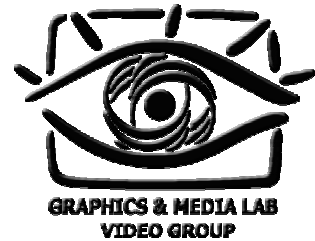


# Video Codecs Comparison

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## Part 3: Frame-accurate Comparison

*Project head: Dmitriy Vatolin*

*Testing: Sergey Grishin*

*Translating: Daria Kalinkina, Stanislav Soldatov*

*Preparing: Nikolai Trunichkin*

**9 testing sequences!**

**11 days (260 hours) total compression time!**

**33 tested codecs!**

**2430 resulting sequences!**

May 2003

CS MSU Graphics&Media Lab

Video Group

<http://www.compression.ru/video/>

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# Video codecs comparison

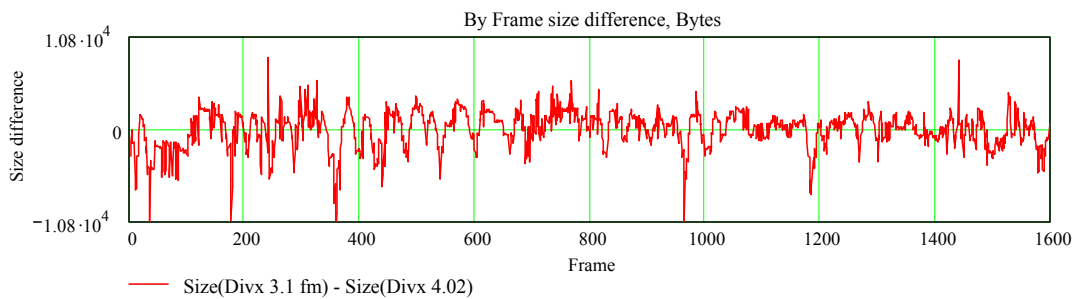
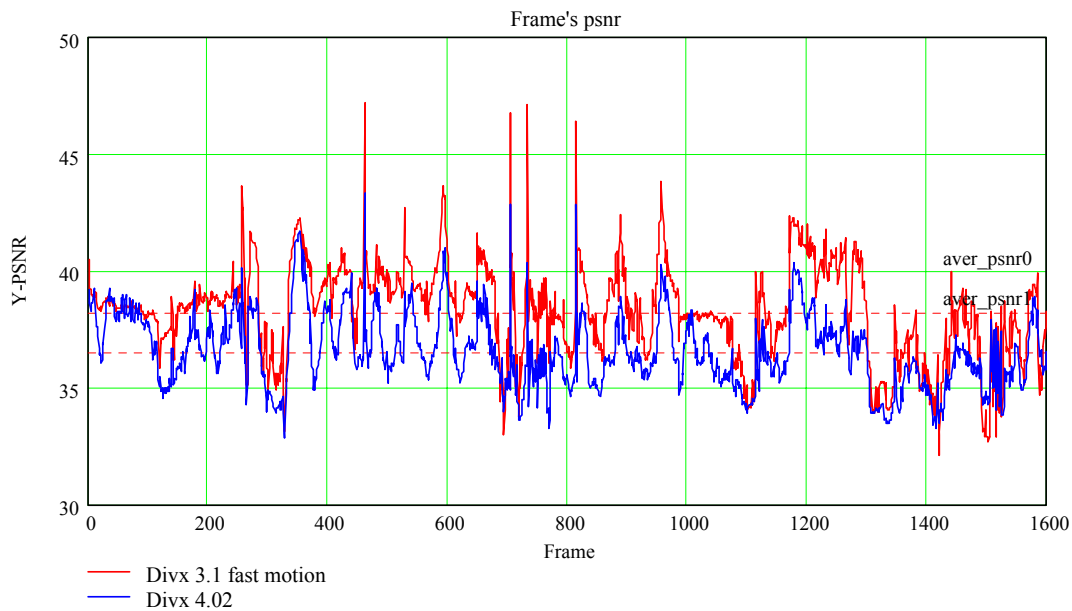
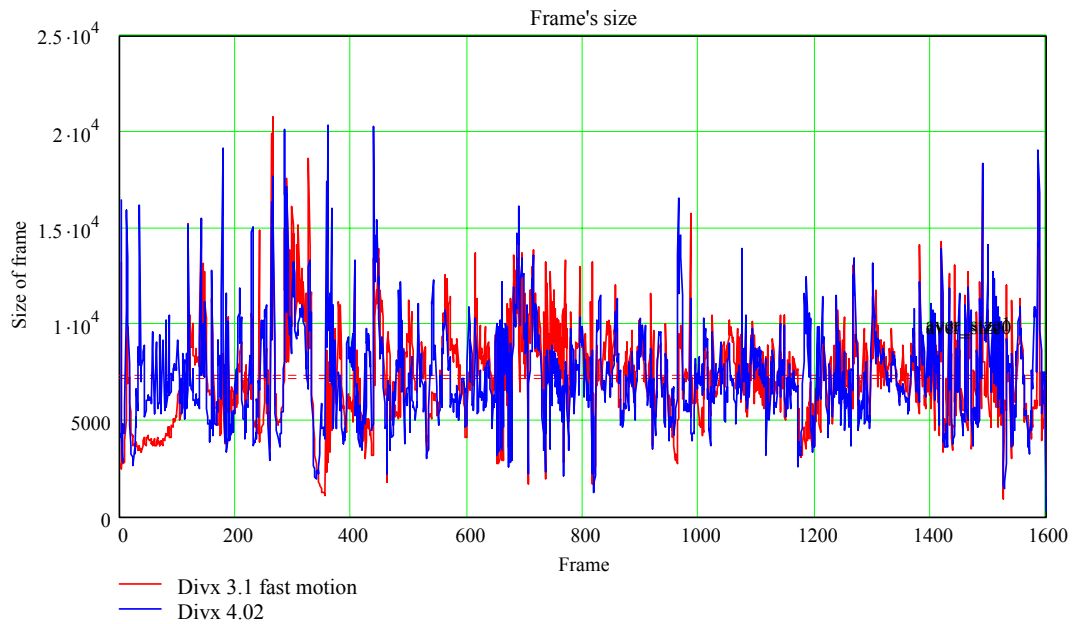
## Part 3: Frame-accurate Comparison

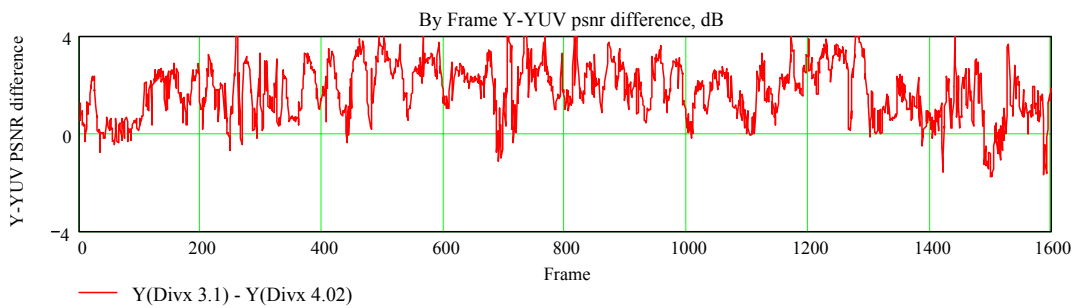
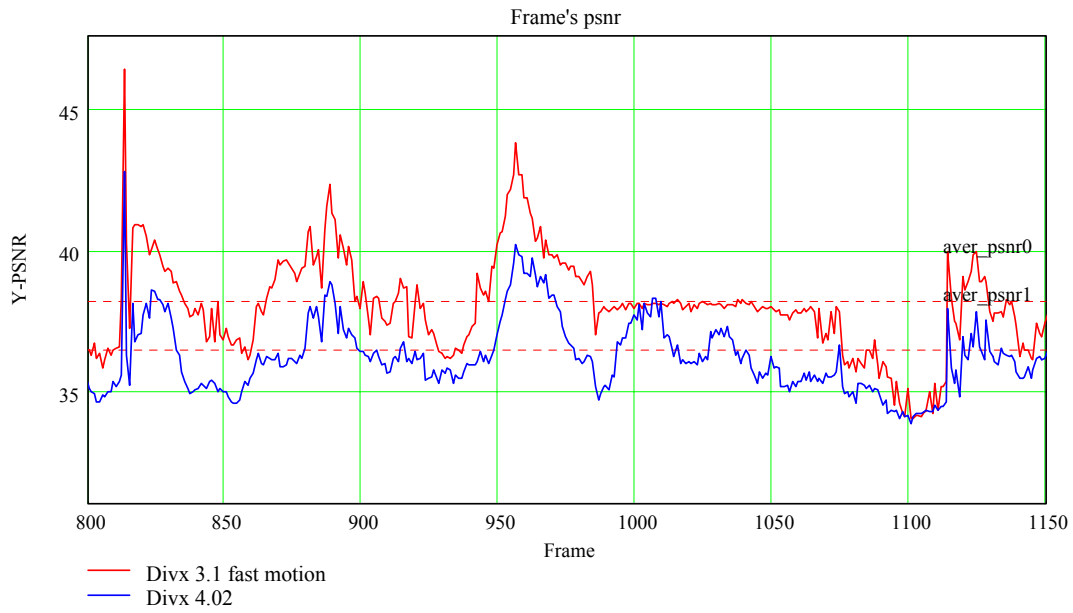
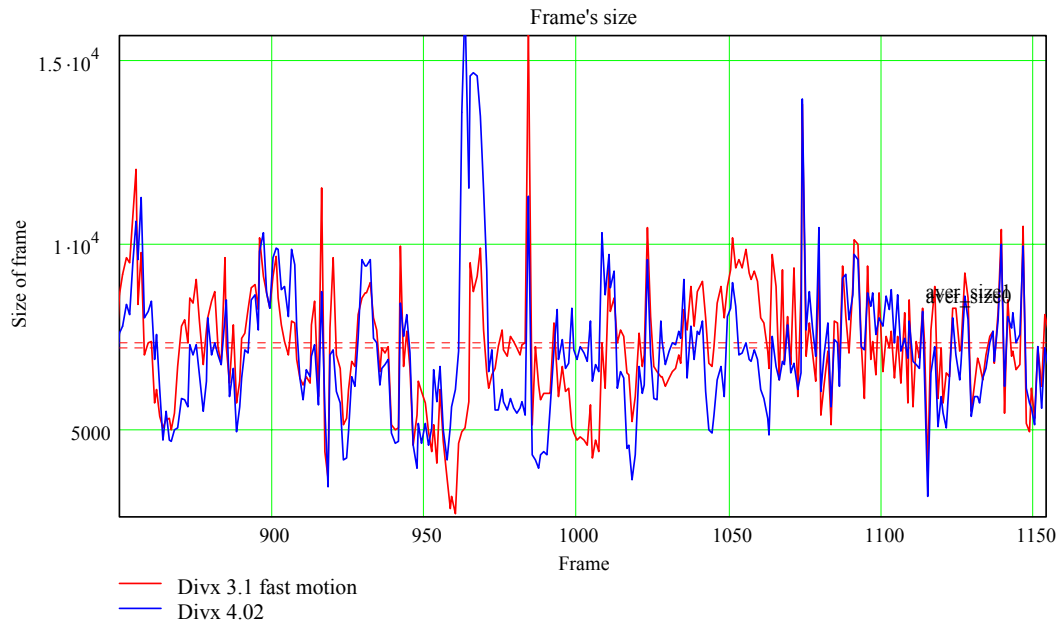
15 May 2003

