X-ray Rotating Spectrometer

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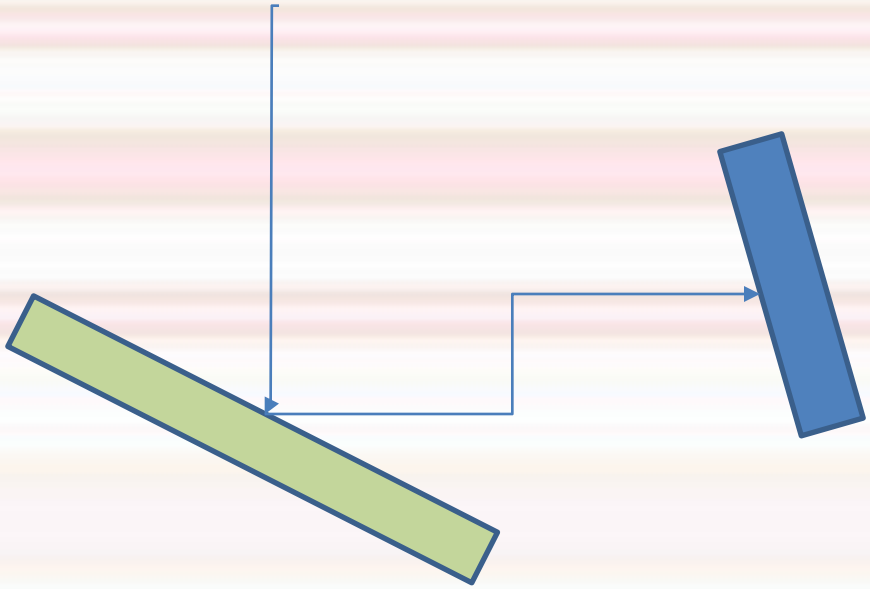
Bragg Crystal Scanning Spectrometer



Crystal is rotated forward and backward.
Detector should be moved with two times greater velocity.
Angle of rotation is read from angle encoders.
Shortcoming: diffirent parts of spectre is not detected at the same time.
Solution: Faster movements , but it is not convinient.

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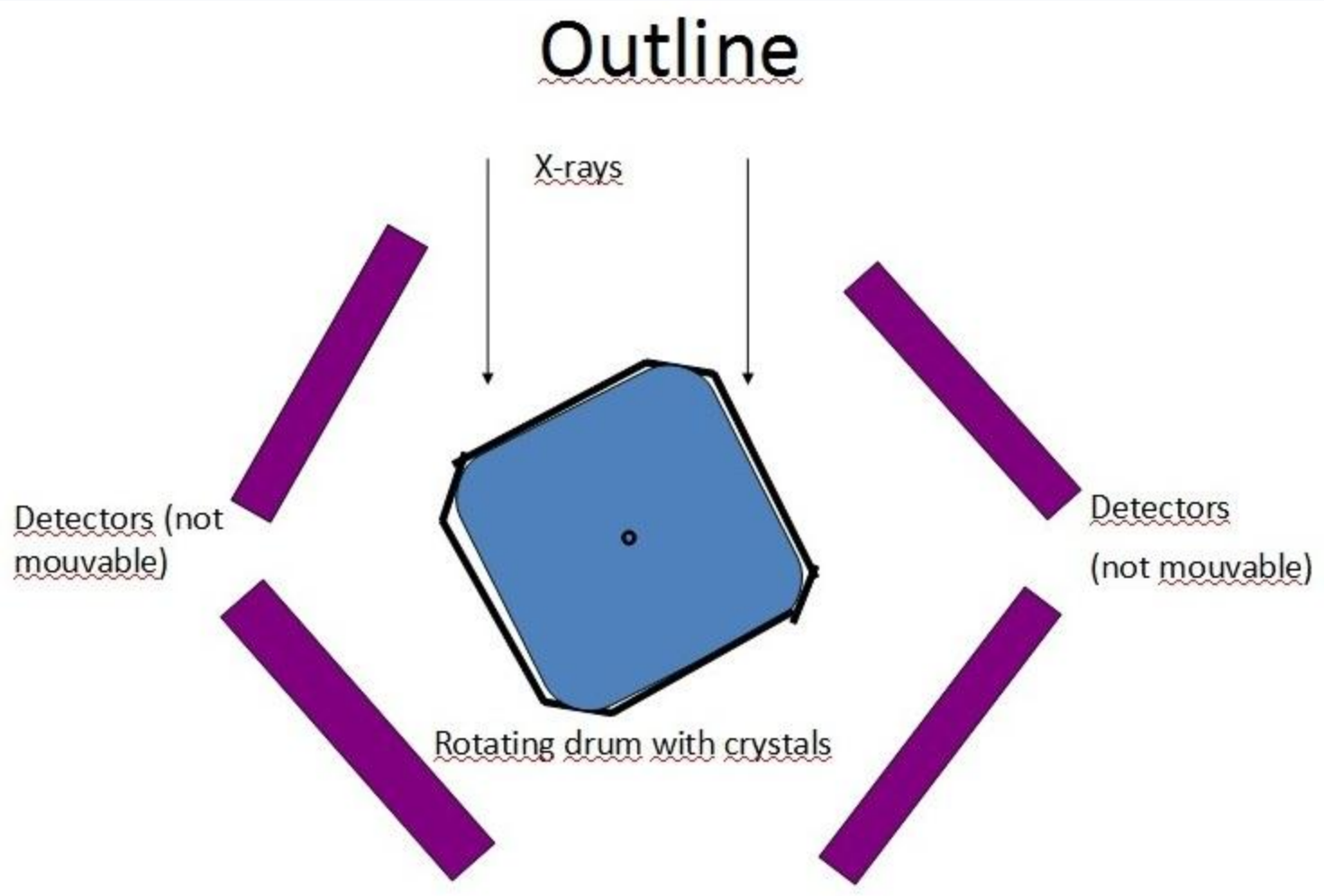


