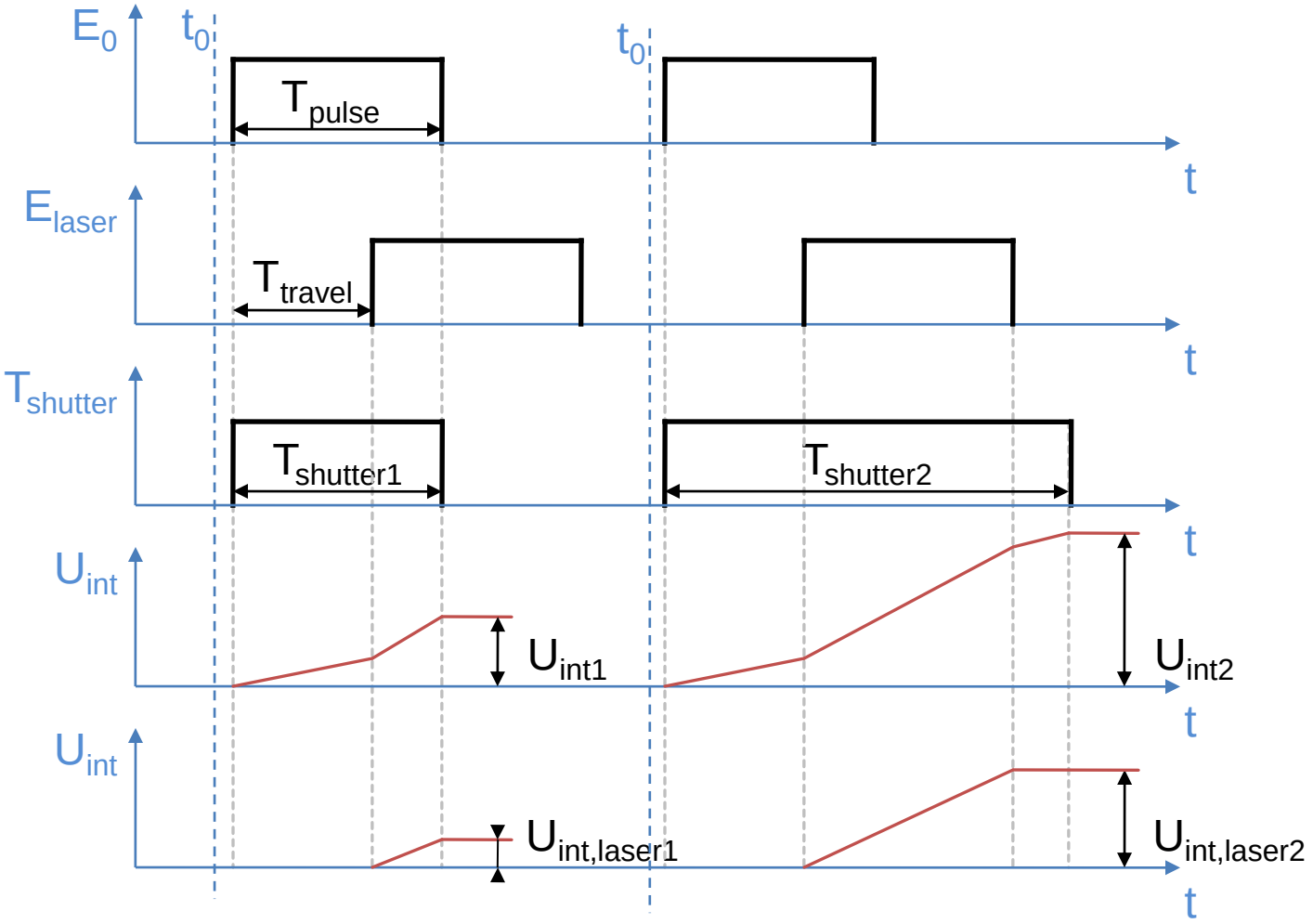

Prinzipskizze

3D Principle

$$d = \frac{c}{2} \cdot T_{pulse} \cdot \left(1 - \frac{U_{\text{int},laser1}}{U_{\text{int},laser2}} \right)$$

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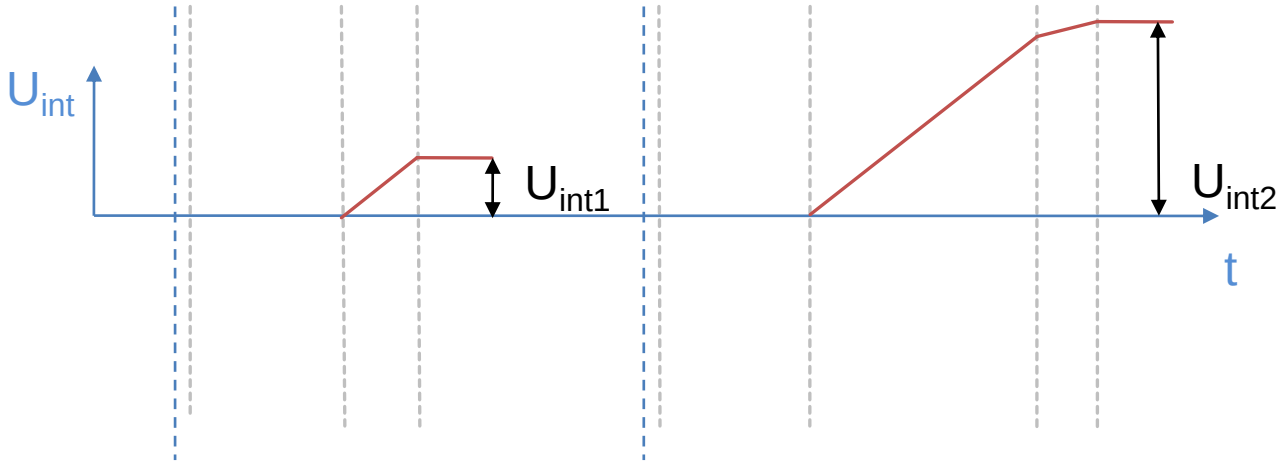

Bright Material

Prinzipskizze

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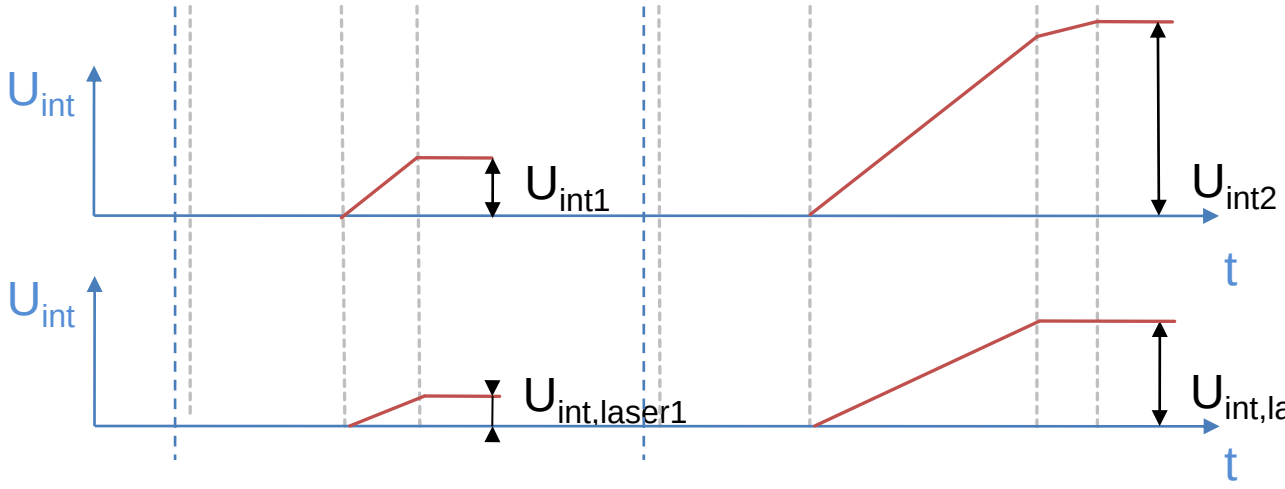

