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# Dynamic Radiation Source : Initial results

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Slide 1



# Introduction

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## ■ Problem:

- Evaluation of CAM heads (sensitivity, time-to-alarm)
  - Currently dependent on radioactive aerosols
  - Time intensive, expensive and requires specialized facility

## ■ Solution:

- Dynamic Radiation Source (DRS)
  - Mimics the challenge of plutonium aerosol detection

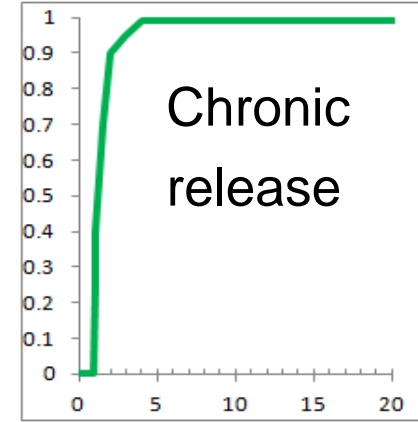
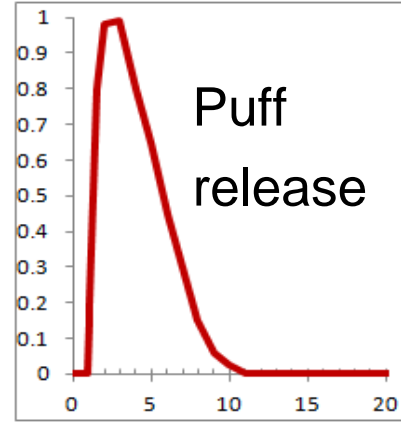
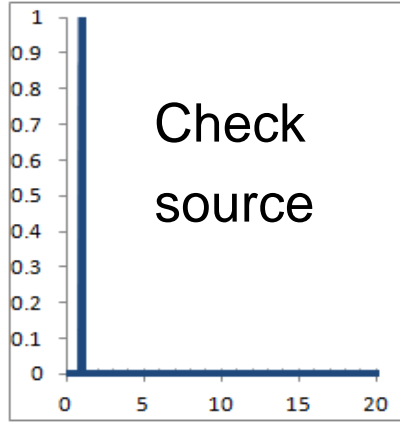
## Introduction: Advantages of DRS

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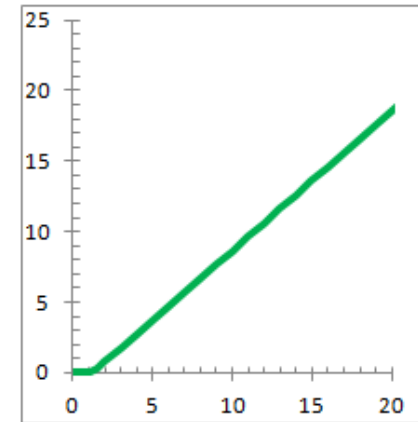
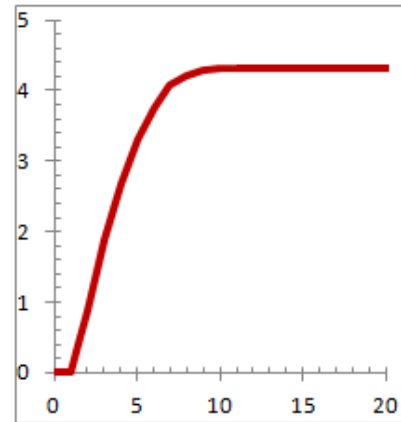
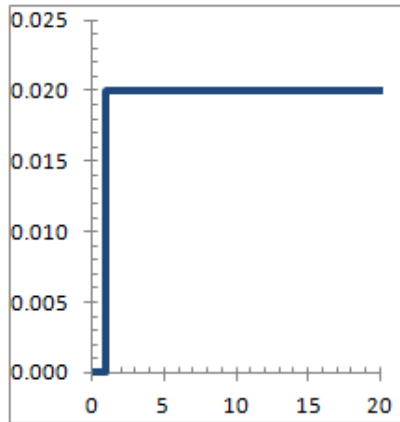
- Provides non-specialized in-house testing
- Low cost (~2K) versus ~10K per aerosol test
- Multiple test scenarios with various CAMs
- Reproducibility
- Supports iterative development of CAM analysis algorithms
- No contamination issues

