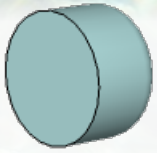
A New Fast Tapestation for ISOLDE

Tim GILES

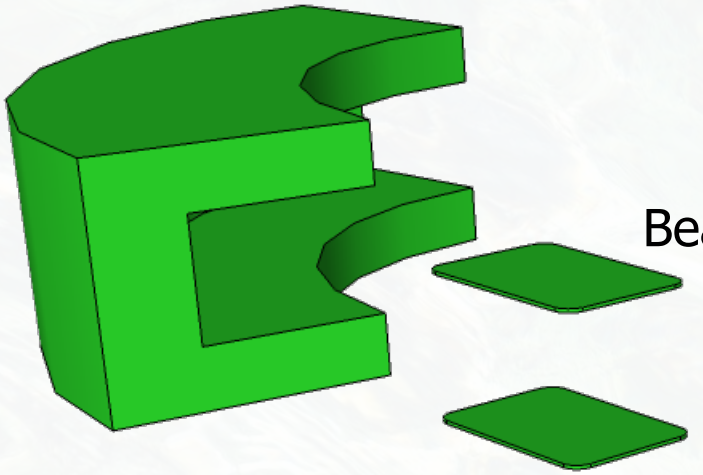
SGUI meeting

3 November 2014

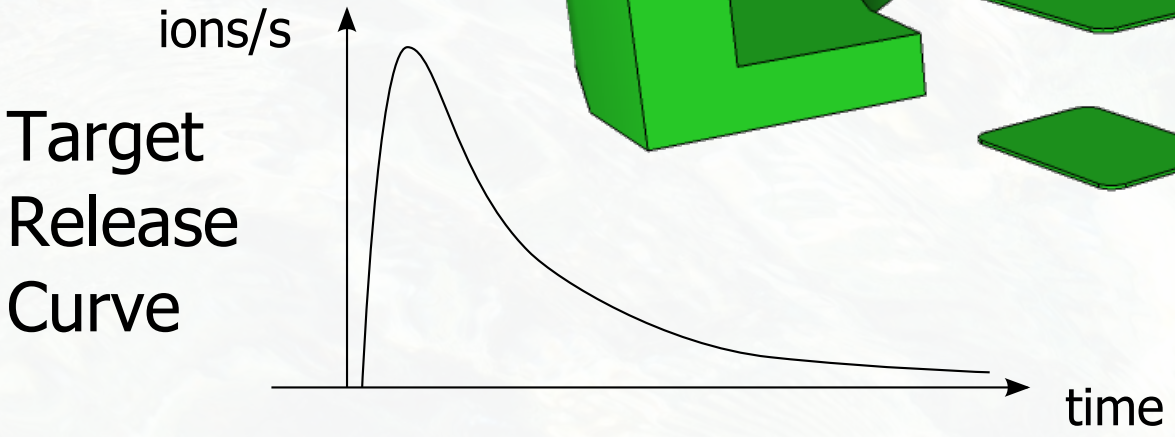
Measurement Cycle: Ready!