Bright Material

Dark Material

Prinzipskizze

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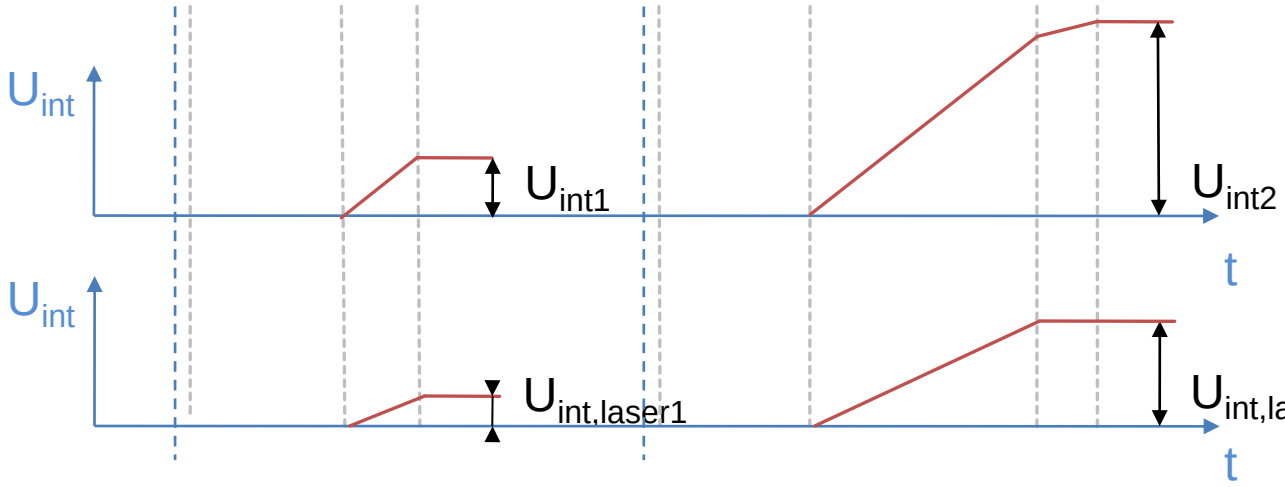

Ratio

Bright Material

Dark Material

Prinzipskizze

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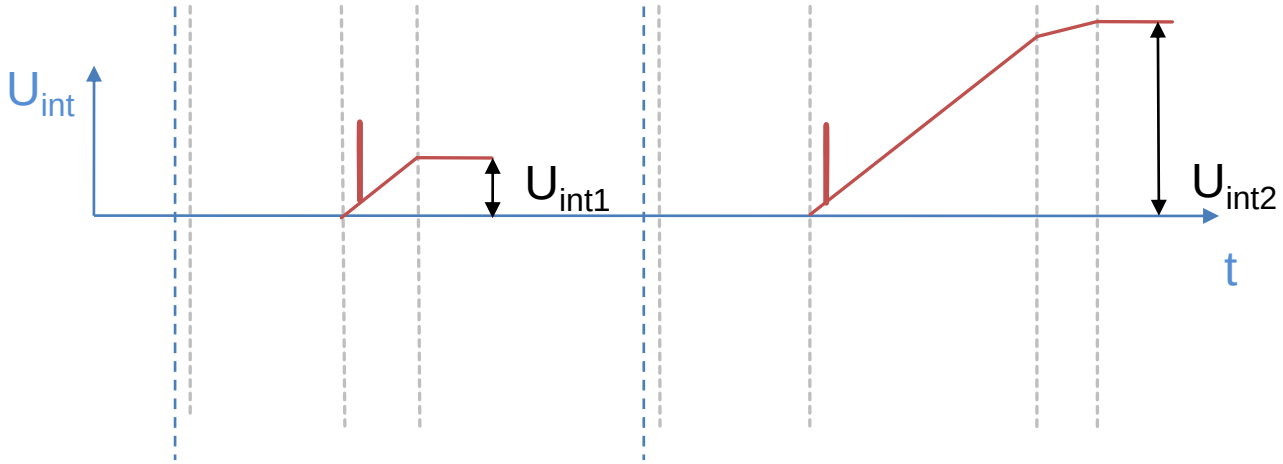

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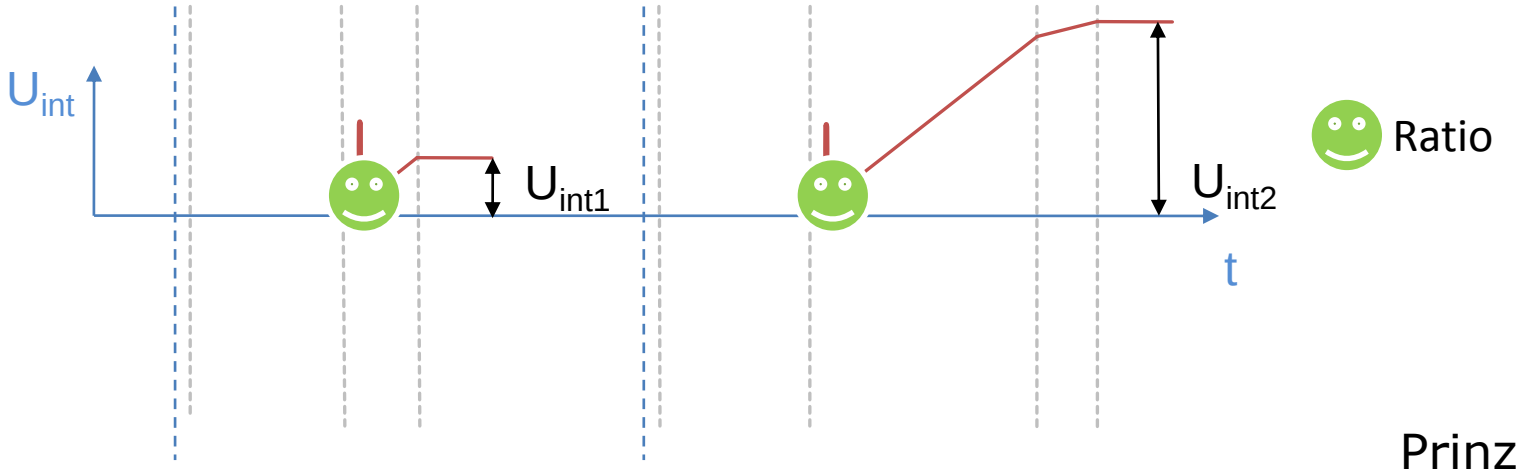

