• New ideas and R&D strongly needed for:
  Light extraction and detection
  Robust and modular imaging devices
  Atomic modeling tools

• Independent/alternate measurements of critical parameters essential

• Basic ITER diagnostics (CXRS, MSE, magnetics) prone to large uncertainties (first mirror, calibration, and SNR issues)

• SXR-VUV imaging spectroscopy can provide
  \( N_z, Z_{\text{eff}}, T_e \), plasma shape & position, current profile constraint
• *Transmissive-diffractive* elements (tungsten grids) could avoid reflectivity degradation encountered with mirrors
• Approach might be scalable to longer wavelengths
Light detection

- ‘Optical arrays’ of **converter / hollow wave guides** may enable wide angle SXR-VUV measurements
- Imaging designs possible with such extraction/detection techniques

Sawtooth crash measured in CDX-U with optical vs. conventional detector
Modeling tools

- Prediction of instrument specific spectral patterns essential
- Develop HULLAC database for low to high-Z elements in ITER