# Introduction: Release scenarios

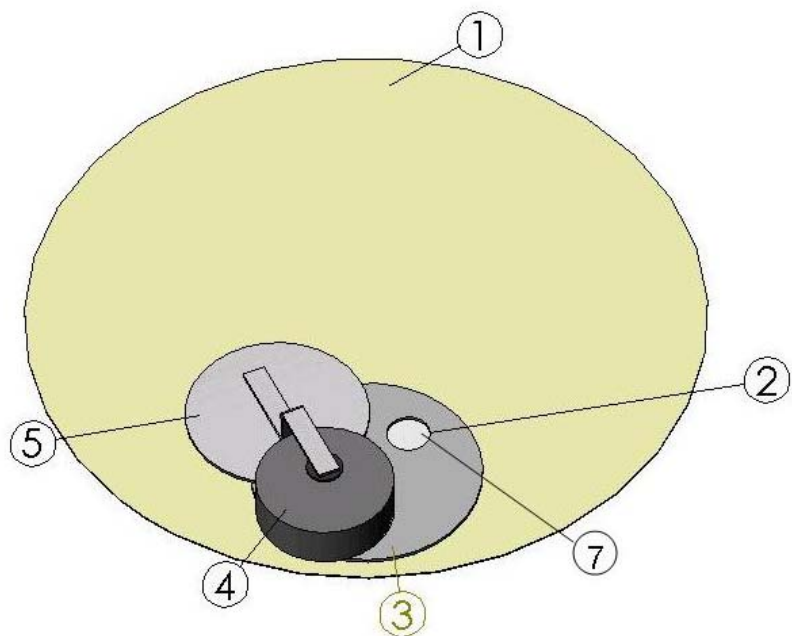
Concentration



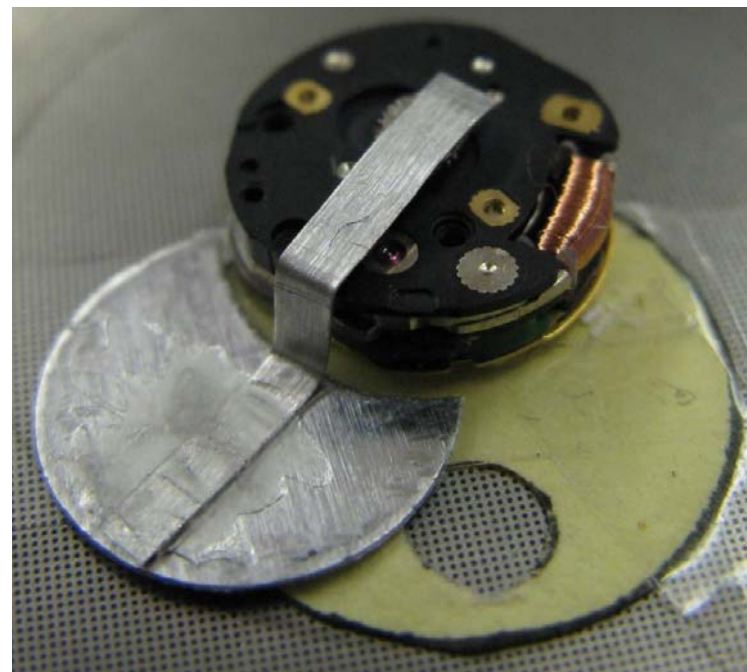
Activity



# Introduction: DRS proof-of-principle device

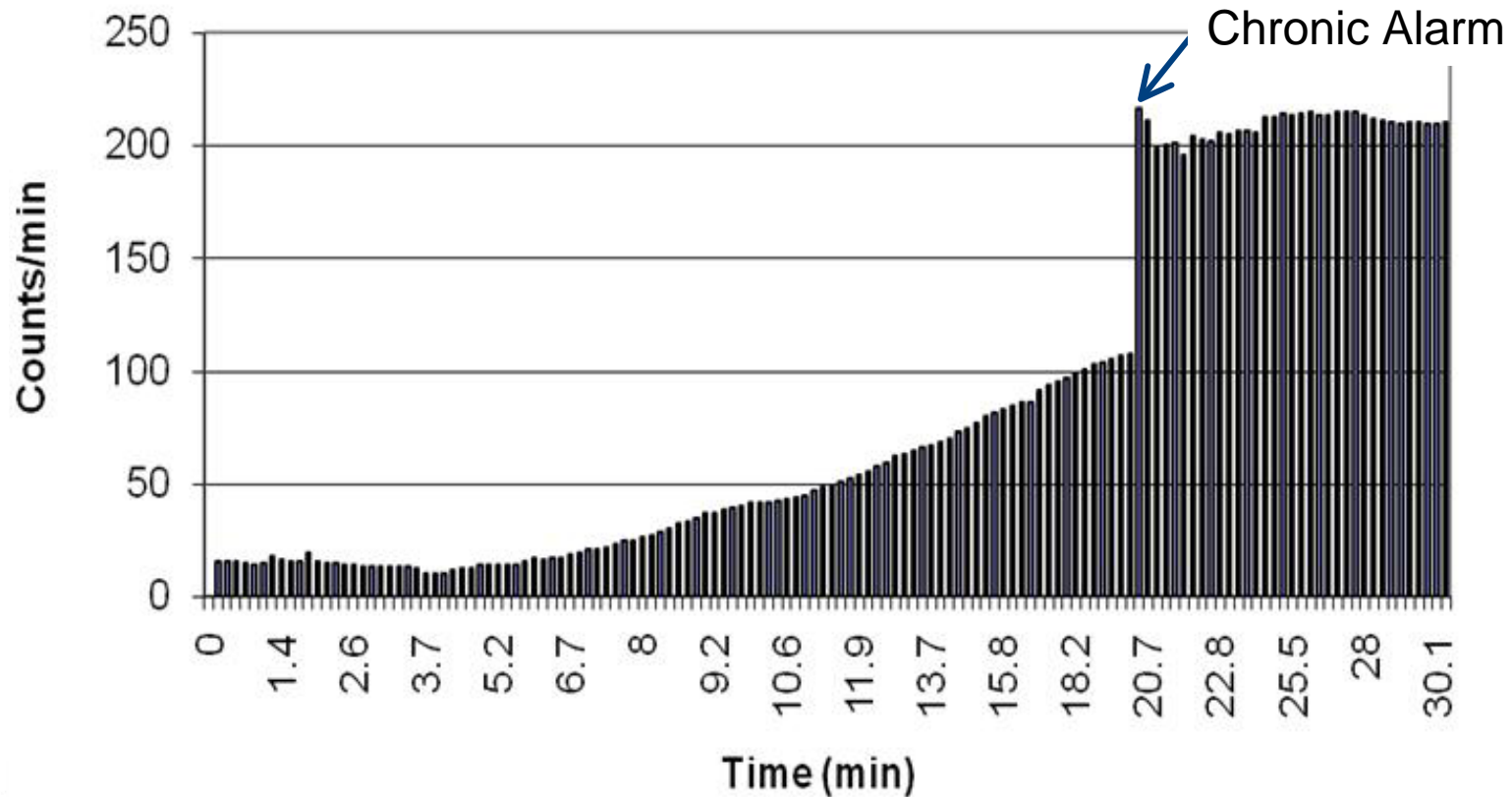


- (1) CAM filter
- (2) Radioactive source
- (3) Source mask
- (4) rotary motor
- (5) rotating mask
- (7) aperture



# Introduction: CAM response to DRS proof-of-principle device

2009 data with  $\alpha$ -Sentry /ASM1000 and 20 minute count cycle



# Introduction : Production model

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## ■ Design considerations

- Compatible with wide range of CAM heads
- Watch movement deemed most convenient method of mimicking a timed release

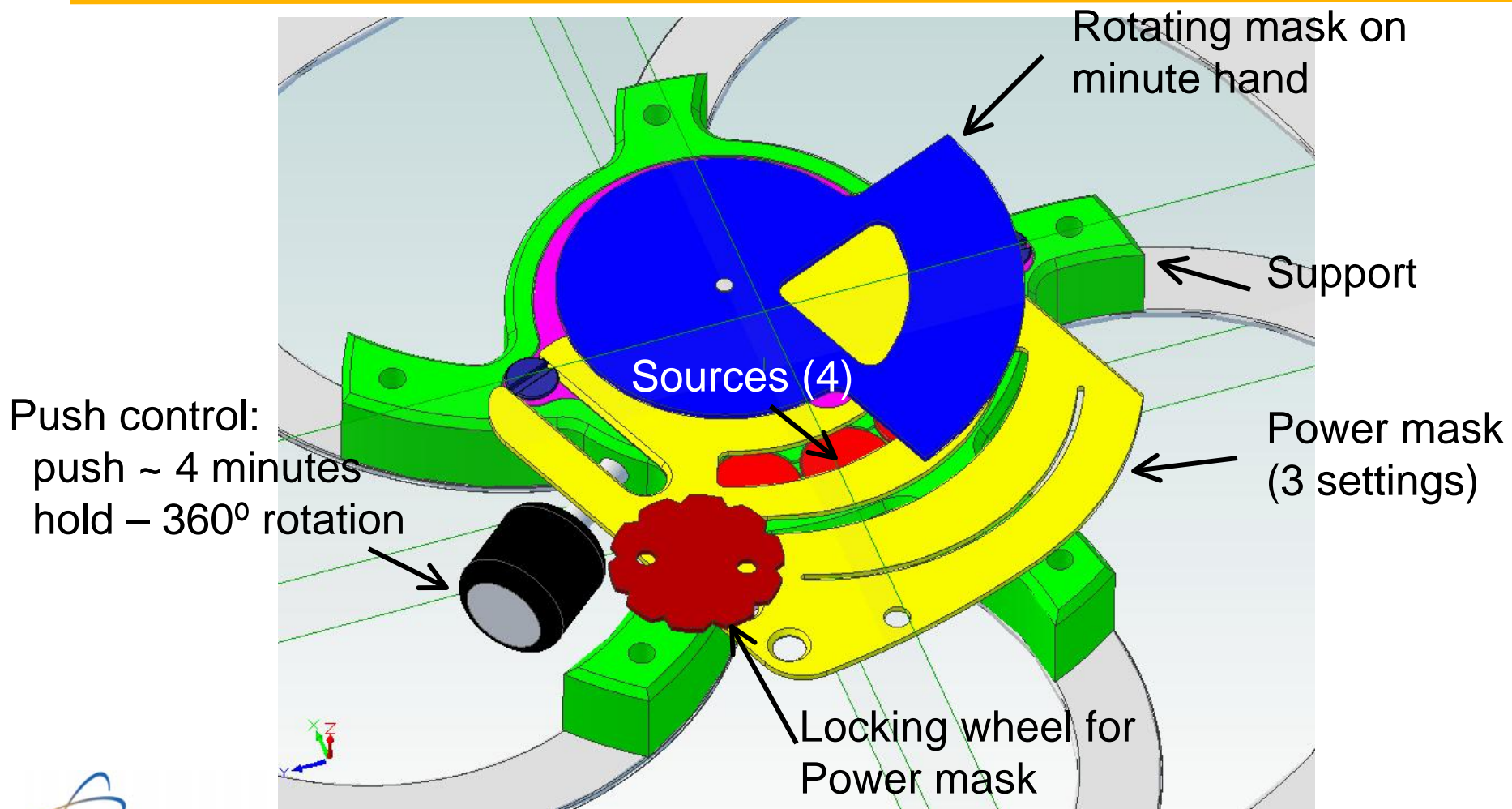
## ■ American watch-makers approached

- RGM LLC ( PA)
- Two units ordered (\$10K total)