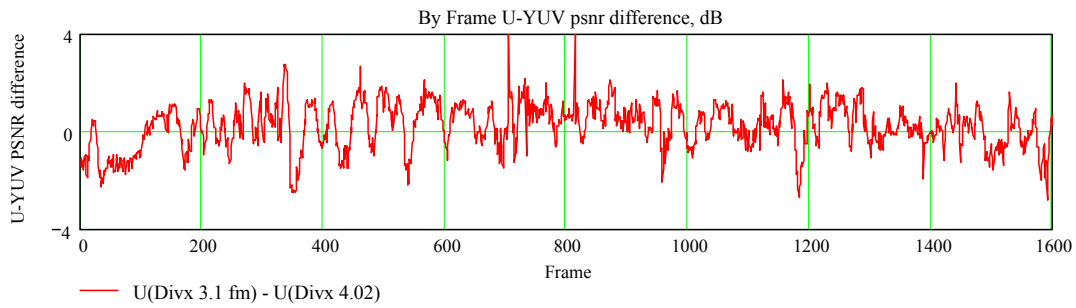
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Divx 4.02 and Divx 3.1 fast motion (battle – 1340kbps)



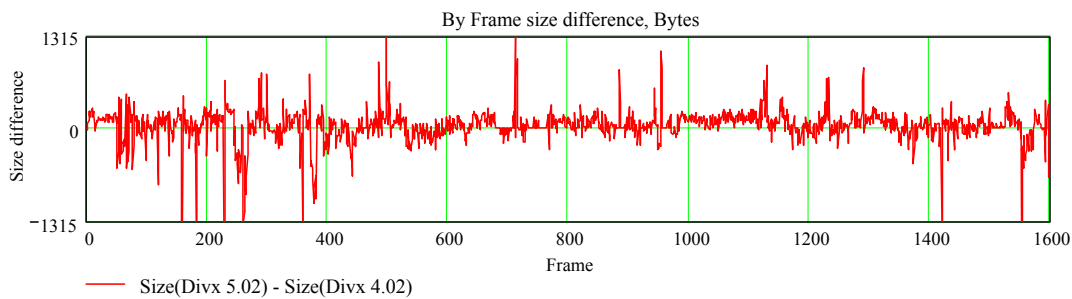
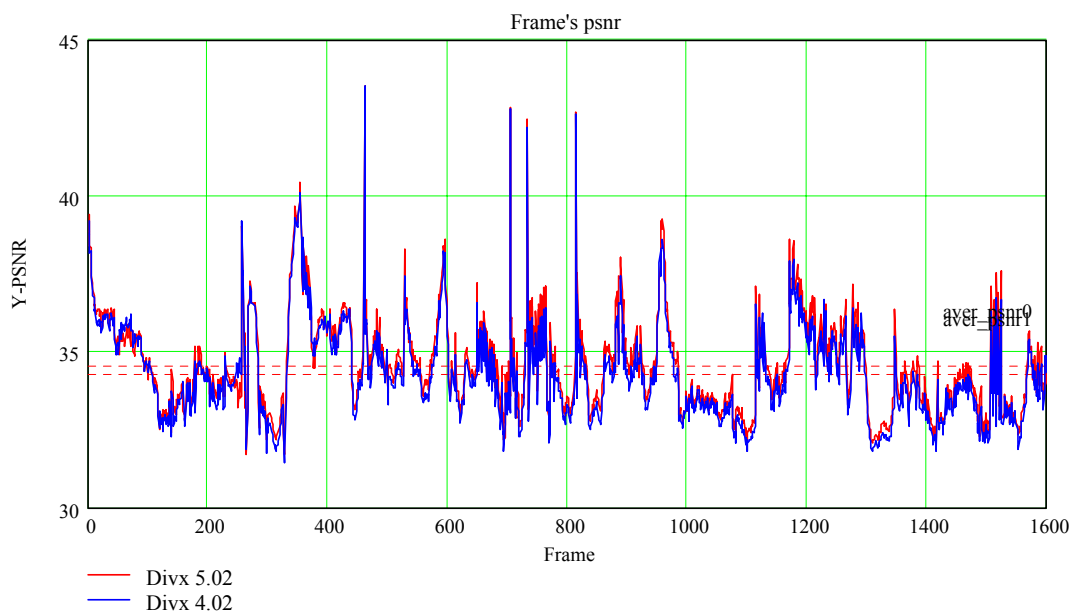
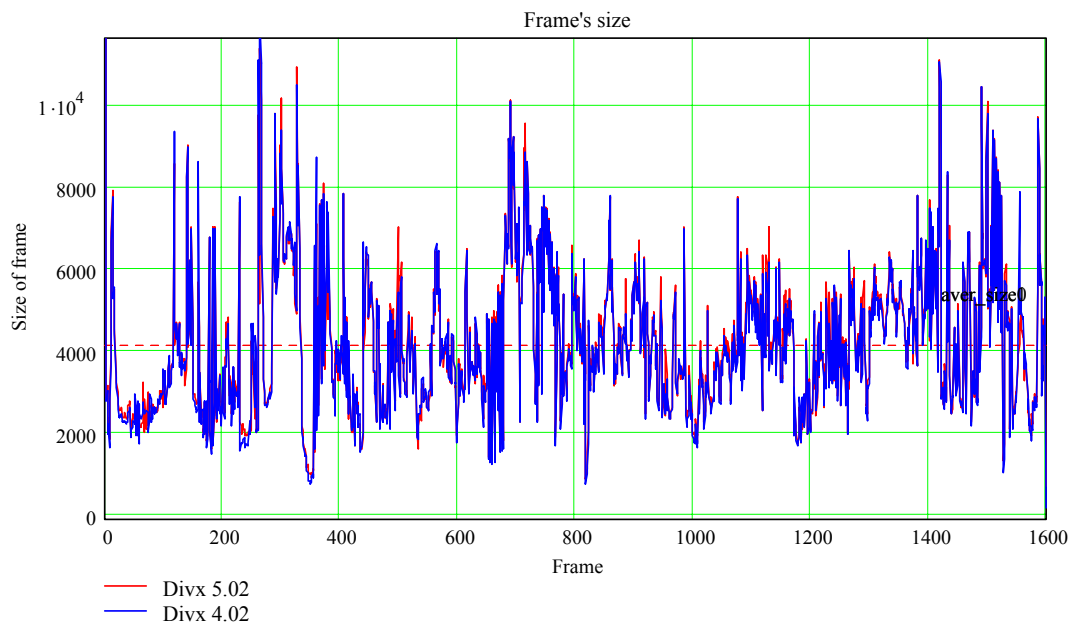


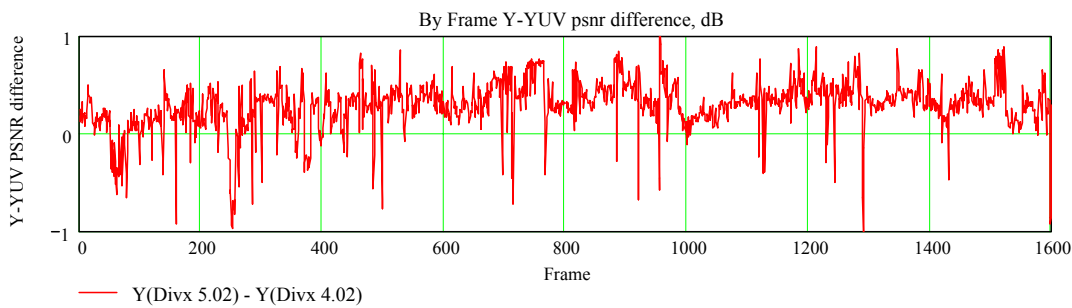
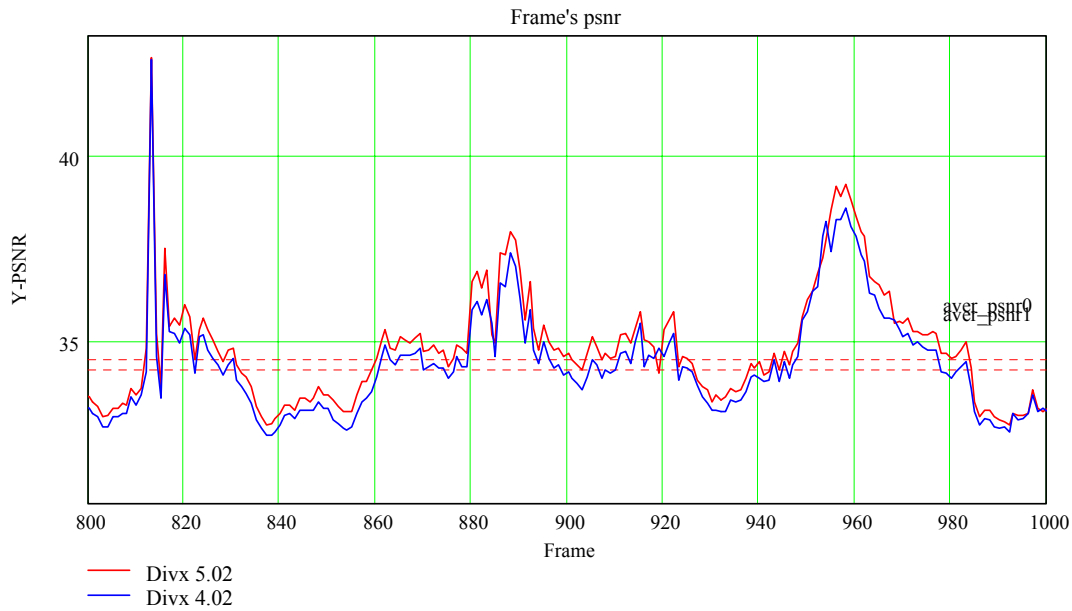
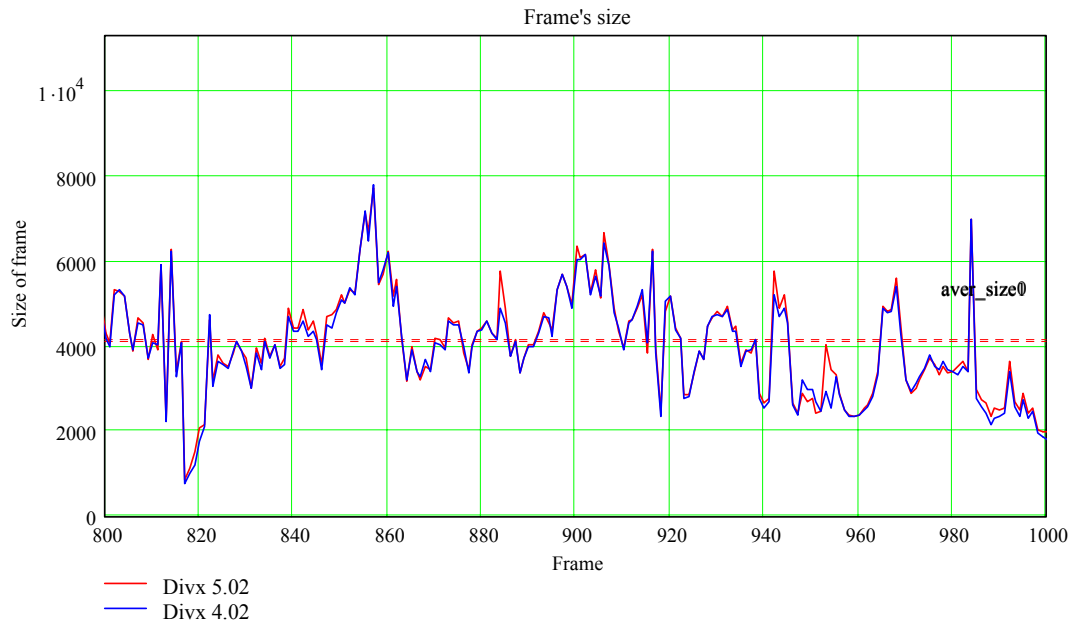