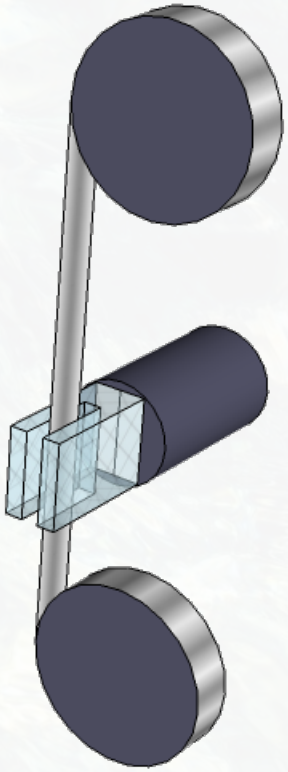
Target



Beamgate

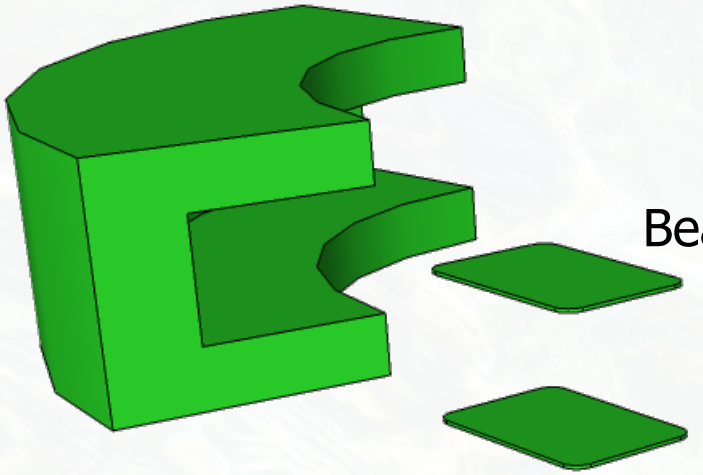


Tape

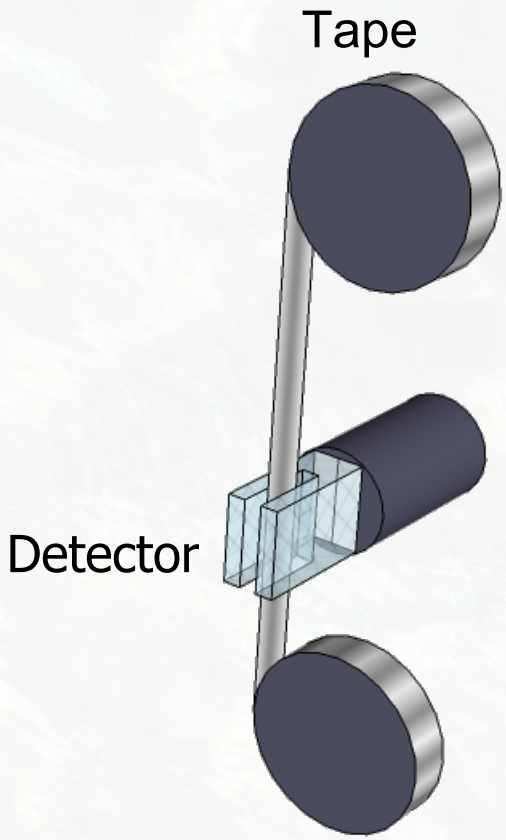


Detector

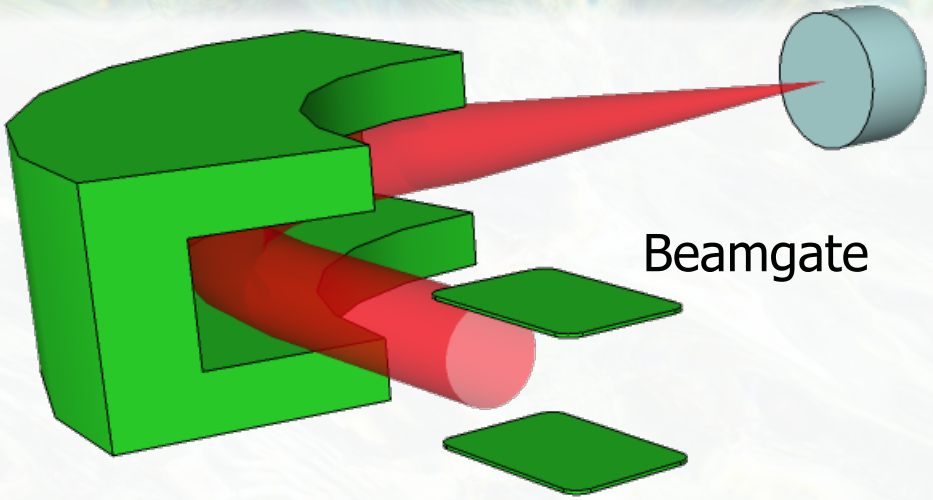
Measurement Cycle: Proton Impact

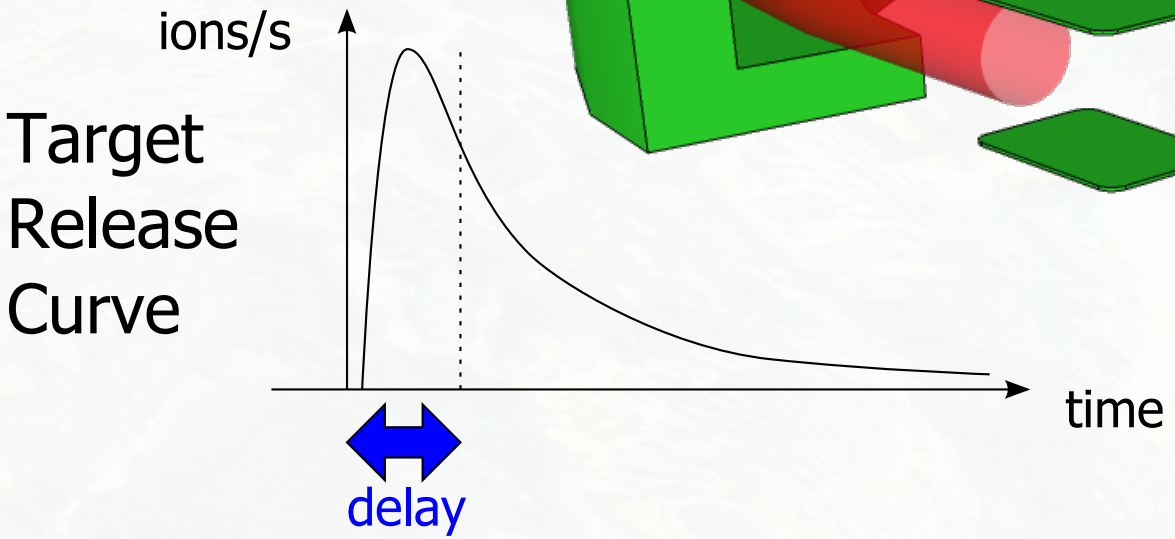


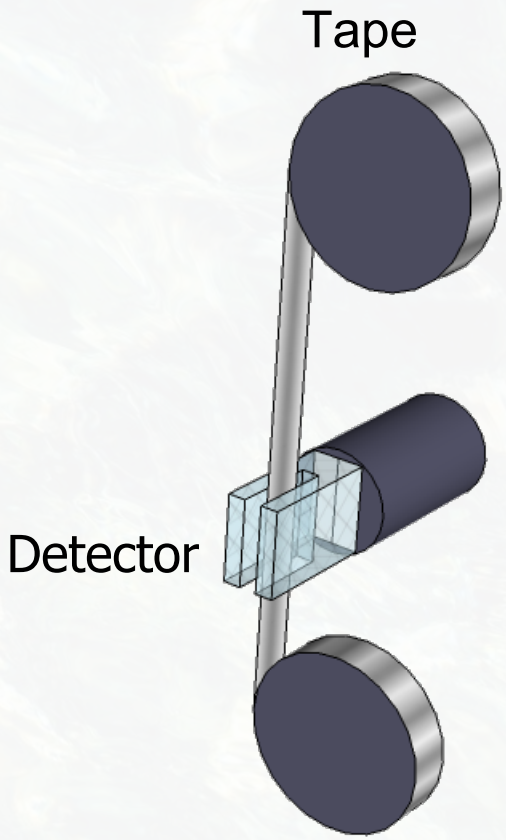
Target Release Curve



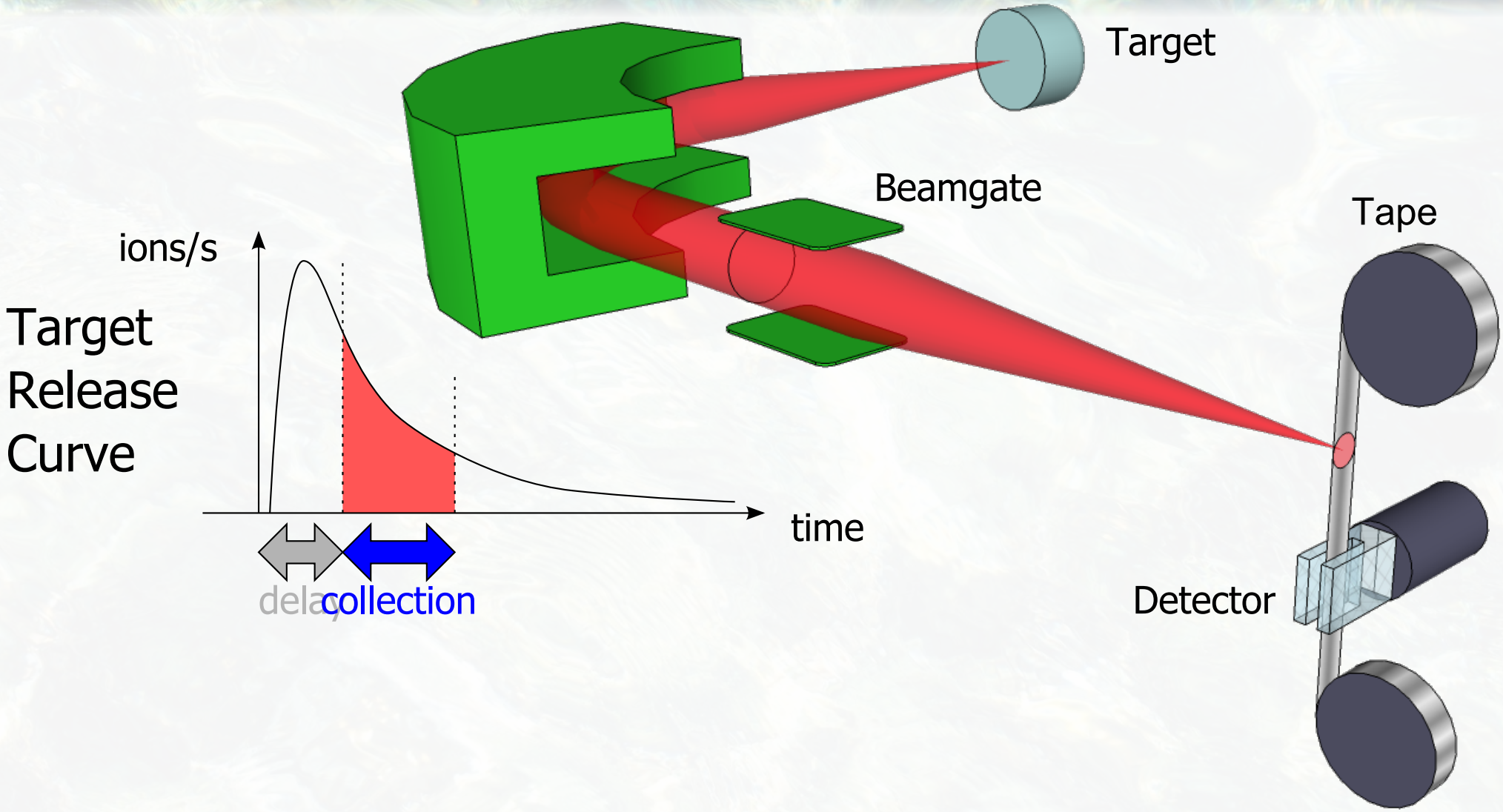
Measurement Cycle: Delay



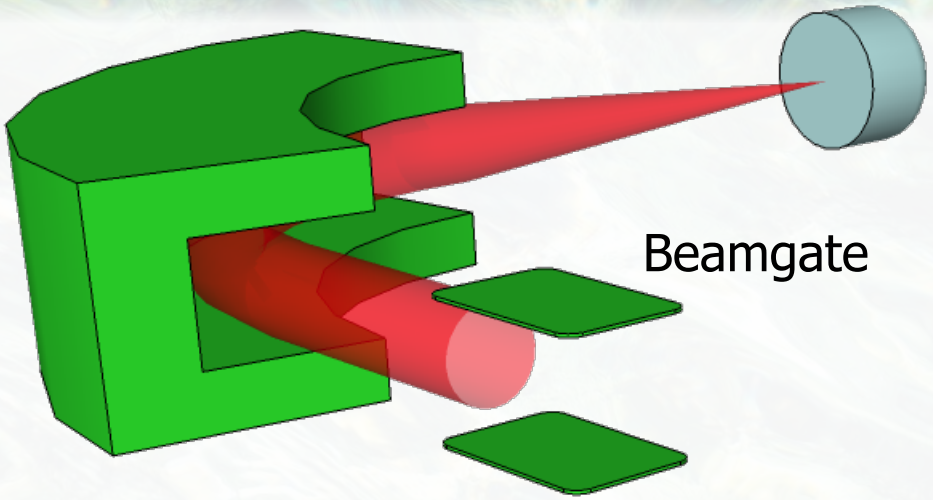


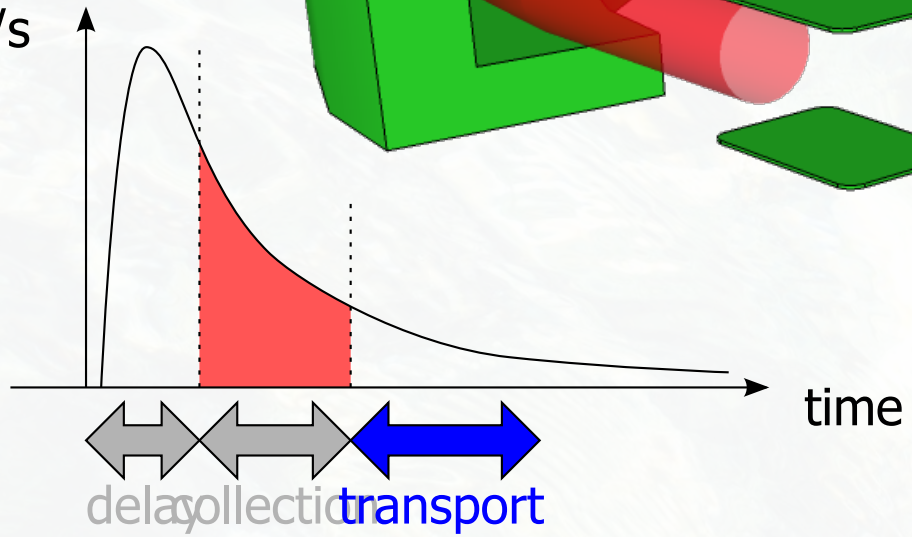


Measurement Cycle: Collection

