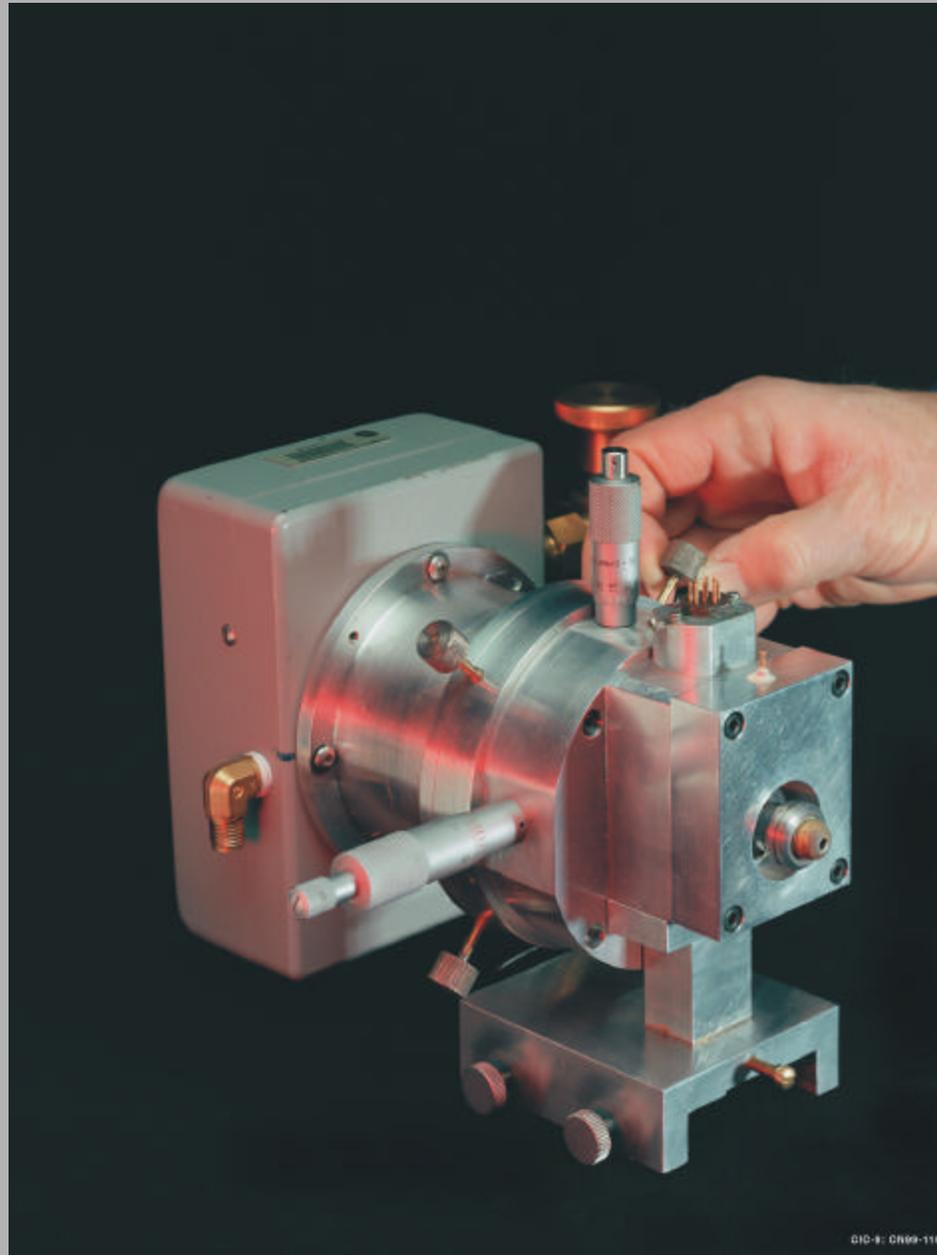