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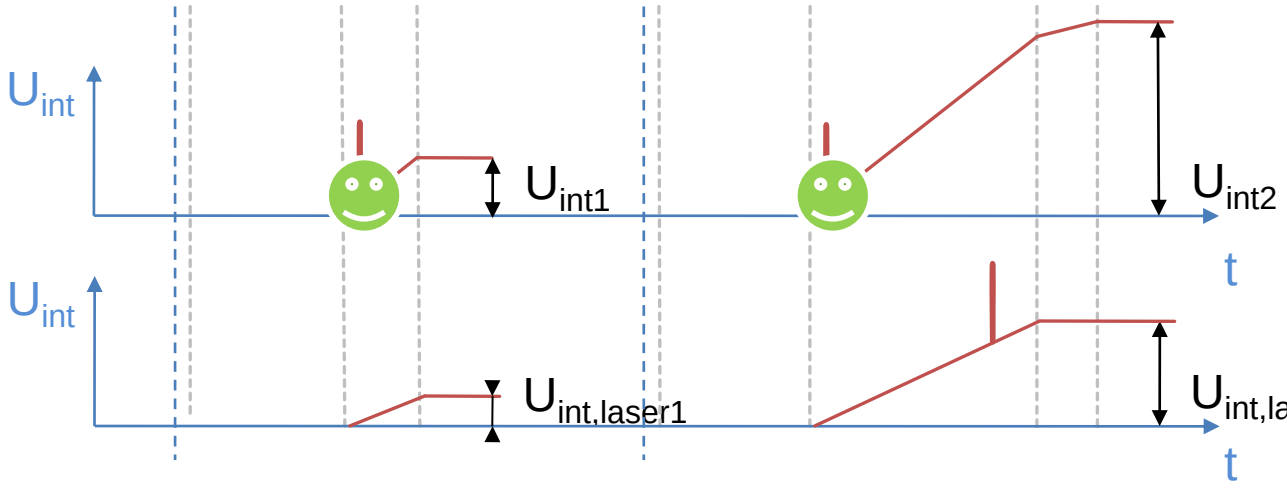

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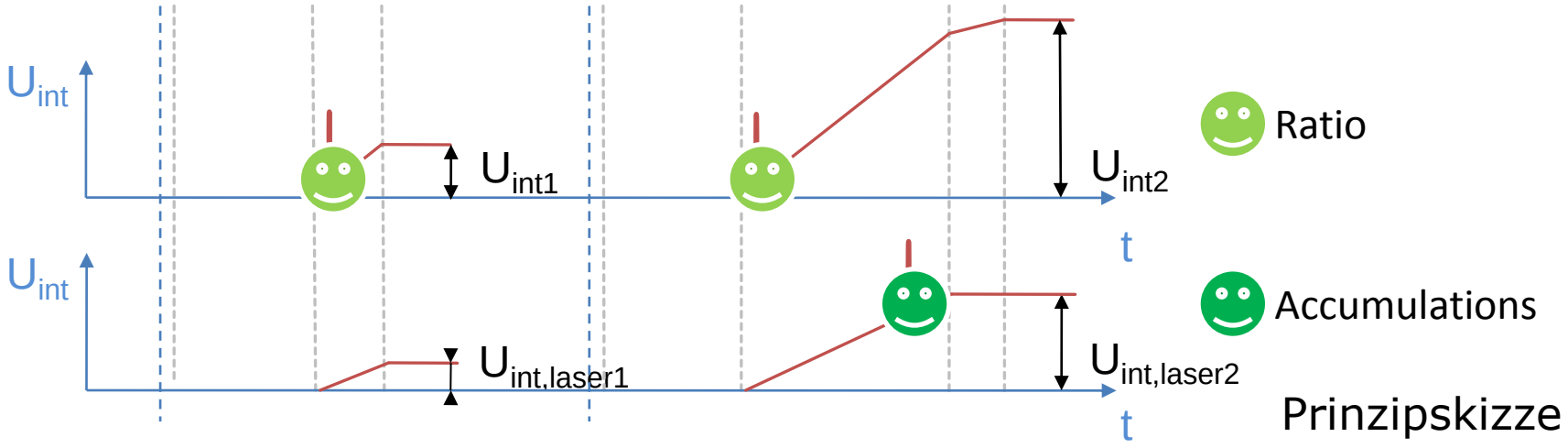

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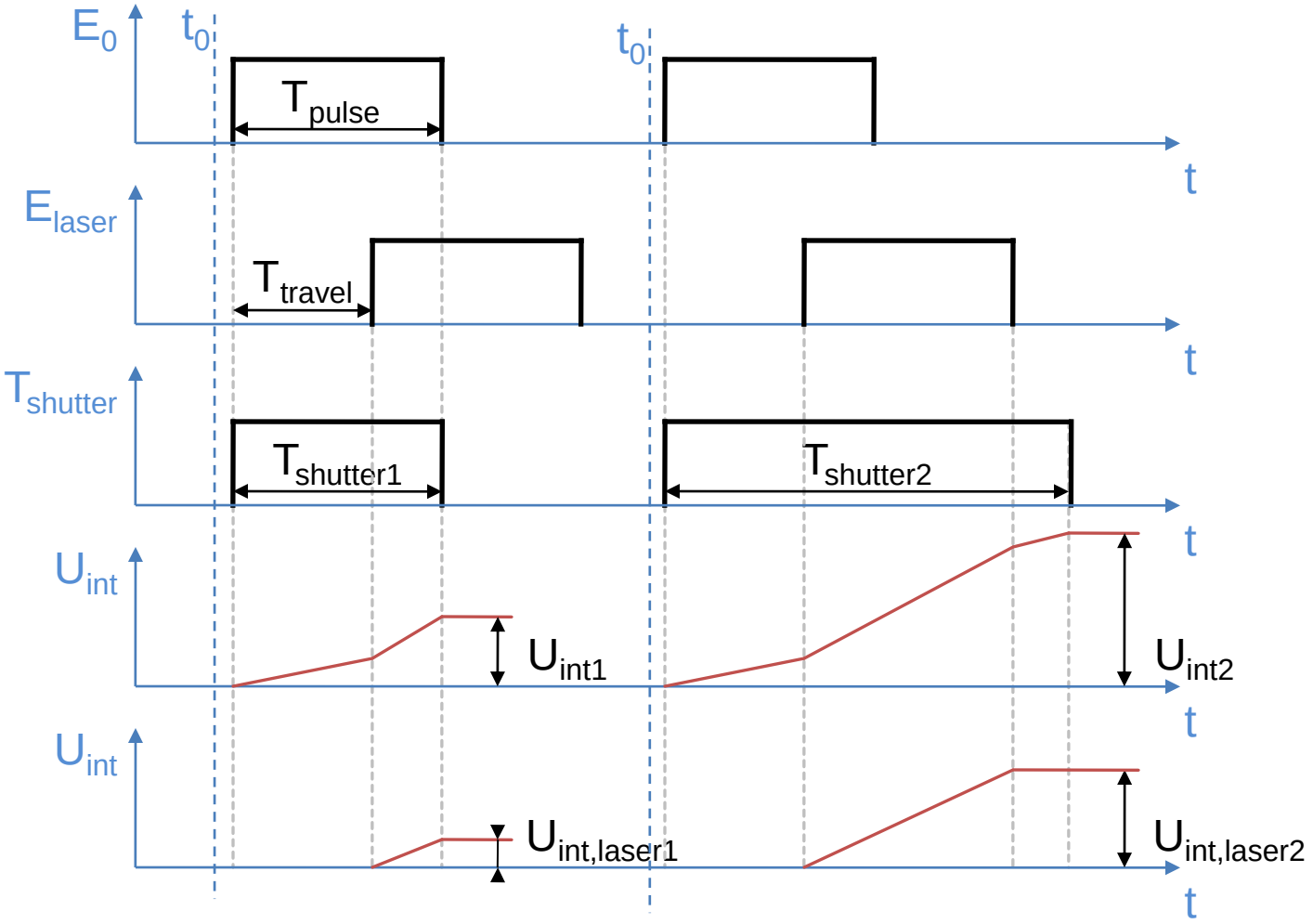

