

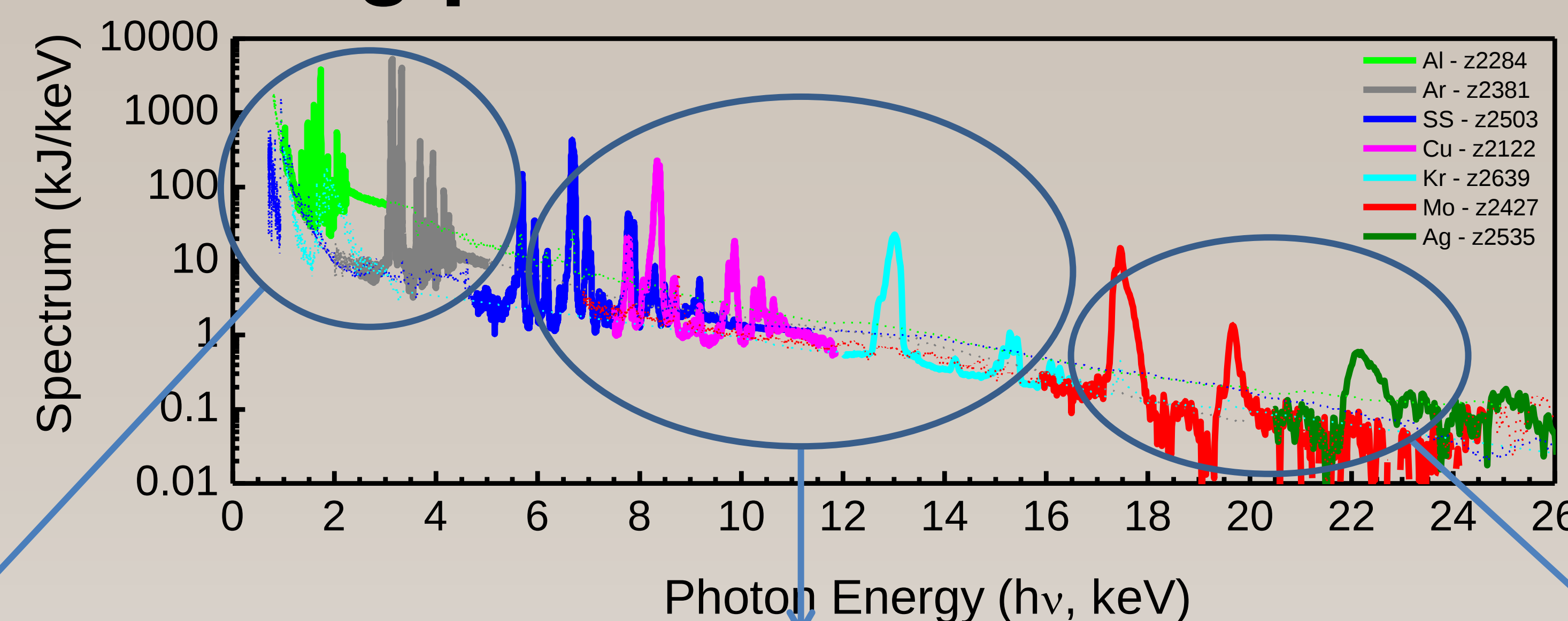
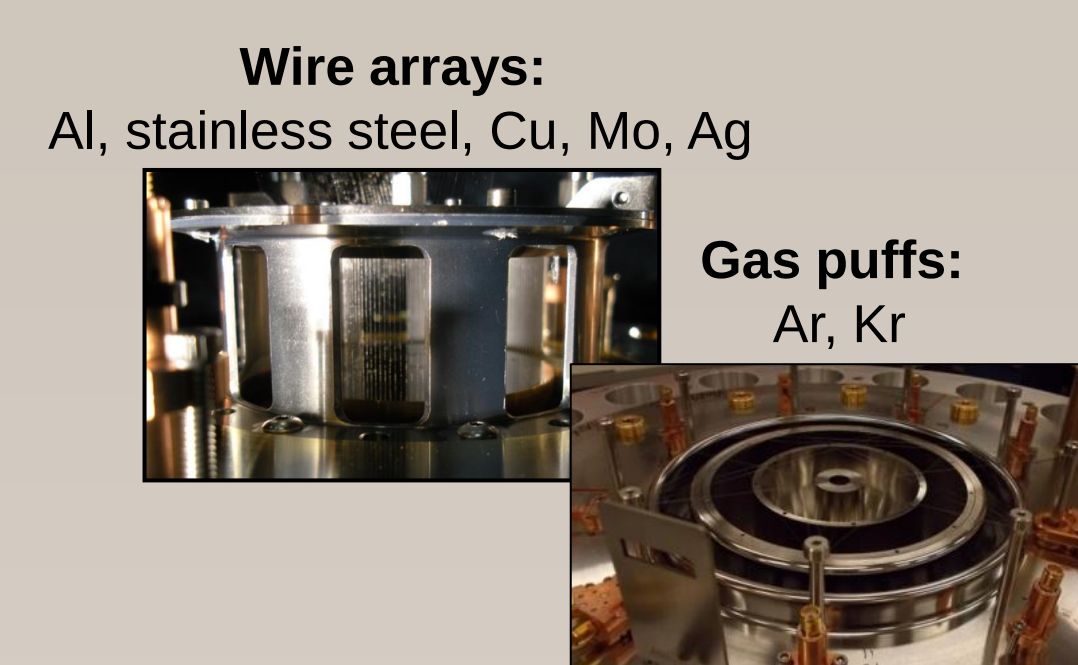
Exceptional service in the national interest



