Canadian National Calibration Reference Centre for Bioassay and *In Vivo* Monitoring

Human Monitoring Laboratory

www.hc-sc.gc.ca/ncrc

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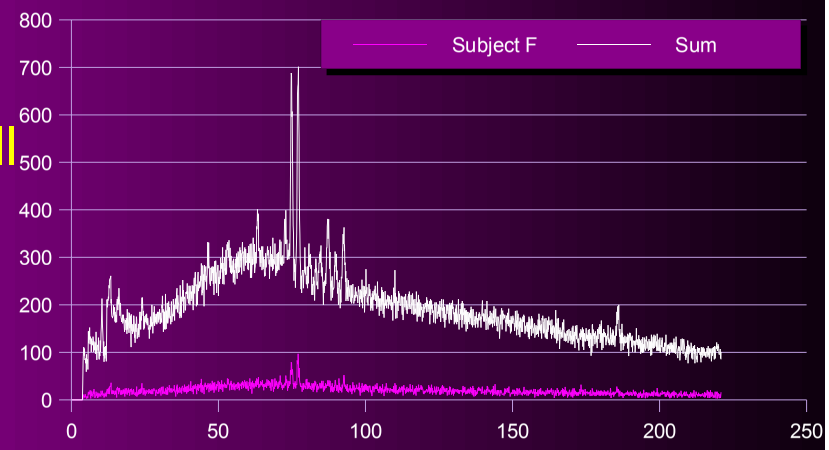
THE Minimum Detectable Activity

- how low can you get?

- **This work was inspired by:**
  - New dose limits (100 mSv per 5-year-period)
  - Need to measure uranium *In Vivo*
  - 4 mg in lung = 20 mSv.
  - Lung Burden can be reduced by external radiation dose.
- **One technique developed that has reduced the MDA**
  - Summed Spectra

SUMMING

- **Count one person repetitively using HpGe and add spectra.**
- **Count a group of people using HpGe and add spectra.**
  - Assumes that all have the same likelihood of intake.
  - Estimate average dose and assign to all group members.
  - The regulator has approved this methodology.



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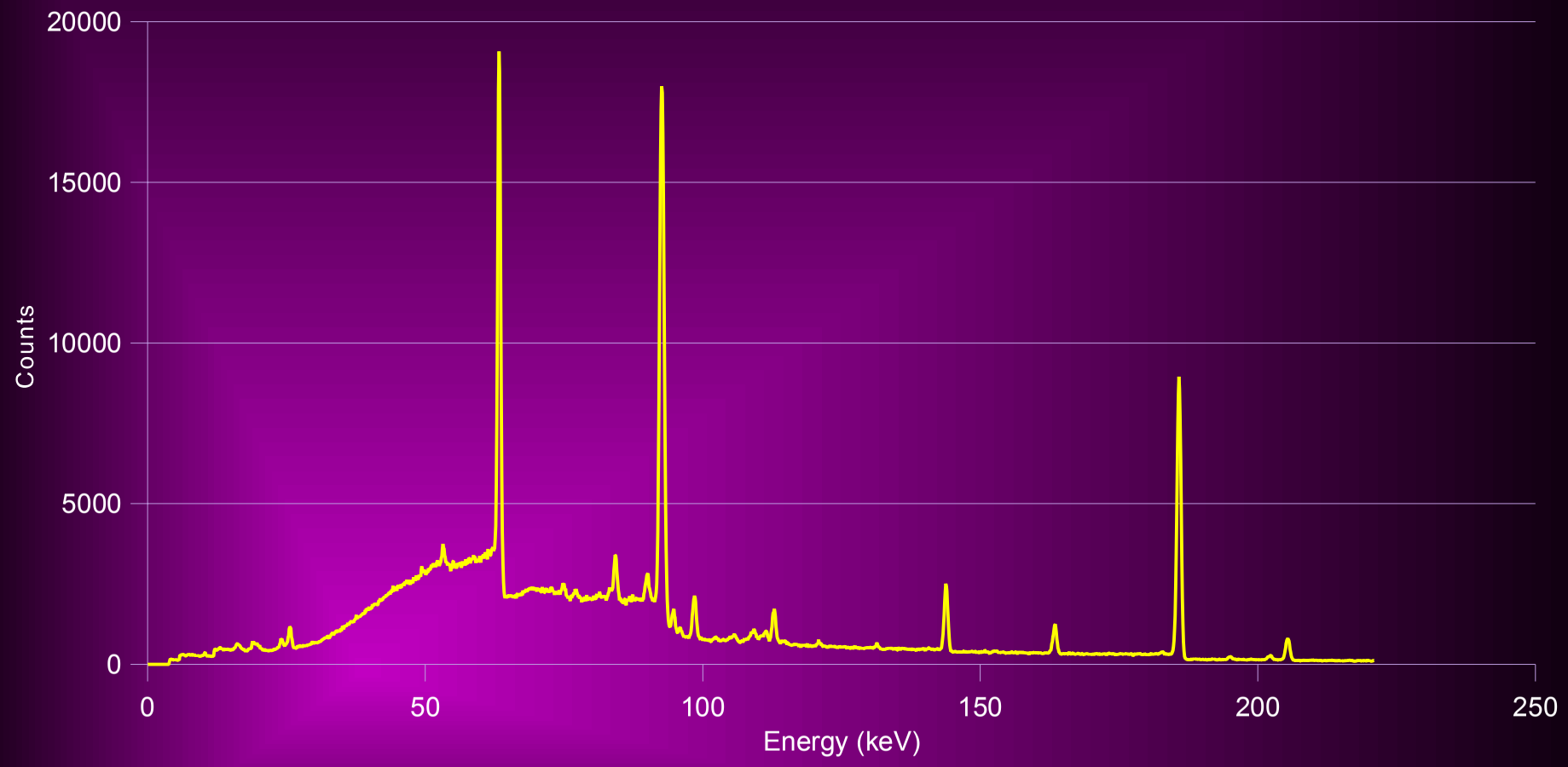
WhatisNowPossible?