## ■ Sources from Eberline Services (Albuquerque ?)

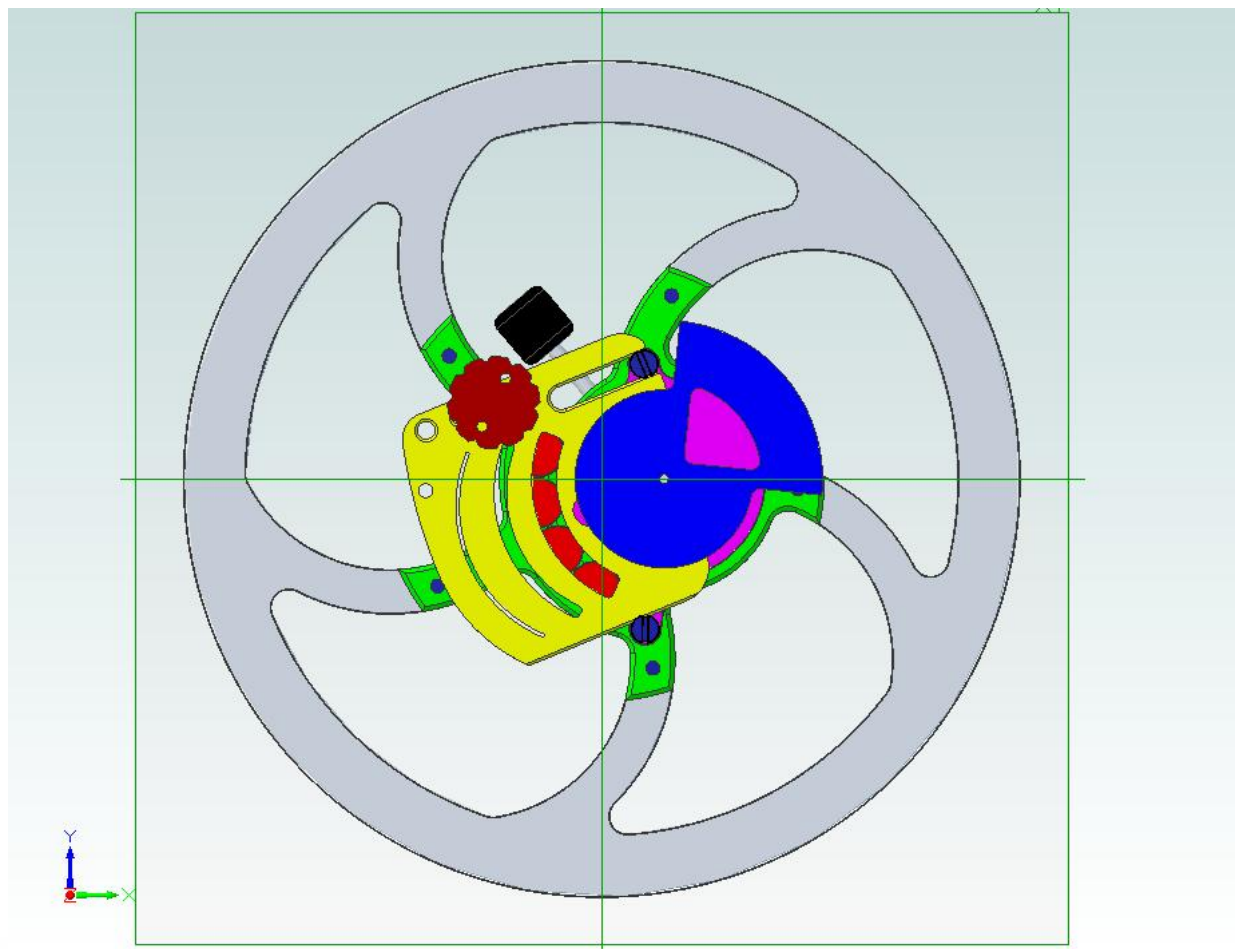
- Total  $^{239}\text{Pu}$  activity based on ~100 DAC-h at 55 lpm and 30% detection efficiency