Development and characterization of multi-keV x-ray sources on Z

D.J. Ampleford, C.A. Jennings, S.B. Hansen, B. Jones, A.J. Harvey-Thompson, D.C. Lamppa, C.A. Coverdale, M. Jobe, A.R. Laspe, T.M. Flanagan, N.W. Moore, V. Harper-Slaboszewicz, T. Webb, E.C. Harding, K. Blesener, D.B. Sinars, M.E. Cuneo, G.A. Rochau

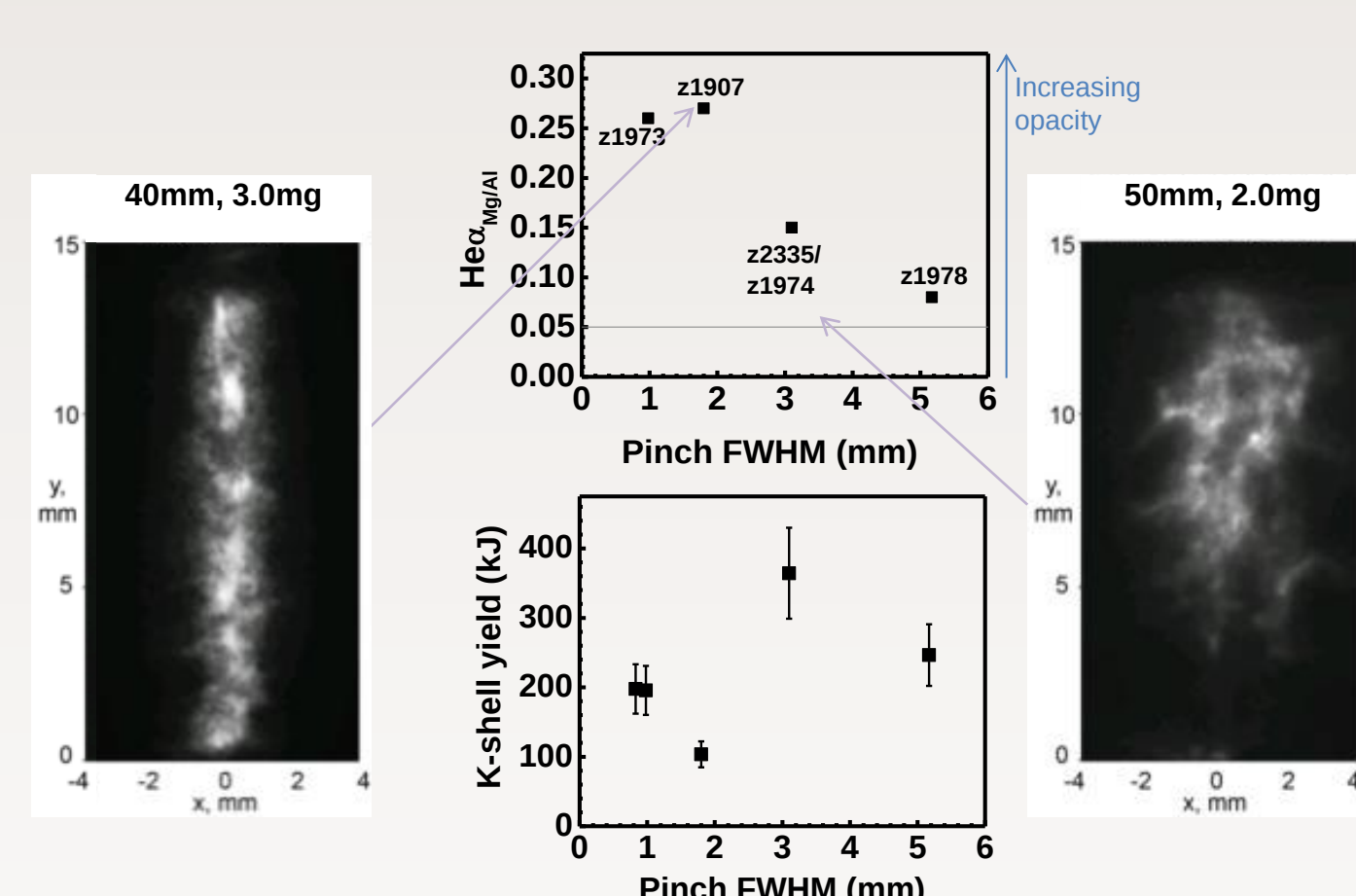
Contrasting processes in 1-25 keV sources¹