	Required counting time (hours)			
CWT (cm)	1 mg	2 mg	3 mg	4 mg
1.5	21.4	5.3	2.4	1.3
2.0	29.8	7.4	3.3	1.9
2.5	41.5	10.4	4.6	2.6
3.0	57.7	14.4	6.4	3.6
3.5	80.4	20.1	8.9	5.0
4.0	112.0	28.0	12.4	7.0
4.5	155.9	39.0	17.3	9.8
5.0	217.2	54.3	24.1	13.6
5.5	302.4	75.6	33.6	18.9
6.0	421.1	105.3	46.8	26.3
6.5	586.5	146.6	65.2	36.7
7.0	816.7	204.2	90.8	51.1

NaturalURANIUM



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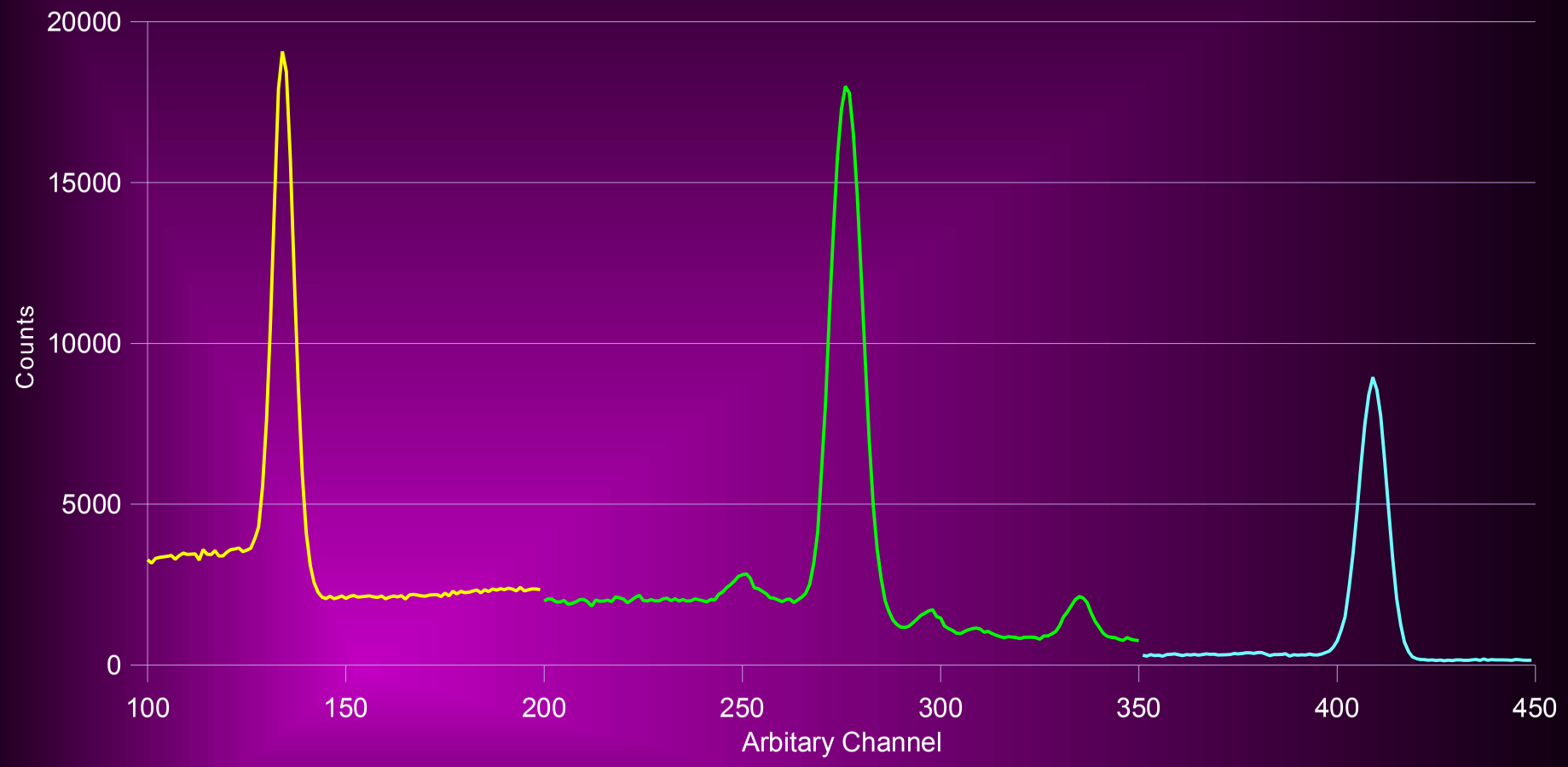
NaturalURANIUM