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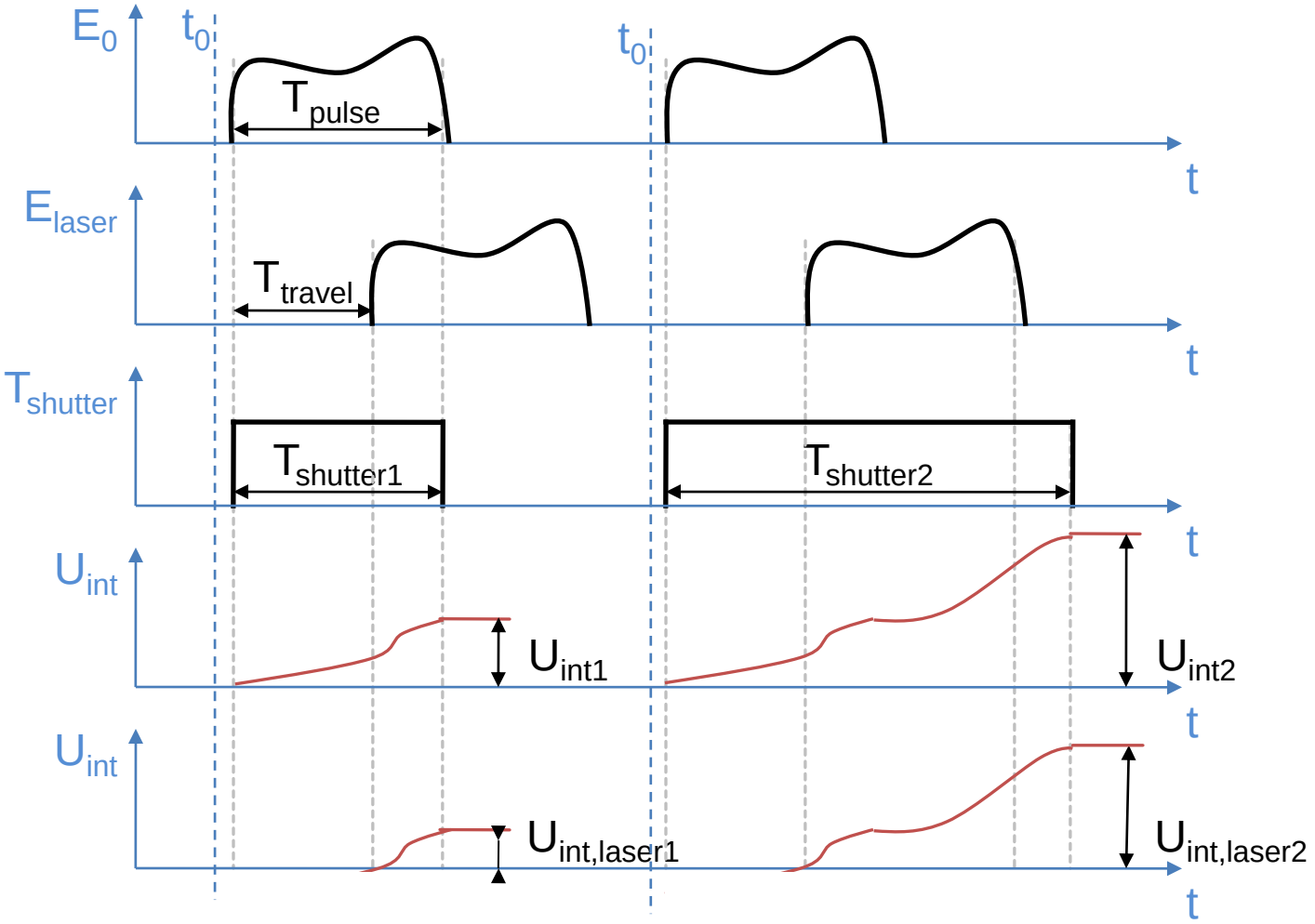