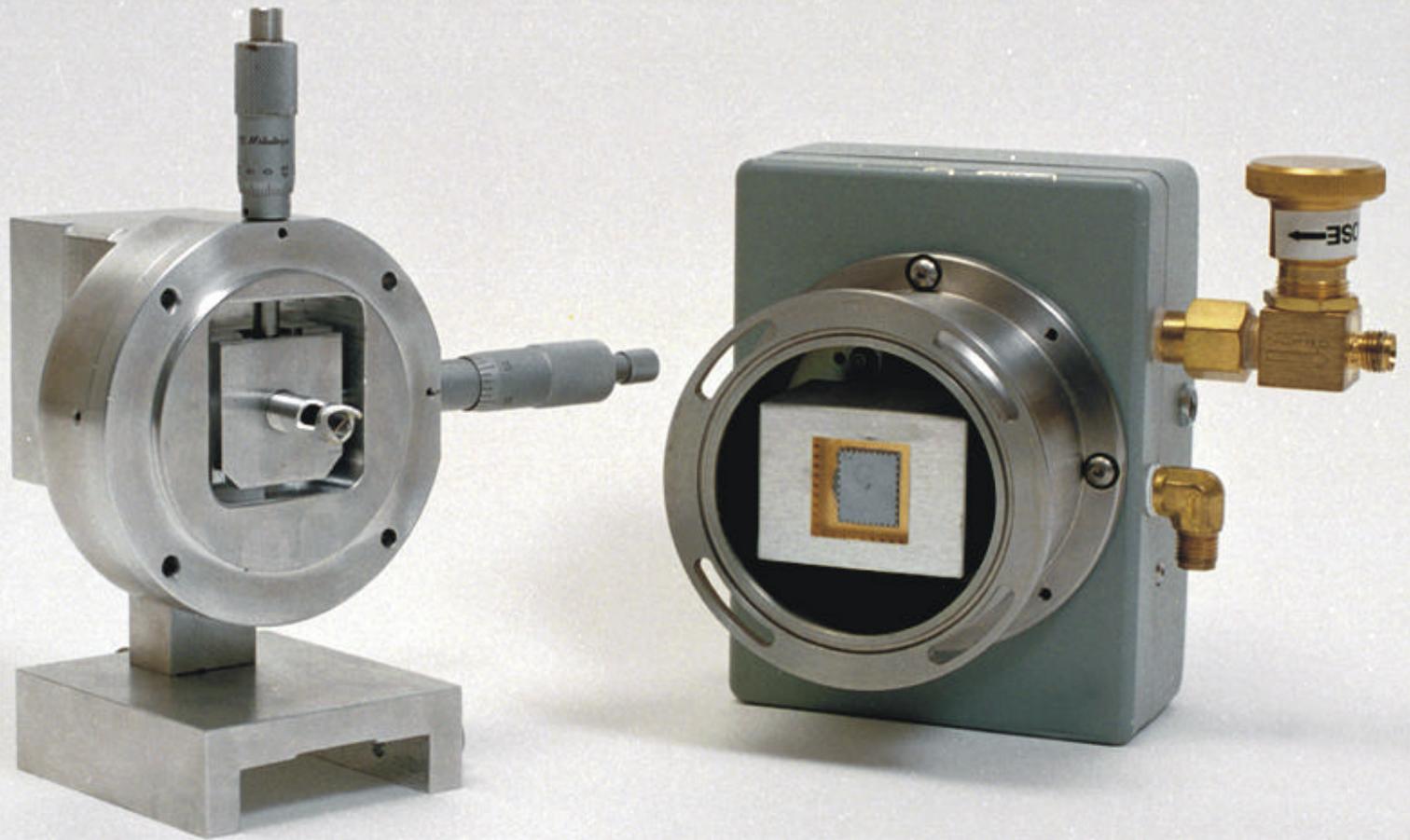