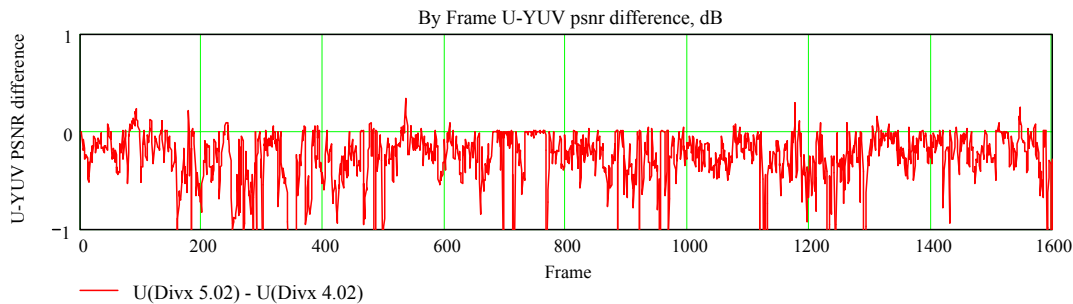
**Conclusions:**

- Divx 3.1 has a higher metric than Divx 4.02; this can be clearly seen on the digrams 2 and 5.
- Both codecs keep the U- and V-components almost similarly (see the last diagram).

Divx 4.02 and Divx 5.02 (battle – 460кбит/с)



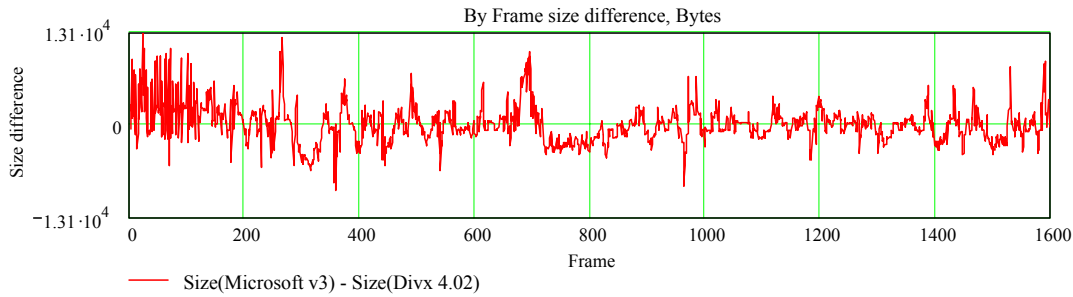
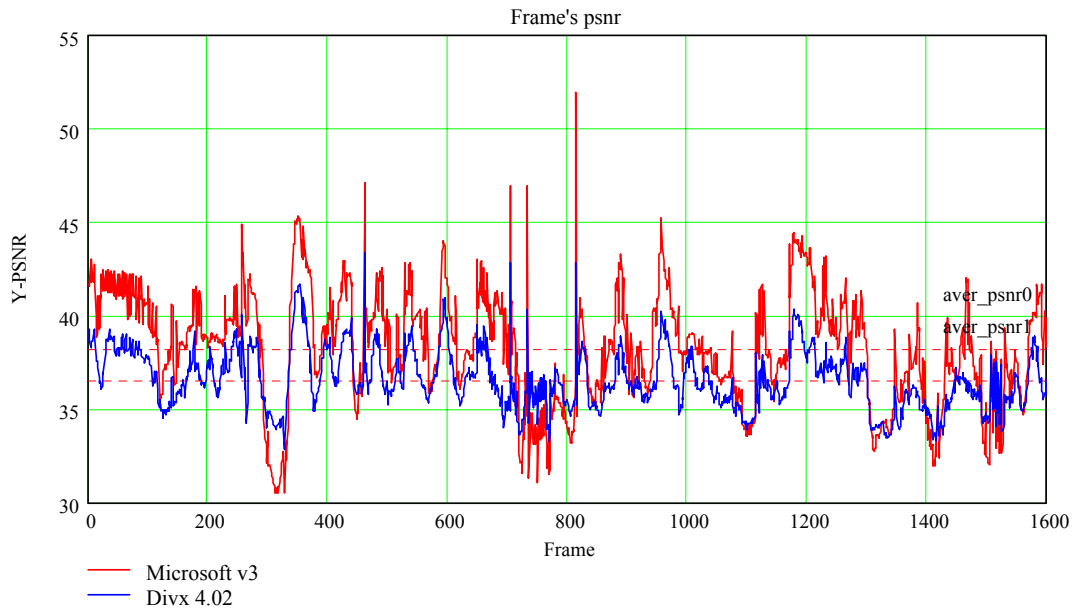
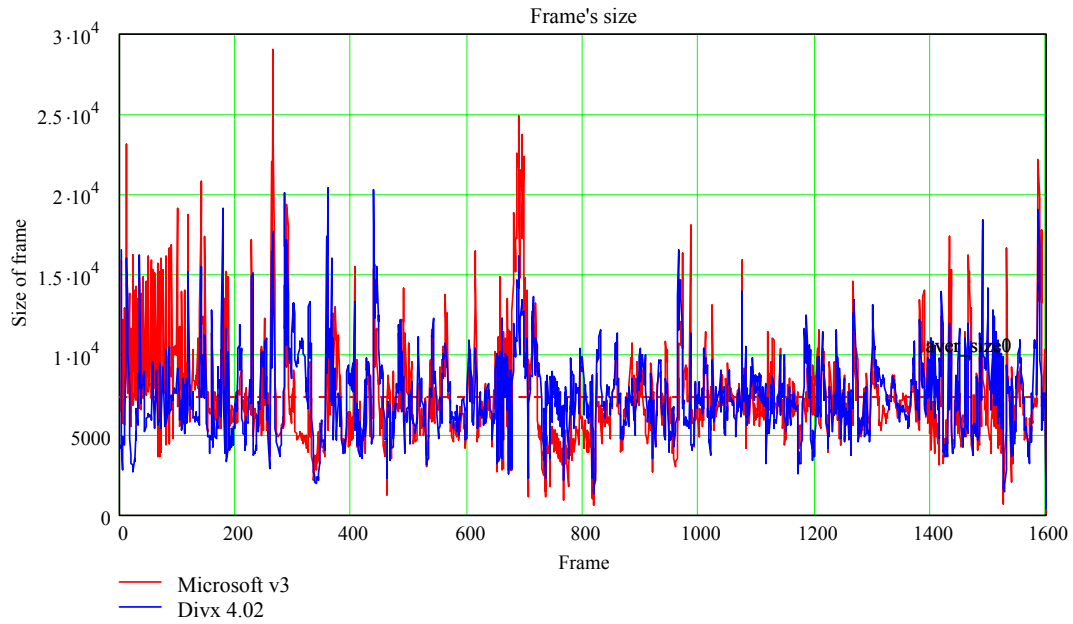


