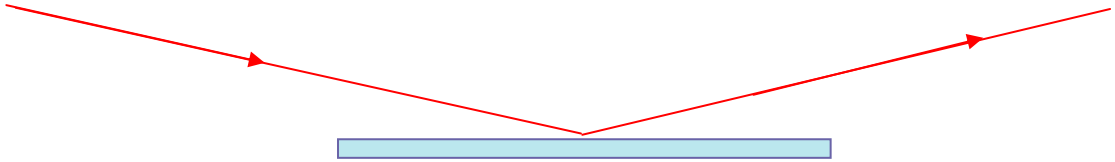
JRA NEUTRON OPTICS

WP1 High flux reflectometry and energy analysis

- **WP1: High flux reflectometry and energy analysis (F. Ott)**
  - **Task 1: Reflective Optics Energy Analyzer (F.Ott)**
  - **Task 2: Refraction-encoded reflectometry (K. Andersen – R. Cubbitt)**
  - **Task 3: Wavelength-encoding by Bragg diffraction (K. Andersen – H. Ronnow)**

High flux specular reflectometry

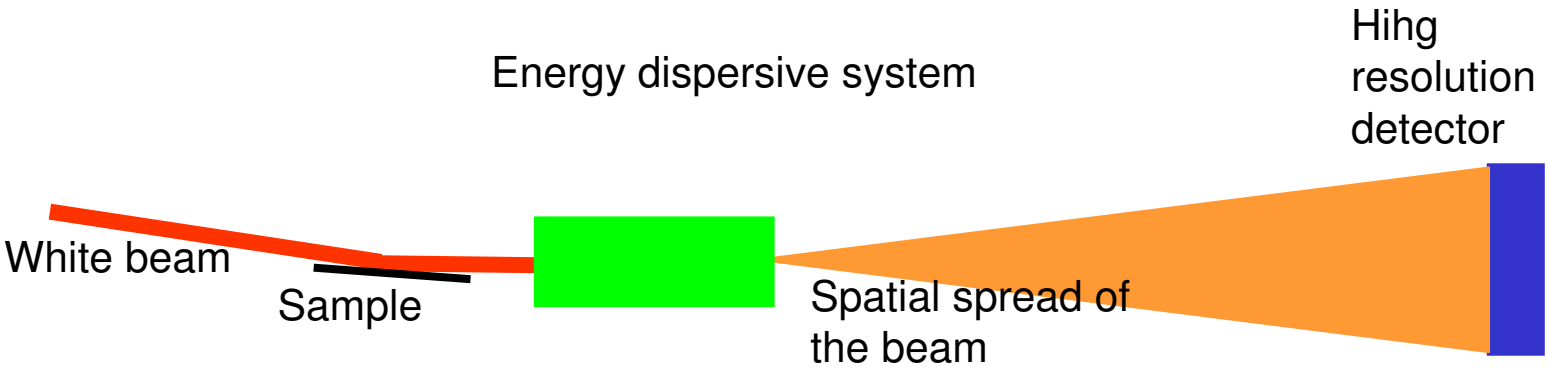
- *Objective:* gain in flux (1-2 orders of magnitude)
- *How:* use all the real space