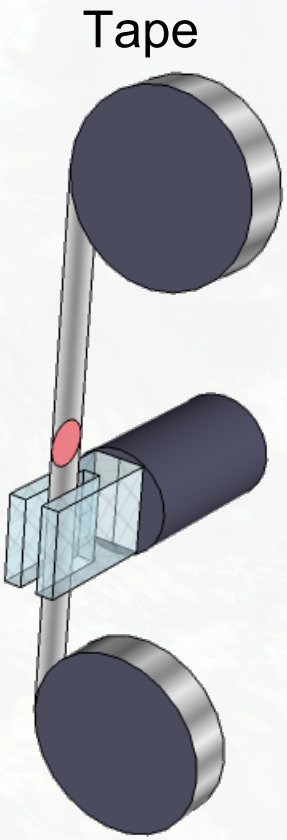


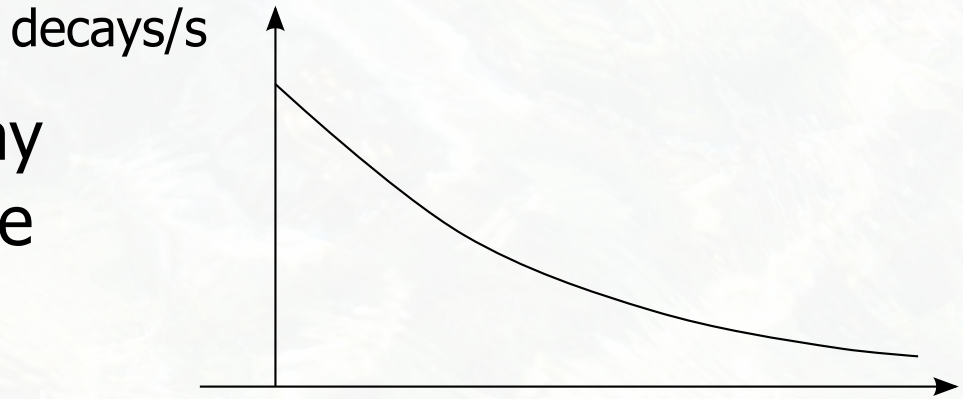
Measurement Cycle: Transport





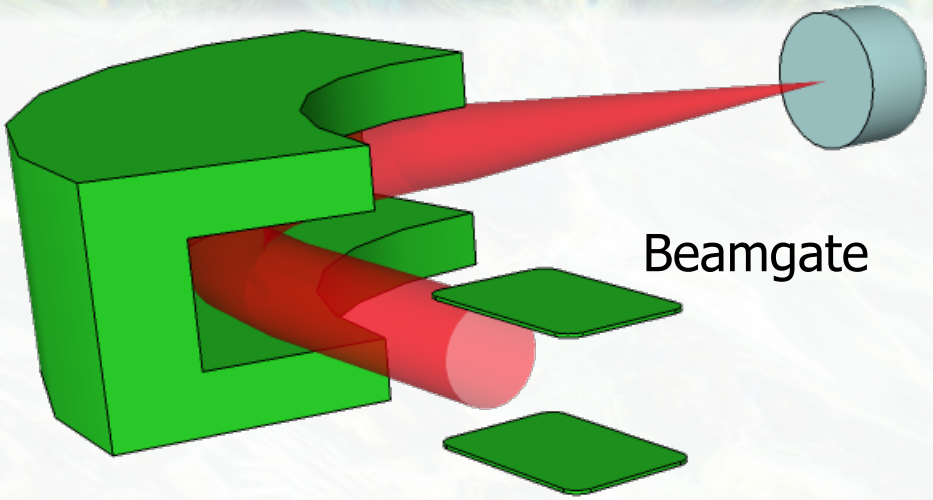
Target Release Curve

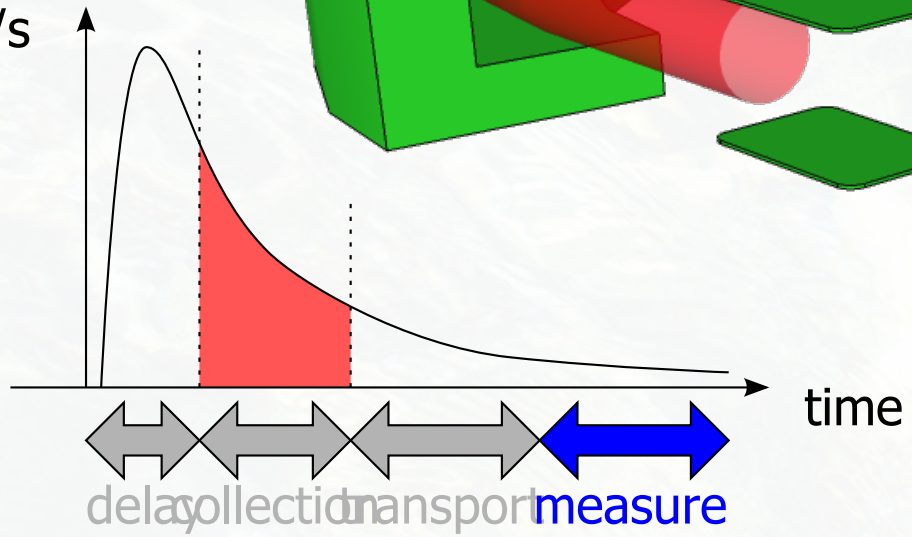




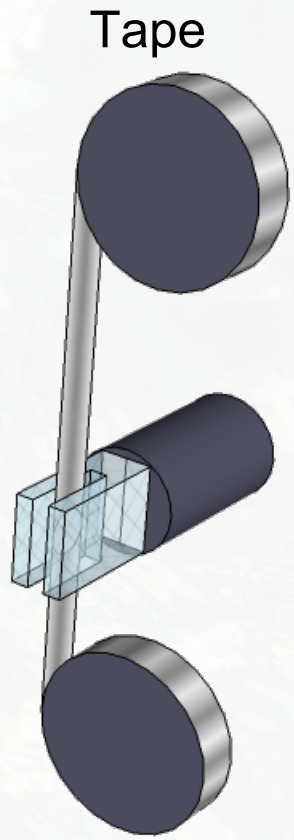
Decay Curve

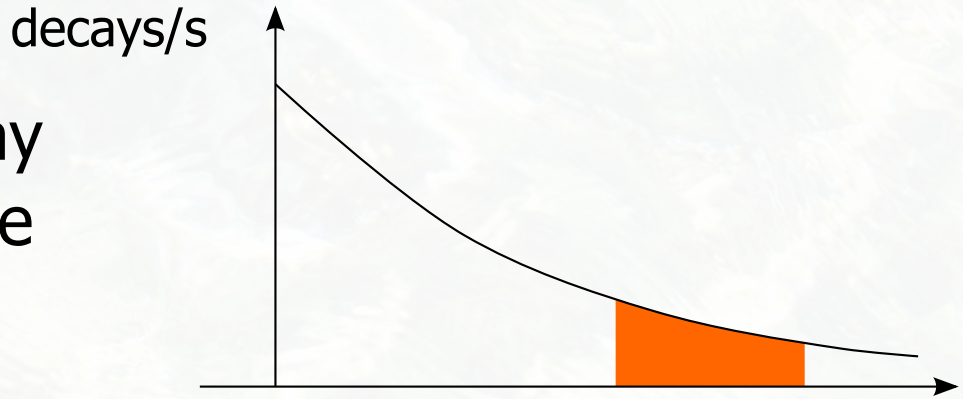
Measurement Cycle: Measure





Target Release Curve





Decay Curve

Yield Analysis

Read data-points from tapestation file

Find isotope decay chain $^{n}X \xrightarrow[\alpha]{} {}^{n-4}Y \xrightarrow[\beta]{} {}^{n-4}Z$