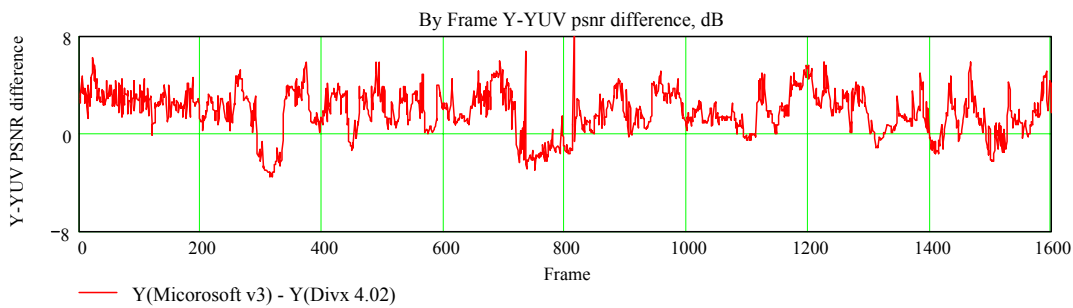
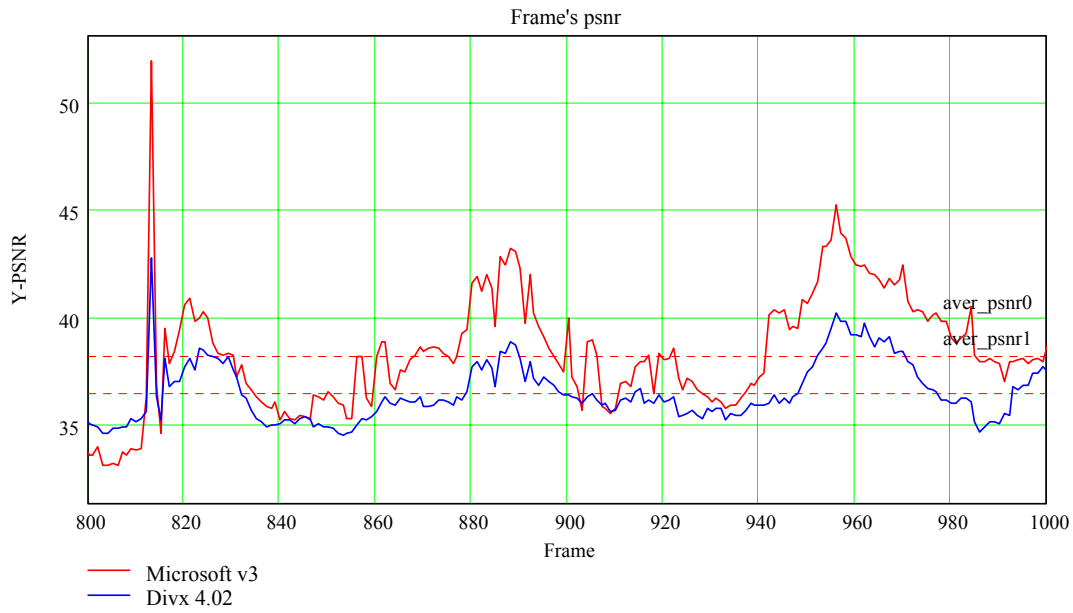
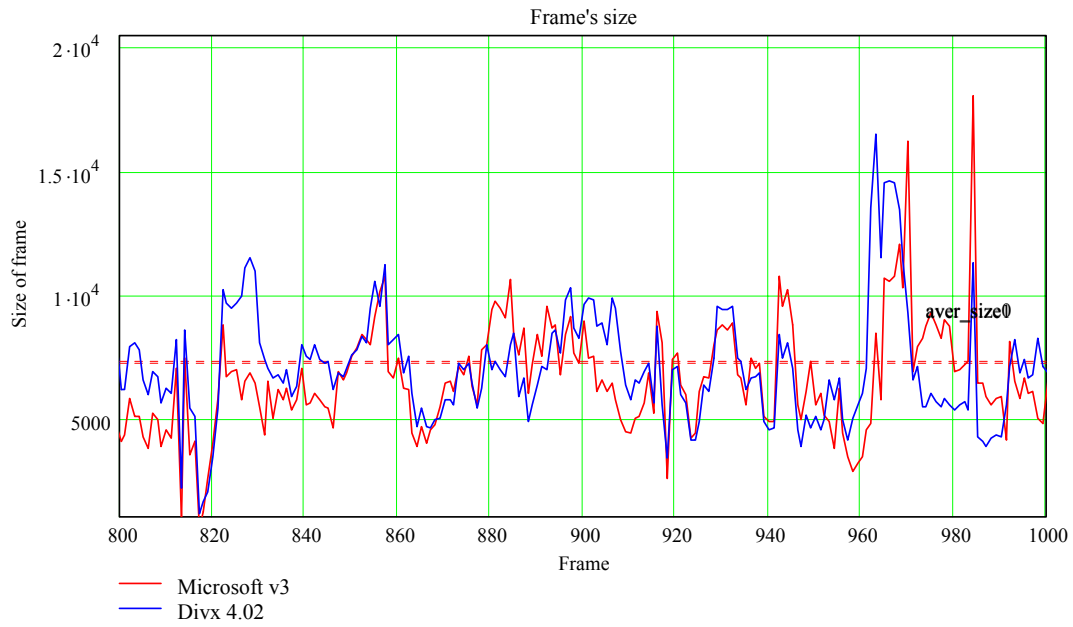


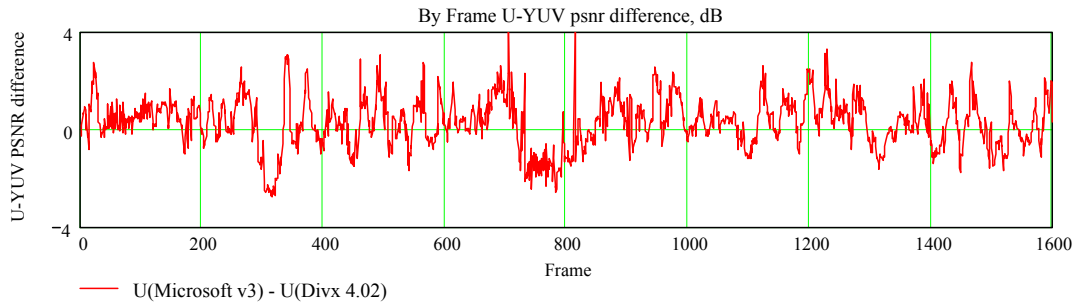
According to the first diagram Divx 5.02 has a better Y-PSNR metric; according to the second one Divx 4.02 has a better U-PSNR metric. That means that the developers of the Divx 5.02 codec improved the Y-component at the expense of the U- and V-components, which seems to be the right decision because the human eye is more sensitive to changes in brightness than to changes in color. Also it should be mentioned that these codecs have approximately the same frame size. It can be especially well seen on diagram 5 (which is an increased diagram 4). The dashed lines mean the average frame size values for each of the two codecs; here these lines flow together into one line. The last diagram represents the difference in Y-PSNR metric.



**Divx 4.02 and Microsoft 3688 v3 (battle – 1340 kbps)**



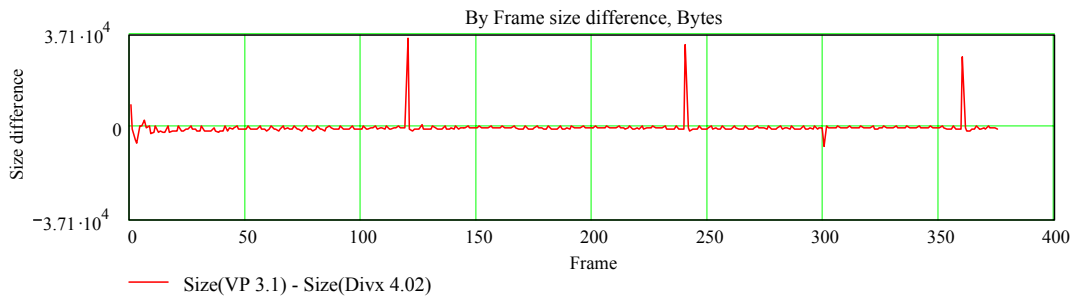
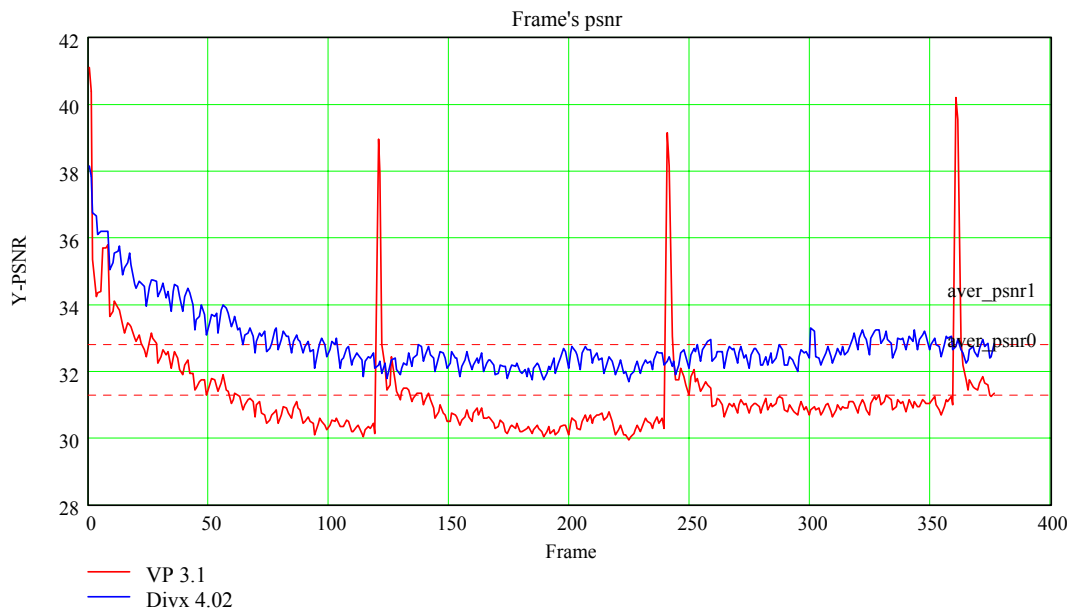
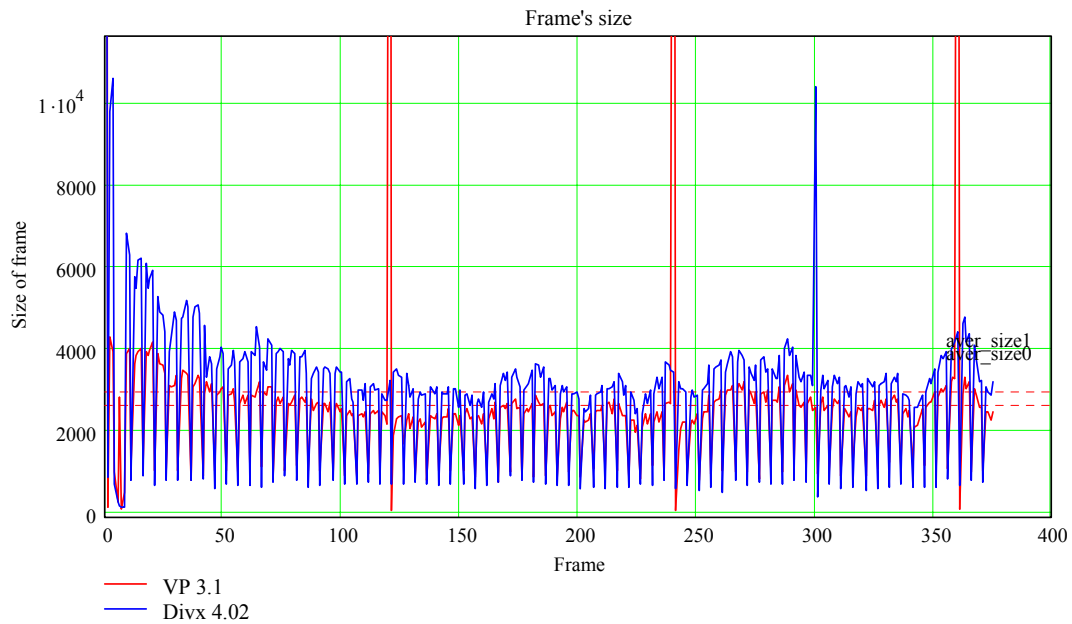