Basic prescription

The spectrometer consist of rotating drum with fasten flat crystals, and several fixed detectors. The drum rotates fairly fast (for example 10 times per second). So all spectrum is collected faster then possible changes occuring on the Sun. Disspersion scale is related to a phase of drum rotation. Constant mass momentum ought to result in constant velocity of rotation, and so crystals orientation would become precisely related to time.

Usage methods

The rotating spectrometer is a very flexibile instrument, which may be easily fit to many scientific tasks, and it may easily adapt to altering Sun activity.

One drum may serve wide range of spectrum by using different crystal and detector sets.

The first mode of observations is a registration of time of every accepted photon (time stamping mode). The second mode is steady data collecting time (DCT) – the spectrometer registers the number of accepted photons in specified time intervals.

Precision of time stamping or time intervals in DCT mode determine spectrometer resolution.

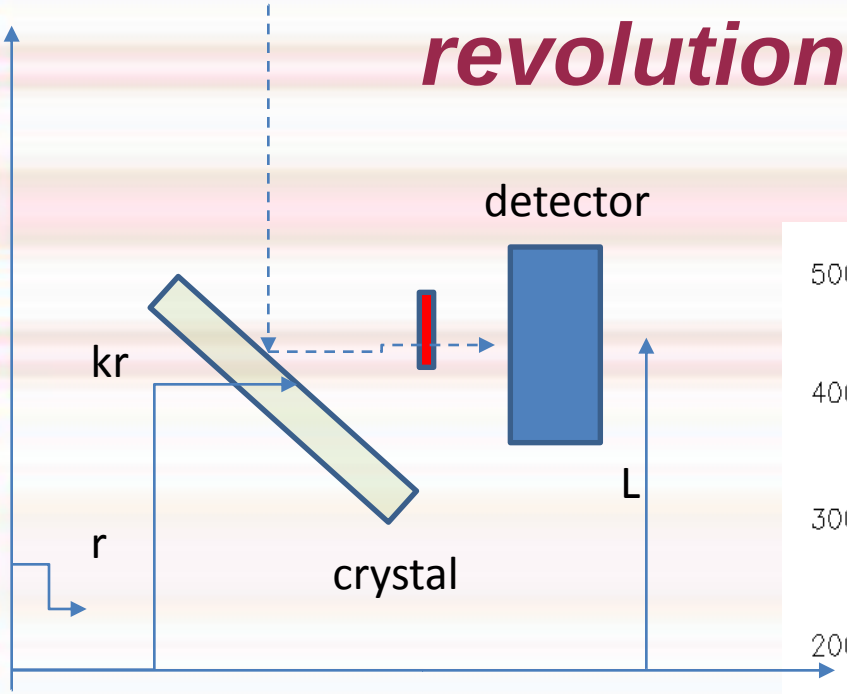
Velocity of drum rotation may be conveniently changed accordingly to needs of a user.