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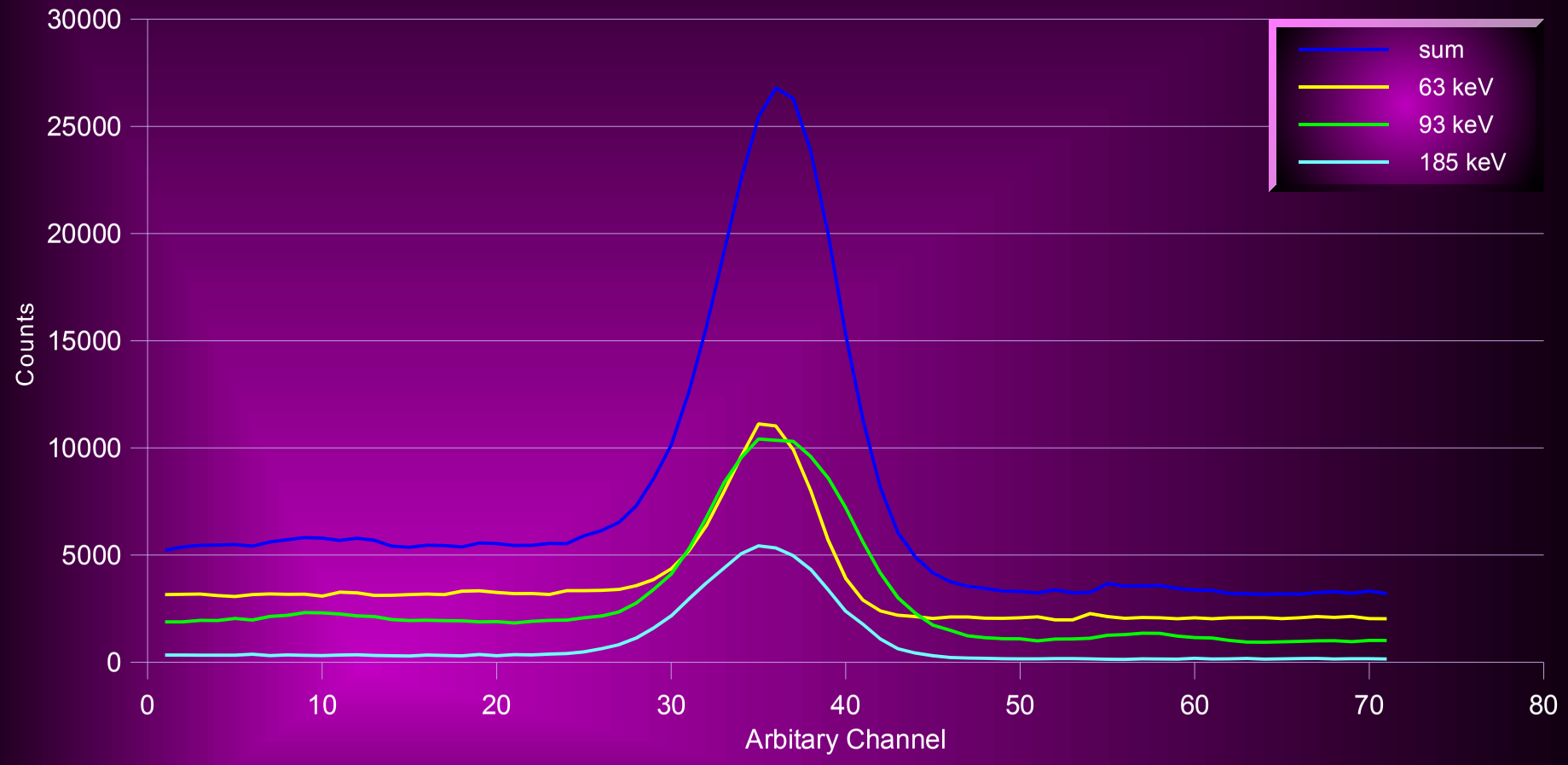
NaturalURANIUM