- References**
1. D.J. Ampleford et al., Physics of Plasmas (invited) (Accepted 2014)
 2. D.J. Ampleford et al., Physics of Plasmas **21**, 031201 (2014)
 3. B. Jones et al., IEEE Trans. Plasma Science (Accepted 2014)
 4. A.J. Harvey-Thompson et al., invited talk ICOPS (2014)
 5. D.J. Ampleford et al., Physics of Plasmas **20**, 103116 (2013)
 6. C.A. Jennings et al., in preparation
 7. S.B. Hansen et al., Physics of Plasmas **21**, 031202 (2014)
 8. D.J. Ampleford et al., in preparation
 9. D.J. Ampleford et al., HEART conference (2014)
 10. V. Harper-Slaboszewicz et al., HEART conference (2014)

1-5 keV: Opacity plays a major role

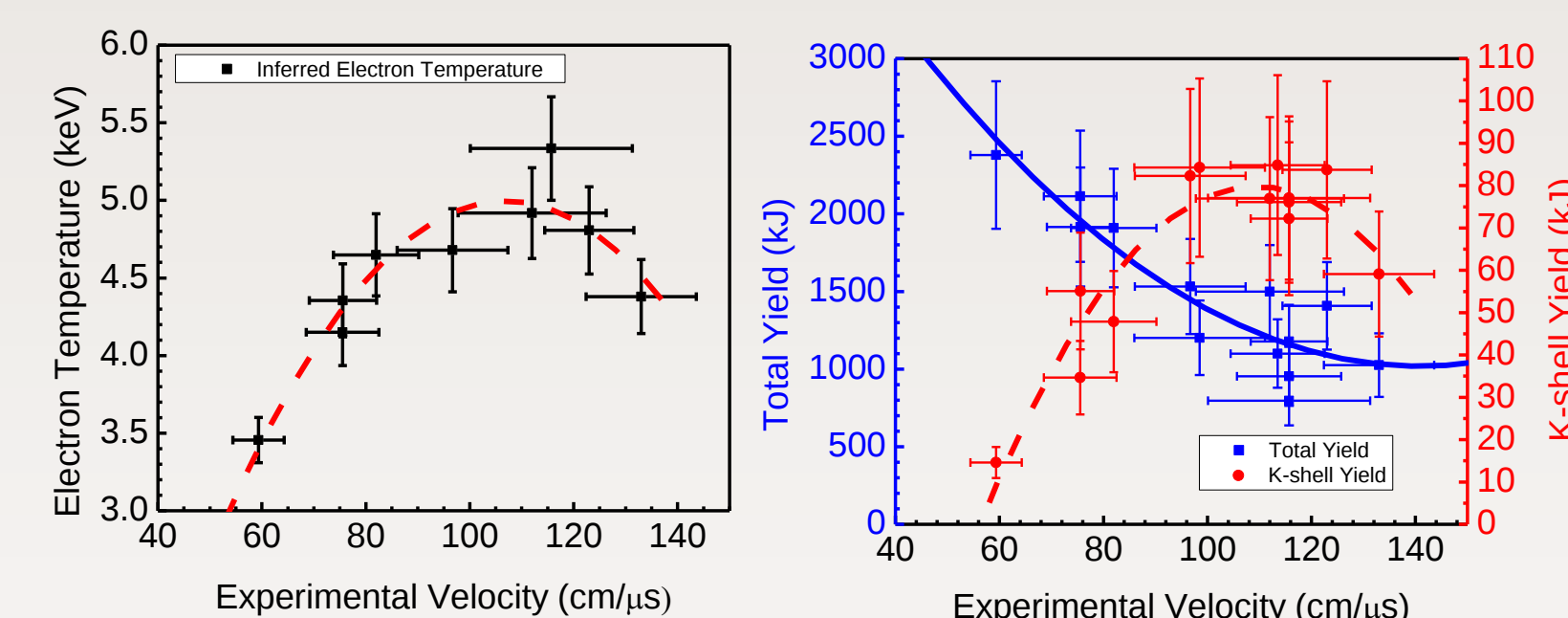
- For low atomic number materials Z is very efficient at ionizing to the K-shell
- Data for Al indicates that pinch size and structure changes effective opacity²