Calculate decay curve

Make initial guess at release-curve parameters

Calculate modelled counts for each data point

¨fit model to data¨
resists problems with long collection times

Minimise average error-per-point

¨robust¨ fit, in units of std. error

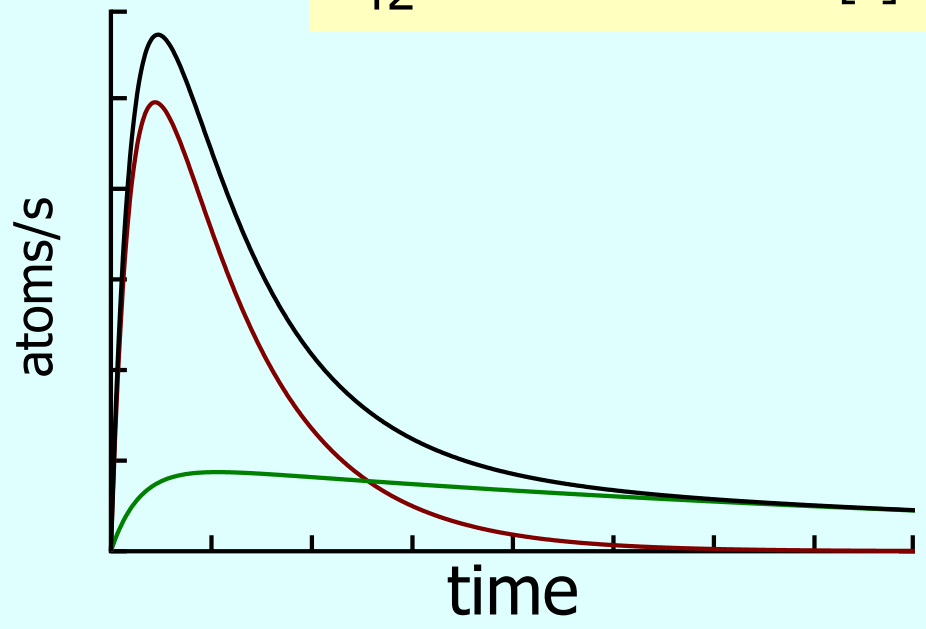
¨Simplex¨ n-dimensional optimiser

Common-sense check

eg. $t_{f2} > t_{half}$; delete outlying points

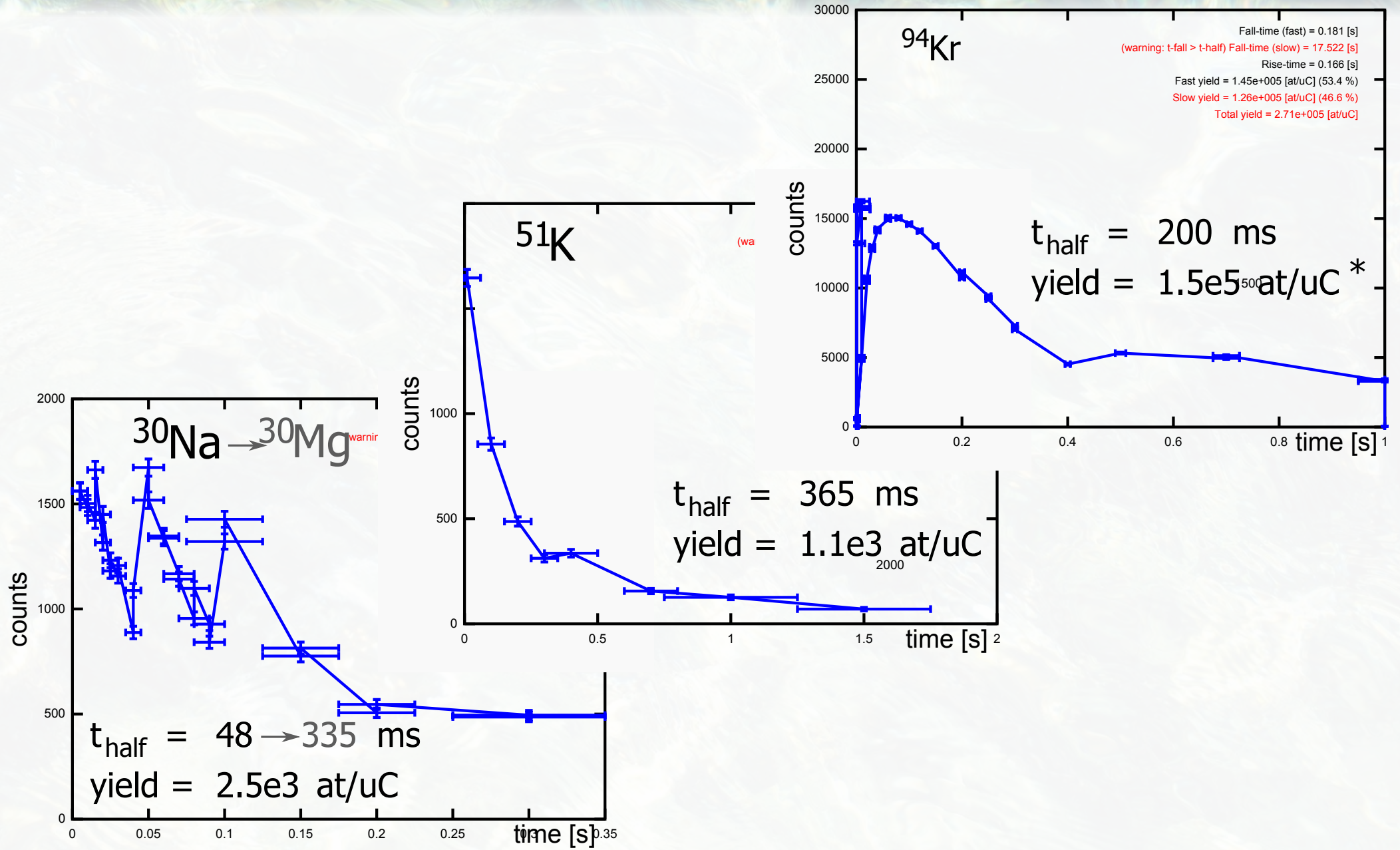
Release curve parameters:

n_0	yield [atoms / uC]
r	fast : slow yield ratio
t_r	rise-time [s]
t_{f1}	fast fall-time [s]
t_{f2}	slow fall-time [s]



Software Demo

Example Results



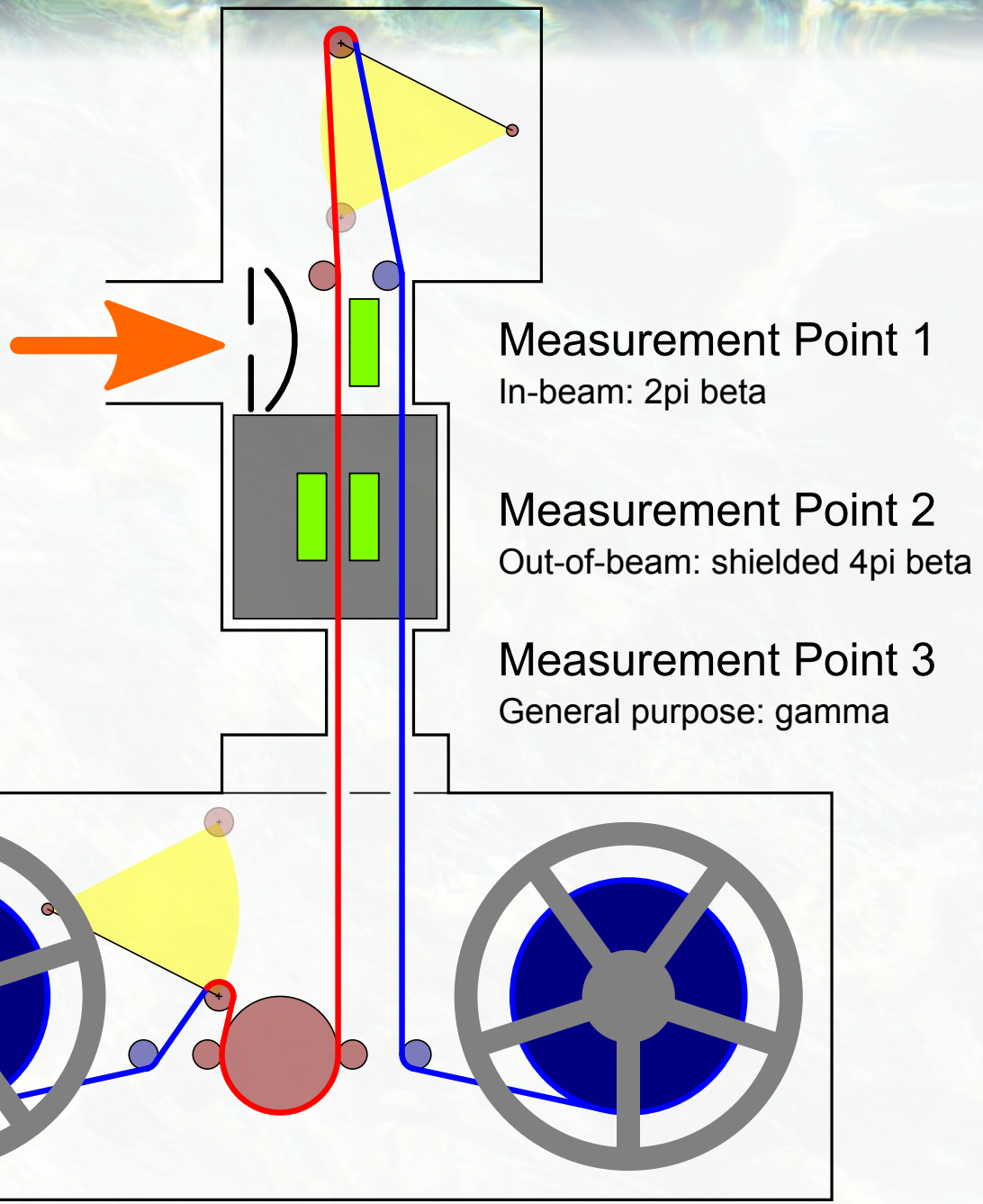
Key design points (1)

Maximise response speed:

- Minimised inertia in high-speed path
- Low bobbin-count
- Minimised transport path
- No sideways tension on capstan pinch-rollers

Beam-line and diagnostics

- Faraday-cup + collimator (minimum)
- Scanner highly desirable
- Mid-beam-line installation?