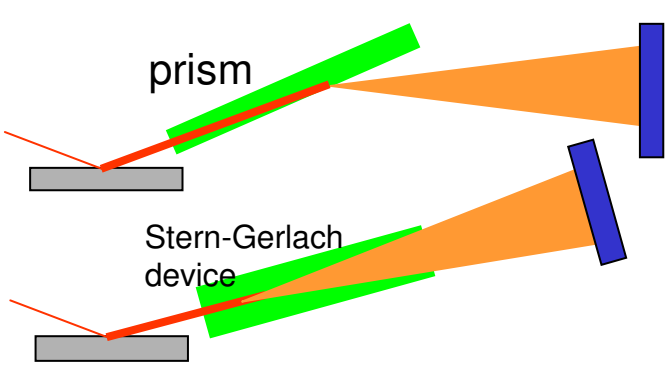


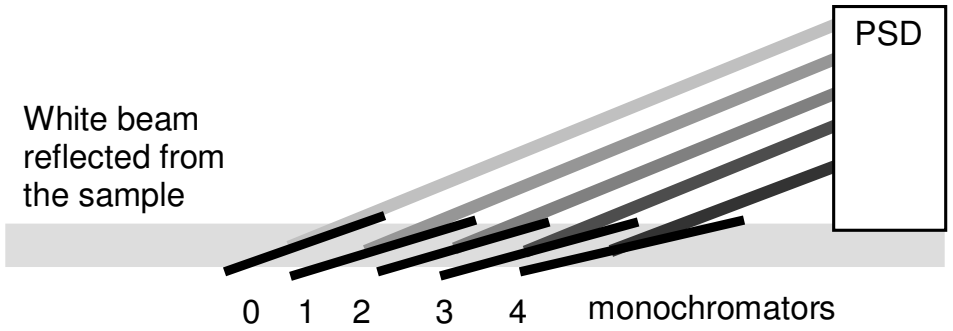
- *Possibilities:*
  - *spin – space encoding (SERGIS)*
  - *time – space encoding (TILTOF)*
  - *energy – space encoding (EASYREF, GRADTOF, REFOCUS)*