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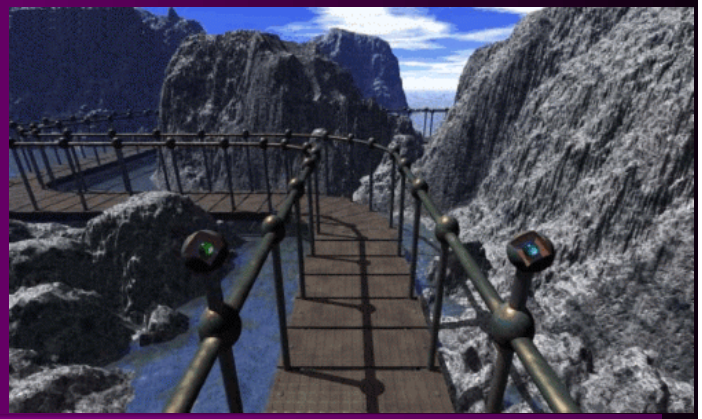
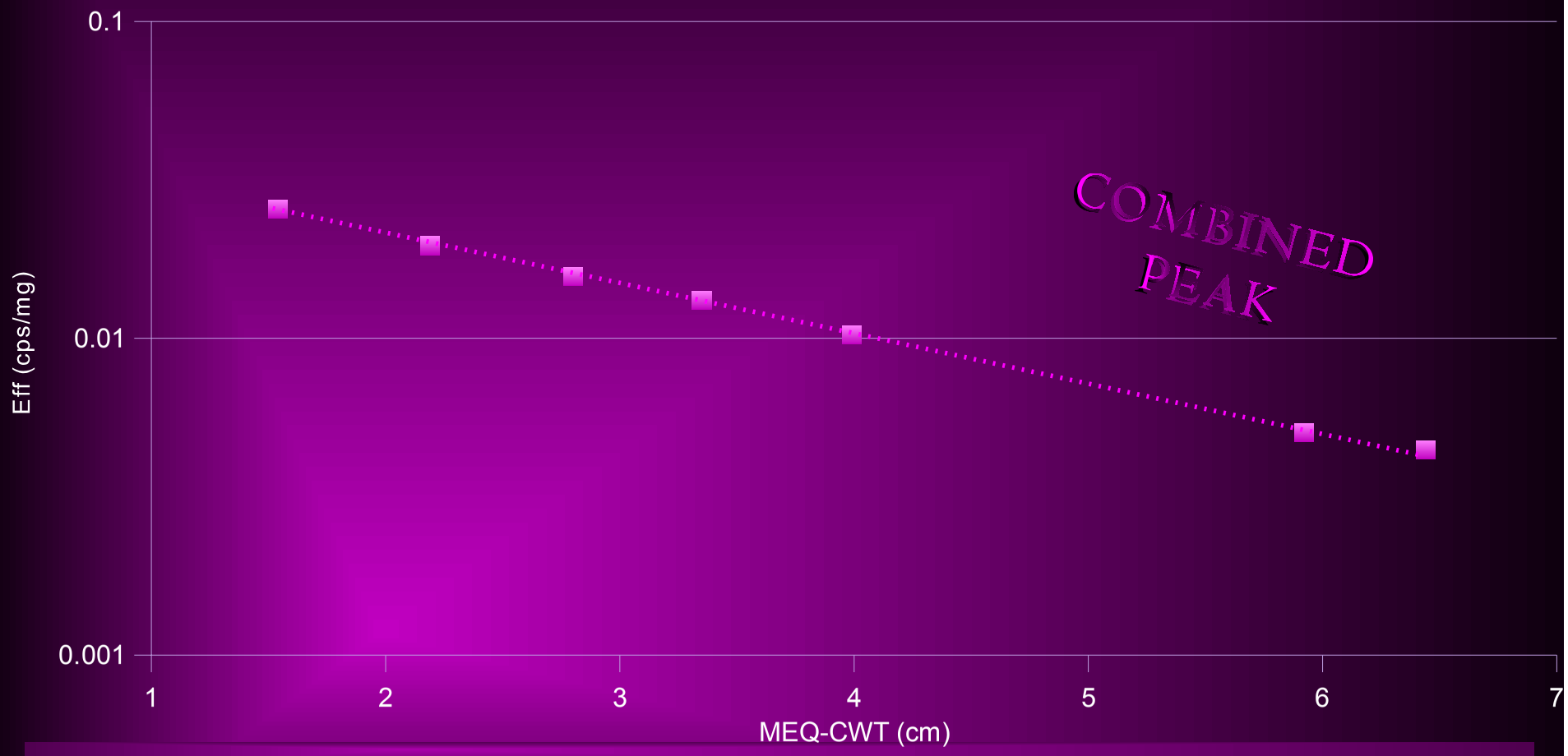
EXPERIMENTAL

- Measure U-nat in LLNL phantom with OVP's
  - OVP1 - OVP6
- Manipulate spectra to create sum**peak**
- Calcluate effciency for sum**peak**
- Measure human backgrounds
- Calculate MDA for sum**peak**
- Compare



thEFFICIENCY



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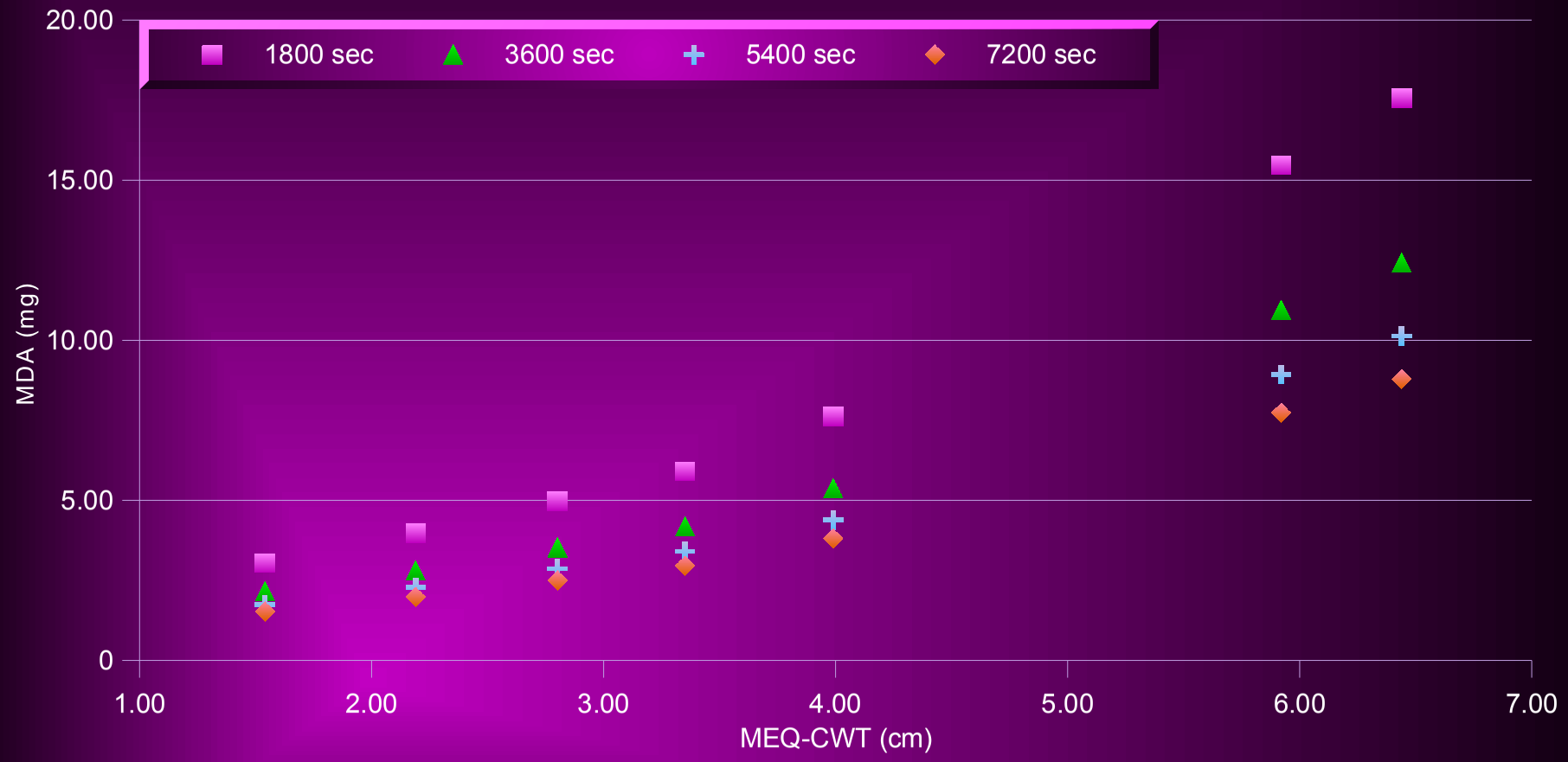
HowLowCanWeGoNow?