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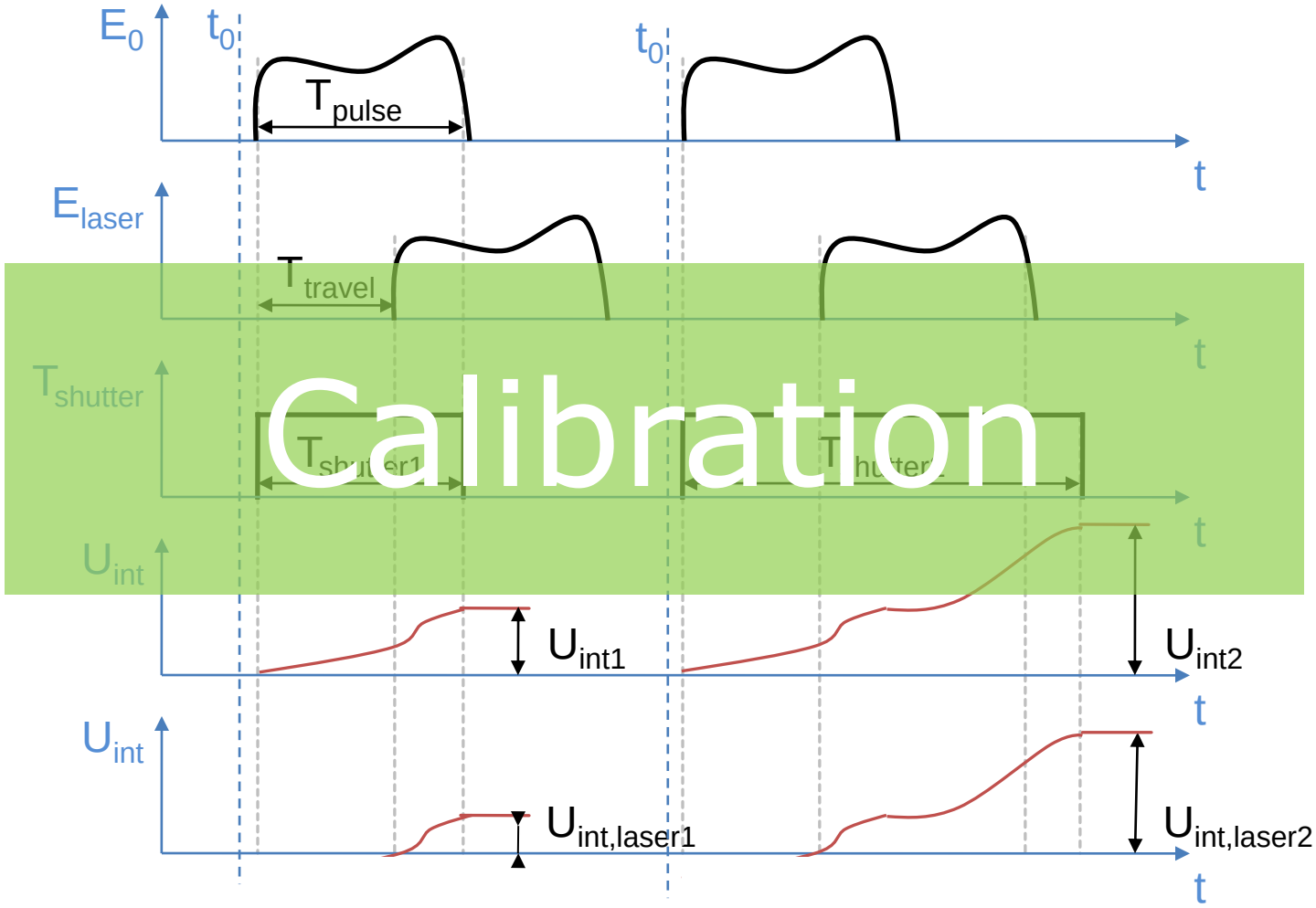
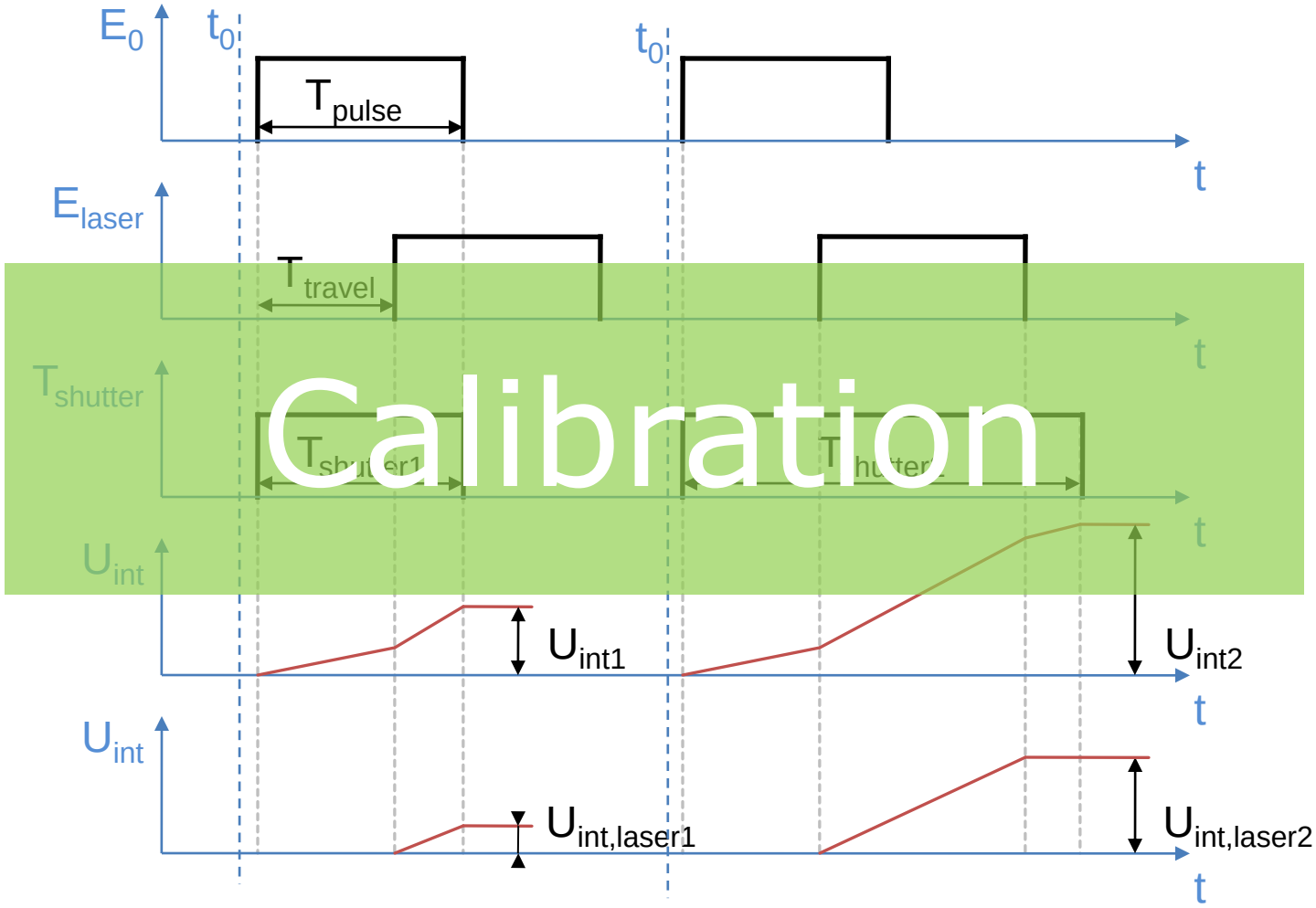