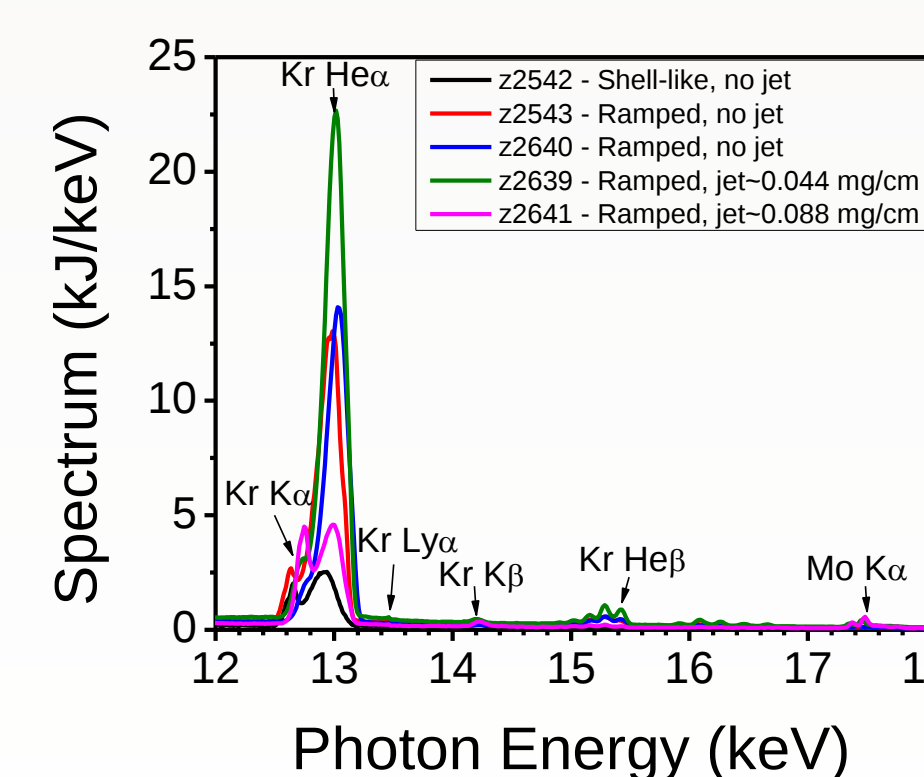
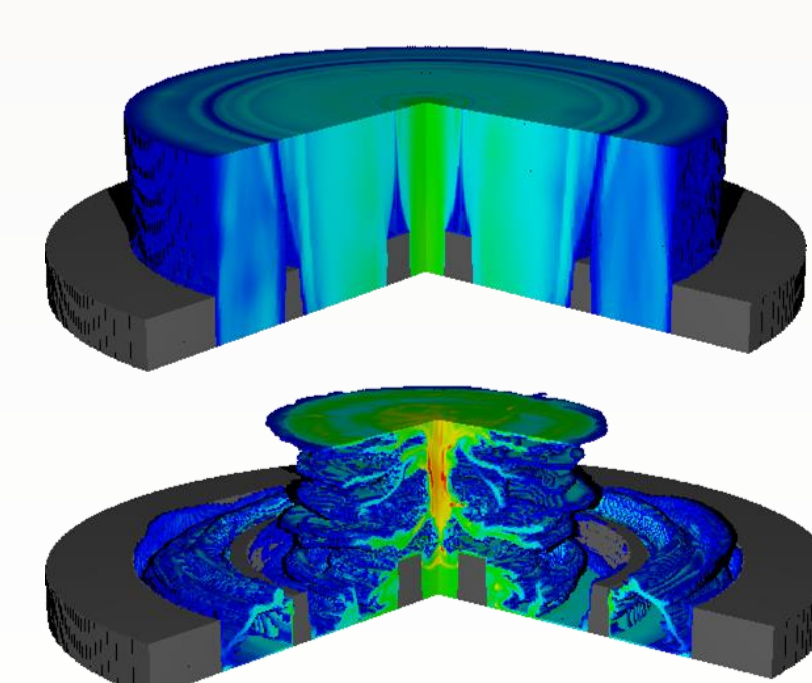
- Compact uniform pinch has high opacity
- Diffuse structured pinch has lower opacity and emits much higher yields
- Similar effects may be present in Ar gas puffs^{3,4}