Energy – space encoding

- Energy analysis after the sample

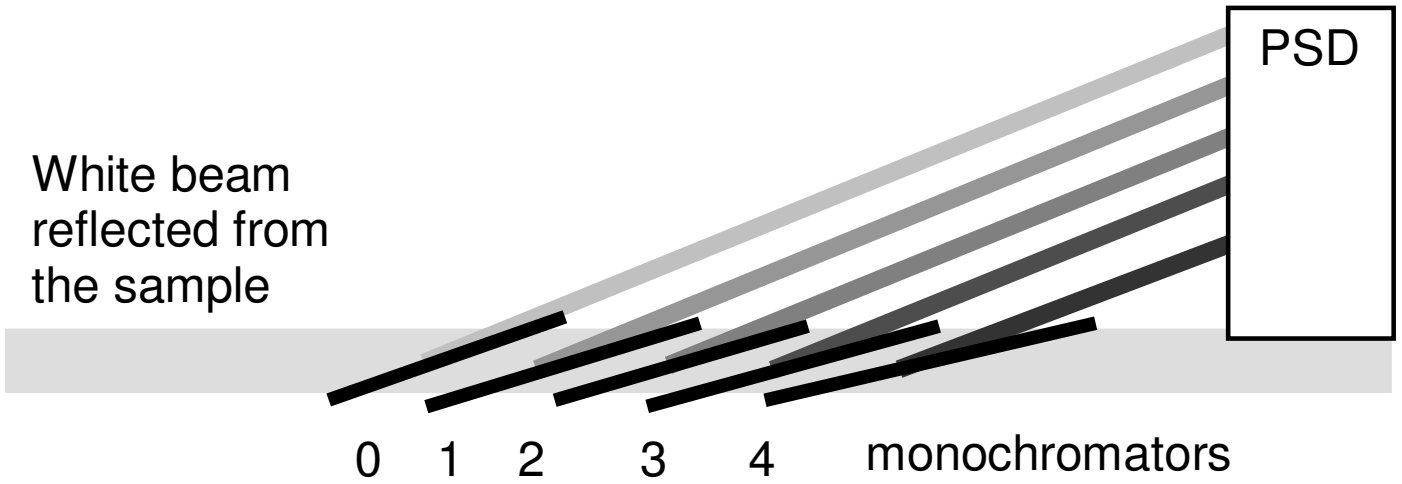






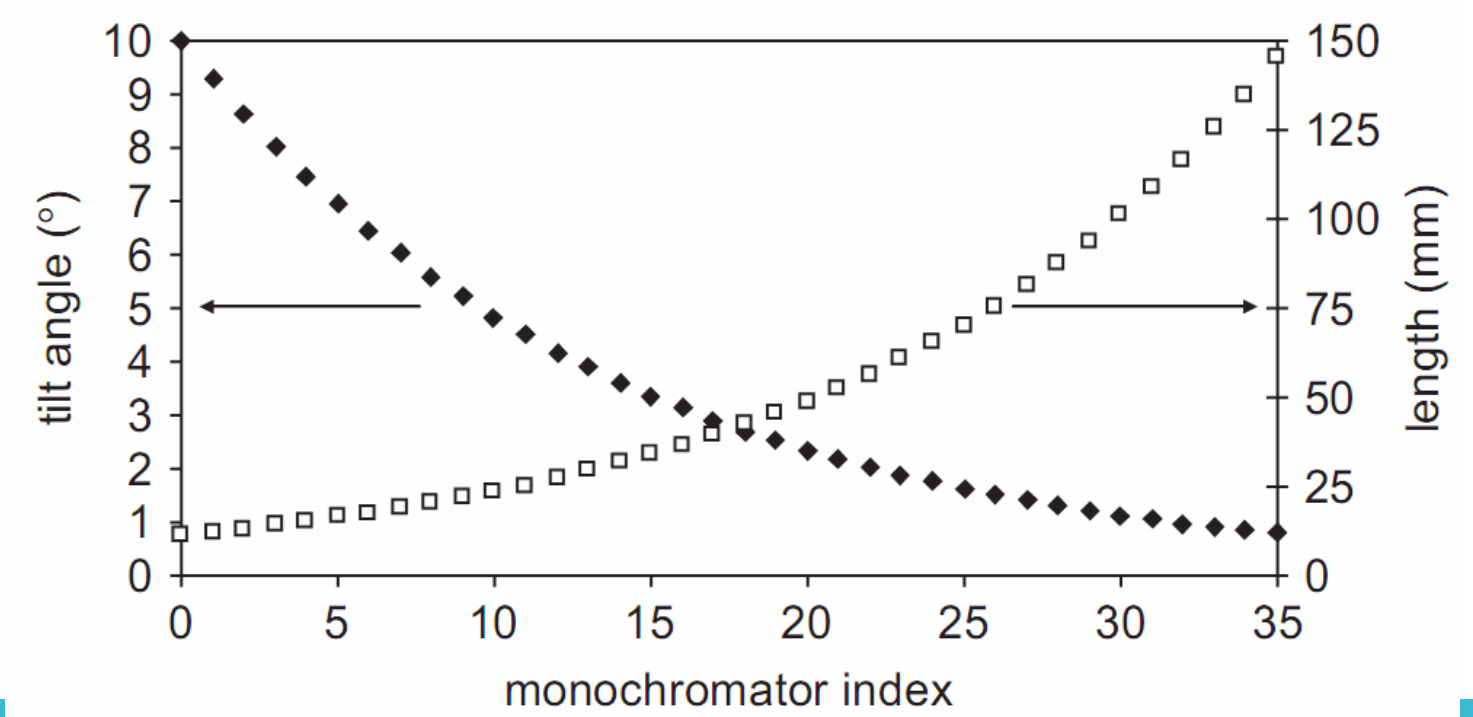
Task 1: EASYREF

- F. Ott, NIM A **584** (2008) 401-405. EASYREF: Energy analysis system for reflectometers.