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What'sTHEimprovement?

MEQ-CWT (cm)	63 (keV)	185 (keV)
1.54	1.6	2.2
2.19	1.7	2.1
2.80	1.7	2.1
2.35	1.7	2.1
3.99	1.8	2.0
5.92	1.9	1.9
6.44	2.0	1.9

CONCLUSI☻NS

The SUM method

clearly

improves sensitivity.

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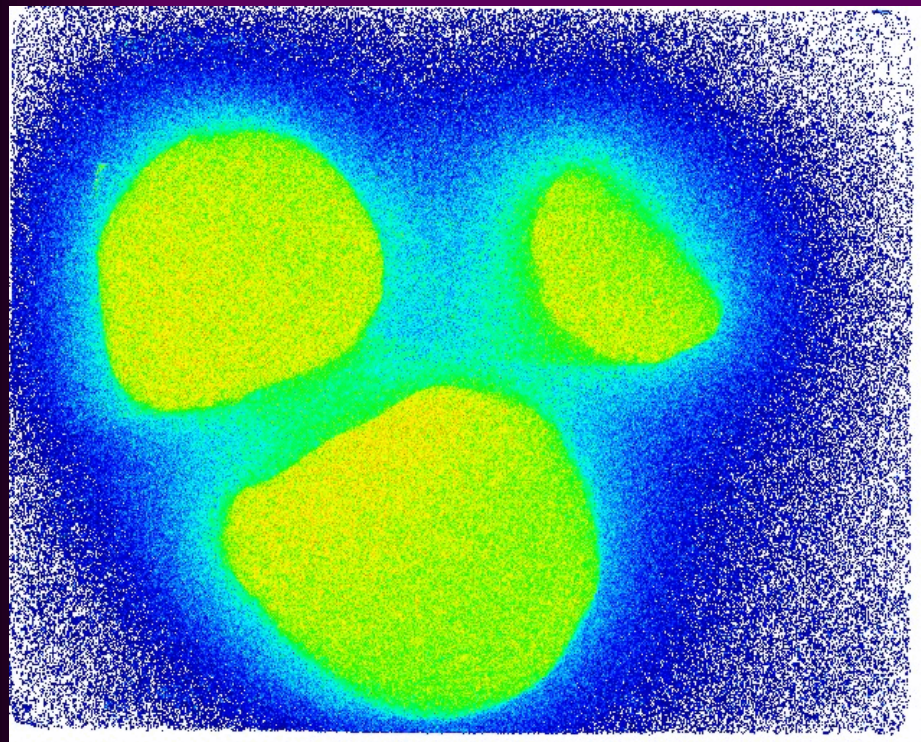
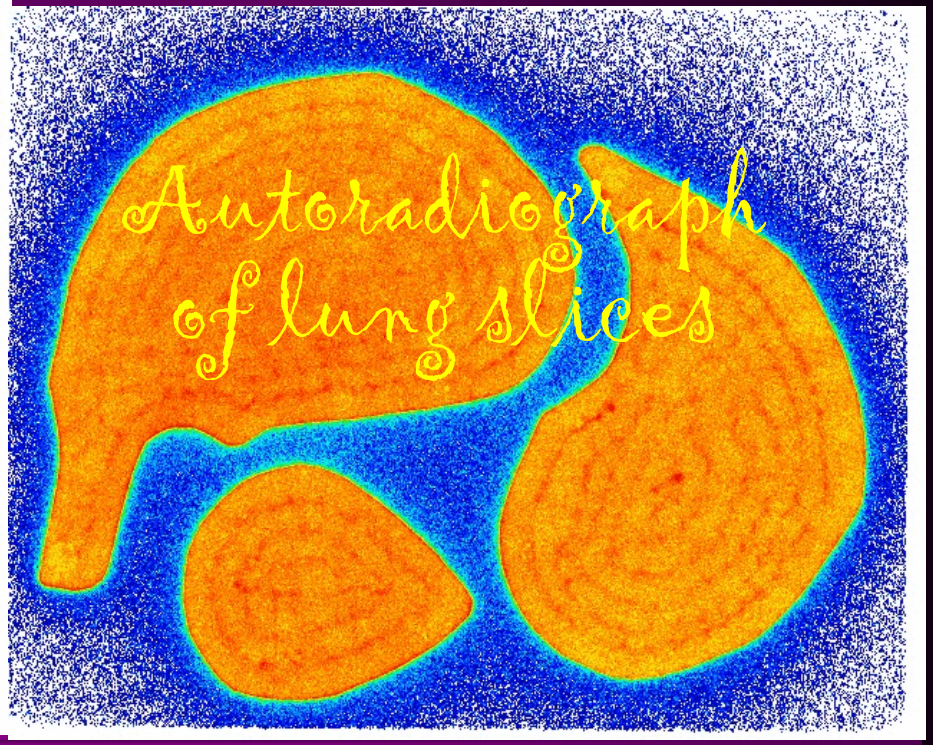
and,
now for
something
completely
different!