***In Situ* Miniaturized X-ray
Diffraction/X-ray
Fluorescence Instrument**

David Bish, David Vaniman, and
Steve Chipera

Prototype CHEMIN instrument

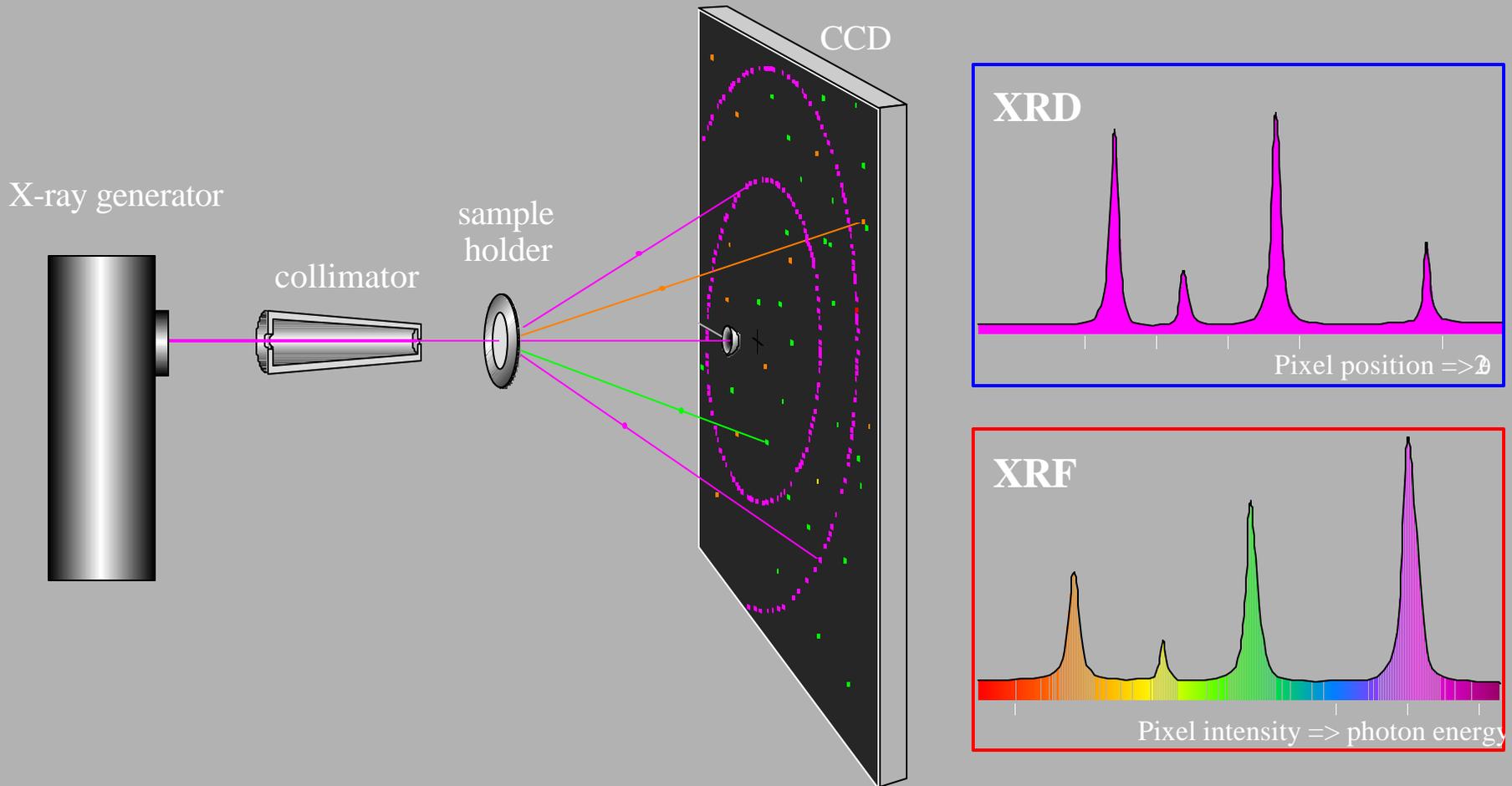


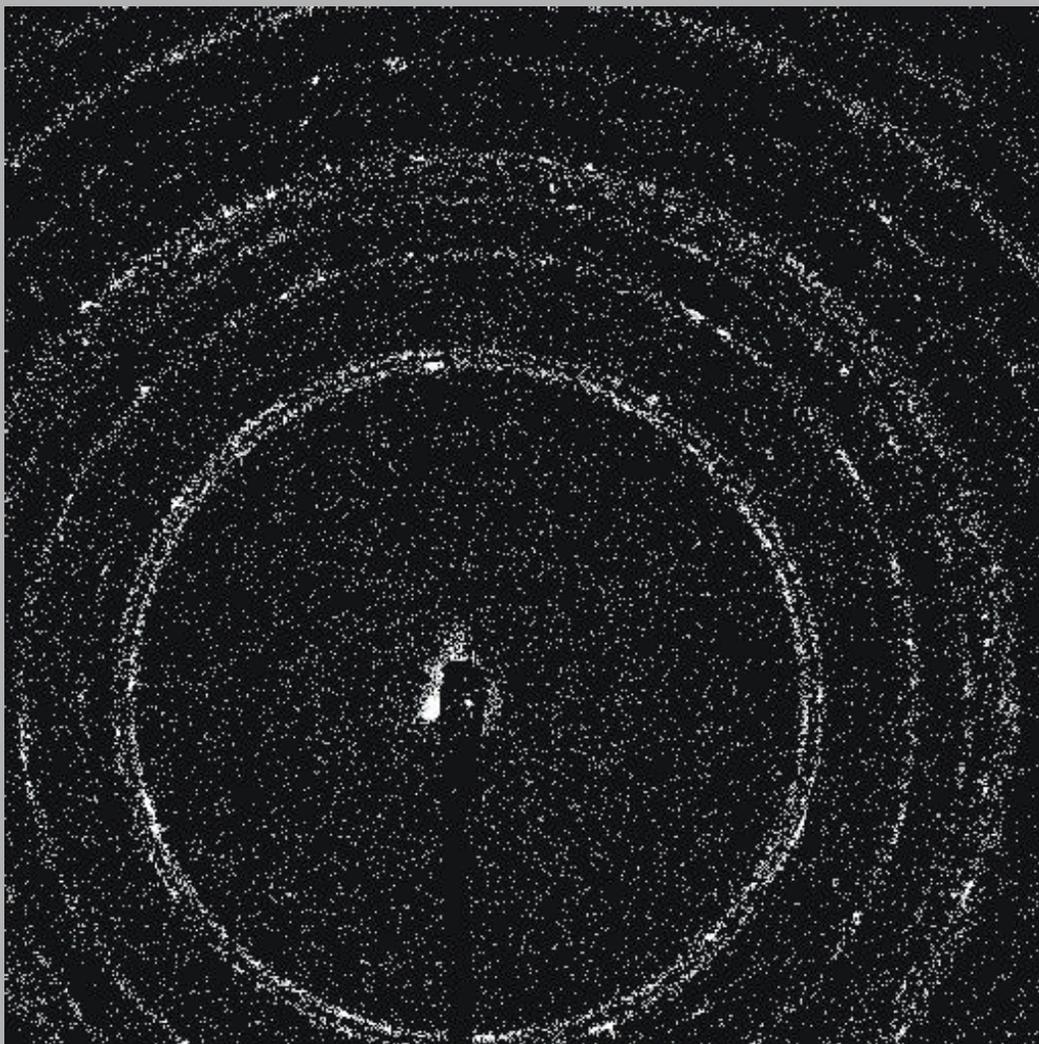


Principle of CHEMIN

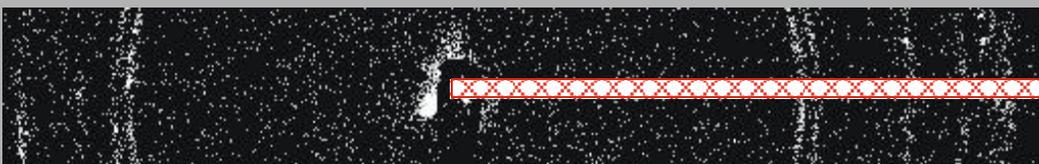
A combined XRD/XRF instrument

- A single detector measures energy, position, and intensity of the X-rays emanating from a sample