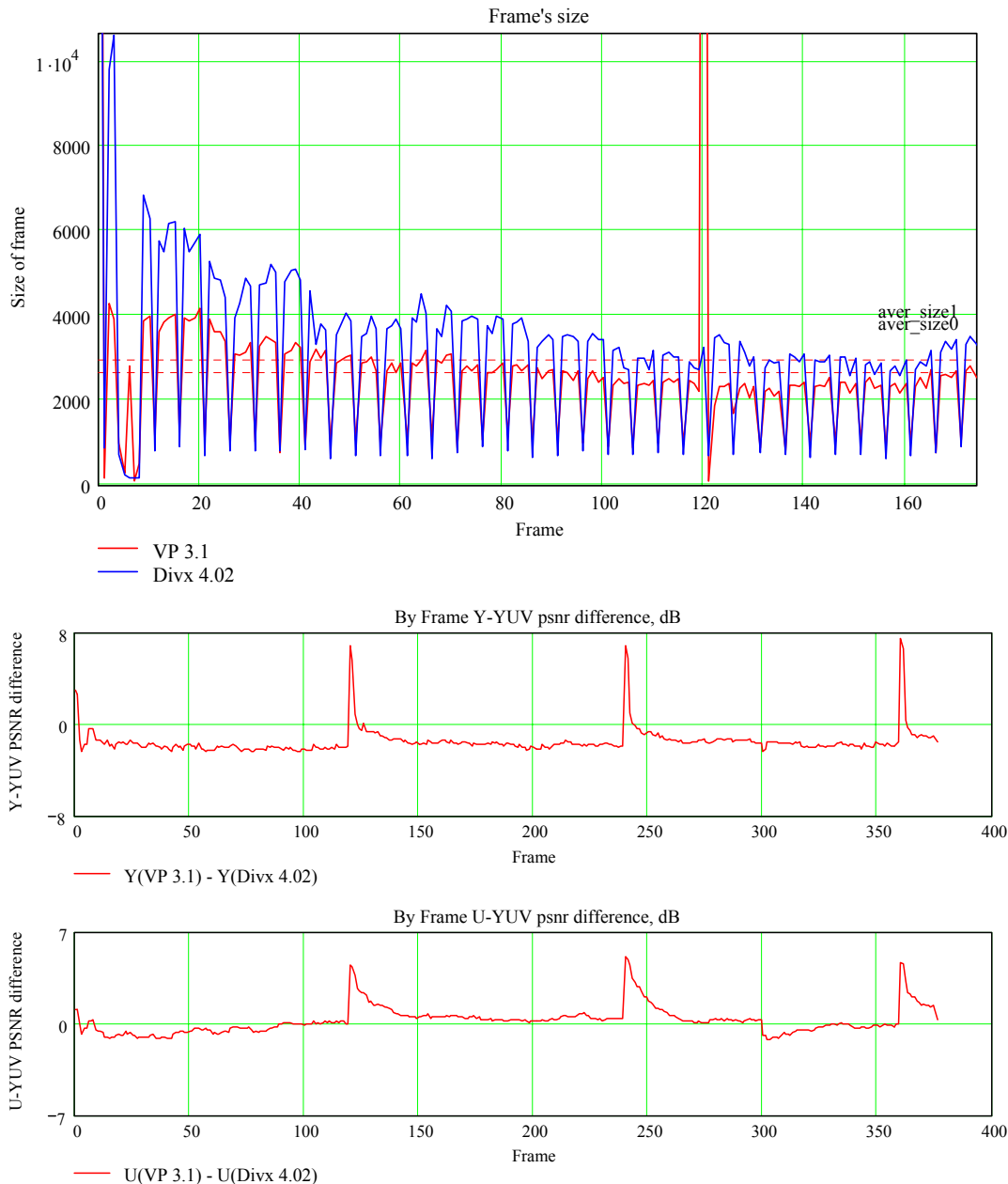


**Conclusions:**

- Microsoft v3 has a noticeably higher average metric value than Divx 4.02.
- Microsoft v3 better keeps the U-component.
- Divx 4.02 better keeps the Y-component; its Y-PSNR diagram has smaller amplitude. The second diagram represents the sharp increase of the Microsoft v3 codec's Y-PSNR near the 800th frame. This increase can be seen by sight during the playback.

Divx 4.02 and VP 3.1 (bankomatdi – 340 kbps)

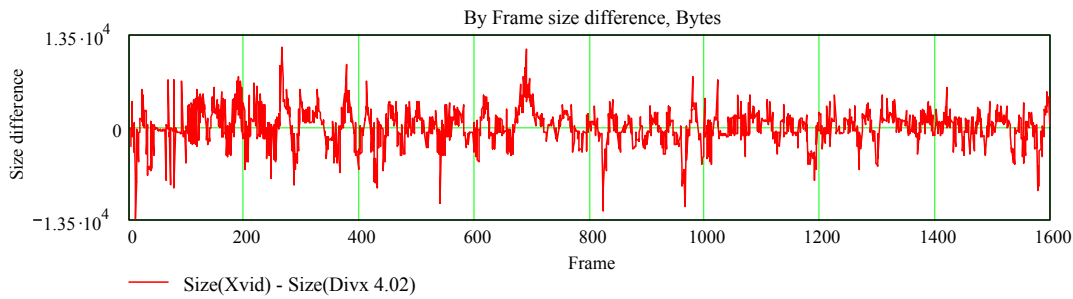
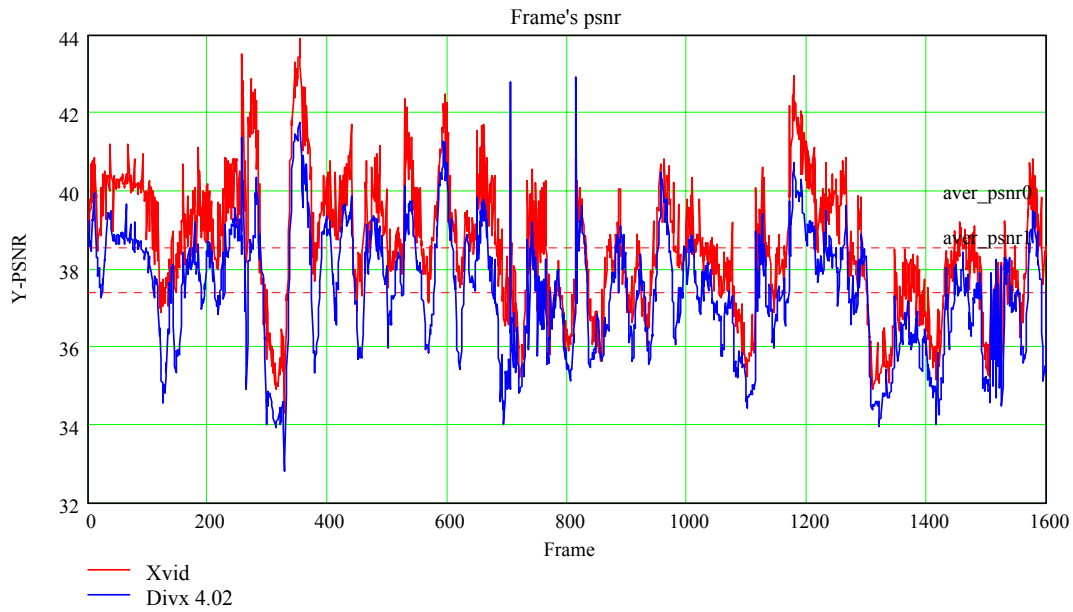
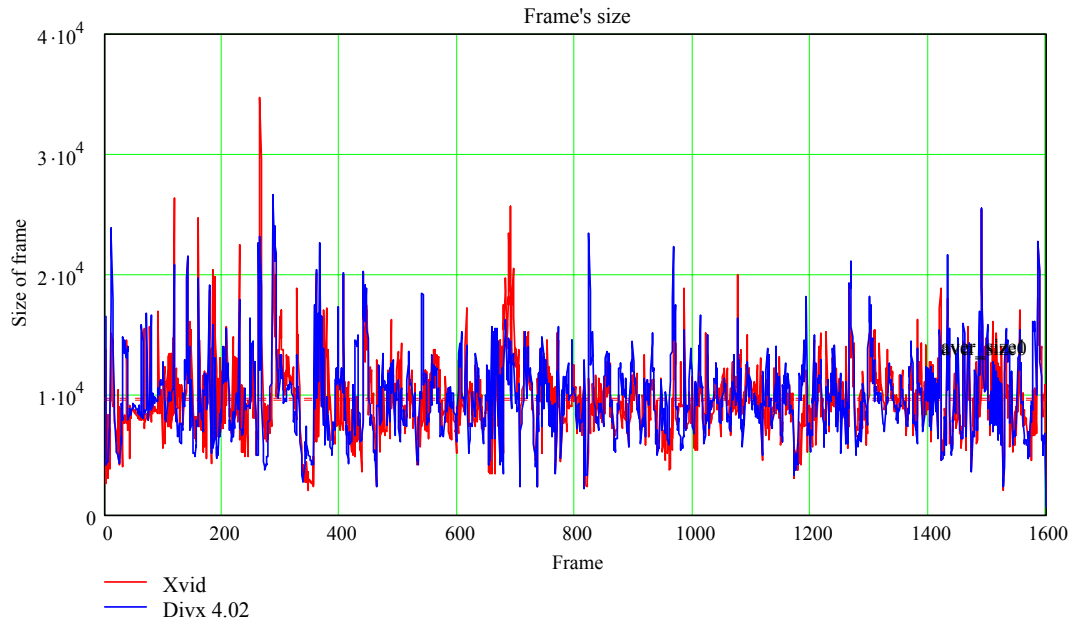