audiencePARTICIPATION





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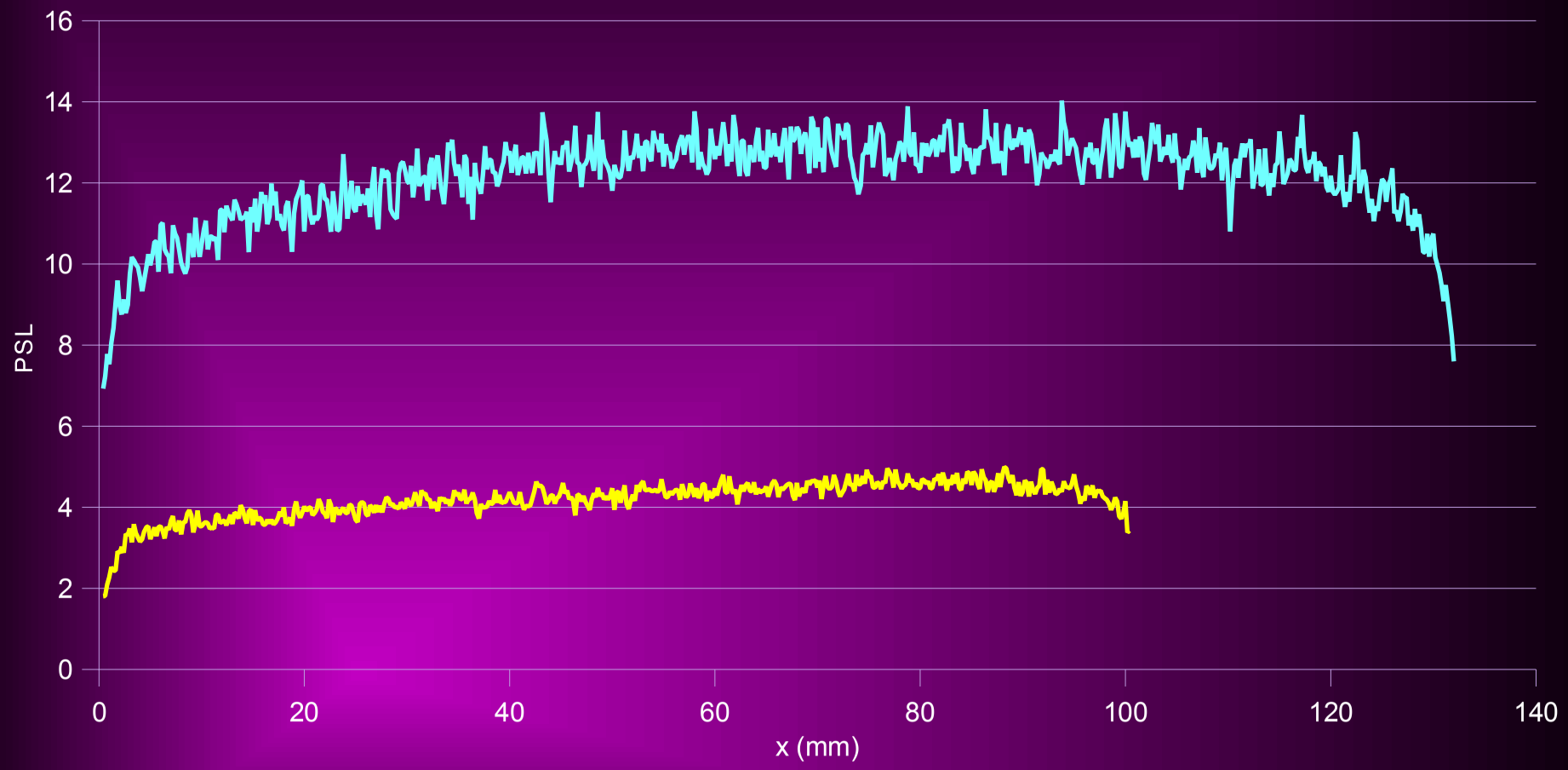
HOMOprofiles