# Production DRS: design



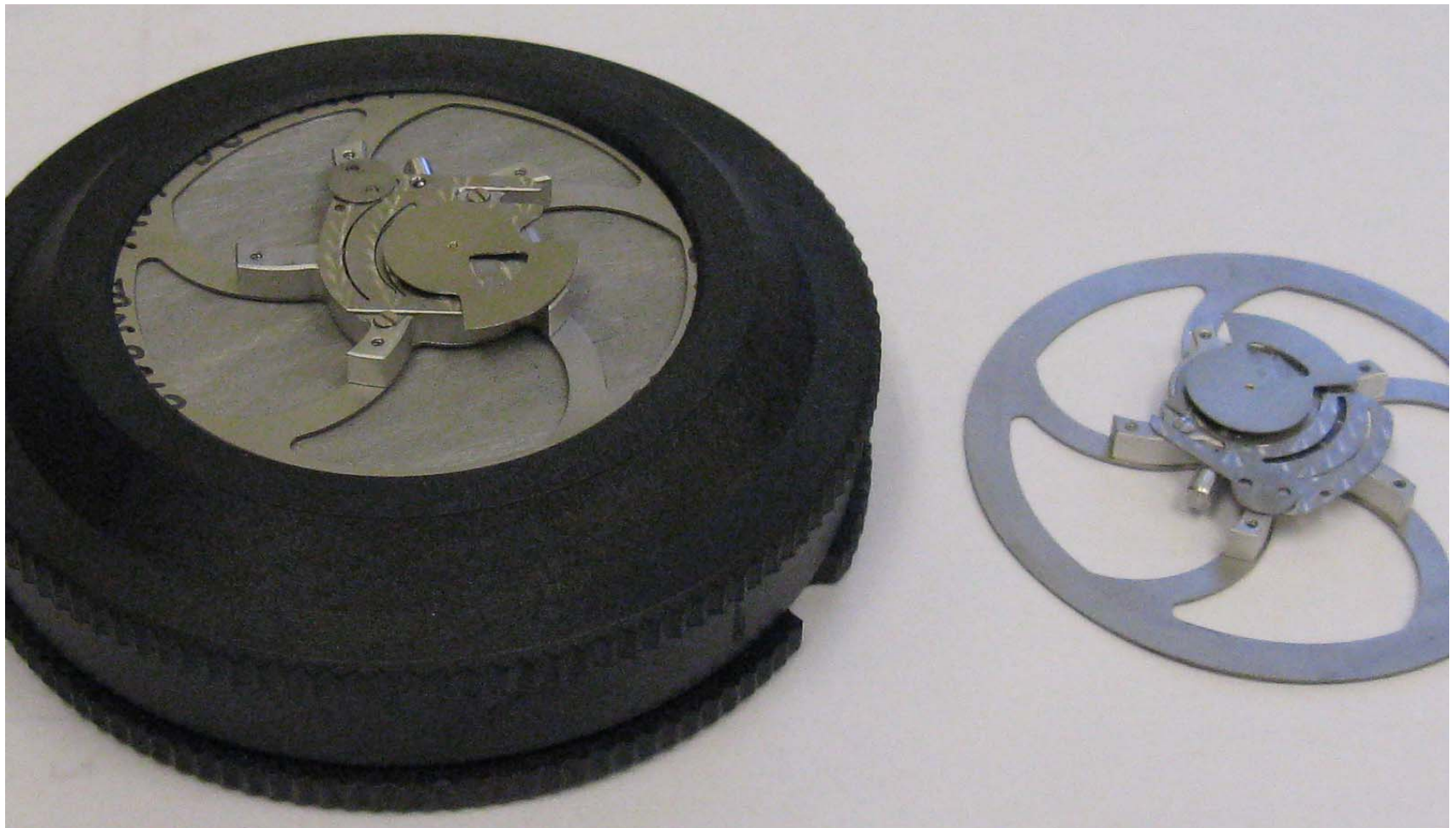


# Production DRS: Overhead view



# Production DRS: In and out of Alpha-Sentry filter cartridge

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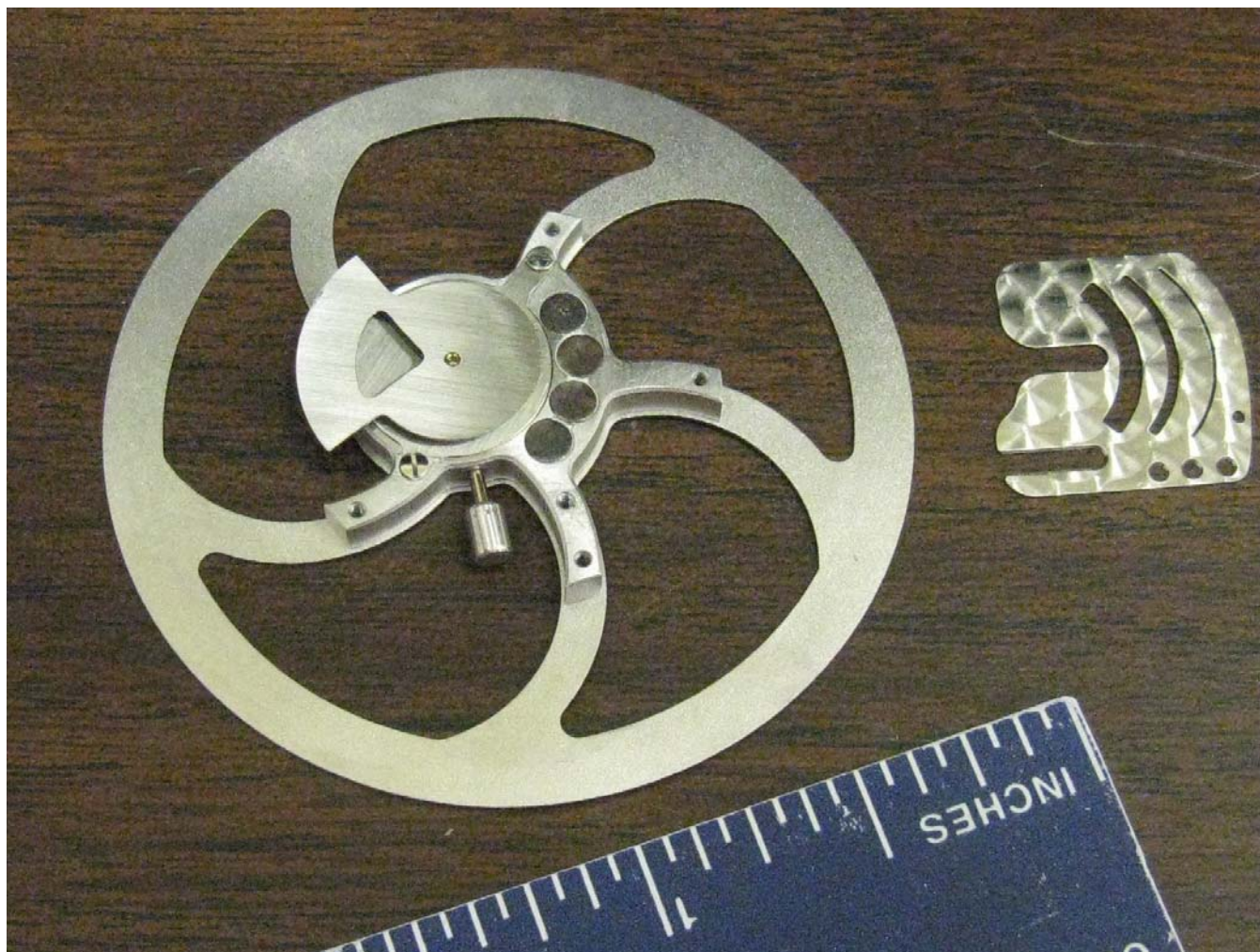
# Production DRS: Movement exposed

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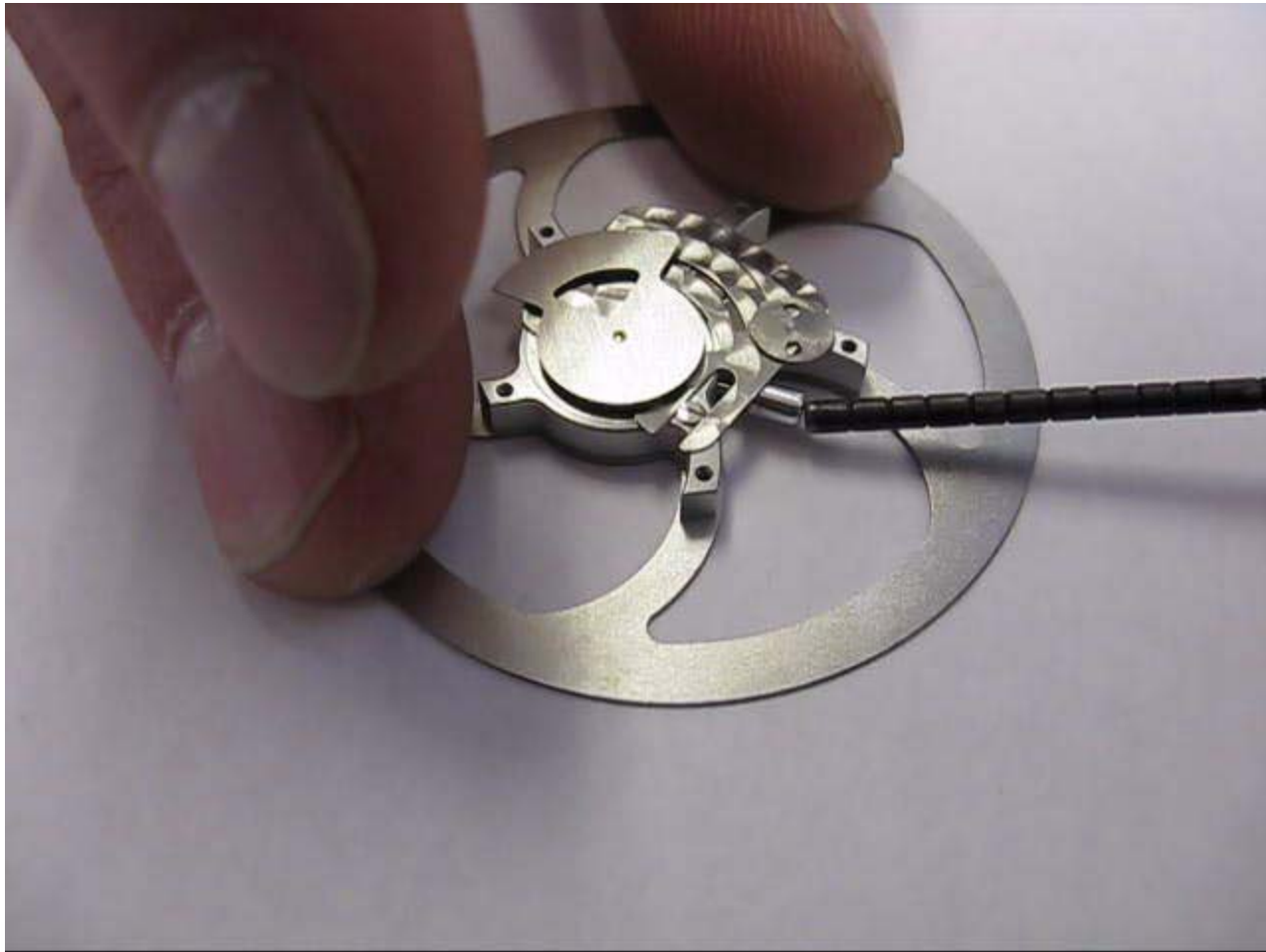


# Production DRS: with power mask removed



## Production DRS: Rotation demonstrated

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# Introduction : Production model

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- **Two production DRS units delivered 1/2012**

- Preliminary data presented here for first time
- DRS movement:
  - Unveils sources over course of 15 minutes (90 degree arc)
  - Sources remain fully exposed for further 30 minutes
  - Sources gradually masked during final 15 minutes

- **DRS Patent Pending**

- “Dynamic Radioactive Particle Source”, Moore, ME, Justus, AL, Gauss, AB, US Patent Application No. 12433503, Report LA-UR-09-02686

# Introduction : Production model

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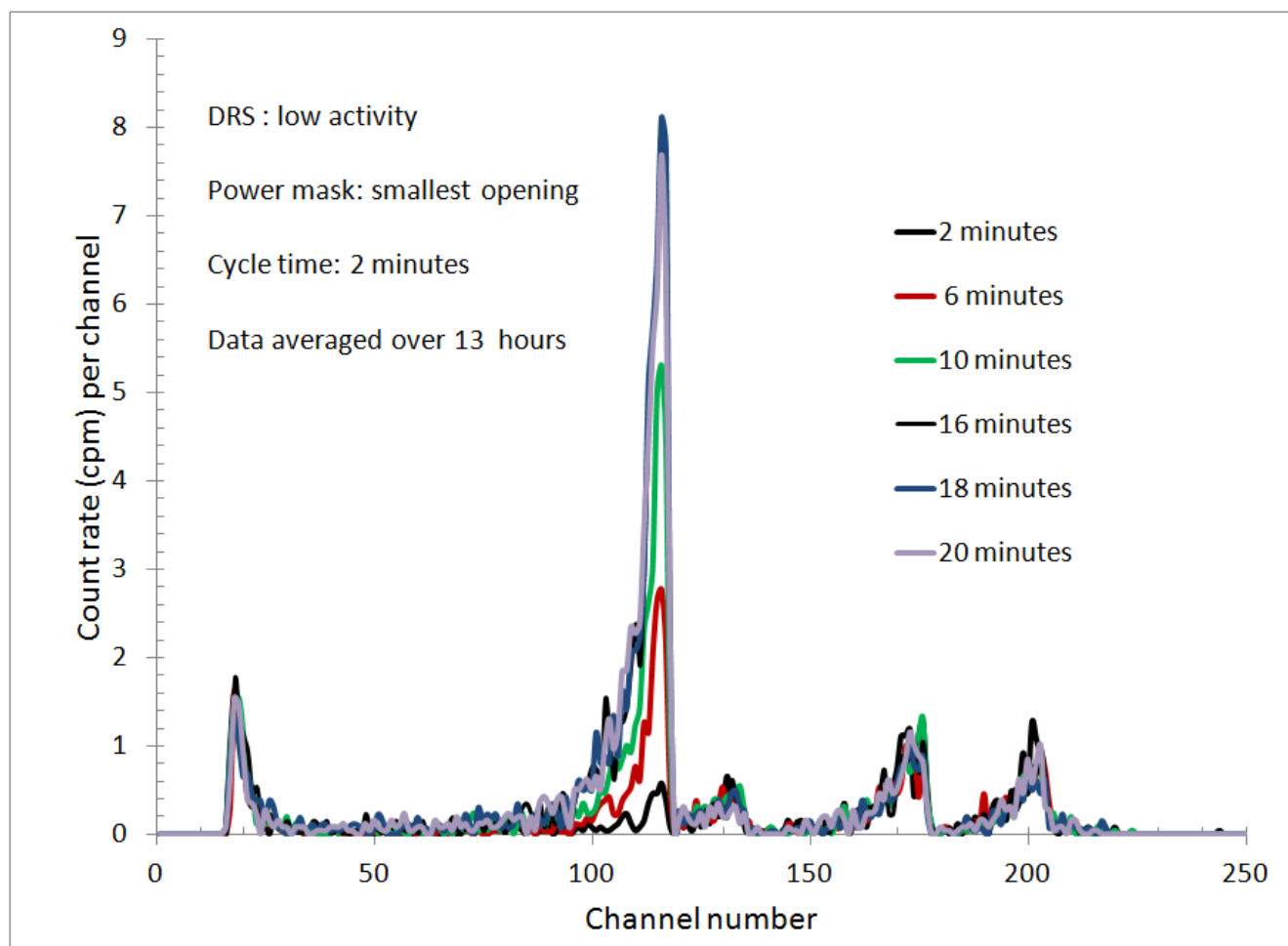
## ■ Source data:

- $^{239}\text{Pu}$  electroplated sources on 0.1" backing
- Individual 2.8mm dia. disks punched from two larger-area parent sources
- Low activity DRS : Total activity of ~ 1200 dpm
- High activity DRS : Total activity of ~ 1600 dpm

## ■ Power mask:

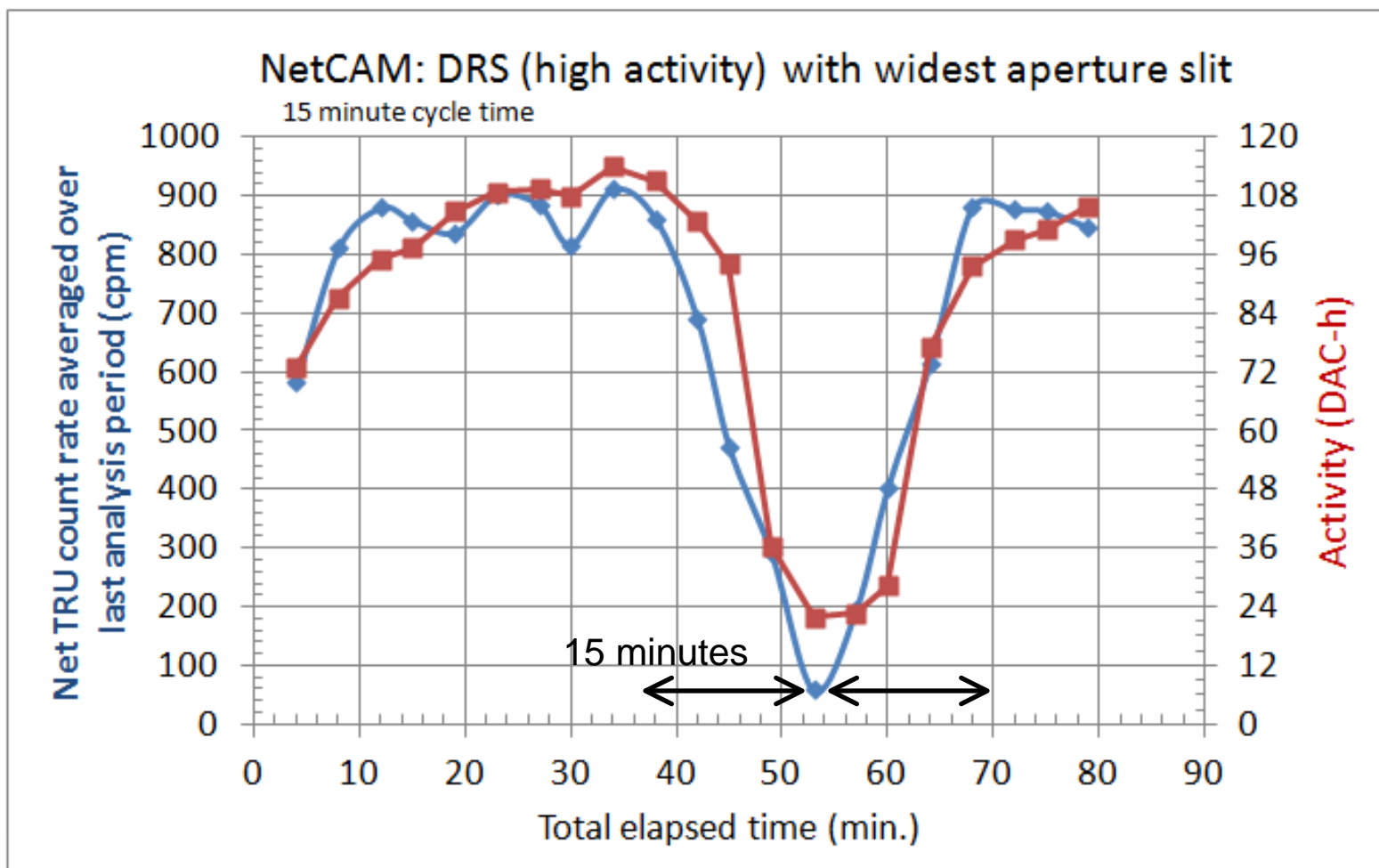
- Slit widths of 0.20 mm, 0.70 mm and 1.40 mm provided