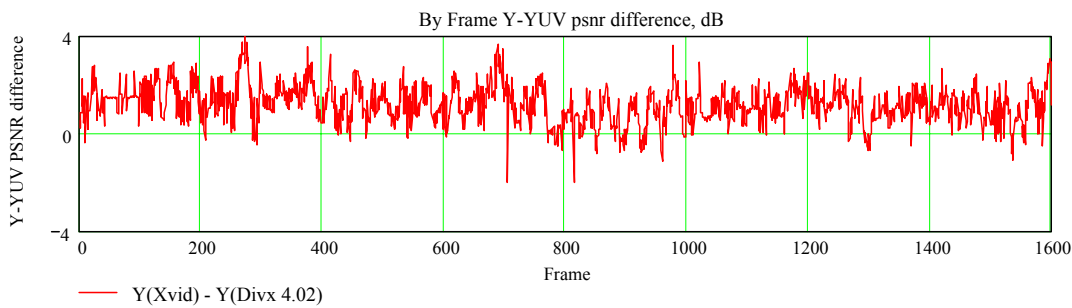
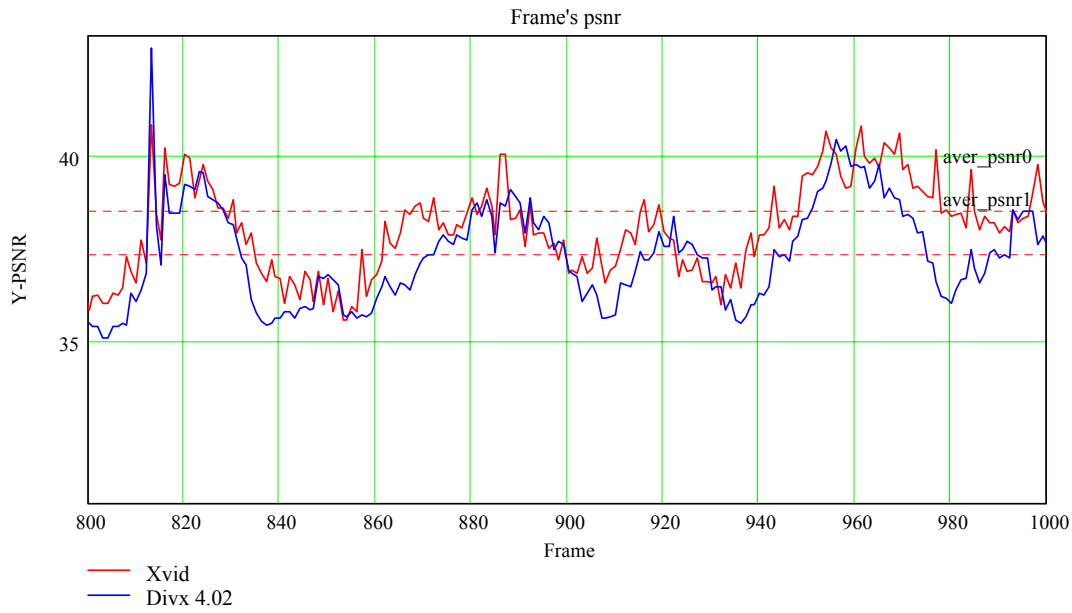
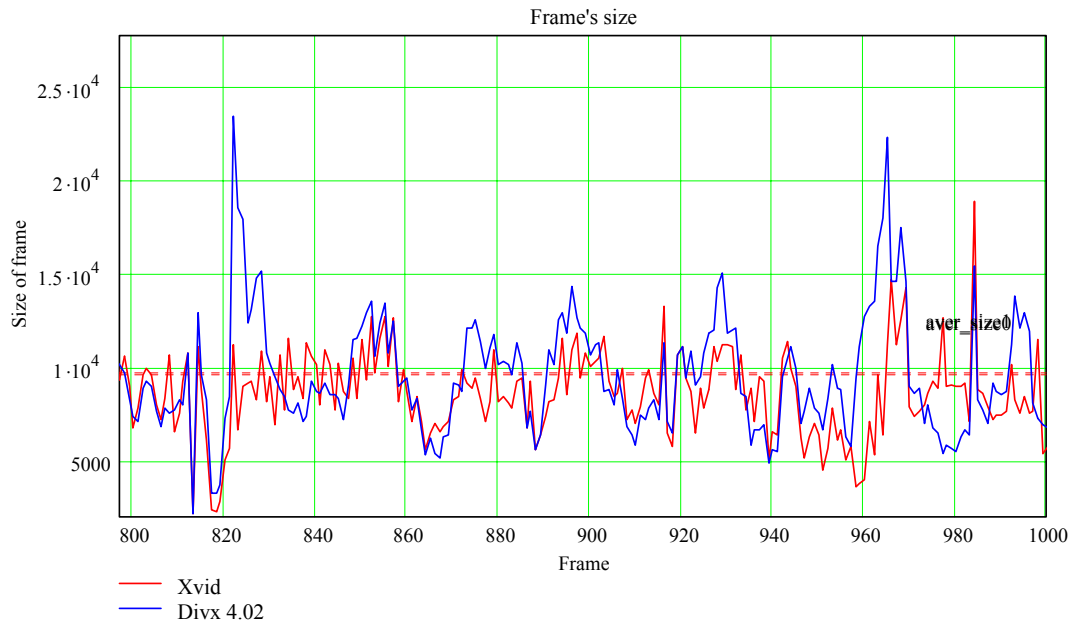


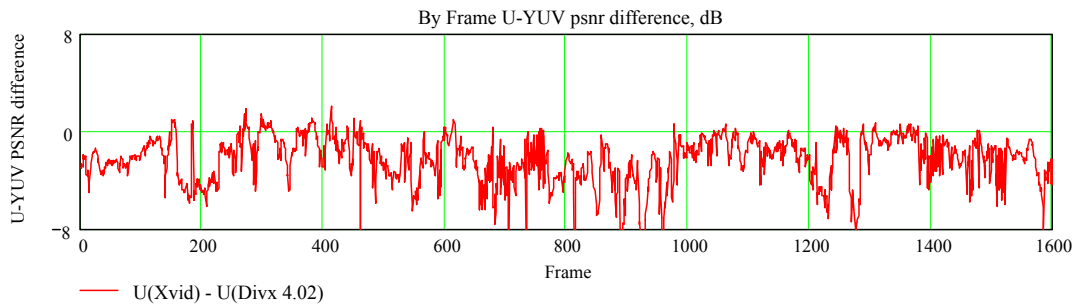
Conclusions:

- Div 4.02 better keeps the Y-component.
- Both codecs keep the U-components similarly.
- Peaks on the diagram for VP 3.1 correspond with the key-frames. So key-frames are the only frames, where PSNR of VP 3.1 is higher than PSNR of Divx 4.02. Changes of metric with such amplitude can be seen by sight. It means that one can see changes in image quality during the playback. Also key-frames usage causes a significant increase of the average frame size, so here it's not justified. Without generating key-frames VP 3.1 would gain much benefit on bitrate.
- Periodical rises on the diagram are caused not by the codec's but by the clip's specificity. The bankomat clip contains periodically appearing sequences.

**Divx 4.02 and Xvid 2.1 (battle – 1840 kbps)**





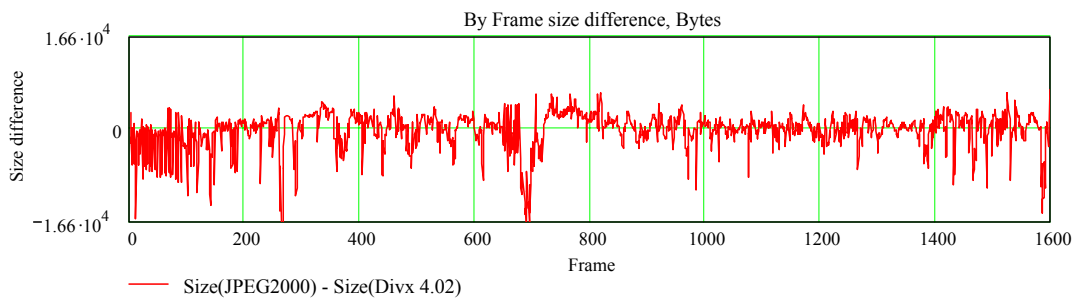
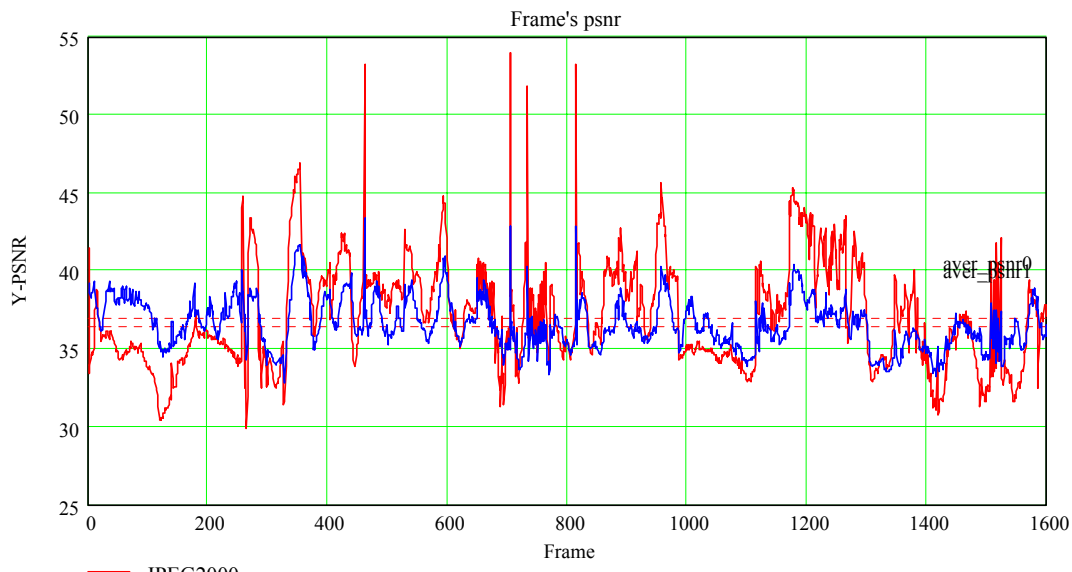
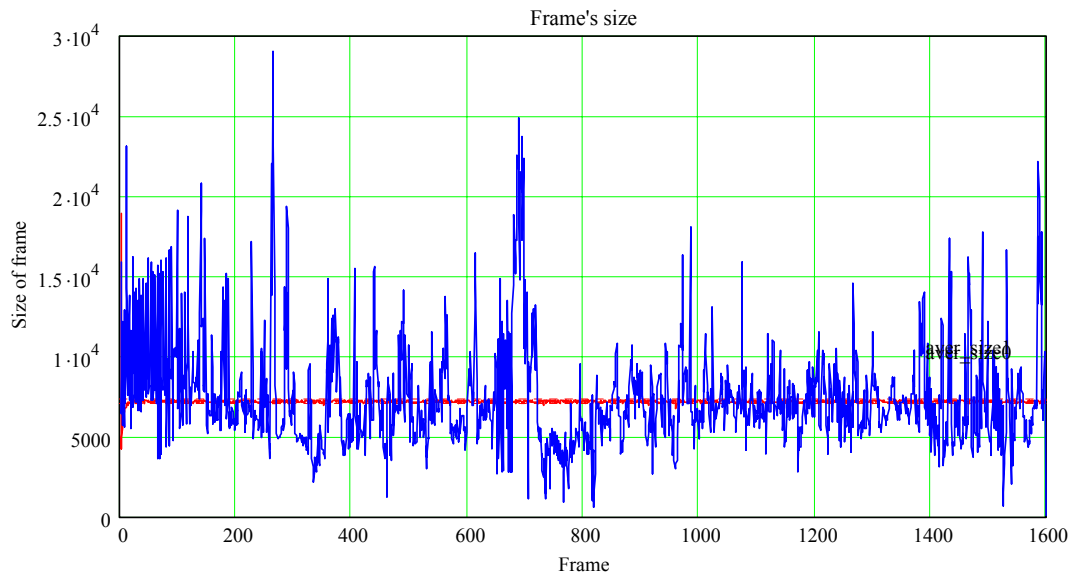