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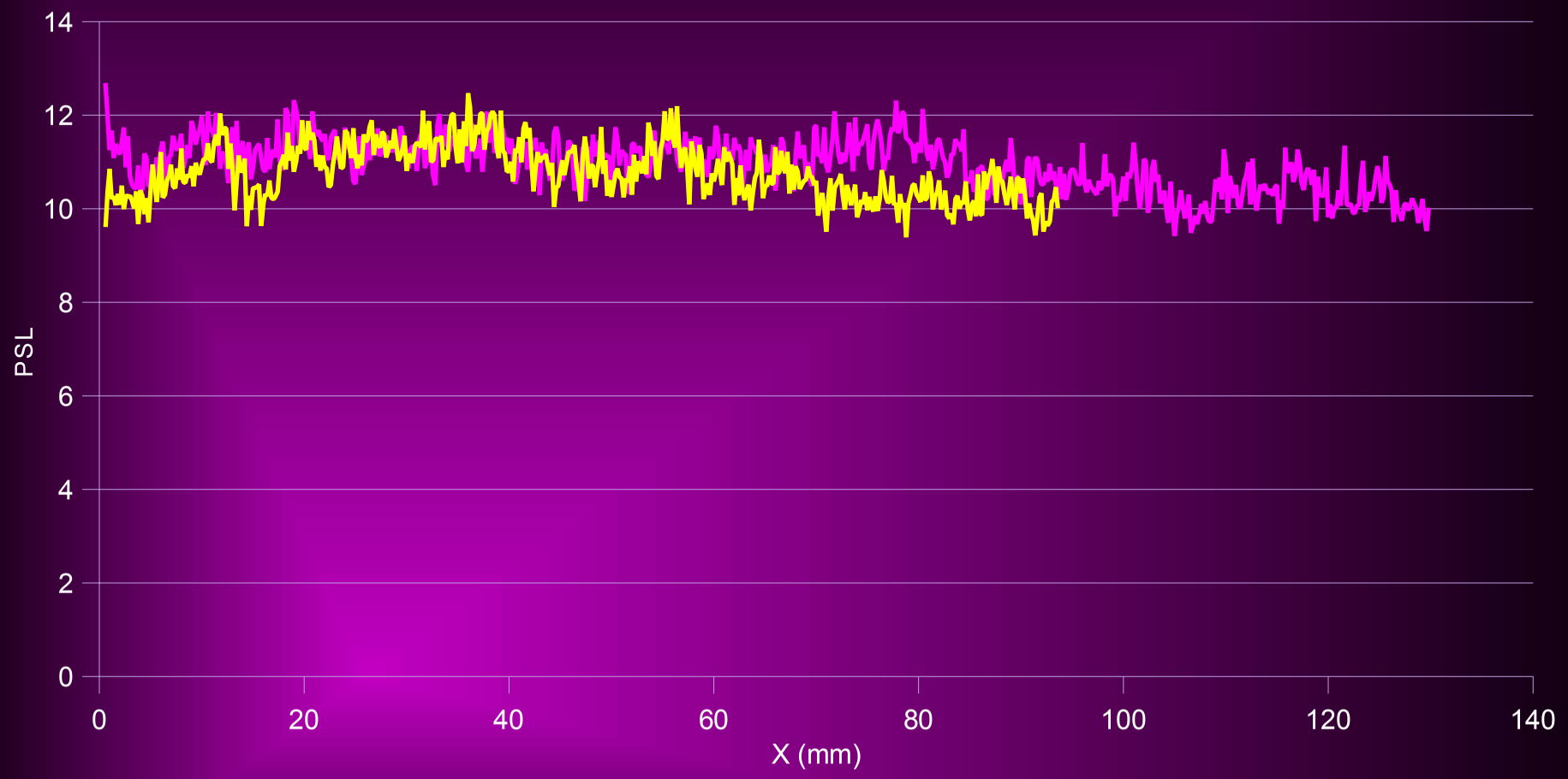
SLICEDprofiles



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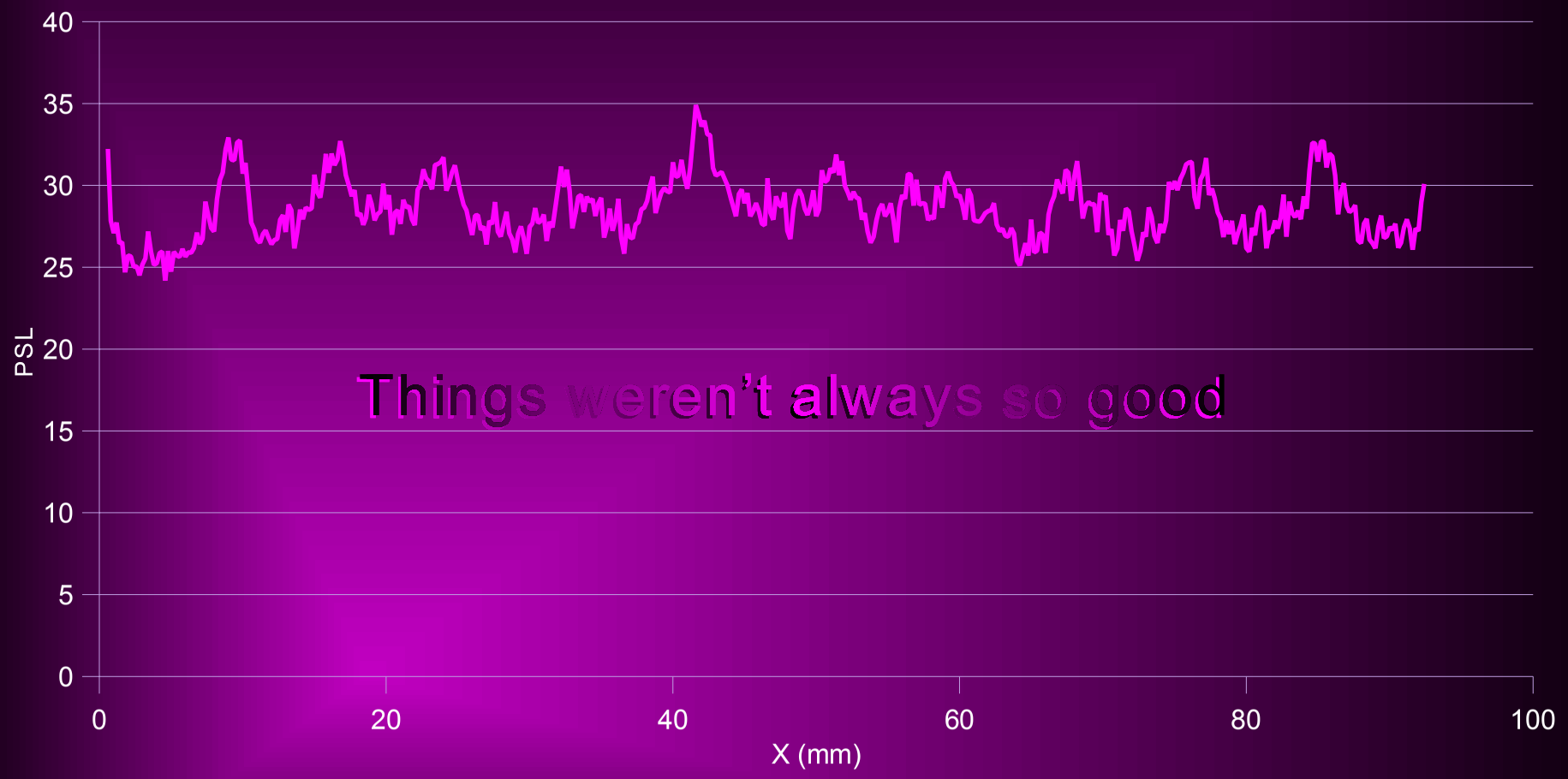