Calibration

Prinzipskizze

3D Principle



Calibration

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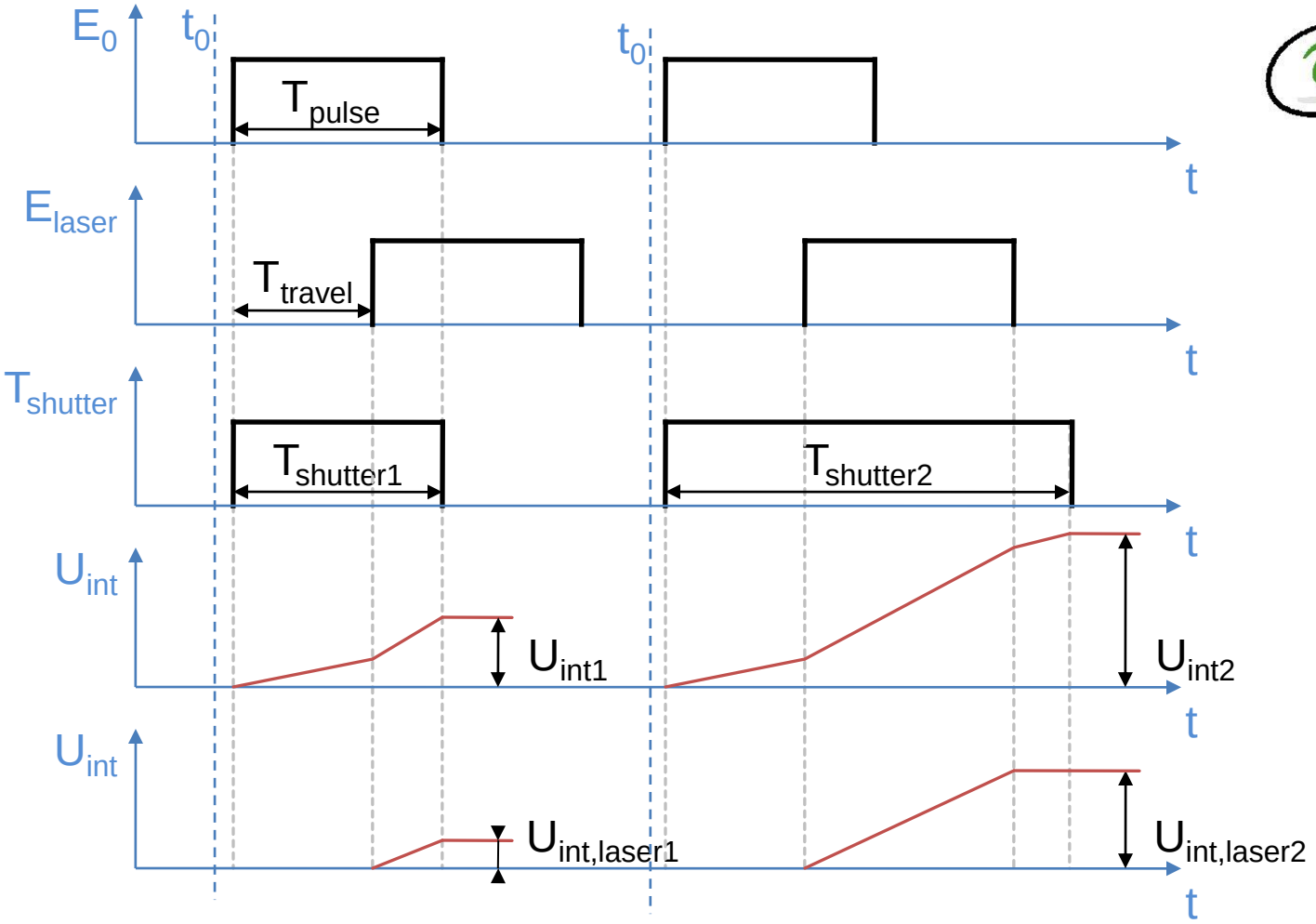

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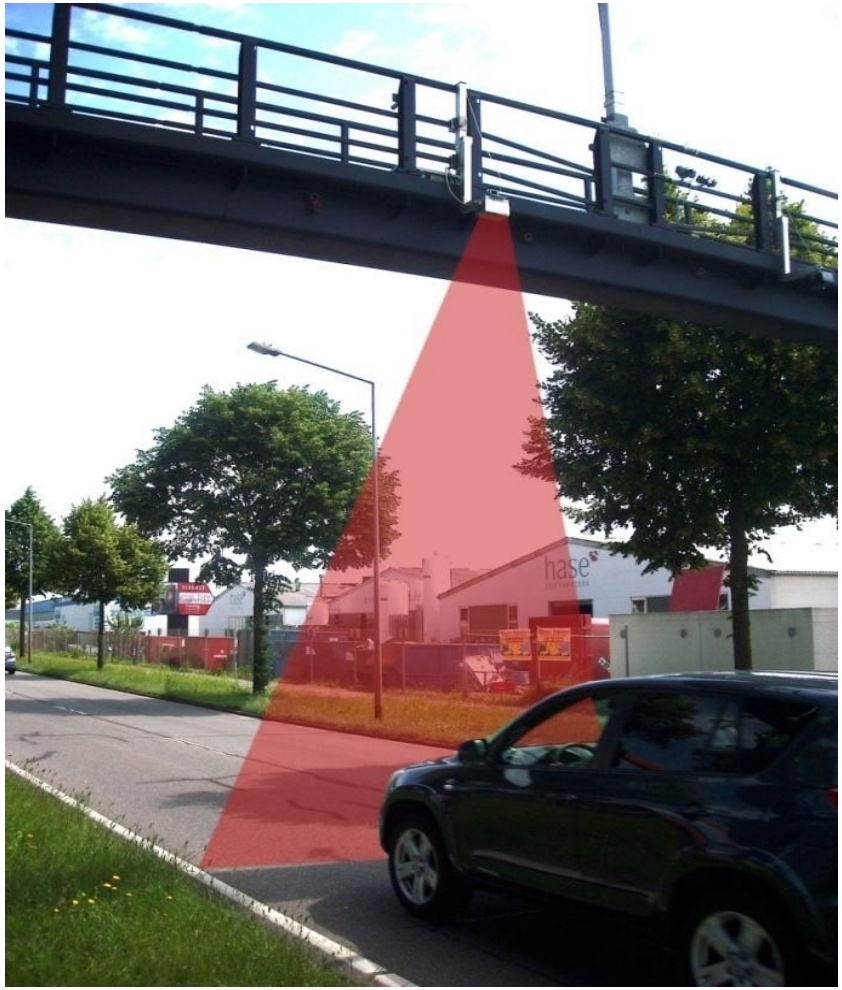
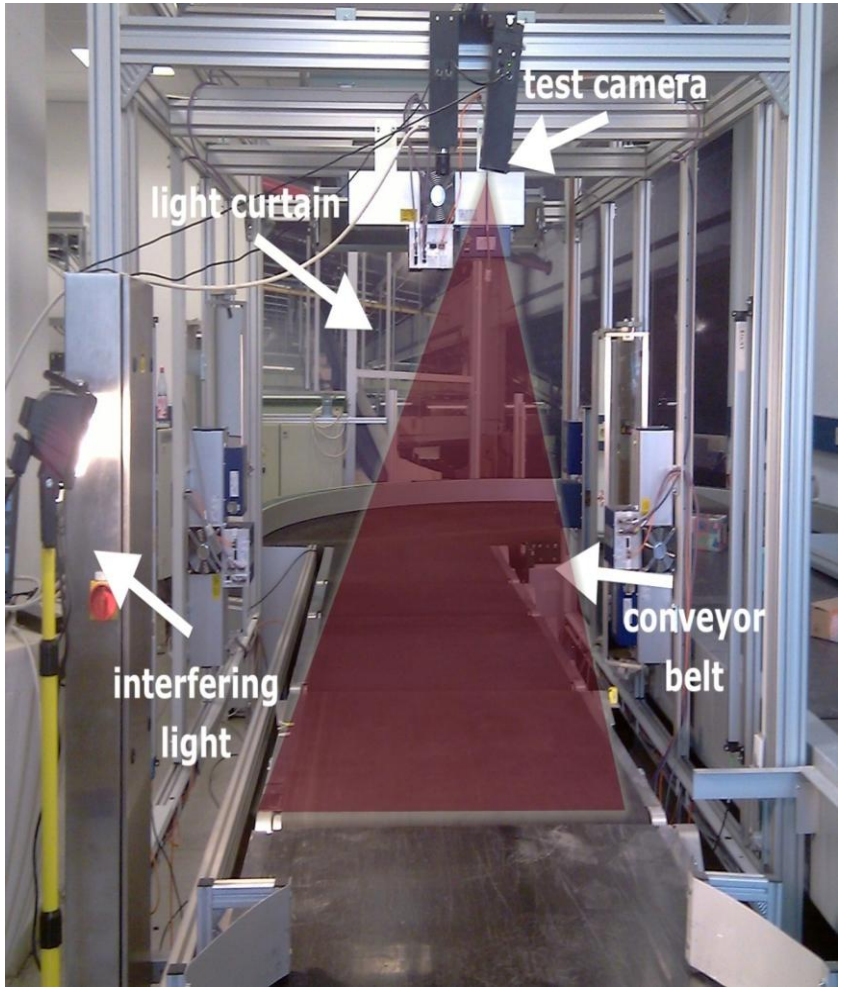


