HEND (Mars-Odyssey) and BTN-M1 (ISS) GRB observations

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Ioffe Workshop on GRBs and other transient sources: 25 Years of Konus-Wind Experiment

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2704 BATSE Gamma-Ray Bursts

Jet collides with ambient medium (external shock wave)

Colliding shells emit low-energy gamma rays (internal shock wave)

Faster shell

Slower shell

Prompt emission

Black hole engine

Low-energy gamma rays

High-energy gamma rays

X-rays

Visible light

Radio

Afterglow
### Mission Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>NASA/JPL</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Lockheed Martin</td>
</tr>
<tr>
<td>Launch date</td>
<td>7 April 2001</td>
</tr>
<tr>
<td>Semi-major axis</td>
<td>3785 km</td>
</tr>
<tr>
<td>Orbit height</td>
<td>400 km</td>
</tr>
<tr>
<td>Eccentricity</td>
<td>0.0115</td>
</tr>
<tr>
<td>Inclination</td>
<td>93.2 deg</td>
</tr>
<tr>
<td>Period</td>
<td>117.84 min</td>
</tr>
<tr>
<td>Orbital insertion</td>
<td>24 October 2001</td>
</tr>
</tbody>
</table>

**High Energy Neutron Detector (HEND)**

**Gamma Sensor Head**
HEND Scintillation Detector description

Boynton et al. (Space Sci. Rev., 2004)
GRB190731A (UT 22:38:24)

GRB Localization Region:
circle (radius 15 arcmin)
(-5.0, +5.0 sec from trigger)
GCN Duration 14.5 sec
Visible (+66 deg)

0.25 sec, 30-200 keV
1 sec, 200-2000 keV
HEND participation in GRB science

- May 2, 2001: first HEND data
- May 8, 2001: first GRB detected by HEND
- April 5, 2002: first IPN localization with HEND participation (GCN#1325)
- June, 2007: first BTN data
- 18 years of successful operation!
Statistics of HEND GRBs

• 522 GRBs (81 short, 441 long)
• 227 localizations with HEND
• 2.5 bursts per month
• 20% of GCN GRBs
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GRBs number

Year

GCN
IPN
IPN with HEND

September 9–13, 2019, St. Petersburg, Russia
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GRB190906A (UT 01:04:49)

Counts/0.25sec

200

150

100

50

0

-400

-200

0

200

400

Seconds after maximal count

GRB Localization Region:
circle (radius 360 arcmin)
( -1.35, +1.33 sec from trigger )

CCN Trigger Time

CCN Duration 1 sec

Visible (+81, +94 deg)
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HEND (Mars-Odyssey) and BTN-M1 (ISS) GRB observations

GRB 190906A

Wind (Konus) - Mars-Odyssey (HEND)

Wind (Konus) - Swift (BAT)

Wind (Konus) - INTEGRAL (SPI-ACS)
SGR 1806-20 light curves detected by HEND outer and inner scintillators.

BTN onboard ISS

BTN onboard ISS

 BTN-M1
HEND and BTN light curve

GRB110918A, HEND – blue, BTN – red
Conclusions

• HEND registered about 522 GRBs

• HEND participated in 227 localizations of GRBs

• We plan to publish joint HEND/BTN catalog of GRBs

Thank you!