Things weren't always so good

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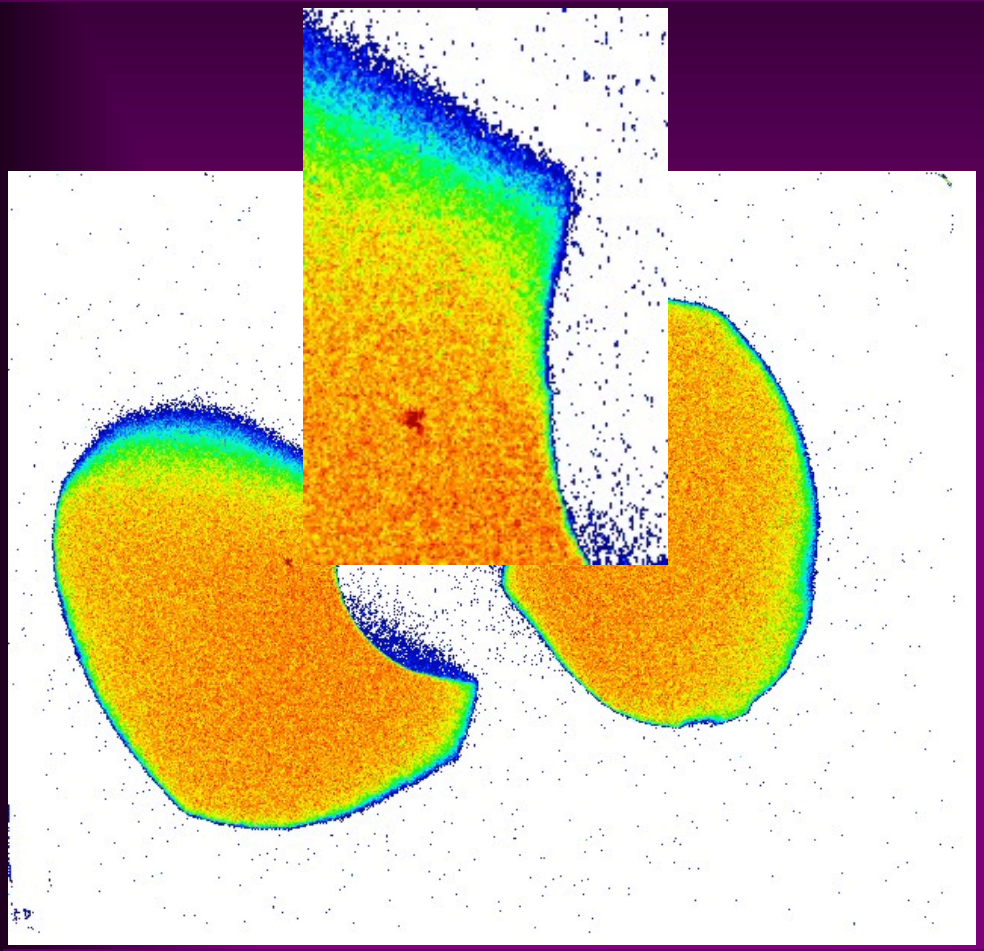
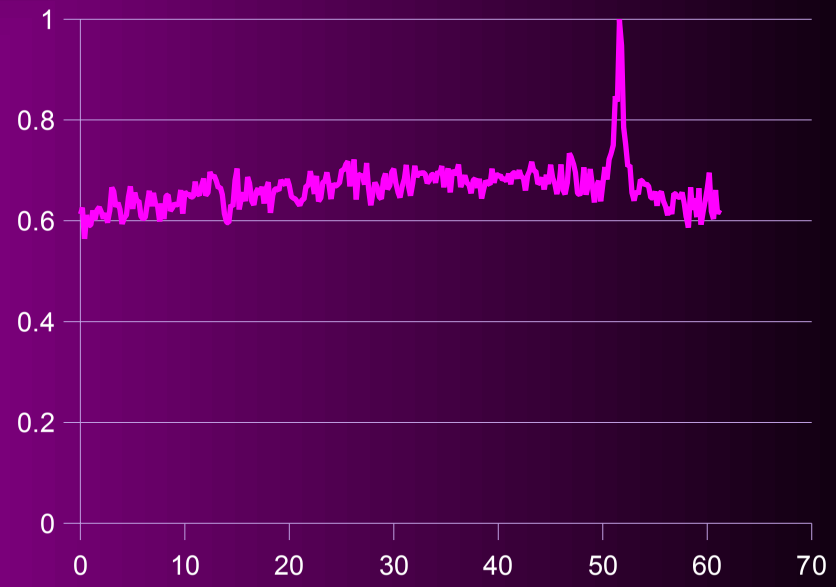
GoodNewsORBAD?



- There's a hot spot!



FUTUREwork

- **Finish:**
  - Generating the profiles
  - Comparing the profiles
    - **T-test on normalised data**
    - **Consult with statistician**
  - Write it up!

THE

END

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