5-15 keV: High velocity is critical

- For moderate atomic number, pinch needs to achieve high temperature to emit efficiently
- For stainless steel find temperature and yield peak for 110 cm/μs implosions⁵

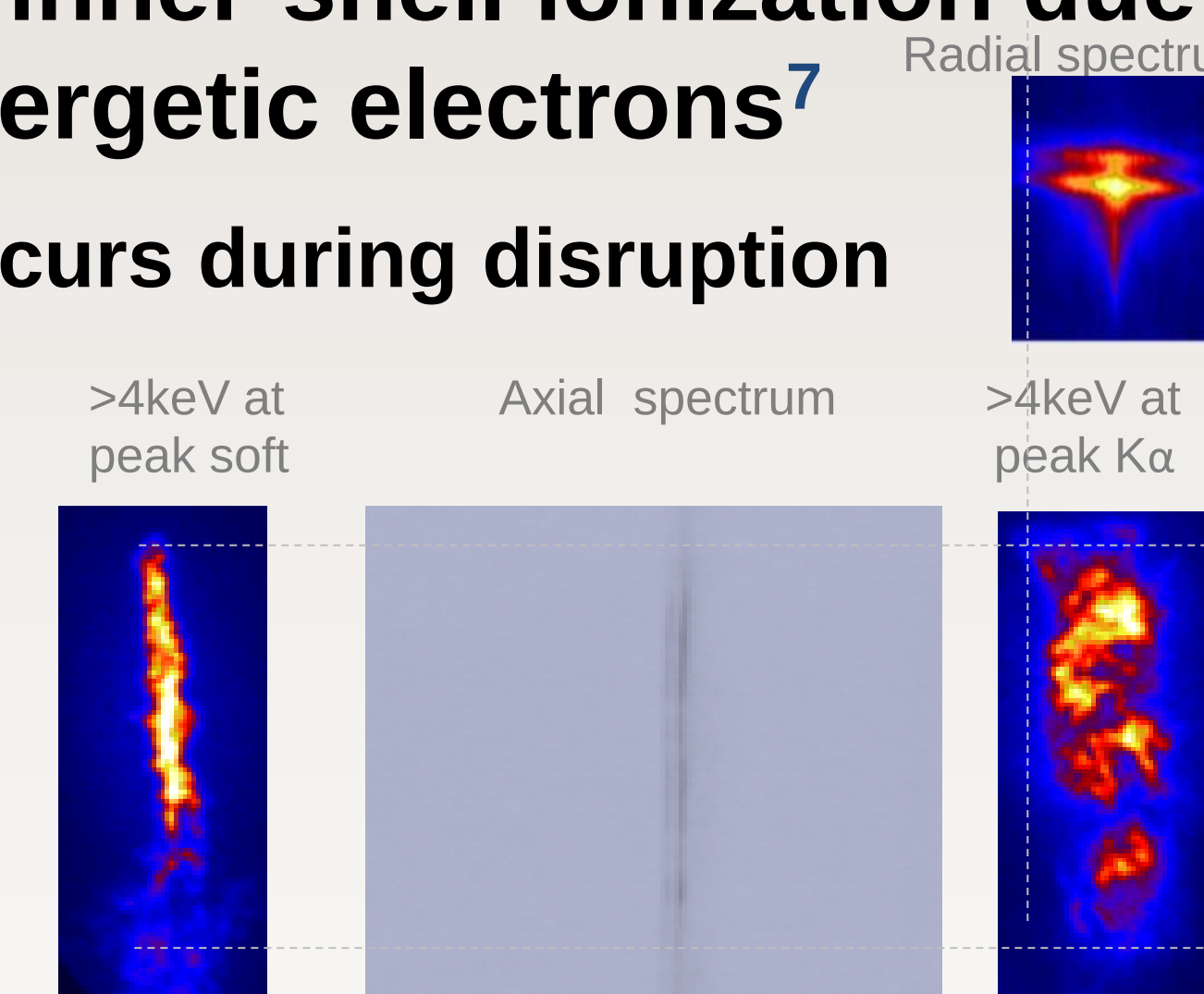


- Experiments have begun to optimize 13-keV Kr emission
 - Tailored density profiles enhance pinch stability⁶