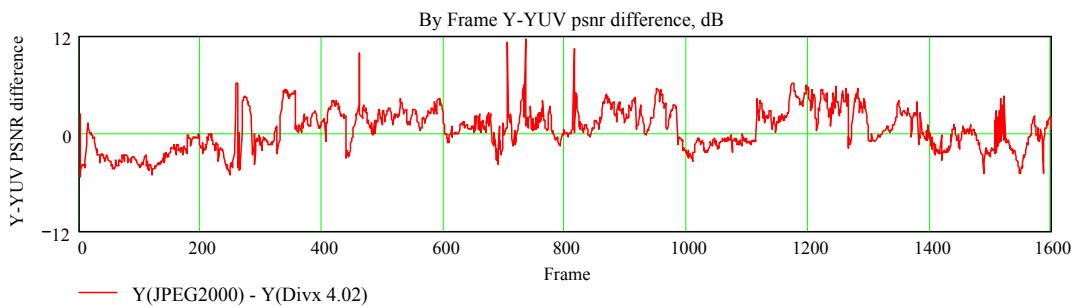
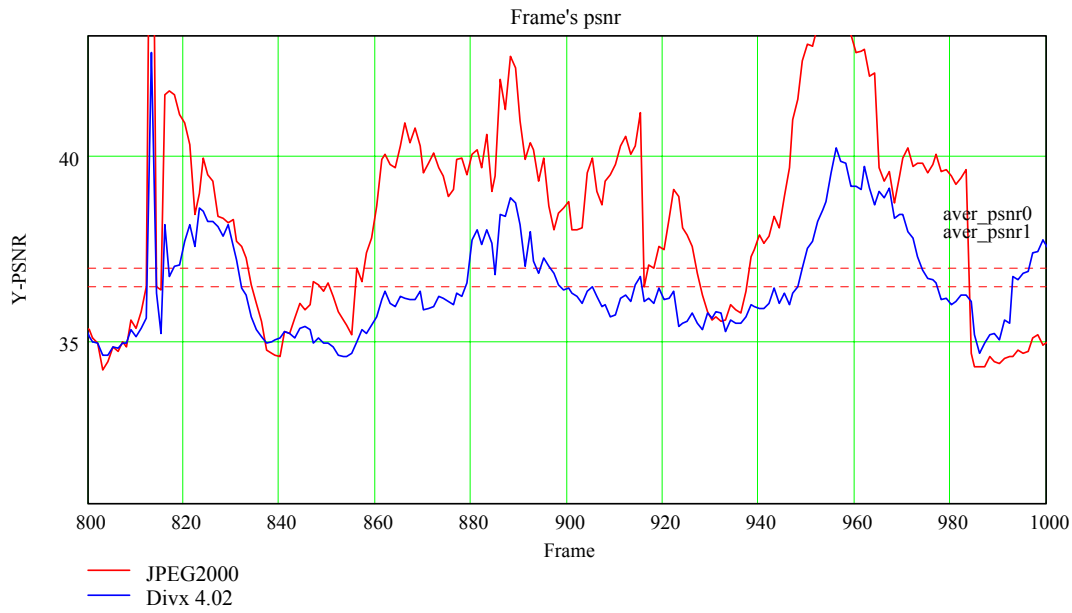
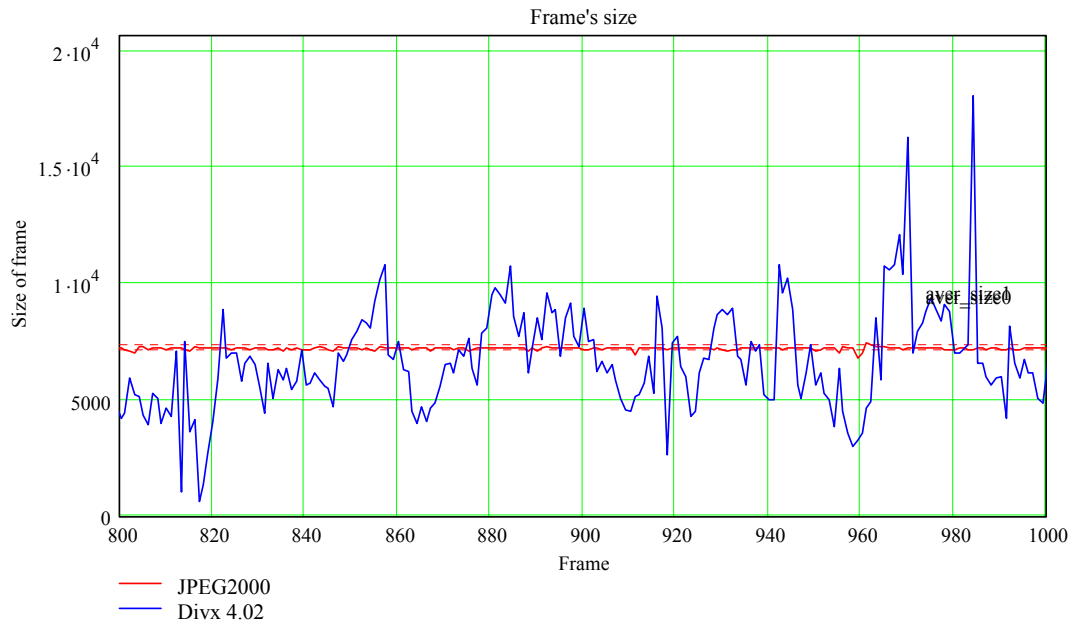
**Conclusions:**

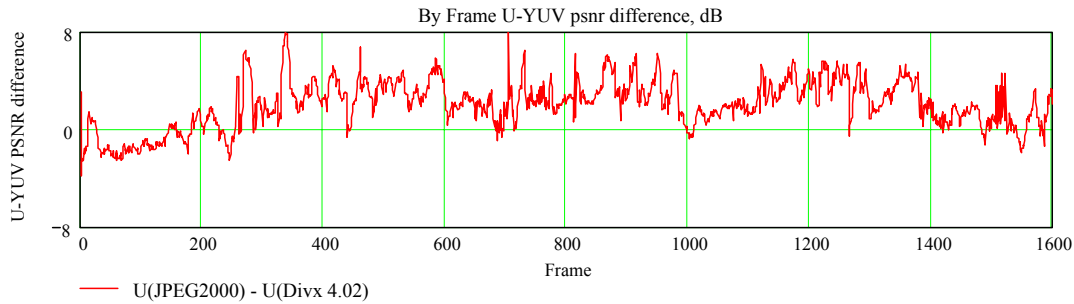
- Y-PSNR of the frame after Divx 4.02 is 2 dB worse.
- Divx 4.02 better keeps the U-component.
- Xvid better keeps the metric and the frame size; oscillations on the corresponding diagrams have smaller amplitude.



**Divx 4.02 and MorganMultimedia JPEG2000 (battle – 1340 kbps)**



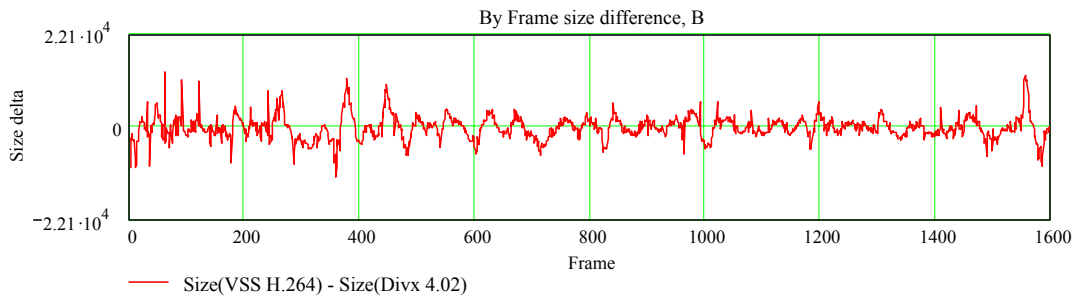
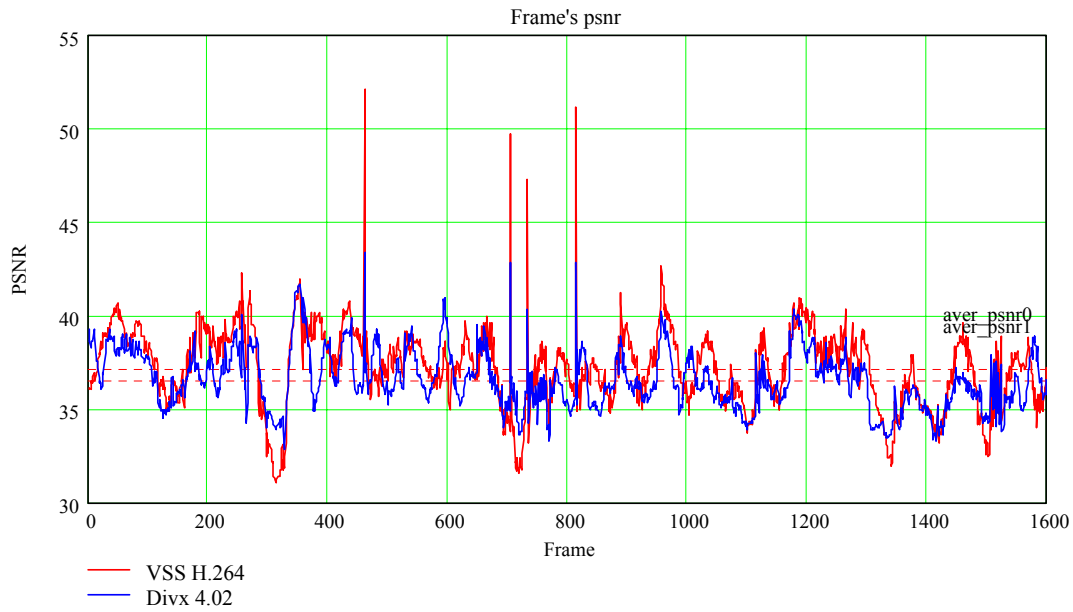
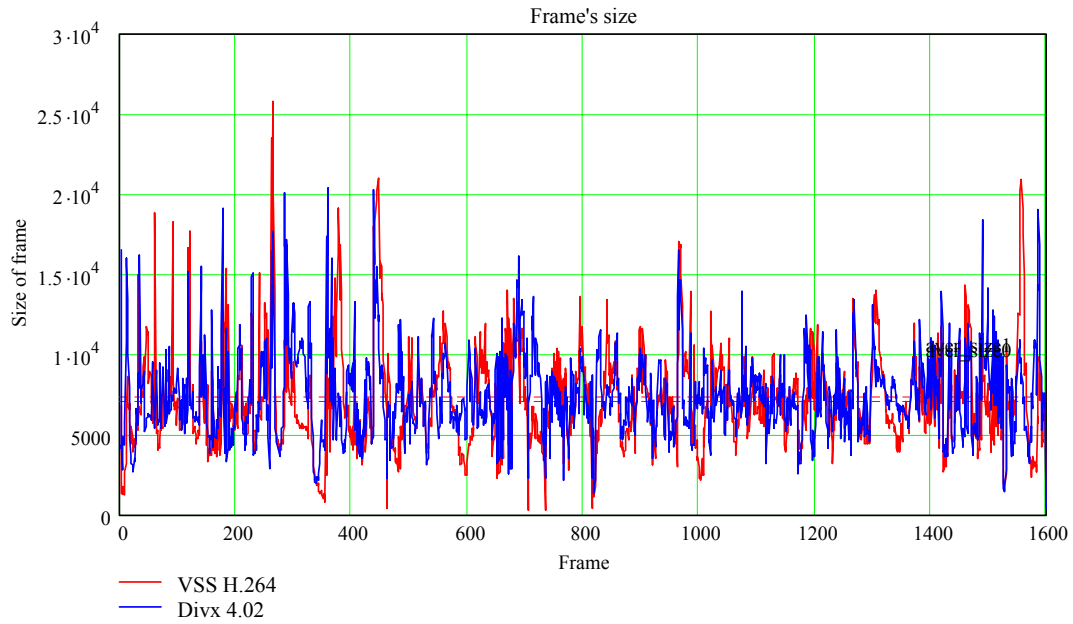