# DRS: Alpha Sentry/ASM1000 count rate variation

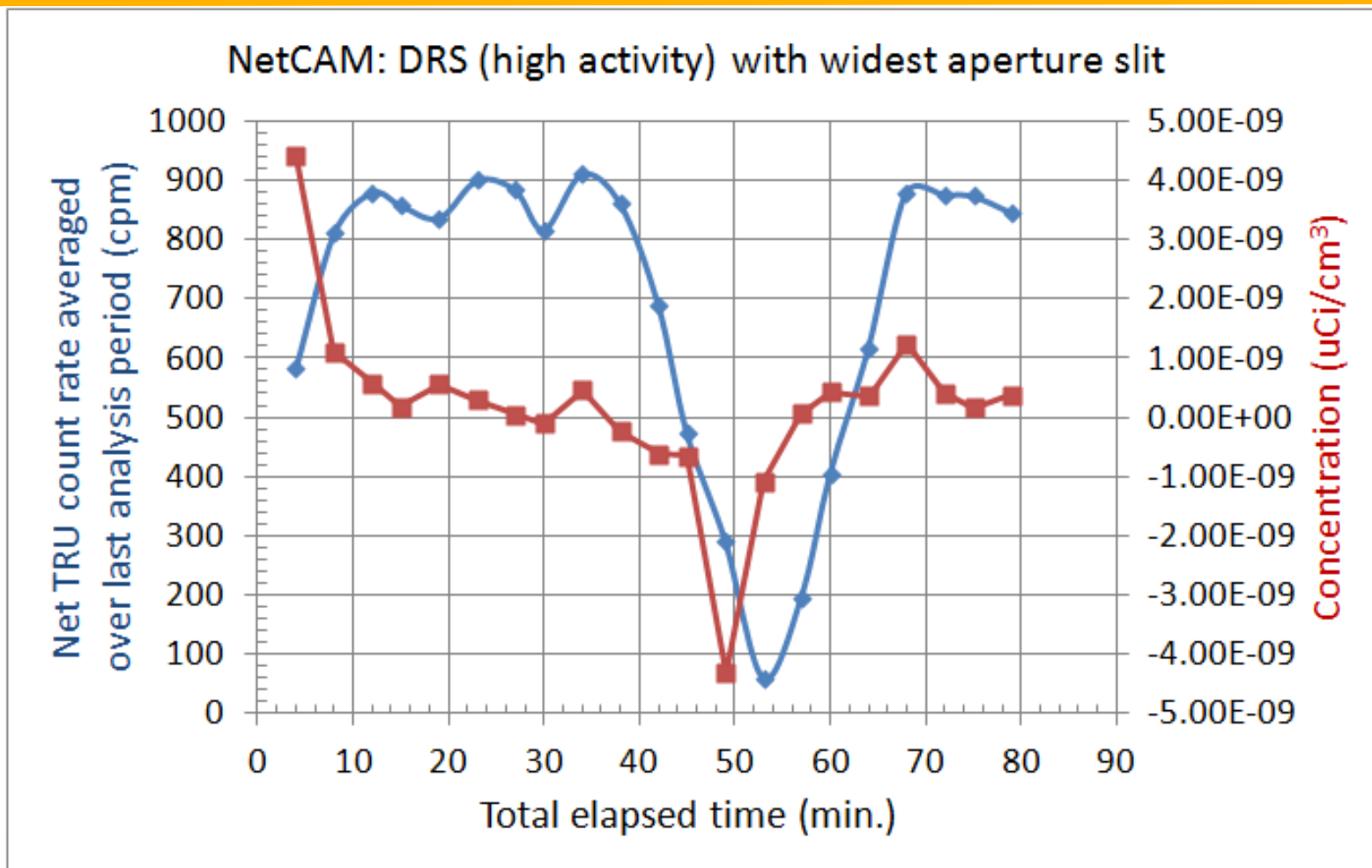




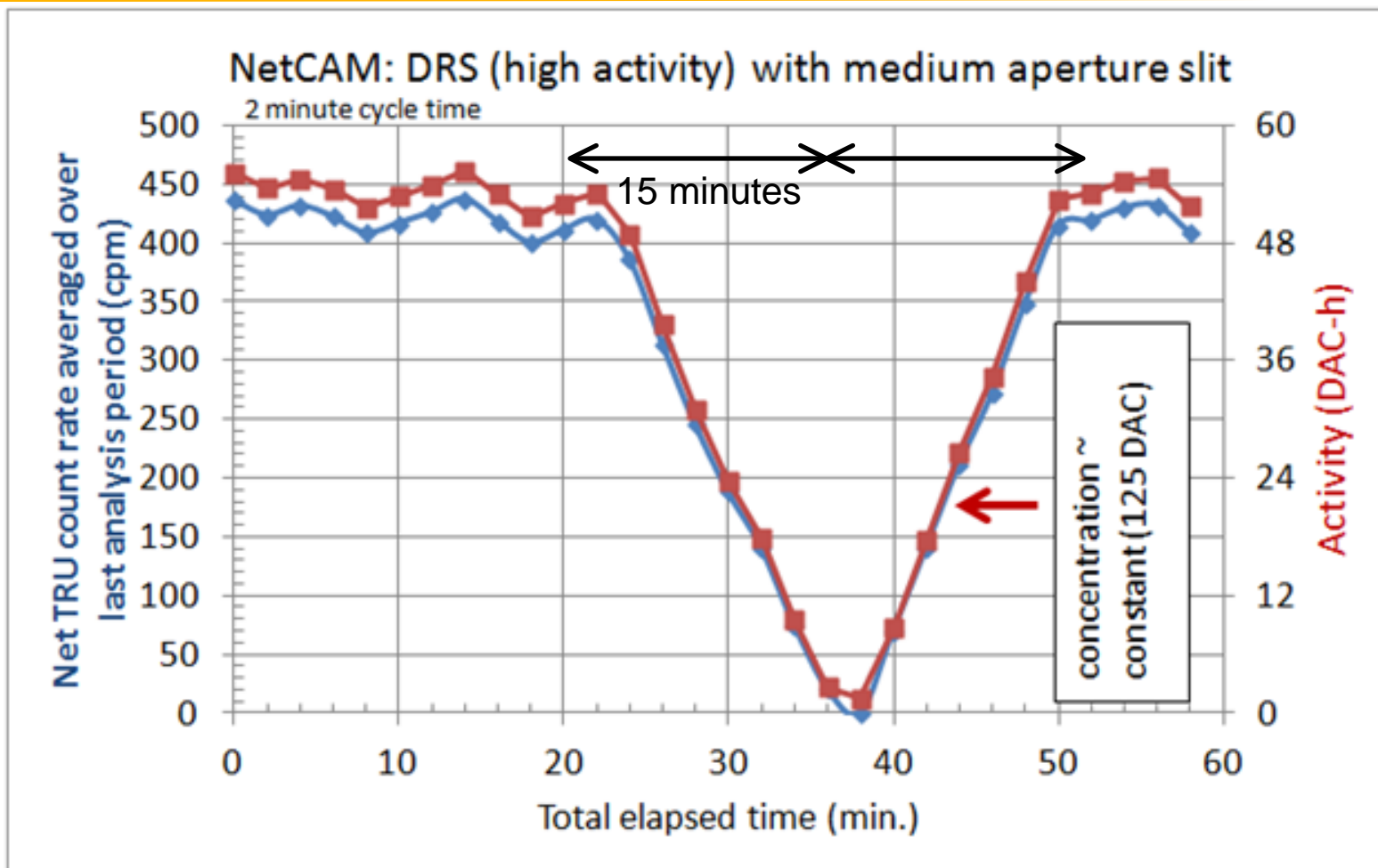
## DRS: Alpha Sentry / NetCAM dongle test data



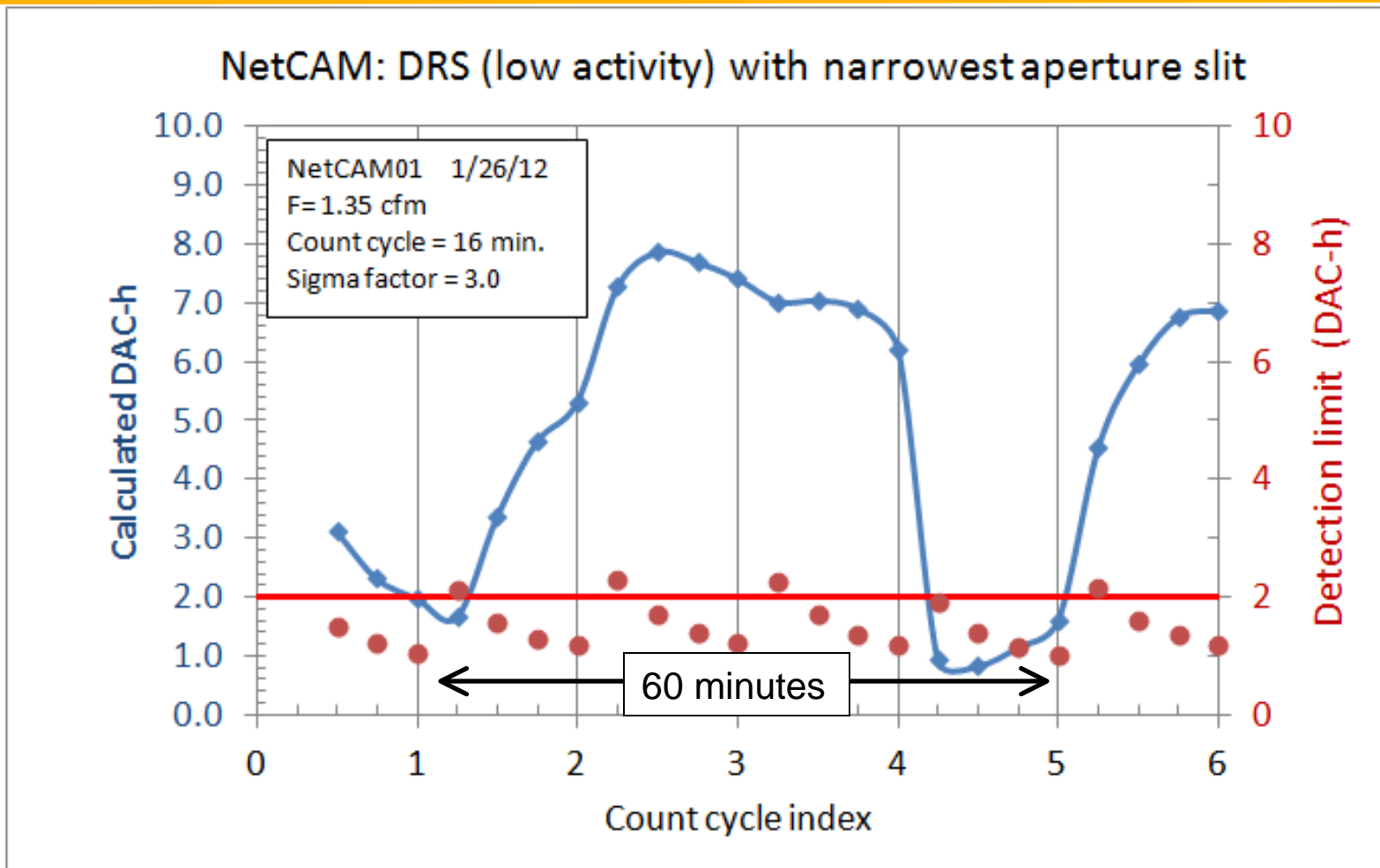
## DRS: Alpha Sentry / NetCAM dongle test data