Key design points (2)

Detectors:

- Point 2 shielded by lead block with slots for tape
- Separate general-purpose measurement point

Control:

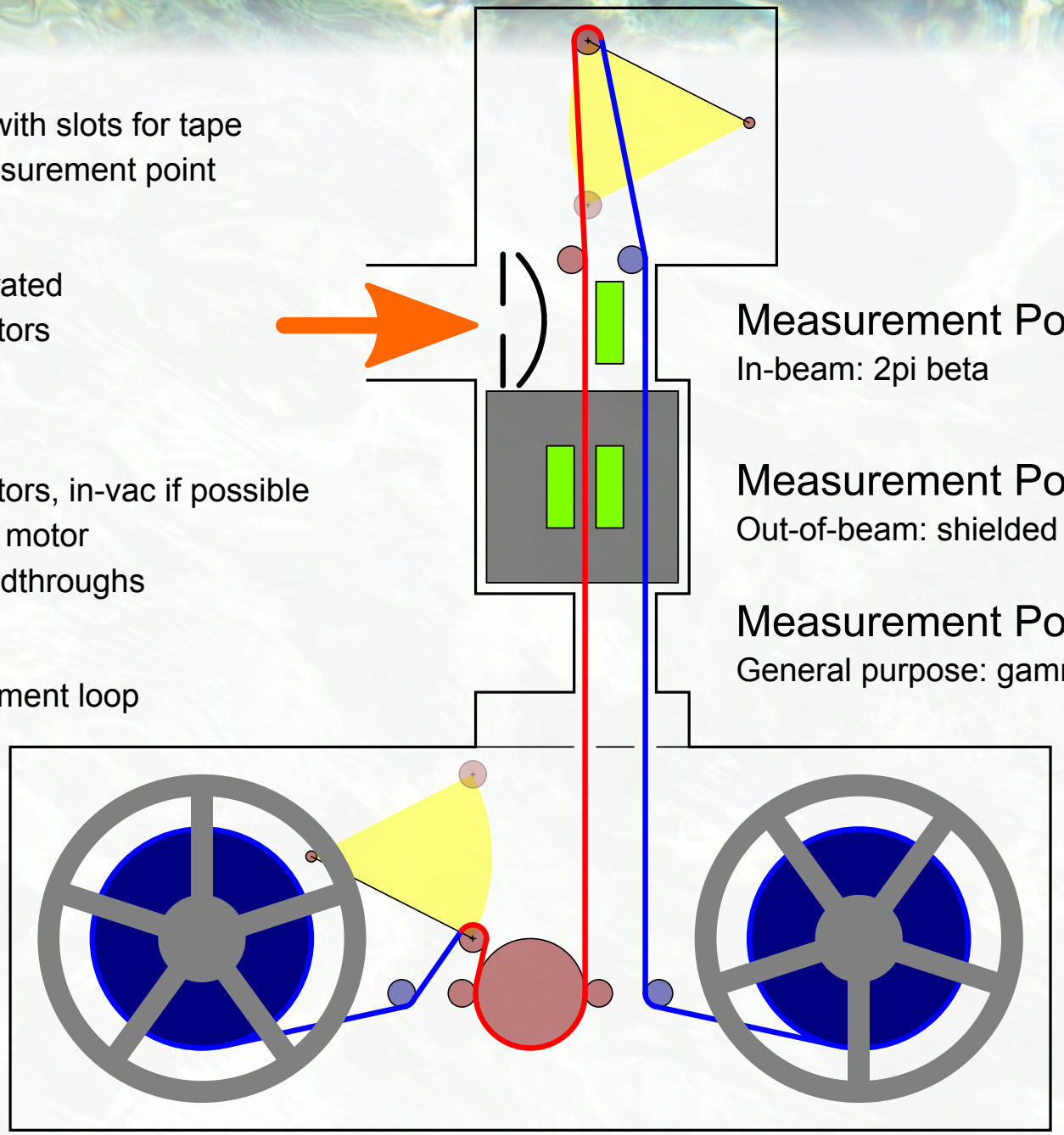
- Timing and motor control integrated
- Separate fast counter for detectors
- Integrated gamma PHA

Motors:

- Reels moved by small slow motors, in-vac if possible
- Capstan moved by fast precise motor
- Planetary gears on vacuum feedthroughs

Vacuum:

- Reels separated from measurement loop



Tapestation

In-beam measurement

State-of-the-art SiPM readout

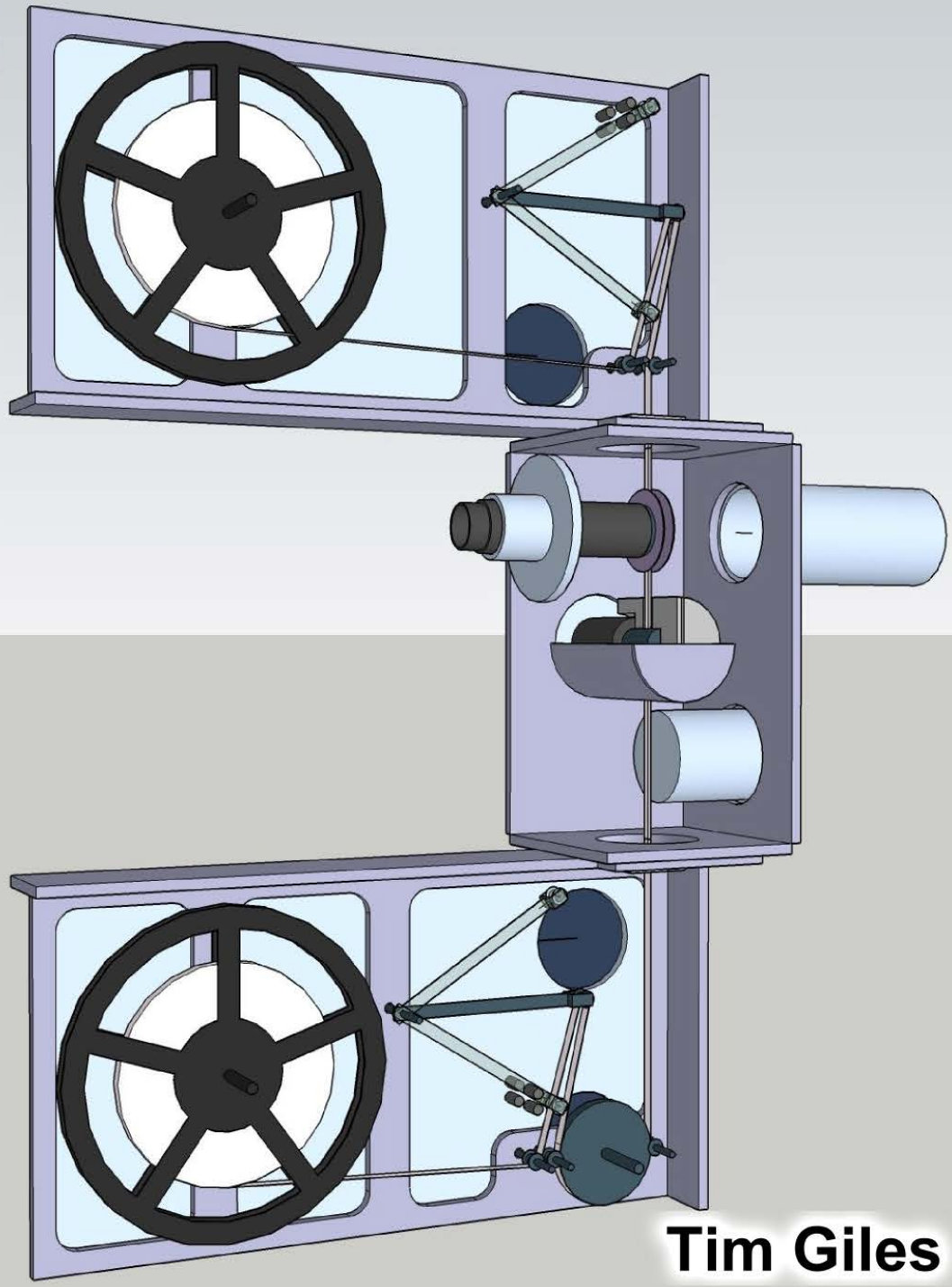
4pi beta detector

General-purpose measurement point

Fast transport (<200ms)