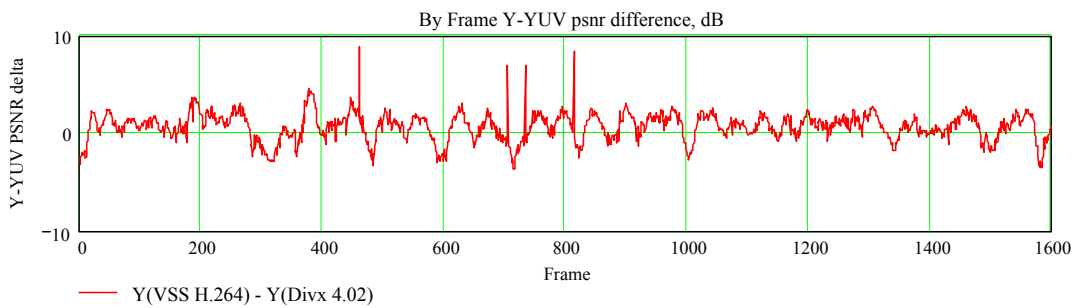
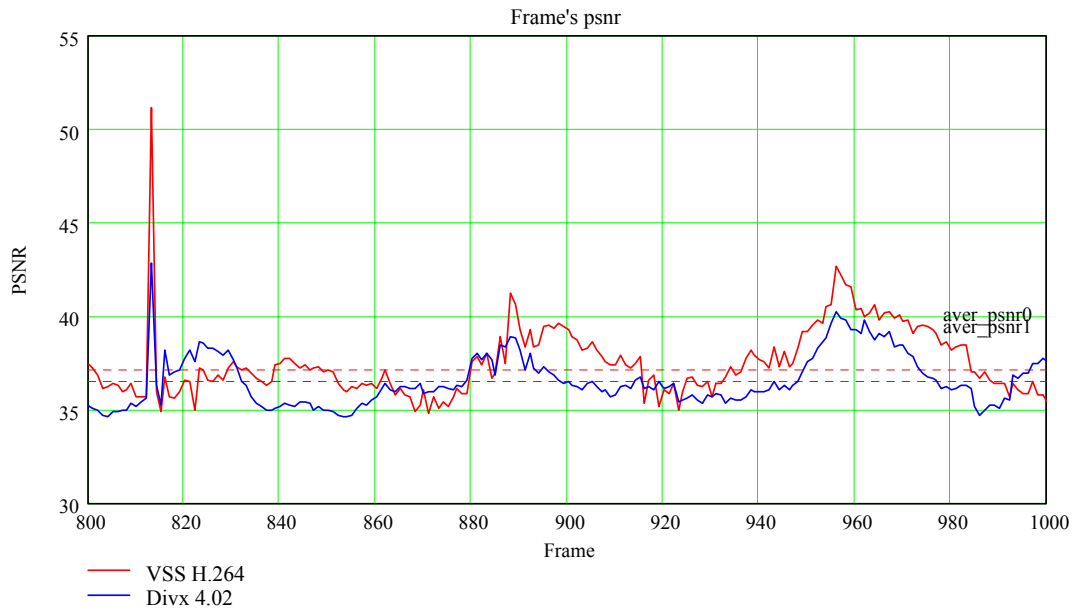
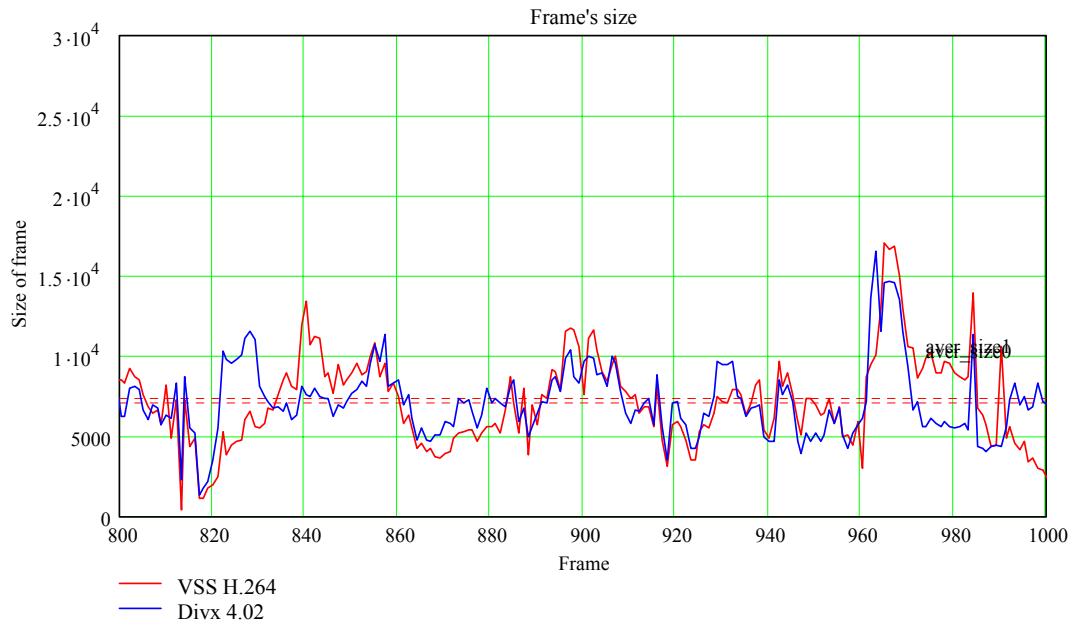


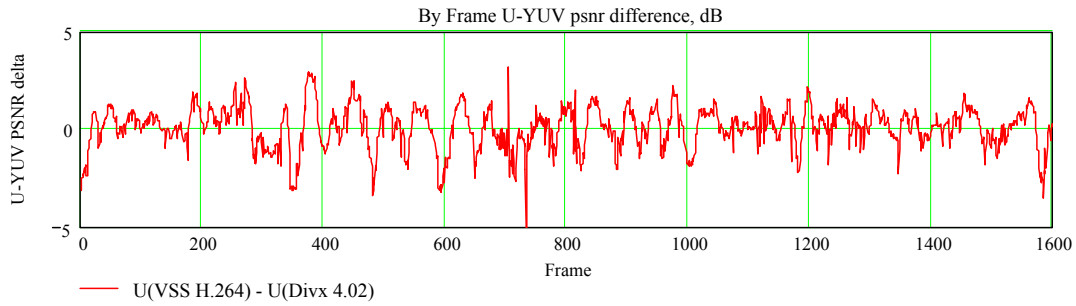
#### Conclusions:

- JPEG2000 perfectly keeps the bitrate (see picture 1).
- JPEG2000 better keeps the metric on the dynamic scenes, although it is significantly inferior to Divx 4.02 on the static ones.
- JPEG2000 better keeps the U-component.
- The difference in their average metric indexes is approximately 0.5 dB. That means that being superior in the frame size JPEG2000 also has a bit better quality.
- Despite the constant frame size, the metric index of JPEG2000 changes greatly. According to the second diagram the amplitude of its oscillations reaches 10 dB. These metric overfalls evidently badly affect the quality of the compressed sequence. Divx 4.02 keeps the metric much more stably.

### Divx 4.02 and VSS H.264 (battle – 1340 kbps)







**Conclusions:**

- Y-PSNR of H.264 is on average 1 dB higher than the one of Divx 4.02.
- Four I-frames, which are characterized by the sudden changes in Y-PSNR, can be seen on the Y-PSNR diagrams for VSS H.264 (1-1600 frames interval). These overfalls can be seen by sight in the video sequence. It should be mentioned that the overalls on the corresponding frames after Divx 4.02 are 10 dB less (see the next to last picture).
- Divx 4.02 keeps the U-component a little better.

## Outline

Video Codecs Comparison consists of the following sections:

- Part 1: Methodology
- Part 2: PSNR Diagrams For All Video Codecs
- **Part 3: Frame-accurate Comparison – *this document***
- Part 4: Visual Comparison

**NOTE: These files contain only a VERY SMALL PART of the processed and measured data.**

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