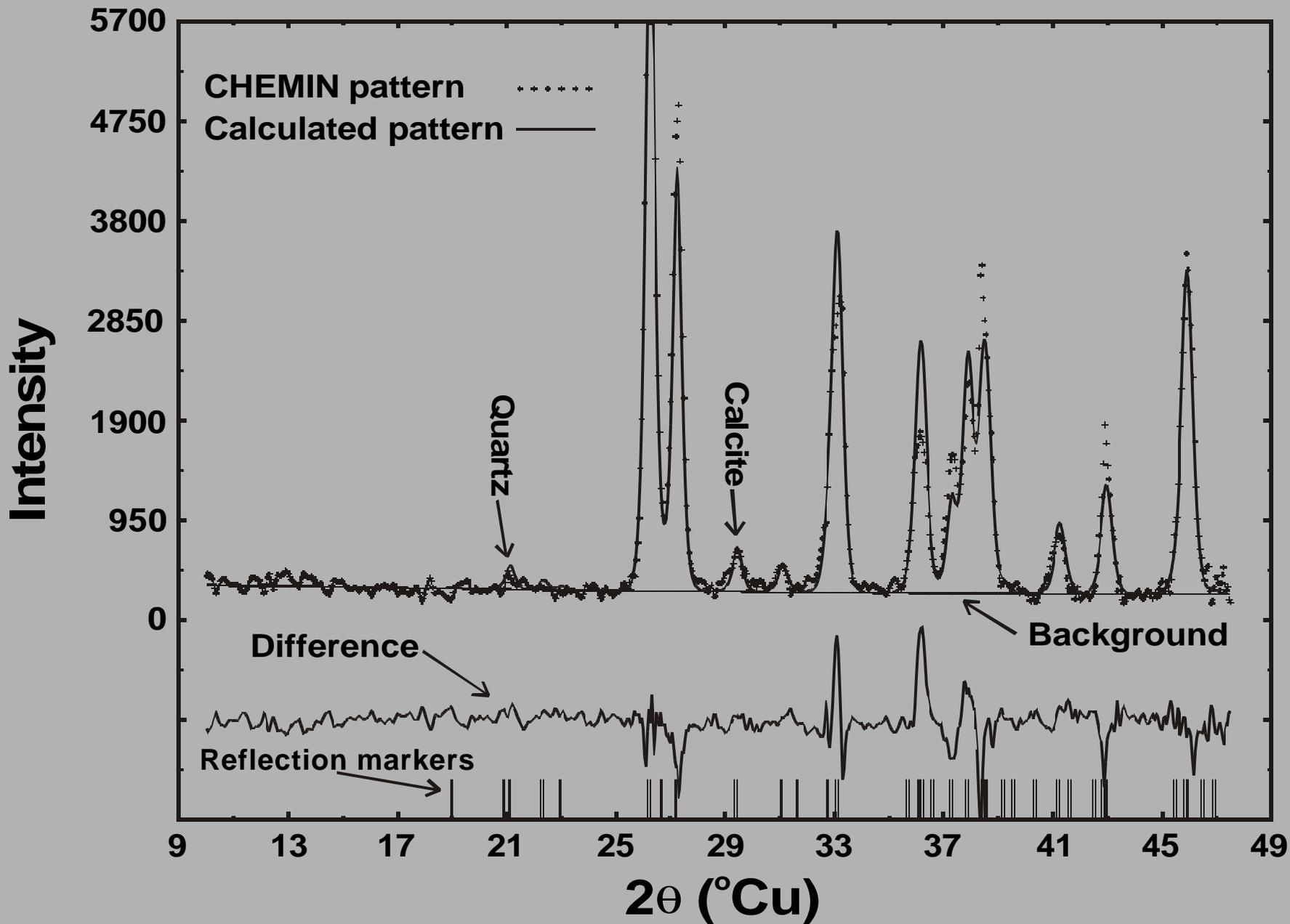


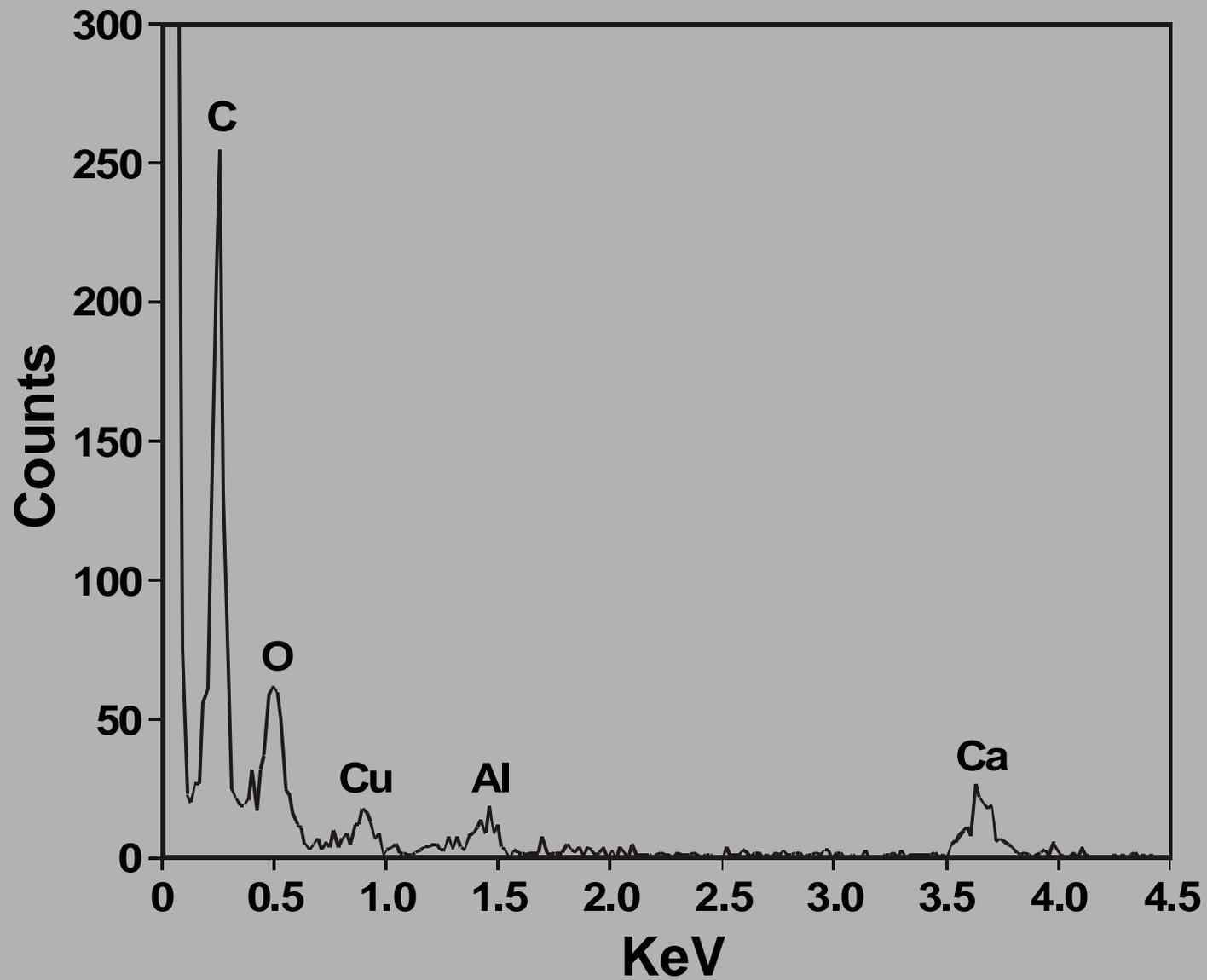
**CHEMIN CCD diffraction image:
spotty Debye ring is integrated
and smoothed by sweeping
around the ring circumference.
This feature allows analysis of
poorly prepared and, often,
unprepared samples.**



**Other diffraction methods
analyze <1% of the Debye ring.**

Aragonite, CHEMIN data





CUBIC-CCD XRF analysis of aragonite

CHEMIN

- **Can simultaneously measure XRD and XRF data (XRF limited by atmosphere)**
- **XRD data augment chemical data, simplify analysis of alteration**
- **Instrument is compact, has few moving parts, low power requirements.**
- **New design can measure XRD data on unprepared surfaces, down-hole or remotely**