Rotating spectrometer may work as a Dopplerometer.

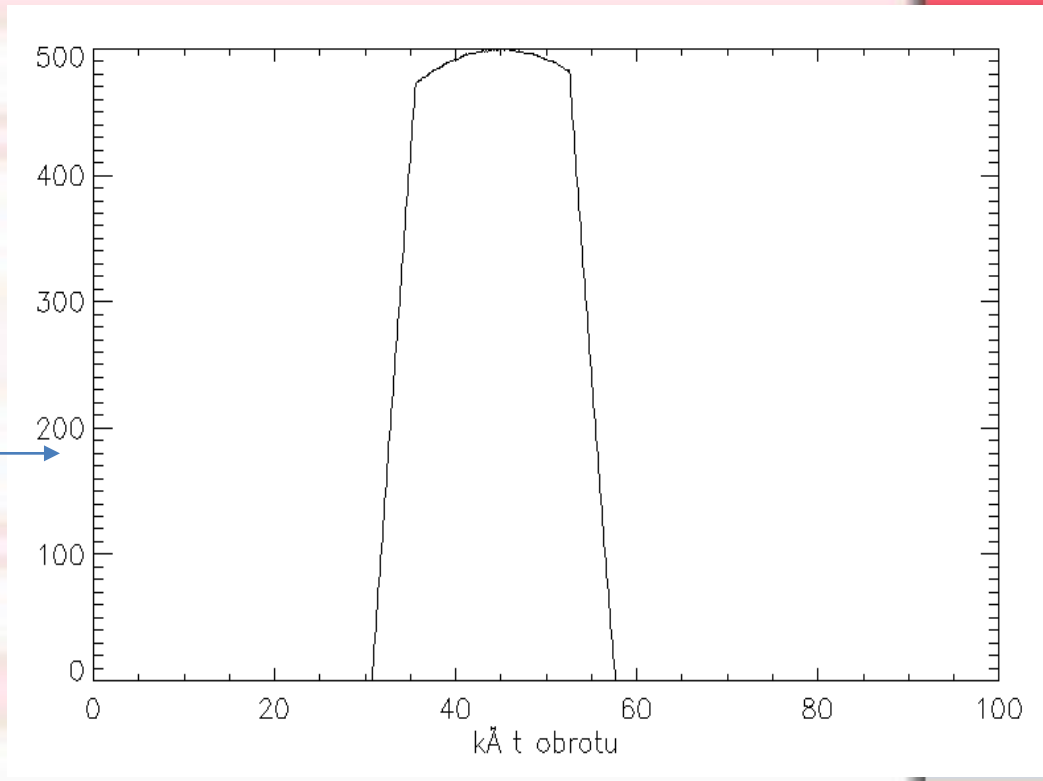
Example

- Presumed rotation speed 10 rps.
- Desired angle resolution 1.e-4 rad.
- Given these circumstances the spectrometer should work with 1.6 µsec time accuracy. Thus, the drum rotation should be recorded with the same accuracy.