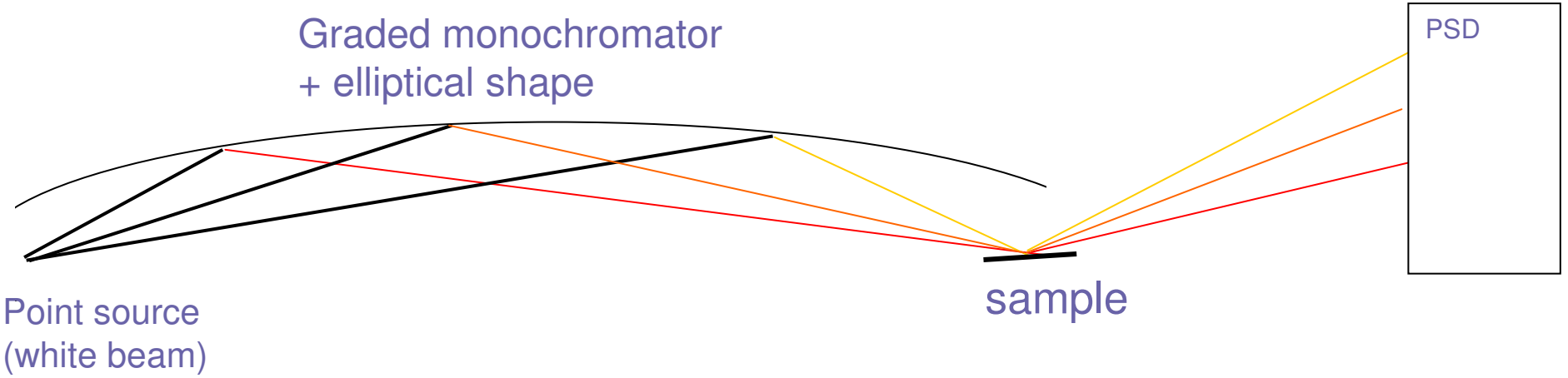
- Key technologies
  - High m, without harmonics ML monochromators (m>3) (PSI)
  - Complex assembly of mirrors (HMI)
  - Objective 1: limited bandwidth system (5 - 25A°)


w
ΔX_i


tilt angle (°)
length (mm)
monochromator index
0
1
2
3
4
5
6
7
8
9
10
0
25
50
75
100
125
150
0
5
10
15
20
25
30
35

Task 1: REFOCUS

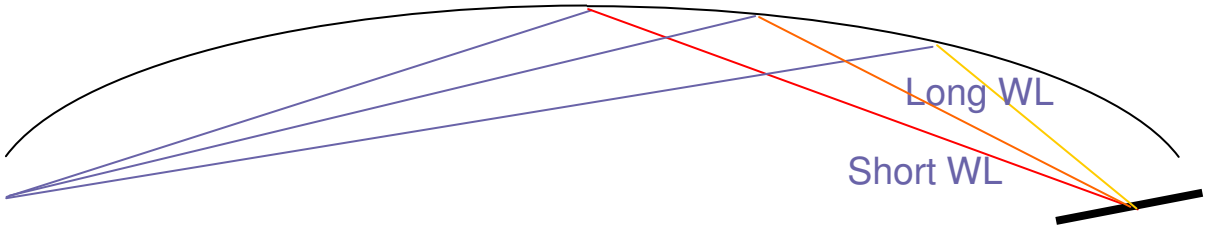
- Energy encoding before the sample



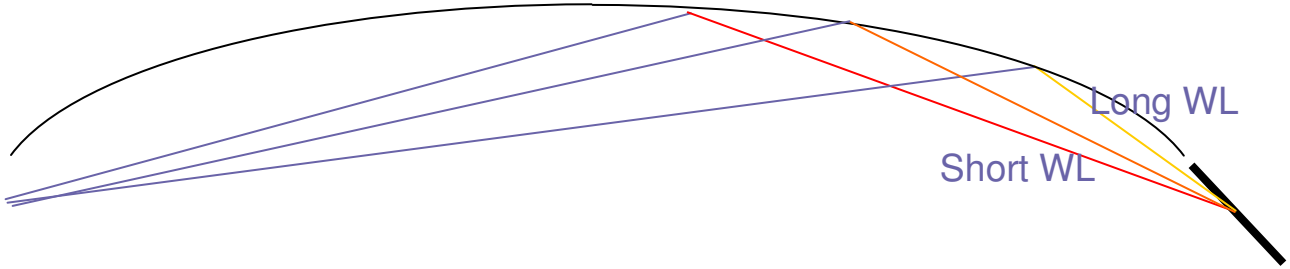
- F. Ott and A. Menelle, NIM A **586** (2008) 23–30.
- Key technologies
  - High m, without harmonics ML monochromators (m>3) (PSI)
  - Graded mirrors (PSI)
  - Elliptical curved mirror (TUM)
  - Objective 1: 2m long proof of principle setup with limited bandwidth system (5 - 25A°)