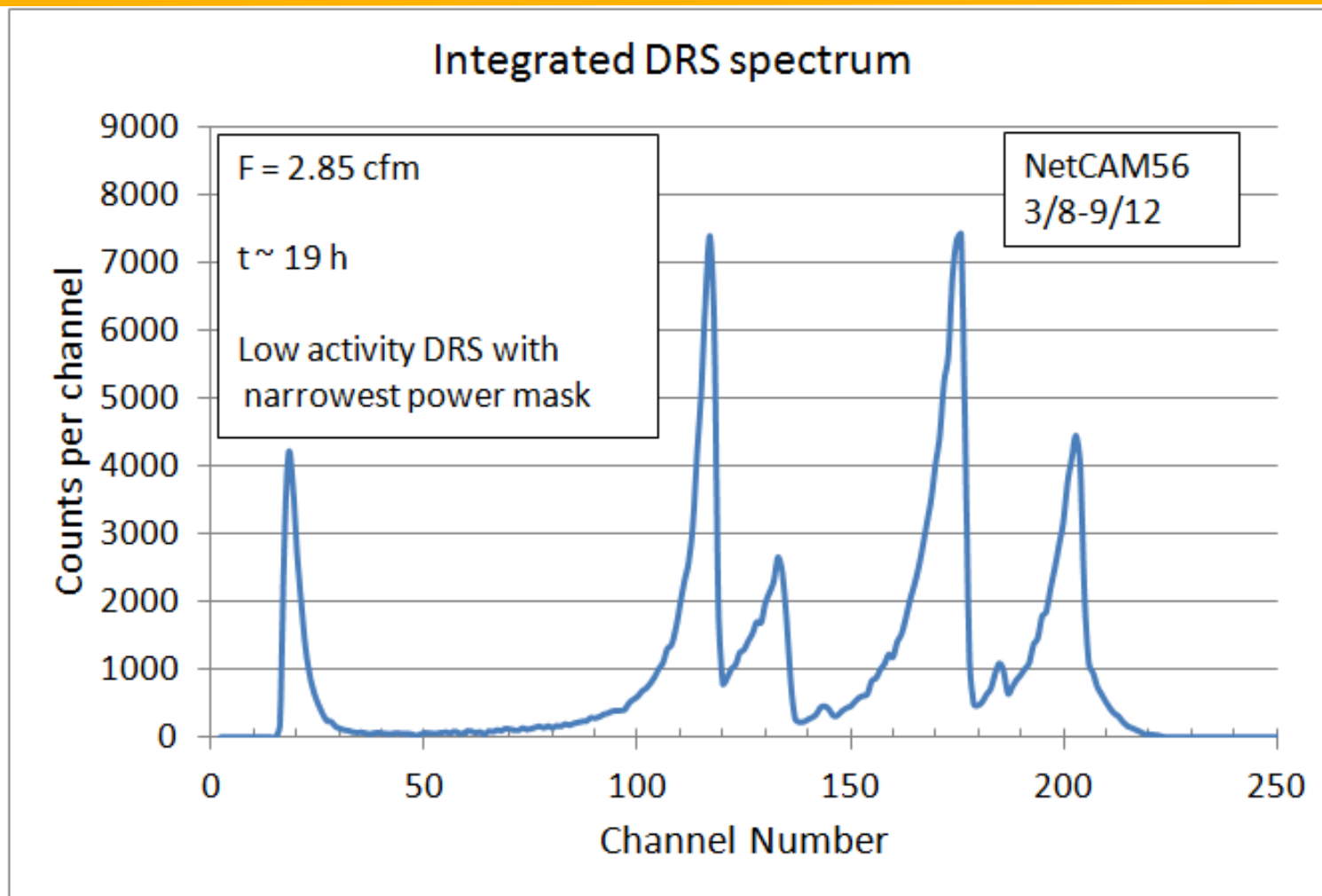
# DRS: Alpha Sentry / NetCAM dongle test data



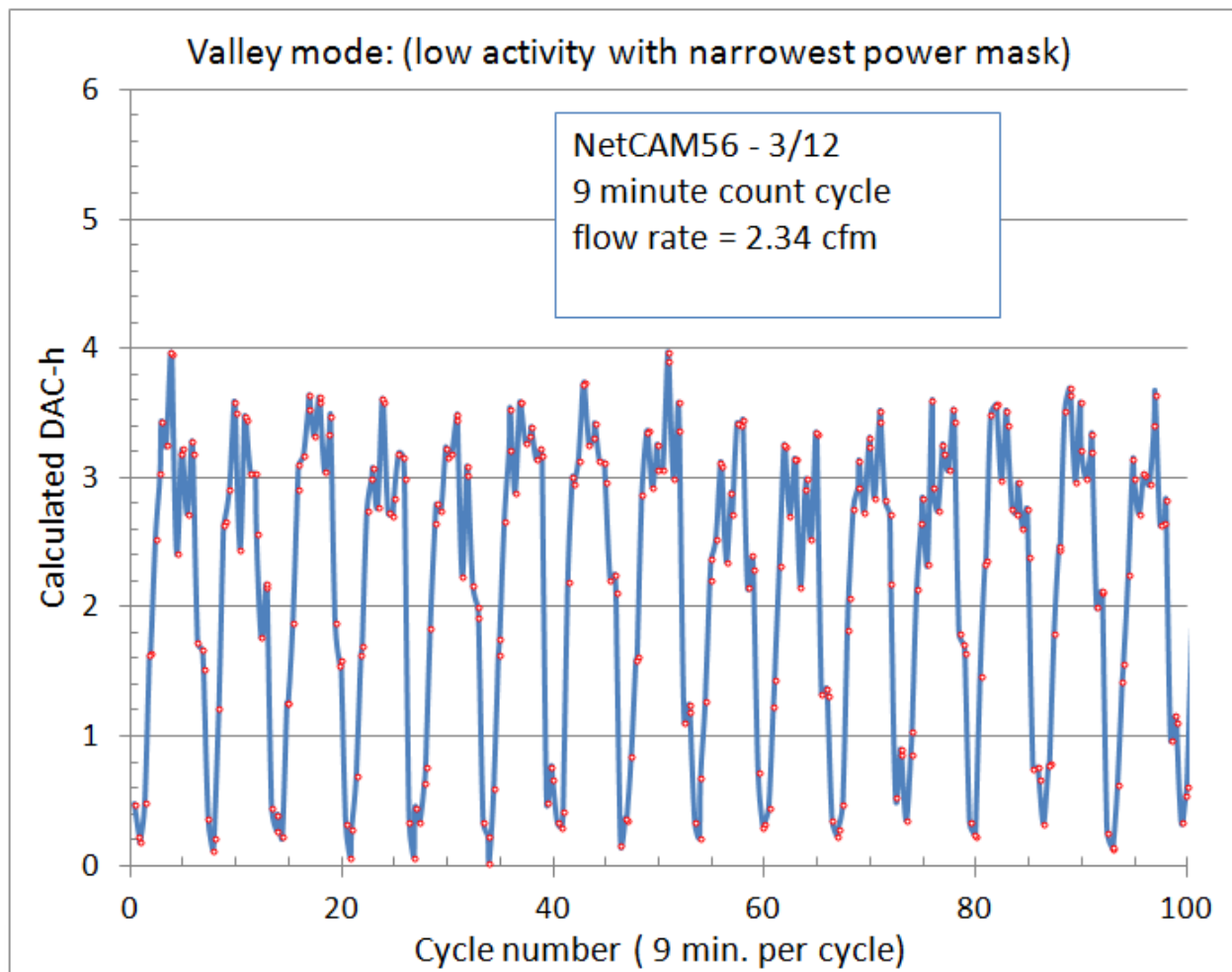
# DRS: Alpha Sentry / NetCAM dongle test data