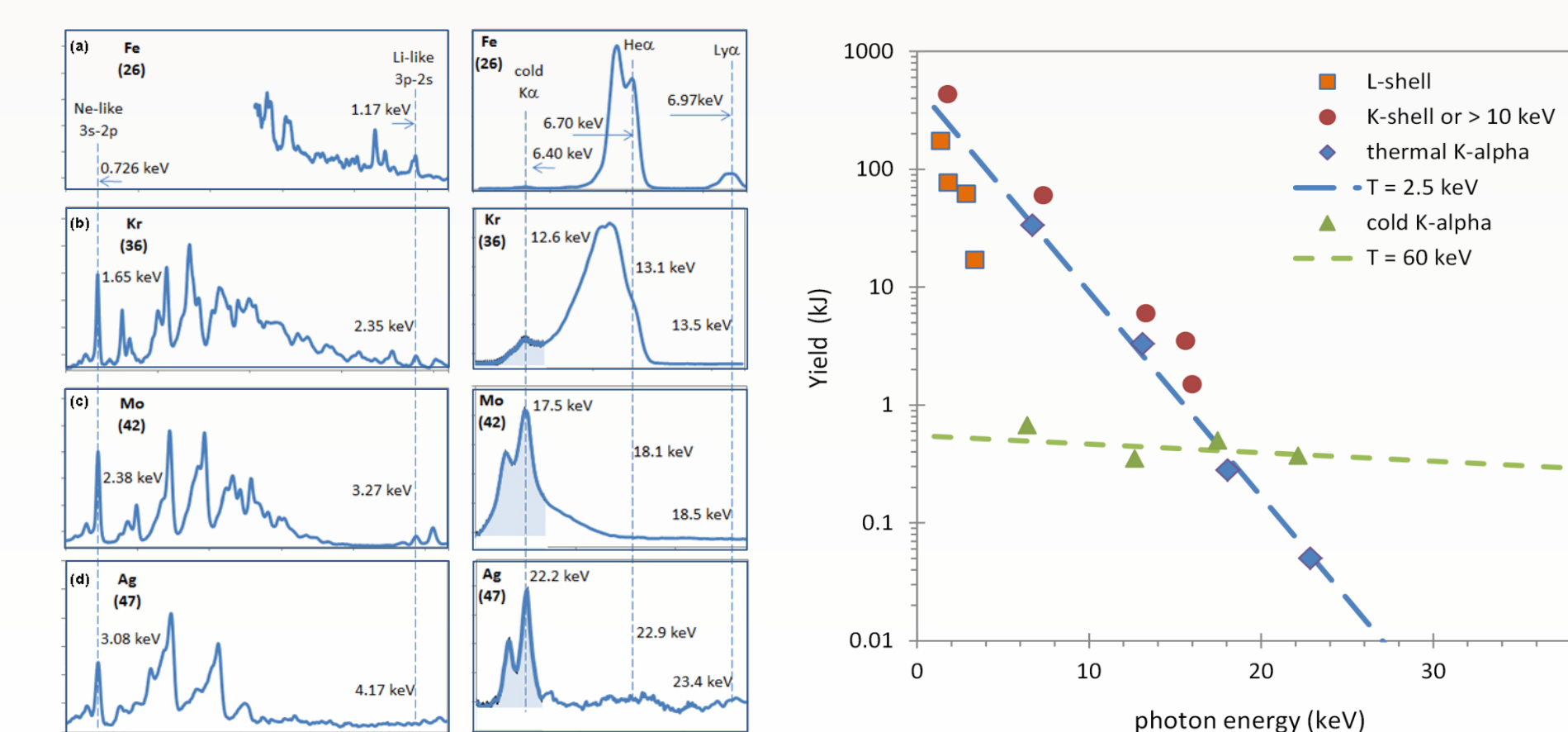


>15 keV: Kα due to energetic electrons

- For >15 keV, velocities for efficient K-shell emission are impractical (~2000 km/s)
- Mo & Ag pinches emit Kα lines from