Effective area dependence on angle of revolution - example

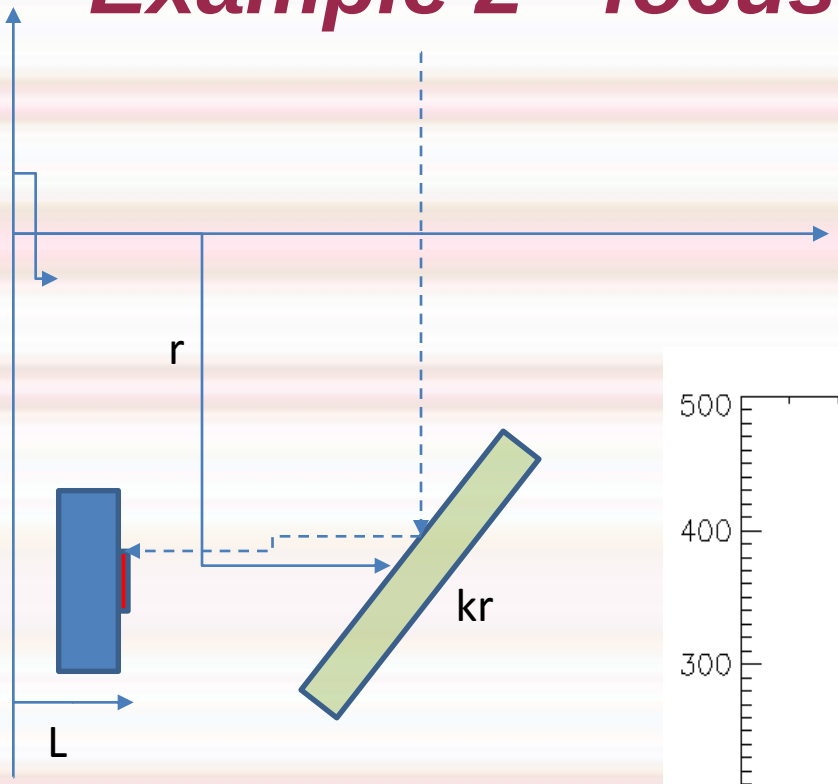


kr=r=30 mm
Det=10 mm
loose=5 mm
L=21.2 mm

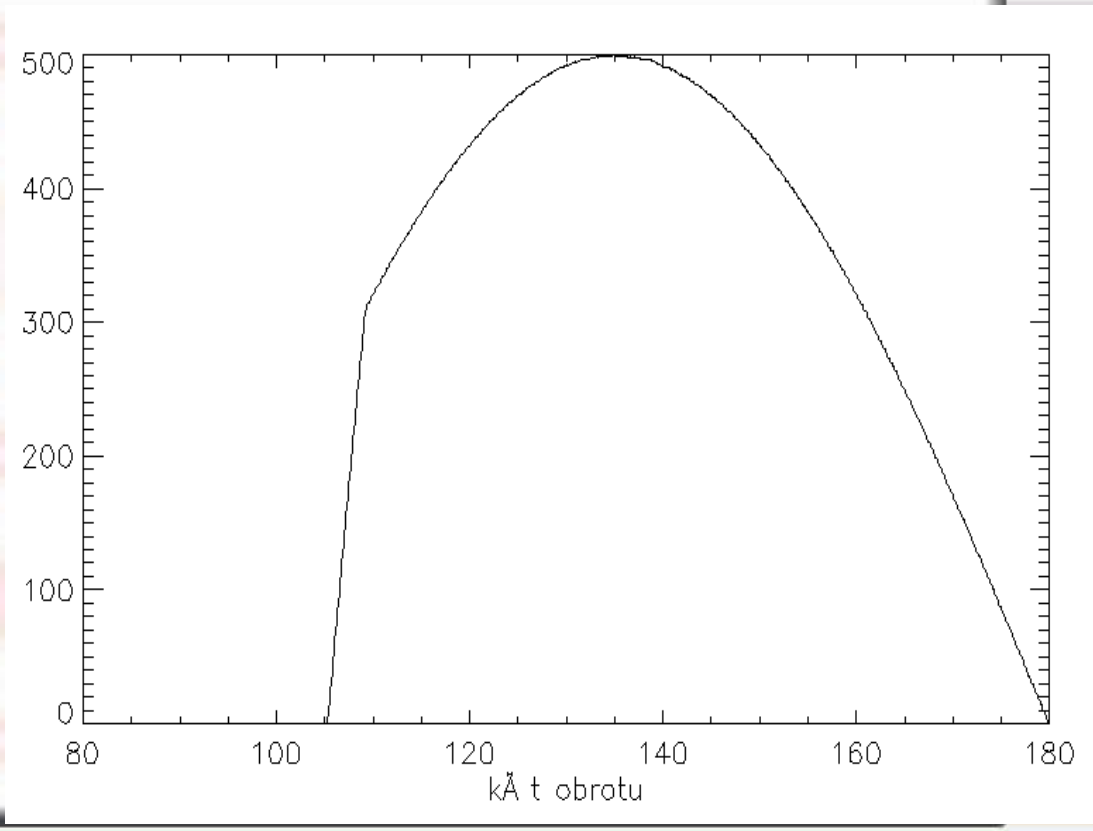


If 8 crystals are on the drum then 55% of the time will be spent on spectrum detecting

Example 2 - focusing configuration



kr=r=30 mm
Det=10 mm
L=15 mm



Comparision between flat and bent crystal spectrometers with the same spectral ranges