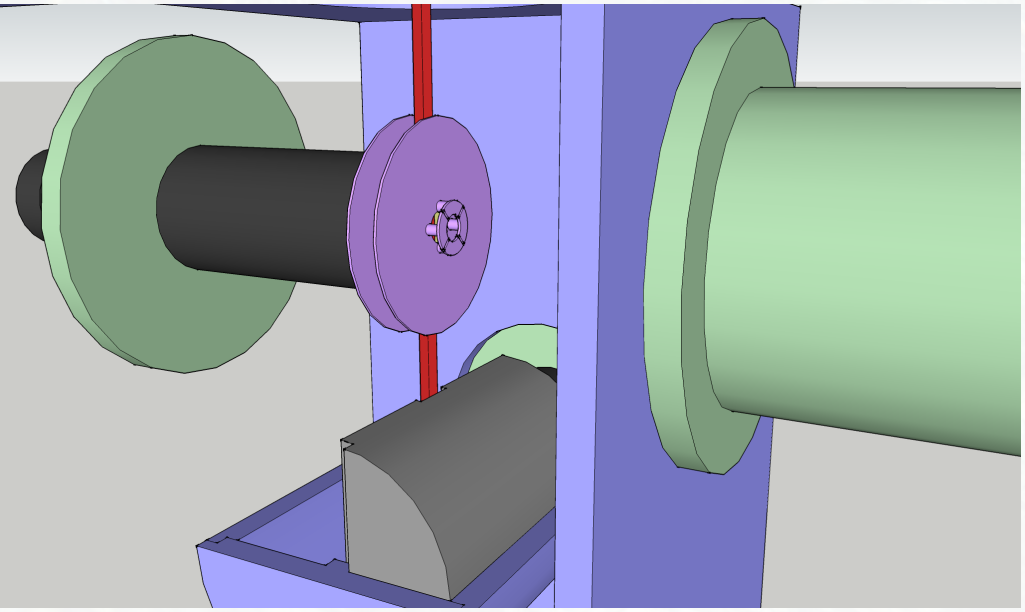
Designed for reliability and ease of use