REFOCUS

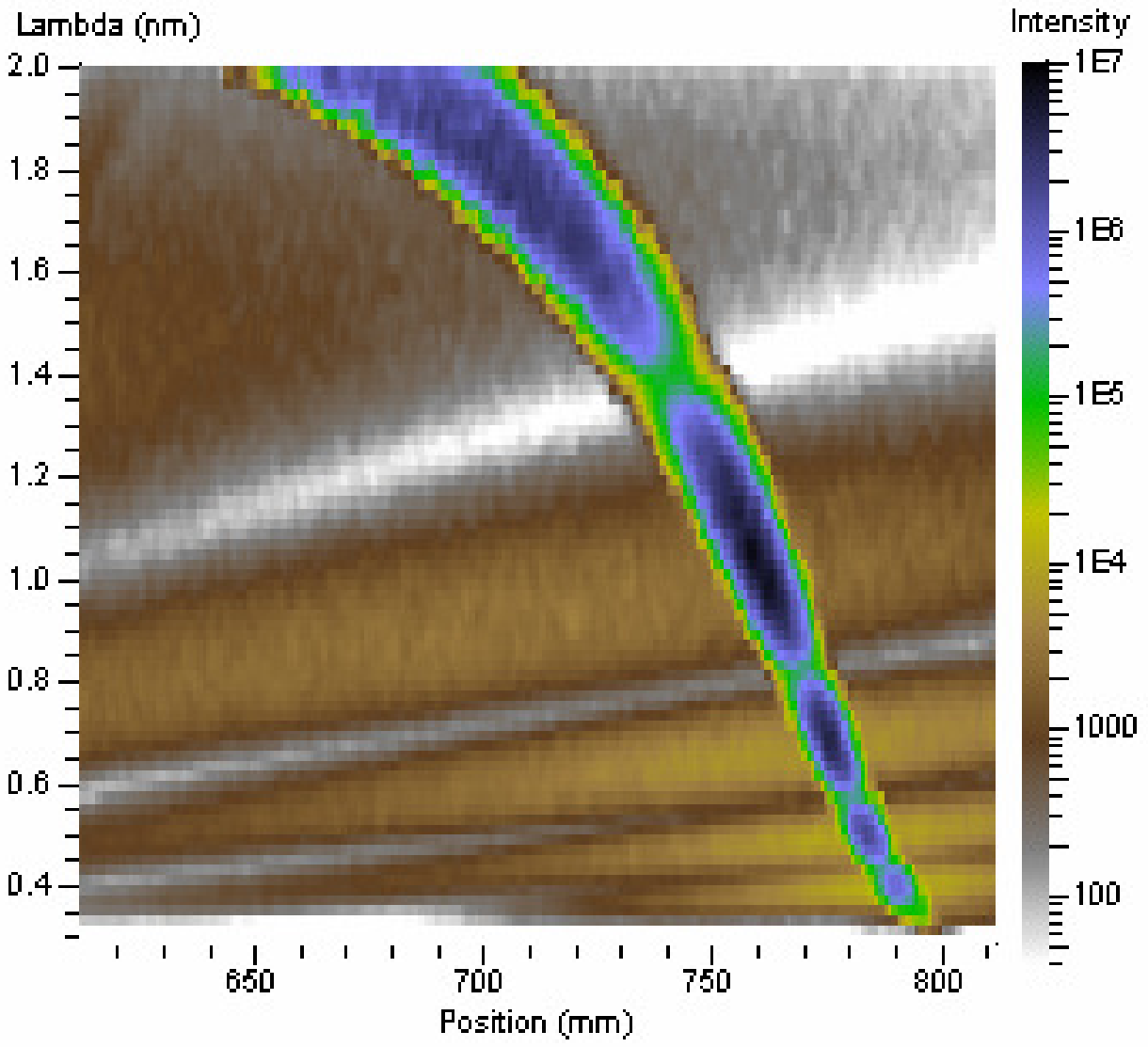
Mode 1



Mode 2

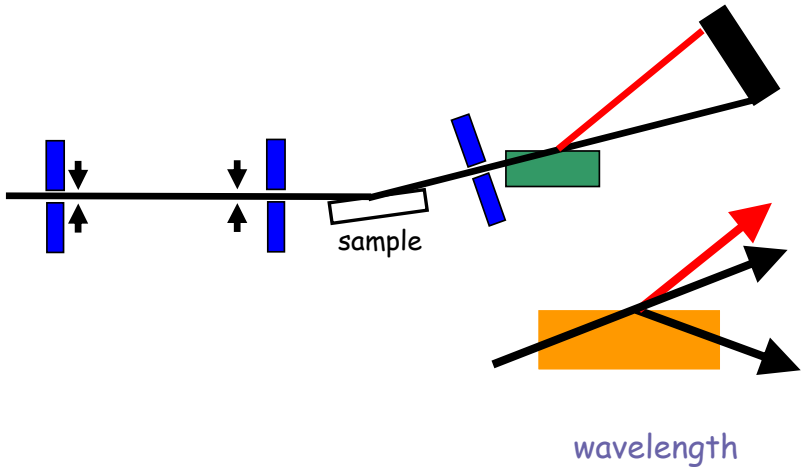


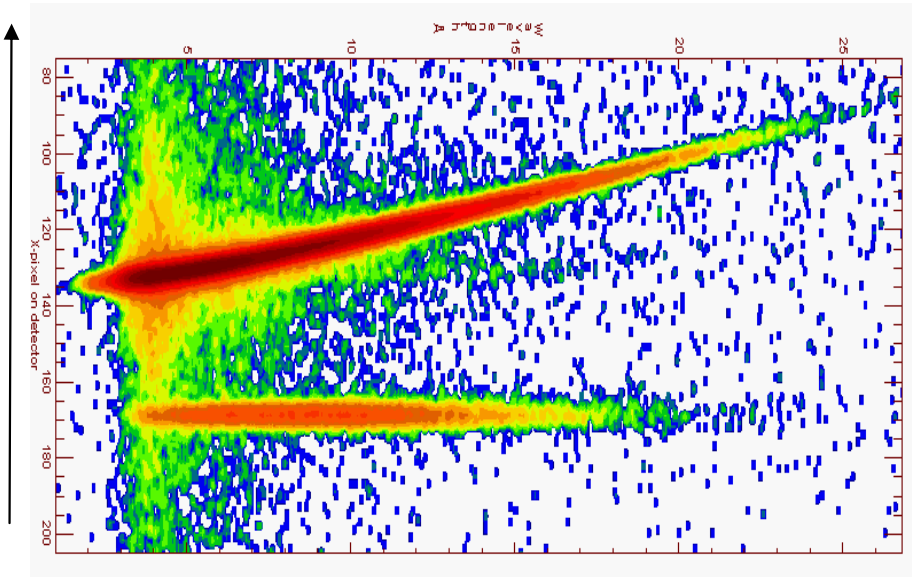
REFOCUS


Lambda (nm)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
650
700
750
800
Position (mm)
Intensity
1E7
1E6
1E5
1E4
1000
100

Task 2: Refraction encoding (R. Cubitt , ILL)