Car Profile-Measurement

Goal:
100 Profiles/s, that is every 55cm a profile of a car driving 200km/h

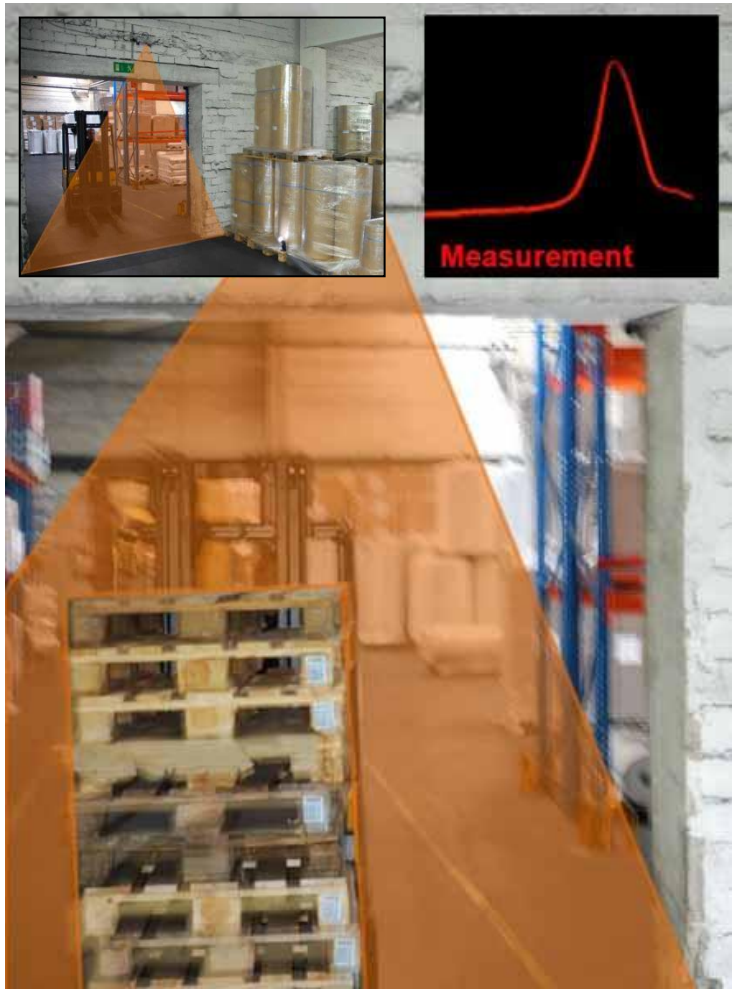
Applications



Parcel Profile-Measurement

Goal:
Scan profiles of parcels out of different materials

Applications



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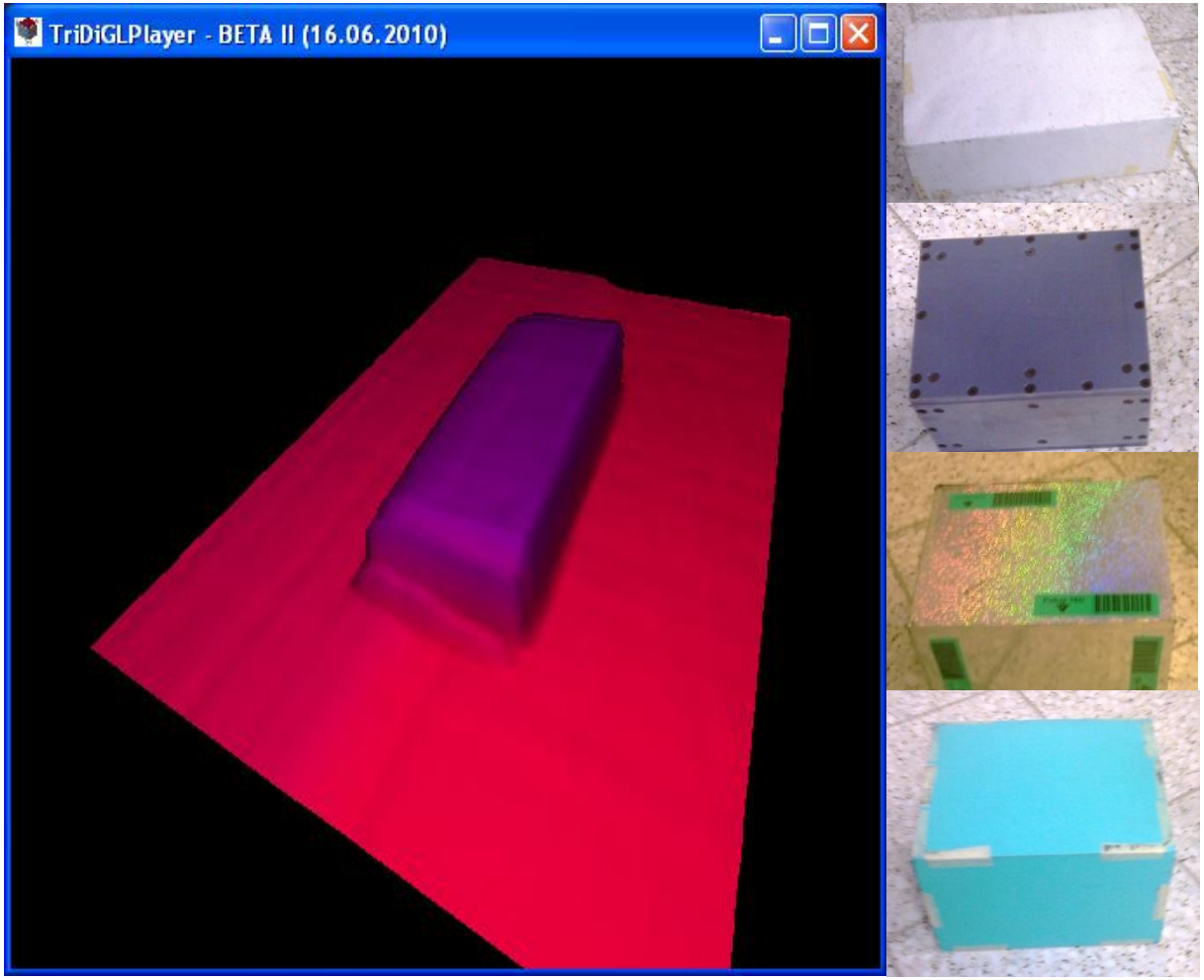
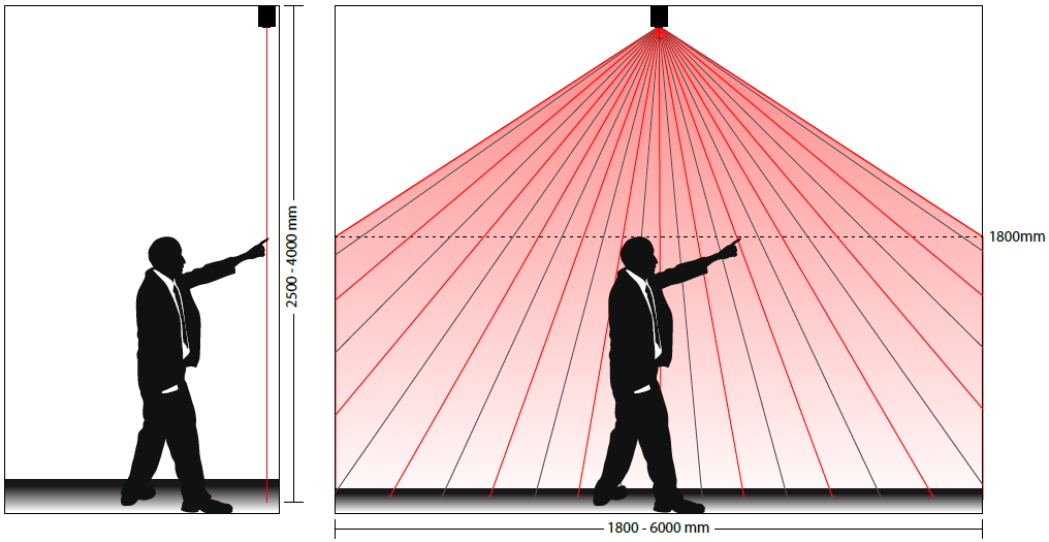