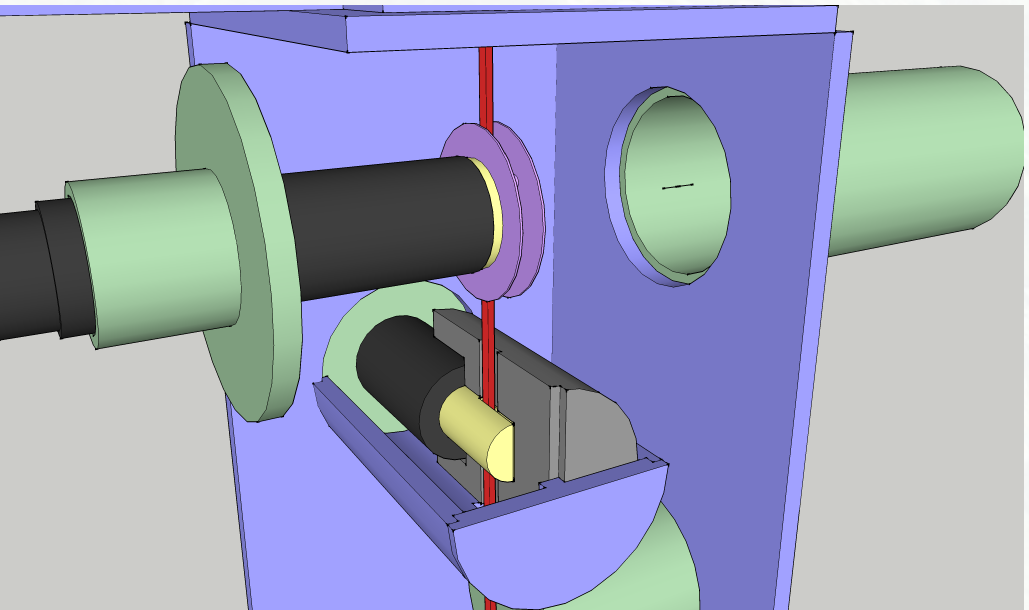
Mid-beamline installation possible

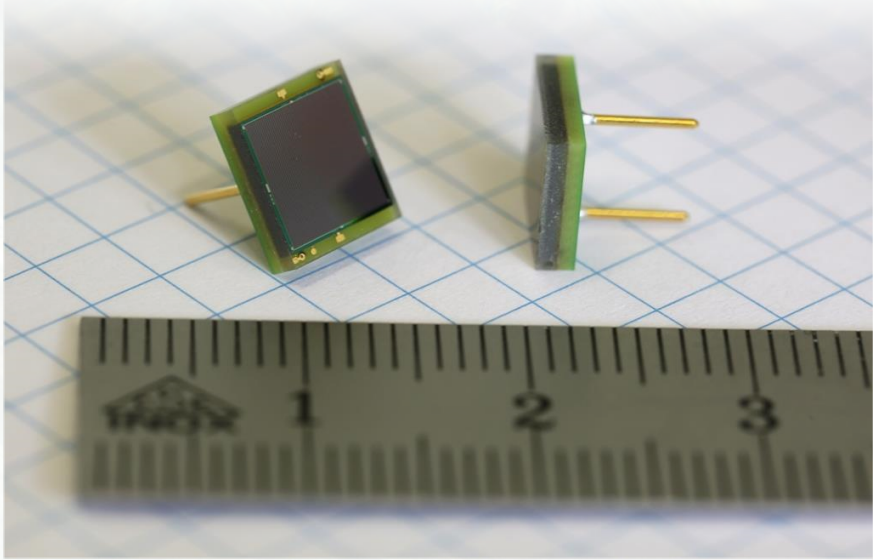


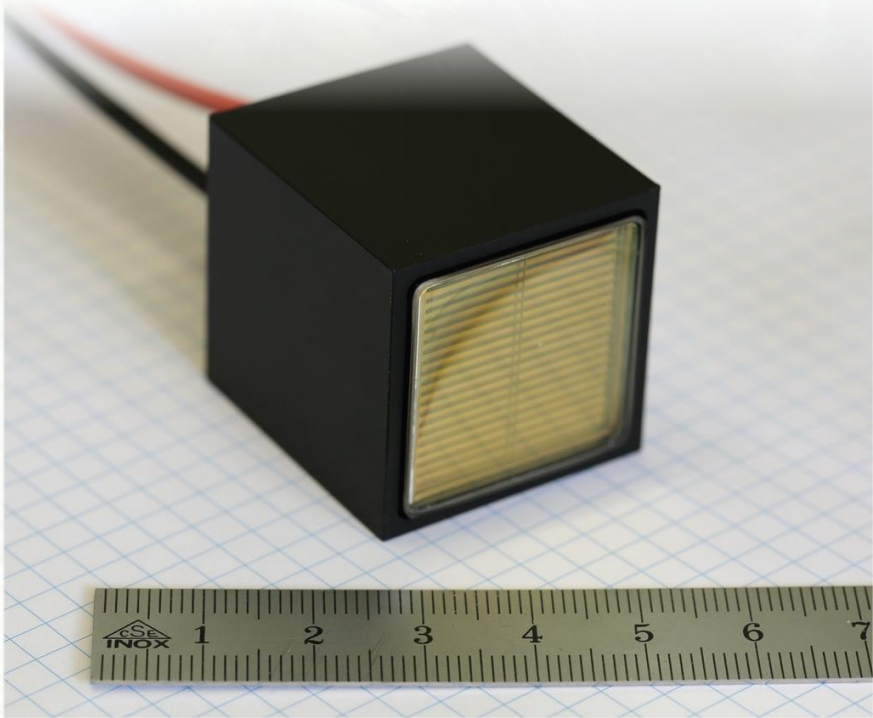
Tim Giles

Detectors

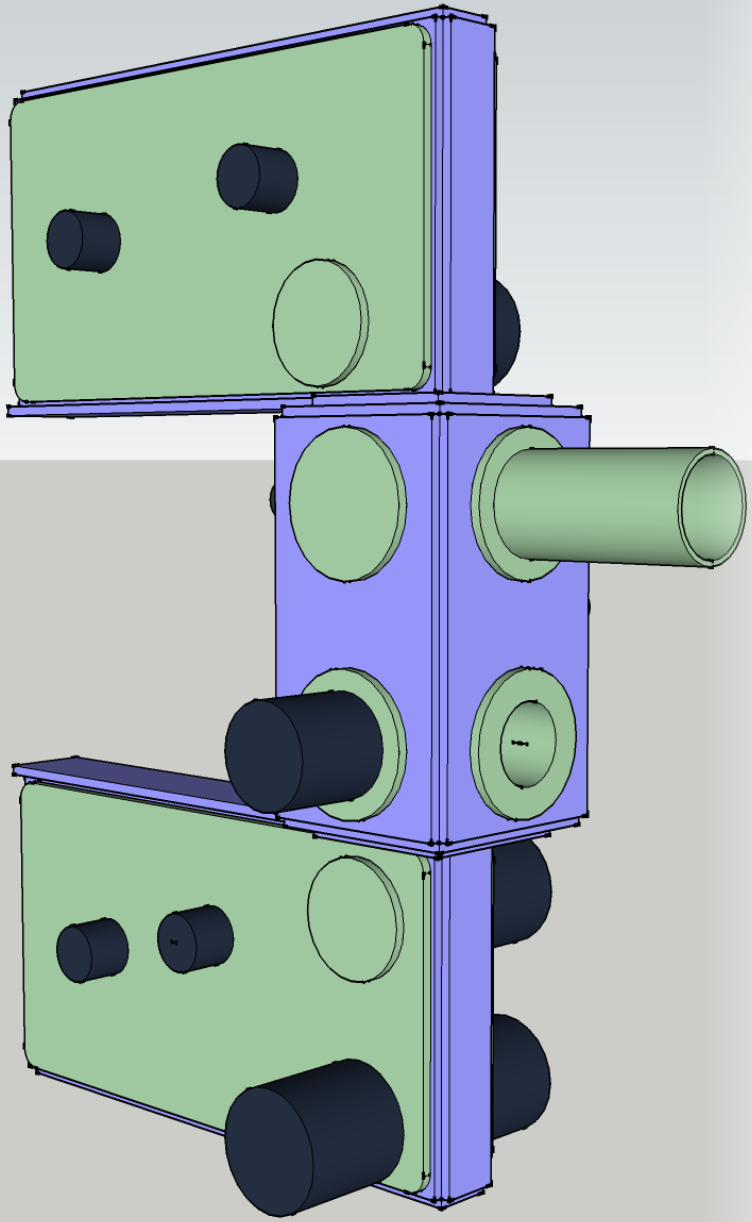




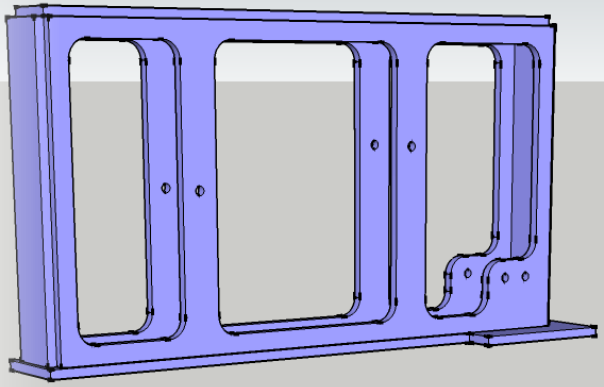




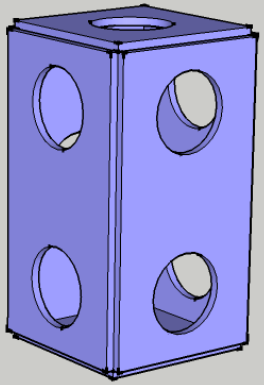
Design



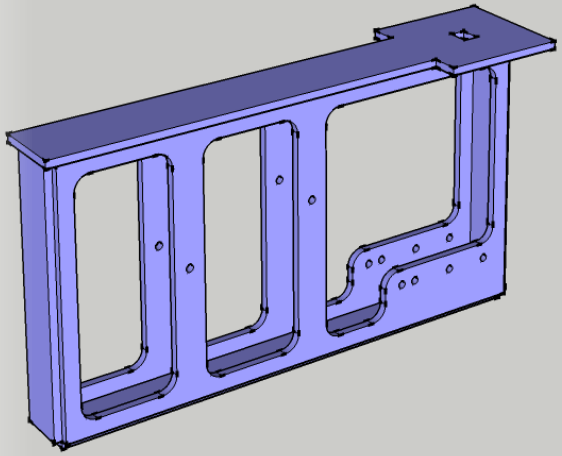
Upper tape box



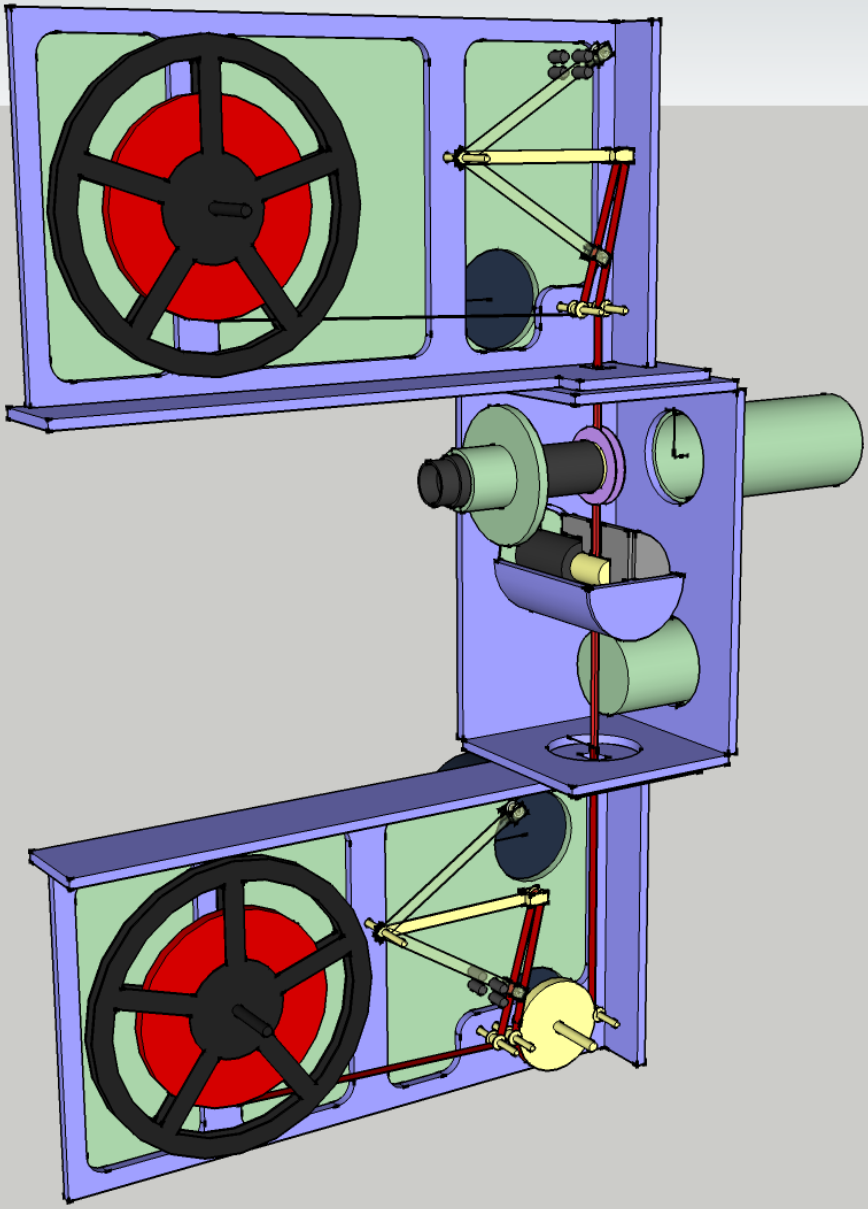
Beamline and
Detector box

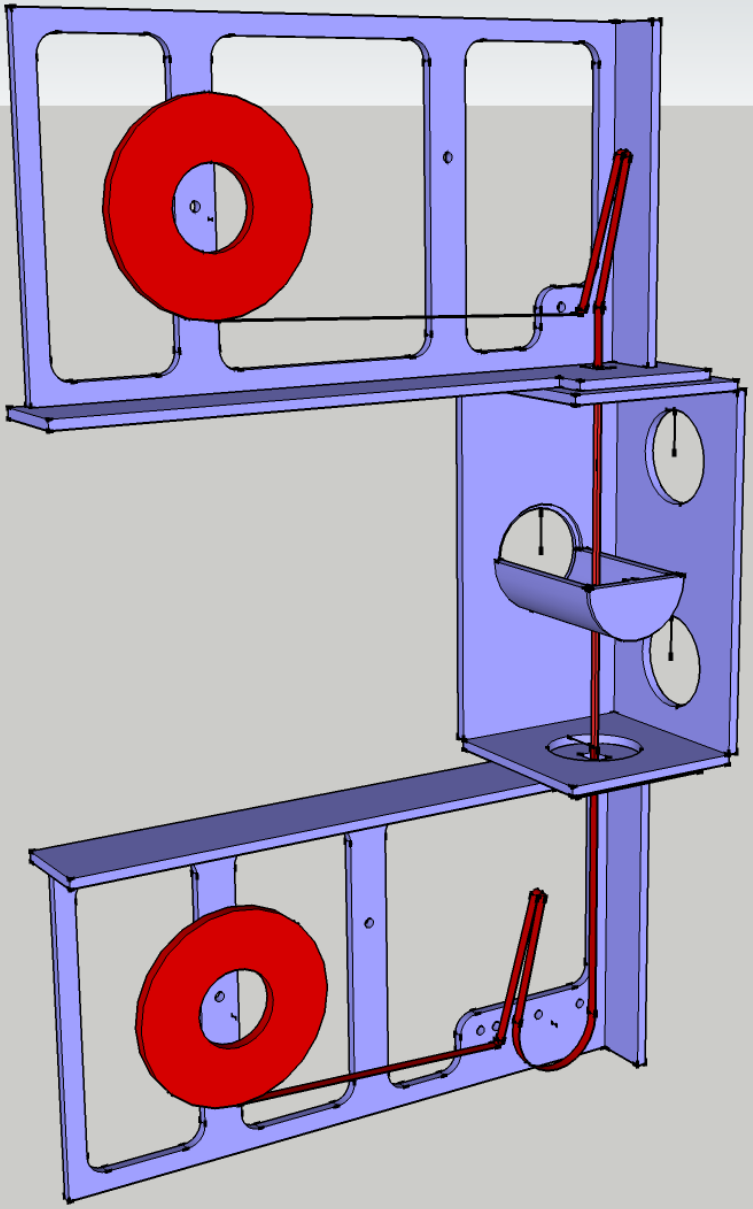


Lower tape box