inner-shell ionization due to energetic electrons⁷
 - Occurs during disruption

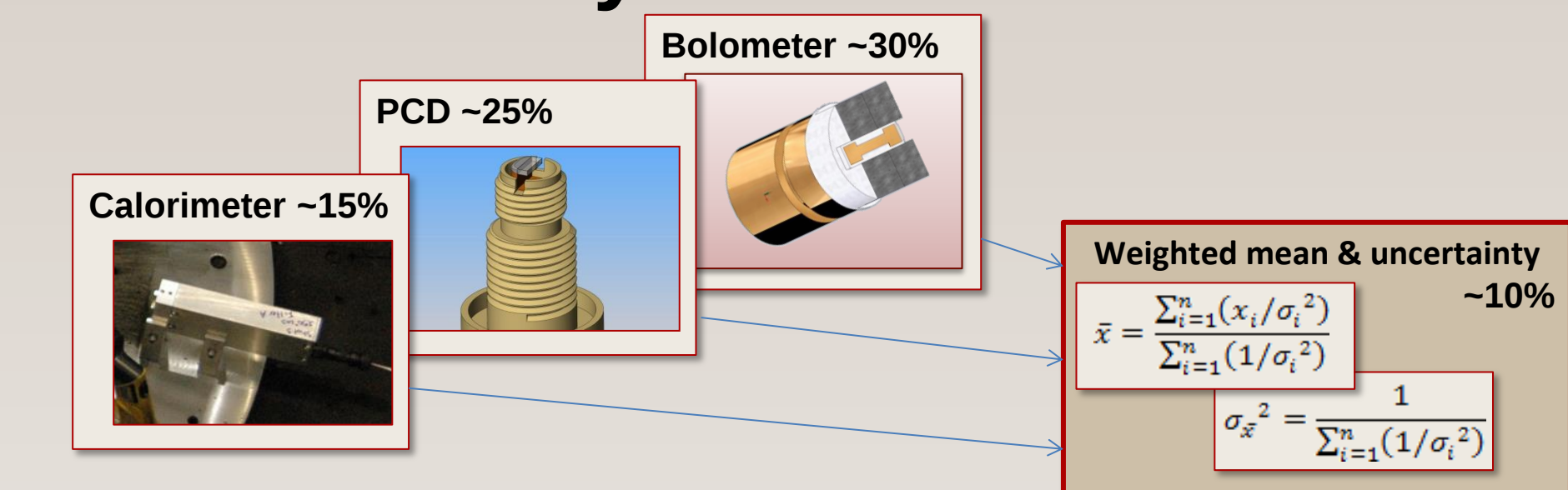


- Modeling and data indicate Kα emission scales favorably to higher photon energies⁸