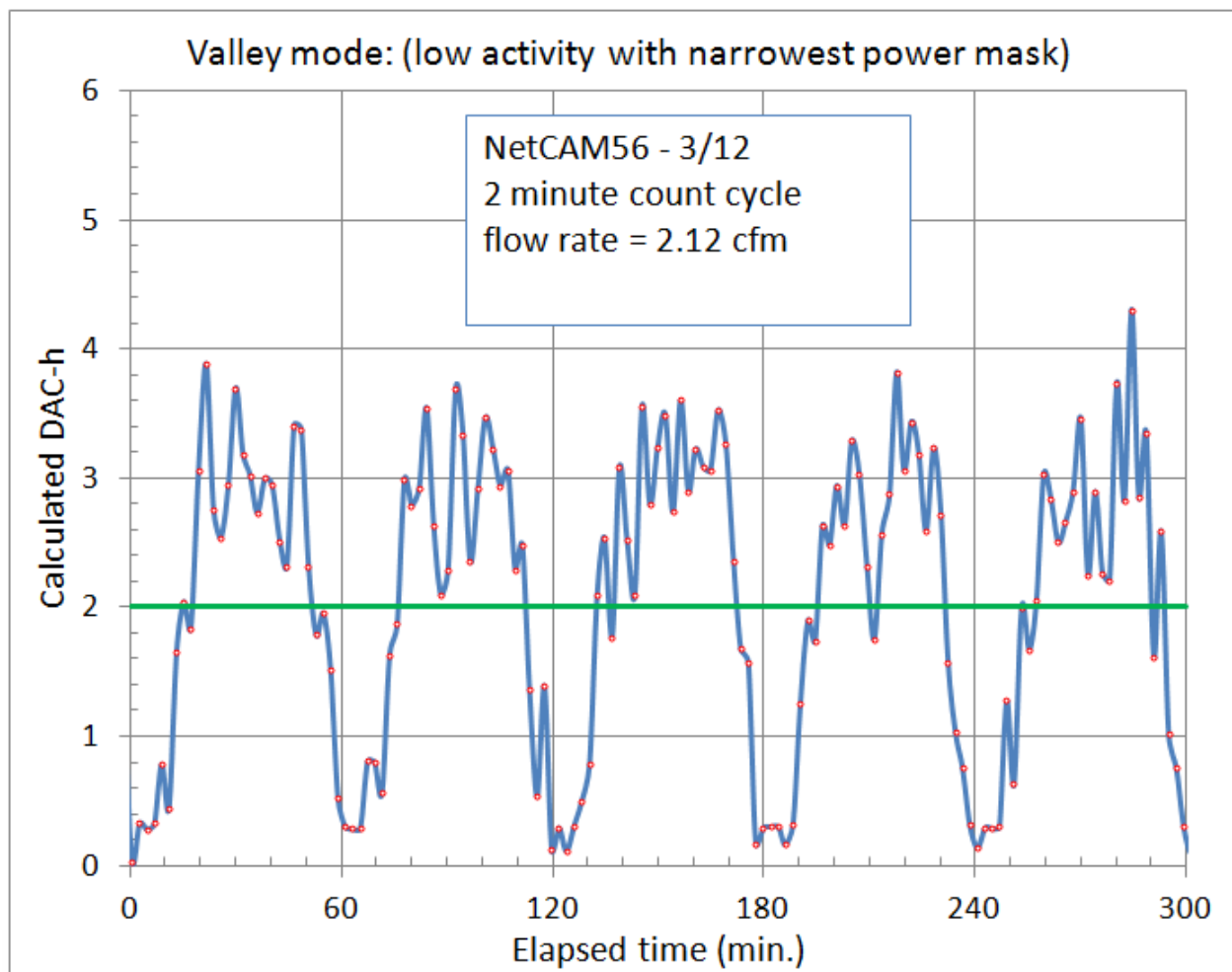
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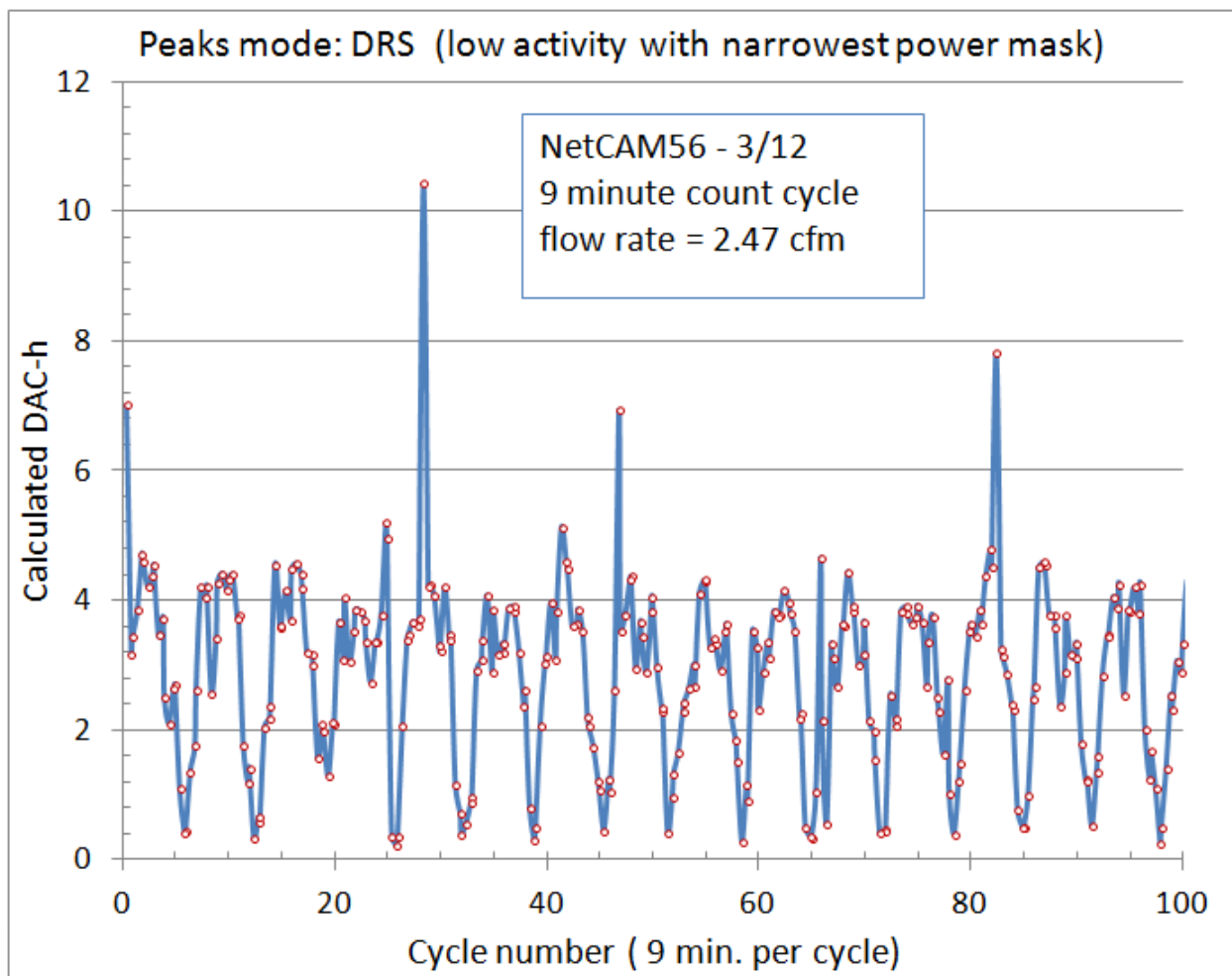
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## Result summary: Average time to alarm

CAM	Analysis mode	Cycle time (min.)	Average time to alarm (min.)	Std. dev. (min.)
AS-1700R / NetCAM	Valley	2	10	2
AS-1700R / NetCAM	Valley	9	11	2
AS-1700R / NetCAM	Valley	17	10	2
AS-1700R / NetCAM	Peaks	2	8	3
AS-1700R / NetCAM	Peaks	9	9	3
AS-1700R / NetCAM	Peaks	17	9	3
AS-1700R / ASM1000	Valley	15	15	0

# Summary

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- **DRS shown to be useful tool in characterizing CAM performance**
  - Evaluation of chronic analysis algorithms
    - Reproducibility
      - Valley (ROI) method shown to be more consistent than Peaks (peak fitting) method
    - Influence of various Rn/Tn background levels on calculated TRU activity
    - Calculation of average response time
  - Plans to extend to Canberra *i*-Sentry and Thermo Alpha-7L CAMs

# Summary

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- **Suggested design changes on next DRS model**
  - Lower overall activity by a factor of ~10 to really challenge CAM performance
  - Lower height of DRS slightly so that it fits comfortably in all CAM housings
  - Extend solid angle of rotating mask so that sources are completely occluded for several minutes.
  - Allow remote control of watch movement
    - Currently must wait an hour for each analysis cycle
    - Eases study of response time wrt to the difference between the start of a count cycle and the onset of activity release.