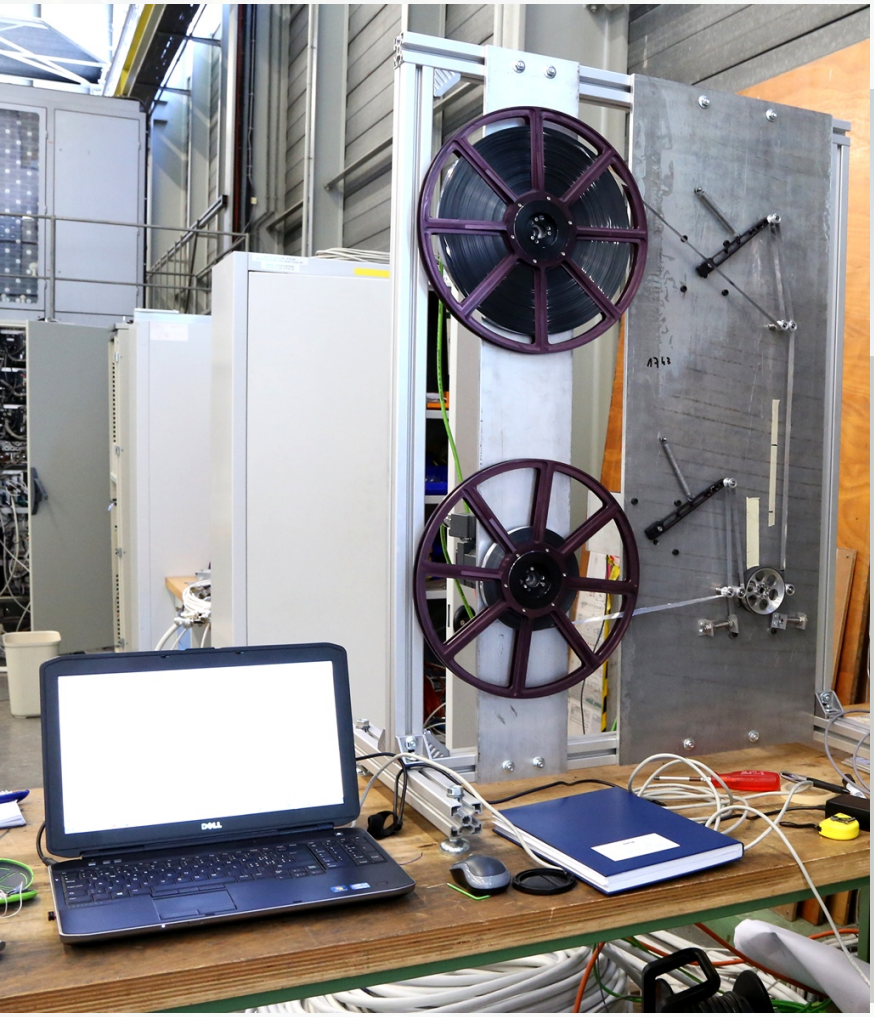


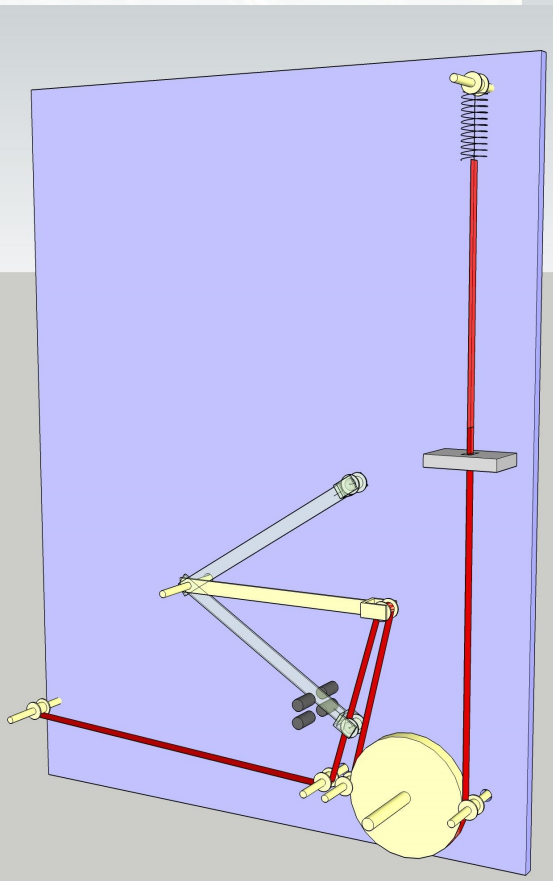
Tape Path

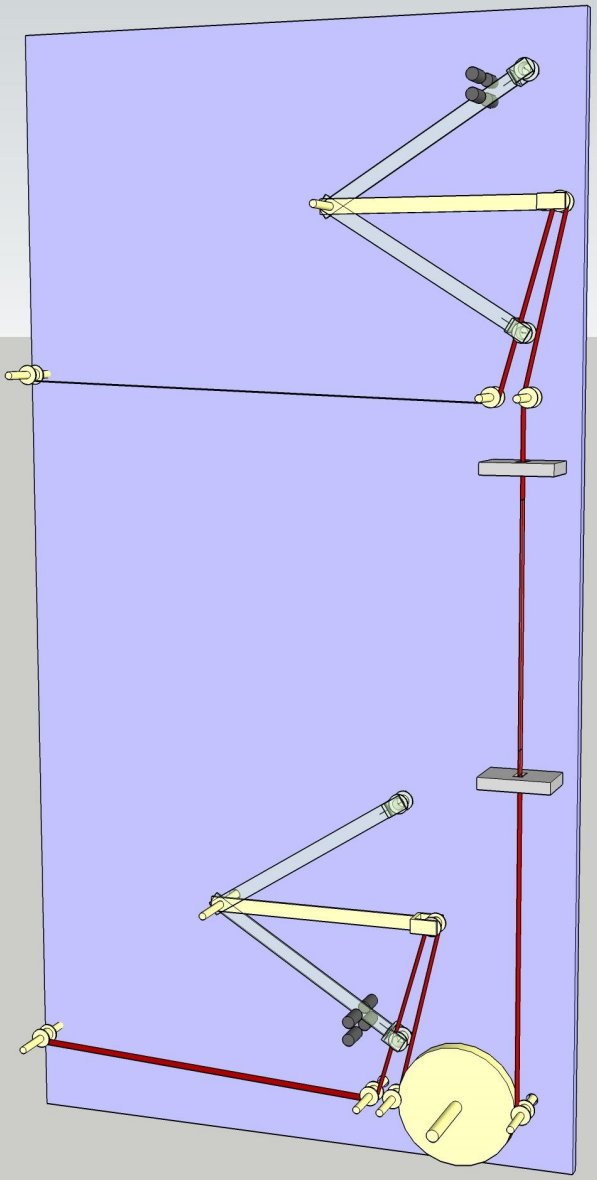




Test Stand







Status Oct 2014

- Concept demonstration, <100ms transport over 110mm
- Component selection : motors, encoders, controllers
- Detector selection : two types of PMT, to be tested

Next Steps

- Turn demonstration stand into test stand : real components
  220mm transport
  mechanical optimisation
- Source / design mechanical components
- Technical student ?
- Offline prototype mid 2015