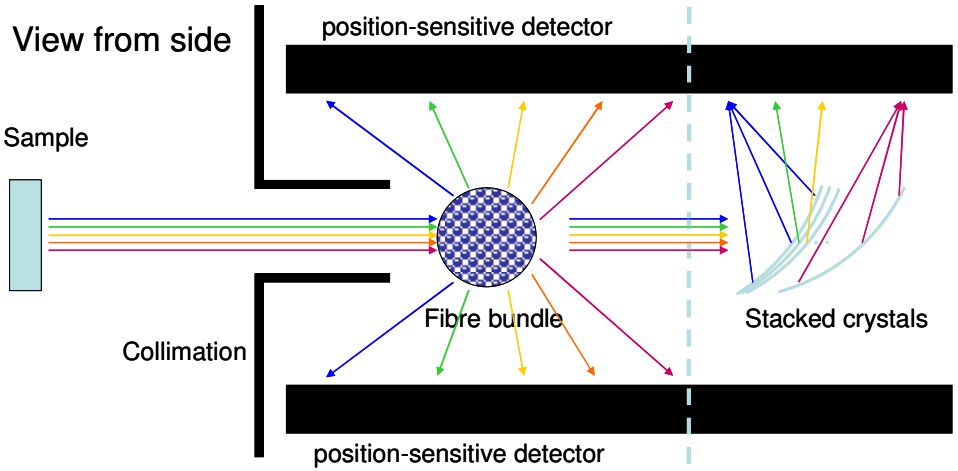
- R. Cubitt, NIM A **558**, 547 (2006).

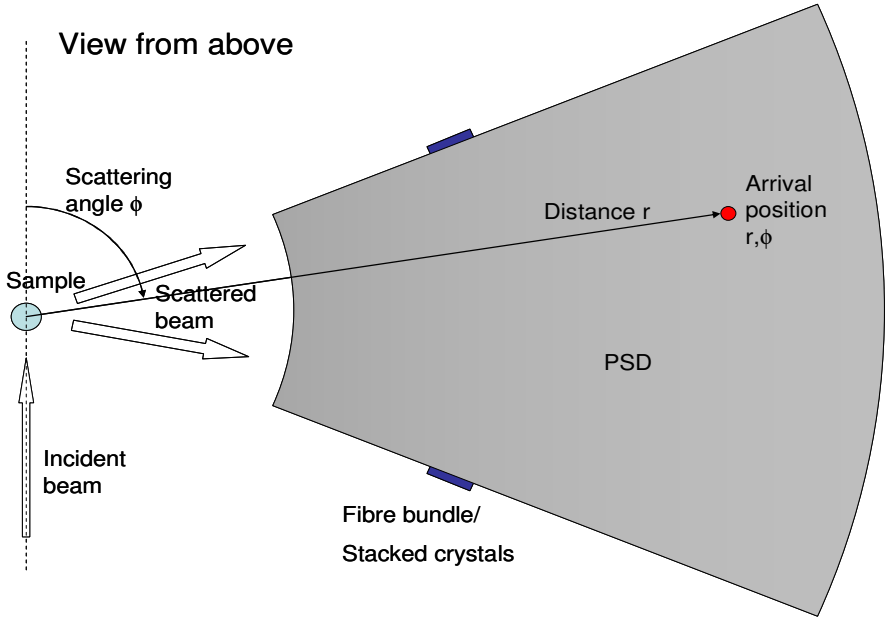




- Key technologies
  - High resolution detector (0.5mm)
  - Flat prism (ILL)
  - Multiple prism array (HMI)

Task 3 : Wavelength-encoding by Bragg diffraction (K. Andersen – H. Ronnow)





- **Key technologies**
  - Stacked-crystal energy analysers — Low risk
  - Bundled-fibre energy analysis — Medium risk

Required key technologies

- High m, without harmonics ML monochromators (m>3)
- Graded coatings
- Elliptical mirrors
- Complex assembly of mirrors
- Stacked-crystal energy analysers
- Bundled-fibre energy analysis
- Ultra flat very large wafer

- Key issue: low diffuse scattering from the optics

- Present status: fine design of the designs is available
- To be done: demonstration prototypes

Outlook towards the future

- Implementation on real spectrometers
  - LLB EROS III
  - ILL D17