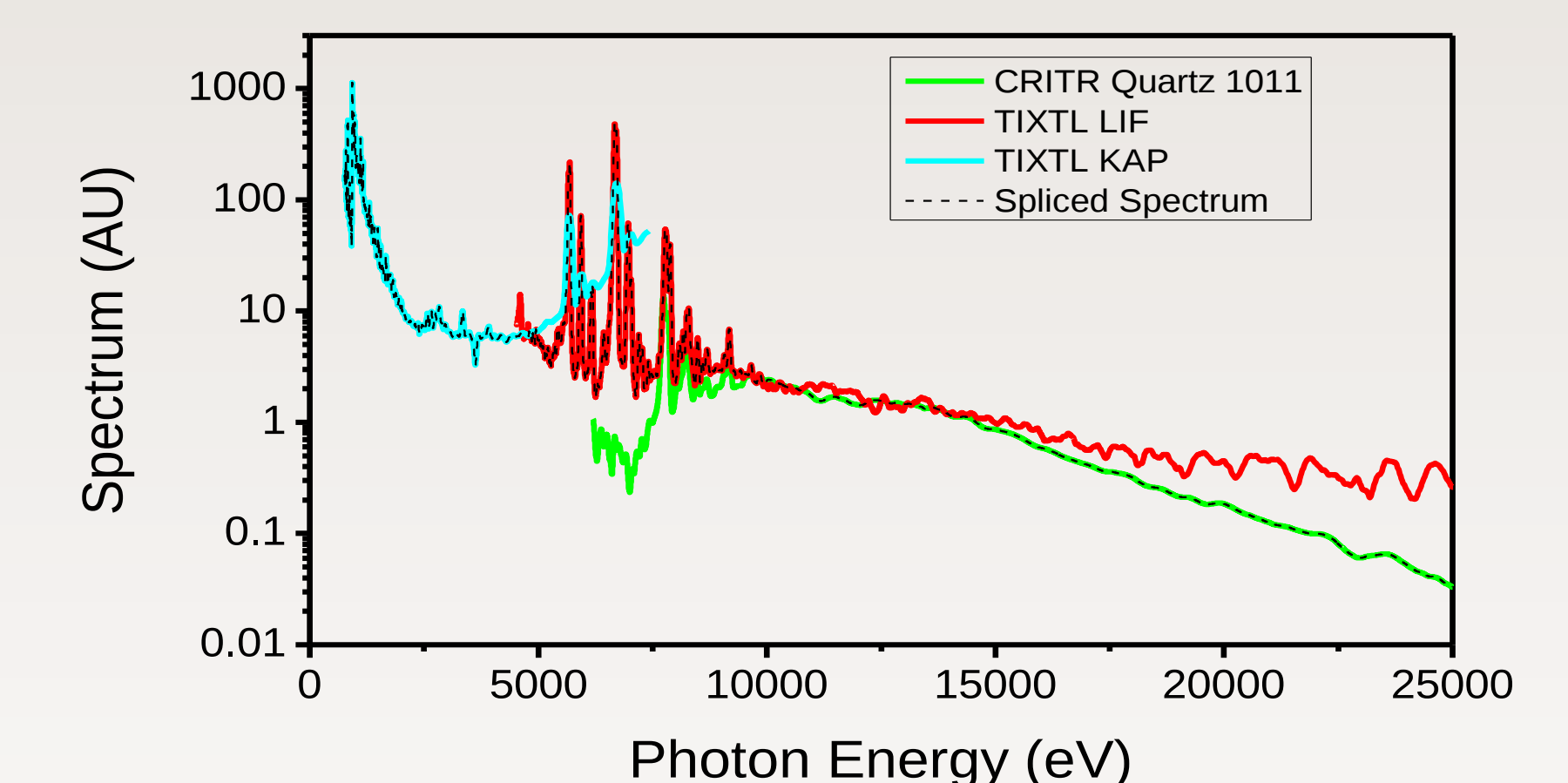


Progress in source characterization⁹

- Recently considerable effort has been placed on improved characterization of K-shell sources⁹
 - Combined efforts of Z RES program, Non-thermal LDRD and Grand-Challenge LDRD
- By combining multiple yield diagnostics we can determine yields to ~10% accuracy⁹



- By combining multiple crystal spectrometers we can measure spectra continuously from 1-25 keV^{2,9}



- By combining multiple diagnostic platforms we can assess the spectrum from 100 eV – 1 MeV^{9,10}