Applications

Sliding Door Problem

Goal:
Detect direction of pedestrians

Applications



Gesture Control

Goal:
Robust gesture control in industrial, domestic and automotive environments.

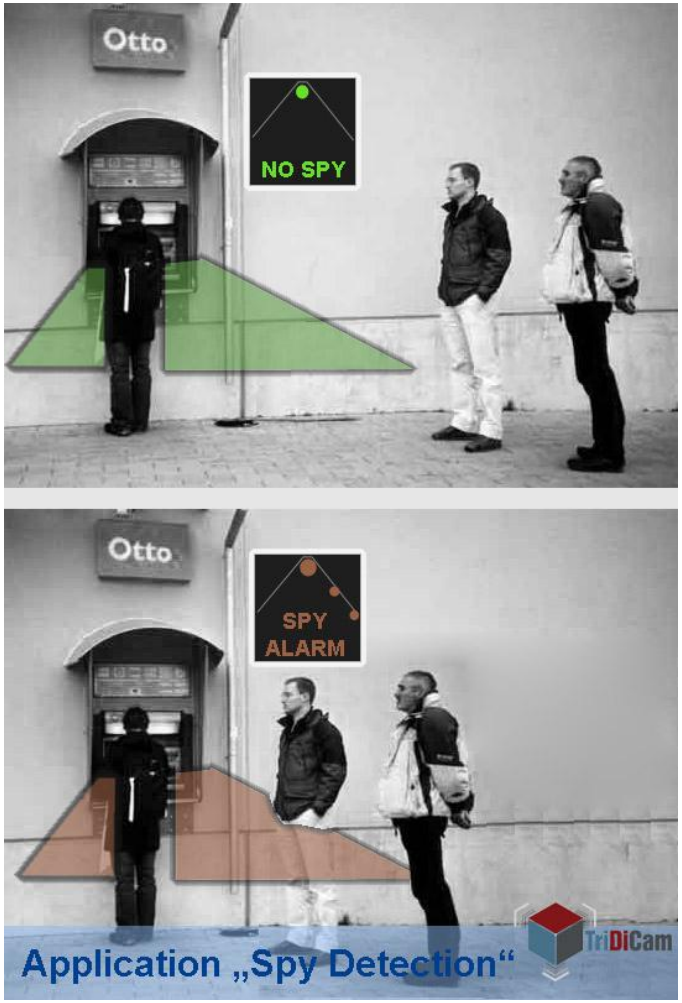
Applications

Application Gesture Control

Gesture Control

Goal:
Robust gesture control in industrial, domestic and automotive environments.

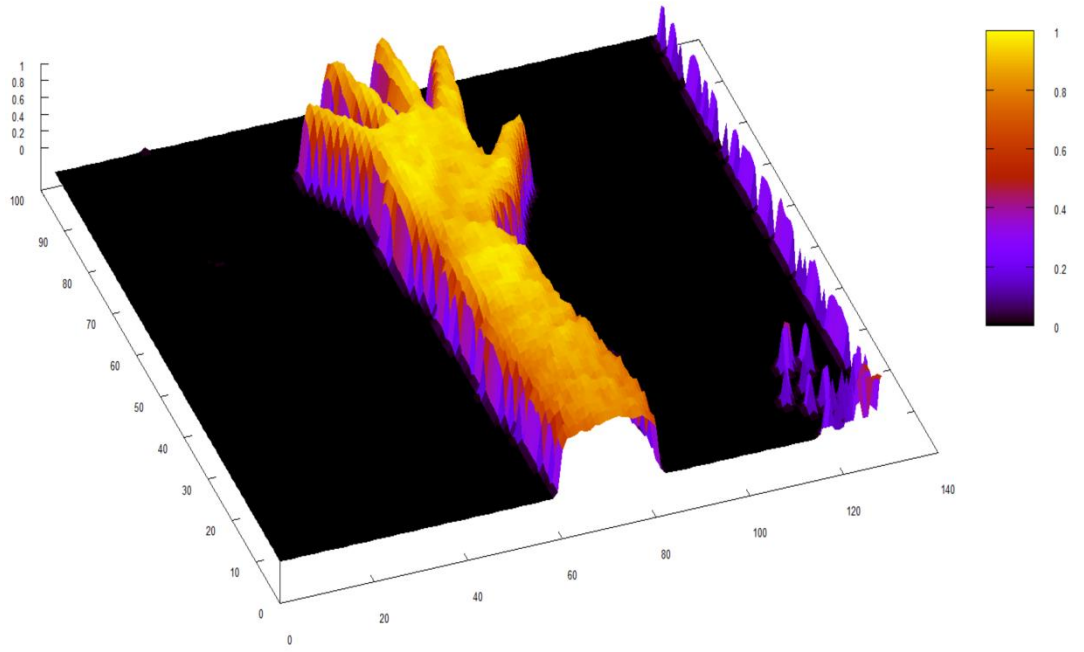
Applications



Spy Detection

Goal:
Check of critical areas.

Array Sensor Data



Thanks!

www.TriDiCam.de

Info@TriDiCam.de